5 Evaluation of Alternatives

> There are a number of factors that affect the feasibility of implementing reuse in Miami-Dade County including dense urbanization, sensitive environmental areas and a highly permeable shallow drinking water aquifer.

5.1 PRESENT VALUE ANALYSIS

In order to fully evaluate each of the alternatives, a financial analysis must be performed. As indicated in the FDEP's *Guidelines for Preparation of Reuse Feasibility Studies* (Guidelines), the appropriate analysis is a Present Value Analysis. This type of analysis results in a comparison of all costs associated with each alternative stated in today's dollars; thus, removing the time impact of money.

5.1.1 General

Based on the reuse alternatives described in Section 4, a preliminary hydraulic analysis was performed to determine the capital components for each alternative. Transmission requirements and pumping capacities were estimated using the reuse volumes for each project and their distance from the existing WWTPs. The transmission lines were assumed to be routed through existing rights-of-way. Similar to the existing MDWASD water distribution system, pump stations were sited in centralized locations rather than creating multiple nodes for transmission. The resulting system is generally composed of larger, yet fewer, pump stations. Appendix E provides an overview of the transmission and distribution system. Treatment upgrades were identified based on the water quality requirements for each alternative, currently-planned improvements for each plant, and existing treated wastewater effluent. These upgrades are discussed in further detail in Section 4.2.4.

Once the capital components were determined, the next step was to determine the capital costs associated with each project in each alternative, and the associated annual operating and maintenance costs. The cost savings due to reduction of water production, treatment, and distribution resulting from reuse implementation, were deducted from these additional costs.

Regardless of whether reuse is implemented, upgrades to the wastewater system including peak flow management measures and other infrastructure, such as new force mains or sanitary sewer lines, will be needed. Treatment upgrades to meet pending regulations for ocean outfalls and deep well injection disposal also have been incorporated into the analysis for all alternatives.

To estimate the capital costs, a variety of different sources were used. Prices were obtained from the actual costs incurred by the MDWASD, estimates from contractors, equipment manufacturers, from published construction cost data, and from the EPA *Technologies and Costs Document for the Final Long Term 2 Enhanced Surface Water Treatment Rule and Final State 2 Disinfectants and Disinfection Byproducts Rule*, 2005. The construction costs were then escalated to include a provision for engineering, planning, administration and legal services and contingencies. For this study, the escalation amount used was 45% (25% for contingencies and 20% for other fees).
At the request of FDEP, a baseline analysis representing those costs associated with MDWASD planned projects over the 20-year period was calculated and incorporated into each of the alternatives. The information for determining the capital costs for these projects was obtained from the "2006 - 2012 Capital Budget / Multi-Year Plan" (MYCP) adopted by MDWASD for the 2006 - 2007 Fiscal Year. Included in this document are projections for projects until the 2014 - 2015 Fiscal Year. Projects beyond this time period were projected using rounded average expenditures planned in previous years. This MYCP was reviewed by MDWASD staff to identify projects that were already included in the reuse alternatives in order to avoid duplication. For those cases, the costs of these projects were deleted, as well as projects that are funded from the Renewal and Replacement Fund.

5.1.2 Phasing of Construction Alternatives

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 wellfield protection areas or en route to wellfield protection areas.
- **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 for wetland recharge for the Maximum Reuse Alternative (Alternative A).

Studies and Demonstration Projects

To study potential impacts of reclaimed water applied in environmentally sensitive areas, test projects will be constructed. The initial investigation and design commenced in 2006 (Year 0 in the present value analysis), with construction and testing to be completed by Year 5. The cost estimate for the Coastal Wetland Reuse Rehydration Demonstration Project is approximately $20 million. The recharge pilot plant project is estimated at $1 million pending approval of a 20,000-GPD plant being acceptable to evaluate the full scale effect.

5.1.3 Present Value Analysis

Alternative A

Table 5.1.3-1 shows the costs incurred to implement the Maximum Reuse Alternative, following the phasing plan described in Section 5.1.2, excluding baseline costs detailed in Table 5.1.3-4, below. 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. A portion of the baseline costs would not be incurred if this alternative were to be implemented, specifically nutrient removal of 1.98 MGD in the NDWWTP. Since Alternative A already includes this nutrient removal, the cost can be reduced, or can be represented as a savings. In the table below, the total costs are reduced, 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.

Table 5.1.3-1. Alternative A Financial Analysis – Maximum Reuse (75%)

	Capital Costs	Operating and Maintenance
Year 0		
Demonstration Projects	$ 500,000	$ 37,500
Years 1 – 5		
Demonstration Projects	29,500,000	2,212,500
North District		
Treatment upgrades: filtration & UV disinfection (3.4 MGD)	7,191,202	787,662
Pipeline	4,167,240	41,672
Pumps & housing	2,685,000	134,250
Storage	165,000	12,375
South District		
Treatment upgrades: microfiltration & RO (34.8 MGD); UV & ozonation (21.6 MGD); microfiltration, UV & nutrient removal (1 MGD)	175,356,300	18,908,817
Pipeline	62,109,458	621,095
Pumps / housing / generators	12,140,000	607,000
Storage	1,715,000	128,625
RITs	1,542,240	77,112
Reject disposal (8.7 MGD)	7,500,000	675,000
Years 6 – 10		
North District		
Treatment upgrades: RO (43 MGD), UV & ozonation (32.25 MGD)	174,504,750	17,162,483
Pipeline	41,158,169	411,582
Pumps / housing / generators	8,500,000	425,000
Storage	2,335,700	175,178
RITs	1,479,408	73,970
Reject Disposal (10.75 MGD)	7,500,000	675,000
Central District		
Treatment upgrades: RO (3.2 MGD), UV (4.0)	20,071,200	2,117,280
Pipeline	55,583,260	555,833
Pumps / housing / generators	3,130,000	156,500
Storage	1,019,240	76,443

Table 5.1.3-1. Alternative A Financial Analysis – Maximum Reuse (75%)

	Capital Costs	Operating and Maintenance
South District		
Treatment upgrades: RO & microfiltration (65 MGD); UV & ozonation (49 MGD)	289,905,000	31,268,200
Pipeline	5,488,560	54,886
Pumps / housing / generators	4,505,000	225,250
Storage	385,700	28,928
RITs	4,568,648	228,432
Reject disposal (16 MGD)	15,000,000	1,350,000
Years 11 - 15		
North District		
Treatment upgrades: RO (34 MGD); UV & ozonation (25 MGD); microfiltration (57 MGD). Nutrient removal cost (56 MGD) included in baseline	182,530,000	20,313,924
Pipeline	8,276,400	82,764
Pumps / housing / generators	13,260,000	663,000
Storage / wet well	1,028,240	77,118
Reject disposal (10 MGD)	7,500,000	675,000
Central District		
Treatment upgrades: RO (93 MGD); UV (67 MGD); microfiltration (72 MGD); microfiltration & ozonation (71 MGD). Nutrient removal cost (71 MGD) included in baseline	376,660,600	40,037,854
Pipeline	70,314,684	703,147
Pumps / housing / generators	15,300,000	765,000
RITs	1,107,176	55,359
Storage	2,707,500	203,063
Reject disposal (25 MGD)	15,000,000	1,350,000
Year 16 - 20		
Central District		
Treatment upgrades: RO (46.5 MGD); microfiltration (35 MGD); UV, ozonation (34 MGD). Nutrient removal cost (34 MGD) included in baseline.	200,052,800	21,085,404
Pipeline	25,942,983	259,430
Pumps / housing	15,300,000	765,000
Storage	1,472,500	110,438
RITs	2,165,800	108,290
Reject disposal (12 MGD)	7,500,000	675,000
South District		
Treatment upgrades: microfiltration (51 MGD), UV & nutrient removal (50 MGD)	68,551,600	8,721,510
Pipeline	4,377,955	43,780
Pumps / housing	6,765,000	338,250
Storage	385,700	28,928
Subtotal	**1,965,905,013**	**176,290,828**
Contingency (25%)	491,476,253	44,072,707
Engineering, Planning, Legal, Administration (20%)	393,181,003	35,258,166
TOTAL Alternative A – REUSE COST ONLY	**$2,850,562,269**	**$255,621,700**

Table 5.1.3-1. Alternative A Financial Analysis – Maximum Reuse (75%)

	Capital Costs	Operating and Maintenance
Savings from Baseline Costs if Implemented		
Years 6 – 10		
North District - Nutrient Removal (1.98 MGD)	(950,400)	(178,200)
Contingency (25%)	(237,600)	(44,550)
Engineering, Planning, Legal, Administration (20%)	(190,080)	(35,640)
TOTAL Alternative A (net of savings)	**$2,849,184,189**	**$ 255,363,310**
TOTAL Baseline Costs (Alternative D)	**$1,956,764,167**	**$103,708,501**
TOTAL Alternative A plus baseline costs	**$4,805,948,356**	**$359,071,811**

Key:
MGD = million gallons per day.
RIT = rapid infiltration trench.
RO = reverse osmosis.
UV = ultraviolet.

Alternative B

Table 5.1.3-2 shows the costs incurred to implement the Medium Reuse Alternative, following the phasing plan described in Section 5.1.2. 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. However, a portion of the baseline costs would not be incurred if this alternative were to be implemented. Specifically, nutrient removal of 18.42 MGD in the North District would not be required if this reuse Alternative was 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.

Table 5.1.3-2. Alternative B Financial Analysis – Medium Reuse (50%)

	Capital Costs	Operating and Maintenance
Year 0		
Demonstration Projects	$ 500,000	$ 37,500
Years 1 - 5		
Demonstration Projects	29,500,000	2,212,500
North District		
Treatment upgrades: filtration & chlorination (3.3 MGD)	2,588,716	232,984
Pipeline	2,571,750	25,718
Pumps & housing	1,505,000	75,250
Storage	234,000	17,550
South District		
Pipeline	62,109,458	621,095
Pumps / housing / generators	3,640,000	182,000
Storage	165,000	12,375

Table 5.1.3-2. Alternative B Financial Analysis – Medium Reuse (50%)

	Capital Costs	Operating and Maintenance
Years 6 - 10		
North District		
Treatment upgrades: filtration / chlorination (13.5 MGD)	9,611,254	865,013
Pipeline	20,295,321	202,953
Pumps / housing / generators	7,560,000	426,750
Central District		
Treatment upgrades: RO (2 MGD)	9,102,000	910,200
Pipeline	129,043,579	1,290,436
Pumps / housing / generators	5,340,000	267,000
Storage	885,000	66,375
South District		
Treatment upgrades: RO, UV & ozonation (99 MGD)	347,391,000	34,044,120
Pipeline	5,488,560	54,886
Pumps / housing / generators	10,200,000	510,000
Storage	1,935,700	145,178
RITs	6,110,888	305,544
Reject Disposal (25 MGD)	15,000,000	1,350,000
Years 11 - 15		
Central District		
Treatment upgrades: RO & microfiltration (81 MGD), UV & ozonation. Nutrient removal cost (61 MGD) included in baseline.	346,840,000	37,480,020
Pipeline	71,193,144	711,931
Pumps / housing / generators	17,000,000	850,000
RITs	882,504	44,125
Storage	1,695,050	127,129
Reject disposal (20.5 MGD)	15,000,000	1,350,000
Year 16 - 20		
Central District		
Treatment upgrades: RO & microfiltration (31 MGD), UV & ozonation. Nutrient removal cost (24 MGD) included in baseline.	145,868,000	15,338,580
Pipeline	28,193,066	281,931
Storage	1,786,400	133,980
RITs	1,401,344	70,067
Reject disposal (7 MGD)	7,500,000	675,000
Subtotal	**1,308,136,735**	**100,918,189**
Contingency (25%)	327,034,184	25,229,547
Engineering, Planning, Legal, Administration (20%)	261,627,347	20,183,638
TOTAL Alternative B – REUSE COST ONLY	**$1,896,798,265**	**$146,331,374**
Savings from Baseline Costs if Implemented		
Years 6 – 10		
North District - Nutrient Removal (18.42 MGD)	(8,841,600)	(1,657,800)
Contingency (25%)	(2,210,400)	(414,450)
Engineering, Planning, Legal, Administration (20%)	(1,768,320)	(331,560)

Table 5.1.3-2. Alternative B Financial Analysis – Medium Reuse (50%)

	Capital Costs	Operating and Maintenance
TOTAL Alternative B (net of savings)	**$1,883,977,945**	**$ 143,927,564**
TOTAL Baseline Costs (Alternative D)	**$1,956,764,167**	**$103,708,501**
TOTAL Alternative B plus baseline costs	**$3,840,762,112**	**$247,636,065**

Key:
MGD = million gallons per day.
RIT = rapid infiltration trench.
RO = reverse osmosis.
UV = ultraviolet.

Alternative C

The costs associated with the Low Reuse Alternative are shown in Table 5.1.3-3. 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. However, a portion of the baseline costs would not be incurred if this alternative were to be implemented. Specifically, nutrient removal of 15.31 MGD in the North District and 5.14 MGD in the Central District would not be required if this reuse Alternative was 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.

Table 5.1.3-3. Alternative C Financial Analysis – Low Reuse (25%)

	Capital Costs	Operating and Maintenance
Year 0		
Demonstration Projects	$ 500,000	$ 37,500
Years 1 – 5		
Demonstration Projects	29,500,000	2,212,500
North District		
Treatment upgrades: filtration & chlorination (3.3 MGD)	2,588,716	232,984
Pipeline	2,571.750	25,718
Pumps / housing	1,122,500	56,125
Storage	191,000	14,325
Central District		
Treatment upgrades: MBR (5.5 MGD)	38,500,000	3,465,000
Land	400,000	20,000
Pipeline	435,600	4,356
Pumps & housing	1,912,500	116,875
Storage	828,240	62,118
South District		
Pipeline	59,452,298	594,523
Pumps / housing / generators	8,400,000	420,000
Storage	1,509,000	113,175

Table 5.1.3-3. Alternative C Financial Analysis – Low Reuse (25%)

	Capital Costs	Operating and Maintenance
Years 6 - 10		
North District		
Treatment upgrades: MBR (4.1 MGD); filtration & chlorination (6 MGD)	33,359,806	3,002,383
Land	400,000	20,000
Pipeline	3,272,074	97,636
Pumps / housing	4,250,000	32,720
Storage	1,140,000	85,500
Central District		
Treatment upgrades: RO (1.5 MGD)	6,826,500	682,650
Pipeline	4,327,660	43,276
Pumps / housing / generators	1,223,750	61,188
Storage	907,400	68,055
South District		
Treatment upgrades: RO& microfiltration (84 MGD); UV & ozonation (63 MGD)	376,984,000	39,843,760
Pipeline	6,708,240	67,082
Pumps / housing / generators	5,270,000	263,500
RITs	4,635,288	231,764
Reject Disposal (21 MGD)	15,000,000	1,350,000
Subtotal	**612,216,322**	**53,360,828**
Contingency (25%)	**154,054,081**	**13,340,207**
Engineering, Planning, Legal, Administration (20%)	**122,443,264**	**10,672,166**
TOTAL Alternative C – REUSE COST ONLY	**$887,713,667**	**$77,373,201**
Savings from Baseline Costs if Implemented		
Years 6 – 10		
North District - Nutrient Removal (15.31 MGD)	(7,348,800)	(1,377,900)
Central District - Nutrient Removal (5.14 MGD)	(2,467,200)	(462,600)
Contingency (25%)	(2,454,000)	(460,125)
Engineering, Planning, Legal, Administration (20%)	(1,963,200)	(368,100)
TOTAL Alternative C (net of savings)	**$873,480,467**	**$ 74,704,476**
TOTAL Baseline Costs (Alternative D)	**$1,956,764,167**	**$103,705,501**
TOTAL Alternative A plus baseline costs	**$2,830,244,634**	**$178,409,977**

Key:
MGD = million gallons per day.
RIT = rapid infiltration trench.
RO = reverse osmosis.
UV = ultraviolet.

Alternative D

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. As presented in Table 5.1.3-4, the costs associated with Alternative D represent an additional cost that will be incurred in all of the above alternatives.

Table 5.1.3-4. Alternative D Financial Analysis – No-Action Alternative

	Capital Costs
Years 1 - 5	
Systemwide	
Treatment Improvements	7,426,917
Pipeline Improvements	24,751,179
Pumps / Housing / Generators Improvements	48,753,249
General Improvements	16,824,197
North District	
Treatment Improvements	1,239,834
Pipeline Improvements	2,217,441
Pumps / Housing / Generators Improvements	535,513
Central District	
Treatment Improvements	4,920,259
Pipeline Improvements	2,911,488
Pumps / Housing / Generators Improvements	15,332,390
South District	
Treatment Improvements	284,626,864
Pipeline Improvements	21,818,559
Pumps / Housing / Generators Improvements	54,717,562
Years 6 - 10	
Systemwide	
Treatment Improvements	146,204,892
Pipeline Improvements	77,786,234
Pumps / Housing / Generators Improvements	25,460,571
General Improvements	40,280,812
North District	
Treatment Improvements	2,068,966
Pipeline Improvements	11,063,983
Pumps / Housing / Generators Improvements	15,103,448
Central District	
Treatment Improvements	40,545,674
Pipeline Improvements	65,252,151
Pumps / Housing / Generators Improvements	59,217,241
South District	
Treatment Improvements	113,100,690
Pipeline Improvements	6,758,621
Pumps / Housing / Generators Improvements	20,551,724
Years 11 - 15	
Systemwide (not broken down by district)	
Treatment Improvements	10,344,828
Pipeline Improvements	26,896,552
Pumps / Housing / Generators Improvements	17,241,379
General Improvements	3,448,276

Table 5.1.3-4. Alternative D Financial Analysis – No-Action Alternative

	Capital Costs
Year 16 - 20	
Systemwide (not broken down by district)	
Treatment Improvements	10,344,828
Pipeline Improvements	26,896,552
Pumps / Housing / Generators Improvements	17,241,379
General Improvements	3,448,276
Subtotal	**1,225,332,529**
Contingency (25%)	**306,333,132**
Engineering, Planning, Legal, Administration (20%)	**245,066,506**
SUB-TOTAL Alternative D	**$ 1,776,732,167**
Additional Costs for Disposal - Years 6 - 10	
North District	
Treatment Improvements - high level disinfection (20 MGD), nutrient removal (98 MGD)	61,280,000
Central District	
Treatment Improvements– nutrient removal (131 MGD)	62,880,000
Subtotal - Additional Costs for Disposal	**124,160,000**
Contingency (25%)	**31,040,000**
Engineering, Planning, Legal, Administration (20%)	**24,832,000**
Total Additional Costs for Disposal	**$ 180,032,000**
TOTAL ALTERNATIVE D	**$1,956,764,167**

Key:
MGD = million gallons per day.

5.1.4 Present Value Methodology

The methodology prescribed in the Guidelines was followed to perform the Present Value Analysis. Below is a description of the key assumptions and analysis factors:

- The required analysis period is 20 years, extending from the period of 2007 – 2026.
- Construction is assumed to have a duration period of 3 years, following a 2-year engineering and planning phase.
- The No-Action Alternative (Alternative D) includes all wastewater costs in the Multi-Year Capital Plan (MYCP), plus an estimate of additional wastewater costs for remaining years as described in section 5.1. Additional costs for upgrading treatment for future regulations governing deep well

injection and ocean outfall were also incorporated. Alternative D is considered the baseline cost.

- The Discount Rate applied to bring the construction dollars to present time is 5.125% for the fiscal year ended September 2006, published in the Federal Register December 2005. Capital costs have been stated in 2006 dollars, with no escalation for future inflation, as prescribed by the Guidelines.

- Salvage Values are shown as a source of revenue at the end of the 20-year analysis period. This is calculated as the remaining, undepreciated book value of the specific asset. The specific depreciation lives are listed below.

- Depreciation is calculated using the straight-line method. The depreciation lives used, as prescribed in the Guidelines, are:

  - Piping – 50 years
  - Structures (including tanks) – 30 years
  - Process equipment and pumps – 15 years
  - Auxiliary equipment – 10 years
  - Land – not depreciated

- Revenues are calculated using the quantity of reuse associated with the sale of reclaimed water to customers. For customers who currently use, or are projected to use, potable water, the fee used is $1.00 per thousand gallons. For customers who currently use private wells, the fee applied is $.25 per thousand gallons. The current customer is projected to continue to pay $0.18 per thousand gallons. The calculation is included in Table 5.1.4-1. Further discussion about rates and charges is provided in Section 5.2.

- Impact Fees may be collected from new customers connecting to the new reclaimed water system. A rate of $1.00 per gallon per day is used. The calculation is included in Table 5.1.4-1. Further discussion about Impact Fees is included in Section 5.2.

- Water Savings is calculated using the quantity of reuse associated with reclaimed water use that replaces potable water currently used that is identified in each alternative. This amount was then multiplied by $0.64, the average operating and maintenance cost of water supply, pumping, treatment, transmission and distribution for the fiscal year ended September 30, 2005. These calculated totals were phased in as construction was completed and reuse implemented. The calculation is shown in Table 5.1.4-1.

Table 5.1.4-1. Summary of Reclaimed Water Impact Fees, Revenues, Water Cost Savings

Fee	Impact Fees $1.00	Revenues: Potable Water $1.00	Revenues: Private Wells $0.25	Revenues: Current Users $0.18	Cost Savings $0.64
ALTERNATIVE A					
Existing					
Quantity (MGD)				0.10	
Total (000s)				$7	
Year 5					
Quantity (MGD)	10.39	10.39	4.44		10.39
Total (000s)	$10,390	$3,792	$405		$2,427
Year 10					
Quantity (MGD)	1.50	2.40	16.21		2.40
Total (000s)	$1,500	$876	$1,479		$561
Year 15					
Quantity (MGD)	1.03	1.03	14.42		1.03
Total (000s)	$1,030	$376	$1,316		$241
Year 20					
Quantity (MGD)	-	-	0.05		-
Total (000s)	$0	$0	$5		$0
Totals (A)	**$12,920**	**$5,044**	**$3,205**	**$7**	**$3,228**
ALTERNATIVE B					
Existing					
Quantity (MGD)				0.10	
Total (000s)				$7	
Year 5					
Quantity (MGD)	10.39	10.39	4.44		10.39
Total (000s)	$10,390	$3,792	$405		$2,427
Year 10					
Quantity (MGD)	1.50	2.40	11.49		2.40
Total (000s)	$1,500	$876	$1,048		$561

Table 5.1.4-1. Summary of Reclaimed Water Impact Fees, Revenues, Water Cost Savings

Fee	Impact Fees $1.00	Revenues: Potable Water $1.00	Revenues: Private Wells $0.25	Revenues: Current Users $0.18	Cost Savings $0.64
Year 15					
Quantity (MGD)	1.03	1.03	5.93		1.03
Total (000s)	$1,030	$376	$541		$241
Year 20					
Quantity (MGD)	-	-	0.05		-
Total (000s)	$0	$0	$5		$0
Totals (B)	**$12,920**	**$5,044**	**$1,999**	**$7**	**$3,228**
ALTERNATIVE C					
Existing					
Quantity (MGD)				0.10	
Total (000s)				$7	
Year 5					
Quantity (MGD)	11.42	11.42	7.90		11.42
Total (000s)	$11,420	$4,168	$721		$2,668
Year 10					
Quantity (MGD)	1.50	2.40	8.39		2.40
Total (000s)	$1,500	$876	$766		$560
Year 15					
Quantity (MGD)	-	-	-		-
Total (000s)	$0	$0	$0		$0
Year 20					
Quantity (MGD)	-	-	-		-
Total (000s)	$0	$0	$0		$0
Totals (C)	**$12,920**	**$5,044**	**$1,487**	**$7**	**$3,228**

Key:
MGD = million gallons per day.

5.1.5 Present Value Results

The summary of results of the present value analysis is shown below on Table 5.1.5-1, with the baseline costs included in each alternative. The present value, applying the methodology required by the Guidelines, indicates an expected increase as the level of reuse increases. These results are consistent with and without the cost savings associated with potable water saved.

Table 5.1.5-1. Summary of Present Value Analysis (000's)

	Without Water Savings	With Water Savings
Alternative A	$3,267,057	$3,242,155,
Alternative B	$2,431,261	$2,406,359
Alternative C	$2,214,449	$2,188,449
Alternative D	$1,409,034	$1,409,034

5.2 FUNDING AND FINANCING

5.2.1 General

Plans for funding and financing reuse systems can include several significant sources. The most likely sources available to the MDWASD include:

Revenue Bonds, which are repaid from an identified revenue source, would include the utility revenues from sales of water, wastewater and reuse services. The bonds are tax-exempt, and in order to maintain this status, there are additional requirement with respect to timing of the use of the funds. This type of financing has generally been the most common form used by the MDWASD in the past.

The State Revolving Fund (SRF) Loan Program is a program administered by FDEP that provides potentially significant cost savings compared to traditional Revenue Bond financing. It can be expected that the interest rate applied to the SRF loan will be approximately 60% less than Revenue Bond market rates. The allocation to eligible projects state-wide is done by FDEP each year in July, and the allocation to any one applicant is dependent upon the availability of funds and the amount of total eligible projects. Although the reporting required by FDEP to obtain funds is considered extensive, the MDWASD has used SRFs in the past and is equipped to meet the record-keeping and reporting requirements.

Senate Bill 444 provides a new source of funds in a program providing grants matched by and administered by the local water management districts to support the development of alternative water supplies. Reuse projects are considered eligible projects. The amount of funding available is extremely limited; however, the program warrants serious consideration.

Direct funding by state and/or federal agencies for certain projects is anticipated. However the magnitude and adequacy of such funding will be explored as specific plans proceed.

Fees for new connections ("Impact Fees" and "Connection Fees") provide a source of funding for all capital projects providing additional capacity. This option is addressed in more detail in Section 5.2.2

Customer user charges must be adequate to fully fund the ongoing operation of the utility, and to meet the requirements of bond holders.

Other innovative funding options that may warrant further investigation include public/private partnerships and partnerships with municipal utilities.

5.2.2 Analysis of Rates and Fees

The impact of each alternative on the community of rate payers is a critical consideration of the analyses. The Guidelines require worksheets that have been completed for each alternative evaluated, and are included in Appendix B. It should be noted that pursuant to the Guidelines, the salvage values and the value of the water saved for each alternative are excluded.

The concept of ratemaking is to fairly apportion costs in an equitable manner to all of the customers. Traditionally, the allocation of costs has been exclusively to reclaimed water recipients with the remainder to wastewater customers. Customarily, the portion charged to reclaimed water customers considers the actual cost of service weighed against the willingness of the customer to receive the reclaimed water for the price indicated. The general test has been to ensure that the reuse rate is low enough to guarantee that reuse could be effectively used as an effluent disposal method.

In more recent years, reclaimed water has been recognized more as a valuable commodity and an alternate water supply. For this reason, the use of reclaimed water in Miami-Dade County is undoubtedly a benefit to the entire community. The apportionment of the cost of reuse must recognize this in order to ensure that it is done in an equitable manner. The methodology and mechanics employed to perform this apportionment can only be done fairly in a full cost allocation study.

Table 5.2.2-1 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. It should be noted that the FDEP worksheets consider recovery from only reuse customers and wastewater customers. Furthermore, the rates included in the worksheets are only for major users and residential users. 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 many 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 5.2.2-1. 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

Although the correct allocation among customers can only be done through an in-depth study, for demonstration purposes only, Tables 5.2.2-2, 5.2.2-3, and 5.2.2-4 show the impact of possible allocation scenarios in Years 5, 10 and 20 which expands the customer base. These tables show 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 5.2.2-2. Year 5 – Demonstration of Possible Allocation of Costs/Impact on Rates and Fees

	FY 2006	Alternative A	Alternative B	Alternative C	Alternative D
Impact Fees (per GPD)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Major Users (per thousand gallons)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Minor Users (per thousand gallons)		$0.25	$0.25	$0.25	
Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$45.62	$41.67	$42.33	$41.81

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

Table 5.2.2-3. Year 10 – Demonstration of Possible Allocation of Costs/Impact on Rates and Fees

	FY 2006	Alternative A	Alternative B	Alternative C	Alternative D
Impact Fees (per GPD)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Major Users (per thousand gallons)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Minor Users (per thousand gallons)		$0.25	$0.25	$0.25	
Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$67.51	$61.13	$61.77	$51.99

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

Table 5.2.2-4. Year 20 – Demonstration of Possible Allocation of Costs/Impact on Rates and Fees

	FY 2006	Alternative A	Alternative B	Alternative C	Alternative D
Impact Fees (per GPD)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Major Users (per thousand gallons)		$1.00	$1.00	$1.00	
Reclaimed Water Fee Minor Users (per thousand gallons)		$0.25	$0.25	$0.25	
Water and wastewater customers (average customer bill – 7,500 gallons per month)	$34.92	$90.89	$76.21	$65.66	$55.41

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

It should be noted that this rate projection does not include rate increases or decreases that may be warranted over the years as a result of other capital programs, or changes in expenses. These tables are intended to show only the incremental impact of the reuse projects in each alternative for comparative purposes. Table 5.2.2-5 shows a comparison of rates for each alternative in Year 10 with other utilities across the country. The rates for other utilities were obtained from the MDWASD Budget for FY 2005 – 2006.

Table 5.2.2-5. Comparison of Rates for Average Customer

City or County	Rate
Atlanta GA	$82.22
San Diego CA	75.14
Boston MA	68.73
Miami-Dade FL Alternative A (Yr 10)	67.51
Miami-Dade FL Alternative C (Yr 10)	61.77
Miami-Dade FL Alternative B (Yr 10)	61.13
St. Petersburg FL	61.04
Broward County FL	59.53
Houston TX	59.25
San Francisco CA	58.32
Philadelphia PA	55.15
Miami-Dade FL Alternative D (Yr 10)	51.99
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
Charlotte NC	43.40
Orlando FL	36.97
Palm Beach County FL	35.75
Miami-Dade FL (FY ending 9/1/2006)	**34.92**
Indianapolis IN	32.86
Chicago IL	18.26

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

5.3 TECHNICAL FEASIBILITY

In accordance with FDEP guidelines, the technical feasibility of each alternative must be considered. As stated in the guidelines, feasibility does not equate with selecting the least costly alternative. The primary definition of feasible is "capable of being carried out" with a secondary definition of "capable of being used or dealt with successfully." Implementing a project successfully carries some cost considerations though. Lack of funding or excessively high user rates to fund the project, may hinder a project altogether. Also, a project must be permittable if it is to be carried out; thus, regulatory agency approval is an important part of the technical feasibility. Outside of cost, the following are some of the key technical issues that have an impact on feasibility:

- Geographical constraints;
- High chlorides at the CDWWTP;
- Treatment of microconstituents in wastewater;
- Treatment to public access standards;

- Reuse in wellfield protection 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.

5.3.1 Geographical Constraints

The eastern portion of Miami-Dade County is highly urbanized and is located between two highly protected National Parks: ENP and BNP. To the east of Miami-Dade County is the State-designated Biscayne Bay Aquatic Preserve which is comprised of 69,000 acres of state submerged land in Biscayne Bay. The waters within ENP, BNP, the Biscayne Bay Aquatic Preserve, and their natural tributaries are all designated as OFWs and, as such, receive a high level of regulatory protection.

The entire area overlies the highly permeable and shallow Biscayne Aquifer, which is the sole water supply for Miami-Dade County. These natural features require consideration of higher levels of treatment for reclaimed water, some of which would result in treatment levels matched by only a handful of WWTPs in the nation. The highly urbanized nature of Miami-Dade County increases distribution costs and increases the difficulty of reuse implementation. These constraints must be recognized in context with those faced by other counties across the State of Florida that may be smaller in scale. Costs to implement wastewater reuse in Miami-Dade County will be higher than in many other parts of the state. Issues related to these costs and constraints have been considered in each of the alternatives.

5.3.2 High Chlorides at the CDWWTP

In the past, high chlorides in the CDWWTP effluent have been a limitation for reuse implementation. This obstacle could be addressed by treating with RO. Compared to the NDWWTP and SDWWTP, when considering only chlorides, these treatment processes would result in higher costs in order to meet public access reuse water quality standards at the CDWWTP.

5.3.3 Treatment to Public Access Standards

Following a number of stakeholder meetings and workshops, DERM expressed concern about public access quality for reuse applications recharging the aquifer given the highly permeable nature and shallowness of the Biscayne Aquifer. For aquifer recharge, DERM recommends mirofiltration, treatment with RO, UV disinfection, and advanced oxidation.

Since advanced oxidation can be achieved through various treatment options such as peroxide or ozonation, it is recommended that further assessment be conducted to determine the most effective treatment technologies for aquifer recharge projects and to evaluate the potential impacts to sensitive areas. Since increased levels of treatment are likely required, the cost of reuse for aquifer recharge projects will be somewhat higher.

A monitoring plan for existing reuse projects can be implemented to evaluate the impacts of using public access quality reclaimed water for irrigation and aquifer recharge. These projects include the existing reuse at FIU and the City of Homestead RIT system. The data can be used to finalize treatment technologies on a project-by-project basis if necessary.

5.3.4 Treatment of Microconstituents in Wastewater

As requested by DERM, 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 microconstituents such as pharmaceutical residuals typically found in wastewater. Microconstituents are unregulated constituents and very few WWTPs across the country currently treat for them.

The most effective process known for microconstituents treatment removes approximately 97% of the known constituents and results in very high-quality reclaimed water. Currently, there is a lack of data regarding the effects of the remaining constituents (mostly at trace levels) and the potential for cumulative effects. Additional microconstituent effluent data will be needed at each WWTP and a risk analysis may be required. To address these concerns, an aquifer recharge pilot study is proposed to assess the effectiveness of the treatment process (microfiltration, RO, UV disinfection, advanced oxidation) in removing microconstituents. The effluents at the NDWWTP and CDWWTP will also be analyzed and evaluated for microconstituents.

It is possible that less extensive levels of treatment may be required for some projects. Conversely, any project that impacts a wellfield or Biscayne Bay will probably require treatment for microconstituents to address public and regulatory concerns.

5.3.5 Reuse in Wellfield Protection Areas

Currently, Chapter 24, the Miami-Dade County Environmental Protection Ordinance, does not specifically list the discharge of reclaimed water or the reuse of treated wastewater as an acceptable operation in a wellfield protection area, nor does Chapter 24 prohibit the use of reclaimed water in a wellfield protection area. In order to allow reuse within designated wellfield protection areas, an EQCB variance is required, making it more difficult to implement and permit reuse within WPAs. This option is less feasible at this time.

Reuse outside a wellfield protection area designed to recharge the wellfield may be allowed as long as there are adequate levels of treatment. To address potential concerns about water quality and potential impacts to the aquifer, an aquifer recharge pilot project will be implemented outside of the wellfield protection areas to determine the required level of treatment to recharge the wellfields.

5.3.6 Impact of Antidegradation Standards for Biscayne Bay Coastal Wetlands

Florida Administrative Code requires that the discharge of reuse water to surface waters must meet both the reclaimed water or effluent limits contained in Chapter 62-650, F.A.C., and the requirements of the antidegradation criteria contained in Rules 62-4.242 and 62-302.300, F.A.C. Biscayne Bay is an OFW and all discharges to Biscayne Bay must meet Class III and OFW Water Quality Criteria antidegradation criteria. Specifically, the water quality from any discharge into Biscayne Bay must be sufficient to prevent degradation of the ambient waters of Biscayne Bay.

The proposed coastal wetlands rehydration demonstration pilot project will provide site-specific data that will help identify the required treatment train to achieve antidegradation standards for Biscayne Bay. Water quality goals for Biscayne Bay are extremely rigid, particularly for phosphorus, which is currently set at 5 ppb. Treatment to this low level may not be readily achieved at the end of pipe. Current technologies can achieve phosphorus levels of 8 to 10 ppb. Based on conversations with various manufacturers of water treatment systems, phosphorous levels at these low ranges have been achieved with varying levels of consistency; thus, further assurances or demonstrations are needed that the resulting levels are still protective of Biscayne Bay. Antidegradation criteria also may apply to microconstituents. The best available technology may need to be used for treatment, but even this technology may result in residual microconstituents.

Many stakeholders are interested in using reclaimed water to rehydrate the Biscayne Coastal Wetlands, provided the discharge does not cause adverse impacts to the receiving waters. Previous evaluations of this reuse option, as part of CERP, recommended that a pilot study be undertaken to assess treatment effectiveness, treatment reliability, and ecological impacts. MDWASD is using the CERP Reuse Technology pilot effort as a guide to model the Biscayne Bay Coastal Wetland Rehydration Demonstration project.

5.3.7 Canal Recharge

Efforts are currently ongoing between DERM, FDEP and the SFWMD to assess water quality requirements for canal recharge. It appears that high levels of treatment will be necessary. Per FDEP rules, the reclaimed water would be subject to a WQBEL. At the high levels of treatment proposed (such as RO, UV, advanced oxidation, and nutrient removal), a WQBEL would be less involved and should not discourage MDWASD in providing reuse for canal recharge. Uncertainties still remain as to whether or not the more stringent antidegradation standards for Biscayne Bay will be applied to canal recharge.

As requested by Miami-Dade County, it is assumed that the reclaimed water will be treated to very high levels, including treatment for microconstituents and nutrient removal. Further assessment is needed since the location of discharge, reclaimed water volume, and operational procedures for canal recharge could determine that less significant levels of treatment would satisfy the water quality requirements.

5.3.8 Implementation of Urban Irrigation

In highly developed areas of Miami-Dade County, providing reclaimed water to select larger irrigation users is much more practical than supplying the same volume to thousands of small-scale users, due to pipeline distribution considerations, increased traffic disruptions and costs. For areas that have yet to be developed, there are fewer complications associated with installing reuse piping. Integrating reuse into the new development can be accomplished more readily. Thus, the focus of the areas considered in this feasibility study are large properties with irrigation needs (i.e., golf courses and county-owned parks) in existing urbanized areas and along the urban development centers where much of the new growth is expected to occur in south Miami-Dade County. An option for areas where development is expected and where reuse pipes are to be installed is to define mandatory reuse zones that encompass a certain extent of land located in close proximity to the new reuse infrastructure (purple pipes). Within these areas, reuse for irrigation of lawns and other public access areas would be mandatory.

Many of the golf courses and parks in Miami-Dade County irrigate using their own wells, so there is little incentive to use reclaimed water. To address this situation, Miami-Dade County may need to adopt an ordinance requiring major irrigation users, such as golf courses and parks, to convert to reclaimed water if it is available, or provide reclaimed water to the users at a lower cost than that incurred by Miami-Dade County.

5.3.9 Implementation of Agricultural Irrigation

In the reuse study conducted in 1998, agricultural reuse was considered technically unfeasible due to a shift to more row crops and the lack of incentives for farmers to use reclaimed water. Row crops could not be irrigated with reuse water. The most viable opportunity was associated with using reclaimed water on tropical fruits, particularly lime trees which relied heavily on drip irrigation. However, due to economic conditions and citrus canker outbreaks, limes now comprise a much smaller percentage of the tropical fruits grown in Miami-Dade County and are scattered over a large area. Currently, avocados make up 70% of the tropical fruits and use irrigation methods that result in water contact with the fruit. Brooks Tropicals, a company that grows the majority of the avocados in south Miami-Dade County, maintains they have strict requirements from their buyers and cannot irrigate with reclaimed water.

There is currently a general concern from the farmers regarding the use of reclaimed water. They have concerns about the availability of reclaimed water and access to their existing water sources, since their livelihood depends on a continuous supply for irrigation and freeze protection. Farmers currently do not incur usage costs (such as meter use) for their water supply, but are responsible for the costs of their water supply wells and associated infrastructure. They have reservations regarding additional costs that might be incurred if they are required to use reclaimed water and when changing their existing irrigation infrastructure and irrigation practices.

While most of the farming community's concerns could potentially be resolved, the biggest complication of implementing agricultural reuse is that the agricultural area is in constant flux. There is an ongoing conversion of agricultural land to urban development, and planning for reuse with those conversions is difficult. Also, crop diseases and economic conditions can quickly change the type of crops grown and location of those crops. Thus, providing reclaimed water to a farm that grew limes one year may not be possible the next year (or years) since the farmer may be forced to switch to another type of crop that could not use reclaimed water.

5.3.10 Hydrogeologic Considerations for Rapid Infiltration Trenches

Geologic conditions are expected to vary from site to site, and site-specific analysis will be required to confirm application rates. Also hydrogeologic analyses need to be completed for projects located in natural forest communities, such as Kendall Indian Hammocks and Castellow Hammocks Preserve, to determine any changes to the water table resulting from reuse projects and assess the potential impacts to the root zone of the plant species present in the area. For Castellow Hammocks, this will also help determine any impact to surrounding farms, which are also susceptible to changes in groundwater levels. Avocadoes, in particular, are greatly impacted by over-watering in the root zone. For Castellow Hammocks, an alternative exists within Fruit and Spice Park, which is a few blocks away, but is also County-owned and has enough area for RITs.

It is expected that areas in the southern portion of Miami-Dade County will be more permeable than the northern portion of Miami-Dade County, and this has been taken into consideration in the application rates utilized for this study. However, the actual rates may differ than what has been assumed in this study and could impact the feasibility if significantly less water can be discharged to the aquifer.

The design concept for RITs is to extend the trench well into the limerock similar to what has been done for the City of Homestead Wastewater Treatment facility. By doing so, moderately high levels of recharge (0.2 to 0.8 MGD per acre of infiltration area) should be viable.

5.3.11 Installation of Large-Diameter Pipelines in Highly Urbanized Areas

While this issue has not been discussed in previous reuse feasibility studies, it must be recognized that large-diameter pipelines will be needed for certain segments of reclaimed water lines. For example, at the CDWWTP, over 8 miles of 84-inch pipeline is needed to route the reclaimed water west. Most of these 8 miles is highly urbanized. While some of the difficulties in handling a large-diameter pipeline have been considered in the cost, many constraints could affect the final routing and ultimate costs.

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

- **Alternative A (Maximum Reuse):** This alternative incorporates a combination of projects including projects that are very distant from the regional treatment plants, projects within wellfield protection areas, as well as canal recharge. The installation of large-diameter pipes for transmission and distribution in highly developed areas results in very high costs. Bringing reclaimed water from Virginia Key across Biscayne Bay, from the CDWWTP, presents additional limits to constructability for this alternative. As discussed above, there are a number of regulatory concerns regarding some of the other reuse applications in this alternative. Several initiatives are proposed to further assess the feasibility of options, including pilot studies for wetland application and aquifer recharge. 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 (Medium Reuse):** The medium reuse alternative includes a number of irrigation and aquifer recharge projects in the wellfield protection area, 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, this reuse alternative is not feasible at this time.

- **Alternative C (Low Reuse):** The low reuse scenario relies predominantly on urban irrigation and aquifer recharge, coupled with a small amount of industrial usage, and is the most technically feasible option of the four considered at this time. All projects are located in areas outside of wellfield protection areas. Several irrigation projects are within 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 US-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 but does include increased treatment needs for ocean outfall and deep-well injection. In consideration of the desires by 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 it results in any offsets to future water supplies.

Initial analysis indicates that the low, and possibly the medium, reuse alternatives could be absorbed by the customers as long as the projects are implemented in a phased approach and the highest level of treatment is not required for all projects. While rate increases are already needed to cover the approximately $2.0 billion proposed for wastewater projects in the Multi-Year Capital Plan for improvements not associated specifically with reuse, it is expected some additional rate increase and impact fees could be viable to successfully implement at least 25% to 50% reuse based on the assumptions used in this feasibility study. The costs for the high reuse scenario will be somewhat more difficult to absorb. However, depending on bond financing, low interest loans, grants and federal funds, the implementation of impact fees, and a more detailed rate analysis, maximum levels of reuse could be possible. If the highest level of treatment is not required for all or most projects, a larger number of reuse projects may be implemented. Note that a regional western WWTP may need to be constructed if pipeline routing constraints prove too difficult for the medium and maximum reuse alternatives. The cost effectiveness of an additional regional plant has not been considered in this study. It is important that whatever is implemented is done so in a fiscally and technically sound manner, and regulatory agency desires are balanced with reasonable costs.

Based on the information presented above, the low reuse is the only option that is currently feasible. However, a goal of at least 40% to 50% reuse is reasonable if the technical issues can be 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.

5.4 ENVIRONMENTAL ASSESSMENT

The FDEP Guidelines also require that the environmental impacts of each alternative be considered. This includes both adverse and beneficial impacts to the physical, ecological, and socioeconomic environment. In general, the highest reuse scenario potentially provides the most benefits since it results in recharging the wellfield, 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 directly in the wellfield protection areas and into the Biscayne Bay Coastal Wetlands must be ruled out before any large-scale effort is initiated. The maximum reuse scenario results in the highest cost and, thus, the highest impact on rate payers. Costs for reuse can be distributed to a large pool of water and sewer customers. However, in comparison to other large communities, Miami-Dade County has one of the highest numbers of people per capita below the poverty level, and such a rate increase must be carefully structured to minimize socioeconomic impact.

The medium and maximum reuse alternatives include very high levels of treatment since there are discharges within or adjacent to wellfield protection areas, in canals/surface waters, and/or in coastal wetlands near Biscayne Bay. This high level of treatment is needed to minimize adverse impacts. The medium reuse alternative results in direct recharge of the wellfields and provides 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 sensitive areas. There are a few parks or golf courses located in proximity of Biscayne Bay, but the application of reclaimed water is limited; thus, concerns about Biscayne Bay should be limited. Furthermore, the Coastal Wetlands Rehydration Demonstration project will provide the highest levels of treatment and controlled discharges.

Table 5.4-1 provides a summary of the environmental impacts of each alternative.

Table 5.4-1. Environmental Impacts

Reuse Alternative	Physical		Ecological		Socioeconomic	
	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse
Alternative A (Maximum Reuse)	Many projects directly recharge wellfields and offset water consumption. Results in reuse of a valuable and finite resource, water.	Significant construction and potential traffic impacts associated with pipeline construction. Canal recharge could impact flood control if not properly managed. Hydraulic loading rates need to be confirmed for site specific locations to prevent runoff and adverse vegetation impacts.	Recharge Biscayne Bay Coastal Wetland and improve wetland habitat and Biscayne Bay nearshore 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 or related to canal recharge. Impacts unlikely at treatment levels proposed but additional review of impacts to OFWs may be required for select projects.	Resolves most or all consumptive use issues and ensures continued water supply.	High costs may require rates that may not be publicly acceptable. Human health impacts of discharging highly treated reclaimed water directly in wellfield has not been resolved and additional review of those impacts may be required.
Alternative B (Medium Reuse)	Many projects directly recharge wellfields and offset water consumption. Results in reuse of a valuable and finite resource, water.	Significant construction and potential traffic impacts associated with pipeline construction. Canal recharge could impact flood control if not properly managed. Hydraulic loading rates need to be confirmed for site specific locations to prevent runoff and adverse vegetation impacts.	None.	Unlikely at the treatment levels proposed but some irrigation or aquifer recharge projects near Biscayne Bay or related to canal recharge. Additional review of impacts to OFWs may be required for select projects.	Resolves most or all consumptive use issues and ensures continued water supply.	High costs may require rates that may not be publicly acceptable. Human health impact of discharging highly treated reclaimed water directly in wellfield has not been resolved. Also, several projects may be in the vicinity of private wells and although treatment levels are high, additional review of human health impacts may be required.

Table 5.4-1. Environmental Impacts

Reuse Alternative	Physical		Ecological		Socioeconomic	
	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse
Alternative C (Low Reuse)	Limited ground-water recharge benefits. Provides some water consumption offsets. Results in reuse of a valuable and finite resource, water.	Only moderate construction and potential traffic impacts associated with pipeline construction.	None.	Unlikely but a few projects near Biscayne Bay. Additional review of impacts to OFWs may be required for select projects.	Rate increases in comparison to Alternative A and B have the least 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.
Alternative D (No-Action)	None.	Loss of a potential water resource.	None.	Discharge via ocean outfall may have localized ecological or water quality effects.	No rate increase associated with additional reuse.	Moratorium on growth and potential reduction of current allocations if alternative water supplies are not implemented. In violation of FDEP guidance if some level of reuse is feasible.

Key:
OFW = Outstanding Florida Waters.
ppb = parts per billion.
FDEP = Florida Department of Environmental Protection.

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