Executive Summary

ES.1 INTRODUCTION

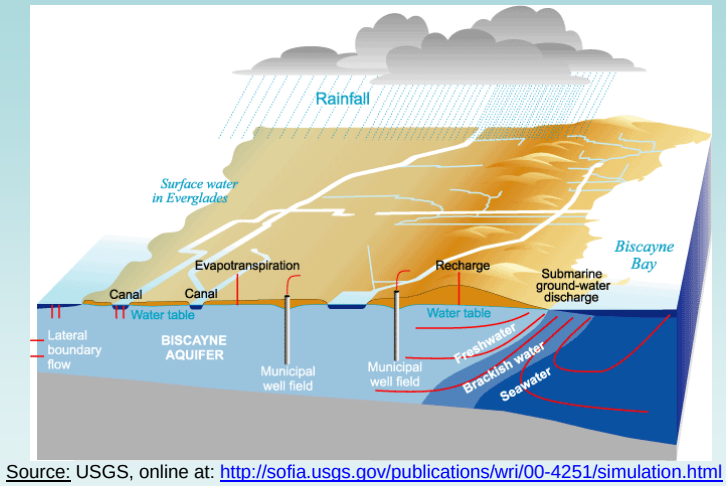
The State of Florida has embraced wastewater reuse as an integral part of the development of water management strategies. Consideration of reuse in Miami-Dade County is becoming a greater priority, given the need to ensure adequate potable water supplies for a growing population and to protect the surrounding sensitive environment. The Miami-Dade Water and Sewer Department (MDWASD) tasked Ecology and Environment, Inc. and its subconsultant, Milian Swain & Associates, Inc., to update a Wastewater Reuse Feasibility Study that was conducted in 1992 and subsequently updated in 1998 by Post, Buckley, Schuh & Jernigan. The work was conducted with the conditions set forth in Miami-Dade County Contract Resolution E-98-699-00 as administered by the Miami-Dade Department of Environmental Resources Management (DERM). This Reuse Feasibility Study Update is a high- to mid-level planning study. Prior to the implementation of projects, additional engineering and technical analysis will be required.

The purpose of this study is to assess the feasibility of wastewater reuse in Miami-Dade County, particularly in light of current water supply issues. This study identifies the constraints and opportunities for reuse; establishes the level of treatment and possible infrastructure needed for various reuse scenarios; and identifies potential projects and provides estimates of reuse volumes; develops a low, medium and high reuse scenario, as required by the Florida Department of Environmental Protection (FDEP), as well as a reformulated alternative that incorporates various projects and stakeholder input. Preliminary costs and an initial evaluation of the impact that those costs could have on the rates are provided. Further, completion of the Reuse Feasibility Study Update will coincide with renewal efforts for Miami-Dade County's water use permits for the county wellfields.

The information contained in this feasibility study is based on input obtained through December 2006. It is expected that additional input will be provided both by the regulatory entities and stakeholders. The results of this feasibility study, subsequent stakeholder input, pilot studies, and more detailed analysis will guide the future direction of reuse in Miami-Dade County.

ES.2 BACKGROUND

Miami-Dade County has been designated by the South Florida Water Management District (SFWMD) as a "critical water supply problem area." The FDEP requires that these areas use reclaimed water unless such use is not economically, environmentally, or technically feasible. Previous reuse studies for Miami-Dade County recommended limited amounts of reuse due in part to high costs. A number of factors make reuse in Miami-Dade County a challenge. Among these are the vulnerability of the Biscayne Aquifer – a U.S. Environmental Protection Agency-designated "sole source aquifer" – to contamination, the proximity of two national parks, and the designation of Biscayne Bay as an "Outstanding Florida Water."



Source: USGS, online at: http://sofia.usgs.gov/publications/wri/00-4251/simulation.html

Miami-Dade's water supply comes from the Biscayne Aquifer

There are increased concerns that the sole source of potable water from the Biscayne Aquifer in Miami-Dade County will not be able to sustain projected population growth without negatively impacting the surrounding natural system, including Biscayne National Park and Everglades National Park. Recent review comments by the FDEP concerning Miami-Dade County's Wastewater Master Plan reveal an increased interest by the State of Florida to see more reuse. It is the SFWMD Governing Board's position that reclaimed water is a resource rather than a waste stream and that efforts should be made to use more of the reclaimed water for beneficial purposes.

As this report is being prepared, SFWMD is preparing additional information to be submitted to the SFWMD to complete an application for a consumptive use permit (CUP) for the next 20 years. Currently, Miami-Dade County withdraws close to 350 million gallons per day (MGD) from the Biscayne Aquifer for potable water supply purposes, and additional demands are projected for the future. Due to concerns about continued

withdrawals, the SFWMD is requiring that Miami-Dade County identify alternative water supplies to, at a minimum, offset additional demands that are currently projected to be 77.5 MGD. This number is subject to change as the MDWASD is conducting additional analysis on future water needs. Reuse is one of several alternative water supplies that can be considered to offset this future water need. Another potential option is to extract water from the Upper Floridan Aquifer, which is below the Biscayne Aquifer and has reasonable yields, but has poorer water quality.

The SFWMD has stated that if reuse is used to fully or partially offset future water demands, only certain types of projects would qualify for water offsets. Essentially, projects that reduce the water demands from the regional system, which impacts the Everglades or Lake Okeechobee, or reduce the impact of groundwater withdrawals from the Biscayne Aquifer would be considered. Projects that do not meet those criteria would still be strongly encouraged since there is an interest by the FDEP and SFWMD to see more reuse in Miami-Dade County.

The previous Reuse Feasibility Study Update conducted in 1998 concluded that the reuse scenarios evaluated posed significant economic, technical, and environmental concerns that impact their feasibility. The "less than 25% reuse scenario" (reflecting reuse of 8.4% of the wastewater volume) was deemed to be economically, technically, and environmentally feasible. The study recommended that MDWASD continue to explore other reuse options as they arise, and compare those opportunities to the cost and feasibility of using other alternative water supplies. It is important to note that Miami-Dade County has long recognized the vulnerability of its water resources by strictly controlling land uses near wellfields and regulating discharges to land and water.

ES.3 WASTEWATER TREATMENT AND REUSE FACILITIES

The North District Wastewater Treatment Plant (NDWWTP) has a treatment capacity of 120 MGD, with an annual average daily flow of 92.75 MGD for 2006. Currently, NDWWTP is permitted for 112.5 MGD. The NDWWTP treats wastewater to secondary wastewater treatment standards with basic disinfection. A portion of the system effluent, up to 2.23 MGD, is processed further through effluent filters and disinfected with chlorine for reuse. The majority of the reuse stream is used onsite as process water or irrigation on the facility property. Approximately 0.1 MGD is supplied to the campus of Florida International University (FIU) for public access irrigation. The remaining effluent is currently disposed of via ocean outfall or deep-well injection. Four injection wells, currently undergoing operational permitting, have been constructed to a depth of approximately 2,400 feet.

The Central District Wastewater Treatment Plant (CDWWTP) has a permitted capacity of 143 MGD, with an annual average daily flow of 110.56 MGD for 2006. There are two independent process trains: one to treat lower-chlorides wastewater from the mainland and one to treat higher-chlorides wastewater from Miami Beach, Virginia Key, and Key Biscayne. The onsite reuse system consists of water transfer pumps, chlorine contact

tanks, chlorine injector pumps, and strainers. The system produces about 9.73 MGD for onsite reuse and the remaining effluent is disposed of via ocean outfall. The CDWWTP has the capacity to treat average flows through the year 2025.

The South District Wastewater Treatment Plant (SDWWTP) is currently permitted to process 112.5 MGD. The plant treated an annual average daily flow of 92.48 MGD in 2006. The SDWWTP currently treats its influent to secondary treatment standards chlorination prior to deep-well injection. Approximately 4.25 MGD of the effluent is reused as non-potable water for the plant. By 2013, an additional capacity of 18.75 MGD is expected to be added to the wastewater treatment plant (WWTP). As part of a Consent Order with the FDEP, MDWASD committed to provide high-level disinfection, which will produce public access reuse quality water. With the proposed expansion and associated permit modifications, the SDWWTP will have the capacity to treat the flows projected through the year 2025, and ultimately provide 131 MGD of public access quality reclaimed water. (Note: Miami-Dade County has committed to the Comprehensive Everglades Restoration Plan [CERP] reuse project. If the Coastal Wetlands Rehydration project is successful and the full CERP project is authorized, Miami-Dade County will be the local sponsor and will need to treat the effluent to a higher quality than public access quality.)

Approximately 297 MGD of wastewater was generated in Miami-Dade County during the year 2006. The total wastewater volume estimated for 2025 is 374 MGD.

ES.4 DESCRIPTION OF ALTERNATIVES CONSIDERED

Opportunities and constraints related to various types of reuse applications were taken into consideration when developing the reuse alternatives listed below. Detailed site-specific investigations must be conducted prior to implementing any reuse option, with appropriate attention given to potential human health and environmental impacts of the alternatives. Of particular concern for all reuse options are “emerging pollutants of concern” (microconstituents) such as pharmaceutical residuals typically found in wastewater. The fate and impact of these materials should be understood prior to implementing any particular treatment technology for these alternatives. Whether and where tertiary treatment with disinfection is adequate to protect public health and the environment in Miami-Dade County will need to be established by competent factual data. Alternatives considered include:

- **Urban Irrigation:** This type of reuse can involve the least restrictive treatment requirements if conditions allow, pursuant to FDEP requirements. Treated wastewater is piped to properties for irrigation of lawns and gardens. Meeting dry season demands becomes a challenge due to storage limitations, as well as to the dependence of reuse on the availability of larger tracts of land or a new development with a multitude of users. Higher levels of treatment could be required on a case–by-case basis if there were to be adverse impacts on Biscayne Bay or the aquifer.

- **Agricultural Irrigation:** Irrigation of agricultural lands is also a widely accepted reuse practice. Most agricultural land is located in the SDWWTP service area. Difficulties for implementation include the continuous conversion of agricultural areas to urban development and highly unpredictable crop types resulting from the dynamic nature of the agricultural industry in Miami-Dade County.

- **Industrial Reuse:** Reuse for industrial purposes requires secondary treatment and basic disinfection per FDEP regulations, which is currently provided or planned for all SFWMD WWTPs. Individual industrial users will require varying water quality standards and higher levels of treatment could be required Some opportunities previously identified in the 1992 and 1998 Reuse Feasibility Studies are no longer available (e.g., Florida Power and Light, Miami-Dade County Resource Recovery) and currently, many industrial users' needs are for potable water use. However, there are a few potential industrial users that still may be viable.

- **Aquifer Recharge via Rapid Infiltration Trenches (RITs):** RITs would be less costly to implement per gallon of water than other reuse options; would directly recharge the Biscayne Aquifer; and, depending on location, could provide CUP offsets. Regulatory concerns do exist for applications within wellfield protection areas (WPAs) or adjacent to Biscayne Bay. Prior to implementing this type of reuse, and during the conceptual design phase, a detailed site-specific analysis would be necessary to determine if the reclaimed water quality is appropriate for the site and what the actual hydraulic loading rate for the site would be.

- **Saltwater Barriers:** The 1998 Reuse Feasibility Study Update recommended four locations in which to install injection wells along the coast. The concept still seems reasonable and no changes are proposed.

- **Canal Recharge:** This reuse option recharges the Biscayne Aquifer and reduces reliance on the regional system (i.e., Lake Okeechobee). Current studies are underway to address regulatory and water quality concerns. Effects to existing flood protection systems may exist.

- **Wetland Application:** Reuse for wetland creation and enhancement provides beneficial reuse of reclaimed water, as well as regional benefits. Many opportunities exist given the large amount of wetlands in the southeastern and western portions of Miami-Dade County. Regulatory and water quality concerns are present for Biscayne Bay Coastal Wetlands and the Bird Drive Recharge Area.

- **Satellite Treatment:** This option is generally achieved with small packaged plants, such as a membrane bioreactor (MBR), for public access quality effluent to irrigate residential lawns, public parks, playing fields, and

landscapes. Satellite treatment would be a site-specific component of all other alternatives. Satellite treatment plants for applications requiring advanced wastewater treatment, such as aquifer recharge, may not be feasible due to high construction and operating costs.

- **Potable Reuse:** Direct potable reuse is generally used as a last resort since a number of large constraints are involved. In particular, the need for treatment technologies such as high-pH lime treatment, single- or two-stage recarbonation, pressure infiltration, selective ion exchange for ammonia removal, two stages of granular activated carbon adsorption, ozonation, reverse osmosis (RO), air stripping, and chlorine dioxide disinfection, and the negative perception of this option by end users are of concern when implementing this type of reuse.

Table ES-1 shows a summary of the minimum treatment upgrades assumed for each district WWTP to produce reclaimed water for each of the reuse options.

Table ES-1. Minimum Treatment Process Improvements Assumed for Reuse Options

Application		NDWWTP	CDWWTP	SDWWTP
Urban Irrigation		Additional filtration and HLD[(a)]	Additional filtration (pre-filters), RO and HLD[(a)]	Additional filtration and HLD[(a),(b)]
Agricultural Irrigation	Non-edible crops	No additional improvements necessary[(c)]	Additional filtration (pre-filters), RO and HLD[(a)]	No additional improvements necessary[(c)]
	Edible crops	Additional filtration and HLD[(a)]	Additional filtration (pre-filters), RO and HLD[(a)]	Additional filtration and HLD[(a),(b)]
Industrial Reuse		Varies[(c)]	Varies[(c)]	Varies[(c)]
Aquifer Recharge		Additional filtration and HLD[(a)], treatment of microconstituents suggested; RO, MF, UV disinfection, advanced oxidation	Additional filtration and HLD[(a)], treatment of microconstituents suggested; RO, MF, UV disinfection, advanced oxidation	Additional filtration and HLD[(a)], treatment of microconstituents suggested; RO, MF, UV disinfection, advanced oxidation
Saltwater Barrier		Additional filtration and HLD[(a)]	Additional filtration (pre-filters), RO and HLD[(a)]	Additional filtration and HLD[(a),(b)];
Canal Recharge		Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation, and nutrient removal by chemical processes	Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation, and nutrient removal by chemical processes	Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation, and nutrient removal by chemical processes

Table ES-1. Minimum Treatment Process Improvements Assumed for Reuse Options

Application	NDWWTP	CDWWTP	SDWWTP
Wetland Application	Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation; additional nutrient removal by chemical processes[4]	Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation; additional nutrient removal by chemical processes[4]	Likely treatment of microconstituents required; RO, MF, UV disinfection, advanced oxidation; additional nutrient removal by chemical processes[4]

Notes:
(a) Minimum treatment requirements per Florida Department of Environmental Protection regulations. Higher levels of treatment may be required per the Department of Environmental Resources Management.
(b) Treatment upgrades in progress for SDWWTP.
(c) Secondary treatment and basic disinfection required per FDEP rules, but more stringent requirements vary by end-user.
(d) Includes projects recharging wellfield protection areas and areas near Biscayne Bay.

Key:
CDWWTP = Central District Wastewater Treatment Plant.
HLD = high-level disinfection.
MF = microfiltration.
NDWWTP = North District Wastewater Treatment Plant.
RO = reverse osmosis.
SDWWTP = South District Wastewater Treatment Plant.
UV = disinfection with ultraviolet light.

The 1992 and 1998 Reuse Feasibility Studies concluded that a reuse alternative consisting of public access reuse projects equivalent to, or in excess of, 25% of the total future wastewater generation, as stated in FDEP's *Guidelines for Preparation of Reuse Feasibility Studies* (the Guidelines), would not be technically feasible. The reuse alternatives incorporated other forms of reuse in addition to public access to achieve the maximum, medium, and low reuse alternatives. As in previous efforts, other types of reuse, such as canal recharge, aquifer recharge, and wetland recharge, were evaluated to develop the reuse alternatives.

The types of reuse options for each alternative (Alternatives A through C) are summarized in Table ES-2. Alternative D, the No-Action Alternative, includes only existing reuse practices.

Table ES-2. Summary of Total Wastewater used for Reuse Projects (MGD) for all Reuse Alternatives

	Alternative A (Maximum Reuse)	Alternative B (Medium Reuse)	Alternative C (Low Reuse)	Alternative D (No-Action)
North District Wastewater Treatment Plant (NDWWTP)				
Existing Process and Irrigation	2.23	2.23	2.23	2.23
Urban Irrigation	22.11	16.49	13.38	0
Rapid Infiltration Trenches	15.54	0	0	0
Canal Recharge	20	0	0	0
Industrial (vehicle wash)	0.1	0.1	0.1	0
NDWWTP Total	**59.98**	**20.42**	**17.31**	**2.23**
Central District Wastewater Treatment Plant (CDWWTP)				
Existing Process and Irrigation	9.73	9.73	9.73	9.73
Urban Irrigation	30.43	22.32	6.41	0
Rapid Infiltration Trenches	34.38	23.99	0	0
Canal Recharge	40	40	0	0
CDWWTP Total	**114.54**	**96.04**	**16.14**	**9.73**
South District Wastewater Treatment Plant (SDWWTP)				
Existing Process and Irrigation	4.25	4.25	4.25	4.25
Urban Irrigation	10.75	9.95	9.95	0
Rapid Infiltration Trenches	64.19	64.19	48.69	0
Canal Recharge	0	0	0	0
Wetland Recharge	50.81	0	0	0
Pilot Project	1	1	1	0
SDWWTP Total	**131**	**79.39**	**63.89**	**4.25**
Total for All Alternatives	**305.52**	**195.85**	**97.34**	**16.21**

Key:
CDWWTP = Central District Wastewater Treatment Plant.
MGD = million gallons per day.
NDWWTP = North District Wastewater Treatment Plant.
SDWWTP = South District Wastewater Treatment Plant.

ES.4.1 Alternative A: Maximum Reuse Alternative

The maximum reuse alternative (Alternative A), which reuses 81.7% of the wastewater generated in year 2025, includes wetland application, canal recharge, aquifer recharge, and irrigation within wellfield protection zones, in addition to a number of other aquifer recharge and irrigation projects outside wellfield protection zones. Table ES-3 lists all projects in Alternative A. Project locations are shown on Figure ES-1.

Table ES-3. Summary of Reuse Projects for Alternative A (Maximum Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
NDWWTP Wastewater Projected = 120 MGD				
Process Reuse (existing)	2.13	No		Existing, does not count towards future offset.
Florida International University (existing)	0.1	No		Existing, does not count towards future offset.
North Miami Stadium Irrigation (99)	0.27	Yes	0.27	Based on previous estimates from 1998 Reuse Feasibility Study estimate.
City of North Miami Beach Irrigation	4.9	Yes	4.9	City of North Miami Beach.
City of North Miami Beach Vehicle Washing	0.1	Yes	0.1	City of North Miami Beach.
Nearby Small Scale User Irrigation	0.1	Yes	0.1	
Ives Estates Park Irrigation (0)	0.73	No		Private wells.
Greynolds Park Golf Course Irrigation (1)	1.05	No		Private wells.
East Greynolds Park Irrigation (54)	0.33	No		Private wells. Adjacent to Biscayne Bay Aquatic Preserve.
California Golf Courses Irrigation (8)	0.89	No		Private wells.
Miami Shores Country Club Irrigation (10)	1.1	No		Private wells.
Biscayne Landing New Development Irrigation	1.5	Yes	1.5	Assume 15% green space to be irrigated. May reduce future potable water demand.
Amelia Earhart Park Irrigation (67)	4.11	No		Private well.
Haulover Golf Course and Marina Irrigation (2)[(b)]	1.35	Yes	1.35	Uses public water supply. Miami Beach (MDWASD). Adjacent to Biscayne Bay Aquatic Preserve.
Fairmount Turnberry Isle Resort & Club (14)	1.76	No		Private well.
Country Club Miami Irrigation (9)	2.56	No		Private well.
Don Shula's Golf Course Irrigation (12)	1.46	No		Lake water.
Amelia Earhart Park RIT (67)	10.45	Possibly		Not upgradient or adjacent to MDWASD wellfield.
Ives Estates Park RIT (0)	1.86	Possibly		Not upgradient or adjacent to MDWASD wellfield.
Greynolds Park (Golf Course) RIT (1)	3.23	Possibly		Not upgradient or adjacent to MDWASD wellfield.
Canal Recharge (C-9)	20	Possibly		Unclear how much water from regional system is provided to C-9 to maintain stages to prevent saltwater intrusion. MGD assumed per 1998 Feasibility Report.
Total NDWWTP	**59.98**		**8.22**	Up to 35.54 MGD of additional offsets may be possible for NDWWTP.

Table ES-3. Summary of Reuse Projects for Alternative A (Maximum Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
CDWWTP Wastewater Projected = 142 MGD				
Process Reuse (existing)	9.73	No		Existing, does not count towards future offset
Crandon Park (Golf Course) Irrigation (5)	0.7	Yes	0.7	Currently using potable water. Adjacent to Biscayne Bay Aquatic Preserve
Key Biscayne Residential Irrigation	0.2	Yes	0.2	Currently using potable water. Estimated based on other residential irrigation. May be greater. Adjacent to Biscayne Bay Aquatic Preserve
Tree Island Park Irrigation (127)[(a)]	0.93	Yes	0.93	Recharge for West Wellfield
Tropical Park Irrigation (154)[(a)]	2.2	Yes	2.2	Recharge for Alexander Orr Jr. WTP/Wellfield
Tropical Park RIT (154)[(a)]	5.58	Yes	5.58	Recharge for Alexander Orr Jr. WTP/Wellfield
Trail Glades Range Irrigation (119)[(a),(c)]	5.5	Yes	5.5	Recharge for West Wellfield
Trail Glades Range RIT (119) [(a), (c)]	13.92	Yes	13.92	Recharge for West Wellfield
Kendall Indian Hammocks Park Irrigation (185)[(a)]	0.05	Yes	0.05	Private wells, currently irrigate 1 acre for ball field. Portion of site Protected Natural Forest Community.
Kendall Indian Hammocks Park RIT (185)[(a)]	0.8	Yes	0.8	Recharge for Alexander Orr Jr. WTP/Wellfield. Portion of site Protected Natural Forest Community
Calusa Country Club Irrigation (15) (closed)[(a)]	1.4	Yes	1.4	Recharge for Southwest Wellfield
Miccosukee Golf & Country Club Irrigation (21)[(a)]	1.75	Yes	1.75	Recharge for West Wellfield
Killian Greens Country Club Irrigation (19)[(a)]	1.05	Yes	1.05	Recharge for Alexander Orr Jr. WTP/Wellfield
Biltmore Gold Course Irrigation (4)	1.03	No		Private wells
Granada Golf Course Irrigation (18)	0.55	No		Private wells
Miami Springs Golf & Country Club Irrigation (20)[(a)]	1.45	Yes	1.45	Private wells but recharge for Hialeah-Preston WTP/Wellfield
Miami Springs Golf & Country Club RIT (20)[(a)]	3.69	Yes	3.69	Recharge for Hialeah-Preston WTP/Wellfield
Canal Recharge (C-2, C-4)	40	Yes	40	Directly influences several wellfields. Exact offset depends on how much recharges groundwater and how much water is provided by regional system to maintain canal stages
Tree Island Park (RIT) (127) [(a)]	2.36	Yes	2.36	Recharge for West Wellfield
Tamiami Park (187)	0.57	Yes	0.57	Recharge for Alexander Orr Jr. WTP/Wellfield
Tamiami Park RIT (187)	4.96	Yes	4.96	Recharge for Alexander Orr Jr. WTP/Wellfield

Table ES-3. Summary of Reuse Projects for Alternative A (Maximum Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
Doral Golf Course Irrigation (3)	3.88	Yes	3.88	Recharge for Hialeah-Preston WTP/Wellfield
Costa Greens Golf Club Irrigation (16)	0.6	Yes	0.6	Lake/canal water but recharge for Hialeah-Preston WTP/Wellfield
Fontainbleau Golf Course: New Residential	1.03	Yes	1.03	New development on former golf course. Also recharge for Hialeah-Preston WTP/Wellfield
Riviera Golf Course Irrigation (22)	0.49	No	0.49	Private wells
International Links of Miami Golf Course Irrigation (11)	1.00	No	1.00	Private wells
Chapman Field Park Irrigation (244)	4.47	Possibly		Private well but adjacent to Biscayne Bay
Snapper Creek Trail Irrigation (478)	0.38	Possibly		Adjacent to Biscayne Bay
West Kendall Regional Park Irrigation (228)[(a)]	1.2	Yes	1.2	Small area within wellfield area
West Kendall Regional Park RIT (228)[(a)]	3.07	Yes	3.07	Small area within wellfield area
Total CDWWTP	**114.54**		**98.38**	Up to 4.85 MGD of additional offsets may be possible for CDWWTP.
SDWWTP Wastewater Projected = 131 MGD				
Process Reuse	4.25	No		Existing, does not count towards future offset.
Homestead Air Reserve Park (354)	0.78	No		Private wells.
Palmetto Golf Course Irrigation (7)	0.91	No		Private wells.
New Developments (residential irrigation)	4.51	Yes	4.51	Potable water use expected for irrigation.
New Developments (park irrigation)	0.88	Yes	0.88	Potable water use expected for irrigation.
New Development Parks RIT (in areas of new development)	30	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent.
Briar Bay Golf Course (6)	0.26	No		Private well.
Metrozoo Irrigation (269)	2.25	No		Private wells. Portion of zoo Protected Natural Forest Community.
Metrozoo RIT (269)	15	Possibly		Portion of site Protected Natural Forest Community.
Goulds Park Irrigation (452)	0.24	No		Private well.
Goulds Park RIT (452)	2.49	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent.
Castellow Hammock Park RIT (425)	5.5	No		Probably to remote for irrigation recharge zone. Most of site protected natural forest community.
Three Lakes Park Irrigation (317)	0.12	No		

Table ES-3. Summary of Reuse Projects for Alternative A (Maximum Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
Three Lakes Park RIT (317)	1.2	Possibly		
Homestead Air Reserve Park RIT (354)	10	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent.
Lakes by the Bay Park Irrigation (321)	0.8	Possibly		Adjacent to Biscayne Bay
Coastal Wetlands Rehydration Project	50.81	Yes	50.81	Water remaining from all other projects. Volume may vary depending on implementation. For example, more reclaimed water could be used for the wetlands instead of new developments or Castellow Park).
Coastal Wetlands Rehydration Demonstration Project	1	TBD		Further discussion necessary with SFWMD to determine potable water offset
Total SDWWTP	**131**		**57.20**	Up to 59.49 MGD of additional offsets may be possible for SDWWTP.
Total/Potential Projects	**305.52**		**163.8**	Up to 99.88 MGD of additional offsets may be possible for Alternative A.

Notes:
(a) Lies partially or fully within existing wellfield protection area.
(b) Golf course being converted to lawn area with potential for additional irrigation.
(c) Potential for wetlands rehydration.
Key:
CDWWTP = Central District Wastewater Treatment Plant.
CUP = Consumptive Use Permit.
MGD = million gallons per day.
NDWWTP = North District Wastewater Treatment Plant.
RIT = rapid infiltration trench.
SDWWTP = South District Wastewater Treatment Plant.
WTP = water treatment plant.

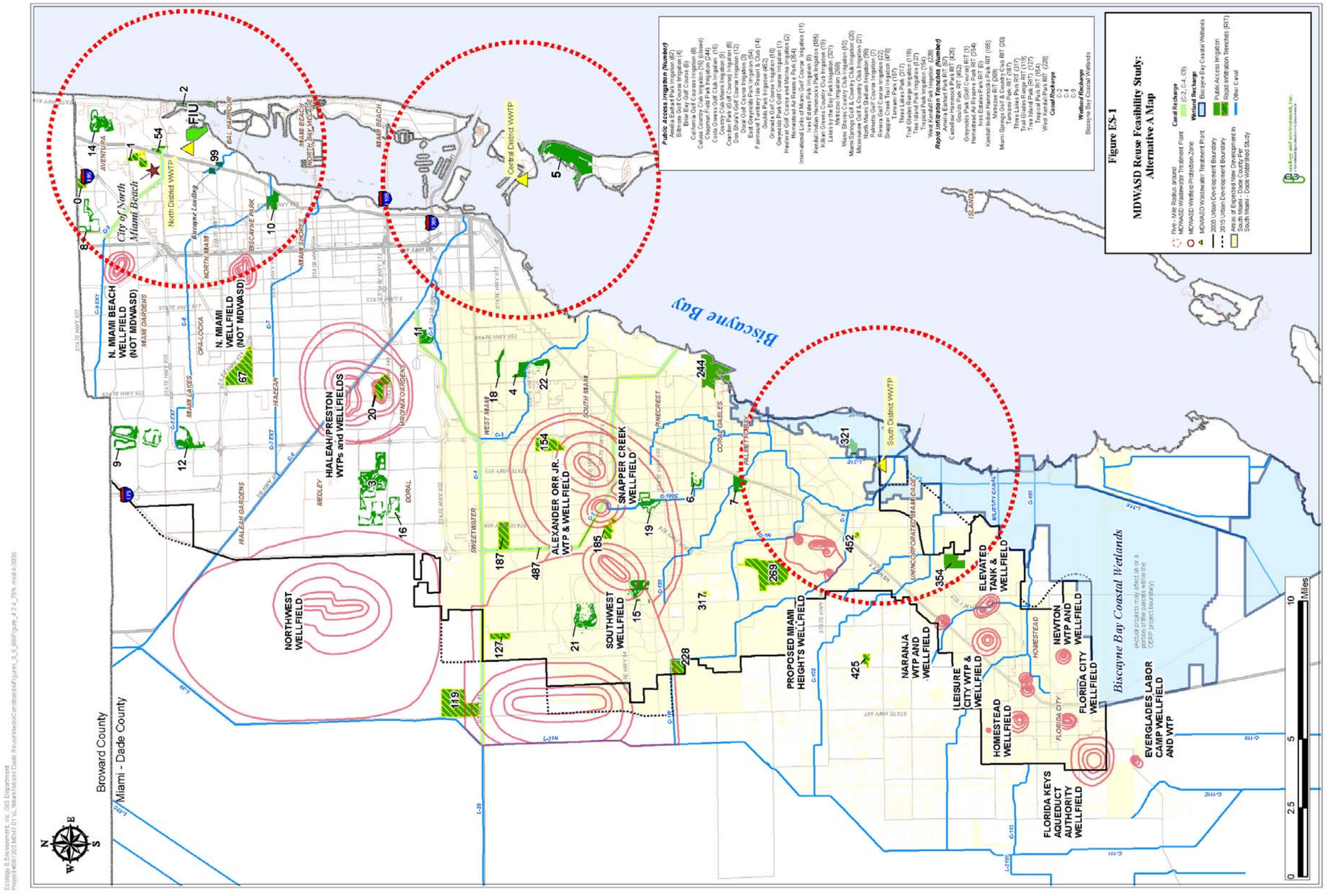


Figure ES-1
MDWASD Reuse Feasibility Study:
Alternative A Map
Five - Mile Radius around MDWASD Wastewater Treatment Plant
MDWASD Wellfield Protection Zone
MDWASD Wastewater Treatment Plant
2005 Urban Development Boundary
2015 Urban Development Boundary
Area of Expected New Development in South Miami - Dade County Per South Miami - Dade Watershed Study
Canal Recharge
C-2
C-4 (C-2,C-4, C-9)
C-9
Wetland Recharge
Biscayne Bay Coastal Wetlands
Public-Access Irrigation
Rapid Infiltration Trenches (RIT)
Other Canal
Public Access Irrigation (Number)
Rapid Infiltration Trenches (Number)
Canal Recharge
Wetland Recharge
Biscayne Bay
Biscayne Bay Coastal Wetlands
City of North Miami Beach
North District WWTP
Central District WWTP
South District WWTP
FIU
N. MIAMI BEACH WELLFIELD (NOT MDWASD)
N. MIAMI WELLFIELD (NOT MDWASD)
HIALEAH/PRESTON WTPs and WELLFIELDS
ALEXANDER ORR JR. WTP & WELLFIELD
SNAPPER CREEK WELLFIELD
SOUTHWEST WELLFIELD
NORTHWEST WELLFIELD
PROPOSED MIAMI HEIGHTS WELLFIELD
NARANJA WTP AND WELLFIELD
LEISURE CITY WTP & WELLFIELD
HOMESTEAD WELLFIELD
ELEVATED TANK & WELLFIELD
NEWTON WTP AND WELLFIELD
FLORIDA CITY WELLFIELD
FLORIDA KEYS AQUEDUCT AUTHORITY WELLFIELD
EVERGLADES LABOR CAMP WELLFIELD AND WTP
Biscayne Bay Coastal Wetlands
Broward County
Miami - Dade County
Miles

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ES.4.2 Alternative B: Medium Reuse Alternative

The medium reuse alternative (Alternative B), which reuses 52.4% of the wastewater generated in year 2025, is similar to the high reuse alternative, with the exception that several of the projects are deleted, including wetland application and canal recharge at the NDWWTP. Individual projects in this alternative are listed in Table ES-4, and their locations are presented on Figure ES-2.

Table ES-4. Summary of Reuse Projects for Alternative B (Medium Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
NDWWTP Wastewater Projected = 120 MGD				
Process Reuse (existing)	2.13	No		Existing, does not count towards future offset.
Florida International University (existing)	0.1	No		Existing, does not count towards future offset.
North Miami Stadium Irrigation (99)	0.27	Yes	0.27	Based on previous 1998 Reuse Feasibility Report estimate.
City of North Miami Beach Irrigation	4.9	Yes	4.9	City of North Miami Beach.
City of North Miami Beach Vehicle Washing	0.1	Yes	0.1	City of North Miami Beach.
Nearby Small Scale User Irrigation	0.1	Yes	0.1	
Ives Estates Park Irrigation (0)	0.73	No		Private wells.
Greynolds Park Golf Course Irrigation (23)	1.05	No		Private wells.
East Greynolds Park Irrigation (54)	0.33	No		Private wells. Adjacent to Biscayne Bay Aquatic Preserve.
California Golf Courses Irrigation	0.89	No		Private wells.
Miami Shores Country Club Irrigation	1.1	No		Private wells.
Biscayne Landing New Development Irrigation	1.5	Yes	1.5	Assume 15% green space to be irrigated. May reduce future potable water demand.
Amelia Earhart Park Irrigation (67)	4.11	No		Private well.
Haulover Golf Course and Marina Irrigation[(b)]	1.35	Yes	1.35	Uses public water supply. Miami Beach (MDWASD). Adjacent to Biscayne Bay Aquatic Preserve.
Fairmount Turnberry Isle Resort & Club Irrigation	1.76	No		Private well and City of North Miami Beach.
NDWWTP Total	**20.42**		**8.22**	

Table ES-4. Summary of Reuse Projects for Alternative B (Medium Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
CDWWTP Wastewater Projected = 142 MGD				
Process Reuse (existing)	9.73	No		Existing, does not count towards future offset.
Doral Golf Course Irrigation (3)	3.88	Yes	3.88	Recharge for Hialeah-Preston WTP/Wellfield.
Costa Greens Golf Club Irrigation (16)	0.6	Yes	0.6	Lake/canal water but recharge for Hialeah-Preston WTP/Wellfield.
Fontainbleau Golf Course: New Residential	1.03	Yes	1.03	New development on former golf course. Also recharge for Hialeah-Preston WTP/Wellfield.
Crandon Park (Golf Course) Irrigation (5)	0.7	Yes	0.7	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve.
Key Biscayne Residential Irrigation	0.2	Yes	0.2	Estimated based on other residential irrigation. May be greater. Adjacent to Biscayne Bay Aquatic Preserve.
Tree Island Park Irrigation (127)[(a)]	0.93	Yes	0.93	Recharge for West Wellfield.
Tropical Park Irrigation (154)[(a)]	2.2	Yes	2.2	Recharge for Alexander Orr Jr. WTP/Wellfield.
Tropical Park RIT (154)[(a)]	5.58	Yes	5.58	Recharge for Alexander Orr Jr. WTP/Wellfield.
Trail Glades Range Irrigation (119)[(a)]	5.5	Yes	5.5	Recharge for West Wellfield.
Trail Glades Range RIT (119) [(a),(c)]	13.92	Yes	13.92	Recharge for West Wellfield.
Kendall Indian Hammocks Park Irrigation (185)[(a)]	0.05	No		Private wells, currently irrigate 1 acre for ball field. Portion of site Protected Natural Forest Community.
Kendall Indian Hammocks Park RIT (185)[(a)]	0.8	Yes	0.8	Recharge for Alexander Orr Jr. WTP/Wellfield. Portion of site Protected Natural Forest Community.
Calusa Country Club Irrigation (15)[(a)]	1.4	Yes	1.4	Recharge for Southwest Wellfield.
Miccosukee Golf & Country Club Irrigation (21)[(a)]	1.75	Yes	1.75	Recharge for West Wellfield.
Killian Greens Country Club Irrigation (19)[(a)]	1.05	Yes	1.05	Recharge for Alexander Orr Jr. WTP/Wellfield.
Biltmore Gold Course Irrigation (4)	1.03	No		Private wells.
Granada Golf Course Irrigation (18)	0.55	No		Private wells.

Table ES-4. Summary of Reuse Projects for Alternative B (Medium Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
Miami Springs Golf & Country Club Irrigation (20)[(a)]	1.45	Yes	1.45	Private wells but recharge for Hialeah-Preston WTP/Wellfield
Miami Springs Golf & Country Club RIT (20)[(a)]	3.69	Yes	3.69	Recharge for Hialeah-Preston WTP/Wellfield
Canal Recharge (C-2, C-4)	40	Yes	40	up to 40 mgd
CDWWTP Total	**96.04**		**84.68**	
SDWWTP Wastewater Projected = 131 MGD				
Process Reuse	4.25	No		Existing, does not count towards future offset
Homestead Air Reserve Park Irrigation (354)	0.78	No		Private wells
Palmetto Golf Course Irrigation (7)	0.91	No		Private wells
New Developments (residential irrigation)	4.51	Yes	4.51	Potable water use expected for irrigation
New Developments (park irrigation)	0.88	Yes	0.88	Potable water use expected for irrigation
New Development Parks RIT (in areas of new development)	30	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extents
Briar Bay Golf Course Irrigation (6)	0.26	No		Private well
Metrozoo Irrigation (269)	2.25	No		Private wells. Portion of site Protected Natural Forest Community
Metrozoo RIT (269)	15	Possibly		Portion of site Protected Natural Forest Community
Goulds Park Irrigation (452)	0.24	No		Private well
Goulds Park RIT (452)	2.49	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extents
Castellow Hammock Park RIT (425)	5.5	No		Probably to remote for irrigation recharge zone. Most of site protected natural forest community
Three Lakes Park Irrigation (317)	0.12	No		
Three Lakes Park RIT (317)	1.2	Possibly		

Table ES-4. Summary of Reuse Projects for Alternative B (Medium Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
Homestead Air Reserve Park RIT (354)	10	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent
Coastal Wetlands Rehydration Demonstration Project	1	TBD		Further discussion necessary with SFWMD to determine potable water offset
SDWWTP Total	**79.39**		**6.39**	Up to 58.69 MGD of additional offsets may be possible for SDWWTP
Total/Potential Projects	**195.85**		**99.29**	Up to 58.69 MGD of additional offsets may be possible for Alternative B

Notes:
(a) Lies partially or fully within existing wellfield protection area.
(b) Golf course being converted to lawn area with potential for additional irrigation.
(c) Potential for wetlands rehydration.
Key:
CDWWTP = Central District Wastewater Treatment Plant.
CUP = Consumptive Use Permit.
MGD = million gallons per day.
NDWWTP = North District Wastewater Treatment Plant.
RIT = rapid infiltration trench.
SDWWTP = South District Wastewater Treatment Plant.
WTP = water treatment plant.

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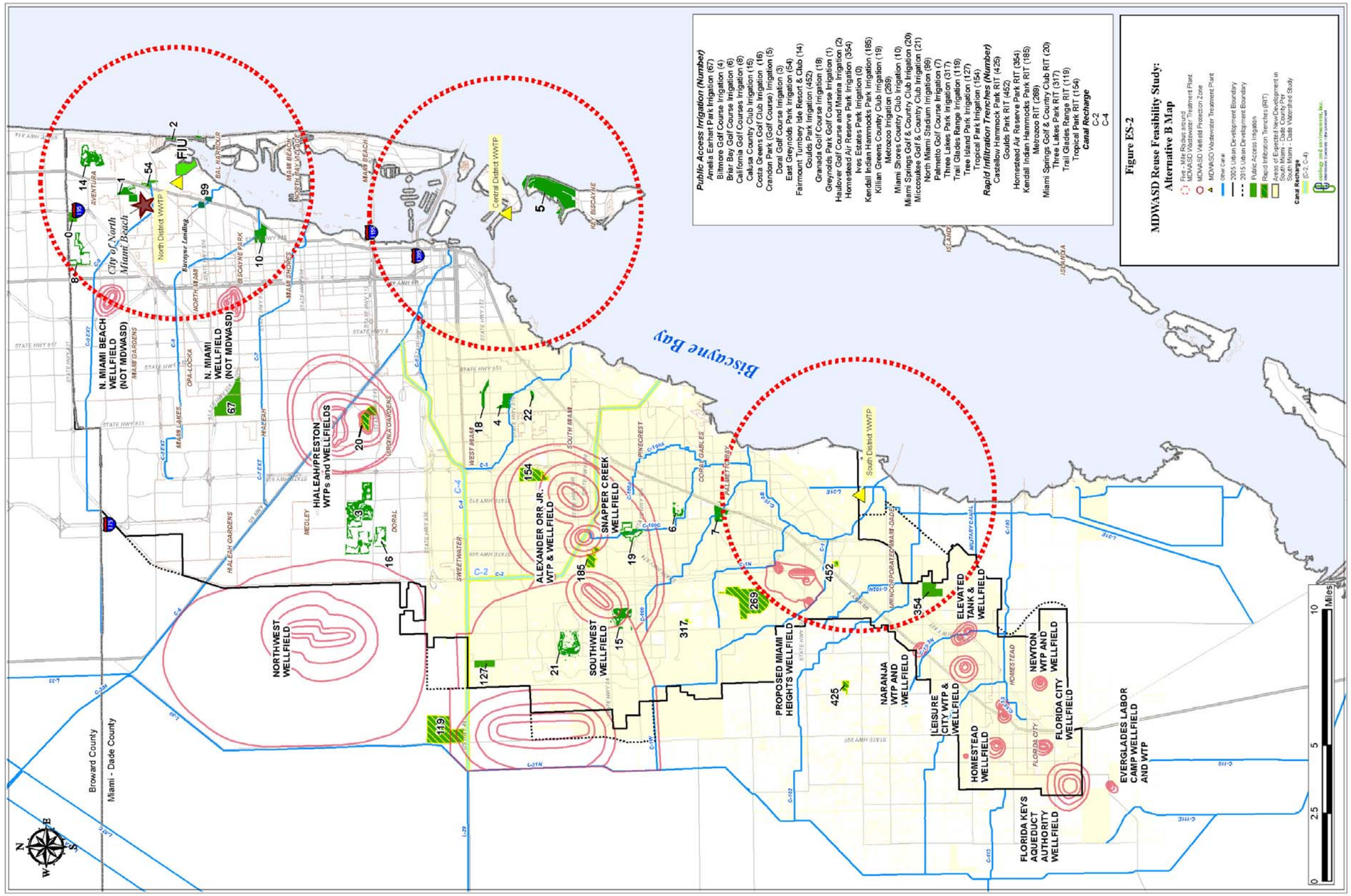
Figure ES-2
MDWASD Reuse Feasibility Study:
Alternative B Map
Five - Mile Radius around
MDWASD Wastewater Treatment Plant
MDWASD Wellfield Protection Zone
MDWASD Wastewater Treatment Plant
Other Canal
2005 Urban Development Boundary
2015 Urban Development Boundary
Public Access Irrigation
Rapid Infiltration Trenches (RIT)
Areas of Expected New Development in South Miami - Dade County Per South Miami - Dade Watershed Study
Canal Recharge
(C-1, C-4)
Public Access Irrigation (Number)
Amelia Earhart Park Irrigation (67)
Biltmore Golf Course Irrigation (4)
Briar Bay Golf Course Irrigation (6)
California Golf Courses Irrigation (8)
Calusa Country Club Irrigation (15)
Costa Sawgrass Golf Club Irrigation (16)
Crandon Park (Golf Course) Irrigation (5)
Doral Golf Course Irrigation (3)
East Greynolds Park Irrigation (54)
Fairmont Turnberry Isle Resort Club (14)
Golf Irrigation (452)
Goulds Golf Course Irrigation (19)
Greynolds Park Golf Course Irrigation (1)
Hadley Golf Course and Marina Irrigation (2)
Homestead Air Reserve Park Irrigation (354)
Ives Estates Park Irrigation (10)
Kendall Indian Hammocks Park Irrigation (185)
Killian Greens Country Club Irrigation (19)
Metrozoo Irrigation (269)
Miami Shores Country Club Irrigation (10)
Miami Springs Golf & Country Club Irrigation (20)
Miccosukee Golf & Country Club Irrigation (21)
North Miami Stadium Irrigation (99)
Palmetto Golf Course Irrigation (7)
Three Lakes Park Irrigation (317)
Trail Glades Range Irrigation (119)
Tree Island Park Irrigation (127)
Tropical Park Irrigation (154)
Rapid Infiltration Trenches (Number)
Castellow Hammock Park RIT (425)
Goulds Park RIT (452)
Homestead Air Reserve Park RIT (354)
Kendall Indian Hammocks Park RIT (185)
Metrozoo RIT (269)
Miami Springs Golf & Country Club RIT (20)
Three Lakes Park RIT (317)
Trail Glades Range RIT (119)
Tropical Park RIT (154)
Canal Recharge
C-2
C-4
Biscayne Bay
City of North Miami Beach
North District WWTP
Central District WWTP
South District WWTP
FIU
N. MIAMI BEACH WELLFIELD (NOT MDWASD)
N. MIAMI WELLFIELD (NOT MDWASD)
HIALEAH/PRESTON WTPs and WELLFIELDS
ALEXANDER ORR JR. WTP & WELLFIELD
SNAPPER CREEK WELLFIELD
SOUTHWEST WELLFIELD
NORTHWEST WELLFIELD
PROPOSED MIAMI HEIGHTS WELLFIELD
NARANJA WTP AND WELLFIELD
LEISURE CITY WTP & WELLFIELD
ELEVATED TANK & WELLFIELD
HOMESTEAD WELLFIELD
NEWTON WTP AND WELLFIELD
FLORIDA CITY WELLFIELD
EVERGLADES LABOR CAMP WELLFIELD AND WTP
FLORIDA KEYS AQUEDUCT AUTHORITY WELLFIELD
Broward County
Miami - Dade County
Miles
0
2.5
5
10

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ES.4.3 Alternative C: Low Reuse Alternative

The low reuse alternative (Alternative C), which reuses 26.0% of the wastewater generated in year 2025, includes projects in close proximity to the district WWTPs (within 5 miles) to reduce transmission costs or MBRs for several more distant locations. The more questionable projects associated with recharging the wellfields and canals, as suggested by the SFWMD, were not included in Alternative C due to the existing uncertainty for implementation. It is expected that this alternative will evolve and that some of the projects included will change as more information becomes available through the implementation of pilot projects. Projects in other alternatives may qualify to be implemented in Alternative C based on new regulatory decisions or as pilot data become available. Table ES-5 lists the projects making up Alternative C and their locations are shown on Figure ES-3.

Table ES-5. Summary of Reuse Projects for Alternative C (Low Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
NDWWTP Wastewater Projected = 120 MGD				
Process Reuse (existing)	2.13	No		Existing, does not count towards future consumptive use.
Florida International University (existing)	0.1	No		Existing, does not count towards future consumptive use.
North Miami Stadium Irrigation (99)	0.27	Yes	0.27	Based on previous 1998 Reuse Feasibility Report estimate.
City of North Miami Beach Irrigation	4.9	Yes	4.9	City of North Miami Beach.
City of North Miami Beach Vehicle Washing	0.1	Yes	0.1	City of North Miami Beach.
Nearby Small Scale User Irrigation	0.1	Yes	0.1	
Ives Estates Park Irrigation (0)	0.73	No		Private wells.
Greynolds Park Golf Course Irrigation (1)	1.05	No		Private wells.
East Greynolds Park Irrigation (54)	0.33	No		Private wells. Adjacent to Biscayne Bay Aquatic Preserve.
California Golf Courses Irrigation (8)	0.89	No		Private wells.
Miami Shores Country Club Irrigation (10)	1.1	No		Private wells.
Biscayne Landing New Development Irrigation	1.5	Yes	1.5	Assume 15% green space to be irrigated. Reduces future potable water demand.
Amelia Earhart Park Irrigation (MBR) (67)	4.11	No		Private well.
NDWWTP Total	**17.31**		**6.87**	
CDWWTP Wastewater Projected = 142 MGD				
Process Reuse (existing)	9.73	No		Existing, does not count towards future offset.
Doral Golf Course Irrigation (MBR) (3)	3.88	Yes	3.88	Recharge for Hialeah-Preston WTP/Wellfield.
Costa Greens Golf Club Irrigation (MBR) (16)	0.60	Yes	0.6	Lake/canal water but recharge for Hialeah-Preston WTP/Wellfield.
Fontainbleau Golf Course Irrigation: New Residential (MBR)	1.03	Yes	1.03	New development on former golf course. Also recharge for Hialeah-Preston WTP/Wellfield.
Crandon Park (Golf Course) Irrigation (5)	0.7	Yes	0.7	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve.
Key Biscayne Residential Irrigation	0.2	Yes	0.2	Currently using potable water. Estimate based on other residential irrigation; may be greater. Adjacent to Biscayne Bay Aquatic Preserve.
CDWWTP Total	**16.14**		**6.41**	

Table ES-5. Summary of Reuse Projects for Alternative C (Low Reuse)

Application	Total Wastewater Used for Reuse Projects (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
SDWWTP Wastewater Projected = 131 MGD				
Process Reuse	4.25	No		Existing, does not count towards future offset.
Homestead Air Reserve Park Irrigation (354)	0.78	No		Private wells.
Palmetto Golf Course Irrigation (7)	0.91	No		Private wells.
New Developments (residential irrigation)	4.51	Yes	4.51	Potable water use expected for irrigation.
New Developments (park irrigation)	0.88	Yes	0.88	Potable water use expected for irrigation.
New Development Parks RIT (in areas of new development)	30	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent.
Briar Bay Golf Course Irrigation (6)	0.26	No		Private well.
Metrozoo Irrigation (269)	2.25	No		Private wells. Portion of site Protected Natural Forest Community.
Metrozoo RIT (269)	15	Possibly		Portion of site Protected Natural Forest Community.
Goulds Park Irrigation (452)	0.24	No		Private well.
Goulds Park RIT (452)	2.49	Possibly		Due to total volume could benefit Biscayne Bay Coastal Wetlands to some extent.
Three Lakes Park Irrigation (317)	0.12	No		
Three Lakes Park RIT (317)	1.2	Possibly		
Coastal Wetlands Rehydration Demonstration Project	1	TBD		Further discussion necessary with SFWMD to determine potable water offset
SDWWTP Total	**63.89**		**5.39**	Up to 48.69 MGD of additional offsets may be possible for SDWWTP.
Total /Potential Projects	**97.34**		**19.67**	Up to 48.69 MGD of additional offsets may be possible for Alternative C.

Key:
CDWWTP = Central District Wastewater Treatment Plant.
CUP = Consumptive Use Permit.
MBR = membrane bioreactor.
MGD = million gallons per day.
NDWWTP = North District Wastewater Treatment Plant.
RIT = rapid infiltration trench.
SDWWTP = South District Wastewater Treatment Plant.
WTP = water treatment plant.

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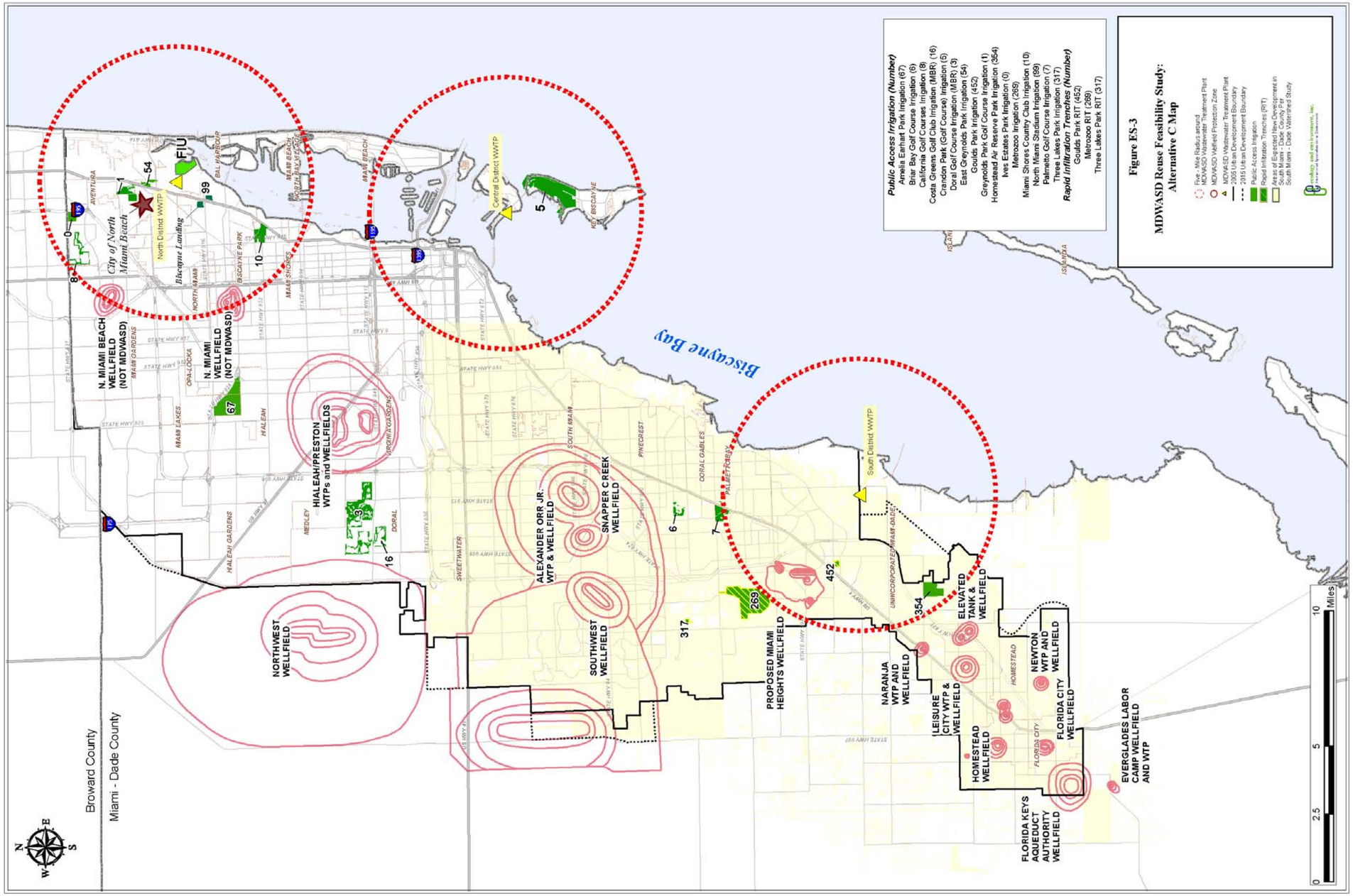
Figure ES-3
MDWASD Reuse Feasibility Study:
Alternative C Map
Five - Mile Radius around
MDWASD Wastewater Treatment Plant
MDWASD Wellfield Protection Zone
MDWASD Wastewater Treatment Plant
2005 Urban Development Boundary
2015 Urban Development Boundary
Public Access Irrigation
Rapid Infiltration Trenches (RIT)
Areas of Expected New Development in
South Miami - Dade County Per
South Miami - Dade Watershed Study
Ecology and Environment, Inc.
Public Access Irrigation (Number)
Amelia Earhart Park Irrigation (67)
Briar Bay Golf Course Irrigation (6)
California Golf Courses Irrigation (8)
Costa Greens Golf Club Irrigation (MBR) (16)
Crandon Park (Golf Course) Irrigation (5)
Doral Golf Course Irrigation (MBR) (3)
East Greynolds Park Irrigation (54)
Goulds Park Irrigation (452)
Greynolds Park Golf Course Irrigation (1)
Homestead Air Reserve Park Irrigation (354)
Ives Estates Park Irrigation (0)
Metrozoo Irrigation (269)
Miami Shores Country Club Irrigation (10)
North Miami Stadium Irrigation (99)
Palmetto Golf Course Irrigation (7)
Three Lakes Park Irrigation (317)
Rapid Infiltration Trenches (Number)
Goulds Park RIT (452)
Metrozoo RIT (269)
Three Lakes Park RIT (317)
Biscayne Bay
City of North Miami Beach
North District WWTP
Central District WWTP
South District WWTP
FIU
Biscayne Landing
AVENTURA
BAL HARBOUR
MIAMI BEACH
NORTH BAY VILLAGE
KEY BISCAYNE
BISCAYNE PARK
MIAMI SHORES
NORTH MIAMI
OPA-LOCKA
MIAMI GARDENS
MIAMI LAKES
HIALEAH
MEDLEY
DORAL
SWEETWATER
SOUTH MIAMI
PINECREST
CORAL GABLES
PALMETTO BAY
HOMESTEAD
FLORIDA CITY
UNINCORPORATED MIAMI-DADE
HALEAH GARDENS
N. MIAMI BEACH WELLFIELD (NOT MDWASD)
N. MIAMI WELLFIELD (NOT MDWASD)
HIALEAH/PRESTON WTPs and WELLFIELDS
ALEXANDER ORR JR. WTP & WELLFIELD
SNAPPER CREEK WELLFIELD
NORTHWEST WELLFIELD
SOUTHWEST WELLFIELD
PROPOSED MIAMI HEIGHTS WELLFIELD
NARANJA WTP AND WELLFIELD
LEISURE CITY WTP & WELLFIELD
ELEVATED TANK & WELLFIELD
HOMESTEAD WELLFIELD
NEWTON WTP AND WELLFIELD
FLORIDA CITY WELLFIELD
FLORIDA KEYS AQUEDUCT AUTHORITY WELLFIELD
EVERGLADES LABOR CAMP WELLFIELD AND WTP
Broward County
Miami - Dade County
Miles
0
2.5
5
10

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ES.4.4 Alternative D: No-Action Alternative

For the No-Action Alternative, there would be no additional expansions or modifications to the WWTPs and associated effluent disposal systems other than what is currently underway or already planned. All the wastewater plants have adequate capacity to treat and dispose the wastewater based on current regulations for the next 20 years of growth. While collection system upgrades are already proposed in Miami-Dade County's Capital Improvement Plan and additional improvements may be needed to address peak flows, and new regulations for ocean outfalls and deep-well injection, these projects will be completed regardless of whether reuse is implemented and are common to all the alternatives.

ES.4.5 Additional Studies and Investigations

In order to study potential impacts of reclaimed water applied in environmentally sensitive areas and for wellfield recharge, two pilot projects will be conducted. The "Coastal Wetlands Reuse Rehydration Demonstration Project" will be implemented to demonstrate that the appropriate levels of treatment can be attained on a consistent basis to discharge to the Biscayne Bay Coastal Wetlands. This project will use highly treated effluent from the SDWWTP and discharge into wetlands adjacent to the SDWWTP. MDWASD has estimated a cost of $19.2 million for a 1 MGD plant. As proposed under the CERP Wastewater Reuse Pilot Project Technology Report, the pilot project will combine microfiltration, disinfection with ultraviolet (UV) light, and advanced oxidation to treat SDWWTP effluent. A separate stream will be treated with RO to evaluate the different treatment trains.

The second pilot effort, the Aquifer Recharge Pilot Study will investigate recharging the Biscayne Aquifer with treated reuse water. The pilot system is currently being designed and is modeled after the Advanced Water Purification Facility that will soon replace Water Factory 21 in California. MDWASD's pilot system will be a dual-stage system that will include primary and secondary treatment in the first stage followed by advanced treatment in the second stage that will be rated at 20,000 gallons per day (GPD), four times the size of Orange County's pilot system. The first stage would include a biological oxidation system to produce a treated effluent with an average biochemical oxygen demand (BOD) concentration of less than 15 milligrams per liter (mg/L), total suspended solids (TSS) concentration of less than 5 mg/L, total organic carbon (TOC) concentration less than 10 mg/L and total nitrogen (TN) concentration less than 10 mg/L. The second stage would include an advanced physical treatment system and consist of membrane filtration (i.e., ultra-filtration) to remove bacteria and TSS followed by RO and ultraviolet light and hydrogen peroxide oxidation to remove TN, TOC, and most other pollutants of concern.

In addition, two studies are proposed to monitor and evaluate the impacts of using public access quality reclaimed water for irrigation and aquifer recharge from existing sites. Several locations n Miami-Dade County currently exist where public access quality water is used for irrigation (e.g., FIU). Additionally, the City of Homestead has an RIT at its

WWTP that is in operation and can be monitored. The purpose of these studies is to ascertain the appropriate treatment levels to achieve groundwater, soil or surface water standards, criteria, goals or Cleanup Target Levels. Data from these and other applicable studies should be used to finalize treatment technologies on a project-by-project basis.

ES.4.6 Reformulated Alternative: Alternative E

Following a draft version of this Reuse Feasibility Study in May 2006, a comprehensive regulatory agency coordination effort was conducted to focus on unresolved or conflicting regulatory issues surrounding reuse in Miami-Dade County. Much of the discussion focused on levels of treatment based on the proximity of potentially sensitive receptors or locations such as wellfield protections areas and Biscayne Bay, among others. SFWMD and the FDEP strongly encouraged additional levels of reuse throughout the County. SFWMD was particularly interested in projects that recharged the aquifer or resulted in less dependence on the regional system and Lake Okeechobee. DERM supported reuse efforts, but wanted to ensure that the unique resources in Miami-Dade County were adequately protected through appropriate treatments levels for reclaimed water. As a result of this agency involvement, Alternatives A through C were reassessed to develop a reformulated alternative that would provide more reuse and could be implemented with a higher degree of certainty.

This reformulated alternative, Alternative E, reuses 40.3% of the wastewater generated in year 2025, includes public access irrigation projects in close proximity to the district WWTPs, aquifer recharge projects located on County-owned property, and coastal wetlands rehydration. The reuse projects related to aquifer recharge and coastal wetlands rehydration will follow the successful implementation of the two pilot projects mentioned above. Table ES-6 lists the projects making up Alternative E and their locations are shown on Figure ES-4.

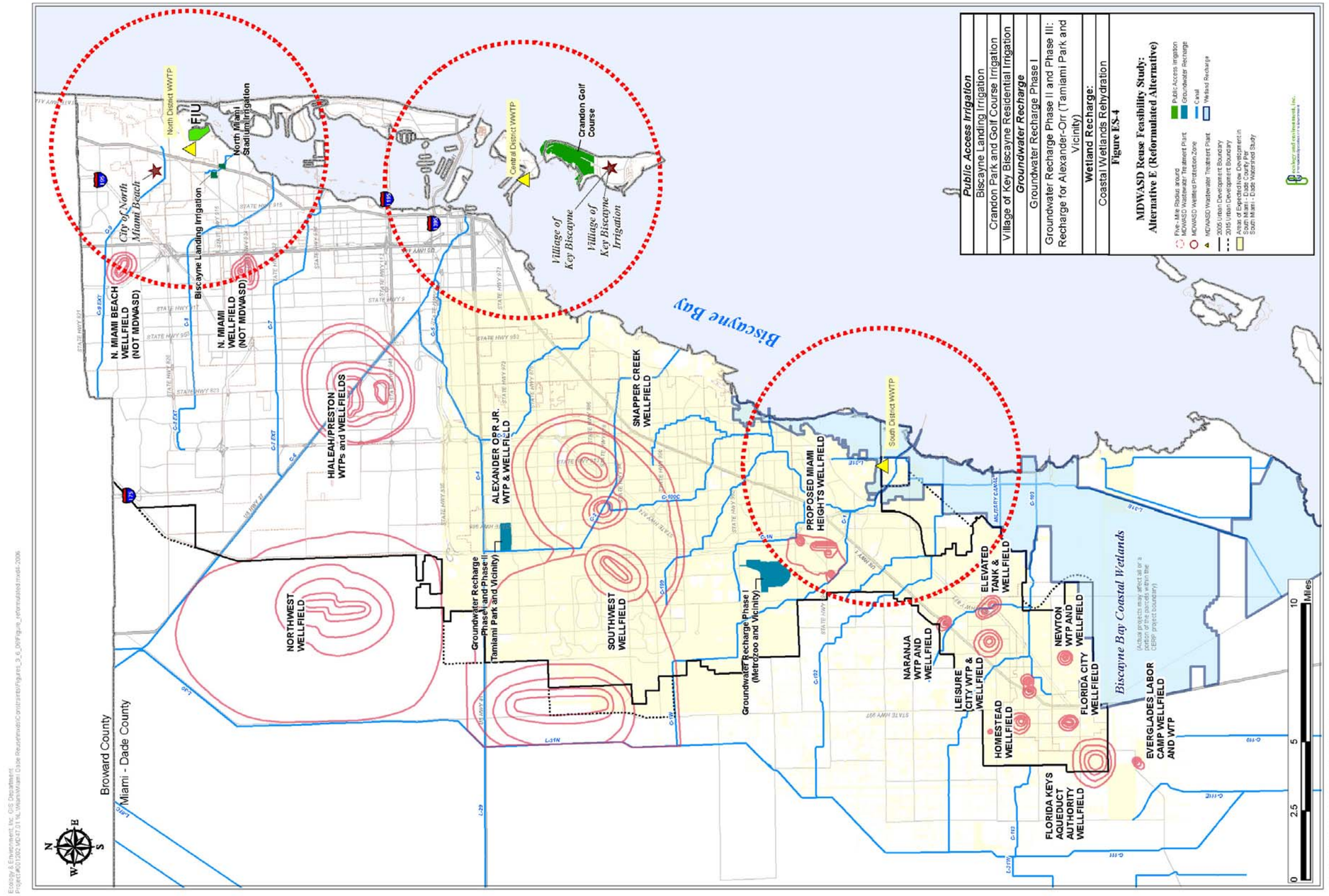
Table ES-6. Summary of Reuse Projects for Alternative E (Reformulated Alternative)

Application	Total Wastewater Used for Reuse Projects (MGD)	Total Reject Stream per Reuse Project (MGD)	Finished Reuse Volume per Project (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
NDWWTP Wastewater Projected = 120 MGD						
Process Reuse (existing)	2.13	Minimal[1]	2.13	No		Existing, does not count towards future offset
Florida International University (existing)	0.1	Minimal[1]	0.1	No		Existing, does not count towards future offset
North Miami Stadium Irrigation (99)	0.27	Minimal[1]	0.27	Yes	0.27	Based on previous estimates from 1998 Reuse Feasibility Study estimate
City of North Miami Beach Irrigation (includes vehicle washing facility, irrigation)	4.9	Minimal[1]	4.9	Yes	4.9	
City of North Miami Beach Vehicle Wash	0.1	Minimal[1]	0.1	Yes	0.1	
Biscayne Landings New Development Irrigation	1.5	Minimal[1]	1.5	Yes	1.5	
Total NDWWTP	**9.0**		**9.0**		**6.77**	
CDWWTP Wastewater Projected = 142 MGD						
Process Reuse (existing)	9.73	Minimal[1]	9.73	No		Existing, does not count towards future offset
Crandon Park (Golf Course) Irrigation (5)	0.7	Minimal[1]	0.7	Yes	0.7	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve
Key Biscayne Residential Irrigation	0.2	Minimal[1]	0.2	Yes	0.2	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve
Total CDWWTP	**10.63**		**10.63**		**0.9**	

Table ES-6. Summary of Reuse Projects for Alternative E (Reformulated Alternative)

Application	Total Wastewater Used for Reuse Projects (MGD)	Total Reject Stream per Reuse Project (MGD)	Finished Reuse Volume per Project (MGD)	CUP Offset?	Minimum Offset Volume (MGD)	Comments
SDWWTP Wastewater Projected = 131 MGD						
Process Reuse	4.25	Minimal[1]	4.25	No		Existing, does not count towards future offset
Groundwater Recharge Phase I: South Dade (Metrozoo Vicinity)	30	7.5[2]	22.5	Yes	18	Recharge for Miami Heights Wellfield. Portion of site Protected Natural Forest Community
Groundwater Recharge Phase II: Alex Orr (Tamiami Park Vicinity)	28.1	7.0[2]	21.1	Yes	20	
Groundwater Recharge Phase III Alex Orr (Tamiami Park Vicinity)	21.1	5.3[2]	15.8	Yes	15	
Coastal Wetlands Rehydration Project (Acceler8 & Coastal Wetlands full-scale)	46.5	0.93[3]	45.57	TBD	TBD	Further discussion necessary with SFWMD to determine potable water offset
Coastal Wetlands Demonstration Project	1.0	1.0	1.0	TBD	TBD	Further discussion necessary with SFWMD to determine potable water offset
SDWWTP Total	**131.0**	**21.2**	**110.16**		**53.0**	
System-wide Total	**150.63**	**21.2**	**129.53**		**60.67**	

Notes:
(1) Public access reuse treatment assumes minimal reject stream.
(2) Reject stream for reverse osmosis is 25%
(3) Reject stream for microfiltration is 2%
Key:
CDWWTP = Central District Wastewater Treatment Plant.
CUP = Consumptive Use Permit.
MGD = million gallons per day.
NA = not applicable.
NDWWTP = North District Wastewater Treatment Plant.
SDWWTP = South District Wastewater Treatment Plant.
SFWMD = South Florida Water Management District.
TBD = to be determined.


Public Access Irrigation
Biscayne Landing Irrigation
Crandon Park and Golf Course Irrigation
Village of Key Biscayne Residential Irrigation
Groundwater Recharge
Groundwater Recharge Phase I
Groundwater Recharge Phase II and Phase III: Recharge for Alexander-Orr (Tamiami Park and Vicinity)
Wetland Recharge:
Coastal Wetlands Rehydration
MDWASD Reuse Feasibility Study: Alternative E (Reformulated Alternative)
Figure ES-4
Five-Mile Radius around MDWASD Wastewater Treatment Plant
MDWASD Wellfield Protection Zone
MDWASD Wastewater Treatment Plant
2006 Urban Development Boundary
2015 Urban Development Boundary
Area of Restrictive Development in South Miami - Dade County Per South Miami - Dade Watershed Study
Public Access Irrigation
Groundwater Recharge
Canal
Wetland Recharge
Biscayne Bay
Biscayne Bay Coastal Wetlands
(Actual projects may affect all or a portion of the parcels within the CERP project boundary)
North District WWTP
Central District WWTP
South District WWTP
FIU
North Miami Stadium Irrigation
City of North Miami Beach
Biscayne Landing Irrigation
Village of Key Biscayne
Village of Key Biscayne Irrigation
Crandon Golf Course
N. MIAMI BEACH WELLFIELD (NOT MDWASD)
N. MIAMI WELLFIELD (NOT MDWASD)
HIALEAH/PRESTON WTPs and WELLFIELDS
ALEXANDER ORR JR. WTP & WELLFIELD
SNAPPER CREEK WELLFIELD
PROPOSED MIAMI HEIGHTS WELLFIELD
NORTHWEST WELLFIELD
Groundwater Recharge Phase I and Phase II (Tamiami Park and Vicinity)
SOUTHWEST WELLFIELD
Groundwater Recharge Phase I (Metrozoo and Vicinity)
NARANJA WTP AND WELLFIELD
LEISURE CITY WTP & WELLFIELD
ELEVATED TANK & WELLFIELD
HOMESTEAD WELLFIELD
NEWTON WTP AND WELLFIELD
FLORIDA CITY WELLFIELD
FLORIDA KEYS AQUEDUCT AUTHORITY WELLFIELD
EVERGLADES LABOR CAMP WELLFIELD AND WTP
Broward County
Miami - Dade County
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ES.5 ECONOMIC FEASIBILITY

The implementation of each alternative was phased incrementally based, in general, on the following assumptions:

North District

- **Years 1 – 5:** Provide treatment upgrades, transmission, distribution, and onsite storage for public access irrigation projects for projects in proximity of the NDWWTP.
- **Years 6 – 10:** Install RITs and provide additional treatment, transmission, and distribution for remaining projects. For the Low Reuse Alternative (Alternative C), install satellite treatment irrigation at Amelia Earhart Park, and purchase associated land.
- **Years 11 – 15:** For Maximum Reuse Alternative (Alternative A), provide additional treatment and distribution and provide for canal recharge.

Central District

- **Years 1 – 5:** For Low Reuse Alternative (Alternative C), install satellite treatment and purchase land for irrigation projects at golf courses in the area of Doral.
- **Years 6 – 10:** Provide treatment (including RO) to treat elevated chlorides levels; and transmission, distribution, pumps and onsite storage for irrigation projects located closer to the CDWWTP.
- **Years 11 – 15:** Provide additional microconstituents treatment and onsite storage, transmission, and distribution for canal recharge and irrigation projects within the WPAs or en route to WPAs.
- **Years 16 – 20:** Provide additional transmission and distribution for irrigation projects and install RITs at remote westerly locations.

South District

- **Years 1 – 5:** Provide storage, transmission, and distribution for irrigation projects within 5 miles of the SDWWTP and construct pilot projects.
- **Years 6 – 10:** Provide additional treatment for rapid infiltration projects potentially affecting Biscayne Bay or recharging the wellfields; and transmission, distribution, and onsite storage for remaining irrigation and rapid infiltration projects.
- **Years 16 – 20:** Provide additional treatment and nutrient removal wetland recharge for the Maximum Reuse Alternative (Alternative A).

Pilot Projects and Studies

Several pilot projects and studies described above are assumed to be implemented in all the alternatives and initiated immediately.

Present Value Analysis

A full present value analysis was performed, starting with the determination of projected capital costs and operating and maintenance expenses associated with each project. The estimates of costs in today's dollars associated with each alternative are described below.

Alternative A: Maximum Reuse - Construction would be completed over a 20-year period, and is estimated to total $2,850,562,269. Annual operating and maintenance expenses are estimated at $255,621,700. However, a portion of the baseline costs would not be incurred if this alternative were to be implemented. This is represented as a savings, and is used to reduce the total costs, resulting in a total construction cost (net of savings) of $2,849,184,189, and annual operating and maintenance expenses of $255,363,310. The total construction cost of this alternative added to baseline costs is $4,805,948,356.

Alternative B: Medium Reuse - Construction would be completed over a 20-year period and is estimated to total $1,896,798,265. Annual operating and maintenance expenses are estimated at $146,331,374. A portion of the baseline costs would not be incurred if this alternative were implemented. This is represented as a savings and is used to reduce the total costs, resulting in a total construction cost (net of savings) of $1,883,977,945 and annual operating and maintenance expenses of $143,927,564.The total construction cost of this alternative added to baseline costs is $3,840,762,112.

Alternative C: Low Reuse - Construction would be completed over a 10-year period, and is estimated to total $887,713,667. Annual operating and maintenance expenses are estimated at $77,373,201. A portion of the baseline costs would not be incurred if this alternative were to be implemented. This is represented as a savings and is used to reduce the total costs, resulting in a total construction cost (net of savings) of $873,480,467 and annual operating and maintenance expenses of $74,704,476.The total construction cost of this alternative added to baseline costs is $2,830,244,634

Alternative D: No Action – The Guidelines require analysis of an alternative that will provide "water supply and wastewater management without implementation of additional reuse." Aside from what is already proposed, the wastewater facilities have adequate treatment and disposal capacity for the next 20 years. As described in Section 5.1.1, baseline costs for capital improvements and planned upgrades are included in this alternative. Also, additional treatment upgrades to comply with pending regulations for ocean outfall and deep well injection are incorporated. The total cost for this alternative is $1,956,764,167 and annual operating and maintenance expenses of $103,708,501

Alternative E: Reformulated Alternative - Construction would be completed over a 20-year period and is estimated to total $949,801,155. Annual operating and maintenance expenses are estimated at $84,535,104. A portion of the baseline costs would not be incurred if this alternative were implemented. This is represented as a savings and is used to reduce the total costs, resulting in a total construction cost (net of savings) of $941,239,666 and annual operating and maintenance expenses of $83,764,570.

Pilot Projects and Studies: The cost estimate for the Coastal Wetland Reuse Rehydration Demonstration Project is approximately $20 million. The aquifer recharge pilot project is estimated at $1 million pending approval of a 20,000-gallon per day (gpd) plant being acceptable to evaluate the full-scale effect. Specific cost estimates for individual study projects have not been performed, though several have been identified, as described previously. Additionally, because of continued concerns regarding microconstituents and Cleanup Target Levels, $43,500,000 has been included in all three reuse alternatives to provide adequate coverage for these costs.

Analysis of Rates and Fees

Table ES-7 provides a summary of the projected user fees from reclaimed water customers, from wastewater customers and connection/impact fees for new customers, and user fees for all other classes of customers. This rate projection includes potential rate increases or decreases that may be warranted over the years as a result of other wastewater capital programs, and changes in expenses. This table is intended to show the incremental impact of the reuse projects in each alternative for comparative purposes. The projected user fee summary is based on specified analysis required by FDEP, and FDEP worksheets consider recovery from only reuse customers and wastewater customers. In reality, there are reuse options that include customers in addition to those specified (wetlands application, canal recharge, aquifer recharge, etc.), and the indirect benefits of such reuse may be realized by a larger population. Also, the amount charged per gallon for reuse may need to vary from user to user based on how they currently obtain potable water and the volume they use. In the present values analysis, it is assumed that users who are currently using private wells will recognize only a small savings from abandoning those wells. The rate to these users, as well as to minimal users, should be significantly lower than both the current potable water rate and the major users' rate.

Table ES-7. Summary of Rates and Fees – FDEP Analysis

Impact Fees (per GPD)	$1.00
Reclaimed Water Fee (per thousand gallons) – Minor Users	$0.25
Reclaimed Water Fee (per thousand gallons) – Major Users	$1.00

Key:
FDEP = Florida Department of Environmental Protection
GPD = gallons per day.

Although the correct allocation among customers can only be done through an in-depth study, for demonstration purposes only, Table ES-8 shows the impact of possible allocation scenarios in Years 5, 10 and 20 which expands the customer base. This table shows the estimated impact on user rates if the reuse rates included in the analysis are used, and the shortfall is spread evenly over all the water and wastewater customers.

Table ES-8. Demonstration of Possible Allocation of Costs/Impact on Rates and Fees

	FY 2006	Altern A	Altern B	Altern C	Altern D	Altern E
Impact Fees (per GPD) from Major Reclaimed Water Users		$1.00	$1.00	$1.00	$1.00	$1.00
Reclaimed Water Fee - Major Users (per thousand gallons)		$1.00	$1.00	$1.00	$1.00	$1.00
Reclaimed Water Fee - Minor Users (per thousand gallons)		$0.25	$0.25	$0.25	$0.25	$0.25
Year 5 Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$45.62	$41.67	$42.33	$41.81	$43.81
Year 10 Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$67.51	$61.13	$61.77	$51.99	$54.52
Year 15 Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$81.22	$70.24	$62.90	$52.99	$61.48
Year 20 Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$90.89	$76.21	$65.66	$55.41	$66.78

Key:
FY = fiscal year.
GPD = gallons per day.

Table ES-9 shows the rates for utilities across the country, for comparison purposes. The rates for other utilities were obtained from the MDWASD Budget for FY 2005–2006.

Table ES-9. Comparison of Rates for Average Customer For Fiscal Year Ending September 30, 2006

City or County	Rate
Atlanta GA	$82.22
San Diego CA	75.14
Boston MA	68.73
St. Petersburg FL	61.04
Broward County FL	59.53
Houston TX	59.25
San Francisco CA	58.32
Philadelphia PA	55.15
New Orleans LA	49.59
Honolulu HI	48.28
Los Angeles CA	47.91
Dallas TX	47.47
Jacksonville FL	46.65
Tampa FL	45.15

Table ES-9. Comparison of Rates for Average Customer For Fiscal Year Ending September 30, 2006

City or County	Rate
Charlotte NC	43.40
Orlando FL	36.97
Palm Beach County FL	35.75
Miami-Dade, FL (FY 2005-2006*)	**34.92**
Indianapolis IN	32.86
Chicago IL	18.26

* Effective 01/01/07 Miami-Dade FL rate is $36.64

ES.6 TECHNICAL FEASIBILITY

Key factors affecting technical feasibility include geographical constraints, high chlorides at the CDWWTP, microconstituents and high levels of treatment, reuse in sensitive areas, impact of antidegradation standards for Biscayne Bay Coastal Wetlands, uncertainty regarding the level of treatment for canal recharge, implementation of urban irrigation, implementation of agricultural reuse, hydrogeologic considerations for RITs, and installation of large-diameter pipelines in highly urbanized areas.

Based on these key issues, the technical feasibility of each alternative was evaluated and is summarized below.

- **Alternative A (81.7% Reuse):** This alternative incorporates a combination of projects including projects that are very distant from the regional treatment plants, projects within WPAs, as well as canal recharge. The installation of large-diameter pipes for transmission and distribution in highly developed areas results in extremely high costs. Bringing reclaimed water from Virginia Key across Biscayne Bay, from the CDWWTP, presents additional limits to constructability for this alternative. Also, a number of regulatory concerns exist with this alternative. Unless the pilot projects and demonstration efforts address existing regulatory concerns regarding reuse within WPAs and final clarification of regulatory requirements for canal recharge are established, this alternative is not feasible at this time.

- **Alternative B (52.4% Reuse):** The medium reuse alternative includes a number of irrigation and aquifer recharge projects in the WPA, as well as canal recharge, as suggested by the SFWMD. Also, a number of projects located distant from the WWTPs are proposed. As mentioned above, unless all the regulatory concerns are addressed with the proposed pilot and demonstration efforts, and regulatory concurrence for reuse within WPAs is fully obtained, this reuse alternative is not feasible at this time.

- **Alternative C (26.0% Reuse):** The low reuse scenario relies predominantly on urban irrigation and aquifer recharge, coupled with a small amount of industrial usage. All projects are located in areas outside of WPAs. Several irrigation projects are within the proximity of Biscayne Bay. This alternative

has focused on large irrigation users (golf courses and parks) and the new growth corridor in South Miami-Dade County along U.S 1, which are all relatively close to the existing WWTPs and potentially are of less concern to all the regulatory entities. Implementing the lower-level reuse scenario will require Miami-Dade County to rely more on other alternative water supplies, such as the Floridan Aquifer, to meet future water demands. It is estimated that the low reuse scenario could offset at least 15% of the additional water supplies needed for growth; however, further assessment of the offset amounts is needed.

- **Alternative D (No-Action):** The No-Action Alternative involves the implementation of no additional reuse projects. In consideration of the policies by the FDEP and the SFWMD and issues associated with consumptive use permitting, the No-Action Alternative is not a feasible option. Some additional level of reuse will be required regardless of whether or not it results in any offsets to future water supplies.

- **Alternative E (40.3%):** The reformulated alternative incorporates urban irrigation, aquifer recharge, and wetland rehydration. Projects are intended to offset future water supplies by recharging the Biscayne Aquifer upstream of water supply wellfields. It is estimated that this alternative will offset most of the future finished water demands. Further assessment of the offset credits for this alternative is needed with the SFWMD, especially for the coastal wetlands rehydration project. This alternative also relies on the successful outcomes of the pilot efforts.

Based on the information developed for this study, Alternatives C and E are the most feasible options at this time. Alternative E reuses 53.26 MGD more wastewater than Alternative C and also incorporates much of the regulatory input gathered throughout the study. Further reuse may be reasonable in the future if other technical and regulatory issues and concerns are resolved, detailed analyses support the planning-level assumptions made in this study, and further rate analysis confirms (with a high degree of certainty) that the costs can be recovered.

ES.7 ENVIRONMENTAL ASSESSMENT

Environmental impacts include adverse and beneficial effects to the physical, ecological, and socioeconomic environment. In general, the maximum reuse scenario potentially provides the most benefits since it results in recharging wellfields, improving ecological functions in Biscayne Bay Coastal Wetlands, and conserving the most water. Adverse effects to human health and ecological receptors from discharging the reclaimed water in the wellfields and the Biscayne Bay Coastal Wetlands must be ruled out before any large-scale effort is initiated. The maximum reuse scenario results in the highest impact on rate payers.

The medium and maximum reuse alternatives would result in significant construction and potential traffic impacts associated with pipeline construction. Canal recharge could impact flood control if not properly managed. The medium reuse alternative would result in direct recharge of the wellfields and provide high benefits, subject to confirmation that there are no significant health impacts.

The low reuse alternative has the least potential adverse impacts since the majority of the projects are not located in the most sensitive areas. There are a few parks or golf courses located in proximity of Biscayne Bay, but the application of reclaimed water is limited to irrigation.

The reformulated alternative also recharges the wellfields and offsets water consumption. It also provides beneficial effects to the coastal wetlands and improves wetland habitat and Biscayne Bay nearshore habitat. As with the maximum reuse alternatives, it is unknown whether residual microconstituents or phosphorous levels between 5 part per billion (ppb) to 10 ppb will have any adverse impact on Biscayne Bay Coastal Wetlands and adjacent area. Loading rates need to be confirmed for site-specific locations to prevent runoff and adverse impacts to vegetation.

ES.8 CONCLUSIONS AND RECOMMENDATIONS

Based on a review of all the alternatives, the least potential for water offsets using reclaimed water is at the NDWWTP and the greatest is at the SDWWTP. By 2012, the SDWWTP will have the capability to produce 112.5 MGD of public access reuse quality water. If pilot projects ascertain that this level of treatment is adequate for some reuse application, several projects may be implemented. The NDWWTP and CDWWTP only have limited capacity to treat to public access reuse quality water standards, and that capacity would need to be increased if additional public access reuse quality water is allowed or more extensive treatment upgrades would be required if more protective standards are deemed necessary. Implementation of projects in, or immediately adjacent to, WPAs (assuming a variance to Chapter 24-5 of the Code of Miami-Dade County is granted) will require each of the plants to incorporate advanced wastewater treatment technologies such as RO, microfiltration, and UV disinfection, among others. Also, projects such as the coastal wetlands rehydration, which are located adjacent to Biscayne Bay, would require nutrient removal in an effort to achieve very low nitrogen and phosphorus concentrations.

In conclusion, levels of reuse between 25% and 33% appear technically feasible, but projects need to be implemented in a manner affordable to the rate payers. Further assessment is needed for all projects, especially for groundwater recharge projects, canal recharge projects, and the coastal wetlands rehydration project; thus, pilot studies and additional data gathering efforts are proposed. Continued partnering is needed among FDEP, SFWMD, DERM and other agency stakeholders for successful reuse implementation. Further rate analysis is recommended to assess the impacts of different cost recovery strategies, and depending upon those efforts and in consideration of other

water and wastewater capital project costs, higher levels of reuse may be feasible and affordable. Additional engineering analysis, including value engineering, is recommended before projects are implemented. As a result of these additional efforts, and based on further input from stakeholders, it is likely that some of the projects listed will not be deemed feasible and additional opportunities will be identified.

In conjunction with these efforts, MDWASD will concurrently pursue other forms of alternative water supplies such as the use of the Floridan Aquifer to meet growth demands in the near future. Implementation of reuse projects will complement alternative water supplies for Miami-Dade County, creating a variety of sources from which to offset their water demands.

The following actions are recommended for the near future:

- Enhance current partnerships with DERM, FDEP, SFWMD, and other agency stakeholders. Based on experience, more formal partnering has proven to be beneficial in facilitating consensus building. This creates shared ownership and a vested interest in solving issues.

- Monitor the impacts of public access reuse irrigation at FIU on the groundwater. Also monitor the impacts of public access reuse aquifer recharge at the City of Homestead's WWTP RIT.

- Initiate the Aquifer Recharge pilot project. Provide a dual-stage package plant and analyze reclaimed water for microconstituents, nutrients, and drinking water standards, and monitor impacts to the groundwater.

- Initiate the Coastal Wetlands Rehydration Demonstration Project and begin biological and ecological baseline monitoring. This pilot effort will include the construction and operation of a state-of-the-art pilot WWTP and monitoring the effluent quality and the impact to the coastal wetlands and Biscayne Bay. Not only will the pilot effort help address the feasibility of applying reclaimed water to the Biscayne Bay Coastal Wetlands, the data from the treatment plant will help address the issues of microconstituents and the feasibility of supplying reclaimed water to the wellfield areas and canals.

- Reevaluate the designated WPAs for Southwest and West wellfields based on actual project pump rates to open up further opportunities for reuse.

- Conduct hydrogeologic investigations to confirm hydraulic loading rates for aquifer recharge projects most specifically in the area of the Metro Zoo, Tamiami Park, and FIU-University Park Campus. These are key sites/areas being considered for aquifer recharge.

- Determine/confirm water supply offsets. While conservative (low) estimates were made regarding water supply offsets, it is likely that modeling is needed to further address offsets, particularly for those projects outside WPAs. Some discussions between the SFWMD and MDWASD have already taken place.

- Further investigate and implement alternative water supplies. MDWASD will continue working with agency stakeholders to develop a plan for alternative water supply sources to offset future water demands. The plan will include offsets obtained by reuse practices as well as by other types of projects, such as use of Floridan Aquifer.

- Conduct additional preliminary rate analysis. While a present worth analysis was conducted for this study, it had to follow FDEP's criteria and is not necessarily consistent with how MDWASD assesses costs and develops rates. To further understand the implication of the costs on rates, different scenarios (varying impact fees and financing methods) should be evaluated. A more comprehensive rate analysis ultimately needs to be conducted, but a less intensive effort as suggested may be appropriate at this time.

- Refine the project list and implementation schedule. A list of possible projects has been identified in each alternative, but regulatory agencies are expected to provide additional input on each of these projects; some may be dropped and others added. Also, while assumptions have been made regarding phasing of projects, these may need to change based on the results of the alternative water supply investigation, subsequent efforts, and Miami-Dade County priorities.

- Initiate reuse implementation. Once the SDWWTP upgrades are completed in 2012, MDWASD will have 112.5 MGD of reclaimed water quality available. One project for consideration is the Goulds Park RIT or another site with an RIT so that the fate of nutrients and microconstituents can be further monitored. While site-specific conditions vary with location, this information will help assess the feasibility of using public access treated water in an RIT in closer proximity to Biscayne Bay, if data from the monitoring at the City of Homestead's facility are favorable. Based on reprioritization of projects, MDWASD should initiate the first phase of design for WWTP upgrades and distribution infrastructure. Also, the implementation of an MBR at Doral Golf Course, Amelia Earhart Park, or some other location in Miami-Dade County where a cluster of potential irrigation users exists, should be considered if public access reuse quality water is deemed acceptable. MDWASD should also evaluate the feasibility of separating the low chloride flows from the high chloride flows at the CDWWTP.

This study only evaluates the feasibility of reuse. Further assessments will be conducted in the Water and Wastewater Facilities Master Planning process that MDWASD is currently g. The information contained herein, and coupled with other efforts, will aid developing. Miami-Dade County in determining how to address future consumptive use issues and the quantities and types of reuse that can be implemented in Miami-Dade County.