INFRASTRUCTURE ELEMENT - DATA AND ANALYSIS

I. Introduction

This support document contains the data and analysis that serves as the basis for the goals, objectives and policies of the Infrastructure Element of the City of Fort Lauderdale Comprehensive Plan. The Infrastructure Element meets the requirements of Subsection 163.3177(6)(c), Florida Statutes.

There are three main reasons for investing in utility infrastructure: to provide a safe, sufficient water supply, to effectively manage stormwater and to treat wastewater to protect the environment.

In addition to these basic needs, the City of Fort Lauderdale faces the continuing challenge of rehabilitating and repairing existing infrastructure and building larger systems to accommodate growth and development. The City provides solid waste, stormwater management, sanitary sewer and potable water services in accordance with federal, state, regional, and county regulations. Fort Lauderdale provides water and sanitary sewer services for areas outside of the City and receives a minimal amount of water and sanitary sewer service from Broward County.

II. Solid Waste

The City collects solid waste from single family and small multi-family housing units within the City. Larger multi-family units and commercial and industrial land uses are required to contract with private hauling firms to collect solid waste.

Adequate solid waste disposal capacity is provided by Broward County under the existing interlocal agreement for resource recovery. This agreement guarantees disposal capacity of the total volume of solid waste tipped by the City. Solid waste is currently disposed of at Broward County facilities; including the landfill in North Broward, and, for future service, two privately operated resource recovery units sponsored by the County. The level of service adopted for the City's solid waste service is 7.2 lbs per capita per day.

III. Stormwater Management

Stormwater quantity, quality, and flood protection are important factors in stormwater management. Stormwater management in the City is primarily the responsibility of the South Florida Water Management District (SFWMD), the Florida Department of Transportation, the Broward County Environmental Protection Department (EPD), and the City Public Works Department. Stormwater management level of service is based on the amount of drainage a development can manage for a given storm for a given period of time. The level of service that is adopted in the City is dictated by SFWMD, EPD, the Unified Land Development Regulations and the South Florida Building Code.

A stormwater master plan will be completed by the end of 2008. A list of capital projects that are the responsibility of the City will be prepared and included in the plan. The City will first address drainage problems that impact safety, health or property. The City will monitor projects by others to ensure they meet the City's level of service standard. The public works department will maintain its street cleaning program to help meet the City's levels of service for stormwater discharge quality.

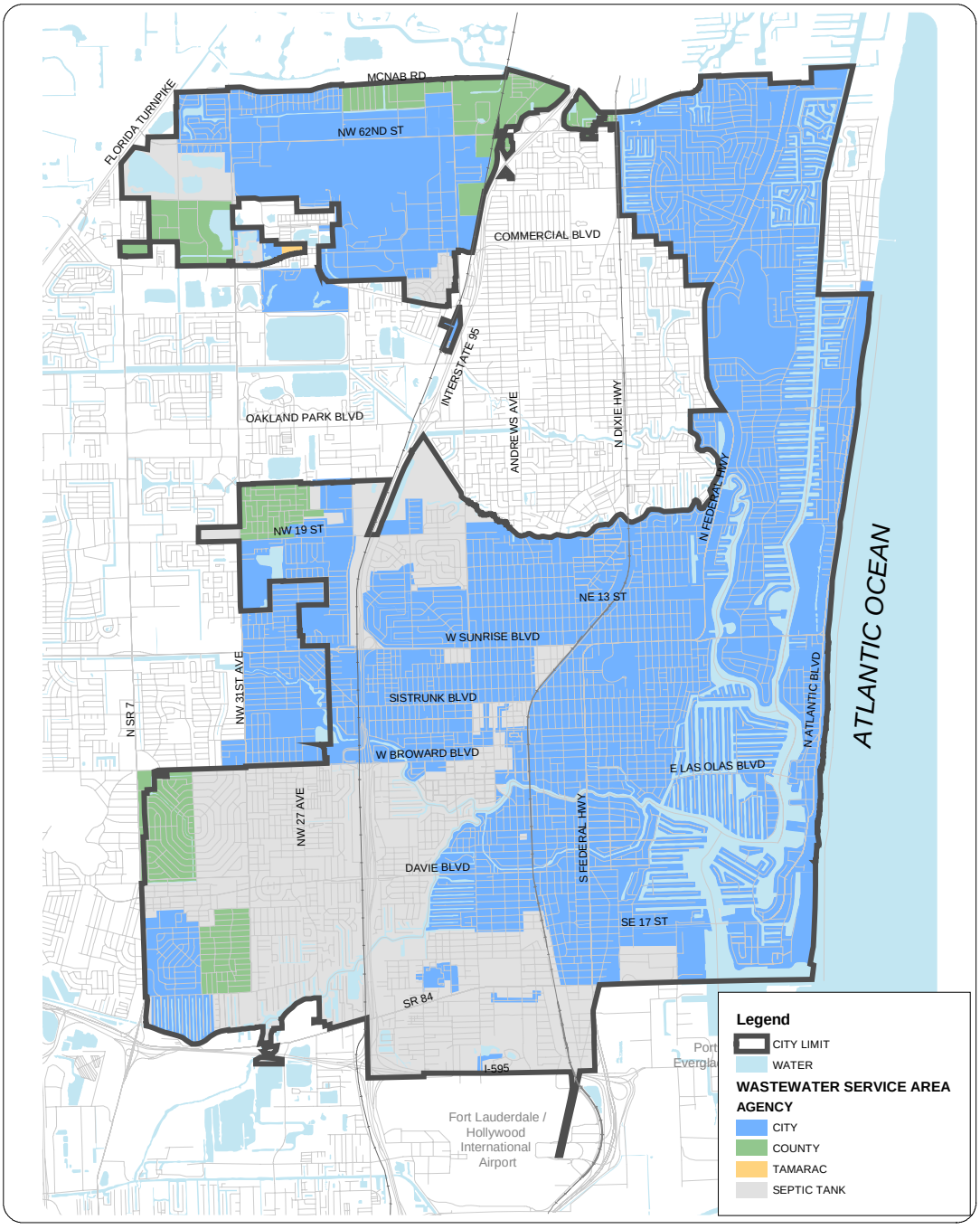
IV. Sanitary Sewer

The City of Fort Lauderdale provides wastewater treatment and disposal services to approximately 190,000 people in central Broward County. Approximately 70 percent of the service population resides within the City, with the remainder located in adjacent governmental jurisdictions. Nearly 34,000 people within the service area have septic tank systems, mostly located within the Fort Lauderdale City limits, which are being replaced with sewer service. Map 1 generally depicts the wastewater service area. All of the wastewater from sewered portions of the service area is treated at the George T. Lohmeyer Wastewater Treatment Plant (GTL WWTP), which is owned and operated by the City of Fort Lauderdale.

The City also owns and operates the regional wastewater transmission system, as well as the wastewater collection system within its boundaries and a small portion of unincorporated Broward County. This system consists of approximately 368 miles of gravity sewers and 135 miles of force main. The other contributing wastewater collection systems located outside the city boundaries are owned and operated by the respective governmental entities.

George T. Lohmeyer Wastewater Treatment Plant

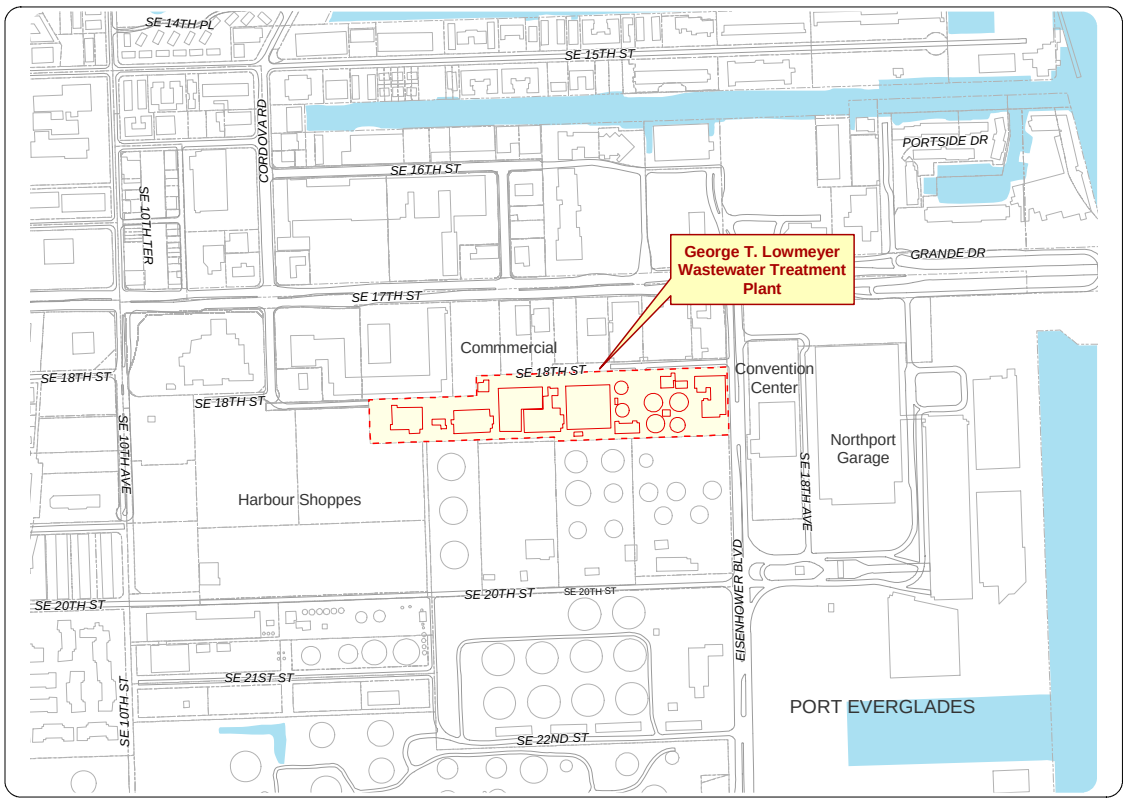
The GTL WWTP is located on a 9.58-acre site near S.E. 17th Street and Eisenhower Boulevard. The plant provides secondary treatment followed by deep-well injection via five injection wells located approximately one-quarter mile south of the site. The plant is owned and operated by the City of Fort Lauderdale (City) and is used to treat wastewater generated in a region encompassing the City, Wilton Manors, Oakland Park, Davie and Port Everglades, as well as part of Tamarac and unincorporated Broward County. The location of the plant is shown in Map 2.



WASTEWATER SERVICE AREA
MAP 1

DATA SOURCE: CITY OF FORT LAUDERDALE PUBLIC SERVICES DIVISION
MAP SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006

0 0.5 1 2 Miles



GEORGE T. LOHMEYER WASTEWATER TREATMENT PLANT

MAP 2

0 250 500 1,000 Feet

DATA SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006
MAP SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006

The facility has been expanded several times over the years. It was converted from a small trickling filter plant to a 22-mgd facility in 1978, with effluent disposal via an outfall to the Intracoastal Waterway. In 1984, four deep injection wells were constructed for effluent disposal and the plant was converted and expanded to a permitted capacity of 38 mgd. New clarifiers and biosolids dewatering facilities were added to the existing treatment train. In 1994 DEP issued a permit with a capacity of 43 mgd, on a maximum three-month average daily flow (M3MADF) flow basis. In 2001, DEP issued a permit modification that increased the design capacity of the plant to 54.0 mgd, pending approval of the increase in disposal capacity of the underground injection well system. The City then re-rated the plant to 55.7 mgd, M3MADF.

Master Plans

The City of Fort Lauderdale published a Water and Wastewater Master Plan in December of 2000. The recommendations of that plan became the basis for the Capital Improvements Program *Waterworks 2011* now in progress, and identified the

improvements necessary to meet the needs of the Fort Lauderdale Service Area through the planning year 2020.

The City of Fort Lauderdale is continuing their infrastructure upgrades in accordance with the *WaterWorks 2011* program. The program is providing citywide sewer service, adding gravity sewers, force mains, and pump stations that are delivering more wastewater to the treatment plant. In addition, the City is spending approximately three million dollars per year on an Inflow and Infiltration (I/I) Program to reduce flows of stormwater and groundwater into the gravity collection system that result in high peak flows requiring treatment and disposal.

An update of the City's Wastewater Master Plan was conducted in 2006 to account for the impacts to the system resulting from the following changes:

- The City updated its population projections and the composite wastewater generation projection for the entire service area requiring a re-analyses of the wastewater treatment plant's capacity needs over the planning period, reevaluated the permittable hydraulic, treatment and effluent disposal capacity at the plant, and determined the pumping capacity of the wastewater transmission system.

- New data available to gage the effectiveness of the City's I/I Program (in progress) and its impact on the capacity of the wastewater transmission system and treatment plant.

- Based upon recent data trends from the annual Capacity Analysis Reports, an updated projection of the timeframe to reach the permitted capacity at the treatment plant.

- Several major wastewater transmission system Master Plan deviations (including the elimination of a major transmission force main, booster station capacity increases, and new interconnections) which have necessarily occurred during both the design and construction phases of the *Waterworks 2011* Capital Improvements Program projects as a result of more detailed analyses, constructability issues, value engineering, and regulatory concerns.

- The number of planned and allowable dwelling units and densities in the center of downtown Fort Lauderdale, zoned as the "Downtown RAC", was increased coupled with newly-planned retail, commercial, office, and hotel land use in this area, further contributing to the increase in demand for wastewater flows.

- Improvements to the wastewater treatment plant over the past five years, including improvements currently underway. The permittable capacity of each major treatment process at the plant was evaluated, and the limiting processes for expansion of the plant capacity were identified. Alternatives for cost-effective expansion of the treatment plant to accommodate future flows

were evaluated and a method and schedule for future plant expansion was recommended.

Historical Wastewater Flows

Historical wastewater flows measured at the George T. Lohmeyer Wastewater Treatment Plant (GTL WWTP) for the 10-year period (1996 through 2005) are shown in Table 1. This figure shows monthly average daily flow (MADF), 3-month average daily flow (3MADF), and annual average daily flow (AADF), defined as follows:

MADF – The total volume of wastewater flow during a calendar month divided by the number of days in that month and expressed in units of million gallons per day (mgd). MMADF refers to the maximum MADF that occurs during a calendar year.

3MADF – The total volume of wastewater flow during a period of three consecutive months, divided by the number of days in that 3-month period and expressed in units of mgd. The 3MADF is computed monthly based on a rolling average of the current month and the two preceding months. This value represents the seasonal flow to the plant. The maximum 3MADF that occurs during a calendar year is termed the M3MADF. The permitted capacity of the GTL WWTP is the M3MADF (currently 55.7 mgd, M3MADF).

AADF – The total volume of wastewater flow during a calendar year divided by 365 and expressed in units of mgd. This value represents the average daily flow to the plant.

Table 1
Historical Influent Flows and Peaking Factors at the George T. Lohmeyer WWTP

Year[1]	Total Rainfall (inches)	AADF (mgd)	M3MADF (mgd)	MMADF (mgd)	MDF (mgd)	MHF (mgd)	M3MADF/ AADF	MMADF/ AADF	MDF/ AADF	MHF/ AADF
1996	72.8	36.51	40.35	46.48	66.4	75.3	1.11	1.27	1.82	2.06
1997	87.1	37.74	40.26	46.74	65.7	74.5	1.07	1.24	1.74	1.97
1998	66.8	32.91	36.18	40.42	65.2	71.0	1.10	1.23	1.98	2.16
1999	81.5	36.34	45.66	50.87	75.3	78.2	1.26	1.40	2.07	2.15
2000	58.2	35.41	40.32	48.53	77.3	79.1	1.14	1.38	2.20	2.25
2001	27.5	36.02	44.86	48.04	73.1	81.1	1.25	1.33	2.03	2.25
2002	67.1	37.47	45.11	50.92	72.3	75.6	1.20	1.36	1.93	2.02
2003	62.8	36.23	39.85	42.75	75.4	92.0	1.10	1.18	2.08	2.54
2004	58.8	35.09	40.52	41.98	64.3	69.5	1.15	1.20	1.83	1.98
2005	70.7	37.53	41.93	46.58	69.0	73.9	1.12	1.24	1.84	1.97
				10-year Average			**1.15**	**1.28**	**1.95**	**2.13**

[1] Calendar Year: January through December
[2] Data not available.

The historical influent flow data indicates a steadily increasing flow from 2000 to 2002, and then decreased in 2003 and 2004, as peak flows to the plant diminished. In 2005, the AADF increased again to the highest average since 1997.

Wastewater Flow Forecasts

Table 2 summarizes the service area population projection and the base residential, non-residential, I/I contribution, and total wastewater flows forecasts for the service area over the 20-year planning period. These values are expressed in terms of annual average daily flows in mgd. The 3-Month Average Daily Flow projection, which is the AADF times the M3MADF peaking factor of 1.15.

Table 2
Projected System-wide Total Wastewater Flows

Year	Estimated Sewered Population	Residential (mgd)	Nonresidential (mgd)	I/I Contribution (mgd)	Total AADF (mgd)	3MADF (mgd)
2005	188,344	13.2	5.7	22.0	40.8	46.9
2010	231,181	16.2	7.5	23.0	46.7	53.7
2015	240,043	16.8	8.4	23.0	48.2	55.4
2020	252,885	17.7	9.5	23.0	50.2	57.7
2025	267,142	18.7	10.7	23.0	52.4	60.2

The GTL WWTP is permitted based on the M3MADF, with a current permitted capacity of 55.7 mgd. Based on the service area population projection, per-capita residential and non-residential flow rates and I/I contribution, the current capacity will be reached in 2015. An expansion of the plant from 55.7 mgd to approximately 61 mgd should suffice for the 20-year planning period.

An alternative to expansion of the GTL WWTP would be to implement measures in the collection system to decrease flows to the plant, such as repairs to gravity sewers to reduce the I/I contribution to the flow or satellite plants in the collection system to remove flow and treat flow for reuse, as long as a firm wet-weather effluent disposal system can be developed and permitted. Because the rated capacity of most treatment processes at the plant are based on maximum flow or loading, reducing the peak flow and loading to the plant will extend the effective permitted capacity of the plant.

Collection and Transmission System and Inventory Update

The City's wastewater collection and transmission system consists of the gravity sanitary sewers, wastewater pump stations, and wastewater transmission forcemains. In 2002, the *City of Fort Lauderdale Wastewater System Conveyance Study,* analyzed and balanced the manifolded system of pump stations, and several of the primary sewage lift stations pumping into gravity systems. The wastewater transmission system was optimized under both peak and low flow conditions using a GIS-based hydraulic model, under the future system buildout scenario. Finally, the proposed new sewered areas were refined from updated preliminary design and

design information to account for the new pump stations and flows. The result was an updated final plan for the transmission system and pump station upgrades in the Program.

Additional 27 pump stations and seven forcemains associated with the new sewer areas are in various stages of being constructed and eleven additional miscellaneous interconnections from the above new forcemains to the existing system are being added.

Discharge Permits

DEP issued a new Domestic Wastewater Facility Permit for the GTL WWTP on March 30, 2005 with an expiration date of March 2010. The permit specifies a plant capacity of 55.7 mgd (M3MADF) and contains standard effluent limitations, monitoring requirements, and provisions for biosolids disposal, industrial pretreatment, and operation and maintenance.

The plant no longer holds an NPDES Permit that would allow for the discharge of treated effluent into the Intracoastal Waterway. Discharging the effluent into the Intracoastal Waterway is limited to emergency situations only. Treated effluent from the plant is discharged to the deep injection wells located approximately one-quarter mile south of the WWTF plant site.

Deep Well Injection Capacity

The effluent pump station discharges to five deep injection wells via 3,500 feet of 54-inch-diameter force main. The wells are permitted to operate at up to 10 feet per second (fps) flow velocity on a sustained basis and 12 fps during emergencies. These velocities yield total injection well capacities of 93.25 and 112 mgd, respectively. The design forecast Maximum Hourly Flow (MHF) is 113 mgd, which would require operation of the wells at greater than 10 fps. Therefore, a sixth injection well will be required unless peak flows to the plant can be reduced through I/I reduction, transmission system flow control, off-site flow equalization or reuse systems in the collection system to divert flow away from the plant. The City is considering a backup force main for the future.

South Florida Regulatory Environment in 2007

In the two years since the *Wastewater Reuse Feasibility Update* was completed, South Florida municipalities have been under increased pressure to implement reclaimed water systems. The population of South Florida continues to increase and demands on the Biscayne Aquifer and the regional surface water supply system has generally reached their maximum sustainable limit. The Comprehensive Everglades Restoration Plan (CERP) is underway and all available water resources are essentially allocated to existing users, agriculture and the environment. As a result, the South Florida Water Management District (SFWMD) is requiring utilities to ensure that their future water needs be met, at least in part, by alternative water supplies as a requirement for the renewal of their water use permits. The Lower

East Coast (LEC) Regional Water Supply Plan was updated by the SFWMD in 2007, in accordance with Chapter 373 of the Florida Statutes. The update was a result of changing conditions and regulations, which have resulted in many of the original assumptions no longer being valid. Assumptions as to the completion of certain projects in the CERP alone have altered the timing and volume of water that will be available to utilities to meet future water supply needs. The SFWMD is also proposing the Regional Water Availability Rule, which is designed to protect the Everglades by limiting Biscayne Aquifer and regional surface water withdrawals to those already allocated; this further emphasizes the need for all South Florida municipalities to identify alternative water supplies to meet future demands.

Taking this into consideration, it is in the best interest of the City to identify methods of creating alternative water supplies, including beneficial reuse of wastewater effluent, to augment water supplies. Implementing such alternatives will be expensive. Due to the current and future policy and water use permitting rules of regulatory agencies such as the SFWMD, the City may not be able to avoid the implementation of reuse projects that develop the water supply needed for future growth

Wastewater Reuse

The City is considering implementing reuse of wastewater effluent, particularly systems that can be used to develop alternative water supplies. The SFWMD is developing policies that require the development of alternative water supplies to meet the potable water needs of future growth as the Biscayne Aquifer and regional surface water supply systems are considered to be at capacity. Indirect potable reuse systems have dual benefits of providing more wastewater treatment and disposal capacity and augmenting local water supplies, which will be important when the City next applies for a Water Use Permit from the SFWMD.

The GTL WWTP is located far from any significant users of reclaimed water, such as golf courses. Therefore, the construction of an irrigation-quality reclaimed water production facility at or near the plant to provide further treatment of effluent to public reuse standards is not feasible. There is little available space on the plant site or plant vicinity to construct the required treatment facilities. In addition, due to high levels of I/I near coastal areas and waterways, the chloride concentration in the treated effluent (approximately 600 mg/L) exceeds the maximum recommended amount (450 mg/L). Therefore, the only practical alternatives for implementing reuse systems are off site, near potential beneficial uses of reclaimed water.

The City submitted an *Updated Wastewater Reuse Feasibility Study* to DEP in July 2004. This document summarized an evaluation of alternatives for the reuse of wastewater effluent and provided a summary of the estimated costs and benefits of the alternative systems. A summary of the reuse alternatives evaluated in this report is provided in this section, as well as several new alternatives that the City is considering.

The implementation of reuse systems, and particularly those that develop an alternative water supply to decrease the City's dependence on the regional water supply system, are an emphasis of the SFWMD and DEP. Projects that serve the dual purpose of reusing wastewater effluent and supporting future water use permitting efforts by developing new sources of water should receive the strongest consideration

Summary of Reuse Feasibility Study Alternatives

In the *Updated Wastewater Reuse Feasibility Study,* the following three alternatives for the implementation of a reuse system within the City of Fort Lauderdale were considered:

1. The use of reclaimed water for wetlands recharge of Pond Apple Slough.

2. The use of reclaimed water for Florida Power & Light (FPL) boiler feed.

3. The use of reclaimed water from satellite treatment Membrane Bioreactor (MBR) facilities for landscape irrigation of the City's parks and golf courses.

At this time, the use of highly treated reclaimed water to recharge Pond Apple Slough and to use as makeup water for FPL's boilers are not considered viable options. The water quality, permitting and cost of treatment, which were identified in the *Updated Wastewater Reuse Feasibility Study,* are still valid and therefore have not changed the recommendation presented in that report.

The use of satellite MBR systems is considered to be a viable option. The costs of MBR technologies have decreased due to the increased demands of the system and the technological advancements in their design. The *Updated Wastewater Reuse Feasibility Study* determined that the use of satellite MBRs was not cost-effective as a source of reclaimed water for golf course irrigation and therefore was not recommended. It was stated that if it was determined at a later time that a MBR facility was necessary, the City should consider constructing such a facility at either the Coral Ridge Golf Course or Holiday Park. The estimated size for both MBR systems was determined to be 50,000 gallons a day; however, the Coral Ridge Golf Course was given a stronger recommendation since it would provide reclaimed water for irrigation and would offset the potable water provided to the golf courses by on-site wells. The cost of the Coral Ridge Golf Course Option B MBR was determined to be $12.40/1,000 gallons.

Further evaluation into this alternative has determined that it has significant disadvantages. It should be noted, however, that at the time the *Updated Wastewater Reuse Feasibility Study* was written, the Coral Ridge Golf Course Option B MBR was the most desirable option, potentially providing the City with a potable water credit at one of the lowest capital costs of all presented options. Despite this fact, some of the disadvantages of Coral Ridge Golf Course Option B

included the high cost of treatment for relatively small flow, the required negotiations with the private golf course owner, and the decreased need for reclaimed water for irrigation during the wet weather season. Emphasis on these points should be placed on the small plant capacity and the fact the golf course would not need a significant quantity of reclaimed water during the summer months. In other words, it would be beneficial for the recommended reclaimed water system to decrease flows to the treatment plant all year, and especially when high infiltration and inflow rates occur in the collection system, resulting in the plant receiving high influent flow.

Indirect Potable Recharge of Prospect Wellfield

The City is currently considering the potential benefits and costs of developing a reclaimed water system using an MBR treatment facility at the "E" Repump Station. The MBR system would provide reclaimed water to be used for irrigation at the Executive Airport, near-by stadium, and to provide reclaimed water for recharge of the Prospect Wellfield.

This system would consist of a six mgd MBR facility that would extract wastewater from E-Repump Station. The MBR effluent would be treated using five mgd of Reverse Osmosis (RO) treatment and then further treated with ultraviolet (UV) disinfection. Due to the significant amount of available land at the pump station site (nearly two acres), the MBR, RO and UV systems could all be housed on City property. This site provides a significant advantage since the City would not be required to negotiate with a private owner to purchase or lease property. Flow from the treatment system would be distributed to the Executive Airport and near-by stadium for irrigation, and also be discharged to existing lakes near the Prospect Wellfield northwest of the station. This reclaimed water, in particular, would offset deliveries from the regional system.

Unfortunately, there is no clear information at this time regarding the level of treatment that would be required for indirect potable reuse via aquifer recharge near wellfield sites. Due to environmental and public health concerns associated with indirect potable reuse projects, it is assumed that MBR treatment coupled with RO and UV disinfection would be required. Additional evaluation and discussions with regulatory agencies, including piloting, would have to be undertaken to identify the permitting requirements, benefits and costs of implementing this project.

Estimated Cost

The estimated capital cost for this five mgd indirect potable reuse alternative is approximately $78 million, and the estimated annual operation and maintenance cost is approximately $5 million, with an estimated annual capital recovery fixed cost of $5.4 million. This results in an estimated unit production cost of approximately $9.17/1,000 gallons.

Wastewater System Capital Improvements

The City has several options for providing additional treatment capacity and/or extending the effective useful life of the existing capacity:

- Expand the treatment plant and/or reduce peak flows to the plant requiring treatment and disposal.

- Construct a new deep well, which would provide adequate effluent disposal capacity through 2025, but may require treatment to high-level disinfection standards prior to disposal in the new deep well unless the wells are used for co-disposal of membrane WTP concentrate.

- Membrane Biological Reactors (MBRs) may be preferred over adding clarifiers as they can provide both clarification and filtration capacity and may be installed on the current plant site, possibly in or on the biological reactors.

- Alternately, the City may evaluate methods to reduce peak flows to the plant to avoid or postpone expansion of the effluent disposal and clarification systems, such as sewer mining using MBRs to extract flow from the system, SCADA programming of the large pump stations to limit peak system-wide flows, off-site flow equalization facilities and/or aggressive I/I reduction.

Wastewater Collection and Transmission Improvements

The improvements described herein for the wastewater collection and transmission system should be considered near-term improvements (within the next five years). Since the City of Fort Lauderdale is in the latter portion of the *Water Works 2011* program, most of the required improvements to the wastewater collection and transmission system have already been included in the program budget, leaving only a few improvements to be completed. The remaining improvements listed in this section are those which were 1) identified in the September 2004, *City of Fort Lauderdale Wastewater Transmission System Hydraulic Model Update and Pump Station and Force Main Analysis* and have yet to be designed or 2) identified in completion of the *City of Fort Lauderdale Wastewater Masterplan Update.* Table 3 lists the remaining improvements to the wastewater collection and transmission system.

Table 3
Wastewater Collection and Transmission System Improvements

Item	Title
	Phase II (In Bidding) Waterworks Funded
1	Rehabilitate Pump Station A14
2	Rehabilitate Pump Station A40
3	Rehabilitate Pump Station B9
4	Rehabilitate Pump Station D33
5	Rehabilitate Pump Station D35
6	Rehabilitate Pump Station D36
	25% Contingency
	Engineering – Services During Construction

	Total
	Phase III (2007-2011) Waterworks Funded
7	Rehabilitate Pump Station A8
8	Rehabilitate Pump Station A29
9	Rehabilitate Pump Station B4
10	Rehabilitate Pump Station B7
11	Rehabilitate Pump Station D37
	25% Contingency
	15% Engineering
	Total
	City Crews (2007-2011) Waterworks Funded
12	Rehabilitate Pump Station A12
13	Rehabilitate Pump Station A28
14	Rehabilitate Pump Station A32
15	Rehabilitate Pump Station A34
16	Rehabilitate Pump Station B10
17	Rehabilitate Pump Station D32
18	Rehabilitate Pump Station E4
19	Rehabilitate Pump Station C3
20	Rehabilitate Pump Station C4
	25% Contingency
	15% Engineering (City)
	Total
	RAC Projects (2007-2011) New Funding Required
21	Install New RAC Area Pump Station
22	Install New RAC Area 10" Diameter Force Main
23	Rehabilitate Pump Station D31
24	Rehabilitate Pump Station D34
25	Rehabilitate Pump Station D37

Rehabilitation of the City's existing pump stations was estimated to cost approximately $500,000 each based on similar improvements recently constructed within the City.

Wastewater Treatment System Improvements

The improvements described in this section are recommended upgrades to the GTL WWTP. These improvements have been separated into Near-Term (planned implementation within the next five fiscal years) and Long-Term (planned implementation over the following fifteen fiscal years) and represent cumulative sums over the planned period. Many of these improvements have been summarized from the *2006 Renewal & Replacement Requirement Analysis* and will use funds from the Renewal & Replacement Reserve Account. Table 4 and Table 5 list near-term and long-term improvements to the wastewater treatment system, respectively.

Table 4
Projected Near-Term (2007-2011) Improvements to Upgrade the Wastewater Treatment System

Title
WaterWorks Funded Improvements
Replace cryogenic oxygen control system
Replace cryogenic oxygen storage tanks
Replace five building roofs
Replace grit classifier
Replace pre-treatment seal water system
Grit chamber roof deck resealing
Plant-wide instrumentation replacement
Replace cryogenic oxygen building resilient floor
Dewatering building truck bay concrete repair
Replace pre-treatment odor control scrubber internals
WaterWorks Funded Total
Renewal & Replacement Improvement Funded
New hoisting equipment for Auger Monsters
Replace grit chamber drives
Replace grit chamber covers
Replace pre-treatment building channel stop gates
Replace influent flow meter to Biological Reactor 2
Clarifier algae resistant resurfacing
Replace sludge pumps (Stations 1-3)
Replace sludge transfer pumps 3 & 4
Install belt filter press sludge feed pump No. 9
Remove lime silo & associated roofing
Replace polymer pumps
Replace traveling water screens
Replace effluent pumps rotation units
Define effluent building spare storage space
Paint injection well pipe platforms (electrical building)
Miscellaneous pump replacement
Verification of underground piping integrity
Replace public address system
Upgrade computer system hardware
4160V switch preventative maintenance
Install electronic operation & maintenance manual
Replace asphalt overlay- plant wide
Plant wide architectural improvements (Hurricane Hardening)
Doors, windows, louver replacement

Table 5
Projected Long-Term (2012-2027) Improvements to Upgrade the Wastewater Treatment System

Title
Renewal & Replacement Improvements
Replace monorail hoisting equipment
Replace grit chamber drives
Replace grit chamber covers
Reseal grit chamber roof deck
Replace grit pumps
Replace grit cyclones
Replace grit classifiers
Repair pre-treatment building façade
Repair pre-treatment channel concrete corrosion
Replace pre-treatment building channel stop gates
Replace pre-treatment isolation gates
Replace clarifier underflow valves
Replace auto clarifier sludge blanket measurement
Clarifier algae resistant resurfacing
Replace sludge grinders
Replace sludge holding tank mixers
Replace effluent pumps rotation units
Replace injection well backflush pumps
Paint injection well pipe platforms (electrical building)
Replace reuse pumps
Replace hydrostrainers
Replace seal water system
Replace auger monsters
Replace screening conveyors
Replace pre-treatment effluent weir gates
Replace influent side gates to reactor
Replace influent flow meter to Biological Reactor 2
Replace lightning aerators
Repair reactor basin concrete corrosion
Repair cryogenic oxygen compressors
Upgrade cryogenic oxygen control system
Replace cryogenic oxygen storage tanks
Replace cryogenic system cooling towers
Replace cryogenic oxygen building resilient floor
Replace sludge pumps (Stations 1-3)
Replace sludge pumps (Stations 1-3) VFDs
Replace sludge transfer pumps 3 & 4
Replace sludge holding tank decanting valves
Install belt filter press sludge feed pump No. 9
Replace belt presses
Replace sludge screw conveyor
Replace sludge distribution screw conveyor

Replace sludge truck weighing scales
Replace polymer pumps
Replace traveling water screens
Repair/Replace dewatering building odor control system
Repaint GTL Exterior/Interior
Repair/Replace odor control system holding tank
Replace head-works odor control duct work and chemical system
Replace emergency chlorine scrubber
Replace chlorine system
Miscellaneous pump replacement
Verification of underground piping integrity
Replace public address system
Upgrade computer system hardware
Plant-wide instrumentation replacement
Preventative maintenance on 4160V switches
Security system
Install electronic operation and maintenance manual
Update wastewater master plan
Roofing replacement – plant wide
Replace asphalt overlay – plant wide
Plant wide architectural improvements (Hurricane Hardening)
Doors, windows, louver replacements-plant wide

Table 6 summarizes improvements for the proposed GTL WWTP expansion alternative for increased capacity utilizing MBR technology.

Table 6
Wastewater Treatment Plant Capacity Expansions

Category
Injection Well (24-inch Dia.)
Membrane Bioreactors (9.57 mgd, AADF)
Chlorine Contact Chamber (9.57 mgd, AADF)
Effluent Pump Station (9.57 mgd, AADF)
Force Main to Injection Well (24-inch Dia.)

This Wastewater Master Plan Update concluded that the George T. Lohmeyer Wastewater Treatment Plant capacity of 55.7 mgd, maximum three-month average daily flow (M3MADF) is expected to be adequate until 2015. Expansion of the plant to approximately 61 mgd, M3MADF is expected to provide adequate capacity through 2025. It should be noted that the projected peak hour flows to the treatment plant may exceed the deep well capacity of 93.25 mgd far sooner, particularly as the sewage conveyance system capacity is expanded. All of the other major treatment processes at the plant are adequate for a 61 mgd, M3MADF plant capacity except for the clarifiers, which are adequate for a permitted capacity of 54 mgd, M3MADF.

V. Potable Water

The analysis described below is the same as the City's adopted Water Supply Plan (Ordinance No. C-09-01).

Introduction

In anticipation of increasing water demands facing the state, and the potential threats to both the economy and natural resources, the Legislature amended the Florida Water Resources Act (Chapter 373, F.S.) in 1997. The amendments required the five water management districts to initiate regional water supply planning in all areas of the state where reasonable anticipated sources of water were deemed inadequate to meet year 2020 projected demands.

The 2002 and 2005 Legislature expanded the local government comprehensive plan requirements to strengthen coordination of water supply planning and local land use planning. The work plan must:

1. Project the local governments water need for at least a 10-year period;
2. Identify and prioritize the water supply facilities and source(s) of water that will be required to meet those needs; and
3. Include in the local government's Five-Year Schedule of Capital Improvements the capital improvements identified as needed for the first five years, including financially feasible revenue sources. A current five-year schedule must always be maintained.

The 10-Year Water Supply Facilities Work Plan must be incorporated into the City's Comprehensive Plan and be accepted by the Florida Department of Community Affairs (DCA).

Section 1 Existing Facilities Information

The City of Fort Lauderdale provides solid waste, stormwater management, sanitary sewer and potable water services in accordance with federal, state, regional, and county regulations. Fort Lauderdale provides water and sanitary sewer services for areas outside of the City and receives a minimal amount of water and sanitary sewer service from Broward County. The sections below describe the City's water supply, water treatment, water storage, sanitary sewer and wastewater treatment facilities.

Section 1.1 Water Service Area

The City of Fort Lauderdale provides retail water service to about 187,200 residents and 6,300 commercial and wholesale customers in the City and surrounding areas, totaling approximately 255,000 customers across several governmental jurisdictions in central Broward County. Map 1.1 depicts the water service area for retail customers.

The City provides wholesale water service to other municipalities and large users that, in total, currently utilize 7.6 MGD, or about 17 percent of the 2005 billed water use. Wholesale customers are as follows:

- City of Oakland Park
- City of Wilton Manors
- Port Everglades
- Oakland Forest subdivision within the City of Oakland Park
- City of Tamarac
- Town of Davie – Hacienda Village
- Broward County Office of Environmental Services
- State of Florida Department of Transportation – Toll Booth

Section 1.2 Consumptive Use Permit

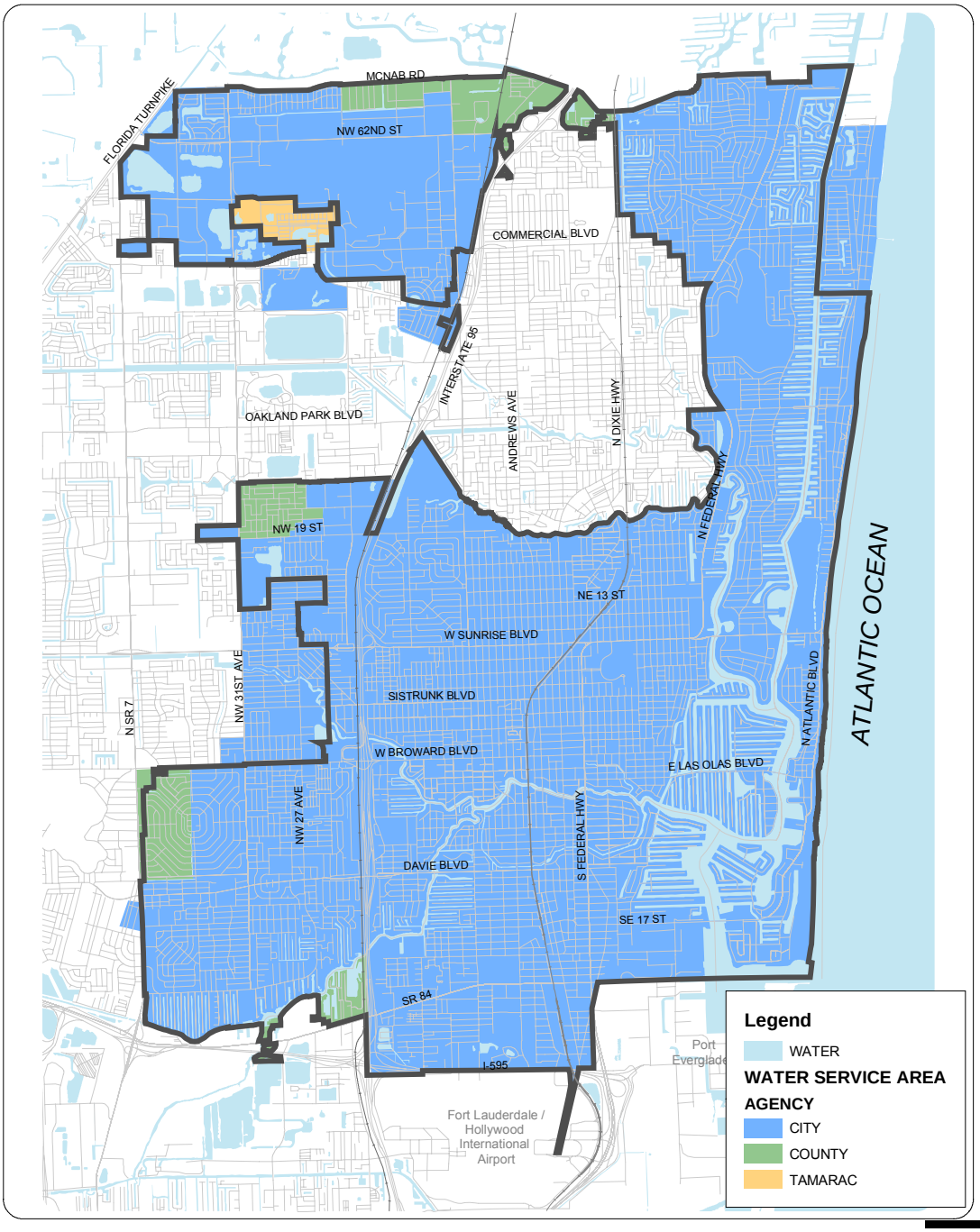
The City of Fort Lauderdale holds a CUP permit number 06-00123-W from the South Florida Water Management District to withdraw water from the Prospect and Dixie Wellfields. This permit allows the City to pump a combined average daily allocation of 52.55 MGD and a maximum monthly allocation of 59.9 million gallons per day (52.55 times the 1.14 maximum month peaking ratio).

Section 1.3 Existing Water Facilities

This section provides a brief summary of the City's existing water facilities, on going improvements and future planning initiatives that are currently underway. Principal water facilities serving the City's customers include the following:

- Fiveash Water Treatment Plant;
- Peele-Dixie Water Treatment Plant;
- Prospect Wellfield;
- Dixie Wellfield;
- Saline Intrusion Monitoring (SALT) Program;
- Distribution System Water Storage Facilities;
- Raw Water Aquifer Storage and Recovery (ASR); and
- Finished Water Distribution System.

Key facility locations are depicted in Map 1.3**.**

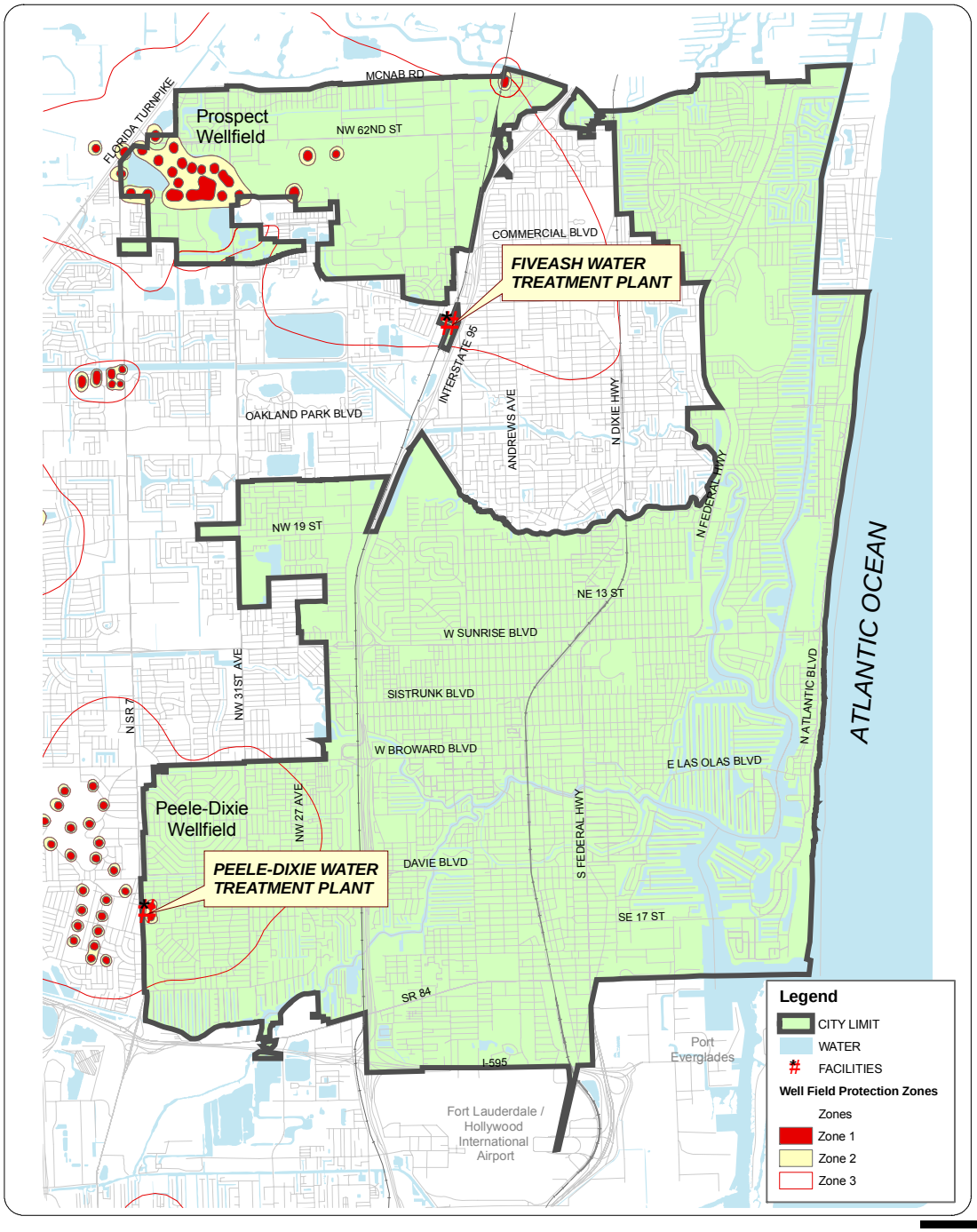


WATER SERVICE AREA

Map 1.1

DATA SOURCE: CITY OF FORT LAUDERDALE PUBLIC SERVICES DIVISION
MAP SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006

0 0.5 1 2 Miles



WATER TREATMENT FACILITIES
Map 1.3

DATA SOURCE: CITY OF FORT LAUDERDALE PUBLIC SERVICES DIVISION
MAP SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006

0 0.5 1 2 Miles

Section 1.4 Fiveash Water Treatment Plant

The City's largest water treatment plant is the Fiveash WTP. The plant was originally constructed in 1950 and has undergone various expansions in subsequent years. The facility's treatment capacity is technically permitted at 70 MGD. The plant uses conventional lime softening at a target pH of 9.0 – 9.5, followed by filtration. At this pH, recarbonation is not needed. Polymers are added for turbidity removal and a ferric sulfate/polymer blend is added to assist in color removal. Disinfection is achieved by chloramination. The plant has a staff of 26 employees, and a produced annual average of about 43 MGD in 2006. This annual average is lower than the typical average because water use restrictions were in effect for portions of this year. The plant produces safe, reliable potable water, which complies with current regulations.

Section 1.5 Peele-Dixie Water Treatment Plant

The existing Peele-Dixie Water Treatment Plant is a nanofiltration treatment plant on the same site as the retired lime softening facilities. The nanofiltration treatment plant has a maximum installed finished water treatment capacity of 12 million gallons per day with all units in service.

A study entitled *"Floridian Aquifer Reverse Osmosis (RO) Conceptual Plan and Assessment for the Peele Dixie WTP"* is currently underway to address technical and constructability issues for the addition of six MGD of RO production capacity from the Floridian Aquifer brackish water supply system. This would supplement the current 12 MGD nanofiltration facility. Space in the facility was pre-planned for such a purpose. When constructed, the Floridian Aquifer Reverse Osmosis treatment units would increase the total installed potable water production capacity at the Peele Dixie WTP site to 18 MGD to partially meet the forecasted potable water production shortfall in the City's service area. This study is further discussed later in Section 4 of this report.

Section 1.6 Current Raw Water Supply

The City obtains all of its raw water supply from the surficial Biscayne Aquifer system via two active wellfields. These wellfields, which are commonly known as the Dixie Wellfield and the Prospect Wellfield, operate independently of each other, the former serving the Peele-Dixie Water Treatment Plant (WTP) and the latter serving the Fiveash WTP. Both wellfields are permitted by the SFWMD under Consumptive Use Permit No. 06-00123-W.

Section 1.7 Prospect Wellfield

Raw water to the Fiveash WTP used to be supplied from groundwater wells that surround Prospect Lake plus wells that surround the Fort Lauderdale Executive Airport. The wells at the executive airport were abandoned in 1999 due to contamination. As a result, all of the raw water supplied to the Fiveash WTP is pumped from wells around Prospect Lake. This site is known as the Prospect Wellfield.

The Prospect Wellfield has 29 active production wells (Well Numbers 25 through 28, 30 through 49 and 50 through 54) that were constructed from 1969 through 2006. Production well No. 35 is only utilized on a standby basis. The wells have pumping capacities of approximately 2,100 gallons per minute (gpm) each, which equates to a total wellfield capacity of approximately 87 MGD.

The old abandoned wells at the Executive Airport site are located directly east of the Prospect Wellfield. These wells were taken out of service due to the presence of volatile organic compounds. An extensive monitoring program has successfully been employed to protect the Prospect Wellfield from contamination.

Section 1.8 Dixie Wellfield

Raw water to the Peele-Dixie Water Treatment Plant is supplied from groundwater from the Dixie Wellfield. The Dixie Wellfield is composed of two wellfield configurations, the “Old Dixie Wellfield” and the “New Dixie Wellfield.” The Old Dixie Wellfield will be removed from service, the wells plugged, and the above ground features (i.e., piping, electrical, etc.) demolished under a future project by the end of 2008. The New Dixie Wellfield conveys water to the Peele-Dixie Nanofiltration Plant.

The installed capacity of the New Dixie Wellfield is approximately 20 MGD (from eight 2.5 MGD wells). The wellfield withdrawal permit limits the maximum withdrawal to 15 MGD on a daily basis. It is noted that volatile organic compounds have been detected in the southern half of the wellfield and the City has been proactive in successfully addressing these concerns by retiring wells, managing withdrawals away from critical areas and implementing an extensive monitoring program to protect the northern wells.

In 2007, the City completed the construction of two Floridan Aquifer test wells at the Dixie Wellfield site. The purpose of these wells is to collect data for the design of Floridan Aquifer wells to supply sufficient brackish water for the addition of six MGD of reverse osmosis (RO) production capacity at the Peele-Dixie Water Treatment Plant.

Section 1.9 Saline Intrusion Monitoring (SALT) Program

The City of Fort Lauderdale operates a SALT program. The goal of the SALT program is to locate and monitor the saltwater interface in and around the City's wellfields. The purpose of the program is to provide an early warning monitoring system to assist wellfield managers in tracking the location and to manage withdrawals to limit the inland movement of the salt front. The City currently has 11 saltwater monitoring wells.

Section 1.10 Distribution System Water Storage Facilities

The City has two distribution system storage sites. These sites are known as the Poinciana Park Water Tank and Pump Station and the Northwest Second Avenue Water Tank and Pump Station. In 2006, the existing tank and pump station at the Poinciana Park Water Tank and Pump Station site were replaced with a 2.0 million gallon pre-stressed concrete ground storage tank and pumping station with backup power diesel engine generator.

The existing elevated steel water tank at the Northwest Second Avenue site is 1.0 million gallons. The facility is currently in service. The City is currently considering rehabilitation plans for the existing facilities.

Section 1.11 Raw Water Aquifer Storage and Recovery

The City's existing Aquifer Storage and Recovery (ASR) well is located at the Fiveash WTP, just east of the ground storage tanks. The ASR well is currently permitted under a no flow permit.

Section 1.12 Finished Water Distribution System

The City of Fort Lauderdale's water distribution system consists of over 750 miles of 2 to 54-inch diameter water mains that convey the finished water from the treatment facilities to the individual customers. In general, the larger diameter transmission mains radiate from the treatment facilities and decrease in size as they extend throughout the service area. The major transmission mains travel east from the water treatment plants to the populated portions of the service area and the two systems are interconnected along major north-south avenues.

Section 1.13 Sanitary Sewer

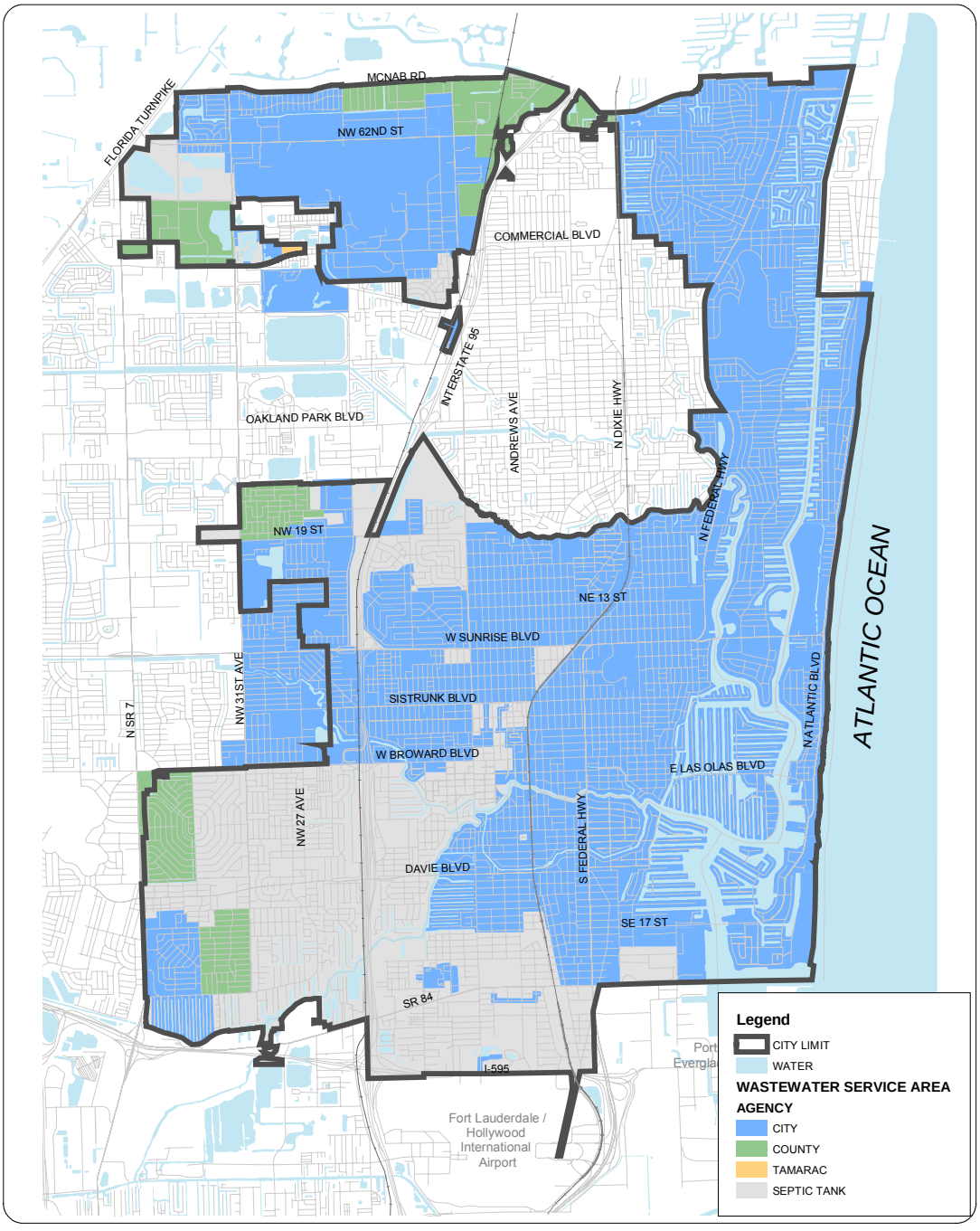
The City of Fort Lauderdale provides wastewater treatment and disposal services to approximately 190,000 people in central Broward County. Approximately 70 percent of the service population resides within the City, with the remainder located in adjacent governmental jurisdictions. Nearly 34,000 people within the service area have septic tank systems, mostly located within the Fort Lauderdale City limits, which are being replaced with sewer service. Map 1.14 generally depicts the

wastewater service area. All of the wastewater from sewered portions of the service area is treated at the George T. Lohmeyer Wastewater Treatment Plant (GTL WWTP), which is owned and operated by the City of Fort Lauderdale.

The City also owns and operates the regional wastewater transmission system, as well as the wastewater collection system within its boundaries and a small portion of unincorporated Broward County. This system consists of approximately 368 miles of gravity sewers and 135 miles of force main. The other contributing wastewater collection systems located outside the city boundaries are owned and operated by the respective governmental entities.

Section 1.14 George T. Lohmeyer Wastewater Treatment Plant

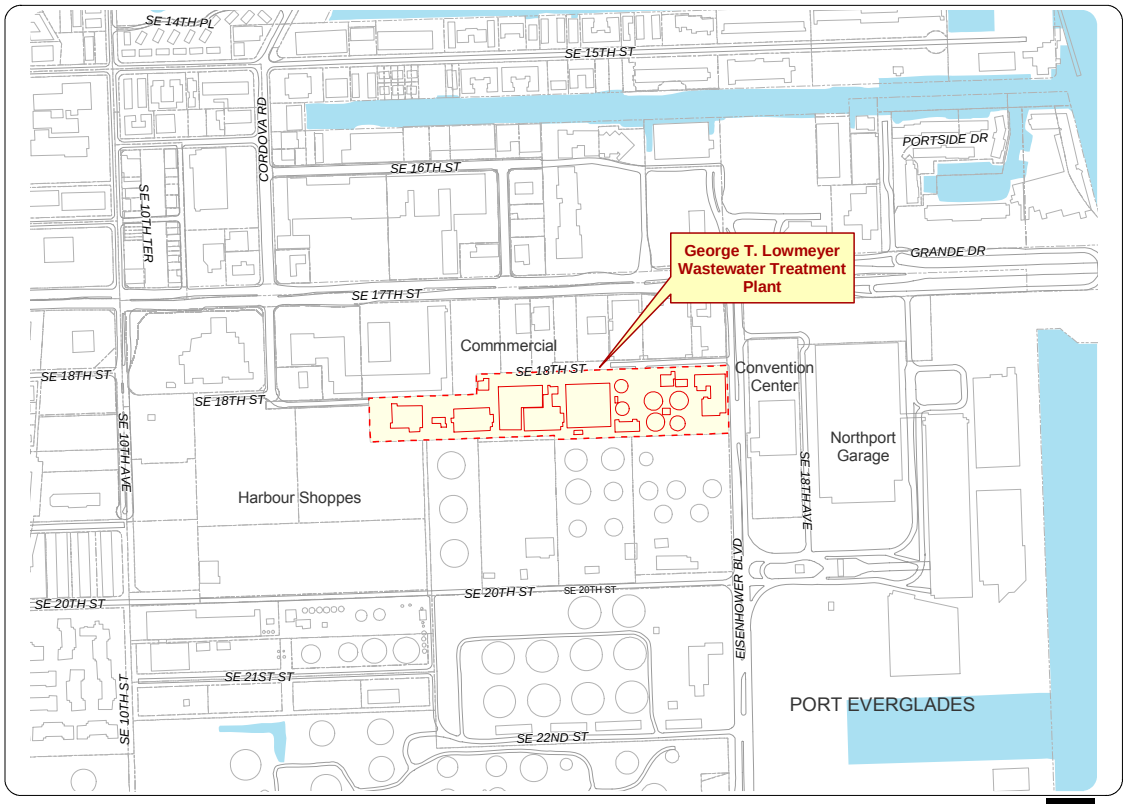
The GTL WWTP is located on a 9.58-acre site near S.E. 17th Street and Eisenhower Boulevard. The plant provides secondary treatment followed by deep-well injection via five injection wells located approximately one-quarter mile south of the site. The plant is owned and operated by the City of Fort Lauderdale (City) and is used to treat wastewater generated in a region encompassing the City, Wilton Manors, Oakland Park, Davie and Port Everglades, as well as part of Tamarac and unincorporated Broward County (See Map 1.14). The location of the plant is shown in Map 1.14.1.



WASTEWATER SERVICE AREA
Map 1.14

T LAUDERDALE PUBLIC SERVICES DIVISION
MAP SOURCE: CITY OF FORT LAUDERDALE PLANNING & ZONING DEPARTMENT- JULY, 2006

0 0.5 1 2 Miles



GEORGE T. LOHMEYER WASTEWATER TREATMENT PLANT

Map 1.14.1

0 250 500 1,000 Feet

The facility has been expanded several times over the years. It was converted from a small trickling filter plant to a 22-MGD facility in 1978, with effluent disposal via an outfall to the Intracoastal Waterway. In 1984, four deep injection wells were constructed for effluent disposal and the plant was converted and expanded to a permitted capacity of 38 MGD. New clarifiers and biosolids dewatering facilities were added to the existing treatment train. In 1994, DEP issued a permit with a capacity of 43 MGD, on a maximum three-month average daily flow (M3MADF) basis. In 2001, DEP issued a permit modification that increased the design capacity of the plant to 54.0 MGD, pending approval of the increase in disposal capacity of the underground injection well system. The City then re-rated the plant to 55.7 MGD, M3MADF.

Section 1.15 Discharge Permits

DEP issued a new Domestic Wastewater Facility Permit for the GTLWWTP on March 30, 2005 with an expiration date of March 2010. The permit specifies a plant capacity of 55.7 MGD (M3MADF) and contains standard effluent limitations, monitoring requirements, and provisions for biosolids disposal, industrial pretreatment, and operation and maintenance.

The plant no longer holds an NPDES Permit that would allow for the discharge of treated effluent into the Intracoastal Waterway. Discharging the effluent into the Intracoastal Waterway is limited to emergency situations only. Treated effluent from the plant is discharged to the deep injection wells located approximately one-quarter mile south of the GTLWWTP.

Section 1.16 Deep Well Injection Capacity

The effluent pump station discharges to five deep injection wells via 3,500 feet of 54-inch-diameter force main. The wells are permitted to operate at up to 10 feet per second (fps) flow velocity on a sustained basis and 12 fps during emergencies. These velocities yield total injection well capacities of 93.25 and 112 MGD, respectively. The design forecast Maximum Hourly Flow (MHF) is 113 MGD, which would require operation of the wells at greater than 10 fps. Therefore, a sixth injection well will be required unless peak flows to the plant can be reduced through inflow and infiltration (I/I) reduction, conservation measures, transmission system flow control, off-site flow equalization or reuse systems in the collection system to divert flow away from the plant. The City is considering a backup force main for the future.

Section 2.0 Population Forecast

Current and forecasted populations through 2025 by Traffic Analysis Zone (TAZ) were used to forecast residential water use of the City's retail water customers and total water use of the City's wholesale water customers. These projections were developed in consultation with Broward County and other wholesale customers are shown in Table 2.1. The percent change in future population relative to 2005 was calculated using these population projections and applied to the actual 2005 water use by TAZ.

Section 2.1 Permanent Residents in City of Fort Lauderdale's Retail Water Service Area

Permanent residents, seasonal residents, and tourists are three distinct population categories that could have been utilized in residential water use forecasting. It was decided that using the percent change in the future permanent resident population would be the most appropriate method for forecasting residential water demands. The water use forecasting methodology includes seasonal residents and tourist populations in either the commercial or resident water use forecasts and does not require that these two population categories be addressed independently.

The permanent resident population forecasts within the City's retail water service area are presented in Table 2.1. The permanent resident population forecasts were organized by TAZ.

The Broward County, Lauderhill and Lauderdale-by-the-Sea water supply plans contain text from the City of Fort Lauderdale's Water Supply Plan. These plans identify their residents as being part of the City of Fort Lauderdale's retail customers. The residents of unincorporated Broward County, Lauderhill, Lauderdale-by-the-Sea and Lazy Lake are shown as retail customers in the City of Fort Lauderdale's Water Supply Plan. Retail population projections are shown in Table 2.1. The population projections contained in the City of Fort Lauderdale are consistent with the three plans referenced above.

Unincorporated Broward County customers include residents of Boulevard Gardens, Franklin Park, Roosevelt Gardens and Washington Park. The unincorporated population of this area in 2005 was 6,127. According to the Broward County Forecasting Model, population in this area is expected to increase by 2,406 to 8,533 in 2025.

The City of Lauderhill's southeast corner served by the City of Fort Lauderdale is approximately 35 acres out of the 24,400 acre City of Fort Lauderdale water service area. Thus, the City of Lauderhill's southeast corner is less than 0.1 percent of the entire City of Fort Lauderdale water service area. Based on the Broward County Forecasting Model, this portion of the City of Lauderhill will increase in population from 315 in 2006 to 474 in 2030. The annual average water demand of the population of this area is not expected to exceed .05 mgd.

In 2005, the City of Fort Lauderdale served 3,767 residents in the southern portion of Lauderdale-by-the-Sea. According to the Broward County Forecasting Model, population in this area is expected to increase by 1,663 to 5,430 in 2025.

According to the Broward County Forecasting Model, the population of Lazy Lake Village in 2005 was 43 residents. It is expected to increase by four to 47 in 2025.

Table 2.1
Population Projections
City of Fort Lauderdale Retail Water Service Area*

Population	2000	2005	2010	2015	2020	2025
Permanent	175,873	187,003	196,981	209,671	223,100	237,645
% change		6.3	5.3	6.4	6.4	6.5

Source: Fort Lauderdale Water and Wastewater Master Plan and Broward County
*Includes population within the City limits, unincorporated Broward County, Lauderdale-by-the-Sea and Lazy Lake.
Some portions of the City are serviced by Broward County.

Section 2.2 Permanent Residents in Cities That Purchase Wholesale Water from the City of Fort Lauderdale

Four cities purchase water from the City of Fort Lauderdale: Oakland Park, Tamarac, Wilton Manors and Davie. The projected populations used for these entities, and Oakland Forest, a subdivision that obtains water from Fort Lauderdale through a master meter, are provided in Table 2.2. The percent changes in projected populations were used to forecast wholesale water demands from these customers. The baseline figures and projections were developed in consultation with the City's wholesale customers and are consistent with figures in their water supply plans.

The City of Fort Lauderdale's Public Works Department monitors water use of wholesale customers through user agreements, monthly meetings and monthly monitoring reports. The user agreements include several measures to ensure that water use remains consistent with projections in the water supply plans. For example, any new utility customer requesting more than 100,000 gallons of water per day must receive written approval from the City of Fort Lauderdale. The user agreements also require the purchasing cities to comply with City of Fort Lauderdale conservation regulations.

Table 2.2
Permanent Populations, Current and Projected
Cities of Oakland Park, Tamarac, Davie and Wilton Manors(a)
Wholesale Customer

	2000	2005	2010	2015	2020	2025
Oakland Park	25,856	26,492	26,618	29,467	32,432	35,216
Oakland Forest(b)	3,219	3,371	3,716	4,042	4,288	4,496
Tamarac(c)	6,359	7,069	7,490	8,060	8,513	8,712
Wilton Manors	12,117	12,390	13,152	14,134	15,030	15,832
Town of Davie – Hacienda Village	2,400	2,400	2,400	2,400	2,400	2,400

(a) Populations in 2000 and 2005 are actual values. Forecasts are provided for all other years.
(b) Oakland Forest is a subdivision of the City of Oakland Park and comprises all of TAZ 414. Potable water from the City of Fort Lauderdale is supplied to this subdivision through a master meter. Water demand by the residents in this subdivision was forecast separately from the water demand of the City of Oakland Park.
(c) The area of Tamarac served by the City of Fort Lauderdale via a master meter includes small portions of TAZ's 398, 393, 394, and 400. These TAZ's also include areas served by Fort Lauderdale retail service and Oakland Park retail service. The population presented for Tamarac includes the total population in these TAZ's from which the percent growth in population was used to forecast future water demand by the City of Tamarac.
(d) Hacienda Village is built out.

Section 2.3 Seasonal Residents / Tourists

Seasonal (nonpermanent) residents are those who reside in the service area for only a portion of the year, generally in the winter months. Most seasonal residents own second homes or condominiums in the area so their water use would be included in the 2005 residential water use data. Residential water use was forecast using this 2005 data and the percent change in the forecasted permanent resident population.

Tourists generally visit for several days to several weeks and are a separate category from seasonal residents. Tourist water use is included in the commercial category for those who reside in hotels or other commercial accommodations and in the residential category for those who stay with family members or friends.

The population forecasts used to estimate residential water use projections did not include the seasonal or tourist populations for the following reasons:

- For those tourists who stay with family members and friends, their water use is included in the residential forecasts. For those tourists who stay at hotels or other public accommodations, their water use is included in the commercial forecasts.
- For seasonal residents, the number of seasonal residents and the average lengths of stay by TAZ are not known. This information would be necessary to adjust the number of seasonal residents to equal year-round resident equivalents.
- Water use by seasonal residents is a small proportion of total water use and is included in the residential water use forecasts. In these forecasts, the percent change in the permanent resident population is used to forecast future water use.

Therefore, using the percent changes in permanent resident populations alone is a better indicator of future changes in residential water use than attempting to include the percent changes in seasonal and tourist populations in the residential water use forecast.

Section 3.0 Baseline Finished Water Demand Forecast

This section describes the methodologies utilized to determine the finished water demand for the City of Fort Lauderdale service area. Finished water demand forecasts were developed and presented through the study period for use in subsequent planning sections.

Section 3.1 Baseline Finished Water Demand Summary

Water use is influenced by several factors including service area population; the types, numbers and sizes of commercial businesses and/or industries; rainfall conditions; the relative price of water[1]; and the distribution of water using technologies. The City maintains water billing account information for various customer categories as summarized in Table 3.1

Table 3.1
Water Account Inventory – Calendar Year 2005

Customer Type	Description	Number of Accounts
Residential Regular Service	• All accounts serving single-family and multi-family dwelling units. Does not include sprinkler accounts.	49,574
Commercial Regular Service	• All accounts serving commercial, industrial, and governmental users. Does not include sprinkler accounts.	6,258
Sprinkler Service	• All accounts that meter sprinkler consumption only. These accounts are provided at the request of the residential or commercial customer.	6,975
Wholesale Service	• All accounts that meter large water deliveries to nearby cities and other jurisdictions.	27
Fire Service	• All accounts that meter water use for fire suppression.	1,057
Mobile Service	• All mobile meters.	83
Total		63,974

Source: City of Fort Lauderdale Water Account Database, 2005.

[1] *The relative water price is the value of the water rate per 1,000 gallons relative to customer income and the prices of other goods and services.*

Water use of customer accounts in calendar year 2005 was chosen as the baseline water use from which forecasts were derived. Calendar year 2005 was chosen as the baseline year for the following two reasons:

- It was the most recent calendar year where water account information, representing current conditions, was available.

- Calendar year 2005 was an average rainfall year[2].

In this report, the 2005 water uses of four customer categories were reviewed for forecasting purposes as follows:

- Residential Category – Residential Regular Service
- Commercial Category – Commercial Regular Service
- Sprinkler Category – Commercial and Residential Irrigation Service
- Wholesale Customers – Bulk Water Customers (local water utilities, Port Everglades, etc.)

Through the use of GIS techniques, the City's regular, sprinkler, and wholesale water billing accounts were matched to planning area Traffic Analysis Zones (TAZs) to arrive at a spatial allocation of 2005 water use by TAZ for subsequent development of water demand projections. Fire service connections are for emergency use and therefore not considered in subsequent water demand forecasts. The amount of water used by mobile meters is not significant. Water use for fire suppression and mobile service were not specifically forecasted but captured in the overall forecast.

The 2005 water billing data was analyzed to forecast and spatially allocate water use during average rainfall conditions. The water accounts were mapped to the TAZ planning areas using GIS modeling. The City provided the service addresses of all retail and wholesale water accounts in 2005. These addresses were used to determine the location of each water account and identify the TAZ number where the account is located.

Total finished water demand is the amount of water that leaves the City's two water treatment plants and is the sum of water use by all four customer categories plus the amount of distribution system loss. Distribution system loss as a percent of total finished water varies from year to year. Over the past six years, 2000 to 2005, the average distribution system loss was 8.1 percent of total finished water. This value was used to convert forecasted customer water use to total finished water.

[2] *The 30-year average annual rainfall in Fort Lauderdale is 57.7 inches. The annual rainfall in Fort Lauderdale in 2005 was 58.4 inches or 1.2 percent over the 30-year average annual rainfall. This information is from the South Florida Water Management District.*

A summary of 2005 finished water demand is provided in Table 3.1a. The table also includes a summary of the 1998 finished water demand which was the baseline water demand used for the 2000 Fort Lauderdale Water and Wastewater Master Plan[3].

Table 3.1a
Baseline Finished Water Demands, 1998 and 2005
City of Fort Lauderdale Water Utility
Annual Average million gallons per day (MGD)

Water Use Category	1998	2005
Residential water use	19.44	19.47
Commercial water use	7.61	8.90
Wholesale water use	9.00	7.61
Sprinkler water use	7.76	9.16
Subtotal	43.81	45.14
Distribution System Loss[(a)]	3.90	3.98
Total Finished Water Demand	47.71	49.12

[(a)] *Distribution system loss in 1998 is the actual loss of 8.2% of total finished water demand. In 2005, the distribution system loss is the forecasted quantity of 8.1%.*

Section 3.2 Water Consumption (Use) Forecasts

Water use by residential, commercial, sprinkler and wholesale customers was forecasted for the years 2010, 2015, 2020 and 2025. Water use does not include the distribution system loss, which is added when computing finished water demand. The methods and results are described below. The water use projections were based upon the following data and information:

- 2005 billed water use of each customer category by traffic analysis zone (TAZ);
- population forecasts by TAZ;
- the current commercial and residential development efforts within the City's service area; and,
- commercial build-out of the remaining vacant land areas that are not likely to be residential and are not classified as wetlands.

[3] *CH2M Hill and Hazen and Sawyer, "City of Fort Lauderdale Water and Wastewater Master Plan", prepared for the City of Fort Lauderdale, Florida, December 2000.*

The methodology to forecast water use for each customer category is discussed in turn.

Section 3.3 Residential Water Use Forecasts

The 2005 water billing records were spatially allocated to determine the total annual average daily residential water consumption in each TAZ. Forecasts were completed by multiplying the 2005 residential billed water use in each TAZ by one plus the forecasted percent change in population within that TAZ.

Residential water uses under average rainfall conditions were projected for the years 2010, 2015, 2020 and 2025 and are summarized in Table 3.3.

Table 3.3
Residential Water Use Category Water Use Forecast, Annual Average MGD, Average Rainfall Conditions

Year	Water Use (MGD)[(a)]
2005 (base)	19.5
2010	20.5
2015	21.7
2020	22.9
2025	24.8

[(a)] *Does not include water distribution system loss.*

Section 3.4 Commercial Water Use Forecasts

Commercial water use can increase under two conditions. First, it is reasonable to presume that the City of Fort Lauderdale will be built out by 2025. Much of the existing vacant land will become either residential or commercial property. Second, general population growth in Broward County will increase the demand for local commercial goods and services resulting in increased water use by existing and new commercial establishments within the City of Fort Lauderdale.

The 2025 forecast of average daily commercial water use within each TAZ was estimated as the average daily commercial water use in 2005 increased by 28 percent. The 28 percent is the forecasted percent increase in the Broward County population from 2005 to 2025. The resulting land use implied by the forecasted 2025 water use for each TAZ was compared to the size of the TAZ and the expected land use of that TAZ in 2025. The resulting 2025 water use forecast of each TAZ was reasonable for the size of the TAZ and the anticipated land uses.

Commercial water use forecasts between 2005 and 2025 were interpolated between the 2005 actual retail commercial water use and the 2025 forecast. Resultant commercial water use forecasts between 2005 and 2025 are summarized in Table 3.4.

Table 3.4
Commercial Water Use Category Water Use Forecasts
Annual Average MGD, Average Rainfall Conditions

Year	Water Use (MGD)[(a)]
2005 (base)	8.9
2010	9.5
2015	10.1
2020	10.7
2025	11.4

[(a)] *Does not include water distribution system loss.*

Section 3.5 Residential and Commercial Sprinkler Account Water Use Forecasts

Residential and commercial customers have the option of opening an account that meters and bills for landscape irrigation (sprinkler) water use only. Customers who choose this option have a regular account that meters and bills for indoor water use and a sprinkler account that meters and bills for outdoor use. Charges for water metered under the sprinkler account do not include wastewater user rates.

Water use of sprinkler accounts is not expected to increase in the future as residential and commercial buildings are expected to occupy more and more of the land within each TAZ. Also, most of the sprinkler accounts are located in high valued residential and commercial areas that are built out and are unlikely to be redeveloped prior to 2025. For the purposes of these water use forecasts, the amount of water used by sprinkler accounts in each TAZ was held constant from 2005 through 2025.

Section 3.6 Wholesale Customer Water Use Forecasts

The City of Fort Lauderdale also provides wholesale water service to large users adjacent to the service area. These types of accounts are called master meters. One customer account is one master meter that records the amount of water that passes through the Fort Lauderdale water system and into the water system of the wholesale customer. There can be more than one account (or master meter) per wholesale customer.

The monthly 2005 water use and customer account information of each meter associated with each wholesale customer was provided by the City of Fort Lauderdale. The sum of the annual 2005 master meter water use for each wholesale customer is provided in Table 3.6. Also presented in this table are the amounts of water used in 1998 by these customers and other wholesale customers that existed in 1998. The year 1998 was the base year used in the 2000 Fort Lauderdale Water and Wastewater Master Plan.

Table 3.6
Water Use by Wholesale Water Customers[(a)]
Annual Average MGD, Average Rainfall Conditions

Wholesale User	1998	2005	Percent Change from 1998
City of Oakland Park	3.99	3.91	0.5%
City of Wilton Manors	1.56	1.60	2.5%
Port Everglades	1.79	1.31	-26.6%
Oakland Forest	0.17	0.50	192.2%
City of Tamarac	0.16	0.19	16.7%
Town of Davie – Hacienda Village	0.04	0.10	150%
Broward County Office of Environmental Services	0.42	0.0007	-99.8%
FDOT – Toll Booth (<0.01 MGD)	0.0004	0.0005	16.4%
Broadview Park Water Company	0.75	Account closed	
City of Dania	0.1	Account closed	
Total	8.98	7.61	-15.3%

[(a)] *Does not include water distribution system loss.*

The method used to forecast water use of each wholesale customer varied depending on the type of customer and the purpose of the water use.

For the City of Oakland Park, City of Tamarac, City of Wilton Manor and Oakland Forest subdivision, the 2005 water use was increased by the projected percent increase in population associated with the geographic areas served by the water supply. Due to the builtout nature of the area, the Town of Davie's Hacienda Village, population and water use was kept at their 2005 levels.

For Port Everglades, 2005 water use was increased by five percent each year through 2025. This percent increase was approved by the Port and its consultant[4]. It was based on the Port's forecasts of anticipated growth in the number of cruise ship passengers through 2020 of five to six percent and the anticipated growth in the amount of cargo through 2020 of 2.4 percent[5]. Because most of the Port's water use is comprised of the potable water loaded onto cruise ships and water used by cruise ship passengers at the Port, a five percent per year overall water use growth rate was used.

The Broward County Office of Environmental Services uses their master meter account to irrigate landscaping at the Fort Lauderdale-Hollywood International Airport. The quantity of water used in 2005 was relatively small, 0.0007 MGD. The decline in water use from 1998 is due to major construction activities that expanded airport capacity and displaced irrigation water needs. No significant increase in the amount of water used in the near future is expected. However, it is possible that more water may be used for landscaping in the future. To account for any unanticipated future increases, the 2005 water use was increased by 10 percent per year.

The Florida Department of Transportation uses their master meter account to supply potable water to a toll booth. Water use is not expected to increase because no changes to the toll booth are anticipated. Therefore, future water use for this customer is held constant as the 2005 level.

The water use projections of the City of Fort Lauderdale's wholesale customers are provided in Table 3.6a.

[4] *Telephone conversations on June 7, 2006 with John Foglesong of Port Everglades and Kevin Hart of Craven Thompson.*

[5] *TranSystems Corporation, "Port Everglades Master Plan", Final Report, August 23, 2001, Fort Lauderdale, Florida.*

Table 3.6a
Wholesale Water Use Category Water Use Forecasts[(a)]
Average Rainfall Conditions, Annual Average MGD

Wholesale User	2005	2010	2015	2020	2025
City of Oakland Park	3.91	4.19	4.63	5.09	5.52
City of Wilton Manors	1.60	1.70	1.82	1.94	2.04
Port Everglades	1.31	1.68	2.14	2.73	3.49
Oakland Forest	0.50	0.55	0.60	0.63	0.66
City of Tamarac	0.19	0.20	0.21	0.22	0.23
Town of Davie – Hacienda Village	0.10	0.10	0.10	0.10	0.10
Broward County WW Services	0.0007	0.0012	0.0019	0.0031	0.0049
FDOT – Toll Booth (<0.01 MGD)	0.0005	0.0005	0.0005	0.0005	0.0005
Total	7.61	8.41	9.50	10.72	12.04

[(a)] *Does not include distribution system losses.*

Section 3.7 Annual Average Finished Water Demand Forecast

The annual average water use forecasts for the residential, commercial, sprinkler and wholesale water accounts are summarized for the years 2005 through the year 2025 in Table 3.7. This table combines the water use forecast with water distribution system loss, resulting in a forecast of finished water demand. The forecasts were based on water use in 2005 and are representative of typical consumptive conditions because 2005 was an average rainfall year and is the most recent year for which water use data was available. Temporary reductions in finished water demands during drought years and SFWMD Phase I/II/III restriction schedules are not reflected in the overall forecast due to their transient nature.

These water use forecasts were based upon end user consumption and need to be augmented with the loss realized within a water distribution system. Distribution system loss is equivalent to the difference between total finished water production and total water billed. This loss is comprised of water leakage from the system, unmetered uses and under registration of installed meters. During the years 2000 to 2005, the average distribution system loss was 8.1 percent of total finished water. This value was used to convert customer water use to total finished water.

Table 3.7
Finished Water Demand Forecast, 2005 to 2025
Average Rainfall Conditions, Annual Average MGD

Water Use Category	2005 (Actual)	2010	2015	2020	2025
Retail Customer:					
Residential[a]	19.47	20.48	21.70	22.90	24.76
Commercial[b]	8.90	9.51	10.13	10.74	11.36
Sprinkler[c]	9.16	9.16	9.16	9.16	9.16
Wholesale Customers[d]	7.61	8.41	9.50	10.72	12.04
Subtotal	45.14	47.57	50.49	53.52	57.32
Distribution System Loss of 8.1%[e]	3.98	4.19	4.45	4.72	5.05
Total Finished Water Demand	49.12	51.76	54.94	58.24	62.37

[a] Residential includes all single-family, multifamily and condominium water customers.
[b] Commercial includes all retail water users other than residential water customers and sprinkler accounts.
[c] Sprinkler accounts represent separate meters used to bill sprinkler water use separately. Includes sprinkler accounts of residential and commercial customers.
[d] Wholesale customers include Broward County, Port Everglades and surrounding cities that purchase water for resale to their water customers.
[e] Distribution system loss is estimated at 8.1 percent of total finished water production. Loss estimate provided by City staff.

Section 3.8 Water Demand Comparison to Previous Planning Efforts

Current finished water demand projections were compared to the 2000 Water and Wastewater Master Plan[6] finished water demand projections. The 2000 Master Plan projected an annual average finished water demand of 50 MGD in 2005. Actual finished water demand was 49 MGD. The current and the 2000 Master Plan forecast of 2010 water demand are the same: 52 MGD. In 2015, the current forecast is 55 MGD and the 2000 Master Plan forecast was 53 MGD. In 2020, the current forecast is 58 MGD and the 2000 Master Plan forecast was 55 MGD. By 2025, the current forecast of water demand is 62 MGD. A 2025 forecast was not provided in the 2000 Master Plan.

These water demand forecasts were based on the best available information including future forecasted percent changes in populations and expected commercial development. Water use forecasts are also based on existing water

[6] CH2M Hill and Hazen and Sawyer, "City of Fort Lauderdale Water and Wastewater Master Plan", prepared for the City of Fort Lauderdale, Florida, December 2000.

using technologies, the current relative price of water, and the existing types of commercial and industrial businesses. Any significant changes in these factors from those used to create the projections reported in this Master Plan could cause actual water use to be higher or lower than these projections. Therefore, changes in these factors should be monitored over time. When these changes are believed to be significant, for example through major redevelopment efforts, future water demand should again be reassessed.

Section 3.9 Water Demand Characteristics

Historical water consumption and production records were reviewed to establish specific system performance characteristics, such as treatment plant losses, unaccounted for water losses and unit flow factors within a distribution system. This information is typically registered via the use of flow meters at key locations within the raw water transmission system, water treatment plant facility and customer billing meters. The City of Fort Lauderdale maintains meters at the Fiveash Water Treatment Plant and at customer connections. Water production is estimated at the Peele-Dixie Plant based upon pump and well operating records.

The Fiveash Water Treatment Plant maintains four raw water meters at the entrance to the treatment plant and three venturi meters along the discharge piping of the plant's high service pump stations. Staff has indicated that flow rate measurements of the finished water via the discharge venturi meters are believed to be inaccurate due to flow turbulence at the entrance and exit of the venturi meters and due to their old age. The Peele-Dixie Water Treatment Plant does not currently have operational raw or finished water flow meters. Finished water is pumped to the distribution system via three constant speed pumps. Finished water flow rates are estimated by monitoring high service pump run times and pump characteristic curves. Use of the pump run time provides an estimate of the pump delivery rate. Plant staff also monitor and maintain records for the fluctuation of the on-site finished water storage tank elevation to refine these estimates. Raw water influent is recorded as the sum of the treatment plant losses and the net change in stored water volume. Short term capital improvements for both treatment facilities include the installation of flow meters at key locations within the raw water and finished water systems which should improve long term reporting of water flow rates.

Section 3.10 Maximum Day Demand Factor

The City's Monthly Water Treatment Plant Operations Reports for the Fiveash and Peele-Dixie Water Treatment Facilities were reviewed to determine the average daily flow rate and maximum day demand factor for the period of January 1995 through December 1998 and January 2005 to December 2005. Results for the former time period were calculated and reviewed during the 2000 Master Water

planning efforts. A summary of the average and maximum daily water production rates and maximum day demand factors for each year is provided in Table 3.10.

The results indicate the ten-year average maximum day demand factors for the Fiveash and Peele-Dixie facilities are 1.27 and 1.25, respectively. The 1995 to 1998 four-year average was 1.30 and 1.38 respectively. For both plants, the maximum day demand factor averaged 1.26 and the highest factor experienced was 1.39 in 1998. Typical maximum day demand factors experienced in similar South Florida municipalities range between 1.3 and 1.5 times the annual average flow.

The 2000 Water and Wastewater Master Plan utilized a maximum day demand factor of 1.5 for water forecasts. A factor of this magnitude has not been experienced at the Fiveash WTP in the past 10 years, however, an estimated maximum day factor of 1.56 was documented at the Peele-Dixie WTP in November 1995.

Considering this historical data and to account for uncertainties associated with the City's current flow metering systems, a systemwide maximum day demand factor of 1.4; representative of the mid-range of maximum day demand factors experienced in South Florida, has been used for transmission system planning in this Master Plan. A maximum day demand factor of 1.3 is suggested for water treatment plant capacity planning where on-site storage and other contingencies are typically incorporated into the process design criteria.

Table 3.10
Historical Treated Water Production
City of Fort Lauderdale

	Fiveash			Peele-Dixie			Total		
	Water Production		Ratio of Max.	Water Production		Ratio of Max.	Water Production		Ratio of
Year[(a)]	Avg. Daily (MGD)	Max. Day (MGD)	Day to Avg. Daily	Avg. Daily (MGD)	Max. Day (MGD)	Day to Avg. Daily	Avg. Daily (MGD)	Max. Day (MGD)	Max. Day to Avg. Daily
1995	41.79	54.86	1.31	6.64	10.39	1.56	48.43	65.25	**1.35**
1996	42.21	51.72	1.23	6.93	8.95	1.29	49.14	60.67	**1.23**
1997	40.35	50.98	1.26	6.84	8.60	1.26	47.19	59.58	**1.26**
1998	41.00	57.17	1.39	6.64	9.16	1.38	47.64	66.33	**1.39**
2000	43.79	51.63	1.18	6.86	10.29	1.50	50.65	61.93	**1.22**
2001	37.28	47.49	1.27	5.99	7.25	1.21	43.27	54.74	**1.27**
2002	42.46	55.97	1.32	6.59	7.91	1.20	49.05	63.87	**1.30**
2003	41.95	51.40	1.23	7.49	7.32	0.98	49.44	58.72	**1.19**
2004	42.91	54.53	1.27	7.51	7.88	1.05	50.42	62.40	**1.24**
2005	40.14	48.17	1.20	7.72	8.16	1.06	47.86	56.34	**1.18**
Avg.:			1.27			1.25			**1.26**
Max.:			1.39			1.56			**1.39**
Min.:			1.18			0.98			**1.18**

[(a)] *Results for the years 1995 to 1998 were calculated during preparation of the 2000 Master Wastewater and Water Plan. Results for the years 2000 to 2005 were calculated during preparation of this Master Water Plan. The year 1999 was not evaluated.*

Section 3.11 Peak Hour Demand Factor

Distribution system piping and pumping facilities must be capable of meeting maximum system demands. The limiting demand criteria for the design and analysis of the water transmission system piping and pumping components is the peak hour demand. The peak hour demand factor is the greatest amount of water produced by both plants (Fiveash and Peele Dixie) in a single hour during the year as measured in MGD divided by the average daily water produced during the year in MGD. It was determined by reviewing the historical hourly plant operating records, as well as the influence (if any) from distribution system storage.

Analysis of hourly water production data from the Fiveash and Peele Dixie plants during the 2000 Master Plan found that the estimated peak hour flow factors for maximum production days ranged between 1.9 and 2.0 times the annual average daily flow from 1995 through 1998. In 2005, the peak hour flow factor was 2.01. Since the Poinciana Tank is currently off-line and the Northeast 2nd Avenue Tank is hydraulically limited, future peak flows are anticipated to increase when these

systems are refurbished or replaced. A peak hour factor of 2.2 and 2.1 times the annual average daily flow was utilized in the 2000 and 1990 Master Plans respectively. Historically, for the City of Fort Lauderdale, the peak hour demand has been associated with lawn irrigation in the early morning hours each day. Typical peak hour demand factors range from 1.2 to 2.5 per American Water Works Association (AWWA) Manual of Water Supply Practices M32 – Distribution Network Analysis for Water Utilities.

For the purposes of this Master Plan, a peak hour demand factor of 2.2 was utilized to account for uncertainties associated with the City's current flow metering systems, and increased water use as system pressures are improved.

In early 2007, drought conditions and falling Lake Okeechobee water levels required the South Florida Water Management District (SFWMD) to impose Phase III (the most stringent) water restrictions throughout South Florida. Under Phase III restrictions, casual water use was severely limited and lawn watering was reduced to one day per week (between 4 am and 8 am) in an "odd" and "even" address basis. The result of the Phase III restriction significantly curtailed overall water demand and essentially eliminated the peak hour demand.

In the long term, it is expected that peak hour demands will return to some level as water restrictions are eased but probably not to historical levels should the City decide to adopt permanent water use restrictions. The long term effectiveness of water use restrictions may defer some improvements and may require additional improvements to other infrastructure to address necessary changes in operation due to the changes historical demand patterns.

Section 3.12 Port Everglades Water Demand Factor

One of the City of Fort Lauderdale's wholesale customers is the Port Everglades Authority whose water demand characteristics differ from typical residential/commercial patterns. The Port purchases potable water from the City of Fort Lauderdale through five metered connections at the following locations:

- 10-inch meter at Southeast 17th Street
- 12-inch meter at Southeast 20th Street
- 8-inch meter at Southeast 24th Street
- 16-inch meter at Southeast Eller Drive / Old South Federal Highway
- 10-inch meter at 900 Southeast 26th Street

Port Everglades distributes this potable water to various commercial and industrial users within its boundaries, such as passenger cruise ships, the Florida Power and Light (FPL) power generation facility, cargo container ships, and commercial space. It is believed that water consumption patterns within Port Everglades are not coincidental to the City of Fort Lauderdale due to the varying land uses found within its boundaries.

Based upon the efforts under the 2000 Water and Wastewater Master Plan, it is recommended that the maximum day demand factor for the Port Everglades water demand forecasts be maintained at 1.5.

It is recommended that water distribution modeling efforts utilize a peak hour demand factor of 2.8 for the Port Everglades to more closely represent cruise ship operations. This factor will be used simultaneously with the remaining distribution system realizing peak hour demand factors as part of the hourly diurnal flow patterns to be applied throughout the system for varying types of consumptive use.

Section 3.13 Adopted Level of Service

As described in Policy 2.3.1 of the Infrastructure Element of the City of Fort Lauderdale Comprehensive Plan, the adopted level of service for potable water is 197 gallons per capita per day.

Section 4.0 Finished Water Demand Forecast Adjusted for Conservation

The “Baseline” finished water demand forecast was prepared based on year 2005 water meter data. The City has experienced approximately a 20 percent reduction in water demand during the District’s Phase 2 and Phase 3 water restrictions implemented in year 2007. The City believes that implementation of a water demand reduction ordinance can reasonably be expected to reduce current and projected water demand by 10 percent. Additionally, the City believes that the SFWMD will recognize conservation as a legitimate method to offset the need for development of alternative water supplies. The City is moving forward with passing the water demand reduction ordinance. It is anticipated that this ordinance will go into effect by about August 2008. Based on an anticipated 10 percent reduction, a new finished water demand forecast, adjusted for conservation, is derived in Table 4.

Table 4
Finished Water Demand Forecast Adjusted for Conservation (AADF MGD)

	2005	2010	2015	2018	2020	2025
Baseline	49.12	51.76	54.94	56.92	58.24	62.37
Conservation (10%)		5.18	5.49	5.69	5.82	6.24
Demand Adjusted for Conservation		46.6	49.4	51.23	52.4	56.1

Section 5.0 Raw Water Demand Forecast

Raw water demand forecast can be derived from the finished water demand forecast along with the expected efficiencies for the treatment processes. The following assumptions are used to derive the raw water demand forecast:

1. The Dixie nanofiltration WTP will go online in 2008.
2. Nanofiltration recovery will be 80 percent of the raw water (i.e., 20 percent loss).
3. The Dixie nanofiltration plant will produce 12 MGD of finished water on an annual average basis.
4. The Fiveash WTP will remain as a lime softening treatment process.
5. The lime softening treatment process recovery is 96 percent of the raw water (i.e., 4 percent treatment loss).

Based on the above assumptions, the raw water demand forecast is presented in Table 5 below.

Table 5
Raw Water Demand Forecast on Annual Average Basis (MGD)

	2005	2010	2015	2018	2020	2025
Demand Adjusted for Conservation	49.1	46.6	49.4	51.2	52.4	56.1
Distribution System Loss of 8.1%*	2.1	4.4	4.6	4.66	4.7	4.9
Raw Water Demand	51.2	50.1	54.0	55.86	57.1	61.0

* Distribution system loss is estimated at 8.1 percent of total finished water production. Loss estimate provided by City staff.

Section 6.0 Water Use Permit Allocation

On September 11, 2008, the City's consumptive use permit (CUP) was issued by the SFWMD. The CUP limits total Biscayne Aquifer withdrawals to 52.55 MGD on an annual average daily basis.

Section 7.0 Water Supply Forecast

Based on the above calculations, the City will experience a water supply deficit in 2012. Consequently, alternative water supply projects are needed to offset this deficit. The water supply deficits are tabulated below.

Table 7
Biscayne Water Supply Forecast (AADF in MGD)

	2005	2010	2015	2018	2020	2025
Raw Water Demand	51.2	51.0	54.0	55.9	57.1	61.0
Water Use Permit	50.6	52.55	52.55	52.55	52.55	52.55
Water Supply Deficit	0.6	0	1.45	3.35	4.55	8.45

Section 8.0 Other Water Supply Initiatives

This section describes other water supply related initiatives. Alternative water sources including wastewater reclamation and reuse (either as an irrigation offset or aquifer recharge) as well as Floridian Aquifer brackish water reverse osmosis are being studied. Additionally, the City is participating in a multijurisdictional study, commonly referred to as the L-8 Reservoir Study. These alternative water supply projects are currently under consideration to supplement the City's Biscayne Aquifer supply.

Section 8.1 Conservation

The City of Fort Lauderdale has actively pursued a Conservation strategy that includes goals, objectives, and policies to conserve water. Within those objectives, Objective 9 of Fort Lauderdale's Comprehensive Plan forms the basis for its programs:

Continue to conserve water as a resource of the City and region as a whole and work to reduce per capita water demand.

This objective is supported by the following Comprehensive Plan policies:

- Work on a local and regional basis to conserve and protect water resources by implementation and enforcement of the conservation rate ordinance adopted in 1996.

- During drought periods, limit the use of water for irrigation and car washing and cooperate with the SFWMD water withdrawal limitations through enforcement of the emergency restrictions ordinance adopted in 1994.

- Distribute literature pertaining to water conservation and appropriately cite residents not complying with mandatory drought prohibitions.

- Replace water mains with a history of leakage through an annual infiltration repair program.

- Review and determine the most cost-effective application of a water reuse system for the City as well as water-saving devices for future City facilities.

- If necessary, implement an emergency conservation of water resources in accordance with the plans of the regional water management district.

- Because studies conducted for the City have demonstrated the practical, logistical and economic infeasibility of instituting a program of reuse of reclaimed water at this time, the City of Fort Lauderdale has developed and will continue to implement alternatives to water reuse for the near future as water conservation measures. These measures include:

    1. The development and construction of a wellfield recharge basin utilizing Prospect Lake as storage, developed in cooperation with Broward County Environmental Protection Department and using grant funds from both the County and the South Florida Water Management District.
    2. The enactment and enforcement of the Water Conservation Rate Ordinance in 1996, which allows the City to charge lower water rates for users that conserve water.

- Continue to enforce City of Fort Lauderdale Ordinance 28-1, which states that the City shall comply with South Florida Water Management District rules and enforce and restrictions relating to water shortages and surface watercourses.

The City continues to maintain an active public information campaign on water conservation and restrictions and enforces water restrictions on irrigation using Environmental Inspectors, Code Enforcement Officers, and Police Officers. In addition, the City is a partner of the County in the operation of the NatureScape Irrigation Service. Over 13 million gallons of water was saved as a result of implementing recommendations based on irrigation system evaluations completed in 2006.

The City also maintains a conservation rate structure for water and wastewater use (Table 8.1). These rates are in effect year-round to encourage users to conserve water.

Table 8.1
Water Commodity Charge

Usage	Consumption (gallons)	Rates ($ per thousand gallons)
Single Family	0 - 3,000	1.23
	4,000 – 7,000	2.12
	> 7,000	3.12
Duplex	0 – 6,000	1.23
	7,000 – 14,000	2.12
	> 14,000	3.12
Triplex	0 – 9,000	1.23
	10,000 – 21,000	2.13
	> 21,000	3.12
4 or More Units Multifamily Condo	0 – 3,000 x # of units	2.12
	> 3,000 x # of units	2.89
Commercial	> 1,000	2.38

Sewer Commodity Charge

Usage	Consumptions (gallons)	Rates ($ per thousand gallons)
Single Family	0 – 3,000	2.87
	4,000 – 20,000	3.96
Duplex	0 - 6,000	2.87
	7,000 – 40,000	3.96
Triplex	0 – 9,000	2.87
	10,000 – 60,000	3.96
Commercial		3.67

In 2006, the City also updated a drought rate ordinance to further encourage residents to conserve water during water shortages, and to recapture the loss of revenue from water restrictions.

Section 8.2 City of Fort Lauderdale Code of Ordinances

Section 28-1 of the City of Fort Lauderdale's Code of Ordinances defines water rate structures under District water restriction levels. This section of the code of ordinances is included below to illustrate the City's proactive approach.

> ***Sec. 28-1. Water shortage--Declaration of emergency; emergency restrictions.***
> *(a) Declaration. The city manager is hereby authorized, after consultation with the director of the utilities department of the city, to have appropriate enforcement personnel enforce the provisions or restrictions of any declaration of the South Florida Water Management District pertaining to a water shortage.*
> *(b) Restrictions. Whenever activated by the South Florida Water Management District in times of a water shortage, those provisions of chapter 40E-21 of the Florida Administrative Code as they relate to water usage restrictions, as same may be amended from time to time, are incorporated herein by this reference and made a part of the Code. It shall be unlawful for any person to fail to comply with said restrictions.*
> *(c) Surcharges. In the event the South Florida Water Management District declares a drought and mandates water restrictions in one (1) of the four (4) established drought phases, the City of Fort Lauderdale will implement a surcharge on the water, wastewater, and sprinkling meter commodity charges established in sections 28-76, 28-143 and 28-144 of the Code of Ordinances and on the user agreements and industrial user charges established in sections 28-77 and 28-78 of the Code of Ordinances. The amount of surcharge shall be based on the level of declaration of a Phase I, Phase II, Phase III or Phase IV level of water restrictions as provided in this subsection and the number of gallons generated by the user with priority consideration given to the purpose of the usage. If a declaration of any Phase level of water restriction is issued prior to or on the 15th of the month, the prescribed surcharge for that level of water restriction shall appear on the first utility billing processed on or after the 1st day of the following month. If such declaration is issued after the 15th of the month, the prescribed surcharge shall appear on the first utility billing issued on or after the 1st day of the month following a thirty-day period after the declaration date. When a declaration of water restrictions is rescinded by the South Florida Water Management District, surcharges shall be rescinded with the adjustment appearing on the first utility billing issued on or after the 1st day of the month following the date the declaration is rescinded. All surcharge adjustments, including the initial imposition, any increases and decreases, and the rescinding of the surcharge shall be implemented as described above. Surcharges shall be charged as follows in the chart below:*

Sec. 28-76 WASTEWATER USER RATES	Phase I	Phase II	Phase III	Phase IV
Sec. 28-76(b)(2) Single-family residences, and duplexes and triplexes that have separately metered units.				
0--3,000 gallons	0%	0%	0%	0%
4,000--20,000 gallons	9%	17%	29%	43%
Sec. 28-76(b)(3) Duplexes that do not have separately metered units.				
0--6,000 gallons	0%	0%	0%	0%
7,000--40,000 gallons	9%	17%	29%	43%
Sec. 28-76(b)(4) Triplexes that do not have separately metered units.				
0--9,000 gallons	0%	0%	0%	0%
10,000--60,000 gallons	9%	17%	29%	43%
Sec. 28-76(b)(5) All Other Consumers.				
All Usage	9%	17%	29%	43%

Sec. 28-77 USER AGREEMENTS	Phase I	Phase II	Phase III	Phase IV
Sec. 28-77 Municipalities, political subdivisions and privately owned utilities in the county.				
All Usage	9%	17%	29%	43%

Sec. 28-78 INDUSTRIAL USER CHARGES	Phase I	Phase II	Phase III	Phase IV
All Usage	9%	17%	29%	43%

Sec. 28-143. WATER RATES	Phase I	Phase II	Phase III	Phase IV
Sec. 28-143(a)(2)a. Single-family residences.				
0--3,000 gallons	0%	0%	0%	0%
4,000--7,000 gallons	0%	0%	17%	31%
8,000 + gallons	5%	8%	17%	31%
Sec. 28-143(a)(2)b. Duplexes served by a single meter.				
0--6,000 gallons	0%	0%	0%	0%
7,000--14,000 gallons	0%	0%	17%	31%
15,000 + gallons	5%	8%	17%	31%
Sec. 28-143(a)(2)c. Triplexes served by a single meter.				
0--9,000 gallons	0%	0%	0%	0%
10,000--21,000 gallons	0%	0%	17%	31%
22,000 + gallons	5%	8%	17%	31%

Sec. 28-143 (a)(2)d. Multifamily residential dwellings having 4 or more dwelling units.				
0--3,000 gallons per dwelling unit	0%	0%	0%	0%
4,000 + gallons per dwelling unit	5%	8%	17%	31%
Sec. 28-143(a)(2)e. Commercial, industrial, and other non-residential units, buildings or complexes connected by meters.				
All Usage	5%	8%	17%	31%
Sec. 28-143(b). Municipalities, political subdivisions and privately owned utilities.				
All Usage	5%	8%	17%	31%
Sec. 28-143 (c). Retail consumers receiving water outside the corporate limits				
All Usage	5%	8%	17%	31%

Sec. 28.144. SPRINKLING METER CHARGES	Phase I	Phase II	Phase III	Phase IV
Sec. 28.144(b). A commodity charge for sprinkling meter services for each one thousand (1,000) gallons or fraction thereof.				
0--10,000 gallons	10%	25%	40%	50%
11,000 + gallons	10%	25%	40%	50%

(Ord. No. C-90-28, § 1, 5-1-90; Ord. No. C-06-30, § 1, 9-19-06)

Editor's note: Section 1 of Ord. No. C-90-28, adopted May 1, 1990, deleted in its entirety § 28-1 and provided for a new § 28-1. Formerly, § 28-1 pertained to emergency restriction of water usage and derived from the 1953 Code, § 45-32.

State law references: Water management district declared water shortages, F.S. § 373.175.

Section 8.3 Floridan Wells

After the 6 MGD RO facility goes online, the City will not need an additional alternative water supply project until 2022. As such, the City has proposed utilization of the Floridan Aquifer as an Alternative Water Supply (AWS) to meet at least a portion of future demands. That proposal was made via a response to a District request for AWS project listings (submitted by the City in November 2005) to be included in the LEC Plan update. The project name as it appears in the 2005-2006 LEC Water Supply Plan is the "Dixie Floridan Water Supply/Treatment Facility."

The City, however, is not certain that utilization of the Floridan Aquifer should be used to make up the entirety of the water "demand-not met" through the Year 2025. The City is evaluating various other options including reuse of treated wastewater effluent and interbasin transfer of surface waters (the latter through a project currently known as the L-8 Reservoir).

Nevertheless, the City believes that projected finished water shortfalls will require at least some amount of Floridan Aquifer water to reliably provide for future demands. Additionally, provision of additional treatment capacity is highly desirable to allow for extended duration maintenance of the Fiveash WTP lime softening treatment units. Hence, the City has decided to initiate planning for 6 MGD of additional finished water production at the Peele-Dixie WTP utilizing reverse osmosis treatment of Floridan Aquifer waters. The City is currently studying the treatment facility upgrades that will be needed at the WTP. It is expected this study will be complete in March 2008.

The City has developed a preliminary plan for implementation of 6 MGD (finished water capacity) of RO facilities at the existing Peele-Dixie WTP. This project includes the construction of 10 MGD of Floridan Aquifer water supply wells at the Dixie Wellfield to supply raw water to the proposed RO facilities.

Section 8.4 Wastewater Reuse

The City is considering implementing reuse of wastewater effluent, particularly systems that can be used to develop alternative water supplies. The SFWMD is developing policies that require the development of alternative water supplies to meet the potable water needs of future growth when the Biscayne Aquifer and regional surface water supply systems are considered to be at capacity. Indirect potable reuse systems have dual benefits of providing more wastewater treatment and disposal capacity and augmenting local water supplies, which will be important when the City next applies for a Water Use Permit from the SFWMD.

The GTL WWTP is located far from any significant users of reclaimed water, such as golf courses. Therefore, the construction of an irrigation-quality reclaimed water production facility at or near the plant to provide further treatment of effluent to public reuse standards is not feasible. There is little available space on the plant site or plant vicinity to construct the required treatment facilities. In addition, due to high levels of I/I near coastal areas and waterways, the chloride concentration in the treated effluent (approximately 600 mg/L) exceeds the maximum recommended amount (250 mg/L). Therefore, the only practical alternatives for implementing reuse systems are off site, near potential beneficial uses of reclaimed water.

In order to update the reuse options to the City, the Public Works Department applied for an Integrated Water Resource Plan (IWRP) grant with Broward County. The City has undertaken an analysis designed to determine the feasibility of implementing selected reclaimed water projects that could offset potable water deliveries from the regional water management system. The intent of the feasibility study is to identify potential sites and determine the feasibility of their use for aquifer recharge and irrigation. The technologies being considered are satellite wastewater treatment facilities using Membrane Bioreactor (MBR) technology and the blending of concentrate from the water treatment plant process with raw water.

As part of the project scope, the City has internally identified several sites that could provide alternative water supply to meet the City's projected demands. These sites are undergoing evaluation for criteria such as permitability, influent characteristics and availability, reclaimed water demand, environmental benefits, consumptive use permit credits for aquifer recharge, and public acceptance. In reviewing potential reclaimed water projects, the City has taken a holistic approach where consideration has been given to achieving multiple benefits for an application of technology rather than using the conservative approach to meet specific treatment capacity needs. This philosophy considered not only the inherent benefits to the environment of this technology, but also other positive factors such as postponing the need for a major expansion of the City's Regional Wastewater Treatment Plant and obtaining consumptive use credits to use the Biscayne aquifer.

Six conceptual projects have developed out of the feasibility study. Descriptions of the potential projects are provided below including location, treatment type and capacity being considered, and environmental benefits.

Section 8.4.1 'E' Repump Station/Prospect Well Field Recharge, 5 million gallons per day (MGD) demand capacity

This project envisions the construction of a MBR treatment facility just south of Fort Lauderdale Executive Airport at the regional 'E' wastewater repump station. The MBR facility would capture up to 6 MGD of influent from the wastewater collection system and process it to highly treated levels meeting Broward County and Florida reclaimed water standards. There is a treatment process loss of approximately 1 MGD at a 6 MGD level of influent flow leaving a net reclaimed water flow of 5 MGD. In addition to the treatment afforded by the MBR (filtration and nutrient removal), it is likely that tertiary treatment in the form of reverse osmosis (RO) filtration and ultraviolet (UV) disinfection would be required to meet these standards. Approximately 5 MGD of highly treated reclaimed water would be distributed in the area of the City's Prospect Well Field to assist in recharging the Biscayne aquifer and relieving the need for replenishment from the regional water delivery system. A consumptive use credit is a possible benefit to the City in this scenario.

Section 8.4.2 'E' Repump Station/Dew Lake, 1 to 5 million gallons per day (MGD) demand capacity

This project is similar to the above project. A MBR facility would be constructed near the 'E' Repump Station to provide reclaimed water that would be distributed to Dew Lake east of Executive Airport. A wetland would be constructed in the lake and the water discharging from the lake's control structure would be used to recharge the aquifer and possibly form a salt water intrusion barrier. The reclaimed water would be treated to above secondary standards through the MBR facility and a disinfection process. Capacity remains to be determined at this stage of the project.

Section 8.4.3 Repump Station/Palm Aire Country Club Irrigation/City of Pompano Beach Well Field Recharge/Fern Forrest Nature Center Replenishment, 5 MGD demand capacity

This project would be a done as a supplement to the Prospect Well Field Recharge project described above. The concept for this project is to construct a larger capacity MBR facility, on the order of 12 MGD, and provide up to 5 MGD of reclaimed water for irrigation to the five golf courses at the Palm Aire Country Club.

The City of Pompano Beach operates its west well field on the golf course property and potential aquifer recharge benefits could accrue to this municipality by using highly treated reclaimed water to recharge the area near the well field. Economically, the City would benefit from sharing the capital and operations and maintenance costs of the project with Pompano Beach.

Broward County operates the Fern Forrest Nature Center to the west of the golf course property. During the dry season, the creek that runs through the center is dry. Consideration is being given to provide 1 MGD of reclaimed water to recharge the creek during these periods.

These flows and uses would be in addition to the 5 MGD of the highly treated reclaimed water that would be utilized to recharge the area near the Prospect Well Field.

Section 8.4.4 'B' Repump Station/Coral Ridge Country Club Irrigation/Saltwater Intrusion Barrier, 6 MGD demand capacity

The concept for this project is to construct an MBR facility at the regional 'B' Repump Station near the driving range of the Coral Ridge Country Club. The MBR facility would treat up to 7 MGD of wastewater from the collection system. The bulk of the resulting reclaimed water supply (5 MGD) would be piped to the west of the facility for the purposes of creating a saltwater intrusion barrier for the Prospect Well Field. A series of injection wells would be manifolded in a northeast-southwest line and reclaimed water would be injected to form a groundwater mound to displace salt water intrusion. The remainder of the reclaimed water (~ 1 MGD) would be distributed to the golf course and to a new residential development for irrigation purposes. The treatment process is anticipated to consist of filtration and nutrient removal through the MBR unit with disinfection.

Section 8.4.5. Peele-Dixie Fort Lauderdale Country Club Well Field/Concentrate Blending, 5 MGD capacity

This project envisions utilizing concentrate from the Peele-Dixie water treatment plant process and blending it with raw water for the purposes of recharging the plant's well field and providing irrigation water for the golf course on which the wells reside. The capacity would be approximately 5 MGD.

Section 8.4.6 Peele-Dixie Fort Lauderdale Country Club Well Field Recharge/Irrigation, 5 MGD demand capacity

Under this project's concept, an MBR facility would be constructed near the Peele-Dixie water treatment plant to provide reclaimed water. The reclaimed water would be used to provide irrigation water to the Fort Lauderdale Country Club and to recharge the area near the Peele-Dixie Well Field, which is located on the Club's property. Reclaimed water used for irrigation would undergo filtration and nutrient removal through MBR treatment with disinfection, while the water used for recharge purposes would undergo the same treatment but with an additional RO filtration step. Five MGD of reclaimed water is proposed for these projects.

Section 8.5 Regional Water Supply Planning Efforts

The U.S. Army Corps of Engineers (COE), in concert with the SFWMD, are currently in the midst of implementing the Comprehensive Everglades Restoration Plan (CERP). The overarching objective of that project is the restoration and protection of the South Florida ecosystem (i.e., the Everglades). The restoration planning efforts have determined that additional water is necessary to re-hydrate the Everglades to achieve their natural functions and values. To provide this needed water, the COE has proposed a comprehensive construction project to create both above ground water storage in a series of reservoirs (i.e., the Lake Belt Reservoir system) and ground water storage in a massive regional aquifer storage and recovery (ASR) system.

In part, this new infrastructure will provide regional water to the coastal areas to maintain canal levels. The water currently used for this purpose, along with additional water stored in the proposed CERP projects, will be redirected to the Everglades.

A second planning effort of importance to the City is the Lower East Coast Regional Water Supply Plan (LEC). The LEC plan incorporates the water supply strategies developed in the CERP, and the expected performance of the CERP infrastructure projects for determining water supply availability in the southeast coast of Florida. The purpose of the LEC Plan is to provide a cost effective strategy for assuring that adequate water supplies are available to meet the demands of natural systems, agriculture, and urban areas within the planning area through the year 2025.

Current schedules for project implementation suggest that water for future drinking water needs in the southeast coast of Florida will not be available in the time frame originally anticipated. Consequently, alternative water supplies will likely be needed to meet regional demand. Additionally, if the proposed CERP projects are less efficient than anticipated, alternative water supplies will likely be needed to meet regional demand. All of these water supply planning efforts have the potential to affect the City's long-term water supply. Even upon completion of the various planning efforts, the efficacy of a modified regionally water supply system will not be known until the proposed water supply infrastructure is constructed, and, perhaps, operated for several years.

Section 9 Costs – Peele-Dixie Floridan Water Supply Treatment Facility

Section 9.1 Construction Costs

The City and their consultant recently completed a study to implement 6 MGD of RO treatment at the Peele-Dixie WTP along with related Floridan Aquifer wellfield facilities. This proposed Alternative Water Supply project is named "Dixie Floridan

Water Supply/Treatment Facility" in the 2005-2006 LEC Water Supply Plan. This study offered an opinion of the probably construction cost for this project of approximately $31.5 million. This value includes a 30 percent contingency. It does not include engineering, legal, administrative services, or land acquisition costs. This opinion of cost is an "order of magnitude" estimate (as defined by the Association of the Advancement of Cost Engineering International). The expected accuracy range would be +50 percent to –30 percent.

Section 9.2 Operating Costs

The cost of operating the Peele-Dixie Floridan Water Supply/Treatment Facility are estimated in 2008 dollars as follows:

- Years 2013 to 2018 O & M cost of $1.8 million/year
- Years 2018 onward O & M cost of $3.6 million/year

Section 9.3 Funding Sources

The funds appropriated for Peele-Dixie are described in Exhibit 1 as part of the City's Water Master Plan projects. On September 16, 2008, the Peele-Dixie RO project was approved as part of the City's FY 2009-2013 Capital Improvement Program. Funding will consist of bonds and state revolving loan funds. State Revolving Loan Funds as a source of external funding for Water Works 2011 projects was undertaken at the direction of the City Commission to maximize this source of low interest funding. To date the City has received State Revolving Loan Funds of $90 million; another $16 million has been approved and is pending distribution to the City. The $1,991,582 of State Revolving Loan funds shown below on the Capital Improvements Program sheet for Water Works 2011 projects is a subset of the $116 million received. This project has been added to the Capital Improvements Plan of the Capital Improvements Element of the Comprehensive Plan.

Section 10 Summary

This water supply plan forecasts finished water and raw water demands through the year 2025. Based on the assumptions that a 10 percent reduction in historical demands are viable through implementation of conservation ordinances; along with a water use permit increase to 52.55 MGD result in the City prediction water supply deficits beginning in the year 2012. Hence, the City proposes to initiate design of a project titled "Dixie Floridan Water Supply/Treatment Facility." This project includes the construction of 6 MGD of finished water capacity reverse osmosis treatment at the Peele-Dixie WTP along with 10 MGD of Floridan Aquifer Wells. This alternative water supply project is predicted to provide the City with sufficient drinking water through the year 2023.

City of Fort Lauderdale

Capital Improvement Program (CIP)

FY2009-2013

PROJECT APPLICATION -- FY20089902

Master Plan Projects

Type:	Replacement	**Priority:**	1	**Address:**	Citywide
Contact:	Mike Nekolny	**Start Date:**	Oct 2006	**City:**	Fort Lauderdale
Department:	Public Works	**End Date:**	Sep 2011	**State:**	FL
District:	☑ I ☑ II ☑ III ☑ IV	**Est. Time:**	5 Years	**Zip:**	Citywide

Description: Water Works 2011 and various other major projects for the Water & Sewer Master Plan including Peele-Dixie Floridan well membrant plant.

Justification: Commission based support for Water Works 2011 and other Water & Sewer related projects.

Project Funding Source(s):

SOURCE	AVAILABLE $	08/09	09/10	10/11	11/12	12/13	TO BE PROG.	5 YR TOTAL
W & S Debt Financed Const Non-Region								
482		$75,300,626	$40,294,880	$11,295,985	$1,709,852			$128,601,343
W & S Debt Financed Const Regional								
485		$254,264	$2,078,223	$364,038				$2,696,525
W & S SRF Loan #4 Capital Projects								
490		$1,981,360						$1,981,360
Central Reg SRF Loan #4 Projects								
491		$10,222						$10,222
TOTAL:		**$77,546,472**	**$42,373,103**	**$11,660,023**	**$1,709,852**			**$133,289,450**

Comments:

Project Budget/Funding Use:

USAGE	AVAILABLE $	08/09	09/10	10/11	11/12	12/13	TO BE PROG.	5 YR TOTAL
CONSTRUCTION								
6599		$54,228,302	$29,631,541	$8,153,862	$1,195,701			$93,209,406
ENGINEERING FEES								
6534		$9,761,094	$5,333,677	$1,467,695	$215,226			$16,777,692
CONTINGENCIES								
9950		$13,557,076	$7,407,885	$2,038,466	$298,925			$23,302,352
TOTAL		**$77,546,472**	**$42,373,103**	**$11,660,023**	**$1,709,852**			**$133,289,450**

Comments: While the rest of the CIP applications reflect appropriation needs, this application is presented on a cash flow basis.

Impact On Operating Budget:

IMPACT	AVAILABLE $	TO BE PROG.	5 YR TOTAL
			$0
TOTAL			**$0**

Comments: There is no impact on operating budget.