

# 6 Alternative Reformulation

Based on additional input from FDEP, SFWMD, and DERM, further analysis of the low, medium and high reuse scenarios was conducted and reformulated reuse alternative was developed.

Based on FDEP guidelines, four different reuse alternatives (maximum reuse [Alternative A], medium reuse [Alternative B], low reuse [Alternative C], and no action [Alternative D]) were developed and discussed in Section 4 of this report. These alternatives were then evaluated in greater detail in Section 5. Following submittal of the draft version of this report, MDWASD solicited additional regulatory input and consensus from DERM, SFWMD, and FDEP to assess the feasibility of implementation and the permissibility of the reuse alternatives. As a result of this effort, many individual reuse projects were revisited and a fifth alternative was generated. This reformulated alternative, or Alternative E, combines projects and elements from all the previous reuse scenarios. This section presents Alternative E and incorporates information developed in the previous sections.

## 6.1 RATIONALE

A draft version of this Reuse Feasibility Study was submitted in May 2006 with the conclusion that Alternative D (low reuse scenario) was the only feasible option at that time. In addition to the physical constraints impacting reuse feasibility in Miami-Dade County, there was lack of consensus regarding treatment levels and risk associated with reuse implementation in certain locations. Pilot efforts were recommended in the draft report, along with consensus building efforts amongst the stakeholders, in order to explore higher levels of reuse further. The most feasible alternative in the draft plan (low reuse scenario) was the starting point for reuse and higher levels of reuse would still be pursued by MDWASD.

While there was not full concurrence on the level of reuse in the draft report, it helped focus attention on unresolved or conflicting issues and facilitated further input from FDEP, SFWMD, and DERM. Written comments from FDEP and the SFWMD were addressed through a series of meetings with the regulatory agencies. Appendix G includes FDEP and SFWMD comments along with responses. Input from DERM was also solicited and their participation in these meetings was key in bringing together local and state regulatory concerns. A workshop was held on September 19, 2006 to discuss specific issues and opportunities for reuse. 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. The SFWMD and 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.

Throughout this process, many local and state rules and regulations were revisited and discussed during the course of two to three months. Issues such as level of treatment, need for pilot studies, economic analysis, and water credit offsets were discussed. A full summary of the discussions is provided in Appendix G. Table 6.1-1 provides a summary of the conclusions reached regarding level of treatment for reuse along with the assumptions for this study. Since the SFWMD does not permit water quality issues, they deferred their discussions to the FDEP.

As a result of meetings and workshop and resolution of several key issues, the reuse alternatives were reassessed to develop a reuse alternative that would provide more reuse and could be implemented with a higher degree of certainty. As regulatory agencies provided more input, MDWASD re-evaluated which facilities yielded the greatest benefit for reuse. Additional meetings with stakeholders such as Miami-Dade Parks and Recreation Department, City of North Miami Beach, and the Village of Key Biscayne were conducted to re-evaluate the reuse projects within their areas and the potential schedule for implementation. During that time, MDWASD also initiated efforts on its Water Supply Master Plan. Planning for future water supply and the Reuse Feasibility Study are closely linked, thus coordination between the E & E team and the Water Master Plan Consultant (CDM) was essential. The most current approach for the MDWASD's Water Supply Plan (as of December 2006), along with the regulatory input obtained through the Reuse Feasibility Study created the need to develop a new alternative.

**Table 6.1-1. Summary of Treatment Conclusions and Reuse Feasibility Study Assumptions**

Type of Reuse	Requirements/Conclusions per FDEP	Requirements/Conclusions per DERM	Reuse Feasibility Study Assumptions
Irrigation outside WPA	Rule 62-610.460, Minimum treatment required: Public access (filtration and disinfection)	Concur with FDEP requirements	Filtration, disinfection (chlorination). RO at CDWWTP due to high chlorides
Irrigation within WPA	Rule 62-610.460, Minimum treatment required: Public access (filtration and disinfection) and 75-ft setback	Sec. 24-43, Sec. 24-42(1) & Sec. 24-28, will require a variance. Not recommended.	Filtration, disinfection (chlorination or UV), RO at CDWWTP due to high chlorides. Note, not in recommended plan.
Irrigation near private wells	Rule 62-610.460, Minimum treatment required: Public access (filtration and disinfection) and 75-ft setback	Sec. 24-42(1) & Sec. 24-28	Filtration, disinfection (chlorination). RO at CDWWTP due to high chlorides. Note, not in recommended plan.
Irrigation in proximity to Biscayne Bay	Rule 62-610.460, Minimum treatment required: Public access (filtration and disinfection)	Sec. 24-42(1), Sec. 24-28 & Sec. 24-48. Concur with FDEP, however, site specific conditions to be implemented (BMPs, engineering controls such as berms)	Filtration, disinfection (chlorination or UV). RO at the CDWWTP due to high chlorides. Note, structural BMPs to be installed.
Aquifer Recharge (RIT) outside WPA	Rule 62-610.525, minimum requirements public access (filtration and disinfection) plus meet primary and secondary drinking water standard. 500-ft setback from public water supply, 100-ft setback for non-pubic water supply	Sec. 24-42(1) & Sec. 24-28, DERM will support EQCB variance with advanced treatment for micronutrients removal or BAT and appropriate setbacks (e.g., from surface water bodies)	RO, microfiltration, disinfection (not chlorination due to byproducts concerns), advanced oxidation.
Aquifer Recharge within WPA	Rule 62-610.525, minimum requirements public access (filtration and disinfection) plus meet primary and secondary drinking water standard	Sec. 24-43, Sec. 24-42(1) & Sec. 24-28, will require a variance. Not recommended.	RO, microfiltration, disinfection (not chlorination due to byproducts concerns), advanced oxidation. Note, not in recommended plan.
Aquifer Recharge near private wells	Rule 62-610.525, minimum requirements public access (filtration and disinfection) plus meet primary and secondary drinking water standard	Sec. 24-42(1) & Sec. 24-28, advanced treatment for micronutrients removal or BAT	RO, microfiltration, disinfection (not chlorination due to byproducts concerns), advanced oxidation. Note, not in recommended plan.

**Table 6.1-1. Summary of Treatment Conclusions and Reuse Feasibility Study Assumptions**

Type of Reuse	Requirements/Conclusions per FDEP	Requirements/Conclusions per DERM	Reuse Feasibility Study Assumptions
Aquifer Recharge in proximity to Biscayne Bay	Rule 62-610.525, minimum requirements public access (filtration and disinfection) plus meet primary and secondary drinking water standard	Chapter 24-48 advanced treatment for micronutrients removal or BAT	RO, microfiltration, disinfection (not chlorination due to byproducts concerns), advanced oxidation. Note, not in recommended plan.
Canal Recharge	Rule 62-610.555(4), shall meet antidegradation policy (62-610.525(4)(f))	Sec. 24-42(1), Sec. 24-28 & Sec. 24-48 RO recommended, nutrient removal, meet surface water standards	Nutrient removal, RO, microfiltration, UV, advanced oxidation.
Biscayne Bay Coastal Wetlands	Rule 62-302.700 Outstanding Florida Waters. Recommend same treatment as CERP Reuse Pilot Technology Report for SDWWTP: nutrient removal, microfiltration, UV disinfection	Recommend same treatment as CERP Reuse Pilot Technology Report Chapter 24-48.	Contingent on Coastal Wetlands Rehydration Project. Assume: nutrient removal, microfiltration, UV, advanced oxidation.
Wetlands Rehydration Demonstration Project	Rule 62-610.555(4), shall meet antidegradation policy (62-610.525(4)(f))	Recommend same treatment and general location of project site as CERP Reuse Pilot Technology Report.	Assume: Nutrient removal, microfiltration, UV, advanced oxidation. A separate stream will also evaluate RO.

Key:

BMP = best management practices.  
CDWWTP = Central District Wastewater Treatment Plant.  
FDEP = Florida Department of Environmental Protection.  
RIT = rapid infiltration tank.  
RO = reverse osmosis.  
UV = ultraviolet.  
WPA = wellfield protection area.

## 6.2 REFORMULATED ALTERNATIVE

The reformulated alternative (Alternative E) includes concepts from the low (opportunities close to WWTPs), medium (recharge near wellfields) and high (Biscayne Coastal Wetlands) reuse scenarios discussed in Sections 4 and 5 with an emphasis on complete reuse at the SDWWTP. The projects grouped to form this alternative were based on the following:

- The types of reuse included urban irrigation, industrial use, rapid infiltration and wetland recharge.
- Small scale users in the North District (Southern Memorial Cemetery, the Justice Center, and Miami-Dade Fire and Rescue) were included because they are located in very close proximity to the NDWWTP and can be implemented within the first planning stages.
- All the wastewater treatment plants will require some degree of upgrading with the most extensive occurring at the SDWWTP where the greatest opportunities for reuse exist.
- Some reuse projects located in the CDWWTP service area will be supplied with reclaimed water from the SDWWTP to avoid routing large reuse lines from the CDWWTP through downtown Miami and out west.
- Several of the rapid infiltration projects are specifically located to recharge the New South Miami Heights and the existing Alexander Orr Wellfields outside the wellfield protection areas. The locations for the rapid infiltration trenches are shown as within the vicinity of the Metrozoo and Tamiami Park, respectively. These locations are subject to change based on site-specific hydrogeologic studies that support the recharge volumes for those areas. The rapid infiltration trenches proposed in this alternative are meant to be constructed within these general areas and additional evaluation is needed to determine the specific locations and dimensions of each trench. Additional discussion on these locations is included in Section 7 (Conclusions and Recommendations).
- Rapid infiltration trenches are located on County-owned property.
- The amount of water that is shown in this alternative for the Coastal Wetlands Rehydration project is the balance of the remaining wastewater effluent not reused for other purposes. The amount of effluent estimated at this time for the BBCW is approximately 50 MGD. However, in the event that recharge of coastal wetlands becomes more accessible, and if the CERP projects for Biscayne Bay Coastal Wetlands come into fruition within an expedited timeframe, this flow may change.

- The volume of the reject stream from RO treatment and microfiltration are expected to be 25% and 2%, respectively.
- The proposed transmission routes are located along existing rights-of-way and/or on other Miami-Dade County-owned land. A more detailed assessment of the transmission routing for all the alternatives will need to be conducted in a subsequent phase since there are a number of logistical constraints associated with pipeline installation (particularly large lines) in an urban area.
- Unlike Alternative C, MDWASD has opted not to include small-scale satellite treatment facilities in this alternative due to maintenance, regulatory compliance and siting issues. The latter issue could be the most controversial. Also note, the Miami-Dade Board of County Commissioners' policy is to consolidate their wastewater treatment facilities into centralized locations for more effective control and regulatory compliance assurance.

Table 6.2-1 shows the projects included in this alternative. Figure 6.2-1 shows the project locations. The total reuse volume for Alternative E amounts to 40.3% of the future total wastewater for 2025 (150.63 MGD). Figure 6.2-2 summarizes the type of reuse and corresponding volumes for this alternative.

Table 6.2-1. 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
<b>NDWWTP Wastewater Projected = 120 MGD</b>						
Process Reuse (existing)	2.13	Minimal <sup>1</sup>	2.13	No		Existing, does not count towards future offset
Florida International University (existing)	0.1	Minimal <sup>1</sup>	0.1	No		Existing, does not count towards future offset
North Miami Stadium Irrigation (99)	0.27	Minimal <sup>1</sup>	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 <sup>1</sup>	4.9	Yes	4.9	
City of North Miami Beach Vehicle Wash	0.1	Minimal <sup>1</sup>	0.1	Yes	0.1	
Biscayne Landings New Development Irrigation	1.5	Minimal <sup>1</sup>	1.5	Yes	1.5	
<b>Total NDWWTP</b>	<b>9.0</b>		<b>9.0</b>		<b>6.77</b>	
<b>CDWWTP Wastewater Projected = 142 MGD</b>						
Process Reuse (existing)	9.73	Minimal <sup>1</sup>	9.73	No		Existing, does not count towards future offset
Crandon Park (Golf Course) Irrigation (5)	0.7	Minimal <sup>1</sup>	0.7	Yes	0.7	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve
Key Biscayne Residential Irrigation	0.2	Minimal <sup>1</sup>	0.2	Yes	0.2	Currently using potable water Adjacent to Biscayne Bay Aquatic Preserve
<b>Total CDWWTP</b>	<b>10.63</b>		<b>10.63</b>		<b>0.9</b>	

Table 6.2-1. 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
<b>SDWWTP Wastewater Projected = 131 MGD</b>						
Process Reuse	4.25	Minimal <sup>1</sup>	4.25	No		Existing, does not count towards future offset
Groundwater Recharge Phase I: South Dade (Metrozoo Vicinity)	30	7.5 <sup>2</sup>	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 <sup>2</sup>	21.1	Yes	20	
Groundwater Recharge Phase III Alex Orr (Tamiami Park Vicinity)	21.1	5.3 <sup>2</sup>	15.8	Yes	15	
Coastal Wetlands Rehydration Project (Acceler8 & Coastal Wetlands full-scale)	46.5	0.93 <sup>3</sup>	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
<b>SDWWTP Total</b>	<b>131.0</b>	<b>21.2</b>	<b>110.16</b>		<b>53.0</b>	
<b>System-wide Total</b>	<b>150.63</b>	<b>21.2</b>	<b>129.53</b>		<b>60.67</b>	

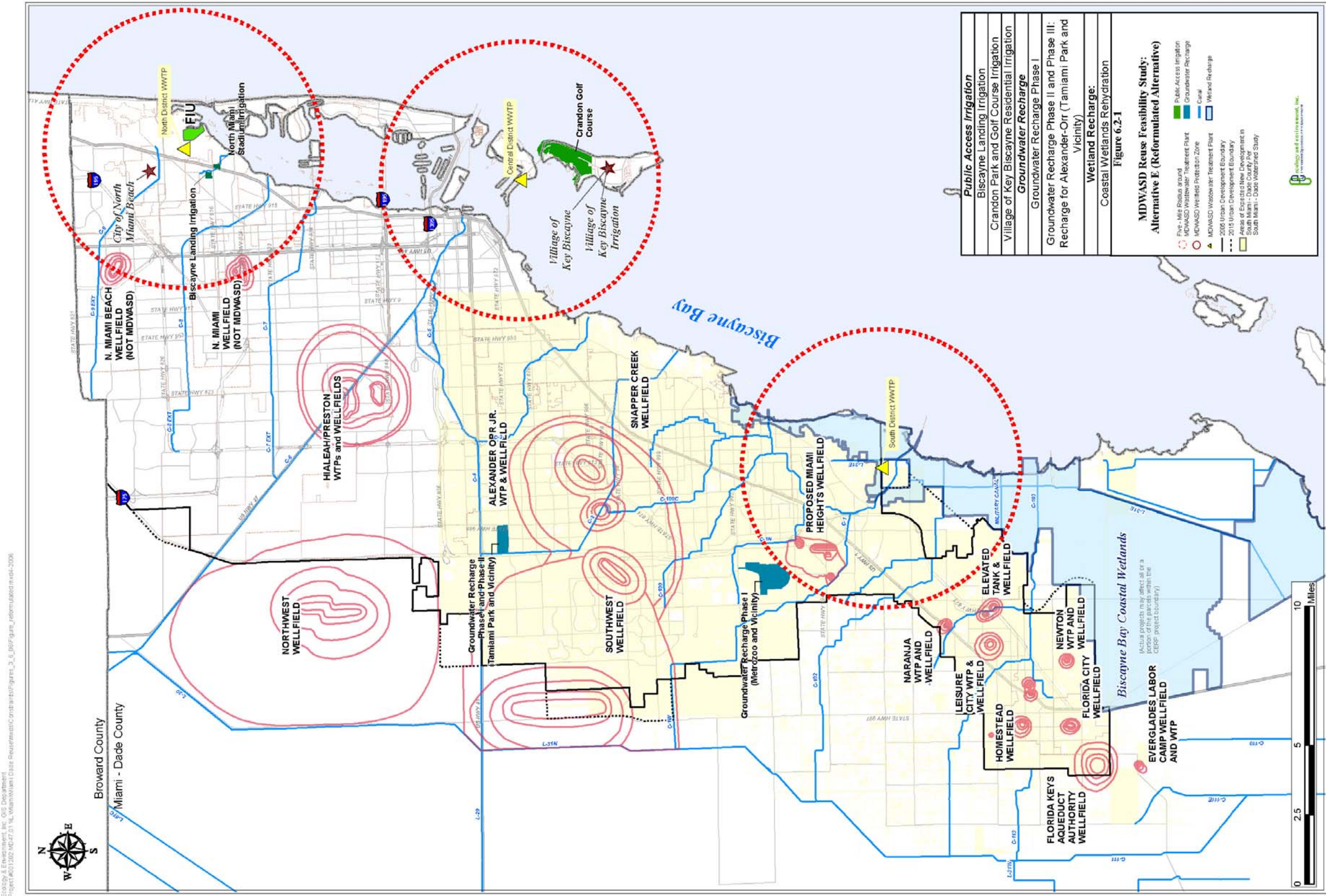
Notes:

- (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.





A "hard hat" label of "wetland" is not a jurisdictional determination, and the information is presented only for general consideration.

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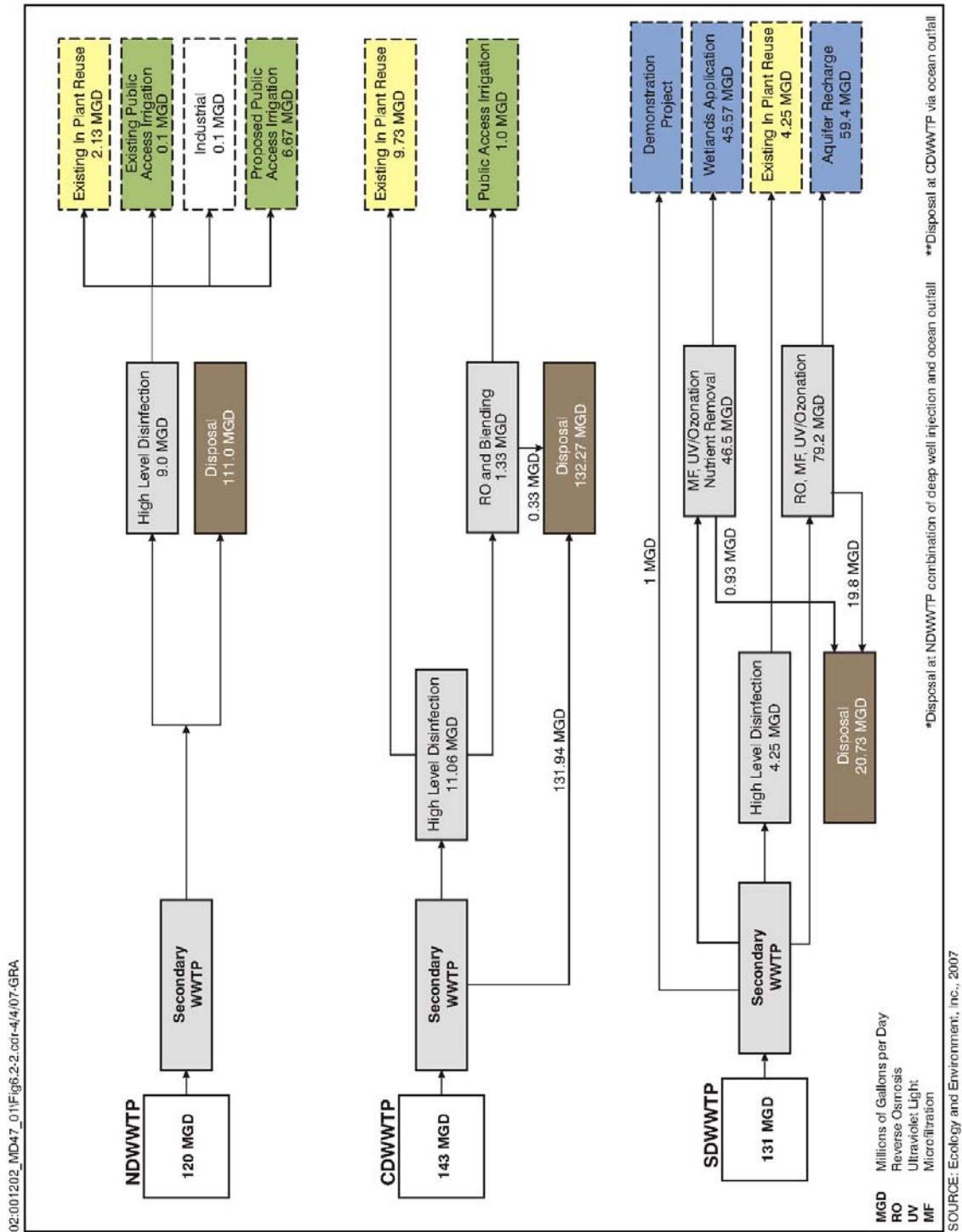


Figure 6.2-2 TYPES OF REUSE FOR ALTERNATIVE E (Reformulated Alternative)

Alternative E results in greater offsets for water supply than the low reuse scenario; however, given restrictions of recharging directly within the wellfield protection zones, limited availability of strategically located lands, and other physical constraints, this alternative will still not offset all the alternative water supplies needs. Table 6.2-1 incorporates the potential water supply offset for the reformulated alternative; however, the exact amount of offset still needs to be confirmed with the SFWMD.

The impacts associated with Alternative E are a cross between the low, medium and maximum reuse scenarios since some standard reuse projects are proposed along with aquifer recharge (notably outside the wellfield protection areas) and reclaimed water will be discharged to the Biscayne Bay Coastal Wetlands. Table 6.2-2 provides a summary of the impacts.

**Table 6.2-2. Environmental Impacts for Reuse Alternative E (Reformulated Alternative)**

	Beneficial	Adverse
<b>Physical</b>	Several projects directly recharge wellfields and offset water consumption. Results in reuse of a valuable and finite resource, water.	Potentially moderate construction and potential traffic impacts associated with pipeline construction for several SDWWTP projects. Hydraulic loading rates need to be confirmed for site specific locations to prevent runoff and adverse vegetation impacts.
<b>Ecological</b>	Recharge Biscayne Bay Coastal Wetland and improve wetland habitat and Biscayne Bay near shore habitat.	Unknown if residual microconstituents or phosphorous levels between 5 ppb to 10 ppb will have any adverse impact on Biscayne Bay Coastal Wetlands and adjacent area. Some irrigation and aquifer recharge projects located near Biscayne Bay. Impacts unlikely at treatment levels proposed and with BMPs implemented but additional review of impacts to OFWs may be required for select projects.
<b>Socioeconomic</b>	Helps resolve some of the water supply offsets for New South Dade and Alexander Orr Wellfields. Rate increases in comparison to Alternative A and B have less impact on Miami-Dade County residents.	Rate increase needed to cover costs. Also, additional alternative water supplies must be implemented to avoid moratorium on growth. Several projects may be in close proximity to private drinking water wells, and although treatment levels are high, additional review of human health impacts may be required.

Key:

BMP = Best Management Practice.

OFW = Outstanding Florida Waters

ppb = parts per billion.

SDWWTP = South District Wastewater Treatment Plant.



### 6.3 PRESENT VALUE ANALYSIS AND RESULTS OF REFORMULATED ALTERNATIVE E

As with the Alternatives detailed in Section 5, once the capital components were determined, the capital costs and annual operating and maintenance costs associated with each project were estimated.

Table 6.3-1 shows the costs estimated to implement this 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. However, there are certain baseline costs that would not be incurred if Alternative E were to be implemented. Specifically, the costs of filtration of 7 MGD in the North District WWTP, and 1 MGD in the Central District WWTP. The costs associated with these improvements are included in the no action alternative. Since Alternative E already includes these improvements, the savings from baseline in the table below are represented as a negative number, and are used to reduce the total Alternative E costs. The total construction cost (net of savings) results in \$941,239,666, and annual operating and maintenance expenses of \$83,764,570.

**Table 6.3-1. Alternative E Financial Analysis**

	Capital Costs	Operating and Maintenance
<b>Year 0</b>		
Demonstration Projects	500,000	37,500
<b>Years 1 - 5</b>		
Demonstration Projects	29,500,000	2,212,500
<u>North District</u>		
Treatment upgrades: filtration (7 MGD) / chlorination (3.3 MGD)	5,319,536	478,758
Pipeline	4,490,068	44,901
Pumps & housing	5,092,000	254,600
Storage	739,100	55,433
<u>Central District</u>		
Treatment upgrades: RO (1.25 MGD) / chlorination (1 MGD)	5,748,494	574,252
Pipeline	1,646,201	16,462
Pumps & housing	1,011,250	50,563
Storage	521,700	39,128
<u>South District</u>		
Treatment upgrades: microfiltration (30 MGD) / UV & ozonation (22.5 MGD)	146,242,500	15,627,825
Pipeline	45,028,230	450,282
Pumps / housing / generators	9,165,000	458,250
Storage	385,700	28,928
Reject disposal (7.5 MGD)	7,500,000	675,000

**Table 6.3-1. Alternative E Financial Analysis**

	Capital Costs	Operating and Maintenance
<b>Years 11 - 15</b>		
<u>South District</u>		
Treatment upgrades: microfiltration (61 MGD), RO (28 MGD), UV & ozonation (21.1 MGD), nutrient removal & UV (32 MGD)	184,755,100	20,595,367
Pipeline	32,960,400	329,604
Pumps / housing / generators	15,355,000	767,750
Storage	385,700	28,928
Reject disposal (8 MGD)	7,500,000	675,000
<b>Year 16 - 20</b>		
<u>South District</u>		
Treatment upgrades: microfiltration (36 MGD), RO (21 MGD), UV & ozonation (16 MGD), nutrient removal & UV (14 MGD)	124,022,000	13,642,960
Pipeline	10,203,300	102,033
Pumps / housing / generators	9,230,000	461,500
Storage	234,000	17,550
Reject disposal (5.3 MGD)	7,500,000	675,000
<b>Subtotal</b>	<b>655,035,279</b>	<b>58,300,072</b>
<b>Contingency (25%)</b>	<b>163,758,820</b>	<b>14,575,018</b>
<b>Engineering, Planning, Legal, Administration (20%)</b>	<b>131,007,056</b>	<b>11,660,014</b>
<b>TOTAL Alternative E</b>	<b>\$949,801,155</b>	<b>\$84,535,104</b>
<b>Savings from Baseline Costs if Implemented</b>		
North District Filtration (7 MGD)	(7,491,303)	(674,217)
Central District Filtration (1 MGD)	(1,070,186)	(96,317)
<b>TOTAL Alternative E – Net of Savings</b>	<b>\$941,239,666</b>	<b>\$83,764,570</b>

Key:

MGD = million gallons per day.  
RO = reverse osmosis.  
UV = ultraviolet.

## 6.4 ANALYSIS OF RATES AND FEES FOR REFORMULATED ALTERNATIVE E

An analysis of rates was performed using the same methodology and assumptions as the analysis employed for Alternatives A, B, and C. After determining the overall cost to provide service, possible revenues from potential reuse customers was considered, and an overall revenue shortfall was calculated. The increase in revenues needed to eliminate any shortfall was applied as a percentage across the board increase to average rates for all classes of both water and wastewater customers. The analysis indicates that the general revenue increase needed is not significantly higher than the increase for the minimum level of reuse (Alternative C). Table 6.4-1 shows the comparison of rates for all of the alternatives analyzed.

**Table 6.4-1. 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
<b>Year 5</b>						
Water and wastewater customers (average customer bill – 7,500 gallons per month)	\$34.92	\$45.62	\$41.67	\$42.33	\$41.81	\$43.81
<b>Year 10</b>						
Water and wastewater customers (average customer bill – 7,500 gallons per month)	\$34.92	\$67.51	\$61.13	\$61.77	\$51.99	\$54.52
<b>Year 15</b>						
Water and wastewater customers (average customer bill – 7,500 gallons per month)	\$34.92	\$81.22	\$70.24	\$62.90	\$52.99	\$61.48
<b>Year 20</b>						
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:

GPD = gallons per day.

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