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CH2MHILL

July 30, 2008

Mr. Mark Charneski
Florida Department of Environmental Protection
South District
2295 Victoria Avenue, Suite 364
Fort Myers, FL 33902

Subject: Marco Island Utilities 2008 Capacity Analysis Report

Dear Mr. Charneski:

On behalf of Marco Island Utilities, we are pleased to submit this Capacity Analysis Report for the Marco Island water treatment system (PWS ID: 5110183). This report is submitted in accordance with F.A.C 62-555.348 and in response to a letter from Elin Jackson of the Florida Department of Environmental Protection dated February 8, 2008.

If you require additional information or have any questions, please call me at 239-596-1715 ext. 59205.

Sincerely,

CH2M HILL

Joseph R. Elarde, P.E.
Project Engineer

c: A. Rony Joel, City of Marco Island
Jeffrey Poteet, City of Marco Island
Bruce Weinstein, City of Marco Island

Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

PREPARED FOR: City of Marco Island

PREPARED BY: CH2M HILL

DATE: July 28, 2008

1.0 Introduction

The City of Marco Island Utilities Department (MIU) operates two water treatment plants (WTP) on Marco Island that are permitted with the Florida Department of Environmental Protection (FDEP) under PWS ID Number 5110183. They are the North Water Treatment Plant (NWTP), which treats raw water from Marco Lakes surface water supply using lime softening and filtration, and the South Water Treatment Plant (SWTP), which desalts brackish groundwater using reverse osmosis (RO). The permitted operating capacity of the NWTP is 6.67 million gallons per day (mgd) and the permitted capacity of the SWTP is 6.0 mgd, for a total WTP production capacity of 12.67 mgd. The two WTPs supply water to the Marco Island service area.

The 2007 maximum day demand of the service area was 12.49 mgd, or 98.6 percent of the permitted operating capacity of 12.67 mgd. Per Florida Administration Code (FAC) Section 62.555.348 "Planning for Expansion of Public Water System Source, Treatment, or Storage Facilities", the FDEP requires an annual capacity analysis report (CAR) for water systems when the total maximum-day quantity of finished water produced by all WTPs connected to a water system exceeds 75 percent of the total permitted maximum-day operating capacity of the system, and the maximum day demand is projected to exceed the permitted capacity within 5 years.

This CAR evaluates the capacities of the source, treatment, and storage facilities connected to the Marco Island water system, and contains the following information:

- The maximum-day and annual average daily quantities of finished water produced by each WTP during each of the past ten years;
- Projected service area total water demands – total annual average daily demand and total maximum-day demand, including fire-flow demand, and projected total finished-water storage needed, including fire storage, for the next ten years;
- The capacity of each WTP's source water facilities and treatment facilities, the permitted maximum-day operating capacity and, if applicable, permitted peak operating capacity of the WTP facilities, and the useful capacity of each finished water storage facility;

- An estimate of the time remaining before the maximum-day water demand, including fire-flow demand, exceeds the current total permitted maximum-day operating capacity of the WTPs, and an estimate of the time remaining before the finished-water storage needs, including fire storage, exceed the existing total useful finished-water storage capacity;
- Recommendations for new or expanded source, treatment, or storage facilities, if required; and
- A recommended schedule showing dates for design, permitting, and construction of recommended new or expanded source, treatment, or storage facilities, if required.

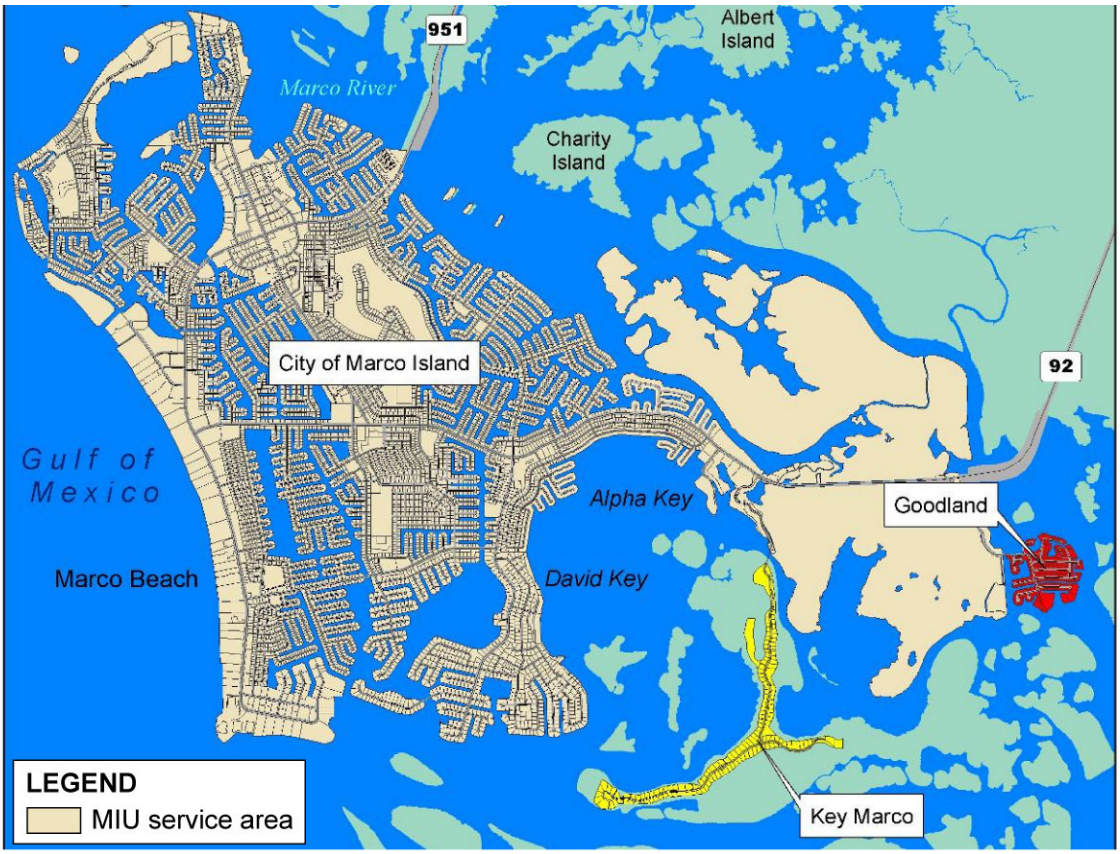
This updated 2008 Marco Island Water Treatment Facilities CAR evaluates the existing capacity of water system's source water, treatment, and storage facilities relative to projected future water demands, and discusses the potential expansion of existing facilities to reliably meet the projected service area water demands through 2017. WTP operating data through December 2007, previous capacity analysis reports, updated residential and commercial development unit data, population projections, and planned reuse system expansion plans have been utilized to write this report. Development planning information was obtained from MIU and the City Public Works Department. WTP facilities design and operating capacity information was obtained from the 2007 CAR, other available technical reports, and interviews with MIU WTP operating staff. This 2008 Marco Island Water Treatment System CAR meets the requirements of FDEP rule 62-555.348.

2.0 Potable Water Service Area

The Marco Island potable water service area includes all of the incorporated City of Marco Island except Key Marco, and is shown in Exhibit 1. The service area contains a mix of single family homes, multi-family developments including condominiums and timeshares, and commercial units including restaurants, hotels, municipal, recreational, and institutional facilities. Exhibit 2 shows the current and projected development units in the service area and effective population equivalent during the peak season.

The City of Marco Island (City) has an interconnection with Collier County (County) for bulk sale of potable water. Each year, the City sells the County bulk finished water and the County distributes the water through direct sales to customers in the Goodland and Key Marco developments. It is very likely that this arrangement will continue in the future, as these areas are too far away from the County's own water system distribution lines to be serviced by the County.

EXHIBIT 1
Marco Island Water Service Area
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report



2.1 Water Service Area ERC Counts and Water Demands

In March 2005, a count was made of all residential development units on Marco Island, empty but buildable lots, and planned but unoccupied or unbuilt condominiums. Exhibit 2 shows the number of development units in 2005 and at build out based on this count. The following changes have been made to the unit counts for the 2008 CAR:

1. Goodland and Key Marco units are now shown as "Collier County Bulk" in Exhibit 2. The water demands of these areas had been included in the total water demands shown in previous years' CARs, and continue to be part of the past and projected water demands shown in this CAR. However, the number of Goodland units had not previously been included in the unit count, have now been estimated based on the Collier County bulk water sales in 2005, and are included in the Collier County Bulk unit count along with the Key Marco units.

2. In the 2007 CAR, 674 existing Timeshare units were inadvertently included in both the Hotel/Timeshare and Multi-Family counts. The Timeshare units are now only included in the Multi-Family counts.

3. Restaurants have been shown in a separate row, since the conversion factor for restaurant units to ERCs is significantly different than the other commercial units.

4. In 2007, one of the major hotels on Marco Island was bought by a developer who is replacing its 280 hotel rooms with 219 timeshare units. The hotel rooms were removed from use in 2007, resulting in a drop in hotel room ERCs for the year. It is estimated that the new timeshare units will be using water in 2009. This also results in a change in the build out levels of these two types of units.

EXHIBIT 2
Marco Island Water Service Area - Land Use and Estimated Peak Season Population
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Land Use	2005 Units	Estimated 2005 Population[1]	Build Out Units	Estimated Build Out Population[1]
Single Family	6,765	12,700	8,704	16,340
Collier County Bulk	491	920	596	1,120
Multi-Family; Condominium; Timeshare	10,297	19,330	10,932	20,515
Hotel Rooms	1,359	2,550	1,079	2,025
Commercial	2,516	-	2,516	-
Restaurants	120	-	120	-
Government/Municipal	136	-	136	-
Total	21,684	35,500	24,083	40,000

[1]Estimate of effective population equivalent during peak season that results in maximum day demand, used for information only. The average equivalent population factor is estimated to be 1.88 capita per dwelling unit.

The Marco Island service area is nearing build out unit and population levels. Approximately 78 percent of the estimated 9,300 buildable lots for single family homes in the Marco Island service area, Goodland, and Key Marco have been developed. The number of existing single family homes in 2007 was essentially unchanged from 2006, as the number of City tear-down permits in 2007 was nearly equal to the number of building permits. Including multi-family units, condos, and timeshares, water is now provided to 87 percent of the planned build out residential units. Including commercial development (near 100 percent in zoned areas), current land use is about 90 percent of build out.

An equivalent residential connection, or ERC, has a water demand equivalent to one residential single family home. Single Family and Collier County units are weighted at 1.0 ERC/unit in this study. Multi-family, condo, and timeshare units are weighted at 0.8 ERC/unit. Hotel and Government/Municipal ERC equivalents were estimated by dividing known water use by a gpd/ERC ratio equivalent to that of one residential ERC. Commercial units were given an ERC weighting from the City's ERC factor tables. The ERC equivalents of the units shown in Exhibit 2 are presented in Exhibit 3. Non-restaurant Commercial units had been inadvertently left out of the unit-to-ERC conversion in last year's CAR, and the ERC equivalents of those units and the Goodland units have now been added to Exhibit 3. A record of the new water connections added in each year from 2004

through 2007 was available, and used to estimate ERC counts in 2004, 2006, and 2007 from the base year 2005. Total ERC counts prior to 2003 were estimated and are unchanged from the previous year's CAR.

EXHIBIT 3
Marco Island Water Service Area 2005-2007 Year-end ERC and Projected Build Out ERC
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Land Use	ERC per Unit	2005 ERC	2006 ERC	2007 ERC	Build Out ERC
Single Family	1.0	6,765	6,866	6,866	8,704
Collier County Bulk	1.0	491	498	498	596
Multi-Family; Residential Condo; Timeshare	0.8	8,238	8,360	8,360	8,746
Hotel Rooms	0.57	775	775	615	615
Commercial	0.227	571	571	571	571
Restaurants[1]	9.1	1,092	1,092	1,092	1,092
Government/Municipal	2.03	276	276	276	276
Total		18,207	18,438	18,278	20,600

[1] Average 100 seats/restaurant; 0.091 ERC/seat

Exhibit 4 shows the recorded water demands and ERC for the past 10 years. Past ERC counts and gpd/ERC usage for 2003 to 2007 have been adjusted from last year's CAR to include Goodland and Commercial ERCs and to remove the extra timeshare ERCs.

EXHIBIT 4
Marco Island Service Area 1998-2007 Water ERC and Water Demand Data
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Year	Water ERC at Year End[1]	Average ERC During Year	ADD (mgd)	Average Usage (gpd/ERC)[1]	MDD (mgd)	Ratio MDD/ADD
1998	14,747	14,562	7.06	485	11.58	1.64
1999	15,115	14,931	6.59	442	10.49	1.59
2000	15,484	15,299	7.58	495	12.03	1.59
2001	15,852	15,668	7.26	463	11.96	1.65
2002	16,221	16,037	7.38	460	12.19	1.65
2003	17,323	16,772	8.05	480	11.27	1.40
2004	17,899	17,611	8.26	469	10.96	1.33
2005	18,207	18,053	7.85	435	11.49	1.46
2006	18,438	18,323	8.26	451	11.28	1.37
2007	18,278	18,358	7.94	433	12.49	1.57
2003-2007 Average				453		1.43

ADD = annual average daily demand; MDD = maximum day demand; gpd = gallons per day
[1]2003-2006 ERC Counts and gpd/ERC usage have been revised to include ERC equivalents for Collier County bulk sales and correct past timeshare and commercial unit counts and ERCs.

2.2 Future ERC Projections and Future Water Demands

2.2.1 Future ERC Projections

The current halt in growth in southwest Florida is expected to continue through 2008. Year-end and average ERC estimates were made for years 2009 through 2017 based on the ERC count in the water service area on December 30, 2007, and the development of the remaining buildable lots and planned multi-family units at a rate of 300 ERC per year starting in 2009. This is somewhat lower than the average rate of growth during the 10 years prior to 2007. The number of ERC at build out is estimated to be 20,600, as shown in Exhibit 3.

2.2.2 Future Water Demands

Future annual average daily water demands (ADD) were calculated based on the projected future ERC counts and a water usage of 453 gpd/ERC, which was the average usage during the past 5 years. The projected maximum day water demands were calculated using an MDD/ADD ratio of 1.45, which is slightly higher than the average ratio from 2003 to 2007. Projected ERC counts and ADD and MDD flows are shown in Exhibits 5 and 6. The projections indicate that if Marco Island adds 300 ERC per year starting in 2009, the existing

WTP system capacity will be exceeded in early 2012, when the highest seasonal demands occur, and therefore the WTP system should be expanded by the end of 2011. Build out could be reached in 2016, and the MDD is projected to level out at about 13.5 mgd.

2.2.3 Impact of Expanded Reuse

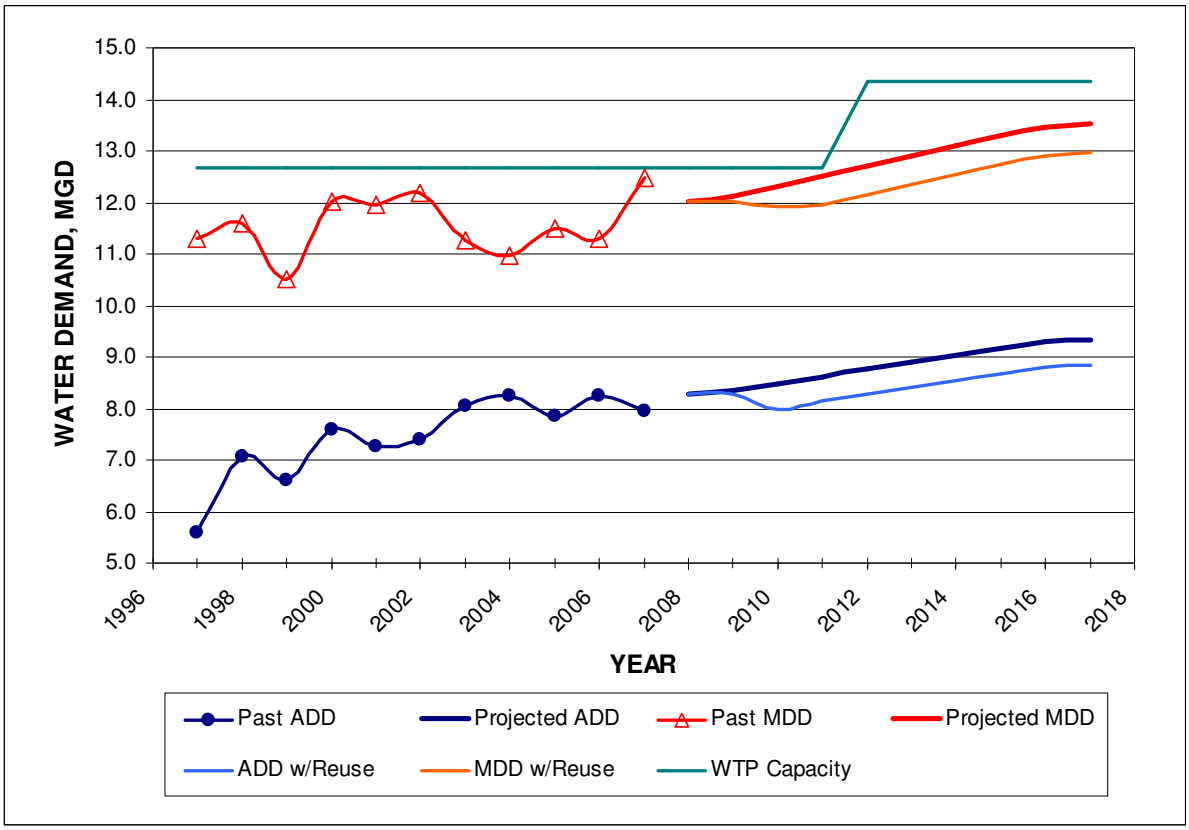
At the present time, an average annual flow of 0.48 mgd of potable water, and about 0.56 mgd on a maximum flow day, is used for irrigation by condominiums near the existing Marco Island reuse (reclaimed) water main. MIU is planning to connect additional condominiums to the reuse system and add 500,000 gallons of reuse water storage to reduce potable water demand. The expanded reuse project construction was underway in 2008, and some reclaimed water will start being used by these condominiums in late 2008. Exhibits 5 and 6 show the impact on potable water demand of using this added reclaimed water for irrigation (Condo Reuse). The total potable water demand will be reduced by the total amount of reclaimed water projected to be used on average flow and maximum flow days.

EXHIBIT 5
Marco Island Service Area 2008-2017 Projected Water Demands
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Year	Projected Water ERC at Year End	Projected Avg. ERC during year	Projected ADD (mgd)	Projected MDD (mgd)	Adjusted ADD[1] with Condo Reuse (mgd)	Adjusted MDD[1] with Condo Reuse (mgd)
2008	18,278	18,278	8.28	12.01	8.28	12.01
2009	18,578	18,428	8.35	12.10	8.27	12.02
2010	18,878	18,728	8.48	12.30	8.00	11.92
2011	19,178	19,028	8.62	12.50	8.14	11.94
2012	19,478	19,328	8.76	12.70	8.27	12.13
2013	19,778	19,628	8.89	12.89	8.41	12.33
2014	20,078	19,928	9.03	13.09	8.54	12.53
2015	20,378	20,228	9.16	13.29	8.68	12.72
2016	20,600	20,489	9.28	13.46	8.80	12.90
2017	20,600	20,600	9.33	13.53	8.85	12.97

[1]Adjusted for planned expansion of the existing reuse system to include condominiums that currently use drinking water for irrigation. Adjusted ADD and MDD flows are based on measured flows from 2004-2006 irrigation flow meters.

EXHIBIT 6
Marco Island Service Area Past and Projected Water Demands
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report



Currently, there is not enough reuse water available to meet the additional maximum day irrigation demand from the condominium irrigation systems. MIU is therefore expanding its wastewater collection system and the capacity of its Marco Island water reclamation facility to increase the production of reclaimed water. The additional reclaimed water will become available gradually over the next four years. The average 0.48 mgd of irrigation demand will be supplemented by potable water on maximum irrigation demand days until 2012, when sufficient reclaimed water will be generated to meet these maximum demands.

3.0 Raw Water Supply

The water use permit (WUP) for Marco Island lists three raw water sources: fresh surface water from Marco Lakes; recovered water from aquifer storage and recovery (ASR) wells located next to Marco Lakes; brackish groundwater from the Mid-Hawthorn aquifer wellfield on Marco Island. Marco Lakes receives it water from Henderson Creek.

The WUP annual allocation from all three sources (Marco Lakes, ASR wellfield, Mid-Hawthorn wellfield) is 4,535 MG, or an average of 12.42 mgd. The maximum month withdrawal limit for direct use from Marco Lakes and the brackish wellfield is 381 MG, or an average of 12.7 mgd (30-day month). ASR well recovered water can be used to supplement these maximum month withdrawals as needed, but is specifically limited on an annual basis to 1,600 MG.

The NWTP uses the Marco Lakes fresh water and water recovered from the ASR wells, while the SWTP uses the water from the Mid-Hawthorn wellfield.

3.1 NWTP Raw Water Supply

The Marco Lakes raw water facility is located 8-9 miles north of the NWTP and includes the following major components:

- Marco Lakes (A & B)
- A connection to Henderson Creek that is controlled by a sluice gate that can be opened to allow additional creek water into the lakes from June 1 to November 30 if Henderson Creek is above +3.5 NGVD. This additional water is used exclusively for ASR storage. The ASR well storage water is not separately limited by annual or monthly allocations.
- One 500,000-gallon ground storage tank (GST) for on-site storage of raw or recovered ASR water
- An ASR system, including seven (7) ASR wells, each with an injection capacity of 1.5 mgd per well (10.5 mgd total), and each with a dedicated pump capable of recovering and sending 1.5 mgd per well (10.5 mgd total) to the GST.
- Two 5,000 gpm (14.4 mgd total) vertical turbine raw water transfer pumps that can transfer raw water from the lake to the GST.
- Two 3,100 gpm (8.93 mgd total) vertical turbine raw water transfer pumps that can transfer raw water from the lakes to the GST or to the ASR system. MIU intends to replace these pumps with larger pumps to meet the full injection capacity of the ASR system. Pump replacement is planned for 2009.
- Five high pressure centrifugal raw water pumps with a total capacity of 23,900 gpm that can transfer raw water from the GST to the NWTP. The total firm capacity of the pumps is 19,375 gpm (27.9 mgd). However, the maximum velocity and pressure drop in the transmission main limits the maximum raw water flow to the NWTP to about 10.5 mgd.

Exhibit 7 shows an aerial view of the Marco Lakes raw water facility, including Marco Lakes, the ASR wells, and the GST and pumping facility location.

The WUP has a specific annual withdrawal limit of 1,935 MG (5.3 mgd annual average) from Marco Lakes for direct transfer to the NWTP. In addition, there is a specific annual withdrawal limit of 1,600 MG from the ASR wells. ASR withdrawals are typically made in the dry season between December 1 and May 31. This is equivalent to an average withdrawal of 8.79 mgd during that 182 day period.

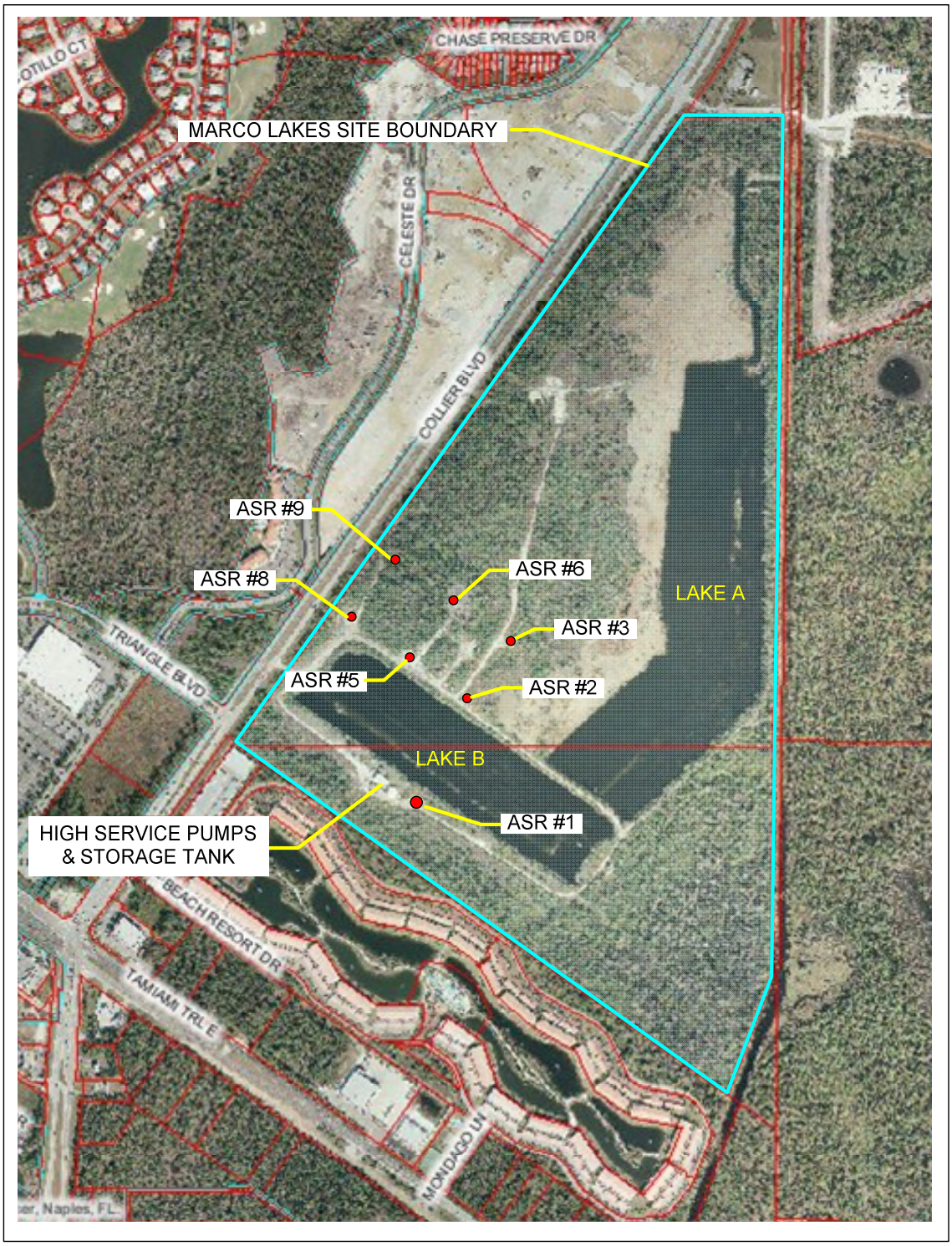
The ASR wells are used to provide a year-round water supply by storing large quantities of Marco Lakes water during the wet season, when water is plentiful, for later recovery during the dry season when water is limited. The two-3,100 gpm raw water pumps discharge into a header that runs through the ASR wellfield. The wells are designed to take in up to 1.5 mgd each (up to 10.5 mgd total). Due to the size of the pumps, the maximum injection rate is currently about 8.9 mgd. MIU is permitted to inject water into the ASR wells from June 1 to November 30 (183 days) if and when the elevation of Henderson Creek is above +3.5 ft

NGVD. At 10.5 mgd, the maximum storage capacity of the ASR wells during each wet season (183 days from June 1 to November 30) is about 1,920 MG.

The raw lake water is stored in a deep and otherwise unused aquifer, which minimizes the flow of the fresh water away from the well. The ambient water in the storage aquifer is higher-density brackish water. There is a significant degree of stratification of the fresh and brackish waters, which limits mixing and changes in the fresh water quality. The intent is that the injected raw water creates a "bubble" of fresh water within the brackish aquifer that can be recovered later by pumping the wells. However, even with the selection of an aquifer that has minimal flow and mixing characteristics, typically only about 65-85 percent of the bubble of water is recovered before the drinking water standards for TDS and chloride are exceeded, and the amount of ASR well water recovered annually has been between 1,200 and 1,600 MG, depending on the amount of water that was injected and the actual TDS of the water that is eventually recovered.

Three golf courses use approximately 250 MG of the raw Marco Lakes water annually for irrigation (1.0 mgd maximum flow during dry season). Therefore, the amount of water available for treatment at the NWTP is typically 3,285 MG annually (9.0 mgd annual average), and the WUP appears to be sufficient for the needs of the NWTP now and at build out. The existing raw water transfer pumps, raw water high pressure transmission main pumps, and ASR well pumps are more than adequate to supply the 6.67 mgd of feedwater needed for the existing NWTP, as well as the 8.34 mgd of water that will be needed for the future expanded facility.

EXHIBIT 7
Marco Lakes Raw Water Source Facilities and ASR Wells
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report



3.2 SWTP Raw Water Supply

The RO system at the SWTP is supplied by a Mid-Hawthorn aquifer brackish wellfield including 17 operating wells that are located on the SWTP site, north of the SWTP along Bald Eagle Dr, and northeast from the SWTP along US 92, as shown in Exhibit 8. MIU has filled in three brackish wells (#3, #6, and #9) due to increasing salinity from those wells, and another well (#18) was removed from service in 2007. Exhibit 9 shows the rated capacity of each of the operating brackish wells. The total capacity of the operating wells with the largest well out of service is 9.727 mgd, which is more than the 8.0 mgd needed to feed the SWTP and produce 6.0 mgd, its permitted capacity, at 75% recovery of raw water as RO permeate.

The existing water use permit allows MIU to withdraw up to 1,460 MG annually (4.0 mgd annual average) from the mid-Hawthorn aquifer system. This results in 1,095 MG (3.0 mgd annual average) of finished water at an RO recovery of 75%. The highest monthly withdrawals occur during the dry winter season when the SWTP operates near its maximum permitted capacity. The water use permit allows a total of up to 381 MG of surface and brackish water to be withdrawn in the maximum demand month, or 12.3 mgd average during a 31-day month. In 2007, the maximum demand month was April, when an average of 9.72 mgd was used in the Marco Island service area. The projected maximum monthly average demand at build out is 11.4 mgd. Assuming 8.0 mgd of brackish water is withdrawn during this month, yielding 6 mgd of finished water at the SWTP, then 4.3 mgd of Marco Lakes water and 1.1 mgd of ASR withdrawals would be needed to completely meet this demand, which is within the design capabilities of those source water facilities.

The Marco Island maximum day demand in 2007 was 12.49 mgd and the maximum day demand at build out is projected to be 13.53 mgd. There is no limit on maximum day well withdrawals. In order to produce 13.53 mgd, the maximum day withdrawal would need to be about 15.53 mgd, which could be met with 8.0 mgd from the brackish wells (producing 6.0 mgd RO permeate) and 7.53 mgd from a combination of Marco Lakes water and ASR water, which is within the design capabilities of the existing source water facilities.

The 9.727 mgd firm capacity of the existing brackish wellfield is more than sufficient to meet the feedwater needs of the SWTP running at capacity, and the wellfield will not require capacity expansion in the near future. MIU will only need to drill new wells to replace existing wells that experience salinity increases that make them unsuitable to feed the RO WTP.

EXHIBIT 8

Location Map: Lime Softening WTP (NWTP) - RO WTP (SWTP) - SWTP Brackish Wellfield (Wells 1-21)

Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

EXHIBIT 9
SWTP Mid-Hawthorn Wellfield Summary
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Name of Well	Aquifer	Design Capacity of Well Pump (mgd)
RO well 1	Mid-Hawthorn	0.691
RO well 2	Mid-Hawthorn	Out of Service
RO well 3	Mid-Hawthorn	Not in use - filled in
RO well 4	Mid-Hawthorn	0.216
RO well 5	Mid-Hawthorn	0.446
RO well 6	Mid-Hawthorn	Not in use - filled in
RO well 7	Mid-Hawthorn	0.698
RO well 8	Mid-Hawthorn	0.648
RO well 9	Mid-Hawthorn	Not in use - filled in
RO well 10	Mid-Hawthorn	0.605
RO well 11	Mid-Hawthorn	0.792
RO well 12	Mid-Hawthorn	0.756
RO well 13	Mid-Hawthorn	0.792
RO well 14	Mid-Hawthorn	0.612
RO well 15	Mid-Hawthorn	0.432
RO well 16	Mid-Hawthorn	0.691
RO well 17	Mid-Hawthorn	0.634
RO well 18	Mid-Hawthorn	
RO well 19	Mid-Hawthorn	0.634
RO well 20	Mid-Hawthorn	0.634
RO well 21	Mid-Hawthorn	0.691
Wellfield Firm Capacity (largest well out of service)	Mid-Hawthorn	9.727

4.0 Water Treatment, Storage and Pumping Facilities

MIU owns and operates two water treatment plants located on Marco Island that are permitted with the Florida Department of Environmental Protection (FDEP) under PWS ID Number 5110183. The two plants are the NWTP that lime softens and filters raw water from Marco Lakes surface water supply and ASR wellfield, and the SWTP that desalts brackish groundwater using RO. The permitted capacity of the NWTP is 6.67 mgd and the permitted

capacity of the SWTP is 6.0 mgd, for a total system production capacity of 12.67 mgd. The two WTPs supply finished water to a single service area.

4.1 NWTP

The NWTP is a lime softening WTP located at Elkcam Circle and Windward Drive in the northern part of Marco Island, as shown in Exhibit 8. Marco Lakes and the Marco Lakes ASR wellfield, located 8-9 miles north of Marco Island, provide raw water to the NWTP. The NWTP is typically operated near its permitted capacity year round, with the SWTP used for peaking in the high demand winter months.

4.1.1 NWTP Treatment Process

The NWTP uses a lime softening reactor/clarifier followed by a rapid sand filter and membrane filter installed in parallel. Lime and alum are added to the reactor/clarifier to remove TOC, color, hardness and alkalinity from the raw water. Primary and residual disinfection are accomplished by adding sodium hypochlorite and ammonia to the reactor/clarifier effluent to form chloramines. The sand filters and membrane filters remove residual turbidity from the lime softening process, as well as provide a critical removal barrier for pathogens. The finished water is transferred to storage tanks for additional disinfection contact time, storage and eventual distribution. All treatment components are sized to operate at 6.67 mgd or greater in accordance with FDEP rules.

Approximately 3.8 mgd of the NWTP finished water is distributed by NWTP high service pumps to the north side of Marco Island. Up to 2.9 mgd of finished water is transferred to the SWTP for blending with RO permeate and distribution to the south end of the island.

4.1.2 NWTP Disinfection Requirements

The NWTP treats a surface water source and is therefore required by the surface water treatment rule and FDEP rules to meet disinfection requirements that include 0.5-log of Giardia after filtration and 2-log of virus after exposure to open air. The Giardia inactivation is required after filtration and therefore must occur in the finished water storage tanks. Virus inactivation may occur before filtration, but according to new FDEP rules, must happen after exposure to air.

The normal temperature range of the Marco Lakes raw water between winter and summer seasons is 20 to 25-degrees. The required chlorine contact concentration-time (CT) for 0.5-log of Giardia inactivation by chloramines at 20 and 25 degrees Celsius is 185 and 125 mg/L-minute, respectively. The required CT for 2-log virus inactivation by chloramines at 20 and 25 degrees Celsius is 321 and 214 mg/L-minute, respectively. Given the typical minimum chloramine residual in the finished water of 3.5 mg/L, the accepted 0.3 baffling factor in the storage tanks, and the peak hourly flow out of the tanks, approximately 1.16 MG of storage will be needed to meet virus and Giardia inactivation after the new FDEP rules go into effect in 2008.

Future EPA regulations may require modifications to the disinfection process at the NWTP. The use of UV disinfection is currently under review.

4.1.3 NWTP Finished Water Storage

An analysis of the diurnal flows from the existing NWTP high service pumps has shown that on the current maximum flow day there is an approximate 700,000-gallon drop in finished water storage tank level during the peak demand time between midnight and noon, when many customers use finished water for residential and commercial irrigation. To meet this diurnal peak demand, the NWTP requires a useful storage volume that is approximately 0.7 MG greater than the total of the required disinfection contact volume and the required fire flow storage volume. It is projected that this diurnal deficit may increase to approximately 1.0 MG as high service flow capabilities from the NWTP are increased after expansion to build out capacity.

In summary, the NWTP needs finished water storage for the following purposes:

- Disinfection contact time for Giardia (260,000 to 560,000 gallons) and viruses (additional 340,000 to 600,000 gallons): total 1.16 MG
- Diurnal peak attenuation (~700,000 - 1,000,000 gallons): 1 MG
- Contribute to the WTP system fire flow storage (3,500 gpm for 4 hours, or 0.84 MG; see Section 4.3)

The NWTP has three 0.5 MG finished water storage tanks (1.5 MG total capacity). MIU is currently constructing a 4 MG storage tank at the NWTP to increase total finished water storage capacity at the NWTP to 5.5 MG, which will allow them to meet diurnal and fire flow storage with the 4 MG storage tank, and use the existing 1.5 MG storage tanks to meet the disinfection requirements. The new tank should be online by the end of 2008 or early 2009.

4.1.4 NWTP Finished Water Pumping

FDEP rule 62-555 requires the firm high service pumping capacity of the WTP system to meet the greater of the fire flow plus the maximum day demand or the peak hourly demand. As recorded, the current peak hourly finished water demand at the NWTP is approximately 12.2 mgd (8,500 gpm), which is higher than the maximum day production of 6.67 mgd (4,632 gpm) plus fire flow (3,500 gpm), or 11.7 mgd (8,132 gpm). The high service pumps must therefore meet the current and projected peak hour demand at the NWTP, which is anticipated to remain greater than the maximum day demand plus fire flow at build out. The future peak hourly demand will likely increase after the NWTP is expanded and finished water production and high service pumping capabilities increase. A maximum high service pumping capacity of 9,900 gpm is projected to be needed to meet build out peak hourly demands at the NWTP.

The NWTP has six existing high service pumps with a total pumping capacity of 9,600 gpm and a firm pumping capacity of 7,600 gpm. The high service pumps at the NWTP and the high service pumps at the SWTP can together be used to meet the current peak hourly flow requirement of the WTP system as a whole. See Section 4.3 for a discussion of the firm high service pump capacity of the WTP system.

MIU is currently adding a new high service pumping system at the NWTP consisting of three 3,300 gpm pumps, with room for a fourth 3,300-gpm pump when needed. The new

pumping system and the existing high service pumps (to used as transfer pumps in the future but can also be used as high service backup pumps) will ensure that the NWTP can meet current and future peak hourly finished water demands through build out.

Exhibit 10 summarizes the capacities of the components of the NWTP water supply and treatment facilities in 2009.

EXHIBIT 10
NWTP Capacity Summary – early 2009
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Component	Number and Capacity	Firm Capacity
Raw Water Transfer Pumps	2 @ 5,000 gpm ea. 2 @ 3,100 gpm ea.	16.13 mgd
ASR well pumps	7 @ 1.5 mgd ea.	9.0 mgd
NWTP Feed Pumps	5 @ 23,900 gpm total (34.4 mgd)	27.9 mgd
Lime Softening Reactor/Clarifier	6.67 mgd	6.67 mgd
Sand Filters + Membrane Filter	6.67 mgd	6.67 mgd
Transfer Pumps (former high service pumps)	6 @ 9,600 gpm total (13.82 mgd)	10.9 mgd
New High Service Pumps	3 @ 3,300 gpm ea. (14.26 mgd)	9.5 mgd

4.2 SWTP

The SWTP is an RO WTP located in the southern part of Marco Island off Lily Court (see Exhibit 8). Raw water is provided to the facility by 17 brackish wells located in the central and eastern portion of the island, shown in Exhibit 8 and described in Exhibit 9. The SWTP has a permitted production capacity of 6.0 mgd and receives up to 2.9 mgd of additional finished water from the NWTP for blending with RO permeate before being distributed from the SWTP.

4.2.1 SWTP Treatment Process

The SWTP utilizes sand separation, cartridge filtration, and scale inhibitor chemical addition as pretreatment to a two-stage RO desalination process. Sulfides are removed from the RO permeate by forced air degasification. The RO concentrate is discharged to a deep injection disposal well. Because the SWTP uses Mid-Hawthorn brackish well water for its source water and the water is not exposed to air during treatment, and since the finished water has been produced using RO membranes, there is no primary disinfection requirement at the SWTP. Chloramines are used for residual disinfection before the permeate is transferred to finished water storage tanks for blending with NWTP finished water, storage, and eventual

distribution. The RO system has been operational since 1991, and each year selected system components are upgraded, based on condition, to maintain the overall good operating condition of the entire SWTP.

4.2.2 SWTP Finished Water Storage

Finished water made at the SWTP is stored in two, 2.0 MG tanks and one, 1.0 MG storage tank (5.0 MG total capacity). An additional 2.0 MG finished water storage tank will be added at the SWTP in the future to potentially replace one of the existing tanks. MIU needs finished water storage at the SWTP to attenuate diurnal peaks in this part of the island and to contribute to the City's fire flow storage (840,000 gallons). An analysis of the diurnal flows from the existing SWTP high service pumps shows that on the current maximum flow day, there is an approximate 1,300,000-gallon drop in finished water storage tank level during the peak demand time between midnight and noon. It is projected that the diurnal deficit may increase to approximately 2,500,000 gallons as high service flow from the SWTP is increased to build out levels.

4.2.3 SWTP Finished Water Pumping

FDEP rule 62-555 requires firm high service pumping capacity to meet the greater of the fire flow plus the maximum day demand or the peak hourly demand. The measured current peak hourly finished water flow at the SWTP (10,500 gpm) is higher than the maximum day flow from the SWTP plus the required fire flow, which is the sum of 6.0 mgd (4,170 gpm) and 3,500 gpm, or a total of 7,670 gpm. The high service pumps must therefore meet current and projected peak hour flows, which are anticipated to remain greater than the maximum day demand plus fire flow at build out. However, the peak hourly flow at the SWTP is not expected to increase through build out. The SWTP has eight existing high service pumps with a total design capacity of 16,600 gpm. The largest pump has a capacity of 3,300 gpm, and therefore the firm capacity is 13,300 gpm. The existing high service pumps can meet the current peak and future anticipated hourly flows. Exhibit 11 summarizes the capacities of the components of the SWTP water supply and treatment facilities.

EXHIBIT 11
SWTP Capacity Summary
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Component	Number and Capacity	Firm Capacity
Wellfield Wells/Pumps	17 @ 10.52 mgd total	9.73 mgd
Sand Separators	2 @ 5.38 mgd ea.	10.76 mgd
Cartridge Filters	6 @ 1.87 mgd ea.	9.35 mgd
RO feed pumps	6 @ 1.34 mgd ea.	8.04 mgd
RO skids	6 @ 1 mgd ea. (75% recovery)	6 mgd
High Service Pumps	8 @ 16,600 gpm total	19.2 mgd (13,300 gpm)

4.3 Fire Flow Storage - WTP System Storage - High Service Pumping

MIU provides fire protection water to Marco Island in compliance with the American Water Works Association (AWWA). MIU can provide fire flow for residential, multi-family, or commercial areas at the medium to higher levels of recommended flows. The assumed fire flow rates are conservatively based on typical AWWA rates. Fire flow storage requirement applies to the entire WTP system, and is based on maintaining the single highest fire flow rate of 3,500 gpm (commercial) for four (4) hours. The total storage volume required to meet the four-hour fire flow demand is 840,000 gallons, as shown in Exhibit 12.

EXHIBIT 12
Marco Island Fire Flow Storage Requirements (4 hours)
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Land Use	Fire Flow Rate (gpm)	Fire Flow Storage for 4 hr (gallons)
Single-family residential	1,500	360,000
Multifamily residential	2,500	600,000
Commercial (hotel)	3,500	840,000
Maximum fire flow storage		840,000

This fire flow storage requirement can be met using the combined storage at the NWTP and SWTP. In addition, the FDEP finished water storage requirement for meeting diurnal peak demands is that the total system storage is 25% of the service area maximum day demand (MDD). (The separate storage volume required for disinfection contact time only applies to the NWTP, and will be met using the existing 1.5 MG storage tanks at that site.)

The required FDEP finished water storage volume for the Marco Island service area is determined as follows:

1. A volume equal to a fire flow volume of 0.84 MG, plus;
2. 25% of the service area MDD. Conservatively, the 2008 MDD can be set equal to the WTP system capacity of 12.67 mgd. The required storage volume to meet current MDD flows is thus 3.17 mgd.

Based on the above criteria, the minimum usable storage volume required for the NWTP and the SWTP together is 4.01 MG. At the present time, the 5.0 MG storage capacity at the SWTP meets this requirement. A total WTP system finished water storage capacity of 4.43 MG (including fire flow storage) will be needed to meet build out finished water demands at the anticipated future WTP system production capacity of 14.34 mgd (see Section 5.0). After installation of the new 4-MG storage tank at the NWTP, the total finished water storage volume in the WTP system will be 9.0 MG, which is more than adequate to meet build out storage requirements.

Because the NWTP and SWTP supply water to the same service area, the high service pumping needs of the service area are allowed to be met with a combination of the pumps

at both the NWTP and the SWTP. The current and future capacities of the high service pumps and projected peak hourly flows in the service area are shown in Exhibit 13.

EXHIBIT 13
Marco Island Service Area High Service Pump Summary
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Location	Pumps (Capacity)	Firm Capacity, gpm	Projected Peak Hourly Flow, gpm
SWTP	Pumps 1-8 (16,600 gpm)	13,300	
NWTP	Existing Pumps 1-6 (9,600 gpm)	7,600	
Total (2007)		20,900	19,000
SWTP	Pumps 1-8 (16,600 gpm)	13,300	
NWTP	New Pumps 1-3 (9,900 gpm)	6,600	
Total (2009)[1]		19,900	19,000
SWTP	Pumps 1-8 (16,600 gpm)	13,300	
NWTP	New Pumps 1-4 (13,200 gpm)	9,900	
Total (Build Out)		23,200	20,400

[1]Existing NWTP High Service Pumps (1-6) will be used as transfer pumps and can be used as spare high service pumps after completion of NWTP 4 MG tank and high service pump project in 2008/2009.

5.0 Planning for Expansion of Source, Treatment, and Storage Facilities

5.1 Source Water Expansion

Based on the capacity analysis of the source water systems for the NWTP and SWTP, an expansion of these systems is not needed prior to build out, which is expected to occur in the next 10 years. A potential future addition of ASR wells for the NWTP or Mid-Hawthorn aquifer wells for the SWTP would be for the purposes of increased reliability. Additional ASR wells could also be used if the brackish water feeding the RO WTP degrades to a point where the permeate recovery and capacity of the SWTP is reduced. In that case more surface water would be needed to supplement this loss in capacity.

5.2 Surface Water Treatment Process Expansion

The design and permitted treatment capacity of the NWTP is 6.67 mgd. The design and permitted treatment capacity of the SWTP is 6.0 mgd. The total treatment capacity of both WTP facilities is 12.67 mgd. Referencing Exhibit 14, the total treatment capacity of the WTP

facilities should be expanded by the end of 2011 to meet the projected MDD of the service area in 2012. MIU plans to add approximately 1.67 mgd of surface water treatment capacity to the NWTP or SWTP, which will increase the treatment capacity of the WTP system to 14.34 mgd. In Exhibit 15, this expansion project is shown to begin in 2008 and be completed by the end of 2011.

The City is currently conducting two pilot programs that will lead to a preliminary process evaluation that will determine the best option for surface water treatment capacity expansion. The evaluation will consider options for organics removal and their abilities to meet finished water goals for color, hardness, disinfection byproducts, chloride, sulfate, and pathogen removal. The studies will also evaluate UV disinfection with the existing and expanded process, and the conversion of an existing RO concentrate transmission line into a blend water transmission line. The following process options will be evaluated:

- In-line coagulation/membrane filtration/blending with RO permeate
- Enhanced lime softening (new and existing reactor)/filtration
- Membrane filtration/ion exchange/blending with RO permeate
- Membrane filtration/conversion of existing RO to low pressure RO/blending with RO permeate

As shown above, one alternative to increasing the surface water treatment capacity at the NWTP is to transfer up to 4 mgd of raw water to the SWTP and convert one RO train to nanofiltration. This treated water would be blended with the RO permeate from the other RO trains.

It is anticipated that a final recommendation for the best treatment option will be made by the end of 2008.

The potential production at each WTP from 2008 through 2017 is shown in Exhibit 14, and is conservatively based on the operation of the NWTP near its permitted capacity, no additional use of reclaimed water, and the operation of the SWTP for peaking during the high demand season. Under these conditions at build out, the projected MDD of 13.53 mgd will be 94 percent of the potential total WTP capacity of 14.34 mgd.

The first phase of the expansion of the reuse system has begun, and will be completed by the end of 2008. The projected maximum day production needs of the WTP system will be 12.97 mgd and 90 percent of the potential total WTP treatment capacity of 14.34 mgd if the reuse system is fully expanded as planned (see Exhibit 5).

EXHIBIT 14
2008-2017 Marco Island Projected Water Service Area Demands and Anticipated WTP Production
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Year	Avg. Day Water Demand	Max Day Water Demand	NWTP Avg. Day Production	NWTP Max Day Production	SWTP Avg. Day Production	SWTP Max Day Production
2008	8.28	12.01	6.50	6.67	1.78	5.34
2009	8.35	12.10	6.50	6.67	1.85	5.43
2010	8.48	12.30	6.50	6.67	1.98	5.63
2011	8.62	12.50	6.50	6.67	2.12	5.83
2012	8.76	12.70	7.50	8.34	1.26	4.36
2013	8.89	12.89	7.50	8.34	1.39	4.55
2014	9.03	13.09	7.54	8.34	1.49	4.75
2015	9.16	13.29	7.58	8.34	1.58	4.95
2016	9.28	13.46	7.59	8.34	1.69	5.12
2017	9.33	13.53	7.59	8.34	1.74	5.19

5.3 Finished Water Storage and Pumping Expansion

The NWTP needs additional finished water storage so that the existing storage tanks can be used to meet future FDEP disinfection regulations that go into effect in 2008. The new 4 MG finished water storage tank will be used to meet local diurnal attenuation requirements in the north part of Marco Island and will contribute to the WTP system finished water storage and fire flow requirements. The 4 MG storage tank and high service pump station project at the NWTP is currently in the construction phase. The anticipated project completion for these new facilities is late 2008 or early 2009.

An additional 2.0 MG finished water storage tank will be added at the SWTP in the future.

In order to meet the projected build out high service pumping requirements, a new 3,300 gpm high service pump will be installed at the NWTP after 2009. The new high service pump station has been designed so that this pump can be installed in the station when it is needed.

5.4 Schedule for Expansion

Exhibit 15 shows a possible schedule for the construction of future expansions at the NWTP and of the Marco Island reuse system.

EXHIBIT 15
Marco Island Utilities Expansion Planning Schedule Through 2017 (Build Out)
Marco Island Water Treatment Facilities 2008 Capacity Analysis Report

Year	Description of Expansion Improvements
2008-2009	Complete Expansion of NWTP Storage and High Service Pumping
2008-2012	Expand Reuse System to Existing Condominiums
2009	Initiate Design of Surface Water Treatment Expansion Improvements
2010-2011	Install 1.67 mgd of additional Surface Water Treatment Capacity
2011	Install 2MG Finished Water Storage Tank at SWTP
2010-Build Out	Install fourth 3,300 gpm High Service Pump at NWTP

6.0 References

1. Marco Island Utilities, 2003-2007 Monthly Operating Reports, Marco Island, FL.
2. Marco Island Utilities, 2005 Analysis of Approved Development Plans to Build Out, Excel file "All-Residential WW-rev 4-li (2).xls", Marco Island, FL.
3. City of Marco Island, 2000 Service Area Boundary Map, Marco Island, FL.
4. Marco Island Utilities, Source Water and Water Treatment Master Plan, Marco Island, FL
5. City of Marco Island, "Preliminary Design Report - City of Marco Island NWTP 4 MG Water Tank and Pump Station", FDEP Construction Permit Application, August 3, 2007.