Technical Publication No. 88

GUIDELINES FOR THE USE OF RECLAIMED WATER IN THE STATE OF FLORIDA

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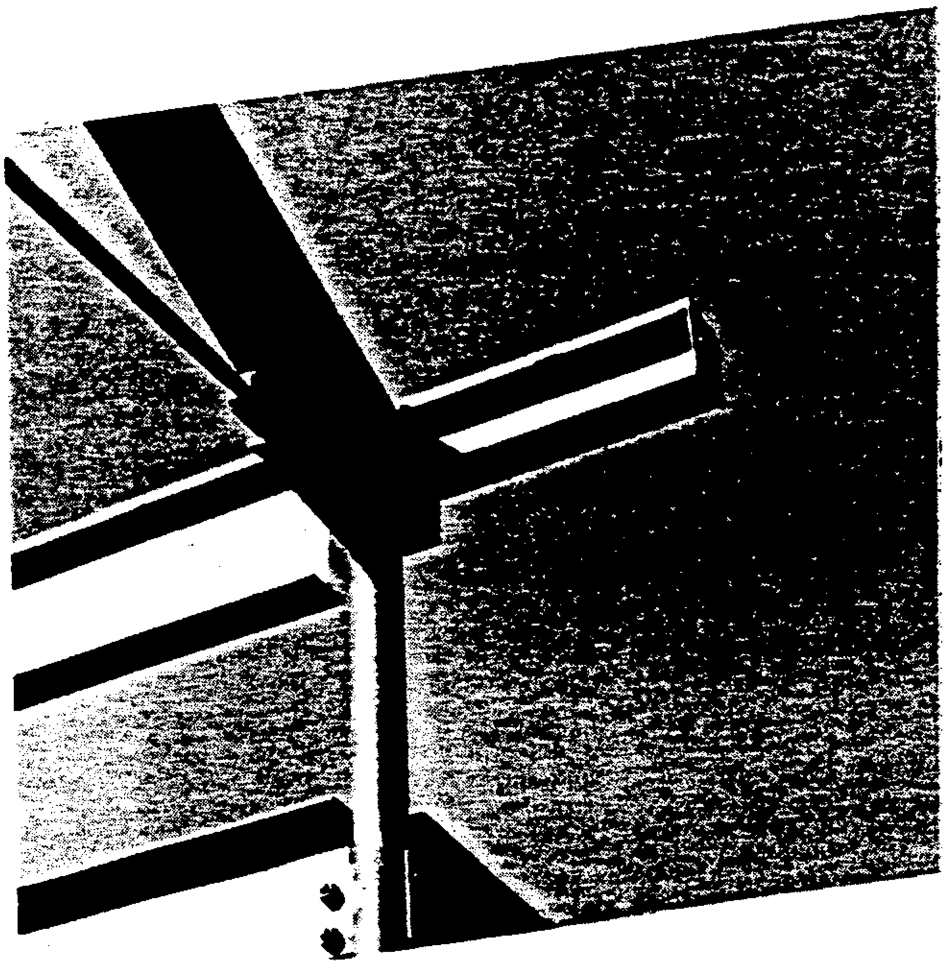

Charles J. Kibert
D. Linda Kone

School of Building Construction
University of Florida
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EXECUTIVE SUMMARY

The thrust of this research report is to consolidate both technical and non-technical information on the subject of reclaimed water as it applies to the State of Florida. Since reclaimed water is a subset of the larger subject of water conservation, various aspects of the bigger picture of water conservation are also addressed. The report begins with basic concepts and moves on to define the various types of reclaimed water or "third-main" system applications that are potentially feasible: agricultural irrigation, golf course irrigation, landscape irrigation, grey water for commercial and industrial applications such as toilet and urinal flushing, fire protection water, cooling tower feedwater, boiler feedwater, and others. Also covered is the subject of Xeriscape$_{tm}$ as a water conservation concept: the use of landscape horticulture that uses minimal water and that can in fact use reclaimed water. The economics of the reclaimed water system are also important and several cases covering a variety of applications are described to provide the reader with insights into the feasibility evaluation and justification of a reclaimed water system. Finally the subject of how the public perceives reclaimed water systems is covered in the final chapter along with the role of government in controlling water distribution and consumption within the State.

Obtaining Copies:

A copy of this report may be obtained by contacting: Executive Secretary, BCIAC, M.E. Rinker, Sr. School of Building Construction, FAC 101, University of Florida, Gainesville, Florida, 32611, 904/392-5965.

FOREWORD

As is the case with most research projects, a fair amount of the credit for the final product must be given to the supporting cast of students who are charged with gathering information and producing drafts of portions of the report. In this regard the following undergraduates at the M.E. Rinker School of Building Construction, University of Florida, deserve abundant praise and commendation for their efforts on behalf of this project: Tanya Cresswell, James Schwartz, Tony Howard, and Doug Schneider. Kevin Grosskopf, a graduate student, assisted in compiling the information provided by these students and made major contributions himself in the production of this volume. This report could not have been produced without their assistance and it is hoped that their efforts will perhaps someday prove beneficial in both a personal and a professional sense. Any errors, omissions, or other failings of this report are strictly the property and burden of the Principal Investigator and all other parties are absolved of other than positive comments.

Charles J. Kibert, Ph.D., P.E.
Principal Investigator

Gainesville, Florida
September 30, 1992

CHAPTER 1
INTRODUCTION

1.0 Purpose

Water is an essential resource for virtually every human endeavor. It is a renewable resource, constantly being purified and redistributed through the hydrologic cycle. The fundamental problem with water is its distribution because much of the precipitation that occurs does so in areas where it is not accessible for human use. Only 10 percent of precipitation is in fact economically accessible to humans, much of it falling in the oceans and other bodies of water. The United Nations estimates that 2 billion people or about 40 percent of the world's population does not have adequate access to potable water. The next major environmental crisis is thought by many to in all likelihood center around the problems of water availability: uneven distribution, inequitable access, and increasing pollution.

Water conservation is not a new idea, but recent events, to include long periods of drought, widespread saltwater intrusion, and ever increasing population pressures are forcing serious consideration of stringent conservation measures in Florida and throughout the United States.

This technical report provides an overview of water conservation strategies, techniques, and measures with a special focus on reclaimed water systems. Systems and products that are designed to conserve water are reviewed for their applicability. Regulatory statutes and standards that govern water use, reuse, and conservation are covered. Examples of public programs in Florida and other states that have successfully designed and constructed water reuse and conservation purposes systems are described for illustrative purposes. The economics of these systems, both in a capitalization and life cycle sense, are factored into the overall picture. Finally issues such as public safety, management, and technical problems are kept in sight to allow the reader to understand the full range of problems that occur when water reuse systems are selected as an option in the overall water management scheme of a region.

1.1 The World Water Resources Problem

Although we are accustomed to thinking of water as an infinitely available, renewable resource, purified and redistributed by the action of the sun, wind, and gravity, the supply of it is becoming increasingly limited. The more pessimistic point of view is that water conservation in the 1990's will become a national priority, much as energy conservation was in the 1970's.

The distribution of freshwater is a major problem facing mankind. Table 1.1 illustrates the problem, indicating that North America, for example, with 8% of the world's population has 40% of the stable or usable freshwater runoff.

Table 1.1 Distribution of renewable freshwater resources by continent

	Average annual runoff (cu km)	Share of global runoff (%)	Share of global population (%)	Share of runoff that is stable (%)
Africa	4,225	11	11	45
Asia	9,865	26	58	30
Europe	2,129	5	10	43
North America	5,960	15	8	40
South America	10,380	27	6	38
Oceania	1,965	5	1	25
Soviet Union	4,350	11	6	30
World	**38,874**	**100**	**100**	**100**

Source: Worldwatch Paper 62: Water, Rethinking Management in Age of Scarcity

The problem becomes even clearer if it is narrowed down to specific countries, contrasting the water poor lands (Table 1.2) with the water rich (Table 1.3) in terms of water availability.

Table 1.2 Water availability in selected water poor countries

Country	Annual renewable reserves (km^3)	Annual capita supply ($1,000m^3$)	Gallons/ capita/yr (x 1,000)
Kuwait	0.00	0.00	0
Bahrain	0.00	0.00	0
Egypt	1.80	0.03	7.9
Qatar	0.02	0.06	15.8
Malta	0.03	0.07	18.5
Libya	0.70	0.15	39.6
Barbados	0.05	0.20	52.8
Saudi Arabia	0.60	0.22	58.8
Hungary	6.00	0.57	150.4
Djibouti	0.30	0.74	195.3
Germany	96.00	1.22	322.0
India	1,850.00	2.17	572.9
China	2,800.00	2.47	650.0

Source: World Resources, 1990-1991

Table 1.3 Water Availability in selected water rich countries

Country	Annual renewable resources (km^3)	Annual per capita ($1,000\ m^3$)	Gallons/ capita/yr (x1000)
Iceland	170	672	177,408
Suriname	200	496	130,944
Papua N. Guinea	801	200	52,800
Canada	2,901	109	28,776
Norway	450	96	25,344
Liberia	232	91	24,024
Congo	181	91	24,024
Laos	270	66	17,424
Brazil	5,190	35	9,240
Zaire	1,019	28	7,392
Soviet Union	4,384	15	3,960
Indonesia	2,530	14	3,696
United States	2,478	10	2,640

Source: World Resources, 1990-1991

Water use varies widely in different countries. India uses 93% of its available freshwater for agriculture while the U.S. uses only 42% (Table 1.4). Use of agricultural water is notoriously inefficient, especially in developing countries. Industrial water use ranges from 70% in industrialized European countries to 5% or less in developing countries such as Egypt.

Table 1.4 Average water use in selected countries

Country	Withdrawal (km^3)	Percent, total avail	% Use by sector		
			Home	Industry	Farm
Brazil	35.04	1	43	17	40
Canada	36.15	1	18	70	12
Congo	0.04	<1	62	27	11
Egypt	56.40	97	7	5	88
Germany	50.53	26	10	70	20
India	380.00	18	3	4	93
Indonesia	16.59	1	13	11	76
Kuwait	0.01	x	64	32	4
Libya	2.62	374	15	10	75
Norway	2.00	<1	20	72	8
Qatar	0.04	174	36	26	38
U.S.	467.00	19	12	46	42
U.S.S.R.	353.00	8	6	29	65
World Avg.	**3296.00**	**8**	**8**	**23**	**69**

x = no natural freshwater available
Source: World Resources, 1990-1991

1.2 Florida's Water Resource Problems

1.2.1 Groundwater in Florida

The State of Florida has an economy in which tourism and agricultural play key roles, both of which are dependent upon an abundant high-quality water supply. Even though Florida is surrounded by water and has numerous lakes and rivers, the primary source of potable and non-potable water is **ground water**. Florida's vital economy is heavily dependent upon the quality and availability of ground water for the adequate supply of industrial, commercial and agricultural uses. Florida's water use is illustrated in Figure 1.1.

Estimated Daily Water Withdrawal in Florida, 1950-1980

	State Population (in millions)	Public Supplies[a] (mgd)	Rural Domestic and Livestock[a] (mgd)	Irrigation[a] (mgd)	Thermo-electric Power Production[b] (mgd)	Self-supplied Industrial[b] (mgd)	Total Fresh Water Withdrawn (mgd)	Per Capita Use[a] (gpd)	Saline Water Withdrawn (mgd)	Total Water Withdrawn (mgd)	Total Per Capita Water Withdrawn (gpd)	Total Fresh Water Consumed (mgd)
1950	2.771	170	55	386	NA	NA	NA	NA	NA	877	316	NA
1955	3.670	319	38	510	NA	NA	2,167	590	645	2,812	766	NA
1958	3.841	380	NA	1,182	NA	NA	NA	NA	NA	3,780	984	NA
1960	4.951	538	110	880	4,800	1,020	3,780	759	3,380	7,120	1,436	1,210
1965	5.805	710	142	3,200	8,100	961	6,862	1,180	6,251	13,113	2,259	1,639
1970	6.789	884	195	2,089	11,076	1,058	5,769	848	9,546	15,313	2,256	1,934
1975	8.486	1,146	285	2,886	13,137	1,003	6,916	815	11,908	18,430	2,170	2,383[c]
1980	9.740	1,361	318	2,887	15,888	630	7,208	759	13,887	21,208	2,177	2,443[c]

[a]Fresh
[b]Fresh and saline water
[c]Does not include the portion of conveyance loss that is consumed
NA=not available

Figure 1.1 Florida water consumption, 1950-1980
Source: Water Resources Atlas of Florida

Ground water is the source of safe drinking water for over 90% of Florida's population, compared with 43% in California. Additionally, at least 20% of the population drink untreated water from private wells while another 70% obtain drinking water from municipal systems using ground water resources.[1] This makes the quality of Florida's groundwater critical.

Florida has more ground water available than any other state.[9] With the exception of a few locations near the coast, ground water is available everywhere.

Florida is an unusual state because it is underlain virtually everywhere by aquifers or underground reservoirs. There are six principle aquifers the largest and most important of which is the Floridan aquifer (Figure 1.2) which extends south to Lake Okeechobee and north into the Carolinas. In addition to the Floridan aquifer there are five intermediate and surficial aquifers:

(1) Sand and Gravel Aquifer located in the western panhandle

(2) Biscayne Aquifer in southeastern Florida

(3) Chokoloskee Aquifer in southwestern Florida

(4) Hawthorn Formation and Tampa Limestone Aquifer

(5) various undifferentiated aquifers in east and south Florida.

These aquifers contain enormous amounts of water, about 1 quadrillion gallons, or about one-fifth the water in the Great Lakes. In spite of this massive water supply there are water shortages and other water resource problems in Florida due to water pollution, salt water intrusion, and withdrawals far exceeding recharge rates.

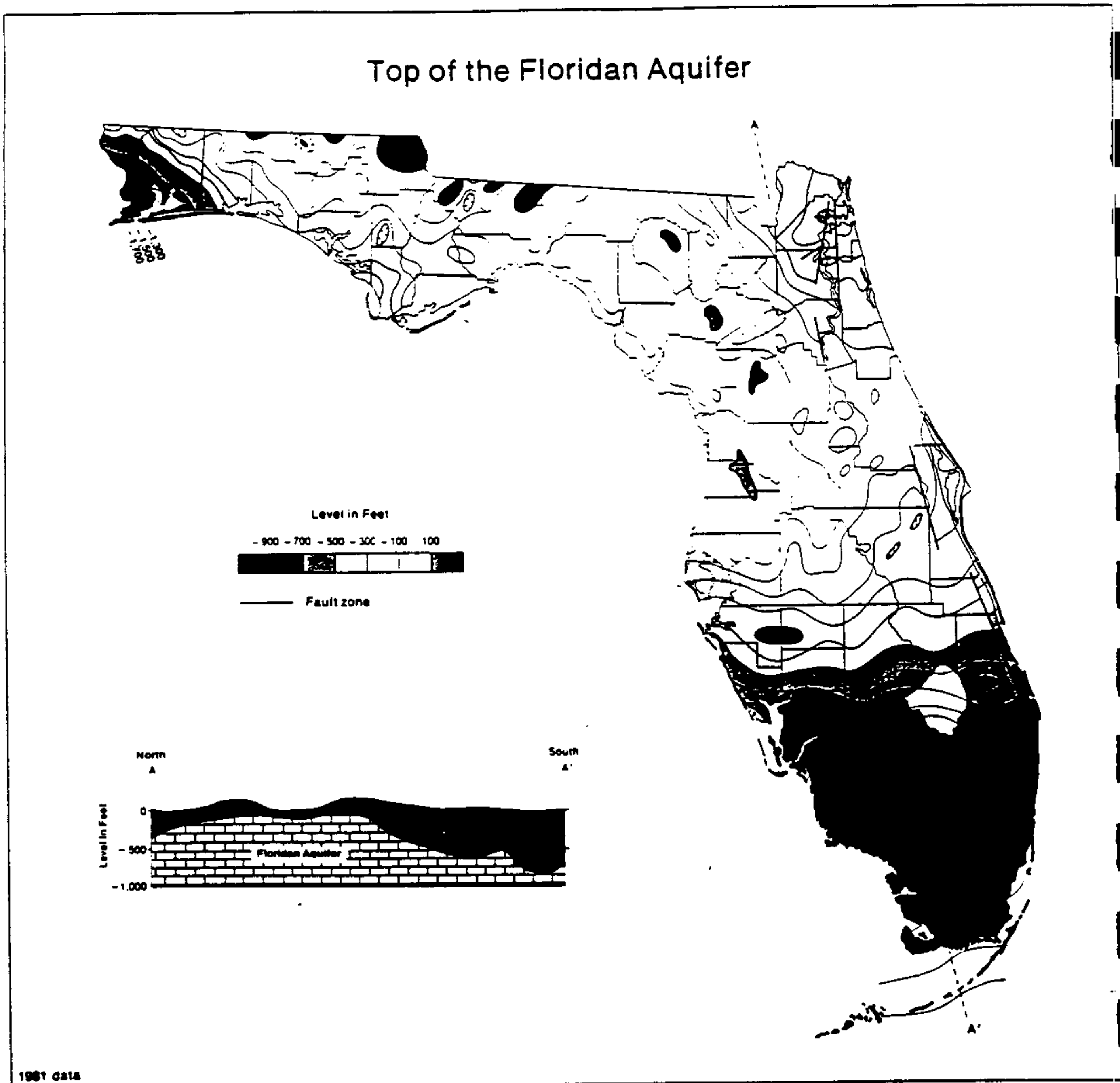

Figure 1.2 The Floridan Aquifer
Source: Water Resources Atlas of Florida

1.2.2 Salt water intrusion

As fresh water is withdrawn from the aquifer system it must be recharged with rain water draining back through a porous layer of limestone several thousand feet thick. The upper part of the aquifer is in contact with salt water on the Gulf and Atlantic coasts and the mass of fresh water is underlain by salt water at some depth everywhere in the state. Since salt water has far greater density than fresh water, the fresh water will "float" on the salt water. For every foot of fresh water removal without timely recharge, the salt water level will rise 40 feet. Additionally as fresh water is removed near coastal areas, the subsurface interface between salt water and fresh water is displaced inland. If a part of the aquifer becomes contaminated by salt water it takes years to flush it clean. In many cases the aquifer simply cannot be cleaned. Numerous fresh water wells have had to be abandoned due to careless pumping practices. The bottom line is that although Florida has an enormous supply of water, only a small fraction of it can be withdrawn for use. Rain is critical to keep the aquifer recharged at the same rate it is being depleted and thus the amount of usable water is limited by a basic factor: rain. Florida has had intermittent problems with drought (Figure 1.3). Rainfall tends to be fairly irregular throughout the year (Figure 1.4). Hurricanes further upset the pattern of rainfall. (Figure 1.5).

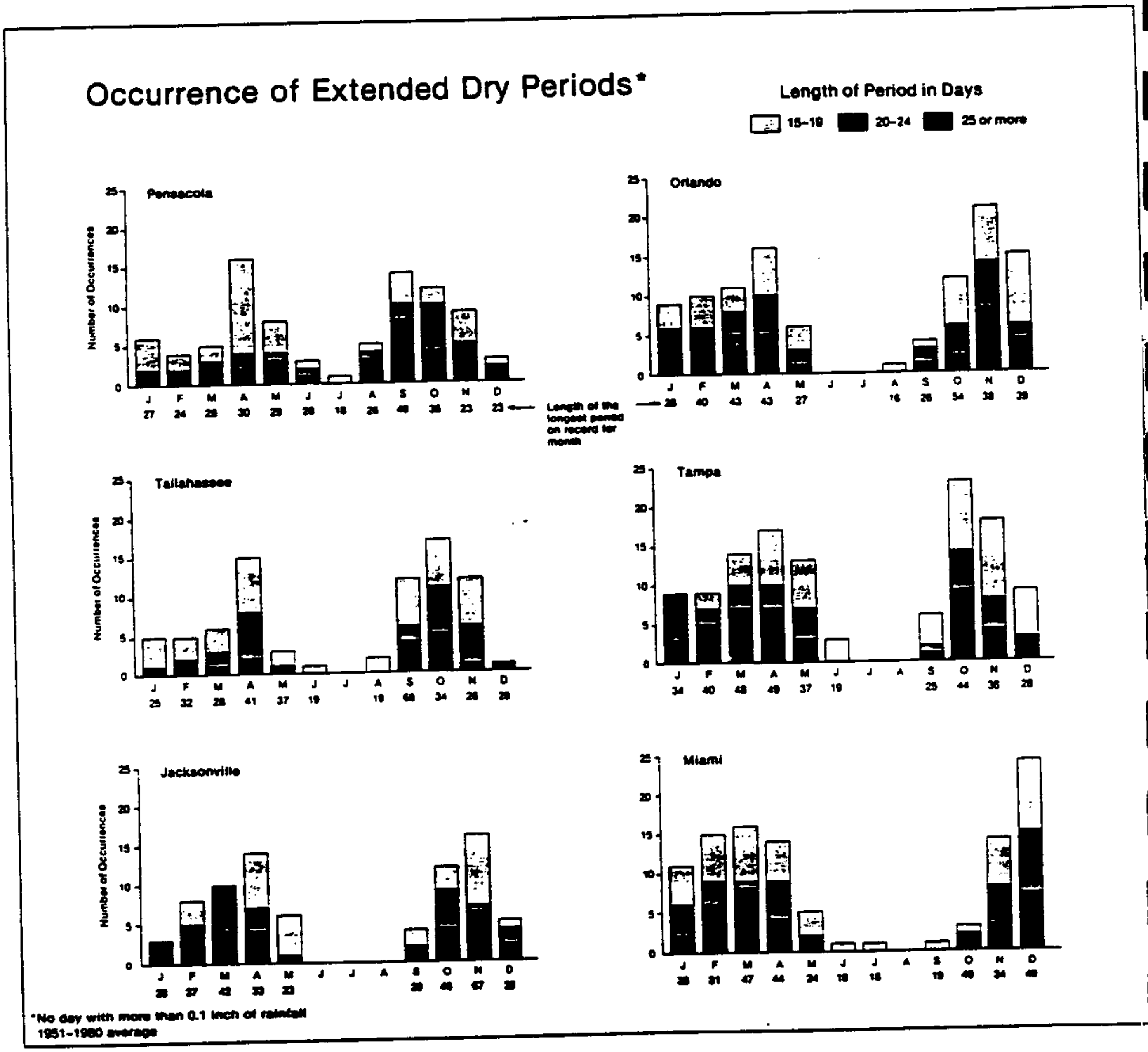

Figure 1.3 Periods of dryness in Florida
Source: Water Resources Atlas of Florida

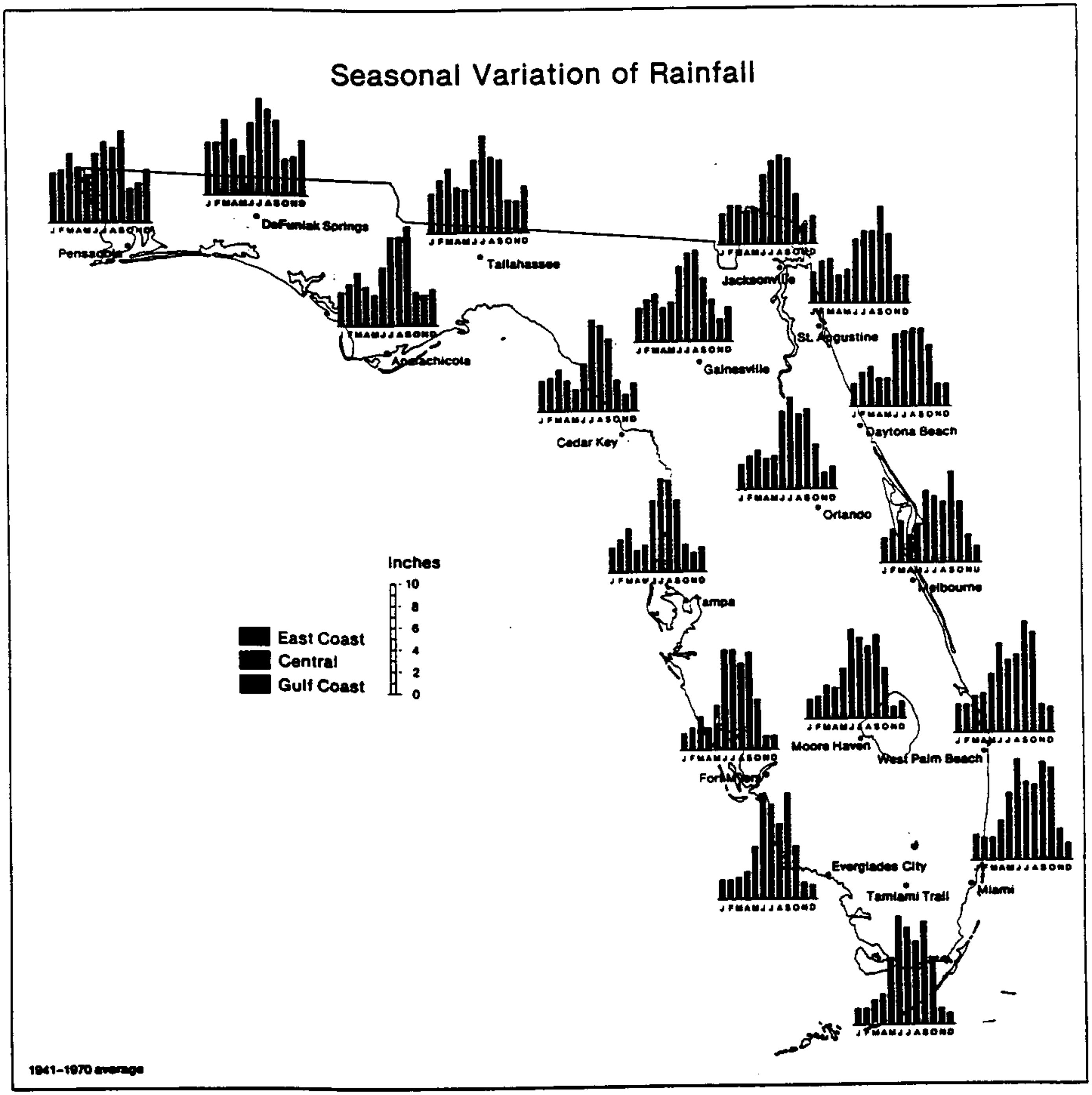

Figure 1.4 Rainfall patterns in Florida
Source: Water Resources Atlas of Florida

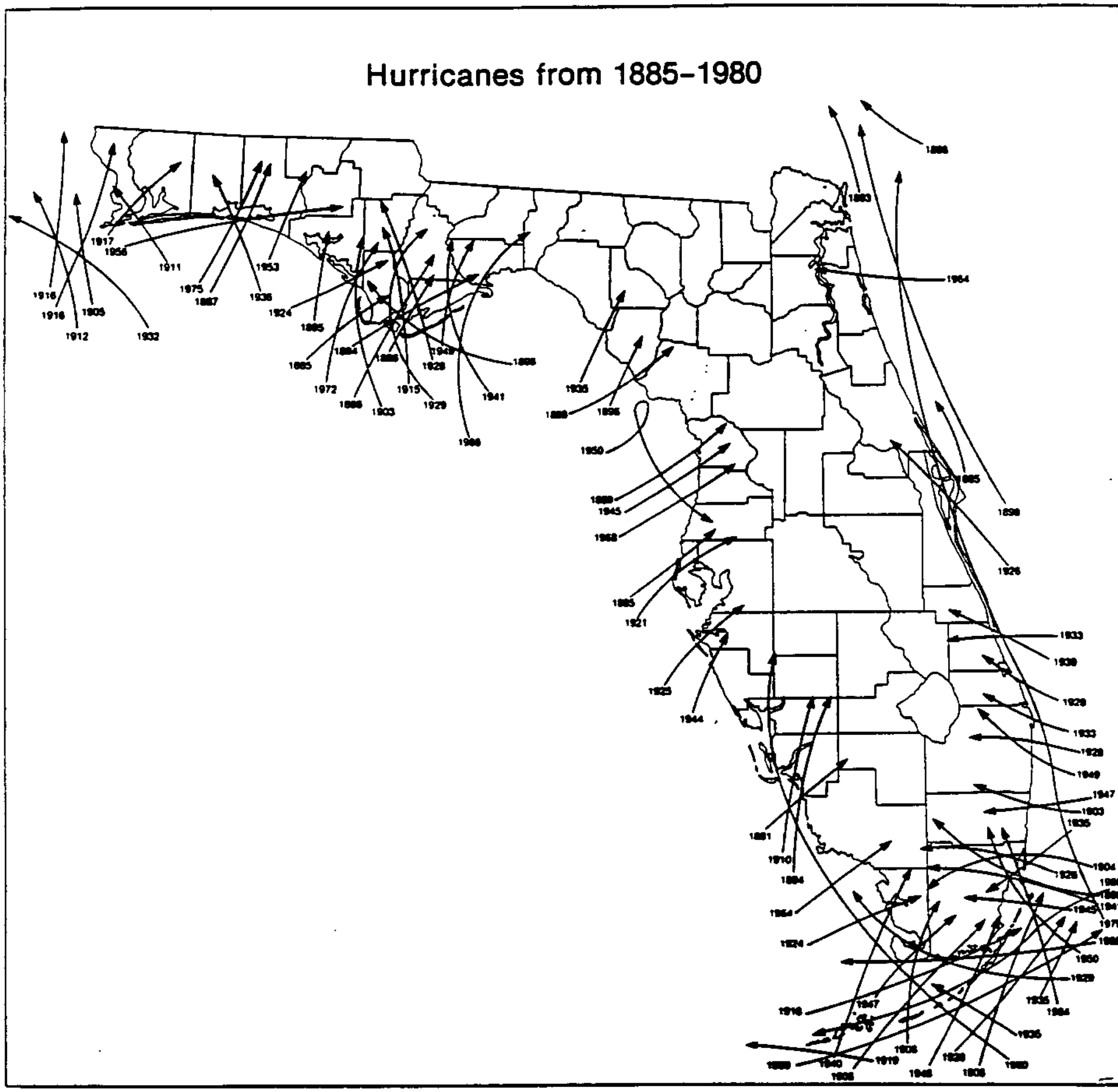

Figure 1.5 Hurricane history of Florida
Source: Water Resources Atlas of Florida

There are two reasons why this is an especially sensitive issue: the United States has the highest per capita consumption of water in the world and the American agricultural industry is heavily dependent upon irrigation for productivity. This situation engenders political battles and creates a climate in which future business and residential development is curtailed or stopped. At worst, this is accompanied by water rationing and a sharp rise in the cost of using water. Many parts of the United States are only now beginning to realize that future development may hinge upon the availability of water. It is therefore important to understand the tremendous impact on the vitality of any given location that either a shortage or degradation of the quality of water can create and along with this, begin to design and use systems which responsibly decrease the demand on fragile underground aquifers.

It has fallen to the local municipalities to have the major responsibility for introducing new measures for conserving water into the consumer marketplace. Local municipalities must supply potable water and treat waste water. It should be noted that along with an increase in the use of potable water comes an increase in the amount of waste water to be treated. Use of potable water has increased by a factor of 6 in the last ninety years, with 75% of the increase occurring in the last twenty-five years.[4] The rise in waste water treatment and purification has increasingly been a burden to local municipalities which are charged with the responsibility of keeping infrastructure functioning. The costs associated with expanding existing facilities and the construction of new treatment facilities are outpacing tax dollars in almost every case. It has become necessary to reduce the amount of potable water consumed and therefore the commensurate amount of waste water treated by creating methods by which actual use is reduced without an accompanying sharp change in consumer lifestyle.

1.3 American Water Works Association (AWWA) Guidelines

The American Water Works Association (AWWA) has outlined a policy statement regarding water use practices out of serious concern over the possibility of future water shortages and their costly effect. Their suggested approach is a combination of several demand management practices which include reclaimed water as well as voluntary customer use reductions. These guidelines are as follows:

(1) Management and efficient utilization of sources of supply;

(2) Accurate monitoring of customer consumption;

(3) Leak detection and repair and appropriate rehabilitation or replacement;

(4) Establishment of water-use-efficiency standards for new plumbing fixtures and appliances and the encouragement of conversion of existing high-water-use plumbing fixtures to more efficient designs;

(5) Encouragement of the use of efficient irrigation systems;

(6) Development and use of educational materials on water conservation;

(7) Public education and information programs promoting efficient practices;

(8) Encouragement of self-administered water conservation programs for all water users;

(9) Waste water reclamation for non-potable uses;

(10) Continued research on more efficient water use techniques and practices.

1.4 The Global Hydrological Cycle

Water exists in solid, liquid, and gaseous states. The dynamics of the ever-changing states of water are best described in the hydrological cycle. A brief examination of the cycle provides the groundwork for understanding water availability.

Approximately 97% of the entire volume of the earth's water is contained in oceans and seas. The tiny remainder is divided up among the various stages of the hydrological cycle. Not all of this small percentage is available for human use. If only the fresh water portion of this is considered, about 98% is contained in ground water. Atmospheric water accounts for only 0.001% of all water in the hydrological cycle.[2]

The global hydrological cycle is a closed system circulating water from the oceans to the atmosphere to the land and back again. It is estimated that approximately 80,000 cubic miles of water evaporate from the earth's oceans on an annual basis.[2] Upon evaporation from the oceans, water becomes vapor or clouds in the atmosphere. When weather conditions are correct for precipitation, water falls onto the land in the form of rain, sleet, snow, or hail. A small amount of precipitation evaporates before landfall or falls on the ocean.

Water flows through land systems as surface water runoff eventually reaching temporary holding systems of lakes, wetlands and rivers. Water in these systems can either evaporate back into the atmosphere, seep into underlying land strata or be carried to the ocean. Precipitation may infiltrate into the ground and percolate downward to be removed by plants and recycled into the atmosphere by evapo-transpiration. Eventually, surplus water in the ground will reach the saturation zone of the water table where it might eventually be discharged again by springs or wells. Ultimately, ground water will make its way by **surficial flow** to the oceans. This can be a long journey with the estimates of the age of ground water ranging from 20 to 30 years to tens of thousands of years.[3]

The quantitative description of the amount of water in a given location is provided by the "water budget equation" as follows:[2]

$$P_t + I_f = E_t + O_f + C_u \pm \text{delta sigma}$$

where:

P_t = precipitation

I_f = inflow from adjacent areas

E_t = water loss through evapo-transpiration from plants

O_f = outflow to other areas

C_u = consumptive use or the amount of water withdrawn from the system by human use

Delta sigma refers to any differences between the amount of water gained or lost through storage in underground or surface systems. Storage in such systems will be much greater during years of heavy rainfall compared to years of drought.

Demand for domestic water use in Florida has grown significantly making the most critical variable in the above equation. From 1950 to 1985, consumptive use has increased from 392 MGD (millions of gallons per day) to 2,332 MGD. Projected demand in the year 2,000 is expected to be 2,880 MGD. By the year 2020, demand is expected to be 3,600 MGD.[6] The total water budget for the state of Florida was approximately 176,000 MGD in 1985. Surface runoff and evapo-transpiration accounted for the loss of approximately 173,000 MGD. Consumptive use accounted for the above figure of around 2,332 MGD. That leaves approximately 668 MGD for aquifer recharge. Because the population has grown about 15% since 1985, it may be assumed the state is currently facing an annual deficit in the water budget. Based upon these figures and considering the fact than many locations in Florida are already at or near their peak operating capacity, the contribution of reclaimed water to the water budget would make a significant difference.

The Florida Department of Environmental Regulation reports the following data for the use of reclaimed water in Florida:

Table 1.5 Reclaimed water in Florida

	1986	**1990**
Total Reuse Facilities	118	214
Total Reuse Flow, MGD	206	320
Total Reuse Capacity, MGD	362	585

Source: Florida Department of Environmental Regulation (DER)

Since population and therefore water consumption is not expected to decrease in the future, balancing the water budget equation will have to occur through a decrease in actual consumption based on reuse and new water use practices such as low consumption fixtures.

1.5 Geology and Hydrology of Florida

The natural resource of Florida ground water is very sensitive to change and is unfortunately experiencing increasing demands. Florida's ground water is also especially vulnerable to contamination due to a unique geology of abundant porous limestone formations, a high water table, and thin, permeable soil cover. Florida has both high rainfall annually and great potential for salt water intrusion.

The average annual rainfall in Florida is around 54 inches per year(almost 150 billion gallons of water per day). Rainfall averages vary widely throughout the state from nearly 66 inches annually in the Panhandle to around 40 inches in the Keys. The State of Florida, surrounded by the ocean contains a little more than 7,700 recorded lakes of ten acres or more and is associated with abundant water. There are over 1,700 streams ranging in length from less than .5 to about 500 miles.[2] The abundance of Florida's surface waters makes it difficult for some people to believe that Florida actually has a water shortage problem. But the surface waters do not provide potable water supply for the vast majority of Florida's water needs.

There is more available ground water in Florida than in any other state. The Floridan aquifer which extends into parts of Georgia, Alabama, and South Carolina underlies the whole state. In addition to this, five more surficial and intermediate aquifers overlie the Floridan Aquifer. Portions of the aquifer such as those found in the Western Panhandle and Southern Florida are saline. Much of the subsurface water in the Floridan aquifer results as outflow from Georgia and Alabama. This inflow from Georgia and Alabama means that the hydrological cycle for the state of Florida alone is not a closed system as is the global cycle because Florida receives water from other states.

1.6 Water Use

The critical questions for Florida's water use practices are **where,when** and **how** water is used. It is important to know where water use is most intense because it is much more expensive to move water over long distances. Because rainfall varies greatly during the year, it is important to know when the periods of the most intense use occur. The question of how water is used is the most critical in terms of water quality issues. The intended use of water determines the necessary quality required for the use. How water is used determines how much will be lost in the system toward reuse. Also affected is the quality of water available for treatment for reuse or discharge into a natural storage receiving system.

In 1980, Florida ranked twentieth of all states in the United States in water consumed on a volumetric basis and projections suggest that by the year 2000, Florida's status will rise to the ninth position. Even more important is the amount of daily residential water consumed by the citizens of Florida which is expected to rise to fourth in the nation by the year 2000 from its 1980 position of seventh place.[2] The statistics for irrigation are also critical to understanding the types of Best Management Practices (BMP) for consumptive use of water. Florida was sixteenth is volume of water used for irrigation and ninth in irrigated acreage. IN 1975 Florida used twice as much water by volume as all the rest of the states east of the Mississippi for irrigation purposes.[5]

Water statistics are based on **withdrawal uses** but **non-withdrawal use** is especially vital to Florida. One of the most important non-withdrawal uses for water in Florida is for the dilution and dispersal of wastes. Consumptive use of water in residences for cooking and eating averages only about one gallon per day and the rest is used for washing, cleaning and removing waste. In 1980, a total of 1,361 million gallons of water per day were withdrawn, treated and distributed to 7,786,300 residents. Approximately 87% of this came from ground water sources.[5]

Counties with the highest populations used the most water. The counties of Dade, Broward, Pinellas, Hillsborough, Palm Beach, Duval, and Orange representing about 58% of the state's population used 68% of the water.[5] These counties are also the counties in which the highest degree of salt water intrusion of the underground aquifer is found.

Most of the publicly supplied water in Florida supplies residential units. The following Table depicts uses of water by percentage:

Table 1.6 Use of publicly supplied water, Florida

Type of Use	**Percent**
Residential	82
Industrial	6
Commercial	9
Agriculture	<1

Source: Water Resources Atlas of Florida

Many categories of use are not publicly supplied but self supplied. This is significant for two reasons: most of the self supplied water becomes waste water to be treated by the public entity and the overall use of fresh water depletes the quantity available no matter which entity supplies it. Categories of self supplied use include: rural (residential and commercial), industrial, and agricultural.

The following amounts of self supplied water were reported in 1980:[2]

Table 1.7 Self-supplied water use in Florida, 1980

Type	**Amount, MGD**
Rural	310
Industrial	781
Agriculture	3,000

Source: Water Resources Atlas of Florida

Of the above categories of use, almost all of the rural use emanated from ground water compared with 82% of the industrial use and 53% of the agricultural use. Additionally, 52% of the agricultural use was lost to the fresh water system. It is interesting to note that agricultural use of water was higher than all that was withdrawn from the public water supply.

1.7 Conclusion

Water for direct human needs in Florida has been increasing at the rate of over 50 mgd as a result of the growth of the state's population. There has also been an increase in amenities consuming water including residential amenities such as swimming pools and external amentities such as golf courses. Industrial and irrigation uses are expected to continue to be high in the future. Exacerbating this problem is the fact that the greatest use of water occurs in areas that are the most intensively paved or drained and water use tends to be heaviest in the driest seasons when recharge from precipitation is at a minimum. Other states such as Nevada an California that have experienced severe water shortages have turned to alternate methods of providing water for basic human needs and water conservation measures (Table 1.8).

Table 1.8 Potential savings, simple conservation measures

Activity	Share of total water use, %	Without conservation (thousands of gal/person)	With conservation	Savings %
Toilet flushing	38	34.5	16.4	52
Bathing	31	27.6	21.8	21
Laundry/ dishes	20	18.0	13.1	27
Drinking/ cooking	6	5.5	5.5	0
Brushing teeth, misc.	5	4.1	3.7	10
Total	**100**	**89.7**	60.5	**33**

Source: U.S. Environmental Protection Agency, Flow Reduction: Methods, Analysis, Procedures, Examples, 1981

The most successful programs have involved the reclamation of water for various non-potable uses. A description of the methods and systems used to reclaim water is given in the following chapter.

1.8 Definitions

Withdrawal Use refers to water taken from its source and used in some kind of manmade system before being released again.

Non-withdrawal Use water used to sustain plant and animal life, provide transportation, propagate aquatic wildlife, and for hydroelectric generation. Note: Water used for cooling in thermoelectric generation is considered a withdrawal use.

Surficial Flow means water which moves underground in a lateral direction at the top portion of the aquifer just at the water table line.

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CHAPTER 2
RECLAIMED WATER AND WATER CONSERVATION CONCEPTS

2.0 Introduction

There are a number of basic definitions and systems that are requisite to the understanding of reclaimed water systems. Terms such as gray water and black water are concepts that describe the level of water treatment that has occurred and the potential uses for the effluent from a wastewater treatment plant.

Reclaimed water, as described in this report, basically refers to systems that utilize the discharge from municipal wastewater treatment plants for a number of water intensive applications such as agricultural irrigation, golf course irrigation, domestic irrigation purposes, cooling tower makeup, and several other uses. The concept here is that rather than eject the water into a nearby bay, stream, or river, the water can be put back into the local water system for use. The reclaimed water system will have several components: piping from the wastewater treatment plant to the user, storage tanks, controls and piping at the user's site. Special coding of the piping is usually required to prevent accidental cross-connection of reclaimed water and potable water.

Not all reclaimed water systems are large regional ones. Systems can be designed for a single structure, reclaiming and recycling the wastewater for other internal building uses. Industrial plants or packing plants can also use a water reclamation system to reuse water and save by not having to purchase as large a quantity of municipal water.

The use of reclaimed water for non-potable applications is the primary focus of some municipal programs under pressure to conserve water use and extend the life of water and waste water infrastructure. Third main systems have been in use for some time now in Florida and California and the considerations for their use are well understood and established. The American Water Works Association (AWWA) has studied the problems accompanying the implementation of reclaimed water systems and published a list of suggested guidelines for the use of reclaimed water.

Reclaimed water systems have proved most successful in recycling **gray water** for non-potable uses. However, there are some locations in the coastal sections of California that are evaluating both the reclamation of black water for non-potable uses and the reclamation of gray water for potable uses due to increasing pressures on the capacity of their waste water treatment infrastructure and the increasing level of regulation by the Environmental Protection Agency (EPA) of disposal of waste water.

In addition to reclaimed water systems this chapter will also cover concepts related to reducing water consumption through the use of low water demand fixtures. These are important components of an overall water conservation strategy and laws and codes requiring their use are becoming more prevalent with each passing year.

2.1 Gray Water

Reclaimed water in use at the present time comes mainly from the treatment of residential **gray water**. Gray water describes water that has been used and is essentially the wastewater from fixtures such as bathroom basins, tubs, showers, laundry rooms and kitchen sinks. The water from kitchen sinks is the least desirable because it frequently contains oils, fats and greases making it difficult to filter and a breeding ground for bacteria.

Gray water systems technology is not new. The technology was first used in areas where water was scarce and involved little treatment because the reuse was relegated primarily to water closets and urinals. The only treatment as such resulted from the settlement of solids in the gray water storage tank prior to redistribution. There was another benefit in that the sewage subsequently collected was more concentrated and therefore more efficiently treated.

2.1.1 Types of Gray Water Systems

There are basically two types of gray water systems. One type (Type A) is composed of two water supplies and two drainage lines. This dual main system supplies potable water to lavatories and bathtubs and non-potable water to water closets. The dual drainage lines provide one drainage route for gray water from bathtubs and lavatories and one drainage route for **"black" waste** from water closets and requires a facility which gives limited treatment for a portion of the waste water flow.

The second system (Type B) also utilizes a dual water supply network but contains a single waste collection system/ requiring a significantly greater treatment of waste water to a larger volume of liquid. Benefits include lower cost of piping installation and the ability to reuse the **effluent** for a greater number of uses. Figures 2.1 and 2.2 show diagrams of the two basic systems.

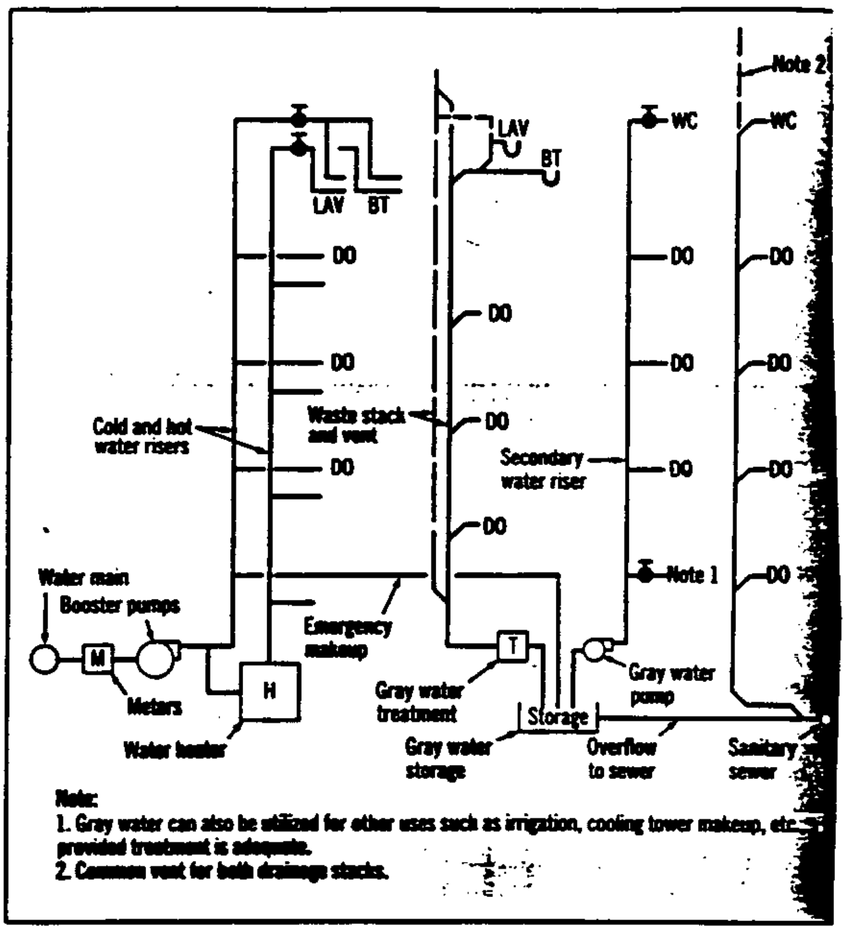

Figure 2.1 Type A Gray Water System Supply/Drainage Piping Arrangement

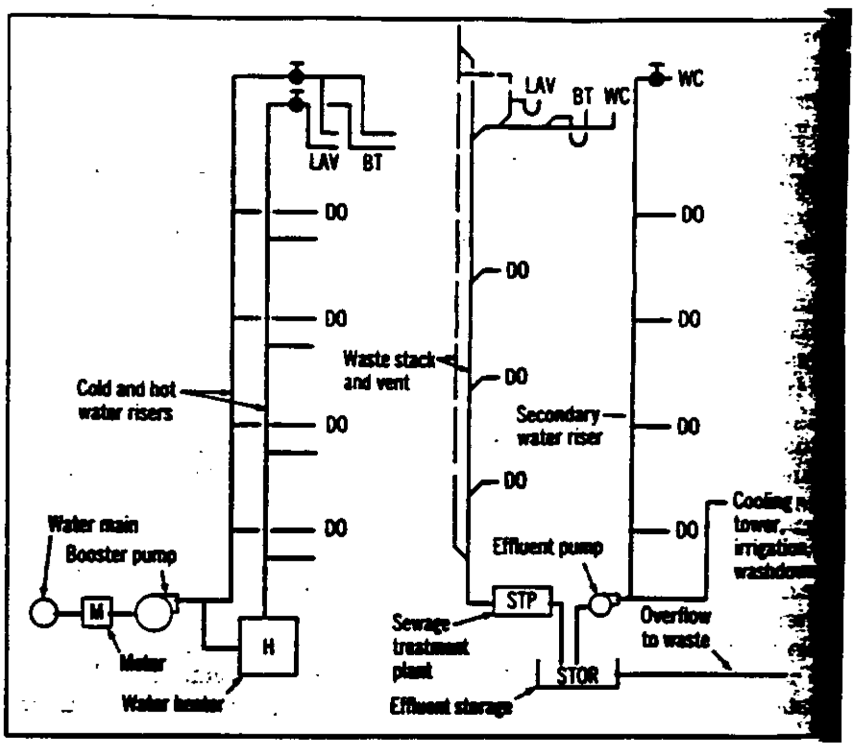

Figure 2.2 Type B Gray Water System Supply/Drainage Piping Arrangement

Table 2.1 on the following page compares the two types of gray water systems in terms of requirements and benefits for an example of a single structure (250 room resort hotel).

Table 2.1 Comparison of gray water system alternatives

System	Piping	Treatment	Potential Gray Water Uses	Water Savings	Sewage Savings
Conventional	Base	None	N/A	0	0
Type A	Separate gray water riser/ separate WC stack	Filtration Chlorination Color	Water Closets	10,000 GPD 17% * 22% **	20,000 GPD 26%
Type B	Separate gray water riser/ separate WC	Chemical Filtration Chlorination Color	Water Closets Cooling Towers Irrigation	35,000 GPD 38% * 30% **	35,000 GPD 46%

* Without Irrigation
** With Irrigation

Source: Heating/Piping/Air Conditioning, Jan 1987, p.106

2.1.2 Commercial Use of Reclaimed Water

The Irvine Ranch Water District (IRWD) located in Orange County, California has successfully used reclaimed water in high rise buildings. Through preliminary feasibility studies, the IRWD determined that approximately 70 - 90% of the water used inside such a building is used for flushing toilets and urinals and that 80% of the total water used for this type of building including landscape irrigation could be reclaimed water.

The Irvine Water District found the factors that make the use of third pipe systems feasible in commercial applications to be:

(1) **Use in buildings which are six stories or more in height**
These buildings tend to have both a large water demand and central utility placement design.

(2) **Large point loads**
The average base allocation of water for a light industrial or

standard office commercial building is 2,400 gallons per acre per day in the IRWD. However, high rise buildings in the six to sixteen story range frequently exceed the allocation. The IRWD attempts to make up for this discrepancy by using a high rise surcharge for large demand. This does not enable the system to operate more efficiently or to meet supply during peak load periods. And because infrastructure is installed before buildings are in place, the cost of enlarging systems or building new ones is not met. Therefore, high rise buildings which use 80% less water are thought to be the most effective way to increase the life of the infrastructure and keep down costs.

(3) **Central utility cores**
In a high rise building of Type 1 as described by the Uniform Building Code, utilities are all placed in the center. This allows all of the reclaimed water fixtures to be supplied by a central common riser while separating the potable water supply from the non-potable supply. Risers can be placed on either side of the core to aid in the prevention of cross connections.

(4) **Primarily occupied by adults**
Because the user of reclaimed water for non-potable uses is required to be aware at all times of the danger of ingestion, a building which is primarily occupied by adults is desirable so that warning signs and user directions may be facilitated.

(5) **Controlled access to plumbing**
Accidental cross connections occur most frequently where the user is uneducated in the use of the system and where there is unlimited access to users who might not be familiar with the system. In high rise buildings, the plumbing is not accessible to the general building user as it is placed behind walls and locked compartments.

(6) **Designated maintenance staff**
Normally, high rise buildings have maintenance staffs with adequate supervision to make all repairs and facilitate cleaning. This represents a single point of control of the system by staff and inspectors from the local municipality. An educated maintenance staff greatly reduces the possibility of accidental tapping.

2.2 Treatment

The central feature of any gray water system is the treatment equipment that conditions recovered water to the extent that it may be reused in either Type A or Type B systems. The idea is to condition the water to the degree of quality required for the intended reuse. This varies with both use and source of effluent. The simplest system involves filtration of waste water followed by chlorination. Sometimes the source water contains such a high amount of detergents that foaming becomes a problem and a defoaming agent must be used.

The level of treatment may be improved by the use of a **coagulation/filtration** process instead of a simple filtration process. Addition of **coagulant/flocculent** to the process makes the water suitable for additional applications such as irrigation and cooling towers. A Type B system requires a complete **tertiary treatment** plant. A biological treatment plant with chemical treatment, filtration and /or carbon adsorption must be used due to the high amount of biological oxygen demand and chemical oxygen demand from the presence of fecal matter. Water from this basic method of treatment can be used for virtually any non-potable use.

2.3 Problems and Considerations for Use of Reclaimed Water

The following is an outline of some of the problems associated with the use of reclaimed water as well as potential mitigation techniques:

(1) **Problem: The treatment process must be specifically for the intended use.** For example, reclaimed water used for cooling tower applications must be relatively free from organic material and other solids as the presence of these elements will affect **blowdown** rates, promote scaling of pipes, and foul valves and equipment. If the water is to be used for irrigation purposes, a much higher

amount of organic material can be tolerated and is beneficial in some instances.

(2) **Problem: Greater care must be taken in the design, installation and use of the system.** The possibility of accidental taps into gray water systems is a dangerous consequence that must be prevented.

Solution: A blue vegetable dye may be added to reclaimed water in order to color it. This has the additional benefit of making the water more aesthetically pleasing (reclaimed water is rarely colorless) while more importantly preventing accidental use as potable water.

(3) **Problem: Cross connection control is vital.** Piping must be more carefully identified and outlets labeled as non-potable.

Solution: All new buried lines distributing non-potable reclaimed water should be adequately marked. The AWWA recommends that marking be colored purple and suggests the use of Pantone 522 TM with additional embossing or stamping of warnings. All pipe should be wrapped with colored tape and warning signs placed at all meters, valves, and fixtures.

(4) **Problem: User education is imperative.**

Solution: Permits must be more carefully regulated and accompanied by required education. Most active programs using reclaimed water for non-potable uses require the users to complete a short course which clearly outlines the use of the system. In residential areas, if the unit changes owners, the new owner is required to complete the course to get permitted.

(5) **Problem: Failure to maintain adequate pressure at the user's meter could result in a breakdown of the system or backflow.** This problem usually occurs when peak hour usage is inadequately estimated and designed for.

Solution: The AWWA recommends that a minimum pressure of 10 psi or greater be maintained with the potable water supply having the higher pressure.

(6) **Problem: Storage facilities are necessary.** Many uses for reclaimed water (such as irrigation) are seasonal in nature.

Solution: In addition to operational storage, facilities are needed for seasonal storage due to the fact that waste water treatment is a continuous process while seasonal applications for reclaimed water are intermittent.

(7) Problem: If open reservoirs are utilized for seasonal storage, algal growth and suspended solids may clog sprinkler heads because most sprinkler heads may pass particles in the range of less than 600 microns (30 mesh screen).

Solution: Irrigation water which enters into the irrigation system should first be filtered through a process similar to the one utilized in the reclamation plant. As a minimum, it is recommended that water be screened through a 200 mesh screen. Additionally, algal growth may be minimized by the covering of the detention reservoir at low level times or by chemical amendment. Operational storage facilities should be sized one and one-half times to twice that of the average summer day demand volume.

(8) Problem: Initial cost is too high for private owners. Owners express concern about the cost of additional piping for buildings as not being cost-effective and requiring an initial investment which is unacceptable.

Solution: Costs for owners may be offset by the municipality by pricing structures designed to encourage acceptance for the use of reclaimed water. For owners of commercial buildings with large water demands, there is frequently a surcharge placed by the municipality for large demand. Owners can recoup cost by having this surcharge eliminated by the municipality. Also, the difference in charge for potable water compared with that for reclaimed water lowers water costs for the owner.

(9) Problem: Reclaimed water emanating from full to near capacity holding reservoirs can be discolored and have unpleasant odors. During drought months, it is advisable to hold water in storage at near capacity. When rainfall comes unexpectedly in large amounts under this condition, water coming directly from the reclamation plant can be discolored and contain residual chlorine levels of up to 10 ppm. If some reclaimed water emanates from natural systems (lake water), musty odors and discoloration can occur.

Solution: Installation of a granulated activated charcoal filter (GAC) system improves color and odor. GAC filters are capable of reducing the color units down to an acceptable level of approximately 8 units (similar to that of domestic water).

2.4 Other Important Recommendations for Reclaimed Water Systems

The American Water Works Association has the following additional recommendations for the health, safety and welfare of the public regarding the implementation and use of reclaimed water from third main systems:

(1) The minimum depth for the top of the pipe should be not less than 36 inches below finished street grade.

(2) Special provisions should be made for pumping facilities distributing non-potable water to identify the type of water handled, provide backflow protection, provide for appropriate drainage of packing seal water, and prevent the release of non-potable water in an uncontrolled manner.

(3) The minimum separation between non-potable water lines and potable water lines should be no less than ten feet horizontally. Vertical separation should be at least one foot. Potable water lines should be higher than non-potable.

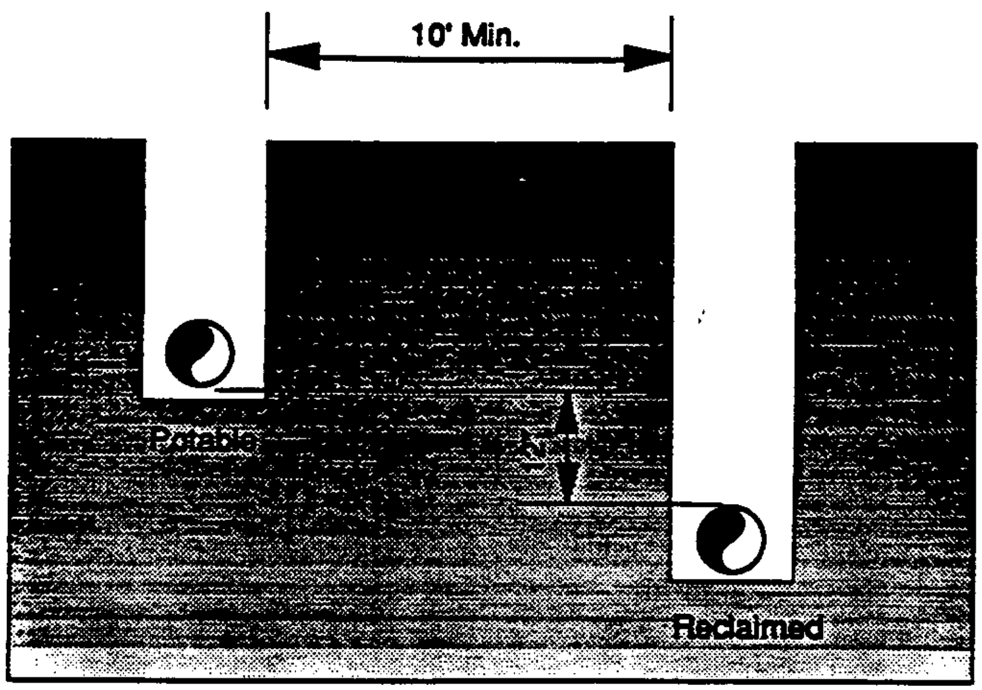

Figure 2.3 Minimum Separation Distances

(4) When using potable water as seal water for non-potable water pumps, seals should be adequately protected from backflow.

(5) To prevent damages such as broken pipes resulting from water hammer and pressure surges, all pumping systems should have appropriate surge protection.

(6) Strainers are required at the point of connection and\or user's meter. These may be installed either before or after the meter and are generally the same size as the line. Types of strainers include: wye strainers (not recommended for below ground installation, basket strainers (suitable for both above and below round), and filter strainers (normally used for drip irrigation above ground). Strainers of 20 to 80 mesh are adequate.

(7) An approved air gap must be provided to protect the potable water system if a connection between potable and non-potable water is necessary.

(8) If non-potable water is used for irrigation, the water should not be applied at a rate exceeding the infiltration rate of the soil to prevent runoff.

The problem of potential cross connections within the system has been further addressed by the Irvine Ranch Water District standards. Some additional guidelines taken from their standards are as follows:

(1) Risers and headers are constructed of Type 1 copper, with the domestic and reclaimed water risers on opposite sides of the utility core.

(2) All piping is wrapped with purple marking tape.

(3) All valves are locking ball, lever valves. All valves are sealed with IRWD seals after initial start-up.

(4) All control valve access panels are equipped with warning signs, supplied by IRWD and sealed after initial start-up.

(5) All valves, pumps, and appurtenances are painted purple.

(6) All restrooms and equipment rooms are equipped with information signs.

2.5 Uses of Non-potable Water

The following list contains some of the different kinds of applications for which non-potable water could be used:

(1) **Irrigation:** agricultural watering, spraying residential lawn and garden watering, golf course watering, park watering, botanical garden watering, spraying commercial nurseries

(2) **Construction water:** soil compaction, dust control, equipment washing

(3) **Industrial processing water**

(4) **Recreational impoundment**

(5) **Fire protection:** hydrant and sprinkler systems

(6) **Street cleaning**

(7) **Car washes**

(8) **Residential car and house washing**

(9) **Residential toilet flushing**

(10) **Ornamental ponds, waterfalls, streams**

(11) **Restoring and creating wetlands**

(12) **Cleaning airplanes, trucks, railroad cars**

(13) **Cooling rocket launch pads**

(14) **Industrial cooling**

(15) **Air conditioning cooling towers**

(16) **Boiler feed**

(17) **Paper manufacturing**

(18) **Concrete production**

(19) **Gas stack scrubbing**

(20) **Industrial floor washing**

(21) **Building washing**

(22) **Commercial toilet and urinal flushing**

2.6 Impacts of Low Consumption Fixtures on Municipal Systems

There are a variety of programs in the United States for which the emphasis has been the lowering of residential consumptive use of water by the use of low consumption fixtures. There are programs in which existing plumbing fixtures are retro-fitted and ones which are oriented toward new construction only. These programs have been successful because they are cost-effective, results are immediate and permanent and they enjoy a high degree of consumer approval.

Advantages of a low consumptive use fixtures program to a local municipality include the following:

(1) Extension of the useful life of the infrastructure:
Since treatment plant operating costs are directly proportional to the amount of effluent to be treated, costs are lowered through the utilization of low consumptive use fixtures.

(2) Lowering of operating costs:
Treatment plants are able to operate more efficiently when the effluent is more concentrated.

(3) Reduction in sanitary sewer flows:
Use of low consumptive toilets has shown that a reduction of sanitary sewer flows of approximately 9 % is possible in residential programs.

(4) Smaller septic drain fields:
The reduction of sanitary sewer flows results in smaller drain fields for septic tanks in both residential and recreational (golf courses) applications. There is also an added benefit of a reduction in the possibility of ground water contamination from overloaded drain fields.

There has been some concern expressed by local municipalities that the use of low consumptive fixtures would impair proper sewage transport. It has been feared that low hydraulic loads would lead to the clogging of sanitary sewer lines. However, this has not been the case. A housing development in Phoenix, Arizona utilizing low consumptive fixtures in residential applications was compared with a similar development using standard fixtures. It was found that lowering hydraulic loads caused no negative impact upon the system. In fact, average monthly water use was reduced by approximately 23% by the use of 1.5 gallon flush toilets compared with the other development using standard 4.5 gallon flush toilets. An equivalent reduction in waste water flows was also reported.

Another program in South Brevard County, Florida in which 20,000 residences and businesses participated saved 14 gallons per day per unit resulting in an overall savings of 1,610,000 gallons. This translated into an additional 5,300 new connections to the existing system without expansion. This program, begun in 1986 and entitled "The Water Wise Home Program", offered a free water audit, free installation of toilet tank dams and aerators for showerheads and faucets where the flow exceeded 3 gallons per minute.

The following tables show the progress in the adoption of local programs employing low consumption fixtures in the United States since 1988. More than eight states have passed legislation or amended their existing plumbing codes to accommodate the use of low-volume showerheads, faucets, urinals, and toilets. Table 2.2 lists these states along with their implementation dates.

Table 2.2 States that have low-consumption plumbing product regulations

State	Effective Date	Water Closets*	Urinals*	Shower-heads**	Lavatory faucets**	Kitchen faucets**
CA	1/1/92	1.6	1.0	2.75	2.0	2.5
CO	1/1/90				2.5	2.5
CT	10/1/90		1.0	2.5	2.5	2.5
	1/1/92	1.6				
GA	7/1/91	1.6	1.0	2.5	2.0	2.5
MA	3/2/89	1.6!		3.0		
	9/91	1.6!!				
NY	1/26/88		1.0			
	1/1/91				2.0	
	1/1/92	1.6				
RI	9/1/90	1.6!				
	3/1/91	1.6!!				
WA	7/1/93	1.6	11.0	2.5	2.5	2.5

* gallons/flush
** gallons/min
! 2-piece
!! all others (1-piece, back outlet, handicap toilets)

Source: Residential Water Conservation: A Review of Products, Processes, and Practices, Research Division, CMHC, Ottawa, Canada, p. 41

At the present time, there are six states that are in the process of adopting laws which would require the use of water conserving fixtures and practices. In addition, the proposed National Plumbing Products Efficiency Act, a bill recently introduced into U. S. Congress, requires the use of low consumption fixtures and products on a nationwide basis. Table 2.3 lists the states that are presently considering the adoption of water conserving methods and plumbing products.

Table 2.3 States wwith Low-consumption plumbing product regulations in progress

State	Effective Date	Water Closets*	Urinals*	Shower-heads**	Lavatory faucets**	Kitchen faucets**	
AZ	1/1/92	1.6	1.0				
	1/1/93				2.2	2.5	
DE	1/1/91	1.6				2.5	2.5
NJ	7/1/91	1.6					
PA	1992	1.6		2.5	2.0	2.5	
TX	9/1/92	1.6	1.0	2.75			
OR	7/1/92!	1.6	1.0	2.5	2.0	2.5	
	7/1/93!!	1.6	1.0	2.5	2.0		

* gallons/flush
** gallons/min
! 2-piece
!! all others (1-piece, back outlet, handicap toilets)

Source: **Residential Water Conservation: A Review of Products, Processes, and Practices, Research Division, CMHC, Ottawa, Canada, p. 41**

2.7 Fixtures and Products For Low Consumptive Water Use

There are currently a variety of products available on the market designed for water conservation. Since the United States has the highest per capita use of water of any country in the world, the variety of uses for water is not expected to drastically decrease as these represent habits which have developed over time as a result of prosperity and the perceived unlimited supply of water. The use of reclaimed water along with the employment of water saving fixtures will be more easily accepted by the public. Water use in a typical residential application is distributed as follows:

toilets	**40%**
showers and baths	**35%**
laundry and dishes	**20%**
cooking and drinking	**05%**

Efficiency of water use has not previously been the hallmark of fixture design. For example, the ratio of water to waste in a conventional flush toilet is 80 to 1. It has been estimated that with the use of low cost, low water use fixtures, the amount to water used in typical residential applications can be reduced by 19 to 44 per cent.

Table 2.4 shows the average water savings for new residential construction using low consumption fixtures.

Table 2.4 Water Saving Devices for New Construction

Application	Water-Saving Device	Function	Water Savings	Estimated Unit Water Savings L/d per capita
Toilet	Low-flush toilet 13 litres per flush	Reduce flush volume	8 L/flush (2 gal/flush)	30.3 (8.0)
Toilet	Low-flush toilet 6 litres per flush	Reduce flush volume	15 L/flush (4 gal/flush)	60.6 (16.0)
Shower	Low-flow shower 10.4 litres per min.	Reduce shower-flow rate	5.7 L/min (1.5 gpm)	27.3 (7.2)
Faucet	Aerator	Reduce faucet-flow rate	—	1.9 (0.5)
Appliances	Water-efficient dishwasher	Reduce water requirement	19 L/load (5 gal/load)	3.8 (1.0)
Appliances	Water-efficient clotheswasher	Reduce water requirement	23 L/load (6 gal/load)	6.4 (1.7)
Hot-Water System	See text	Reduce hot water use	—	—

The following is a brief discussion of water saving devices currently on the market.

(1) Toilets: A conventional toilet uses about 4.5 gallons per flush. These may be retrofitted to reduce volume by as much as one half. New water saving toilets can reduce water use by as much as 75%. Since toilet use of water accounts for approximately 40 % of residential water use, this can be a significant saving. Toilet retrofits include the displacement devices, toilet tank dams, and alternative flush devices (AFD). Retrofit devices displace or reduce the amount of water without changing the head pressure (pre-flush water level. **Toilet dams** prevent excess water from exiting with the flush. As much as two dams may be installed per tank with one dam holding back one gallon.

(2) Alternative flush devices: Fasten onto the overflow pipe in the tank to limit the height the flapper may rise, reducing the amount of water used with each flush by as much as 50%. Retrofitting poses the potential problem that the user will flush twice if there is not sufficient water to move the effluent. Retrofitted devices such as toilet tank dams can be modified to change the flow to the appropriate amount. New installation of water efficient toilets represent the best method for conserving water because they are tamper-proof. Domestic water use can be reduced by thirty per cent. These fixtures feature redesigned bowls and tanks and use 3.5 gallons per flush.

Another category of water efficient toilet is the low volume toilet using 1.3 gallons per flush. This is in compliance with the National Plumbing Efficiency Act now before congress which would mandate all new construction have such fixtures.

(3) **Showerheads:** Flow rates of up to 4.5 gallons per minute are characteristic of conventionally engineered showerheads whereas low-flow showerheads use 1.5 to 2.5 gallons per minute and do not lower consumer preference in terms of acceptable performance. Low-flow showerheads are either aerated or non-aerated. Non aerated showerheads pulse the water while aerated showerheads mix air with water simultaneously maintaining pressure.

It has been reported that a 16.4 % decrease in water use occurred in a pilot program with the use of low-flow shower heads in a residential development in Amherst, Massachusetts. In a Canadian study, it was found that using low-flow heads in a 719 unit apartment building reduced water use by 53%.

(4) **Faucets:** Low-flow faucet aerators can reduce the water flow of the average kitchen or bathroom faucet's conventional rate of 3 gallons per minute by 50 % or more.

(5) **Appliances:** Appliances such as washing machines and dishwashers can use more than 26 gallons per month depending upon use. At the present time, there are not a great variety of water saving machines available. Front loading washers, common in Europe, use up to one third less water than top loading models favored by Americans.

(6) **Pressure Reducing Valves:** Maintaining adequate water pressure for residential areas is important for efficiency in the system but frequently water pressure is higher than is normally required. A pressure of between 50 to 60 psi for the mains and 40 psi inside a residential unit is appropriate but it is not unusual to find pressures twice this occurring. This wastes water at sinks and showers. One method for conserving water in the installation of a pressure reduction valve in the main water line.

2.8 Conclusion

Third main systems have been in use for the distribution of reclaimed gray water for non-potable applications for some time now. The technology is available for the treatment and distribution of reclaimed water. There are three important considerations for the implementation of a third main system:

(1) The uses for the reclaimed non-potable water must be determined first in order to understand the specific treatment and storage necessary.

(2) The education and certification of the user is imperative.

(3) Extra precaution must be undertaken to insure separation of the potable and non-potable systems.

2.8 Definitions

Black water or waste: water that has come from a sanitary sewer line.

Coagulation/filtration: a process by which clustered particles are removed from effluent by means of filters or screens.

Coagulant/flocculent: individual particles which have come together to form a cluster (coagulant) containing fine particles which are in suspension in water coagulant (flocculent).

Cross connection: an unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur should be considered to be cross connections.

Effluent: the outflow from a body of water such as a stream or that from a first use of potable water which renders that water as waste. Effluent from sewage is categorized degree of treatment. For example, primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method.

Gray water: waste water other than toilet and or urinal wastes.

Reclaimed water: water which, as a result of treatment of domestic waste water, is suitable for director beneficial use or a controlled use that would not otherwise occur.

Reclamation Plant: an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

Tertiary Treatment: advanced, third stage water treatment, usually with chemicals, primarily to remove nitrogen and phosphates from the effluent stream.

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CHAPTER 3

WATER RECLAMATION SYSTEMS AND APPLICATIONS

3.0 Introduction

The diminishing potable water supply throughout Florida has sent state and local authorities seeking alternative methods to reduce potable demand and increase supply. As mentioned throughout previous chapters, Florida has experienced growing irrigation demands, periods of drought, groundwater contamination, and infrastructure inefficiencies. However, the greatest burden on the potable supply rests with Florida's escalating population, which has been growing at nearly 600 people per day. Figures 3.1.1 and 3.1.2 represent the relationship between the domestic water demand in Florida and population growth.

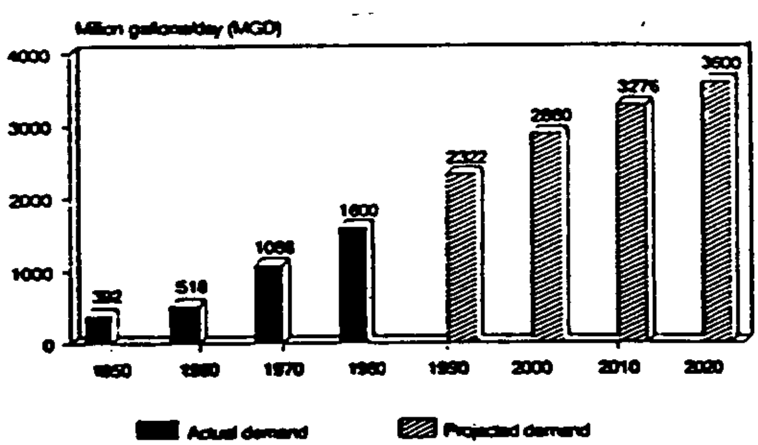


Figure 3.1.1 Domestic water demand in Florida

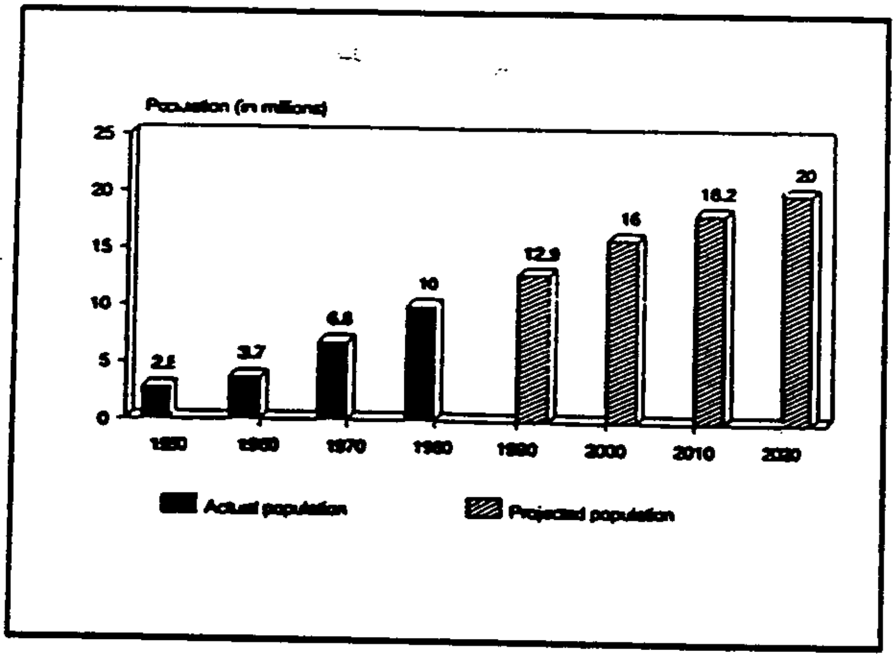


Figure 3.1.2 Florida population growth

Public perception traditionally considers water to be an "infinite resource". However, research has concluded that the underground water supply in Florida's aquifer system has been drastically depleted. When fresh water is removed, the much denser salt water surrounding the aquifer fills the displacement. It is estimated that for every foot of fresh water removed, forty feet of salt water intrusion occurs. Another critical development in the depletion of potable water is surface and groundwater contamination. Wastewater effluent has often returned to the environment in a hazardous conditions, polluting ecologically sound areas and destroying potential sources of potable water. Therefore, the days of considering water as a self-renewing resource are over.

Public reuse of wastewater and the release of exhausted effluent safely into the environment has proven the most effective method for reducing potable contamination and demand. Arid and semi arid regions around the country have employed reclaimed water to reduce the demand on a very limited supply. Figure 3.2 illustrates the distribution of effluent reuse in such climates. Although Florida is not usually considered an arid climate, it is nevertheless confronted with several of the water critical issues encountered in such regions.

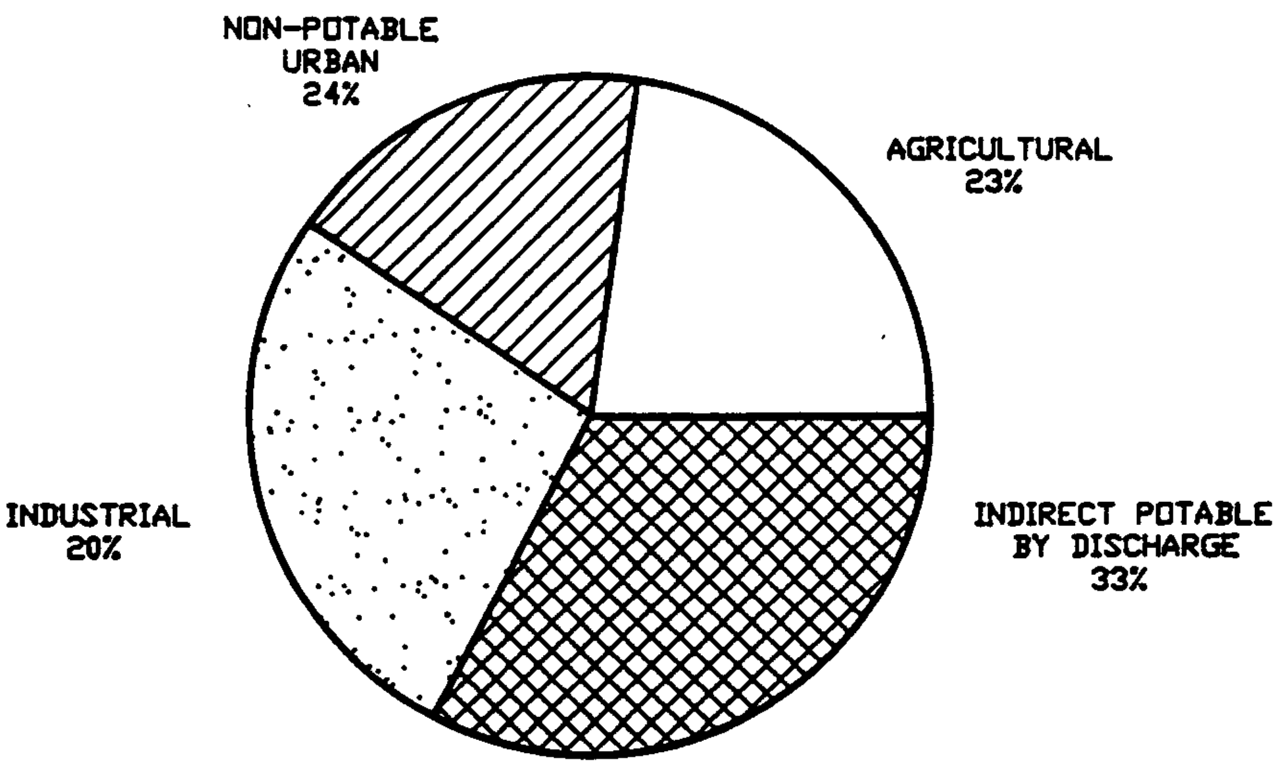


Figure 3.2 Reuse distribution in arid and semi-arid regions

3.1 Reclaimed water classification and value

Reclaimed water applications can be classified as follows:

(1) Agricultural Use: wastewater that receives primary and secondary treatment for irrigation purposes.

(2) Non-Potable Urban: the use of grey water in third-pipe systems for landscape and park irrigation, dual distribution, ornamental, and recreational impoundments.

(3) Industrial: involves the use of pH balanced grey water for uses in mechanical and industrial cooling equipment.

(4) Direct Potable Discharge: involves the use of highly disinfected reclaimed water for either direct injection or percolation into the ground water supply.

Chapter 3 will examine the complete "reclamation cycle", including the collection and treatment of wastewater, the practical uses of reclaimed effluent, and its subsequent re-collection and disposal. A secondary study will concentrate on the analysis of innovative reclamation systems used in the state of Florida. Additionally, the many ecologically and economically feasible options of reclaimed water usage will be explored. The goal of this chapter is to provide insight into the conservation and the environmental management of Florida's water resources. In achieving this goal, the primary focus is drawn toward the reuse of wastewater with an additional emphasis on potable and non-potable conservation techniques to:

(1) Reduce the amount of pollutants entering into the environment by way of rivers, lakes, and aquifers.

(2) Reduce the demand and dependency on potable water reserves within Florida's diminishing underground water supply (overdrawn water has resulted in a loss of head pressure, saltwater intrusion, and ground failure).

(3) Provide the community with an environmentally cohesive and economically life-cycled alternative.

The average American may use up to 100 gallons of potable water in the course of a day. The cost of those 100 gallons to the ecosystem mounts, even if the cost to the user is very little. This fact, coupled with fragile and limited water resources throughout Florida, have become the engineers's latest design challenge. Although the concept of reclaimed water to lessen demand is not new, the full-scale implementation required to make this system effective is. The Florida Department of Environmental Regulation has set a goal of 40% reuse of the state's total wastewater flow. In the most densely populated areas of the state, the South Florida Water Management District (SWFMD) has indicated a need for 100% reuse within the next 30 years. A few of the benefits full scale reclamation can provide include:

(1) Conservation of existing potable water supplies.

(2) Extension of potable water supply production.

(3) Enhancement of overall water supply reliability.

(4) Replacement of wastewater treatment and disposal.

(5) Conservation of energy to produce reclaimed water.

(6) Utilization of otherwise wasted nutrients.

(7) Reduction in receiving water loading pollution.

Reclaimed water has its greatest economical value when its level of treatment is limited to its intended use. To treat reclaimed water well beyond established safety standards could make recycled effluent more expensive than potable drinking water, thereby reducing its practicality. To become a viable alternative, reclaimed effluent must offer economic incentives to justify the added cost of **dual distribution** or third-main piping. To serve this requirement, municipal reclamation plants must limit the treatment of water to suit its reclaimed use. The sample flow chart below (Figure 3.3) provides municipal planners general treatment requirements for three common wastewater applications: agricultural and landscape irrigation, as well as groundwater recharge. Diagrams such as Figure 3.3 are easily understood, and are commonly employed to bridge communication barriers between technical entities municipal administrators.

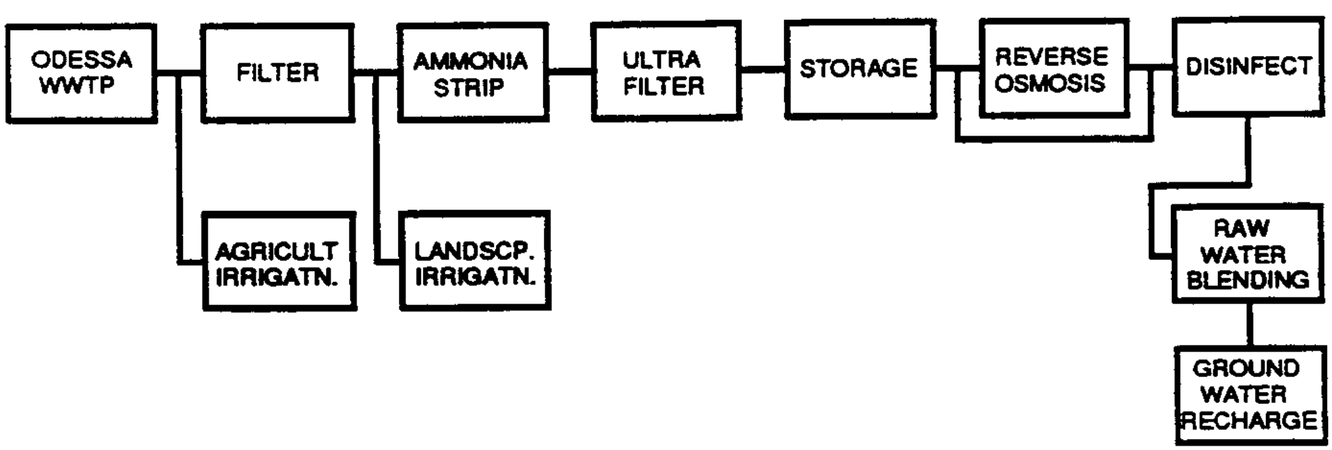


Figure 3.3 Wastewater treatment for intended use (Odessa, Texas)

3.2 Reclaimed Water Systems

Reclaimed water by definition "is water, as a result of treatment of waste, that is suitable for a direct beneficial use or a controlled use that otherwise would not occur". The primary focus for developing reclaimed water is to find alternative sources of non-potable use such as toilet flushing and irrigation, as well as the indirect potable use of ground water recharge. Potable use of reclaimed waste effluent has been addressed and even proven effective by reclamation efforts in Denver, Colorado. Although this reclaimed waste effluent was treated above most drinking standards, cost, negative public perception, and liabilities associated with direct potable use warranted the abandonment of the program. However, activities requiring potable water such as drinking and cooking, comprise only about 5% of the total potable water usage per capita. This criteria alone makes direct potable use of reclaimed water environmentally inconsequential and economically inefficient.

As stated previously, the growing environmental concern over wastewater disposal and increasing potable demand has motivated municipalities to enhance their reclamation infrastructure. Criteria for assessing the difficulties associated with potable demand and wastewater disposal have been identified as:

(1) Current and future water supplies.

(2) Existing and projected water demand.

(3) Existing and projected wastewater generated.

(4) Current and future wastewater treatment and disposal.

However, Table 3.1 demonstrates that Florida has had the capacity to handle almost twice the flow of wastewater that it currently processes. Therefore, an efficient operation of existing infrastructure seems to be lacking.

Table 3.1 Reuse in Florida

	1986	1990
Total number of reuse facilities	118	214
Total reuse flow	206 MGD	320 MGD
Total reuse capacity	362 MGD	585 MGD

Incorporating a reclamation system not only involves considering the quantity of water required, but also the quality of wastewater effluent to be produced. Water quality, therefore dictates the extent and cost of the reclamation process. Controllable and uncontrollable factors are also cost critical in implementing a reclamation program. Controllable factors include the general type and quality of service to be provided and are subsequently easily accountable. Uncontrollable factors however, consist of circumstances that cannot be foreseen, such as drought and political influence, that can drastically effect the efficiency of any reclamation system. Additionally, the **reliability limits** of the system must be initiated at the onset of the planning process to establish the parameters regarding cost, value, and return on investment (Chapter 5: Water Economics). For the guiding principal behind water reclamation is to provide a method that requires fewer resources to recycle an acre/foot of water than to import one.

3.2.1 Water quality objectives

Reclaimed water has traditionally been treated for disposal or limited irrigation. However, as reclaimed water use adapts to further applications, the quality of treated effluent must also adapt. Table 3.2 provides general treatment requirements for agricultural, nonpotable urban, industrial, and indirect potable reuse.

Table 3.2 General treatment of reclaimed water types

Use	Treatment Requirements
Agricultural	Secondary effluent No irrigation of food chain crops.
Nonpotable Urban	Secondary effluent 20 mg/L BOD and TSS. 1.0 mg/L chloride residual Total coliforms, 200/L Filtration recommended
Industrial	Chlorides, 100-500 mg/L TDS, 500-1650 mg/L Alkalinity, 20 mg/L BOD, 25 mg/L TSS, 25 mg/L Sulfates, 200 mg/L
Indirect Potable	Treatment to potable quality

To achieve these and other water quality objectives, chemical and physical processes are manipulated by wastewater treatment facilities. Figure 3.5 on the following page outlines several additional water quality objectives, the treatment process necessary to achieve those objectives, and suitable applications for specific water qualities. Figure 3.4 below illustrates a schematic relationship between the various levels of raw waste water treatment incorporated to achieve various water qualities.

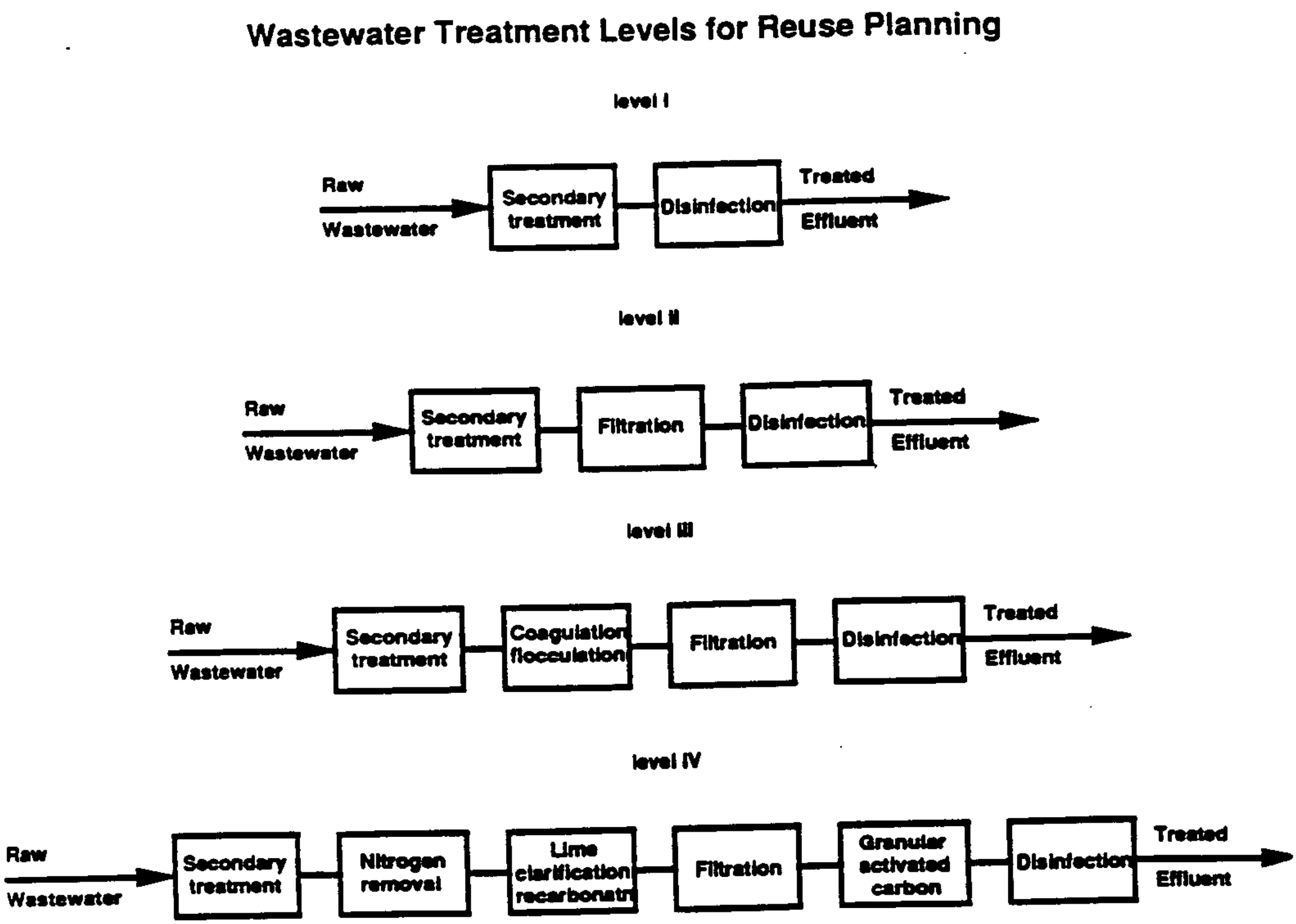


Figure 3.4 Wastewater treatment levels for reuse planning

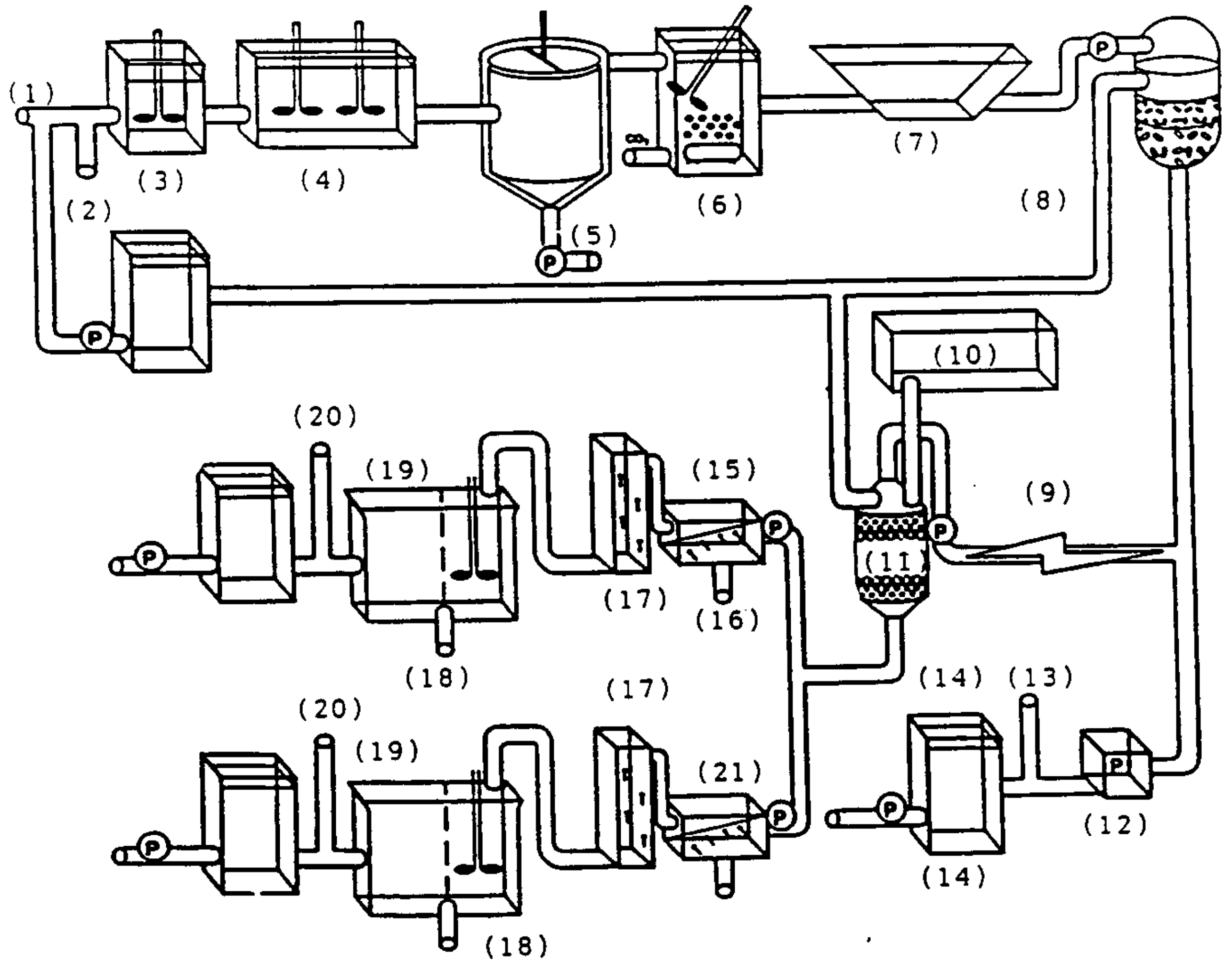
Water Quality Objective	Treatment Processes	Remarks
Oxidation of BOD	Biological Processes - Biotowers - Activated sludge	Activated sludge more versatile to handle varying wastewater quality
Removal of turbidity in Suspended Solids	Coagulation/flocculation/filtration	Provision of alum and polymer addition is mandatory
Removal of Coliforms (and therefore pathogens)	Disinfection using chlorine	- Detention time in chlorine contact tank varies based on desired coliform level. - Demonstrate equivalence if other disinfectants or different contact time is employed
Oxidation of Ammonia	Biological Processes - Biotowers - Activated Sludge	BOD and ammonia oxidation can be combined in one treatment step
Removal of Magnesium, Silica, Carbonate Hardness, Organics, and Disinfection	Lime Treatment - pH of 11.0+	Achieves increased cycles of concentration in cooling towers
Removal of Non-Carbonate Hardness	Soda Ash Treatment	
Removal of additional Calcium Carbonate or pH Adjustment	Recarbonation	Further increases cycles of concentration in cooling towers by removing calcium
Removal of organics, TDS and Bacteria	Reverse Osmosis	Enhances acceptability for groundwater injection
Nutrient Removal (N&P)	Reverse Osmosis; Bardenpho process, A 2/O process (anaerobic, anoxic and oxic) in conjunction with chemical precipitation	Required for reuse for recreational impoundments and/or discharge into lakes

Figure 3.5 Treatment processes to meet water quality objectives

3.2.2 Effluent treatment

The actual treatment of reclaimed water is critical to its performance and acceptability. For this reason, most wastewater treatment facilities producing treated effluent use a **multiple barrier design.** This incorporates multiple pathogen barriers such as lime treatment, ozone, reverse osmosis, and chlorine dioxide to ensure public health protection. No single process therefore, is wholly responsible for the removal of a single contaminate. On the following page, Figure 3.6 illustrates the multiple barrier design through an overall treatment process involving lime clarification, recarbonazation, filtration, ultraviolet disinfection, activated carbon absorption, reverse osmosis, air stripping, ozonation, and chlorination as a residual disinfectant.

Inherent to virtually all wastewater treatment is the filtration of solids. Once wastewater is collected, it generally is subjected to a pre-treatment process that involves the screening of large matter and the settling of heavy grit. Primary treatment involves the physical clarification of water in a basin. This clarification process is achieved by adding **flocculents** to the pre-treated effluent to suspend the smaller particles in the water. **Coagulants** are often added prior to bond these particles into clusters for easier filtration. Secondary treatment is commonly referred to as biological clarification, and involves the removal of organics passing primary clarification. To establish the amount of organic waste remaining in the water, **BOD** (Biological Oxygen Demand) and **COD** (Chemical Oxygen Demand) tests are performed. The BOD test



1. Unchlorinated secondary effluent
2. Lime
3. Rapid mix
4. Flocculation
5. Lime clarification
6. Recarbonation
7. Ballast pond
8. Filtration
9. Ultraviolet radiation
10. Carbon regeneration
11. Carbon absorption
12. No. 2 water pump station
13. Chlorine dioxide
14. Disinfection
15. Reverse osmosis
16. Brine
17. Air stripping
18. Ozone generation
19. Ozonation
20. Chlorine
21. Ultrafiltration

Figure 3.6 Multiple barrier design for wastewater treatment

identifies the quantity of oxygen required for bacteria to metabolize the degradable organic matter present in the wastewater. Test samples are "loaded" with oxygen and nutrients to create the perfect environment for maximum bacteria metabolization. The amount of oxygen consumed provides technicians with the ability to assess the amount of degradable organic matter in the water prior to bacterial enzyme catalyzation. COD tests measure oxygen demands at an accelerated rate by artificially oxidizing the water. This chemical process will oxidize organic compounds that bacteria cannot. Often, a BOD to COD ratio is calculated. This allows wastewater treatment plants to determine the biodegradability of the organic compounds present. A high ratio indicates a very degradable solute where as a very low ratio indicates less enzyme degradable compounds or compounds foreign to that particular species of bacteria.

Activated carbon absorption is a common process often associated with Advanced Waterwater Treatment (AWT). This tertiary process allows the absorption of organic and some inorganic compounds associated with undesirable water color and odor. The loading capability of the carbon is attributed to the surface area in relation to its mass. The extremely porous internal structure of granulated and powdered carbon provides up to 1000 square meters of loading area per 1 gram of mass. Fifteen minutes of "true contact time" with this carbon in gravity fed or pressurized columns is usually sufficient for fine organic removal. However, at a given time interval the granular activated and powdered carbon will become exhausted. The granular carbon can either be disposed of in the sludge process with the powdered carbon, or it can be recharged. Carbon absorption may be used in place or in combination with filtration and chemical treatment due to the high BOD and COD of fecal matter in most "black" wastewater.

Reverse osmosis is characterized by the use of spiral wound polyamide membranes that act as a physical barrier to the passage of pathogens and other extremely fine particles. In addition, this process removes toxic metals, some nitrogen forms, and certain organic compounds. The osmotic process involves the separation of pure water and contaminated water. Once the barrier is removed, only a semi-permeable membrane remains. The pure water proceeds to move through the membrane with tremendous thermodynamic force to dilute the contaminate. Once this occurs, the reverse osmotic process is initiated by forcing the solution back through the membrane with sufficient force to overcome the natural osmotic pressure. This process is commonly required to remove chlorides for pH and salinity control. Brackish water requires approximately 400 psi of pressure to achieve reverse osmosis whereas undiluted saltwater may require pressures in excess of 1000 psi.

Ion exchangers commonly used in water softeners can be adapted into municipal service as well if ion pollutants are present. The polymer structure of the basic resign in the exchanger can either be positively or negatively charged. This process is induced by adding the required opposite charged solution to create a stable loading surface. When the effluent passes through the ion exchanger, the less favored ion is exchanged for the more favored. The less favored ion is then allowed to intercede with the outflow effluent. An ideal example of this process occurs when positively charged hydrogen ions are introduced to the negatively charged polymer resin. Influent wastewater is gravity or forced fed through the exchanging unit. If the water consists of other ions of greater positive charge, the hydrogen is replaced on the polymer with that ion. The hydrogen is then allowed to flow out into the effluent. Common elements extracted by this process include hard water calcium, and sodium. In addition, this process can be reversed by creating a positive polymer field, resulting in the extraction of undesirable negative ions. A commonly displaced negative compound by this reversed process is hydroxide. If the positive and negative systems work in tandem, the hydrogen and hydroxide will bond to yield pure water. Coincidentally, the loading on the resin during ion exchange is very similar to that of carbon absorption. Therefore, the resin must also be recharged.

Ozonation is a highly rigorous oxidation process to further alter organic compounds for carbon absorption and disinfection. Ozone can be produced by forcing pure oxygen gas through a strong electromagnetic field called a corona, energized just short of arcing. This process creates the ozone along with very unstable oxygen radicals. This poor covalent bonding possess a constant tendency to revert back to pure oxygen. Because of this situation, ozone cannot be stored or used as a long lasting residual disinfectant. However, ozone is nevertheless a very powerful initial disinfectant. When mixed with water entering the ozonation chamber, the ozone can rapidly disinfect and dissipate without any "deozonation" process required.

Another popular disinfection processes is the use of chlorine. Chlorine reacts with water to form hydrochloric acid and hydrochloric ions. These are the actual free chlorine disinfectants in the water solution. However, chlorine disinfectants in reclaimed water could have limitations as well. Chlorine as a residual also deteriorates over a relatively short time span, leaving an ideal environment for biological growth. The addition of ammonia into the chlorination process however, allows further oxidation, yielding monochloromine. This compound could provide a very long lasting residual for high recycling applications such as cooling towers and heat exchangers. Yet, concern regarding ammonia's corrosiveness to common piping material such as copper, may severely limit this practice.

Ultraviolet radiation has also been in limited use to destroy pathogenic organisms remaining in secondary effluent. The **ultraradiation** process destroys the reproductive capabilities of micro-organisms in reclaimed wastewater. Subsequently, the 30 second life span of most viral and bacterial cells in the effluent is radically shortened. Finally, nutrients may also be removed to prevent adverse plant growth in sensitive waterways.

Along with nutrient concentrations, salinity levels have become another nuisance commonly overlooked in advanced wastewater treatment that could potentially devastate irrigated crops, landscaping, and mechanical equipment using reclaimed water. Treatment plants along the coast of the California having the same hydrological characteristics of coastal Florida, have discovered alarming chloride concentrations in both influent and effluent wastewater. Three common sources for wastewater salinity include:

(1) Infiltration and inflow from brackish waters.

(2) Discharges from industrial brine sources.

(3) Discharges from Regenerative Water Softeners (RWS).

The generally accepted norm for sodium chloride concentrations in domestic wastewater is approximately 100-140 mg/L. However, salinity readings at treatment facilities along California's coastline have recorded chloride concentrations as high as 2400 mg/L. Florida too has experienced high salinity levels in areas where saltwater intrusion has not only penetrated waste return lines, it has additionally backflowed into storm sewer mains and service laterals. As would be expected, salinity levels have shown dramatic fluctuations between tides, resulting in the need to treat varying concentrations of chlorides at varying time intervals. Figure 3.7 defines the relationship between tide heights and chloride concentrations over specified time intervals at the Larkspur Pump Station in San Francisco. A careful analysis of the graph shows the salinity "spike" occurring only at the greatest of the two high tides, indicating a presence of saltwater intrusion associated with tides exceeding four feet.

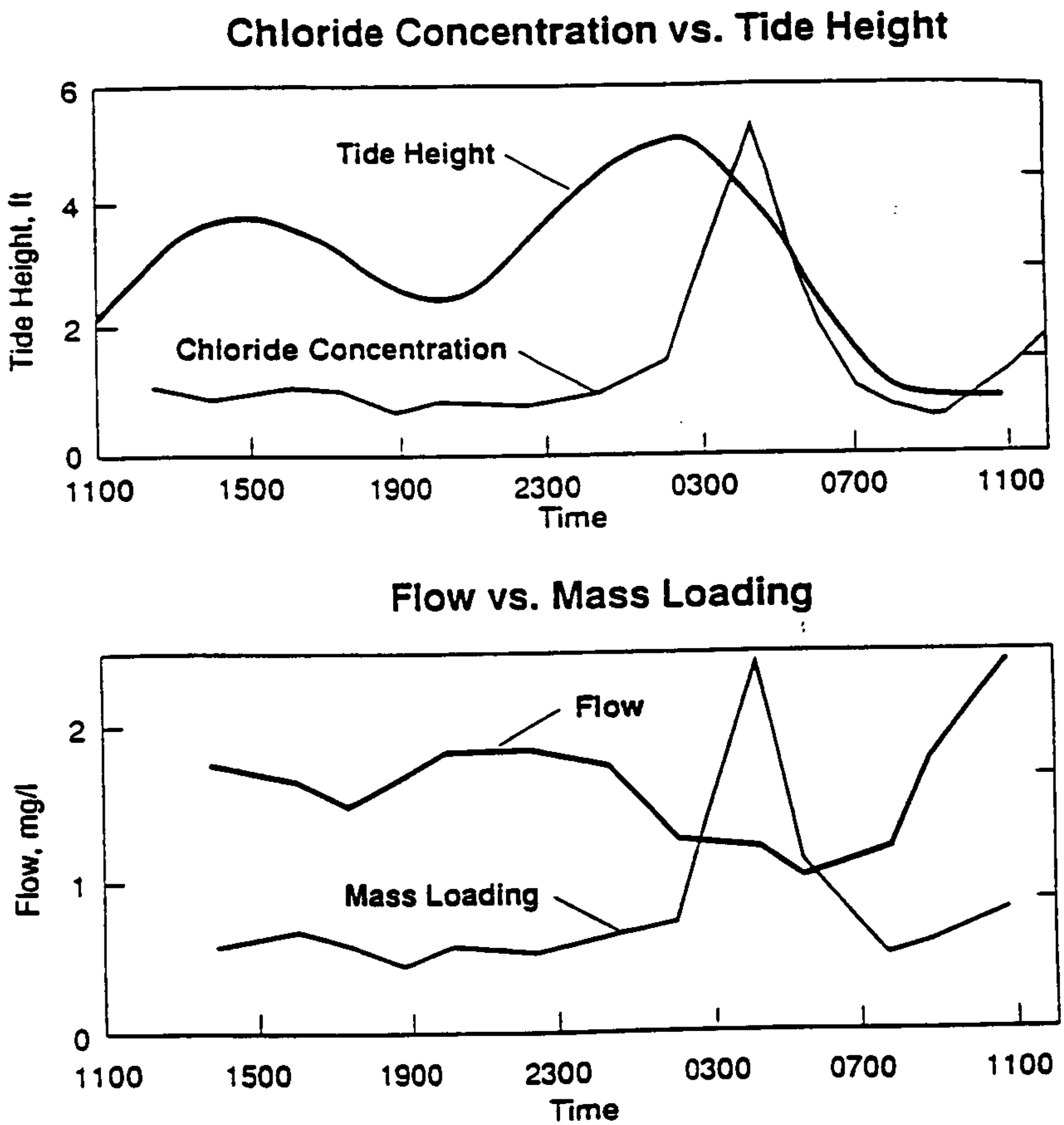


Figure 3.7 Salinity analysis of influent wastewater

The costs for chloride removal ranges from $5.00 to $800.00 /lb. This figure is directly proportional to the concentrations of chloride in the influent wastewater. The extreme fluctuations of salinity levels would force the treatment facility to equip and treat wastewater for the highest potential chloride concentrations to ensure a safe effluent for agricultural and mechanical reuse. This technique would be grossly inefficient and very expensive. However, the solution to this dilemma can be found at the root cause. First, salt water must be retarded from entering the system. This can be accomplished by designing storm and sanitary sewer returns as far away from the maximum encroachment of saltwater. Existing piping and return lines in salt intrusive locations could incorporate slip or inversion lining to reduce as much as 90% of the chlorides from entering the system.

Finally, the inevitable chlorides penetrating the system from other sources such as self regenerative water softeners (RWS), can be easily extracted through membrane filtration (300-420 psi) and reverse osmosis. Legislative action has all but eliminated salinity discharges from non-natural sources such as the RWS and industrial brine processes. Figure 3.8 on the following page illustrates the priority or "target" range of salinity removal versus cost. This graph demonstrates the increasing cost relationship for added removal of chlorides. Therefore, most municipalities assign a priority level to the wastewater facilities where the greatest salinity concentrations are being reported. This process allows for maximum chloride removal at minimum cost.

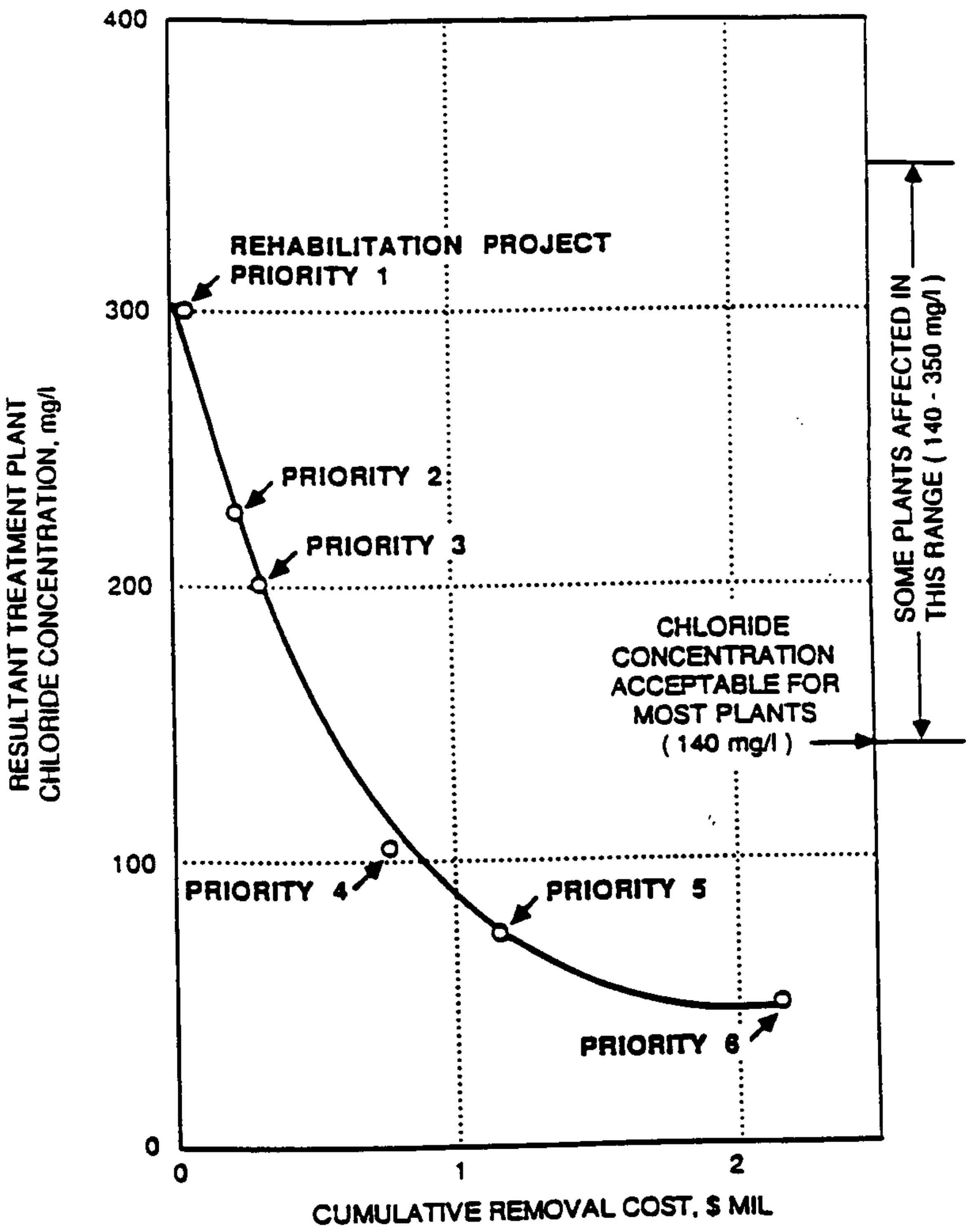


Figure 3.8 Chloride concentration and cumulative removal costs

3.2.3 Wastewater facilities and distribution

The increasing demand and diversity of reclaimed water use has led many reclamation facilities to produce several grades of treated wastewater effluent. This not only allows a safer and more economical means to distribute and use reclaimed water, it also can stimulate further reuse development. The extent of treatment depends almost exclusively on its raw composition and its intended purpose. Influent wastewater requiring extensive treatment costs considerably more than influents with lesser contaminates. Efforts to safely and economically treat various grades of greywater are currently in operation at wastewater treatment sites around the country. Figure 3.9 on the following page provides a schematic view into the possible cost saving process of reclaiming several grades of wastewater at a single facility.

Two of the very general reclamation systems discussed in Chapter 2 included the **Type A** and **Type B** grey water distribution systems. In review, type A grey water systems are composed of a dual supply lines and dual collection lines. The supply lines serve both potable and non-potable reclaimed water. The potable line serves domestic fixtures such as sinks, lavatories, and showers. The grey line in turn serves the non-potable fixtures such as water closets and urinals. Grey water collected from non-sanitary fixtures such as sinks and showers, are returned for treatment. Sanitary effluent or **blackwater**, from urinals and toilets, are channeled to the municipal sewers for disposal.

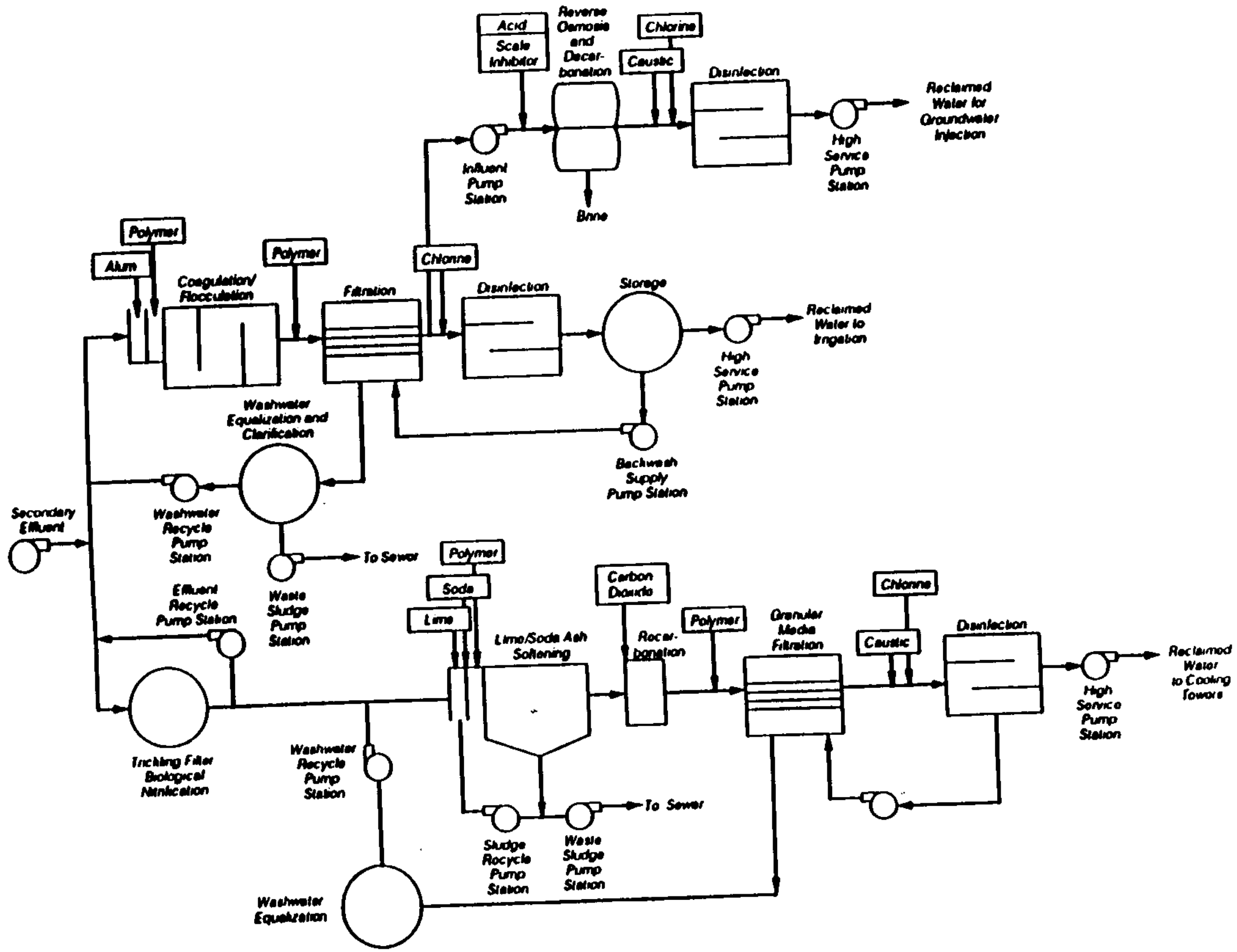


Figure 3.9 Possible cost saving reclamation process

Although additional piping may increase initial costs, the influent produced requires far less treatment and is subsequently less expensive to reclaim. Type B systems also provide a dual distribution supply, yet possess only a single collection line. The concept concedes a higher cost of treatment in favor of reducing start-up costs.

3.3 Non-potable Urban

Although several reclaimed water qualities are currently available in a growing number of municipalities, most facilities reclaim only a single "irrigation grade" water. In addition, this reclaimed grade is purposely maintained at lower pressures than potable water to prevent intrusion in cases where accidental cross-connections have occurred. Beyond landscape irrigation, the lack of recycled grades and head pressure have significantly hindered non-potable urban use of reclaimed water.

3.3.1 Commercial applications of grey water

Reclaimed quality and pressure reductions have severely limited reuse within commercial structures. For instance, the state of Florida possesses more commercial condominiums than the other forty-nine states combined. Yet, commercial structures such as these represent only a small portion of the reclamation effort in Florida. Ironically, structures such as these could allow some of the highest reuse opportunities per square foot of land area, due to the vertical density of people occupying the building.

Once the residual in the treated effluent deteriorates, intricate mechanical systems such as illustrated in Figure 3.12, can provide excellent biological breeding grounds. In addition, scaling and corrosion can likewise increase inner pipe friction, constrict flow, and reduce blowdown rates. Furthermore, concentrations of constituents in circulating cooling water are much higher than those in make-up water due to the evaporation process that leaves the constituents behind. Subsequently, the three major problems encountered in reclaimed circulating water are scaling, corrosion, and biofouling.

Scaling factors:

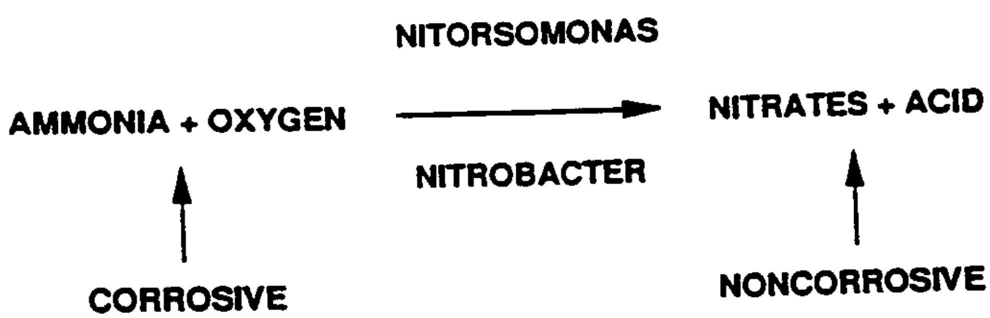
Calcium carbonate scale formers are present in both fresh water and greywater, however they are more numerous in the later. Calcium phosphate scale formers are specific to reclaimed water because of its inherent phosphate content. This situation could become a strong scaling factor, especially on the surface of heat exchangers and similar units.

Corrosion factors:

Corrosion factors specific to wastewater effluent include ammonia, which has proven to be corrosive to copper alloys frequently used in heat exchange systems.

Biofouling factors:

Due to the high concentrations of nutrient rich elements such as nitrogen, biogrowth may be enhanced in recirculating cooling systems by the residual organic substrates remaining in the reclaimed wastewater. Secondary treatment does not go far enough to remove or sufficiently reduce ammonia,.phosphates, alkalinity, calcium, and the suspended solids that are responsible for scaling and corroding mechanical equipment. Therefore, tertiary treatment is generally required for industrial mechanical use. However, research has shown when a significant level of nitrate is present, the result is a reduction in the amount of corrosive ammonia (Figure 3.13).



$$NH_4 + 2O_2 \longrightarrow NO_3 + 2H^+ + H_2O$$

Figure 3.13 Nitrification reaction equation

The reduction in pH levels from 10.5 in the make-up water to 7.8 in the recirculating cooling water without any additional acid, confirms that ammonia reducing nitrification has taken place within the system. Nitrates are not corrosive to copper alloys and even go as far to act as a corrosion inhibitor to many metals. In addition, the acid produced through the nitrification process acts to balance or neutralize the high alkalinity observed in circulating reclaimed water. The alkaline carbonates and hydroxides present in the effluent are therefore balanced and the nitrification process additionally serves as a self-regulating pH control mechanism without the need of external acid addition. However, if a low pH is apparent in the circulating wastewater, the acidity result of nitrification may overbalance the alkalinity present and cause a corrosive condition.

Biofouling can be controlled by using biocides such as chlorine, however where nitrification is economical and beneficial, this process cannot be applied or the result will be an elevated acidity concentration within the circulating system. Instead, more frequent cleaning operations of heat exchangers and a higher initial quality of grey water must be applied. Table 3.3 lists the general level of treatment for acceptable circulating water.

Table 3.3 Criteria for circulating cooling water

Component	Unit	Raw wastewater	Secondary effluent	Tertiary effluent	Circulating cooling water
pH			7.2	10.5	7.9
Alkalinity	mg/L		620	250	300
Hardness	mg/L		450	150	250
Chlorides	mg/L		350	350	500
Suspended solids	mg/L	400	60	15	30
BOD5	mg/L	450	50	10	<5
COD	mg/L	950	240	80	110
Ammonia	mg/L	60	35	25	<1
Nitrate	mg/L	nil	2.2	2.2	13.6
Phosphate	mg/L	30	20	0.2	0.1

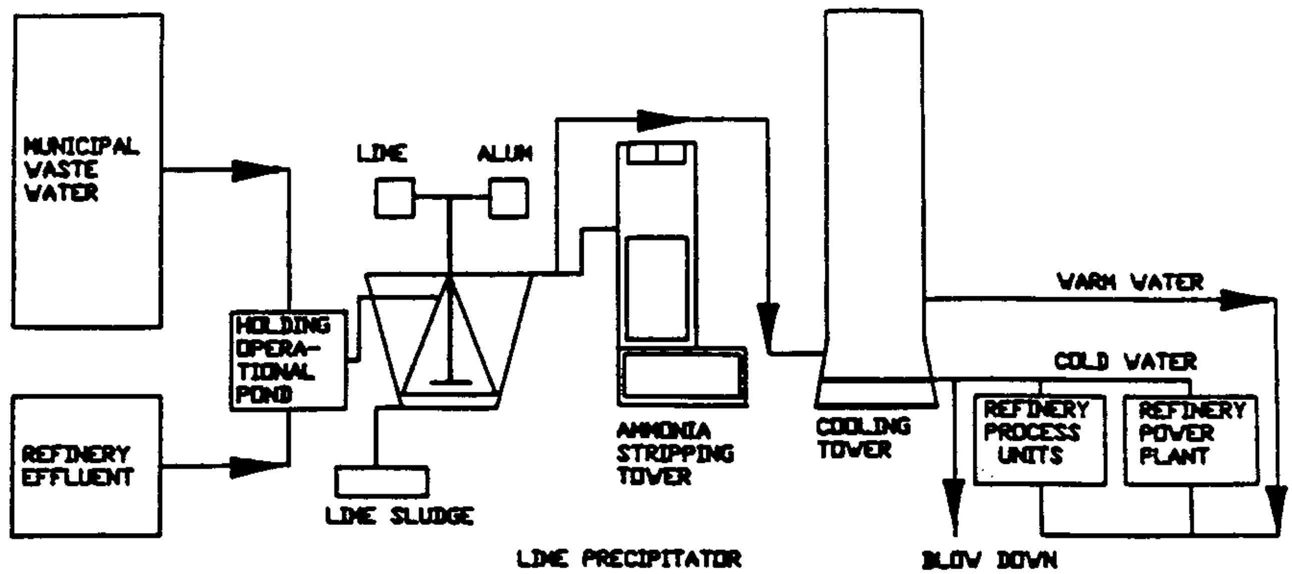


Figure 3.14 Industrial treatment of AWT wastewater

Treatment of reclaimed water for specialized purposes beyond the AWT tertiary stage is generally the responsibility of the consumer. Figure 3.14 above illustrates the capabilities of certain specialized industrial users to further treat reclaimed water to suit equipment specifications. The final disposal of untreated circulating cooling water is environmentally sound because the resultant wastewater from the original tertiary treatment is, in most cases, well above the EPA standards of disposable secondary effluent.

1.2.3 Other water resource issues

The sensitive nature of maintaining both an adequate and high quality water supply plus increasing demand on this essential resource has prompted great concern over the future situation of the water supply. Insuring the sustainability of water will require that new methods of water use be examined for their ability to insure the continued supply of this vital part of Florida's economy. The key issue is to maintain an acceptable level of service in terms of water supply at a cost-effective rate while using management practices that will maintain a sustainable resource. The question of the cost of an acceptable level of service to consumers is complicated by the fact that water has historically been undervalued and overused. This has resulted in an emphasis upon increasing <u>supply</u> sources instead of designing and regulating <u>demand</u>. It is becoming more apparent that demand management should be more carefully considered since the water supply is not infinite.

These concerns are not confined only to Florida. Rapid and intense demand on public water supplies caused primarily by sudden increases in population is causing the same problems in many parts of the United States. When an area suddenly experiences a sharp increase in population with commensurate demand on the water supply infrastructure, an accompanying conflict with previously existing water demands from such sources as industry and agriculture will frequently occur. This has a tendency to pit industry and rural interests against urban residential interests.

3.5.1 Industrial applications of grey water

The Sunflower Electric Plant located in the arid sandhills of western Kansas, has maintained a zero discharge water balance since commercial operations began in 1983. The closed water loop balance at the 320MW coal fired plant is being maintained at the Holcomb generating station by operating the cooling system at high cycles and recycling cooling tower blowdown. The net effect is a drastic reduction in ground water demand. Well water is only used to replace evaporated water lost during operations. The reuse of the lower quality recycled water is delegated to the desulfurization of stacks, bottom ash, and coal handling systems. As mentioned previously, one of the major concerns of using reclaimed water in equipment is the extent to which the water will corrode or scale the internal piping carrying the reclaimed water. The LSI (Langlier Saturation Index) indicates the tendency of the water to scale or be corrosive. The power plant maintains that water with a slight tendency to scale rather than corrode is preferred, making the optimum pH between 8.0 and 8.3 on the LSI scale.

Additional industrial uses that are less common include industrial cleaning, such as stack gas scrubbing at the McIntosh Power Plant in Lakeland, Florida. This practice removes sulfur dioxide accumulation. Alternative uses include mist eliminator sprays, water seals, and ash pond make-up. The phosphate industry too, has become another major reclaimed water consumer in the state of Florida. The International Minerals and Chemical Corporation uses secondary effluent from Bartow for their mining operations, while eliminating effluent discharge into the Peace river. Paper manufacturers likewise have become interested in tertiary effluent to satisfy their 4000 cubic meter water demand for high quality paper stationary products. The construction industry is currently using tertiary effluent as well for on site concrete batching, soil compaction, and dust control. Rockwell International Corporation has tailored reclaimed water usage into some of the most sophisticated testing facilities in the world. At the Canoga Park laboratory in California, reclaimed secondary effluent is being used to cool rocket engine deflector pads. As demonstrated by this last section, the potential uses of reclaimed water are nearly limitless.

3.6 Agricultural

Agricultural uses of reclaimed water are one of the most sensitive areas for effluent reuse because of the potential of contaminate transmission to food sources. These food sources are characterized as being direct (crops) or indirect (grazing) paths of biological and chemical compounds. Other factors to be considered when determining the suitability of sites for reclaimed water usage are climate, physical and chemical compositions of the soil, and proposed agricultural operations.

Climate considerations are imperative for supply and demand provisions in Florida. Reclaimed irrigation facilities must cope with the high demand of droughts and the environmentally safe release of stored effluent during the wet season. Physical characteristics of the soil and its topography are also important considerations for finding the rate of permeability. However, the most significant factor for applying reclaimed water to food crops is the extent to which substantial levels of consumer hazardous or growth retarding chemicals are being absorbed by plants. In short, receiving vegetation must be considered when using reclaimed water due to the fact that plant growth may either be enhanced or diminished by the presence of salts, metals, and organics in the water.

Excessive salinity is an overriding concern for growers in the state of Florida where saltwater intrusion of freshwater aquifers has all but destroyed coastal well points. High salinity is often detrimental to the growth and quality of commercial planting. The existence of salts such as boron can have toxic effects on nearly all of Florida's money crops. However, the presence of chlorides through saltwater intrusion is inevitable within coastal reclamation systems. Fortunately, the slightly alkaline composition (pH of 9.0) of most reclaimed water throughout Florida should complement minor chloride concentrations, producing a favorable environment for crop growth. Figure 3.15 on the following page, provides chloride tolerances of selected plant species common throughout the state of Florida.

Tolerance	Species
High Tolerance - (Resists chlorides in excess of 400 mg/l)	Australian Pine Dahoon Holly Oleander Hibiscus Cabbage Palm Live Oak Sea Grape Bougainvillea Lantana Bermuda Grass
Moderate Tolerance - (Cannot tolerate chlorides in excess of 400 mg/l)	Banana Carambola Grapefruit Orange Slash Pine Rubber Tree Canna Lily Bromeliads Iris Pampas Grass
Low Tolerance - (Cannot tolerate chlorides in excess of 100 mg/l)	Avocado Crape Myrtle Rose Camphor Tree Mango Persimmon Poinsettia Jacaranda
No Tolerance - (No resistance to chlorides)	Chinese Privet Dwarf Azalea Formosa Azalea

Figure 3.15 Chloride tolerances of selected species

Nitrogen balances are often required to ensure that reclaimed water used for large scale crop irrigation is not degrading the ground water supply. A common method of calculating the amount of nitrogen (N) or nitrates percolating into the watershed is outlined by the U.S. Environmental Protection Agency's Process Design Manual for Land Treatment of Municipal Wastewater, EPA 625/1-T1-008. The following example compares two sample crops where the denitrification of the soil profile is 20%, maximum percolate nitrogen limitation of 10mg/L-N, solving for mu, percolation water, effluent nitrogen loadings, effluent hydraulic loading, and irrigated land required.

First calculate the hydraulic loading in feet per year.

$$Wp = Lw + Pr - ET$$

Where:

Wp = Percolation water (ft/yr)
Lw = Effluent loading (ft/yr)
Pr = Precipitation = 5.18 inches/yr = 0.43 ft/yr (Table 2)
ET = Evapotranspiration or consumptive use
Cotton: 2345 acres x 35% x 31.0 inches/yr = 2120 AFY
Alfalfa: 2345 acres x 65% x 48.9 inches/yr = 6211 AFY
Total calculated ET = 8331 AFY

$$\text{Avg ET} = \frac{8331 \text{ AFY}}{2345 \text{ Acres}} = 3.55 \text{ ft/yr}$$

Therefore:

$$Wp = Lw + .43 \text{ ft/yr} - 3.55 \text{ ft/yr}$$
$$Wp = Lw - 3.12 \text{ ft/yr}$$

Next calculate the annual nitrogen loading.

$$Ln = U + D + 2.7\, WpCp$$

Where:

Ln = Effluent nitrogen loadings (lb/ac-yr)
U = Crop nitrogen uptake (lb/ac-yr)

390 lb/ac-yr x 65% (alfalfa) = 253.5 lb/ac-yr
100 lb/ac-yr x 35% (cotton) = 35.0 lb/ac-yr
288.5 lb/ac-yr

D = Denitrification = 20% Ln
Wp = Lw - 3.12 ft/yr
Cp = design maximum percolate nitrogen loading = 10 mg/l-N
Ln = 288.5 lb/ac-ft + 0.20 Ln + 2.7 (Lw - 3.12)(10 mg/l-N)

Ln = 2.7 CnLw (From EPA 625/1-T1-008)

Where

Cn = applied nitrogen concentrations 25 mg/l-N
Lw = effluent hydraulic loading (ft/yr)

Therefore:

Ln = 2.7 (25 mg/l-N)(Lw)

or:

Lw = 0.0148 Ln

Inserting the above expression into the equation for Lw

Ln = 288.5 lb/ac-ft + 0.20 Ln + 2.7(0.0148 Ln - 3.12)(10 mg/l-N)
Ln = 288.5 lb/ac-ft + 0.20 Ln+.3996 Ln - 84.24 lb/ac-ft

0.4004 Ln = 204.26 lb/ac-ft
Ln = 510 lb/ac-ft

Finally, the irrigated land required is:

$$\text{Irrigated Land} = \frac{3.06\ (365\ \text{days/yr})\ 7.1\ \text{MGD}}{.0148\ (510\ \text{lb/ac-ft})} = 1050\ \text{acres}$$

3.6.1 Agricultural applications of grey water

The reclaimed water cooperative between the City of Sarasota and the Hi Hat Ranch provides a example of how agricultural reuse of secondary effluent can be implemented. The 1988 upgrade of Sarasota's wastewater facilities enabled the 12,400 acres of Hi Hat citrus and pasture land to be irrigated by reclaimed secondary effluent. The AWT quality of this new effluent also allowed safe surficial discharge in the event of overflow.

As shown in Figure 3.16 on the following page, a 36" **forced main** extends 12 miles from the Sarasota Waste Water Treatment Plant to the Hi Hat Ranch. The residual pressure in this main satisfies all perimeter demands except for the individual spraying of the citrus groves. Sub-mains ranging from 12 to 30 inches in diameter, extend in all directions from the central forced main. The site consists of 61,000 feet of these ductile, cast-iron sub-mains. A **turnout-structure** is located at the end of each turn-out from the main and consists of an isolation valve, a flow control valve, a flow meter, and a flow splitter unit.

A **pipe gallery** system is implemented to interconnect all flow routes of the distribution system. The valving layout connects the two sources of supply from the treatment plant and storage pond with the three sources of demand in the northern and southern portions of the ranch. The operator has the added flexibility to simultaneously channel water into the storage pond as water is being extracted from it. The individual irrigation systems implemented to distribute the reclaimed water consist of the ridge-furrow system for pasture lands, and the micro-jet sprayer for the groves. Additional pumps were required to increase the static head pressure to 60 psi for spray irrigation. Additionally, the 110 acre, 185mg storage pond fulfills two purposes. First, the pond serves as the location for the repump and boost of the 60 psi water for direct use in the groves. Secondly, it provides the required storage capacity to supply peak demands. The schematic (Figure 3.16) below illustrates the flexibility of this agricultural reuse system.

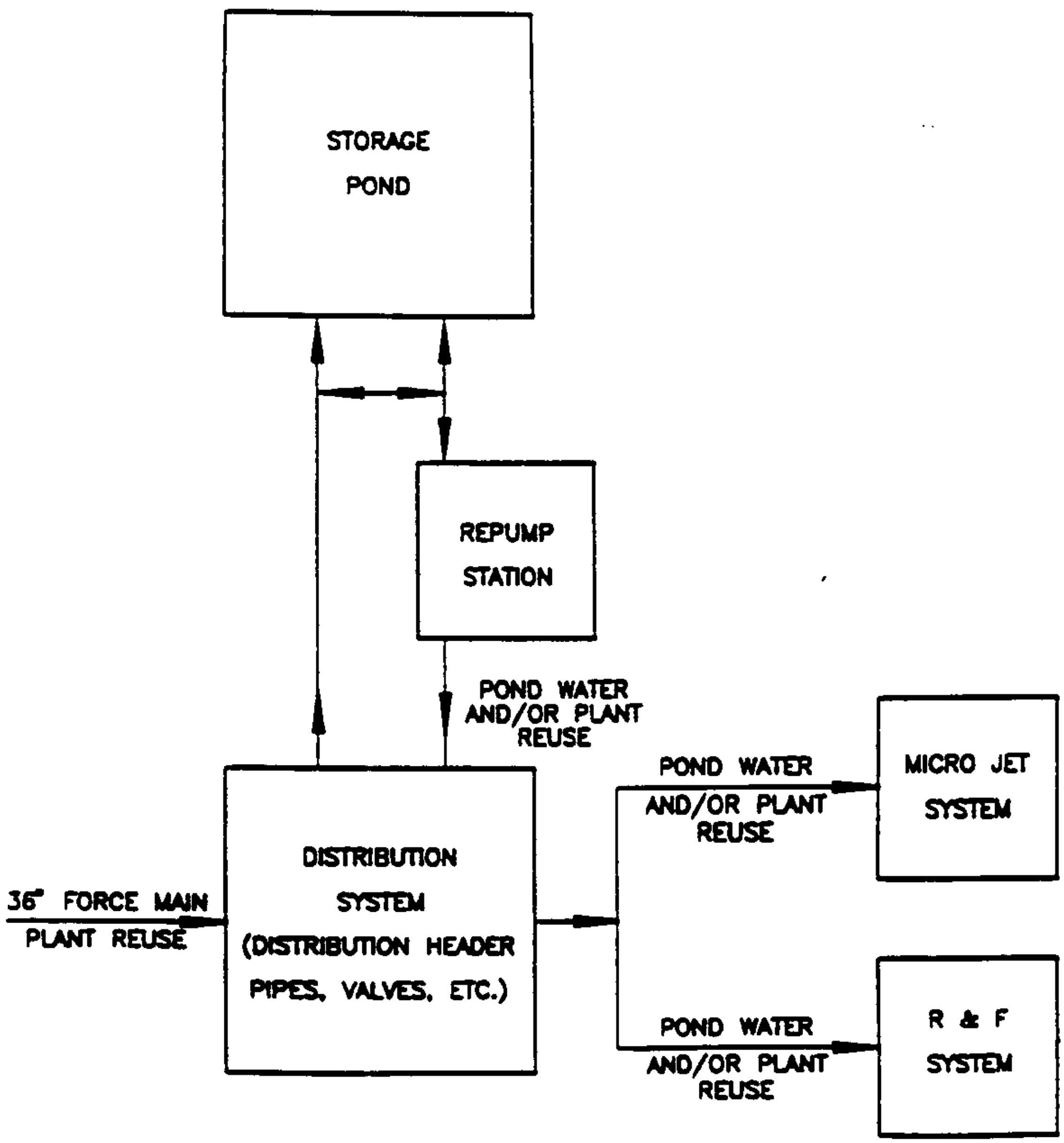


Figure 3.16 Hi Hat Ranch distribution system

3.7 Indirect potable use of grey water: recovery and release

The concept of reclaimed water for indirect potable use began when the first civilizations began disposing wastewater into bodies of water upstream of other civilizations. In the state of Florida, the majority of potable water originates in underground aquifers. Therefore, **groundwater recharge** using reclaimed effluent is one of the only practical methods of indirect potable use. Groundwater recharge by reclaimed effluent has proven to achieve several of the following:

(1) To prevent and even displace salt water intrusion in fresh water aquifers.

(2) To store reclaimed water for future use.

(3) To control or prevent ground subsidence.

(4) To augment non-potable or potable groundwater aquifers.

Recharge can occur by **direct injection** or by **surface spreading**. In surface spreading, reclaimed water percolates from basins through an unsaturated zone into groundwater. This filtration process through permeable layers of strata cleanses the recharge water further until finally reaching non-permeable bedrock. Figure 3.17 on the following page illustrates the general principle behind influent treatment and subsequent aquifer recharge. In natural surface spreading, it is estimated that the time required for water to condense in the atmosphere, fall to the earth in a form of precipitation, percolate into the aquifer, and evaporate upon surfacing through a spring or well, may take thirty to several thousand years.

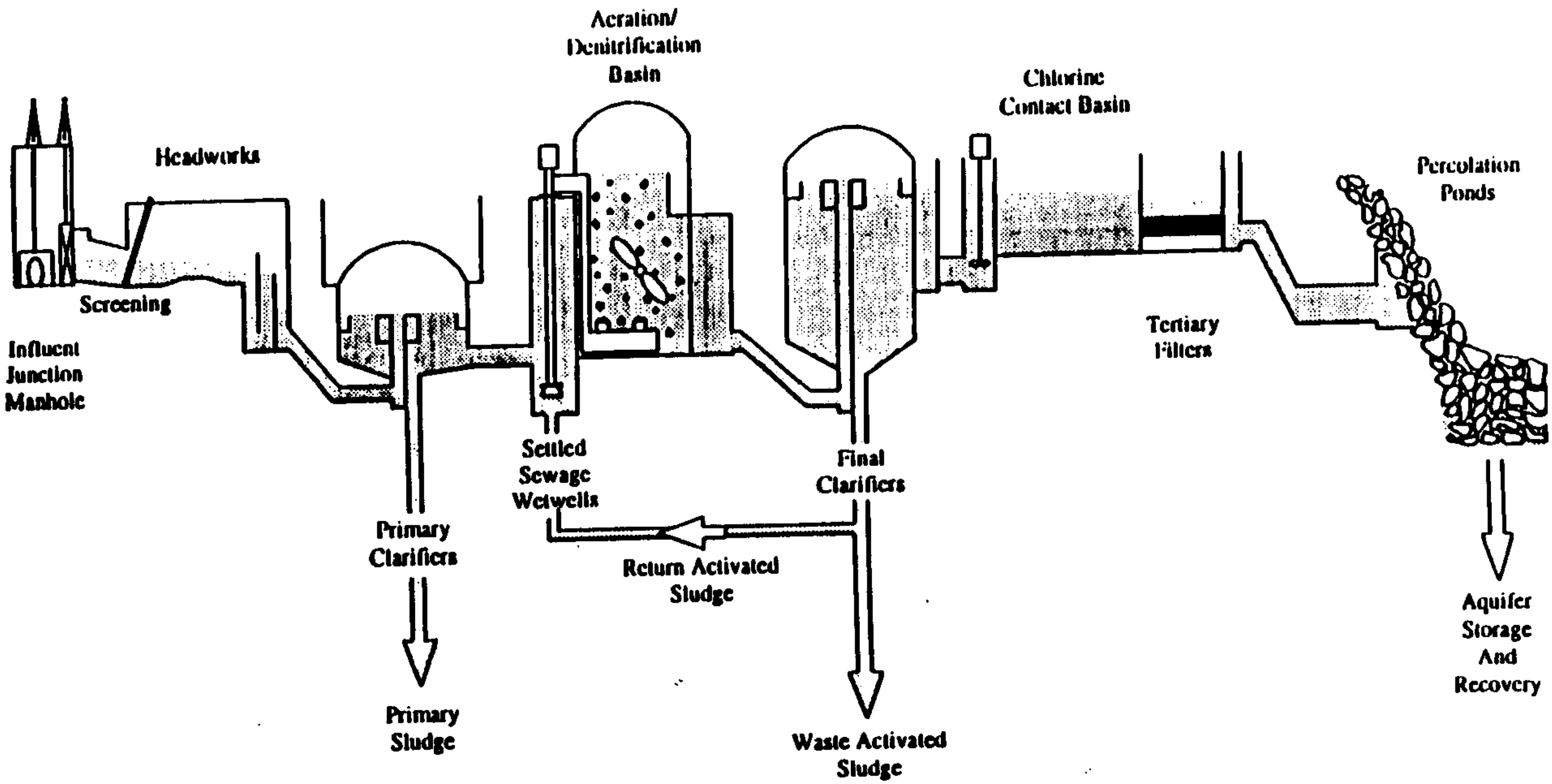


Figure 3.17 Influent treatment and aquifer recharge

Direct injection involves pumping reclaimed water directly into a confined aquifer. Although this method involves considerably less time for recharge, it nevertheless poses a much greater risk to public health, and subsequently involves greater expense. Direct injection systems similar to those in Montebello Forebay, California are generally used as a last resort to save a diminishing aquifer from salt water intrusion. Another form of indirect potable use can be found along the Colorado river where state project water and storm runoff are recovered, blended, and subjected to tertiary treatment involving media filters, activated carbon, chlorination, and dechlorination. The reclaimed effluent complying with the coliform and turbidity requirements of potable drinking water is then released for watershed recharge.

3.7.1 Wetlands restoration using grey water

Defined, **wetlands** are transitions between terrestrial and aquatic regions. In addition to surficial recharge basins, wetlands provide an excellent source of flood control, pollutant removal, temperature moderation, wildlife habitat, and public recreation. Therefore, the innovative concept of using reclaimed water for wetlands restoration has had widespread acceptability. However, in the fierce competition for a dwindling water supply, the economic and political influences of the agricultural, commercial, and industrial community have often taken precedence.

The level of treatment for wetland reuse depends greatly on the level of human exposure. Health concerns consist of the pathogenic and pollutant contamination potential in reclaimed water. Human health risks are classified within the potentiality of direct contact with the water, and through indirect contact such as disease transmission by parasitic organisms. Parasites such as mosquitoes, are notorious disease carriers in such habitats. These wetland parasites are often in close proximity to urban areas large enough to provide the volume of secondary effluent necessary to sustain the ecosystem. However, the conditions necessary to transmit diseases associated with highly organic water are very complex. Thus the possibility of indirect exposure to organic contaminates is classified as "remote".

The risk of direct or indirect contamination from pathogenic organisms such as bacteria, viruses, and protozoans, as well as the risk posed by non-biological pollutants can be minimized by three wetlands activities:

(1) Sufficient wastewater treatment for wetlands use.
(2) Natural Wetlands processes.
(3) Wetlands design and operation.

Wastewater treatment for wetlands use includes an initial pretreatment involving the screening of large solids and the settling of heavy grit. The following primary treatment involves the physical clarification of the waste water in a tank. A primary clarifier is used to allow solids to settle and be removed. Few treatment plants discharge primary effluent into surface waters.

Secondary treatment is often used to clarify primary water through biological treatment. Secondary water is commonly used for wetlands enhancement and surface water discharge. Tertiary treatment involves fine filtration of suspended solids and is commonly used for municipal irrigation where direct public contact may occur. Wetlands enhancement rarely involves this level of treatment due to the high cost of the advanced treatment. Additional nutrient removal may be required for discharges into sensitive receiving waters because of the potential for harmful algae growth. Disinfection can additionally reduce the pathogenic content of treated wastewater by a factor of 1,000,000 through the use of chlorine, ozone, and ultraviolet radiation as discussed previously. Therefore, disinfected secondary water is the most common effluent discharged into reclaimed wetlands.

Natural wetland processes consist of the physical, chemical, and biological characteristics of the wetland. These natural properties can greatly reduce the pollutants and pathogens in the reclaimed effluent, thus reducing the costs of additional treatment. The following wetland features that enhance this process are slow moving water, aerobic and anaerobic zones, water with high and low light transmittance, porous soils, and a diversity of aquatic and terrestrial organisms. The presence of these conditions allows the natural settling of solids, permeation of water through soils, chemical conversion and fixation of many materials, and predation of adult parasites and larvae. This process not only allows for the development and enhancement of seconds. According to the Xeriscape Council and IFAS(University of Florida Institute of Food an Agricultural Sciences) there are six ways to help make the lawn more drought tolerant.

(1) Apply the correct amount of water to the lawn when it is required. The roots will grow deeper and the turfgrass will be hardier. Deeper roots enable the turfgrass to take water from a larger portion of the ground. In addition to a healthier lawn, money will be saved on the monthly water bill and fertilizer will not be wasted.

(2) Mow turfgrass to the appropriate height to encourage deeper root growth. Set the mower blades to the highest setting recommended for type of turfgrass used (Table 4.5).

(3) Mow frequently enough so that less than half of the grass blade is cut at a time. Otherwise, it will be stressed and require more care.

(4) Sharpen mower blades regularly. Leaf blades which are cut cleanly heal faster than those which are torn. Therefore, less water is lost through the wounds.

(5) Reduce the amount and number of nitrogen fertilizer applications to the minimum required. Excess nitrogen fertilizer produces fast shoot growth, reduces root growth, and wastes water. Potassium fertilizer can improve turfgrass tolerance to stress by increased root growth and thicker cell wall development.

(6) Before selecting or renovating the lawn, evaluate the needs and the site so that the most suitable type of turfgrass will be chosen. If properly selected it will require the least amount of attention in the long haul.

4.7 Use of Mulches

According to the Florida Guide to Environmental Landscapes there are five benefits to using mulch:

(1) Reduced water loss from soil.

(2) Insulated soil temperature.

(3) Enhanced root growth.

During the establishment period(the time between planting and new root growth) regular watering to the root zone is necessary. The following table gives examples of how to water during the establishment period.

Table 4.3 Water requirements for newly planted landscape plants

	WARM MONTHS: APRIL - OCTOBER			
	week 1	week 2-3	week 4-6	week 7-12
Ground Covers, Sod and mass plantings	0.5" daily	0.5" every two days	0.75" twice a week	
Trees and Shrubs in containers	fill basin twice per appli. daily	fill basin twice per appli. every 2 days	fill basin twice per appli. twice a week	
Trees and Shrubs - ball & burlap	fill basin twice per appli. daily	fill basin twice per appli. every 2 days	fill basin twice per appli. every 2 days	fill basin twice per appli. twice a week

	COOL MONTHS: NOVEMBER - MARCH			
	week 1	week 2-3	week 4-6	week 7-12
Ground Covers, Sod and mass plantings	0.25" daily	0.5" twice a week	0.5" once a week	
Trees and Shrubs in containers	fill basin once daily	fill basin once every 2 days	fill basin once, twice a week	
Trees and Shrubs-ball and burlap	fill basin once daily	fill basin once every 2 days	fill basin once every 2 days	fill basin once, twice a week

Established plants or grass do not need to be watered every day. For landscape plants, the best time to determine watering needs is when the plants start to wilt. If the plant begins to wilt, water late in the evening or the following morning when the plant can make the most use of the water. Trees and shrubs probably will not wilt. Established trees and shrubs have extensive root systems and only need watering during prolonged periods of drought. Turfgrass needs to be watered when the grass blades fold together exposing their bases or, the lawn takes a dull blue-green color, or footsteps on the lawn remain compressed for more than a few

4.6 Efficient Irrigation

Selecting the correct type of irrigation system for the landscape is the first step to efficient irrigation. By choosing and operating the system correctly it can reduce water bills, fungal diseases, and maintenance requirements of the landscape.

Other ways to maximize the irrigation system is to group the plants according to their water and sunlight requirements and then irrigate the groups separately. By doing this, the plants receive only the amount of water they need. The three main plant groups in a Xeriscape landscape are: oasis, drought tolerant, and natural.

The oasis zone requires frequent watering. The drought tolerant plants can survive extended periods of time without rainfall or supplemental watering. Natural zones are filled with native plants that are adapted to the wet and dry extremes of the Florida climate.

The success of the grass areas highly depends on the soils ability to drain water. Before sodding, sprigging, plugging, or seeding, spray water over the future lawn area to check the soil absorption. If the water is repelled, use a pitch fork to break the surface tension. Water the area again just before sodding to again check drainage and to encourage root penetration.

and cause the tree to die. If top soil (fill) is brought onto the site, it is best to mix the soils together before they are spread. By mixing the soil it will help prevent problems that may be caused from the layering of different soils. If it is impractical to mix the topsoil because of cost, the fill soil should be as uniform as possible, and the texture should be as close as possible to the existing soil.

If the soil does not have the proper pH level, it may be necessary to change its value by adding organic material. The organic matter(dry manure, peat, composed leaves, or grass clippings) will improve plant growth and water absorption. If soil amendments are used they should be mixed into the top 6 - 12 inches of large areas of soil before planting. If the soil has a low acidic pH it can be corrected with dolomite or lime. In the case of high acidic pH values, it is sometimes a better solution to use plants that tolerate a high pH because the high level cannot be permanently corrected.

4.4 Appropriate Plant Selection

One common mistake made during plant selection is using a fast growing shrub. A fast growing shrub will get quicker aesthetic results, but it will also require a lot more maintenance because of its need for frequent pruning. The Florida Guide to Environmental Landscape has set up a table to help match the plants to the site (Table 4.1). Begin in step 1 by checking the site characteristics which match those found in the specific areas of planting. Proceed changes that need to be made to correct erosion and runoff.

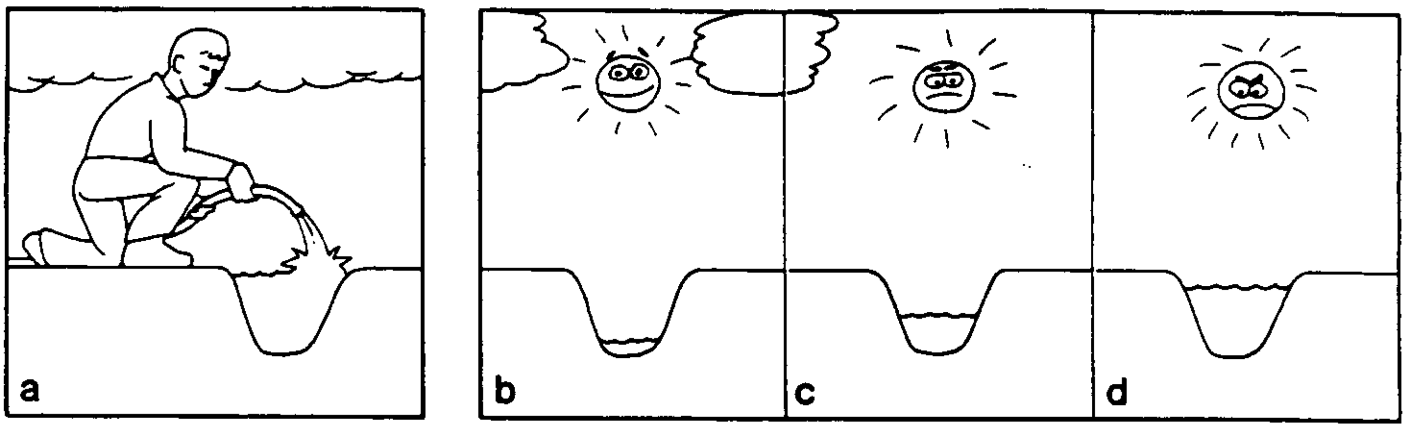


Figure 4.6 Soil analysis

Soil samples should be taken in order to test the pH level. The pH of a soil governs its ability to supply nutrients to plants. The soil should be tested in two or three areas of the site and in any place where the soil is visibly different in color, texture, or consistency. If there is going to be a garden or a designated area for certain plants such as roses or vegetables, it is a good idea to test these areas also.

If there is compacted soil on the site, it should be broken up before planting begins. The soil can be rotilled, but this should be avoided beneath tree canopies because it can damage the roots

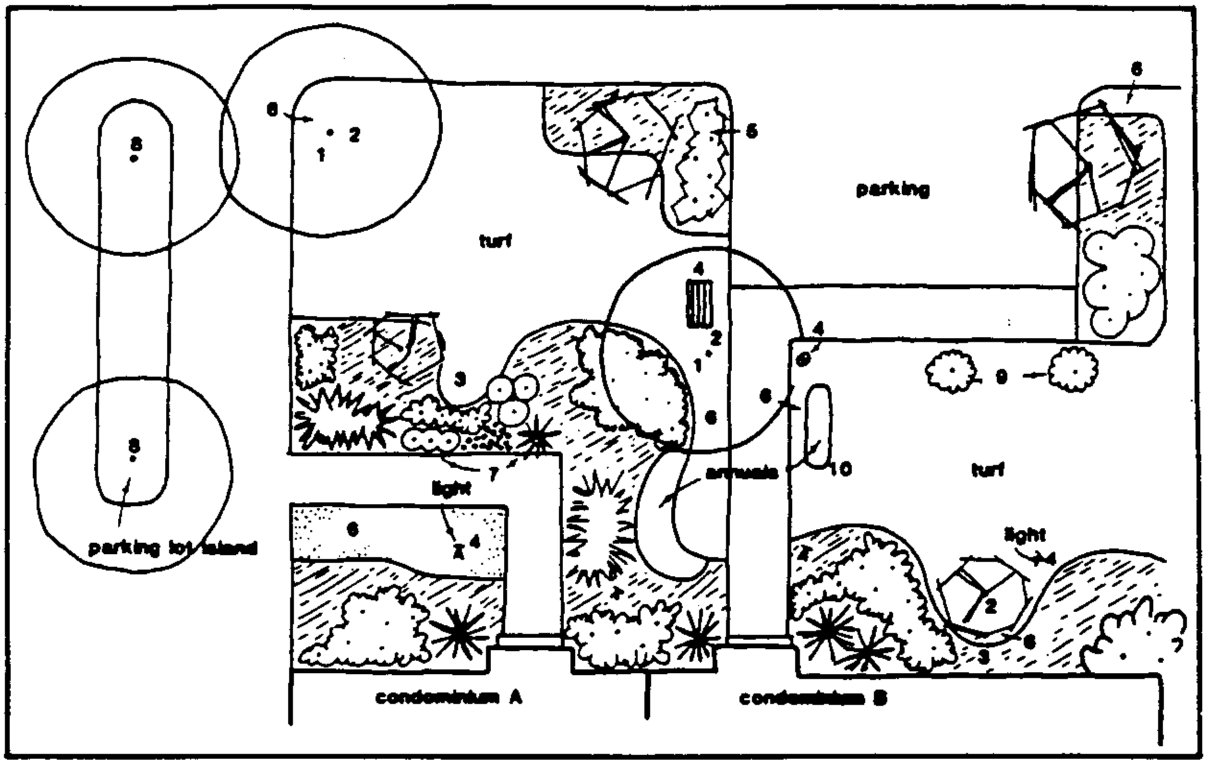


Figure 4.5 Design pitfalls

4.3 Soil Analysis

A soil analysis is essential for every site in order to give the plants full growth potential. If the soil is too compacted or poorly drained, it may not contain enough oxygen for the plants to grow. To test soil for drainage, dig several holes about 18" deep in each section of the site (Figure 4.6). Compacted areas will be difficult to dig in and may retain water longer. During and after rainfall, study the flow of water across the property, and note the

Figure 4.3 demonstrates the low maintenance landscape. The landscape is set up more for entertainment than recreation and the smaller turf area requires less upkeep. In Figure 4.4 the landscape is set up more for recreational use in the lawn area. The landscape in Figure 4.4 requires higher maintenance and may be more suitable for a family with children.

4.2.3 Avoiding Design Errors

In order to avoid design errors the design steps provided by the Florida Guide to Environmental Landscape should be followed (Figure 4.5).

(1) Locate large trees at least 8-feet away from curbs and sidewalks to avoid damage.

(2) Locate trees in beds or mulched areas to avoid difficult mowing conditions.

(3) Smooth out bed lines. Wavy lines often distract form an otherwise good design.

(4) Do not place obstacles in the lawn, put them in beds.

(5) Large shrubs in the parking lot block visibility.

(6) Eliminate narrow strips of grass. They add to mowing costs and are difficult to irrigate.

(7) Do not complicate the design with too many kinds of plants.

(8) Allow at least a 12 x 12 foot soil-area for proper tree growth. Trees planted in small areas grow poorly or raise the curb.

(9) Eliminate individual shrubs growing in lawn. They increase maintenance and distract from a good design.

(10) Locate annuals in beds, not in the lawn.

4.2.2 The Xeriscape Design Process

After all important elements are considered, the design process can begin. A proper design can cut utility costs by 30% and decrease water bills by up to 50%. When designing a landscape the principles provided by the Florida Guide to Environmental Landscape should be followed:

(1) Design the landscape so maintenance costs are low.
(2) Group plants which have similar cultural requirements.
(3) Use mostly drought tolerant plants.
(4) Design an efficient irrigation system.

The two following sketches demonstrate how different families may design their landscape to fit into their lifestyles and maintenance requirements.

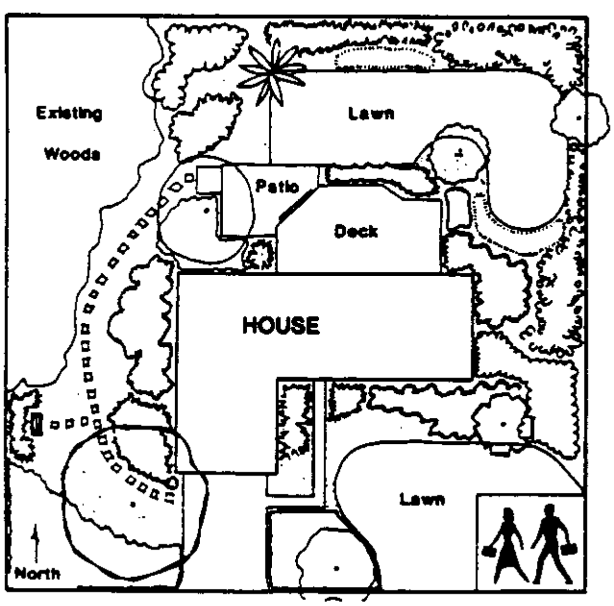


Figure 4.3 Low maintenance landscape

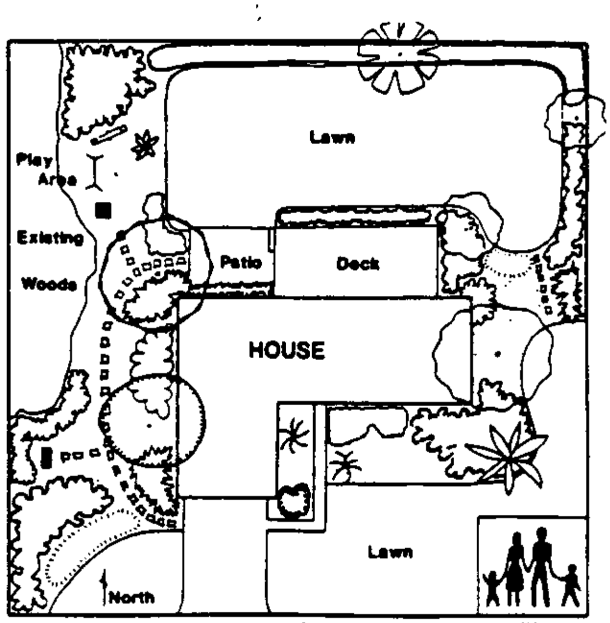


Figure 4.4 High maintenance landscape

To maximize energy savings, make note of the shading patterns cast onto the building by existing trees and shrubs. Save or plant new trees and shrubs that shade the east and west walls to lower air conditioning costs. Prune the shrubs and trees on the north and south walls to allow sunlight to reach the building during the winter months.

In order to achieve maximum effectiveness of the landscape, note the hours of direct sunlight each area of the landscape receives (Figure 4.2). The sun areas need to be noted so that sun and shade loving plants will be planted in their appropriate environments.

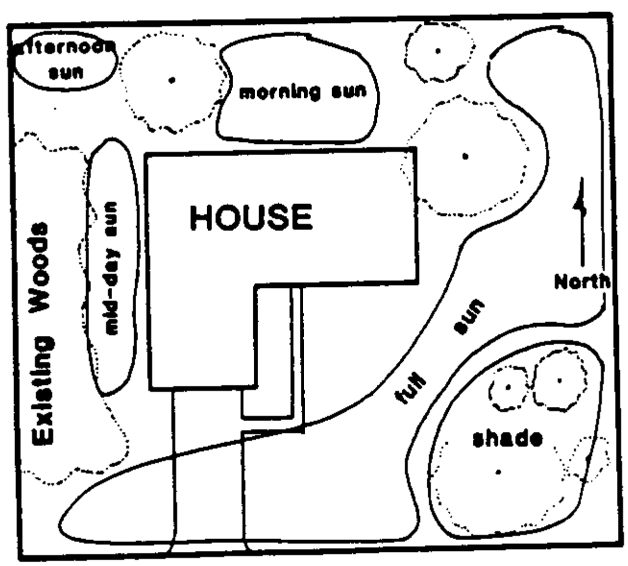


Figure 4.2 Sunlit areas of proposed landscape site

(8) Views
Note any views that may need to be preserved, or blocked/screened.

(9) Existing qualities
What plants, rocks, slopes, structures will be retained in the landscape?

(10) Drainage
Is the existing drainage adequate, or does it lose or retain too much water?

4.2.1 Site Attributes and Problems

According to the Florida Guide to Environmental Landscapes, the first step in designing a new landscape or modifying an older one is to determine the attributes and problems of the site. To determine all aspects of the property, a bird's eye sketch should be drawn (Figure 4.1). The sketch should show approximate locations of property lines and existing or planned structures such as the house, driveway, walks, deck or patio. The sketch should also note any existing plants or trees that are to remain in the landscape, and other characteristics such as sun patterns, utility lines, and water runoff.

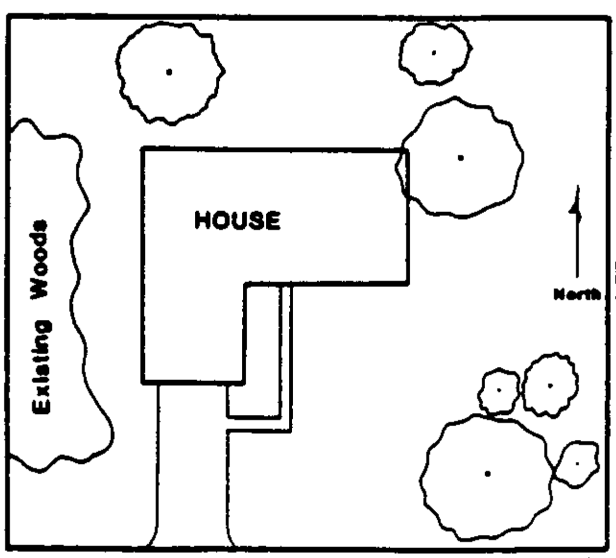


Figure 4.1 Bird's eye view of a proposed landscaping site

enhance a quality Xeriscape landscape. When the first six principles have been followed, maintenance of a Xeriscape landscape is easier and less expensive. In addition, because a Xeriscape landscape is healthier and uses a minimal amount of water, less fertilizer, pesticides, and other chemicals are needed to maintain the plant material.

4.2 Planning and Design

Planning is the most important step in a Xeriscape landscape because it takes into account every aspect of the property and it determines whether or not the final Xeriscape design will be successful. Properly planning a Xeriscape landscape can reduce the initial expenses by installing the landscape in phases. When planning a Xeriscape landscape, a number of important elements should be taken into consideration. Some elements are:

(1) Landscape needs
Which is more important in the final outcome, function or beauty? How much money is in the budget for the landscape? How quickly does the landscape need to be finished (immediate results vs. phased-in design execution)?

(2) Time
How much time will be spent maintaining the landscape? Will the design require high or low maintenance?

(3) Yard activities
Make sure the Xeriscape is designed with all yard activities in mind: ie. garden parties, formal entertaining, recreation, or pleasure.

(4) Storage needs
Will there be any need for storage in the landscape?

(5) Style/image
Will the landscape look traditional, formal or natural?

(6) Plants desired
If particular plants are desired, make sure they are incorporated in the design.

(7) Vegetable gardens
Are there any special purpose areas that need to be set aside?

CHAPTER 5
WATER ECONOMICS

5.0 Introduction

Today's population is becoming increasingly interested in the concept of a sustainable society, a society that recycles resources to the maximum extent possible and that uses resources in a fashion that allows them to regenerate. Water is a renewable resource if properly utilized. A sustainable society would collect, treat, and recycle its wastewater and price its potable water at the same cost as obtaining new supplies.[1] Importing water is a potentially dangerous trend that may result in wholesale ecosystem upset and should be considered only a short term solution. If water is priced appropriately, waste and uneconomic uses will be diminished and appropriate conservation will occur.

5.1 Pricing Mechanisms

The supply of water has been considered virtually limitless by Americans, treated as if it had no intrinsic value. Pricing mechanisms, in fact, tend to make water appear to be far cheaper than it really is. In California, for example, a 1985 study showed that farmers in the Central Valley were paying only $6.15 per acre-foot (85.8 cu m) for water that cost the government $72.99 per acre-foot to deliver, amounting to a subsidy of $50,000 per year for each farm. Translating this to cost per thousand gallons, the subsidized cost is $0.27/thousand gallons while the government's cost is $3.22/thousand gallons. This order of magnitude difference due to government subsidies makes water so cheap that there is little reason for farmers to exercise caution in using water. Typically 50% of all water used in agriculture is wasted, lost through leaks, application to areas where plants do not grow, and evaporation. The Federal Government pours $3.5 billion per year into water projects, in effect subsidizing the wholesale waste of water. If farmers were to save 10% of the water they use, the water availability for other uses would double. Present pricing mechanisms make it unlikely that agricultural interests will institute water conserving and water reclamation methods because economic incentives are not in place.

The same lack of concern for a scarce resource holds true for many municipalities that in effect provide a similar level of subsidy for their residents. In New York there was for many years only a flat rate charge for domestic water use. Water meters were simply not used, with the result being that 200 million gallons (750,000 cu m) of water per year were wasted through leaky faucets, toilets, and water pipes. A drought in 1988 finally convinced the city to begin a ten-year, $290 million program to install meters and reduce waste.

The real cost of water should include environmental damage, future use, and public subsidies. If this were the case, conservation and the use of reclaimed water systems would be far more attractive. Another view is that water should be subject to market forces as are other commodities. However this is not possible in Florida because it is against the law. The water management districts allocate water and it could be said that the system used in Florida is a "political economic allocation system" rather than a "market allocation system." The challenge is that, in order to make the system function properly, the opportunity costs of water should somehow be reflected in the pricing mechanisms and the state would then be serving the role of a market system.

Another point that should be noted in discussing the economic implications of water reclamation systems is that water resources and the waste assimilative capacity are closely coupled. The more water that is consumed means in general that there will be a corresponding increase in wastewater to be processed. Third-main water reclamation systems help mitigate the demand on wastewater plant capacity by providing a relatively low cost of water disposal and a reduction in water demand for non-potable, clean water uses.

5.1 Water Cost in Florida

Current water rates in Florida vary greatly, from 80 cents to over five dollars per thousand gallons. The true cost of water is difficult to determine although there are several methods that can be utilized. The replacement cost of water can be compared to the potential need to turn to desalination, costing about $3.20/thousand gallons to convert raw seawater to potable water. Florida's Water Reuse Task Force applied a method called eMergy Analysis, developed at the University of Florida, to determine the overall cost of water. Using the eMergy method, the Task Force concluded that groundwater had an average value of $0.90/thousand gallons. Broward County used a price of $1.50/thousand gallons in a recent study to assess the feasibility of a water reclamation system. Clearly the outcome of any benefit-cost analysis will be greatly affected by the price of water utilized in the study and it is important that water not be undervalued in order to afford water reclamation systems a fair opportunity to demonstrate their economic advantages.

5.2 Economics of Reclaimed Water (Third-Main) Systems

The economics of implementing a reclaimed water or third-main system has three components:

(1) the retrofit of the existing wastewater treatment with tanks, piping, controls, and other system components to provide reclaimed water to the third pipe system;

(2) the cost of the distribution system (third-pipe) to deliver the reclaimed water to the end-users;

(3) the cost of the third-pipe system within the facility or the cost of new distribution piping for irrigation.

Item (1) above could also consist of an expansion to an existing wastewater treatment plant or the construction of a totally new plant. Thus the unit costs for reclaimed water could vary greatly from jurisdiction to jurisdiction depending on the situation at the local treatment plant. The more modifications that need to be made, the higher the cost of the reclaimed water. Construction of a totally new plant may or may not increase the costs depending on the age and capacity of the existing plant. Consideration must also be given to upgrading the plant, if necessary, to provide adequate treatment of the wastewater for recycled use. Offsetting these costs may be the reduced costs associated with disposing of the wastewater through well injection, Rapid Infiltration Basins (RIB), or other means because the water is being reused rather that posing a disposal problem.

Item (3) will also vary greatly depending on the situation. For a new building the cost of a third-main system will be far less than the cost of retrofitting an existing building. New buildings would also have the option of an internal grey water system, further reducing demand for potable or reclaimed water. Irrigation of agriculture or golf courses would also require the consideration of a control system to interconnect the local irrigation system with the third-main so that contamination will not occur. If adequate reclaimed water is made available then the withdrawal of ground water can be minimized.

The result is that the economics will vary greatly from jurisdiction to jurisdiction and within the jurisdiction depending on use type. In every case however, the cost of providing additional potable water service has to be compared to the cost of providing reclaimed water service via a third-main system. As mentioned in paragraph 5.1 above the price of water can be considered to vary greatly. The lower the price selected for water for a feasibility study of water reclamation systems, the less probable will be the outcome in favor of selecting a reclamation system for implementation. It would appear that, in 1992, a price between $1.50 and $3.00/thousand gallons for a new raw potable water source would be appropriate for most locations in Florida as a basis for examining a potential third-main reclaimed water system. Additionally it would be a fair assumption that the cost of water will escalate or inflate at a rate substantially greater than the general inflation rate.

The following are several case studies that may assist decisionmakers in selecting appropriate parameters for determining the benefit-cost ratio for third-main systems.

(1) Aqua II, San Diego, California

Description: Aqua II is a 1 MGD, full reuse treatment plant at San Pasqual, California. Water is provided for irrigation of municipal, industrial, and agricultural areas. No storage facilities are available for meeting peak water demands.

Economics: The following criteria were utilized for the financial analysis.

Loan interest:	4%
Discount rate:	6%
Rate of inflation:	4%
Useful life, pumps, stations:	30 years
Useful life, pipelines:	50 years
Loan period:	20 years

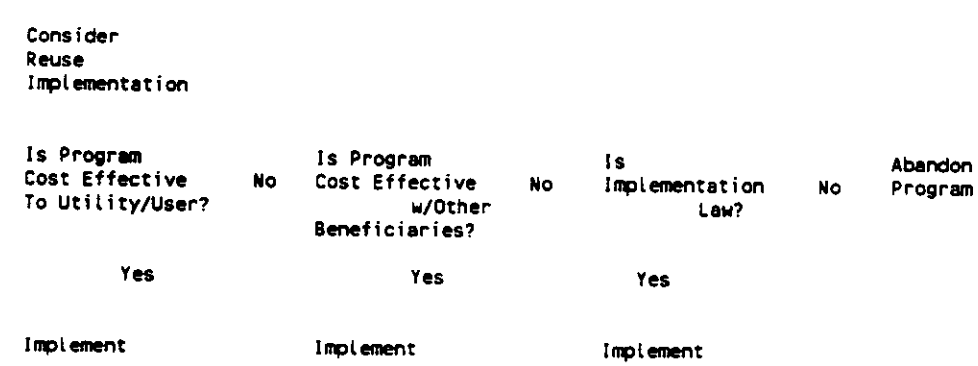
The capital cost of the plant was $4,517,000 with loans administered by the State of California Water Resources Board. The pricing of the reclaimed water has two tiers: $0.756/thousand gallons for agricultural users and $1.09/thousand gallons for municipal and industrial users. The cost of the treated water was $1.89/thousand gallons and for a source of new water the cost would be $2.00/thousand gallons. At the present time revenues exceed O&M costs by $256,800/year and the loan is expected to be paid off within the required 20 years.

(2) **Broward County, Florida**

Description: In May 1991, the South Florida Water Management District (SFWMD) issued a draft plan for the water supply in Broward County. The goal of the plan is to reuse all domestic wastewater flows within 20 years.

Economics: After comparing several reuse strategies, the plan concluded that the optimum reuse would be large scale irrigation at a cost of $0.83/thousand gallons, compared to the development of new sources from the Floridan aquifer of $1.50/thousand gallons. Residential irrigation use was predicted to cost $1.35/thousand gallons and a system to provide this service is currently not economically feasible. Future water price increases or water shortages may change this situation.

The decision flowchart that was used by the SFWMD is shown inn Figure 5.1.



Source: A Comprehensive Review of Effluent Reuse Potential in Broward County, Florida: P. Davis, J. Cowgill, W. Kerwin, G. Fox

Figure 5.1 Reclaimed water project decision program

(3) IQ Water Project, Loxahatchee River, Florida

Description: The Irrigation Quality or "I.Q." Water Project has been in operation for seven years, serving nine golf courses on Florida's east coast with 4.6 MGD of treated wastewater daily. Another three golf courses will be brought on line in the next four years, delivering an additional 1.4 MGD.

Economics: The full water reclamation system will cost $6.8 million upon completion with $5.65 million having been expended to date. Approximately 45% of the system cost has been incurred due to the construction of a filter pump station and filters.

Costs for capital ranged from 17.3 to 19 cents/thousand gallons\, depending on the stage of system development.

Significant new operational and maintenance costs were incurred with the functioning of the water reclamation system components, 40% being due to manpower, 20% due to utilities, 20% to additional chemicals such as chlorine, and 20% due to spare parts and other expenses. Operating costs of the IQ System have averaged 11.8 cents/thousand gallons for the past five years.

Fees were set at 20.5 cents/thousand gallons for the original golf courses under contract, with later contracts being established at 27.5 cents/thousand gallons. Provisions for increasing fees due to inflation are part of the contracts. In 1995 when all 12 golf course are connected, annual revenues are forecast to be $510,000.

The result of combining the capital cost of about 18 cents/thousand gallons with the operational cost of about 12 cents/thousand gallons gives a total cost of about 30 cents/thousand gallons. The result is a shortfall of between 6 and 10 cents/thousand gallons that must be subsidized. The decision on the part of the local authorities to proceed under these conditions was driven largely by the desire to reduce the demand on the limited supply of groundwater in the aquifer by golf courses. This would allow the planned growth of their community to continue without risking an inadequate future water supply.

A second result is that the need for a deep injection well to dispose of the effluent has been largely eliminated by the reuse program. Use of reclaimed water for domestic uses such as lawn watering would have the added benefit of reducing the demand for potable water, thereby decreasing the load on the water treatment plant and the potable water distribution system.

5.3 Economics of Reclaimed Water in Commercial Buildings

The Irvine Ranch Water District (IRWD) located in Orange County, California has successfully used reclaimed water in high rise buildings. Through preliminary feasibility studies, the IRWD determined that approximately 70 - 90% of the water used inside such a building is used for flushing toilets and urinals and that 80% of the total water used for this type of building including landscape irrigation could be reclaimed water. In a study made for the seven story high rise building, 3 Park Plaza, the first commercial building to use reclaimed water in the United States, the following data were collected:

Table 5.1 Total water use, 3 Park Plaza (Jamboree Tower), Irvine, California

Percentage of Domestic Water Used	21.54%
Percentage of Reclaimed Water Used	78.46%
Cost of Domestic Water	$0.53/thousand gal
Cost of Reclaimed Water	$0.48/thousand gal

The Irvine Water District found the factors which make the use of third pipe systems feasible in commercial applications to be:

(1) **Use in buildings which are six stories or more in height**
These buildings tend to have both a large water demand and central utility placement design.

(2) **Large point loads**
The average base allocation of water for a light industrial or standard office commercial building is 2,400 gallons per acre per day in the IRWD. However, high rise buildings in the six to sixteen story range frequently exceed the allocation. The IRWD attempts to make up for this discrepancy by using a high rise surcharge for large demand. This does not enable the system to operate more efficiently or to meet supply during peak load periods. And because infrastructure is installed before buildings are in place, the cost of enlarging systems or building new ones is not met. Therefore, high rise buildings which use 80% less water are thought to be the most effective way to increase the life of the infrastructure and keep down costs.

(3) **Central utility cores**
In a high rise building of Type 1 as described by the Uniform Building Code, utilities are all placed in the center. This allows all of the reclaimed water fixtures to be supplied by a central common riser while separating the potable water supply from the non-potable supply. Risers can be placed on either side of the core to aid in the prevention of cross connections.

(4) **Primarily occupied by adults**
Because the user of reclaimed water for non-potable uses is required to be aware at all times of the danger of ingestion, a building which is primarily occupied by adults is desirable so that warning signs and user directions may be facilitated.

(5) **Controlled access to plumbing**
Accidental cross connections occur most frequently where the user is uneducated in the use of the system and where there is unlimited access to users who might not be familiar with the system. In high rise buildings, the plumbing is not accessible to the general building user as it is placed behind walls and locked compartments.

(6) **Designated maintenance staff**
Normally, high rise buildings have maintenance staffs with adequate supervision to make all repairs and facilitate cleaning. This represents a single point of control of the system by staff and inspectors from the local municipality. An educated maintenance staff greatly reduces the possibility of accidental tapping.

The cost to a private owner for plumbing to accommodate a third pipe system is higher on an initial basis than that for conventional plumbing. For residential applications, this higher cost is not nearly as significant as that for commercial and industrial buildings. There are various methods for structuring costs of water use utilized by local municipalities and therefore a variety of incentives which might by offered to owners to help defray costs. Local conditions such as propensity for seasonal droughts, availability of water, and cost of supplying water create variability in water costs for owners. Some municipalities have actually subsidized the cost of a commercial building by paying for the increase in cost of plumbing. Using cost data from the case study of the 20 story Jamboree Tower in Irvine Ranch, California, an understanding of the increased cost to owners and one of the possible strategies to mitigate this cost may be found.

The building is located in a drought-prone area where the local municipality has adopted a sliding scale rate assessment to encourage water conservation. In this area, users have been required to reduce water consumption by at least 20% in order to avoid paying higher rates. The cost of the plumbing for Jamboree Tower is as follows:

Table 5.2 Cost of Plumbing System, Jamboree Tower, Irvine, California

Total Estimated Cost of Building	**$28,240,000.00**
Total Estimated Cost of Conventional Plumbing	**$717,470.00**
Estimated Increased Cost for Third Main System	**$64,130.00**
High Volume Water Surcharge Fee (Deferred)	**$35,110.00**
Developer's Capital Cost Increase	**$29,000.00**

The number of fixtures for this building are as follows:

Fixture	**Number**
Toilets	76
Urinals	38
Sinks	95
Floor Drains	19
Total	**228**

The building was plumbed to use reclaimed water only for those fixtures listed above. Estimated cost per unit fixture is $127.19.

The following water charges were calculated based on the months of April, May and June 1991 in which actual water charges were compared with what the building would have paid had it used only domestic water and not reduced consumption by 20 per cent.

Table 5.3 Actual and projected water charge comparisons, Jamboree Tower, Irvine, California

Month	Actual	Projected
April 1991	$ 363.45	$ 428.24
May 1991	$1,763.28	$2,490.00
June 1991	$5,204.23	$7,171.41

The net result of this analysis is that the owner can reasonably expect to recover the initial capital cost of the third main system in approximately four years.

5.4 Economics of Industrial Reclaimed Water Systems: Citrus Industry

The advantages of reclaimed water systems are not limited to commercial and recreational businesses. Industrial operations such as the citrus industry could benefit from the installation of reclaimed water systems in their packing houses.

The citrus industry utilizes washwater to clean newly picked citrus as the first step in packinghouse operations. Chlorinated water is sprayed onto the fruit for disinfection for this purpose. Due to problems with disposing of the washwater and increased regulatory pressures from DER, packinghouses are determining that it is economically feasible to consider reusing the washwater. The reused water can be used for several purposes:

1. Washing and rinsing fruit
2. Washing trucks and process equipment
3. Make-up water for cooling towers
4. Cooling water for refrigeration compressors
5. Non-potable water supply

A typical packinghouse with a requirement for 20,000 GPD will have a construction cost of $25,000 to $30,000 for a reclaimed water system. The payback period for a typical treatment/reuse facility is 15 to 30 months of operation. Savings are estimated to be upwards of $2500 per month for a plant that would otherwise use 20,000 GPD.

Among the Florida citrus organizations that have had experience with packinghouse reclaimed water systems are:

1. Mount Dora Growers Cooperative
2. Gray's Orange Barn, Lake County

Washwater reuse has the potential of saving 1.5 MGD. The problems with disposal of citrus washwater and pressures from State and local regulatory agencies is forcing the industry to consider reclaimed water systems as a viable option for handling their washwater problems.

REFERENCES

1. ReVelle, P. and ReVelle, C. The Global Environment: Securing a Sustainable Future, Jones and Bartlett Publishers, Boston, 1992.

CHAPTER 6
PUBLIC PERCEPTION AND GOVERNMENT POLICY

6.0 Introduction

The reuse of wastewater evolved from two basic needs. First, it began in Europe as a method of disposing of urban wastewater from European cities, avoiding the pollution of rivers, lakes, and streams by using the effluent for agricultural irrigation. Second, and more recently, it has served as a source of additional water for water-short regions.[1] Water reuse or reclamation projects usually are initiated with large scale agricultural or industrial users. If the economics dictate, the reuse system can extend into newly developed areas of the region. Accomplishing the same operation in areas that have already been developed are far more costly due to system retrofit costs.

6.1 Public Perception

Reusing wastewater for other than drinking purpose poses no health problems and has generally been enthusiastically welcomed by the general public. Using reclaimed water for drinking water is not presently practiced due to the uncertainty as to health effects and the public perception that reclaimed wastewater, no matter how well processed and cleaned, is not suitable for consumption. Reclaimed water can serve as a substitute for potable water in many applications: urban irrigation, industrial processing, cooling, cleansing, construction, toilet flushing, fire protection, reinjection into the aquifer system. The result is the release of significant quantities of drinking quality water for the use of the public.

Public perception can serve both as a source of support for a proposed water reclamation project if the public is carefully and clearly informed as to the purpose of the system, the uses of the reclaimed water, the advantages of the system, the economics of the system, and the overall environmental effects that will result. Mishandling of the marketing effort to positively influence public perception can also cause the end of a reclaimed water project, especially if health issues are not addressed and if the economics of the proposed system are not clearly justified. Policy makers need to pay heed to the basics and insure that the public is included in the decision making process.

6.2 National Policy

National policies concerning water were basically formed at the beginning of the century when there was a need for toll-free inland waterways and protection of existing populations against flooding. A 1970 report by the National Water Commission concluded that policy regarding water use was anachronistic and had no bearing on present and future water needs. Further encroachment into floodplains to create new housing developments and commercial enterprises could no longer be considered good practice. The vast increase in the use of chemicals created potential dangers for existing populations as the struggle to keep the sources of drinking water safe became increasingly difficult. Overpopulating naturally dry regions caused serious long term water shortages. The conclusion of the report was that the country had a serious problem which called for debate and resolution of water issues. Appropriate follow-on legislation was deemed to be imperative. However, since that time little has been accomplished because a consensus on major issues has not been reached by the opposing forces.

Problems with policy setting include the fundamental difference between the water rich eastern United States and the water poor western United States, the validity of massive transfer of water from one region to another, and cost sharing. The report concluded that the nation has two critical issues facing policy makers. These same issues are central to Florida's water concerns. They are: (1) the in-stream recreational and property development uses of water versus the out-of-stream individual and corporate uses of water and (2) the inability of the population to be able to view water as a scarce resource.

6.3 Laws and Regulations

The following is a brief overview of the origins of the regulatory bodies and laws which control the use and disposal of water in the United States and Florida.

6.3.1 Federal Laws and Policy

(1) Flood Control Act, 1948
The Flood Control Act directed massive projects related solely to flood control to be carried out in the United States, particularly in south Florida, by the Army corps of Engineers.

(2) Water Quality Act, 1965
This required states to classify waters according to their uses and to set water quality criteria and standards so that the designated uses would be protected.

(3) Water Pollution Control Act Amendments, 1972
These amendments tightened the language of the Water Quality Act and provided for intervention by the federal government if states failed to set water standards.

6.3.2 Florida Laws and Policy

(1) Central and Southern Florida Flood Control District, 1949
This was the precursor to the present-day existing five water management districts and was created in direct response to severe flooding in southern Florida in 1947 and 1948. Its chief responsibility was to manage the newly formed Central and Southern Florida Flood Control Project which constructed numerous canals, levees, and control structures in south Florida.

(2) Restructuring of the State Board of Health
Chapter 381, Florida Statutes was written giving the State Board of Health the authority to adopt and enforce rules concerning communicable diseases, sewage disposal, and drinking water quality (treatment and supply). This, in effect, represented the first attempt to consolidate an increasingly large number of Florida pollution laws.

(3) Florida Water Resources Act
This act created the Department of Water Resources. The Department was responsible for permitting consumptive use of water and initiating water conservation measures in areas where there was significant salt water intrusion.

(4) South Florida Water Management District, 1961
Because of heavy flooding and property damage in the Tampa Bay area in 1960, the South Florida Water Management District was created.

(5) Florida Air and Water Pollution Control Act, 1967
Written as a response to the Federal Water Quality Act and the Water Pollution Control Amendments, this act repealed most of the previous pollution control laws in Florida and basically consolidated control authority in the governor and cabinet through the creation of the Florida Air and Water Pollution Control Commission. However, it did nothing more than require prior notice

of proposed construction with an accompanying sixty day waiting period during which it had the power to refuse. In 1971, all construction considered to be a source of pollution was required to obtain a permit.

(6) Governor's Conference on Water Management, 1971
This conference marked a change in Florida's water management policy by concluding that the issues of water use, land use, and growth policy were interconnected.

(7) Water Resources Act, 1972
This act was part of the legislation which followed the Governor's conference. It was recognized by the National Water Commission as a landmark model water statute. Other important acts of 1972 which were born of the conclusions of the conference were the Environmental Land and Water Management Act, The Comprehensive Planning Act, and the Land Conservation Act.

The Water Resources Act created the remaining three water management districts: the St. Johns Water Management District, the Suwannee Water Management District, and the North Florida Water Management District. The scope and power of the five districts were greatly expanded by this act and general administrative control was placed in the hands of the Department of Natural Resources.

(8) The Environmental Reorganization Act and The Department of Environmental Regulation, 1975
The act was in response to the perceived lack of accountability and duplication of functions concerning water use. The agency was created to centralize management of Florida's environmental problems and given general authority to supervise the actions of the five water management districts which were given the authority to exercise all of the responsibilities outlined in the 1972 Water Resources Act.

(9) Safe Water Drinking Act, 1977
This act gave the Department of Environmental Regulation the power to regulate public water systems.

(10) The Water Quality Assurance Act, 1983
The most important impact of this act was to relegate water well contracting licensing, regulation of stormwater runoff, and deep well injection permitting to the five water management districts. It also provided for mechanisms to detect ground water contamination and prevent groundwater pollution resulting from indirect sources such as septic tanks, pesticide runoff and improper disposal of hazardous materials.

6.4 Current Florida Water Policy and Concerns

Several prolonged periods of drought in Florida which have caused water management districts to place restrictions on irrigation have led to the growing popularity of reclaiming water for non-potable uses. The state has published guidelines for municipalities considering reclaimed water programs and call for a minimum of four levels of reuse to be studied:

Maximum:	Reuse of 75% of wastewater generated
Medium:	Reuse of 40 to 75 % of wastewater generated
Minimal:	Reuse of less than 40% of wastewater generated
No Action:	No additional reuse is implemented.

The basic concept behind the various water reuse programs in Florida is stated by a Florida DER directive found in the Florida Administrative Code, Chapters 17-40, Section 17-40-03 which states: "Before a consumptive use permit (for water extraction) is issued, consideration will be given to the lowest quality water which the applicant has the ability to use. If it is determined that the applicant can use lower quality water and such water is available, ...the consumptive use permit will be issued only for the use of the lower quality water." The mandate for use of the lowest quality of water sufficient for the intended use is the foundation of the various reclaimed water programs in Florida. The need to use the lowest quality of water is a direct result of the inability of infrastructure and sources of clean ground water to keep pace with Florida's growth.

The most important laws and policy statements concerning the reuse of water in the state of Florida are the following:

(1) **Chapter 17-4 ,Florida Administrative Code,(FAC), Permits**
This statute requires performing reuse feasibility studies prior to permitting new or expanded surface water discharges.

(2) **Chapter 17-302, FAC, Surface Water Quality Standards**
This statute reiterates the requirement of the feasibility study prior to the permitting of new or expanded surface water discharges.

(3) **Chapter 17-40, FAC, Water Policy**
This statute makes reuse mandatory in "critical water supply problem areas" if economically, technically, and environmentally feasible.

(4) **Chapter 17-600, FAC, Domestic Wastewater Facilities**
This statute defines terms pertaining to reuse and treatment standards such as levels of disinfection and reliability.

(5) **Chapter 17-610, FAC, Reuse of Reclaimed Water and Land Application**
This statute describes comprehensive rules governing the use of reclaimed water. It is attached to this report as Appendix IV.

(6) **Section 403.064, Florida Statutes**
This section promotes reuse of water as a state goal and requires reuse feasibility studies in designated "critical water supply problem areas".

(7) **"Guidelines for Preparation of Reuse Feasibility Studies for Applicants Having the Responsibility for Wastewater Management" Florida DER, 1991.**
This document describes the Florida DER guidelines for conducting reuse feasibility studies.

Consumptive use of water is primarily regulated by the five water management districts of the state of Florida. The Department of Environmental Regulation has set a goal for the state of Florida to reuse 40% of total wastewater flow. The South Florida Water Management District, located in the most heavily populated area of the state, predicts it will have to mandate 100% reuse within the next 30 years. Florida has long held the idea that water management is a regional issue, hence the creation of the five districts and their respective geographical territories. For a proper understanding of the direction that policy making will take in the future, a brief description of the issues and recommendations as formulated by each district follows.

6.4.1 The Northwest Florida Water Management District

The Northwest Florida Water Management District (NWFWMD) is comprised of all or part of sixteen counties in the western portion of the state containing approximately 11,200 square miles. The Floridan Aquifer supplies about forty-two per cent of potable water supplies. Ground and surface water in this district is generally of good quality and abundant. Total withdrawal totaled second lowest with the Suwannee River Water Management District totals being the lowest.

Because of a relatively low population and the abundance of good quality water, there are very few serious problems in this district compared with others. The primary problem rests in the uneven distribution of the population which is mainly concentrated in a narrow strip along the coast. The heavy seasonal pumping in the Ft.Walton Beach and Destin areas has created a large reduction in the potentiometric pressure (the level to which water will rise in a tightly confined well within the aquifer) over a large portion of the Floridan Aquifer. The Floridan Aquifer lies approximately 400 to 500 feet below Ft.Walton Beach. First records of well levels show pressure adequate to produce artesian flows 30 to 40 feet above land surface. The increasing demands have caused surface declines in annual potentiometric pressure as much as 240 feet in parts of Okaloosa county. In other parts of Florida, reduction in potentiometric pressures of this level has resulted in salt water intrusion. Current management practices are centered around relocating wells in areas of higher availability and reducing or abandoning those in low availability areas. Water needs could be met in this area for the next ten years through this practice if the population does not significantly increase.

6.4.2 The St. Johns River Water Management District

The St. Johns Water River Water Management District (SJRWMD) contains all or part of nineteen counties and over 12,000 square miles. Twenty-five per cent of the state's population live within this district. The main source of fresh water is from the Floridan Aquifer. In some areas, poor water quality has already limited its use.

High chloride content east of the St. Johns River has been attributed to urban overuse, industrial use, and agricultural use. Additionally, abandoned free-flowing wells have contributed to depletion of the aquifer and the instance of salt water intrusion. Reduction in ground water levels also is a significant contributing factor to sinkhole formation.

The population is expected to reach 3 million by the year 2000 from its present estimate of 2.5 million. The largest increase in the use of fresh water is expected of be in the public sector category.

6.4.3 Southwest Florida Water Management District

The Southwest Florida Water Management District (SWFWMD) is comprised of all or part of sixteen counties encompassing approximately 10,000 square miles and supporting about seventeen per cent of the state's population. About ninety per cent of the water used in the district comes from ground water. The only source of recharge in this district is that from precipitation.

Pinellas County experienced salt water intrusion many years ago and as a result, property was purchased outside the county by large water suppliers for the development of adequate ground water supplies. Manatee, Sarasota, and Charlotte counties have water quality problems resulting from the fact that the aquifer is confined at a depth too great for adequate recharge from precipitation. This causes the water to be highly mineralized. Water supply is basically being met by the development of ground water sources further inland. However, increasing population will deplete the reserves currently in place by the year 2000.

Nearly forty-five per cent of the total water used in this district comes from Polk County. In fact, the four counties of Polk, Hillsborough, Highlands, and Pinellas use approximately seventyfive per cent of the total water consumed in the district.

One of the primary problems in supplying fresh water in this district is the fact that many of the counties ,such as Pinellas County, have aquifers that are surrounded by salt water. Pinellas County's water suppliers developed large well fields in Pasco and Hillsborough counties to pipe water to Pinellas. This created the "water wars" in the early 1970's between the growing populations of Pinellas and Hillsborough counties. Regulatory bodies such as the West Coast Regional Water Supply Authority, the Withlacoochee Regional Water Supply Authority, and the Peace River/Manasota Regional Water Supply Authority were created to help resolve the problem of water shortage. It is generally agreed that desalinization will play an increasingly important role in public water supply in the future. The primary problem with desalinization and long distance piping is the sharp rise in the cost of water. Political and physical condition problems also abound. It is certain that the use of reclaimed water could make significant inroads into extending the life of the public water supply.

6.4.4 South Florida Water Management District

The South Florida Water Management District, comprised of sixteen counties and more than 17,000 square miles, contains forty per cent of the state's population and thirty-one per cent of the population.

6.5 Conclusion

Florida and virtually all other States are having difficulties assuring sufficient water for the various residential, commercial, agricultural, and industrial purposes that are ever increasing in size and scope. The development of reclaimed water as a water resource can prove beneficial to all sectors of Florida's complex economy. A key issue is how to convince both the private citizen and the political system that reclaimed water is a valuable and viable potential method of delivering badly needed water for a wide variety of uses. Appendix V contains a very good example of how one municipality tackled the problem of public perception by publishing a comprehensive newsletter that addressed virtually all public concerns, from the system's cost, its financing, its advantages, and the rationale for creating a reclaimed water system.

Ultimately the decision will hinge on economic grounds. For a reclaimed water system to be competitive, the true cost of the water that it is replacing must be factored into the analysis. As pointed out in Chapter 5 on Water Economics, water has been a heavily subsidized resource and its historical cost has to the consumer has been extremely low compared to the cost to develop, treat, and pump the water. Selection of realistic pricing mechanisms for water would greatly assist in the widespread development of reclaimed water systems. Additionally realistic pricing of water would cause a general trend to water conservation measures and greatly relieve pressure on the already overstressed aquifer system in Florida.

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3. **Consumptive Uses of Water**, Southwest Florida Water Management District. , Chapter 2-11. 1985.

4. Florida Administrative Code (FAC), Chapter 17-610, **Reuse of Reclaimed Water and Land Application.**

5. **Guidelines for Preparation of Feasibility Studies for Applicants Having the Responsibility for Wastewater Management**, Florida Department of Environmental Regulation, 1991.

APPENDIX I

WATER RECLAMATION SYSTEMS

ST. PETERSBURG, FLORIDA

APPENDIX I

A.1 St. Petersburg's water reclamation system

St. Petersburg is a city located in central Florida on the Gulf Coast. The city started a water reclamation program in the early 1970's to stop the discharge of treated waste water to surface waters. The program also addressed the problem of diminishing potable water supply. With the city expanding, the increased demand for potable water would also increase. With an increase in demand for potable water the city would soon need to procure potable water from other adjacent counties.

In 1987 the city of St. Petersburg had 4,400 reclaimed water customers. Customer use comprised of 3,900 acres of commercial and residential irrigation, 289 fire hydrants as part of an existing emergency system, and other commercial uses such as cooling water used in chillers and fire protection. The network that supplies the reclaimed water has 76 miles of trunk and transmission mains with diameters ranging from 10 to 48 inches. Branching out from the mains are 134 miles of distribution pipe with diameters of 2 to 8 inches.

The Public Utilities Department provides customers service and management of the reclaimed water system. Other departments supporting the system are the General Maintenance Department and Public Information Department. The General Maintenance Department installs and maintains all pipelines, valves and other components of the distribution system. The Public Information Department helps to educate and answer questions about the uses of reclaimed water. The department helps in publication and distribution of literature when new water conservation programs come into effect. The

Department of Public information also helps to produce information on the current status and needs to conserve potable water.

A.1.1 Reclaimed water quality

The quality of the reclaimed water produced in the treatment system is generally good to excellent for non-potable uses. The nutrient rich water is very good for irrigation uses. In the treatment process filters are used to clean the water. Monthly testing is completed on the filter system for virus detection. The Department of Health and rehabilitative services performs the testing.

Samples of the reclaimed waste water indicated excellent fecal coliform removal with values under 1.5 fc/100 ml as measured by the geometric mean. In one of the four plants the chloride amounts were high due to saltwater intrusion into the sewer system. This could pose a problem if the amounts were higher. One problem with current treatment is that chlorides are not removed, sometimes leaving the chloride concentration too high resulting in harmful effects to some plants and allowing iron pipes to corrode. However, desalinization is an expensive process and while the chlorides appear in the reclaimed water, the concentrations of chlorides are not high enough to warrant the cost of desalinization. However there may be an alternative to desalinization. If the city could update the sewer lines that have experienced saltwater intrusion, the problem would then be resolved.

The water quality of each plant is tested by plant personnel and is recorded. The law of water quality in the city of St.Petersburg is that a standard must be met or or the water can not be discharged into the reclaimed water distribution system. Also the law states that the unusable water will not be discharged above ground. Any treated water not meeting the standards, is discharged by deep well injection. In deep well injection the unusable water is injected at the base of the water table and is then dispersed in the ground water. The standard set for the city of St. Petersburg is effluent meeting the following characteristics: chloride concentrations less than 600 mg/l, turbidity must be less than 2.5 nephelometric turbidity units, or suspended solids must be less than 5 mg/l. Figure A.1 flowcharts effluent disposal criteria.

In 1987 the city of St. Petersburg gathered a panel of experts to examine the reclaimed water quality and to determine the safety of the public. The panel of experts presented "The White Paper, Urban Water Reuse in the City of St. Petersburg". In the report the panel came to the conclusion that there is no evidence of increased gastro-intestinal diseases in urban areas irrigated with treated reclaimed water using coagulation, filtration, and disinfection. In addition the panel found no evidence of the transmission of viral or microbial diseases as a result of exposure to effluent from spray aerosols from spray irrigation with reclaimed water.

As for maintaining the standard set by the city, The White Paper recommends an advanced secondary treatment system that would be able to handle projected hydraulic loads and organic loading, with the capability for chemical addition prior to filtration. The report also recommends constant 7 days a week, 24 hours a day testing and operations control management. In addition to the constant monitoring of the treatment plant, the distribution

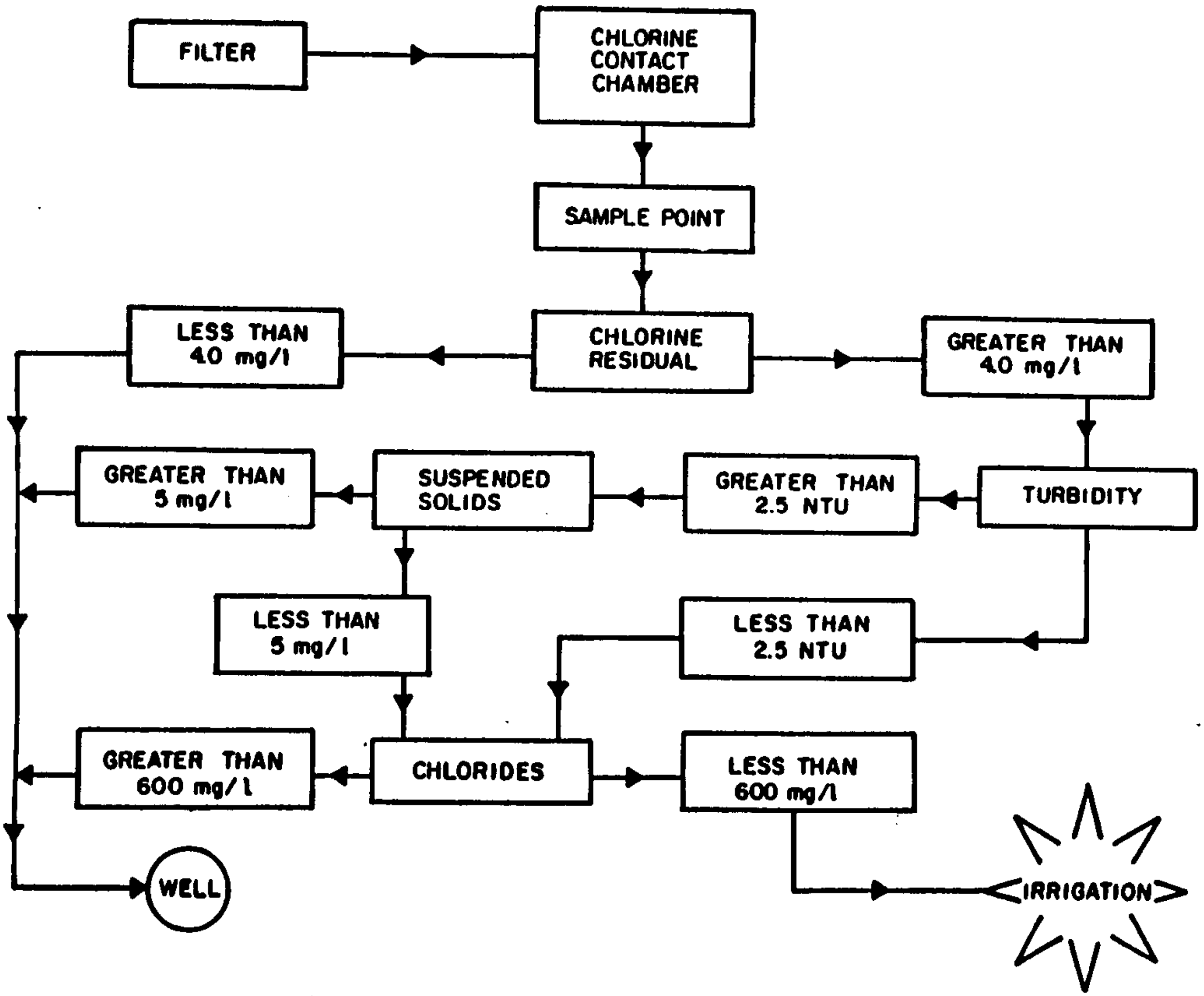


Figure A.1 Effluent disposal criteria

system should also be monitored to guard against bacterial growth.

A.1.2 Reclaimed Water Quantity

The supply of reclaimed water is in direct proportion with the amount of waste water that is treated. While the total amount of treatable water is not recovered, about 80 percent to 85 percent can be recovered from current systems such as in the city of St. Petersburg. The annual flow of available waste water for treatment varies with seasonal changes. Not only does the seasonal change of weather vary the rate, but annual population changes will also affect the rate. A correct assessment of the maximum flow rate must be determined in order to design a system to meet peak rates. When the peak rate of waste water flow is determined, expansion must be planned for in order to meet future demands. To illustrate, the city of St. Petersburg had an annual flow rate of 47.7 mgd in 1985 to an estimated 54.6 mgd by the year 2030. Table A.1 displays population served and average daily flow from 1985 to the projected year of 2030.

	Population Served (1,000s)					
Population Served (by district)	1985	1990	2000	2010	2020	2030
Albert Whitted	51.3	51.9	49.8	50.2	50.4	51.6
Northeast Plant	68.9	78.4	83.0	87.9	88.2	88.2
Northwest Plant	73.7	81.8	85.3	88.9	90.5	92.7
Southwest Plant	90.1	105.4	111.2	117.5	119.5	120.0
TOTALS	284.0	317.5	329.3	344.5	348.6	352.5

Table A.1 Population served

One problem associated with the quantity of reclaimed water is the daily flux in waste water flow rates. During the day, the influent flow rate and the effluent flow rate change. These changes can create a high or low flow condition in the amount of reclaimed water available for use. To remedy the problem a storage tank, acting as a buffer is provided to handle excess demand for effluent in a low condition. In a high condition the storage tank is pumped down by way of the deep well injection system (Figure A.2). This problem can reoccur when expanding a treatment facility, and the storage tank acting as a buffer is not large enough to handle excess demand in a low condition. The solution is to build a larger tank to handle the demand. However tanks are expensive and require land that can be costly or sometimes not available. Two alternative methods of storage are sometimes available depending on geographic location.

The first method of storage is similar to ground water recharging. If excess reclaimed water could be injected to a level in the stratum where a bubble could be formed, the bubble could then be retapped in a low condition. The city of St. Petersburg has tried this method in several locations but the bubble could not be formed. Another alternative is a collapsable bag, similar to a tank that is anchored off the coastline. The collapsable tank is airtight and expands in a vertical direction when filled and collapses when drained. This new idea could be a less expensive alternative to costly reinforced concrete tanks on land.

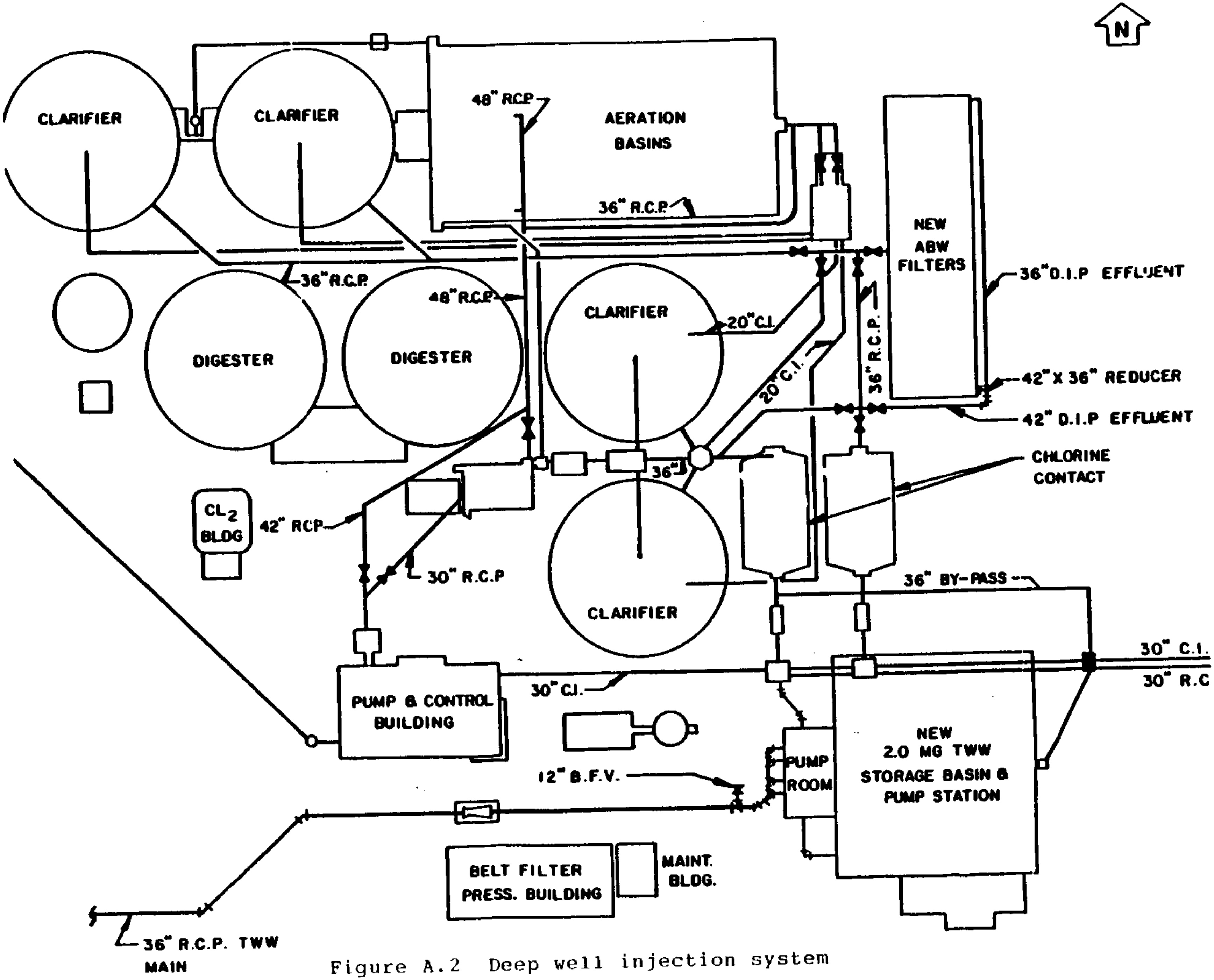


Figure A.2 Deep well injection system

A.1.3 Demands and Uses

While the treatment process was originally developed as a solution to the disposal problem of waste water, the reclaimed water service is now a utility that serves the public. While reclaimed water has a high initial cost to the end user, the service will pay for itself over the long term. Because as of date, reclaimed water is not metered and subsequently, commercial irrigation and other large users benefit from lower monthly water bills. In the city of St. Petersburg the demand for reclaimed water is increasing due to the savings. Table A.2 shows types of general uses and the corresponding number of uses for the years 1982 to 1985.

	Number of Customers (mid-year)			
	1982	1983	1984	1985
Parks	44	44	44	44
Schools	36	36	36	36
Golf Courses	6	6	6	6
Commercial	41	41	43	68
Residential	237	472	672	2,745
Other	—	11	11	11
Total	364	610	812	2,910

Table A.2 General characteristics of system customers

A.3.4 Systems Costs and Revenues

St. Petersburg's reclamation facility was originally funded by a federal grant for waste water reclamation and distribution pipeline construction. Currently, there are no available federal grants for treatment systems. All new construction costs must be met by local government programs.

Basically, the cost of the new distribution pipeline can be met by new customer installations with a cost of $13 to $14 per foot. In addition, a one time tapping fee is included in the first monthly water bill. All customers will pay a small flat rate to help recoup initial construction and maintenance costs.

<u>Metered service</u>

The City of St. Petersburg does not recoup all of the annual cost to run the system. Since reclaimed water is now considered a third public utility, the idea of metering the flow of reclaimed water to each service has been suggested. With the use of meters, the cost of the reclamation system could be evenly distributed to the customers that use it the most. Metering the water would also put an end to the abuse of using to much reclaimed water due to its flat rate cost.

A.3.5 System Objectives and Policies

The first design of the waste water system had main objectives that were to be adhered to. The first objective was to comply with federal and state regulations, and criteria to comply with waste water management. The second was to reduce to quantity of imported potable water. With the current system, both of these objectives have been met. However potable water still needs to be conserved. The city of St. Petersburg has developed a new set of objectives organizing them into primary and secondary objectives.

PRIMARY OBJECTIVES

(1) Reclaimed water should be fully developed as a resource to be managed and conserved as an element of the total water resources available to the city.

(2) The city should establish in-house standards for effluent quality from all waste water treatment plants that supply the reclaimed water system, and make the improvements required to ensure the reclaimed water supply.

(3) The city should establish better defined priorities for reclaimed water use.

SECONDARY OBJECTIVES

(1) The Reclaimed Water section should establish adequate utility cost accounting methods within the Public Utilities Department, to more fully isolate all three utility functions.

(2) All cost and benefits for reclaimed water system operations and maintenance should be quantified.

(3) All waste water treatment facilities should be operated to optimize reclaimed water system supplies.

(4) Reclaimed water service should be extended to as many customers as economically feasible.

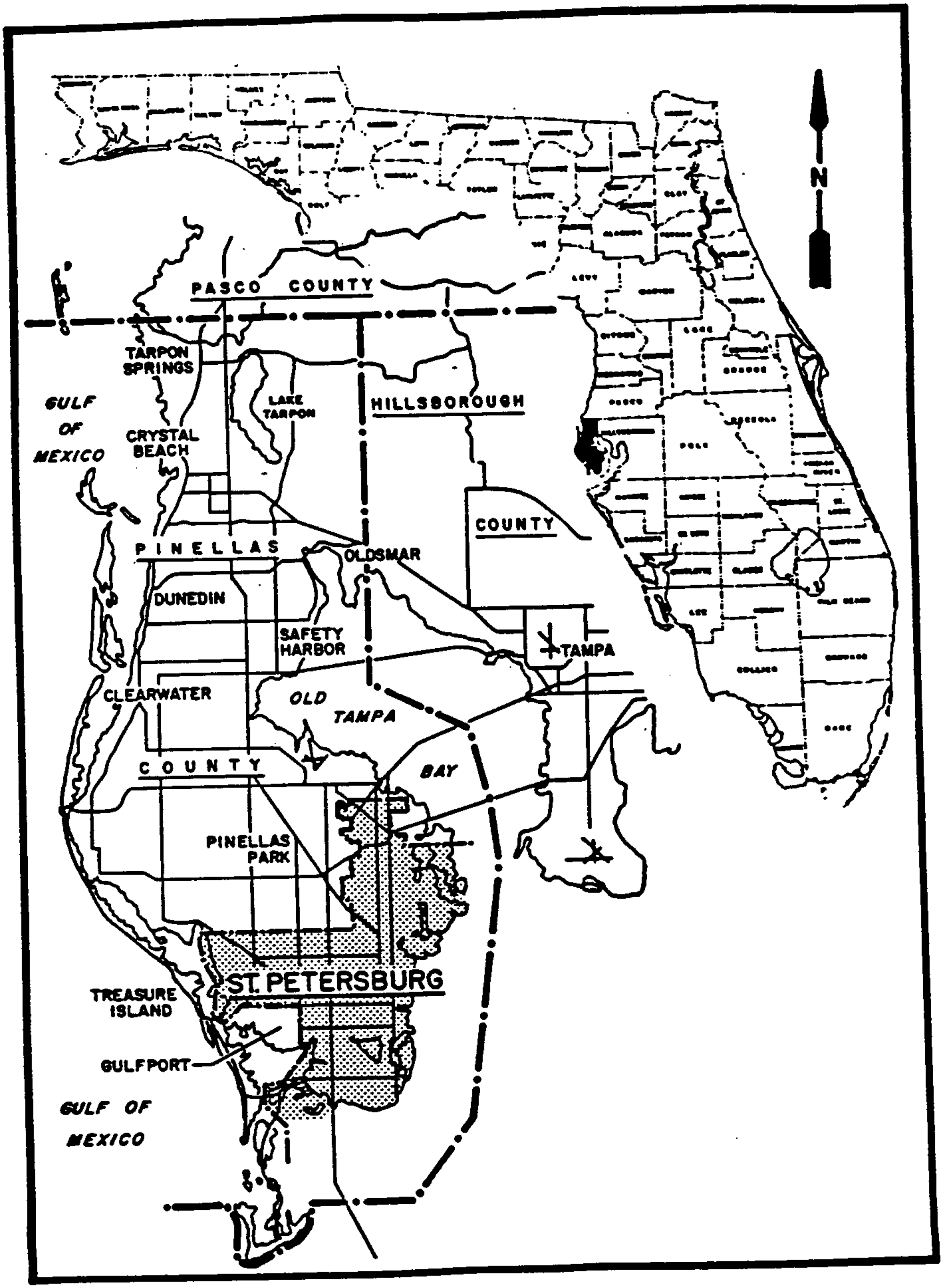
(5) Reclaimed water should be suitable for irrigation and selected non-potable uses.

(6) Reclaimed water supplies should be optimized to reduce total demand on the potable water system.

The city of St. Petersburg has also developed key policies when dealing with the implementation of reclaimed water service. Inside city service is given first priority and out side second priority if current in-city demand is met. All applications outside the city must be approved by City Council. As for priority inside the city, small lot users in critical groundwater quality areas get first priority. Then, major users in critical groundwater areas get second priority. Third priority is given to major users near the existing system. Fourth priority is then given to major volume users anywhere in the city. Last priority is given to small lot users near the existing system.

A.3.6 Applications For Service

Applications for reclaimed water service must be accompanied by a site master plan or construction plans showing proposed service or water main diameter and location. The point of service must be at least 10 feet from any potable water meter. With the approval of the Director of Public Utilities, the service may be less then ten feet, but never less then five feet from any potable water meter. A hold harmless clause is included in each contract for reclaimed water connection. An application for reclaimed water service will not be approved until the customer has suitable underground irrigation system with permentally placed sprinkler devices. Meters must be provided by non-irrigation users, and by larger irrigation users. On final approval where reclaimed water service is provided, the public potable water supply must be protected by an approved double check valve assembly on services of 1-1/2 inches or larger; and by a dual check device on a 1- inch and 3/4- inch services.


N
PASCO COUNTY
TARPON SPRINGS
LAKE TARPON
HILLSBOROUGH
COUNTY
GULF OF MEXICO
CRYSTAL BEACH
PINELLAS
OLDSMAR
DUNEDIN
SAFETY HARBOR
TAMPA
CLEARWATER
OLD TAMPA BAY
COUNTY
PINELLAS PARK
ST. PETERSBURG
TREASURE ISLAND
GULFPORT
GULF OF MEXICO

APPENDIX II

WATER RECLAMATION SYSTEMS

ALTAMONTE SPRINGS, FLORIDA

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

Several years ago the City Commission of the City of Altamonte Springs adopted an innovative environmental program which has been given the name - "Project Apricot."* The heart of this program is the installation of a comprehensive reclaimed water distribution system which will convey reclaimed water throughout the City's Utility Service District to be used primarily for irrigation of residential, commercial and public properties, parks, highway medians, golf courses and other athletic and recreational facilities. Other potential uses for the reclaimed water include: toilet flushing in new office and industrial buildings, cooling water, industrial process water, supply for automatic car washes, and in specific cases; lake level control and ornamental uses such as foundations and waterfalls.

* A P R I C O T - A Prototype Realistically Innovative Community Of Today

1.2 Benefits

The benefits to be derived from the success of this program are several, and include conservation of the potable water supply, reuse of a valuable water resource, recharge of the upper aquifer, reduction in nutrient discharge to surface waters, reduction in transfer of fresh water from the area, reduction of threat of saltwater contamination of the aquifer, and utilization of an environmentally safe and sensible method of disposing of effluent (reclaimed water).

1.3 Source and Quality of Reclaimed Water

The source of the reclaimed water, which is delivered to the point of use by the reclaimed water distribution system, is the effluent from the City's Regional Wastewater Treatment Plant. This plant, through process changes and additions, has been upgraded to the status of a sophisticated "Water Reclamation Plant." The major processes include: primary, secondary and tertiary treatment followed by deep-bed, dual media filtration and high-level disinfection. These treatment processes produce a reclaimed water with the following qualities: good appearance, good clarity, non-staining, odorless, low turbidity and bacteriologically safe. The water contains a low-level of nutrients, nitrogen and phosphorus, which if properly applied will be beneficial to plant and turf growth. While you should not drink the reclaimed water, there is no known danger to an individual's health from casual contact when the water is being used for the intended purposes.

The following policies and regulations govern the installation and uses of the reclaimed water distribution system and its related sub-systems and facilities within the Utility Service District of the City of Altamonte Springs, Florida.

2.0 DEFINITIONS

2.1 General

The following definitions of titles, terms and system components are presented for the purposes of uniformity and to afford a more specific understanding of the following policies and regulations governing the installation and use of the City's reclaimed water utility. The two other utilities owned and operated by the City which have varying degrees of relationship with the reclaimed water utility are the potable water system and the wastewater collection and treatment system.

Available or Availability - shall mean contiguous to or within 100 feet of any property line.

Backflow Prevention Device - shall mean an approved device as designated for a particular application and as described in the Cross-connection Control Manual which has been adopted by reference as a part of Ordinance Number 872-86.

Billings - shall mean monthly billings for reclaimed water services and shall be rendered with the monthly potable water and wastewater and solid waste billings.

City - shall mean the City of Altamonte Springs, Florida and its Utility Service District.

City Commission - shall mean the City Commission of the City of Altamonte Springs.

City Manager - shall mean the City Manager of the City of Altamonte Springs.

Cross-connection - shall mean any physical connection or arrangement which could allow the transfer of waters between the City,s potable water supply and distribution system, the reclaimed water supply and distribution system, or any other non-potable water source.

Cross-connection Control Ordinance - shall mean Ordinance Number 872-86 of the Code of the City of Altamonte Springs.

Cross-connection Control Supervisor - shall mean the City employee in the Potable Water Division who is responsible for the cross-connection control program.

Customer - shall mean the actual user of the reclaimed water.

Customer Category - Customer Class B shall mean all public, commercial, office, industrial/warehousing. Customer Class AM shall mean all multi-family developments. Customer Class A shall mean all detached single family residential users.

Director - shall mean the Director of Public Works of the City of Altamonte Springs.

Distribution Mains - shall mean those mains to be installed within individual streets, a development or subdivision to deliver reclaimed water from the transmission system to the customer's service connection. Distribution mains may be installed in City streets in residential subdivisions or be an integral part of the infrastructure systems of public, multi-family, commercial, office or industrial/warehousing developments.

Division Manager - shall mean the manager of the Reclaimed Water Division.

Dual Distribution System - is a general term used by the American Water Works Association to describe a two component water distribution system designed to serve an area. One component delivers potable water for drinking, cooking, bathing and other uses requiring potable water. The other component delivers non-potable water, in the case of Altamonte Springs reclaimed water, for irrigation and other uses not requiring potable water. While these two systems may parallel one another and both may serve a property, there is no interconnection and their separation is strictly defined and carefully monitored.

Irrigation System - shall mean the customer's in-ground piped system which delivers water to spray or drip-type irrigation devices located throughout the property. The system may be controlled by an electric timer or may be controlled manually. The system may be equipped with special hose bib boxes providing for irrigation by hose and/or portable sprinkler devices in lieu of an in-ground piped system.

Irrigation Well - shall mean a well located on private property and used to supply water to an in-ground irrigation system or other irrigation devices which serve the property.

Metered Connection - all service connections to public, commercial, office, industrial/warehousing and multi-family customers shall be metered. Single family residential service connections will not be metered.

Reclaimed Water - non-potable water which is extensively-treated effluent from the City's advanced wastewater treatment plant. This water has received additional treatment through chemical addition, deep-bed, dual-media filtration and high-level disinfection, which produces a product that is bacteriologically safe with no odor, good appearance, low turbidity, good clarity, non-staining and containing a low level of nutrients, nitrogen and phosphorus which, if properly applied, is beneficial to plant and turf growth.

Reclaimed Water Charges - shall mean all other charges relating to providing or discontinuing reclaimed water service.

Reclaimed Water Distribution System - a comprehensive piping system which parallels the City's potable water system to deliver reclaimed water to customers within the City's Utility Service District. The reclaimed water distribution system is made up of the following components: ground and elevated storage tanks, high-service delivery pumps, transmission mains and distribution mains and property service connections.

Reclaimed Water Division - shall mean that division of the Department of Public Works which operates, maintains, installs and repairs the reclaimed water distribution system.

Reclaimed Water Rates - shall mean the monthly charges for reclaimed water service, which have been established by, and may be changed by, the City Commission. The monthly charge for single family residential customers shall be on the basis of a flat rate which shall include an availability charge. The monthly charge for metered customers shall be on the basis of a unit rate per 1,000 gallons of reclaimed water used, plus an availability charge for each equivalent residential unit.

Service Connection - shall mean the reclaimed water service connection from the transmission or distribution main to the customer's property line and shall include a corporation stop or tapping valve at the main, the service connection pipe and a curb stop and box or shut-off valve at the property line.

Transmission Mains - These mains together with the storage and pumping facilities transmit the reclaimed water to the distribution systems and other points of use for the reclaimed water. This transmission (delivery) system has been provided by the City.

<u>Use for Reclaimed Water</u> - Reclaimed water shall be used for irrigation of public and private landscaped areas and such other uses as are permitted by law.

3.0 POLICIES RELATING TO RECLAIMED WATER SERVICE

3.1 In-City Service

Reclaimed water service shall be provided for properties located within the City of Altamonte Springs, on a first priority basis, which comply with the provisions for such service as set forth in these policies. Reclaimed water service shall be available to these properties as the transmission and distribution systems are extended.

3.2 Outside-City Service

Reclaimed water service may be provided to properties located outside of the City but within the boundaries of the City's Utility Service District on a second priority basis. At the City's option and convenience, service to such properties strategically located along transmission main routes may be provided on a first priority basis.

3.3 Service Outside the Utility Service District

Reclaimed water service may be provided to properties located outside of the boundaries of the City's Utility Service District on a third priority basis. At the City's option and convenience, service to such properties located along transmission mains which are also outside the boundaries of the City's Utility Service District, may be provided on a first priority basis. Fees and charges for reclaimed water service to these properties will be on a negotiated basis.

3.4 Availability of Service

Reclaimed water service is available from either the primary transmission mains or the installed distribution mains. Distribution mains will be extended into areas not presently served in accordance with procedures outlined in these policies and regulations.

3.5 Use of the Reclaimed Water Distribution System

Connection to the system is required for all public, commercial, office, industrial/warehousing and multi-family development within the City's Utility Service District as transmission and distribution mains become available. Single family residential developments constructed after January 1, 1989 shall include reclaimed water distribution mains, and connection to the system is required as reclaimed water service becomes available.

Connection to the system is voluntary for all existing single family residences within the City's Utility Service District. Distribution mains will be extended into these areas as reclaimed water service becomes available in accordance with the procedures outlined in these policies and regulations.

3.6 Dual Use of Private Irrigation Wells Not Permitted

Existing private irrigation systems which connect to the reclaimed water system and are presently served by an on-site well shall disconnect the well permanently. Dual or temporary connections of wells to irrigation systems served by reclaimed water are not permitted. Commercial property served by wells shall have five (5) years to make connection to the reclaimed water system from date of installation of the well.

3.7 Ownership of System

All reclaimed water facilities, buildings, pumping equipment, storage tanks, transmission and distribution mains and property service connections from the main to the property line, when constructed or accepted by the City, shall become and remain the property of the City. No person shall, by payment of any charges provided herein or by causing any construction of facilities accepted by the City, acquire any interest or right in any of these facilities, or any portion thereof, other than the privilege of having their property connected thereto for reclaimed water services.

3.8 Property Service Connections

Property service connections shall be as required by the property served, but, in no case, shall be less than one inch in diameter. Each service connection shall be equipped with a corporation stop or shutoff valve at the main and a curb stop or shutoff valve and box at the property line. The City's valve box cover at the property line shall be square and marked "Reclaimed Water." This service connection together with its valves are the property of the City. The customer shall install his own shutoff valve immediately inside his property line for his own use. Two or more customers may be served by one service connection if sufficient capacity is available. Such common service lines will be sized to provide adequate supply to each customer.

3.9 Customer's System - Single Family Homes (Class A)

The customer's on-site system may be either a standard in-ground landscape irrigation system or a specially designed in-ground hose bib box containing one or two hose bibs to be used to irrigate the property by means of garden hoses and portable sprinklers. The in-ground system may be controlled either manually by manually-operated zone valves or automatically by a timer and related zone valve. If the customer elects to use the in-ground hose bib box, it will be supplied at cost by the City for installation by the customer. The box may be installed anywhere on the property and will be equipped with a special wrench-type locking device to provide to the customer the capability to control the use of reclaimed water on his or her property. The lid of the hose bib box will be clearly marked - "Irrigation - Reclaimed Water."

3.10 Customer's System - Public, Commercial, Office, Industrial/Warehouse (Class B) and Multi-family Developments (Class AM)

The customer's on-site system for these types of development shall be a standard in-ground landscape irrigation system. The system shall be zoned and shall be controlled by a timer. Low trajectory or drip-type systems are recommended, however, they are not mandatory. Signs as approved by the City shall be placed in conspicuous locations within the landscaped areas of the developments. They shall read, "Irrigation with Reclaimed Water, Do Not Drink." If the owner or manager of these types of developments permits or causes vehicles to be washed on the property, a special area shall be set aside for that purpose and it shall be served by one or more in-ground hose bib boxes connected to the on-site reclaimed water system. The hose bib rack shall be clearly marked and readily visible with at least one sign stating "Auto Washing, Reclaimed Water, Do Not Drink."

3.11 <u>Inspections of Irrigation Systems and Other Reclaimed Water Facilities</u>

The City reserves the right to enter private property to make inspections of the initial installation and operation of irrigation systems and other reclaimed water facilities and to make periodic inspections thereafter to satisfy itself that the systems are being properly maintained and operated in strict accordance with these policies and regulations.

3.12 <u>Maintenance of City System</u>

All portions of the system owned by the City will be operated and maintained by the City. No person shall do any work or be reimbursed for any work or in connection with any work on the system unless written authorization from the City is provided prior to beginning any part of the work. The City shall take all reasonable measures to regularly inspect and keep its facilities in good repair. However, the City assumes no liability for any damage that may be caused by the system that is beyond the control of normal and prudent operation and maintenance functions or due to situations not previously reported to the City.

3.13 <u>Maintenance of Customer's System</u>

The customer shall be responsible for the proper maintenance of all on-site facilities, including irrigation lines, spray heads and appurtenances, on the property served by the City. Failure to maintain the on-site system in a proper manner, will be construed as just cause for the City to discontinue service until such time as the City is satisfied that the required maintenance has been performed. The City will maintain the meters on the property.

3.14 <u>System Pressures</u>

The City will provide reclaimed water at pressures which are adequate to satisfactorily operate all standard irrigation systems and devices. Should the customer require pressures which are higher he shall provide, at his cost, whatever devices are necessary to provide the higher pressures. Before installing such devices, the customer shall obtain a permit from the City Reclaimed Water Division. Electrical permits are separate permits which are still required.

4.0 EXTENSIONS TO THE RECLAIMED WATER SYSTEM CUSTOMER CLASS A

4.1 The Distribution Svstem

The reclaimed water distribution system for delivery of reclaimed water has two major components: the primary transmission mains and the secondary street distribution mains. Those facilities which supply and support the dual distribution system are the Distribution Center located at the Water Reclamation Facility which delivers water into the system and the elevated storage tanks which provide storage and maintain system pressures. The primary transmission mains have been located in major thoroughfares and form the backbone of the system to transmit water to the sub-area distribution mains located for the most part in residential side streets and other secondary City streets. As the primary transmission mains are laid and extended, they will provide points of connection for distribution mains to be extended into the adjacent network of City streets.

4.2 Petition for Distribution Main Extension

Reclaimed water service may be provided to a single street or to an entire subdivision or to any contiguous part of a subdivision. Ideally, an orderly distribution main extension program will require, wherever possible, that those streets and subdivisions, or parts of subdivisions, immediately adjacent to the primary transmission main network be served first. The City has therefore developed a least-cost reclaimed water distribution main extension program which it will following to the fullest extent possible.

To request service, the property owners along a street, or within a subdivision or any contiguous part thereof, shall petition the City on a Reclaimed Water Service Petition Form which is obtainable from the offices of the Reclaimed Water Division. The petition will be considered valid when signed by the owners of at least 51 percent (51%) of the property along a street or in an area.

4.3 Distribution Main Extensions and Service Connections

Upon receipt of completed and signed petitions for reclaimed water service from the owners of at least 51 percent (51%) of the property along a street, or in an area, the City will consider same and, if approved, schedule the installation of the requested distribution main extension and complete it at the earliest possible date. At the time the distribution main extension is being installed, reclaimed water service connections will be made to all abutting properties.

5.0 APPLICATION FOR RECLAIMED WATER SERVICE

The requirements for site plans, building permits and the like that presently exist are not altered by these regulations, but where connection is proposed to the reclaimed water system, there will be an additional submittal to the Reclaimed Water Division, as hereinafter described.

5.1 Obtaining Application Forms

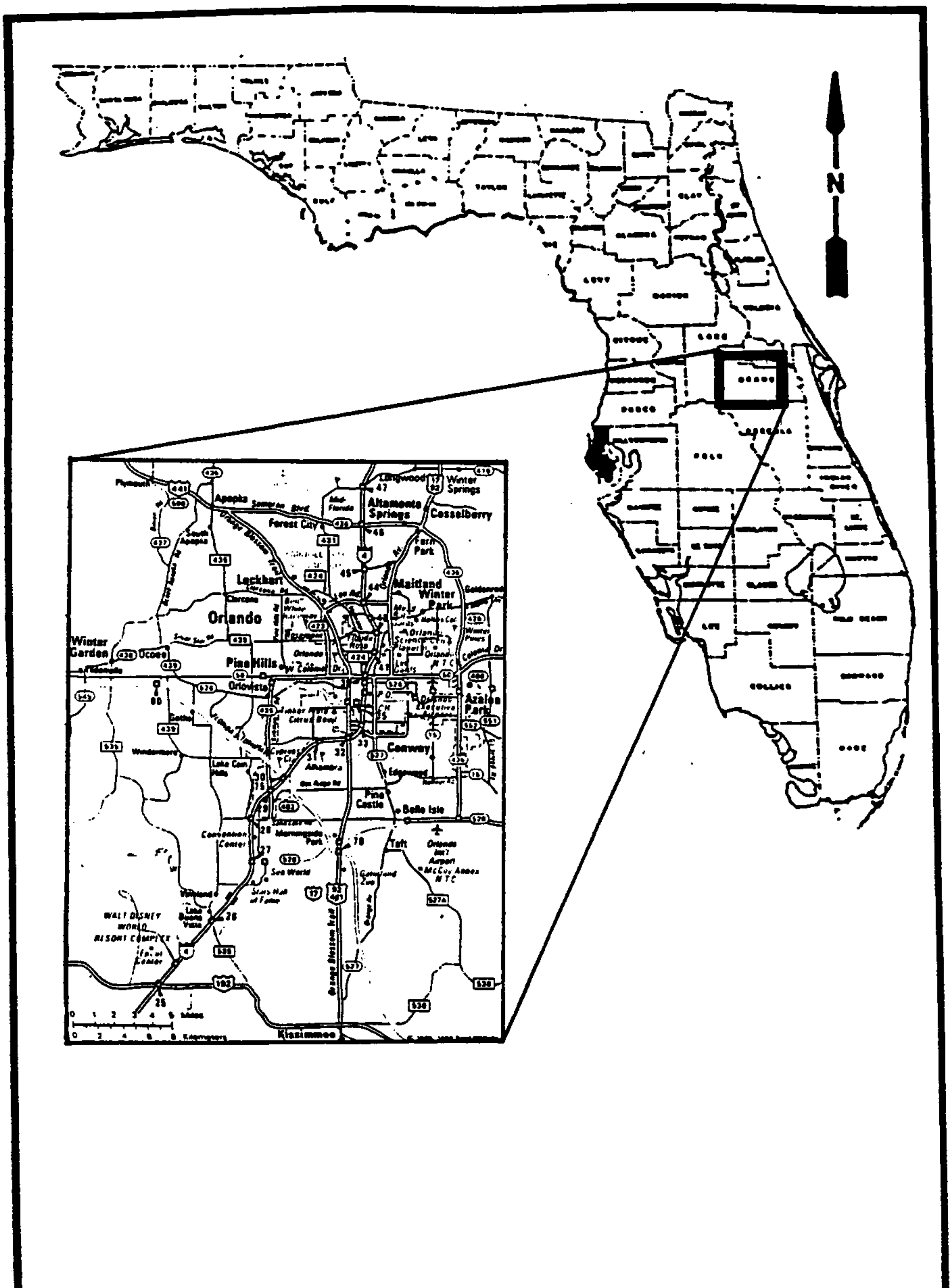
Application forms for reclaimed water service may be obtained from the Utility Billing Office in the City Hall or from the Customer Service Representative in the offices of the Reclaimed Water Division located at the Swofford Water Reclamation Facility on Keller Road. All questions relating to completing the application form should be directed to the Customer Service Representative of the Reclaimed Water Division. Completed application forms should be mailed or hand delivered to the Customer Service Representative of the Reclaimed Water Division at the Division offices on Keller Road. The application form must be accompanied by a check or money order, made payable to the City of Altamonte Springs, in an amount sufficient to cover any fees and charges for the reclaimed water service connection. The application shall specify whether the customer requires increased reclaimed water pressures which are higher than standard as described below.

5.2 Application for Reclaimed Water Service, Class AM and Class B Customers

Applications for reclaimed water service to Class AM or Class B Customers, including public, commercial, office, industrial/warehouse or multi-family developments, shall be accompanied by a detailed site plan showing the size and location of the service connection to the distribution main, the layout of the primary delivery mains within the development and the location and type of irrigation devices to be installed in the irrigation system. The maximum steady-state demand for reclaimed water that the irrigation system will require to function properly must also be provided. The irrigation system shall be a standard in-ground type with permanently placed sprinkler devices. The service connection shall be equipped with a shutoff valve just inside the public right-of-way, a meter, a backflow prevention device and a customer shutoff valve on the customer side of the meter. The size of the service connection and meter will be determined by City personnel based upon the maximum steady-state demand of the irrigation system. Small, neat signs stating: "Irrigation with Reclaimed Water, Do Not Drink" shall be placed in conspicuous locations throughout the landscaped areas. If auto washing is permitted on the property, a special area shall be set aside for this activity and it shall utilize reclaimed water. A sign, or signs, shall be placed on the hose bib or hose bib rack stating: "Auto Washing, Reclaimed Water, Do Not Drink."

5.3 <u>Application for Reclaimed Water Service. Class A Customer</u>

The application must state the type of irrigation system which will be used, that is; a standard in-ground system with fixed sprinkler devices or the special hose bib box to be furnished at cost by the City. A single residential service connection will consist of a corporation stop at the distribution main, the service pipe and a curb stop and box at the property line. A single reclaimed water service connection will be one inch in diameter. A double service connection, one serving two residential lots, will be one and one-half inches in diameter. No meter will be required. Immediately inside the property line, the customer shall install a shutoff valve for his use in repairing, extending and maintaining the on-site system. If the customer presently uses an irrigation well, he must so state and agree to disconnect that well from the system.


N
Plymouth
Apopka
Longwood
Winter Springs
Altamonte Springs
Casselberry
Forest City
Fern Park
Lockhart
Maitland
Winter Park
Orlando
Winter Garden
Ocoee
Pine Hills
Orlovista
Azalea Park
Conway
Alhambra
Pine Castle
Belle Isle
Taft
Convention Center
Sea World
WALT DISNEY WORLD RESORT COMPLEX
Orange Blossom Trail
Kissimmee
Miles
Kilometers

APPENDIX III

HILLSBOROUGH COUNTY SPECIFICATIONS FOR RECLAIMED WATER DISTRIBUTION DESIGN STANDARDS

SECTION 6

HILLSBOROUGH COUNTY
SPECIFICATIONS FOR RECLAIMED WATER
DISTRIBUTION SYSTEM DESIGN STANDARDS

6.1 GENERAL

These specifications cover the design, review of plans and specifications; installations; inspection; testing; and acceptance of reclaimed water distribution systems, reclaimed water main extensions and all appurtenant items which are to be owned and maintained by Hillsborough County.

6.2 PLANS PREPARATION

6.2.1 Reclaimed water distribution systems, reclaimed water main extensions and all appurtenant items shall be designed in accordance with the applicable regulations of the County, the Hillsborough County Health Department, the Florida Department of Environmental Regulation, and the standards established herein.

6.2.2 Hillsborough County shall own and maintain all portions of the reclaimed water distribution system up to and including the reclaimed water meter where such meters are present. Where meters are not present, Hillsborough County shall own and maintain all portions of the system up to and including the curb stop.

6.2.3 No reclaimed water distribution system or reclaimed water main extension or any portion thereof, which is to become the property and sole responsibility of Hillsborough County will be designed or constructed outside of any public right-of-way and/or easement which may be used for said purpose.

6.3 PLANS REVIEW

6.3.1 The Developer or his authorized representative shall submit plans and associated documentation in accordance with the procedures and requirements set forth in the County's "Subdivision Regulations" and "Site Development Regulations".

The leakage for all reclaimed water mains, as determined by the above test, will not exceed the allowable leakage as given by the following formula in Section 4.1 of AWWA Specification C600:

$$L = SD\ (P)^{1/2} - 133,200$$

in which L is the allowable leakage, in gallons per hour: S is the length of water main tested in feet, D is the nominal diameter of the pipe in inches; and P is the average test pressure, psi gauge. (S is based on 18' sections. When 20' sections are used, change 133,100 to 148,000).

During the test each valve shall be operated through several complete cycles of closing and opening. In addition, each valve, when in the closed position shall have the test pressure applied to one end of the valve only. Each end of the valve shall be tested in this manner. There shall be no visible leakage through the valve, and the valve shall not show any evidence of structural distress.

All restrained sections of the buried main shall be completely backfilled before such sections are tested.

(b) When leakage occurs in excess of the specified amount, defective pipe, pipe joints or other appurtenances shall be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a reclaimed water main within the allowable leakage limits upon such retesting.

(c) All valves and appurtenances shall be hydrostatically tested with the line in which they are installed.

6.4.3 Separation of Reclaimed Water, Potable Water, and Sewer Lines.

ductile iron fittings. Fittings shall meet the requirements of ANSI/AWWA C110/A21.10. Where corrosion soils or other conditions dictate, encase fittings in polyethylene. Encasement shall meet the requirements of ANSI/AWWA C105/A21.5.

(c) Joints: Joints for PVC pressure pipe shall be of the compression rubber gasket type. The assembly of the joint should be as recommended by the pipe manufacturer.

6.5.2 Ductile Iron Pipe and Fittings

(a) Pipe: Ductile iron pipe shall meet the requirements of ANSI/AWWA C151/A21.51. The minimum thickness of buried ductile iron pipe shall be Class 50 and shall comply with the requirements of AWWA C150.

(b) Fittings: All ductile iron pipe fittings shall meet the requirements of ANSI/AWWA C110/21.10 and shall have a pressure rating of 250 psi. All fittings shall be full-radius fittings. Ductile iron fittings shall be provided with retainer glands and shall be Ebb Series 1100 or equal.

(c) Joints: Joints shall conform to the requirements of the pipe fittings used, the laying conditions and service required.

Mechanical and push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11.

Restrained joints, other than mechanical joints with retainer glands at fittings, shall be Clow F-128 "Super-Lock Joint", American Cast Iron Pipe "Lock-Fast Joint", U.S. Pipe and Foundry "TR Flex" or equal.

(d) Coating and Linings: All ductile iron pipe shall have the standard bitumastic outside coating specified in ANS/AWWA C151/A21.51.

All ductile iron pipe and fitting shall have a cement mortar lining with a bituminous seal coat meeting requirements of ANSI/AWWA C104/A21.4.

not be accepted. The designer shall submit thrust block calculations for review. Calculations shall be signed and sealed by a Registered Civil Engineer licensed in the State of Florida.

6.6 SERVICE CONNECTIONS

6.6.1 General: Service Connections can be either dual or single service. Single service lines shall be 1 inch minimum diameter. Dual service lines shall be 1 inch diameter tubing for short side services and 1-1/2 inch minimum diameter tubing for long side services. See Exhibits R-2 and R-3.

6.6.2 Service Tubing: Service tubing shall be polyethylene (PE) tubing meeting the requirements of ASTM D2239 and ASTM D1248 for Type III, Grade 3, Class C. Service tubing shall have a cell classification of 355434C as specified in ASTM D3350.

6.6.3 Service Saddles: Service saddles shall be provided for connecting house services to distribution mains. Service saddles shall have dual stainless steel straps with a ductile iron body suitably protected against corrosion. Service saddles shall be TaperSeal Model 317 with NPT threaded outlet as manufactured by Rockwell International, Pittsburgh Pennsylvania, Series 184 as manufactured by R. H. Baker and Co., Inc., Los Angeles, California, or equal.

6.6.4 Corporation Stops: Corporation stops shall be brass and designed for a cold water working pressure of 150 psi. Corporation stops shall have iron pipe thread inlet and CTS compression outlet with internal or external locking device. Corporation stops shall be Mueller H-15028, Ford F1100, or equal. See Exhibit R-2 for location.

6.6.5 Curb Stops: Curb stops shall be brass and designed for a cold water working pressure of 150 psi. Curb stops shall have one end with CTS compression connection with internal or external locking device and the other end with female iron pipe thread. Curb stops shall be Ford B11-444W with locking wing. See Exhibit R-3 for location.

6.6.6 Dual Service Wyes: Dual service wyes shall be solid brass, minimum 1" X 1", and have CTS compression type connections with internal and

6.8 CROSS CONNECTION CONTROL

6.8.1 General

No cross connection between the reclaimed water system and the potable water system shall be allowed. At all locations where reclaimed water service is provided, the public potable water supply shall be protected by installation of an approved backflow prevention device.

6.8.2 Backflow Preventers for Potable Water Service

Backflow prevention is required in accordance with PL 93-623, the Federal Safe Drinking Water Act, Florida Administrative Code (FAC) 17-22.107(4), and FAC17-610.470(5) for the protection of the potable water system. The Contractor shall call Quality Control Personnel at 272-5067 for the Northwest Area and 272-5068 for the South/Central Area for inspection immediately after installation. Within thirty (30) days following installation the Contractor shall send a certified "Test and Maintenance Report" form (Form 1) on the assembly installed. A listing of approved certified backflow prevention device testers in the Hillsborough County area is included at the end of the section as Exhibit R-4.

Backflow preventers for single family residential service shall be the dual check valve type. The reduced pressure principle type backflow preventer shall be used for all other types of service. Backflow preventers shall meet the following requirements:

(a) Reduced Pressure Principle Backflow Prevention Assembly.

This type of assembly shall consist of two independently operating approved check valves with an automatically operating differential relief valve between the two check valves, tightly closing shut-off valves on both sides of the check valves, plus properly located test cocks for the testing of the check and relief valves. The entire assembly shall meet the design and performance specifications and approval of a recognized and County approved testing agency for backflow prevention

- Below ground valves, meters, and other devices on the reclaimed water system shall be color coded brown with the application of adhesive tape.

- All above ground piping, valves, backflow prevention devices, and other appurtenances shall be painted brown. The color standard for reclaimed water paint shall be Tnemec AE12 Espresso.

- Electronically detectable tape shall be installed in trenches above all PVC or polyethylene reclaimed water piping approximately one foot below grade. Tape shall be a minimum 2 inches wide with an aluminum core covered by a brown polyethylene coating with the words "CAUTION RECLAIMED WATER LINE BELOW". Tape shall be Terra Tape as manufactured by Reef Industries, Houston, Texas, or equal.

  Covers for all valve boxes, meter boxes, and other below ground devices on the reclaimed water system shall be painted brown. Covers shall be permanently embossed with the wording "Reclaimed Water". Valve boxes shall be square.

6.10 TRENCH EXCAVATION

6.10.1 Make all excavations by open cut, with banks of trenches kept as nearly vertical as possible. Make trenches wide enough to allow approximately 8 inches clearance on each side of the water main; bottom uniform to provide accurate and uniform bearing for as nearly the full length of pipe section as practicable. Excavate bell holes after trench has been graded. Perform all excavations of whatever substance encountered to the depths shown or indicated on plans. In the event unsuitable or unstable soil is encountered, remove it and replace with select sand, gravel, crushed stone or crushed slag.

6.10.2 Dewatering: Remove all water from excavations and maintain the excavations free of water while construction therein is in progress. Provide dewatering equipment as necessary to conform to this requirements.

6.13.3 Place all backfill in layers compatible with compacting requirements, unless otherwise specified.

6.14 BACKFILLING

6.14.1 After pipe and conduit have been inspected and approved, backfill the trenches, carefully depositing the fill on both sides of the main and thoroughly ramming the fill until enough has been placed to provide a cover of at least one foot in depth above the pipe or conduit. Place the remainder of the backfill in one foot layers and compact as hereinafter specified. After backfilling, dress trenches to conform to adjacent contours. If trenches are improperly filled or if settlement occurs, they shall be refilled and redressed.

6.14.2 Structures such as manholes, junction boxes and the like: Remove forms, lumber, trash, mortar incrustations and other objectionable material and install backfill in layers. Compact each layer in one foot increments. Grade final layer to final elevation and dress smooth.

6.15 COMPACTION REQUIREMENTS

6.15.1 Place backfill in equal layers compatible with equipment used and compact each layer in accordance with Table 1 below. Fill and backfill not included in Table 1 shall be compacted to the same density as adjacent in-place material.

APPENDIX IV

REUSE OF RECLAIMED WATER AND LAND APPLICATION

(F.A.C. 17-610)

CHAPTER 17-610
REUSE OF RECLAIMED WATER AND LAND APPLICATION

PART I
GENERAL

PART II
REUSE; SLOW-RATE LAND APPLICATION SYSTEMS; RESTRICTED PUBLIC ACCESS

PART III
REUSE; SLOW-RATE LAND APPLICATION SYSTEMS; PUBLIC ACCESS AREAS, RESIDENTIAL IRRIGATION, AND EDIBLE CROPS

PART IV
REUSE; RAPID RATE LAND APPLICATION SYSTEMS

PART V
REUSE; ABSORPTION FIELD SYSTEMS

PART VI
EFFLUENT DISPOSAL; OVERLAND FLOW SYSTEMS

PART VII
OTHER LAND APPLICATION SYSTEMS

PART VIII
PERMITTING

PART IX
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CHAPTER 17-610

REUSE OF RECLAIMED WATER AND LAND APPLICATION

PART I

GENERAL

17-610.100 Scope/Intent/Purpose

(1) Section 403.021(2), Florida Statutes, as amended, established that no wastes are to be discharged to any waters of the state without first being given the degree of treatment necessary to protect the beneficial uses of such water. Sections 403.085 and 403.086, Florida Statutes, set forth requirements for the treatment and reuse or disposal of domestic wastewater. Section 403.051(2)(a), Florida Statutes, requires that any Department planning, design, construction, modification or operating standards, criteria, and requirements for wastewater facilities be developed as a rule. This rule is promulgated to implement the requirements of Sections 403.051, 403.085, 403.086, 403.087, 403.088, Florida Statutes, concerning domestic wastewater facilities.

(2) It is the policy of the Department to encourage an applicant, before submittal of a permit application, to evaluate alternative wastewater management techniques and to discuss alternatives with the Department.

(a) The Department encourages inclusion of public health, economic, scientific, energy, engineering and environmental considerations in such evaluations. Each prospective domestic wastewater facility shall be assessed on an individual basis.

(b) The Department encourages environmentally acceptable alternatives which provide the most economic and energy efficient methods of complying with the requirements of this rule, and promote the beneficial reuse of reclaimed waters and treated residuals.

(3) The Commission, recognizing the complexity of water quality management and the necessity to temper regulatory actions with the realities of technological progress and social and economic well-being, nevertheless, intends to prohibit any discharge that constitutes a hazard to human health.

(4) These rules shall be construed to assure that all waters of the state shall be free from components of wastewater discharges which, alone or in combination with other substances, are acutely toxic; are present in concentrations which are carcinogenic, mutagenic, or teratogenic to humans, animals, or aquatic species; or otherwise pose a serious threat to the public health, safety, and welfare.

(5) This rule contains the specific reuse and land application requirements of the Florida Department of Environmental Regulation and of Local Pollution Control Programs approved and established pursuant to Section 403.182, F.S., where such authority has been delegated to those programs. It may be necessary for domestic wastewater facilities to conform with requirements of other agencies, established via interagency agreements (e.g., for mosquito control). The absence of reference to such arrangements in this rule does not eliminate the need to comply with those requirements.

(6) The purpose of Rule 17-610, F.A.C., is to provide design and operation and maintenance criteria for land application systems that may discharge reclaimed waters or domestic wastewater effluent to Class G-II ground waters and to a limited extent to Class G-I ground waters (as defined by Rule 17-3, F.A.C.). Requirements for systems that involve potential discharges to other classes of ground water (as defined by Rule 17-3, F.A.C.) will be established by the Department on a case-by-case basis. The requirements in this rule shall apply to systems involving potential discharges to Class G-I ground waters (as defined by Rule 17-3, F.A.C.) to the extent that these rule provisions do not conflict with requirements for G-I ground waters. Supported by moderating provisions, it is intended that Rule 17-610, F.A.C., establish a framework whereby design flexibility and sound engineering practice can be used in developing systems with which to manage domestic wastewater in an environmentally sound manner. This rule contains operation and maintenance requirements so as much information as possible on reuse and land application can be presented in a single rule.

(7) Rule 17-610, F.A.C., shall be used in conjunction with Rule 17-600, F.A.C. Systems shall be designed in accordance with sound engineering practice. Minimum design waste treatment and disinfection standards are specified in Rule 17-600.420 and 17-600.440, F.A.C. Additional waste treatment standards, where appropriate, are addressed in this rule.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.110 Applicability

(1) Requirements in this rule shall apply only to domestic wastewater treatment facilities.

(2) Unless specifically provided otherwise, requirements in this rule shall apply to all new reuse and land application systems for which construction permit applications are approved by the Department after April 5, 1989. This rule also shall apply to all existing facilities when such facilities are to be modified or expanded, but such applicability shall apply only to the expansion or modification thereof, or if treatment processes are altered such that the quality of reclaimed water or effluent or reliability of such processes is adversely affected. Where violations of permit conditions or water quality standards have occurred, appropriate requirements in this rule may be deemed applicable to existing facilities by the Secretary or designee.

(3) All reuse systems, to which construction permits were approved by the Department before April 5, 1989, involving irrigation of public access areas, residential properties, and edible crops (systems subject to regulation under Part III of this rule), shall meet the waste treatment and disinfection requirements contained in Rule 17-610.460(1), F.A.C. The waste treatment and disinfection requirements contained in Rule 17-610.460(1), F.A.C., shall not apply to citrus irrigation systems if:

(a) Public access shall be restricted;

(b) The reclaimed water shall not directly contact the fruit;

(c) The fruit that is produced shall be processed before human consumption;

(d) At a minimum, secondary treatment and basic disinfection shall be provided; and

(e) The construction permit was approved by the Department before April 5, 1989.

(4) The following sources are exempted from the requirements of this rule:

(a) Septic tank drainfield systems and other on-site sewage systems with subsurface disposal of a design capacity of 5,000 gallons per day average daily flow, or less, which serve the complete wastewater disposal needs of a single establishment, with the exception of restaurant facilities with greater than 3,000 gallons per day average daily flow or those defined as industrial facilities in this Part, and all commercial laundry facilities.

(b) Other means of individual waste treatment or disposal which are otherwise subject to state regulation.

(5) Minimum setback distances required by Rules 17-610.421(5), 17-610.471(3), 17-610.521(7), 17-610.571(7), 17-610.621(4), and 17-610.660(1)(d), F.A.C., shall not apply to reuse or land application projects for which the Department received a complete construction permit application before April 15, 1990.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90

17-610.200 Definitions

Terms used in this rule shall have the meaning specified below. The meaning of any term not defined below, shall be taken from definitions in other rules of the Department, unless such meaning would defeat the purpose or intent of Rule 17-610, F.A.C.

(1) "Absorption field" means a drainfield, including the application/distribution system, intended for the reuse of reclaimed water.

(2) "Aquifer" means a geological formation, group of formations, or part of a formation (stratum) that is capable of yielding potentially usable quantities of water from wells or springs.

(3) "Aquitard" means a geological formation or stratum, or artificial barrier, of relatively low permeability which will not transmit water fast enough to furnish an appreciable supply; confining zone.

(4) "Biochemical oxygen demand (BOD)" means the quantity of oxygen utilized in the biochemical oxidation of organic matter present in water or wastewater, reported as a five-day value established as determined using approved methods.

(5) "Carbonaceous biochemical oxygen demand (CBOD5)" means the quantity of oxygen utilized in the carbonaceous biochemical oxidation of organic matter present in a water or wastewater, reported as a five-day value determined using approved methods.

(6) "Commission" means the Environmental Regulation Commission.

(7) "Department" means the Department of Environmental Regulation.

(8) "Developed areas" means areas in or adjacent to residential, commercial, or residentially or commercially-zoned areas.

(9) "Disinfection" means the selective destruction of pathogens in wastewater effluents and sludges.

(10) "Disposal" means the discharge of effluent to injection wells, effluent outfalls, subsurface drain systems, and other facilities utilized strictly for the release of effluents into the environment.

(11) "Domestic wastewater" means wastewater derived principally from dwellings, business buildings, institutions, and the like; sanitary wastewater; sewage. Where wastewater from sources other than typical domestic sources (e.g., industrial sources) is combined and treated with wastes from domestic sources, the determination of whether or not the wastewater treatment plant is designated as "domestic" shall be made by the Department considering any or all of the following: sludge classification; whether wastewaters have been pretreated or contain constituents within 50-150%, by concentration, of typical domestic wastewater; and whether the permittee, when not required to provide more stringent or otherwise specific levels of treatment, can provide assurance of facility compliance with domestic wastewater treatment standards contained in Rule 17-600, F.A.C.

(12) "Dwelling unit" means a residence for the housing of a single family whether such a residence is a detached structure or a unit of a multiple family building.

(13) "Edible crops" means crops that are intended for human consumption.

(14) "Effluent", unless specifically stated otherwise, means water that is not reused after flowing out of any plant or other works used for the purpose of treating, stabilizing, or holding wastes.

(56) "Underground injection" means effluent disposal by well injection into underground geologic formations.

(57) "Unrestricted access" means that access to the reuse site by the general public is uncontrolled or that the site is frequently used by humans.

(58) "Wastes" means sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive, or other substances which may pollute or tend to pollute any waters of the State.

(59) "Wastewater" means the combination of liquid and water-carried pollutants from residences, commercial buildings, industrial plants, and institutions together with any groundwater, surface runoff or leachate that may be present.

(60) "Wastewater facilities" means any or all of the following: the collection/transmission system, the treatment plant, and the reuse or disposal system.

(61) "Waters" shall be as defined in Section 403.031(12), Florida Statutes.

(62) "Water quality-based effluent limitation (WQBEL)" means an effluent limitation, which may be more stringent than a technology-based effluent limitation, that has been determined necessary by the Department to ensure that water quality standards in a receiving body of water will not be violated.

(63) "Water quality standards" means standards comprised of designated most beneficial uses (classification of waters), the numerical and narrative criteria applied to the specific water use or classification, the Florida anti-degradation policy, and the moderating provisions continued in Rules 17-3 and 17-4, F.A.C.

(64) "Water table" means the upper surface of the zone of saturation where groundwater pressures are equal to atmospheric pressure, except where that surface is formed by an impermeable stratum.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.300 General Technical Guidance.

(1) The technical standards and criteria contained in the following standard manuals and technical publications listed in Rule 17-610.300(4), F.A.C., are hereby incorporated by reference and shall be applied to supplement the requirements of this rule, if applicable, in determining whether permits to construct or modify reuse of reclaimed water facilities or land application facilities shall be issued or denied.

(2) Deviations from the standards and criteria contained in the publications listed in Rule 17-610.300(4), F.A.C., may be approved by the Department provided that:

(a) The requirements of all other sections of this rule shall be met;

(b) The engineer's report provides reasonable assurance that the proposed design will provide treatment and reuse or effluent disposal meeting the requirements of this rule; and either

(c) Conforming with these standards cannot be done except at unreasonably higher costs; or

(d) It is not technically feasible to conform to these standards because of site conditions or incompatibility with a proposed facility design employing new and innovative techniques which assure compliance with the remainder of this rule.

(3) The Department shall require deviation from the standards and criteria contained in the publications listed in Rule 17-610.300(4), F.A.C., upon a finding that conformance to them will not assure compliance with the remainder of this rule or other rules of the Department.

(4) Standard Manuals and Publications

(a) 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.

(b) 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.

(c) U. S. Environmental Protection Agency, 1974. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability-MCD-06. Environmental Quality Instructional Resources Center, The Ohio State University, 200 Chambers Road, Room 310, Columbus, Ohio 43212.

(d) U.S. Environmental Protection Agency, 1977. Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities. National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

(e) 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.

(f) 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.

(g) Florida Department of Transporation, 1985. Florida Land Use, Cover and Forms Classification System. Procedure No. 550.010-001-A. Transportation, Maps and Publications Sales, Mail Station 12, 605 Suwannee Street, Tallahassee, Florida 32399-0450.

(h) 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.

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

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

(5) Members of the public may request and obtain copies of the publications listed in Rule 17-610.300(4), F.A.C., by contacting the appropriate publisher at the address indicated. Copies of the above publications are on file with the Florida Secretary of State and the Joint Administrative Procedures Committee. Copies are also on file and available for review in the Department's Tallahassee offices and in the Department's district and branch offices where they may be reviewed during normal business hours.

Specific Authority: 403.061(7), F.S.
Law Implemented: 403.061, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.310 Engineering Report

(1) In accordance with the requirements and provisions of Rules 17-4 and 17-600, F.A.C., an engineering report shall be submitted in support of construction permit applications for new reuse or land application projects. The requirement for an engineering report for modifications of existing systems and for those existing facilities which have had past violations of permit conditions or water quality standards shall be a case-by-case determination by the Department based on the frequency and severity of past violations, the potential for adverse affects on reclaimed water quality and on surface and ground water quality, and the scope of proposed modifications.

(2) Abbreviated Report

(a) For projects involving only expansion of existing sites, for Type III facilities, and for slow-rate land application systems in public access areas, the Department shall accept an abbreviated engineering report. Information contained in the application together with the best available information referenced in Rules 17-610.310(3)(a), 17-610.310(3)(b)3, 17-610.310(3)(c)6, 17-610.310(3)(d), 17-610.310(3)(e), 17-610.310(3)(f), and 17-610.310(3)(g), F.A.C., shall suffice for the abbreviated engineering report. For rapid-rate and absorption field projects, the engineering report or abbreviated engineering report shall include the ground water mounding analysis required by Rule 17-610.310(3)(c)8, F.A.C.

(3) The engineering report shall include the following:

(a) Land Use Requirements

1. The exact boundaries of the reuse or land application project, with setback distances shown, shall be located on the most recent USGS topographic maps (7.5 minutes series, where available). These maps, or similar scale maps, shall show present land uses and anticipated land uses for the next 10 years within one mile of the site boundaries, based on approved Local Government Comprehensive Land Use Plans where available. The Florida Land Use Cover and Forms Classification System (Rule 17-610.300(4)(g), F.A.C.) shall be utilized in designating the character of the surrounding area.

2. All potable and nonpotable water supply wells and monitoring wells within a 0.5 mile radius of the land application site shall be located on the maps and identified as to use (e.g., potable) and ownership (e.g., private).

3. If expansion of the proposed facility is anticipated, the area likely to be used in the expansion shall be shown on the maps. The information required by Rules 17-610.310(3)(a)1 and 17-610.310(3)(a)2, F.A.C., shall be provided for the proposed expansions.

4. Surface waters classified pursuant to Rule 17-3, F.A.C., within one mile of the project area, shall be located on the maps and shall be described, with respect to their classification, uses, and approximate distance from the site.

(b) Soils Information

1. A soils map of the reuse or land application site shall be provided. The soils shall be named and described in accordance with the standard criteria (e.g. soil surveys) of the Soil Conservation Service (SCS) unless advised by the soil scientist of the SCS 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 and 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 described in Rule 17-610.310(2), F.A.C., the Department may accept an abbreviated report from the permittee addressing the soil characteristics at the proposed site, based upon the best available information in lieu of the more detailed soils information requirements described in Rule 17-610.310(3)(b), F.A.C.

(c) Hydrogeologic Survey

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. A proposed ground water monitoring plan, if applicable, meeting the requirements of Rule 17-28.700(6)(d), F.A.C., 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 conductivities, porosity, thickness); head relationships between aquifer systems; and information on the annual range of ground water elevations at the proposed site.

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

3. Information on potable and nonpotable water supply wells (and monitoring wells, as appropriate) identified in Rule 17-610.310(3)(a)2, F.A.C., including the depth, length of casing, cone of depression and geophysical surveys of the wells (if available) shall be provided.

4. The proposed ground water monitoring system shall also be described and displayed. Background water quality data shall be provided.

5. Flood prone areas on the proposed site and within 0.5 mile of the site shall be located on a map. Discussion of flooding frequencies and magnitude shall be included.

6. For projects described in Rule 17-610.310(2), F.A.C., the Department may accept an abbreviated report from the permittee covering the hydrogeologic characteristics at the proposed site, based upon the best available information, in lieu of the more detailed hydrogeologic information requirements described in Rule 17-610.310(3)(c), F.A.C.

7. For overland flow projects and certain underdrained slow-rate projects involving alternative secondary preapplication treatment levels, determinations of the required number of core samples, representative hydraulic conductivity values, and aquitard extent or continuity shall be included in the engineering report.

8. For rapid-rate and absorption field projects, a ground water mounding analysis based on site-specific information shall be included. This analysis shall demonstrate acceptable long-term hydraulic performance of the system.

(d) Land Management System

1. The present and intended soil vegetation management program shall be discussed and the vegetative covers identified. Reclaimed water or effluents to be applied shall be characterized in terms of their 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. Water and nutrient budgets for the project shall be included in the engineering report.

2. The harvesting frequencies and the ultimate use of the crops shall be indicated. Lengths 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 agricultural/agronomic aspects of wastewater reuse shall be used in the preparation of the above report information.

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

5. For overland flow projects and certain underdrained slow-rate projects involving alternative secondary preapplication treatment levels, operational control aspects of the land management system discussed in Part VI and Part VII of this rule also shall be documented.

(e) 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 or land application project (including ground water mounding that may occur under the site), prediction of the rate and direction of movement of applied reclaimed water or effluent, changes in water quality in the area associated with the project, and similar information.

2. For projects that will have a limited wet weather discharge, the data required by Rule 17-610.860, F.A.C., shall be included.

3. Justification and documentation for using setback distances, selection of hydraulic loading rates, loading and resting cycles, determining that the reclaimed water or effluents will not violate the standards set by Rules 17-600 and 17-610, F.A.C., and use of any design criteria for which flexibility is provided in this rule also shall be provided.

4. For projects regulated by Part III or Rule 17-610, F.A.C., an evaluation of the industrial pretreatment program required by Rule 17-610.460(4), F.A.C., shall be provided.

5. An evaluation of the proposed project with respect to public health, safety, and welfare shall be provided.

(f) The requirements of each section within the appropriate part of Rule 17-610, F.A.C., shall be addressed in the engineering report or abbreviated engineering report. (For example, a project to be permitted as a rapid-rate land application system shall have the requirements of all sections in Part IV of Rule 17-610, F.A.C., addressed in the engineering report.)

(g) The engineering report or abbreviated engineering report shall contain information required by Rule 17-610.810(3), F.A.C.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.320 Operation and Maintenance Requirements

(1) Land application systems shall be operated and maintained to achieve applicable waste treatment requirements, before final release of reclaimed water or effluent to the environment, as required in Rule 17-600.530, F.A.C.

(a) Where all land used as part of the treatment/reuse/disposal system is under the direct control of the permittee for the useful life of the facilities, an operator shall perform the duties for which he is certified under Rule 17-602, F.A.C. The permittee shall maintain control over, and be responsible for, all activities inherent to all reuse and land application systems (e.g., crop removal) to ensure that the entire reuse or waste treatment system operates as approved by the Department.

(b) Where the wastewater treatment plant permittee reuses reclaimed water or disposes of effluent 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 Rules 17-600, and 17-610, F.A.C. Such binding agreements are required for all reuse or disposal sites not owned by the permittee. The permittee shall retain primary responsibility for ensuring compliance with all requirements of the Florida Administrative Code.

(2) Reuse and land application systems designed to use crops for the uptake of nutrients from applied reclaimed waters or effluents shall provide for removal of the crop at appropriate intervals, as described in the engineering report and as approved by the Department.

(3) Ground water sampling parameters, schedules, and reporting requirements (where necessary) shall be established pursuant to the provisions of Rule 17-28.700, F.A.C. For each report on ground water quality the permittee shall verify to the Department (based on ground water elevations) the direction(s) of ground water movement from the land application site. In accordance with Rule 17-28.700(6)(k)3, F.A.C., other information requirements shall be imposed on any facility whenever there is a change in the permitted volume, location, or composition of the discharge.

(4) The permittee of any reuse or land application system shall be responsible for making facilities safe in terms of public health and safety at all times, including periods of inactivation or abandonment. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a reuse or land application system and shall specify what steps will be taken to safeguard public health and safety.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.330 Operation and Maintenance Manual

(1) An operation and maintenance manual or addition to the treatment plant operation and maintenance manual or stand-alone instructional booklet, as appropriate, shall be published for all reuse or land application systems, in accordance with Rule 17-600.720(2), F.A.C.

(2) In addition to the requirements specified in Rule 17-600, F.A.C., the reuse/land application system operation and maintenance instructions shall provide the operator with an adequate description and schedule of routine reclaimed water or effluent application rates and cycles involved with the system; operation procedures (including any notification and reporting requirements of appropriate agencies) during adverse climatic conditions and maintenance of equipment; schedules for harvesting and crop removal; routine maintenance required for the continued design performance of the system; ground water monitoring procedures and schedules; listings of spare parts to have on hand; and any other information essential to the operation of the system in accordance with the requirements of this rule.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

PART II
REUSE; SLOW-RATE LAND APPLICATION SYSTEMS; RESTRICTED PUBLIC ACCESS

17-610.400 Description of System

(1) Slow-rate land application systems involve the application of reclaimed water to a vegetated land surface with the applied reclaimed water being treated as it flows through the plant-soil matrix. A portion of the flow percolates to the ground water and some is used by the vegetation. Offsite surface runoff of the applied reclaimed water is generally avoided. Surface application techniques include ridge-and-furrow and border strip flooding. Spray irrigation systems can use fixed risers or moving systems, such as center pivots. These systems generally involve the reuse of reclaimed water that has received secondary treatment and basic disinfection.

(2) Public access shall be restricted, except as allowed by Rule 17-610.418(2), F.A.C.

(3) Subsurface application systems may be used. Systems shall be designed and operated to preclude saturated conditions at the ground surface.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.410 Waste Treatment and Disinfection

(1) For all slow-rate systems involving irrigation of sod farms, forests, fodder crops, pasture land, or similar areas where it is intended that public access shall be restricted, preapplication waste treatment shall result in reclaimed water meeting, at a minimum, secondary treatment and basic disinfection levels before the land application unless the system is being designed and permitted as an other system pursuant to Part VII. Additional treatment shall be required if necessary to meet Department rules as a result of other discharge systems, subsurface drainage, or hydraulic loading rate provisions.

(2) Systems using subsurface application systems shall be subject to the following additional limitation on TSS.

(a) The reclaimed water shall contain not more than 10 mg/l of TSS at all times, unless the application system has been designed to provide specific flexibility and reliability in operation and maintenance of the system. Alternatives to the specified TSS limitation, which is intended to ensure non-clogging of the system, shall be established on a case-by-case basis to the satisfaction of the Department.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.412 Monitoring of Reclaimed Water

Waste treatment limitations shall be met after disinfection and before discharge to system storage ponds or to reuse systems.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.414 Storage Volume Determinations

(1) System storage ponds as described herein shall not be required where it is documented in the engineering report that an alternative system (e.g., permitted surface water discharge, deep wells) is incorporated into the system design to ensure continuous facility operation in accordance with the requirements of Rule 17-600, F.A.C. If system storage is not required, provision of flow equalization or storage shall be evaluated in the engineering report to ensure that reclaimed water flows will match the demand pattern during a diurnal cycle.

(2) Unless exempted by Rule 17-610.414(1), F.A.C., system storage ponds shall have capacities determined as follows.

(a) System storage ponds shall have sufficient storage capacity to assure the retention of the reclaimed water under adverse weather conditions, harvesting conditions, maintenance of irrigation equipment, or other conditions which preclude land application.

(b) Storage capacity or a limited wet weather discharge system shall be provided for wet weather conditions which preclude land application and shall be described in the engineering report and subject to Department approval. The system storage period shall be established by determining the volume of storage that would be required for a ten year recurrence interval, using weather data that is available from, or is representative of, the area involved.

(c) At a minimum, system storage capacity shall be the volume equal to three times that portion of the average daily flow of the reuse capacity for which no alternative reuse or disposal system is permitted.

(d) Analytical means (water balance calculations or computer hydrological programs such as the Department's LANDAP program) of determining system storage requirements shall be used and shall account for all water inputs into the system. Analysis shall be based on site specific data.

(e) The methods used shall be described and justified in the engineering report.

(f) A minimum of 20 years of climatic data shall be used in storage volume determinations.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.415 Storage Pond Design and Operation

(1) System storage ponds shall be designed for continuous flow through or off-line storage of the reclaimed water from the treatment plant. For continuous flow through, the pond shall be designed such that reclaimed water can be retained for the required storage period. For off-line ponds the reclaimed water transmission system shall be designed such that all produced reclaimed water can be diverted to the pond and retained for the required storage period under conditions which preclude land application.

(2) System storage ponds shall be lined or sealed to prevent measurable seepage. The permeability, durability, strength, thickness, and integrity of the liner material shall be satisfactorily demonstrated for anticipated pressure gradient, climatic, installation and daily operation conditions. A quality assurance/quality control plan which substantiates the adequacy of the liner and its installation shall be incorporated into, or shall accompany the engineering report. Synthetic liners shall be installed in accordance with the manufacturers specifications and recommendations. Documentation of quality assurance and quality control activities on liner installation along with permeability or seepage test results shall be submitted with the operation permit application.

(3) System storage ponds may be unlined if designed to provide both storage and percolation functions. When designed for percolation such ponds are subject to the provisions of Part IV or Part VII of this rule. System storage ponds may be unlined if high-level disinfection is provided.

(4) Provisions for monitoring ground water quality adjacent to unlined system storage ponds shall be incorporated into the ground water monitoring plan.

(5) System storage holding ponds shall provide a minimum three feet of freeboard. Holding ponds shall be provided with an emergency discharge or overflow device to prevent water levels from rising closer than one foot to the top to the embankment or berm. The overflow device shall have sufficient capacity to discharge excess flows. Disposition of the overflow discharge shall be identified in the engineering report and is subject to Department approval.

(6) Provisions for the control of algae shall be included in the design, operation, and maintenance and shall be described in the engineering report. Pond design shall also address the control of mosquito breeding habitat. Minimum pond depths (excluding freeboard but including the design operating range) of six feet, with inside bank side slopes steeper than 3:1 (horizontal to vertical), but no steeper than 1:1, are required to discourage growth of rooted aquatic weeds. Maintenance of a minimum pond water depth of 18 inches is required. Routine aquatic weed control and regular maintenance of pond embankments and access areas are required. The use of other depth criterion for mosquito control shall be justified in the engineering report.

(7) Ponds shall be sited to avoid areas of uneven subsidence, sinkholes, pockets of organic matter or other unstable soils unless provisions are made for their correction. Ponds used to impound reclaimed water above natural grade shall be designed to prevent failure of the embankment due to hydrostatic forces, seepage or soil piping, wind and wave action, erosion and other anticipated conditions. Results from field and laboratory tests from an adequate number of test borings and soil samples shall be the basis for computations pertaining to seepage and stability analyses. Conservative safety factors shall be used in these computations.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.417 Surface Runoff Control

(1) The land application site shall be designed to prevent the entrance of surface runoff. If necessary, berms shall be placed around the application area for this purpose. Provisions for on-site surface runoff control shall be described in the engineering report and subject to Department approval.

(2) Discharge from perimeter drainage features that collect reclaimed water after land application, may be restricted by surface water quality considerations pursuant to additional treatment or WQBEL provisions of Rules 17-600.420(2) and 17-600.430, F.A.C., respectively.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.418 Access Control and Warning Signs

(1) For all systems, appropriate warning signs shall be posted around the site boundaries to designate the nature of the project area. Fencing around the site boundary is not required. Storage ponds shall be enclosed with a fence or otherwise designed with appropriate features to discourage the entry of animals and unauthorized persons.

(2) The permittee may allow public access to the land application site if a subsurface application system is used.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, 4-2-90.

17-610.419 Application/Distribution Systems

(1) New reclaimed water application/distribution systems (and replacements of existing systems) shall be designed such that:

(a) Drawdown of holding ponds shall be accomplished as soon as is appropriate. For this purpose, a minimum hydraulic capacity of 1.5 times the maximum daily flow (at which adequate treatment can be provided) of the treatment plant is required; the actual hydraulic criterion selected shall be justified in the engineering report on the basis of holding pond storage capacity, assimilative capacity of the soil-plant system, and similar considerations;

(b) the system design facilitates maintenance and harvesting of the irrigated area and precludes damage from the use of maintenance equipment or harvesting machinery;

(c) the system is designed to prevent clogging with algae;

(d) exposed pipes are labeled;

(e) spray equipment is designed and located to minimize aerosol carry-over from the application area (e.g., low pressure sprays) to buffer zones described in Rule 17-610.421, F.A.C.; and

(f) there are no above ground hose bibbs (spigots or other hand-operated connections).

(2) Subsurface application systems may be used if the reclaimed water is made available to the plant root zone and the hydraulic loading rates and cycles comply with Rule 17-610.423, F.A.C.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.420 Potable Water Cross-Connections

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

(2) For all systems, there shall be readily identifiable "non-potable" notices, marking, or coding on application/distribution facilities and appurtenance.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.421 Stcback Distances

(1) The permittee shall maintain setback distances between the wetted site area subject to land application and surface waters and potable water supply wells to ensure compliance with water quality and drinking water standards, and to protect the public health, safety and welfare. All systems shall be designed to minimize adverse effects resulting from noise, odor, lighting and aerosol drift. Adequate site area shall be provided for operation and maintenance, and for controlling emergency discharges.

(2) Slow-rate land application systems shall maintain a distance of 100 feet from the edge of the wetted area to buildings that are not part of the treatment facility, utilities system, or municipal operation; or to the site property line.

(a) This distance shall be reduced to 50 feet if the setback is vegetated with trees or shrubs to create a continuous visual barrier at least five feet high to minimize aerosol drift. This distance shall be reduced to 25 feet if high-level disinfection is provided in addition to the setback vegetation.

(b) This distance shall be reduced to 50 feet if only low trajectory, low pressure nozzles or surface application techniques are used within the outermost 50 feet of the application area. This distance shall be further reduced to 25 feet if high-level disinfection is also provided.

(c) If subsurface application systems are used, this distance shall be reduced to 30 feet. If subsurface application systems are used and if high-level disinfection is provided, this distance shall be reduced to 10 feet.

(d) This on-site setback distance shall be reduced to 50 feet if high-level disinfection is provided.

(3) A 500-foot setback distance shall be provided from the edge of the wetted area to potable water supply wells that are existing or have been approved by the Department or by the Department of Health and Rehabilitative Services (but not yet constructed); Class I surface waters; or Class II surface waters approved or conditionally approved for shellfish harvesting. This distance shall be reduced to 200 feet if facility Class I reliability is provided in accordance with Rule 17-610.462(1), F.A.C. This distance shall be reduced to 100 feet if facility Class I reliability is provided in accordance with Rule 17-610.462(1), F.A.C., and if high-level disinfection is provided.

(4) No setback distance is required to any nonpotable water supply well.

(5) A 100-foot setback distance shall be provided from a reclaimed water transmission facility to a public water supply well. No setback distance is required to other potable water supply wells or to nonpotable water supply wells.

(6) Setback distances for potable water supply wells shall be applied only for new or expanded reuse facilities. Setback distances shall not be applied when considering an operation permit.

(7) Minimum setback distances to other classes of surface waters shall be established case-by-case based on compliance with applicable water quality standards.

(8) The minimum setback distances described above shall only be used if, based on review of the soils and hydrogeology of the area, the proposed hydraulic loading rate, quality of the reclaimed water, expected travel time of the ground water to the potable water supply wells and surface waters, and similar considerations, there is reasonable assurance that applicable water quality standards will not be violated.

(9) The edge of the wetted area of the land application system shall be at least 100 feet from outdoor public eating, drinking, and bathing facilities.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, Amended 4-2-90.

17-610.422 Subsurface Drainage

If a subsurface drain system is necessary to prevent the water table from rising into the plant root zone, the system shall be designed in accordance with appropriate portions of Rule 17-610.300(4)(f), F.A.C., concerning Soil Conservation Service criteria for subsurface drains. The drainage system shall be designed so that the water table is drawn down generally to provide for 36 inches of unsaturated soil thickness during the time when irrigation is not practiced; unsaturated thicknesses less than this value shall only be approved where justified in the engineering report on the basis of renovating and agronomic aspects of the soil-plant system. Pollutant content (including fecal coliforms) of reclaimed water collected by underdrains may be restricted by surface water quality considerations pursuant to additional treatment or WQBEL provisions of Rules 17-600.420(2) and 17-600.430, F.A.C., respectively.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.423 Hydraulic Loading Rates

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

(2) Loading of nitrogen shall promote use by vegetation and nitrification-denitrification reactions in the soil. If supplemental fertilizers are used, the effect of such fertilizer use on nitrate concentrations in the groundwater shall be assessed in the engineering report.

(3) Other factors which shall be considered in establishing loading rates are the infiltration capacity and hydraulic conductivity of the geologic materials underlying the site; the resulting pollutant load shall be within the assimilative capacity of the soil-plant system. The hydraulic loading rate shall not produce surface runoff or ponding of the applied reclaimed water. Additionally, the quality and use of underlying ground water may dictate the loading rates to be used.

(4) Since soil-plant relationships are complex, the initial design loading rate shall be conservative; a maximum annual average of two inches per week is recommended. The Department will consider a rate higher than the two inches per week average provided the rate is justified in the engineering report on the basis of 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 hydrogeologic conditions.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.424 Monitoring of Ground Water

(1) A ground water monitoring well program shall be established by the permittee and approved by the Department, pursuant to Rule 17-28.700, F.A.C., (unless otherwise exempted by that section).

(2) The manual referenced in Rule 17-610.300(4)(d), F.A.C., contains general technical guidance regarding the design and construction of monitoring wells and ground water sampling procedures. Ground water test wells resulting from hydrogeologic exploratory programs, background water quality determinations or other requirements may be approved by the Department for use as part of the compliance monitoring well system.

(3) Ground water sampling parameters for monitoring background and receiving water quality will be established by the Department based upon the quality of reclaimed water to be discharged, site specific soil and hydrogeologic characteristics, and other considerations, in accordance with Rule 17-28.700, F.A.C. Water levels shall be recorded before evacuating wells for sample collection. Elevation references shall include the top of the well casing and land surface at each well site (NGVD allowable) at a precision of plus or minus 0.1 foot.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.425 Cattle Grazing

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.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.426 Edible Crops

Irrigation of edible crops shall be governed by Part III of this rule.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

PART III
REUSE; SLOW-RATE LAND APPLICATION SYSTEMS; PUBLIC ACCESS AREAS, RESIDENTIAL IRRIGATION, AND EDIBLE CROPS

17-610.450 Description of System

This type of reuse system involves the irrigation of areas that are intended to be accessible to the public, such as residential lawns, golf courses, cemeteries, parks, landscape areas, and highway medians. Public access areas may include private property that is not open to the public at large, but is intended for frequent use by many persons. Reclaimed water may also be made available for fire protection, aesthetic purposes (such as decorative ponds or fountains), irrigation of edible crops, dust control on construction sites, or other reuse activities. These reuse systems feature reclaimed water that has received high-level disinfection.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.451 Minimum System Size

(1) No treatment facility with a design average daily flow of less than 0.1 mgd shall have the produced reclaimed water made available for reuse by slow-rate land application in public access areas.

(2) No treatment facility with a design average daily flow of less than 0.5 mgd shall have the produced reclaimed water made available for reuse by slow-rate land application on residential properties or on edible crops, except as provided for in Rule 17-610.451(3), F.A.C.

(3) The Department shall permit a treatment facility with a design average daily flow of greater than or equal to 0.1 mgd and less than 0.5 mgd to provide reclaimed water for the irrigation of citrus only if all the following conditions are met:

(a) Reclaimed water shall not directly contact the fruit;
(b) The fruit that is produced shall be processed before human consumption; and
(c) Public access shall be restricted.

Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.460 Waste Treatment and Disinfection

(1) Preapplication waste treatment shall result in a reclaimed water that meets, at a minimum, secondary treatment and high-level disinfection. The reclaimed water shall not contain more than 5.0 milligrams per liter of suspended solids before the application of the disinfectant.

(2) An operating protocol as described in Rule 17-610.463, F.A.C., shall be developed and implemented.

(3) Filtration shall be provided for TSS control. Chemical feed facilities for coagulant, coagulant aids, or polyelectrolytes shall be provided. Such chemical feed facilities may be idle if the TSS limitation is being achieved without chemical addition.

(4) Where an industrial pretreatment program would be required by EPA if the facility were discharging to surface waters, an industrial pretreatment program of like nature shall be required before the reuse system is placed into operation.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.462 Reliability

(1) The following reliability requirements shall apply. Facility reliability shall have a minimum Class I reliability as described in Rule 17-610.300(4)(c), F.A.C. The Department shall approve alternate levels of treatment facility reliability if the permittee provides reasonable assurances in the engineering report that the facility will provide a level of reliability equivalent to Class I reliability.

(a) Multiple aeration basins shall not be required for an oxidation ditch facility to comply with Class I reliability requirements, if the following conditions are met:

1. The construction permit application was approved by the Department before April 5, 1989;
2. The treatment facility is not being expanded; and
3. All other Class I reliability criteria are met.

(2) Additional reliability features shall be provided by one or more of the following options. These additional reliability features shall be justified in the engineering report and shall be approved by the Department.

(a) Staffing by a Class C or higher operator 24 hours per day, 7 days per week. The lead/chief operator shall be at minimum Class B, or higher if required by Rule 17-602, F.A.C.

(b) Staffing by a Class C or higher operator 6 hours per day, 7 days per week, unless Rule 17-602, F.A.C., requires additional operator presence or a higher level of operator, in conjunction with one or more of the following.

1. Diversion of acceptable quality reclaimed water to the reuse system only during periods of operator presence.
2. Other provisions for reliability.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.463 Monitoring and Operating Protocol

(1) Reclaimed water limitations shall generally be met after disinfection and before discharge to holding ponds or reuse systems. The total suspended solids limitation shall be achieved before disinfection, regardless of the actual reclaimed water compliance monitoring location.

(2) The treatment facility shall include continuous on-line monitoring for turbidity before application of the disinfectant. Continuous on-line monitoring of total chlorine residual or for residual concentrations of other disinfectants, if used, shall be provided at the compliance monitoring point. Instruments for continuous on-line monitoring of turbidity and disinfectant residuals shall be routinely calibrated and maintained. The permittee shall develop, and the Department shall approve, an operating protocol designed to ensure that the high-level disinfection criteria will be met before the reclaimed water is released to the system storage or to the reclaimed water reuse system. The operating protocol shall be reviewed and updated and shall be subject to Department review and approval at least annually. Reclaimed water produced at the treatment facility that fails to meet the criteria established in the operating protocol shall not be discharged into system storage or to the reuse system. Such substandard reclaimed water (reject water) shall be either stored for subsequent additional treatment or shall be discharged to another permitted reuse system requiring lower levels of pretreatment or to a permitted effluent disposal system.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.464 Storage Requirements

(1) System storage shall not be required where another permitted reuse system or effluent disposal system is incorporated into the system design to ensure continuous facility operation in accordance with the requirements of Rule 17-600, F.A.C. If system storage is not required, provision of flow equalization or storage should be evaluated in the engineering report to ensure that reclaimed water flows will match the demand pattern during a diurnal cycle.

(2) Unless exempted by Rule 17-610.464(1), F.A.C., system storage ponds shall have capacities determined as follows.

(a) Requirements for system storage pond capacity shall be as contained in Rule 17-610.414, F.A.C., for restricted access slow-rate land application systems. System storage or a limited wet weather discharge authorization shall be required for wet weather conditions. At a minimum, system storage capacity shall be the volume equal to three times that portion of the average daily flow of the total reuse capacity for which no alternative reuse or disposal system is permitted.

(3) In addition, a separate, off line system for storage of reject water shall be provided, unless another permitted reuse system or effluent disposal system is capable of discharging the reject water in accordance with requirements of Rule 17-600, F.A.C. Reject water storage shall have sufficient capacity to ensure the retention of reclaimed water of unacceptable quality. At a minimum, this capacity shall be the volume equal to one day flow at the average daily design flow of the treatment plant or the average daily permitted flow of the reuse system, whichever is less. Provisions for recirculating this reject water to other parts of the treatment plant for further treatment shall be incorporated into the design.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.465 Storage Pond Design and Operation

(1) Requirements for system storage and reject water holding ponds shall be as contained in Rule 17-610.415, F.A.C., for restricted access slow-rate land application systems.

(2) System storage ponds do not have to be lined.

(3) Reject storage ponds shall be lined or sealed to prevent measurable seepage.

(4) Existing or proposed golf course ponds are appropriate for storage of reclaimed water and stormwater management provided all Department rules are met and provided the use of golf course ponds for reclaimed water storage will not impair the ability of the ponds to function as a stormwater management system.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.468 Access Control and Warning Signs

(1) No provisions for access control are needed.

(2) The public shall be notified of the use of reclaimed water. This shall be accomplished by the posting of advisory signs in the area where reuse is practiced, notes on scorecards, or by other methods.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.469 Application/Distribution Systems

(1) New slow-rate land application systems, expansions of existing distribution systems, and replacement of existing systems shall be designed to provide, at a minimum, hydraulic capacity of 1.5 times maximum daily flow (at which adequate treatment can be provided) of the treatment facility. The actual hydraulic criterion selected shall be justified in the engineering report on the reclaimed water.

(2) Application of reclaimed water on public access facilities shall be controlled by agreement with the wastewater management entity or by local ordinance. Above ground hose bibbs (spigots or other hand operated connections) shall not be present. Hose bibbs shall be located in locked, below grade vaults which shall be clearly labeled as being of nonpotable quality. As an alternative to the use of locked, below-ground vaults with standard hose bibb services, hose bibbs which can be only operated by a special tool may be placed in nonlockable underground service boxes clearly labeled as nonpotable water.

(3) Reclaimed water shall not be used to fill swimming pools, hot tubs, or wading pools.

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

(a) All applicable requirements in Part III of Rule 17-610, F.A.C., are met;

(b) The truck used to transport and distribute reclaimed water is not used to transport potable water that is used for drinking water; 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 requirements of Part III of Rule 17-610, F.A.C., unless the tank has been evacuated and properly cleaned prior to the addition of the reclaimed water.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.470 Potable Water Cross-Connections

(1) No cross-connections to potable water systems shall be allowed. The permittee shall establish and shall obtain Department approval for a cross-connection control and inspection program, pursuant to Rule 17-555.360, F.A.C.

(2) Reclaimed water shall not enter a dwelling unit or a building containing a dwelling unit except as allowed by rules 17-610.476 and 17-610.477, F.A.C.

(3) Maximum obtainable separation of reclaimed water lines and domestic water lines shall be practiced. A minimum horizontal separation of five feet (center to center) or three feet (outside to outside), shall be maintained between reclaimed water lines and either potable water mains or sewage collection lines. The provisions of Rule 17-604, F.A.C., are applicable to crossings.

(4) All reclaimed water valves and outlets shall be appropriately tagged or labeled to warn the public and employees that the water is not intended for drinking. All piping, pipelines, valves, and outlets shall be color coded, or otherwise marked, to differentiate reclaimed water from domestic or other water.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.471 Setback Distances

(1) There shall be a setback distance of 75 feet from the edge of the wetted area of the public access land application area to potable water supply wells that are existing or have been approved by the Department or by the Department of Health and Rehabilitative Services (but not yet constructed). To comply with this requirement a utility providing reclaimed water for residential irrigation may 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 nonpotable water supply well.

(3) A 75-foot setback distance shall be provided from a reclaimed water transmission facility to a public water supply well. No setback distance is required to other potable water supply wells or to nonpotable water supply wells.

(4) Setback distances for potable water supply wells shall be applied only for new or expanded reuse facilities. Setback distances shall not be applied when considering an operation permit.

(5) Setback distances are not required for surface waters or developed areas.

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

(7) No setback distances are required for private swimming pools, hot tubs, spas, saunas, picnic tables, or barbeque pits or grills.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.473 Hydraulic Loading Rates

Loading rates generally shall be as specified in Rule 17-610.423, F.A.C.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.474 Monitoring of Ground Water

Monitoring of ground water requirements shall be as contained in Rule 17-610.424, F.A.C.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.475 Edible Crops

(1) Irrigation of edible crops that will be peeled, skinned, cooked or thermally processed before consumption is allowed. Direct contact of the reclaimed water with such edible crops is allowed.

(2) Irrigtion of tobacco or citrus is allowed. Direct contact of the reclaimed water with tobacco or citrus is allowed.

(3) Irrigation of edible crops that will not be peeled, skinned, cooked, or thermally processed before consumption is allowed if an indirect application method that will preclude direct contact with the reclaimed water (such as ridge and furrow irrigation, drip irrigation, or a subsurface distribution system) is used.

(4) Irrigation of edible crops that will not be peeled, skinned, cooked or thermally processed before consumption using an application method that allows for direct contact of the reclaimed water on the crop is prohibited.

(5) Any operating permit which may be issued shall identify the crops and shall stipulate the conditions under which such land application may be practiced.

(6) If requested, the Department may authorize special demonstration projects to collect and present data related to the direct application of reclaimed 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. If the Applicant, based on the data collected, demonstrates to the Department that public health will be protected if their reclaimed water is directly applied to crops which are not peeled, skinned, cooked, or thermally processed, the Department shall waive the prohibition described in Rule 17-610.475(4), F.A.C., for that project. When considering such demonstration projects, the Department shall seek the advice of the Department of Health and Rehabilitative Services.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89, 9-13-89

17-610.476 Toilet Flush

Reclaimed water may be used for toilet flush in commercial or industrial facilities or buildings. Reclaimed water may be used for toilet flush in motels, hotels, apartment buildings, and condominiums where the individual guests or residents do not have access to the plumbing system for repairs or modifications. Reclaimed water pipes shall be color coded. Reclaimed water shall not be used for toilet flush in any residential property or dwelling unit where the residents have access to the plumbing system for repairs or modifications.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.477 Fire Protection

(1) Reclaimed water may be used to provide water for fire protection. Reclaimed water may be supplied to fire hydrants. Hydrants shall be color coded, shall have tamper-proof hold-down nuts, and shall be capable of being operated only with a special wrench. Hydrants supplied by reclaimed water shall have no connection to the potable water supply.

(2) Reclaimed water may be used to provide water for fire protection in sprinkler systems located in commercial or industrial facilities or buildings. Reclaimed water may be used to provide water for fire protection in sprinkler systems located in motels, hotels, apartment buildings, and condominimums where the individual guests or residents do not have access to the plumbing system for repairs or modifications. Such sprinkler systems shall be color coded and shall be supplied only by reclaimed water.

(3) Fire protection systems using reclaimed water shall be designed and operated in accord with local fire protection codes, regulations, or ordinances.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: 4-5-89; Amended 4-2-90.

17-610.478 Construction Dust Control

Reclaimed water may be used for dust control at construction sites.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.479 Aesthetic Purposes

Reclaimed water may be used for aesthetic purposes. Such uses include, but shall not be limited to decorative fountains, ponds, lagoons, and pools.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.480 Other Reuse Applications

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

(1) All requirements of Part III of Rule 17-610, F.A.C., are met; and

(2) The engineering report provides reasonable assurance that the intended use will meet applicable rules of the Department and will protect the public health.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-2-90.

17-610.490 Permitting Concept

Normally, a single permit for the reuse system will be issued to the wastewater management facility. Regulation and management of individual users of reclaimed water will be by the wastewater management entity through binding agreements with individual users of reclaimed water or by local ordinance. Individual permits for use of reclaimed water shall not be issued to individual property owners.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.491 Additional Operation and Maintenance Requirements

(1) In addition to the operation and maintenance requirements specified in Rule 17-610.320, F.A.C., and the engineering report requirements specified in Rule 17-610.310, F.A.C., the following requirements apply to reuse systems for irrigation in public access areas.

(a) The permittee shall develop and obtain Department approval of an operating protocol as discussed in Rule 17-610.463, F.A.C.

(b) The permittee shall develop and obtain Department approval for a cross-connection prevention and inspection program as discussed in Rule 17-610.470, F.A.C.

(c) As part of the permit application, the applicant shall submit documentation of controls on individual users of reclaimed water through detailed agreements (including copy of the agreement) or by local ordinance (include copy of appropriate ordinance).

(d) An industrial pretreatment program shall be developed and implemented if required by the EPA or by Rule 17-610.460(4), F.A.C.

(2) Items required by Rules 17-610.491(1)(a), (b), and (d), F.A.C., shall be approved prior to placing the reuse system into operation.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

PART IV
REUSE; RAPID RATE LAND APPLICATION SYSTEMS

17-610.500 Description of System

Rapid-rate land application involves reuse of reclaimed water by spreading in a system of percolation ponds (cells) which may be underlain with subsurface drains. The percolation area shall be divided into two or more cells (each of which need not have identical size and shape) to allow for alternate loading and resting. Because of the somewhat limited ability of these systems to renovate reclaimed water, the permittee shall, in the engineering report, address (in detail) potential water quality standards violations arising from the proposed project.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.510 Waste Treatment and Disinfection

At a minimum, preapplication waste treatment shall result in a reclaimed water meeting secondary treatment and basic disinfection levels prior to spreading into the pond system. The nitrate concentration in the applied reclaimed water shall not exceed 12 mg/l (as nitrogen) unless reasonable assurance is provided in the engineering report that nitrate as measured in any hydraulically down-gradient monitoring well located at the edge of the zone of discharge established in accordance with Rule 17-28.700, F.A.C., will not exceed 10 mg/l or background levels in the receiving ground water, whichever is less stringent. Design nitrate content of the reclaimed water prior to reuse shall be established by the permittee subject to Department approval. Additional treatment may be required as a result of the pond location, subsurface drainage, and hydraulic loading rate provisions contained below.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.513 Monitoring of Reclaimed Water

Waste treatment limitations shall be met after disinfection and before discharge to holding ponds or to reuse systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.514 Storage Requirements

System storage is not required for rapid-rate land application systems. However, it shall be demonstrated in the engineering report that percolation ponds (cells) or rapid infiltration basins and trenches will function adequately under high ground water conditions and that reclaimed water storage or other discharge provisions are not required.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.515 Storage Pond Design and Operation

Where holding ponds are provided for reclaimed water storage such ponds are subject to the requirements of Rule 17-610.415, F.A.C., for restricted access slow-rate land application systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.516 Emergency Discharge

Percolation ponds shall be designed to provide a minimum of three feet of freeboard in order to protect the integrity of pond embankments. Percolation ponds shall be provided with an emergency discharge device to prevent water levels from rising closer than one foot from the top of the embankment or berm. The overflow device shall have sufficient capacity to discharge potential excess flows. Disposition of the overflow shall be described in the engineering report and shown on the plans and shall be approved by the Department.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History New 4-5-89

17-710.517 Surface Runoff Control

(1) The land application site shall be designed to prevent the entrance of surface runoff. If necessary, berms shall be placed around the application area for this purpose. Provisions for on-site surface runoff control shall be described in the engineering report and subject to Department approval.

(2) Discharge from perimeter drainage features that collect reclaimed water after land application, shall be restricted by surface water quality considerations pursuant to additional treatment or WQBEL provisions of Rules 17-600.420(2) and 17-600.430, F.A.C., respectively. Rapid-rate land application systems that result in the collection and discharge of more than 50 percent of the applied reclaimed water shall be considered as effluent disposal systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.518 Access Control and Warning Signs

For all systems, appropriate warning signs shall be posted around the site boundaries to designate the nature of the project area. Fencing around the entire site boundary is not required. Percolation ponds, infiltration basins or trenches, and storage ponds shall be enclosed with a fence or otherwise designed with appropriate features to discourage the entry of animals and unauthorized persons.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.521 Setback Distances

(1) The permittee shall maintain setback distances between the wetted site area subject to land application and surface waters and potable water supply wells to ensure compliance with water quality and drinking water standards, and to protect the public health, safety and welfare. All systems shall be designed to minimize adverse effects resulting from noise, lighting, aerosol drift, and odors. Adequate site area shall be provided for operation and maintenance, and for controlling emergency discharges.

(2) A setback distance of 500 feet shall be provided from the edge of the pond, basin, or trench embankments to potable water supply wells that are existing or have been approved by the Department or by the Department of Health and Rehabilitative Services (but not yet constructed); Class I surface waters; or Class II surface waters approved or conditionally approved for shellfish harvesting. The distance to Class I and II surface waters shall be reduced to 100 feet if high level disinfection is provided. The distance to potable water supply wells shall be reduced to 200 feet if the following requirements are met:

(a) Class I reliability is provided in accordance with Rule 17-610.462(1), F.A.C.;

(b) High-level disinfection is provided; and

(c) The applicant provides information in the engineering report dealing with soils, hydrogeologic conditions, the depth and casing characteristics of such wells, proposed hydraulic loading rates quality of reclaimed water, and expected travel time of the ground water to the potable water supply wells that provides reasonable assurance that applicable water quality standards will not be violated at the point of withdrawal.

(3) No setback distance is required to any nonpotable water supply well.

(4) Setback distances for potable water supply wells shall be applied only for new or expanded reuse facilities. Setback distances shall not be applied when considering an operation permit.

(5) Minimum setback distances to other classes of surface waters shall be sufficient to provide reasonable assurance of compliance with applicable water quality standards.

(6) A setback distance of at least 100 feet shall be maintained from the edge of the pond, basin, or embankments to buildings that are not part of the treatment facility, utilities system, or municipal operations; or to the site property line.

(a) This on-site setback distance shall be reduced to 50 feet if the following requirements are met:

1. The reuse site is adjacent to a right-of-way;

2. The engineering report demonstrates that operation of the reuse system, including ground water mounding, will not adversely affect the intended use of the right-of-way; and

3. Information in the engineering report dealing with soils, hydrogeologic conditions, proposed hydraulic loading rates, quality of reclaimed water, and expected travel time of ground water to the site property line provides reasonable assurance that applicable water quality standards will not be violated.

(b) This on-site setback distance shall be reduced to 25 feet if high-level disinfection is provided in addition to the requirements of Rule 17-610.521(6)(a), F.A.C.

(c) This on-site setback distance shall be reduced to 50 feet if the following requirements are met:

1. High-level disinfection is provided; and

2. Information in the engineering report dealing with soils, hydrogeologic conditions, proposed hydraulic loading rates, quality of reclaimed water, and expected travel time of ground water to the site property line provides reasonable assurance that applicable water quality standards will not be violated.

(7) A 100-foot setback distance shall be provided from a reclaimed water transmission facility to a public water supply well. No setback distance is requried to other potable water supply wells or to nonpotable water supply wells.

(8) The minimum setback distances described above shall only be used if, based on review of the soils and hydrogeology of the area, the proposed hydraulic loading rate, quality of the reclaimed water, expected travel time of the ground water to the potable water supply wells and surface waters, and similar considerations, there is reasonable assurance that applicable water quality standards will not be violated.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.522 Subsurface Drainage

Subsurface drain systems, where necessary, shall be designed in accordance with appropriate portions of Rule 17-610.300(4)(f), F.A.C., concerning Soil Conservation Service criteria for subsurface drains. The drainage system shall be designed so that the seasonal high water table is drawn down to a minimum of 36 inches below pond bottoms during resting periods. Pollutant content (including fecal coliforms) of the reclaimed water collected by the underdrains may be further restricted by surface water quality considerations pursuant to additional treatment or WQBEL provisions of Rules 17-600.420(2) or 17-600.430, F.A.C., respectively. Rapid-rate land application systems that result in the collection and discharge of more than 50 percent of the applied reclaimed water shall be considered as effluent disposal systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.523 Hydraulic Loading Rates and Cycles

(1) Hydraulic loading rates shall be developed on the basis of representative percolation tests (drainfield percolation tests described in Rule 10D-6.057, F.A.C. are inappropriate) which simulate actual loading conditions that will prevail during the design life of the rapid-rate system. This shall involve bench-scale or pilot-scale hydraulic testing with either the actual reclaimed water to be applied, or other water properly adjusted to correspond to the composition of the reclaimed water to be applied. The design loading rate shall allow for the expected gradual reduction in percolation rate due to long-term application of reclaimed water.

(2) The design hydraulic loading (and application) rate shall be related to the hydraulic conductivity and transmissivity and of the geologic formations at the project site which shall be evaluated in-depth by the permittee, with assistance from organizations or individuals qualified by training or experience in soil science, geology, and hydrology.

(3) Initial average annual hydraulic loading rates shall be limited to 3 inches per day, or 1.9 GPD/FT^2, as an annual average where hydrogeologically feasible and as applied to the total bottom area of percolation cells. An applicant may request higher average annual loading rates based on justification provided in the engineering report, but such rates shall not exceed 9 inches (5.6 GPD/FT^2) per day. The average annual hydraulic loading rate shall be related to the clear water saturated vertical hydraulic conductivity for the most restrictive layer in the unconsolidated medium underlying the site. However, application rates during the loading cycle for individual percolation cells comprising the system will depend on the average annual hydraulic loading rate and the loading/resting cycle for the system. Application rates during the loading cycle shall be conservative and shall not exceed 25 percent of the documented vertical hydraulic conductivity, as described above, to control ground water mounding and ensure hydraulic performance of the system. Application rates during the loading cycle may exceed the maximum average annual hydraulic loading rates specified above. Justification for the use of selected design hydraulic criteria shall be required in the engineering report. These design criteria shall be based on the pollutant load in the reclaimed water to be applied, the characteristics of the underlying soil and aquifer system, loading and resting cycles to be used, and other process design considerations (including denitrification reactions that may be incorporated into the facility's design).

(4) Hydraulic loading and resting cycles shall be developed so as to restore operating percolation rates of the pond system to design levels by the end of the resting period. Hydraulic loading periods of 1-7 days with resting periods of 5-14 days to dry the cell bottoms and enable scarification or removal of deposited solids are required. Design loading and resting cycles and other maintenance measures required to ensure system performance shall be described in the engineering report. Systems which achieve restoration of design operating percolation rates on a diurnal cycle will be evaluated on a case-by-case basis as an "other" system (Part VII).

(5) A ground water mounding analysis based on site-specific information shall be included in the engineering report. This analysis shall demonstrate acceptable long-term hydraulic performance of the system.

(6) Rapid rate systems shall be routinely maintained to control vegetation growth and to maintain percolation capability by scarification or removal of deposited solids.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.524 Monitoring of Ground Water

Requirements shall be as contained in Rule 17-610.424, F.A.C., concerning ground water monitoring of slow-rate systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.525 Percolation Pond Location

The physical characteristics of unconsolidated materials overlying the bedrock shall be such that direct rapid movement (short-circuit) of the applied reclaimed water to underlying aquifers does not occur, unless treatment before discharge is adequate to ensure compliance with ground water quality provisions of Rules 17-3 and 17-600, F.A.C.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

PART V
REUSE; ABSORPTION FIELD SYSTEMS

17-610.550 Description of System

(1) This method of land application involves reuse of domestic reclaimed water through discharge to absorption fields. This method involves high rates of application of reclaimed water and loading to subsurface absorption fields, and is distinguished from "drip" irrigation. Facilities shall be designed such that portions of the absorption field shall be isolated for alternate loading and resting without interrupting application of reclaimed water. The application/distribution system shall be designed with appropriate materials and dimensions compatible with the physical (particularly soil) conditions at the specific site.

(2) Absorption fields shall be designed to use the soil/plant overburden. They shall not be designed to have paved or impervious overburden surfaces. Systems designed with paved or impervious overburden surfaces shall be considered by the Department on a case-by-case basis as an "other" system (Part VII). Particular attention shall be given to the reliability and flexibility of operating and maintaining the proposed application/distribution system as well as the level of preapplication treatment and surface drainage effects on the absorption fields.

(3) Absorption fields shall be designed and operated to preclude saturated conditions at the ground surface.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.560 Waste Treatment and Disinfection

(1) Preapplication waste treatment shall result in a reclaimed water that meets, at minimum, secondary treatment and basic disinfection levels before discharge to the application/distribution system. In addition, the reclaimed water shall contain not more than 10 mg/l TSS prior to discharge to the application/distribution system unless the absorption field and the application/distribution system have been designed to provide specific flexibility and reliability in operation and maintenance of the system. Alternatives to the specified TSS limitation, which is intended to ensure non-clogging of the system, shall be established on a case-by-case basis to the satisfaction of the Department. Additional treatment may be required as a result of the absorption field location and hydraulic loading rate provisions contained below.

(2) The nitrate content of the reclaimed water before discharge to the application/distribution system shall not exceed 12 mg/l (as nitrogen) unless reasonable assurance is provided in the engineering report that nitrate, as measured in any hydraulically down-gradient monitoring well, will not exceed 10 mg/l, or background levels in the receiving ground water, whichever is less stringent. Design nitrate content of the reclaimed water before discharge shall be established by the permittee and subject to Departmental approval.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.563 Monitoring of Reclaimed Water

Waste treatment limitations shall be met after disinfection and before discharge to holding ponds or to reuse systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.564 Storage Requirements

System storage is not required for absorption field systems. However, it shall be demonstrated in the engineering report that absorption fields will function adequately under high ground water conditions and that reclaimed water storage or other discharge provisions are not required.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.565 Storage Pond Design and Operation

Where holding ponds are provided for reclaimed water storage, such ponds are subject to the requirements of Rule 17-610.415, F.A.C., for restricted access slow-rate land application systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-710.567 Surface Runoff Control

(1) The land application site shall be designed to prevent the entrance of surface runoff. If necessary, berms shall be placed around the application area. Provisions for on-site surface runoff control shall be described in the engineering report and subject to Department approval.

(2) Discharge from perimeter drainage features that collect reclaimed water after land application, may be restricted by surface water quality considerations pursuant to additional treatment or WQBEL provisions of Rules 17-600.420(2) and 17-600.430, F.A.C., respectively.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.568 Access Control and Warning Signs

Appropriate warning signs shall be posted around the site boundaries to designate the nature of the project area. Fencing around the entire site boundary is not required. The permittee may allow public access to the site. Storage ponds shall be enclosed with a fence or otherwise designed with appropriate features to discourage the entry of animals and unauthorized persons.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.571 Setback Distances

(1) The permittee shall maintain setback distances between the wetted site area subject to land application and surface waters and potable water supply wells to ensure compliance with water quality and drinking water standards, and to protect the public health, safety and welfare. All systems shall be designed to minimize adverse effects resulting from noise, lighting, and odors. Adequate site area shall be provided for operation and maintenance, and for controlling emergency discharges.

(2) A setback distance of 500 feet shall be provided from the edge of absorption fields to potable water supply wells that are existing or have been approved by the Department or by the Department of Health and Rehabilitative Services (but not yet constructed); Class I surface waters; or Class II surface waters approved or conditionally approved for shellfish harvesting. The distance to Class I and II surface waters shall be reduced to 100 feet if high-level disinfection is provided. The distance to potable water supply wells shall be reduced to 200 feet if the following requirements are met:

(a) Class I reliability is provided in accordance with Rule 17-610.462(1), F.A.C.;

(b) High-level disinfection is provided; and

(c) Information in the engineering report dealing with soils, hydrogeologic conditions, the depth and casing characteristics of such wells, proposed hydraulic loading rates, quality of reclaimed water, and expected travel time of the ground water to the potable water supply wells provides reasonable assurance that applicable water quality standards will not be violated at the point of withdrawal

(3) No setback distance is required to any nonpotable water supply well.

(4) Setback distances for potable water supply wells shall be applied only for new or expanded reuse facilities. Setback distances shall not be applied when considering an operation permit.

(5) Minimum setback distances to other classes of surface waters shall be established case-by-case based on compliance with applicable water quality standards.

(6) A setback distance of at least 100 feet shall be maintained from the edge of the absorption field trench to buildings that are not part of the treatment facility, utilities system, or municipal operations; or to the site property line.

(a) This on-site setback distance shall be reduced to 50 feet if the following requirements are met:

1. The reuse site is adjacent to a right-of-way;

2. The engineering report demonstrates that operation of the reuse system, including ground water mounding will not adversely affect the intended use of the right-of way; and

3. Information in the engineering report dealing with soils, hydrogeologic, conditions, proposed hydraulic loading rates, quality of reclaimed water, and expected travel time of ground water to the site property line provides reasonable assurance that applicable water quality standards will not be violated.

(b) This on-site setback distance shall be reduced to 25 feet if high-level disinfection is provided in addition to the requirements of Rule 17-610.571(6)(a), F.A.C.

(c) This on-site setback distance shall be reduced to 50 feet if the following requirements are met:

1. High-level disinfection is provided; and

2. Information on the engineering report dealing with soils, hydrogeologic conditions, proposed hydraulic loading rates, quality of reclaimed water, and expected travel time of ground water to the site property line provides reasonable assurance that applicable water quality standards will not be violated.

(7) A 100-foot setback distance shall be provided from a reclaimed water transmission facility to a public water supply well. No setback distance is required to other potable water supply wells or to nonpotable water supply wells.

(8) The minimum setback distances described above shall only be used if, based on review of the soils and hydrogeology of the area, the proposed hydraulic loading rate, quality of the reclaimed water, expected travel time of the ground water to the potable water supply wells and surface waters, and similar considerations, there is reasonable assurance that applicable water quality standards will not be violated.
Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.573 Hydraulic Loading Rates and Cycles

(1) Requirements specified in Rule 17-610.523, F.A.C., for hydraulic loading (and application) rates for rapid-rate systems generally shall be applicable to absorption field systems. Adjustment of the rates established pursuant to the considerations for rapid-rate system design shall be approved by the Department where the permittee establishes the pollutant reduction capabilities of the soil-plant system involved and provides reasonable assurance that Department rules will be met. The loading rates shall be used in conjunction with the absorption field area (computed as the bottom width of the absorption field trench multiplied by the total length of the application/distribution lines) to establish final reclaimed water application rates. Discharge to the application/distribution system shall be at rates which will prevent physical damage to the absorption field or otherwise impair the functioning of the system. The loading and resting period for absorption field systems may vary from that recommended for rapid-rate systems and shall be established by the permittee and documented, complete with justifications, in the engineering report.

(2) A ground water mounding analysis based on site-specific information shall be included in the engineering report. This analysis shall demonstrate acceptable long-term hydraulic performance of the system.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.574 Monitoring of Ground Water

Requirements shall generally be as contained in Rule 17-610.424, F.A.C., concerning ground water monitoring of slow-rate systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.575 Absorption Field Location

The criteria for absorption field siting shall be as contained in Rule 17-610.525, F.A.C., concerning percolation pond location.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

PART VI
EFFLUENT DISPOSAL; OVERLAND FLOW SYSTEMS

17-610.600 Description of System

This method of land application involves treatment of domestic wastewater to meet effluent limitations for discharge to surface waters. Wastewater is applied by sprinkling or flooding upper reaches of terraced, sloped, vegetated surfaces, such as sod farms, forests, fodder crops, pasture lands, and similar areas. A runoff conveyance system is provided at the ends of the sloped surfaces

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.610 Waste Treatment and Disinfection

(1) Approval of projects involving preapplication treatment below secondary treatment and basic disinfection levels shall be given provided the physical site conditions in Rule 17-610.625, F.A.C., are met. Proposed preapplication treatment levels shall provide reasonable assurance that long-term performance of the land treatment system shall, at a minimum, result in an effluent meeting the secondary treatment and basic disinfection levels before release of effluent to the environment by final surface water discharge from land treatment sites. The pollutant content of the final effluent may be more stringently limited by effluent limitations required in Rule 17-600 and 17-650, F.A.C., as required to satisfy water quality requirements

(2) Preapplication treatment processes shall produce an effluent prior to discharge to holding ponds or to the application/distribution system containing not more than 40-60 mg/l of BOD and 40-60 mg/l of TSS, and meeting the low-level disinfection criteria of 2400 fecal coliforms per 100 ml. Additional treatment may also be required as a result of the hydraulic loading rate, and surface runoff control provisions contained below.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.613 Monitoring of Effluent

(1) Preapplication waste treatment limitations shall be met after disinfection and before discharge to holding ponds or to the overland flow system.

(2) Final effluent monitoring shall be accomplished after the overland flow system and any additional treatment or disinfection and before release to the environment.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.614 Storage Requirements

(1) System storage ponds shall have sufficient storage capacity to assure the retention of the preapplication wastewaters under adverse climatic conditions, harvesting conditions, maintenance of irrigation equipment, or other conditions which preclude land application. At a minimum, this capacity shall be the volume equal to 1.5 days flow at the annual average daily design flow of the treatment plant or the average daily permitted flow of the disposal system, whichever is less.

(2) Additional storage capacity (beyond the minimum requirement) shall be provided based on the need for flow equalization to maintain design hydraulic loading rates or to comply with mass discharge effluent limitations and shall be described in the engineering report and is subject to Department approval.

(3) Analytical means (water balance calculations or computer hydrological programs) of determining system storage required for overland flow land application systems shall be utilized. Such methods shall be described and justified in the engineering report.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.615 Storage Pond Design and Operation

Requirements for system storage holding ponds shall be as contained in Rule 17-610.415, F.A.C., for restricted access slow-rate land application systems. Where a continuous aquitard is present at the overland flow site, the aquitard may be used to provide assurance of compliance with the liner or seal requirements of Rule 17-610.415, F.A.C.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.617 Surface Runoff Control

Requirements for control of runoff entering the land application site shall be as contained in Rule 17-610.417, F.A.C. All discharges from the application site shall result in maintenance of water quality standards.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.618 Access Control and Warning Signs

Requirements shall be as contained in Rule 17-610.418(1), F.A.C., for slow-rate systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.621 Setback Distances

(1) The permittee shall maintain setback distances between the wetted site area subject to land application and surface waters and potable water supply wells to ensure compliance with water quality and drinking water standards, and to protect the public health, safety and welfare. All systems shall be designed to minimize adverse effects resulting from noise, lighting, aerosol drift, and odors. Adequate site area shall be provided for operation and maintenance, and for controlling emergency discharges.

(2) Overland flow land application systems shall maintain a distance of 100 feet from the edge of the wetted area of the land application area to buildings that are not part of the treatment facilities, utilities system, or municipal operations; or to the site property line, and to potable water supply wells that are existing or have been approved by the Department or by the Department of Health and Rehabilitative Services (but not yet constructed).

(3) A setback distance of 500 feet shall be provided from the edge of the wetted area to Class I surface waters; or Class II surface waters approved or conditionally approved for shellfish harvesting.

(4) A 100-foot setback distance shall be provided from a reclaimed water transmission facility to a public water supply well. No setback distance is required to other potable water supply wells or to nonpotable water supply wells.

(5) Setback distances to potable water supply wells shall be applied only for new or expanded overland flow systems. Setback distances shall not be applied when considering an operation permit.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.623 Hydraulic Loading Rates and Cycles

A maximum annual average hydraulic loading rate of seven inches (or 4.4 GAL/FT^2) per week as applied to the entire area receiving overland flow is required. Rates higher than seven inches per week shall be accepted where rates are substantiated in the engineering report on the basis of the renovative ability of the system or other considerations and demonstration that Department rules will be met. Application cycles of wetting and drying the system shall be developed so as to maintain the presence and activity of microogranisms on the soil surface and shall be described in the engineering report.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.624 Monitoring of Ground Water

Soil and hydrogeologic conditions shall preclude ground water quality problems from arising, and substantiating data shall be provided to the Department in the engineering report. Ground water monitoring requirements, if any, shall be established pursuant to Rule 17-610.424, F.A.C., concerning ground water monitoring of slow-rate systems.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

17-610.625 Design Influences

(1) Due to the objective of overland flow systems, the design will provide for runoff of applied effluents, and limited infiltration. Most suited to this type of system are areas with soils of relatively low infiltration and vertical hydraulic conductivity with an aquitard in the soil profile.

(2) A continuous aquitard (natural or artificial) shall be present in the unconsolidated medium under the proposed land application site such that effluent percolating through the soil system above the aquitard is under operational control (for further treatment if necessary). Operational control exists when the percolate flows to the surface drainage system (as opposed to vertical leakage through the aquitard or lateral movement beyond the influence of the drain system).

(a) The confining zone shall be present at relatively shallow depths; shall have a representative hydraulic conductivity no greater than 10% of the average hydraulic conductivity of the unconsolidated medium overlying the aquitard; and shall be of such permeability and thickness to provide reasonable assurance that downward percolation of waters will be minimized.

(b) The permittee shall establish the number of soil samples required to determine representative hydraulic conductivity values and to affirmatively demonstrate that a natural aquitard is continuous at a particular site. Samples shall be distributed throughout the project site. An estimate of sample size required shall be determined through statistical techniques which, based on the size and variance of an initial number of partially-distributed samples, predict the minimum number of samples required to assure that the population and sample means are within a 95 percent confidence interval.

(c) Other methods (e.g., geophysical techniques) to establish the extent and continuity of a natural aquitard shall be approved by the Department upon justification by the permittee.

(3) Design land surface slopes, slope lengths, and detention times required for the system will be governed by preapplication treatment levels and by final effluent limitations required as a result of receiving water conditions. Land surface slopes of 2-8 percent shall be applicable, with slope lengths of 100-300 feet involved

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89.

PART VII
OTHER LAND APPLICATION SYSTEMS

17-610.650 General

The following design/performance standards are for other land application systems that may discharge domestic reclaimed water or domestic wastewater effluent to Class G-II ground waters. The Department shall establish requirements for systems not addressed in Rules 17-610.660 or 17-610.670, F.A.C., including systems comprising components of slow-rate, rapid-rate, or overland flow involving potential discharges to ground water or surface water, on a case-by-case basis with the permittee.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.660 Projects Involving Additional Levels of Preapplication Waste Treatment

(1) Preapplication waste treatment and reliability features, at least as stringent as that required in Rules 17-610.460, 17-610.462, 17-610.463, F.A.C., for slow-rate land application systems involving unrestricted public access, resulting in reclaimed water or effluents meeting the standards for community drinking water systems stipulated in Rule 17-550, F.A.C, shall be required. An individual effluent pollutant criterion (specified in Rule 17-550, F.A.C.) of concern shall be established by the Department, at a value up to the level occurring in ambient receiving ground water. Enforcement of community drinking water standards (as opposed to wastewater effluent limitations) shall be pursuant to Rule 17-550, F.A.C. These above wastewater treatment standards shall be applicable to projects which have hydrogeologic or other project characteristics unfavorable for achieving the combined objectives of wastewater renovation, effluent disposal, and ground water protection. New rapid-rate application projects designed for continuous loading to a single percolation cell shall be subject to such standards unless the Department is provided with reasonable assurances that additional pollutant removal, if any, will occur in the unconsolidated medium underlying the land application site. The following are additional design considerations for projects of this nature:

(a) Storage requirements and the provisions for alternate or back-up disposal systems are established with the Department's approval on a case-by-case basis;

(b) Ground water monitoring requirements, if any, shall be established on a case-by-case basis;

(c) Facility reliability is established on a case-by-case basis, but in no event shall be less than Class I reliability, as described Rule 17-610.462(1), F.A.C.; and

(d) Setback distances shall be established by the Department based on the level of preapplication treatment, application method, loading rate, site characteristics, and mode of operation. Setback distances specified in Rules 17-610.421, 17-610.471, 17-610.521, 17-610.571, and 17-610.621 F.A.C., shall be used based on which type of system best approximates the proposed project (for example, a project that is most similar to a rapid-rate land application system shall have setback distances established pursuant to Rule 17-610.521, F.A.C.).

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89; Amended 4-2-90.

17-610.670 Projects Involving Lower Levels of Preapplication Waste Treatment

(1) Approval of certain slow-rate land application projects involving restricted public access, underdrain systems, and preapplication treatment standards stipulated in Rule 17-610.610, F.A.C., shall be given if the following physical site criteria and design requirements are met:

(a) The continuous aquitard referenced in Rule 17-610.625, F.A.C., is present in the unconsolidated medium underlying the proposed land application site and an underdrain system is designed and employed such that effluent percolating through the soil system above the aquitard is under operational control (for additional treatment, if necessary). Operational control exists when the percolate flows to the underdrain system (as opposed to vertical leakage through the aquitard or lateral movement beyond the influence of underdrain system). Such control exists only when downward movement of the water table is influenced by the underdrain system.

1. The confining zone shall be present at less than twice the bottom depth of the proposed underdrain system, shall have a representative hydraulic conductivity no greater than 10 percent of the average hydraulic conductivity of the unconsolidated medium overlying the aquitard, and shall be of such permeability and thickness so as to provide reasonable assurance that downward percolation of waters will be deterred. Design of the underdrain system shall maintain design water table levels, maximize lateral movement of water toward drains, but prevent overdrainage of the land treatment system; or

2. Where the zone is present at a greater depth, it shall be demonstrated to the Department through appropriate field testing or analytical means that the design underdrain performance standards contained in Rule 17-610.670(1)(a)1, F.A.C., can be assured under this potentially adverse condition; and

3. Establishing representative hydraulic conductivity values and affirmative demonstration that a natural aquitard is continuous at a particular site shall be in accordance with Rule 17-610.625, F.A.C.

(b) The proposed project is in accordance with the other appropriate design considerations for slow-rate systems in restricted public access situations as contained in Part II. However, warning sign, access control and buffer zone requirements shall be in accordance with Rules 17-610.618 and 17-610.621, F.A.C., concerning overland flows systems. The Department may require the installation of monitoring well clusters as described in Rule 17-610.300(4)(d), F.A.C.

(c) The project evaluation in the engineering report provides reasonable assurance to the Department that there will be adequate protection of surface and ground water as well as public health, safety, and welfare.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-5-89

PART VIII
PERMITTING

17-610.800 General

(1) Construction or modification of reuse or land application systems requires an appropriate permit from the Department in accordance with Parts I and II of Rule 17-4, F.A.C., and with this rule.

(2) The permittee shall comply with applicable design and performance criteria pursuant to this rule and the permitting requirements contained in Rule 17-4, F.A.C.

(3) Reuse/land application construction permits may be issued based on engineering reports provided certain requirements as described in Rules 17-610.810, 17-610.820, and 17-610.830, F.A.C., are met.

(4) If sufficient engineering reports are submitted, the Department shall not withhold action on a reuse/land application construction permit application for lack of detailed plans and specifications, unless they are required for federal or state funding.

(5) Reuse/land application permits normally will be combined with the appropriate permits for the wastewater treatment plant. Reuse/land application permits may be issued separately but shall cross-reference appropriate wastewater treatment plant permits.

(6) A reuse/land application permit shall contain limitations on flow and quality of reclaimed water to be applied and shall list appropriate monitoring requirements. Reuse/land application permits shall contain limitations on flow and quality of waters being discharged from the reuse or land application system and shall list appropriate monitoring requirements. Multiple reuse/land application permits may be issued to an applicant to serve a treatment facility.

(7) Operation of all reuse/land application systems requires an appropriate operation permit obtained from the Department in accordance with procedures and criteria specified in Parts I and II of Rule 17-4, F.A.C., and this rule.

(8) The operation permit for a reuse or land application system may be combined with the operation permit for the wastewater treatment plant.

(9) Under certain conditions as specified in Rule 17-610.850, F.A.C., a renewal of an operation permit may be issued for a reuse or land application system for a period of up to 10 years.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.810 Reuse/Land Application Construction Permits

(1) Construction of new reuse or land application facilities or modification of existing facilities requires an appropriate permit from the Department. The permittees shall comply with applicable design and performance criteria contained in this rule as part of the permitting standards under Rule 17-4, F.A.C.

(2) The reuse/land application construction permit may be combined with a construction permit for the wastewater treatment plant.

(3) An applicant for a reuse/land application permit shall submit an application with documentation providing reasonable assurances that the criteria in Rule 17-610, F.A.C., and all other applicable rules will be met. Form 17-610.910(1) shall be used for this purpose. An application shall be accompanied by an engineering report meeting the requirements of Rule 17-610.310, F.A.C. The applicant may submit detailed plans and specifications to support the application and design report. Detailed plans and specifications and the engineering report shall be signed and sealed by the engineer of record. The engineering report submitted as part of the application shall contain the following information in addition to that required by Rule 17-610.310, F.A.C.:

(a) Forecast of flows and wastewater characteristics - current and design year:

1. Physical, chemical, and biological characteristics and concentrations.

2. Wastewater flow patterns - monthly average, daily average, daily maximum, and seasonal peak one-hour flow during current and design years.

3. Domestic, industrial, and infiltration and inflow contributions.

(b) Site plan showing operations and unit processes.

(c) Technical information and design criteria for reuse/land application system:

1. Hydraulic, organic, and nutrient loadings - miminum, average, and maximum quanities.

2. Flow metering.

3. Monitoring points.

4. Concentrations of reclaimed water or effluent percolated to ground water or being discharged to surface waters, with supporting data including design calculations.

(d) Operation and control strategies.

(4) Upon issuance of a reuse/land application construction permit, an applicant may begin construction.

(5) The applicant shall not place a reuse system permitted under Part III of Rule 17-610, F.A.C., in service for any purpose without written permission from the Department.

(6) The applicant shall not place a reuse or land application system permitted under Parts II, IV, V, VI, or VII of Rule 17-610, F.A.C., in service for any purpose, other than testing for leaks and equipment operation, prior to submittal of information required by Rule 17-610.840(2), F.A.C.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.820 Implementation of Slow-Rate Land Application Projects in Public Access Areas, Residential Irrigation and Edible Crop Irrigation

(1) The reuse/land application construction and operation permits for a project regulated by Part III of Rule 17-610, F.A.C., shall include:

(a) Designation of the general areas to be irrigated using reclaimed water.

(b) Designation of major users of reclaimed water. A major user is a site, such as a golf course, that will use at least 0.1 mgd of reclaimed water.

(c) Designation of areas where edible crops will be irrigated. Pursuant to Rule 17-610.475(5), F.A.C., the operation permit shall identify the crops and shall stipulate the conditions under which such land application may be practiced.

(d) Identification of other approved uses of reclaimed water and the conditions under which such uses may be practiced. Other uses may include, but are not limited to, toilet flush, fire protection, construction dust control, aesthetic uses, and others.

(2) Expansions of the reclaimed water distribution system within areas designated in the reuse/land application construction or operation permit do not require a new permit or modification of the existing permit, except as required in Rules 17-610.820(3) or (4), F.A.C.

(3) A new permit or modification of the existing permit shall be required for:

(a) Expansion of the reclaimed water distribution system outside of the area designated in an existing permit.

(b) Addition of a new major user not identified in the existing permit, if the permittee requests that the permitted capacity of the reuse system be increased.

(c) Addition of a new area where edible crops will be irrigated.

(d) Modification of the irrigation system or crops to be grown on an area designated in the existing permit as an area on which edible crops are grown.

(4) A general permit pursuant to Rule 17-610.890, F.A.C., is needed for the addition of a new major user that is not identified in the existing permit and is located within the area designated in an existing permit, and the permittee does not request modification of the permitted capacity.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.830 Project Documentation

(1) Comprehensive engineering report documentation to justify any reuse or land application project shall be submitted with the reuse/land application construction permit application.

(a) An engineering report pursuant to Rule 17-610.310 and 17-610.810, F.A.C., shall be submitted.

(b) For projects regulated by Part III of Rule 17-610, F.A.C., the following materials shall also be submitted:

1. Assessment of possible need for an industrial pretreatment program pursuant to Rule 17-610.460(4), F.A.C.

2. Documentation of controls on users required by Rule 17-610.491, F.A.C.

(c) For projects permitted under Parts II, IV, V, VI, or VII of Rule 17-610, F.A.C., the permittee shall submit binding agreements for projects involving discharge of reclaimed water or effluent onto property not owned or under the direct control of the permittee. Binding agreements generally shall be for the useful life of the appropriate treatment, reuse, or disposal facilities, to ensure adequate operation and maintenance of the facilities.

(d) A proposed ground water monitoring plan, if applicable, meeting the requirements of Rule 17-28.700, F.A.C., shall be provided.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.840 Placing a Facility in Operation

(1) The permittee shall obtain written approval from the Department before placing any reuse system permitted under Part III of Rule 17-610, F.A.C., into operation. Written application shall be made using Form 17-610.910(3). The following items shall be submitted in support of a request to place a Part III reuse system into operation:

(a) Certification on forms approved by the Department of substantial completion of construction prepared by the project design engineer or an engineer who has been retained by the permittee to provide professional engineering services during the construction phase of project completion. The engineer shall certify therein that the system has been constructed substantially in accordance with the reuse/land application construction permit and the associated engineering report and application materials, or that any deviations will not prevent the system from functioning in compliance with the requirements of this rule. The engineer shall note and explain substantial deviations from the reuse/land application construction permit and supporting engineering report. The certification shall be based upon on-site observation of construction (scheduled and conducted by the engineer or by a project representative under his direct supervision) for the purpose of determining that the work proceeded in compliance with the reuse/land application construction permit and supporting documentation.

(b) Certification from the permittee on forms approved by the Department that record drawings are available in a specified location. Record drawings are required for treatment, transmission, distribution, storage, reuse, land application, and discharge facilities. For projects permitted under Part III of Rule 17-610, F.A.C., record drawings are not required for application and distribution facilities on the properties of individual users of reclaimed water. Record drawings shall be furnished by the contractor (based on information gathered and prepared under his direction), and reviewed by the engineer to determine their adequacy. The record drawings shall identify substantial deviations referenced in the certification of completion of construction that have occurred since the reuse/land application construction permit was issued.

(c) Written certification from the permittee on forms approved by the Department that an appropriate operation and maintenance manual or addition to the plant operation and maintenance manual or separate instructional booklet (pursuant to Rule 17-610.330, F.A.C.) is available at a specified location.

(d) Documentation of approval by the Department or the Environmental Protection Agency of an industrial pretreatment program, if required by Rule 17-610.460(4), F.A.C.

(e) Documentation of approval of an operating protocol pursuant to Rule 17-610.463, F.A.C.

(f) Documentation of approval of a cross-connection control program pursuant to Rule 17-610.470, F.A.C.

(2) The permittee shall provide the following certifications and documentation to the Department on Form 17-610.910(6) before placing a reuse or land application system permitted under Part II, IV, V, VI, or VII of Rule 17-610, F.A.C., into operation for any purpose, other than testing for leaks and equipment operation:

(a) Certification of completion pursuant to Rule 17-610.840(1)(a), F.A.C.

(b) Certification of availability of record drawings pursuant to Rule 17-610.840(1)(b), F.A.C.

(c) Certification of availability of an operation and maintenance manual pursuant to Rules 17-610.840(1)(c) and 17-610.330, F.A.C.

(d) The permittee shall submit binding agreements for projects involving discharge of reclaimed water or effluent onto property not owned or under the direct control of the permittee, generally for the term of the useful life of any treatment, reuse, or disposal facilities, to ensure adequate operation and maintenance of the facilities.

(3) A facility may be operated for up to six months under a reuse/land application construction permit in order to demonstrate satisfactory project performance.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.850 Operation Permits

(1) Operation of all reuse and land application systems, whether new or existing, requires an appropriate operation permit from the Department in accordance with procedures and criteria specified in Parts I and II of Rule 17-4, F.A.C. Modifications of existing facilities which would require revisions to a currently valid operation permit and new wastewater facilities may be operated under, and in accordance with, specific conditions of a valid reuse/land application construction permit generally for a six month period after completion of construction. An application for an operation permit must be submitted using Form 17-610.910(4) at least 60 days before the expiration date of the construction permit.

(2) The operation permit for the reuse or land application system may be combined with the operation permit for the wastewater treatment plant.

(3) A renewal of an operation permit for a reuse or land application project may be issued for periods up to ten years if requested, provided the following conditions are met:

(a) The waters from the reuse or land application system are not discharged to Class I municipal injection wells or the treatment plant is not required to comply with the federal standards under the underground injection control (UIC) program pursuant to Rule 17-28, F.A.C.;

(b) A treatment facility or reuse or land application system is not operated under a temporary operation permit and does not have any enforcement action pending against it by the Environmental Protection Agency or the Department or a local program approved pursuant to Section 403.182, Florida Statutes;

(c) A treatment facility and reuse or land application system has operated under an operation permit for five years and within the limits of permitted flows and other conditions specified in the permit satisfactorily for at least the preceding two years;

(d) The Department has reviewed the monthly operation reports required under Department rules and is satisfied that the reports are accurate;

(e) The treatment facility and reuse or land application systems have met all water quality standards for the preceding two years, except for violations attributable to events beyond the control of treatment plant or reuse or land application systems or their operators, such as destruction of equipment by fire, wind or other abnormal events that could reasonably be expected to occur;

(f) The Department or local program has conducted, in the preceding 12 months, an inspection of the wastewater treatment plant and the reuse or land application systems and has verified in writing to the operator of the facilities that they are not exceeding capacity and are in proper working order.

(3) Upon issuance of an operation permit under this rule,if the Department determines based on subsequent noncompliance, that the facility no longer qualifies for a permit, the Department shall revoke, reissue or modify in accordance with the provisions of Rule 17-4, F.A.C.

Specific Authority: 403.061, 403.087, 403.0881, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.0881, F.S.
History: New 4-2-90.

17-610.860 Limited Wet Weather Discharge

(1) The Department encourages implementation of reuse of reclaimed water programs. Demand for reclaimed waters normally declines during wet weather periods. During such wet weather periods, surface water stream flows normally increase. Allowing limited wet weather discharge of excess reclaimed waters during such wet weather periods will facilitate implementation of reuse projects. Therefore, persons implementing reuse projects are authorized to seek approval for limited wet weather disharges as described below.

(2) An applicant requesting a permit for a limited wet weather discharge shall include the following information in the engineering report:

(a) A map showing the locations of the point of discharge and of the proposed receiving stream.

(b) Descriptions and locations of downstream lakes, estuaries, reservoirs, Outstanding Florida Waters, or Class I waters.

(c) An analysis of the historic records for daily rainfall for a period of record covering at least the most recent 20 years, using climatic data that are available from, or are representative of, the area involved. This shall include calculation of the average annual rainfall.

(d) An analysis of the historic records for stream flow in the proposed receiving stream.

(e) Estimates of time of travel from the proposed point of limited wet weather discharge to downstream lakes, estuaries, reservoirs, Outstanding Florida Waters, or Class I waters during periods when limited wet weather discharge would occur.

(f) Analysis of the proposed operation of the reuse, storage, and limited wet weather discharge systems including identification of the proposed operating schedule, frequency of limited wet weather discharge, duration of limited wet weather discharge, quantity of reclaimed water to be discharged, quality of the reclaimed water to be discharged, and the flow in the receiving stream during limited wet weather discharge periods.

(g) Calculation of the required stream dilution factor as follows:

$$SDF = P(0.085\ CBOD5 + 0.272\ TKN - 0.484)$$

Where:

SDF = Minimum required stream dilution factor (dimensionless),

P = Percent of the days of the year that limited wet weather discharge will occur during an average rainfall year (e.g. if discharge will occur on 73 days; P = 100% X (73/365) = 20; if P is less than 1, use P = 1),

CBOD5 = the treatment facility's design monthly maximum limitation for CBOD5 in milligrams per liter,

TKN = the treatment facility's design monthly maximum limitation for TKN expressed in milligrams per liter of nitrogen.

APPENDIX V

PUBLIC PERCEPTION

CITY NEWSLETTER:

A PUBLICATION OF THE CITY OF

ST. PETERSBURG BEACH

A PUBLICATION OF THE *CITY OF ST. PETERSBURG BEACH* *SPRING 1992*

City Newsletter

Special Referendum Election on Reclaimed Water June 30, 1992

Letter from Mayor Horan

Dear Citizens:

This particular newsletter may well be one of the most important ever published by the City. Please take time to read it carefully!

Most of the newsletter is devoted to the reclaimed water project which will be voted on in a city referendum on June 30th. While this is a costly undertaking, I am convinced that reclaimed eater will greatly enhance the quality of life in St. Pete. Beach.

Referendum questions can sometimes be confusing. I would like to suggest that there is but one major thing you have to decide with your vote on June 30th: should we should use $4.5-million of excess sewer reserve funds to pay for the reclaimed water system. It is clear that our sewer system can be maintained without this money and the city can use it for some other purpose. You must decide if bringing reclaimed water to our City in order to keep and improve our community as a green and tropical place to live is a worthy enough purpose.

When I took office last March, there was a lot of misunderstanding and just plain untruths about reclaimed water system proposed by the city. Unfortunately, much of this still exists. It appears that there are some people in our community who have dedicated themselves to deliberately spreading false information and confusion. I urge you to carefully read this newsletter and the state pamphlet, "Reuse of Reclaimed Water," before you vote in this most important referendum.

While I personally might have taken a different approach on the proposed Reclaimed Water project, I compliment our former mayors and commissions for their foresight and efforts. All of the actions and expenditures to this point have only been those re-

(Continued on next page)

Answers to your questions...

What will the Reclaimed Water System cost?

$10,430,400.

Will it be a complete system where water will be available to anyone who wants to use it?

Yes!

Could the reclaimed water system cost more than $10,430,400?

No.! The referendum question limits the amount to be spent. If the contracts to build the entire system does not come in at or below $10,430,400, the system will not be built. The Contractors will have to furnish a performance bonds to build the system within the fixed amount. If a contractor does not complete the project for the contract amount, the bonding company will have to provide any extra money to do so.

How will the city finance the reclaimed water system?

The system will be financed through a Southwest Florida Water Management District (SWFWMD) grant, a low interest State of Florida, Department of Environmental Regulations (DER) loan, the investment of existing $4.5-million city sewer fund reserves, and low cost user fees.

How will the city pay off the low interest loan?

The low interest loan will be paid off over a 20 year period from user fees and revenues realized from the investment of an existing $4.5-million from the city's sewer reserves.

quired to prepare a full and definite proposal for us to vote on in the referendum.

Shortly after taking office, I asked for the appointment of a special Blue Ribbon Committee to do an independent study of reclaimed water and make a recommendation if and how we might accomplish it. This committee included some of our most distinguished private citizens who were not previously involved in the work the city had been doing. The committee was made up of a medical doctor, an attorney, an engineer, a chemist, a contractor and two certified public accountants. With the experience of these citizens, the committee could cover all aspects of reclaimed water and recommend if it was desirable and financially practical.

On April 30, 1992, the Blue Ribbon Committee provided a report and recommendations for a reclaimed water project which the City Commission approved and is submitting to you on the June 30th referendum. This Blue Ribbon Committee took all of the work, data and proposals that were being considered in the past and came up with a new proposed system that would bring reclaimed water to anyone in the city who might want to use it at a very low monthly cost. The system will be voluntary; no one has to hookup. The committee not only devised a manner of financing the system which is sound and does not overburden us, but also provides for unheard of low monthly user fees: a single family home using the water will only pay $7.50 monthly.

Please disregard all of the wild figures and predictions that have been talked about and rumored about over the past year or so! Read the questions and answers in this newsletter and the "Summary of Findings and Recommendations of the Blue Ribbon Committee" which are also contained herein. If you would like to see the complete report of the Blue Ribbon Committee, stop by City Hall or the Library. If you have any questions or concerns, a list of names and the phone numbers of the Committee Members is available. I know each one would be happy to talk with you.

Regardless of how you will vote in the June 30th referendum, please vote. Our recent history is one of very close voting margins, so every vote counts. Whatever you do, please get the facts from someone who knows and has the background to know what they are talking about. A lot of money has been spent to provide you with the facts. It would be most unfortunate if your decision on this important project was influenced by the few people spreading misleading information just to confuse the issue. Your vote is crucial. If you can not vote on June 30th, y‹ u may arrange to vote early by calling the City Clerk at 363-9221. Thank You, Mayor Mike Horan.

Will any property taxes be used?

No!

———

How would the city pay off the loan if not enou people use the reclaimed water?

Although such an event is highly unlikely, the city c use other readily available sources of money, such sales taxes received from the state and county.

———

Will I be forced to use reclaimed water?

No! Use of reclaimed water will be strictly voluntar

———

If I don't use reclaimed water will I have to pay an way?

No! Only users will have to pay.

———

Can we afford to use money from our sewer reser fund for something other than sewer work?

Yes! Many years ago on the advice of a consultan the city began to set aside large amounts of money order to replace major parts of our sewer system. time the city built up a reserve in excess of $5. million. However, in the mean time the city, und advisement of professional engineers, has engaged an intensive maintenance and repair program that h placed our sewer system in good condition. The city faced with having excess amounts of money set asi to maintain the sewer system in good repair.

———

If sewer reserves are used for reclaimed water, ho much will be left for sewer system emergencies?

$1-million. A recent report from the profession engineers tells us that our repair and maintenan program will keep our system in good working cond tion and that only $1-million needs to be held in reser for emergencies, such as damages from a hurricane.

———

When will reclaimed water be available?

If the project is approved in the special referendu election on June 30th, then the city can provi service by late 1993 or 1994.

———

Why should we use excess sewer reserve money to pay for reclaimed water?

This project will benefit the entire city! Even those who never use the water will benefit indirectly from its use by others and by the city's use of it on parks and other public areas. It will free our community from the ever increasing water restriction which prevent us from keeping things green and beautifying our island paradise. The use of reclaimed water will greatly reduce demands on the drinking water system! This reduction in demand will help insure the availability of drinking water for everyone. With less demand, we should have greater drinking water pressure throughout the city. Less demand may also help reduce the ever increasing costs of drinking water. Being able to keep our lawns green and beautiful will certainly make our city a more desirable place to live and, thereby, increase the value of our properties.

How much will reclaimed water cost the single-family owner?

The cost of watering using reclaimed water will be only $7.50 per month for single-family customers as compared to $14.98 per month for use of drinking water; the single-family home owner will save approximately $7.50 each month.

How much will reclaimed water cost two-family, multi-family, condominium and commercial properties?

For two-family, multi-family, and commercial properties the cost will be $7.50/month for the 1st 3,150 sq. ft. of landscaping plus $6.00/month for each additional 3,150 sq. ft. or fraction thereof. There will be no per unit charge! Condominium associations and other multiple-tenant properties will only pay for the areas being watered.

Will there be a connection fee?

There will be no connection or hookup fee during the first year the water is made available to the property. After the first year, however, there may be a charge and cost to those who have delayed hookup.

Will an in-ground sprinkler system be required to use reclaimed water?

No! A special hose bibb in a lock box will be included with your connection.

If I have a well, can I still get reclaimed water service?

Yes, but then you will have to abandon your well.

Why should I use reclaimed water if my well is in good working order?

The quality of reclaimed water is better. The cost of reclaimed water is comparable to the costs for maintaining and operating a well. Above all, the use of reclaimed water will not be restricted.

Will a pump station/storage tank be necessary?

A pump station/storage tank is planned for the city hall complex to reduce low pressure problems when irrigation demands are high, or when the pipeline needs maintenance. The storage tank will be "hidden" in the architecture of the buildings.

FINANCING FACT SHEET

$ 0	Property taxes or assessments
$ 0	Connection fees
$2,034,700	SWFWMD grant
$9,340,216	DER low interest loan including financing costs
$176,288	Annual debt service (loan repayment) from user fees
$504,410	Annual debt service (loan repayment) from investment of $4.5-Million of city existing sewer system funds
$681,198	Total annual debt service (loan repayment)
$10,430,400	Total project cost

Typical Cost Savings

Single-family home: $7.50/month saving
1/2 acre landscaping: $60.18/month saving
1 acre landscaping: $121.44/month saving

Special Blue Ribbon Committee Recommends City-wide Reclaimed Water System

On March 17, 1992, Mayor Horan and the city commission formed a special Blue Ribbon Committee to independently study any and all information relating to reclaimed water and to make recommendations with regards to the city's proposed participation in a regional reclaimed water system with the city of South Pasadena, Pinellas County and the unincorporated community of Tierra Verde.

The Blue Ribbon Committee was composed of independent private citizens who have expertise in various fields relating to health, engineering, implementation and financing of such a project. The members of the Committee were:

- Mr. Robert A. Douglass - Chairman - attorney - 360-6954
- Mr. Jack A. Ohlhaber - Vice-Chairman - engineer - 360-5918
- Dr. John R. Phillips - retired medical doctor representing the medical opinion of the Committee - 360-8497
- Mr. Jim E. Eorgan - retired chemist representing the chemical problems for the Committee - 360-3164
- Mr. Jim Nelson - retired general contractor representing the construction aspects for the Committee - 360-4552
- Mr. Larry Sharer - Certified Public Accountant representing financing issues on behalf of the Committee - 360-1112
- Ms. Helen Igar - Certified Public Accountant representing financing issues on behalf of the Committee - 360-1811

Over several weeks, the Blue Ribbon Committee met, discussed and poured over reams of materials. The Committee was supported with testimony and information by city staff members, professional engineers and scientists of Camp, Dresser and McKee, Inc., *(the city's sanitary engineers)*, and interested citizens. The Blue Ribbon Committee concluded that reclaimed water is a safe, abundant and inexpensive source of water for irrigation and other non-potable uses. The Committee also concluded that due to the availability of grant funds from the Southwest Florida Water Management District (SWFWMD) and low interest loan funds from the State of Florida, Department of Environmental Regulations (DER), coupled with the investment potential of $4.5-Million unreserved funds in the Sewer Revenue Fund, that the time was ripe for the city to develop a city-wide system. *(A free copy of the final Committee report is available at city hall for citizens*

The city commission accepted the committee repc with great appreciation of the hard work performed l committee members and, in accordance with tl report, has scheduled a special referendum election (June 30, 1992, in order for the citizens of St. Peter burg Beach to make the final decision on the matte On June 30th you will be asked whether the ci should construct a reclaimed water system in accc dance with the plan developed by the special Bl Ribbon Committee. Thus, this important decision (the future well being of the community has been plac directly in the hands of the voters of St. Petersbu Beach. The decision is up to YOU!

YOUR VOTE COUNTS!

Summary Findings and Recommendations of the Blue Ribbon Committee

(There are many recommendations contained in tl final report. This article merely summarizes the maj recommendations of the Blue Ribbon Committee.)

•The deployment of a secondary reclaimed wat system throughout St. Petersburg Beach should mak reclaimed water available to each homeowner ar business within a two and one-half year period fro the commencement to the completion of the project . a cost not to exceed $10,400,400. The Committe feels that the total cost of this system to the Ci should be capped at $10,400,400 and should be pa for with fees from a combination of $2,034,700 gran funds from the Southwestern Florida Water Manag ment District (SWFWMD) and a low interest (3.9% (less) Department of Environmental Regulations loan f $9,340,216. The loan payment, administration ar maintenance and administration cost should be paid b use of $4,500,000 in the City's existing Sewer R serve Funds, monthly user fees and other water an sewer fund savings allocated or collected over the 2(year loan period. The total system cost should b achievable with the cooperation from other commun ties involved with this project.

•Pinellas County would supply reclaimed water from it 20-mgd, South Cross Bayou Wastewater Treatmer Facility, using a new transmission system, comprisin a pump station and 5.9 miles of 18- and 20-inc diameter pipe, constructed along the Pinellas Trail, t convey water through South Pasadena and into S Petersburg Beach. The transmission would be share as the primary means of reclaimed water supply to South Pasadena, St. Petersburg Beach and Tierra Verde. Participation by the City of St. Petersburg anticipates the shared use of a portion of existing St. Petersburg reclaimed water pipelines and pumping facilities. Such shared use could reduce the need to construct new facilities including approximately 0.9 miles of 20-inch diameter pipe and the storage tanks otherwise required in both South Pasadena and in St. Petersburg Beach.

"The transmission system would deliver reclaimed water into a storage tank and pump station facility constructed adjacent to the Community Services facility in the City Hall Complex. The storage tank and pump station, together with 6.6 miles of 12- and 16-inch diameter pipe, form the trunk system. The trunk system would be shared by St. Petersburg Beach and Tierra Verde for the reclaimed water supply. The trunk system would extend, essentially, the entire length of St. Petersburg Beach.

"Distribution pipelines would connect to the trunk system for the delivery of reclaimed water to City residents who elect to connect. Service to all properties in the City would require the construction of 31.4 miles of 2-,4-, 6- and 8-inch diameter pipe. Distribution service would bring reclaimed water to a property owner's property line

"All connections to the reclaimed water system, residential and commercial, should be on a voluntary basis. The Committee recommends a $7.50 per month charge for single-family dwellings. For businesses, City lands and condominium properties the recommended fee is $7.50 per month for the first 3,150 square feet of water used plus an additional $6.00 per month for each additional 3,150 square feet or fraction thereof used. These rates should be subject to re-evaluation and adjustment after the fifth year of the project.

"For those electing to connect to the system as the system is installed on their street(s) the recommendation is that the connection from the lateral to the users sprinkler system or desired outlet be made free of charge. There should be no system connection fee to a user during the first year as it is being made available. A connection fee should be charged after the first year of availability.

"We also recommend that as construction proceeds down each street or area of the City, that the City should take "sign-ups" from the property owners who wish to connect to their property immediately. In return for immediate connection we recommend that the City provide FREE connection from the property line lock box to a single desired hose outlet or sprinkler input at the users discretion. We suggest that the City arrange for local plumbers to bid on the entire connection job for the area and accomplish the work along with the installation of the laterals.

There is clear evidence that low cost sources of drinking water, often called potable water, will continue to be in short supply and that the cost to the community will continue to grow to the point that the watering of gras and shrubbery will no longer be feasible. There is no clear economical source for addition of drinking water. The demands on the existing well systems are expected to increase throughout south Florida. Alternatives for drinking water, such as desalinization or pipes bringing additional water from north Florida rivers, are much more expensive alternatives. The best approach is to use treated sewage water, known generally as reclaimed water, for the purpose of watering lawns, shrubbery and other suitable uses, for the future. This effectively reduces the consumption of potable/drinking water, reduces the demand on the existing potable/drinking water distribution systems allowing for some community growth and provides a desirable alternative to deep well injection of this surplus water from sewage disposal systems.

"The recommended system is to be completed with the cooperation of South Pasadena who will use an allocation of 0.5 million gallons of water per day and of Tierra Verde who will use an allocation of 1.0 million gallons of water per day. St. Petersburg Beach will use an allocation of 2.3 million gallons of water per day. Each community is to pay its fair share of the implementation cost.

"Efforts are being made to incorporate the City of St. Petersburg into an area-wide plan which would further reduce the initial cost. Our findings are that the recommended system can be implemented for $9,683,500 (St. Petersburg Beach share) if we can form a cooperative agreement with the City of St. Petersburg early in the project by sharing some of their distribution system. The cost is estimated at $10,430,400 (St. Petersburg Beach share) if we proceed without the cooperation of St. Petersburg.

"We should plan to proceed on this plan with the cities of South Pasadena and Tierra Verde, without St. Petersburg if necessary. Because this is an area-wide problem, the City should strongly endeavor to reach agreement with St. Petersburg and other communities such as Treasure Island, Gulfport and Madeira Beach to incorporate them into the plan through all reasonable means.

"The negative side of this approach is that it will require the installation of a separate secondary water distribution system, isolated from the potable/drinking water system, capable of supplying up to 2.3 million gallons of water per day. Despite this, the use of reclaimed water is still the most economical alternate source of water suitable for watering lawns and shrubbery.

"Considering that the source of reclaimed water is treated sewage, waste water from our sinks, dishwashers, clothes washers, etc., even though it is extensively processed, the health suitability was a major concern. Data was collected and discussed from both a chemical content and medical (disease) viewpoint. We find, that when properly treated and controlled, reclaimed water poses no health hazards to our community. The inherent salt content makes this secondary water unsuitable for some plants, such as vegetables and a few ornamental plants, but the quality is far better than that found in any farm irrigation ditches or in the runoff from any rainstorm in St. Petersburg Beach.

"Standards for reclaimed water have been set by Arizona, California and the City of St. Petersburg. St. Petersburg is one of the national leaders in the use and control of reclaimed water. The quality of the water is largely controlled by the processes (methods) used to purify it. St. Petersburg and the Cross Bayou plant uses more than adequate secondary treatment methods to meet all State and Federal standards. We further recommend that the City's legal counsel review all agreements concerning the source of reclaimed water and assure that the quality of this water is stipulated and that there is sufficient legal recourse to guarantee the quality of the source(s) prior to the implementation of the system.

"To be most effective and more cost efficient, a secondary water supply system using reclaimed water should be deployed to the maximum extent. Its objective in the short term is to be a low cost source of water for lawns, shrubbery and fire hydrants. In the longer term, as sources of water become increasingly difficult, it may be expanded as the source of water for toilets as well. We recommend that this requirement be considered for all new construction or improvements by the City.

"We believe that the contingency and cost estimates made by Camp, Dresser and McKee are conservative. In addition, we note that an added 20% contingency has been included in the construction estimates. The actual cost will be determined by good design, competitive bidding and efficient management of the job. This job should be able to be completed within the recommend limits. We feel that the reclaimec water project should move forward at the quickest reasonable speed to secure the most favorable bids and funding sources to pay for construction, administration a maintenance of the reclaimed water system.

"The scope of the program necessary to provide claimed water to the community is very large. It v involve digging in all of the streets of the commun and will affect all of the community, even those w may elect not to participate. This project can have dramatic positive impact to the future character of t City and should be equally beneficial to both t residents and businesses which operate within Petersburg Beach. Because the system will eventua parallel all of the present potable/drinking water dis bution, it is one of the largest financial obligations t City will undertake.

"Therefore, the Committee strongly endorses a concurs with the decision of the City Commission hold a referendum on this question on Tuesday, Ju 30, 1992. We believe that this report and its reco mendations should be used as the basis of this progr and that its contents should be distributed and brief at homeowners meetings and other City discussions the widest possible extent so that there will be misunderstandings in the referendum.

"If the referendum approves construction of the claimed water system in St. Petersburg Beach, facil construction could begin about November, 1992, a be completed within the following two years."

Other Important Answers...

The following are questions were posed to the spec Blue Ribbon Committee by Mayor Horan and the c commission when the committee was formed a answered in time by committee members:

"Are there any known health dangers to persons animals associated with the use of reclaimed water irrigation of private or public areas?"

"From the review of all the information, data a studies presented to the Committee, it would app that, provided the amount of potentially hazardo materials and the level of bacteria are maintained bel standards specified by the United States Department Environmental Regulations, there are no signific health dangers to persons or animals associated w the use of reclaimed water for irrigation of public private areas. This finding is conditioned upon assumption that the reclaimed water will not be us as drinking water for human beings or for animals a that normal hygiene procedures would be observ following physical contact with the water such washing hands before eating, etc."

"What is the experience of other cities in the area or any other areas of the country?"

"As far as the Committee has been able to determine, in the City of St. Petersburg where this water has been used for almost 15 years, there are no known reported problems or experiences of any kind of adverse reactions to persons or animals as a result of use of reclaimed water. It appears that this has been the case throughout the State of Florida and in other areas of the United States where it has been used."

"What is the Committee's recommendation with respect to the health aspects for the use of reclaimed water within St. Petersburg Beach?"

The public should be adequately informed that the reclaimed water should be used ONLY for irrigation or other uses which will not involve the direct ingestion of the water by humans or animals and that all reclaimed water outlets should be adequately labeled or identified as reclaimed water in some satisfactory manner.

"Are there any dangers?"

"There are no significant dangers other than as noted hereinabove."

"Will the system provide adequate safeguards to preclude cross-connections to the potable water system?"

"The Committee has been assured that the system is designed in a way where a cross-connection would not be possible unless it was intentionally and illegally done by a property owner."

"Are there any adverse environmental impacts on the use of reclaimed water?"

"It is the Committee's considered opinion that there are no adverse environmental impacts involved in the use of reclaimed water. The overall net environmental impact of the use of reclaimed water is a positive one in that the use of the effluent for irrigation as opposed to forced pumping into the subterranean aquifer is a substantial environmental improvement."

"What are the alleged impacts upon the environment?"

"It is assumed from this question that the inquiry revolves around negative alleged impact. The Committee received some anecdotal testimony from several persons during the course of the hearings with respect to negative impacts and is aware of the rumors circulating in the Community about impacts on the environment. These appear to be centered on concerns that the effluent is hazardous to some plants, trees and grass and that the effluent would find its way into Boca Ciega Bay or the Gulf Mexico causing harm to marine life or causing pollution of some kind."

"What is the Committee's analysis of any of these alleged environmental impacts?"

"The Committee received a substantial body of evidence, reports and findings which indicate that when chlorine levels are properly maintained the effluent is in no way harmful to plants, trees and grass of any kind. This effluent has been used for many years to irrigate commercial citrus groves and other crops without any adverse consequences whatsoever. It has been recommended by the Florida Department of Environmental Regulation for such use, both commercially and residentially. The Committee also received satisfactory information to the effect that, provided established levels of organic and non-organic compounds and elements are maintained in the system, this negative environmental impact must be treated as a non-issue. With respect to the latter issue of pollution of the Gulf of Mexico and Boca Ciega Bay, the Committee again, received substantial input in the negative. If the effluent was pumped directly into Boca Ciega Bay, the nutrients would have to be removed or it could cause organic "bloom" within the water which would cause environmental harm. For the envisioned use of the water as irrigation for plants, trees and grass, the amount of effluent and compounds contained therein which could conceivably reach the Gulf of Mexico or Boca Ciega Bay is so small that it is of the Committee's opinion that this alleged adverse impact is also a baseless rumor."

"Can reclaimed water be used to irrigate fruits and other crops?"

"Yes, as cited hereinabove. This use has been regular and continuous for many years not only in Pinellas County and throughout the State of Florida, but throughout the United States, without adverse environmental impact."

"Are there any implications of legal liability for individual citizens or the City in the use of reclaimed water?"

"Provided that levels of organic or inorganic harmful chemicals are monitored on a regular basis, distribution lines are clearly marked and delivered and no illegal and intentional interconnections of the system with the fresh water system occur, there will be little or no chance of legal liability of individual citizens or the City in the use of reclaimed water."

"Is the existing Interlocal Agreement reasonable for any reclaimed water project?"

"Yes."

"What would be the impact of other cities joining us in a reclaimed water project?"

"a. Financial impacts?"

"It is rather obvious that the more communities that participate in the reclaimed water system the more economical it would become for everyone. We are sure that the City Commission is aware that the ongoing prospect of eliminating the long pipeline from Cross Bayou in favor of a connection with the St. Petersburg reclaimed water system would save approximately $800,000."

"b. Operational impacts?"

"Again, it is the opinion of the Committee that the more cities that cooperate in a reclaimed water project, the greater the chance for enjoying a more economical project."

"What would be the advantages and disadvantages of the use of reclaimed water versus well water?"

"Advantages. The use of reclaimed water would eliminate electrical pumping costs and maintenance costs of a well system to the user. Reclaimed water has no chemicals which would cause the rust stain which quite often is found in well water and is absent of the "rotten egg" odor found most frequently in well water. Well water has no nutrient qualities. The reclaimed water does promote healthy plant growth. Well water also faces the distinct possibility of salt water intrusion which would eventually lead to the necessity to abandon the well."

"Disadvantages. The main disadvantage of the reclaimed water is the large initial start-up cost of installing the transmission and distribution systems. However, it is a capital expense which should bear fruit in the years to come. Another disadvantage would be the possibility of an occasional shut down of the system in the event that the demand should become too great c in the event that the levels of organic or inorgani compounds within the water temporarily rose to a unacceptable level."

"Are there any identifiable Community benefits whic would accrue to non-users of reclaimed water?"

"Yes. Obviously the benefits are not as great to nor users as they are to users. Benefits to non-users woul include the cessation of the pumping of effluent int the underground aquifer. However, this is a long-terr benefit not readily visible or appreciated by a nor users. Disposal of the treated effluent is a part of th treatment of sewage and a method of disposal c effluent which must be accounted for by all persor who are connected to the sewer system. Non-user would also benefit by the City's use of the effluent fc irrigation of parks and common City areas which shou decrease the City's expenditures for potable water."

"Do these benefits justify Community financing su port?"

The Committee believes that it does justify Communit financial support for the principal reason that the ult mate treatment of the sewage is the responsibility of a users of the sewer system. It must be recognized th all capital improvements which are undertaken by ot government do not necessarily benefit each and eve person in the Community to the same extent."

"If so, to what extent?"

"It is believed that there is an overall benefit to th entire Community of maintaining healthy and attra tive landscape areas in both the public and priva areas of our City. The maintenance of these are benefit the entire community in a number of su stantial ways and if the use of the effluent ca improve the quality and quantity of the landscap plantings and green areas of the City, it is a benef to all of our citizens, businesses and visitors alike

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"Will any reclaimed water system foster redevelo ment?"

In the opinion of this Committee, this is another "re herring" that has no justifiable basis. The City present Land Use Plan and zoning ordinances put a ca on development and redevelopment within our City. is unlikely that a decrease in the use of fresh wate which may be brought on by the use of reclaime

...ting that density within the

"Will the design of any proposed system provide adequate pressures for the potential use of the reclaimed water throughout the City?"

"Testimony given by the City engineers with the regard to this issue have lead the Committee to the opinion that adequate pressures for purposes of the City of St. Petersburg Beach will be provided. It is also the opinion of this Committee that even if pressures do not allow adequate "on demand" instant use throughout the City, appropriate changes could be made by staggering days throughout the City such as "SWFWMD" has done in regulating the use of fresh water for irrigation. In short, we do not feel that there are any significant problems in this regard."

"Will a storage tank and pump station be required within the City limits?

"We feel that a pump station may be required initially but that a storage tank will not be required if the system is connected to the St. Petersburg system."

"If so, where would the tank and pump station be located?"

"The most likely location would be within the City Hall Complex adjacent to the Department of Community Services compound on Mangrove Avenue."

"Will any reclaimed water system increase property values now or in the future?"

"We received no direct testimony on this issue. However, the general consensus of the Committee is that the reclaimed water system availability would more than likely add to the value of properties but not in a significant manner."

"What is the most cost effective distribution system for St. Petersburg Beach to provide reclaimed water to any projected initial demand? What is the Committee's recommendation with respect to the scope of the initial project?"

"The Committee believes that if the City's Sewer Reserve Funds are going to be used as the principal

...ing vehicle ($4.5 millio transmission system be const St. Petersburg to St. Petersbur system should be provided which will indicate a desire to

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"Should any other infrastructur as underground utilities, be include

"We feel that other infrastructure i not be included in this project. Th other utilities should not be a part o should be financed from the nor budget. If the City should make a grounding utilities, it should be a sep funding analysis and should be segr project in a clear manner.

"How do other cities finance reclaim jects?"

"Other cities have used a variety of financ er, many of these financing opportunities available, such as Federal Revenue Sharing Federal grants such as the grant that built th St. Petersburg system. It is the Committe that the City of St. Petersburg Beach must ine financing alternatives which are presently a to the City of St. Petersburg Beach and make choice from those sources."

"What current and projected City funds are avai finance reclaimed water?"

The Committee believes that $4.5 million dollars City's Sewer Reserve Fund should be used as principal financing vehicle. It is the Committee's go to keep user fees at a rate of $7.50 per month. shortfalls between user fees and the City's Se Reserve Fund can be made up through the use of innovative financing techniques as suggested by the Budget and Finance Review Committee. Shortfalls revenues are projected to be small and can be supplemented by modest application of sales tax infrastructure funds if necessary."

"Should the City finance any portion of a reclaimed water system through a loan?"

"We definitely recommend that the low interest loan made available by the Florida Department of Environmental Regulation be used to the utmost. It appears that the estimated cost of the system recommended by the Committee, after application of the Southwest Florida Regional Management District grant, would be $9.3 million dollars. We recommend that this entire amount be borrowed and that the financing recommendations of the Finance and Budget Review Committee be utilized. The effective rate of interest, based upon a loan rate of 3.9% on a 20-year amortization after allowance for closing costs and organization fees, would be less than 4.6%."

"Should the City use revenues from the Pinellas County Infrastructure Sales Tax for a loan security or for financing any reclaimed water system?"

"We believe that the Infrastructure Sales Tax should be used for both purposes."

"What is the most equitable user fee structure?"

"The Committee feels there should be a base user fee structure for every connection to the sewer system whether it be residential or commercial. The base rate should be less than $8.00 per month. The Committee further believes that all commercial or multi-family connections which have a permeable area in excess of 3,150 square feet should be charged an additional fee. The exact fee for each multi-family and commercial property should be determined upon connection and rechecked every time a site plan is modified or a building permit is issued to ensure that the amount of permeable area has been correctly calculated."

"Should there be a connection fee?"

"We feel there should NOT be an initial connection fee. At the end of one year from the date that service becomes available at a particular connection location, a connection fee should be charged. The amount of such a fee should be established at the completion of construction."

"Should property taxes be utilized to support any reclaimed water?"

"No."

"What would be the expected cost savings to the City from the use of reclaimed water for irrigation of City parks and public lands?"

"City staff has estimated savings would amount to approximately $45,000 per year."

"What is the projected availability and cost of potab water in the future?"

"No definite data was presented to the Committee (this subject. However, based upon the testimony th was taken was that potable water availability w certainly decrease in the future and the cost of potab water in the future will continue to rise in costs signi cantly. This has been the case every year for the la ten years and there is no reason to assume this situ tion will not become more acute as we move into tl future."

Referendum Question

SHOULD ST. PETERSBURG BEACH CONSTRUCT A RECLAIMED WATER SYSTEM AT A COST NOT TO EXCEED $10,430,400?

UNDER THE PLAN, RECLAIMED WATER WILL BE AVAILABLE TO ANY PROPERTY OWNERS WITHIN THE CITY WHO SHALL REQUEST IT. THE MONTHLY USER FEE FOR A SINGLE FAMILY HOME SHALL BE $7.50 PER MONTH FOR THE FIRST FIVE YEARS OF OPERATION. THE COST OF CONSTRUCTION SHALL BE FINANCED WITH $4,500,000 FROM THE CITY'S SEWER RESERVE FUND, A GRANT, A STATE LOAN, AND MONTHLY USER FEES. NO AD VALOREM REAL PROPERTY TAXES SHALL BE USED.

YES (For) [ ]
NO (Against) [ ]

VOTE JUNE 30TH

Absentee Ballots

If you are disabled or going to be out of the city on election day, or will be working at the polls, call the Supervisor of Election's Office at 462-4590 or the City Clerk's Office at 363-9221 and an absentee ballot will be sent to you. In-office voting will also be available by calling one of the above numbers for details.

Voter Registration

If you are a U.S. citizen and a permanent resident of Pinellas County who is at least 18 years of age, you are eligible to register to vote. There is no residency requirement in Pinellas County. Registration books close thirty (30) days before an election.

Absentee registration is available if you or your family are a member of the Armed Forces or Merchant Marines; a citizen of the United States; a permanent resident of Pinellas County and temporarily out of the country, state, or county; or physically unable to get to a local registration location.

If you need to change your name, address, or party affiliation, you may come into the Clerk's Office. If you need to change only the address, you may fill in the reverse side of your voter identification card and mail it to the Supervisor of Elections, 315 Court Street, Clearwater, FL 34616. There is no fee for voter registration.

City Commission Meetings

The Agenda/Regular City Commission meetings are held on the first and third Tuesdays of each month at 7:00 p.m. at City Hall, 7701 Boca Ciega Drive. Public hearings, special meeting dates, and regular City Commission meeting agendas will be posted on the bulletin board in City Hall and can be seen on cable television, channel 15. The meetings are televised for those citizens who are unable to attend.

If you would like an item placed on the agenda, information and format for requests can be obtained from the Clerk's Office. The deadline for submission of material is no later than noon on the Monday of the week preceding the meeting. An agenda book for citizens is located at City Hall and is available for review on the Friday preceding the meetings. For information on the above, call 363-9221.

Improved Services

This is our second year of service in the Pinellas Public Library Cooperative (PPLC). The goal of the Cooperative is to provide Library service to all eligible residents of Pinellas County. To obtain a new Cooperative Library Card all residents of member cities and the unincorporated county may register at their nearest library. You will be asked to provide the following identification with your current address, a Florida Driver's License or Florida Identification Card. You may substitute a current picture I.D. and any one of the following: your current Pinellas TRIM notice or TAX bill, a current utility bill (includes cable), Declaration of Domicile, a deed to property in Cooperative area, vehicle registration (current year), your homestead exemption form, Pinellas Voter Identification card.

Your Pinellas Public Library Cooperative card entitles you to borrow materials from any of the twelve (12) member libraries. Rules for borrowing will vary at the individual libraries (audio-visual materials must be returned to the owning library) so please check when you visit. We hope you will enjoy the use of cooperative libraries and services for years to come!

The Pinellas Public Library Cooperative (PPLC) is not the only organization the Library has joined in the past year. The St. Petersburg Beach Public Library has become a part of the Tampa Bay Library Consortium (TBLC), a network of libraries established in 1979. The Consortium is dedicated to promoting and coordinating sharing of materials, information and services among public, academic, and special libraries of ten counties in the Tampa Bay area. The group includes 25 public, 26 academic, 14 special and 2 county school system libraries. The group is composed of individual libraries which remain autonomous, yet share resources with others in the network. TBLC is supported by funding acquired from member service fees, foundations, corporate sponsors and special funding, some of which is administered by the State Library of Florida.

TBLC is currently providing consultation and training to our librarians through workshops in the use of automated library equipment. TBLC technicians are doing the conversion of the "shelf list" of our library holdings into a "Machine Readable Format" known as MARC. This "Retrospective Conversion" is only the first step in the automation of the St. Petersburg Beach Public Library. Our program is being greatly helped by our association with both the Pinellas Public Library Cooperative and the Tampa Bay Library Consortium.

City's Ambulance Subscription Plan

Last year the City of St. Petersburg Beach initiated the St. Petersburg Beach Ambulance Subscription Plan. We wish to remind you that each year in March a renewal application contract has to be filled out. Please complete and return "Sunstar Ambulance Subscription Program" form (insert) to the St. Petersburg Beach Fire Department as soon as possible.

If you are not familiar with the plan or you have specific questions regarding the plan, please call Gwen Ludwig in the Fire Administration at **363-9206**, Monday through Friday from 8:00 am to 4:30 pm. Should Mrs. Ludwig not be available, other Fire Administration personnel will be able to answer your questions.

City's Hurricane Preparedness Plan

The St. Petersburg Beach Fire Department wishes to remind you that Hurricane Season is here. It starts on June 1st and ends on November 31st. Information regarding hurricane preparedness, evacuation, shelters, etc. can be gotten from the Fire Department. If you wish to have a representative speak to your civic association on this topic or if you need assistance in planning for this type of a disaster, please telephone the Fire Department.

If you are in need of special help due to physical handicap or medical problems, or if you know of some one who is in need of such special help, please contact the fire department. Our fire department has a special needs evacuation program. Call: 363-9602

Insurance Rating Survey

It has been 12 years since our last Insurance Services Organization (ISO) fire insurance survey. Presently, our city has a fire insurance rating of 5. Since our community, as well as our Fire Department, have undergone quite a few changes since the last rating, a new survey is warranted. Therefore, City Manager, Jeffrey B. Stone, has requested ISO to come to our city and perform another survey. Preparations for the survey require an enormous amount of work. We are now in the initial stages of preparing for this visit and hope that once the survey is completed, we will be able to lower fire insurance ratings.

Flood Insurance Rate Reductions

The Federal Insurance Administration congratulated the city on the community's achievements in contributing to the success of the National Flood Insurance Program (NFIP). As a result of actions undertaken by the city which exceed the minimum standards of the National Flood Insurance Program (NFIP), the flood insurance rating for St. Petersburg Beach has been reduced from Class 9 to Class 8 in accordance with the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS).

Within the State of Florida alone approximately 363 cities and counties participate in the NFIP program. To date, 22 have attained a Class 9 rating while only 4 other jurisdictions besides St. Petersburg Beach have attained a Class 8 rating. The reward to the community for the lowered flood insurance rating is an additional 5% reduction in flood insurance premiums. The 5% is to be added to the existing 5% for a total premium reduction of 10%. This premium reduction is to be applied to all new or renewed flood insurance policies in place on or after October 1, 1992. *(Check with your insurance agent.)* Yearly, property owners within St. Petersburg Beach contribute approximately $2,020,534 for flood insurance on the 5,360 policies which have been written within the city. The annual savings to the community as a whole will be in excess of $200,000.

This program and the community's high rating are a combined effort by the City Commission, City Manager, staff and all of the residents who have diligently made the effort to abide by the rules and regulations of state and national floodplain management programs. Sometimes all the rules and regulations seem like just more bureaucratic nonsense; however, in this particular case, diligence, hard work and sacrifice have paid off.

Reclaimed Water Benefits

- Conserve the drinking water supply.
- Create a new water source for irrigation that is not restricted!
- Reduce water bills and save $$$
- Beautify the community through landscaping.
- Reduce fertilizing costs and pollution.