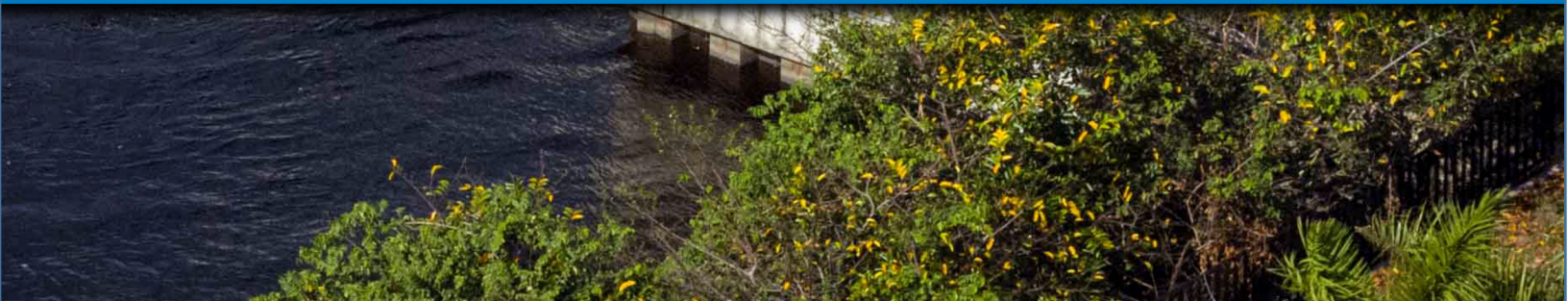
BROWARD COUNTY
FLORIDA

Water Management Element Support Document



The associated BrowardNEXT2.0 Comprehensive Plan was adopted on March 28, 2019 (Ordinance No. 2019-11) by the Board of County Commissioners.

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List of Acronyms

AADF	Annual Average Daily Flows
ACOE	Army Corps of Engineers
BCPHU	Broward County Public Health Unit
BCWWS	Broward County Water and Wastewater Services
BMSD	Broward Municipal Services District
cfs	Cubic Feet per Second
CUP	Consumptive Use Permit (SFWMD)
EEPD	Environmental Engineering and Permitting Division (Broward County)

EPA	Environmental Protection Act or Environmental Protection Agency
EPCRD	Environmental Planning and Community Resilience Division (Broward County)
EPGMD	Environmental Planning and Growth Management Department (Broward County)
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FS, F.S.	Florida Statutes
gpcd	gallons per capita per day
GPM	Gallons per Minute
MFL	Minimum Flows and Levels
MGD, mgd	Million Gallons per Day
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System (US EPA)
NRW	North Regional Wellfield
SFWMD	South Florida Water Management District
SAS	Surficial Aquifer System
US EPA	United States Environmental Protection Agency
WSFWP	Water Supply Facilities Work Plan
WTP	Water Treatment Plant

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Aquifer – A stratum or formation of permeable material that will yield groundwater in useful quantities (U.S. EPA). Also defined as a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield useful quantities of ground water to wells, springs or surface water.

Average Daily Flow – Total flow for a one-year period averaged over a 365-day basis.

Best Management Practices – The most effective methods and devices to reduce or prevent non-point source pollution of groundwater or surface water.

Borrow Canal – In most cases the material for construction of a levee is obtained by excavation immediately adjacent to the levee. The excavation is termed a borrow. When the borrow paralleling the levee is continuous and allows for conveyance of water, it is referred to as a borrow canal (SFWMD).

Canal – A trench, the bottom of which is normally covered by water, with the upper edges of its two sides normally above water. A channel, usually open, that conveys water by gravity (FAC 01-04, Bureau of Reclamation).

Channel – A trench, the bottom of which is normally covered entirely by water, with the upper edges of its sides normally below water.

Collection System – Piping that receives sewage from customers and delivers it to the transmission system. By definition, collection system piping is 12 inches in diameter and smaller.

Control Structures – Devices (e.g., culverts, spillways and weirs) placed in the canals to control water surface elevations (stage divide), amount of flow (stage divide or water supply structure), or direction of flow (divide structure) in the canals. In general, a stage divide controls water surface elevation upstream of the structure, and it controls water flow (or discharge) downstream of the structure. A divide structure is usually located at or near a basin boundary. It prevents water in one basin from entering the other basin. A water supply structure is also usually located near a basin boundary. It is used to pass water from one canal to another.

Culvert – A drain, ditch, or conduit, not incorporated in a closed system that carries drainage water under a driveway, roadway, railroad, pedestrian walk, or public way.

Design Storm – The most severe storm for which the canals and structures in the basin will accommodate that storm's runoff without flooding occurring in the basin.

Distribution System – Piping that receives water from the transmission system and delivers it to customers. By definition, distribution system piping is 12 inches in diameter and smaller.

Drainage Basin or Stormwater Basin – The subdivision of a watershed, further described as the area defined by topographic boundaries which contributes stormwater to a watershed, drainage system, estuarine waters, or oceanic waters, including all areas artificially added to the basin.

Drainage Detention Structure – Structure which collects and temporarily stores stormwater for the purpose of treatment through physical, chemical, or biological processes with subsequent gradual release of the stormwater.

Drainage District – A local unit of government with the specific purpose of providing drainage within a limited boundary. Drainage districts may be classified as dependent or independent. A dependent drainage district is one where the membership of its governing body is identical to that of the governing body of a single county or municipality. An independent drainage district is one that is not dependent.

Drainage Ditch or Irrigation Ditch – A man-made trench dug for the purpose of draining water from the land or for transporting water for use on the land and is not built for navigational purposes.

Drainage Facilities – Structures designed to collect, convey, hold, divert, or discharge stormwater; includes stormwater sewers, canals, detention structures, and retention structures.

Drainage Retention Structure – Structure designed to collect and prevent the release of a given volume of stormwater by complete on-site storage.

Dredging – The excavation, by any means, in waters of the state. It is also the excavation (or creation) of a water body which is, or is to be, connected to any of the waters listed in Section 62-312.030(2), FAC., directly or via an excavated water body or series of excavated water bodies (Chapter 62-312, FAC.).

Filling – The deposition, by any means, of materials in the waters of the state.

Flood Control – Structural and non-structural measures designed to mitigate flood damage to developed areas.

Flood Plains or Floodprone Areas – Areas inundated during a 100-year flood event or areas identified by the National Flood Insurance Program as an A zone on Flood Insurance Rate Maps of Flood Hazard Boundary Maps.

High Recharge Areas or Prime Recharge Areas – Areas so designated by the South Florida Water Management District governing body.

Impound – Collecting and confining water as if in a reservoir.

Maximum Daily Flow – The total flow for the one highest flow day of the year averaged over a 24-hour basis.

Nanofiltration – A water treatment process utilizing membranes that retain solute molecules ranging from 100 to 1,000 molecular weight.

Natural Drainage Features – The naturally occurring features of an area which accommodate the flow of significant amounts of stormwater, such as streams, rivers, lakes, sloughs, floodplains and wetlands.

Natural Drainage Flow – The pattern of surface and stormwater drainage through or from a particular site before the construction or installation of improvements or prior to regrading.

Natural Groundwater Aquifer Recharge Areas or Natural Groundwater Recharge Areas or Groundwater Recharge Areas – Areas contributing to or providing volumes of water which contribute to the storage or regional flow of an aquifer.

Natural Systems – An ecological system supporting aquatic and wetland-dependent natural resources, including fish and aquatic and wetland-dependent wildlife habitat.

Navigable Waters – The waters of the United States, including territorial seas (Federal Water Pollution Control Act, U.S.C. 13627).

Peak Hour Flow – The total flow for the one highest flow hour of the year averaged over a 60-minute basis.

Percolation – Downward flow or filtering of water through pores or spaces in rock or soil (U.S. EPA).

Pumping Station – A building or structure containing the necessary equipment to pump a fluid to a higher level.

Recharge – The addition of water to the groundwater system by natural or artificial processes (U.S. EPA).

Runoff – That portion of rainfall not absorbed by soil, evaporated, or transpired by plants, which finds its way into canals or other surface waterbodies.

Seepage – The flow of water through the sides or bottom of a canal or levee caused by a hydraulic gradient.

Service Area – The combination of the geographic area currently served by a utility and the geographic area the utility intends provide service to potential customers.

Spillway – A passage for surplus water to run over or around an obstruction.

Standard Project Storm – A rain fall event yielding amounts of precipitation equivalent to the 100 year storm increased by 25%. (SFWMD)

Standard Project Flood – The stormwater runoff which occurs during the standard project storm. (SFWMD)

Stormwater – The flow of water which results from a rainfall event.

Stormwater Management System – A system which is designed and constructed or implemented to control discharges which are necessitated by rainfall events, incorporating methods to collect, convey, store, absorb, inhibit, treat, use, or reuse water to prevent or reduce flooding, over drainage, environmental degradation, and water pollution or otherwise affect the quantity and quality of discharges from the system. (Ch. 373.403(10), F.S. and Ch. 403.031(16), F.S.)

System Uses – The difference between the amounts of water pumped into the transmission/distribution system and the sum of all customer meters. System use includes differences in calibration of meters, water lost to leaky pipes, water used in construction and water used in maintenance of the transmission/ distribution system.

Tailwater – Water below a dam. (Webster's Collegiate Dictionary)

Transmission System – Piping that moves large volumes of water from one point in the potable water piping system. By definition, transmission system piping is larger than 12 inches in diameter. Usually customers are not permitted to connect directly to the transmission system.

Watershed – The land area which contributes to the flow of water into a receiving body of water.

Water Surface Elevations – The distance from the water's surface in a canal to some referenced elevation or "datum," typically, the National Geodetic Vertical Datum (NGVD). Water surface elevations may be measured in feet or stages.

Weir – A dam in a stream to raise the water level or divert its flow.

Wetlands – Those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas.

Water Management

Introduction

A. General

The purpose of the Water Management Element (WME) is to assure that necessary public drainage and aquifer recharge facilities, potable water facilities, and sanitary sewer facilities and services correlate to future land use projections. The Water Management Support Document provides the data and analysis used as the basis for the Water Management goals, objectives and policies. **The data contained in this document was last updated in 2012 during the required update of the County's 10-Year Water Supply Facilities Work Plan (WSFWP) per Chapters 163 and 373, Florida Statutes.** This document is a compilation of three former individual support documents for the Potable Water, Sanitary Sewer and Drainage and Natural Aquifer Groundwater Recharge elements. The content has been rearranged under the major titles with subtitles by topic covering each former element.

B. Service Area

The planning service area is the watershed serving Broward County. The regulatory service area is area within the boundaries of Broward County's four dependent drainage districts and the BMSD areas not within an independent drainage district, the regional wastewater system, regional raw water system, and the municipal water utility areas.

C. Planning Horizon

The planning horizon for the BMSD areas is five years in accordance with the County's capital improvements plan. The long-term planning horizon for the Broward County Operated Retail Utility and Broward County Operated Regional Raw Water Supply is to the year 2040. BCWWS decided to use the year 2040 planning horizon because: a) new population projections were available to the year 2040; b) decisions regarding source of supply and treatment processes might change when a longer term is considered; and c) given the 40 to 50-year service life of distribution/transmission system piping, sizing of those facilities should be based on long term flow projections. Long-term planning horizons are updated every 5-8 years with the update of the Region's and the County's Water Supply Plans.

Data Requirements

A. Potable Water

1. Broward County Operated Retail Utility

a. Service Area and Customer Base

The Broward County Operated Retail Utility is one of the 28 utilities that provide potable water service within the urbanized area of the County. The Retail Utility was created on January 31, 1962 with the County's purchase of a small, investor-owned water and wastewater utility. Between 1962 and 1975 the County acquired a number of investor-owned systems. Under the County Code of Ordinances, the Broward County Board of County Commissioners exercises exclusive jurisdiction, control and supervision of the Utility system. The BCWWS is the County organizational unit directly responsible for the Retail Utility.

The Retail Utility supplies potable water to retail customers in several sections of the County and to one significant bulk water user. Over the past ten years, the Utility has grown from 51,044 customers to its present retail base of 56,503 (2012) customers, representing an estimated population of 179,000 (2012). The City of Coconut Creek, the bulk water user, has approximately 54,000 customers. Including the City of Coconut Creek, the Retail Utility serves about 13 percent of the County's total population. For the year 2012, treated water sold to retail customers equaled about 22.9 million gallons per day (MGD) on an annual average basis. Metered water sales to Coconut Creek equaled an additional 4.5 MGD. Notably, finished water production has decreased in recent years. This may be attributable to a downturn in the economy during the planning period for the water supply plan, slowdown in population growth and the County's water conservation efforts, including year-round lawn irrigation restrictions. Water conservation became increasingly important following a series of droughts over the past several years.

The Retail Utility operates three service districts know as District 1, District 2, and District 3. These service districts are shown on Figure WM-1 below, and cover about 41 square miles. The three service districts are operated as independent entities, but are managed as a single entity. The District 1 service area contains all of Lauderdale Lakes and portions of the cities of Fort Lauderdale, Lauderhill, North Lauderdale, Oakland Park, Plantation, Pompano Beach, and Tamarac. The District 2 service area contains portions of the cities of Deerfield Beach, Lighthouse Point and Pompano Beach; and provides water to portions of the City of Coconut Creek as described below. The District 3 service area contains portions of the cities of Dania Beach, Davie, Fort Lauderdale, Miramar, West Park, Pembroke Park, Pembroke Pines and Hollywood; and provides water to the Fort Lauderdale-Hollywood International Airport. All three service districts also include BMSD areas.

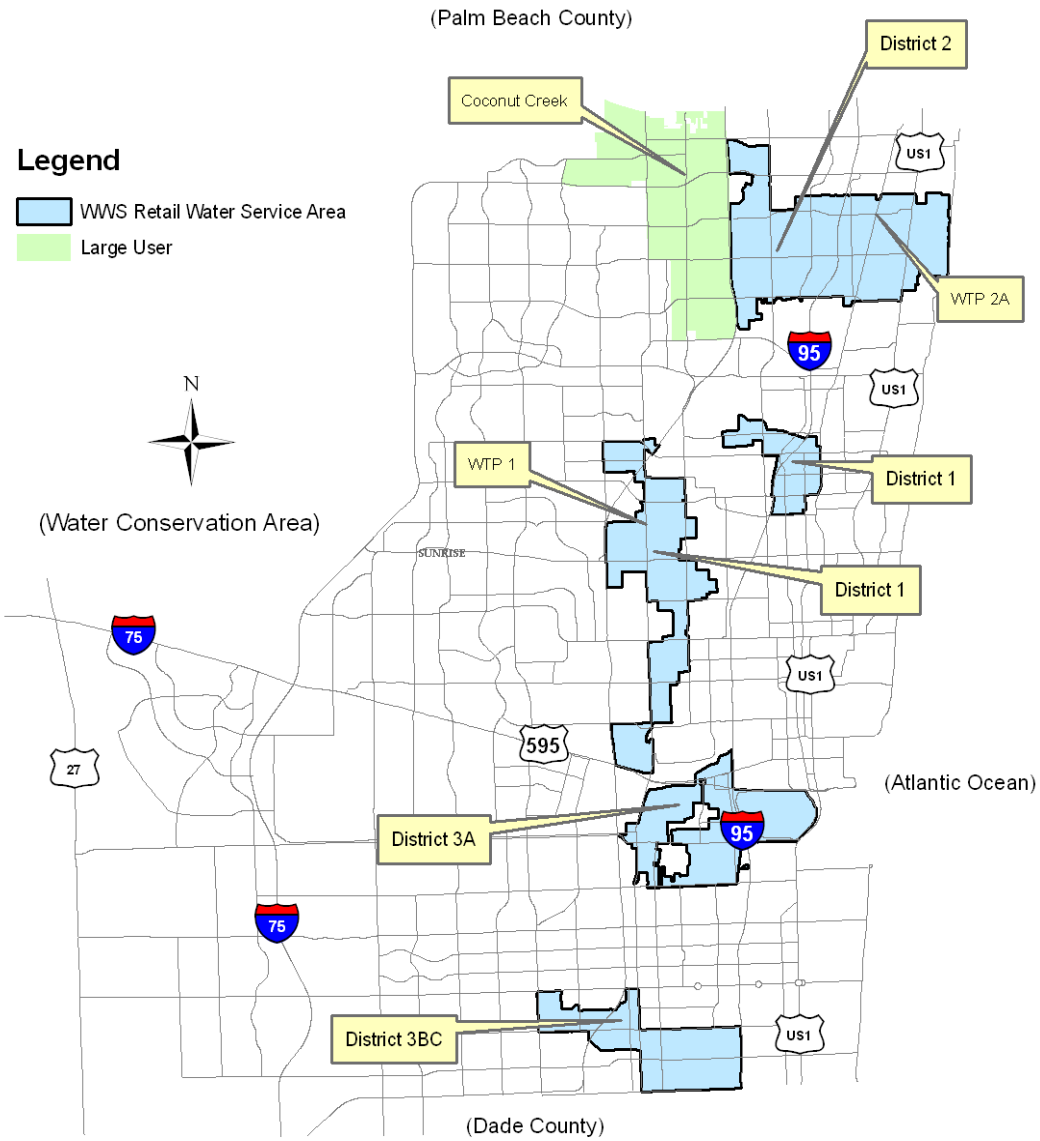


Figure WM-1: Broward County WWS Retail Water Service Areas

The Retail Utility supplies water primarily to retail customers, but also provides water to the City of Coconut Creek under a resale agreement. Presently, there is no practical or economic incentive for the City to pursue development of its own treatment facilities. Without prior approval from the County, the City is prohibited from buying or otherwise providing water within its service area from any source other than the County.

b. Level of Service Standards

BCWWS has the responsibility to determine if it can adequately serve existing and potential customers. To that end, BCWWS has set potable water level of service standards as shown by Table WM-1.

Table WM-1: BCWWS Retail Potable Water Level of Service Standards

Facility	Level of Service Standard
Raw Water Supply	Maximum Day Plus In-Plant Uses
Treatment Plant	Maximum Day
Finished Water Storage	40% of Maximum Day demand to cover operational (10%) and emergency (30%) storage; plus fire protection storage of 630,000 gallons (3500 GPM for 3 hours)
Transmission/Distribution System	The most stringent of: (1) Peak Hour at 45 psi residual pressure, or (2) Maximum Day Plus Fire Flow at 25 psi residual pressure

BCWWS Land Development Standards contain the methodology currently used to determine if the level of service standard can be met. BCWWS changes the methodology administratively from time to time as new information becomes available.

c. Existing Raw Water Supply

Raw water for District 1 is supplied by the BCWWS District 1 Wellfield which draws raw water from the Surficial Aquifer System (SAS). Raw water is treated at the District 1 Water Treatment Plant (WTP) prior to distribution to retail customers. The wellfield is comprised of nine wells, all of which are currently in service. The total design capacity of the wellfield is approximately 23.5 MGD. The total firm capacity of the wellfield is approximately 19.6 MGD, with the largest well out of service. Pursuant to the SFWMD Consumptive Use Permit (CUP), No. 06-00146-W issued in April 2008 for a 20 year permit duration, the maximum month and average annual daily withdrawals allowed from the District 1 SAS wellfield are 280 MG per Month (MGM) and 9.2 MGD, respectively. Two alternative water supply upper Floridan aquifer wells are under construction to provide raw brackish water for membrane treatment by 2020. The current SFWMD CUP allows for a maximum month withdrawal from the upper Floridan aquifer of 181 MGM with an associated average daily withdrawal of 4.7 MGD.

Raw water for District 2 is supplied by the BCWWS District 2 Wellfield, which draws raw water from the SAS, and the North Regional Wellfield (NRW) described in the Regional Raw Water Supply section below. Raw water is treated at the District 2 WTP prior to distribution to retail customers, and the City of Coconut Creek. The District 2 wellfield contains seven wells with a total design capacity of approximately 27.1 MGD. The total firm capacity of the wellfield is approximately 21.3 MGD, with the largest well out of service. Wells 1, 2, 3 and 5 have been plugged and abandoned. Pursuant to the SFWMD CUP No. 0601634-W for the combined District 2 and North Regional Wellfields, issued in March 2008 with a 20-year permit duration, a maximum monthly withdrawal of 585.2 MGD, and an average annual daily withdrawal of 17.5 MGD from the SAS. The District 2 CUP also allots for a Floridan aquifer allocation of 152.8 MGM on a maximum month and 4.6 MGD on an average daily basis. No alternative water supply Floridan aquifer raw water wells have yet been located or constructed at the District 2 location.

District 3 does not have raw water supply facilities. The County has entered into an agreement with the City of Hollywood whereby the City provides treated water to this district. See the "Existing Treatment Facilities" Section for more information.

d. Existing Treatment Facilities

Broward County operates two WTPs. The District 1 WTP was originally constructed in 1960 with a treatment capacity of 3.0 MGD and was expanded to 10.5 MGD in 1979. The plant was expanded again in 1994 to a capacity of 16.0 MGD. The facility's operating permit number is 06-58-00009. The plant uses up-flow clarifiers and multimedia filtration to provide lime softening of the raw water supply. Per BCWWS' 2012 Annual Report, the plant is in very good condition and all equipment was operating in a satisfactory manner. The plant operates 24 hours a day and meets current water quality standards. The level of service standard for treatment plants is the maximum day. Per the 2014 Water Supply Facilities Work Plan, the projected year 2015 maximum day is 11.6 MGD or 71% of plant capacity.

The District 2 WTP was originally constructed in 1972 with a treatment capacity of 20.0 MGD and was expanded to a physical capacity of 40.0 MGD in 1994. The plant's permitted capacity is 30.0 MGD. The facility's operating permit number is 06-58-00010. The plant uses up-flow clarifiers and multimedia filtration to provide lime softening of the raw water supply. Per BCWWS' 2012 Annual Report, the plant is in good condition and all equipment was operating in a satisfactory manner. The plant operates 24 hours a day and meets current water quality standards. The level of service standard for treatment plants is the maximum day. Per the 2014 Year Water Supply Facilities Work Plan, the projected year 2015 maximum day is 17.3 MGD or 57% of permitted plant capacity and 61% of physical plant capacity.

District 3 does not have a treatment facility. The County has entered into an agreement with the City of Hollywood whereby the City provides treated water to this district. The City is responsible for ensuring adequate raw water supply and treatment facilities. The City's existing CUP (Permit No. 06-00038-W) was issued by SFWMD on April 9, 2008 and expires April 9, 2028. The permit contains sufficient allocation to meet demands through the year 2028. BCWWS coordinated closely with the City during its CUP renewal process to ensure that future demands for District 3 were adequately addressed. The 2014 Water Supply Facilities Work Plan (WSFWP) projected a year 2015 maximum day of 9.57MGD for District 3.

e. Existing Treated Water Storage Facilities

District 1 has water storage facilities at the treatment plant site and four at remote locations. Including the 1.0 million gallons (MG) of clearwell storage that can be pumped directly to the distribution system, total District 1 storage equals 7.1 MG. All but one of the storage facilities are ground storage tanks, meaning the storage facilities use pumps to feed the distribution system. The level of service standard for storage is 40% of the maximum day demand to cover

operational and emergency storage; plus fire protection storage of 630,000 gallons (3,500 GPM for 3 hours). Based on the projected year 2015 maximum day demand of 11.4 MGD; required storage equals 5.2 MG, or 73% of available storage.

District 2 has three above ground concrete storage facilities and two underground clearwells at the treatment plant site providing a total of 8.5 MG of storage. The level of service standard for storage is 40% of the maximum day demand to cover operational and emergency storage; plus fire protection storage of 630,000 gallons (3,500 GPM for 3 hours). Based on the projected year 2015 maximum day demand of 8.5 MGD (for BCWWS District 2 only, Coconut Creek is obligated to provide its own storage); required storage equals 4.0 MG, or 47% of available storage.

District 3A has treated water storage facility equaling 2.0 MG. The level of service standard for storage is 40% of the maximum day demand to cover operational and emergency storage; plus fire protection storage of 630,000 gallons (3500 GPM for 3 hours). Based on the projected year 2015 maximum day demand of 4.43 MGD; required storage equals 2.4 MG, or 120% of available storage. BCWWS CIP Project 9058 will provide a 2.5 MG concrete potable water storage facility.

District 3BC has two treated water storage facility equaling 4.0 MG. The level of service standard for storage is 40% of the maximum day demand to cover operational and emergency storage; plus fire protection storage of 630,000 gallons (3500 GPM for 3 hours). Based on the projected year 2015 maximum day demand of 4.95 MGD; required storage equals 2.6 MG, or 65% of available storage.

f. Existing Transmission/Distribution System

The District 1 transmission and distribution system contains approximately 246 miles of pipe. The capacity of the system to handle existing and projected demands was determined by BCWWS using water distribution system hydraulic modeling. To correct identified deficiencies, BCWWS implemented a major water system rebuilding effort in District 1, which included rebuilding substantial portions of the water and wastewater systems and providing wastewater service to those on septic tanks. The projects were anticipated to be completed by the year 2011 at an estimated cost of $320 million. BCWWS maintains water system interconnections with the systems of the Cities of Fort Lauderdale, Tamarac, Plantation and Lauderhill. These interconnects are used for emergency purposes.

The District 2 transmission and distribution system contains approximately 247 miles of pipe. The capacity of the system to handle existing and projected demands was determined by BCWWS using water distribution system hydraulic modeling. To correct identified deficiencies, BCWWS is implemented a major water system rebuilding effort in District 2, which included rebuilding substantial portions of the water and wastewater systems and providing wastewater

service to those on septic tanks. The projects were anticipated to be completed by the year 2012 at an estimated cost of $167 million. BCWWS maintains water system interconnections with the systems of the Cities of Pompano Beach and Deerfield Beach; the Town of Hillsboro Beach and Palm Beach County. These interconnects are used for emergency purposes.

The District 3A transmission and distribution system contains approximately 94 miles of pipe. The capacity of the system to handle existing and projected demands was determined by BCWWS using water distribution system hydraulic modeling. To correct identified deficiencies, BCWWS is implemented a major water system rebuilding effort in District 3A, which included rebuilding substantial portions of the water and wastewater systems and providing wastewater service to those on septic tanks. The projects were anticipated to be completed by the year 2013 at an estimated cost of $50 million. BCWWS maintains water system interconnections with the systems of the Cities of Fort Lauderdale, Hollywood and Dania Beach. These interconnects are used for emergency purposes.

The District 3BC transmission and distribution system contains approximately 118 miles of pipe. The capacity of the system to handle existing and projected demands was determined by BCWWS using water distribution system hydraulic modeling. The District 3BC Service area is provided treated water for distribution by the City of Hollywood. BCWWS maintains water system interconnections with the systems of the Cities of Hollywood and Miramar. These interconnects are used for emergency purposes.

All transmission system/distribution system facilities have been inventoried using Geographical Information System (GIS) software. The data is updated on a continuous basis and posted to the BCWWS network for use once or twice a month.

g. Regulatory Requirements

Broward County, like any potable water utility, falls under the regulation of multiple authorities. The Safe Drinking Water Act ("SDWA", 1974) and the Safe Drinking Water Act Amendments ("SDWAA", 1986) authorized the United States EPA to establish national primary and secondary drinking water regulations to regulate maximum permissible levels of contaminants in finished drinking water. These standards were incorporated into the State of Florida Water Quality Regulations in 1993.

This section discusses three of the most significant authorities, the Broward County Public Health Unit (BCPHU), Broward County EPGMD and the Florida Department of Environmental Protection (FDEP). The discussion of SFWMD under the Broward County Operated Regional Raw Water Supply Section also applies to Broward County Operated Retail Utility raw water supply.

FDEP has given to the BCPHU general supervision and control over all public and private water systems in Broward County. The BCPHU regulates WTPs, treated water storage tanks, the transmission and distribution system and wellfields. The BCPHU utilizes standards developed by the FDEP as well as other reference material such as the "Recommended Standards for Water Works"; also known as "Ten States Standards". In addition, the BCPHU monitors water quality.

In 1984, Broward County adopted a Wellfield Protection Ordinance (Ordinance Number 84-60), which was revised in 1993 (Ordinance Number 93-17). The Wellfield Protection Ordinance is administered by EPGMD and establishes criteria for the regulation of storage, handling, use or production of hazardous or toxic substances within the zone of influence of a water supply well to protect existing and identified future supply well locations from potential contamination.

h. Conservation

Potable water conservation is addressed in the Conservation Element.

i. Overview of Financial Operations

All three operating Districts are managed financially as one utility; with one set of rates, fees and charges. Operating and general maintenance costs are recovered through service charges, connection charges, and miscellaneous fees and charges. Capital costs for system development, large maintenance project and renewal and replacement projects are funded through net revenues, bond proceeds, developer contributions, contributions from other municipalities and capital recovery charges.

User charges and fees are established by BCWWS and approved by the Board of County Commissioners (Board). The Board has specific legal authority to fix charges and collect rates, fees and charges from its customers and to acquire, construct, finance and operate the Utility.

2. Broward County Operated Regional Raw Water Supply

a. Service Area and Customer Base

The Broward County Operated Regional Water Supply consists of two independently operated systems; known as the "North System" and "South System"; that are managed as a single entity.

The concept of "service area" does not apply to the regional water supply. Many of its customers use regional raw water to supplement their own raw water supplies.

The North Regional Wellfield (NRW) System has two customers, the City of Deerfield Beach and Broward County Retail District 2. The South Regional Wellfield (SRW) System has four customers, the City of Dania Beach, the City of Hallandale, the City of Hollywood and the Florida Power and Light Corporation. The contractual agreements with each customer are substantially similar and run for an indefinite period of time. The exception is the City of Hollywood

agreement that has a four-year term with an automatic renewal for four years unless otherwise terminated.

b. Level of Service Standard

The level of service standard for the regional water supply is the obligations of the County as described in the contractual agreements with its customers and is limited by the Regional Water Availability Rule "Base Condition Use" for each regional wellfield.

c. Existing Raw Water Supply

The NRW is located in Quiet Waters Park and along Hillsboro Boulevard, just west of Powerline Road. The NRW is comprised of ten wells, each with a capacity of 2 MGD, providing a total design capacity for the wellfield of 20.2 MGD, with a firm capacity of 18.1 MGD with the largest well out of service. The NRW is operated in concert with the District 2 Wellfield to supply water to its customers. The SFWMD CUP (Permit No. 06-01634-W) provides a combined allocation for both the NRW and District 2 wellfield as stated under the corresponding section above. The County's CUP for District 2 was re-issued in April 2008 with a 20-year permit duration. Pursuant to the CUP staff report, the withdrawal allowance for the NRW is 7.4 MGD average annual daily and 271 MGM on a maximum month based on the results of groundwater modeling.

The South Regional Well (SRW) System is located in the southern central portion of the County. The majority of the wells are located in Brian Piccolo Park to the east of Palm Avenue and north of Sheridan Street. The SRW includes eight, 4 MGD wells that are currently in operation providing a total design capacity for the wellfield of approximately 32.3 MGD and 28.2 MGD with the largest well out of service. The CUP (Permit No. 06-01474-W) was due for renewal in 2007 and, due to the need to determine Large User requirements, is still in the process of being renewed. Pursuant to the Regional Water Availability Rule adopted by the SFWMD in February 2007, the "base use condition" for the SRW is 11.84 MGD average daily withdrawal. The existing CUP allows for an average day withdrawal of 14.2 MGD and a maximum monthly withdrawal of 672.0 MGM. The County is currently working with the SFWMD to resolve large user water demands.

d. Existing Treatment Facilities

Treatment of the raw water to render it in compliance with water quality standards is the responsibility of the entity receiving the raw water.

e. Existing Transmission/Distribution System

The NRW raw water transmission system consists of about 5 miles of pipeline ranging in size from 12 inches to 48 inches in diameter.

The SRW raw water transmission system consists of about 15 miles of pipeline ranging in size from 20 inches to 42 inches in diameter.

f. Regulatory Requirements

BCWWS is a potable water utility that falls under the regulation of multiple authorities. The FDEP, BCPHU and EPGMD facility regulation was briefly described above. The NRW and SRW are protected by the Wellhead Protection ordinance.

The SAS which contains the Biscayne aquifer is one of the most productive aquifers in the world and is the primary source of fresh water to residents of Broward County, Miami-Dade County, and southeastern Palm Beach County. In 1979 it was designated a sole source aquifer by U.S. Environmental Protection Agency (EPA), under the Safe Drinking Water Act (1974). The SFWMD is the state agency responsible for water supply planning in the LEC Planning Area, which includes all of Broward County. Withdrawals (both volume and rate) from the SAS are managed by the SFWMD through the issuance of CUPs for irrigation, industrial processes, agriculture, diversion and impoundment, dewatering and public water supply. In order to secure and maintain a CUP, applicants must meet the criteria of the "three-prong test". This test requires that the proposed water use is: 1) a reasonable and beneficial use of the resource; 2) will not interfere with any existing legal use of water and 3) is consistent with public interest, including compliance with the minimum flows and levels (MFLs) established for surface water and groundwater sources (Chapter 373, FS).

The MFLs outlined in the Florida State Statutes are defined as the "limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area" (Section 373.042(1), FS). They serve to protect the SAS from saltwater intrusion, ensure adequate groundwater levels for maintenance of natural systems, and prevent excessive groundwater seepage or surface water flows out of the regional water system (Everglades) as required under Chapter 40E-8, FAC.

The SFWMD's adoption of the Regional Water Availability Rule in February, 2007 set in place a "base condition water use" that limits the withdrawals for public water supply to those allocations of water that were permitted as of April 1, 2006. The Water Availability Rule is a subset of Chapter 40E-8, FAC. the MFL rule. According to the rule, additional water supply demands over and above the base condition water use will come from alternative water supplies or other demand offset mechanism.

CUPs are typically issued for five to twenty-year durations with updates to projected water demands every 10 years for the longer duration permits. Broward County takes an integrated approach to raw water supply, drainage and aquifer recharge working closely with the SFWMD and County municipalities to coordinate water use. See the Drainage and Natural Aquifer Groundwater Recharge element for more information.

g. Conservation

Water conservation is addressed in the Conservation Element.

h. Overview of Financial Operations

The wellfields were constructed using general County revenues and the assets were contributed to the Utility. Service is provided pursuant to individual, contractual agreements between the County and each large user. The agreements provide for a method to set fees, rates and charges, bill for use of the system, collect for improvements, repairs and replacements and adjust charges at year end to reflect the actual number of gallons used and actual operation and maintenance expense.

3. City of Fort Lauderdale

a. Service Area and Customer Base

The municipal utility owned and operated by the City of Fort Lauderdale is the single largest purveyor of potable water in Broward County, in terms of total water delivery, providing service to approximately 250,000 Broward County customers in 2013. This includes approximately 6,127 retail customers residing in the Roosevelt Gardens, Franklin Park, Washington Park, and Boulevard Gardens communities of BMSD. The utility's service area encompasses a total area of 43 square miles, approximately one-tenth the total area of urban Broward County. Other retail customers include residential, commercial, and industrial properties within the City of Fort Lauderdale, Lazy Lake, and a portion of Lauderdale-by-the-Sea. The utility also maintains wholesale agreements for potable water supply with the Cities of Oakland Park, Wilton Manors, Tamarac (east of 34th Avenue), the Town of Davie and Port Everglades. Emergency potable water interconnections are maintained with the Cities of Dania Beach, Pompano Beach, and Plantation, and BCWWS service area.

b. Level of Service Standard

Fort Lauderdale has adopted their level of service for potable finished water at 197 gallons per capita per day (gpcd). In 2013, the average demand throughout their service area was 206 gpcd.

c. Existing Raw Water Supply

Raw water for the City of Fort Lauderdale is supplied by the Peele-Dixie and Prospect wellfields, which draw from the SAS. The raw water is treated at two lime softening water treatment facilities, the Peele-Dixie and the Fiveash WTPs. There is a total of 29 active wells between the two well fields and 18 wells in operation at a given time. The Peele-Dixie and Prospect Wellfields have a combined pumping capacity of approximately 107 MGD. Wholesale customers receive finished water from the Fiveash WTP.

The City of Fort Lauderdale's CUP (Permit No. 06-00123-W) issued on September 11, 2008 for 20 years allows the City to pump a combined average daily allocation for the two wellfields of 50.6 MGD, and a maximum daily allocation of 67.3 MGD. In 2013, the combined pumpage from the Peele-Dixie and Prospect Wellfields averaged 46.76 MGD (3.8 MGD below the permitted allocation).

d. Existing Treatment Facilities

In 1926, the 6 MGD capacity Peele-Dixie lime softening WTP was opened in western Fort Lauderdale. The lime softening plant was converted to a state-of-the-art nanofiltration membrane facility in 2008 which has a treatment capacity of 12 MGD (Table WM-2). Built in 1954, the Fiveash lime softening WTP was designed to treat 8 MGD. Through a series of expansions, the plant has been able to keep pace with the rapid growth experienced in Fort Lauderdale and today has a capacity of 70 MGD (Table WM-2). The Fiveash WTP is supplied raw groundwater for treatment from the Prospect wellfield.

Although the Peele-Dixie and Fiveash WTPs have a combined design capacity of 82.0 MGD, hydraulic constraints at the Fiveash WTP are suspected to limit its operating capacity to between 55.0 and 60.0 MGD.

e. Existing Treated Water Storage Facilities

The Peele-Dixie WTP storage facilities include a 2.3 MG. Two additional 4.0 MG ground storage tanks will be available when the new facility begins operation. The Fiveash WTP has onsite storage of 21.8 MG, provided by two 5.0 MG tanks, one 4.0 MG tank, one 7.0 MG tank, and seven clearwells totaling 0.8 MG. The City also has two distribution system storage sites providing an additional 3.0 MG of storage.

Table WM-2: Summary of Statistics for the City of Fort Lauderdale WTPs

Water Treatment Plant (WTP)	Treatment Type	Treatment Capacity (MGD)	Storage Capacity (MG)	Source Water
Peele-Dixie	Nanofiltration Membrane	12.0	10.3*	Peele-Dixie Wellfield
Fiveash	Lime Softening	70.0	21.8	Prospect Wellfield

** Includes 8.0 MG for Peele-Dixie scheduled to come on-line in mid-2008.*

f. Existing Transmission/Distribution System

The City of Fort Lauderdale's transmission and distribution system contains approximately 750 miles of pipe. Ongoing infrastructure improvements under the current Waterworks 2011 program are anticipated to significantly improve water delivery flows and system pressures in many areas served by the City. The City most recently updated their Water and Wastewater Master Plan in 2006. The Master Plan is updated every five years. The City of Fort Lauderdale maintains a total of 10 water system interconnections with BCWWS District 1 (3 connections),

the Cities of Plantation (1 connection), Dania Beach (1 connection), Tamarac (3 connections), Pompano Beach (1 connection) and Town of Davie (1 connection).

g. Conservation

The City of Fort Lauderdale has an active water conservation program. The policies and practices of the City of Fort Lauderdale's conservation program are discussed in the Broward County 2014 Water Supply Facilities Work Plan (WSFWP) (Appendix WM-D). The WSFWP will be updated in 2021.

B. Sanitary Sewer

1. Broward County Operated Retail Utility

a. Service Area and Customer Base

The Broward County Operated Retail Utility is one of the many utilities that provide sanitary sewer service within the urbanized area of the County. The Retail Utility was created on January 31, 1962 with the County's purchase of a small, investor-owned water and wastewater utility. Between 1962 and 1975 the County acquired a number of investor-owned systems. Under the County Code of Ordinances, the Board exercises exclusive jurisdiction, control and supervision of the Utility system. The BCWWS is the County organizational unit directly responsible for the Retail Utility.

The retail wastewater system provides wastewater collection service to approximately 77 percent of the County's retail water customers and sewer only customers. The County's wastewater retail customer base has grown from 35,704 customers (connections) in 2003 to its present base of 47,799 customers in the past ten years and will continue to grow through the County's extension of sanitary sewers into currently unsewered areas. Additional Retail Wastewater System Information is shown in Table WM-3. Collection, treatment and effluent disposal management is provided by the County-operated NRW System and by the SRW System operated by the City of Hollywood.

Table WM-3: Summary of Retail Water System and Retail Wastewater System

System Components	Units	Fiscal Year 2003	Fiscal Year 2012	Change	Percent Change
Customer Base	Customers	35,704	47,799	11,207	31.39%
Wastewater Service Area	Square miles	39.70	40.70	1.00	2.52%

Source: Broward County Water and Wastewater Services

The Retail Utility operates three (3) non-contiguous service districts – District 1, District 2, District 3 – which collectively cover 41 square miles, shown on Figure WM-2. The districts are operated as independent entities but managed as a single entity. District 1 service area contains portions

of the cities of Fort Lauderdale, Lauderdale Lakes, Lauderhill, North Lauderdale, Oakland Park, Plantation, Pompano Beach, and Tamarac. District 2 service area contains portions of the cities of Deerfield Beach, Lighthouse Point and Pompano Beach. District 3 service area contains portions of the cities of Dania Beach, Davie, Fort Lauderdale, Miramar, Pembroke Park, West Park, Pembroke Pines, and Hollywood; and provides sanitary sewer service to part of the Fort Lauderdale-Hollywood International Airport. All three service districts also include BMSD areas. The sanitary sewer service area is different than the potable water service area for all Districts.

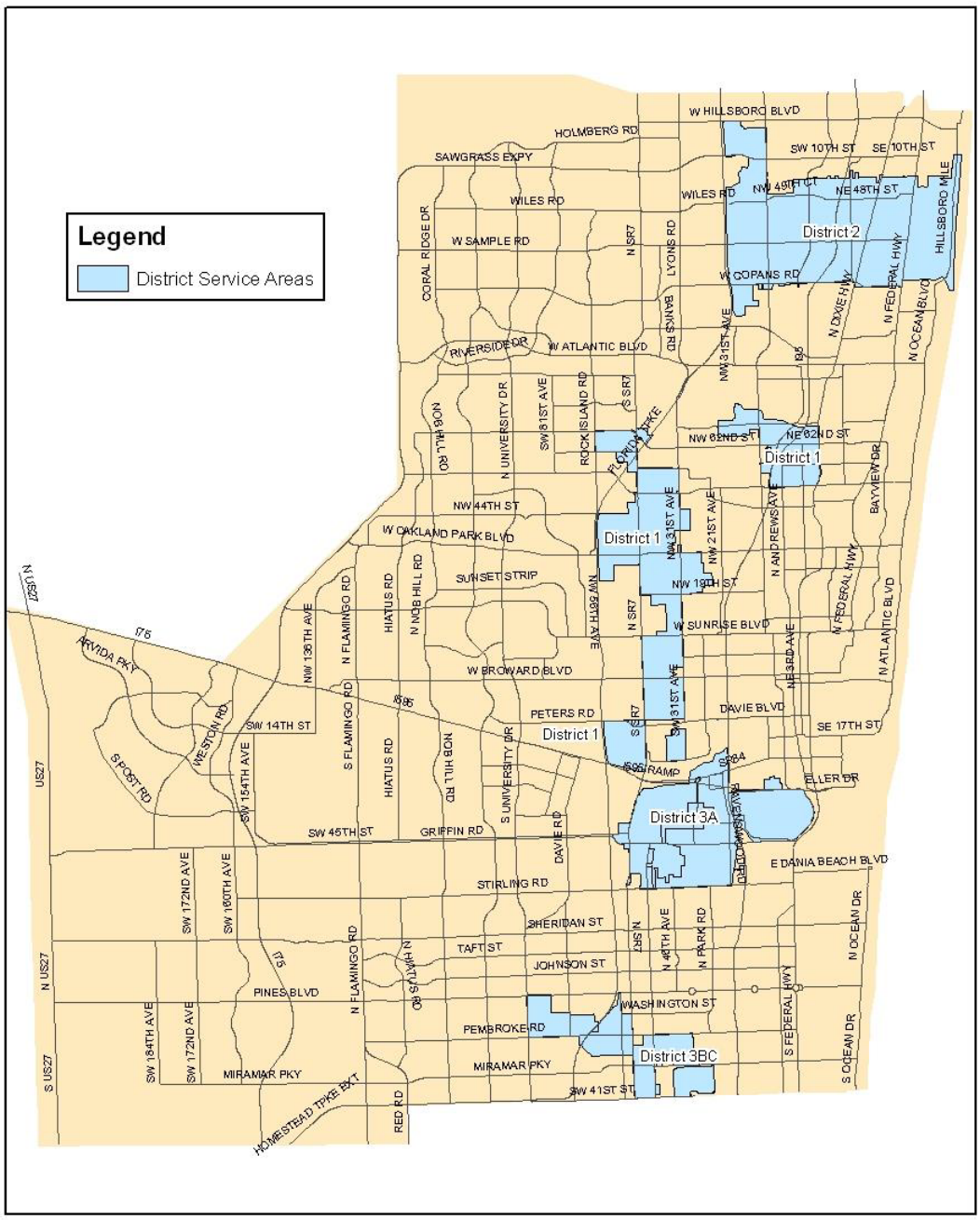


Figure WM-2: WWS Service Areas
Source: Broward County WWS, July 2005.

b. Level of Service (LOS) Standard

BCWWS has the responsibility to determine if it can adequately serve existing and potential customers. BCWWS has set sanitary sewer LOS standards as shown by Table WM-4.

Table WM-4: BCWWS Facility LOS Standards

Facility	Level of Service Standard
Treatment Plant and Effluent Disposal	Average Day
Collection/Transmission System	Peak

BCWWS Land Development Standards contain the methodology currently used to determine if the LOS standard can be met. BCWWS changes the methodology administratively from time to time as new information becomes available.

c. Existing Treatment and Effluent Disposal Facilities

Sewage treatment and effluent disposal for Districts 1 and 2 is via the Broward County Operated Regional Wastewater System. See that portion of this document for more information.

Sewage treatment and effluent disposal for District 3 is via agreement with the City of Hollywood. The agreement acknowledges the City's affirmative, continuing obligation to provide wastewater services for District 3.

d. Existing Transmission/Collection System

The District 1 transmission and collection system contains approximately 180.4 miles of gravity sewer pipe, 41.6 miles of force main pipe and 74 lift stations. District 1 connects to the Broward County Operated Regional Wastewater System at six locations. The capacity of the system to handle existing and projected demands was determined by BCWWS using hydraulic modeling. To correct identified deficiencies, BCWWS is implementing a major rebuilding effort in District 1, which includes rebuilding substantial portions of the water and wastewater systems and providing wastewater service to those on septic tanks.

The District 2 transmission and collection system contains approximately 158 miles of gravity sewer pipe, 34 miles of force main pipe and 95 lift stations. District 2 connects to the Broward County Operated North Regional Wastewater System at two locations. The capacity of the system to handle existing and projected demands was determined by BCWWS using hydraulic modeling. To correct identified deficiencies, BCWWS is implementing a major rebuilding effort in District 2, which includes rebuilding substantial portions of the water and wastewater systems and providing wastewater service to those on septic tanks.

The District 3 transmission and collection system contains approximately 82 miles of gravity sewer pipe, 34 miles of force main pipe and 60 lift stations. District 3A and District 3BC each connect

to the City of Hollywood at one location. The capacity of the system to handle existing and projected demands will be determined by BCWWS using hydraulic modeling: Once identified, BCWWS will implement an effort to correct deficiencies.

All transmission system/collection system facilities have been inventoried using Geographical Information System (GIS) software. The data is updated on a continuous basis and posted to the BCWWS network for use once or twice a month. In addition, paper maps of the entire transmission/ distribution system are produced twice a year from the GIS database.

e. Regulatory Requirements

Broward County, like any sanitary sewer utility, falls under the regulation of multiple authorities. These include the United States Environmental Protection Agency (USEPA), the Florida Department of Environmental Protection (FDEP), the Broward County EPGMD and the Broward County Public Health Unit (BCPHU).

The BCPHU has regulatory responsibility for issuing septic tank permits under Chapter 10D-6 of the Florida Administrative Code and Broward County Ordinance 78-50.

Connecting new sanitary sewers to the BCWWS collection system is the regulatory responsibility of EPGMD. This includes verifying that the treatment facility has adequate capacity.

Capacity, Management, Operation and Maintenance (CMOM) will be a federally mandated program that when implemented will have significant effect on all Utilities throughout the United States. CMOM is intended to eliminate or drastically reduce Sanitary Sewer Overflows (SSO). When CMOM is implemented into law, utilities will be required develop and follow very detailed Operating Standard Operating Procedures (SOP's), Maintenance SOP's, Design Standards, Modeling Requirements, Emergency Response Planning/SOP's and other additional standards throughout the utility. Utility plans will be submitted for authorization and assessment will constantly be monitored.

f. Overview of Financial Operations

All four operating Districts are managed financially as one utility; with one set of rates, fees and charges. Operating and general maintenance costs are recovered through service charges, connection charges, and miscellaneous fees and charges. Capital costs for system development, large maintenance project and renewal and replacement projects are funded through net revenues, bond proceeds, developer contributions, contributions from other municipalities and capital recovery charges.

User charges and fees are established by BCWWS and approved by the Board. The Board has specific legal authority to fix charges and collect rates, fees and charges from its customers and to acquire, construct, finance and operate the Utility.

2. Broward County Operated Regional Wastewater System

a. Service Area and Customer Base

The concept of "service area" does not apply to the Regional Wastewater System. The Regional Wastewater System has 12 customers, termed "Large Users". Large Users include the Cities of Coconut Creek, Coral Springs, Deerfield Beach, Lauderhill, North Lauderdale, Oakland Park, Parkland, Pompano Beach and Tamarac, the North Springs Improvement District, Royal Utilities (a private utility), and the Broward County Operated Retail Utility (Districts 1 and 2) Altogether, the Large Users account for service to about 40% of the County's population.

Service is provided pursuant to individual contractual agreements between the County and each Large User. Generally, the agreements specify the large user's reserve capacity in the plant and provisions for billing and payment of service. All Large Users, except Oakland Park, are required to deliver all wastewater flows collected by it to the Regional Wastewater System. Oakland Park sends a portion of their flow to the Fort Lauderdale wastewater treatment facility.

b. Level of Service (LOS) Standard

The LOS standard for the regional wastewater system is the obligation of the County as described in the contractual agreements with its customers. The Agreements specify that the Regional Wastewater System will treat and dispose of all wastewater delivered to it. Large Users are responsible for maintaining their individual systems and to deliver wastewater to the Regional Wastewater System at the required elevation or pressure. They are responsible for the prevention of excessive peak flow rates. Large Users must submit annual updates of flow estimates. The County is required to use these estimates to plan future treatment capacity. System annual average flows and reserve capacities are shown in Table WM-5.

The County's obligation to provide service is limited to the capacities reserved by the Larger Users, which may be changed by amendment to the Agreement. The Agreement allows a Large User to lease or sell excess capacity to another Large User, subject to County approval. The agreements provide that the County will extend and expand the Regional Wastewater System to provide for the Large User's scheduled flow.

Table WM-5: Regional Wastewater System Annual Flow and Reserve Capacity

Customer	Annual Average Flow (MGD)**	Reserve Capacity (MGD)**
WWS Districts 1 & 2	14.01	16.71
Coconut Creek*	4.48	6.04
Coral Springs	7.90	9.79
Deerfield Beach	6.67	7.00
Lauderhill	5.77	7.10
North Lauderdale	3.54	3.80
North Springs	2.33	3.53
Oakland Park	1.13	1.52
Parkland	0.25	0.31
Pompano Beach*	16.12	15.71
Royal Utilities	0.24	0.45
Tamarac	7.39	8.04
Not Allocated	----	4.00

** All of Pompano Beach and portions of Coconut Creek do not use the North Regional Wastewater System transmission facilities.*

***All values rounded to the nearest hundredth of an MGD. The County (BCWWS) does not have a contract with itself; therefore, there is no contractual reserve capacity for BCWWS.*

Source: Broward County, September 2012.

c. Existing Treatment and Effluent

The North Regional Wastewater Treatment Plant (NRWWTP) is located at 2555 West Copans Road, Pompano Beach. The facility was originally constructed in 1974 with a treatment capacity of 20 MGD. The plant has since been expanded to its current permitted capacity of 95 MGD ADF. The facility's operating permit number with FDEP is FL0031771. The NRWWTP utilizes an activated sludge treatment process for liquid treatment and an anaerobic digestion system for handling the sludge produced from the liquid treatment process. About 75% of the 80,000 tons of biosolids (sludge) generated annually by the treatment process are recycled via landspreading; the remainder is landfilled.

Effluent from the liquid treatment process is chlorinated and either pumped through about 6 miles of 54-inch diameter outfall piping into the Atlantic Ocean, disposed of in on-site deep injection wells, or filtered via the County's 10 MGD reclaimed water system. Permitted effluent disposal capacity is 95 MGD ADF.

The County's effluent management program includes a 10 MGD system provides highly treated water for industrial and landscape irrigation purposes. Currently reclaimed water is used for irrigation, industrial process water at the North Resource Recovery Plant (a solid waste incinerator), and at the NRWWTP. Due to state law, the County will be required to reduce discharges to the ocean outfall and increase utilization of reclaimed water by 2025. The County

and nearby municipalities have been actively pursuing state and local funding for further development of the reclaimed water system.

d. Existing Transmission System

The regional wastewater transmission system consists of about 66 miles of force main pipeline ranging in size from 12 inches to 54 inches in diameter and 11 master pump stations.

e. Regulatory Requirements

Operation of the Regional Wastewater System is regulated by the USEPA, FDEP, and EPGMD. Regulatory requirements are focused on effluent management, sludge disposal, reclaimed water and an industrial pretreatment program. Broward County submitted an application to FDEP on August 2, 2007 for the renewal of the National Pollutant Discharge Elimination System (NPDES)/ Facility permit for the Regional Wastewater System. The new Regional Wastewater System permit was issued on January 25, 2013 and became fully enforceable in March 2013.

The FDEP continues to promote a reduction of nutrients in the face of opposition to ocean discharges from interested groups, but they have worked with the wastewater utilities with ocean outfalls (including Broward County) to reduce the economic impact of the Leah Schad Memorial Ocean Outfall Program, which became the law effective July 1, 2008. Subsequent legislation has been proposed each year to amend the law. In 2013, the Florida Legislation passed the following changes to the current law:

- Allows peak flow backup discharges not exceeding 5% of the facility's cumulative baseline flow, measured on a 5-year rolling average and requires that such discharges meet the FDEP's applicable secondary waste treatment and water-quality-based effluent limitations.
- Requires the detailed plan that an outfall utility must submit to FDEP to identify technically, environmentally and economically feasible reuse options, and to include an analysis of the costs associated with meeting state and local water quality requirements, and comparative costs for reuse using outfall flows and other domestic wastewater flows.
- Requires the detailed plan to evaluate reuse demand in context with several factors considered in the South Florida Water Management District's (SFWMD) Lower East Coast Regional Water Supply Plan.
- Requires FDEP, SFWMD and the outfall utilities to consider the above information for the purpose of adjusting, as needed, the reuse requirements, and requires FDEP to report to the Legislature any changes that may be necessary in the reuse requirements by February 15, 2015.

In order to meet the advanced wastewater treatment requirements of the rule, the County has implemented cumulative nutrient reduction strategies including modifying the existing

treatment process to augment biological nutrient removal and reducing outfall discharges via diversion to the existing deep injection well system.

As noted, the effluent management system also includes Class I injection wells. The Operation Permit 0051336-502-UO for Injection Wells 1 through 6 was issued on July 2, 2010 and is valid for five (5) years. This permit requires the installation of a new monitoring well (number 5) to replace monitoring well number 4. Work began in January 2012 for monitoring well 5 and was completed in early September 2012.

In August 2010, revisions to the state regulations governing the treatment and disposal of biosolids, Chapter 62-640 F.A.C., went into effect. The Regional Wastewater System became subject to the new regulations upon renewal of the facility's operating permit in January, 2013. New land application sites were permitted under these new regulations. The County has secured alternate disposal capacity at a nearby Class I landfill and continues to investigate cost-effective long-term biosolids management alternatives. Disposal at the landfill meets all current federal, state and local regulations and since the landfill cogenerates electricity from its methane gas production, this disposal option is currently the most carbon neutral.

In fiscal year 2012, the Regional Wastewater System had no violations. The System was in full compliance with effluent quality standards.

f. Overview of Financial Operations

Large User agreements extend for a term that is one year past the last payment of any debt obligation applicable to the Regional Wastewater System. Each agreement designates a Large User's reserve capacity and provides a method to charge each Large User for the availability and provision of service. On a monthly basis, each user is billed a fixed charge depending upon the user's reserve capacity. This fixed charge is designed to recover each large user's equitable share of debt service. Operation and maintenance costs are also billed on a monthly basis, and are based on the Large User's pro rata usage of the Regional Wastewater System. Changes to the rates, fees and charges must be approved by the Board of County Commissioners at a public hearing.

3. Broward Municipal Services District (BMSD) Areas

Currently very little of the BMSD areas of Broward County are provided water service by BCWWS. However, a significant County boundary change took place in 2009 with approval of House Bill 1315 that approved the transfer from Palm Beach County to Broward County of a 1,949-acre wedge-shaped property located between County Line Road and Loxahatchee Road. Currently the area of BMSD land is 11.4 sq. miles with a population of less than 16,000, which includes the recently annexed 'Wedge' south of the Hillsboro Canal.

The land use and zoning for many of the BMSD areas of significant size, such as Hillsboro Pines near Parkland, support large lot residential development. Public sanitary sewer service is not available for many of these areas, and sanitary service is currently accomplished by on-site treatment and disposal facilities such as septic systems.

Discussions were held with representatives of the utility and/or planning departments of the Cities of Cooper City, Fort Lauderdale, Hollywood, Plantation, and Sunrise. Comprehensive Plan data and other information from the municipalities and from the Broward County EPGMD were utilized to prepare the following sections for the BMSD area.

a. City of Cooper City

The City of Cooper City provided sanitary sewer service for two homes in the BMSD area as reported in the 1997 version of this support document. Discussions with City growth management and utility staff were not conclusive as to whether or not these two homes are still in the BMSD area. The planning service area stated in the February 2003 revision of the City of Cooper City Comprehensive Plan, Chapter 4, Infrastructure Element; this includes BMSD areas that either have since become incorporated or contain large lot residential areas that utilize septic systems.

b. City of Fort Lauderdale

The City of Fort Lauderdale provides sanitary sewer service for three areas (e.g., Roosevelt Gardens, Franklin Park, and Washington Park) of BMSD Broward County, as noted in the Sanitary Sewer, Solid Waste, Drainage, Potable Water and Natural Groundwater Aquifer Recharge Element support document amendments of 2014.

c. City of Hollywood

City of Hollywood utility representatives indicated that there may be a small amount of the BMSD area near State Route 7 for which sanitary sewer service is provided by the City of Hollywood. They also reported that a large portion, if not all, of what was BMSD area was annexed into the City of Dania Beach. The City of Hollywood also provides wastewater treatment and disposal service for two regional county facilities that remain in the BMSD area: Fort Lauderdale-Hollywood International Airport and the resource recovery plant and ash landfill east of State Route 7 and south of Interstate 595.

d. City of Plantation

Broward County Water and Wastewater Services has completed installation of sanitary sewers in the BMSD area. Sewage from Broadview Park is transmitted to the North Regional Wastewater Treatment Plant.

e. City of Sunrise

The City of Sunrise provides sanitary sewer collection/transmission, treatment, and disposal services for Pine Island Ridge, which was annexed into the Town of Davie effective September 15, 2006.

f. Wastewater Demands, Treatment Plants and Disposal Methods

Wastewater demands, treatment plant information, and disposal information for the three municipal systems that provide significant service to the BMSD areas are shown in the following Table WM-6.

Table WM-6: Population, Sewage Flow, Capacity, Treatment, and Disposal Information for Municipalities Serving the BMSD Area

	Fort Lauderdale	Hollywood	Sunrise
2000 Census city population as annexed through October 2005	170,823	139,545	85,787
Annual average daily flow (MGD-2005)	37.52	41.78	22.85
Licensed design capacity (MGD-AADF)	48.00	48.75	30.45
Treatment type	Secondary	Secondary	Secondary
Disposal method	Deep well injection	Reuse, ocean outfall, and deep injection well	Deep well injection and percolation ponds

C. Drainage and Natural Groundwater Recharge

1. Drainage Systems

Water flowing overland during and immediately following a storm event is called stormwater drainage or stormwater runoff. Under the effects of gravity, the drainage flows toward sea level through depressions and channels which comprise the drainage system of an area. Stormwater runoff can be witnessed in any parking lot, driveway, or street during practically all rainstorms, except during the lightest mist. The drainage system may consist of natural features, man-made features, or a combination of both.

Natural drainage systems are defined by the topography of an area. The largest feature of a natural drainage system is the drainage basin, or watershed. The watershed consists of a network of streams, rivers and tributaries which collectively convey all the surface water from a geographic region to one particular place. This place is called the major drainage feature or receiving body and it may be a river, lake or bay. The boundary of a basin is called the basin divide. This is the point where elevation differentials delineate receiving bodies. In South Florida, the natural elevation differentials are not as easily discernable as they are in hilly or mountainous terrain.

Man-made drainage facilities are artificial constructs, designed to store or convey stormwater runoff. Swales, ditches, canals and stormsewers are typical conveyance structures, collecting stormwater runoff and directing it toward downstream receiving waters. Stormwater storage structures are generally classified as either detention or retention facilities. Detention facilities are designed to temporarily impound runoff and release it gradually to downstream portions of the drainage system through an outlet structure. Retention facilities are impoundments which release stormwater by evaporation and by percolation into the ground, with no direct discharge to surface waters. There are two types of on-site detention/retention systems. Wet detention/retention uses a water storage area with a bottom elevation less than one foot above the average wet season water table to provide storage and recharge the aquifer. Dry detention/retention uses open areas with a bottom elevation at least one foot above the average wet season water table to store the storm water runoff. Both of these techniques will provide aquifer recharge, however, dry detention is preferred from a water quality standpoint since the soils and ground cover provide a natural filtering process.

Drainage systems were used in the past to reclaim land from the Everglades for agricultural development and human settlement. Contemporary thought during the time period was that all wetlands, including the Everglades, were useless wastelands which should be drained for more useful purposes.

Today, drainage systems are used to reverse some of the impacts to the Everglades through the creation of the Water Conservation Areas, which provide protection of the remaining Everglades. Drainage systems are also used as a means of recharging groundwater and preventing saline intrusion, in addition to the original purpose of protecting life and property from floods.

Drainage systems can be structured into three tiers: primary, secondary and tertiary. Each tier is designed to accommodate a certain quantity of storm water runoff. Water flow is managed and controlled throughout the system by devices which include spillways, culverts, weirs, canals, and pumping stations.

Tertiary drainage systems provide the initial localized control, collection and treatment of stormwater runoff. In the BMSD areas and its dependent districts, these drainage systems are permitted by the Broward County EPGMD under county-wide rules and regulations. Tertiary water flow consists of runoff from streets, parking lots, driveways, lawns and other saturated surfaces. Typical tertiary drainage structures include retention and detention ponds, ditches, culverts, and storm sewers. Tertiary drainage systems serve a spectrum of development types including residences, shopping malls, industrial parks and planned communities.

The secondary drainage system consists of canals and other structures which operate as intermediate mechanisms to deliver storm water from the tertiary drainage system to the primary drainage system. The conveyance structures include canals, pumping stations, spillways, culverts

and weirs. The secondary drainage system is operated by dependent and independent local water control districts and municipalities. Dependent drainage districts are managed by the county or municipal governments, while independent drainage districts operate autonomously by a special grant of authority. As illustrated in Map WM-5, there are a total of twenty-three drainage districts: nine are dependent drainage districts and fourteen are independent drainage districts. Local water control districts are divided into sub-basins which empty into the primary drainage system.

Some districts contain only one sub-basin and others may contain several. Sub-basins empty into a primary drainage canal. Secondary canals often flow north or south towards a primary canal which often flows from the west to the east. Every sub-basin contains at least one secondary canal. A typical sub-basin usually drains a narrow strip of land, approximately one mile wide, separated by major roadways. County canals, and canals maintained by the County under contract, are periodically inspected by the Water Management Division (WMD) to insure debris removal, aquatic weed control, and proper operation of flood control gates. All complaints are investigated and, if necessary, the responsible party is notified to correct deficiencies. An inventory of the dependent and independent drainage districts, their enabling authority, and their permitting programs are included as Appendix WM-A.

The primary drainage system collects and conveys storm water from the secondary drainage system to the Atlantic Ocean, Intracoastal Waterway and Dade County water bodies, and in a limited number of cases, to the Everglades. Primary drainage canals, rivers, and levees in Broward County are components of a regional water management system which is controlled by the South Florida Water Management District (SFWMD) and the US Army Corps of Engineers (COE). It consists of 14 drainage basins ranging in size from less than 5 square miles to over 500 square miles. The SFWMD and the COE operate and maintain the primary canal system within the basins and establish discharge limits for releases from the secondary canal system. Limitations on discharge are determined by the capacity of the receiving primary canal to accept and safely remove storm water. Discharge is measured in cubic feet per second per square mile.

2. Major Drainage Features

There are fourteen (14) major drainage features or basins within Broward County: four drainage basins are situated in the undeveloped (western) area and ten drainage basins are within Broward County's developable (eastern) area. Appendix WM-B provides information on the functions and the level of service standard for each of the fourteen basins. Appendix WM-C provides information on the design criteria for the structures within each drainage basin. The descriptions of the drainage basins summarized herein and the information in Appendices WM-B and WM-C are based upon technical memoranda prepared by the South Florida Water Management District SFWMD.

The following abbreviations are used to describe the structures located within each drainage basin:

C – Canal

G – non-Federal structure used to supplement the Federal Central and South Florida Flood Control Project (C&SF)

L – Levee designation in the C&SF Project

S – Structure in the sub-basin.

a. Water Conservation Area 2A

The Water Conservation Area 2A (WCA 2A) basin has an average area of 164.7 square miles and is located in south-central Palm Beach County (65.5 square miles) and in north-central Broward County (99.2 square miles). The WCA 2A is connected to Lake Okeechobee by way of the North New River Canal (NNRC). Regulatory releases from the lake, made to the canal by way of the S-351, are passed through the S-2 and the S-7 basins in the Everglades North New River and Miami Area, and are discharged by gravity flow or pumping from the canal into the WCA by way of the S-7. Regulatory releases from the lake to the WCA 2A are rare events and are only a small part of the water discharged to the WCA by way of the S-7.

In addition to regulatory releases from the lake, the NNRC may be used to supply water from Lake Okeechobee to the C-13, C-14 and the NNRC basins for irrigation and municipal water supply. These water supply releases are passed through the WCA 2A by way of the NNRC and the L-35B borrow canal.

There are two C&SF Project canals affecting water management in WCA 2A: the NNRC and the L-35B borrow canal. The NNRC connects Lake Okeechobee to WCAs 2A and 3A. The connection to Lake Okeechobee is by way of the S-2 and the S-351 at the north end of the canal at South Bay west of Belle Glade. The connection with WCA 2A is by way of the S-7 at the intersection of the L-5 and the L-6, just east of U.S. Highway 27 on the Palm Beach/Broward County line. The connection with WCA 3A is by way of the S-150 just west of the S-7. From the S-7, the NNRC passes on through the WCA and provides a means of conveying water from Lake Okeechobee to eastern Broward County.

The L-35B borrow canal connects the NNRC to the C-13 and the C-14. The canal runs west-east just north of the L-35B making an open channel connection to the NNRC at its west end and connecting to the C-14 at its east end by way of the S-38.

The WCA 2 also is impounded by six levees: L-6, L-35B, L-36, L-38E, L-38W, and L-39. These levees were designed to hold water in WCA 2A at stages estimated to occur during the Standard Project Flood.

b. Water Conservation Area 2B

The WCA 2B basin, located in central Broward County, has an area of 43.8 square miles. WCA 2B is an area of significant recharge to the Biscayne Aquifer. Water supplied to the aquifer by way of WCA 2B is important to maintaining groundwater levels in coastal areas. Adequate groundwater levels are essential to proper management of municipal wellfields and to restrict saltwater intrusion to groundwater. The borrow canals of the levees impounding the WCA on the east cut into the Biscayne Aquifer and intercept some of the groundwater flow to the east. The intercepted groundwater and seepage through the levees are an important source of water to adjacent basins in Broward County: to the C-13 and C-14 basins by seepage to the L-35A and L-36 borrow canals and to the NNRC basin by seepage through L-35 to the NNRC. The rates of seepage through L-35, L-35A, and L-36 are not regulated by specific operation of Project structures, although the rates are probably affected by the stages held in the NNRC and the L-35A and L-36 borrow canals.

WCA 2B is impounded by five levees: L-35, L-35A, L-35B, L-36, and L-38E. The L-35, L-35A, and L-36 intercept seepage from the WCA and conveys this water to adjacent basins for maintenance of groundwater levels for municipal water supply.

c. Water Conservation Area 3A

The WCA 3A basin has an area of 767.3 square miles and is located in western Broward County (568.4 square miles) and northwestern Dade County (198.9 square miles). WCA 3A is connected to Lake Okeechobee by way of the North New River and Miami Canals. Regulatory releases from the lake are made to the NNRC by way of the S-351, are passed through the S-2 and S-7 basins in the Everglades Agricultural Area (EAA), and are discharged into the WCA by way of the S-150. Regulatory releases from the lake to the Miami Canal are made by way of the S-354, are passed through the S-3 and S-8 basins in the EAA, and are pumped to WCA 3A by way of S-8. Regulatory releases from the lake to WCA 3A are rare events and are only a small part of the water discharged to the WCA by way of S-8 and S-150.

The four C&SF Project canals primarily affecting water management in WCA 3A are the Miami Canal, the L-37A borrow canal, the NNRC, and the C-60. The Miami Canal and the NNRC connect WCA 3A to Lake Okeechobee.

The Miami Canal connects to Lake Okeechobee by way of S-3 at the north end of the canal at the town of Lake harbor. The connection to WCA 3A is by way of the S-8, 15 miles west of U.S. Highway 27 on the Broward/Palm Beach County line. The Miami Canal crosses WCA 3A from northwest to southeast leaving WCA 3A and entering WCA 3B at the S-151. The canal continues to the southeast entering tidewater at Biscayne Bay. Most of the Miami Canal within WCA 3A has been re-dug parallel to its original channel and is known by its Project name, the C-123.

The L-67A borrow canal is on the WCA 3A side of the L-67A and connects the Miami Canal to S-333 and the S-12 structures. There are no structures directly controlling flow into or out of this canal. Flow in the canal is indirectly affected by the operation of the S-12 structures, S-333 and S-151.

The NNRC connects to Lake Okeechobee by way of the S-2 at the north end of the canal at South Bay west of belle Glade. The connection with WCA 3A is by way of the S-150 just west of the S-7. It also makes a connection with WCA 2A by way of the S-7 at the intersection of L-5 and L-6, just east of U.S. Highway 27 on the Palm Beach/Broward County line.

The C-60 conveys discharge from the S-140 to a bridge on I-75 about 4.3 miles east of the L-28. It was constructed to facilitate the movement of water away from the S-140 so that the tailwater level at the pump remains within design conditions. The canal is aligned from the S-140 due east for 2.7 miles. It then extends to the southeast connecting to the north borrow of I-75. A bridge on I-75 at that point allows conveyance to the south. This alignment was chosen to make use of an existing bridge on what was then the Everglades Parkway (SR 838), and to form an impoundment for research studies between the canal levee and the Everglades Parkway (now I-75). The impoundment area was to be used for studies in wildlife management and evaporation and seepage control experiments. Water levels in the impoundment are controlled by two 48-inch culverts.

WCA 3A is impounded by seven levees: L-4, L-5, L-28, L-29, L-38W, L-67A, and L-68A. These levees were designed to hold water in WCA 3A at stages estimated to occur during the Standard Project Flood.

d. Water Conservation Area 3B

The WCA 3B basin has an area of 153.6 square miles and is located in south-central Broward County (30.5 square miles) and north-central Dade County (123.1 square miles). WCA 3B is an area of significant recharge to the Biscayne Aquifer. Water supplied to the aquifer by way of WCA 3B is important to maintaining groundwater levels in coastal areas. Adequate groundwater levels are essential to proper management of municipal wellfields and to restrict saltwater intrusion to groundwater. The borrow canals of the levees impounding WCA 3B cut into the Biscayne Aquifer and intercept some of the groundwater flow to the east. The intercepted groundwater and seepage through the levees is an important source of water to adjacent basins in Dade County.

The Miami Canal is the C&SF Flood Control Project canal primarily affecting water management in WCA 3B. The C-304 is that section of the Miami Canal from the S-151 to the S-31. It crosses the upper quarter of the WCA from northwest to southeast. It is used primarily to convey water across the WCA from either Lake Okeechobee or WCA 3A to eastern Dade County and

southeastern ENP. The reaches of the Miami Canal west of WCA 3B convey water to WCA 3B from Lake Okeechobee and WCA 3A.

WCA 3B is impounded by four levees: L-29, L-30, L-33, and L-67A.

e. Hillsboro Canal Basin

The Hillsboro Canal basin has an area of approximately 102 square miles and is located in northeastern Broward County (40 square miles) and southeastern Palm Beach County (62 square miles). The two Project canals in the basin are the Hillsboro Canal and the section of the L-36 borrow canal between the Hillsboro Canal and the S-38B control structure.

The Hillsboro Canal connects Lake Okeechobee to the Atlantic Ocean. It enters the basin through the S-39 control structure at the intersection of L-36 and L-40. Within the Hillsboro Canal basin, the Hillsboro Canal is aligned to and just north of SR 827 west of SR 7 and parallel to and one-half mile north of SR 810 east of SR 7. Direction of flow in the canal is normally to the east with discharge to the Intracoastal Waterway just west of the intersection of A1A and SR 810.

The L-36 borrow canal is aligned north-south along the western boundary of the basin and south of the Hillsboro Canal. The canal intercepts seepage from WCA 2A and is tributary to the Hillsboro Canal. Direction of flow in the canal is to the north to the Hillsboro Canal.

f. Cypress Creek (C-14) Canal Basin

The C-14 basin has an area of 59 square miles and is located in northeastern Broward County. The C-14 basin is divided into an eastern basin (34 square miles) and a western basin (25 square miles). There are two Project canals in the C-14 basin: C-14 and the section of the L-36 burrow canal between the C-14 and control structure S-38B.

The C-14 is aligned east-west in the alignment of the old Pompano Canal from the L-36 burrow canal to a point approximately one-half mile east of Florida's Turnpike. East of that point, the canal alignment follows the old channel of Cypress Creek. Direction of flow in the canal is to the east with a discharge to the Intracoastal Waterway about threequarters of a mile south of SR 814. A short reach of canal connects C-14 to the Pompano Canal. This interconnecting canal makes an open channel connection with C-14 one-half mile east of Florida's Turnpike, and it connects to the Pompano Canal by way of G-65 at 21st Avenue, one-quarter mile west of Powerline Road. Since G-65 is normally closed, flow in this canal is usually to the west to C-14. When G-65 is open to supply water to the Pompano Canal basin, flow in the canal is reversed.

The L-36 borrow canal is aligned north-south along the western boundary of the basin. Only that part of the canal north of C-14 is in the C-14 basin. Direction of flow in the northern part

of the L-36 borrow canal is to C-14. The part of the L-36 borrow canal south of C-14 conveys water from C-14 to the C-13 basin. It does not contribute flow to the C-14 basin.

g. Pompano Canal Basin

The Pompano Canal basin has an area of approximately 7.2 square miles and is located in northeastern Broward County. The Pompano Canal is the only C&SF Project canal in the basin and is aligned east-west, south of and approximately parallel to Atlantic Avenue from 21st Avenue (one-quarter mile west of Powerline Road) to Cypress Road. East of Cypress Road, the canal is aligned northwest-southeast and extends from Cypress Road to the Intracoastal Waterway. At its west end at 21st Avenue, the canal connects to the C-14 by way of G-65. At its east end the canal makes an open channel connection with the Intracoastal Waterway about three-quarters of a mile south of SR 814. Direction of flow is to the east with discharge to the Intracoastal Waterway.

h. Middle River (C-13) Canal Basin

The C-13 basin has an area of approximately 39 square miles and is located in eastern Broward County. The C-13 is divided into an eastern basin (9 square miles) and a western basin (30 square miles). The boundary between the basins runs approximately north-south through S-36. A five square mile area north of the eastern C-13 drains to the North Fork of the Middle River and is known as the North Fork of the Middle River basin. This basin includes no canals or control structures.

There are three C&SF Project canals in the C-13 basin: C-13, the section of the L-36 borrow canal between C-14 and L-35A, and the section of C-42 between S-125 and L-35A. The C-13 is aligned east-west extending from C-42 on the west to the Intracoastal Waterway on the east. C-13 makes an open channel connection with C-42, 1.8 miles south of the intersection of L-35A and L-36. At the I-95 crossing the canal bifurcates, one channel extending to the east to connect to the North Fork of the Middle River and the other channel extending to the southeast to connect to the South Fork of the Middle River. The North Fork is the main channel for flows from C-13 to be discharged to the Intracoastal Waterway. The North Fork has been channelized while the South Fork remains in its natural state. The design criteria calls for 300 cfs to be discharged to the South Fork. Flow in the C-13 is to the east.

The L-36 borrow canal and C-42 form a continuous canal aligned north-south along the western side of the basin. The juncture of the two canals is at the intersection of L-36 and L-35A. Flow in these canals is to the south to C-13.

There is one other Project canal, the L-35A borrow canal, associated with the C-13 basin. The land drained by the L-35A borrow canal is in the North New River Canal (NNRC) basin, however, under non-flood conditions, runoff and seepage to the L-35A borrow canal are

drained to the C-13 basin by way of C-42. Under flooding conditions the L-35A borrow canal discharges to the NNRC by way of S-124. The operation of S-124 determines whether the L-35A borrow canal drains to the C-13 basin or to the NNRC basin. The L-35A borrow canal is aligned northeast-southwest along the northwest border of the NNRC basin. At its north end the L-35A borrow canal makes an open channel connection to C-42 at C-42's juncture with the L-36 borrow canal. At its south end the L-35A borrow canal connects to the NRC by way of S-124.

i. North Fork Middle River Basin

The North Fork Middle River Basin has an area of approximately 5 square miles and is located in eastern Broward County. The area drains into the North Fork of the Middle River and does not contain any canals or any other control structures.

j. Plantation (C-12) Canal Basin

The C-12 basin has an area of approximately 19 square miles and is located in eastern Broward County. The C-12 is the only Project canal in the C-12 basin. It is aligned east-west parallel to and one-mile north of Broward Boulevard from University Drive on the west to S-33 on the east. East of S-33, C-12 follows the old channel of the North Fork of the New River. Flow in the canal is to the east with discharge to the New River.

k. North New River Canal Basin

The North New River Canal (NNRC) basin has an area of approximately 30 square miles and is located in eastern Broward County. The NNRC basin is divided into an eastern basin (7 square miles) and a western basin (23 square miles). The boundary between the basins is approximately SR 817. There are three Project canals in the NNRC basin: the NNRC, the L-35A borrow canal, and the C-42.

The NNRC connects Lake Okeechobee to the Atlantic Ocean. It enters the NNRC basin at S-34 near the intersection of SR 84 and US 27. Within the NNRC basin, the canal is aligned parallel to and just to the north of SR 84. Flow in the canal is to the southeast with discharge to the South Fork of the New River about four miles east of Sewell Lock.

The L-35A borrow canal is aligned northeast-southwest along the northwestern border of the basin. The land drained by the L-35A borrow canal is in the NNRC basin, however, under non-flood conditions, runoff and seepage to the L-35A borrow canal are drained to the C-13 basin by way of C-42. Under flooding conditions the L-35A borrow canal discharges to the NNRC. The operation of S-124 determines whether the L-35A borrow canal drains to the C-13 basin or discharges to the NNRC basin.

The C-42 is aligned north-south parallel to and just east of Hiatus Road and is the continuation of the L-36 borrow canal south of L-35A. The canal enters the NNRC basin at S-125 just south

of C-13. The C-42 makes an uncontrolled open-channel connection with the NNRC one mile east of the intersection of SR 84 and SR 823. Flow in the canal is to the south to the NNRC.

l. South New River Canal (C-11) Basin

The C-11 basin has an area of approximately 104 square miles and is located in south central Broward County. The C-11 basin is divided into an eastern basin (23 square miles) and a western basin (81 square miles).There are four C&SF Project canals in the C-11 basin: the C-11, the C-11S, the section of the L-33 borrow canal between the C-11 and Hollywood Boulevard, and the L-37 borrow canal. The C-11 is aligned east-west parallel to and north of Griffin Road from the L-37 borrow canal on the west to S-13 at US 441. Direction of flow in the reach of the canal in the eastern basin is to the east with discharge to the South Fork of the New River. Direction of flow in the reach of C-13 in the western basin depends on the operation of the control structures S-13A and S-9 located at either end of the reach.

The C-11S is aligned north-south parallel to and three-tenths of a mile east of Flamingo Road from G-87 at Sheridan Street on the south to C-11 on the north. The canal is tributary to and makes an open channel connection with the C-11. Direction of flow in the C-11S is to the north.

The L-33 and L-37 borrow canals make up a continuous canal aligned north-south along the western boundary of the basin. The L-33 borrow canal is south of the C-11 and extends to and makes a connection with the C-9. The L-37 borrow canal is north of the C-11 and extends to but does not make a connection with the North New River Canal. Direction of flow in the L-33 borrow canal depends on the operation of the S-9XS, S-30, and the S-32 and may be either to the north to C-11 or to the south to the C-9. Flow in the L-37 borrow canal is to the south to the C-11.

m. Hollywood (C-10) Canal Basin

The C-10 basin has an area of approximately 15 square miles and is located in southeast Broward County. There are two C&SF Project canals in the C-10 basin: The C-10 and the C-10 Spur Canal.

The C-10 begins at Johnson Road one-quarter mile west of I-95. It extends to the north connecting to the Dania Cut-off Canal 2.6 miles west of the Intracoastal Waterway. Flow in the canal is to the north.

The C-10 Spur Canal begins one-quarter mile north of Sheridan Street and 1.6 miles west of I-95. It extends to the east connecting to the C-10 six-tenths of a mile north of Sheridan Street. Flow in the canal is to the east. There C-10 basin was constructed without a control structure in order to maintain the water surface elevation in the canal high enough to prevent salt water intrusion into local groundwater. Since there is no water supply to the C-10 from outside the

basin, it would be impossible to maintain the required water surface elevation in the canal during periods of low flow even if a structure was in place.

n. Snake Creek (C-9) Canal Basin

The C-9 basin has an area of approximately 98 square miles and is located in southeastern Broward County (59 square miles) and northeastern Dade County (39 square miles). The basin is divided into an eastern basin (45 square miles) and a western basin (53 square miles). There are two C&SF Project canals in the C-9 basin: the C-9 canal and the L-33 borrow canal.

The C-9 is aligned east-west extending from the L-33 on the west to Dumfoundling Bay on the east. The C-9 makes an open channel connection with the L-33 borrow canal one mile north of the intersection of L-30 and L-33 and one-half mile west of US 27. Flow in the C-9 is to the east with discharge by way of S-29 to Dumfoundling Bay.

The L-33 borrow canal is aligned north-south along the western boundary of the C-9 basin. It makes an open channel connection to the west end of the C-9 and is connected to the C-6 by way of S-32. Flow in the borrow canal depends upon the operation of S-30, S-32, and S-9XS, and may be either to the C-9 or the C-11.

There is one small non-Project canal of interest. The Flamingo Road Canal is aligned north-south, west of and parallel to Flamingo Road. It makes an open channel connection with the C-9. Normal flows in this canal are to the south to the C-9. Flows of 110 to 140 cfs are pumped to this canal from a portion of the C-11 basin in the Pembroke Pines area. Without pumping, the runoff from the Pembroke Pines area would flow north to the C-11S. Of the flow entering the C-9 from the Flamingo Canal, 40 - 50 cfs may subsequently be diverted to the C-8 by way of the west borrow canal of NW 67th Avenue.

3. Major Aquifers

Broward County is underlain by two major aquifers: the Biscayne aquifer and the Floridan aquifer. The Biscayne aquifer is currently the principle source of potable water in the County. It is one of the most productive unconfined aquifers in the United States and one of the most permeable aquifers in the world. It underlies all of Broward County except the most westerly sections. The Biscayne aquifer is wedge-shaped being more than 300 feet thick in eastern Broward County and thinning to an edge in the Florida Everglades. The Floridan aquifer is located below the Biscayne aquifer at a depth of 1,200 feet. It is composed of a system of limestones of variable permeability and is approximately 1,000 feet thick. The upper part of the Floridan aquifer is brackish and can be treated to potable standards through membrane treatment, however the lower Floridan water is hard, sulfurous, corrosive, and too saline for potable water use with standard treatment methods, thereby requiring the use of reverse osmosis membrane technology to meet drinking water standards.

The top of the Floridan aquifer system in Broward County is about 950 to 1000 feet below sea level and is considered to be a relatively confined surface overlain by a 550 to 800-foot-thick sequence of clay, silt, limestone and sand referred to as the intermediate confining unit. Unlike the Biscayne Aquifer, which receives recharge through surface water seepage, there is no direct recharge to the Floridan aquifer system in Broward County. Consequently, wells drilled into the Floridan aquifer system in Broward County yield highly mineralized water which is not suitable for most purposes without undergoing advanced water treatment.

Overlying the intermediate confining unit is the surficial aquifer system (of which the Biscayne aquifer is the only formally named unit in Broward County). Although there are significant differences in the water-bearing characteristics and transmissivity of the surficial aquifer system throughout the County, the entire remaining pervious surface of Broward County is the recharge area. Included as part of the pervious surface in Broward County are the water conservation areas (2A, 2B, and 3A). These areas include highly regulated and protected areas of levees, canals, dikes and berms used for storing and recharging water, and they cover approximately the western two-thirds of the county. Because the upper surface of the surficial aquifer system is so close to land surface, and recharge readily occurs on any pervious surface, the few remaining and aerially-limited natural recharge areas are not particularly significant in the overall protection of the surficial aquifer system.

The top of the surficial aquifer system may be considered to be land surface because virtually all of Broward County formerly was seasonally or perennially flooded, although drainage by canals has reduced the occurrence of flooding in east and south-central Broward County. The oolitic limestone and sand that form the upper surface of the surficial aquifer readily absorb rainfall; their porosity provides the principal recharge mechanism to the aquifer. Observation wells generally show rapid response to rainfall and the same phenomenon occurs wherever there are thin, sandy or slightly organic soils overlying the upper surface of the aquifer.

4. Major Natural Groundwater Aquifer Recharge Areas

The SFWMD has not designated any area within Broward County as a "prime groundwater recharge area." Nonetheless, rainfall within the urban portion of Broward County represents a significant source of groundwater recharge to the superficial aquifer, along with recharge from the four Water Conservation Areas (WCAs). The WCAs (2A, 2B, 3A, and 3B) within Broward County, remnants of the original Everglades, total 719 square miles and comprise approximately two-thirds of the County's area. The SFWMD measures water storage in the Conservation Areas by a network of water depth gauges. The level of water stored in the Conservation Areas is a prime consideration in the decision by SFWMD to release water from Lake Okeechobee into the canals for aquifer recharge and/or to declare a condition of water shortage.

Other major sources of recharge include the system of canals in the developable areas of the County. The land surface, itself, is also a major source of aquifer recharge. Generally, soil conditions in the County are conducive to recharge of the aquifer (See the Planning Council Natural Resource Map Series). Except for those areas in the Southwest Sector with thick muck soils, movement of water into the ground is rapid. Recharge also may be obtained through injection and spray irrigation. While the County does not currently engage in either of these two recharge methods, the County is exploring alternative water supply projects that could enhance aquifer recharge via infiltration trenches.

In addition to their drainage and aquifer recharge functions, some canals are operated so as to increase the water level of the aquifer between the wellfield and the ocean and, thereby, prevent saltwater intrusion to well fields. The County's North Regional Recharge System, constructed as part of the County's Integrated Water Resources Plan, is an example of how the canals are used not only to address saltwater intrusion, but to also provide recharge benefits for the County's wellfield system, natural areas, and potential downstream benefits for municipalities such as Pompano, Fort Lauderdale and Hallandale. The interconnectivity of northern Broward County drainage districts also allows for west-east hydrologic connectivity.

Relatively few acres of wetlands are left in the developable area of the County (See Conservation Element and the Planning Council Natural Resource Map Series). As a result, wetlands, other than the WCAs, are not a major source of recharge to the Biscayne aquifer, although there are ongoing efforts to enhance surface water deliveries to various urban wetlands to improve natural system function. While natural system recovery is the primary objective, it is estimated that through seepage, 80% of the surface water recharge will reach the groundwater with indirect benefits for downstream wellfields.

5. Level of Service (LOS) Standard

Broward County has expressed its drainage concurrency level of service (LOS) standard in terms of performance based criteria which recognize the discharge limitation set by the SFWMD upon its primary canals as the effective limitation upon water management systems. The level of service standard for the stormwater management basins controlled by the SFWMD is shown in Appendix WM-B.

The LOS criteria for the BMSD Area are based on adopted standards and criteria for water management works. The minimum standards shown in Table WM-1 are implemented through the development review process of the Broward County Land Development Code.

The submission of detailed drainage plans and calculations is required to show how conformance is to be achieved. The plans and calculations are reviewed for compliance. If they are found not to be in compliance additional information or revision is requested. Permits are not issued until the plans and calculations are brought into conformance. After permitting, the regulatory programs

include inspection and certification to assure construction is conducted in accordance with the standards. Application of the LOS standards through the regulatory systems of the SFWMD, Broward County, and local water control districts assure that a development order shall not be issued unless the necessary drainage facilities either exist at the time of application or are provided for through an approved plan of concurrent construction with financial assurance in the form of a bond, letter of credit, cash deposit of similar mechanism. Policy WM3.1 addresses drainage concurrency LOS standards.

In terms of impervious area for developments in the BMSD Area, impervious surfaces cannot exceed seventy-five percent for an industrial development, seventy percent for commercial, and sixty percent for residential. Variations are allowed if mitigating design improvements are utilized, but under no circumstances can the percentage of impervious area exceed eighty-five percent for industrial, eighty percent for commercial, and seventy percent for residential uses. Municipalities regulate impervious areas according to their respective municipal ordinances.

Table WM-7: Drainage Level of Service Standards

Subject	Adopted Drainage Level of Service Standard Standards
Road Protection	Residential streets not greater than fifty feet wide rights-of-way to have crown elevations no lower than the elevation for the respective area depicted on the ten year "FEMA Flood Map." Rights-of-way greater than fifty feet wide to have an ultimate edge of pavement no lower than the elevation for the respective area depicted on the ten year "FEMA Flood Map."
Building Elevations	To have the lowest floor elevation no lower than the elevation for the respective area depicted on the "100 Year Flood Elevation Map", the FEMA Base Flood Elevation for the area or the site-specific 100-yr, 3-day design storm stage, whichever is highest. Off Site Discharge Not to exceed the inflow limit of SFWMD primary receiving canal or the local conveyance system, whichever is less.
Storm Sewers	Design frequency minimum to be three-year rainfall intensity of the State Department of Transportation Zone 10 rainfall curves.
Flood Plain Routing	Calculated flood elevations based on the ten-year and one hundred-year return frequency rainfall of three day duration shall not exceed the corresponding elevations of the ten year "FEMA Flood Map" and the "100-Year Flood Elevation Map."
Antecedent Water Level	The elevation depicted on the map "Average Wet Season Water Levels".
On Site Storage	Minimum capacity above antecedent water level and below flood plain routing elevations to be design rainfall volume minus off site discharge occurring during design rainfall, except for the 100-yr, 3-day design storm event, which is zero discharge.
Water Quality	Prior to discharge to surface or ground water, 80% or 95% reductions in pollutant load must be achieved based on the rebuttable presumptions of the water quality treatment criteria.

6. Existing Drainage Facility Needs

Drainage facility needs in the areas under the County's jurisdiction are being met through Broward County's Neighborhood Improvement Program (NIP). Originally authorized in 1993, the NIP is a set of public works projects in eight major communities, representing 25 neighborhoods in mostly BMSD Broward County. While the NIP started as drainage improvement projects designed to alleviate flooding in low-lying areas of the County, it has expanded to include a number of infrastructure improvements in the right-of-way of a number of communities. The NIP areas encompass 8,812 acres, 92,000 people, and 28,200 homes. Construction, currently estimated at $658 million, began in 1996 and is scheduled to be completed in 2011. Completion of the drainage improvements associated with the NIP will address

7. Adequacy of Current Level of Service

The effectiveness of a drainage system is frequently measured by the extent to which it reduces damage and inconvenience from flooding. The primary canal system, operated by the SFWMD, is generally adequate to meet the Standard Project Flood. Further, the County's regulatory procedures ensure that discharges from the secondary canal system do not exceed design capacities of the primary canal system.

The secondary canal system generally provides an adequate level of service. Discharges from the secondary system to the primary system are limited to the SFWMD allowable discharge criteria by control structures placed between the two systems. However, uncontrolled connections exist that discharge in excess of the drainage area's pro rata share of the receiving primary canal. Such conditions reduce the capacity available to a property that is served by controlled secondary canals, thus increasing the effect of rainfall on the property. In addition, canals such as the western reach of the C-9 and the C-11 have such limited capacity that agricultural uses are often precluded or severely restricted and the effects of flooding on developed land are excessive. Similar conditions but of differing extent also exist within other primary canal basins. These conditions could be reduced and water management could be enhanced if unrestricted connections were to be brought into conformance and inadequate primary canals were improved to a capacity corresponding to reasonable land use expectations.

Proposed development, in accordance with the LDC, will not receive a development order without having received approval, from the appropriate approval authority, of a water management plan that meets the LDC Requirements. Thus, the two are an inseparable part of the review mechanism with each assuring conformance to adopted standards. Policy WM2.9 addresses the ensurance of proper drainage by the EPGMD.

The drainage level of service standards is based on rainfalls with predicted return frequency but they do not define the frequency of flooding due to other effects or due to other rainfall events. The design rainfall for determining minimum road crown elevations has a ten percent annual

change of occurrence. In certain areas, including southwest Broward County, other design considerations necessitated an upward adjustment to the criteria depicted on the "FEMA Flood Map". When normal groundwater levels were found to be high enough to saturate road base material the minimum road crown elevation was adjusted upward sufficiently to place the base material above the groundwater. Also, when the design flood condition did not recede below the base material within a reasonable period of time the road crown elevation was adjusted upward. Building protection is based on a design rainfall that has a one percent annual chance of occurrence. The flood elevations predicted as a result of the one percent design rainfall are depicted on Broward County's "100 Year Flood Elevation Map." Design storms have not been adopted for the protection of other areas such as parking lots and yards. In general, yards and other open space, and to a lesser extent parking lots, are allowed to be used for stormwater storage on an as-needed basis. The need has been found to be greatest in lower density residential development and in higher coverage non-residential development.

Analysis Requirements

A. Potable Water

1. Broward County Operated Retail Utility

a. Projected Flows

i. *Broward County Demographic Forecast Model (BCDFM) Update* – The Broward County Planning and Development Management Division (PDMD) updated their 2012 forecast model in 2013 to facilitate the upcoming Water Supply Facilities Work Plan and Comprehensive Plan update processes. BCPRD assigned the forecasted estimates from the University of Florida's Bureau of Economic and Business Research (BEBR), "Detailed Population Projections by Age, Sex, Race, and Hispanic Origin, for Florida and Its Counties, 2015-2040, with Estimates for 2012 All Races" to Broward County's municipalities' 2010 Traffic Analysis Zones (TAZ).

BEBR forecasts were assigned to TAZ and municipalities utilizing a household-based model. BEBR's forecasts by population age are converted to countywide household forecasts using a weighted average of the years 2000 and 2010 Census householders by age group data. The converted countywide household forecasts were then assigned to TAZ based on the interaction between: (1) The change in the countywide household size distribution through forecast periods; (2) The established TAZ level distribution of households; and (3) The capacity of each the TAZ to absorb additional housing units. Since the County's population is expected to continue to grow and change, the future distribution of population and housing by municipality and TAZ is likely to be varied. Input from the local planning and service delivery entities guided the distribution process. Underlying the distribution process are land development characteristics and the Broward County Land Use Plan.

ii. *Methodology Used to Determine Projected Flows* – BCWWS uses utility analysis zones (UAZ) to plan and coordinate utility activities within its service areas. The UAZ defines the boundaries of the utility's service areas within each TAZ. BCWWS service areas encompass 150 of the 892 TAZ, which are then divided into 130 UAZ. Retail customers in each of the UAZ are categorized as "single family residential", "multi-family residential", "commercial" and "other".

Finished water usage for each of the four customer categories listed above was determined for each UAZ using BCWWS billing records. System uses and losses were calculated on a District by District basis and allocated to each UAZ to determine a total potable water demand per UAZ. The percentage of a TAZ in each UAZ was also

determined. Adjustments were made to account for UAZ where BCWWS does not provide potable water service (i.e. those UAZ or portions of UAZ where BCWWS provides services for sewer only, not water) and for UAZ that contained a portion of a TAZ that did not include single or multi-family residential land use.

BCWWS projections utilized the year 2010 as a base year. The 2040 demands for "single family residential" and "multi-family residential" were estimated by multiplying the year 2010 demands by the change in population from2010 to 2040 for each UAZ. The year 2040 demands for "commercial" and "other" required a slightly different approach. Because it was not reasonable to assume that a person works or even shops in the same UAZ in which they live, the overall change in population of the County was multiplied by year 2010 "commercial" and "other" demands for each UAZ.

Residential demand was calculated by dividing the service area into sub areas, then doing a traditional per capita forecast for each sub area. Therefore, when population growth rates in relatively lower per capita usage sub areas exceeded population growth rates in relatively higher per capita usage sub areas, lower overall residential per capita demands occurred.

Table WM-8 shows the District 1 projected population and finished water demand potential to the year 2040.

Table WM-8: District 1 Projected Population and Finished Water Demand Potential, 2010-2040

Year	Projected Population[1]	Finished Water Demand Avg. Day (MGD)[2]	Finished Water Demand Max. Day (MGD)[3]
2010	75,091	8.63	11.23
2015	75,546	8.69	11.29
2020	75,889	8.73	11.35
2025	77,950	8.96	11.65
2030	82,923	9.54	12.40
2035	84,116	9.67	12.58
2040	84,826	9.75	12.68

1 Based on 2014 BCPRD TAZ estimate translation to UAZ populations.
2 Based on 115 gallons per-capita day.
3 Based on a maximum day to average day ratio of 1.30.

Table WM-9 through 11 show the District 2 projected population and finished water demand potential to the year 2040.

Table WM-9: District 2 Projected Population (excluding Coconut Creek) and Finished Water Demand Potential, 2010-2040

Year	Projected Population[1]	Finished Water Demand Avg. Day (MGD)[2]	Finished Water Demand Max. Day (MGD)[3]
2010	55,687	6.63	8.61
2015	56,256	6.69	8.70
2020	55,799	6.64	8.63
2025	56,185	6.69	8.69
2030	57,675	6.86	8.92
2035	57,725	6.87	8.93
2040	57,575	6.85	8.91

1 Based on 2014 BCPRD TAZ estimate translation to UAZ populations.
2 Based on 119 gallons per-capita day.
3 Based on a maximum day to average day ratio of 1.30.

Table WM-10: Coconut Creek Projected Population and Finished Water Demand Potential, 2010-2040[1]

Year	Projected Population[2]	Finished Water Demand Avg. Day (MGD)[3]	Finished Water Demand Max. Day (MGD)[4]
2010	53,494	6.37	8.28
2015	55,240	6.57	8.55
2020	60,473	7.20	9.36
2025	63,974	7.61	9.90
2030	66,534	7.92	10.29
2035	67,706	8.06	10.47
2040	68,347	8.13	11.57

1 For the portion of Coconut Creek and Parkland that uses BCWWS potable water.
2 Included 0.16 MGD of BCWWS system uses/losses incurred providing water to Coconut Creek.
3 Based on 119 gallons per-capita day.
4 Based on a maximum day to average day ratio of 1.30.

Table WM-11: District 2 and Coconut Creek Projected Population and Finished Water Demand Potential, 2010-2040

Year	Projected Population[1]	Finished Water Demand Avg. Day (MGD)[2]	Finished Water Demand Max. Day (MGD)[3]
2010	109,181	12.99	16.89
2015	111,496	13.27	17.25
2020	116,272	13.84	17.99
2025	120,159	14.30	18.59
2030	124,209	14.78	19.22
2035	125,431	14.93	19.40
2040	125,922	14.98	19.48

1 Included 0.16 MGD of BCWWS system uses/losses incurred providing water to Coconut Creek.
2 Based on 119 gallons per-capita day.
3 Based on a maximum day to average day ratio of 1.30.

Table WM-12 shows the District 3A projected population and finished water demand potential to the year 2040.

Table WM-12: District 3A Projected Population and Finished Water Demand Potential, 2010-2040

Year	Projected Population[1]	Finished Water Demand Avg. Day (MGD)[2]	Finished Water Demand Max. Day (MGD)[3]
2010	15,821	3.12	4.27
2015	16,298	3.21	4.40
2020	17,014	3.35	4.59
2025	17,442	3.44	4.81
2030	17,962	3.54	4.85
2035	17,928	3.53	4.84
2040	17,827	3.51	4.81

1 Based on 2014 BCPRD TAZ estimate translation to UAZ populations.
2 Based on 197 gallons per-capita day.
3 Based on a maximum day to average day ratio of 1.37.

Table WM-13 shows the District 3BC projected population and finished water demand potential to the year 2040.

Table WM-13: District 3BC Projected Population and Finished Water Demand Potential, 2010-2040

Year	Projected Population[1]	Finished Water Demand Avg. Day (MGD)[2]	Finished Water Demand Max. Day (MGD)[3]
2010	32,480	3.35	4.88
2015	32,852	3.38	4.94
2020	33,706	3.47	5.07
2025	33,825	3.48	5.09
2030	35,763	3.68	5.38
2035	36,285	3.74	5.46
2040	36,640	3.77	5.51

1 Based on 2014 BCPRD TAZ estimate translation to UAZ populations.
2 Based on 103 gallons per-capita day.
3 Based on a maximum day to average day ratio of 1.46.

b. Level of Service Standards

The Level of Service Standards, as described in Table WM-14, are not anticipated to change over the planning horizon. WWS Land Development Standards contains the methodology currently used to determine if the level of service standard can be met. BCWWS changes the methodology administratively from time to time as new information becomes available.

c. Raw Water Supply Needs

The level of service standard for source of supply is maximum day, meaning the system must have enough firm source of supply capacity to meet its maximum day needs. Firm capacity is the design capacity with the largest unit out of service.

The South Florida Water Management District, through its permitting process, has limited District 1's long term use of the SAS to a "base condition use" of 9.2 MGD average day flow for District 1. To meet the projected future finished water demands as indicated in Table WM-8 for District 1, the withdrawal and treatment of water from the Floridan Aquifer has been proposed.

The District 1 treatment plant currently uses approximately 4% of the SAS raw water supply in its lime softening treatment process. This means it takes 104 gallons of SAS raw water to produce 100 gallons of finished water. The amount of water used by the treatment process varies from plant to plant and by type of treatment process. The raw water flows in Table WM-14 are based on a level of service of 120 gallons per capita day with a 1.09 maximum day to average day ratio. Table WM-15 indicates that District 1 WTP has available treatment capacity but, SAS raw water capacity is likely to be limited between 2020 and 2040 by the base condition use.

Table WM-14: District 1 Comparison of SAS Raw Water Supply Facility Capacity and Permitted Capacity

Year	2015	2020	2025	2030	2035	2040
Population Served[1]	75,546	75,889	77,950	82,923	84,116	84,826
Avg. Daily Demand (MGD)[2]	9.07	9.11	9.35	9.95	10.09	10.18
Max. Day Demand (MGD)[3]	9.88	9.93	10.20	10.85	11.00	11.10
Facility Capacity Surplus/(Deficit)(MGD)[4]	5.42	5.37	5.10	4.45	4.30	4.20
Permitted Raw Water Surplus/(Deficit)(MGD)[5]	0.13	0.09	(0.15)	(0.75)	(0.89)	(0.98)

1 Population July 2013, Broward County WWS.
2 Based on 120 gallon per-capita day raw water
3 Based on 1.09 maximum to average day raw water ratio.
4 Calculated by subtracting Max. Day Demand from Available Facility Firm Capacity of 15.30 MGD.
5 Calculated by subtracting Avg. Daily Demand from Permitted Raw Water Avg. Day of 9.20 MGD.

BCWWS is proposing to use the Floridan aquifer as an alternative source of supply to provide the additional water to meet demands at the end of the planning period. Use of this brackish water from the Floridian aquifer will require a significantly different treatment process than the type currently used for SAS raw water source. Nanofiltration, membrane and reverse osmosis treatment plants using the Floridan aquifer as the source of supply reject approximately 20% to 25% of the raw water in the treatment process. This means for every 100 gallons of finished water it takes 133 gallons of Floridian aquifer raw water, since the treatment process recovery rate is approximately 75%.

Table WM-15 and WM-16 show the limitation of the SAS water source, the potential Floridan aquifer water source demand and the firm treatment capacity needed to treat both water sources, based on a 75% use of treatment plant capacity. A subsequent section describes the proposed Floridan aquifer source of supply project.

Table WM-15: SAS Source of Supply Future Needs

Year	SAS Raw Water Avg. Day Demand Flow (MGD)[1]	Finished Water Avg. Day Demand Flow (MGD)[2]	Finished Water Max. Day Demand Flow (MGD)[2,3]	WTP Firm Capacity Required (MGD)[4]
2015	9.07	8.69	11.29	14.12
2020	9.11	8.73	11.35	14.19
2025	9.20	8.85	11.5	14.38
2030	9.20	8.85	11.5	14.38
2035	9.20	8.85	11.5	14.38
2040	9.20	8.85	11.5	14.38

1 SAS average day demand up to SFWMD SAS baseline allocation limit for District 1 of 9.2 MGD.
2 Finished water average and maximum day based on Table WM-8 for 2015 and 2020. Average daily finished water for Years 2025 through 2040 are based on raw to finished water ratio of 1.04.
3 Years 2025 through 2040 based on estimated finished water maximum to average day ratio of 1.30.
4 Based on a treatment capacity that is 25% more than the finished water maximum day demand.

Table WM-16: District 1 Floridan Aquifer Source of Supply Future Needs

Year	SAS Raw Water Avg. Day Demand Flow (MGD)[2]	Finished Water Avg. Day Demand Flow (MGD)[1]	Finished Water Max. Day Demand Flow (MGD)[3]	WTP Firm Capacity Required (MGD)[4]
2015	0	0	0	0
2020	0	0	0	0
2025	0.15	0.11	0.14	0.18
2030	0.92	0.69	0.90	1.12
2035	1.09	0.82	1.07	1.33
2040	1.20	0.90	1.17	1.46

1 Finished water average day demand flow not available from SAS water source.
2 Based on raw to finished water ratio of 1.33 reflecting 75% recovery from the treatment process.
3 Based on estimated finished water maximum to average day ratio of 1.30.
4 Based on a treatment capacity that is 25% than the finished water maximum day demand.

The SFWMD, through its permitting process, has limited the long-term use of District 2's current source of supply, the SAS, to the "base condition use" of 17.5 MGD average day flow. This base condition use includes 0.6 MGD SAS raw water for purchase by the City of Deerfield Beach Large User.

The District 2 treatment plant currently uses approximately 4% of the SAS raw water supply in its lime softening treatment process. This means it takes 104 gallons of SAS raw water to produce 100 gallons of finished water. The amount of water used by the treatment process

varies from plant to plant and by type of treatment process. The raw water flows in Table WM-16 are based on a level of service of 124 gallons per capita day with a 1.10 maximum day to average day ratio. Table WM-17 indicates that District 2 WTP has available treatment capacity. The SAS raw water base condition use for District 2/NR wellfields provide enough capacity through the end of the planning period to meet project finished water demands without establishment of an alternative water source.

Table WM-17: North Regional/2A Wellfield Comparison of SAS Raw Water Supply, Facility Capacity, Not Including Deerfield Beach

Year	2015	2020	2025	2030	2035	2040
Population Served[1]	111,496	116,272	120,159	124,209	125,431	125,922
Avg. Daily Demand (MGD)[2]	13.83	14.42	14.90	15.40	15.55	15.61
Max. Day Demand (MGD)[3]	15.21	15.86	16.39	16.94	17.11	17.18
Facility Capacity Surplus/(Deficit) (MGD)[4]	15.09	14.44	13.91	13.36	13.19	13.12
Permitted Raw Water Surplus/(Deficit) (MGD)[5]	3.67	3.08	2.60	2.10	1.95	1.89

1 Population July 2013, Broward County WWS.
2 Based on 124 gallon per-capita day raw water.
3 Based on 1.10 maximum to average day raw water ratio.
4 Calculated by subtracting Max. Day Demand from Available Facility Firm Capacity of 30.30 MGD.
5 Calculated by subtracting Avg. Daily Demand from Permitted Raw Water Avg. Day of 17.5 MGD.

Table WM-18 shows the SAS aquifer source of supply proposed to be used to meet future needs and how it relates to WTP capacity needed through the planning period.

Table WM-18: District 2 SAS Source of Supply Future Needs[1]

Year	SAS Raw Water Avg. Day Demand Flow (MGD)[1]	Finished Water Avg. Day Demand Flow (MGD)[2]	Finished Water Max. Day Demand Flow (MGD)[2]	WTP Firm Capacity Required (MGD)[3]
2015	13.83	13.27	17.25	21.56
2020	14.42	13.84	17.99	22.49
2025	14.90	14.30	18.59	23.24
2030	15.40	14.78	19.22	24.03
2035	15.55	14.86	19.40	24.25
2040	15.61	14.98	19.48	24.35

1 SAS average day demand up to SFWMD SAS base condition use for District 2 of 17.5 MGD (SAS raw water average day shown does not include 0.6 MGD raw water allotted to Deerfield Beach).
2 Finished water average and maximum day from Table WM-17 above.
3 Based on 25% increase over finished water maximum day demand.

BCWWS is also implementing a reclaimed water irrigation project. It is anticipated that by 2015, this project will result in 0.1 MGD demand reduction, which will increase to 0.3 MGD by 2020 as more customers use reclaimed water for irrigation.

The County purchases finished water from the City of Hollywood (City) to meet the demands in the District 3 service area. The City is responsible for ensuring adequate raw water supply and treatment facilities. The City's existing CUP was issued by SFWMD on April 2008 and expires April 2028. The permit contains sufficient allocation to meet demands through the year 2028.

d. Treatment Facility Needs

The level of service standard for treatment is maximum day, meaning the system must have enough firm treatment capacity to meet its maximum day needs. The type of treatment is dependent on the source of supply. Since BCWWS intends to have two different sources of supply, two different treatment processes will be required. Table WM-19 and Table WM-20 show the combination of Lime Softening and reverse osmosis treatment processes proposed to be used to meet District 1's future needs.

Table WM-19: District 1 Lime Softening Treatment Plant Future Needs

Year	Finished Water Max Day Demand Flow (MGD)[1]	WTP Firm Capacity Required (MGD)[1]
2015	11.30	11.33
2020	11.35	14.19
2025	11.50	14.38
2030	11.50	14.38
2035	11.50	14.38
2040	11.50	14.38

1 Based on Table WM- 15 SAS Source of Supply Future Need.

Table WM-20: District 1 Floridan Aquifer Treatment Plant Future Needs

Year	Finished Water Maximum Day Demand Flow (MGD)[1]	WTP Firm Capacity Required (MGD)[1]
2015	0	0
2020	0	0
2025	0.14	0.18
2030	0.90	1.12
2035	1.07	1.33
2040	1.17	1.46

1 Based on Table WM- 16 District 1 Floridan Aquifer Source of Supply Future Needs.

Table WM-21 shows the SAS and proposed to be used to meet District 2's future needs.

Table WM-21: District 2 SAS Aquifer Treatment Plant Future Needs

Year	Finished Water Maximum Day Demand Flow (MGD)[1]	WTP Firm Capacity Required (MGD)[2]
2015	17.25	22.16
2020	17.99	23.09
2025	18.59	23.84
2030	19.22	24.63
2035	19.40	24.85
2040	19.48	24.95

1 Based on Table WM-18 District 2 SAS Source of Supply Future Needs.

e. Storage Facility Needs

The level of service standard for finished water storage is 40% of maximum day demand for meeting peak demands during the day and routine operational purposes, plus 0.63 million gallons (MG) for fire protection purposes.

Table WM-22 shows District 1's future storage needs. Since existing storage capacity is 7.1 MG, BCWWS will not need to increase its storage capacity during this planning period.

Table WM-22: District 1 Future Finished Water Storage Needs

Year	Required Minimum Finished Water Storage (MG)
2015	5.20
2020	5.25
2025	5.35
2030	5.59
2035	5.69
2040	5.77

Table WM-23 shows District 2's future storage needs. Since Coconut Creek is required to have its own finished water storage, the maximum day demand is the BCWWS portion of the overall maximum day demand. Since existing storage capacity is 8.5 MG, BCWWS does not need to increase its storage capacity within the foreseeable future. However, BCWWS CIP Project 9154 will replace some existing storage and will accommodate future demands.

Table WM-23: District 2 Future Finished Water Storage Needs

Year	Required Minimum Finished Water Storage (MG)
2015	4.03
2020	4.05
2025	4.07
2030	4.15
2035	4.17
2040	4.17

Table WM-24 shows District 3A's future storage needs. Since existing storage capacity is 2.0 MG, BCWWS needs to increase its storage capacity. BCWWS CIP Project 9058 will provide a 2.5 MG concrete potable water storage facility.

Table WM-24: District 3A Future Finished Water Storage Needs

Year	Required Minimum Finished Water Storage (MG)
2015	2.40
2020	2.46
2025	2.51
2030	2.57
2035	2.57
2040	2.57

Table WM-25 shows District 3BC's future storage needs. Since existing storage capacity is 4.0MG, BCWWS will not need to increase its storage capacity during this planning period.

Table WM-25: District 3BC Future Finished Water Storage Needs

Year	Required Minimum Finished Water Storage (MG)
2015	2.61
2020	2.66
2025	2.68
2030	2.77
2035	2.81
2040	2.85

f. Transmission/Distribution Facility Needs

In the late 1990s, BCWWS implemented a program to address drainage issues in certain areas. This program was quickly expanded by the County to include street improvements, sidewalks and neighborhood landscaping. BCWWS decided to upgrade a substantial portion of its piping system in the area covered by the program. Water and sewer system were planned to be repaired/replaced as necessary and service (mostly sewer service) extended to those that did not have it. These programs are called Neighborhood Improvement Projects (NIPS) and have grown into significant efforts requiring a substantial portion of BCWWS's retail utility resources, in terms of money and staff effort. From about 1997 to 2004, BCWWS' retail utility capital improvement program focused on the NIPS as its major component.

- District 1 and District 2 NIPS are anticipated to be completed by the year 2014.
- District 3A does not contain a NIPS.
- District 3BC NIPS have been completed.

The NIPS described above constitute a major commitment on the behalf of BCWWS to upgrade and improve its water transmission/distribution system. All totaled, they will address about 32% of the combined districts utility system (by area).

However, BCWWS realizes that the effort cannot stop with the previously identified NIPS. In 2001 BCWWS developed a Capital Projects Prioritization methodology that is described more fully in the Capital Improvements Section. This methodology provides a systematic approach to continued upgrading of the BCWWS systems.

g. Changing Regulatory Requirements

Please see the Section on Broward County Operated Regional Raw Water Supply Changing Regulatory Requirement for information that applied to the Broward County Operated Retail Utility and its raw water sources.

One of the most significant regulations in the past five years was the SFWMD adoption of the Regional Water Availability Rule in February 2007. This rule limits water use from the SAS to those withdrawal levels permitted prior to April 2006. Implementation of this rule has removed the SAS from consideration as a raw water source to meet future increases in water supply demand. This document explains how BCWWS intends to meet future needs through alternative water supplies.

Another significant change in the regulations was initiated with the passing of a bill in 2008 by the Florida legislature requiring all facilities that discharge domestic wastewater through ocean outfalls to meet higher treatment standards by 2018. By 2025 domestic wastewater facilities with ocean outfalls are required to achieve at least 60% reuse of the generated wastewater

and cease discharge to the ocean outfalls, except in emergency situations. The Broward County North Regional Wastewater Treatment Facility has an ocean outfall and will be required to comply with the new regulations. The implementation of these requirements for wastewater reuse may have positive impact on water availability into the future.

h. Alternative Water Supply

BCWWS plans to meet its future source of supply and water treatment needs by obtaining raw water from the Floridan aquifer where SAS base condition limitations are outstripped by service area finished water demands. BCWWS will continue to permit and operate its District 1 SAS facilities at the base condition use for the SAS of 9.2 MGD average annual and 280 MGM maximum month flow. BCWWS also is pursuing the incorporation of 0.837 MGD average day allocation to establish a SAS base condition use of 10.04 MGD and the correction of the SAS maximum monthly allocation to 333 MGM. This modification will provide more SAS reliability into the future.

BCWWS is currently exploring construction of a reverse osmosis membrane treatment plant for the treatment of brackish water from the upper Floridan aquifer alternative water supply source. The treatment plant is planned to be located at the existing District 1 treatment site. The first phase of the treatment plant is planned to produce a minimum 4.5 MGD of finished water (maximum day basis), and will be designed so that it is expandable to a minimum of 5.5 MGD. According to demand projections, the initial Floridan treatment plant combined with the lime softening treatment plant should meet demands until after 2040.

The alternative water supply project will include enough Floridan well capacity to supply the treatment plant. Using a recovery rate of 75%, Floridan wells with an average annual day withdrawal of 6.0 MGD will be required for the first phase of the treatment plant. The plant expansion would require an additional 1.3 MGD of annual average day withdrawal. The initial phase of the Floridan wellfield will be designed for its eventual expansion. The wellfield should have enough physical capacity to insure delivery of raw water with the largest well out of service.

BCWWS plans to meet its District 2 future source of supply and water treatment needs from the existing SAS facilities. A Floridian aquifer water source will be evaluated over the planning period for eventual development. BCWWS will continue to permit and operate its SAS facilities at base condition use of 17.5 MGD average annual and 585.2 MGM maximum month flow.

BCWWS is also implementing a reclaimed water irrigation project in the District 2 service area. It is anticipated that by 2015, this project will result in 0.1 MGD less demand. Demand reduction will increase to 0.3 MGD by 2020 as more customers utilize the reclaimed water for irrigation.

BCWWS has $48.2 million for the proposed District 1 Floridan WTP in its five-year capital improvement program to provide the required Floridan Aquifer production capacity. This project received its initial funding in FY08. The anticipated schedule is:

Planning and Design	2008 – 2016
Permitting and Procurement	2010 – 2016
Construction and Startup	2011 – 2018

Planning and design includes any necessary Floridan test wells and final production well consumptive use permitting. BCWWS will continue to pursue demand reduction practices. This will not impact the sizing of the initial Floridan aquifer project, but may delay the need for the subsequent expansion.

i. Capital Improvement Program

The Board is the authority responsible for approving BCWWS capital improvement program budgets. Each year the Board approves an encumbrance budget for the next fiscal year and a five-year capital improvement plan. See the Capital Improvements Element for information on BCWWS' capital improvement program.

2. Broward County Operated Regional Raw Water Supply

a. Level of Service (LOS) Standards

The level of service standards for the regional wellfields are the Regional Water Availability Rule "Base Condition Use" as defined by the SFWMD for each regional wellfield as described above. Table WM-26 summarizes the large user demands based on current SFWMD CUPs for each BCWWS regional wellfield.

Table WM-26: Regional Wellfield Base Condition Water Use and Large User's Allocations

	NORTH REGIONAL WELLFIELD		SOUTH REGIONAL WELLFIELD			
Description	BCWWS WTP 2 (MGD)	Deerfield Beach (MGD)	Hallandale Beach (MGD)	Hollywood (MGD)	Dania Beach (MGD)	FPL (MGD)
Current Permitted (Avg. Day-Max. Day)	Avg. Day 7.4 MGD Max. Day 8.9 MGD		Avg. Day 14.2 MGD Max. Day 22.4 MGD			
Large User Allocation (Avg. Day)[2]	6.8	0.6	4.4	5.9	1.7	2.0
Large User Allocation (Max. Day)[2]	8.1	0.8	5.3	7.1	2.0	2.4
Total for Large Users (Avg. Day-Max. Day)	Avg. Day 7.4 MGD Max. Day 8.9 MGD		Avg. Day 14.0 MGD Max. Day 16.8 MGD			

1 Based on current CUP allocations under permits 06-01634-W and 06-01474-W.
2 Based on current large user CUP demand projections and large user agreements.

b. Capital Improvement Programs

As both NRW and SRW facilities have adequate capacity to provide service to the year 2028, there is no capital improvement program associated with these facilities.

3. Other Water Providers

a. City of Fort Lauderdale

Future water demands for the Fort Lauderdale water utility service areas was estimated based on per capita rates of consumption measured in 20008 and the projected increase in the number of wholesale and retail customers. Distribution losses were also taken into account. For the BMSD areas of the County supplied water by Fort Lauderdale, the 2005 water use was increased by the projected percent increase in population associated with the area served by the water supply and as presented in population forecasts.

i. *Projected Flows* – The population projections and projected water demands for the BMSD areas provided water by the City of Fort Lauderdale were estimated based on per capita rates of water consumption measured in 2008 and the projected increase in the number of retail customers. The per capita water demand in these areas was conservatively estimated to be 197 GPD. The total projected demands on the City of Fort Lauderdale water utility for all areas provided water are summarized in Table WM-27. Tables WM-28 and 29 show the projected populations for the City of Fort Lauderdale Wholesale and Retail Service Areas respectively, including the BMSD populations serviced by the City of Fort Lauderdale utility.

ii. *Ability to Meet Future Needs* – The City of Fort Lauderdale water utility has adequate wellfield capacity (85.2 MGD) to meet the projected water supply demands of the BMSD areas of 1.46 MGD of finished water demand in 2035. The City also has sufficient treatment capacity (82.0 MGD) to meet this projected demand, based on the current treatment technology, through 2035. While wellfield capacity might limit the utility's ability to meet peek demands of 91 MGD, on-site storage of 24.0 MG will likely mediate these deficiencies. Although the City of Fort Lauderdale appears to have sufficient wellfield and treatment capacity to meet the projected demands, the utility's current consumptive use permit limits withdrawals from the Biscayne Aquifer, the sole source of water for both the Peele-Dixie and the Fiveash WTPs, to an average of 52.55 MGD to 2028. The City has proposed that any additional demand be met by the development of the Floridan Aquifer and a reduced water demand rate. By 2035, the utility's water supply needs are projected to reach 55.50 MGD.

Table WM-27: Projected Population and Water Demands for the City of Fort Lauderdale Water Utility

Year	Projected Population	Average Daily Demand (MGD)[1]
2015	267,774	47.21
2020	285,763	50.48
2025	304,301	53.63
2030	322,901	56.79

1 Demands are estimated from the projected water needs of retail and wholesale customers and are in MGD. Calculation of the average daily demand was based on per-capita water demands and population projections for each of the service areas in the 2008 CUP.

Table WM-28: City of Fort Lauderdale Wholesale Population Projections, 2010-2035

Municipality	2015[1]	2020[1]	2025[1]	2030[1]	2035[1]
Davie[2]	528	530	527	534	585
Lauderdale Lakes	381	383	378	386	386
Lauderhill	2,890	2,881	2,840	2,927	2,969
Lazy Lake[3]	26	26	26	26	26
North Lauderdale	349	352	1,060	1,291	1,403
Oakland Park	27,122	28,097	28,682	29,818	30,176
Oakland Forest Subdivision (within Oakland Park)[4]	3,584	3,621	3,575	3,659	3,649
Tamarac	2,152	2,162	2,137	2,179	2,188
Wilton Manors	11,611	11,740	11,693	11,931	11,929
Total:	48,643	49,792	50,918	52,751	53,311

1 The 2015 to 2030 population projections are based on the 2014 Traffic Analysis Zones and Municipal Forecasts Update prepared by the Broward County Planning and Development Management Division (PDMD). The update assigns the forecasted estimates from the University of Florida's Bureau of Economic and Business Research (BEBR), "Detailed Population Projections by Age, Sex, Race, and Hispanic Origin, for Florida and Its Counties, 2015-2040, With Estimates for 2012 All Races" to Broward County's 2010 Traffic Analysis Zones (TAZ) and municipalities.

2 Area includes a portion of the Hacienda Village neighborhood, which comprises TAZ 651.

3 The Village of Lazy Lake is built-out.

4 Oakland Forest is a subdivision of the City of Oakland Park and comprises all of TAZ 414. Potable water from the City of Fort Lauderdale is supplied through a master meter. Water demand by the residents in this subdivision was forecast separately from the water demand of the City of Oakland Park.

Source: City of Fort Lauderdale Department of Sustainable Development, Urban Design & Planning Division, June 12, 2014.

Table WM-29: City of Fort Lauderdale Retail Population Projections, 2010-2035

Municipality	2015[1]	2020[1]	2025[1]	2030[1]	2035[1]
Fort Lauderdale	169,094	174,316	189,166	198,394	201,880
Lauderdale-by-the-Sea	3,841	4,009	3,960	3,922	3,894
Sea Ranch Lakes	703	720	709	704	697
BMSD Broward County	6,265	6,652	7,005	7,297	7,414
Total:	179,903	185,697	200,840	210,317	213,885

1 Notes: The 2015 to 2030 population projections are based on the 2014 Traffic Analysis Zones and Municipal Forecasts Update prepared by the Broward County Planning and Development Management Division (PDMD). The update assigns the forecasted estimates from the University of Florida's Bureau of Economic and Business Research (BEBR), "Detailed Population Projections by Age, Sex, Race, and Hispanic Origin, for Florida and Its Counties, 2015-2040, With Estimates for 2012 All Races" to Broward County's 2010 Traffic Analysis Zones (TAZ) and municipalities.

Source: City of Fort Lauderdale Department of Sustainable Development, Urban Design & Planning Division, June 12, 2014.

iii. *Capital Improvement Projects* – The City of Fort Lauderdale plans to develop a Floridan wellfield and treatment facility in order to meet the projected water supply needs of approximately 62 MGD in 2025. Major capital improvement projects currently underway include the construction of new wells at the Peele-Dixie wellfield to replace 19 wells that are being abandoned due to wellfield contamination issues and transitioning from lime softening to nanofiltration at the Peele-Dixie WTP. While nanofiltration will enhance the quality of finished water by removing discoloration associated with high levels of dissolved organics, the replacement of lime softening processes with membrane treatment will also increase the total raw water demand. Since membrane treatment has a finished water recovery equal to 80% of raw water treated, compared to 96% with lime softening, the utility will need to increase pumpage and treatment to provide the same amount of finished water.

iv. *Upgrade of the Peele-Dixie WTP 2018* – Planned upgrade of the Peele-Dixie WTP will provide finished water via nanofiltration. Continued use of the Fiveash WTP for treatment by lime softening will, in conjunction with the Peele-Dixie facility, provide water for the City's wholesale and retail customers. There will be continued system improvements through the WaterWorks 2011 program and additional transmission system infrastructure improvements will be required.

B. Sanitary Sewer

1. Broward County Operated Retail Utility

a. Projected Flows

i. *Broward County Demographic Forecast Model (BCDFM) Update* – The Broward County Planning and Development Management Division (PDMD) periodically updates their forecast model. The update assigns the forecasted estimates from the University of Florida's Bureau of Economic and Business Research (BEBR), "Detailed Population Projections by Age, Sex, Race, and Hispanic Origin, for Florida and Its Counties, 2015-2040, with Estimates for 2012 All Races" to Broward County's 2010 traffic analysis zones (TAZ) and municipalities.

BEBR forecasts were assigned to TAZ and municipalities utilizing a household-based model. BEBR's forecasts by population age are converted to countywide household forecasts using a weighted average of the years 2000 and 2010 Census householders by age group data. The converted countywide household forecasts were then assigned to TAZ based on the interaction between: (1) The change in the countywide household size distribution through forecast periods; (2) The established TAZ level distribution of households; and (3) The capacity of each the TAZ to absorb additional housing units.

Since the County's population is expected to continue to grow and change, the future distribution of population and housing by municipality and TAZ is likely to be varied. Input from the local planning and service delivery entities guided the distribution process. Underlying the distribution process are land development characteristics and the Broward County Land Use Plan.

ii. *Methodology Used to Determine Projected Flows* – BCWWS estimated future potable water flows, and will determine future sanitary sewer flows based on the potable water estimates by 2016. BCWWS' potable water and sanitary sewer service areas cover geographically different areas. Each district has locations where BCWWS provides water service but not sanitary sewer service, and/or vice versa. These differences were accounted for when estimating future Sewered population.

BCWWS uses utility analysis zones (UAZ) to plan and coordinate utility activities within its service areas. The UAZ defines the boundaries of the utility's service areas within each TAZ. BCWWS service areas encompass 150 of the 892 TAZs, which are then divided into 130 UAZs. Retail customers in each UAZ are categorized as "single family residential", "multi-family residential", "commercial" and "other".

In 1995, as part of a master planning effort, water usage for each of the four customer categories listed above was determined for each UAZ using current BCWWS billing records. System uses were calculated on a District by District basis and allocated to each UAZ to determine a total potable water demand per UAZ. The percentage of a TAZ in each UAZ was also determined. Adjustments were made to account for UAZs where BCWWS does not provide potable water service (i.e. those UAZs or portions of UAZs where BCWWS provides services for sewer only, not water) and for UAZs that contained a portion of a TAZ that did not include single or multi-family residential land use. The adjustment consisted of a deduction in the TAZ percentage based on land area.

In February 2012, EPGMD provided BCWWS with projected population changes prepared by PRD in five year increments from 2010 to 2030 for each TAZ that is totally or partially within the BCWWS' retail service areas. EPGMD also provided PRD estimates of dwelling unit changes through the year 2030. Based upon the numbers provided and subsequent briefings by EPGMD staff, BCWWS service areas are expected to be impacted by two phenomena in the future: (1) A redevelopment corridor loosely defined as bordering and to the east of State Road 7; and (2) An increase in the number of people living in each dwelling unit, both new and existing.

BCWWS population projections utilize the year 2010 as a base year. Following the methodology used in the BCWWS Master Plan, the year 2010 population was

determined for each UAZ based on the 2010 Census data and for the year 2040 based on projections provided by EPGMD.

Currently not all BCWWS water customers are on sanitary sewer. It is assumed that by the year 2040 all BCWWS water customers will be on sanitary sewer. The 2002 Master Plan established two infiltration/inflow criteria: one for new sewer systems and the other for rehabbed sewer systems.

Interim year demands will be determined by doing the same detailed population projection as was done for the year 2040, then calculating change in demand as a percentage of change in population. Tables WM-30 through 33 contain those projected demands.

Table WM-30: BCWWS 2002 Master Plan Retail District 1 Projected Sewered Population and Sanitary Sewer Demands

Year	Projected Sewered Population	Average Day Sanitary Sewer Flow (MGD)
2015	86,465	12.0
2020	87,634	12.3

Note: All flows are annual average flows, rounded to the nearest tenth of an MGD.

Table WM-31: BCWWS 2002 Master Plan Retail District 2 Projected Sewered Population and Sanitary Sewer Demands

Year	Projected Sewered Population	Average Day Sanitary Sewer Flow (MGD)
2015	61,391	9.7
2020	62,110	10.2

Note: All flows are annual average flows, rounded to the nearest tenth of an MGD.

Table WM-32: BCWWS Retail District 3A Projected Sewered Population and Sanitary Sewer Demands

Year	Projected Sewered Population	Average Day Sanitary Sewer Flow (MGD)
2015	16,068	3.4
2020	16,702	3.6

Note: All flows are annual average flows, rounded to the nearest tenth of an MGD.

Table WM-33: BCWWS 2002 Master Plan Retail District 3BC Projected Sewered Population and Sanitary Sewer Demands

Year	Projected Sewered Population	Average Day Sanitary Sewer Flow (MGD)
2015	34,228	2.1
2020	34,619	2.3

Note: All flows are annual average flows, rounded to the nearest tenth of an MGD.

b. Level of Service Standards

The LOS Standards as described in Table WM-26 Regional Wellfield Base Condition Water Use and Large User's Allocations are not anticipated to change over the planning horizon. BCWWS has linked its level of service analysis to its developer coordination process as described in Appendix - Determining BCWWS' Ability to Serve.

c. Treatment of Effluent Disposal Facilities' Needs

District 1 and District 2 treatment and effluent disposal facilities needs will be met by the Regional Wastewater System. See that Section for more information. District 3A and District 3BC treatment and effluent disposal facilities needs are met by the City of Hollywood's facilities. BCWWS has 5.88 MGD of reserve capacity at the Hollywood WWTP, which should be sufficient until about the year 2018. This provides sufficient time for BCWWS and Hollywood to make arrangements for Hollywood to handle the additional capacity required to meet year 2040 needs.

d. Transmission/Collection System Needs

The 2002 Master Plan did not contain significant transmission system recommended improvements. Collection system recommended improvements were identified to increase the capacity of a few force mains and lift stations as growth occurs. Piping that might reach the end of its useful life during the planning period was not addressed as BCWWS had started implementation of its Neighborhood Improvement Program (NIP) as described below. An updated master plan is scheduled to be completed in 2016.

Simultaneous with Master Plan development in the late 1990s, BCWWS implemented a program to address drainage issues in certain areas. This program was quickly expanded by the County to include street improvements, sidewalks and neighborhood landscaping. BCWWS decided to upgrade a substantial portion of its piping system in the area covered by the program. Water and sewer system were planned to be repaired/ replaced as necessary and service (mostly sewer service) extended to those that did not have it. The NIP which consists of a set of projects (Project) in eight major communities representing 25 neighborhoods have grown into a significant effort requiring a substantial portion of BCWWS' retail utility resources, in terms of money and staff effort. From about 1997 to 2014, BCWWS' retail utility capital improvement program focused on the NIP as its major component.

The NIP was initiated by the County in 1993 to upgrade the infrastructure in what were BMSD neighborhoods. The improvements include upgrades to the existing water and sewer system, installation of drainage, new pavement, swales and landscaping. The total estimated cost of the program is approximately $752 million dollars. Approximately $388 million, or 53 percent of total cost, is for water and sewer upgrades. The remaining 47 percent of total cost associated

with sidewalk, drainage and landscaping improvements is being funded by the County's general fund.

The NIP encompasses an area the size of a medium city with 9,335 acres, 92,500 people and 28,555 homes. The planned improvements include 295 miles of roadways, 428 miles of sidewalk and 623 miles of pipeline which will enable the elimination of 10,607 septic tanks. Construction started in 1996 and is currently scheduled to be completed in 2018. Of the 66 planned bid packages, 59 have been completed and 6 are in construction. The final bid pack, Hillsboro Pines is expected to begin construction in 2015.

In mid-2004, Broward County acquired the Broadview Park private utility. The Broadview Park service area contains about 715 acres and is located by State Road 7 to the east, Peters Road to the north, and Florida's Turnpike to the west and Interstate I595 to the south. The area contains about 6,500 people. Projected future sewer demand is 0.6 MGD ADF. BCWWS completed construction of the updated water system and install sanitary sewers in the area.

e. Changing Regulatory Requirements

Changing regulatory requirements are not expected to significantly affect the BCWWS retail utility.

f. Capital Improvement Program

The Broward County Board of County Commissioners is the authority responsible for approving BCWWS capital improvement program budgets. Each year the Board of County Commissioners approves an encumbrance budget for the next fiscal year and a five-year capital improvement plan. See the Capital Improvements Element for information on BCWWS' capital improvement program.

2. Broward County Operated Regional Wastewater System

a. Projected Flows

Each year users of the Regional Wastewater System are requested to submit flow projections. Table WM-34 provide the 2013/2014 projections. Data not available are indicated by "n/a," and BCWWS data are from the 2002 wastewater master plan.

Table WM-34: Regional Wastewater System Projected Demands

Year	BCWWS Districts 1 & 2	Coconut Creek	Coral Springs	Deerfield Beach	Lauderhill	North Lauderdale
2015	21.7	4.5	8.61	6.7	6.59	3.66
2020	22.6	6.54	9.20	7.4	6.94	3.66
2025	n/a	6.54	9.35	7.7	7.09	4.01
2030	n/a	6.54	9.50	8.0	7.10	4.14
Year	North Springs	Oakland Park	Parkland[1]	Pompano Beach	Royal Utilities[1]	Tamarac
2015	3.32	1.51	0.27	13.91	n/a	7.88
2020	3.36	1.51	0.27	15.11	n/a	8.15
2025	3.37	1.52	0.27	16.24	n/a	8.25
2030	3.37	1.52	0.27	17.45	n/a	8.50

Note: All flows are annual average flows, rounded to the nearest tenth of an MGD.
1 Current projected demands not available; used current plant allocation.

b. LOS Standards

The LOS standard for the regional water supply is not anticipated to change from the current level of service standard, which is to provide the customer with a "reserve capacity".

c. Treatment/Effluent Disposal Needs

Treatment and effluent disposal facilities have been expanded to 95 MGD ADF. This expansion was completed in 2007 and should meet the needs of the Large Users through the year 2040.

d. Transmission System Needs

The transmission system was most recently modeled the year 2002. The Approved FY14 Capital Budget includes the following projects in Table WM-35:

Table WM-35: Regional Wastewater System FY14-18 Projects

Pump Station Project	Total Cost Estimate ($M)	Completion Year
PS 456 Improvements	4.0	2016
PS 450 Improvements	2.9	2016
C-14 Canal Force Main	2.2	2014
Master PS 454 Rehabilitation	1.5	2017
Master PS 462 Emergency Generator	0.5	2014
Master PS Controls Upgrade	3.0	2017
Retail Wastewater Meter M-471 Rehabilitation	0.6	2014
Misc. Master PS improvements	2.5	2018
Regional System Master Plan	3.0	2016

All other pump stations and the transmission piping were adequately sized through the year 2030. BCWWS should re-examine the transmission system's capacity after each Large User has completed its 10-Year Water Supply Facilities Work Plan update for 2014 and adjust the wastewater projections accordingly.

e. Changing Regulatory Requirements

Management of effluent and biosolids will likely continue to challenge BCWWS. Three potential concerns that could have significant financial impacts to the regional system are:

- EPA rule-making with regards to the practice of disposing treated wastewater in deep wells. Rule changes that would necessitate higher treatment levels would have a significant financial impact on BCWWS operations.
- The growing concern over the potential impact that prescription and other drug residuals that reach wastewater effluent may have on both the natural system and humans. Research is under-way that will attempt to measure these impacts and at what dosages they may cause harm. These studies, the results and subsequent potential rule-making will probably occur in the next ten years. New treatment methods will need to be developed and implemented to comply with any rule making.
- The FDEP's continued promotion of nutrient reduction related to ocean discharges under the Leah Schad Memorial Ocean Outfall Program (effective date July 1, 2008) and the EPA mandate for closure of the County's outfall by 2025 has increased the County's focus on reuse system expansion and alternative disposal methods.

f. Capital Improvement Program

The regional wastewater treatment plant has been expansion to 95 MGD. Several projects are presented in the FY2014-FY2018 CIP to develop cogeneration facilities, improve septage facilities, make electrical upgrades, improve aeration, increase deep injection well capacity, and other improvements.

3. Broward Municipal Services District Areas

Currently very little of the BMSD areas of Broward County are provided water service by BCWWS. However, a significant County boundary change took place in 2009 with approval of House Bill 1315 that approved the transfer from Palm Beach County to Broward County of a 1,949-acre wedge-shaped property located between County Line Road and Loxahatchee Road. Currently the area of BMSD land is 12.4 sq. miles with a population of less than 16,000, which includes the recently annexed 'Wedge' south of the Hillsboro Canal.

The future needs of the municipal wastewater treatment facilities and their respective collection/transmission systems will not be greatly impacted by the annexation or continued BMSD

area status of the remaining BMSD areas. Most of the areas are already developed, and either are already connected to a municipal system or utilize septic systems. Table WM-36 illustrates that the municipal facilities have sufficient capacity to support the development of the undeveloped properties in the projected remaining BMSD area outside of the 5.8 acres of already developed regional facilities such as landfills and airports.

Table WM-36: Wastewater Treatment Plant Committed and Available Capacities for Plants Serving the BMSD Area

	Fort Lauderdale	Hollywood	Sunrise
Licensed design capacity (MGD-AADF)	48.00	50.00	30.45
Annual average daily flow (mgd-2012)	42.69	40.41	24.20
Committed flows per building permits (MGD)	1.53	1.39	0.40
Total capacity utilized (MGD)	44.22	41.78	24.60
Total capacity utilized (%)	92	84	79
Available capacity (MGD)	3.78	8.22	5.85
Available capacity (%)	8	16	21

C. Drainage and Natural Groundwater Recharge

1. Facility Capacity Analysis

The primary and secondary drainage systems should continue to be able to meet future demands in accordance with the design storm criteria established by the SFWMD and the WMD. The systems within the western three sectors, however, may need to be expanded to accommodate drainage needs as development occurs.

The regulatory process working in concert with the development review process of the LDC will reduce the probability of future development that does not conform to the adopted level of service standards for drainage.

2. Expected Life of Drainage Facilities

Since the expected life of drainage facilities varies, depending upon such factors as the type of facility, the amount of use, and the age of the facility, it is often difficult to estimate the expected life of the facilities. Consequently, the approach used by both the SFWMD and the WMD is to allocate funds for other drainage improvements. This approach allows for the gradual replacement of drainage facilities as the facilities start to deteriorate.

3. Impact of Drainage Facilities on Adjacent Natural Resources

The landscape has been dramatically altered from its original state. Installation of the elaborate system of canals, levees, and other water control structures drained eastern portions of the Everglades, opening the land for development. Nearly all of the developable land in Broward

County is attributable to drainage. Impacts upon surface water, groundwater, fisheries and wetlands have occurred as a result.

Nonpoint source pollution is one of the major causes of water quality degradation. One of the primary ways nonpoint source pollution reaches surface water and groundwater is through the flow of stormwater runoff. Pollutants are often dissolved in the water or absorbed to sediments suspended in the water. There are many types of nonpoint source pollutants which result from different types of land uses. Common types of contaminants include pesticides, sediments, heavy metals, bacteria and nitrates. These contaminates can originate from residential lawns, construction sites, urban streets and parking lots, and agricultural activities.

The few natural rivers which exist in the county have been incorporated into the primary drainage system. Concurrently, the water carrying capacities in these rivers has been increased to accommodate greater quantities of stormwater runoff received from the secondary and tertiary drainage systems. Several negative effects on rivers include dredging, channel alterations, and nonpoint source pollution.

Alterations in the natural drainage system, increasing demands on the aquifer system, and threats to coastal wellfields from saltwater intrusion have prompted changes in the way water is managed in the County. Improved operation of the canal system and efforts to enhance recharge through these improved operations have helped to maintain groundwater levels and protect wellfields against saltwater intrusion, particularly during dry periods and times of drought when increasing demands are placed on wells for irrigation.

The drainage system has also had negative effects upon fisheries. The introduction of nutrients into the marine environment stimulates the growth of algae and other aquatic vegetation at inflated rates. As the plant life dies and decays, it consumes oxygen dissolved in the water. Occurrences of low dissolved oxygen or no dissolved oxygen result in kills of fin fish and shell fish. The input of toxics into the aquatic eco-system also poses risks to aquatic animals. Some toxins can bio-accumulate, which is the process whereby the concentration of a toxin increases at higher levels in the food chain, with associated harmful effects. Marine life may also become diseased by pathogens found in stormwater runoff.

Wetlands dominated the landscape prior to drainage and provided habitat for flora and fauna. Drainage has significantly reduced the quality and quantity of wetland habitat. Most remaining wetlands in the developable area are severely degraded from nonpoint source pollution and physical alterations and simply do not serve the same functions they did at one time. Programs are effectuating the protection of high quality wetlands which still exist (See Conservation Element).

Policy WM1.13 addresses the impacts of stormwater management facilities on adjacent natural resources.

4. Problems and Opportunities for Drainage Facilities Replacement, Expansion and New Facility Siting

There are several problems which have been identified regarding the replacement and expansion of existing drainage facilities and the siting of new facilities. Some developed areas are maintaining exiting LOS standards rather than using adopted LOS standards. The purpose behind the policy is for accommodation of desirable infill development, which could be financially feasible if compliance with adopted level of service standards was compulsory. Expansion and siting of facilities in these developed areas is difficult because a predominance of the land has been consumed. Existing uncontrolled connections from older stormwater systems input an unquantifiable amount of storm water into the drainage system. These uncontrolled connections from older stormwater systems reduce the amount of input allowable for permitted connections. Capital facilities planning is difficult as well because it is difficult to estimate the longevity of drainage facilities and structures.

Opportunities for replacing and expanding drainage facilities do exist. Priority expenditures for capital improvements which are necessary to ensure facilities are adequate have been identified through the year 2012. Deficiencies in areas complying with existing LOS standards are expected to have facilities upgraded to meet adopted LOS over the next thirteen years. Spending projections allow for the difficulty in estimating facility longevity by including a category of spending called 'other' in the capital facilities plan. Growth in the undeveloped areas of the county is being closely scrutinized during the permitting process to ensure adopted LOS standards will be met. Concurrency is more easily achieved in the undeveloped areas of the county because land is more readily available for facility siting.

5. Assessment of Regulations and Programs

Providing good drainage while, at the same time, promoting aquifer recharge with water of desirable quality, requires careful design and placement of drainage systems. Section 5-182(d) of The Broward County Land Development Code (LDC), requires adequacy of water management works prior to the issuance of any development permit in the BMSD area. Section 5-198(d) of the LDC requires adequacy of water management works for developments within municipalities which are required to plat. Adequacy of water management is based upon compliance with applicable provisions of the Broward County Code of Ordinances, Broward County Administrative Code, Water Resource Management Regulations, and Drainage Design Criteria and the "Minimum Standards Applicable to Public Right-of-Way Under Broward County Jurisdiction" of the Broward County Engineering Division in conjunction with the adopted drainage or Water Resources Management Master Plans of the County, and of any other governmental agency having jurisdiction over the area.

Implementation

A. Potable Water

1. Authority

All water wells 12-inches in diameter or smaller, including irrigation wells and monitoring wells, located in Broward County shall require a permit from Florida Department of Health in Broward County prior to well construction, abandonment, repair, or modification. This does not include AC drainage, air sparging or vapor extraction wells that are processed by the Florida Department of Environmental Protection (FDEP). Wells larger than 12-inches in diameter shall continue to be permitted by the South Florida Water Management District (SFWMD).

While the EPGMD does not implement adequacy or concurrency for potable water nor regulate potable WTPs, it is responsible for ensuring continuing availability of adequate water supplies for competing uses, while maintaining the functions of natural systems.

SFWMD regulates withdrawals from surface and groundwater systems. The SFWMD issues general and individual water use permits for any use, diversion, or withdrawal from surface or groundwater within the SFWMD boundaries and works with other water management districts to resolve jurisdictional water use boundary impacts.

BCWWS is concerned with the groundwater withdrawal, treatment and distribution of treated finished water to retail customers, and through agreements with large users and other municipal systems.

Planning and Development Management Division (PDMD) administers the Land Development Code (LDC). All development permits issued in Broward County, whether incorporated area or the BMSD areas must be in compliance with the Land Development Code. The Broward County LDC states that potable water service for new developments must be available before a certificate of occupancy is issued regardless whether BCWWS is the service provider or the service provider to the development is another municipality.

Broward County LDC Section 5-182(e) regulates the potable water requirements and level of service standards. This process conditions the issuance of a development permit on the availability of adequate potable water service prior to occupancy in accordance with Chapter 5, Article IX, "Board County LDC," Section 5-182(f) for the BMSD Area and Section 5-198(e) for municipalities.

The BCHD assesses availability of facilities by applying a “gallons per day” design flow demand rate to the proposed development and then determining whether the proposed development's demand will exceed the licensed capacity of the treatment plant considering the existing utilized and "committed" capacity.

BCWWS will use the WWS Land Development Standards to assess concurrency at the time of application for site plan approval or building permit for properties within the BCWWS utility district service areas. BCWWS retains the authority to require appropriate information to be submitted to settle any dispute. BCWWS utilizes Equivalent Residential Units (ERUs) to monitor committed and reserve capacities of its facilities as part of the ongoing permitting process.

BCHD will use the following potable water design flow rates in Table WM-37, which were adopted by the Board of County Commissioners to assess adequacy of service at the time of plat approval for all properties that are required to be platted and for those properties within the BMSD Area that are not required to be platted, at the time of site plan approval. In the case where the type of connection is not listed, then the most suitable one is to be used.

Table WM-37: Potable Water Demand Rates

Facility Type	Water Use in Gallons per Day
Residential per capita per day per single-family unit	 100 350
Retail per square-foot	0.1
Office per square-foot	0.2
Other non-residential per capita	20

BCHD uses the development review process of the LDC to assure adequate potable water services are available prior to occupancy consistent with the potable water design flow rates adopted by the Board. Applicants for development permits are required to utilize existing potable water facilities if lines are "available" as defined by Rules 62-550, 62-555, and 62-560, FAC. Chapter 10D-6, "Standards for Onsite Sewage Disposal Systems," Section 10D-6.041 (2), FAC, states that "It is the policy of the State of Florida to require all buildings served by onsite sewage disposal systems to connect to a publicly owned or investor-owned permitted sewerage system within 365 days after notification that such a system is available."

Wellfield Protection Ordinance, No. 93-17, establishes criteria for the regulation of storage, handling, use or production of hazardous or toxic substances within the zones of influence of water supply wells. EPGMD continues to implement this ordinance.

BCHD will reduce potential groundwater pollution sources by continuing to implement Chapter 34 "Water and Sewers," Article II "Water and Sewer Connection Ordinance," Broward County Code of Ordinances. The Board adopted Ordinance 71-5 creating this chapter which states that all premises used for human habitation or occupancy shall be connected to a sanitary sewer main within 180 days of the availability of said sewer main for use. This applies to premises within an area served

by a public or private sanitary sewer treatment and disposal utility system and which abuts a sanitary sewer main owned by the utility system.

BCHD will continue to protect the groundwater supply from potential sources of contamination pursuant to Chapter 34, "Water and Sewers," Article II ½, "Water and Septic Tank Ordinance," Broward County Code of Ordinances. The Board adopted Ordinance 78-50 creating this article which requires proposed subdivisions of three or more homes to connect to a public water supply which is located within 1/4 mile of the subdivision. This regulation also prohibits the installation of a septic tank discharging greater than 1,500 gallons of wastewater per day per acre where there exists an approved public water distribution system. In instances where there is no approved public water distribution system, no septic tank shall be permitted which discharges over 750 gallons of wastewater a day per acre.

EPGMD protects groundwater quality by implementing Chapter 27, Water Pollution Control "Wellfield Protection Ordinance," Broward County Code of Ordinances, which regulates the storage, handling, usage or production of regulated or toxic substances within designated zones of influence as identified in the Code.

Broward County continues to implement Chapter 36, "Water Resources and Management," Article II, "Water Emergencies," Section 36-55, "Restrictions on landscape irrigation," Broward County Code of Ordinances, which imposes year-round, county-wide landscape irrigation restrictions. The Board adopted Ordinance 91-8 on February 19, 1991, creating this section which restricts landscape irrigation for new and existing installations to the hours of 5:00 p.m. to 9:00 a.m. seven days per week; low-volume irrigation systems or low-volume hand watering using a self-canceling nozzle shall not be restricted. This section also provides that in the event the SFWMD imposes restrictions on landscape irrigation for new and existing installations which are more restrictive than those imposed by this section, such more restrictive regulations shall apply. In 2010, the County amended Chapter 36, Broward County Code of Ordinances, to provide for further restrictions on landscape irrigation that mirror the SFMWD district-wide, year-round water conservation measures adopted in 2008.

Broward County Permitting, Licensing, and Consumer Protection Division enforces Chapter 39, "Zoning," Article VIII "Landscaping for Protection of Water Quality and Quantity" Broward County Code of Ordinances, which addresses landscaping and incorporates the guidelines of the SFWMD. Broward County adopted the SFWMD Model Landscape Code for South Florida as a guide in the development of requirements applicable in the BMSD Area. The Landscaping for Protection of Water Quality and Quantity Code complies with Section 125.568, "Conservation of Water; Florida-Friendly Landscaping," FS, requiring local governments to consider enacting a Florida-Friendly Landscaping ordinance in order to conserve water.

Broward County Environmental Licensing and Building Division enforces Chapter 46, "Plumbing," Section 46-14.13, Table 46R2, The South Florida Building Code, Broward Edition, which contains standards for ultra-low volume plumbing fixtures to be used in all new construction. See Table WM-38: Plumbing Standards.

Table WM-38: Plumbing Standards

Fixture	Flow Rate
Toilet	1.6 gal/flush
Shower Heads	2.5 gal/minute
Faucets	2.0 gal/minute

Broward County Board of Rules and Appeals has approved the above standards for ultra-low plumbing fixtures at 80 psi, effective September 1, 1992 in Broward County. This continues an ongoing conservation program.

BCWWS continues to implement its conservation-oriented rate structure within its BCWWS utility systems. BCWWS implemented a progressive rate structure on June 1, 1988, applicable to all customers within the BCWWS utility districts.

BCWWS maintains a leak detection program to reduce the amount of unaccounted-for water loss within its BCWWS utility systems. BCWWS has increased the frequency of meter calibration for large meters to an annual level and improved the change-out cycle for small meters so that replacement occurs every 10-15 years rather than 20 years.

BCWWS conducts a year-round public information and education program promoting water conservation. BCWWS also participates in the Broward Water Partnership Program and conducts its own toilet rebate program.

PWE addresses only the needs of the BCWWS system and BMSD areas of Broward County as the County has no control over the systems of municipal and private service providers. Data was provided in section II for completeness purposes only. Specific funding needs for municipal systems will be addressed in the Capital Improvements Element of the respective government's comprehensive plan. The Capital Improvement Element applies only to improvements for which the local government has fiscal responsibility.

2. Sources

1. Broward County Health Department (BCHD)
2. Broward County Water and Wastewater Services (BCWWS)
3. Broward County Planning and Development Management Division (PDMD)
4. South Florida Water Management District (SFWMD)

5. Broward County Environmental Licensing and Building Division (ELBPD)
6. City of Hollywood Utilities Division
7. City of Ft. Lauderdale Utilities Division
8. City of Pompano Beach Planning

B. Sanitary Sewer

1. Authority

The BCWWS is concerned with the treatment and collection of wastewater. The EPGMD regulates the operation of sanitary sewer treatment facilities. The EPGMD applies a stringent performance standard to wastewater treatment plants. Because most package plants cannot meet the standard, they are effectively disallowed under the regulations. The Florida Department of Health issues septic tank permits in Broward County for installation, design, and location of septic tanks.

The wastewater daily flow design factors for development utilized by EPGMD in determining adequacy and concurrency of sanitary sewer facilities described in Broward County Code of Ordinances, Chapter 27, Article V, Water Resource Management shall be applied to the County's sanitary sewer facilities as well as those municipal and private utilities serving the BMSD Areas EPGMD

The Broward County Land Development Code (LDC) Section 5-182(g), requires adequate wastewater treatment and disposal service prior to issuance of any development permit in the BMSD Area. Section 5-198(f) of the LDC requires adequacy of wastewater treatment and disposal service for developments within municipalities which are required to plat. Adequacy of service is based upon the demonstration that an existing wastewater treatment and disposal facility has sufficient capacity to provide for the needs of the new development and the other developments in the service area. If service is not currently available, but there is an economically and fiscally feasible plan to provide service, the development permit may be conditioned on that availability.

The Broward County PHU has regulatory responsibility for issuing septic tank permits under Chapter 10D-6, FAC and Broward County Ordinance 78-50. The PHU Environmental Health Section inspects all constructed systems before they are covered to assure compliance with State and County rules. Permits must be obtained from the Broward County PHU to install a septic tank. The permitting of septic tanks is conducted on a case by case basis. Septic tanks are permitted if existing sewer lines are more than one-quarter (1/4) mile from a proposed subdivision or one hundred feet from a single-family unit. There are approximately 200 new septic tank systems approved for operation annually. The demand factor is based on the square footage for residential, private well or public water supply, and commercial use. The design flow demand factor is 2500 gallons per day for residential use and 1500 gallons per day for commercial use.

2. Sources

1. Broward County Public Health Unit (BCPHU)
2. Broward County Water and Wastewater Services (BCWWS)
3. Broward County Environmental Protection and Growth Management Department (EPGMD)
4. Broward County Planning and Development Management Division (PDMD)
5. Broward County Environmental Licensing and Building Permitting Division (ELPBD)
6. City of Hollywood Utilities Division
7. City of Ft. Lauderdale Utilities Division
8. City of Sunrise City Utilities Division
9. City of Cooper City Utilities Division
10. Indian Trace Community Development District
11. City of Pompano Beach Planning

C. Drainage and Natural Groundwater Aquifer Recharge

1. Authority

The Broward County Water Management Division (WMD) was created in 1983 by merging the Broward County Water Management Division with the Section 208 staff of the Broward County Planning Council. Established by Section 40.11 of the Broward County Administrative Code, the WMD was vested with the responsibilities of the Water Management Division created by Chapter 61-1969, Special Acts, Laws of Florida. This included the responsibility for county-wide issuance of water management works permits, in accordance with the "Water Management Regulations and Standards" manual, July, 1977. Following another reorganization, that authority is now exercised by the EPGMD. The WMD also acts as the staff to various dependent water management districts. The DNRP was established in 1991 pursuant to Section 8.17 of the Charter of Broward County. The County Charter transferred and vested County Government (DNRP) the authority of the Broward County Environmental Quality Control Board (EQCB) originally created by the Broward County Charter. DNRP's successor agency, first DPEP and currently EPGMD, has the power to adopt regulations which must then be ratified by the Board of County Commissioners. The EPGMD exercises jurisdiction over all of Broward County through existing regulations. Water quality standards for both surface waters and groundwaters are established and enforced by the EPGMD as part of its responsibilities for water pollution control and abatement. The EPGMD maintains a surface water quality and ground water monitoring network throughout the County and regulates wastewater discharge. Also, the EPGMD has promulgated storage tank and hazardous materials

regulations intended to prevent contamination of the aquifer. A license is required from the EPGMD for any dredging and filling within the "regulated aquatic and wetland resources" as defined in Chapter 27 Article 11 of the Broward County Code of Ordinances.

There are fourteen independent and nine dependent special taxing districts within Broward County which are responsible for operating and maintaining drainage systems within their boundaries. Independent special taxing districts have final authority for decisions regarding taxes levied against property owners. Four of the dependent special taxing districts are reliant upon the Broward County Board of Commissioners for taxing authority, while the Bonaventure Development District, Indian Trace Development District, Lauderdale Isles Water Management District, North Lauderdale Water Control District, and Twin Lakes Water Control District rely upon the local municipal commissions in which they are located. The independent water management districts issue surface water management permits within their respective districts. The EPGMD exercises jurisdiction for surface water management in all other areas of the County, including the County's dependent drainage districts.

The South Florida Water Management District (SFWMD), formerly known as the Central and Southern Florida Flood Control District, is the primary drainage permitting authority for South Florida. Its water management permitting program was initiated in 1976 through Chapter 373, Florida Statutes. Permitting rules and permitting criteria are contained within Chapters 40E-4, 40E-40, and 40E-41, FAC with detailed information and criteria contained within "Management and Storage of Surface Waters - Permit Information Manual Volume IV".

The Florida Department of Environmental Protection and the South Florida Water Management District have delegated authority to the Broward County Environmental Protection and Growth Management Department (EPGMD) for certain permitting, compliance and enforcement responsibilities, in the geographical areas of Broward County outside of the independent drainage districts, associated with the implementation of the Environmental Resource Permit (ERP) program under the authority of Chapter 373 Florida Statutes. There is no project acreage limitation on EPGMD's delegated authority.

The SFWMD may also delegate its water management permitting functions for projects less than forty acres to local governments under the authority of Chapter 373 Florida Statutes. Three independent drainage districts have obtained this permitting authority. The Coral Springs Improvement District, North Springs Improvement District, and Old Plantation Water Control District may review and approve permits for projects under 40 acres, without SFWMD review. The Plantation Acres Improvement District has the same condition, but with a 10 acres threshold.

The U.S. Army Corps of Engineers (COE) permitting authority emanates from the Rivers and Harbors Act of 1899 and the Federal Water Pollution Control Amendments of 1972 and 1977. Current permitting authority extends to dredge and fill activities in waters of the United States. The

Florida Department of Environmental Protection (DEP) also has permitting authority with regard to dredge and fill activities in state waters, although Broward County has been given authority to issue these permits within certain areas of the County.

Most municipalities conduct limited water management reviews and issue permits in accordance with Section 4605 of the South Florida Building Code which states, that it is unlawful to commence any work involving surface or other drainage work without a permit. The Broward County Planning and Development Management Division routes all approvals for projects located outside of the boundaries of the independent drainage districts through the WRD for review and permitting of water management facilities.

2. Sources

The primary document used to develop this Element is the Analysis of Water Management Review and Permitting in Broward County, Florida, 1986, prepared by the Economic Development Council of Broward County and the Broward County Water Management Division, and the SFWMD's Atlas.

Appendix

Appendix WM-A: Broward County Water Control Districts, 2006

District Name	Type	Local Government Authority	Creation Documents	Statutory Authority	Permitting Program
Bonaventure Development District	Dependent	City of Weston	City Ordinance 98-61 Ch 2001-303 LOF	189.4041 F.S.	Permitting of district facility usage
Central Broward Water Control District	Independent	Broward County	Ch. 61-1439, 65-1006, 70-479, 91-350, 94-426 LOF	Section 298.01 F.S.	Permitting of district facility usage
Cocomar Water Control District	Dependent	Broward County	Margate City Ordinance 80-23, Coconut Creek City Ordinance 109-80	Section 298.01 F.S.	Permitting of all water facilities within district
Coral Bay Community Development District	Independent	City of Margate	City Ordinance 89-22	Chapter 190, F.S.	Permitting of district facility usage
Coral Springs Improvement District	Independent	Broward County	Ch. 70-617, LOF	Chapter 298, F.S.	Surface water management; permitting projects less than 40 acres (by delegation of SFWMD); permitting facility usage
Cypress Cove Community Development District	Independent	City of Margate	City Ordinance 90-7	Chapter 190, F.S.	Permitting of district facility usage
Indian Trace Community Development District	Dependent	City of Weston	City Ordinance 18	189.4041 F.S.	Permitting of district facility usage

District Name	Type	Local Government Authority	Creation Documents	Statutory Authority	Permitting Program
Lauderdale Isles Water Management District	Dependent	City of Fort Lauderdale	County Resolution 11/17/70; Ch. 77-518 LOF	Ch 298 F.S.	Permitting of district facility usage
North Springs Improvement District	Independent	Broward County	Ch. 71-580, LOF	Ch 298 F.S.	Surface water management; permitting projects less than 40 acres (by delegation of SFWMD); permitting facility usage
North Lauderdale Water Control District	Dependent	City of North Lauderdale	Ch. 63-661 LOF	Ch 298 F.S.	Permitting of district facility usage
Oakridge Community Development District	Independent	City of Hollywood	City Ordinance 95-71	Chapter 190, F.S.	Permitting of district facility usage
Old Plantation Water Control District	Independent	Broward County	Ch. 99-435, LOF	Section 298.01 F.S.	Surface water management; permitting projects less than 40 acres (by delegation of SFWMD); permitting facility usage
Pine Tree Water Control District	Independent	Broward County	Ch. 61-1979, 85-391, 93-372, 94-430, LOF	Ch 298 F.S.	Permitting of district facility usage
Plantation Acres Improvement District	Independent	Broward County	Ch. 2002-367, LOF	189.404 F.S.	Surface water management; permitting projects less than 40 acres (by delegation of SFWMD); permitting facility usage

District Name	Type	Local Government Authority	Creation Documents	Statutory Authority	Permitting Program
South Broward Drainage District	Independent	Broward County	Ch. 98-524, LOF	Section 298.01 F.S.	Permitting of district facility usage
Sunshine Water Control District	Independent	Broward County	Ch. 63-661 LOF	Section 298.01 F.S.	Permitting of district facility usage
Tindall Hammock Irrigation & Soil Conservation District	Independent	Broward County	Ch. 98-523 LOF	189.404 F.S.	Work within the District (rightsof-way) and surface water management
Turtle Run Community Development District	Independent	City of Coral Springs	City Ordinance 86-163	Ch. 190, F.S.	Surface water management
Twin Lakes Water Control District	Dependent	City of West Park	County Resolution 12/29/70	Section 298.01 F.S.	Permitting of district facility usage
West Lake Community Development District	Independent	City of Hollywood	City Ordinance 93-15	Ch. 190, F.S.	Permitting of district facility usage
Broward County Water Control District # 2	Dependent	Broward County	Chapter 61-1969; LOF	Section 298.01 F.S.	Permitting of all water facilities within district
Broward County Water Control District # 3	Dependent	Broward County	Chapter 61-1969; 90- 487; 91-348, LOF	Section 298.01 F.S.	Permitting of all water facilities within district
Broward County Water Control District # 4	Dependent	Broward County	County Resolution # 1998-850	Section 298.01 F.S.	Permitting of all water facilities within district

Source: http://www.floridaspecialdistricts.org/OfficialList/by_distr.asp

WCA 2A	To provide viable wetland habitat; to detain and store flood and drainage water during the wet season for water supply during the dry season; to prevent water accumulating in the Everglades from overflowing into urban and North New River and Miami lands in eastern Broward County; to receive and store regulatory releases from Lake Okeechobee and WCA 1; to provide conveyance for water supply releases from Lake Okeechobee to eastern Broward County; and to supply water to eastern Broward County and WCA 2B.	Designed to pass the Standard Project Flood.
WCA 2B	To provide viable wetland habitat; to recharge regional groundwater (i.e., the Biscayne Aquifer); to supply water to adjacent basins in Broward County; to receive and store regulatory discharges from WCA 2A; and to prevent water accumulating in the Everglades from overflowing into urban and agricultural lands in eastern Broward County.	Designed to pass the Standard Project Flood.
WCA 3A	To provide viable wetland habitat; to detain and store flood and drainage water during the wet season for water supply during the dry season; to prevent water accumulating in the Everglades from overflowing into urban and agricultural lands in eastern Dade and Broward counties; to receive and store regulatory releases from Lake Okeechobee and WCA 2A; to provide conveyance for water supply releases from Lake Okeechobee to eastern Dade County and Everglades National Park (ENP); and to supply water to eastern Dade County and ENP.	Designed to pass the Standard Project Flood.
WCA 3B	To provide viable wetland habitat; to recharge regional groundwater (i.e., the Biscayne Aquifer); to supply water to adjacent basins in Dade County; to provide conveyance for water supply releases from Lake Okeechobee and WCA 3A to eastern Dade County and southeastern Everglades National Park (ENP) to receive and store regulatory discharges from WCA 3A; to prevent water accumulating in the Everglades from overflowing into urban and agricultural lands in eastern Dade County; and when WCA 3B cannot store the regulatory discharges from WCA 3A, to provide conveyance for the discharges through the WCA for subsequent discharge to tidewater.	Designed to pass the Standard Project Flood.

Hillsboro Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; to convey excess water from WCA 1 to tidewater; to intercept and control seepage from WCA 2A; and to maintain a groundwater surface elevation west of the Deerfield Lock adequate to prevent saltwater intrusion into local groundwater.	There is no design storm for the Hillsboro Canal as it was constructed prior to the Project. The Hillsboro Canal above the Deerfield Lock provides flood protection of approximately three-quarters of an inch of run-off per day; however, allowable runoff into the canal above Deerfield Lock is 1.3 inches of runoff per day.
Cypress Creek (C-14) Canal	To provide flood protection and drainage for the basin; to supply water to the C-14, the Pompano Canal and the C-13 basins during periods of low natural flow; to convey excess water from WCA 2A to tidewater; to intercept and control seepage from WCA 2A; and to maintain a groundwater surface elevation west of the S-37A adequate to prevent saltwater intrusion into local groundwater.	The eastern basin was designed for 1-30 year flood protection; the western basin was designed for 1-10 year flood protection.
Pompano Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; and to maintain a groundwater surface elevation west of the G-57 adequate to prevent saltwater intrusion into local groundwater.	Designed for 1-25 year flood protection.
Middle River (C-13) Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; to intercept and control seepage from WCA 2B; to supply water to the City of Plantation in the North New River Canal basin; and to maintain a groundwater surface elevation west of the S-36 adequate to prevent saltwater intrusion into local groundwater.	The C-13 was designed to provide 1-25 year flood protection.
Plantation (C-12) Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; and to maintain a groundwater surface elevation west of the S-33 adequate to prevent saltwater intrusion into local groundwater.	The C-12 was designed to provide 1-25 year flood protection.
North New River Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; to convey excess water from WCAs 2A, 2B, and 3A to tidewater; and to intercept and control seepage from WCA 2B.	Adequate for 1-25 year protection.

South New River (C-11) Canal	To provide flood protection and drainage for the basin; to supply water to the basin during periods of low natural flow; to intercept and control seepage from WCA 3A; and to maintain a groundwater surface elevation west of the S-13 adequate to prevent saltwater intrusion into local groundwater.	The C-11 system was designed to provide flood protection of up to three-quarters of an inch of runoff per day from the western basin. The pumping station at S-13 was designed to provide the eastern basin with flood protection of up to three-quarters of an inch of runoff per day. Depending on the headwater and tailwater stages at the S-13 spillway, gravity flow from the eastern C-11 basin to the east may provide additional flood protection of up to three-quarters of an inch of runoff per day.
Hollywood (C-10) Canal	To provide flood protection and drainage for the basin.	The C-10 was designed to pass the Standard Project Flood.
Snake Creek (C-9) Canal	To provide flood protection and drainage for the basin; to supply water to the C-9 basin for irrigation and municipal water supply during periods of low natural flow; to intercept and control seepage from WCA 3B; and to prevent saltwater intrusion into local groundwater.	The C-9 in the eastern basin was designed to pass the Standard Project Flood. The western subbasin is prone to flooding because of low ground surface elevations relative to the eastern subbasin.

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
Hillsboro	Deerfield Lock (G-56) Stage divide	Weir with flashboards 5-bays, 12 ft. each Crest lgth = 60 ft. Crest elev = 1.0 ft. NGVD gated Spillway Crest lgth = 25 ft. Crest elev = 4.5 ft. NGVD	4.0	3.5	HW=7.7	1,600	HW = 10.86 TW + 9.2 Q = 3,700
	S-39 Water supply, regulatory releases to Hillsboro Canal from WCA-1	Spillway Taintor gate 16 ft. x 9.2 ft. Weir lgth = 15 ft. Crest elev = 2.5 ft. NGVD	11.0	9.0	TW = 9.0 max HW = WCA 1 Regulation schedule	800	TW=12.39
	S-39A Stage divide	Culvert with riser and stop logs 3 - 72 in. x 54 ft. CMP			HW =7.0 to 7.5		
	S-38B Divide C-14 and Hillsboro basins	Gated Culvert 1 - 66 in x 72 ft. CMP Invert elev = 0 ft. NGVD	9.0	7.65			
C-14	S-37A Stage divide	Spillway, 2 gates 25 ft. x 12.8 ft. Crest lgth = 50 ft. Crest elev = 7.7 ft. NGVD	3.0	2.0	HW=3.5	3,890	HW = 5.19 TW = 4.28 Q = 3,800 Q = 3,060 (measured)
	S-37B Stage divide	Spillway, 2 gates 25 ft. x 6.6 ft. Crest lgth = 50 ft. Crest elev = 0 ft. NGVD	7.2	4.7	HW=7.5	3,390	HW = 8.99 TW = 6.14 Q = 3,108 (measured)
	G-65 Divide C-14 and Pompano Canal	Gated Culvert 1 - 54 in. x 1,500 ft. RCP Invert elev = 0 ft. NGVD			TW = 4.5 (at G-57)	50 - 55 (water supply)	

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
	S-38C Stage divide, C-13 and C-14 water supply C-13	Culvert with risers and stop logs 2 - 72 in. x 35 ft. CMP Invert elev = 1.55 ft. NGVD					
	S-38A Stage divide, L-36 stage and C-14 stage	Culvert with risers and stop logs 2 - 60 in x 70 ft. CMP Invert elev = 1.55 ft. NGVD	9.0	8.0	HW = 7.65	190	
	S-38 Water supply, C-13 and C-14	Gated Culvert 2 - 72 in x 52 ft. Invert elev =2 ft. to 3 ft. NGVD	9.8	7.0	TW = 8.2 max (not to exceed 8.2)	500	HW = 15.47 TW = 10.47 Q = 586
Pompano	G-57 Stage divide	Steel sheet - pile dam with 6-bay, flashboard controlled weir Net lgth = 31.5 ft. Crest elev = 2.5 ft. NGVD			HW = 4.5 (dry season) HW = 2.5 (flood conditions)	375	HW = ~5.5
	G-65 Divide C-14 and Pompano Canal	Gated Culvert 1 - 54 in. x 1500 ft. RCP Invert elev = 0 ft. NGVD			TW = 4.5 (at G-57)	50 - 55 (water supply)	
C-13	S-36	Spillway, 1-gate 25 ft. x 14 ft. Crest lgth = 25 ft. Crest elev = 7 ft. NGVD	5.6	5.0	HW = 4.5	1,560	HW = 7.38 TW = 5.71 Q = 2390
	S-125 Divide C-13 and North New River Canal (Water supply to City of Plantation)	Gated Culvert 1 - 48 in. x 40 ft. CMP Invert elev = 2 ft. NGVD	6.5	6.0	HW = 6.0 TW = 3.5 - 4.5 (at Sewell Lock)	40 (Regulatory releases)	HW = 8+

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
	S-38C Stage divide, C-13 and C-14 water supply C-13	Culvert with risers and stop logs 2 - 72 in. x 35 ft. CMP Invert elev = 1.55 ft. NGVD					
	S-38 Water supply, C-13 and C-14	Gated Culvert 2 - 72 in. x 52 ft. CMP Invert elev = 2 - 3 ft. NGVD	9.8	7.0	TW = 8.2 Maximum	500	HW = 15.47 TW = 10.47 Q = 586
	S-124 Normal flow-closed Flood conditions - open	Gated Culvert 5 - 72 in. x 48 ft. CMP Invert elev = 1 ft. NGVD	7.02	6.57	HW =5.0 - 5.5	490	*HW = 7.8+ TW = 6.86 *HW may have been above 8.0
C-12	S-33 Stage divide	Spillway, 1-gate 20 ft. x 9 ft. Crest lgth = 20 ft. Crest elev = 2 ft. NGVD	5.9	4.9	HW=35	920	HW = 6.13 TW = 5.89 Q = 614
North New River	Sewell Lock (G-54) Stage divide	Flash board spillway 8 bays Net lgth = ~ 45 ft. Weir elev = 3.6 ft. NGVD	3.5	3.0	HW=3.5-4.0	1,300	HW = 5.97 TW = 4.66 Q = 2040
	S-124 Normal flow - closed Flood conditions - open	Gated Culvert 5 - 72 in. x 49 ft. CMP Invert elev = 1 ft. NGVD	7.02	6.57	HW = 5.0 - 5.5	490	*HW = 7.8+ TW = 6.86 *HW may have been above 8.0
	S-34 Water supply to NNR Canal	Gated Culvert 2 - 72 in. x 133 ft. CMP Invert elev = 3 - 4 ft. NGVD	16.9	6.0	HW = ~ 11 - 11.5 TW = 3.5 - 4.0 TW = 6.0 max	350	HW = 13.08 TW = 7.05 Q = 728

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
	S-125 Divide C-13 and North New River Canal (Regulatory releases to NNRC from C-13	Gated Culvert 1 - 48 in. x 40 ft. CMP Invert elev = 2 ft. NGVD	6.5	6.0	HW = 6.0 TW = 3.5 - 4.5 (at Sewell Lock)	40 (Regulatory releases)	HW = 8+
	G-123 Pumps from NNRC to WCA-3A	Pumping Station 4 units: 100 cfs each	2.0	12.0	HW = 3.5 HW = 11.0	400	
	S-141 Stage divide	Sheet-pile overflow weir in L-38E Flashboard control Crest lgth = 30 ft. Crest elev = 7 ft. NGVD	10.0	8.0	Regulation Schedule in WCA 2B	435	
	S-142 Stage divide Water supply	Gated Culvert 2 - 72 in. x 42 ft. CMP Invert elev = 2 ft. NGVD	11.0	9.0	Regulation Schedule in WCA 3A	500	
	S-143 Stage divide Water supply	Gated Culvert 2 - 72 in. x 70 ft. CMP Invert elev = 2 ft. NGVD	13.0	10.0	Regulation Schedule in WCA 2A	500	
C-11	S-13 Stage divide	Pump and spillway, 3 units, 180 cfs each 1 - 16 ft. x 11.3 ft. gate Weir lgth = 16 ft. Weir crest elev = -8 ft. NGVD	1.2 (gravity) 2.2 - 2.5 (pump)	1.0 (gravity) 6.2 - 6.5 (pump)	HW = 1.6 (gravity) HW = 2.2 (gravity)	540 (gravity) 540 (pumped)	HW = 4.02 TW = 4.85 Q = 1050
	S-13A Divide structure during flooding	Gated Culvert 2 - 72 in. x 66 ft. CMP 2 - 54 in. x 60 ft. CMP	2.5	2.0	3.0 to west	120	HW (west) 6.27 TW (east) 4.79

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
	S-9	Pump, 3 units 960 cfs each	4.0	14.4	HW = 3.0 - 3.5	2,880	Intake = 6.1 Q = 2060
	S-9XS Stage divide	Culvert with risers and stop logs 2 - 72 in. x 42 ft. CMP Invert elev = -1 ft. NGVD			HW = 6.8		
	S-9XN Stage divide	Culvert with risers and stop logs 2 - 72 in. x 84 ft. CMP Invert elev = -4.8 ft. NGVD			HW=6.0		
	G-86S Stage divide	Culvert with risers and stop logs 1 - 60 in. x 135 ft. CMP Invert elev = -1.14 ft. NGVD			HW = 5.5		
	G-86N Stage divide	Culvert with risers and stop log 1 - 60 in. x 135 CMP Invert elev = -1 ft. NGVD			HW = 5.5		
	G-87 Presently used as a drainage divide between C-11 and C-9 basins	Gated Culvert 1 - 84 in. x 75 ft. CMP Invert elev = -5 ft. NGVD				(Divide structures)	
C-9	S-29 Stage divide	Spillway, 4 gates 22 ft. x 15 ft. Crest lgth = 88 ft. Crest elev = -11 ft. NGVD	3.0	2.5	HW = ~2.0	4,780	HW = 3.88 Q = 4,100

Basin	Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design G (cfs)	Peak Stage (ft NGVD) and Q (cfs)
	S-31 Controls outflows from CA-3B to C-6	Gated Culvert 3 - 84 in. x 172 ft. CMP Invert elev = -3 ft. NGVD	6.0	4.0		700	TW = 6.59 Q = 1090
	S-30 Controls water stored between L-30 and SR 27	Gated Culverts 3 - 84 in. x 288 ft. Invert elev = -5 ft. NGVD					
	S-32 Water supply to C-9	Gated Culvert 2 - 72 in. x 40 ft. CMP Invert elev = -2 ft. NGVD	2.5	~1.60	TW = 2.0 HW = 6.0	2	HW = 6.59

Source: An Atlas of Eastern Broward County Surface Water Management Basins, by Richard M. Cooper and Jim Lane (November 1987), South Florida Water Management District.

KEY TO ABBREVIATIONS USED IN APPENDIX WM-C

in = inches	Lgth = length	CMP = Corrugated metal pipe	HW = Head water
ups = upstream	ft = feet	TW = Tail water	RCP = Reinforced concrete pipe
cfs = Cubic feet per second	elev = elevation	Q = discharge in cfs	ds = downstream
ft NGVD = Feet relative to National Geodetic Vertical Datum			

BROWARD COUNTY FLORIDA BOARD OF COUNTY COMMISSIONERS

BROWARD COUNTY WATER SUPPLY FACILITIES WORK PLAN

NOVEMBER 24, 2014

Source: Broward County Board of County Commissioners, Broward County Water Supply Facilities Work Plan.

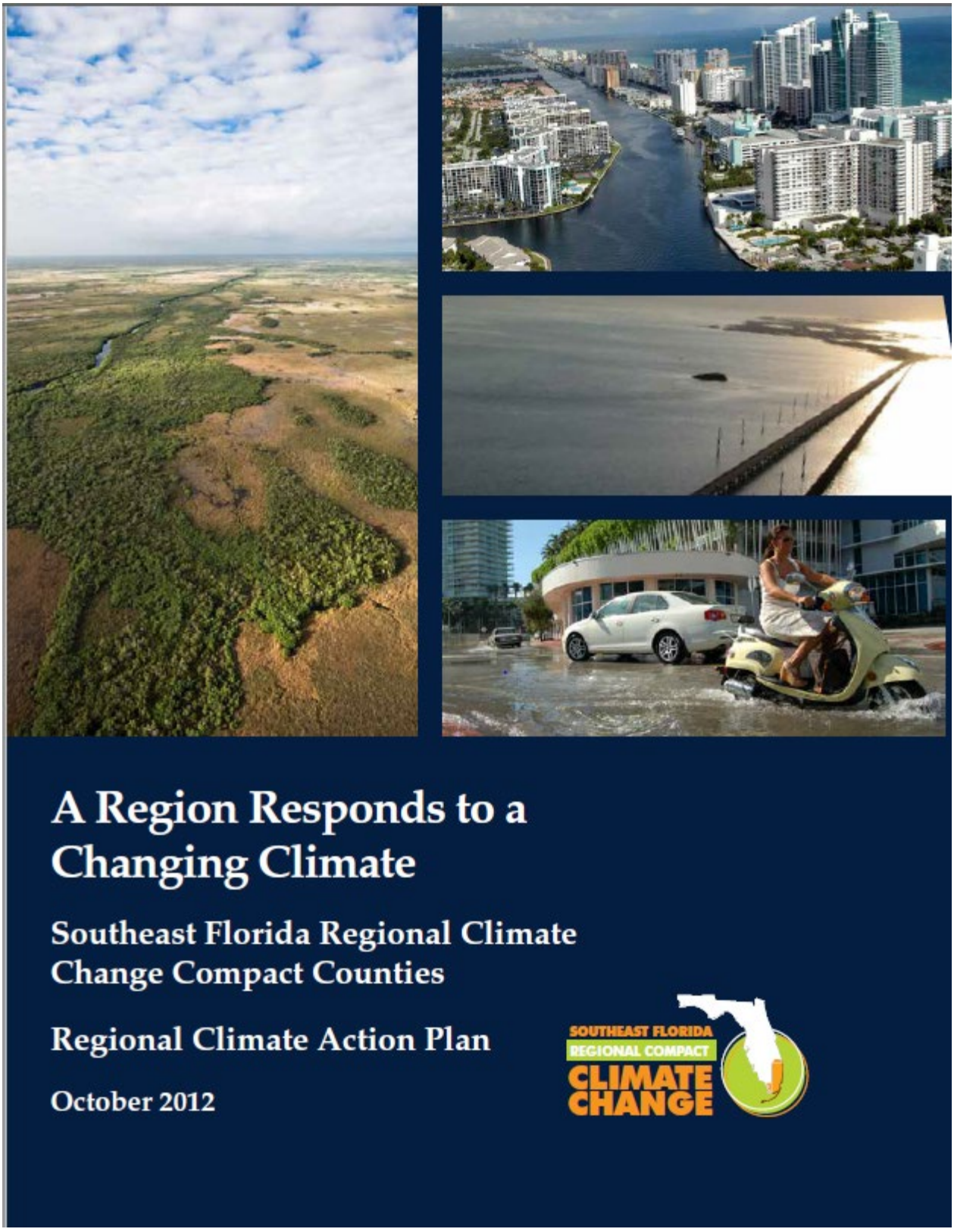
Analysis of the Vulnerability of Southeast Florida to Sea Level Rise

Southeast Florida Regional Climate Change Compact
Inundation Mapping and Vulnerability Assessment
Work Group

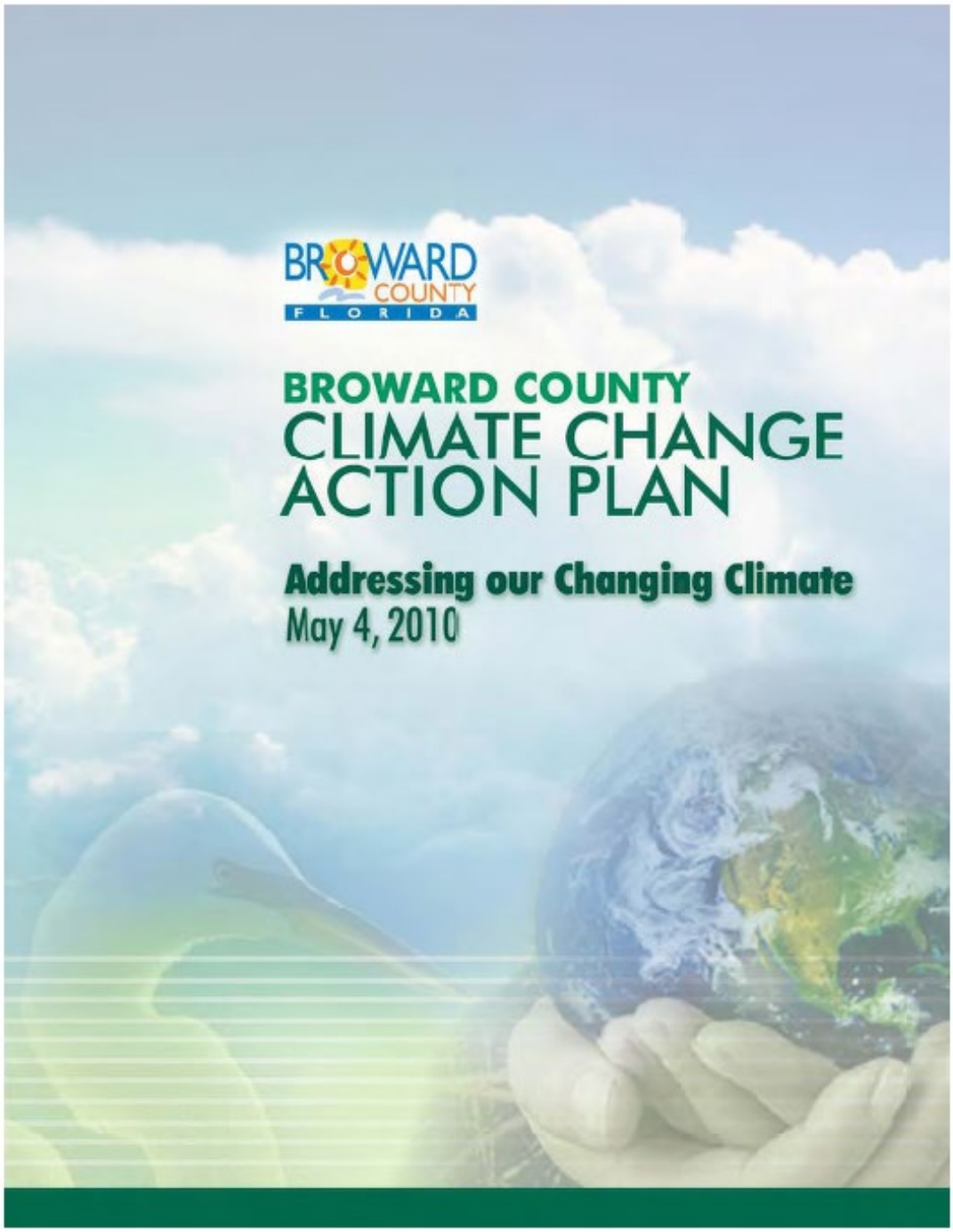
August 2012

SOUTHEAST FLORIDA
REGIONAL COMPACT
CLIMATE
CHANGE

Source: Southeast Florida Climate Compact.



Source: Southeast Florida Climate Compact.



Source: Broward County Environmental Planning and Community Resilience Division.