ATTACHMENT 12

Miami Dade County

Facilities Work Plan

Miami Dade Water and Sewer Department

20-year Water Supply Facilities Work Plan (2014 – 2033)

Support Data

November 2014

Report

Executive Summary

The Update to the Miami-Dade Water and Sewer Department's (MDWASD) 20-Year Water Supply Facilities Work Plan is prepare as required by Section 163.3177(6)(c)3 of the Florida Statutes. Said statutory provision requires all local governments to adopt a water supply work plan that identifies the alternative water supply projects, traditional water supply projects and conservation and reuse measures necessary to meet projected water demand. The work plan is to be updated, at a minimum, every five years and within 18-months of an adopted update to the regional water supply plan. The Lower East Coast (LEC) Regional Water Supply Plan was adopted by the South Florida Water Management District Governing Board in September 2013.

The Water Supply Facilities Work Plan Update presents MDWASD's water supply systems and provides a plan for implementing water supply facilities, including the development of traditional and alternative water supplies necessary to serve existing and new development.

This Water Supply Facilities Work Plan Update includes the following primary sections:

- Section 1 - Introduction
- Section 2 – Water Service Area
- Section 3 – Existing Water Supply Facilities
- Section 4 – Population and Water Demand Projections
- Section 5 – Planned Water Supply Facilities
- Section 6 – Climate Change and Sea Level Rise Plan

The County's projected finished water demands are now significantly lower than anticipated when the first 20-year water use permit application was submitted to South Florida Water Management District (SFWMD) in 2007. The updated water demand projections have resulted in a 71 million gallons per day decrease by the year 2030. This demand reduction has eliminated the anticipated supply shortages which were the basis for an ambitious schedule of several costly alternative water supply projects which are no longer required or needed. As such, reuse projects to address water supply have been eliminated. However, MDWASD will be implementing a total of 117.5 mgd of

reuse to address the Ocean Outfall Legislation which includes 27.6 mgd of Floridan Aquifer Recharge and up to 90 mgd of reuse water to FPL for Turkey Point Units 5, and6.

The decrease in water demands has been a result of the successful implementation of the County's Water Conservation Plan, and new population projections based on the 2010 Census. Through 2013, a total of 11.2 mgd have been saved through the implementation of the Water Conservation Plan Best Management Practices. Additionally, Miami-Dade County has enacted water use efficiency-legislation including permanent landscape irrigation restrictions, landscape ordinances requiring Florida Friendly landscaping in new construction, in right of ways, and the installation of high efficiency plumbing fixtures in new construction

Based on the decrease in water demands, MDWASD submitted an application for modification and extension of the 20-year Water Use Permit (WUP) on June 20, 2014. The requested modification to the WUP included new population data, revised water demand projections and alternative water supply projects to support water demands through the year 2033. The alternative water supply project include a new South Miami Heights Reverse Osmosis Water Treatment Plant with a capacity of 17.45 mgd. This update to the Water Supply Plan reflects the water supply projects required per the WUP Modification request, which is anticipated to be approved by November 2014.

In addition, MDWASD's evaluation and planning for sea level rise and climate change is detailed over the planning horizon in the Work Plan. The primary concern to MDWASD water supply is salt water intrusion into the freshwater Biscayne aquifer, the primary source of drinking water in Miami-Dade County. Results of evaluation and data analysis completed to date indicate that within the next thirty years, MDWASD will be able to operate its wellfields and water treatment facilities as designed, as groundwater modeling indicates even with a high level of projected sea level rise, the wellfields will not be impacted by salt water intrusion. Further modeling is currently underway to extend the planning scenarios fifty years out, and will include climate change such as increases and decreases in annual precipitation, and extreme weather events.

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Section 1

Introduction

Miami-Dade County (County) is continuing to experience growth, as it has over the last several decades. The Miami-Dade Water and Sewer Department (MDWASD) provides drinking water to approximately two million customers in the County. Because of rapid population growth, complex environmental issues and regulatory and statutory requirements, MDWASD is updating its comprehensive 20- year plan for water supply development. The previous Water Supply Facilities Work Plan was dated April 2008 and adopted by the County's Board of County Commissioners on April 24, 2008.

1.1 Background

In response to the finding that traditional water supply sources will not be sufficient to meet demands of the growing population, of industries and of the environment, the Florida Legislature enacted bills in 2002, 2004 and 2005. These bills, Senate Bills 360 and 444, significantly changed Chapters 163 Intergovernmental Programs and 373 Water Resources, Florida Statute (F.S.), to improve the coordination of water supply and land use planning by strengthening the statutory requirements linking regional water supply plans prepared by the water management districts and the comprehensive plans prepared by local governments.

Section 373.709, Florida Statutes, Section 163.3177(6)(c)3, Florida Statutes, requires that the water supply and work plan be updated within 18 months after a water management district's governing board approves an updated regional water supply plan to reflect whatever changes in the regional plan affect their local water supply and work plan. The current statutory provisions direct local governments to do the following with regard to water supply:

1. Coordinate appropriate aspects of its comprehensive plan with the appropriate water management district's regional water supply plan. [s. 163.3177(4)(a), F.S.]

2. Revise the Potable Water Sub-Element to adopt a water supply facilities work plan covering at least a 10-year planning period to meet existing and projected demand. The work plan should address those water supply facilities for which the local government has responsibility and include the facilities needed to develop alternative water supplies. The work plan should also identify conservation and reuse measures to meet future needs. [Section 163.3177(6)(c), Florida Statutes.]

3. Revise the Conservation Element to assess current and projected water needs and sources for at least a 10-year planning period. The analysis must consider the existing levels of water conservation, use, and protection and the applicable policies of the water management district, and the district's approved regional water supply plan. In the absence of an approved regional water supply plan,

the analysis must consider the district's approved water management plan. [Section 163.3177(6)(d)3, Florida Statutes.]

4. Revise the Capital Improvements Element to identify capital improvements projects to be implemented in the first 5 years of the work plan for which the local government is responsible, including both publicly and privately funded water supply projects necessary to achieve and maintain adopted level of service standards; and adopt a five-year schedule of capital improvements to include those projects as either funded or unfunded, and if unfunded, assigned a level of priority for funding. [163.3177(3)(a)4, Florida Statutes.]

5. Revise the Intergovernmental Coordination Element to adopt principles and guidelines to be used to coordinate the comprehensive plan with the regional water supply authority (if applicable) and with the applicable regional water supply plan. [163.3177(6)(h)1, Florida Statutes.]

6. During the Evaluation and Appraisal review, determine if comprehensive plan amendments are necessary to reflect statutory changes related to water supply and facilities planning since the last update to the comprehensive plan. If necessary, transmit the amendments to incorporate the statutory changes as appropriate. [Section 163.3191(1) and (2), Florida Statutes.]

7. Ensure that adequate water supplies and facilities are available to serve new development no later than the date on which the local government anticipates issuing a certificate of occupancy and consult with the applicable water supplier prior to approving a building permit, to determine whether adequate water supplies will be available to serve the development by the anticipated issuance date of the certificate of occupancy. [s. 163.3180(2)(a), F.S., effective July 1, 2005.] Local governments should update their comprehensive plans and land development regulations as soon as possible to address this water supply concurrency requirement.

This Water Supply Facilities Work Plan Update is meant to satisfy portions of the above statutory requirements (other portions are satisfied through existing policies in the County's Comprehensive Development Master Plan) as stated in Item 1 above, to coordinate with the Lower East Coast (LEC) regional water supply plan. The 2013 LEC Water Supply Plan Update was adopted by the South Florida Water Management District (SFWMD) Governing Board on September 12, 2013.

1.2 Purpose and Objectives

The purpose of this Water Supply Facilities Work Plan Update is to present MDWASD's water supply systems and to provide a plan for implementing water supply facilities, including the development of traditional and Alternative Water Supplies necessary to serve existing and new development. These water supplies were developed by first incorporating demand reductions due to conservation. In addition,

this plan incorporates information on wholesale customers and other water suppliers that provide water to portions of Miami-Dade County: the City of North Miami, the City of North Miami Beach, and the City of Homestead.

On May 2, 2014, the MDWASD and the SFWMD held a joint workshop with local governments to assist them in their efforts to prepare an update to the Water Supply Facilities Work Plan (Work Plan). MDWASD will coordinate and provide information to the local governments in Miami-Dade County to assist them in the preparation of their Work Plans Update.

The information contained within this Work Plan Update will be included in an amendment to various elements of the County's Comprehensive Plan. This Work Plan Update is to be updated and updated every five years within 18 months after the SFWMD Governing Board approves an updated LEC regional water supply plan.

This Water Supply Facilities Work Plan Update includes the following primary sections:

- Section 1 - Introduction
- Section 2 – Water Service Area
- Section 3 – Existing Water Supply Facilities
- Section 4 – Population and Water Demand Projections
- Section 5 – Planned Water Supply Facilities
- Section 6 – Climate Change

Section 2

Water Service Area

2.1 MDWASD Service Area

The MDWASD water service area contains interconnected systems and thus, for the most part, functions as a single service area. However, for the convenience of discussing existing facilities, the service area may be broken down into three subareas by water treatment facilities: the Hialeah-Preston area serving the northern part of Miami-Dade County, the Alexander Orr, Jr. area serving the central and portions of the southern part of Miami-Dade County and the South Dade area (formerly known as the Rex Utility District) serving the southern part of Miami-Dade County, shownon **Figure 2-1**.

Within the MDWASD service area, there are 15 wholesale customers. Thirteen (13) of the fifteen (15) wholesale customers have executed 20-year water use agreements, and one (1) has executed a 30-year water agreement. The water use agreement between MDWASD and the City of Hialeah is currently under negotiations. The City of North Miami Beach stopped purchasing water from MDWASD in 2008, and has a 30-year wholesale agreement with MDWASD to purchase water on an as needed basis. The City of Miami Springs is no longer a wholesale customer of MDWASD, as the water and sewer infrastructure was transferred to the County in July 2008. Table 2-1 identifies the 15 wholesale customers and the status of their large user contracts.

In addition to MDWASD, there are four other water suppliers within Miami-Dade County that provide water to parts of unincorporated Miami-Dade County and within their respective municipal boundaries. Two such water suppliers in the South Dade area are Florida City and the City of Homestead. MDWASD does not have an agreement with Florida City. Water is sold to and purchased from the City of Homestead. MDWASD purchases water from the City of Homestead to provide water to serve the Redavo area and pays retail rates. In 2010, the City of Homestead entered into a 20-year water use agreement with MDWASD to purchase up to 3 MGD to meet the demands of its retail water customers. The water furnished will be received by the City of Homestead at the interconnection point located at SW 137th Avenue and 288th Street. In the North Dade area, the City of North Miami and the City of North Miami Beach provide water to portions of unincorporated and incorporated parts of Miami-Dade County.

2.2 Hialeah-Preston Subarea

The Hialeah-Preston (H-P) subarea is comprised of dedicated low-pressure pipelines, remote storage tanks, pumping facilities and high pressure systems. This system delivers water to Hialeah, Miami Springs, the City of Miami and other portions of northeastern Miami-Dade County, shown on **Figure 2-2,**

generally north of Flagler Street. The Hialeah Reverse Osmosis (R.O.) plant was completed in October 2013 and is providing water to the City of Hialeah and unincorporated Miami-Dade County.

2.3 Alexander Orr, Jr. Subarea

The Alexander Orr, Jr. (AO) subarea is comprised of a high pressure system comprised of two major piping loops. This system delivers water to nearly all of Miami-Dade County south of approximately Flagler Street and north of SW 248th Street, including Virginia Key, Fisher Island, the Village of Key Biscayne and, upon request, to the City of Homestead, and Florida City, shown on **Figure 2-3.**

2.4 South Dade Subarea

The South Dade subarea consists of small distribution systems and storage tanks that evolved around each individual water treatment plant (WTP) within each WTP's distinct service areas. These systems deliver water to nearly all of Miami-Dade County south of S.W. 248th street and east of S.W. 197th avenue. Homestead and Florida City are within this area. Florida City provides water service within its incorporated boundaries and to a small portion of unincorporated Miami-Dade County. In addition, Florida City purchases water from the City of Homestead to service a small portion of Florida City's service area on the southeast corner of U.S. 1 and S.W. 328th Street. The City of Homestead provides water within its municipal boundary and for a portion of unincorporated Miami-Dade County including the Redavo development. This development consists of 107 homes and an approximate population of 310. **Figure 2-4** shows the current South Dade subarea.

The design of the new South Miami Heights (SMH) WTP in the South Dade subarea is underway. The SMHWTP is scheduled to come on line by December 31, 2018. Of the five existing plants in the South Dade subarea, only Everglades and Newton WTPs will remain in service on a stand-by-basis after the SMHWTP begins operations. The existing distribution and storage systems will be incorporated into the future plans. A general shift will occur in the northern boundary of the South Dade subarea once the proposed South Miami Heights Water Treatment Plant comes into service by 2018. The northern boundary will be shifted northward such that portions of the population currently within the Alexander-Orr subarea will be within the South Dade subarea. Figure 2-1 and 2-4 illustrate the boundary shift. The boundary shift will cause a general redistribution of service between the Alexander-Orr and South Miami-Dade areas, but will not have other effects on the population expected to be served by MDWASD.

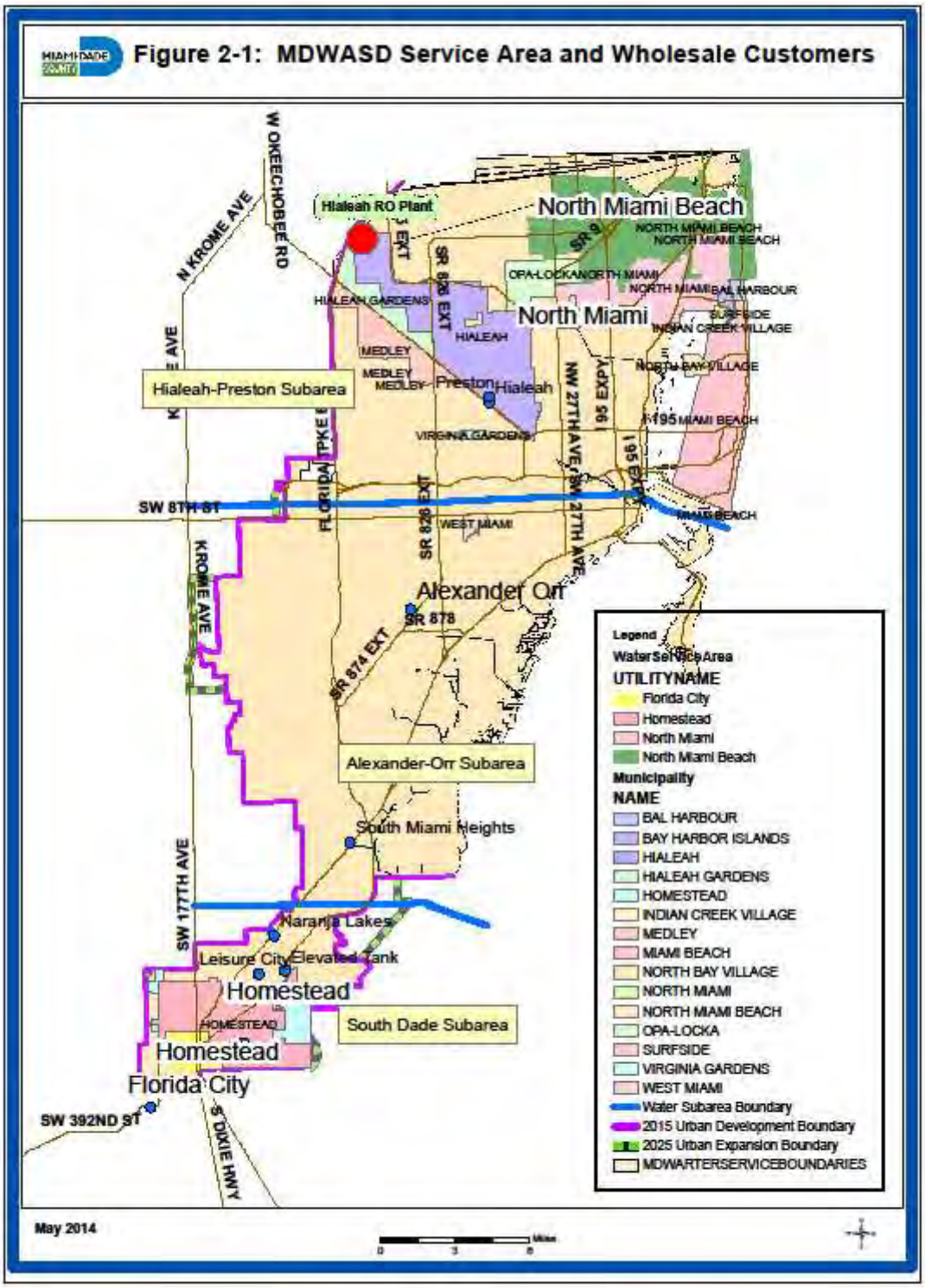


Figure 2-1: MDWASD Service Area and Wholesale Customers
Hialeah RO Plant
North Miami Beach
North Miami
Hialeah-Preston Subarea
Alexander Orr
Alexander-Orr Subarea
South Miami Heights
Naranja Lakes
Leisure City Elevated Tank
Homestead
South Dade Subarea
Florida City
W OKEECHOBEE RD
N KROME AVE
SW 8TH ST
SW 177TH AVE
SW 392ND ST
S DIXIE HWY
FLORIDA TPKE
SR 826 EXT
SR 874 EXT
SR 878
NW 27TH AVE
SW 27TH AVE
I-95 EXPY
Legend
WaterServiceArea
UTILITYNAME
Florida City
Homestead
North Miami
North Miami Beach
Municipality
NAME
BAL HARBOUR
BAY HARBOR ISLANDS
HIALEAH
HIALEAH GARDENS
HOMESTEAD
INDIAN CREEK VILLAGE
MEDLEY
MIAMI BEACH
NORTH BAY VILLAGE
NORTH MIAMI
NORTH MIAMI BEACH
OPA-LOCKA
SURFSIDE
VIRGINIA GARDENS
WEST MIAMI
Water Subarea Boundary
2015 Urban Development Boundary
2025 Urban Expansion Boundary
MDWARTERSERVICEBOUNDARIES
May 2014

Figure 2-2:
Hialeah-Preston Sub-Area and Water Treatment Plants

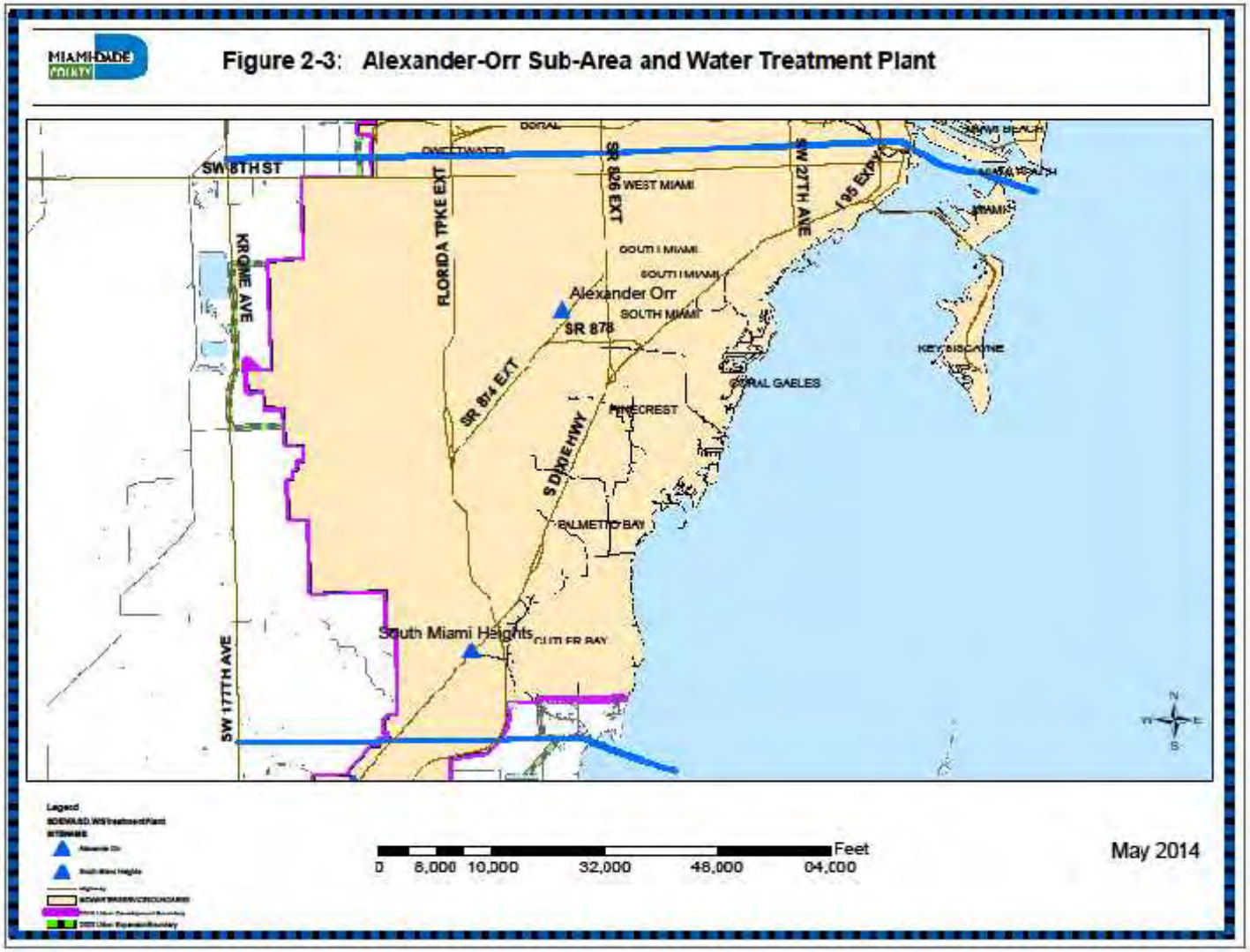


Figure 2-3: Alexander-Orr Sub-Area and Water Treatment Plant
SW 8TH ST
KROME AVE
FLORIDA TPKE EXT
SR 826 EXT
SW 27TH AVE
I-95 EXPY
WEST MIAMI
SOUTH MIAMI
Alexander Orr
SR 878
SR 874 EXT
S DIXIE HWY
PINECREST
CORAL GABLES
KEY BISCAYNE
PALMETTO BAY
South Miami Heights
SW 177TH AVE
Feet
0 8,000 16,000 32,000 48,000 64,000
May 2014

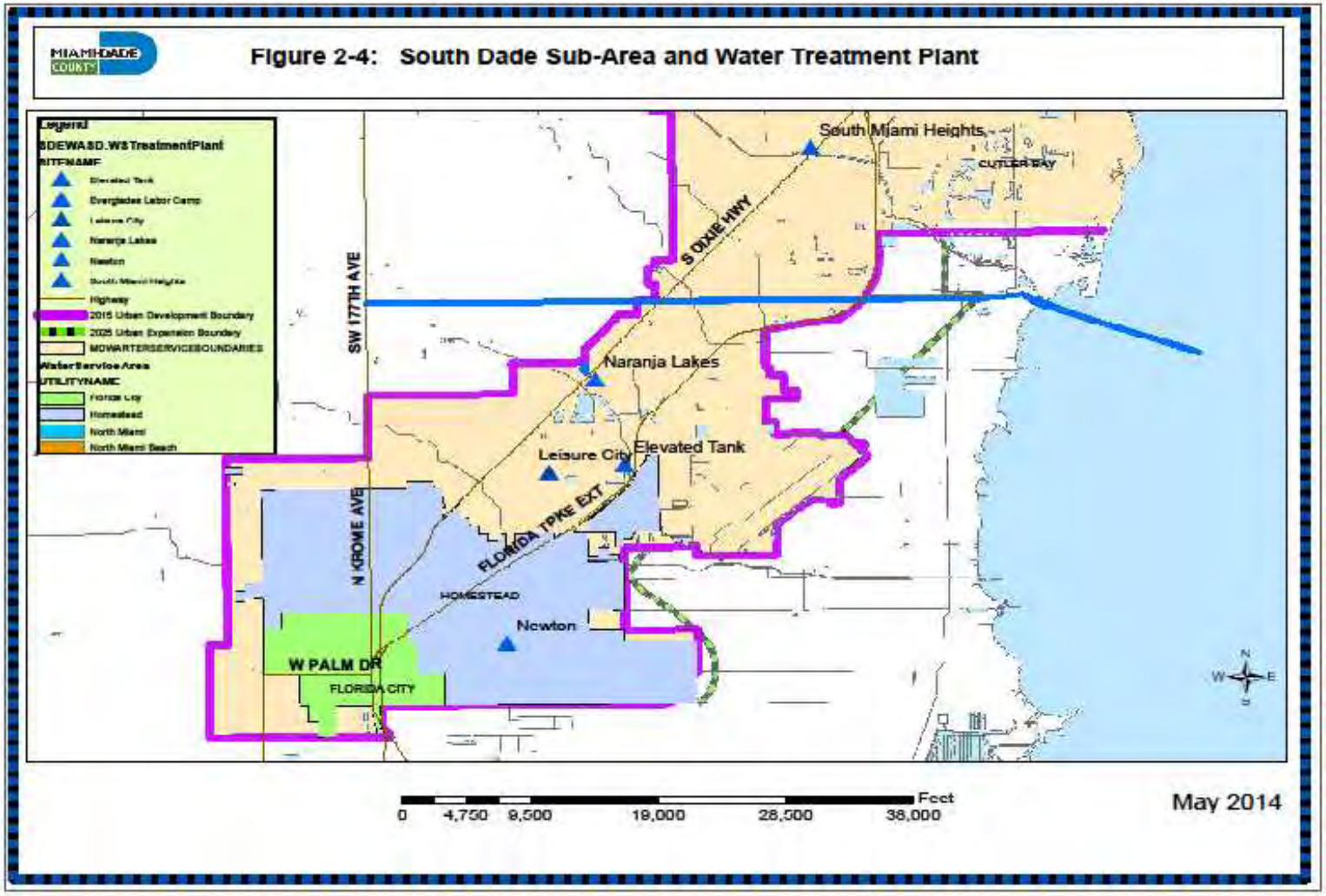


Figure 2-4: South Dade Sub-Area and Water Treatment Plant
Legend
SDEWASD.WSTreatmentPlant
FACILITYNAME
Elevated Tank
Everglades Labor Camp
Leisure City
Naranja Lakes
Newton
South Miami Heights
Highway
2015 Urban Development Boundary
2025 Urban Expansion Boundary
MDWATERSERVICEBOUNDARIES
Water Service Area
UTILITYNAME
Florida City
Homestead
North Miami
North Miami Beach
South Miami Heights
CUTLER BAY
S DIXIE HWY
SW 177TH AVE
Naranja Lakes
Leisure City
Elevated Tank
FLORIDA TPKE EXT
N KROME AVE
HOMESTEAD
Newton
W PALM DR
FLORIDA CITY
N
W
E
S
Feet
0
4,750
9,500
19,000
28,500
38,000
May 2014

2.5 Wholesale Customers

Fourteen (14) of the 15 wholesale water customers within the MDWASD service area have large user agreements. One (1) wholesale water agreement with the City of Hialeah is under negotiations. These agreements, with the exception of the City of North Miami Beach, are for 20-year periods. The water agreement with the City of North Miami Beach is for a period of 30-years. In 2007, the City of Miami Springs indicated their desired to pursue the transfer of the Miami Springs water and sewer department to the County. Said transfer was approved by the Miami-Dade County Board of County Commissioners (BCC) on July 17, 2008. **Table 2-1** identifies the 15 wholesale customers and the status of their large user contracts.

As outlined in the Miami-Dade County Code of Ordinances, Chapter 2, Article XXXVII, Section 2-347, if a private or municipal water or sewer utility proposes to expand its assigned service area, the Director or designee shall determine whether or not the Department shall release the portion of the service area requested.

Table 2-1 Wholesale Water Agreements for 20 Year Period

Municipality	Status
Bal Harbour Village (BLH)	Signed, executed agreement
Town of Bay Harbour Islands (BHI)	Signed, executed agreement
City of Hialeah (CH)	20 Year agreement under negotiation. Joint participation agreement between Miami-Dade County and the City of Hialeah for the RO Plant was entered on 12/27/07.
City of Hialeah Gardens (HG)	Signed, executed agreement
City of Homestead (HOMSTD)	Signed, executed agreement; 3 MGD Max.
Indian Creek Village (IC)	Signed, executed agreement
Town of Medley (MED)	Signed, executed agreement
City of Miami Beach (MB)	Signed, executed agreement
City of North Bay Village (NB)	Signed, executed agreement
City of North Miami (NM)	Signed, executed agreement
City of North Miami Beach (NMB)	Signed, executed agreement, as needed basis
City of Opa-Locka (OPLOC)	Signed, executed agreement
Town of Surfside (SURFS)	Signed, executed agreement
Village of Virginia Gardens (VG)	Signed, executed agreement
City of West Miami (WM)	Signed, executed agreement

Source: MDWASD Water Use Permit No. 13-00017-W, Re-issue July 16, 2012

2.6 Other Water Suppliers (Non-MDWASD)

Other water suppliers located in Miami-Dade County have facilities and provide water to portions of Miami-Dade County. These facilities are located in the extreme northern and extreme southern parts of the County as shown in **Figure 2-5**. Other water suppliers within the County are:

- City of North Miami
- City of North Miami Beach
- Florida City
- City of Homestead

The Florida Keys Aqueduct Authority (FKAA) has facilities in the southern part of the County to serve Monroe County. These facilities include supply wells, a treatment facility and a transmission main to serve Monroe County.

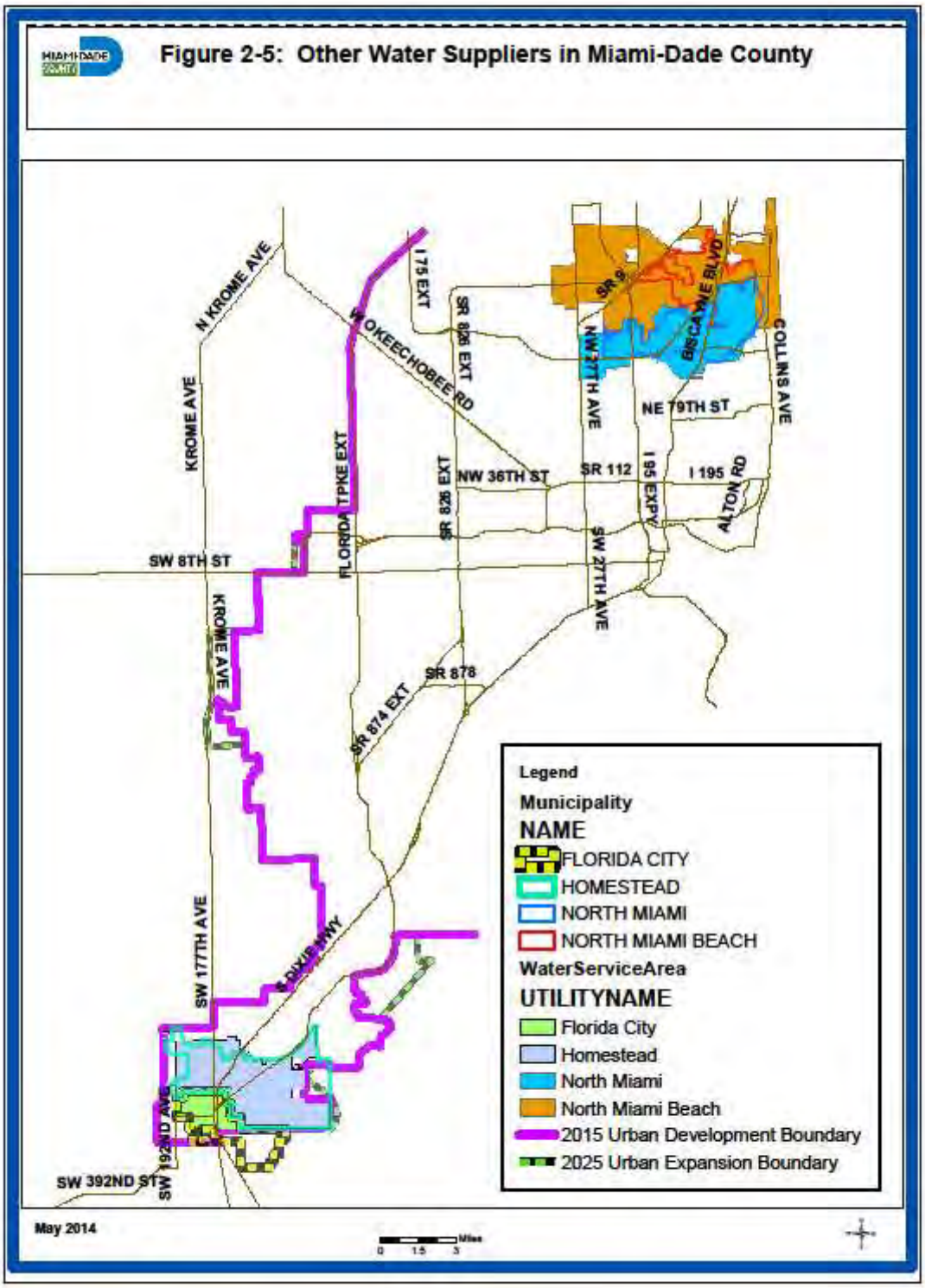
2.6.1 City of North Miami

In the northern part of the County, the City of North Miami provides water service to parts of northern Miami-Dade County within its municipal boundaries, as well as outside of its municipal boundaries extending into the northwestern parts of unincorporated Miami-Dade County.

The City's service area consists of a high pressure distribution system comprised of three main distribution lines, which are interconnected. The service area is generally bounded by NE 163rd Street to the north, Biscayne Bay to the east, NW 105th Street to the south, and NW 27th Avenue to the west. It serves a population of over 91,000 people in a 13 square-mile area, servicing the City of North Miami, the Village of Biscayne Park, small area of Miami Shores, and parts of unincorporated Miami Dade County. The City currently purchases approximately 37% of their water needs from MDWASD.

2.6.2 City of North Miami Beach

In the northern part of the County, the City of North Miami Beach provides water service to parts of northern Miami-Dade County within its municipal boundaries, as well as outside of its municipal boundaries extending into the northeastern and northwestern parts of unincorporated Miami-Dade County. The City of North Miami Beach provides service entirely or to portions of the City of Aventura, Town of Golden Beach, City of Miami Garden, and City of Sunny Isles Beach. The City of North Miami Beach has emergency interconnections with Bal Harbor Village, City of Hallandale Beach, and City of North Miami.



The City's distribution system consists of a high pressure system, distributing

potable water service to more than 163,962 people in northeast Miami-Dade County, specifically servicing the City of North Miami Beach, City of Miami Gardens, City of Aventura, City of Golden Beach, and City of Sunny Isles Beach and some areas of unincorporated Miami-Dade County. The service area is generally bounded by the Snake Creek Canal and Ives Dairy Road to the north, NW 37th Avenue to the west, NE and NW 135th Street to the south, and Collins Avenue to the east. Only about 25 percent of the City system's service area is within City limits.

2.6.3 City of Homestead

The City of Homestead provides water within most of its municipal boundaries and to a small part of southern Miami-Dade County including a portion of Florida City and parts of unincorporated Miami-Dade County. The City of Homestead sells water to MDWASD to serve a portion of unincorporated Miami-Dade County in a development consisting of 107 homes. This development, named Redavo, has an estimated population of 310. Currently, the City of Homestead and Miami-Dade County have an agreement.

Pursuant to the terms of a Consent Decree between the City of Homestead and the SFWMD, dated December 7, 2009, the City is required to reduce its withdrawl from the Biscayne Aquifer by approximately 3 MGD to meet the conditions of the City's Water Use Permit. On July 9, 2010, the City of Homestead entered into a 20-year water wholesale agreement with MDWASD to purchase up to 3 MGD of water to meet the demands of its retail customers.

In addition, MDWASD provides some water service within portions of the municipal boundary of the City of Homestead. Furthermore, the City of Homestead sells water to Florida City to service a small portion of Florida City's service area on the southeast corner of U.S. 1 and S.W. 328th Street.

The City of Homestead's service area comprises a high pressure water distribution system that services approximately 10,240 acres in southern Miami-Dade County, with an estimated present population of over 65,000. The service area is generally bounded by SW 296th Street to the North, SW 137th Avenue to the east, SW 344th Street to the south, and SW 192nd Avenue to the west.

2.6.4 Florida City

In the southern part of the County, Florida City provides water service to parts of southern Miami-Dade County within its municipal boundaries and to a small portion of unincorporated Miami-Dade County. The City's service area is comprised by a high pressure distribution system that services approximately 1,520 acres in southern Miami-Dade County. The service area has a current population of over 9,700, and is generally bounded by SW 328th Street to the north, SW 172nd Avenue/SW 167th Avenue to the east, SW352nd Street/SW 360th Street to the south, and SW 187th Avenue to the west.

2.6.5 Florida Keys Aqueduct Authority

The Florida Keys Aqueduct Authority (FKAA) has facilities in the southern part of the County to serve Monroe County. The FKAA does not provide service within Miami- Dade County, despite some of their water supply, treatment, and transmission facilities being located within Miami-Dade County. These facilities include supply wells, a treatment facility and a transmission main to serve Monroe County.

2.6.6 Large and Small Public Water Supply Systems

Additional public water supply systems within Miami-Dade County exist. Miami-Dade County has conducted a preliminary survey of these public water systems. A list of these public water supply systems provided by the State of Florida Department of Health is contained in Appendix G.

Section 3

Existing Water Supply Facilities

3.1 Water Supply Wellfields (Sources of Water)

The MDWASD water system is currently served by the previously mentioned three large treatment plants, the new Hialeah Reverse Osmosis (RO) Water Treatment Plant (WTP), and the five (5) smaller treatment plants in the southern portion of Miami-Dade County. The existing water supplies serving these treatment plants originate from two major aquifer systems in Miami-Dade County: the Surficial and the Floridan Aquifer Systems. The Surficial Aquifer System, also known as the Biscayne Aquifer, is the major source of drinking water and occurs at or near the land surface in most of the County, and is the principal water-bearing unit of the Surficial Aquifer System in the region (Causaras, 1987). Groundwater from the Floridan Aquifer (FA) is the drinking water source for the new Hialeah RO WTP.

The 20-Year Water Use Permit (WUP)for Miami-Dade County was approved by the SFWMD Governing Board on November 15, 2007. Subsequent modifications were issued, with the latest one dated July 16, 2012. The water use permit limits the annual allocation to 149,906 million gallons (MG) and the maximum monthly allocation to 13,117 million gallons until the permit expires on December 31, 2030. These allocations are further limited by the wellfield operational plan described in Limiting Condition 27 of the water use permit. A copy of the approved water use permit and limiting conditions is located in Appendix H.

On June 20, 2014 the MDWASD submit an application for modification and extension of the existing WUP. Said modification includes new water demand projections based on 2010 population data and revised alternative water supply and reuse projects.

3.1.1 Wellfields and Capacities

The existing MDWASD water supply system is comprised of eight (8) major Biscayne Aquifer wellfields in the Hialeah-Preston and Alexander Orr, Jr. subareas, twelve (12) Biscayne Aquifer water supply wells located at five individual water systems (formerly Rex Utility District water system) in South Dade County and the ASR wells at the Alexander Orr, Jr. Subarea, as shown in **Table 3-1, Table 3-2** and **Figure 3-1**. Each of the wellfield is described below.

3.1.2 Hialeah-Preston Subarea Wellfields

The Hialeah-Preston WTPs are supplied by four water supply wellfields, shown on **Figure 3-1**. The total designed installed capacity from the four wellfields in the Hialeah-Preston subarea is approximately 295 million gallons per day (MGD). Appendix A provides detailed information about well construction and capacities of the Hialeah-Preston area wellfields.

The new Hialeah RO WTP is supplied by six (6) FA wells, as noted on **Figure 3-2.** The total installed capacity for the six wells is 12 MGD. A total of four (4) additional FA wells wi+ll be constructed with a total capacity of 8 MGD. The City of Hialeah is in the process of bidding the four wells and are scheduled to be completed by April 2015.

In addition to these wellfields, four abandoned wells at a Medley Wellfield have been rehabilitated and would be available on a stand-by basis in the event of an emergency.

Table 3-2 Floridan Aquifer Wellfield Data

Wellfield	Wellfield Data	
	Design Capacity (mgd)	**Number of Wells**
Alexander Orr WTP (use of FA Wells for ASR)[c]		
Southwest	10.00	2
West	15.00	3
Subtotal	25.00	**5**
Hialeah RO WTP (use of FA Wells for RO)		
Hialeah RO [b][d]	12.00	6
Future Hialeah RO[a][d]	8.00	4
South Miami Heights WTP (Future use of FA Wells for RO))[c]		
Future South Miami	24.00	7
Existing MDWASD System Total (Floridan Aquifer)	**37.00**	**11**
Future MDWASD System Total (Floridan Aquifer)	69.00	22

(a) Proposed wells
(b) Hialeah RO WTP (Phase 1, 10 mgd by 2015;
(c) Source: MDWASD Water Use Permit No. Re-issue 13-00017-W, July 16, 2012
(d) Source: MDWASD Water Use Permit No. 13-00017-W proposed modification, June 2014

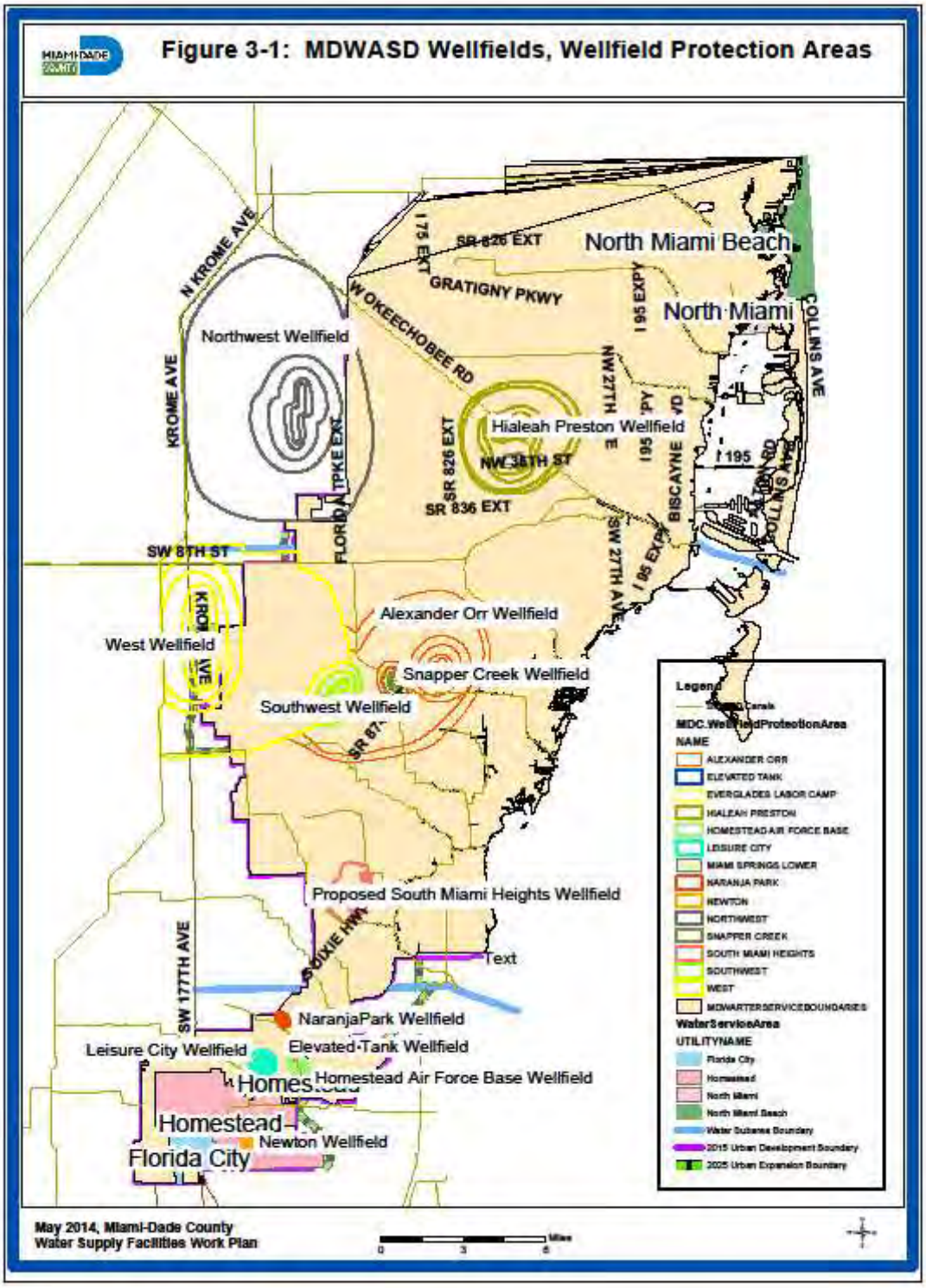


Figure 3-1: MDWASD Wellfields, Wellfield Protection Areas
North Miami Beach
North Miami
Northwest Wellfield
Hialeah Preston Wellfield
Alexander Orr Wellfield
West Wellfield
Snapper Creek Wellfield
Southwest Wellfield
Proposed South Miami Heights Wellfield
Text
NaranjaPark Wellfield
Leisure City Wellfield
Elevated Tank Wellfield
Homestead Air Force Base Wellfield
Homestead
Newton Wellfield
Florida City
N KROME AVE
KROME AVE
W OKEECHOBEE RD
GRATIGNY PKWY
SR 826 EXT
SR 836 EXT
NW 36TH ST
NW 27TH AVE
I 95 EXPY
BISCAYNE
COLLINS AVE
SW 8TH ST
SW 27TH AVE
SW 177TH AVE
DIXIE HWY
Legend
MDC WellfieldProtectionArea
NAME
ALEXANDER ORR
ELEVATED TANK
EVERGLADES LABOR CAMP
HIALEAH PRESTON
HOMESTEAD AIR FORCE BASE
LEISURE CITY
MIAMI SPRINGS LOWER
NARANJA PARK
NEWTON
NORTHWEST
SNAPPER CREEK
SOUTH MIAMI HEIGHTS
SOUTHWEST
WEST
MDWARTERSERVICEBOUNDARIES
WaterServiceArea
UTILITYNAME
Florida City
Homestead
North Miami
North Miami Beach
Water Subarea Boundary
2015 Urban Development Boundary
2025 Urban Expansion Boundary
May 2014, Miami-Dade County
Water Supply Facilities Work Plan
Miles
0
3
6

Figure 3-2: MDWASD Water Treatment Plants and Finished Water Lines

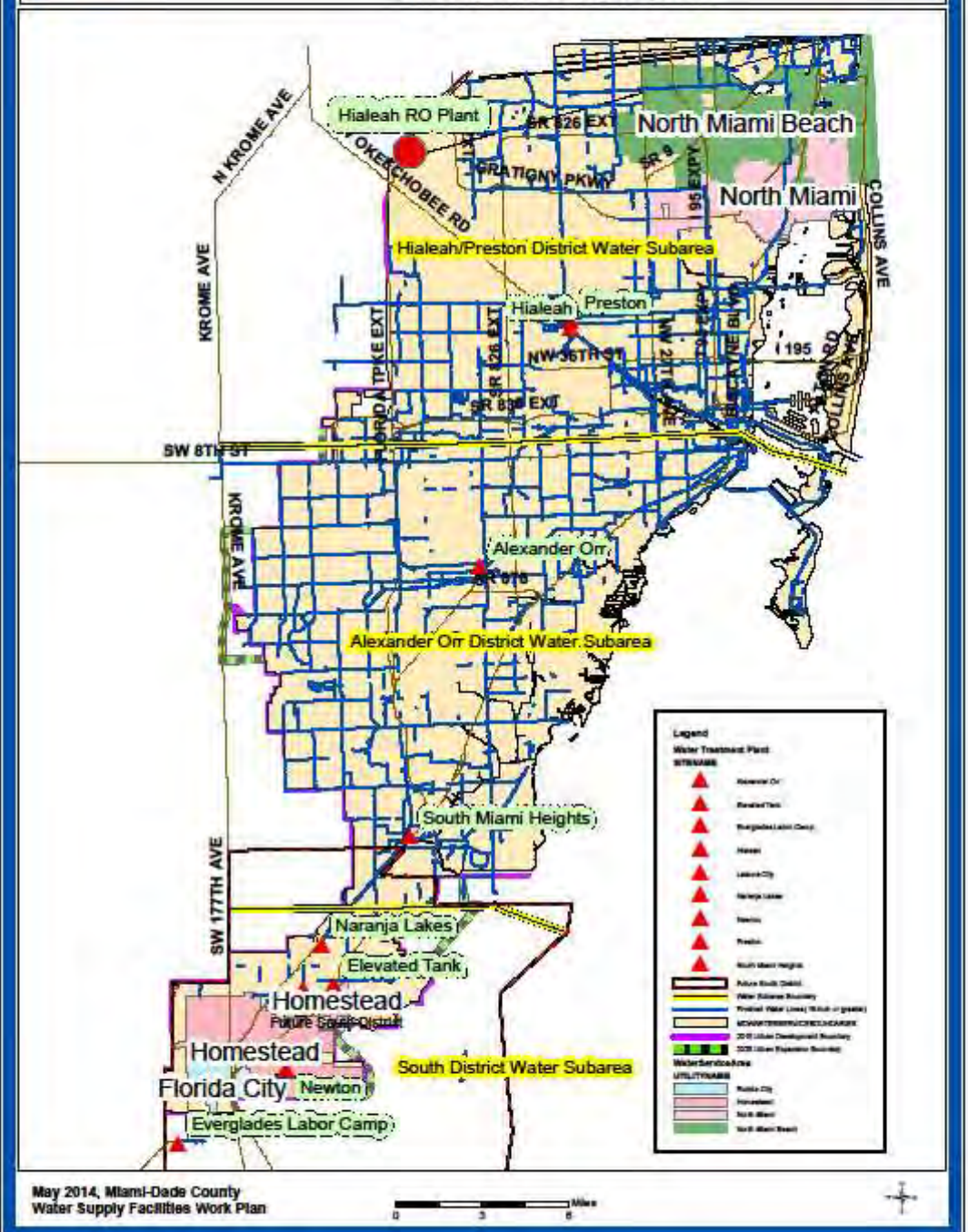


Table 3-1 Biscayne Aquifer Wellfield Data

Wellfield	Wellfield	
	Installed Design Capacity	**Number of Wells**
Hialeah-Preston		
Hialeah	12.54	3
John E. Preston	53.28	7
Miami Springs	79.30	20
Northwest[a]	149.35	15
Subtotal	**294.47**	**45**
Medley Wellfield (emergency only)[b]	48.96	4
Alexander Orr		
Alexander Orr	74.40	10
Snapper Creek	40.00	4
Southwest	161.20	17
West	32.40	3
Subtotal	**308.00**	**34**
Existing South Dade		
Elevated Tank[c]	4.32	2
Everglades Labor[d]	5.04	3
Leisure City[c]	4.18	4
Naranja[c]	1.15	1
Newton[d]	4.32	2
Subtotal	**19.01**	**12**
***Proposed South Miami Heights*[e]**		
Former Plant	*4*	*1*
Roberta Hunter Park	*6*	*4*
Subtotal	***10.00***	***5***
Existing MDWASD System Total(Biscayne Aquifer)	**670.44**	**95**
Proposed MDWASD System Total(Biscayne Aquifer)	**680.44**	**100**

(a) Northwest wellfield capacity at 150 mgd when pumps operate at low speed.
(b) Wells in this wellfield had been abandoned. They have been restored with the purpose of using them only during an emergency
(c) Abandoned when SMH WTP on line by 2018
(d) Stand-by when SMH WTP on line by 2018
(e) SMH WTP on line by 2018
Source: MDWASDWater Use Permit No. Re-issue 13-00017-W, July 16, 2012, and proposed modification, June 2014

3.1.2.1 Hialeah Wellfield

The three active wells located in the Hialeah Wellfield were constructed in 1936. Each well is 14 inches in diameter, 115 feet deep and have casing depths of 80 feet. The total wellfield capacity is 12.54 mgd or 8,700 gpm (2,900 gpm for each well).

3.1.2.2 John E. Preston Wellfield

The seven active wells located in the John E. Preston Wellfield were constructed in 1966 and 1972. Each well is 42 inches in diameter, 107 feet deep and have casing depths of 66. The capacity of wells No. 1 through No. 6 is 5,000 gallons per minute (gpm) each and the capacity of well No. 7 is 7,000 gpm. The total wellfield capacity is 53.28 mgd.

3.1.2.3 Miami-Springs Wellfield

The twenty active wells located in the Miami Springs Wellfield were constructed between 1924 and 1954. These wells are 14 inches and 30 inches in diameter, 80 to 90 feet deep and have casing depths of 80 feet. The total wellfield capacity is 79.30 mgd or 55,070 gpm (ranging between or 2,500 and 5,000 gpm for each well).

3.1.2.4 Northwest Wellfield

The Northwest Wellfield has fifteen active wells that were constructed in 1980. The wells are 40 inches and 48 inches diameter and 80 to 100 feet deep, with casing depths ranging from 46 to 57 feet. These wells have two-speed motors. The total nominal capacity of the wells at the low speed flow rate is 149.35 mgd. The capacity of each well, except well No. 10, is 10 mgd at the low speed flow rate. Well 10 have a low speed capacity of 9.35 mgd. The total nominal capacity for the wells at the high speed flow is 220.94 mgd.

3.1.2.5 Medley Wellfield

The Medley Wellfield had previously been abandoned. However, four wells were recently rehabilitated for emergency use only. The wells are 42 inches and 48 inches in diameter and 100 to 115 feet deep, with casing depths ranging from 42 to 48 feet. The total wellfield capacity is 48.96 mgd or 34,000gpm

3.1.2.6 Hialeah RO Wellfield

The Hialeah RO wellfield has six (6) active wells that were contructed in 2012. The wells are 16 and 17-inches in diameter, with depth ranging from 1,452 to 1,490 and casing depths ranging from 1,060 to 1,080 feet. The capacity of each well is 2 mgd. The total capacity of the wellfield is 12 mgd.

3.1.3 Alexander Orr, Jr. Subarea Wellfields

The Alexander Orr, Jr. WTP is supplied by four water supply wellfields as shown on Figure 3-1. The total designed installed capacity from the four wellfields in the Alexander Orr, Jr. service area is approximately 308 mgd. There are Floridan Aquifer wells at two of the wellfields. Appendix A provides detailed information about well construction and capacities, of the Alexander Orr, Jr. area wellfields.

3.1.3 Alexander Orr, Jr. Subarea Wellfields

The Alexander Orr, Jr. WTP is supplied by four water supply wellfields as shown on Figure 3-1. The total designed installed capacity from the four wellfields in the Alexander Orr, Jr. service area is approximately 308 mgd. There are Floridan aquifer wells at two of the wellfields. Appendix A provides detailed information about well construction and capacities, of the Alexander Orr, Jr. area wellfields.

3.1.3.1 Alexander Orr, Jr. Wellfield

The ten active wells located in the Alexander Orr, Jr. Wellfield were constructed between 1949 and 1964. These wells are 16 inches and 42 inches in diameter, 100 feet deep and have casing depths ranging from 40 to 50 feet. The capacity of the wellfield is 74.4 mgd (ranging between 4,170 and 7,500 gpm for each well). In the past, there was some concern about Saltwater intrusion in this wellfield. As a result improvements were implemented to a control structure on the C-2 Canal, which reduced the saltwater intrusion.

3.1.3.2 Snapper Creek Wellfield

The four active wells located in the Snapper Creek Wellfield were constructed in 1976. These wells are 24 inches in diameter, 108 feet deep and have casing depths of 50 feet. The total wellfield capacity is 40.0 mgd or 27,760 gpm (6,940 gpm for each well).

3.1.3.3 Southwest Wellfield

The seventeen (17) active wells located in the Southwest Wellfield were constructed between 1953 and 1997. These wells are 20 inches to 48 inches in diameter, 88 to 104 feet deep and have casing depths ranging from 33 to 54 feet. The total wellfield capacity is 161.20 mgd (ranging between or 4,900 and 7,500 gpm for each well).

3.1.3.4 West Wellfield

The West Wellfield has three wells that were constructed in 1994. The wells are 24 inches in diameter and 70 feet deep, with casing depths of 40 feet. The total wellfield capacity is 32.4 mgd or 7,500 gpm per well. This wellfield is limited by the SFWMD to 15 mgd on either an average or maximum daily basis. Well No. 29 pumpage is limited to 5 mgd; Well No. 30 is limited to 10 mgd; and Well No. 31 is to be used as a standby well only to be used with prior written approval from the SFWMD.

3.1.3.5 Floridan Aquifer ASR

Three Upper Floridan Aquifer wells are located in the West Wellfield (WWF) and two are located in the Southwest Wellfield (SWWF). These wells were constructed in 1996 and 1997 and are 30 inches in diameter. The total depth of these wells is between 1,200 feet and 1,300 feet with casing depths between 835 feet and 850 feet. The total capacity of the West Wellfield wells is 15.00 mgd or 3,500 gpm per well. The total capacity of the Southwest Wellfield wells is 10.08 mgd or 3,500 gpm per well.

MDWASD is cycle testing the ASR wells at the SWWF and WWF. MDWASD anticipates using these wells for storage of fresh Biscayne Aquifer water in the

Floridan Aquifer during the wet season for extraction and use in the dry season. As part of the Underground Injection Control (UIC) ASR permit requirements, MDWASD installed an ultra-violet (UV) light disinfection system at both the SWWF and the WWF to provide treatment of Biscayne Aquifer water prior to injecting in the Floridan Aquifer.

MDWASD operates the ASR system according to Department of Environmental Protection UIC permits. Injected water from the Biscayne Aquifer is from the Biscayne Aquifer water allocation in the 20-year Water Use Permit 13-00017-W for the WWF and the SWWF.

3.1.4 South Dade Subarea Wellfields

The five (5) South Dade WTPs are supplied by five individual water supply wellfields as shown on Figure 3-1. The total designed installed capacity from the five wellfields for the South Dade subarea is 19.01 mgd. Appendix A provides detailed information about well construction and capacities, of the existing South Dade area wellfields. The proposed South Miami Heights Wellfield will serve the South Dade area by December 31, 2018.

3.1.4.1 Elevated Tank Wellfield

The two (2) active wells located in the Elevated Tank Wellfield were constructed in 1982 and 1996. These wells are 12 inches and 16 inches in diameter, 45 to 50 feet deep and have casing depths of 35 and 40 feet. The wellfield's capacity totals 4.32 mgd or 1,500 gpm for each well.

3.1.4.2 Everglades Wellfield

The three (3) active wells located in the Everglades Wellfield were constructed from 2000 to 2001. These wells are 18 inches in diameter, between 50 and 55 feet deep and have casing depths of 40 and 45 feet. The wellfield's capacity totals 5.04 mgd, ranging between or 700 and 1,500 gpm for each well, excluding the three abandoned wells.

3.1.4.3 Leisure City Wellfield

The four (4) active wells located in the Leisure City Wellfield were constructed between 1953 and 1971. These wells are 6 inches and 12 inches in diameter, approximately 30 to 40 feet deep and have casing depths ranging from 25 to 35 feet. The wellfield's capacity totals 4.18 mgd, ranging between or 450 and 1,500 gpm for each well.

3.1.4.4 Naranja Wellfield

The only active well located in the Naranja Wellfield was constructed in 1975. This well is 12 inches in diameter, 40 feet deep and has a casing depth of 35 feet. The wellfield's capacity totals 1.15 mgd or 800 gpm.

3.1.4.5 Newton Wellfield

The two (2) active wells located in the Newton Wellfield were constructed in 2000 and 2001. These wells are 18 inches in diameter, approximately 65 feet deep and have casing depths ranging from 50 to 53 feet. The wellfield's capacity totals 4.32 mgd or 1,500 gpm for each well, excluding two abandoned wells.

3.1.4.6 Future South Miami Heights Wellfield

MDWASD has commenced the design of the South Miami Heights WTP and associated wellfields in the South Dade subarea. Of the five existing WTPs and wellfields in the South Dade subarea, only Everglades and Newton WTPs and wellfields will remain on a stand-by basis The three anticipated wellfields and their capacities are: Former Plant Wellfield, 4.0 mgd; Roberta Hunter Park Wellfield,6 mgd; and South Miami Heights 24 mgd. The future SMHs WTP will have a capacity to produce 20 mgd (max day) finish water using a combination of Floridan and Biscayne raw water.

3.1.5 Other Water Supply Wellfields

3.1.5.1 City of North Miami

The City of North Miami Winson Water Treatment Plant (WTP) is currently supplied exclusively from the Biscayne Aquifer. There are presently eight (8) 12-inch diameter wells, ranging in depths from 56 to 124 feet. They were drilled and put into service in 1962. Two wells are located at the WTP site, and another three pairs are located at three different public parks in the vicinity of the WTP. These wellfields provide water supply to a portion of unincorporated Miami-Dade County in addition to within the City of North Miami municipal boundary.

3.1.5.2 City of North Miami Beach

The City of North Miami Beach Norwood Water Treatment Plant is supplied by sixteen (16) Biscayne aquifer and four (4) Floridan aquifer wells. These wellfields provide water supply to a portion of unincorporated and incorporated Miami-Dade County in addition to within the City of North Miami Beach municipal boundary.

3.1.5.3 City of Homestead

The City of Homestead is currently supplied by six Biscayne Aquifer withdrawal wells, with a current capacity of 15.22 MGD. There are two 16-inch, two 18-inch, and two 20-inch diameter wells, all 60 feet in depth. The Wittkop Park wellfield, in the northwest part of the service area, has 4 wells, and the Harris wellfield, located just east of Federal Highway, US-1, has two wells. These wellfields provide water supply to a portion of unincorporated Miami-Dade County in addition to within the City of Homestead municipal boundary.

3.1.5.4 Florida City

The City of Florida City water treatment plant is supplied by four (4) production wells located on a site adjacent to the treatment plant. There are two (2) 12-inch and two (2) 10- inch diameter wells. All four wells withdraw water from the Biscayne Aquifer.

3.2 Water Treatment/Storage Facilities

The MDWASD water system is based on the three large treatment plants, the Hialeah RO plant and the smaller treatment plants in the extremely southern portion of Miami-Dade County, as shown on **Figure 3-2**.

3.2.1 Hialeah-Preston Water Treatment Plants (WTPs)

The Hialeah and John E. Preston WTPs are located at 200 W. 2nd Avenue and 1100 W. 2nd Avenue, respectively. The adjacent facilities in Hialeah share interconnected source water and finished water storage capacity. These two plants serve the Hialeah-Preston subarea, generally, the service area that lies north of Flagler Street. The two plants have similar treatment processes, which are described separately below.

3.2.1.1 Hialeah Water Treatment Plant

The Hialeah WTP was originally designed in 1924 with a total capacity of 10 mgd. By 1935, the plant's capacity totaled 40 mgd. In 1946, capacity was increased to 60 mgd. Air strippers with a capacity of 84 mgd were added to the treatment process in 1991 to remove volatile organics from the finished water. A 3.2 MG storage reservoir for both the Hialeah and John E. Preston WTPs was also added in 1991. There are plans to rerate and upgrade the Hialeah WTP to a capacity of 70 mgd, if necessary.

The source water for Hialeah WTP is from the Hialeah-Miami Springs Wellfields, supplemented by the Northwest Wellfield. The Hialeah WTP has a current rated capacity of 60 mgd. The treatment process includes lime softening with sodium silicate activated by chlorine, recarbonation, chlorination, ammoniation, fluoridation, filtration, and air stripping. The plant site is relatively small, and is surrounded by residential areas.

3.2.1.2 John E. Preston Water Treatment Plant

The John E. Preston WTP was originally designed as a 60 mgd plant in 1968 and upgraded to 110 mgd in 1980. The plant was rerated to a total capacity of 130 mgd in 1984. The plant reached its present capacity of 165 mgd with another addition in 1988. In 1991, the plant was modified with an air stripping capacity of 185 mgd to remove VOCs. In 2005, the plant process modifications to provide enhanced softening for reduction of color and total organic carbon came on line.

The main source of water for the Preston WTP is from the Northwest Wellfield. The current rated capacity is 165 mgd with a treatment process similar to that of the Hialeah WTP. This includes lime softening with ferric and other coagulant and chemicals added prior to lime for enhanced softening, recarbonation, chlorination, ammoniation, fluoridation, filtration, and air stripping. The Preston plant is also cited in a residential area of Hialeah.

3.2.1.3 Hialeah Reverse Osmosis (RO) Water Treatment Plant

On December 27, 2007, the Miami-Dade County and the City of Hialeah entered into a Joint Participation Agreement (JPA) to design, construct, and operate a water

treatment plant. The JPA specified that the County and the City would be equal partners in funding the project.

The Hialeah RO WTP was released for operation by the Florida Department of Health in November 2013. The Plant is located at 4250 W. 114th Terrace in the City of Hialeah, and is approved to operate at a capacity of 7.5 MGD. An additional capacity of 2.5 MGD is scheduled to be completed by December 31, 2015. The main source of water for the Hialeah RO WTP is the Floridan Aquifer. The Hialeah RO plant is currently in operation serving 50% of its water capacity to the City of Hialeah and 50% to unincorporated areas within the MDWASD's service area.

3.2.2 Alexander Orr, Jr. Water Treatment Plant

The Alexander Orr, Jr. WTP is located at 6800 S.W. 87th Avenue in Miami. The original design capacity was 40 mgd in 1954. This plant has undergone several expansions during the past 50 years. The raw water pumping capacity was increased by 32 mgd to 262 mgd in 1995 with an additional source from the West Wellfield. Additional reservoir and high pressure service capacities were also added to bring the total plant design capacity to 256 mgd. The plant rated capacity is 217.74 mgd.

The Alexander Orr, Jr. WTP receives its source water from the Alexander Orr, Jr. Wellfield, Snapper Creek Wellfield, Southwest Wellfield, and the West Wellfield. The Alexander Orr, Jr. WTP treatment process is similar to the other two major plants utilizing lime softening with activated sodium silicate added prior to lime as a coagulant aid, recarbonation, fluoridation, chlorination, ammoniation, and filtration. Unlike the Hialeah and Preston WTPs, this plant does not utilize enhanced softening or air stripping towers. The Alexander Orr, Jr. WTP can also receive groundwater from five Upper Floridan Aquifer wells located in the West Wellfield and the Southwest Wellfield. Finished water is distributed to a service area generally delineated as south of Flagler Street.

3.2.3 South Dade Water Treatment Plants

In 1985, MDWASD purchased an existing private utility known as the Rex Utility District Water System. Today, this system is referred to as the South Dade Water System. At the time of purchase, the system consisted of six plants and associated wellfields. Since the time of purchase, the Redavo WTP has been taken out of service.

The South Dade Water System is currently made up of five small WTPs that draw groundwater from the 12 wells located at the plant sites. The five small plants serving the South Dade Service Area include Elevated Tank, Everglades Labor Camp, Leisure City, Naranja, and Newton WTPs. These plants are located in the Southern portion of the County as shown on Figure 3-2. The plants utilize in-line disinfection with free chlorine and stabilization with the addition of polyphosphate. The 2013 annual average daily flow (ADF) for the plants is 7.29 mgd. This system serves a population of approximately 46,673 in the Leisure City, Everglades Labor Camp, and Naranja areas excluding the cities of Homestead and Florida City, which provide their own water service. These small treatment plant capacities are limited by the pumping capabilities at each plant.

MDWASD commenced the design of a new South Miami Heights (SMH) WTP in the South Dade subarea. Of the five existing plants in the South Dade subarea, only Everglades and Newton WTPs will remain on a stand-by basis when the SMH WTP comes into service by the end of 2018. The total annual average daily demand for the future South Miami Heights WTP will be approximately 18 mgd.

3.2.4 Other Water Treatment Plants

3.2.4.1 City of North Miami

The City of North Miami Norman H. Winson Water Treatment Plant is located at Sunkist Grove, 12098 NW 11th Avenue, and was commissioned in 1962. The Winsom WTP utilizes lime-softening and is capable of supplying 9.3 MGD of water to consumers, but on average the plant produces 7.7 MGD, or 63 percent of the total demand which is approximately 12.2 MGD. The Winson WTP provides treated water to a portion of unincorporated Miami-Dade County in addition to within the City of North Miami municipal boundary and the Village of Biscayne Park.

3.2.4.2 City of North Miami Beach

The City of North Miami Beach supplies water through the City owned and operated Norwood-Oeffler Water Treatment Plant, located on the northeast corner of NW 191st Street and NW 9th Avenue. The Norwood-Oeffler Water Treatment plant, originally constructed in 1953, is a lime-softening water treatment facility. The plant was upgraded in 2007 to include membrane treatment of raw water from the Biscayne and Floridan Aquifers. The treatment now consists of blending of lime softening and nanofiltration of Biscayne Aquifer water with reverse osmosis for the Floridan Aquifer water. The treated water is stored in two above-ground storage tanks at the Norwood-Oeffler WTP prior to being pumped into the City's water transmission and distribution system. The Water Treatment Plant is currently permitted by the South Florida Water Management District (SFWMD) to withdraw 26.31 mgd of raw water from the Biscayne Aquifer and 12.07 mgd from the Floridan Aquifer The treatment plant has an approved capacity of 32 mgd. The WTP provides treated water to a portion of unincorporated and incorporated Miami-Dade County in addition to within the City of North Miami Beach municipal boundary.

3.2.4.3 City of Homestead

The City is supplied by two water treatment plants. The Wittkop Park plant is located at 505 NW 9th Street, and is supplied by four Biscayne Aquifer wells with a capacity of 11.2 MGD. The Harris Field water treatment plant is located at 1084 NE 8th Street. This plant is supplied by two Biscayne Aquifer wells, and has a capacity of 5.7 MGD. Both water treatment facilities use chlorination for disinfection, and have a combined capacity of 16.92 MGD. The Wittkop Park and Harris Field WTPs provide treated water to a portion of unincorporated Miami-Dade County in addition to within the City of Homestead municipal boundary.

3.2.4.4 Florida City

The City of Florida City supplies water through a chlorination water treatment facility, with a capacity of 4 MGD. The water treatment plant is located at 461 NW 6

Avenue, adjacent to the City's Loren Roberts Park.

3.2.5 Finished Water Storage

3.2.5.1 Hialeah Preston Subarea

The finished water storage facilities for the Hialeah-Preston subarea consist of both "in-plant" and remote storage facilities. The storage facilities are summarized in **Table 3-3**.

Table 3-3 Hialeah-Preston Finished Water Storage Facilities

Location	Description	Capacity (MG)
Hialeah WTP	Reservoir – Ground Storage	3.0
Hialeah WTP	Clearwell	1.7
John E. Preston WTP	Ground Storage Tank No. 1	9.0
John E. Preston WTP	Ground Storage Tank No. 2	14.0
John E. Preston WTP	Clearwell	1.1
N.W. 20th Street	Ground Storage Tank	7.5
N.W. 36th Street	Ground Storage Tank	5.0
N.W. 67th Street	Ground Storage Tank	8.2
N.W. 30th Street	Ground Storage Tank	2.5
N.E. 79th Street	Elevated Storage Tank	2.0
Carol City	Ground Storage Tank	2.0
	Total Storage	**56.0**

Source: MDWASD Water Facilities Master Plan, 2003 and MDWASD

3.2.5.2 Alexander Orr, Jr. Subarea

The water storage facilities of the Alexander Orr, Jr. subarea consist of a 39-MG ground storage tank located at the WTP site and a 1.6-MG plant clear well.

3.2.5.3 South Dade Subarea

The South Dade Subarea currently has no significant storage facilities. Therefore, the system is very vulnerable to emergency situations.

MDWASD commenced design of the new South Miami Heights WTP in the South Dade subarea. As part of the projects, a 5 MG reservoir was constructed in 2012, which is currently operating as a re-pump station, until the WTP is completed.

3.2.5.4 Other Water Suppliers

The City of North Miami has two storage tanks that hold treated water prior to being pumped into the distribution system. The total combined storage capacity of the two tanks is 2.25 million gallons, or 17 percent of the current average daily demand. These storage tanks provide storage of treated water to service a portion of unincorporated Miami-Dade County in addition to within the City of North Miami municipal boundary.

The City of North Miami Beach stores the treated water in two above-ground storage tanks at the Norwood-Oeffler WTP prior to being pumped into the City's water transmission and distribution system. The storage capacities of the tanks are 4.2 and 2.0 million gallons. The City also uses a 2-million gallon remote tank bringing the total storage capacity in the City's water-supply system to 8.2 million gallons. These storage tanks provide storage of treated water to service a portion of unincorporated Miami-Dade County in addition to within the City of North Miami Beach municipal boundary.

The City of Homestead stores the finished water in three elevated storage tanks. After treatment, water from five of the six wells is stored in an elevated water storage tank at either Harris Field (0.5 MG), Wittkop Park (0.5 MG), or the Homestead Motorsports Complex (1.0 MG). Water from Well No. 5 at Harris Field is pumped directly into the system after treatment on an as-needed basis. The combined capacity of the storage tanks is 2 MG. These storage tanks provide storage of treated water to service a portion of unincorporated Miami-Dade County in addition to within the City of Homestead municipal boundary.

Florida City has one storage tank that holds treated water prior to distribution within its service area. The tank's storage capacity is 0.5 million gallons.

3.3 Water Distribution Facilities

The MDWASD water distribution system is currently supplied by three regional treatment plants ,five (5) smaller treatment plants located in the southern portion of Miami- Dade County, and the Hialeah RO WTP. The distribution systems serving these treatment plants are comprised of loops and are interconnected, as shown on Figure 3-2.

3.3.1 Hialeah-Preston Subarea

Finished water from the Hialeah and John E. Preston WTPs is pumped through a system of dedicated low-pressure pipelines to remote storage tanks and pumping facilities. This system provides water service to the southeastern part of the Hialeah-Preston subarea. The low pressure system starts at the Hialeah WTP with a 42-inch diameter main heading due east along N.W. 62nd Street, and 36-inch and 42-inch diameter mains running southeast along Okeechobee Road then parallel to the Miami River. The main on N.W. 62nd Street connects to the N.W. 67th Street pumping station, which pumps the water to the south through a 30-inch diameter main running along N.W. 10th Ave. The 30-inch diameter main continues south and connects into the N.W. 36th Street pumping station. This main continues further south and connects into the golf ground pump station.

The 36-inch and 42-inch diameter mains combine into a 54-inch diameter main at N.W. 42nd Avenue. They split again into a 36-inch and a 42-inch diameter main at N.W. 32nd Avenue. These mains connect to the 30th Avenue pump station. The 30th Avenue pump station feeds two 36-inch diameter mains that connect to the 20th Street pumping station to complete the loop. The pipe loop is made predominantly of concrete and cast iron pipes that were installed in the early 1930s. Some segments of this loop

having been in service for more than 60 years. Replacement of these pipes are scheduled in the MDWASD maintenance program.

The remaining part of this subarea is served by a high pressure system. Water is pumped into the system by five high service in-plant pumps with a total capacity of 34.1 mgd at 167 feet total dynamic head (TDH). The high pressure system delivers water service to Hialeah, Miami Springs, and a high pressure main connected to the City of Miami. The northern section of the subarea is supplied by one major piping loop. The loop begins at the plant with a 72-inch diameter main heading north along West 2nd Avenue, next it turns west at West 20th Street, and then it turns North along West 4th Avenue to NW 191st Street. At this location, it turns east until it reaches N.E. 18th Avenue. It then turns south and connects into a 54-inch diameter main that connects to the N.W. 67th Street pumping station.

The southwestern portion of the subarea is supplied by a 36-inch diameter main that connects to the 54-inch diameter main heading out of the John E. Preston WTP at West 25th Street. The main heads west on N.W. 74th Street then turns south on N.W. 107th Avenue. It eventually interconnects with the Alexander Orr, Jr. subarea piping network on S.W. 56th Street around S.W. 117th Avenue.

3.3.2 Alexander Orr, Jr. Subarea

The distribution system of the Alexander Orr, Jr. subarea is comprised of two major piping loops. The first major loop traverses the south and west portion of the subarea. The loop starts at the WTP with a 60-inch diameter main heading west on S.W. 64th Street and a 48-inch diameter main that runs south along S.W. 87th Avenue (Galloway Road) until S.W. 216th Street. The 48-inch diameter main then heads west along S.W. 216th Street to a tee connection at S.W. 127th Avenue. One branch of the tee runs north on S.W. 127th Avenue to S.W. 184th Street and then turns west to 137th Avenue. The 48-inch diameter main travels north on 137th Avenue to S.W. 152nd Street, where it connects into a 24-inch diameter main running east-west on 152nd Street and a 36-inch diameter main that continues north on 137th Avenue to S.W. 120th Street. There, the 36-inch diameter main turns west, then runs north along Hammocks Boulevard to S.W. 88th Street where it reduces to a 24-inch diameter main that runs north along S.W. 152nd Avenue to 72nd Street. The 24-inch diameter main then runs east-west on S.W. 72nd Street. At S.W. 147th Avenue, it connects with a 36-inch diameter main that runs north to S.W. 56th Street (Miller Road), where it connects with a 42-inch diameter main that runs east on Miller Road. This 42-inch diameter main enlarges to a 48-inch diameter main that eventually connects to the 60-inch diameter main at the intersection of Miller Road and S.W. 117th Avenue to complete the loop. A 36-inch diameter main branches off of the 60-inch diameter main at the intersection of Miller Road and S.W. 117th Avenue. This 36-inch diameter main heads north along S.W. 117th Avenue and eventually interconnects the Alexander Orr, Jr. and the Hialeah-Preston subareas.

The second loop starts at the WTP with two 48-inch diameter mains. One main runs north on S.W. 87th Avenue (Galloway Avenue) to S.W. 40th Street (Bird Road) and then turns east. The main continues east along Bird Road, reduces to a 42-inch

diameter main at N.W. 57th Avenue, then connects through a 30-inch diameter pipe connection with the second 48-inch diameter main at Bird Road and S.W. 37th Avenue (Douglas Road). The second 48-inch diameter main travels along Highway 874 to S.W. 56th Street, where it turns east then northeast between S.W. 67th Avenue and S.W. 62nd Avenue to S.W. 48th Street. The main runs east on S.W. 48th Street then northeast through several changes in direction, where it connects to the other 48-inch diameter main at Bird Road and S.W. 37th Avenue. The main then travels north along South Dixie Highway and eventually interconnects with the Hialeah-Preston Service Area piping network through a 36-inch diameter pipe that runs along S.W. 2nd Avenue.

3.3.3 South Dade Subarea

The South Dade water distribution system consists of small water mains with diameters ranging from 16 inches to 4 inches. The distribution system is centered around each individual WTP. Each has its own sets of water main loops within the distinct service areas. The Leisure City, Elevated Tank, and Naranja WTPs, however, are so well interconnected that they can be generally considered as one distribution area. More than 63 percent of the South Dade subarea is served by these three plants. The distribution system of these three plants form one major loop that is bounded on the north by S.W. 248th Street, on the south by S.W. 304th Street, on the east by S.W. 117th Avenue, and on the west by S.W. 172nd Avenue.

The Everglades Labor Camp WTP serves a small area that is bounded on the north by S.W. 376th Street, on the south by S.W. 384th Street, on the east by S.W. 192nd Avenue, and on the west by S.W. 194th Path. This distribution system consists of one 12-inch-diameter loop around the service area interconnected with several 8-inch diameter distribution mains. The Everglades Labor Camp and the Newton WTP distribution system are interconnected via an 8-inch diameter main that runs east along S.W. 376th Street then heads north on S.W. 187th Avenue, where it connects with a 12-inch diameter main at S.W. 360th Street. The 8-inch diameter main continues north on S.W. 187th Avenue until S.W. 352nd Street, where it connects into a small distribution loop that terminates with a 16-inch diameter stub-out.

The Newton WTP distribution system consists of a single 12-inch diameter water main that runs east and west on S.W. 336th Street. The eastbound main then branches north and south along S.W. 152nd Avenue. The southbound branch then turns east on S.W. 344th Street and ultimately connects to the FP&L Turkey Point generating plant. The northbound branch continues along S.W. 152nd Avenue, where it connects to the Leisure City WTP distribution system at S.W. 304th Street. A 6-inch diameter main running south from SW 288th Street on S.W. 137th Avenue then east on S.W. 328th Street connects to an 8-inch diameter main that runs south on 117th Street. This 8-inch diameter main connects to the 12-inch diameter main to FP&L Turkey Point generating plant. This main ultimately completes the interconnection of the Newton WTP with the Leisure City, Elevated Tank, and Naranja WTPs' distribution areas.

The westbound branch of the 12-inch diameter main turns south on S.W. 162nd Avenue then heads south and west on Palm Drive. The main then continues south on S.W. 167th Avenue then west on S.W. 360th Street until it connects to the Everglades Labor Camp WTP 8-inch diameter main that runs north on SW 187th Avenue.

The South Dade distribution system is interconnected with the Alexander Orr distribution system in the vicinity of SW 127th Avenue. MDWASD commenced the construction and operation of the South Miami Heights WTP and associated wellfields in the South Dade Subarea. Of the five exsisting WTPs and wellfields in the South Dade area, only Everglades and Newton WTPs and wellfields will remain on a stand-by service when the SMHWTP comes on line by 2018. MDWASD will be constructing a water main to interconnect with the Everglades and Newton Systems to provide water and meet additional future demands. The SMHWTP will connect to the existing distribution systems of the South Dade Plants to be taken out of service by 2018, when SMHWTP comes online.

3.3.4 Other Water Distribution Facilities

3.3.4.1 City of North Miami

The City of North Miami's distribution system consists of two 16-inch and one 12-inch diameter ductile iron pipes. The two 16-inch diameter pipes mostly service the areas east of the WTP. One of the 16-inch pipes eventually connects to a 20-inch pipe and then to two 12-inch pipes. The 20-inch and one of the two 12-inch pipes connects o a large 30-inch transmission main at different points. This 30-inch pipe serves as the main transmission line on the far-east side of the City. The other 16-inch main reduces to a 12-inch pipe. The 12-inch transmission main leaving the WTP travels west, then south, and expands into the distribution system. The City also maintains seven supply interconnections with MDWASD and a emergency interconnections with the City of North Miami Beach and City of Opa-Locka. This distribution system provides treated water to service a portion of unincorporated Miami-Dade County in addition to within the City of North Miami municipal boundary.

3.3.4.2 City of North Miami Beach

The City of North Miami Beach distribution system provides treated water to service a portion of unincorporated Miami-Dade County in addition to within the City of

North Miami Beach municipal boundary from the WTP.

The City has eleven high service pumps that deliver finished water to the distribution system at approximately 60 to 80 psi and have a combined capacity of 45 mgd with largest one pump out of service. The City's distribution system is fed by 18-inch, 24-inch, and 36-inch diameter transmission mains.

3.3.4.3 City of Homestead

The City's water distribution system is comprised of an interconnected string of mains ranging from 2-inches to 24-inches in diameter, mostly of ductile iron pipe. The water from the storage tanks flows into the mains, with a pressure of 45 to 60 psi.

On July 9, 2010, the City of Homestead entered into a 20-year water wholesale agreement with MDWASD to purchase up to 3 MGD of water to meet the demands of its retail customers. The interconnection between the City and MDWASD occurs at SW 137th Avenue and SW 288th Street. ?????

3.3.4.4 Florida City

Florida City's water distribution system is comprised of an interconnected string of mains ranging from 2-inches to 16-inches in diameter, mostly of ductile iron pipe. The City's distribution system provides service within its municipal boundaries..

3.4 Summary

As shown within this section, the MDWASD water supply and treatment systems have sufficient installed capacity to produce more potable water than is currently required. The supply capacity and treatment capacity are 724.44 MGD and 517.19 MGD respectively. **Table 3-4** summarizes this information. **Table 3-5** summarizes other suppliers facilities capacities.

The capacities of these water supply and treatment systems have been coordinated with future demands and allocations. Sections 4 and 5 of this Work Plan address future demands and required water supply facilities.

Table 3-4 MDWASD Facilities Capacities

Facility	Installed Capacity (mgd)
Hialeah-Preston Water Treatment Plants	60 + 165 = **225**
Hialeah-Preston Well fields	
Preston	53.28
Hialeah	12.54
Miami Springs	79.30
Northwest[(a)]	149.35
Medley Wellfield [(b)]	48.96
Hialeah RO Water Treatment Plant	**10**
Hialeah RO Wellfield (Floridan Aquifer)	
Existing Hialeah RO	12.00
Future Hialeah RO (2015)	8.00
Alexander Orr Water Treatment Plant	**248**
Alexander Orr Well fields	
Orr Plant	74.40
Snapper Creek	40.00
Southwest	161.20
West	32.40
South Dade Water Treatment Plants	**14.19**
South Dade Wellfields	
Elevated Tank	4.32
Everglades Labor Camp	5.04
Leisure City	4.18
Naranja	1.15
Newton	4.32
Future South Miami Heights Water Treatment Plant (2018)	***20.00***
Future South Miami Heights Wellfields	
Former Plant (Biscayne Aquifer)	*4.00*
Roberta Hunter Park (Biscayne Aquifer)	*6.00*
South Miami Heights RO (Floridan Aquifer)	*24.00*
Existing WASD Wellfield Total	**682.44**
Existing WASD Water Treatment Plant Total	**497.19**
Future WASD Wellfield Total	**724.44**
Future WASD Water Treatment Plant Total	**517.19**

(a) Northwest wellfield capacity at 150 mgd when pumps operate at low speed.

(b) Wells in this wellfield had been abandoned. They have been restored with the purpose of using them only during an emergency.
Source: MDWASD Water Use PermitNo. 13-00017-W, revised July 2012 , and requested revision June 2014.

Table 3-5 Other Suppliers' Facilities Capacities

Facility	Installed Capacity (mgd)
City of North Miami	
Norman H. Winsom Water Treatment Plant	9.30
City's well fields (8 wells)	**14.96**
City of North Miami Beach	
Norwood-Oeffler Water Treatment Plant	**32.00**
City of North Miami Beach Wellfields	
Biscayne Aquifer Wellfields	27.90
Floridan Aquifer Wellfields	12.07
City of North Miami Beach Wellfields	**39.97**
City of Homestead	
Wittkop Park – Harris Field Water Treatment	11.2+5.7=**16.9**
City of Homestead Wellfields	
Wittkop Park	11.23
Harris Field	5.76
City of Homestead Wellfields	**16.99**
Florida City	
Florida City Water Treatment Plant	***4***
Florida City Wellfields	***4***

Source: City of North Miami Beach SFWMD Water Use Permit Staff Report (August 2007) and Water Use Permit No. Re-issue 13-00060-W, Draft Water Supply Facilities Work Plan (City of North Miami, March 2008), Information provided by discussions with staff for the City of Homestead and Florida City

Section 4

Population and Water Demand Projections

This section presents historical and projected population projections from Year 2010 through Year 2033 for MDWASD's service area. Population data were obtained from the Miami-Dade County Department of Regulatory and Economic Resources (RER), Planning Division, based on the 2010 Census and derived from Transportation Analysis Zone (TAZ), On June 20, 2014, MDWASD submitted an application for modification and extension of the 20-year Water Use Permit (WUP) No. 13-00017-W. The modification and extension to the current WUP are a result of revised population projections based on the 2010 Census and the continued successful implementation of the County's Water Conservation Plan. The requested modification to the WUP included new population data, revised water demand projections and alternative water supply projects to support water demands through the year 2033. MDWASD's Reuse projects were listed but they are not required to address water supply. The revised population projections for the year 2030 are consistent or slightly lower, than the projections in the District's Lower East Coast Water Supply Update, dated October 2013.

4.1 Historical Population

Historical populations served by the MDWASD system are shown in **Table 4-1** in one year increments from Year 2010 to Year 2013. The population in MDWASD's service area grew approximately 2.8% between Year 2010 and year 2013. Table 4-1 also provides a summary of historical population within Miami-Dade County. The MDWASD system served approximately 86% of the County total population in 2013.

Table 4-1 Historical Population Served by MDWASD

YEAR	TOTAL MDWASD	TOTAL COUNTY
2010	2,160,138	2,496,435
2011	2,181,073	2,523,474
2012	2,202,008	2,550,513
2013	2,222,944	2,577,552

Source: Miami-Dade County RER, Planning Division, 2010 Census TAZ data

4.2 Population Projections

Population projections for MDWASD's service area in five year increments from Year 2014 to 2033 are shown in **Table 4-2**. Overall, the population served by MDWASD is expected to increase approximately 17.78% from Year 2014 to Year 2033.

Table 4-2 Population Projections to be Served by MDWASD

Year	Total MDWASD	Total* County
2014	2,243,879	2,604,590
2015	2,266,092	2,631,629
2020	2,370,769	2,766,823
2025	2,475,446	2,902,018
2030	2,580,123	3,037,212
2031	2,601,058	3,064,251
2032	2,621,994	3,091,289
2033	2,642,929	3,118,328

Sources: *Miami-Dade County RER, Planning Division, 2010 Census TAZ Data

Upon completion of the New South Miami Heights Water Treatment Plant by 2018, the South-Dade subservice area boundary will be shifted northward such that portions of the population currently within the Alexander-Orr subarea will be within the South Dade subarea. **Figure 4-1** illustrates the boundary shift. The boundary shift will cause a general redistribution of service between the Alexander-Orr and South Dade areas, but will not have other effects on the population expected to be served by MDWASD. In 2033, MDWASD will serve potable water to approximately 85% of the total County population.

4.3 Historical Water Use

Historic water use figures reflect water provided by the Hialeah-Preston, Alexander-Orr, Everglades, Leisure City, Newton, Elevated Tank, and Naranja WTPs and associated wellfields. These water use figures provide the basis for forecasting future water demands for MDWASD's service area.

Table 4-3, referred to as Table F in previous submittals to the SFWMD**,** provides the historical raw and finished water use for Year 2004 through Year 2013. Information shown in Table 4-3 includes per capital annual average and maximum month water use.

4.4 Water Demand Projections

The water demand projections presented herein are based on an initial system-wide finished water daily per capita use rate of 137.2 gallons per capita per day (gpcd). The per capita use was determined by taking a 3-year average from 2011 to 2013. The initial per capita rate has declined due to water use reductions resulting from water conservation and reuse irrigation water projects. **Table 4-4,** referred to as Table G in previous submittals to the SFWMD**,** provides the projected raw and finished water use for Year 2014 through Year 2033. Table 4-4 also provides projected raw water pumpage from the Biscayne and Floridan Aquifers in five-year increments to indicate how the sources of water will be used to meet future demand.

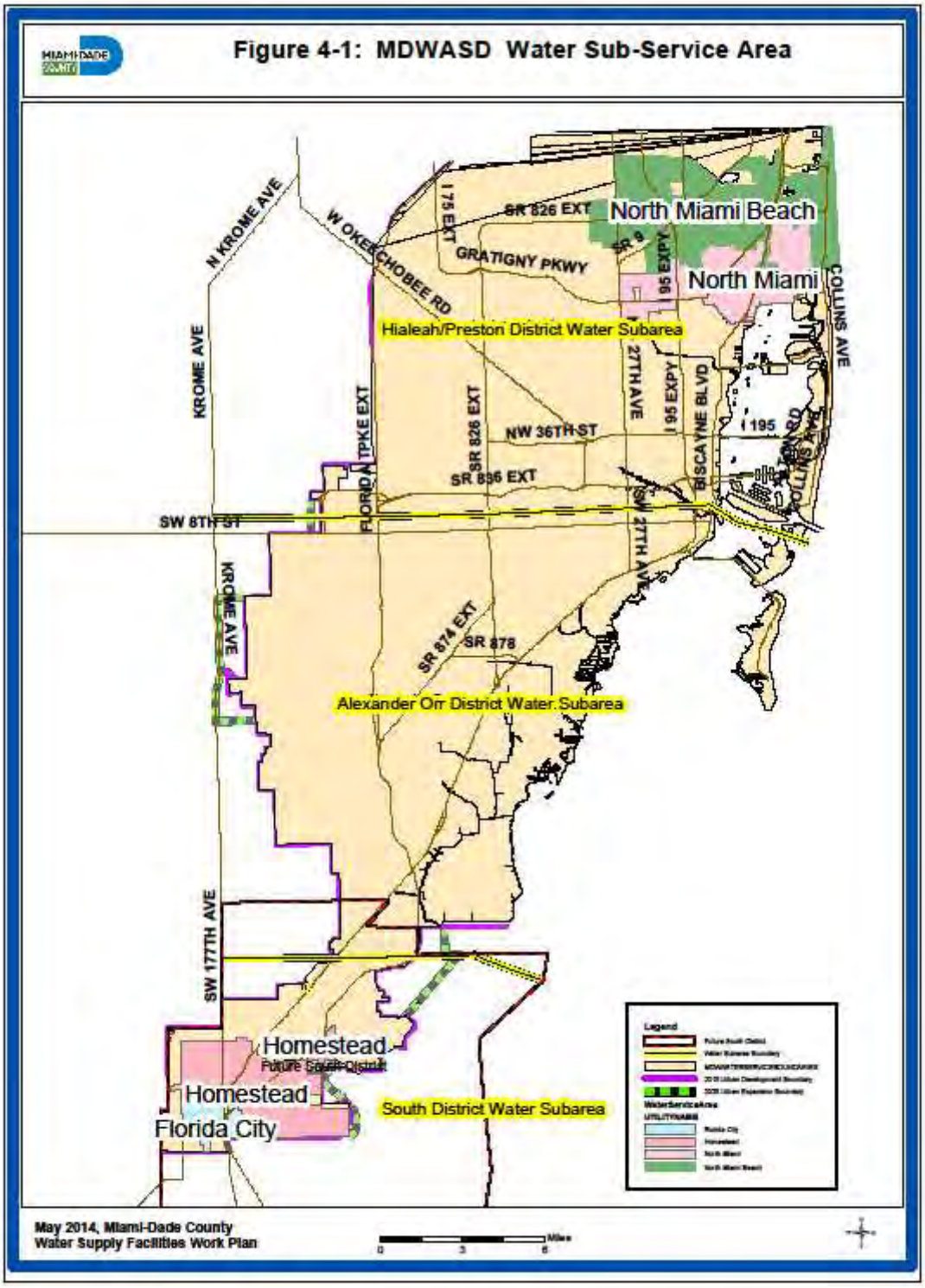


Figure 4-1: MDWASD Water Sub-Service Area
North Miami Beach
North Miami
Hialeah/Preston District Water Subarea
Alexander Orr District Water Subarea
South District Water Subarea
Homestead
Homestead
Florida City
N KROME AVE
W OKEECHOBEE RD
SR 826 EXT
GRATIGNY PKWY
I 75 EXT
SR 9
I 95 EXPY
COLLINS AVE
KROME AVE
FLORIDA TPKE EXT
SR 826 EXT
NW 36TH ST
27TH AVE
I 95 EXPY
BISCAYNE BLVD
I 195
SR 836 EXT
SW 8TH ST
SW 27TH AVE
SR 874 EXT
SR 878
SW 177TH AVE
Legend
May 2014, Miami-Dade County
Water Supply Facilities Work Plan
Miles
0
3
6

TABLE 4-3 (September 2014) Miami-Dade Water and Sewer Department (MDWASD) Past Water Use (2004-20013)

1	2	3	4	5	6	7	8	9	10	11	12	13
FINISHED WATER HISTORICAL USE							RAW WATER HISTORICAL USE (a)					Ratio Finished:Raw (Total Annual Use)
Year	Population Served *	Per Capita Usage (gpcd)	Total Annual Use (MG)	Average Month Use (MG)	Max Month Use (MG)	Ratio Max : Aver. Month	Per Capita Usage (gpcd)	Total Annual Use (MG)	Average Month Use (MG)	Max Month Use (MG)	Ratio Max : Aver. Month	
TOTAL MDWASD WATER SYSTEM SERVICE AREA **												
2004	2,090,099	162.5	124,301	10,358	10,861.1	1.05	165.6	126,685	10,557	11,063	1.05	1.019
2005	2,101,772	161.8	124,098	10,342	10,734.8	1.04	165.1	126,670	10,556	11,031	1.04	1.021
2006	2,113,445	161.6	124,677	10,390	10,988.6	1.06	164.7	127,019	10,585	11,170	1.06	1.019
2007	2,125,118	150.3	116,602	9,717	10,485.4	1.08	151.6	117,585	9,799	10,648	1.09	1.008
2008	2,136,791	138.1	108,029	9,002	9,583.0	1.06	149.4	116,820	9,735	10,508	1.08	1.081
2009	2,148,464	142.3	111,627	9,302	9,662.7	1.04	151.2	118,575	9,881	10,550	1.07	1.062
2010	2,160,138	141.4	111,453	9,288	9,700.0	1.04	151.0	119,056	9,921	10,346	1.04	1.068
2011	2,181,073	140.2	111,585	9,299	9,597.6	1.03	149.2	118,768	9,897	10,273	1.04	1.064
2012	2,202,008	134.8	108,626	9,052	9,693.9	1.07	142.5	114,807	9,567	10,223	1.07	1.057
2013	2,222,944	136.5	110,388	9,199	9,483.7	1.03	144.6	117,623	9,802	10,252	1.05	1.066
3-year Average (2011-2013)	-	137.2	-	-	-	1.04	145.4	-	-	-	1.05	1.062

* Source of Population Information: Miami-Dade County RER Planning Division. Historic Population 2001 to 2009 adjusted (downward) based on, and 2010 to 2013 represents the 2010 TAZ population projections by the MDC RER Planning Division, based on 2010 Census.

** For 2004 - 2007 from MDWASD Raw & Finished Water Historical Data, For 2008 - 2013 from MDWASD reports to SFWMD of Water Treatment Plant Influent & Effluent Flow Meter Flows

(a) Raw-to-finished water ratio is 1.06. MDWASD is improving its raw water metering/accounting system.

TABLE 4-4 (September 2014)
MDWASD PROJECTED FINISHED WATER DEMANDS

1	2	3	4	5	6	7	8	9
	PROJECTIONS (2013) FOR MDWASD SERVICE AREA							
Year	Pop.[a]	Finished Water Use (gpcd)	AADD Finished Water Use[b] (MGD)	Water Conservation[c] (MGD) Credit	Reuse/ Reclaimed Water [d] (MGD) Credit	Adjusted Finished Water Demand[e] (MGD)	Adjusted Finished Water Use (gpcd)	CITY OF HOMESTEAD Finished Water Demand (MGD)
System-Wide								
2014	2,243,879	137.2	307.19	1.36	0.00	306.43	136.56	2.50
2015	2,266,092	137.2	310.84	2.04	0.00	308.80	136.27	3.00
2020	2,370,769	137.2	325.20	5.44	0.00	319.76	134.88	3.00
2025	2,475,446	137.2	339.56	8.84	0.00	330.72	133.60	3.00
2030	2,580,123	137.2	353.92	9.55	0.00	344.37	133.47	3.00
2031	2,601,058	137.2	356.79	9.55	0.00	347.24	133.50	3.00
2032	2,621,994	137.2	359.66	9.55	0.00	350.11	133.53	3.00
2033	2,642,929	137.2	362.53	9.55	0.00	352.98	133.56	3.00

Footnotes

(a) Population Served represents the TAZ population projections based on 2010 Census Data provided by the MDC RER Planning Division.

(b) Annual Average Daily Demand (AADD) Finished Water Projections between 2014 and 2033 assume 137.2 gpcd (a decrease from 145.4 gpcd total water system demand prior to application of credits (e.g. conservation).

(c) MDWASD has implemented a 20-year water use efficiency plan and is experiencing reductions in per capita water consumption. Water Conservation projections were revised based on the 2010 Annual Water Conservation Plan Conserve Florida Report (March 2011). Real losses in non-revenue water (e.g. unaccounted-for-water) are assumed to remain at less than 10%. The conservation amounts experienced through 2010 (6.54 MGD) were deducted from the 20-year conservation amount in the Conserve Florida Report and the remaining conservation amounts were distributed for the balance of the 20-year period (2011-2027).

(d) Not Used

(e) Adjusted after taking credit in finished water demand projections for reductions in finished water use associated with water conservation.

4.5 Water Conservation and Reuse

4.5.1 MDWASD

4.5.1.1 Water Conservation

The per capita usages contained in Table 4-4 are adjusted taking into consideration MDWASD water conservation. MDWASD is implementing a 20-year water conservation plan and is implementing ways for reducing non-revenue water. The *MDWASD 20-year Water Use Efficiency Goal Based Plan* (Plan) was approved by the SFWMD in May 2007. The Water Conservation projections included in Table 4-4 were revised based on the *2010 Annual Water Conservation Plan Conserve Florida Report* (March 2011). Included in the 20-year Plan is the Water Conservation Best Management Practices (BMP) Planning Spreadsheet prepared by Malcolm Pirnie, Inc. in 2007. Table 5: Countywide BMP Implementation Schedule, Costs, and Savings Projections from *The Water UseEfficiency 5-Year Plan* is located in Appendix E. Currently, MDWASD is implementing all BMPs included in the Plan. Additionally, Miami-Dade County has enacted water use efficiency-legislation including permanent landscape irrigation restrictions, landscape ordinances requiring Florida Friendly landscaping in new construction, in right of ways, and the installation of high efficiency plumbing fixtures in new construction (see Appendix D) and some reuse within the three wastewater treatment plant sites or in their vicinities.

Water conservation activities are funded annually through the operations and maintenance budget and are therefore not included in capital budgets. Values contained within Table 4-4 reflect projections as of June 2014.

Water conservation projections do not reflect water demand reductions presented by the "Unaccounted Water Loss Reduction Plan (February 2007)" prepared by Malcolm Pirnie, Inc. The potential additional reduction in water demands as a result of real non-revenue water loss is estimated at 14.25 mgd over the next ten years.

Water Conservation is in accordance with SFWMD Water Use Permit No. Re-Issue 13-00017-W, Limiting Condition Nos. 45 and 49 and Exhibit 27.

For more information about our Water Conservation Program please go to http://www.miamidade.gov/conservation/home.asp

4.5.1.2 Water Reuse

On June 28, 2013, MDWASD submitted to the Secretary of FDEP the Ocean Outfall Legislation Compliance Plan. A total of 117.5 mgd of reuse will be implemented, out of that 27.6 mgd of reclaimed water will be used to recharge the Floridan Aquifer. The Floridan Aquifer recharge will be applied on equal capacities at the existing Central and South District Wastewater Treatment Plants, and a proposed West District Wastewater Treatment

Plant (9.2 mgd each), and up to 90 mgd of reuse water will be provided to FPL for Turkey Points Units 5, 6 and 7 cooling. The reuse projects and completion dates are listed in Exhibit 14 of the County's 20-year water use permit modification request, included in Appendix F.

The County's projected finished water demands are now markedly lower than anticipated when the first 20-year water use permit application was submitted. This demand reduction has eliminated the anticipated supply shortages which were the basis for an ambitious schedule of several costly alternative water supply projects. As such, reuse to address water supply is no longer required or needed

As noted in Exhibit 14 in Appendix F, MDWASD is currently implementing a total of 16.49 mgd of reuse at each of the Wastewater Treatment Plants. The reclaimed water is used for industrial and public and non-public irrigation.

4.5.2 Other Water Suppliers

4.5.2.1 City of North Miami

The City of North Miami has developed a water conservation plan to help reduce the demand for potable water and lower its consumption on a per capita basis. The conservation plan includes the adoption of Florida friendly landscaping methods, the implementation of a water conservation public education program, the implementation of a leak detection program, water loss prevention programs, and the exploration of the utilization of reuse water for irrigation and non-potable water uses. The City is also implementing an incentives program, and encouraging the development of "green buildings". They will also continue to enforce the wellfield protection ordinance which limits the allowable land uses within the wellfield's cone of influence, and will continue to monitor water quality levels in the drainage basins to maintain a minimum level of service standards. Currently, all the City's wastewater is treated by MDWASD, and therefore the City does not have a water reuse and reclamation program.

4.5.2.2 City of North Miami Beach

The City of North Miami Beach has seen major successes in ways of alerting and educating residents on water and environmental conservation. In 2005, the City created a Water Conservation Program that applies conservation methods to reduce water demand and to lower the per capita consumption of potable water. The program includes collective efforts to increase the overall water use efficiency and to limit water losses to 10 percent or less. They have also initiated a water conservation educational and outreach program. Another aspect of the conservation program is the continuation and installation of water efficient landscape, plumbing and irrigation ordinances, as well as a water shortage and emergency ordinance. In addition, they have begun the use of alternative water sources, mainly the Floridan aquifer. Other methods for water conservation taking

place at the City include meter replacements and a showerhead exchange program.

Also, the North Miami Beach Water fund established the Foundation for Water and Environmental Education which is a not-for-profit organization with funds and programs managed by its own directors and established to maintain and aid water resource management in the City of North Miami Beach community.

4.5.2.3 City of Homestead

The City of Homestead has developed a water conservation plan to reduce potable water consumption. The plan includes a permanent irrigation ordinance which establishes irrigation restrictions prohibiting landscape irrigation between 9:00 AM and 4:00 PM., a Florida Friendly ordinance that promotes use of drought landscape methods, a high efficiency plumbing fixture ordinance that establishes water conservation standards for plumbing fixtures installed in new construction, and a leak detection program. In addition, the City has a residential and commercial meter replacement program where all meters will be replaced within the next 5 years. The City will adopt the Automatic Meter Reading technology which allows the reading of water consumption remotely which will allow accurate and true monthly readings. Also, the City is implementing a rain sensor device ordinance that requires all irrigation systems equipped with automatic controls to have a rain sensor switch which turns off the system when more than 0.5 inches of rain has fallen. A water conservation education program is also taking place.

The City has also implemented a reclaimed water system, where most of the wastewater from the City's sewer service area is treated at the City's Wastewater Treatment Plant (WWTP). The wastewater from the City's WWTP receives treatment (including ultra-violet radiation to eliminate the possible formation of disinfection by- products) and is reused to recharge the surficial aquifer. 100% of the City's WWTP output [approximately 6 MGD (4.730 MGD, average)] is currently recharging the aquifer via two primary and four secondary rapid infiltration trenches.

4.5.2.4 Florida City

Florida City is currently implementing a water main replacement program, where they are abandoning all existing 2, 4 and 6-inch diameter mains and installing new 8 and 12-inch diameter DIP water mains. They are also following the SFWMD restrictions for irrigation water use that are currently in place.

4.6 Summary

In summary, the historically based MDWASD service area projected water demands as adjusted for water conservation and reuse are presented in **Table 4-5** as "adjusted" finished water demand and per capita water use. The resulting

anticipated finished water demands in 5-year increments to 2030, and from 2031-2033 is as follows:

Table 4-5 MDWASD Service Area Incremental Water Demands

Year	Population[(a)]	Adjusted Finished Water (mgd)	Adjusted Per Capita Water Use (gpcd)
System-Wide			
2014	2,243,879	306.43	136.56
2015	2,266,092	308.80	137.27
2020	2,370,769	319.76	134.88
2025	2,475,446	330.72	133.60
2030	2,580,123	344.37	133.47
2031	2,601,058	347.24	133.50
2032	2,621,994	350.11	133.53
2033	2,642,929	352.98	133.56

Section 5
Planned Water Supply Facilities

This section details the water supply facilities that are planned in order to meet MDWASD's water demands through 2033. The County's projected finished water demands are now markedly lower than anticipated when the first 20-year water use permit application was submitted to South Florida Water Management District (SFWMD) in 2007. This demand reduction has eliminated the anticipated supply shortages which were the basis for an ambitious schedule of several costly alternative water supply projects which are no longer required or needed. Reuse projects to address water supply have been eliminated. The decrease in water demands is a result a successful implementation of the County's Water Conservation Plan and new population projections based on the 2010 Census. For ease of reference, the project start and finish dates have been provided below the title of the following subsections. The Capital Improvement Elements Tables 8 and 12 located in Appendix B.

5.1 Alternative Water Supply Projects

The following proposed alternative water supply (AWS) projects are to meet MDWASD's water demands through 2033, which encompasses the proposed modification to the 20-year Consumptive Use Permit period. AWS projects have been identified to meet water demands in the MDWASD service area and are presented in **Table 5-1, Table 5-2** and **Figure 5-1**.

The plan described herein demonstrates that the proposed projects, by their location, volume of water produced, and timing of implementation, will be sufficient to meet the water demand increases. These projects will undergo further refinement and development over the next few months. The flow (Q MGD) shown in parentheses below represents the corresponding amount of finished water annual average daily demand (AADD) provided by the projects in terms of million gallons per day (MGD). These AWS projects and AADD assume that all current wholesalers will remain on the MDWASD system through 2033.

Table 5-1: MDWASD) Proposed Alternative Water Supply Projects From Alternative Water Supply Project D3evelopment Submitted to SFWMD June 2014

Year	Annual Average Finished Water Quantity in MGD and Source		
2013	7.5	Hialeah Floridan Aquifer RO WTP-Phase 1-a, 10 MGD & 6 Floridan Aquifer supply wells	AWS
2015	2.5	Hialeah Floridan Aquifer RO WTP-Phase 1-b, 4 Floridan Aquifer supply wells	AWS
2018	12.45	South Miami Heights WTP Phase 1(RO portion)	AWS
2030	5.0	South Miami Heights WTP Phase 2(RO portion)	AWS
Total	27.45		

TABLE 5-2 (September 2014)

MDWASD FINISHED WATER DEMAND BY SOURCE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	PROJECTIONS (2013) FOR MDWASD SERVICE AREA								ADJUSTED FINISHED WATER AADD (MGD)								
									Biscayne Aquifer					Floridan Aquifer			Total All Sources
Year	Population[a]	Finished Water Use (gpcd)	AADD Finished Water Use[b] (MGD)	Water Conservation[c] (MGD) Credit	Reuse/ Reclaimed Water[d] (MGD) Credit	Adjusted Finished Water Demand[e] (MGD)	Adjusted Finished Water Use (gpcd)	CITY OF HOMESTEAD Finished Water Demand (MGD)	South Dade[g] Elevated Tank/ Leisure City/ Naranja	South Dade[g] Everglades Labor Camp/ Newton[h]	South Miami Heights (SMH) Membrane Softening WTP[i,m]	Hialeah-Preston/ Alexander-Orr Lime Softening (j)	Total Biscayne Aquifer (f)	Hialeah RO WTP[l]	South Miami Heights (SMH) RO WTP[m]	Total Floridan Aquifer	
System-Wide																	
2014	2,243,879	137.2	307.79	1.36	0.00	306.43	136.56	2.50	4.30	4.08	0.00	293.05	301.43	7.50	0.00	7.50	308.93
2015	2,266,092	137.2	310.84	2.04	0.00	308.80	136.27	3.00	4.30	4.10	0.00	293.40	301.80	10.00	0.00	10.00	311.80
2020	2,370,769	137.2	325.20	5.44	0.00	319.76	134.88	3.00	0.00	*4.10*	2.55	297.76	300.31	10.00	12.45	22.45	322.76
2025	2,475,446	137.2	339.56	8.84	0.00	330.72	133.60	3.00	0.00	*4.10*	2.55	308.72	311.27	10.00	12.45	22.45	333.72
2030	2,580,123	137.2	353.92	9.55	0.00	344.37	133.47	3.00	0.00	*4.10*	2.55	322.37	324.92	10.00	12.45	22.45	347.37
2031	2,601,058	137.2	356.79	9.55	0.00	347.24	133.50	3.00	0.00	*4.10*	2.55	320.24	322.79	10.00	17.45	27.45	350.24
2032	2,621,994	137.2	359.66	9.55	0.00	350.11	133.53	3.00	0.00	*4.10*	2.55	323.11	325.66	10.00	17.45	27.45	353.11
2033	2,642,929	137.2	362.53	9.55	0.00	352.98	133.56	3.00	0.00	*4.10*	2.55	325.98	328.53	10.00	17.45	27.45	355.98

See Footnotes on page 5-3

Footnotes

(a) Population Served represents most recent represents the 2010TAZ population projections by the MDC Planning Department.

(b) Annual Average Daily Demand (AADD) Finished Water Projections between 2014 and 2035 assume 137.2 gpcd (a decrease from 145.4 gpcd) total water system demand prior to application of credits (e.g. conservation).

(c) WASD has implemented a 20-year water use efficiency plan and is experiencing reductions in per capita water consumption. Water Conservation projections were revised based on the 2010 Annual Water Conservation Plan Conserve Florida Report (March 2011). Real losses in non-revenue water (e.g. unaccounted-for-water) are assumed to remain at less than 10%. The conservation amounts experienced through 2010 (6.54 MGD) were deducted from the 20-year conservation amount in the Conserve Florida Report and the remaining conservation amounts were distributed for the balance of the 20-year period (2011-2027).

(d) Not Used (TBD).

(e) Adjusted after taking credit in finished water demand projections for reductions in finished water use associated with water conservation.

(f) The Modified Base condition raw water use (349.5 mgd) represents values agreed to by SFWMD and MDWASD and demonstrated by modeling to not cause a net increase in water from the regional canal system. Biscayne Aquifer base condition raw water use allocation of 349.5 mgd (South Dade at 7.1 mgd, North and South at 342.4 mgd) equates to 342.8 mgd of finished water annual average daily demand (AADD).

(g) South Dade (Raw : Finished) Ratio = 1.0 : 1.0

(h) Becomes *stand-by* once SMH WTP starts up. This *stand-by* capacity is not used in the total raw and finished water amounts.

(i) Assumes withdrawals from Elevated Tank, Leisure City, Naranja, Caribbean Park, Former Plant, and Roberta Hunter Park are consolidated. Biscayne Aquifer supplied Membrane Softening (Raw : Finished) Ratio = 1.17 : 1.00 (85% Recovery).

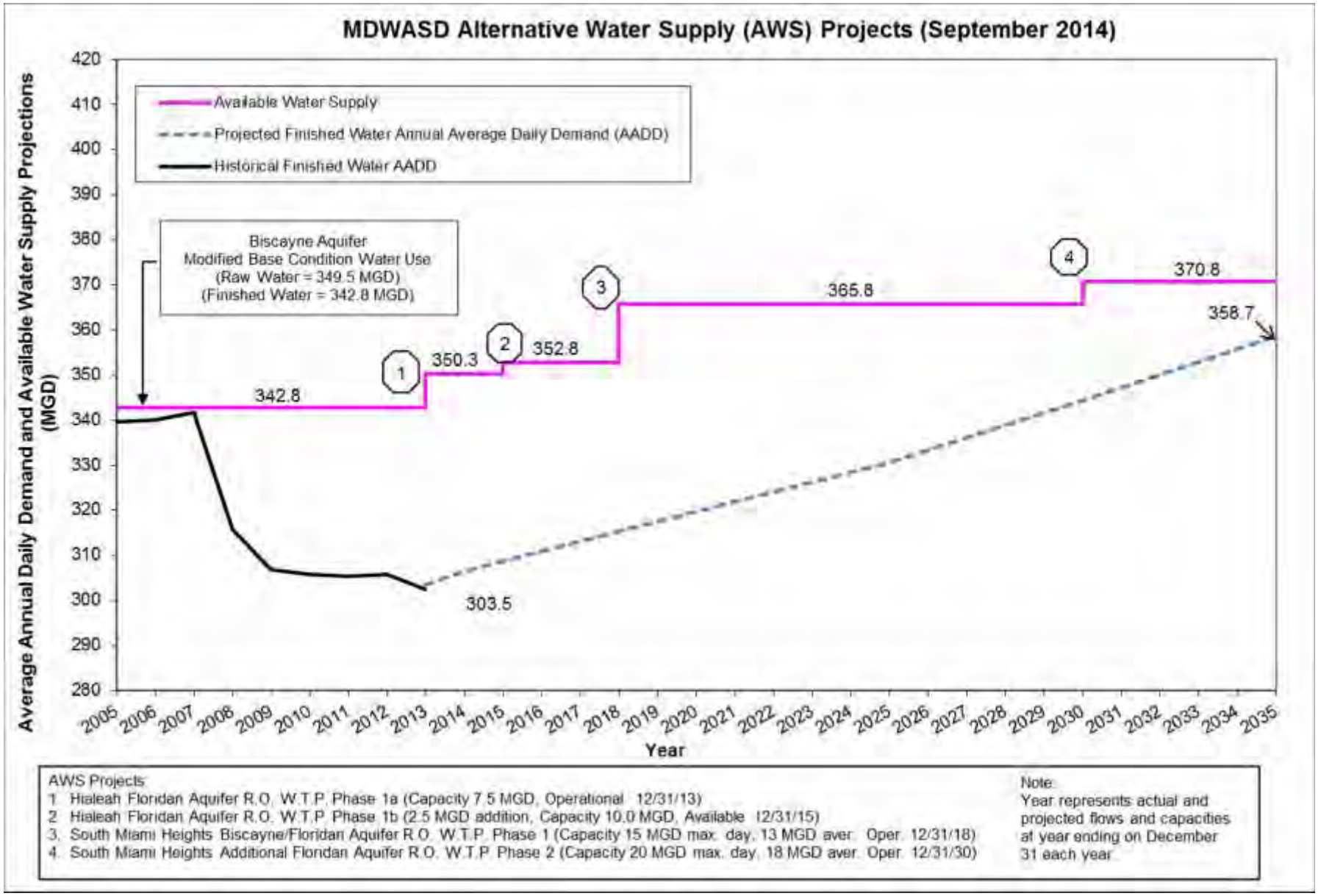
(j) Hialeah-Preston / Alexander-Orr (Raw : Finished) Ratio = 1.060 : 1.00 (Lime Softening)

(k) The values are based on initial cycle testing of the ASR well facilities and the projected seasonal operations of the ASR well facilities at full design capacities with the storing of Biscayne aquifer water during the wet weather months of June through October and the recovery of the stored Biscayne aquifer water during the dry weather months of December through April, assuming an ultimate storage loss of 1.31%.

(l) Floridan Aquifer supplied RO WTP (Raw : Finished) Ratio = 1.333 : 1.00 (75% recovery)

(m) At an ultimate 20 mgd plant operating capacity, the raw water withdrawal would be 3.00 MGD from the Biscayne and 23.27 MGD from the Floridan in accordance with the Wellfield Operation Plan. In order to maintain operational flexibility and protect the nanofiltration membranes (Biscayne supply), MDWASD is requesting that the WTP be allowed to operate with up to a constant supply of 3.0 MGD from the Biscayne aquifer and the rest, to meet demand, be provided from the Floridan aquifer. The full use of the small Biscayne aquifer allocation at SMH supplemented by Floridan aquifer water will allow a blended finished water product that is expected to be lower in sodium and chloride, which will be beneficial to customers on low sodium diets, and more will require less chemical addition for product water stabilization.

(n) An additional 0.82 MGD of Raw Water AADD has been included in year 2033 for Hialeah-Preston / Alexander Orr Lime Softening to maintain the total Biscayne aquifer Modified Base condition raw water use at 349.5 mgd and to provide needed operational flexibility in withdrawals of Floridan aquifer water.


MDWASD Alternative Water Supply (AWS) Projects (September 2014)
Average Annual Daily Demand and Available Water Supply Projections (MGD)
Year
Available Water Supply
Projected Finished Water Annual Average Daily Demand (AADD)
Historical Finished Water AADD
Biscayne Aquifer
Modified Base Condition Water Use
(Raw Water = 349.5 MGD)
(Finished Water = 342.8 MGD)
342.8
350.3
352.8
365.8
370.8
358.7
303.5
1
2
3
4
AWS Projects:
1. Hialeah Floridan Aquifer R.O. W.T.P. Phase 1a (Capacity 7.5 MGD, Operational 12/31/13)
2. Hialeah Floridan Aquifer R.O. W.T.P. Phase 1b (2.5 MGD addition, Capacity 10.0 MGD, Available 12/31/15)
3. South Miami Heights Biscayne/Floridan Aquifer R.O. W.T.P. Phase 1 (Capacity 15 MGD max. day, 13 MGD aver. Oper. 12/31/18)
4. South Miami Heights Additional Floridan Aquifer R.O. W.T.P. Phase 2 (Capacity 20 MGD max. day, 18 MGD aver. Oper. 12/31/30)
Note:
Year represents actual and projected flows and capacities at year ending on December 31 each year

5.1.1 Hialeah Floridan Aquifer R.O. W.T.P (10 MGD)

A new upper Floridan Aquifer Reverse Osmosis (RO) water treatment plant was constructed in 2013, and is located at 4250 W. 114th Terrace in the City of Hialeah. The WTP was constructed pursuant to a Joint Participation Agreement between the City of Hialeah and the County which was approved by the Board of County Commissioners on July 24, 2007 and called for the design, construction, and operation of a water treatment plant constructed in the annexation area and supplied by the brackish Floridan aquifer to produce initially 10 mgd with the capacity to expand to 17.5 mgd.

Approval from the Florida Department of Health to produce and distribute water was received in November 2013. The WTP utilizes the Floridan Aquifer as the alternative water supply using the RO treatment to remove the salt. The initial operational phase of the Plant is 7.5 mgd, increasing to 10 mgd by the end of 2015 when construction of additional wells is expected to be completed.

5.1.1.1 Hialeah Floridan Aquifer R.O. W.T.P. Phase 1-a (7.5 MGD) Completed 2013

Phase 1-a of the RO WTP included a 10 mgd plant and an initial six (6) Floridan Aquifer supply wells. The phase 1-a cost was about $95 million.

5.1.1.2 Hialeah Floridan Aquifer R.O. W.T.P. Phase 1-b (2.5 MGD)

Start 2014
Finish 2015

Phase 1-b of the RO WTP will consist of the construction of four (4) Floridan Aquifer supply wells for a maximum treatment capacity of 10 mgd. The Phase 1-b cost is estimated at approximately $5 million.

5.1.2 South Miami Heights W.T.P. and Wellfield (20 MGD)- 17.45MGD Floridan Aquifer RO and 2.55 MGD Biscayne Aquifer

Start 2014
Finish 2018

Design of the South Miami Heights Water Treatment Plant (WTP) and Wellfield commenced in 2014. The WTP will be located at 18800 SW 208 Street in Miami. The RO WTP and associated facilities will have a capacity to produce 20 mgd (max day) finished water using a combination of 17.45 mgd from the Floridan Aquifer and 2.55 mgd from the Biscayne Aquifer. Phase 1 will have a maximum capacity of 15 mgd to be operational by December 31, 2018, and Phase 2 will a maximum capacity of 20 mgd, operational by December 31, 2030. A total of five (5) Biscayne Aquifer wells and seven (7) Floridan Aquifer wells are planned to be constructed.

Upon completion of the WTP, the Elevated Tank, Leisure City, and Naranja WTPs will be abandoned and their associated allocations will be transferred to the SMHs

WTP. Everglades Labor Camp and Newton WTPs will remain on stand-by service.

5.2 Miscellaneous Projects

5.2.1 Water Conservation/Non-Revenue Potential Water Loss Reduction Program (Up to 19.62 MGD)

Start 2006
Finish 2027

These projects serve to reduce the demand for water through demand management. They include, but are not limited to, various water conservation projects currently being implemented by MDWASD. The County's Water Use Efficiency Five-Year Plan was approved by the Board and has been expanded to cover the next 20 years with a projected reduction in demand of 19.62 MGD over that time period. Examples of ongoing conservation projects include the bathroom and kitchen retrofits program, Miami-Dade green lodging and restaurant program, , rebates for high efficiency toilets, and landscaping irrigation evaluations for residential, commercial and governmental uses. Similarly, the Non-Revenue Real Water Loss Program identified potential reductions in water demand of as much as 14.25 MGD by 2030 through demand management activities.

5.3 20-Year Work Plan and Capital Improvement Plan

As mentioned in the previous sections, the latest lower population projections based on the 2010 Census results and historically lower per capita daily finish water use have reduced the projected finish water demands which have eliminated the need for other alternative water supply projects by several years. The Alternative Water Supply projects to address water demands through 2033 include the Hialeah RO and South Miami

The projects for the 20-Year Work Plan have been included in the County's Capital Improvement Element. A copy of Table 12 from the County's Capital Improvement Element is contained within Appendix D and summarized in **Table 5-3** for the next 5 years (2014 – 2018).

Table 5-3 MDWASD Water/Alternative Water Supply CIE Projects

Project Name	Expenditure[(a)]						Six Year Totals
	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	
Water Facilities							
South Miami Heights W.T.P. & Wellfield	17.11	46.20	43.80	5.19	0.00	0.00	112.31
Hialeah Floridan Aquifer R.O.W.T.P. Phase 1 (10.0 mgd)	23.79	4.77	1.34	7.383	4.08	6.09	47.48

Source: MDWASD Adopted FY 2012-2013 budget, (a) Millions of Dollars

5.4 Other Water Suppliers Future Plans

5.4.1 City of North Miami

The City of North Miami's plans for a two-phase expansion of the Winson WTP have been put on hold. The plans entailed a Phase I, to be concluded by 2010, to add an additional 8.5 MGD capacity from a Reverse Osmosis (RO) system. Phase II to add additional membrane treatment to the RO facility, which would create an additional 4.0 MGD capacity. The proposed improvements would total an increase of 12.5 MGD to the capacity of the WTP.

The City also identified that the Floridan aquifer would be the only water resource alternative for the increase in demand. Therefore, the City planned to construct an additional ten Floridan wells to supply the RO Facility. The City planned to add a raw water transmission main from the wells to the WTP.

On hold is also the third expansion plan for the addition of a 5 MG storage tank, to be located on a vacant parcel owned by the City's new Biscayne Landing development. The City may decide to forgo with the construction of the tank and utilize the parcel for another smaller RO Treatment facility or a reuse facility.

These water supply system improvements planned by the City of North Miami will provide water supply for those portions of unincorporated Miami-Dade County which are currently served by the City of North Miami.

The City is currently designing upgrades to the existing facility to maximize its efficiencies.

5.4.2 City of North Miami Beach

The City of North Miami Beach plans to increase the capacity of the its WTP to 35 MGD by 2020 and 38 (MGD) by 2025. These water supply system improvements planned by the City of North Miami Beach will provide water supply for those portions of unincorporated and incorporated Miami-Dade County which are currently served by the City of North Miami Beach.

5.4.3 City of Homestead

The City of Homestead is currently in the process of analyzing the different ways of improving or expanding their systems to increase capacity as the population within its municipal boundary and in parts of unincorporated Miami-Dade County where it provides water increases. The two major alternatives are either upgrading the existing well pumping capacity or installing additional wells. However, the City has not yet agreed on any type of improvements, and therefore no additional information can be provided at this time.

5.4.4 Florida City

Due to the fact that the SFWMD is currently adjusting any further withdrawals from the Biscayne aquifer, the City plans to increase its Water Treatment Plant capacity by installing additional wells and withdrawing water from the Floridan aquifer, which will require membrane filtration treatment and chlorination prior to distribution. The timeline for this expansion is not yet known.

5.5 Conclusion

In conclusion, and as **Table 5-2** shows, MDWASD has prepared a work plan which demonstrates that the Department (e.g. public) facilities are available to meet the projected growth demands (which reflect credits for conservation). The current permit and the limiting conditions are located in Appendix H, and the permit modification request is located in Appendix I.

Section 6
Climate Change and Sea Level Rise Plan

This section details MDWASD evaluation and planning for sea level rise and climate change over the planning horizon in this document. The primary concern to MDWASD water supply is salt water intrusion into the freshwater Biscayne aquifer, the primary source of drinking water in Miami-Dade County. Results of evaluation and data analysis completed to date indicate that within the next thirty years MDWASD will be able to operate its wellfields and water treatment facilities as designed, as groundwater modeling indicates even with a high level of projected sea level rise our wellfields will not be impacted by salt water intrusion. Further modeling is currently underway to extend the planning scenarios fifty years out, and will include climate change such as increases and decreases in annual precipitation, and extreme weather events.

6.1 Introduction

Southeast Florida is one of the most vulnerable regions to the impacts of climate change and sea level rise as a result of our flat topography, porous limestone geology, and dense coastal development. Climate change and sea level rise are expected to present significant challenges relating to water resource planning, management and infrastructure for the counties located in south Florida, including Broward, Miami-Dade, Monroe, and Palm Beach Counties. These counties have agreed to partner in regionally-coordinated climate mitigation and adaptation strategies as part of the Southeast Florida Regional Climate Change Compact and have adopted a Regional Climate Action Plan which highlights "Water Supply, Management, and Infrastructure" as a primary focal area. (http://southeastfloridaclimatecompact.org/). Investigations and evaluations conducted at the national, regional, and local levels have reinforced the need to plan for the predicted impacts of more frequent and severe drought, increases in tidal and storm-related flooding, and the loss of coastal wellfield capacity due to saltwater intrusion. In the absence of proactive planning, these impacts will present liabilities for coastal and inland communities with implications for urban water supplies, water and wastewater infrastructure, and both regional and local drainage/flood control systems. Investments in water supply planning and infrastructure that account for these predicted trends will improve the resilience of our communities, provide public health benefits, and reduce the potential for economic losses.

Miami-Dade County along with Broward, Monroe, Palm Beach Counties, local governments and water utilities in the southeast Florida region have begun to formalize the integration water supply and climate change considerations as part of

coordinated planning efforts, including updates to local government and water utility 10 year Water Supply Facility Work Plan and enhancements to local government's Comprehensive Plans. Key considerations for communities within the four County Compact planning area areas include: 1) sea level rise, 2) saltwater intrusion, 3) extreme weather, and 4) infrastructure investments to support diversification and sustainability of water supply sources, and adaptive stormwater and wastewater systems. Sea level rise produces varied challenges with the respect to water resources sustainability, water management, and water/wastewater facilities and infrastructure. Impacts include salt water intrusion into coastal wellfields, infiltration of groundwater with chloride levels into wastewater collection systems, impairing normal operations and maintenance as well as challenges for beneficial use of reclaimed water as an alternative water supply. Water management systems are also at risk with systems constrained by rising groundwater and canal gate tailwater elevations, which reduce soil storage and discharge capacity, with increased potential for both inland and coastal flooding.

6.2 Miami-Dade County Sea Level Rise and Climate Change Recent Government Action

As part of the Miami-Dade County Evaluation and Appraisal Report adopted in 2011, climate change was identified as one of the priorities to address in the County's Comprehensive Development Master Plan (CDMP). Miami-Dade has incorporated climate change considerations and language in several of the Elements of the CDMP update which was approved by the Board of County Commissioners in October, 2013.

The Miami-Dade Sea Level Rise Task Force was created by Resolution R-599-13 on July 2, 2013 to review the relevant data and prior studies, assessments, reports, and evaluations of the potential impact of sea level rise on vital public services and facilities, real estate, water and other ecological resources, water front property, and infrastructure (http://www.miamidade.gov/planning/boards-sea-level-rise.asp). Their recommendations included in the June 2014 Final Report Recommendation 4:

> *While recognizing the recent efforts to address flood protection and saltwater intrusion by the South Florida Water Management District and the Miami-Dade County, the Sea Level Rise Task Force recommends that Miami Dade County work jointly with the District and the SE Climate Compact partners to conduct a comprehensive study and develop adaptation strategies to address potential flood damage reduction and saltwater intrusion associated with sea level rise. This strategy should expeditiously address rising sea levels, a time frame for implementation, and a potential funding mechanism.*

Miami-Dade Board of County Commissioners adopted in September an ordinance relating to the rules of procedures of the Board of County Commissioners amending Section 2-1 of the Code of Miami-Dade County, Florida, to require that in all agenda items related to planning, design, and construction of county infrastructure a statement be included that the impact of sea level rise has been considered (File 141211 http://www.miamidade.gov/govaction/matter.asp?matter=141211&file=true&yearFolder=Y2014).

6.3 Saltwater Intrusion

Along the coast of southeast Florida, and several miles inland, groundwater supplies and potable wells are vulnerable to saltwater contamination. The Biscayne Aquifer, which serves as the region's primary water supply, is a shallow, surficial aquifer characterized by limestone karst geology which is highly porous and transmissive. Salt water intrusion is defined by the South Florida Water Management District (SFWMD) as chloride concentrations exceed drinking water standards of 250 mg/l. The SFWMD has identified "Utilities at Risk" for salt water intrusion, which include utilities with wellfields near the saltwater/freshwater interface that do not have an inland wellfield, have not developed adequate alternative sources of water, and have limited ability to meet user needs through interconnects with other utilities; and "Utilities of Concern", which include utilities having wellfields near the saltwater/freshwater interface, the ability to shift pumpages to an inland wellfield, or an alternative source that is not impacted by the drought (SFWMD, 2007). Miami-Dade WASD wellfields included as "Utility at Risk" are South Miami-Dade Wellfields (Newton, Elevated Tank, Naranja, Leisure City, Roberta Hunter- Caribbean Park). MDWASD Utilities of Concern include the North and Central Miami-Dade Wellfields (Hialeah-Preston and Alexander Orr) (Figure 1).

Figure 6-1. Utilities and Risk and Utilities of Concern, Miami-Dade County (SFWMD, 2007).

6.3.1 Salt Intrusion Monitoring Network

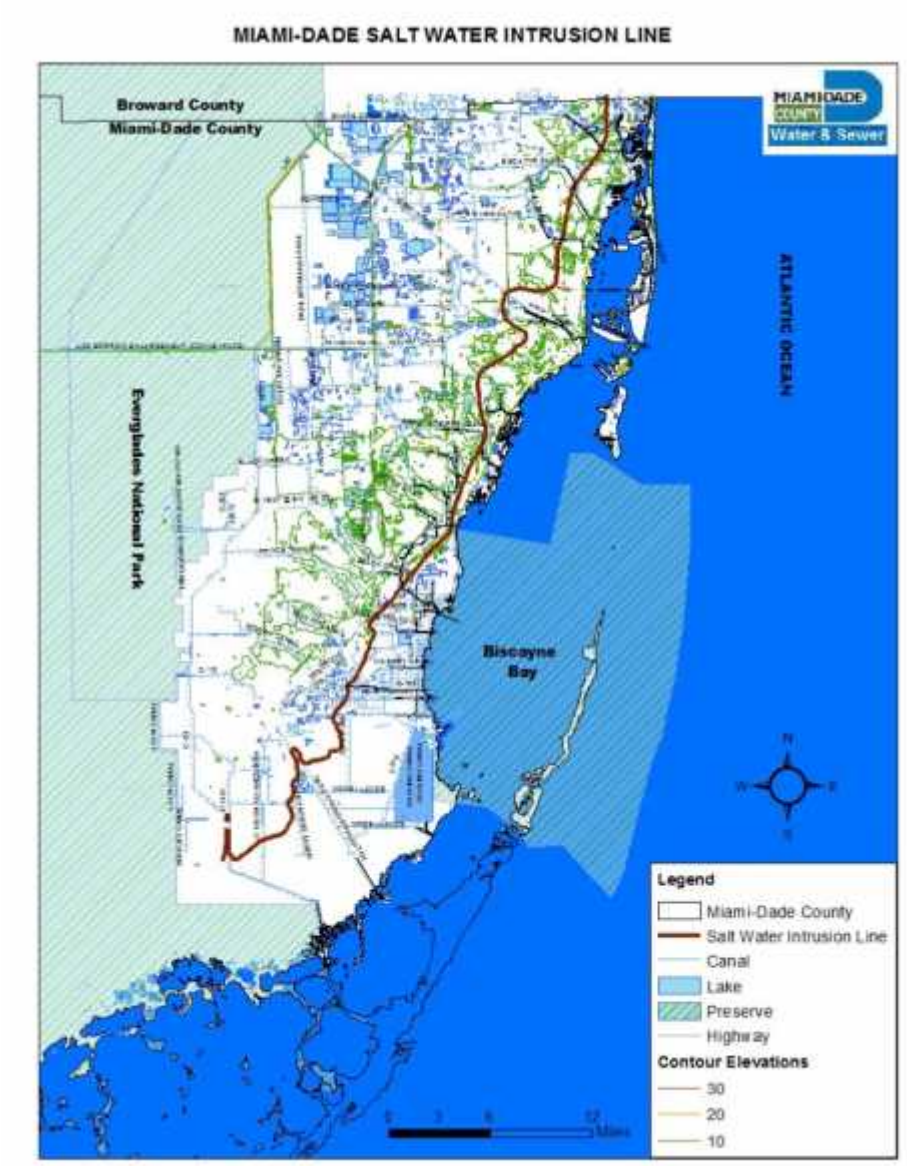
Saltwater intrusion in Miami-Dade County is monitored through a joint effort of the Miami-Dade Water and Sewer Department (MDWASD), Miami-Dade Department of Regulatory and Economic Resources (RER), and the U.S. Geological Survey (USGS). A network of small diameter wells have been drilled to the base of the aquifer to serve as monitor wells to identify the location of the saltwater

intrusion front. The salt front is identified as the location, at the base of the aquifer, of the 1,000 milligrams/per liter (mg/L) isochlor, or line of equal chloride concentration of 1,000 mg/L). Sampling of the monitor wells is done by the USGS, under a co-operative Joint Funding Agreement (JFA) contract with Miami-Dade County for wells currently included in the salt front monitoring program (JFA #14GGESMC0000109). Additional wells are sampled quarterly or yearly basis depending on well location, but every year the sampling schedule includes a county-wide sampling event conducted at the height of the dry season to coincide with the time when inland movement of the saltwater front would be at its peak. The data derived from that sampling is used by the USGS to identify any significant movement of the salt front, and to map the location of the salt front if a significant movement is evident. MDWASD reports the data to the South Florida Water Management District (SFWMD) quarterly, as part of the WUP #13-00017-W requirements, and is required as part of Limiting Condition 37 of the 20-Year WUP (SFWMD, 2007; Appendix H) to submit an annual report summarizing the data collected and recommendations for adjustments to the salt front monitoring network as a result of data analysis.

6.3.2 Salt Intrusion Front Delineation

Miami-Dade WASD entered into a JFA with the USGS in 2007 (JFA #08E0FL208004) to delineate the current extent of saltwater intrusion in the Biscayne aquifer, to characterize how the extent has changed since the last mapping effort, to improve salinity monitoring in the Biscayne aquifer and to identify the sources of the saltwater to better understand the actions required to prevent or mitigate saltwater intrusion. As part of this effort eleven new monitoring wells have been installed in areas where there was insufficient information to identify the location of the front, and data from geophysical tools and techniques were incorporated into the analysis. To improve accessibility of salinity monitoring information to the public, the USGS cooperative water conditions website was improved and a new website created. "Saline Intrusion Monitoring, Miami-Dade County, Florida," serves data collected during this study, as well as data from the active salinity monitoring network, and provides the interpreted maps of the inland extent of saltwater intrusion (*http://www.envirobase.usgs.gov/FLIMS/SaltFront/viewer.htm*, U.S. Geological Survey, 2011g). This website allows the USGS to deliver timely hydrologic data, analyses, and decision-support tools concerning saltwater intrusion. As a result of the JFA, an updated salt front map was published in 2011 (Figure 2) and the final report summarizing the study and recommendations and conclusions published in 2014 (Prinos, et. al. 2014).

Figure 6-2. Salt Water Intrusion extent, Miami-Dade County, FL. (USGS 2011)



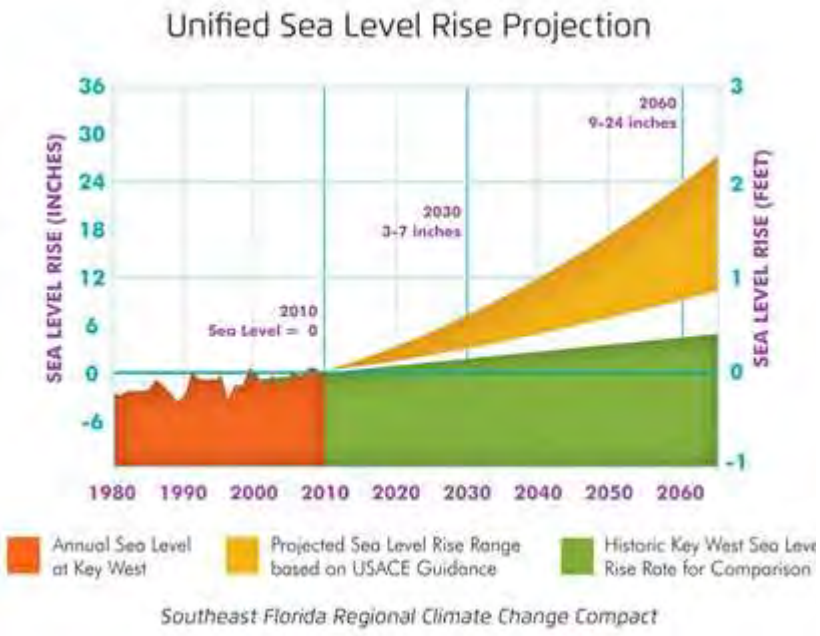
6.4 Urban Miami-Dade County Surface Water/Groundwater Model

Miami-Dade County entered into a Joint Funding Agreement (JFA 08E0FL20817) with the USGS in February 2008 to develop an integrated surface/groundwater numerical flow model, with one of the objectives of the project to evaluate if sea level rise will cause salt water intrusion into coastal wellfields. The numerical model is designed among other uses to evaluate if the current surface-water structure control operational criteria effectively control saltwater intrusion with projected population increase and sea level rise. MDWASD and the USGS use this integrated surface-water/groundwater model to evaluate how the position of the freshwater/saltwater interface will change with increased well field pumpage, increased sea level, and a combination of increased well field pumpage and increase sea level.

The model was developed and calibrated a coupled surface-water/groundwater model of the urban areas of Miami-Dade County, Florida. The model is designed to simulate surface-water stage and discharge in the managed canal system and dynamic canal leakage to the Biscayne aquifer as well as seepage to the canal from the aquifer. The model was developed using USGS MODFLOW-NWT with the SWR1 Process and the SWI2 Package to simulate the surface-water system and seawater intrusion, respectively (Hughes et. al., 2013). Automated parameter estimation software (PEST) and highly-parameterized inversion techniques were used to calibrate the model to observed surface-water stage, surface-water discharge, net surface-water sub-basin canal discharge, and groundwater level data from 1997 through 2004 by modifying hydraulic conductivity, specific storage coefficients, specific yield, evapotranspiration parameters, canal roughness coefficients (Manning's *n* values), and canal leakance coefficients (Walsh and Hughes, 2014).

MDWASD and the USGS used the modified guidance developed by the U.S. Army Corps of Engineers (USACE, 2011) and a planning scenario of 9 to 24 inches additional rise by 2060, consistent with projections presented in the 2014 NCA, and formally adopted by the partner counties in the Southeast Florida Regional Climate Change Compact (Figure 3) for the modeling effort.

Figure 6-3: Unified Southeast Florida Sea Level Rise Projection for Regional Planning Purposes



The USGS has completed the preliminary model and initial scenarios regarding sea level rise, and results are pending publication (USGS, verbal communication). The model simulation period is from 1/1/1996 to 12/31/2010, with daily surface-water and groundwater timesteps. The model was calibrated using highly-parameterized inversion methods, with an 8 year calibration period (1997-2004) and a 6 year verification period (2005-2010). To represent future conditions, 30-year scenario simulation periods representing conditions from 2011 through 2040 were run. The thirty year scenario period was chosen as being scientifically defensible at this point in time with available sea level rise and climate change data available.

Four scenarios have been completed to date, and will be included in the pending publication:

- ***Base scenario***
    - Daily 2010 well field withdraws repeated for 30 year daily
    - meteorological data set (recycled twice)
    - 2008 land use
    - Predicted Virginia Key tidal stage with current linear rate of SEA LEVEL RISE-0.5 ft over 30 years

  - Everglades Depth Estimation Network (EDEN) data set (recycled twice)
  - Historical structure operations - effective gate openings

- ***Scenario 1***
  - Base scenario
  - Increased WASD well field withdrawals - increased rates provided by WASD (WUP 2012 allocations)

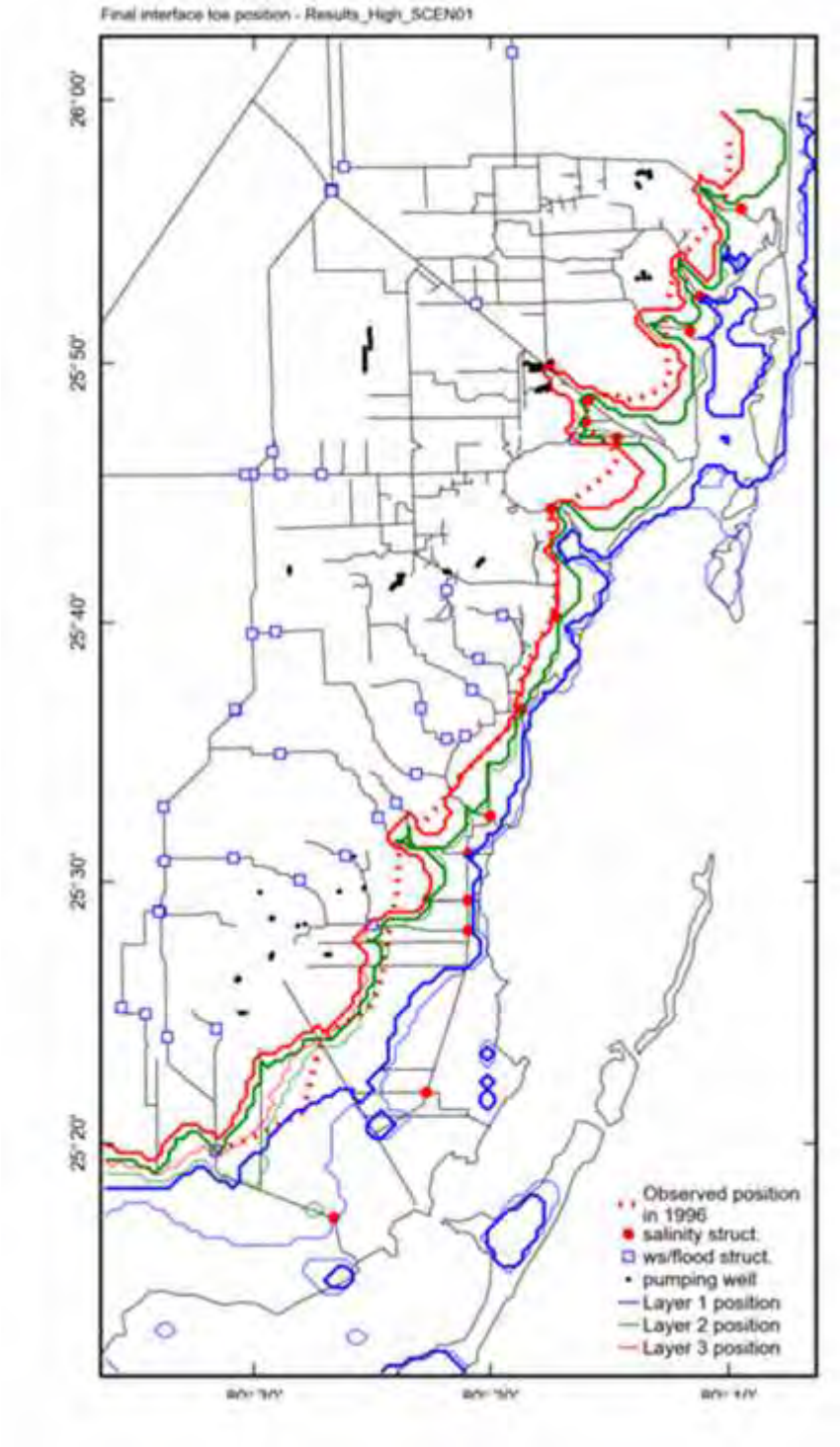
- ***Scenario 2***
  - Base scenario
  - High sea-level rise rate (NRC III rate - 1.23 ft increase over 30 years) added to predicted
  - Virginia Key tidal stage
  - Blend EDEN data and increased sea level where needed

- ***Scenario 3***
  - Scenario 2
  - Increased WASD well field withdrawals at permitted 2025 allocations

Therefore, Scenario 3 represents the high-level rate of sea level rise and the permitted wellfield withdrawals allocated in the SFWMD 20-Year WUP. Results of Scenario 3 indicate minimal change in the salt front (Figure 4).

As a result of the USGS Salt Front JFA, and the on-going salt front monitoring, and the groundwater flow modeling project, Miami-Dade WASD wellfields are not considered at risk for salt water intrusion within the next ten years.

Figure 6-4. Scenario 3 Salt Water Intrusion Results. (Walsh and Hughes, 2014).



6.5 Extreme Weather Events

As extreme events increase in frequency and severity, MDWASD will consider impacts and risks associated with drought, water shortages and reduced groundwater tables, all of which can hasten saltwater intrusion and exacerbate water supply impacts. Conversely, more intense and rapid rainfall will cause flooding, increased runoff, impacts to the natural systems and provide less recharge potential. Integrated water resources management strategies will help to mitigate for these impacts, particularly those projects that can serve to provide additional storage of stormwater runoff, long term storage, and redistribution of excess rainfall during dry periods and drought. Regional surface water reservoirs and belowground aquifer storage and recovery systems are potentially viable alternative water supply projects and climate adaptation strategies. Increases in groundwater elevations, in both direct and indirect response to sea level will challenge the function of drainage systems and is expected contribute to exacerbate flooding, for even mild storm events. Conditions will be more severe with extreme rainfall events can increase damage to lowlying utility infrastructure and contribute to prolonged surface water flooding. Planning for the combined influences of storm events, high tides and sea level rise on drainage system functions and other public infrastructure is a critical need as is the assessment of viable water supplies and impacts to the natural systems from prolonged droughts.

MDWASD has entered into a JFA in 2014 (JFA 14GGESMC0000110) with the USGS to continue the modeling effort, and will develop additional future scenarios with County Departments, local governments, regional agencies for further climate change and sea level rise assessment. These scenarios will include additional years simulation, changes in recharge as a result of climate change, land use changes, and revised sea level rise projections. Future model scenarios to be developed with the USGS include simulating extreme weather events superimposed on future conditions as simulated in model runs.

6.6 Infrastructure Assessment

Effective water treatment plant operations require proper control of flooding from both stormwater (riverine) and tidal sources. Comprehensive engineering analysis considers both short-term and long-term effects of climate change. Short-term effects, such as current increased sea levels and higher estimates of tidal boundary conditions, will be incorporated into the system design and operations as necessary. Potential longer-term climatic changes are typically addressed incrementally as needed through systems master planning, to provide the appropriate level of protection for the given time period, including:

- Greater levels and rates of sea level rise,
- Higher spring tides (exceptionally high astronomical tides that occur around the new and full moon when the planets align to exert maximum effect on the tides),
- Higher tidal boundary effects and backflow,
- Increased levels of tidal surge and wind and wave effects from tropical storms and hurricanes, and
- Potential changes in design rainfall depths and intensities.

MDWASD requires capital improvement projects to include an assessment of climate change and sea level rise. Background information on the site stormwater and tidal conditions is required for site specific projects, and assessment includes projections of potential increases in sea levels, potential ranges of effects on the WTP stormwater management system, and site grading considerations and access for proper operations. The Miami-Dade County hydrologic and hydraulic model XP-SWMM is used to develop peak stage and flood inundation maps. XPSWMM uses a node-link architecture to dynamically route rainfall-runoff through pipe networks and open channels. A variety of data can be analyzed (example FDEP and NOAA tidal data, canal stage data, tidal stillwater data) to adequately assess MDWASD operational sites' vulnerability to continued sea level rise and to provide for potential adaptation options (CDM Smith, 2013).

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