
City of Bradenton Public Facilities Element Data Inventory and Analysis

INTRODUCTION

Public facilities include potable water, wastewater, solid waste, drainage and natural groundwater aquifer recharge, In accordance with the requirements of 163.177(6)(f), F.S. and 9J-5011,F.A.C., this section provides an inventory and analysis of the public facilities and services within the City of Bradenton as well as its water and sewer utility service areas that extend into unincorporated Manatee County.

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Methodology

The methodology for the Public Facilities Element includes an analyzing the baseline operating capabilities of existing sewer, water and drainage facilities and mapping existing service area boundaries. Current demand and design capacity as well as the level of service each facility was operating at were also identified. After the baseline information was analyzed, future needs were projected based on projected population growth and current planned improvements for each of the facilities analyzed. Each sub-element in this element contains unique background information related to individual public facilities and services and includes projections developed separately for each public facility.

In 2005, Jones - Edmund & Associates, Inc. completed an *Evaluation of Growth and Annexation Impacts on Water and Wastewater Infrastructure* and in May 2009 a draft *Water Supply Facilities Work Plan* for the City. Data and analyses in these reports provide the basis for the preparation of this element.

Wastewater Sub-Element

Wastewater service is comprised of three components – sewage collection, treatment, and disposal. Disposal includes biosolids and

effluent reuse, which is also referred to “grey” or reclaimed water.

Within the City of Bradenton, most development receives wastewater service from a sewer system that transports sewage through underground pipes to an offsite treatment facility for processing and disposal. This type of wastewater service is referred to as a *central sewer system*. Centralized wastewater sewer systems must meet standards established and monitored by the Florida Department of Environmental Protection and the U.S. Environmental Protection Agency. There are no septic systems or package treatment plants within the City limits

Map PFE -1 delineates areas within the City’s jurisdictional boundaries that are served by the central sewer system.

Centralized Wastewater Service: The City of Bradenton operates its own wastewater collection and treatment system. The Public Works Department is responsible for its operation. The plant has a capacity of 9 million gallons (MGD) of wastewater per day and treats approximately 5.89.

The City’s central wastewater service is managed and operated by the Utilities Division of the Department of Public Works. The sewer system consists of approximately 200 miles of

sewer lines (gravity sewers and force mains), 3,812 manholes, and 56 pumping stations.

Service Area: The service area is approximately 15 square miles and includes all of the incorporated area except the Seabreeze Mobile Home Park (Neighborhood 4.0l) - which is serviced by Manatee County. The City also services the Casa Del Sol and Cape Vista residential areas in the unincorporated area. The customer population in the Seabreeze mobile home park is roughly the same as in Casa Del Sol Cape Vista. The City’s water and sewer service areas share the same geographical boundaries, forming a single contiguous utility service area.

Wastewater Collection & Transmission Facilities: According to the Florida Department of Environmental Protection, collection/transmission systems include sewers, pipelines, conduits, pumping stations, force mains, and all other facilities used for collection and transmission of wastewater from individual service collection laterals to facilities intended to provide treatment before the wastewater is released to the environment.

Each wastewater service system physically functions independently, having no connections that allow effluent flows to be redirected from one system to another. Each system stands on its own for collection and

distribution to a treatment facility. Each collection system consists of gravity sewer lines, lift stations, or force mains (Map PFE – 2: Wastewater Service System).

1. **Sewer System Transmission:** From the central sewer system wastewater flow is directed to the City's treatment plant, at 17th Avenue and 1st Street West, via master pumping stations.
2. **Inflow and Infiltration:** The inflow and infiltration of groundwater and stormwater into sewer lines is common to sewer collection systems throughout Florida. Inflow involves stormwater entering sanitary sewer lines through manholes or cracked lines during or after rainstorms. Infiltration involves a continual seepage of groundwater into sewer lines and laterals through cracked lines or offset joints. Seepage from infiltration will vary based on seasonal and climatic changes affecting rainfall levels. Because of the overall age of the system the City has undertaken an extensive replacement and rehabilitation of system lines. Over one-half (300,00 feet) of the system lines have been replaced or rehabilitated, significantly reducing the inflow/infiltration problem.
3. **Performance and Improvement:** For the collection system to maintain effective performance and continue to meet FDEP

standards, the City will continue an ongoing maintenance and repair program through its Utility Division. These activities will include:

- a. Repairing or replacing sanitary sewer manholes deteriorated by hydrogen sulfide gas to avoid potential water infiltration.
- b. Replacing of deteriorated lines to prevent exfiltration of waste water and/or infiltration of groundwater.

Unpredicted malfunctions to the collection system can occur causing overflow. Also, malfunctions at lift stations due to pump failure can occur as a result of storm events, power outages, or equipment breakdowns. All malfunctions that result in an overflow are reported to the FDEP through a Sewer Overflow Report.

All collection and transmission facilities must comply with standards set forth in Chapter 62-604, F.A.C., which are enforced by FDEP. These standards establish, design, construction, and operation requirements for wastewater collection and transmission systems and establish procedures to obtain a permit to construct or modify a domestic wastewater collection and transmission system.

Treatment Facility: The City of Bradenton provides wastewater treatment. The City's wastewater treatment plant was constructed in 1955 at the southwest corner of 17th Avenue and 1st Street West. The original plant was a three-million-gallon-per-day, high-rate trickling filter plant consisting of dual-parallel primary clarifiers, trickling filters, and secondary clarifiers with anaerobic digesters and sludge drying beds. In 1970 the treatment plant was modified and expanded to an activated-sludge facility, using the contact stabilization process with a design capacity of six million gallons per day.

A renovation and expansion of the plant, was completed in 1987 which resulted in significant reductions in biochemical oxygen demand, total suspended solids, nitrogen, and phosphorus.

In April 2003, FDEP issued a Domestic Wastewater Facility Permit for the Bradenton Water Reclamation Facility. Under this permit the City is able to discharge 6.0 MGD, on an annual average daily flow basis, into the Manatee River.

The FDEP issued Domestic Wastewater Facility Permit was scheduled to expire in April 2008. The City, however applied for renewal of the permit within the required time and the permit has been administratively extended by FDEP. At this time FDEP and the

City are discussing new testing and monitoring requirements for surface water (Manatee River) discharge.

1. **Water Reclamation:** The City’s reclamation facility is permitted under the Domestic Water Facilities Permit issued by FDEP. At the time of application the permit allowed for 9.0 MGD annual average daily flow for the plant’s reclaimed water reuse system. The system has two, 2.0-MG ground storage tanks and ancillary pumping stations. Due to various factors however, a number of the heavy reclaimed water users have discontinued their reclaimed water use. Consequently, the full permitted expansion of the reclaimed/reuse water system has not taken place.

The current level or reuse of reclaimed water is approximately 0.62 MGD (Table PFE – 1).

Over the past several years the City of Bradenton, the City of Palmetto, Manatee County, and SWFWMD have jointly and independently conducted several studies exploring the feasibility of developing a regional reclaimed water reuse system. In 2006 the City of Bradenton in conjunction with SWFWMD completed a study that analyzed the feasibility of 15 alternatives

Table PFE – 1: Reuse Flows, 2009	
Reuse Site	Permitted Flow (MGD)
Mixon Fruit Farms	0,0004 MGD
River Run Golf Club	0.2500 MGD
Tropicana Products	0.0060 MGD
In Plant Reuse	0.2500 MGD
Median Watering	0.0500 MGD
McKechnie Field	0.0400 MGD
Pirate City	0.0250 MGD
TOTAL	0.6214 MGD

Source: Bradenton Utilities, 2009

for expanding the City’s reuse system. The selected alternative was one in which the cities of Bradenton and Palmetto would interconnect their reclaimed water reuse systems via a transmission line across the Manatee River and the City of Bradenton and Manatee County would form an interconnection by extending a transmission main from the City’s storage tank near River Run Golf Links to the County’s reuse transmission main at State Route 70 (Map PFE – 3: Water Reclamation System).

2. **Biosolids:** The Bradenton Water Reclamation Facility is permitted to produce AA, A, and B grade biosolid. Currently the plant is producing high quality (AA) sludge, which is being spread

on private property in Hardee County and on a 600 acre City site (Kibler Tract).

Because of cost factors the City will switch over to producing B grade biosolid which will be transported to a licensed facility capable of accepting biosolid of this grade.

Current Wastewater Demand: In 2008, the City had approximately 15,125 single-family, multi-family, commercial and industrial customers within the City limits. Of these accounts 14,666 were active and 459 were inactive (seasonal). According to 2008 billing information from the City’s Utilities Division approximately 96% of wastewater demand is generated from the residential customers.

Table PFE – 2 summarizes the historical wastewater flows (1985 – 2008) entering the City’s treatment plant providing service to the City of Bradenton. Based on annual daily flows experienced in 2008 for the service area, the 15,125 service accounts generated demand of 5.04 MGD. Although average annual sewage flows show greater variations year to year than water demands due to the influence of rainfall and varying groundwater conditions, the general trend has been for sewage flow to track the population growth. From 1985 to 2008, The City’s population increased about 33% and the average annual sewage flow increased 49%. The per capita

sewage flow averaged 109 gpcd in 1985 and 110 gallons per capita per day (gpcd) in 2008.

Future Wastewater Demand: Bradenton’s service area basically covers the incorporated City limits within Manatee County. The service area is urban and substantially developed. Vacant land comprises a very small portion (14%) of the service area. While development of vacant land will create additional demands for wastewater services, redevelopment may also result in additional wastewater demands where new development replaces existing buildings and uses with those having higher development intensities.

Wastewater flows generally have a direct relationship with potable water flows; however, this is not true if stormwater is also processed through a wastewater system. The City of Bradenton separates waste water from storm water through the use of dedicated systems. Never-the-less the City’s wastewater flows occur at volumes less than potable water flows, since irrigation demand makes up a significant portion of the City’s potable water flow.

As a consequence of the water demand, wastewater generation relationship, future conservation measures will result in a rate of decline that is higher for per capita potable water demand than per capita wastewater generation.

- **Projected Wastewater Flows:** Based on a study conducted for the City by Jones, Edmunds & Associates, Inc., (*Evaluation of Growth and Annexation Impacts On Water and Wastewater Infrastructure, August 2005*) wastewater demand is anticipated to increase at an average annual rate of about 2.1 percent through 2030. The population projections used for this study were adjusted in 2009 to reflect the changing market conditions. The projections for 2010 were reduced by 12,490 (8.4%), 13,300 (8.3%) by 2020 and 2030 by 26,300 (7.4%) people. Wastewater flows anticipated from 2008 through 2030 are provided in Table PFE – 3. The projected flows represent future demands which are anticipated to occur at an average annual rate of 115 gallons per person. This average is derived from system-wide flows that include wastewater collected from residential and non-residential land uses.
- **Capacity Needs:** Based on anticipated demand for wastewater flows projected, sufficient capacity is available on a system-wide basis through the year 2020.
- **Level of Service:** The Level of Service (LOS) standard has been set at an annual daily rate of 115 gallons per capita. The

level of service is based on total flows for the general wastewater service area and service area population.

Impact of Waste Wastewater Facilities on Natural Environment: The City is responsible for all of the wastewater collection system within the City’s wastewater service area. Based on review of FDEP records and contact with the Manatee County Health Department, an agency of the Florida Department of Health, no substantial impacts to the natural environment have occurred in recent years as a result of failures in sanitary sewer systems. Malfunctions in the system are generally short-term and isolated overflow of effluent and when such spillage occurs within the collection system the City submits a Sewer Overflow Report to FDEP. These reports indicate the extent of the spillage and remedial actions implemented.

Table PFE – 2: Historical Wastewater Flows			
YEAR	POPULATION	AVERAGE DAILY FLOW (mgd)	PER CAPITA USE (gpd/C)
1985	36,374	3.961	109
1986	37,374	4.832	129
1987	38,027	4.109	108
1988	39,776	4.232	106
1989	40,852	3.915	96
1990	43,779	3.792	87
1991	44,554	5.272	118
1992	45,203	6.051	134
1993	46,626	5.376	115
1994	47,129	5.706	121
1995	47,679	6.240	131
1996	48,031	5.590	116
1997	48,462	6.129	126
1998	48,029	6.112	127
1999	48,472	5.596	115
2000	49,504	5.240	106
2001	49,470	5.324	107
2002	51,364	4.541	88
2003	52,498	6.696	128
2004	53,329	5.890	110
2005	53,990	5.940	109
2006	54,659	5.680	103
2007	54,409	5.370	99
2008	54,409	5.040	93

Source: City of Bradenton Public Works Department, 2009

Table PFE- 3: Future Wastewater Flows and Capacity Needs				
YEAR	POPULATION	AVERAGE ANNUAL DAILY FLOW (mgd)	2000 SYSTEM DESIGN CAPACITY (mgd)	CAPACITY SURPLUS (NEEDS) mgd
2010	56,300	6.475	7.200	0.725
2015	60,900	7.004	7.200	0.196
2020	67,000	7.705	7.200	(0.505)
2025	71,200	8.188	7.200	(0.988)
2030	74,200	8.533	7.200	(1.333)

Source: City of Bradenton Public Works Department, 2009

Potable Water Sub-Element

Centralized Water Service: The City of Bradenton owns and operates a potable water system that serves customers within the corporate limits of the City (Map PFE - 4 Potable Water Service Area). This service area is virtually identical with the wastewater system and forms a single unified and contiguous utility service area. The City does purchase finished water (0.18 MGD) from Manatee County to serve City residents on the south side of Perico Island in the far west portion of the City. This service is provided through an interlocal agreement between the City and County executed in 1983. Under this agreement the County provides water service and the City agreed to provide wastewater transmission service to Perico Island. The population served by the water system was approximately 54,000 in 2008.

The City distributes water on a retail basis; The City does not have wholesale water agreements with any customers, but it does have a wholesale water purchase agreement with Manatee County. To provide an alternative source of water, in the event of an emergency, several tie-in points exist between the City of Bradenton's and Manatee County's water distribution systems.

The primary source of water supply for the City is the Bill Evers Reservoir, located outside the City limits. The reservoir was originally developed as a water supply source in 1939 by construction of a low head dam across the Braden River. In 1986, a major expansion of the reservoir was completed which increase its size to approximately 360 acres and a storage volume of 1.4 billion gallons. In addition to the reservoir the City is

permitted to construct eleven (11) augmentation wells to supplement the surface water supply (to date only one well has been developed). The water treatment plant is permitted by FDEP to treat an average flow of up to 8 MGD and a peak flow of 12 MGD. During 2008, the average daily production rate was 5.3 MGD.

In cooperation with the SWFWMD the City has constructed an aquifer storage recovery (ASR) well to supplement the City's water supply. The City is conducting cycle testing at the ASR well and anticipates to have the well on-line by 2011.

The quality of water in the City's water supply reservoir varies considerably with the amount of rainfall and seasonal conditions. Generally, the water is of excellent quality with low dissolved solids and mineral content. The most significant problem encountered at the reservoir is the growth of algae and other plants caused by excessive nutrients, primarily nitrogen. Color removal and softening are the major treatment concerns.

Nutrients originate from urban and from agricultural land uses in the watershed of the

Braden River. The nutrients are washed into the river, adding suspended solids containing nitrogen and phosphorus, which feed plant growth. Decayed organic material washes into the water and the respiration and decay of aquatic plants depletes the oxygen in the water. Excessive nutrients can lead to a condition of "eutrophication" or aging of the water body, the ultimate result of which could clog the stream with vegetation and choke the stream. In addition, the debris in the water can clog intake structures.

Urban development of the drainage basin of the Braden River will also present new water quality problems. Bradenton is in the difficult position of having a water supply in another jurisdiction, Manatee County, where the City has no direct influence on regulating development. Development pressures are now extremely high in the watershed with residential and associated commercial developments proposed for the area west of 1-75.

The City has been working closely with the County over the past few years to review development proposals and to establish County ordinances to protect our water supply. Currently there are several mechanisms for protecting of the reservoir:

- **Ordinances:** Manatee County has two overlay districts, that regulate the watershed area.
 1. **Watershed Protection:** establishes setbacks for septic tank placement, provides that stormwater systems and mining activities will not cause receiving waters to violate water quality standards, and prohibits alteration of wetlands in the flood plain with some exceptions.
 2. **Special Treatment:** requires the use of Best Possible Technology by mining and earth-moving operations.
- **Manatee Plan:** The County's Comprehensive Plan has been amended to provide for growth management in the watershed area (termed the "Southeast Area") in the Plan. The City has included recommendations for ordinances designed to implement the Plan in the goals, objectives and policies of the Public Facilities Element.
- **Development Reviews:** The City has been closely involved in ~~the~~ reviewing ~~of~~ developments seeking approval in

the watershed. Several of the developments are large projects requiring Development of Regional Impact (DRI) review under State law. Protecting ~~of~~ the City's water supply is an important regional issue that needs to be carefully addressed by Tampa Bay Regional Planning Council in its review of DRI's.

- **Evers Reservoir Management Study:** The City Council adopted ~~the following as developed by~~ a Council-appointed committee's recommendations for managing of the Reservoir.

The primary and overriding purpose of the Reservoir is to supply potable water; management policies should be based upon protection and enhancement of this use,, and all other uses should be considered secondary and permitted only if they do not conflict with this primary purpose.

It is recommended that fishing be allowed within the Reservoir, both from land and boats.

The Florida Game and Freshwater Fish Commission should be permitted to

undertake projects within the Reservoir, provided that a ~~determination is made by~~ the Director of Public Works determines that each program is compatible with the primary use of the Reservoir as a public water supply.

Committee recommendations include:

- a) "Motor boat use should be allowed but not encouraged in the Reservoir; additional boat access facilities are not recommended.
 - b) A boating speed limit should be imposed on the Reservoir if and when it is determined necessary by the Director of Public Works.
 - c) It is recommended that water skiing be prohibited on the Reservoir because of its potential to increase turbidity by eroding banks and disturbing bottom sediments; a special purpose ordinance for prohibiting water skiing should be recommended to the Manatee County Commission.
 - d) There should be no public use of City-owned lands adjacent to the Reservoir for a period of at least three years following the completion of the reservoir expansion in order to allow
- e) Development of a passive public recreation area compatible with the Reservoir's purpose is recommended for the West Bank of the Reservoir, following a minimum three-year period. Such a recreation area would include such facilities as picnic shelters, walkways, and a Reservoir education pavilion, along with adjunct facilities as determined necessary such as parking areas, restrooms, fishing platforms, and play facilities. It is not recommended that swimming in the Reservoir be encouraged or provided for or that boat launching ramps or other intensive recreation facilities such as play fields be constructed. It is further recommended that usage of the facility be limited so that the drinking water quality is not damaged by the effects of recreational use.
 - f) The re-vegetation plan as submitted by the Division of Forestry is recommended for implementation and vegetation should be well maintained and replaced as necessary to help prevent erosion of soils into the Reservoir.
 - g) Construction of a new water treatment plant has been completed at the Reservoir site. It is further
- recommended that educational materials and/or an educational display be continued and made available to the public at the Water Treatment Plant Site regarding water quality preservation, Reservoir management, and potable water treatment and distribution.
 - h) A long-term aquatic weed control program combining mechanical and chemical methods should be developed with the advice of the state's Department of Natural Resources. Until such a program can be implemented, continuation of current methods of chemical treatment is recommended.
 - i) It is recommended that the City apply for financial assistance from the Department of Natural Resource's Aquatic Plant Control Program and that the Braden River aquatic weed control program of the Southwest Florida Water Management District be combined.
 - j) It is recommended that the City closely monitor the updating of the Manatee Plan in regard to policies for the Evers Reservoir watershed and submit recommendations and comments to the County.
 - k) It is recommended that the City provide comments and recommendations for the revision of the Manatee County Comprehensive

Zoning and Land Development Code, particularly the Watershed Protection and Special Treatment overlay district regulations.”

Service Area: The water service area of the City of Bradenton includes all of the area within the City’s corporate limits, approximately 15 square miles. The predominant land use types within the service area shown on in Table PFE-4. The Population served by the water service system was approximately 54,000 in the year 2007 with approximately 750 City residents being served by Manatee County water service.

Land Use Type	Percentage
Residential	36%
Professional/Commercial	7%
Public/Semipublic	4%
Recreation/Open Space	10%
Vacant	24%

Raw Water Supply: The primary source of raw water supply for Bradenton is the Bill Evers reservoir located about five miles east and four miles south of downtown Bradenton. The surface water supply (1.4

billion gallons) is augmented by one augmentation well with a permitted capacity of 1.0 MGD. This well is only used during the dry season to augment the reservoir supply. The City does have a SWFWMD permit to construct a total of 11 augmentation wells.

Water Treatment Facility: The water treatment plant has a permitted treatment capacity of 12.0 MGD. During 2008, the average daily production rate was 5.32MGD.

Water is pumped from the reservoir via a forebay or intake channel. Floating aerators in the forebay help increase the dissolved oxygen level and remove some of the volatile organic material from the raw water. The raw water intake is located at the end of the forebay and provides for withdrawal of water at different levels and includes a mechanical screen for removing suspended or floating materials from the water. A raw water pumping station (16 MGD capacity) pumps water to the treatment plant adjacent to the reservoir.

Treatment consists of a combination of standard chemical and physical processes, including the addition of powdered activated carbon, coagulation, flocculation, sedimentation, filtration, disinfection,

flouridation and the addition of corrosion inhibitors.

Aquifer Storage and Recovery (ASR): In cooperation with SWFWMD the City completed a feasibility study of using aquifer storage recovery (ASR) wells to supplement the City’s water supply. The availability of water from the reservoir is seasonally variable and the addition of ASR wells could balance the seasonal cycle of high water availability (low demand, low water availability) high demand. The constructed ASR well is undergoing extensive start-up testing with expected completion in 2009. If water testing is successful the City will apply for an operating permit for the ASR well (projected to occur in 2010). It is expected that the permitted ASR well will store approximately 160 MG

Regulatory Analysis and Performance: The quality of drinking water must comply with standards established by the U.S. Environmental Protection Agency (EPA) and by the Florida Department of Environmental Protection. All public water systems are required to periodically test water served to the public for contamination. The Safe Drinking Water Act, 1974, authorizes the EPA to establish water quality standards

that will ensure safe drinking water for the public. The Florida Legislature enacted a similar “Safe Drinking Water Act”, Sections 403.850 – 403.864 F.S. This statute authorizes FDEP to formulate and enforce rules pertaining to drinking water. FDEP’s rules follow the national primary and secondary drinking water standards of the federal government. Florida’s water quality standards and monitoring requirements are contained in Chapters 62-550, 62-555, and 63-560 F.A.C.

The City is required to monitor drinking water for concentrations of regulated and unregulated compounds to determine if they meet standards established by FDEP and the Safe Drinking Water Act. According to the City’s latest Water Quality Report the Bradenton water system is monitored 8 hours a day, 5 days a week, by state certified water treatment operators. Operators test the water daily to ensure state and federal water quality regulations are being met.

Water Distribution System: The water distribution system is composed of approximately 180 miles of piping varying from 2 inches to 30 inches in diameter Map PFE – 5: Potable Water Distribution System.

The piping network ranges from over 50 years old to less than 1 year old. The system is composed of cast iron, galvanized iron, ductile iron, polyvinyl chloride (PVC), and asbestos-cement (AC) pipe. The City has performed an in-depth evaluation of the distribution system and based on the age of the pipes; the location, nature, and frequency of customer complaints; and analysis of pipe samples, has developed a long-term program to replace old cast iron water mains with new piping. The City also plans to replace AC pipe and small galvanized iron water mains.

Finished water is pumped (via four transfer pumps) from the water treatment plant through two (2) separate transmission mains to the ground storage tanks at the High Service Pumping Station. The range of pumping capability of the transfer pumps is from 4 MGD (Pump 1) to approximately 13 MGD (Pumps 3 and 4 at high speed). The two ground storage tanks, located at the High Service Pump Station are prestressed concrete tanks 100 feet in diameter with a maximum liquid depth of 33 feet, 8 inches and a nominal volume of 2.0 million gallons (MG) each. In addition the City has six (6) elevated storage tanks located throughout

the water distribution system with a total storage capacity of 2.25 MG.

To provide an alternate source of water in case of an emergency, the City’s water distribution system has several tie-in points with Manatee County’s water distribution system.

Water Demand and Available Capacities

A water demand analysis was performed as part of the City’s Ten Year Water Supply and Facilities Plan completed June 2009. Most of the following information and text is from this report.

Population Growth: The population of Bradenton has increased from less than 3,000 in 1910 to over 54,000 today. During that time the City’s population has grown at an average growth rate of 3.05 percent per year.

Current Water Demands: The City’s water use permit (No. 206392.03) was issued by SWFWMD on April 28, 1998, and is a 20-year permit expiring April 28, 2018. The permit allows the City to withdraw up to an

Table PFE – 5: Historic Population and Water Use						
YEAR	POPULATION	AVERAGE DAILY FLOW (MGD)				PER CAPITA USE (gpd/capita)
		RAW WATER PUMPED	FINISHED WATER	PURCHASED FROM COUNTY	TOTAL USE ¹	
1995	47,679	5.51	5.50	0.20	5.70	120
1996	48,031	5.52	5.42	0.18	5.60	117
1997	48,462	5.91	5.86	0.19	6.05	125
1998	48,029	5.79	5.76	0.18	5.94	124
1999	46,782	5.92	5.87	0.18	6.05	124
2000	49,504	5.81	5.73	0.17	5.90	119
2001	50,250	5.43	5.33	0.16	5.49	109
2002	50,950	5.54	5.51	0.16	5.67	110
2003	53,918	5.43	5.23	0.17	5.40	103
2004	52,599	5.57	5.40	0.15	5.55	106
2005	54,303	5.80	5.52	0.16	5.68	105
2006	54,911	5.98	5.69	0.16	5.85	107
2007	54,409	5.75	5.72	0.21	5.93	109
2008	54,184	5.36	5.31	0.20	5.51	102

Source: DRAFT City of Bradenton Ten-Year Water Supply and Facilities Work Plan, May 2009

Note: (1) Finished water plus the amount purchased from Manatee County.

annual average daily amount of 6.95 MGD and a peak monthly average daily amount of 8.13 MGD. From the Evers Reservoir. In addition, an annual average of 0.22 MGD and maximum month average day amount of 1.00 MGD can be withdrawn from the augmentation well

The City withdrew 5.8 MGD on the average. This is a reduction from in a historically high withdrawal rate of 6.2 MGD (1981). The reduction is largely attributable to an water conservation rate structure instituted in 1982. Current consumption is about 100 gallons per capita per day, including a system loss of 7% to 10 % and bulk industrial and commercial use. Table PFE – 5: Historic Population and Water Use illustrates the City’s water use over time.

Water Use: The number of commercial, industrial, and other (exempt, temporary construction and sprinkler) units are expected to increase at approximately the same rate as the population. This is based on the review of the number of these units and their water use relative to the number of residential units and water use during the 10 year period from 1994 to 2003 (Ten-Year Water Supply and Facilities Work Plan, 2009 “the

Plan”). The ratio of the number of commercial, industrial and other units to residential units varied from 4.78% to 5.19% with an average of 5.0%. Water use varied during this same period from 25.2% to 27.8% with an average of 26.1% of the residential water use.

Table PFE – 6 indicates the number of units at the end of the 2008 and the average water for use each user category.

The “Plan” concluded that future water demand can be projected using total water use per capita and the projected future population.

- **Per Capita Use:** The average per capita use from 1990 through 2008 is shown in Table PFE – 7. The per capita use has dropped during the 18-year due to the implementation of a water conservation rate structure with a substantial rate increase in 1998 and 2000. Implementing additional conservation measures and increased public awareness of the need to conserve water are also believed to have contributed to the decrease in per capita use.

Table PFE – 6: Existing Water Use		
Land Use	Units	Water Usage (MGD)
Single Family	10,501	1.8554
Multi-Family	13,336	1.457
Trailer Court	1,166	0.108
Commercial	1,076	1.050
Industrial	18	0.035
Exempt (City)	96	0.197
Temp. Const.	7	0.002
Sprinkler	31	0.042

Source: City of Bradenton Utilities Division, 2009

For 2008 the recorded annual average per capita water use was 102 gallons per day (gpd/capita). To project future water demands a conservative (based on use over the past 15 years) per capita use of 115 gpd/capita is projected.

Future Water Demand: Future per capita use is expected to remain fairly constant (115gpd/capita). The 10-Year Water Supply and Facilities Work Plan (“Plan”), May 2009, indicated that the historic ratio of peak month demand to average daily demand was 1.10; therefore this ratio was used as the peak factor to calculate future peak month demands. Similarly, the Plan

established a future peak day demand of 1.40 by evaluating the historic ratio of peak day demand to annual average daily demand.

Table PFE – 7: Projected Water Use indicates the potable water demands the City will need to meet within the short and long term planning horizon. By 2015 withdrawal is projected to be at 7.0 MGD, for a service population of 60,900; for 2020, the withdrawal is projected to be 7.71 MGD for a service population of 67,000; for 2025 the with-drawal is projected to be 8.19 MGD for a service population of 71,200; and for 2030, the projected withdrawal is expected to be 8.53 MGD for a service population of 74,000.

Supply Analysis: The City of Bradenton’s water is primarily supplied from a surface water reservoir and augmented by one, 14-inch diameter well. The reservoir has a storage volume of 1,404 million gallons. Due to poor groundwater quality (high hardness, sulfates and total dissolved solids) this well is used infrequently (generally 1 day per month to exercise the well). If necessary (during drought or emergency conditions) the well could produce up to 83 million

gallons to augment the withdrawal from the reservoir.

The City's ability to supply water is based on three factors: water availability (reservoir storage volume, plus augmentation): permitted withdrawal and treatment capacity, and distribution system (lines and pumps) capacity.

The volume of raw water available to the water system is limited by the levels established in the consumptive use permit issued by SWFWMD in 1998. The consumptive use permit does not cover the planning period from 2019 to 2030. The City will apply for renewal of the consumptive use permit before that time.

The Bradenton water system currently has sufficient reservoir, treatment plant and delivery system capacity to meet water demands generated from existing customers within the City's service area. As indicated As illustrated In Table PFE – 8, the City can also meet projected water demands until 2015. In the second half of the planning period (2016 to 2030) the projected average day withdrawal rates (7.04 to 8.32 MGD respectively) will be greater than permitted under the City's

existing consumptive use permit (6.95 MGD).

The shortfall in available water is due to the storage volume of the City's reservoir. Based on a drought frequency analysis (DRAFT 10 - Year Water Supply and Facilities Work Plan, 2009) the City of Bradenton will require an additional storage capacity of approximately 755 million gallons by 2030 (Table PFE – 10).

The City's has already begun the design of a 755-million-gallon upland, off stream, storage reservoir to expand raw water storage. The storage capacity of this planned reservoir is based on exceeding the 2030 water demand projections. The City and SWFWMD also decided not to rely on the planned ASR well nor existing augmentation well to supply water during a severe drought. Thus the design capacity requirements shown in Table PFE – 8 reflect this decision.

The design of the expanded reservoir is underway (90% Plans completed). It is expected that permitting will be completed in mid-2010 and construction starting in the later part of 2010.

Table PFE – 7: Projected Water Use						
YEAR	PROJECTED POPULATION	FINISHED WATER USE (MGD)		RAW WATER PUMPED (MGD)		
		TOTAL ⁽¹⁾	PURCHASED FROM COUNTY ⁽²⁾	AVERAGE DAY ⁽³⁾ PUMPED	PEAK MONTH ⁽⁴⁾ PUMPED	PEAK DAY ⁽⁵⁾ PUMPED
2010	56,300	6.47	0.20	6.42	7.06	8.99
2015	60,900	7.00	0.23	6.93	7.63	9.71
2020	67,000	7.71	0.36	7.52	8.27	10.52
2025	71,200	8.19	0.39	7.95	8.78	11.17
2030	74,200	8.53	0.40	8.32	9.16	11.65

Source: *City of Bradenton Ten-Year Water Supply and Facilities Work Plan, May 2009*

- Notes:
- (1) Projected Population X 115 gpd/capita
 - (2) Water purchased from County to supply City residents/businesses on Perico Island.
 - (3) Total water use – amount purchased from Manatee County + 2.35% treatment loss.
 - (4) Average day X 1.10
 - (5) Average day X 1.40

TABLE PFE – 8: RESERVOIR EXPANSION REQUIREMENTS			
YEAR	PROJECTED DEMAND (MGD)	REQUIRED CAPACITY (MGD)	REQUIRED ADDITIONAL CAPACITY (MGD)
1990	5.34	1,381	-23
1995	5.51	1,452	21
2000	5.82	1,505	101
2005	5.80	1,500	96
2010	6.42	1,660	256
2015	6.93	1,792,	388
2020	7.52	1,944	540
2025	7.98	2,063	659
2030	8.32	2,151	747

SOURCE: 10-Year Water Supply and Facilities Work Plan, 2009

Water Conservation and Reuse

Practices: The following conservation and reuse practices and regulations are used by the City of Bradenton:

1. The reclaimed and reuse water facility has a permitted capacity of 9.0 MGD annual average daily flow. The system has two, 2.0 MG ground storage tanks and ancillary pumping stations. Due to various factors however, a number of the heavy reclaimed water users discontinued their reclaimed water use. Consequently, the full permitted expansion of the reclaimed/reuse water system has not taken place. The current level of reuse of reclaimed water is approximately 0.62 MGD
2. In 2006 the City of Bradenton in conjunction with SWFWMD completed a study that analyzed the feasibility of expanding the City's reuse system. The selected alternative was one in which the cities of Bradenton and Palmetto would interconnect two reclaimed water reuse systems via a transmission line across the

Manatee River and the City of Bradenton and Manatee County would form an interconnection by extending a transmission main from the City's storage tank near River Run Golf Links to the County's reuse transmission main at State Route 70.

3. The City of Bradenton has adopted a water conservation rate structure for its utility system.
4. Chapter 300 of the Bradenton Code of Ordinances includes landscape regulations. Native and xeriscape plants are encouraged and organic mulch is required around trees in turf grass areas.

Natural Groundwater and Aquifer Recharge:

Drinking water for City residents is supplied from a surface water reservoir outside the City limits. The sole use of groundwater in the City is irrigation for landscaping in private developments.

According to the *Groundwater Resource Availability Inventory, Manatee County, Florida* prepared by the Southwest Florida Water Management District (SWFWMD) (March 1988), the surficial, intermediate, and

Floridan aquifers have poor quality water in the coastal areas, and areas close to tidally affected streams. Much of the area within the City limits is considered coastal, where groundwater is highly mineralized.

SWFWMD identifies areas suitable for future groundwater supply development in Figures 45, 46, and 47 of the report referenced above. Regarding the water supply potential of the intermediate aquifer system, the entire geographic area of the City of Bradenton is classified as "least suitable." The potential of the upper Floridan and surficial aquifers is "least suitable" in the western portion of the City and "less suitable" in the eastern portion.

Solid Waste Sub-Element

Garbage and trash are generated by population and development within the City of Bradenton. To protect the health and safety of residents and property, solid waste collection and disposal services are provided to the City's residents and businesses. The City provides a comprehensive solid waste collection program for all residents and

businesses requiring containerized trash pickup.

Regulatory Analysis: In 1988 the Florida Legislature passed the Solid Waste Act (SWMA) requiring Florida’s counties to reduce the amount of solid waste disposed of at landfills. The SWMA forced county solid waste management programs to achieve a reduction of 30% in the weight of solid waste being sent to landfills by December 31 1994. To achieve this goal, all construction and demolition debris, and most newspaper, aluminum cans, glass and bottles must be separated and made available for recycling. Separation of plastics, other metal, other paper and yard trash is also encouraged by the Act.

The Solid Waste Management Act also prohibits disposal of certain materials at Class 1 landfills. Solid waste materials that cannot be permanently disposed at landfills are yard waste, tires, white goods (major appliances), batteries, used oil and oil based paints.

To meet the requirements and goals established by the SWMA, Bradenton established a solid waste program that separates garbage, large and bulky items, such as white goods, recyclables, and yard waste. Used oil and hazardous wastes must also be properly separated and disposed of. Manatee County administers programs addressing the collection and proper disposal of used oils and hazardous wastes.

Solid Waste Collection: The mandatory solid waste collection service provides twice-weekly residential garbage service, approximately 70% at curbside and 30% at backyard collection points. Commercial pickup frequently is geared to need, from twice-weekly to five times weekly, and schools are serviced four times a week. Waste collection services are provided by the City’s Solid Waste Division.

For large or bulky items that cannot be accommodated by trash containers, single-family residential customers are given designated dates during the year. A fee may be charged for collection of

large or bulky items discarded outside of the designated dates

According to the Solid Waste Division an average of 21,637.46 tons is collected from residential customers and 14,165.64 tons from commercial customers per year within the City. Combining the tonnage from the two customer sources, and annual average of 35,803.10 tons is collected within the City. This does not include recyclables and yard waste. Based on a 2008 population of 54,184 an average of 1321.5 pounds per year is generated on a per capita basis.

Future Solid Waste Demand: Table PFE – 9 lists the current and estimated future solid waste generated within the City. Future estimates are based on a per capita rate applied to anticipated future population. This amount will increase up to 255 tons of waste per day or 16% of the established daily capacity by 2030. According to Manatee County there will be enough capacity to serve the City’s needs until March 2025, the end of the lifecycle of the landfill.

Table PFE – 9: Projected Tonnage of Solid Waste				
YEAR	POPULATION	LEVEL OF SERVICE (Lb./Capita)	TOTAL POUNDS	TOTAL TONS
2010	56,300	1,321.5	74,400,450	37,200
2015	60,900	1,321.5	80,479,350	40,240
2020	67,000	1,321.5	88,540,500	44,270
2025	71,200	1,321.5	94,090,800	47,045
2030	74,200	1,321.5	98,055,300	49,028

1. **Yard Waste:** The City collects lawn debris and other yard waste are collected once a week from residential dwellings and commercial establishments. This collection service also includes the pickup of discarded Christmas trees. According to the Solid Waste Division the City averages about 7,418 tons per year in yard waste collection.

2. **Recyclables:** Recyclable materials include newspapers, glass bottles, metal cans (aluminum and tin), plastic containers, and similar material that are being recycled. Special containers are used to separate recyclables from garbage and yard waste. The City provides recycling collection services for single-family dwellings at the curbside on public streets or from other specifically defined location approved by the City. According to the Solid Waste Division about 1,757.20 tons of recyclable material is collected per year.

3. **Hazardous Waste and Petroleum:** The City does not collect household

hazardous waste and petroleum products are not collected by the City of Bradenton. Bradenton residents can take these waste materials to Manatee County facilities which are at 3035 Lena Road, East Bradenton and 4410 66 Street, West Bradenton

Level of Service: Based on the average annual tonnage of solid waste collected and transported to landfills for disposal, the City's level of service for solid waste collection and disposal is 1,321.5 pounds per year per capita, equivalent to an annual daily average of 3.62 pounds per capita. This level of service does not included separately collected recyclables and yard waste.

Solid Waste Disposal: The City currently contracts with Manatee County to dispose of all collected solid and yard waste collected in Bradenton. The Manatee County landfill, located on Lena Road about 9 miles east of the City, is a solid waste disposal facility approved by the Florida Department of Environmental Protection. The landfill which opened in October, 1993 has 330 acres and receives approximately 1,400 tons of garbage every day. As 2009, the City is using

approximately 10% of the established daily capacity.

The interlocal agreement with Manatee County allows the City to use the facility for disposal of solid waste and yard waste.

Stormwater Sub-Element

The primary purpose of the Stormwater Drainage Sub-Element is to establish goals, objectives and activities to protect future water quality and quantity. Data used in the preparation of this element is extracted from the City's Stormwater Management Plan. This Plan is available in the City of Bradenton's Department of Public Works.

The City of Bradenton has become one of the leading communities in Florida in addressing the impacts of stormwater drainage. This is accomplished in part through the City's stormwater Stormwater Management Program which is funded through monthly stormwater fees. This program facilitates an improvement in terms of mitigating local flooding issues., and in funding stormwater drainage improvement projects that will improve water quality of drainage (direct and

indirect) into the Manatee River. In addition to its stormwater drainage ordinance the City also enforces the requirements for permitting by the SWFWMD as a prerequisite for all new construction and redevelopment projects.

The approximately 14 square miles of land area in the City of Bradenton drain into the Manatee River, the County's largest water course, directly or through tributaries, including the Braden River and Wares Creek, and into Palma Sola Bay via the Cedar Hammock Drainage Canal (Map PFE – 6: Storm Drainage Areas).

The predominant types of land use served by the City's drainage facilities are illustrated in Table PFE – 10.

Table PFE – 10: Land Uses Served By Drainage Facilities	
Residential	58%
Professional/Commercial	12%
Public/Semipublic	4%
Industrial	1%

NOTE: 12 % of the land is vacant and 13 % is recreation and open space

The topography of the land, sloping from the southeast to north and west divides the City into three drainage study areas: Wares Creek, Cedar Hammock Drainage Canal, and East Bradenton area.

In addition to the continuing need to replace and expand the City's storm drainage facilities, the City jointly responsible, with Manatee County, for two major drainage features - Wares Creek and Cedar Hammock Drainage Canal. In 2009 the City gained final state and federal approval and funding for the Wares Creek dredging project. The project is expected to increase drainage capacity and to reduce potential flooding within the City during storm events.

- **Regulatory Analysis:** Federal laws have been the primary impetus for much of the state and local initiatives to protect the environment. Many laws have a direct impact on stormwater quantity and quality while other have an indirect effect. Below are listed the federal, state and local laws that affect the City are listed below:

Federal Laws:

1. **The Water Pollution Control Act (Clean Water Act):** This law was instrumental in the 1970s for implementing of several programs to assess the environmental impacts from wastewater treatment (Section 201) and point and non-point sources (Section 203). The law also established objectives for water pollution abatement (Section 101) and standards for water quality of effluent discharge for sewage treatment plants (Section 301). The most important outcome was the establishment of the National Pollution Discharge Elimination System (NPDES) permit (Section 402) which requires permits for all discharges of polluted waters. Also this Section laid out dredge and fill wetland responsibilities for EPA and the Army Corps of Engineers (Section 404).
2. **The Safe Drinking Water Act:** This law sets standards for drinking water quality. The law also sets out to protect potable water sources by implementing state wellhead protection programs and controlling

underground injection of polluted waters. Additional protection of aquifers is accomplished through the “Sole Source Aquifer” designation.

3. **The National Flood Insurance Program:** This program identifies areas of the 100- and 500-year floodplain. The program requires sound land-use planning to minimize potential flood damage.

State Laws:

1. **Chapter 163, Intergovernmental Programs, Local Comprehensive Planning Act:** This Chapter requires each local government to adopt a comprehensive plan which must contain required elements, studies and surveys. A drainage and aquifer recharge element is one such element.
2. **Chapter 373, Water Resources Act:** This act provides for the conservation, protection, and management of State waters. It provides the legislation for the creation of the Florida Department

of Environmental Regulation (FDER), the Water Management Districts (WMD), and pertinent county and city programs. Further, Section 373.451 established the Surface Water Improvement and Management Act (SWIM). This legislation is resolving and correcting surface water pollution problems. Also, it contains the State Water Resource Plan, provides for the permitting of consumptive uses of water, the regulation of wells, and the management and storage of surface waters.

3. **Chapter 380, Land and Water Management Act:** This legislation was enacted to establish land and water management policies to guide and coordinate local decisions relating to growth and development. The law set up areas of critical concern, sets policies and procedures for Developments of Regional Impacts and, the Florida Quality Developments Program, and established the appeal procedure through the Florida Land and Water Adjudicatory Commission.

4. **Chapter 403, Environmental Control Act:** This act has direct impact on stormwater management. The act sets water quality standards and policies for pollution control, resource recovery and management, environmental regulation, drinking water, and permitting activities in wetlands.
5. **Chapter 64E - 6, Florida Administrative Code (F.A.C.):** This chapter enables the county health departments (an extension of the Florida Department of Health) to regulate septic tanks and private wells.
6. **Chapter 62, F.C.A.:** This chapter is important as it relates to drainage and aquifer recharge, public wastewater treatment facilities, public water treatment systems, and reclaimed water systems. It also provides the rules and regulations of the FDEP and the SWFWMD. It gives the Department the power to invoke building moratoriums if wastewater plants are not operating efficiently. The legislation requires permits for stormwater management systems

and for dredge-and-fill activities in any waters of the state including wetlands. Section 62-302 sets surface water quality standards.

Section 62-600, Domestic Wastewater Facilities; Section 762-601: Domestic Wastewater Treatment Plant Monitoring; Section 62-620: Wastewater Facility and Activities Permitting: These sections regulate wastewater treatment and monitoring.

Section 62-312, Dredge-and-Fill Activities: This section requires FDEP permits for these types of activities.

Section 62-550, Water Treatment Facilities, Drinking Water Standards, Monitoring and Reporting; and Section 62-555, Permitting, Construction Operation, and Maintenance of Public Water Systems. These sections set forth the requirements for domestic wastewater facilities.

Section 62-610, Reuse of Reclaimed Water and Land Application; and

Section 62-730, Hazardous Waste: These sections address the requirements of Reclaimed Water Facilities.

7. **Chapter 40 F.A.C., Waste Management Districts:** This chapter sets out the administrative requirements of Waste Management Districts. The main duties of the WMD's are to approve stormwater management systems, issue consumptive-use permits, and to give technical assistance. Wetland jurisdictional claims are also a part of the District's duties in approving stormwater management plans. Section 62-340 establishes definition and wetland delineation methodology for wetlands, while Section 62-345, addresses the mitigation requirements for wetland impacts.

- **City Ordinances:** City codes and regulations applicable to stormwater management and drainage are listed below. The following regulations and standards do not include those set forth within the Goals, Objectives, and

Policies of the City of Bradenton Comprehensive plan.

1. **Chapter 70, Article V:** This chapter is the City's stormwater management ordinance of the City of Bradenton Code of Ordinances. This code establishes stormwater criteria for all new construction as well as a "retrofit" provision for development and renovation throughout the City. The requirements include on-site stormwater management systems for all new construction (buildings and parking lots). These systems must be constructed as prescribed by the Southwest Florida Water Management District (SWFWMD).

This chapter also contains the City ordinance that creates the Stormwater Utility with adopted service charges and the method for computing such fees. Each of the parcels within the City limits is charged a user fee for use of the City-wide storm water management system. All fees are deposited to the Stormwater Fund (enterprise fund) which is specifically dedicated to fund the maintenance of the

drainage systems and to construct new capital improvements projects aimed at stormwater abatement.

Inventory, Maintenance and Existing

Programs: A complete set of stormwater maps can be found in the Department of Public Works offices at 1411 9th Street West, Bradenton. These maps depict all drainage pipelines, inlets, manholes and river outfalls; pipe sizes, surface lid elevations and invert elevations are given. The Public Works Department routinely updates these maps when new areas are annexed and when projects modify existing configurations. The maps are considered accurate and have been maintained as such.

A number of localized drainage areas exist in street or intersection areas where flooding occurs after heavy rainfalls. While other problem drainage situations occur from time to time, they are primarily the result of clogged stormwater inlets.

As part of the updated *Comprehensive Storm Water Management Study, 1986*, capital improvements have been and will continue to be undertaken to

reduce/eliminate drainage problems in the City.

Bradenton contains a portion of the Wares Creek and the Cedar Hammock Drainage Canal and shares responsibility for these two major drainage features with Manatee County. Both of these features act as primary drainage systems and are an essential route for drainage during an extreme rainfall event such as a tropical storm or hurricane. These drainage areas is as follows.

1. **Wares Creek:** Wares Creek drains land in Manatee County lying to the south and east of the City and enters the City limits at 26th Avenue West. The creek drains the central portion of the City, approximately one-third of the City's land area.

Wares Creek is an improved watercourse, which means that each reach of the stream is either a dug ditch or a walled estuary. It is essentially an engineering structure suffering from deferred maintenance and is subjected to flood waters beyond the limits of its

original design. Alignment of the stream through the City is well-defined and not subject to major change.

At the 14th Avenue Bridge, eddy currents indicate the upper end of the tidal effect. South of the bridge, bank growth is thick and luxuriant, overgrown with vines. The channel here is circuitous but clearly defined. For these reasons, 14th Avenue is considered the southern boundary of the lower basin.

The confluence of the creek with the Manatee River is estimated to be 200 feet north of Manatee Avenue, where surface and subsurface movements of the waters over the normal tidal range appear to be wholly determined by the stage of the river.

North and south of the 12th Avenue Bridge along the east bank there are short stretches of concrete wall, but these are disconnected and in each case end at individual property lines.

The lower basin (north of 14th Avenue) is for the most part confined within retaining walls, usually low, unobtrusive and in poor condition. In some cases in the upper portions of the basin, property owners have filled in front of existing walls, and narrowed, and deepened the channel.

The wall along Virginia Drive is reported to have been constructed by the City, although title may rest with the owners of the upland lots. Surcharging by traffic along Virginia Drive has fractured this wall in many places with outward displacement toward the stream. This is particularly true of the section of wall between the 8th and 9th Avenue bridges.

North of Manatee Avenue, the wall on the east bank was cast in place with tie blocks on approximately 30-foot centers. Openings for drainage are placed just below the integrally cast cap. On the West Bank, the wall appears to be cast of shell concrete, founded on wooden pin piles with stone rubble facing.

The stream lying south of 14th Avenue is termed the *upper channel*. This section was developed as a portion of the old Cedar Hammock Drainage District, with 17th Avenue shown as the northern limit on the old district maps. By action of the state legislature in 1961, the drainage districts of Manatee County outside the boundaries of the municipalities were made a single drainage district.

South of 14th Avenue trees 4 to 8 inches in diameter are growing on the banks of the creek and heavy cane growth characterizes the bank condition on both sides of the reach extending from 17th to 18th Avenues. Aquatic growth on the bottom here indicates extended periods of slack water. This type of growth results in extremely high friction losses and a decrease in the capacity of the stream. Trees of relatively large diameter (12 to 14 inches) characterize the main stream of Wares Creek outside the City limits south to Cortez Road. South of that point, the stream is shallower,

straighter, and not so heavily overgrown.

Extensive siltation has occurred in the lower basin of the creek because of erosion in the upper basin. During storms the velocity of the water in the upper basin erodes the banks and carries material downstream where it settles in the lower basin where the creek is wide and slow. Much of the siltation took place as the result of major storms in 1944 and 1962, but erosion and deposition is a regular occurrence even in moderate storms.

As an improved natural watercourse, Wares Creek is a major drainage outlet for much of the City as well as for a large area outside of the municipal limits. The basic requirement of the stream is that it should be able to convey safely a flood of major proportions without damage to itself or adjacent property.

At present the floodplain of the creek as determined by the Federal Emergency Management Agency is

extensive because of the configuration of the stream, the extensive siltation which has taken place, particularly in the lower basin south of Manatee Avenue, and because of tidal influences. With the increased intensity of land development within the City and, of equal importance, the change in the character of the drainage basin in the County from rural to urban and suburban, the intensity of rainfall and subsequent storm flow has increased greatly. In addition, the removal of natural vegetation during the development of property has resulted in sheet erosion with considerable amounts of silt being transported downstream.

Dredging of the creek and improvements to the stream bed and banks are needed to improve Wares Creek's drainage capacity. Prevention of erosion of the channels can be accomplished by increasing the cross-sectional area of the stream, decreasing the volume of water to be handled or lining the channel so that high

velocities may be tolerated without transporting sand. The U.S. Army Corp of Engineers is planning a project for such improvements. The work should take place in 2002-2010.

2. **CEDAR HAMMOCK CANAL:** Cedar Hammock Canal is an improved watercourse, which flows from approximately 32nd Street West at Cortez Road westward to Palma Sola Bay. The canal runs through portions of the City and the County. Its alignment is well defined and not subject to major changes.

There are 7 bridge crossings on the Cedar Hammock Canal. The bridge on Palma Sola Boulevard is a multiple-span concrete bridge with a total opening of 62 feet. The bridges at Alhambra and 75th Street West are pre-stressed concrete with 30-foot openings. At 59th, 51st, and 43rd Streets are metal arches of varying sizes. The structure at Southern Parkway is a large-diameter metal pipe.

From its source to 47th Street West, the Canal is best described as a long

narrow lake, 20 feet wide and about 5 feet deep. From 47th Street to 75th Street West the Canal increases in depth from 10 feet to 20 feet. The Canal widens to over 100 feet west of 75th Street and varies in depth from 5 feet to 15 feet. The Canal in this area is heavily overgrown.

The Canal is currently maintained by Manatee County, although much of it is within the City limits.

3. **EAST BRADENTON DRAINAGE AREA**
East Bradenton can be divided into nine sub-drainage areas, which are drained primarily by pipes of less than 72 inches in diameter. Although there are existing open ditches in East Bradenton, these ditches are small enough so that they could be piped.

Most of East Bradenton consists of older, established neighborhoods. In these areas, the installation of major trunk lines is needed and the replacement and upgrading of existing storm drainage systems are needed.

The northeast area, adjacent to the Braden River, is the most poorly drained area of East Bradenton. Drainage consists almost entirely of poorly maintained open ditches.

Bradenton has implemented the flood control program initiated by the U.S. Corps of Engineers and the H.U.D. Flood Insurance Administration. The City initially adopted floodplain regulations consistent with their requirements in 1981 and has updated it to remain concurrent.

Areas within the City are subject to flooding from a hurricane or some other 100-year storm. To reduce the number of properties impacted by flooding, the City has been very active in two FEMA programs administered by FDCA – Flood Mitigation Assistance Program and Severe Repetitive Loss Program. Since 2001 the City has received \$1.5 million in grants from these programs to flood proof 10 projects. Currently (2009) the City is working with 4 project applicants for grant funding.

The City uses a vactor-like truck to clean and maintain inlets, manholes, and drainage pipe. Contractors are occasionally hired to clean drain lines of a heavy buildup of sand. Many of the drainage systems throughout the City are starting to deteriorate due to age; repairs and replacement are conducted on yearly basis.

Street sweeping is a fully funded program that sweeps all City streets weekly. Pollution control benefits include the removal of sand, grit, and dust that reduces sediment volume to the Manatee River with a corresponding reduction in heavy metals and phosphorus.

Existing Levels of Service: *Level of Service* (LOS) is defined as the capacity per unit of demand for a public facility, usually expressed in terms of a per capita per day or land-use unit per day. Stormwater runoff measurements however, are not expressed in these terms, but can be stated by a design storm condition. This requires the selection of a storm frequency and duration factor such as a 5-year/3-hour storm. This translates into rain intensity per hour over so many hours to yield a rain volume. This 5-

year/3-hour storm produces 2 – 6 inches of rain per hour for three hours yielding 7 – 8 inches of rain for the storm. If this example was used for design criteria, a project under consideration would be designed to retain, detain, or convey the volume of rain and resulting runoff.

The City of Bradenton has been developed under two sets of design criteria. Most of Bradenton was developed before stormwater management requirements were implemented. It was not until mid-1980s that the City established requirements for retaining, detaining and conveying runoff, furthering refining these requirements in 1996 to meet the requirements of NPDES.

As a result, the old guidelines did not require any on-site retention or detention or runoff. It appears that during this time the conveyance systems were designed for the 2-year/1-hour storm. However, as sites are redeveloped they must be “retrofitted” to meet SWFWMD and City requirements for on-site retention, detention and conveyance of stormwater. Thus, as more properties are “retrofitted” and more retention is developed in the watersheds of

the City the conveyance capacities of old systems will improve.

Today, the level of service standard adopted by the City for new development or redevelopment is for the design of drainage facilities and the retention and treatment of the first inch of stormwater. Specifically this means:

1. Peak discharge rate from new development or redevelopment shall be equal to or less than the peak discharge rate that existed prior to development on a 25-year frequency, 24-hour duration storm event;
2. Trunk storm sewers and major drainage channels shall be designed to accommodate the maximum stormwater resulting from a design storm of 25-year frequency, 24-hour duration without flooding;
3. Internal or on-site drainage facilities or developments shall be designed to accommodate the stormwater resulting from a design storm of 10-year frequency, critical duration,

based on the project site's time of concentration.

This is consistent with the requirements of Section 62-302, F.A.C.

Natural Groundwater Aquifer Recharge

Drinking water for City residents is supplied from a surface water reservoir located outside of the City limits. The sole use of groundwater in the City is irrigation for landscaping in private developments.

According to the Groundwater Resource Availability Inventory, Manatee County, Florida prepared by the Southwest Florida Water Management District (SWFWMD) (March 1988), the surficial, intermediate, and Floridan aquifers have poor quality water in the coastal areas, and areas close to tidally affected streams. Much of the area within the City limits is "coastal" where groundwater is highly mineralized.

SWFWMD identifies areas suitable for future groundwater supply development in Figures

45, 46, and 47 of the above referenced report. Regarding the water supply potential of the intermediate aquifer system, the entire geographic area of the City of Bradenton is classified as "least suitable." The potential of the upper Floridan and surficial aquifers is "least suitable" in the western portion of the City and "less suitable" in the eastern portion.

Water Supply Facilities Work Plan

The Florida Legislature enacted bills in 2002, 2004 and 2005 to more effectively address the state's water supply situation by improving the coordination between local land use planning and water supply planning. The focus of the 2002 legislation was to add requirements to Chapter 163, F.S., for local governments to prepare 10-year water supply facilities work plans and to incorporate certain portions of the work plans into their comprehensive plans. This legislative change emphasized the need for local work plans to consider the applicable regional water supply plans prepared by the water management districts. In 2004, the Legislature further amended Chapter 163 to

give local governments until December 1, 2006, to prepare the 10-year water supply facilities work plans,

In 2005, the Legislature enacted Senate Bills 360 and 444. The legislature significantly changed Chapters 163 and 373, F.S., to improve the coordination of water supply and land use permitting. The legislation strengthened the statutory linkage between regional water supply plans prepared by water management districts and comprehensive plans prepared by local governments.

The City of Bradenton's *Updated Water Supply Facilities Work Plan, May 2009*, provides the City's response to the current legislation and establishes planning time frame of 20 years (2010 – 2030) which is consistent with the comprehensive plan.

Background Data: The City of Bradenton (except for a small area- Perico Island - served by Manatee County through an interlocal agreement) is the only entity responsible for water supply in its jurisdictional area. The City has a consumptive use permit(No. 206392.03) for the period from April 28, 1998 to April 28, 2018.

The City's water system serves retail customer groups within the City limits, except for customers on Perico Island . Under an interlocal agreement with Manatee County, the County provides water service to retail customer groups on the island.

The potable water demand projections identified in Table PFE – 7, are lower than those presented by SWFWMD. The population projections used by the City of Bradenton to develop the water demand projections are based on a reevaluation of recent development trends , vacant land within the City and potential annexations. In the opinion of the City these projections represent a more realistic projection of future conditions.

Only a portion of the wastewater collected by the City is reused. The City's initial reclaimed water transmission system was completed in 1994 and included the construction of a reuse pumping station and an 18-inch diameter transmission main from the treatment plant to a 3.0-million-gallon ground storage tank. In 2001 the City completed an expansion of the reclaimed water system by constructing another 2.0-million-gallon ground water storage tank

and pumping station. The City is currently supplying 0.6214 MGD of reclaimed water for irrigation (see Table PFE – 1).

The City has three sources of water. The first is the Bill Evers Reservoir which pulls water from the Braden River and is used for potable water purposes. The City has also purchased an average of 0.17 MGD (over the past 10 years) from Manatee County under an interlocal agreement. It is projected that the development potential of the service area will require an annual average daily amount of 0.40 MGD, which is below the 0.50 MGD average daily reserve capacity of the agreement. The second source is the City's water reclamation facility which provides 0.6214 MGD of reuse water for irrigation (see Table PFE – 1).

Based on a *20-year drought frequency analysis model*, the City has exceeded recommended storage capacity since 1995.. Using a 20-year drought frequency analysis it was determined a 755 million gallon upland, off stream storage reservoir would be needed. Table PFE – 8 illustrates past storage capacity shortages, and future, storage capacity needs. The storage reservoir is currently being designed and is part of the City's CIP. The City, in

conjunction with SWFWMD, decided not to rely on the planned ASR nor on the existing augmentation well to supply water during a severe drought.

Conservation and Reuse: As described in the City's *Draft Water Supply and Facilities Work Plan, 2009*, the City of Bradenton's conservation program has proven to be very effective in that the City has experienced a drop in total water use of 8% from 1982 to 2008. During the same period the City has seen a "served population" increase of over 61% while the per capita water use has dropped from 178 gpd/capita to 102 gpd/capita.

The implementation of a conservation oriented rate structure in conjunction with rate increases in 1982, 1998, and 2000 is believed to be the primary reasons for the significant drop in per capita flow. Other City water conservation efforts include:

1. A leak-detection program that provides free inspections of private homes plus participation in a cooperative program with SWFWMD to detect and repair leaking pipes

and fittings in the water distribution system;

2. A water main replacement program to replace old cast-iron and small galvanized-iron water mains in the water distribution system;
3. A wastewater reuse program which provides reclaimed water for irrigation;
4. Enforcement of SWFWMD's water conservation rules and water shortage orders;
5. A water meter testing and replacement program in which all meters are tested and/or replaced every 5 years.

The City has also implemented a Water Demand Management Plan which defines the phases and conditions of a water shortage for the City's water supply system and establishes restrictions that will apply for each phase.

Compatibility with Regional Water Supply Program: As described in the draft water supply and facilities plan, the City of

Bradenton lies within the most impacted area of the Southern Water Use Caution Area (SWUCA). This designation resulted from the impacts of ground-water withdrawals (i.e. saltwater intrusion limiting potable water) on the areas water resources. Regional Water Supply Plan (RWSP) was completed by SWFWMD in 2001 and updated in 2006. The 2006 RWSP update used a planning period that was from a base year of 2000 through 2025.

The water supply strategy presented in the City's Water Supply and Facilities Work Plan is compatible with the recommendations of the latest RWSP. In general, the recommendations are:

1. Optimize and maximize development of surface-water sources. *The City's first priority strategy is to maximize the use of the Bill Evers reservoir by constructing an upland, off-stream reservoir to increase raw water storage capacity.*
2. Increase efficiency and utilization of reclaimed water. *The City has implemented reuse of reclaimed water in 1994 and is working with*

the City of Palmetto and Manatee County in planning a regional reuse system.

3. Research advanced technologies such as ASR. *The City has constructed a treated water ASR which is currently undergoing cycling testing. The City has also constructed an exploratory well near the reservoir for possible use in a partially treated surface water ASR system. These facilities were constructed with cooperative funding from SWFWMD. As a result of arsenic mobilization from the underground formation at the treated water ASR site degasification equipment has been installed and is being tested. Since the outcome of this effort has statewide significance it is being funded by the City, SWFWMD, South Florida Water Management District, St. Johns River Water Management District, and Peace River Manasota Regional Water Supply Authority.*
4. Expand demand measures, *The City's Water Demand Management*

Plan was prepared through the assistance of SWFWMD,

5. Develop and coordinate regional water supplies. *The City is a partner in the Water Planning Alliance, a voluntary planning body formed to work together on regional water issues. Member include, Charlotte, DeSoto, Manatee and Sarasota Counties; the Cities of Arcadia, Bradenton, North Port, Palmetto, Punta Gorda, Sarasota and Venice; the Town of Longboat Key; and the Englewood Water District.*

Facilities Analysis: The City's 5-year Capital improvement program for public works and utilities projects is presented in the CIP Element. This program is updated annually as part of the City's budgeting process and will be updated to incorporate the 10-year Work Plan summarized as follows:

1. Braden River Watershed Management Plan: The Surface Water Resource Assessment portion of the WMP has been completed in cooperation with SWFWMD, Manatee County, and Sarasota County. The jurisdictions need to

complete the watershed evaluation and the watershed management plan.

2. Reservoir Expansion Project: The City has obtained cooperative funding from SWFWMD and completed Phase 1 in 2007. This phase included completion of the boundary and topographic survey, preliminary geotechnical exploration, and preparation of a preliminary design report. Phase 2, Design and Permitting began in June 2008 with construction of the project scheduled to begin in 2010.
3. Potable ASR Project: Seven cycle tests of the ASR well have been completed with testing indicating favorable conditions for the feasibility of the project. Arsenic has been detected in recovered water at levels exceeding newly established standards. Degasification equipment has been installed and tested. Additional testing is planned to confirm the effectiveness of the degas system for reducing the arsenic concentration in recovered water.

4. Reclaimed Water System Expansion: A reuse feasibility study was completed in 2006 which identified potential customers in the Bradenton area and evaluated alternatives for extending service to them. The selected alternative from the study was to develop interconnections with the City of Palmetto's PARS and Manatee County's MARS reuse systems. Detailed interconnection studies are being prepared to define the feasibility and costs of constructing the proposed facilities.
5. Water Treatment Plant Rerating: Complete construction of an in-plant CT tank and expansion of chemical storage and feed facilities as stipulated by the FDEP re-rating permit.
6. Sixteen-inch Transmission Main Replacement Projects: Replace approximately 2,300 feet of main in 2nd Street West, south of the high service pump station, with new 24-inch pipe.

7. Water Main Replacement Program: Replace approximately 4,200 feet of old 6-inch water main with 12-inch pipe in Manatee Avenue between 1st Street West and 15th Street West.
8. Downtown Area Water Main Replacement Project: Replace approximately 15,500 feet of old cast iron water mains in the downtown area of the City.
9. Northwest Area Water Main Replacement: Replace approximately 35,900 feet of old cast iron water mains in the northwest area of the City.
10. East Area Water Main Replacement Project: Replace approximately 22,700 feet of old cast iron water mains in the area east of 1st Avenue.
11. Southwest Area Water Main Replacement Project: Replace approximately 40,500 feet of old cast iron and small galvanized iron water mains in the southwest area of the City.
12. Seabreeze Area Water Main Replacement Project: Replace

approximately 18,700 feet of undersized water mains.

13. Asbestos Cement Water Main Re[placement] Program: Replace approximately 18,700 feet of asbestos cement water mains.

Concurrency Management System

The Growth Management Act, and all local government comprehensive plans prepared in conformance with the Act, require that public facilities and services necessary to support the proposed development occur concurrent with the impacts of such development. Policies throughout this Comprehensive Plan require that the issuance of development orders be contingent upon the availability of adequate public facilities at acceptable levels of service. Successful, implementation of such policies however, will depend on review and monitoring procedures established by the City.

The City of Bradenton, like all other local governments in the State of Florida, must ensure that certain public facilities and

services needed to support development are available at the time the impacts of development occur.

It is the Concurrency Management System which will ensure that the impact of development will not degrade the levels of service adopted in the City of Bradenton's Comprehensive Plan for public facilities and services.

Concurrency Review: The City therefore requires a concurrency review be made with applications for development approvals and a Certificate of Concurrency issued prior to development. If the application is deemed concurrent, a Certificate of Concurrency will be issued by the Planning and Development Department. If the project requires any other development permit, a copy of the Certificate of Concurrency will be included with any future application for a development permit. A separate concurrency review will not be required for each development permit for the same project.

Concurrency review addresses only the availability of facilities and capacity of services and a Certificate of Concurrency does not represent overall development approval.

If the application for development is not concurrent, the applicant will be notified that a Certificate cannot be issued. The burden of showing compliance with the adopted levels of service and meeting the concurrency test will be upon the applicant. The Planning and Community Development Department will direct the applicant to the appropriate staff to assist in the preparation of the necessary documentation and information.

The City of Bradenton's Planning and Community Development Department will review applications for development and a development approval will be issued only if the proposed development does not lower the existing level of service (LOS) or mobility and access management standards of public facilities and services below the adopted level of service in this plan or the mobility and access management standards to be developed by July 2011. A project will be deemed concurrent if the following standards are met:

1. The necessary facilities and services are in place at the time a development permit is issued;
2. The development permit is issued subject to the condition that the necessary facilities and services will be in

place concurrent with the impacts of development;

3. The necessary public facilities and services are guaranteed in an enforceable development agreement to be in place concurrent with the impacts of development.

In addition to 1 through 3 above, roadways, mobility and access management projects (by July 2011), and mass transit facilities will be deemed concurrent based on the adopted five-year Capital Improvements Program as outlined below:

1. The five-year Capital Improvements Program and the Capital Improvements Element of the City of Bradenton's Comprehensive Plan are financially feasible. As permitted by Section 9J-5.055 (2) (C) 1., Florida Administrative Code, concurrency determinations will include transportation projects included in the first three years of the Florida Department of Transportation Five-Year Work Program.
2. The five-year Capital Improvements Program includes improvements necessary to correct any identified facility deficiencies and maintain adopted levels of service for existing and permitted development.
3. The five-year Capital Improvements Program is a realistic, financially feasible

program based on currently available revenue sources and development orders will only be issued if the public facilities necessary to serve the development are available or included in the five-year schedule of capital improvements.

4. The five-year Capital Improvements Program identifies whether funding is for design, engineering, consultant fees, or construction, and indicates, by funded year, how the dollars will be allocated.
5. The five-year Capital Improvements Program identifies the year in which actual construction of roadway and mobility and access management projects will occur, and only those projects scheduled for construction within the first three years of the City of Bradenton or Florida Department of Transportation five-year programs will be utilized for concurrency determination.
6. Land Development Regulations, ~~to be~~ addressing mobility and access management shall be adopted no later than ~~November 1, 2000~~ July 2011, ~~will~~ to support this plan and further ensure that development orders and permits will only be issued when public facilities and services at adopted levels of service are available concurrent with the impacts of development.

7. The City of Bradenton's Comprehensive Plan clearly identifies all facilities and services to be provided by the City of Bradenton with public funds in accordance with the five-year Capital Improvements Program.

- Mobility and Access Management
Roadways
- Potable Water
- Wastewater
- Solid Waste
- Drainage
- Parks and Recreation
- Mass Transit

Concurrency Determination Procedures: The concurrency test for facilities and services will be determined by comparing the available capacity of a facility or service to the demand created by the proposed project. Available capacity will be determined by adding together the total excess capacity of existing facilities and the total capacity of any new facilities which meet the previously defined concurrency standards and subtracting any capacity committed through concurrency reservations or previously approved development orders.

An applicant may wish to determine quickly if there is sufficient capacity to accommodate their project. The Planning and Development Department staff will make an informal, non-binding determination of whether there appears to be sufficient capacity in the public facilities and services to satisfy the demands of the proposed project. The staff will then make a determination of what public facilities or services would be deficient if the development were approved.

There are certain development actions which are ineligible to receive a concurrency reservation because they are too conceptual and, consequently, do not allow an accurate assessment of public facility impacts. These developments include Land Use amendments to the Comprehensive Plan, and rezoning requests. Development actions of this type will receive a non-binding concurrency determination as part of the project review process.

Any concurrency determination, whether requested as part of an application for development action or without an application for development action, is a non-binding determination of what public facilities and services are available at the date of inquiry. The specific procedures for

receiving a concurrency determination for each level of service facility are outlined below.

CONCURRENCY DETERMINATION - Roadways

1. ~~The City of Bradenton will provide level of service information as set forth in the City of Bradenton's Comprehensive Plan. If the preliminary level of service information indicates a level of service failure, the developer has two alternatives:~~
 - a. ~~Accept the level of service information as set forth in the Comprehensive Plan;~~
 - b. ~~Prepare a more detailed Highway capacity Analysis as outlined in the Highway capacity Manual, Special Report 209 (1985), or a Speed and Delay Study following the procedures outlined by the Florida Department of Transportation, Traffic and Engineering Office in its Manual For Uniform Traffic Studies;~~
2. ~~If the developer chooses to do a more detailed analysis, the following procedure will be followed:~~
 - a. ~~Planning Staff will provide the developer with an acceptable methodology for preparing the alternative analysis.~~

~~b. The developer will submit the completed alternative analysis to Planning staff for review.~~

~~c. The Planning Staff will review the alternative analysis for accuracy and appropriate application of the methodology.~~

3. ~~If the alternative methodology, after review and acceptance by the Planning Staff, indicates an acceptable level of service where the Comprehensive Plan indicates a level of service failure, the alternative methodology will be used.~~
4. ~~If the developer is at the application stage for the project, this alternative methodology can be used to obtain a Concurrency Determination - Roadways. This Concurrency Determination - Roadways is a non-binding determination that, at the date of application, adequate roadway facility capacity and levels of service are available.~~
5. ~~If the developer is at the final approval stage for the project, this alternative methodology can be used to obtain a Certificate of Concurrency.~~
6. ~~Any proposed development generating more than 750 trips a day, will be required to provide a trip distribution model in addition to the requirements outlined above~~

The City has adopted a city-wide Transportation Concurrency Exception Area (TCEA) pursuant to SB 360. The City shall monitor development trends, transportation network functions, and multi-modal standards as part of the development review process to ensure that new development will occur concurrent to or after provision for needed mobility and access management projects, and in a manner consistent with the vision outlined in the Comprehensive Plan.

The City shall, by July 2011, develop a fee methodology to address access and mobility management services in support of the City's multi-modal transportation system.

CONCURRENCY DETERMINATION - Potable Water/Wastewater/Solid Waste/ Drainage/ Parks and Recreation/Mass Transit

1. The City of Bradenton will provide level of service information as set forth in the City of Bradenton's Comprehensive Plan.
2. If the level of service information indicates that the proposed project would not result in a level of service failure, the concurrency determination would be that adequate facility capacity at acceptable levels of service was available at the date of application or inquiry.

-
3. If the level of service information indicates that the proposed project would result in a level of service failure, the concurrency determination would be that adequate facility capacity at acceptable levels of service was not available at the date of application or inquiry.

Certificate Of Concurrency: A Certificate of Concurrency will only be issued upon final development approval and indicates that concurrency will be met for all monitored facilities and services. The Certificate of Concurrency will remain in effect for the same period of time as the development order with which it was issued. If the development approval does not have an expiration date, the Certificate of Concurrency will be valid for twelve months from the date of issuance.

Appendix

Map Series

PFE – 1: Sewer System Service Area

PFE – 2: Wastewater Service System

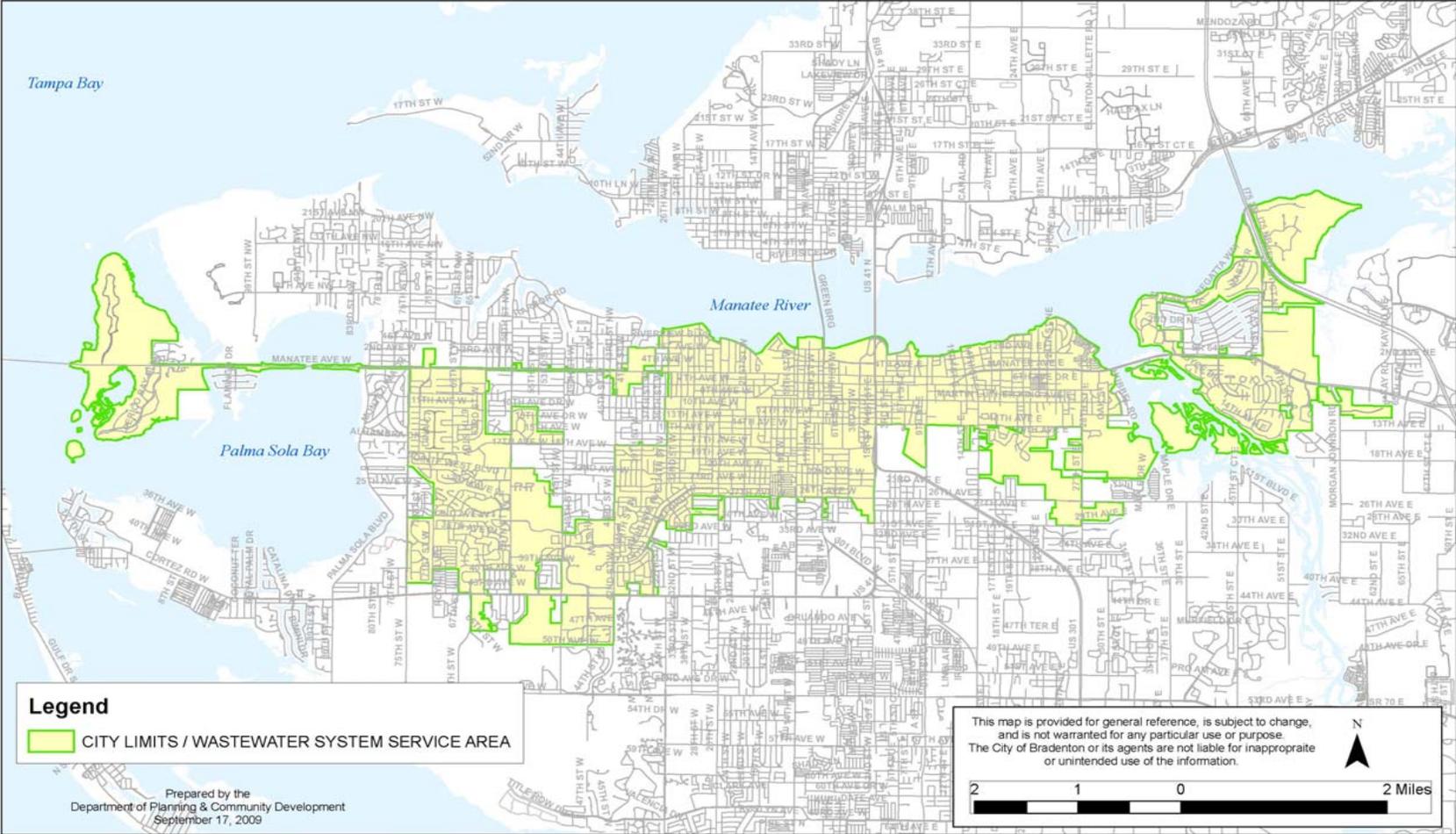
PFE – 3: Water Reclamation System

PFE – 4: Potable Water Service Area

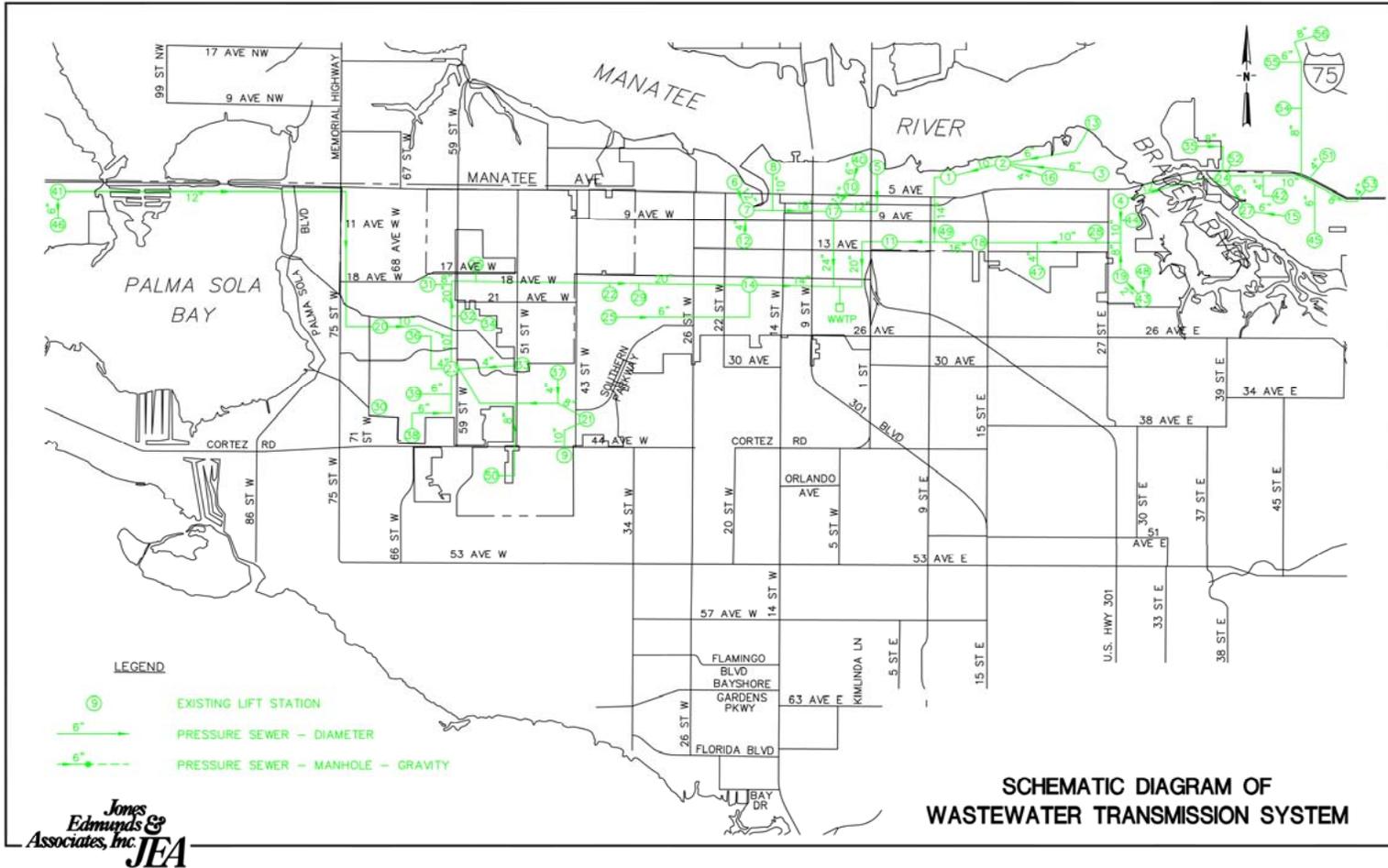
PFE – 5: Potable Water Distribution System

PFE – 6: Storm Drainage System

WASTEWATER SYSTEM SERVICE AREA

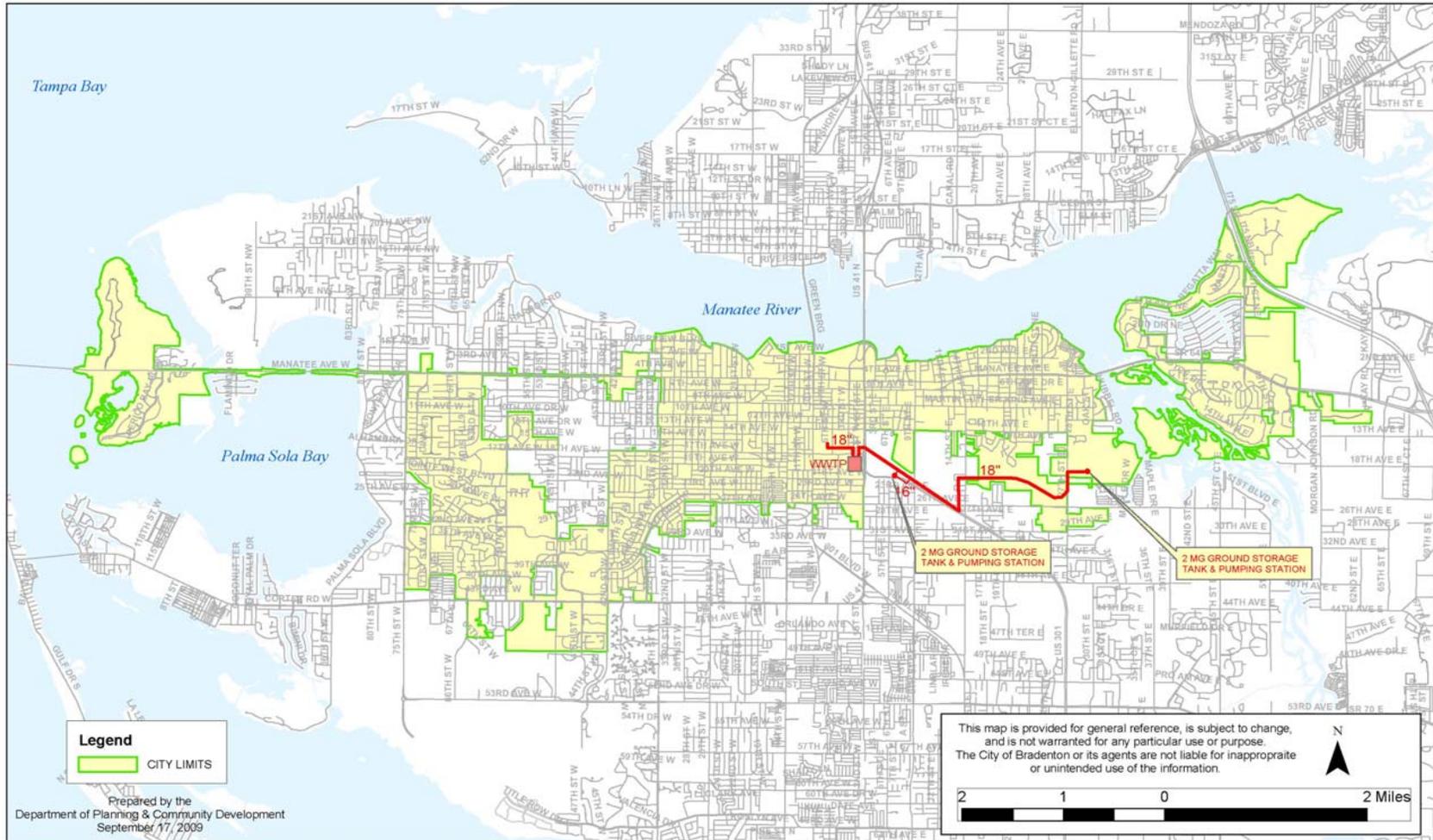


Map PFE – 1: Sewer System Service Area



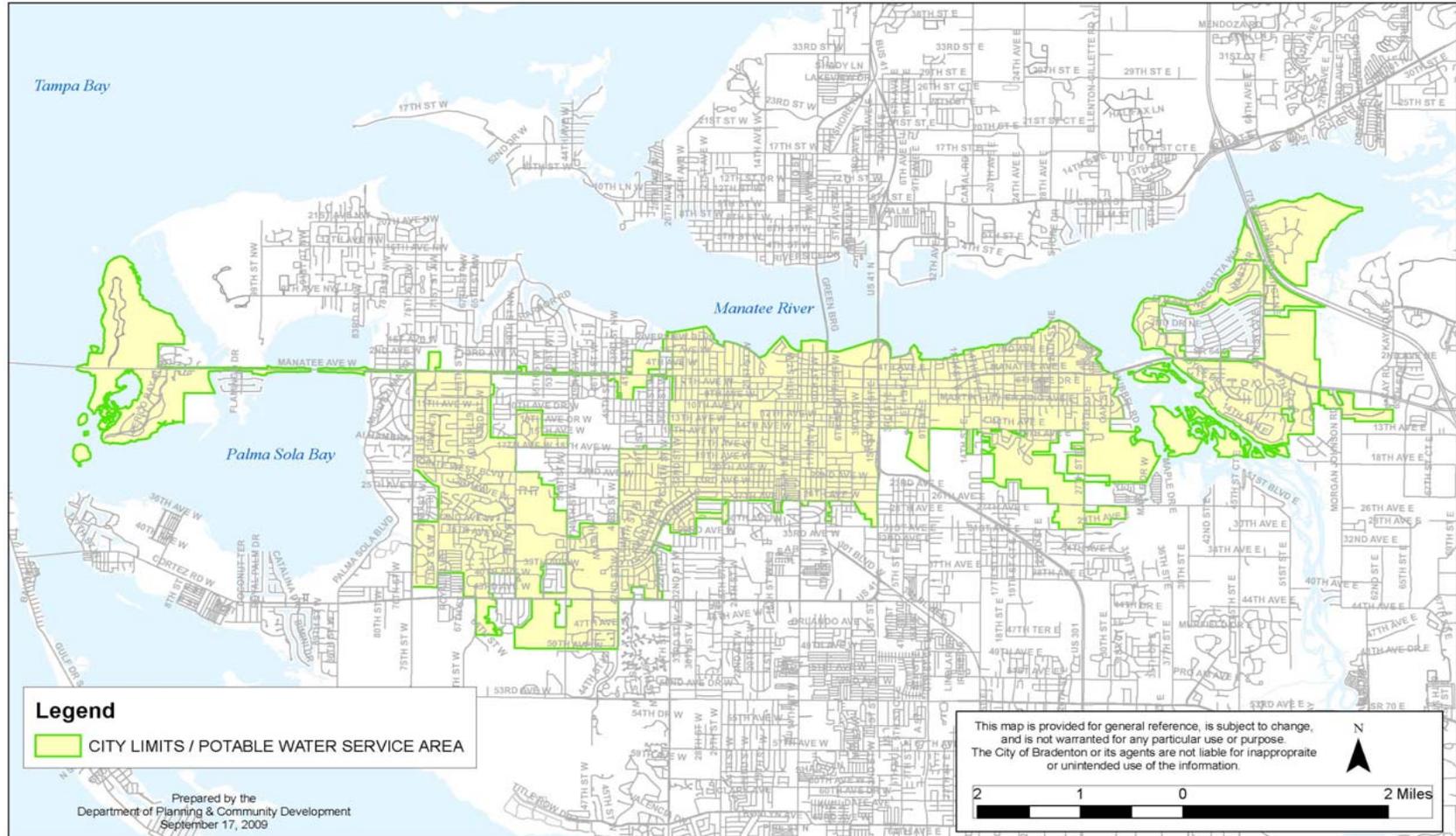
Map PFE – 2: Wastewater Service System

WATER RECLAMATION SYSTEM



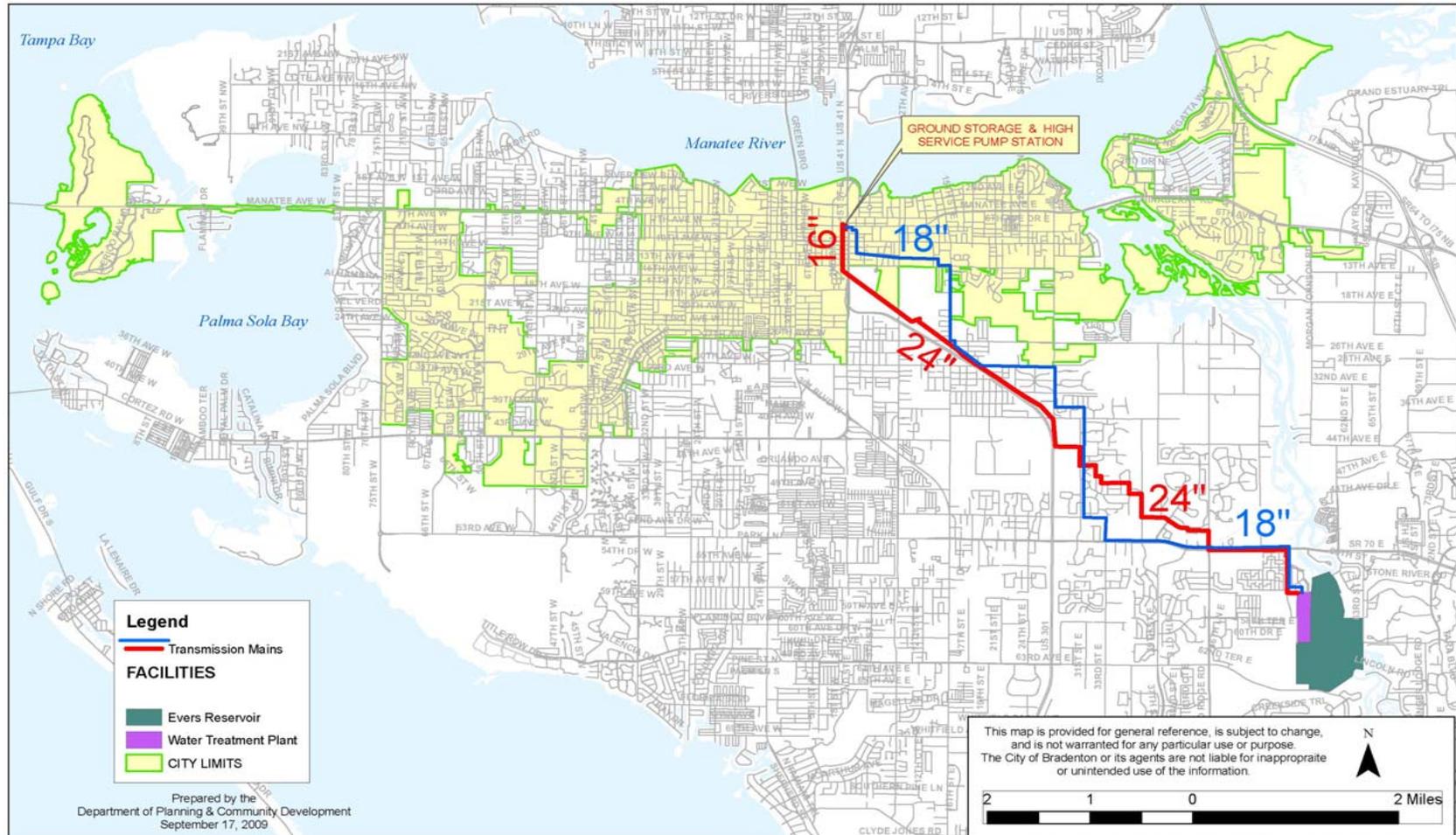
Map PFE -3: Water Reclamation System

POTABLE WATER SERVICE AREA

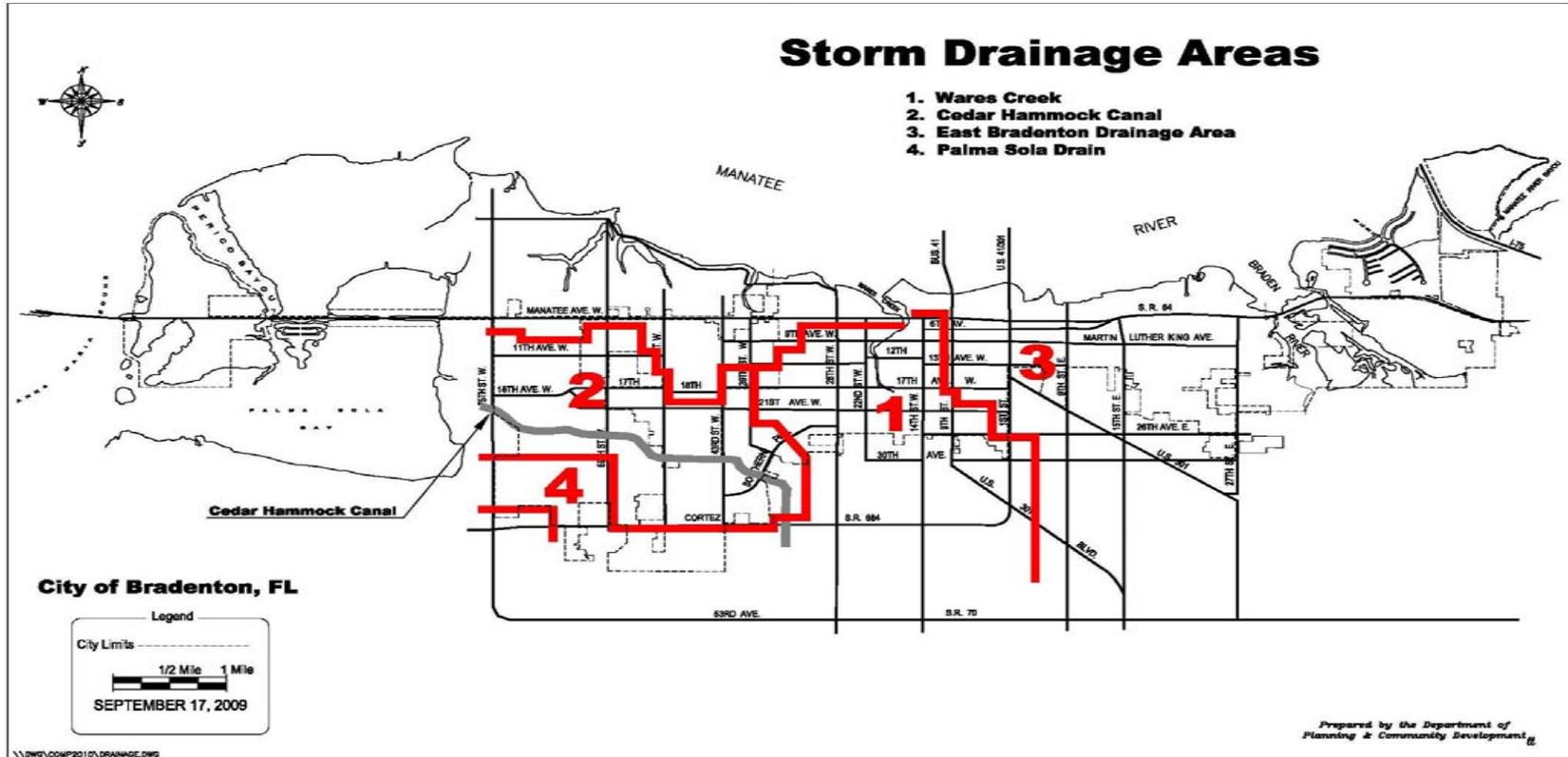


Map PFE – 4: Potable Water Service Area

POTABLE WATER TRANSMISSION SYSTEM



Map PFE – 5: Potable Water Distribution System



Map PFE – 6: Storm Drainage Areas