# MARCO ISLAND
# 10-YEAR WATER AND WASTEWATER
# MASTER PLAN

*for*

## SSU SERVICES

*January 1991*

MARCO ISLAND
10-YEAR WATER AND WASTEWATER MASTER PLAN

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## EXECUTIVE SUMMARY AND RECOMMENDATIONS

### SUMMARY

Marco Island Utilities, Inc., provides retail water and wastewater service to the utility's FPSC certificated area and wholesale water and wastewater service on the Island to Collier County Utilities Department and North Marco Utilities, Inc. The respective service areas are shown on Figure 2-2. The only service area expansion available is the conversion of wholesale customers to retail customers in the area. Since the utility is the provider of water supply and wastewater treatment, any certificated area modification would not impact the expected demands on the utility's regional facilities.

The level of service used for this report are 121 gallons per day per capita for wastewater and 800 gallons per day per single family residential unit and 285 gallons per day for a multi-family unit for water use. The majority of the existing water use attributed to lawn or green space irrigation. Water conservation, xeriscape education programs blended with a limited, yet cost-effective reclaimed water (wastewater effluent reuse) program should ultimately reduce the extremely high per capita potable water usage. The State of Florida average is 120 gallons per day per capita with 100% occupancy. We believe given that there is some seasonality to the occupancy on Marco Island, our projections of the level of service necessary over the next ten (10) years is appropriate.

The population, water demand and wastewater flow projections are presented in Section 2. The following is a synopsis of the analysis:

**Marco Island**
**Population, Water and Wastewater**
**Projections**

| Year | Population | Average Annual Wastewater Flow (1) | Average Annual Water Demand(1) | Maximum Daily Water Demand (1) |
|---|---|---|---|---|
| 1990 | 24,997 | 2.10 | 5.90 | 8.85 |
| 1995 | 29,504 | 2.65 | 7.99 | 11.59 |
| 2000 | 34,011 | 3.15 | 10.65 | 14.91 |

(1) Values shown are in millions of gallons per day.

Presently, the utility has secured a 6.23 MGD consumptive use permit (WUP) and a lease for the use of the Collier's land. The CUP renewal tests are expected to be satisfied from a reasonable and beneficial use standpoint. Due to water degradation problems at the existing site, we expect that future CUP's for this site would have a lower value than 6.23 MGD. Moreover, if additional raw water supplies are developed nearby the Collier's property, a potential for interference and regional potential water quality problems should further reduce the allocated capacity from this site. Nonetheless, the Company should vigorously pursue the renewal of the Collier's lease, with reasonable terms and conditions, such that this known supply facility can be maintained within the system. The raw water pumping stations and dual (12" and 14") raw water pipelines with the booster station enroute to the seven (7) MGD water treatment (lime softening) plant are presented in Section 4.

The water treatment plant is composed of a 5 MGD relatively new system which is expandable to 10 MGD as a lime softening facility and some two (2) to three (3) MGD of small, old, individual units which are probably not worth refurbishment. The storage and high service pumping facilities are described in Section 4. The system storage and repumping station has worked well to hydraulically balance the transmission system. A small (12") in-line booster pumping station is used to maintain adequate pressure in the "high-grounds" ridge area of the island.

The on-going water supply programs are consistent with the utility's consumptive use permit. A reduction in the dependency on the Collier's lease area was accomplished through a 1.0 MGD agreement between the Company and Collier County. The agreement provides for wholesale service from the County which also provides a lower TDS and chloride water for blending with the existing source. Other activities have included the evaluation of the existing source, the Dude site, and the 160 acre site for future water supply. It is important to secure the next water source and implement its development. If the Dude site proves acceptable, then a facilities development program completed by December 1991 would be beneficial.

The C.R. 951 corridor is slated for road reconstruction and widening which will require the replacement of the existing raw water mains with a 24-inch main. Considering the existing hydraulic restrictions, a 24-inch raw water main will allow the existing pumping facilities to transmit greatly increased volumes without additional facilities. This main will intertie with the existing 30-inch main which is under the Marco River.

Of course, Marco Shores will tap this main for their necessary raw water supply.

The Company also is cooperating with Collier County regarding planning studies (90%-10% County - Company cost sharing) and for feasibility testing studies of potential raw water sources (for low pressure R.O.), potential aquifer storage and recovery wells (ASR), or potential deep well injection (treated effluent) facilities at the County's Manatee Road site on C.R. 951. After the testing and preliminary costing studies are complete, the Company should consider the cost-effectiveness of such county facilities and the terms and conditions of potential service.

The ongoing 4 MGD R.O. program at the Unit 25 site involves a well field on the island, an expandable reverse osmosis plant from the initially designed 4 MGD to an ultimate 6 MGD in the future, the incorporation and expansion of the repumping station facilities, a brine pump station and force main to the proposed deep well location at the wastewater treatment plant site for brine disposal.

The water facilities capacity versus demand analysis resulted in the following conclusions.

The existing raw water supply consisting of the two borrow pits and two infiltration galleries is inadequate to meet the existing demands. The immediate resolution to the lack of supply is already well underway in the decision to construct eight deep wells on the island to provide the raw water supply to a 4.0 MGD reverse osmosis water treatment plant to be constructed in the near future. It has been recommended that SSUS move ahead rapidly with the plan to secure the Dude parcel as a raw water source in order to reduce the demand on the existing supply. In addition, the company needs to move ahead with the plans to utilize the 160 acre parcel in Section 35 as a water supply source.

The existing raw water pumping station has a firm capacity of 17,000 gpm which is sufficient capacity to meet the current demands and any future demands that may be pumped through this facility. On the other hand, the 12-inch and 14-inch transmission lines do not provide sufficient capacity at a reasonable flow rate. SSUS has realized this shortcoming, but cannot correct the situation until a decision is made concerning the reconstructions of C.R. 951. A 24-inch transmission line is proposed to be constructed in the future.

The water treatment facility is currently a 7.0 MGD lime softening plant. This does not meet the current demands. The 4.0 MGD reserve osmosis will increase the water treatment capacity to 11 MGD which is adequate to meet the short term demands with the 1.0 MGD purchased from Collier County. However, shortly after the R.O. facility comes on line, the wastewater plant will require expansion prior to which the 2 MGD softening unit is proposed to be demolished to provide room for the expansion. Therefore, the capacity will be reduced to 9 MGD.

The second phase of water treatment facility improvements will be the demolition of an old existing 2 MGD treatment facility and the construction of a new 5.0 MGD lime softening plant. The final phase of the water treatment plant improvements is to expand the reverse osmosis facility from 4 MGD to 6 MGD. This will provide 16 MGD of water treatment capacity which is sufficient to meet the projected demands of the planning period and out into the 21st century.

The existing water storage capacity is not adequate to meet the demands through the planning period. Improvements are scheduled at each water treatment plant expansion to correct these deficiencies. The water transmission system has a few improvements that will improve the system operation and provide for better use of the water treatment facilities.

The raw wastewater collection system and pumping stations serving the Company's retail customers are generally adequate and in good working order. In the future, as flows increase, the existing pumping units should be replaced with pumps meeting the increased hydraulic requirements of the system. The Company's collection system does not exhibit unreasonable inflow and/or infiltration characteristics. In contrast, the County's collection system was constructed, in part, within the stormwater swales of the development areas and has historically exhibited high inflow characteristics during rainfall events. The Company should require the County to retrofit the existing manholes with the inflow prevention lids or other acceptable methods to correct this situation.

The raw wastewater pumping stations discharge into manifolded 12" and 16" force mains which tie together outside of the plant and continue as a 16" force main to the 500,000 gallon flow equalization tank. The existing facility has been expanded several times in accordance with the regulations in order to obtain the maximum allowable rate of return.

A one (1.0) MGD wastewater treatment plant expansion is under construction. Once completed, a total capacity of 3.5 MGD will be available. Associated with the 1.0 MGD plant expansion is a complete sludge handling facility improvement. By dewatering the sludge from the existing 0.5 to 1.0% to a 3% to 5% stream, cost savings from liquid haling is expected and less trucks and manpower will be required. Additional filters are also being constructed such that all flow can be reused as reclaimed water for public access receiving advanced secondary treatment. Company consultants have performed an odor control study and preliminary design. In the near future these odor control facilities are expected to alleviate aesthetic complaints regarding this facility. Finally, a complete site-wide (water and wastewater treatment plants) electrical power distribution, instrumentation and auxiliary power study has been completed. The recommendations from this study provide the cost-effective combined plant power improvements necessary to meet the requirements of Chapter 17-610 F.A.C.

The existing effluent disposal facilities include reuse systems at the golf courses (these facilities are not required to take flows, therefore there are extended periods during which the courses do not use reclaimed water) and the percolation ponds/overland flow system. The combined facilities are rated at 2.5 MGD. The 1.0 MGD of additional capacity under construction will use an expansion of percolation pond/overland flow system. The reclaimed effluent leaving the island for use on the mainland (golf course and percolation pond/overland flow systems) is restricted by the existing eight (8) inch force main crossing under the Marco River. Once the C.R. 951 widening plans are finalized and the scheduled project funded by the State of Florida, it is the intent of the Company to replace the 8-inch main with a 16-inch main. Both the proposed 24-inch diameter raw water main and the proposed 16-inch diameter reclaimed water main are expected to be constructed utilizing a FDOT joint project agreement such that the FDOT contractor builds both mains at the same time as the road is being constructed and this same contractor is responsible for maintaining service during construction.

The effluent disposal regulations are currently being revised and the overland flow option will not be allowed in the future. The existing treatment plant site is too limited in size to store flows during wet weather conditions. In addition, the golf courses do not apply or store flows during wet weather. Since the reuse system customers do not use reclaimed water during the rainfall events, then the only other option available is to develop a deep well on the wastewater treatment plant site for the discharge of effluent.

This work is underway and is being coordinated very cost-effectively with the need for deep well injection of the brine discharge from the proposed Reverse Osmosis facility. The effluent flows are much greater than the brine flows so the most cost-effective location is on the wastewater treatment plant site. An economy of scale is realized when combining the two flows. Note that the requirements for materials and construction are more stringent for the brine flow stream. The proposed 24-inch diameter deep well is expected to accommodate the full expanded wastewater and expanded reserve osmosis brine flows.

The wastewater facilities capacity versus demand analysis indicated the following:

1. Pumping Stations - Individual lift stations capacities should be periodically evaluated by the utility to determine that appropriate levels of service are maintained.

2. Raw Wastewater Force Mains - The combined capacity of the raw wastewater force mains with the addition of the 12" force mains is sufficient to handle peak wastewater flows during most of the planning period.

3. Wastewater Treatment - The present 1.0 MGD expansion to 3.5 MGD is required to meet present day and projected maximum month average daily flows. A second expansion to bring the total treatment capacity to 4.25 MGD will be required to be on-line by 1995. A subsequent 1.75 MGD expansion will probably be required at the end of the ten year planning period.

4. Effluent Force Main and Pumping Stations - The present program to increase the capacity of the Coast Guard Booster Pumping Station and upsizing of the effluent transmission main to 16" from there to the percolation pond site is required to provide for maximum daily flow requirements through 1995. The transmission facilities will then be adequate for the remainder of the planning period assuming the deep well is placed in service for wastewater effluent disposal in 1991.

5. Effluent Disposal Sites - The present expansion of the effluent disposal site is required to provide adequate capacity to support the 1.0 MGD WWTP

expansion to 3.5 MGD. Further expansion of the percolation pond site will not be required assuming the deep well is placed in service in 1991.

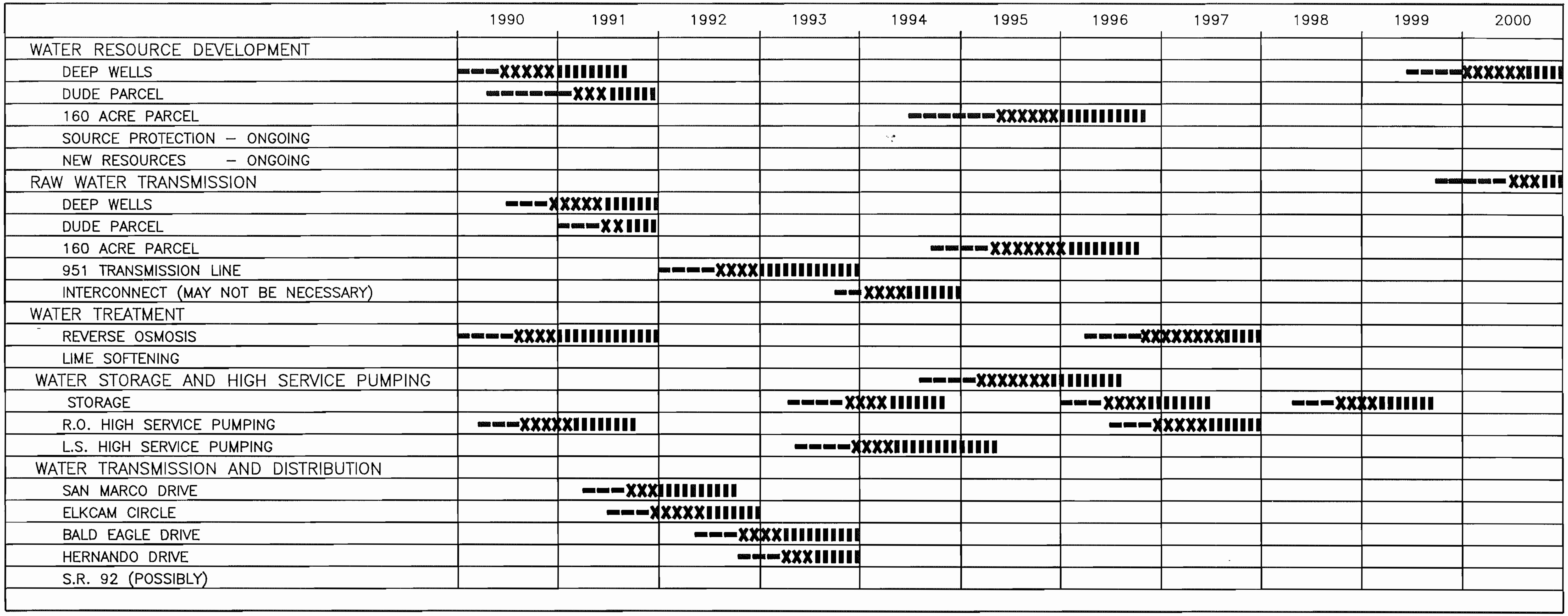
6. Proposed Deep Well Injection Facilities - The deep well injection facilities will need to be placed into service for wastewater disposal by 1991 concurrent with the plant expansion since a large part of the on-site substandard and equalization storage volume will be destroyed by the expansion. Secondly, with the expected injection pressures of approximately 50 psi, it is more cost effective on a per gallon basis to pump to the deep well rather than the percolation ponds on the mainland. Finally, utilization of the deep well, postpones or eliminates the need for subsequent upgrades of the effluent transmission system, during the 10 year planning period. The capacity of the deep well in combination with continued utilization of the percolation ponds and golf course systems will provide adequate effluent disposal capacity through the end of the ten year planning period and beyond.

The water master plan was divided into four (4) periods. The timing of the facilities is based upon the realization of customer growth projections. The 1990-1992 program reiterated the need for the on-going construction programs. The 1993-1995 program centers on the completion and implementation of water supply source facilities and the lease extension with the Colliers. Moreover, major raw water transmission facilities should be nearing implementation. Finally, in the later part of the period activities should be initiated to expand the existing, softening WTP to 10 MGD. Certain major potable water transmission facilities on the island are needed as presented in Section 6. The 1996-2000 program incorporated the expansion of the reverse osmosis plant, if demand dictates. The 1996-2000 water program is presented in Section 6. Finally, the post 2000 program involves the optimization of the raw water sources.

Figure E-1 provides a summary of the implementation schedule of the various water capital improvements projects. Figure E-2 provides a summary of the water capital improvements program budgets.

The wastewater master plan also was divided into four (4) periods. The timing of the proposed facilities is based upon the realization of customer growth projections. The 1990-1992 plan reconfirms the necessity of the on-going construction programs and deep well

# Marco Island Utilities
# Water and Wastewater Master Plan




LEGEND

▬▬▬▬ PLANNING, PRELIMINARY AND FINAL DESIGN
XXXXX PERMITTING, BIDDING AND AWARD
IIIIIII CONSTRUCTION

**HARTMAN & ASSOCIATES, INC.**
engineers, hydrogeologists, scientists & management consultants

**Water Capital Projects Implementation Schedule**

FIGURE E-1

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| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | TOTAL PROJECT COST |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WATER RESOURCE DEVELOPMENT** | | | | | | | | | | | |
| 8 R.O. DEEP WELLS & PUMPS FOR 4 MGD – A | $400,000 | | | | | | | | | | $400,000 |
| DUDE PROPERTY CUP PERMIT AND TESTING – B | $118,000 | | | | | | | | | | $118,000 |
| 160 ACRE PARCEL CUP PERMIT AND TESTING – C | | $100,000 | | | | | | | | | $100,000 |
| COLLIER LEASE AGREEMENT NEGOTIATION | $50,000 | | | | | | | | | | $50,000 |
| DEVELOPMENT OF DUDE PROPERTY – B | $450,000 | | | | | | | | | | $450,000 |
| DEVELOPMENT OF 160 ACRE PARCEL – C | | | | | $200,000 | $800,000 | | | | | $1,000,000 |
| 5 R.O. DEEP WELLS & PUMPS FOR 2 MGD EXPANSION | | | | | | | | | | $250,000 | $250,000 |
| **SUB-TOTAL** | $1,018,000 | $100,000 | | | $200,000 | $800,000 | | | | $250,000 | $2,368,000 |
| **RAW WATER TRANSMISSION** | | | | | | | | | | | |
| RAW WATER TRANSMISSION LINE EASEMENTS | $25,000 | $25,000 | | | | | | | | | $50,000 |
| R.O. DEEP WELL RAW WATER TRANSMISSION LINE – A | $447,000 | | | | | | | | | | $447,000 |
| DUDE PROPERTY RAW WATER TRANSMISSION LINE – B | $550,000 | | | | | | | | | | $550,000 |
| 160 ACRE PARCEL RAW WATER TRANSMISSION LINE – C | | | | | $830,000 | $835,000 | | | | | $1,665,000 |
| C.R. 951 RAW WATER TRANSMISSION LINE – D | | $3,080,000 | | | | | | | | | $3,080,000 |
| R.O. DEEP WELL RAW WATER TRANSMISSION LINE EXPANSION | | | | $354,000 | | | | | | | $354,000 |
| R.O. DEEP WELL/SURFACE WATER INTERCONNECT / BRINELINE | | | | $246,000 | | | | | | | $246,000 |
| **SUB-TOTAL** | $1,022,000 | $3,105,000 | | $600,000 | $830,000 | $835,000 | | | | | $6,392,000 |
| **WATER TREATMENT** | | | | | | | | | | | |
| 4 MGD R.O. PLANT & INJECTION WELL | $10,550,000 | $1,000,000 | | | | | | | | | $11,550,000 |
| 5 MGD LIME SOFTENING PLANT | | | | | $500,000 | $4,700,000 | | | | | $5,200,000 |
| 2 MGD R.O. PLANT EXPANSION | | | | | | | | | | $3,000,000 | $3,000,000 |
| **SUB-TOTAL** | $10,550,000 | $1,000,000 | | | $500,000 | $4,700,000 | | | | $3,000,000 | $19,750,000 |
| **WATER STORAGE & HIGH SERVICE PUMPING** | | | | | | | | | | | |
| R.O. PLANT HIGH SERVICE PUMPING (2200 gpm) | $150,000 | | | | | | | | | | $150,000 |
| 2 MG STORAGE TANK & SITE (L.S.PLANT) | | | | $710,000 | | | | | | | $710,000 |
| 2 MG STORAGE TANK & DEMOLITION (L.S. PLANT) | | | | | | | | $75,000 | $575,000 | | $650,000 |
| LIME SOFTENING PLANT HIGH SERVICE PUMPING (2000 GPM) | | | | | $10,000 | $90,000 | | | | | $100,000 |
| 2 MG STORAGE TANK,SITE & PUMPING (NEW SITE) | | | | | $150,000 | $550,000 | $300,000 | | | | $1,000,000 |
| R.O. PLANT HIGH SERVICE PUMPING (2000 gpm) | | | | | | | | | | $100,000 | $100,000 |
| **SUB-TOTAL** | $150,000 | | | $710,000 | $160,000 | $640,000 | $300,000 | $75,000 | $575,000 | $100,000 | $2,710,000 |
| **WATER TRANSMISSION & DISTRIBUTION** | | | | | | | | | | | |
| San Marco Drive (4000'OF 12") | $15,000 | $105,000 | | | | | | | | | $120,000 |
| Elkcam Circle (3300' OF 24") | $20,000 | $178,000 | | | | | | | | | $198,000 |
| Bald Eagle Drive (6600' OF 24") | | | $40,000 | $356,000 | | | | | | | $396,000 |
| Hernando Drive (1700' OF 12") | | | | $7,000 | $44,000 | | | | | | $51,000 |
| **SUB-TOTAL** | $35,000 | $283,000 | $40,000 | $363,000 | $44,000 | | | | | | $765,000 |
| **ON-GOING WATER PROGRAMS** | | | | | | | | | | | |
| **SUB-TOTAL** | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | 1,990,000 |
| **ANNUAL CIP BUDGET** | **$12,974,000** | **$4,687,000** | **$239,000** | **$1,872,000** | **$1,933,000** | **$7,174,000** | **$499,000** | **$274,000** | **$774,000** | **$3,549,000** | **$33,975,000** |

All costs are nonescalated 1990 dollars.

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## Water Capital Improvements Program Budget

FIGURE E-2

TABLE

injection facilities. Certain other minor improvements are documented for the Company's consideration. Table 7-1 summarizes the wastewater system 1990-1992 Master Plan for Marco Island. The 1993-1995 program centers on the construction of the first oxidation ditch and pre-treatment facilities for the plant. Table 7-1 illustrated the 1993-1995 wastewater Master Plan for Marco Island. The 1996-2000 program presents the 1996-2000 Wastewater Master Plan for Marco Island. Finally, the post 2000 program includes the construction of the second oxidation ditch with associated facilities. Refurbishments and renovations of the existing old 2.5 MGD will be required. In the 1990-1992 program certain superstructure facilities will be renovated. In the post 2000 program, a complete replacement of the internal facilities will be needed. Table 7-1 also summarizes the post 2000 program.

Figure E-3 provides a summary of the implementation schedule of the various wastewater capital improvements projects. Figure E-4 provides a summary of the wastewater capital improvements program budgets.

**RECOMMENDATIONS**

We recommend that the Company:

1. Adopt and fund the 1990-1992 water and wastewater master plan.
2. Budget adequate funds for replacement and renewals which are needed for this harsh saline environment.
3. Continue and complete the on-going programs indentified herein for both the water and wastewater systems.
4. Prepare a finance plan to fund the 1993-1995 program.
5. Adjust and reapply for rate and capital charge fees and revenues sufficient to support the capital and operational cost needs of the existing and future customers of the system.

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5. Adjust and reapply for rate and capital charge fees and revenues sufficient to support the capital and operational cost needs of the existing and future customers of the system.

# Marco Island Utilities
# Water and Wastewater Master Plan

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WASTEWATER TREATMENT FACILITIES | | | | | | | | | | | |
| WW-1 | XXXIIIII | | | | | | | | | | |
| WW-2 | -- | XXXIIIIIIII | | | | | | | | | |
| WW-5 | | | | ---- | XXXXXIIIIIIIII | IIIII | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| EFFLUENT DISPOSAL FACILITIES | | | | | | | | | | | |
| WW-4 | ---- | XXXXIIIIII | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| EFFLUENT TRANSMISSION FACILITIES | | | | | | | | | | | |
| WW-3 | | --- | XXXXIIIII | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| RAW WATER TRANSMISSION FACILITIES | | | | | | | | | | | |
| WW-6 | | | | | | | | ----X | XXXXIIIIIII | | |
| | | | | | | | | | | | |

LEGEND

| | |
|---|---|
| ---- | PLANNING, PRELIMINARY AND FINAL DESIGN |
| XXXXX | PERMITTING, BIDDING AND AWARD |
| IIIIIII | CONSTRUCTION |

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**Wastewater Capital Projects Implementation Schedule**
FIGURE E-3

90/06000105

# Marco Island Utilities
# Water and Wastewater Master Plan

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | TOTAL PROJECT COST |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WASTEWATER TREATMENT FACILITIES** | | | | | | | | | | | |
| WW-1, WWTP SITE WORK | PERFORMED IN 1990 | | | | | | | | | | |
| WW-2, 1.0 MGD WWTP EXPANSION TO 3.5 MGD (1) | $2,155,000 | | | | | | | | | | $2,155,000 |
| WW-5, .75 MGD WWTP EXPANSION TO 4.25 MGD | | | | $1,123,000 | $700,000 | | | | | | $1,823,000 |
| SUB-TOTAL | $2,155,000 | | | $1,123,000 | $700,000 | | | | | | $3,978,000 |
| **EFFLUENT DISPOSAL FACILITIES** | | | | | | | | | | | |
| WW-4, 2.5 MGD PERCOLATION POND ADDITION | $750,000 | | | | | | | | | | $750,000 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| SUB-TOTAL | $750,000 | | | | | | | | | | $750,000 |
| **EFFLUENT TRANSMISSION FACILITIES** | | | | | | | | | | | |
| WW-3, 16-INCH EFFLUENT TRANSMISSION MAIN | $1,290,000 | $1,400,000 | | | | | | | | | $2,690,000 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| SUB-TOTAL | $1,290,000 | $1,400,000 | | | | | | | | | $2,690,000 |
| **RAW WASTEWATER TRANSMISSION FACILITIES** | | | | | | | | | | | |
| WW-6, 16-INCH FORCE MAIN | | | | | | | $50,000 | $310,000 | | | $360,000 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| SUB-TOTAL | | | | | | | $50,000 | $310,000 | | | $360,000 |
| **ON-GOING WASTEWATER PROGRAMS** | | | | | | | | | | | |
| | | | | | | | | | | | |
| SUB-TOTAL | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $1,650,000 |
| | | | | | | | | | | | |
| **ANNUAL CIP BUDGET** | **$4,360,000** | **$1,565,000** | **$165,000** | **$1,288,000** | **$865,000** | **$165,000** | **$215,000** | **$475,000** | **$165,000** | **$165,000** | **$9,428,000** |

(1) Excludes 1990 costs, includes sludge facilities, odor control and auxiliary power facilities.

All cost are in December, 1990 dollars.

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**Wastewater Capital Improvements Program Budget**

FIGURE E-4

90/0600074

## SECTION 1
## INTRODUCTION

### 1.01 PURPOSE

This report represents an early output of the overall SSU Services, Inc. - LONG RANGE STRATEGIC PLANNING PROGRAM. Additional tasks are required prior to completing all of the PROGRAM goals and objectives. Marco Island was selected as one of the fourteen (14) pilot plan projects due to the system's characteristics, needs, customer base and environmental location. The Company prioritized the planning efforts for Marco Island such that an early output report would be prepared to address facility needs in an integrated cost-effective manner as soon as possible. This report provides the conceptual framework for policy decision making to both appropriately serve the system's customers and to provide responsive planning input to the overall Collier County Comprehensive Planning Process.

### 1.02 SCOPE OF SERVICES

Hartman & Associates, Inc. (HAI) scope of services included the 1) collection of available data, reports and tests, 2) review of existing facilities, 3) review of on-going programs, 4) projection of water demands and wastewater flows, 5) analysis of the above four tasks, 6) existing or near term capacity versus service area demand analysis, 7) review of options investigated for future facility improvements, 8) discussion of service area expansion possiblities, 9) development of a 10-year water and wastewater master plan with comments regarding post year 2000 facility needs, 10) preparation of draft and final early output master plan reports to the Company.

### 1.03 AUTHORIZATION

This report was authorized by Mr. Frank L. Novak, P.E. - Vice President of Engineering and Planning - SSU Services, Inc. on August 31, 1990. HAI had the benefit of the previous Company planning efforts and materials derived from Company consultants.

## 1.04 ACKNOWLEDGEMENTS

We would like to take this opportunity to thank Mr. Wood, P.E., Mr. Terrero, P.E. and the Marco Island operational staff for their assistance in the development of this report. This report was prepared by Mr. Hartman, P.E., Mr. Christopher, P.E., Mr. Quinlan, E.I., Mr. Bliss, E.I. and Mr. Luke and others of HAI.

## 1.05 ABBREVIATIONS

The following abbreviations are used in this document:

| | |
|---|---|
| ADF | Average Daily Flow |
| BOD5 | 5-day Biochemical Oxygen Demand |
| B & J | Bore and Jack |
| cfm | Cubic Feet per Minute |
| Cl | Cast Iron (pipe) |
| COD | Chemical Oxygen Demand |
| D.O. | Dissolved Oxygen |
| dia. | Diameter |
| DIP | Ductile Iron Pipe |
| ERC | Equivalent Residential Connection |
| FAC | Florida Administrative Code |
| FDER | Florida Department of Environmental Agency |
| FEMA | Federal Emergency Management Agency |
| FPSC | Florida Public Service Commission |
| F.S. | Florida Statutes |
| ft | Foot (feet) |
| FY | Fiscal Year |
| gpd | Gallons Per Day |
| HP | Horsepower |
| hr | Hour |
| I/I | Infiltration/Inflow |
| imp. | Impeller |
| in. | Inch |
| lb | Pound |
| LF | Linear Foot (feet) |

| | |
|---|---|
| m | Meter |
| mm | Millimeter |
| ml | Milliliter |
| mg/l | Milligram per Liter |
| MG | Million Gallons |
| MGD | Million Gallons per Day |
| MLSS | Mixed Liquor Suspended Solids |
| MLVSS | Mixed Liquor Volatile Suspended Solids |
| MOP | Manual of Practices |
| MOR | Manual of Practice |
| NGVD | National Geodetic Vertical Datum |
| O & M | Operation and Maintenance |
| PVC | Polyvinyl Choride (pipe) |
| PS | Pump Station |
| pis | Pounds per Square Inch |
| RAS | Return Activated Sludge |
| SFD | Single Family Dwelling |
| SFWMD | South Florida Water Management District |
| SOR | Surface Overf;low Rate |
| TN | Total Nitrogen |
| TP | Total Phosphorus |
| TSS | Total Suspended Solids |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| VC | Vitrified Clay (pipe) |
| WAS | Waste Activated Sludge |
| WPCF | Water Pollution Control Federation |
| WTP | Water Treatment Plant |
| WWTP | Wastewater Treatment Plant |

# *SECTION 2*

## SECTION 2
## SERVICE AREA INFORMATION

### 2.01 BACKGROUND

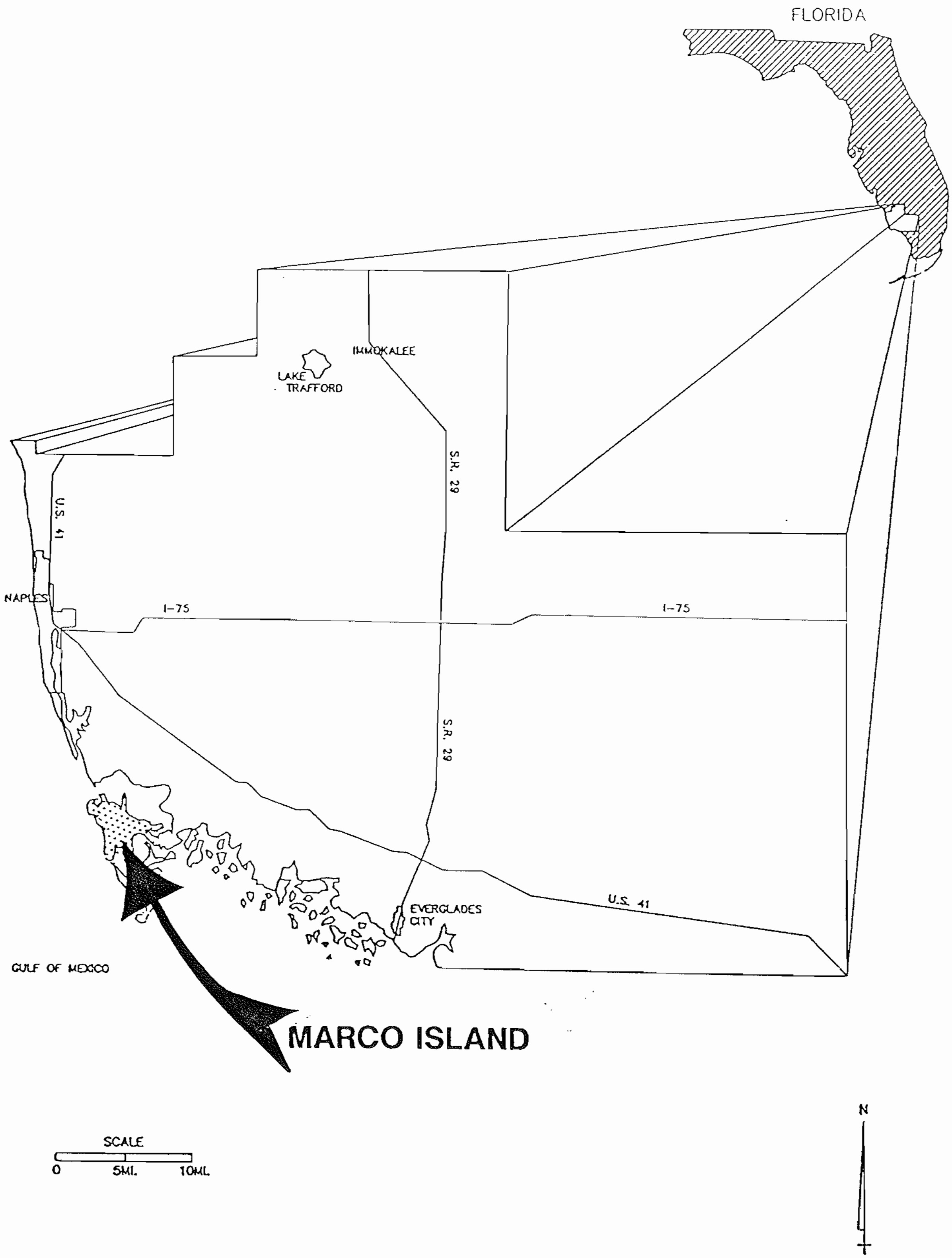
Prior to July, 1989, Deltona Corporation developed the areas of Marco Island and Marco Shores. Concomitant with the developments the Corporation established an extensive water and wastewater utility.

Since the Island did not have adequate water supply or effluent disposal capacity, the utility negotiated a lease for the use of groundwater from the Collier's manmade lake area as a source of freshwater supply. The lease for the use of the property terminates in December of 1994. Later, an infiltration gallery was constructed on the property to obtain additional flows. With the source of supply secured, the Utility later Florida Public Service Commission (FPSC) certificated both a water and wastewater service area.

In July, 1989, ultimately SSU Services, Inc. assumed managerial control of the utility which was sold by Deltona Corporation. Since that time, capital expansion projects necessary to adequately serve the utility customers have been underway for both the water and wastewater systems.

### 2.02 LOCATION

The Marco Island water and wastewater systems are located in southwestern Collier County, Florida as shown on Figure 2-1. The water and wastewater FPSC certificated areas are shown on Figure 2-2. These areas were transferred to SSU Services, Inc. via FPSC Order. The actual wastewater service area encompasses a larger area than the FPSC certificated service area since wholesale wastewater service is provided to Collier County Utilities and North Marco Utilities. These utilities operate collection systems on the island as shown in Figure 5-1. The remainder of the island is served by individual on-site septic tank systems. The actual water service area also encompasses a larger area than the FPSC certificated service area since wholesale water service is provided to Collier County Utilities. The County system provides potable water services to the Goodland Water District.

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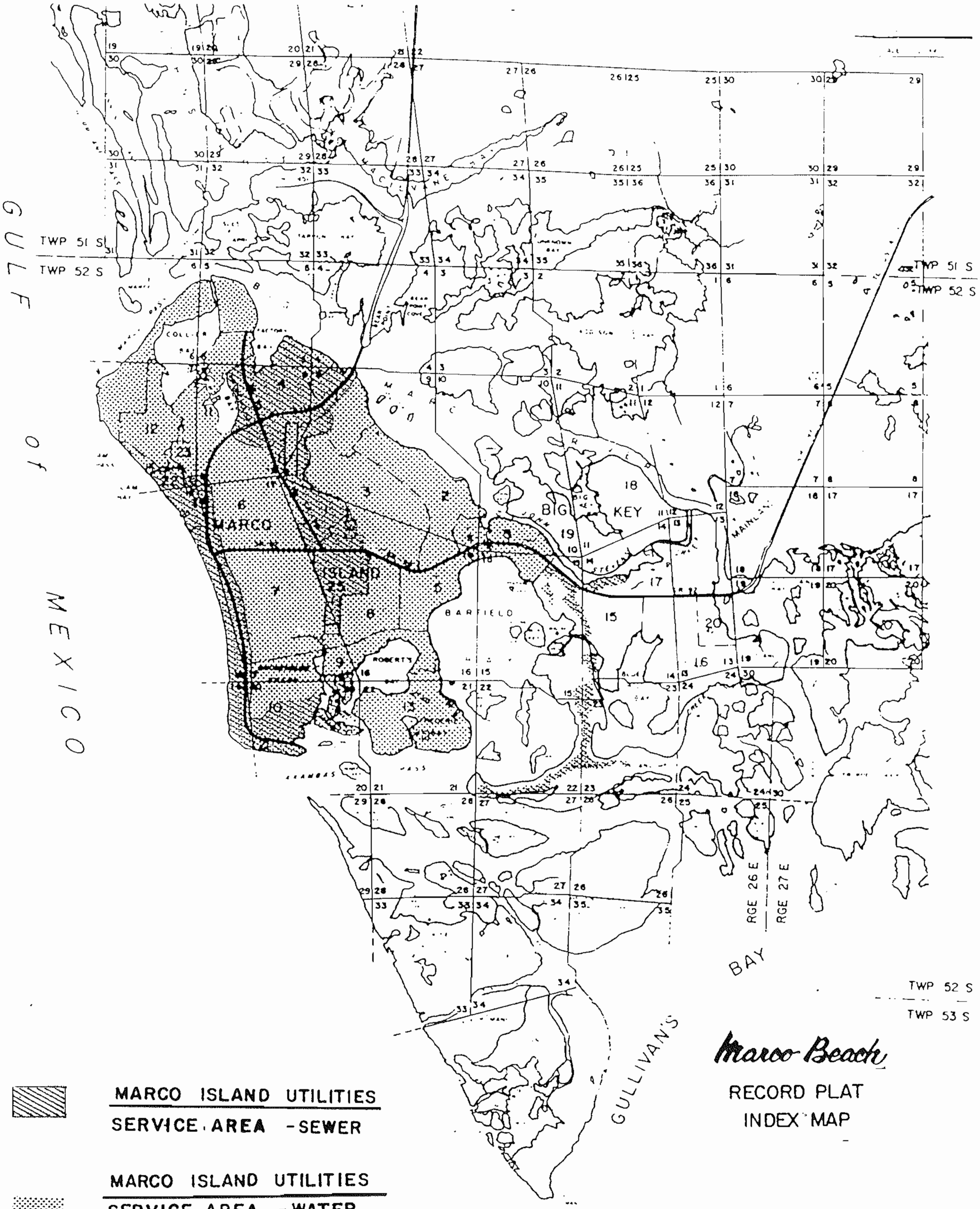
Location Map

FIGURE 2-1

MARK0101A

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Marco Island Utilities FPSC
Service Area Map

**FIGURE 2-2**

## 2.03 PROJECTED GROWTH AND POPULATION

Projected growth of the potable water system is expected to occur as a result of: 1) buildout of the existing developed areas within the present service area, 2) redevelopment of existing developed areas to higher densities, 3) development of presently undeveloped lands within the service area mainly in the Horrs Island area, and 4) an increase in the occupancy rate of existing residential units. No significant expansion of the potable water service area beyond the limit of the FPSC certificated service area and the Goodland Water District is anticipated during the planning period. Projected growth of the wastewater system is expected to occur as a result of: 1) buildout of existing developed areas within the present service area, 2) redevelopment of existing areas to higher densities, 3) development of presently undeveloped lands outside the present service area mainly in the Horrs Island area, 4) sewering of areas presently served by septic tanks by Collier County as development densities exceed 60% of buildout, and 5) an increase in the occupancy rate of existing residential units. The wastewater service area is expected to be expanded during the planning period as a result of sewering presently unsewered areas and development of presently undeveloped properties. However, the future service area is not expected to extend outside the limits of the present certificated potable water service area.

Historical and projected development data and population information was obtained from two sources for use in the preparation of this master plan. The first source of information was prepared by Deltona Utilities Consultants, Inc. (DUCI) for the wastewater system as contained in the Dyer, Riddle, Mills & Precourt, Inc. report entitled "Engineering Preliminary Design Report Marco Island Wastewater Treatment Plant Expansion Program" (EPDR). The second source of information was prepared by Collier County as presented in the "Collier County Growth Management Plan, Future Land Use Element. -- Support Document: Land Use Data and Analysis", January, 1989, (CLUP) and updated in 1989 as contained in the report entitled "Demographic and Economic Profile of Collier County," (DEP) Revised September, 1989.

The DUCI data was prepared for the existing wastewater service area based upon the use of estimated residential unit counts for single family and multi-family units within the existing wastewater service area. Future unit growth was projected by DUCI for the years 1984 through 2009 and is summarized in Table 2-1. The growth projections were based upon a linear regression of the historical unit growth data for the years 1984 through 1989. The regression analysis predicts a single family growth rate of 129 dwelling units per year and a multi-family growth rate of 251 units per year. Corresponding projections of the wastewater

TABLE 2-1
DELTONA UTILITIES CONSULTANTS, INC.
WASTEWATER SERVICE AREA POPULATION ESTIMATES

| Year* | Single-Family Units No. | Single-Family Units Pop. | Multi-Family Units No. | Multi-Family Units Pop. | Total Units | Total Population |
|---|---|---|---|---|---|---|
| 1984 | 1,072 | 2,894 | 7,526 | 16,557 | 8,598 | 19,452 |
| 1985 | 1,083 | 2,924 | 8,065 | 17,743 | 9,148 | 20,667 |
| 1986 | 1,109 | 2,994 | 8,389 | 18,456 | 9,498 | 21,450 |
| 1987 | 1,232 | 3,326 | 8,518 | 18,740 | 9,750 | 22,066 |
| 1988 | 1,613 | 4,335 | 8,682 | 19,100 | 10,295 | 23,456 |
| 1989 Estimated | 1,633 | 4,409 | 8,889 | 19,556 | 10,522 | 23,965 |
| 1990 Projected | 1,742 | 4,704 | 9,224 | 20,294 | 10,966 | 24,997 |
| 1991 Projected | 1,871 | 5,052 | 9,476 | 20,846 | 11,347 | 25,899 |
| 1992 Projected | 2,000 | 5,401 | 9,727 | 21,399 | 11,727 | 26,800 |
| 1993 Projected | 2,129 | 5,749 | 9,978 | 21,952 | 12,107 | 27,701 |
| 1994 Projected | 2,258 | 6,098 | 10,229 | 22,505 | 12,487 | 28,603 |
| 1995 Projected | 2,388 | 6,446 | 10,481 | 23,058 | 12,869 | 29,504 |
| 1996 Projected | 2,517 | 6,795 | 10,732 | 23,611 | 13,249 | 20,405 |
| 1997 Projected | 2,646 | 7,143 | 10,983 | 24,163 | 13,629 | 31,307 |
| 1998 Projected | 2,775 | 7,492 | 11,235 | 24,716 | 14,010 | 32,208 |
| 1999 Projected | 2,904 | 7,841 | 11,486 | 25,269 | 14,390 | 33,110 |
| 2000 Projected | 3,033 | 8,189 | 11,737 | 25,822 | 14,770 | 34,011 |
| 2001 Projected | 3,162 | 8,538 | 11,988 | 26,375 | 15,150 | 34,912 |
| 2002 Projected | 3,291 | 8,886 | 12,240 | 26,927 | 15,531 | 35,814 |
| 2003 Projected | 3,420 | 9,235 | 12,491 | 27,480 | 15,911 | 36,715 |
| 2004 Projected | 3,549 | 9,583 | 12,742 | 28,033 | 16,291 | 37,616 |
| 2005 Projected | 3,678 | 9,932 | 12,994 | 28,586 | 16,672 | 38,518 |
| 2006 Projected | 3,808 | 10,280 | 13,245 | 29,139 | 17,053 | 39,419 |
| 2007 Projected | 3,937 | 10,629 | 13,496 | 29,691 | 17,433 | 40,320 |
| 2008 Projected | 4,066 | 10,977 | 13,747 | 30,244 | 17,813 | 41,222 |
| 2009 Projected | 4,195 | 11,326 | 13,999 | 30,797 | 18,194 | 42,123 |
| 2010 Projected | 4,324 | 11,675 | 14,250 | 31,350 | 18,574 | 43,025 |

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HAI #90-060.00

TABLE 2-2

HOUSING UNIT AND POPULATION PROJECTIONS

| | 1989 | 1990 | 1995 | 2000 | 2005 | 2010[1] |
|---|---|---|---|---|---|---|
| Marco Island Service Area | | | | | | |
| Single-Family[2] | 3,347(3) | 3,421 | 5,349 | 7,920 | 10,592 | 13,265 |
| Multi-Family[2] | 8,712(3) | 9,224 | 10,481 | 11,737 | 12,994 | 14,250 |
| Total Housing Units | 12,059 | 12,645 | 15,380 | 19,657 | 23,586 | 27,515 |
| Permanent Population (0.81 persons/unit) | 9,768 | 10,246 | 12,822 | 15,922 | 19,105 | 22,287 |
| Seasonal Population[4] | 3,126 | 3,279 | 4,103 | 5,095 | 6,114 | 7,132 |
| Total Population | 12,894 | 13,525 | 16,925 | 21,017 | 25,219 | 29,419 |
| Potential Population[6] (100% occupancy, 2.25 persons/unit) | 27,133 | 28,460 | 35,618 | 44,228 | 53,069 | 61,909 |
| Marco Shores Service Area | | | | | | |
| Housing Units | 225 | 269 | 492 | 724 | 983 | 1,241 |
| Permanent Population[5] (0.81 persons/unit) | 182 | 218 | 399 | 586 | 796 | 1,005 |
| Seasonal Population[4] | 58 | 70 | 128 | 188 | 255 | 322 |
| Total Population | 240 | 288 | 527 | 774 | 1,051 | 1,327 |

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HAI #90-060.00

## TABLE 2-2 (Con't)

## HOUSING UNIT AND POPULATION PROJECTIONS

| | 1989 | 1990 | 1995 | 2000 | 2005 | 2010[1] |
|---|---|---|---|---|---|---|
| Marco Island Service Area | | | | | | |
| Potential Population[6] (100% occupancy, 2.25 persons/unit) | 416 | 498 | 910 | 1,339 | 1,819 | 2,296 |

(1) Year 2010 data is projected from straight line projection of year 2000 to 2005 data.
(2) Based on 1989 data that 28% of the housing units on Marco Island were single family and 22% were multi-family.
(3) Based on data in the Demographic and Economic Profile of Collier County, revised September 1989.
(4) Seasonal population estimate based upon Collier County estimate of 32% of permanent population.
(5) Permanent population estimates assume an occupancy level the same as urban Marco Island area.
(6) Persons per dwelling unit derived from 1989 data presented in Demographic and Economic Profile of Collier County, Revised September, 1989.

services area population are shown in Table 2-1 based upon an occupancy rate of 2.7 persons per single family residence and 2.2 persons per multi-family dwelling unit. The DUCI projections indicate a 35% increase in the total number of dwelling units by the end of the ten year planning period in 2000 and a 66% increase in the total number of dwelling units by the year 2009. Their projections indicate a corresponding increase in service area population from 24,997 in 1990 to 34,011 by 2000 and an increase to 42,123 by 2009.

The CLUP and DEP reports prepared by Collier County contain growth and population estimates for the Marco Island planning area which includes Marco Island, Isles of Capri, Goodland, and areas immediately to the north and south of Marco Island and west of C.R. 951. Therefore, the Collier County projections must be adjusted to exclude Isles of Capri and the areas north of Marco Island which are not contained within the existing or future service areas of Marco Island Utilities. Also, the Marco Shores development is not included within the County's Marco Island Planning area since it is on the east side of C.R. 951 and is contained with the Royal Fakapalm planning area. Separate projections for the Marco Shores area will be provided herein since it receives raw water from the Marco Island Utilities raw water supply and transmission system and shares effluent disposal facilities with Marco Island Utilities. Projections of dwelling units and population are summarized in Table 2-2. The projections were based upon the projections contained in the DEP report for the Marco Island Planning Area which were then adjusted by subtracting data for geocells 109531, 108512, and 108513 which include Isle of Capri and areas to the north which are not part of the utilities service area. Similar projections for Marco Shores are also presented in Table 2-2 based upon projections contained in the DEP report for geocell 111529Z of the Royal Fakapalm planning area which encompasses the Marco Shores development. The Collier County projections indicate a 55% increase in the number of dwelling units by the end of the ten year planning period in 2000 and a 118% increase in the total number of dwelling units by the year 2009. Their projections indicate a corresponding increase in permanent population from 10,246 in 1990 to 15,922 by 2000 and an increase to 22,287 by 2010.

The DUCI unit growth and population projections were prepared specifically for the wastewater system, whose present service area encompasses a signficantly smaller area of the island than the water system. These projections (see Table 2-1) will be utilized in Section 2.06 for preparation of the wastewater demand projections. The Collier County unit growth and population projections were adjusted herein so that they are representative of conditions within the present and future potable water service areas. These projections (see Table 2-2) will be utilized in Section 2.05 for preparation of the water demand projections.

## 2.04 LEVEL OF SERVICE REQUIREMENTS

Level of service requirements are established prior to projecting water demands and wastewater flows. Typically the requirements are developed using a standard residential home as one unit called an equivalent residential connection (ERC) or on a per capita basis.

The level of service requirements for Marco Island Utilities are discussed in four different documents:

1. The 1989 Collier County Growth Management Plan.

2. The most current Florida Public Service Commission (FPSC) approved tariff.

3. The Collier County and Marco Island Water Supply Feasibility Study.

4. The Engineering Preliminary Design Report for the Marco Island Wastewater Treatment Plant Expansion Program.

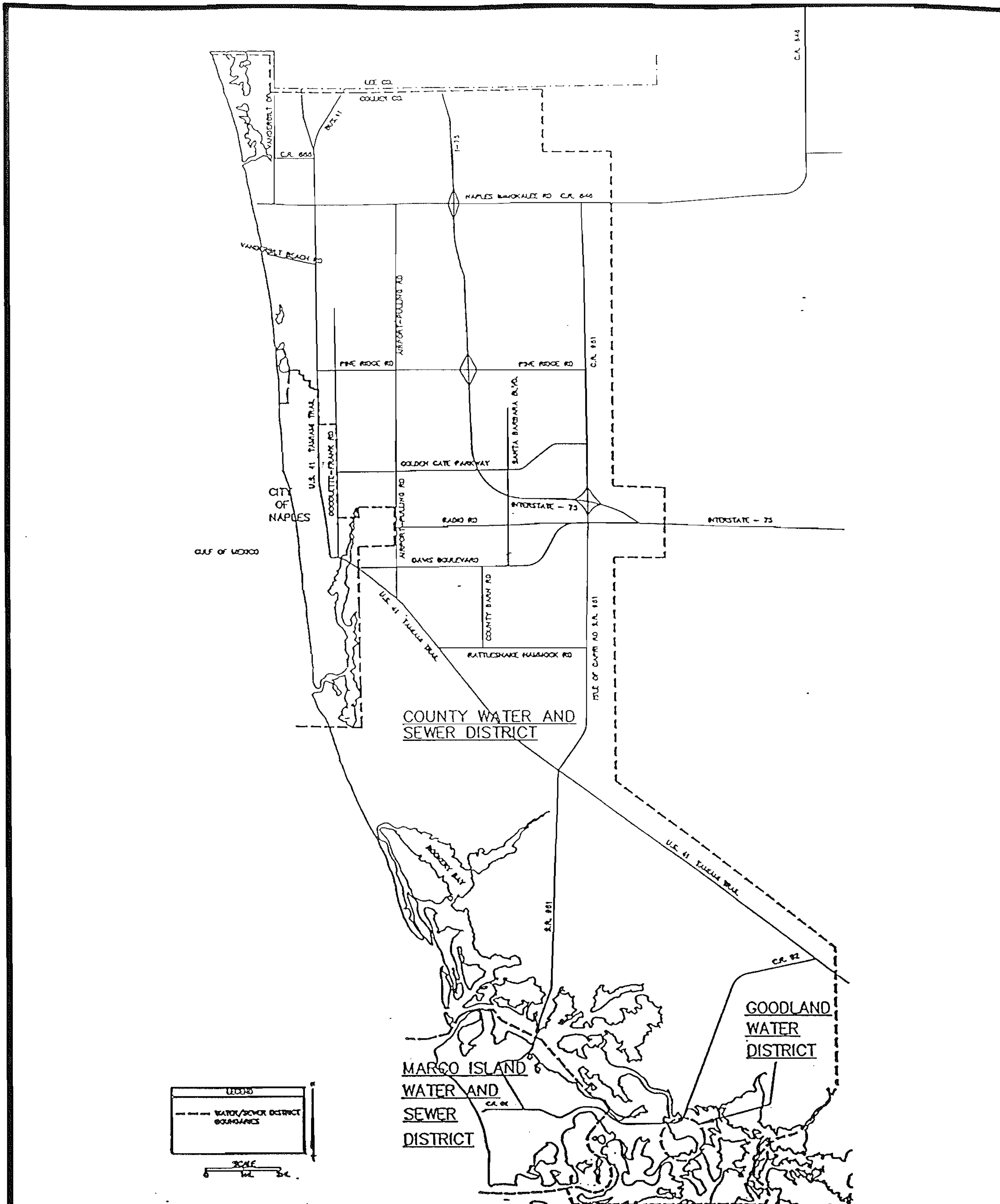
The first two documents contain general water and wastewater level of service requirements and the last two documents contain specific engineering, planning, and design related level of service requirements for water and wastewater, respectively.

A. The Collier County Growth Management Plan

The Collier County Growth Management Plan (i.e., the local comprehensive plan), dated January, 1989, discusses the level of service requirements for water and wastewater facilities in the Public Facilities Element of the plan.

The Potable Water sub-element discusses three water districts within the unincorporated areas of Collier County as shown in Figure 2-3:

1. County Water and Sewer District.
2. Marco Water and Sewer District.
3. Goodland Water District.

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Collier Co. Growth Management Plan

Water Service Area

FIGURE 2-3

08000104

The Marco Water and Sewer District is essentially the same as the existing FPSC approved water service area (see Figure 2-2). This Marco Water and Sewer District was established in 1972 by Collier County to construct primarily wastewater collection facilities outside the "housing areas" of the Marco Island PUD that Deltona Corporation was not intending on providing wastewater service. For the Marco Water and Sewer District, the county has established a water level of service of 200 gallons per day per capita. It should be noted that this level of service is higher than the other two districts' 163 gallons per day per capita.

The Sanitary Sewer sub-element discusses four distinct wastewater service areas for the unincorporated portions of Collier County as shown in Figure 2-4:

1. North Service Area.

2. Central Service Area.

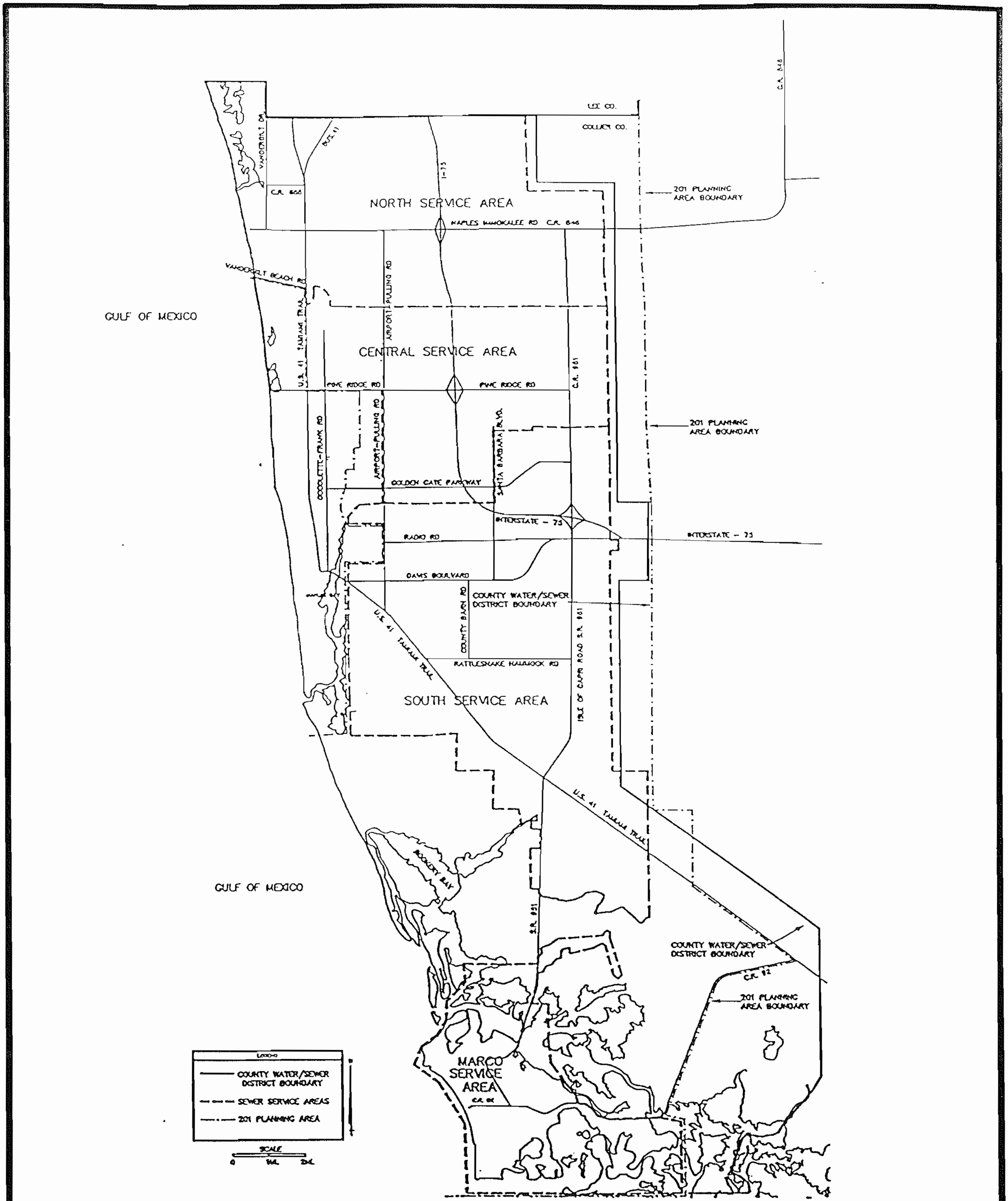
3. South Service Area.

4. Marco Service Area.

The Marco Service Area, shown in Figure 2-5, includes Marco Island, Isles of Capri, Marco Shores and Goodland which are not included in the Marco Water and Sewer District. This figure also indicates the approximate areas currently being provided wastewater collection service by the Marco Water and Sewer District. The county has established a level of service for this area of 100 gallons per day per capita. In addition, they have included a 21% non-residential factor for commercial usage. Thus, Collier County has established a wastewater level of service of 121 gallons per day per capita.

B. FPSC Approved Tariff

The most current FPSC approved tariff, which was revised during the last Marco Island rate case, Docket Number 850151-WS, identifies two different water and wastewater ERC values. Due to the large single family residential water uses, the FPSC has determined that it would be equitable to establish two ERC values such that customers would pay their fair share of the capital costs via the service availability charges. Thus, the FPSC established residential and multi-family ERC values as follows:

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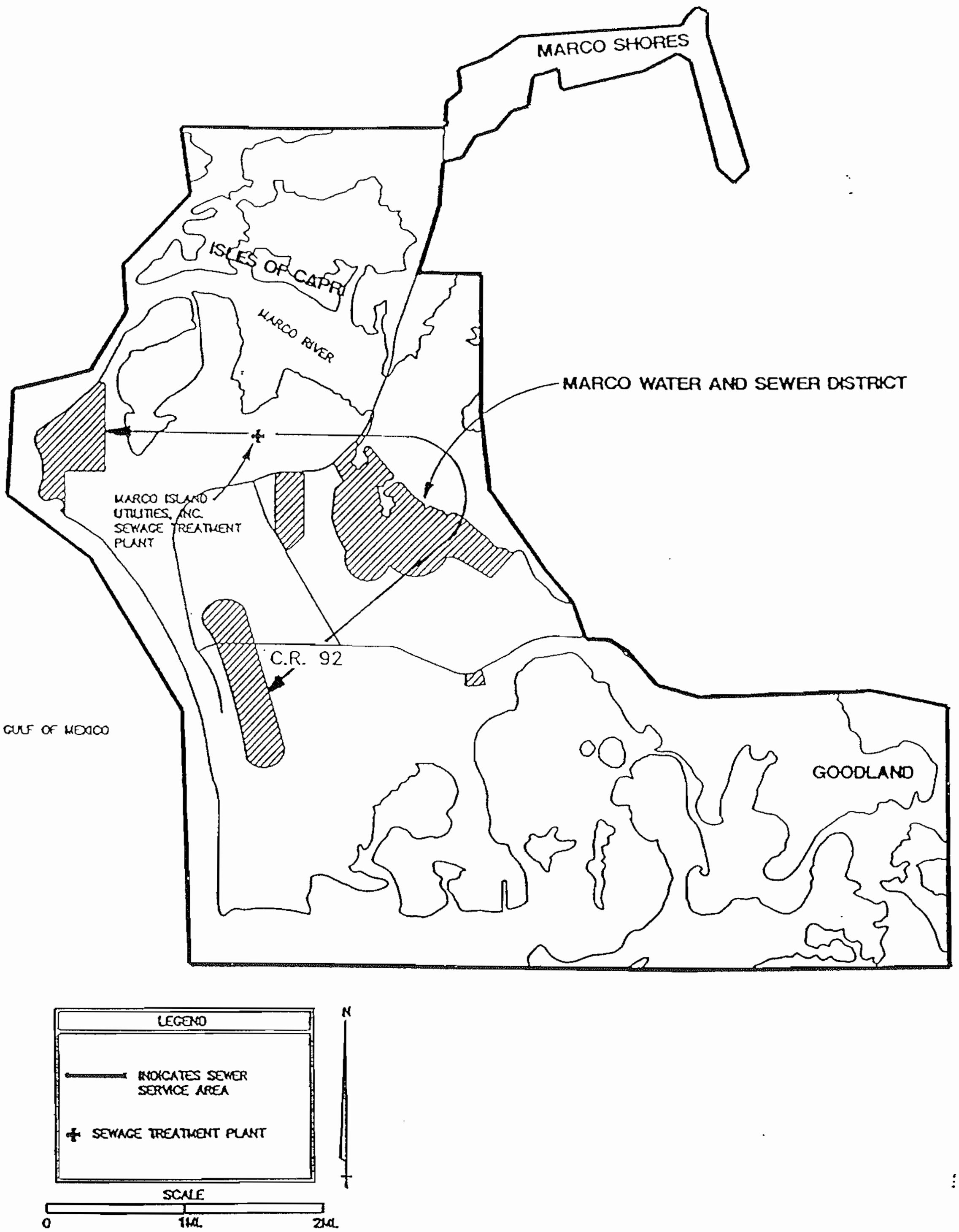
Collier Co. Growth Management Plan

## Wastewater Service Area

FIGURE 2–4

06000104

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Collier Co. Growth Management Plan

Marco Wastewater Service Area

FIGURE 2-5

08000104

| Type of Connection | ERC Value |
| --- | --- |
| Water | |
| Single Family | 800 gpd |
| Multi-family | 285 gpd |
| Wastewater | |
| Single Family | 300 gpd |
| Multi-family | 250 gpd |

Typically these values are reviewed at the time of a rate adjustment application and are a function of the gallons of water billed and the average number of customers during the test year.

C. The Water Feasibility Study

The Collier County and Marco Island Water Supply Feasibility Study dated August, 1989, discusses water demands in Section 3. It states that the authors reviewed the determinations presented in the 1986 Water Master Plan for Western Collier County and concurred with its results that 200 gallons per day per capita applied to the "peak seasonal population" was satisfactory. This caveat of "peak seasonal population" is confusing due to the report's statement that a maximum month to annual average day factor is 1.35. Apparently the 200 gallons per day per capita is an annual average daily demand not a "peak seasonal population" demand. This level of service requirement is the same as is established in the Collier County Growth Management Plan.

For facilities planning purposes, it is necessary to establish, in addition to the annual average daily demand per ERC or capita level of service requirement, other pertinent level of service requirements. These other level of service requirements are as follows for water service:

1. Average daily demand during the maximum month of the year to annual average daily demand ratio (MMD/ADD).

2. The average daily demand during the maximum day of the year to annual average daily demand ratio (MDD/ADD).

3. The average of the five maximum days of the year to the annual average daily demand ratio (5DD/ADD).

4. Maximum peak hour demand to annual average daily demand ratio (PHD/ADD).

5. Fire flow requirements are usually specified in gallons per minute for a specified period of time called a duration. Typically this figure is based on the highest fire flow required within the service area. Normally these fire flow requirements are established by the county fire marshall in conjunction with the Insurance Services Office (ISO) Fire Suppression Rating Schedule.

The MMD/ADD and MDD/ADD ratios are used to design the capacity required of the sources of supply and the water treatment facilities, The 5DD/ADD ratio is used by the FPSC in calculating the "used and useful" water facilities and thus affects the planning of facilities for an investor owned utility, but is unique to only that purpose. The PHD/ADD ratio and MDD plus the fire flow requirements are used to determine the capacity required of water storage, high service pumping, and water transmission and distribution systems.

As stated before, the water feasibility study determined the MMD/ADD ratio to be 1.35. The water feasibility study made no mention of the PHD/ADD flow ratio nor the fire flow requirements since the study was concerned only with the water supply and treatment and not the water storage, pumping or transmission and distribution facilities.

D. Marco Island WWTP Expansion

The Engineering Preliminary Design Report for the Marco Island Wastewater Treatment plant Expansion Program, dated December, 1989, discusses the level of service requirement used to determine the wastewater flow projections in sub-section 2.06. The report states that the wastewater flow projections were determined using Deltona Utilities Consultants, Inc. (DUCI) requirements of 300 gallons per day for single family residential units and 250 gallons per day for multi-family residential units. These figures are the same as what has been established in the FPSC approved sewer tariff.

Similar to water facilities, planning of wastewater facilities requires level of service requirement in addition to the annual average daily flow per ERC or per captia requirements. The additional level of service requirements are as follows:

1. Average daily flow during the maximum month of the year to annual average daily flow ratio (MMF/ADF).

2. The annual maximum day flow of the year to annual average daily flow ratio (MDF/ADF).

3. The average of the five peak days during the year to the annual average daily flow ratio (5DF/ADF).

4. The peak hour flow during the year to the annual average daily flow ratio (PHF/ADF).

The MMF/ADF, MDF/ADF and 5DF/ADF ratios are used to determine the capacities of the wastewater treatment and effluent disposal facilities. The PHF/ADF ratio is used to determine the capacity of the wastewater collection system, the wastewater pumping stations and force mains and effluent disposal pumping facilities.

The engineering report reviewed the 5DF/ADF data and determined a ratio of 1.40 was appropriate. The report also determined that the MDF/ADF ratio is 1.50.

E. Summary of Level of Service Requirements

Below is a summary of the four sources reviewed for level of service requirements.

**Water**

| Source | ADD | MDD/ADD | MMD/ADD |
|---|---|---|---|
| Collier County | 200 gpd/capita | --- | --- |
| FPSC(1) | S.F. - 800 gpd/ERC | --- | --- |
| | M.F. - 295 gpd/ERC | --- | --- |
| Water Study | 200 gpd/capita | 1.50 | 1.35 |

---

(1) Based on average of 5 peak days during the year.

Wastewater

| Source | ADD | MDD/ADD | MMD/ADD |
|---|---|---|---|
| Collier County | 200 gpd/capita | --- | --- |
| FPSC(2) | S.F. - 300 gpd/ERC | --- | --- |
| | M.F. - 250 gpd/ERC | --- | --- |
| Engineering Report | Same as FPSC | 1.50 | 1.40 |

(2) Based on MMF.

## 2.05 WATER DEMAND PROJECTIONS

At the heart of a good water master plan is the projection of the water demands. These projections are the basis of the determination of the necessary capacity of water facilities. The projected demands are what drive the capital improvements program and established the timing of these improvements in order to meet the customers demands and maintain the level of service requirements established in sub-section 2.04. For an investor owned utility, these projections are very important since they provide the critical timing of the facilities to not only meet the demands of the customers, but also assure that the most economical and reliable facilities are available to meet the demands. These projections should be analyzed on an annual basis and updated as necessary such that this safe, reliable and cost effective service can be maintained.

For Marco Island, the water demands are difficult to forecast due to the seasonal population, the very large demands of the customers and the above average projected population growth. After reviewing all the various sources of data and analyzing the numerous different methods of projecting the water demand based upon this information, the annual average daily water demands have been projected as shown in Table 2-3. During the ten year planning period it is projected that the finished annual average demand water demand in the Marco Island service area will rise from 5.90 mgd in 1990 to approximately 10.65 in 2000.

The projected growth and population information discussed in sub-section 2.03, based upon the Demographic and Economic Profile of Collier County was used as the basis of the projected water demands. The housing unit projections shown in Table 2-2, which are adjusted Collier County projections so as to coincide with the Marco Island service area, were the figures used for total housing unit projections. These figures were interpolated linearly between 1990 and 1995 and between 1995 and 2000 to arrive at the Total Housing Units shown in Table 2-3.

Since the FPSC level of service requirements were established based upon a single family unit and a multi-family unit, it was necessary to disaggregate the total housing units into single family and multi-family. It was assumed that the majority of the connections on Marco Island are either single family or multi-family and thus the retail and commercial connections are minimal.

The multi-family unit projections are based upon the Deltona Utilities Consultants, Inc. (DUCI) Populations Projections for the Wastewater Service Area as contained in the Engineering Preliminary Design Report for the Marco Island Wastewater Treatment Plan Expansion Program and as summarized in Table 2-1. In using this data, the assumption is made that all the existing and future multi-family connections are provided both water and wastewater services; thus there are the same number of multi-family units projected to receive water service as there are projected by DUCI to receive wastewater service.

The projected single family units shown on Table 2-3 are the difference between the adjusted Collier County total housing unit, and the DUCI projected multi-family units. The DUCI projected single family units were not used because the existing wastewater service area is significantly smaller than the water service area in the residential areas of Marco Island.

The total projected water demands were calculated using the FPSC level of service requirements of 800 gpd for a single family unit and 285 gpd for a multi-family unit. Since this level of service requirements based upon an annual average daily demand, the projected water demands are also annual average daily demands. The FPSC establishes these level of service requirements based upon water billed not water pumped; therefore, it is necessary to adjust these projected water demands upward to include the "unbilled" water demands. Typically these "unbilled" water demands consist of line flushing, fire flows, main breaks, system leaks, stolen water, etc. The FPSC normally allows approximately ten percent for these "unbilled" water demands; therefore, the calculate demands were increased by ten percent to arrive at the Total Water Demands shown in Table 2-3.

These projected demands could possibly be on the "high side" because the Collier County population and housing unit projections were based upon the Bureau of Economic and Business Research (BEBR), Bulletin No. 88, March, 1989 "high-range" estimates which could possibly estimate inflated population growth. However, they are considered to be conservative for planning purposes and the timing of recommended activities can be postponed if actual growth lags behind the projections.

We analyzed the possibility of projecting the water demand based upon a per capita basis as was done in the Water Feasibility Study, but found that the correlation with the historical data was not very high. This is probably due to the difficulty in determining a population for the island since it is so seasonal. We believe that the more accurate method is based upon the number of connections. The method described above correlated very well with the actual 1989 water demand of 5.67 mgd. The reason that this method correlated so well is that such a large portion (approximately 50% to 65%) of the water demand is for irrigation purposes which is a function of the number of connections and not the number of inhabititant of the dwelling unit.

In addition to the projections of water demand on an annual average daily demand basis, it is necessary to project the annual maximum day demand (MDD). The purpose of projecting the annual maximum day demand is that normally the water supply and treatment facilities must be designed to meet this demand.

Table 2-4 shows the historical annual average daily demand and the annual maximum day demand from 1973 to 1989. Figure 2-6 shows these historical annual average daily demands and annual maximum day demands in graphical form. As expected the trend of these lines is in an upward direction with a few minor variations probably due to climatic conditions. Since Marco Island relies heavily on tourism, a rainy "tourism season" would have two impacts on the demand: first, it would reduce the irrigation demand and secondly, it would reduce the seasonal population and thus the potable water demands.

Table 2-4 also presents the ratio of the annual maximum day demand to annual average daily demand. This ratio is significant in that it allows one to calculate the projected annual maximum day demand using the historical trends. Figure 2-7 shows this ratio in a graphical form. As can be seen, there has been a general downward trend in this ratio since 1973. This is typical, because the larger the water system, the less variation there is between the annual average daily demand and the maximum day demand. Based upon this trend, the maximum day to average day ratio for the projected period of 1990 to 2000 will also be based upon a decline value. The average during the last five years has been 1.47; therefore, a conservative starting value for 1990 will be 1.50. Each year the ratio will be decreased one hundredth to the year 2000 ratio of 1.40. Table 2-5 shows the annual average daily demand computed

TABLE 2-3
MARCO ISLAND UTILITIES
AVERAGE DAILY WATER DEMAND PROJECTIONS (1)

| Year | Single Family Units (2) | Multi Family Units (3) | Total Housing Units (4) | Total Water (5) Demand (mgd) |
|---|---|---|---|---|
| 1989 | 3,170 | 8,889 | 12,059 | 5.67(6) |
| 1990 | 3,421 | 9,224 | 12,645 | 5.90 |
| 1991 | 3,806 | 9,476 | 13,282(7) | 6.32 |
| 1992 | 4,192 | 9,727 | 13,919(7) | 6.74 |
| 1993 | 4,578 | 9,978 | 14,556(7) | 7.16 |
| 1994 | 4,964 | 10,229 | 15,193(7) | 7.58 |
| 1995 | 5,349 | 10,481 | 15,830 | 7.99 |
| 1996 | 5,863 | 10,732 | 16,595(8) | 8.52 |
| 1997 | 6,377 | 10,983 | 17,360(8) | 9.05 |
| 1998 | 6,890 | 11,235 | 18,125(8) | 9.58 |
| 1999 | 7,405 | 11,486 | 18,891(8) | 10.12 |
| 2000 | 7,920 | 11,737 | 19,657 | 10.65 |

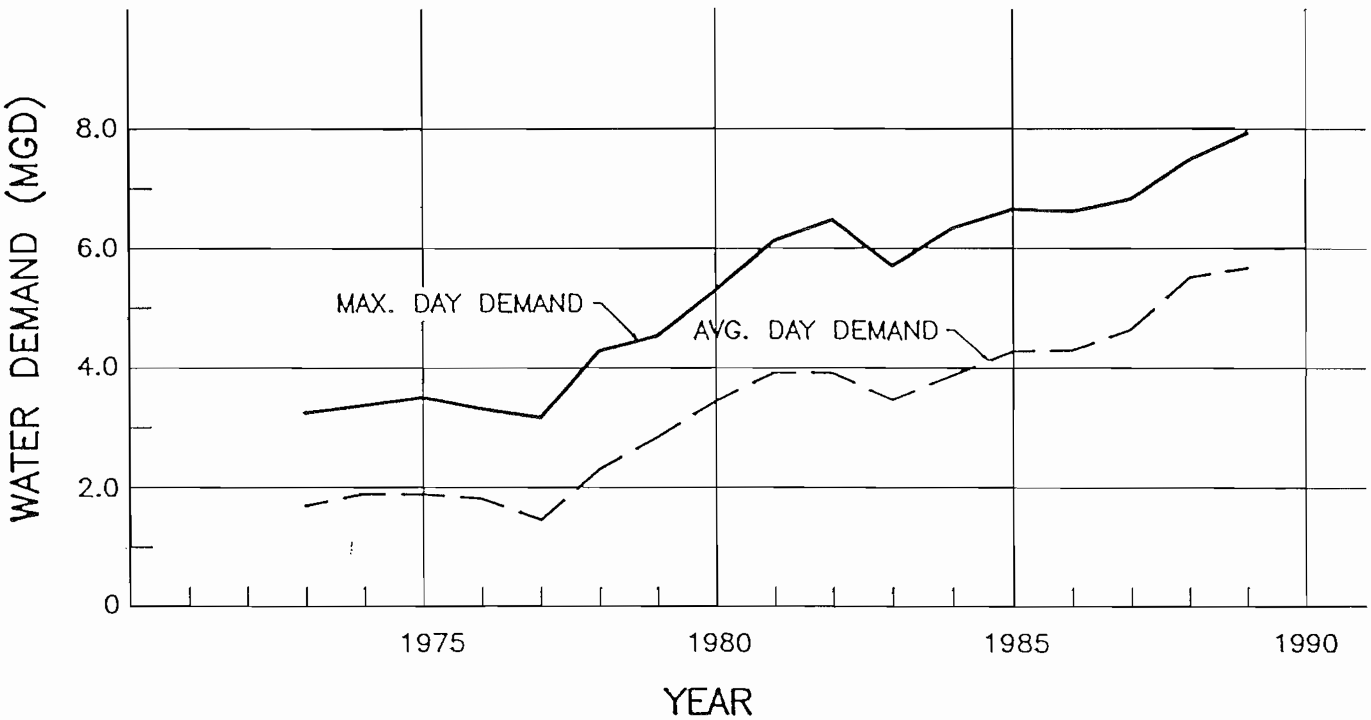
Notes:
1) Annual average daily demand for finished water in the Marco Island service area.
2) Based on the difference between the total units and the multi-family units.
3) Based on Deltona Utilities Consultants, Inc. Population Projection for the Wastewater Service Area.
4) Based on adjusted (see Table 2-2)Collier County Housing Unit Projection contained in the Demographic and Economic Profile of Collier County, Revised September, 1989.
5) Calculated based upon the FPSC billed water demands of 800 gpd for single family units and 285 gpd for multi-family units and a FPSC allowed 10% unbilled water factor.
6) Based upon the historical annual average daily demand.
7) Linearly Interpolated Between The 1990 and 1995 data
8) Linearly interpolated between the 1995 and 2000 data

TABLE 2-4
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
HISTORICAL WATER DEMAND DATA

| Year | Date | Maximum Day Demand(mgd) | Average Day Demand(mgd) | Max. Day/ Avg. Day |
|---|---|---|---|---|
| 1973 | 10/24 | 3.25 | 1.69 | 1.92 |
| 1974 | 2/22 | 3.38 | 1.89 | 1.79 |
| 1975 | 3/8 | 3.51 | 1.88 | 1.87 |
| 1976 | 8/23 | 3.32 | 1.81 | 1.83 |
| 1977 | 11/18 | 3.17 | 1.45 | 2.18 |
| 1978 | 5/19 | 4.2 | 2.31 | 1.85 |
| 1979 | 5/18 | 4.54 | 2.85 | 1.59 |
| 1980 | 6/26 | 5.31 | 3.45 | 1.54 |
| 1981 | 11/28 | 6.14 | 3.93 | 1.56 |
| 1982 | 3/23 | 6.48 | 3.92 | 1.65 |
| 1983 | 6/17 | 5.70 | 3.46 | 1.65 |
| 1984 | 11/2 | 6.34 | 3.88 | 1.63 |
| 1985 | 1/31 | 6.66 | 4.28 | 1.56 |
| 1986 | 3/30 | 6.62 | 4.29 | 1.54 |
| 1987 | 5/5 | 6.83 | 4.65 | 1.47 |
| 1988 | 10/29 | 7.49 | 5.51 | 1.36 |
| 1989 | 11/14 | 7.93 | 5.67 | 1.40 |
| | | | **Total** | **28.39** |
| | | | **Average** | **1.67** |
| | | | **5 yr. average (1985-1989)** | **1.47** |
| | | | **10 yr. average (1980-1989)** | **1.54** |
| | | | **15 yr. average (1975-1989)** | **1.65** |
| | | | **Max.** | **2.18** |
| | | | **Min.** | **1.36** |

TABLE 2-5
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
MAXIMUM DAY WATER DEMAND PROJECTIONS

| Year | Average Daily Demand (mgd) | Max Day to Average Day Ratio | Maximum Day Demand (mgd) |
|---|---|---|---|
| 1990 | 5.90 | 1.50 | 8.85 |
| 1991 | 6.32 | 1.49 | 9.42 |
| 1992 | 6.74 | 1.48 | 9.98 |
| 1993 | 7.16 | 1.47 | 10.53 |
| 1994 | 7.58 | 1.46 | 11.07 |
| 1995 | 7.99 | 1.45 | 11.59 |
| 1996 | 8.52 | 1.44 | 12.27 |
| 1997 | 9.05 | 1.43 | 12.94 |
| 1998 | 9.58 | 1.42 | 13.60 |
| 1999 | 10.12 | 1.41 | 14.27 |
| 2000 | 10.65 | 1.40 | 14.91 |

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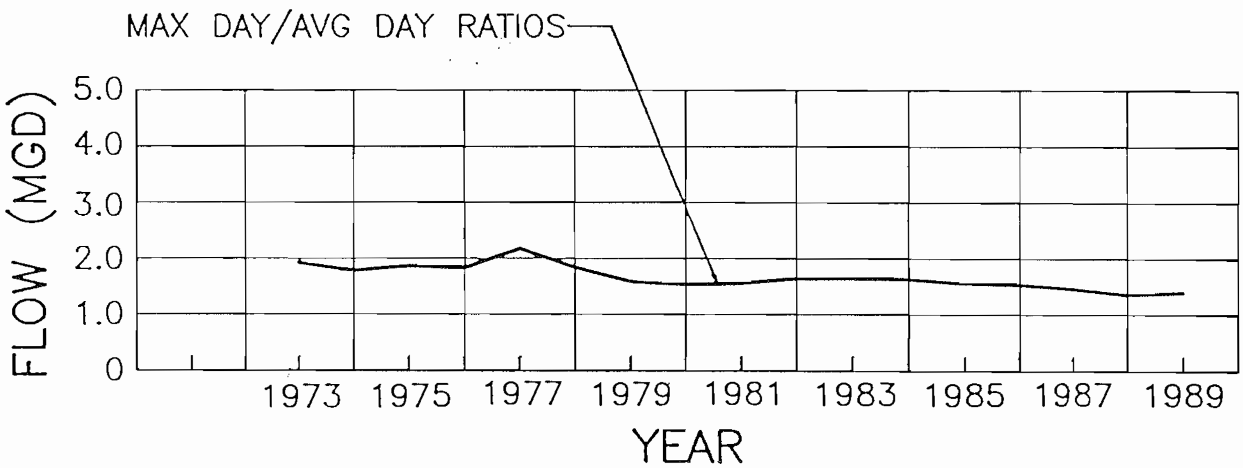
Marco Island Utilities
Historical Water Demands
FIGURE 2-6

08000104

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Marco Island Utilities
Historical Max Day/Avg Day ratios
FIGURE 2–7

08000104

earlier and the calculated annual maximum day demand using the declining ratio factor. Figure 2-8 shows the last five years of historical annual average daily and maximum day water demands and the 1991 through 2000 projected demands in graphical form.

## 2.06 WASTEWATER FLOW PROJECTIONS

This sub-section presents historical and projected wastewater flows as well as flow variability. Historical flow data for the Marco Island WWTP were obtained for the years 1985 through 1989 from the FDER monthly operating reports. This data is summarized in Table 2-6. The historical data includes the annual average daily flow (ADF), the maximum month average daily flow (MMF) and the maximum daily flow (MDF). These data were utilized to estimate per capita wastewater flow generation rates and factors for the ratio of MMF/ADF and MDF/ADF.

The population figures were obtained from Deltona Utilities Consultants, Inc. (DUCI) data presented in Table 2-7 which were utilized to calculate per capita flow. The per capita flow rate varied from 48.8 gpcd in 1985 to 80.6 gpcd in 1989 and showed and increasing trend over the five year period. The DUCI population figures are based upon projected dwelling units and represent an average occupancy of 2.3 persons per dwelling unit. This closely corresponds to the 100% occupancy rate of 2.24 persons per dwelling unit contained in the Collier County CLUP and DEP documents. However, the Collier County data indicates that actual occupancies very between 0.84 and 1.38 persons per dwelling unit based on permanent population. Therefore, actual recent (1989) per captia wastewater flow rates may range between 109 and 179 gpcd when seasonal flow fluctuations are factored out and per capita flow is based upon estimated current occupancy rates which are significantly less than 100% based upon Collier County demographic data.

Wastewater flows to the treatment facilities very seasonally in response to the influx of population during the winter and spring months. Figure 2-9 shows the monthly flows for the year 1985 through 1989. The historical flow data show an increasing trend in average daily wastewater flow over the last five years of record. Figure 2-10 shows the monthly flows normalized by dividing them by the annual average daily flow. Maximum month average daily flows occurred in March of each year at the height of the tourist season. The ratio of the maximum month flow to annual average daily flow ranged from 1.30 to 1.42 and averaged 1.36. The maximum daily (24 hr.) flow occurred at differenct times of the year probably attributable to either peak population or inflow/infiltration following rainfall events. The

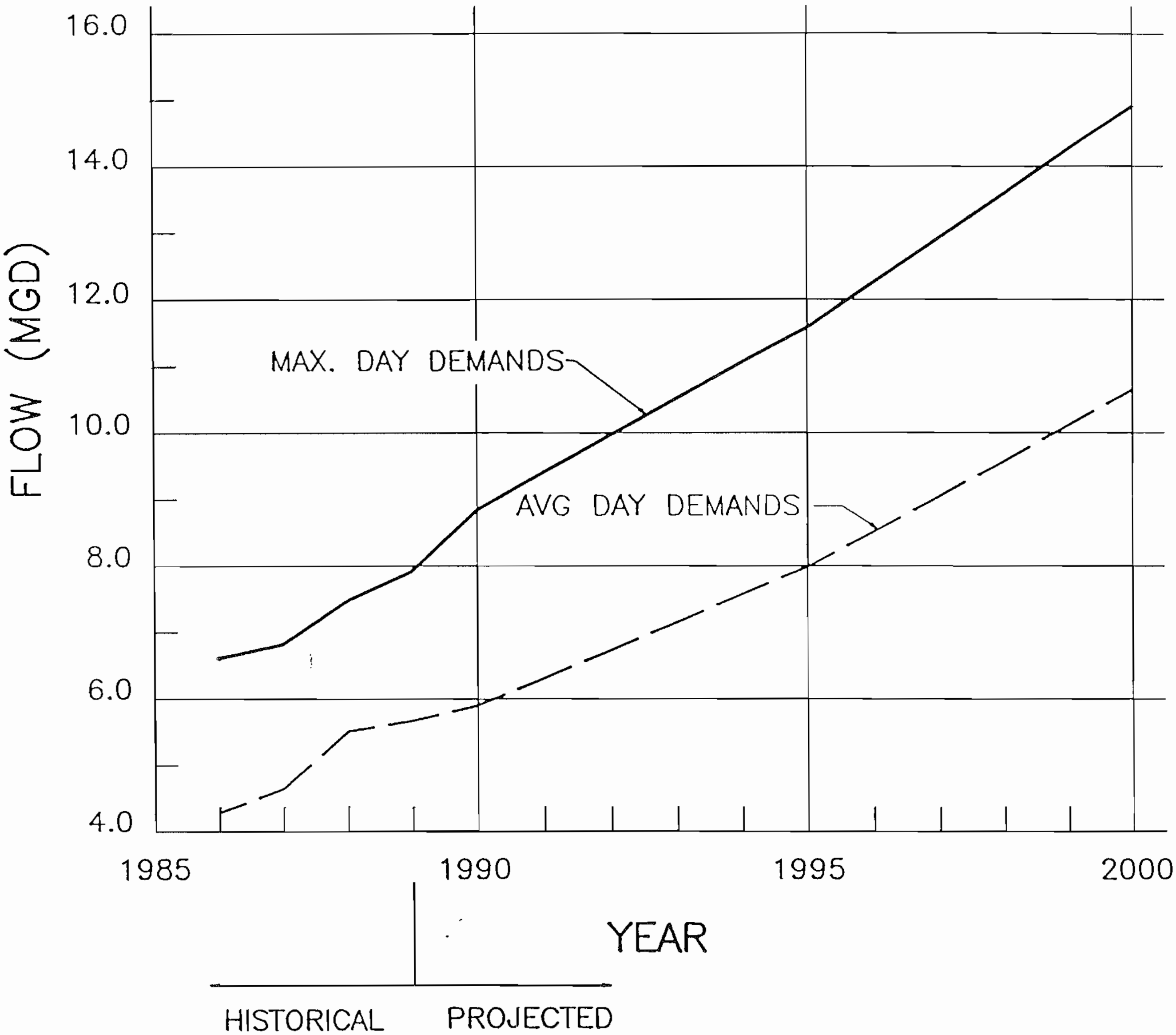
## TABLE 2-6
## MARCO ISLAND UTILITIES WATER AND WASTEWATER MASTER PLAN
## HISTORICAL WASTEWATER FLOW DATA

| Year | Annual Average Daily Flow,MGD (ADF) | Per Capita Flow, GPCD | Maximum Month Average Daily Flow, MGD (MMF) | Ratio (MMF/ADF) | Maximum Daily Flow, MGD (MDF) | Ratio (MDF/ADF) |
|---|---|---|---|---|---|---|
| 1985 | 1.009 | 48.8 | 1.401(3) | 1.39 | 1.884(7) | 1.87 |
| 1986 | 1.118 | 52.1 | 1.506(3) | 1.35 | 2.264(12) | 2.03 |
| 1987 | 1.459 | 66.1 | 2.076(3) | 1.42 | 2.735(5) | 1.87 |
| 1988 | 1.545 | 65.9 | 2.034(3) | 1.32 | 2.297(2) | 1.49 |
| 1989 | 1.931 | 80.6 | 2.518(3) | 1.30 | 3.021(3) | 1.56 |

Note: The month in which the maximum daily and maximum month average daily flow occurred are shown in parentheses.

## TABLE 2-7
## DESIGN WASTEWATER FLOW PROJECTIONS

| Year | Average Daily Flow MGD | Maximum Month Average Daily Flow, MGD | Maximum Day Flow, MGD | Peak Design Flow, MGD |
|---|---|---|---|---|
| 1990 | 2.10 | 3.02 | 3.36 | 5.38 |
| 1995 | 2.65 | 3.57 | 4.17 | 6.57 |
| 2000 | 3.15 | 4.12 | 4.88 | 7.62 |
| 2005 | 3.65 | 4.66 | 5.57 | 8.65 |
| 2010 | 4.15 | 5.21 | 6.23 | 9.67 |

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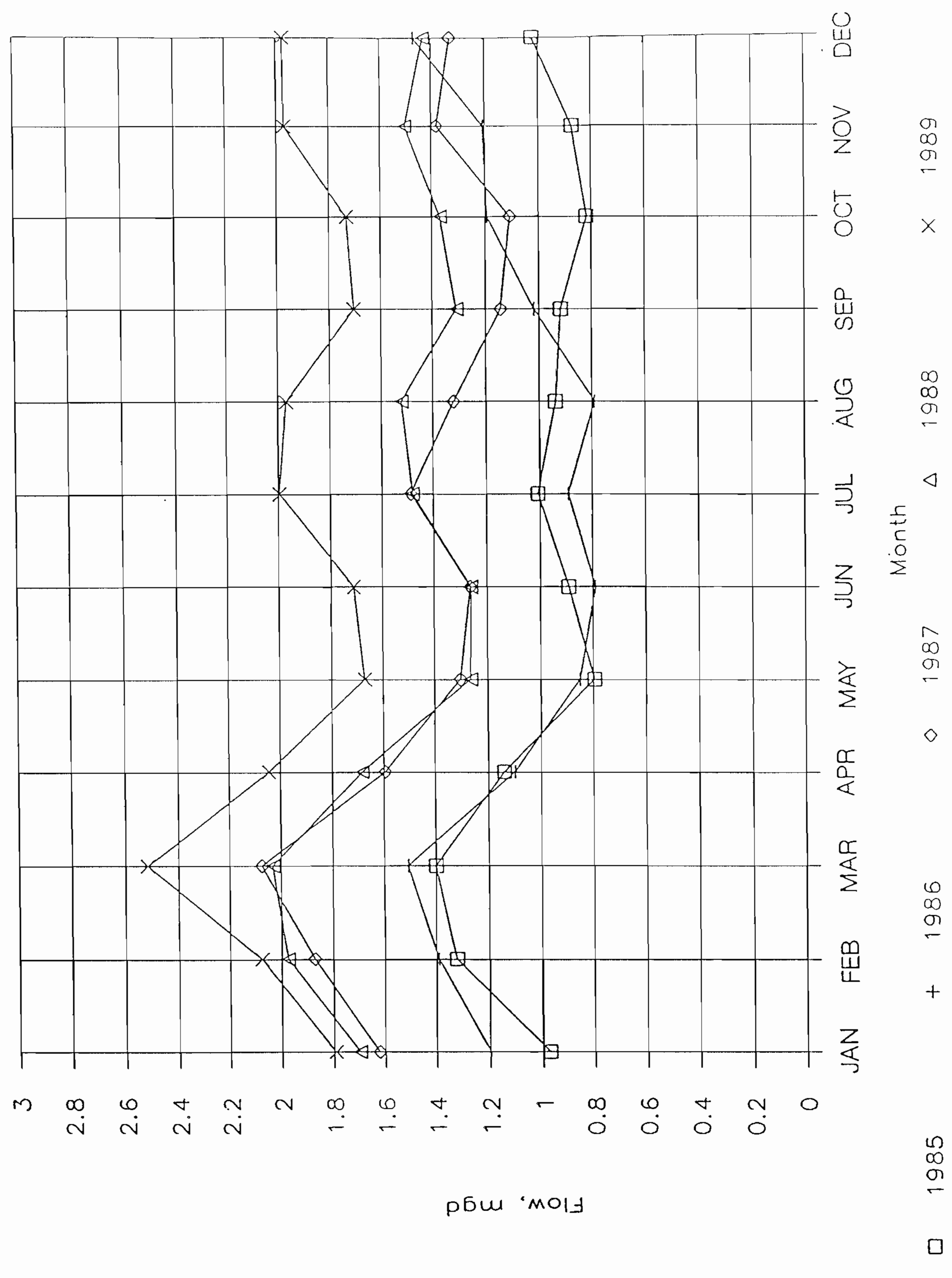
Projected Average Daily And Maximum Day Water Demands

FIGURE 2–8

06000104

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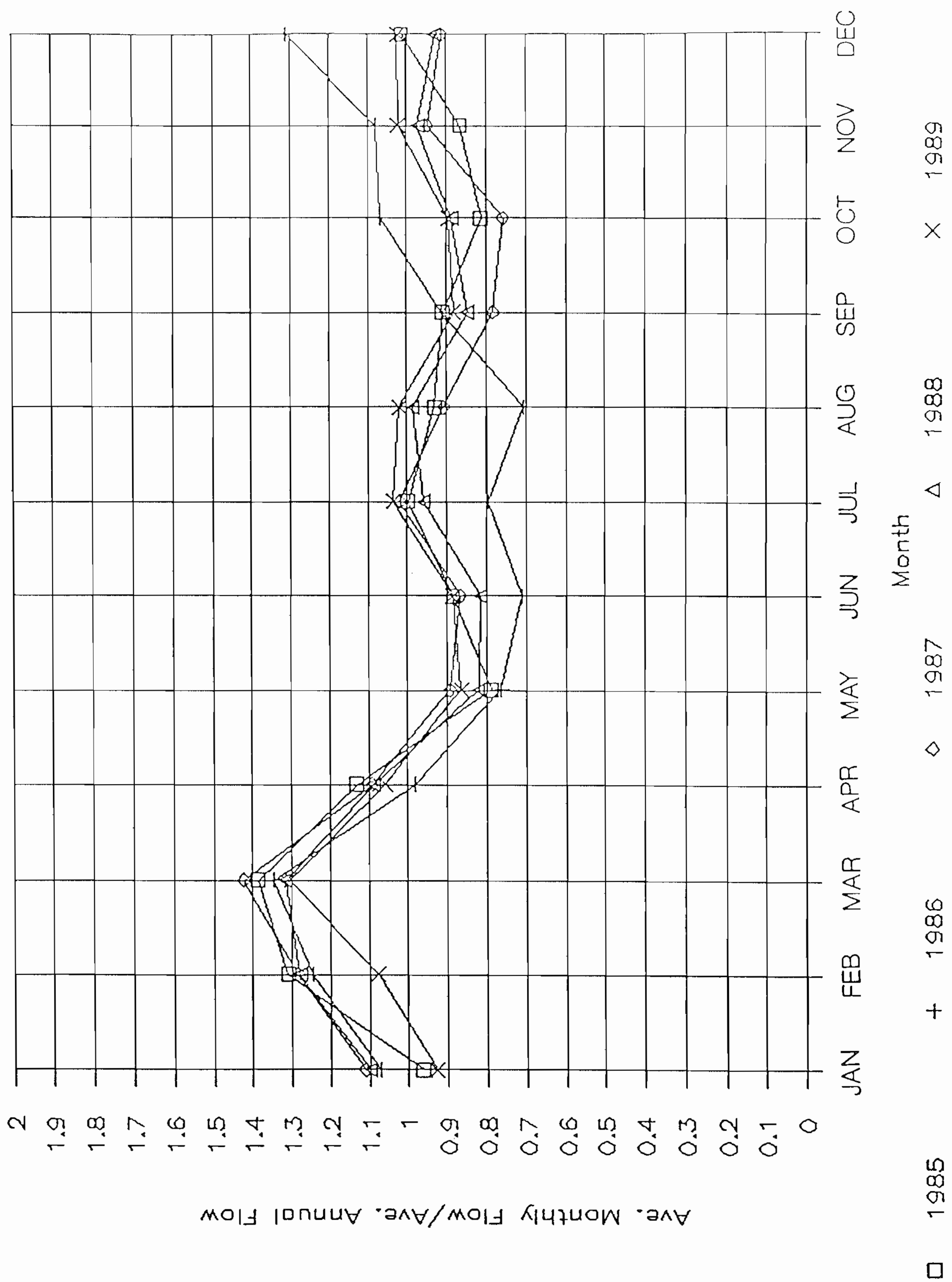
Historical Monthly Wastewater Flows 1985-1989

FIGURE 2-9

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Normalized Monthly Wastewater Flows 1985-1989

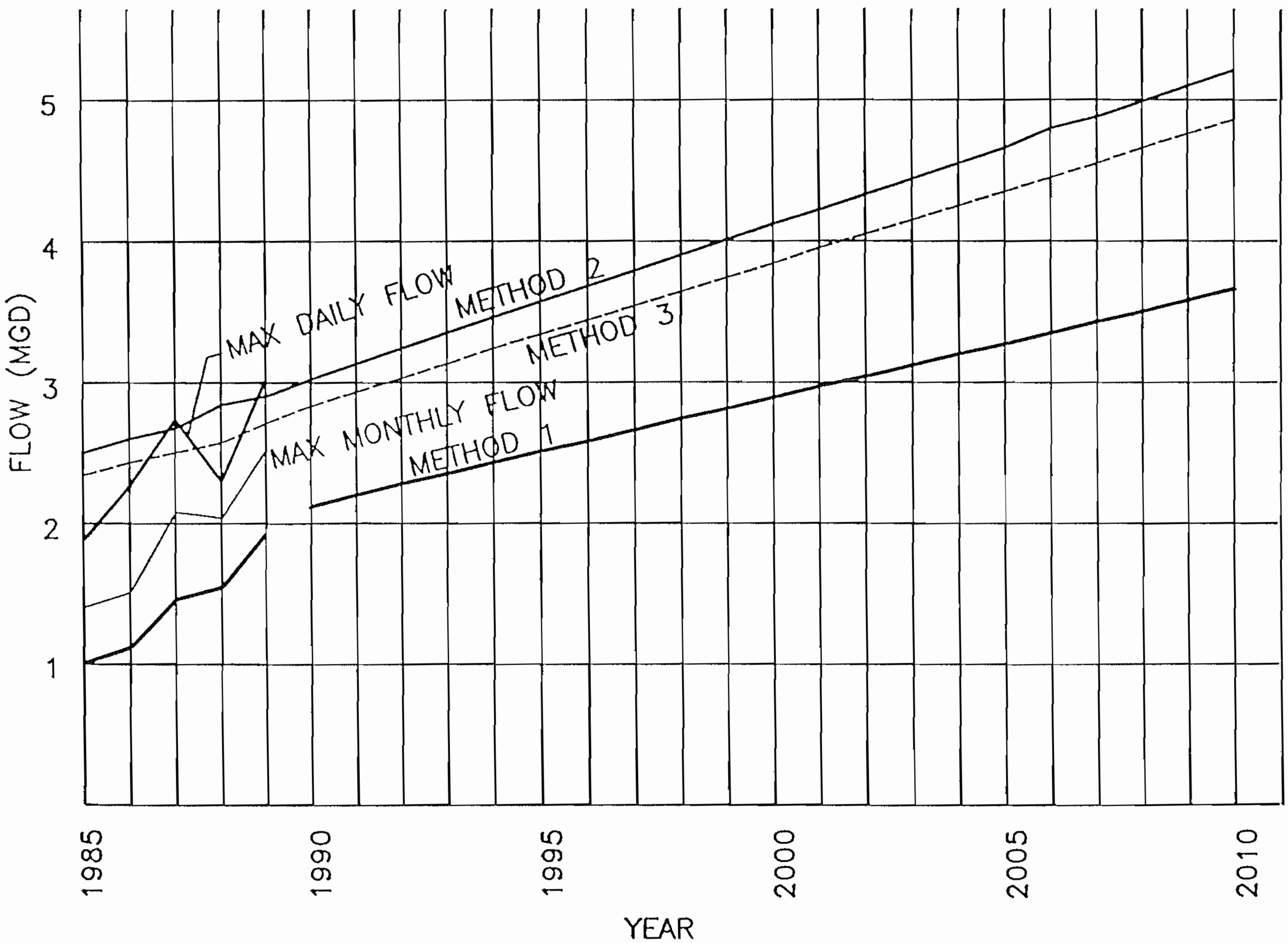
FIGURE 2-10

maximum day to annual average daily flow ranged from 1.49 to 2.03 with an average of 1.76. The maximum day ratio appears to be decreasing as the annual average daily flow increases as would be expected.

Wastewater flow projections for the wastewater system were prepared using three methods and compared to historical data. The flow projections are shown in Figure 2-8. Each method for projecting future wastewater flows was based upon the housing unit and population projection data as contained in Table 2-2. The first method project flow based upon population and a per capita flow generation rate of 86 gpd. The second method projects the flow based upon the population and a per capita flow generation rate of 121 gpd based upon the Collier County level of service standards in the CLUP. The third method projects flow based upon housing units utilizing the FPSC level of service requirements of 300 gpd per single family dwelling unit and 250 gpd per multi-family dwelling unit.

Wastewater flows projected by the three methods are graphed in Figure 2-11. The flows projected by method 1 correspond to annual average daily flow rates whereas the flow projected by methods 2 and 3 correspond more closely to maximum monthly and maximum daily flows. This is understandable considering the low permanent population relative to the seasonal and potential population of the service area. Typically wastewater facilities are designed on an annual average daily flow basis. However due to the seasonal variability of the flow and the high potential service population, it is recommended that the facilities design be based upon the maximum month average day flow condition. This will ensure that the facilities are sized to provide adequate capacity to consistently meet water quality standards. Since the flow projections based upon method 2 approximate this condition based upon the flow ratio of 1.42 (121 gpcd/85 gpcd) it is recommended that they be utilized to represent the maximum month flow and for determination of when future facilities should be placed in service.

Design flow projections to be used later in the planning document are tabulated in Table 2-7 and graphed in Figure 2-12. Averaged daily flow is expected to increase at a higher rate than predicted by applying the 85 gpcd due to the trend toward increasing per capita flow. Therefore, the slope of the line has been adjusted upward to match this trend. Maximum monthly flow has been predicted using method 2 described above. The maximum monthly flow will serve as the basis for design of the overall wastewater treatment plant and effluent disposal facilities capacity. Maximum daily flow has been estimated based upon a ratio of 1.60 in 1990 which decreases to 1.50 over the 20 year period. Maximum daily flows are

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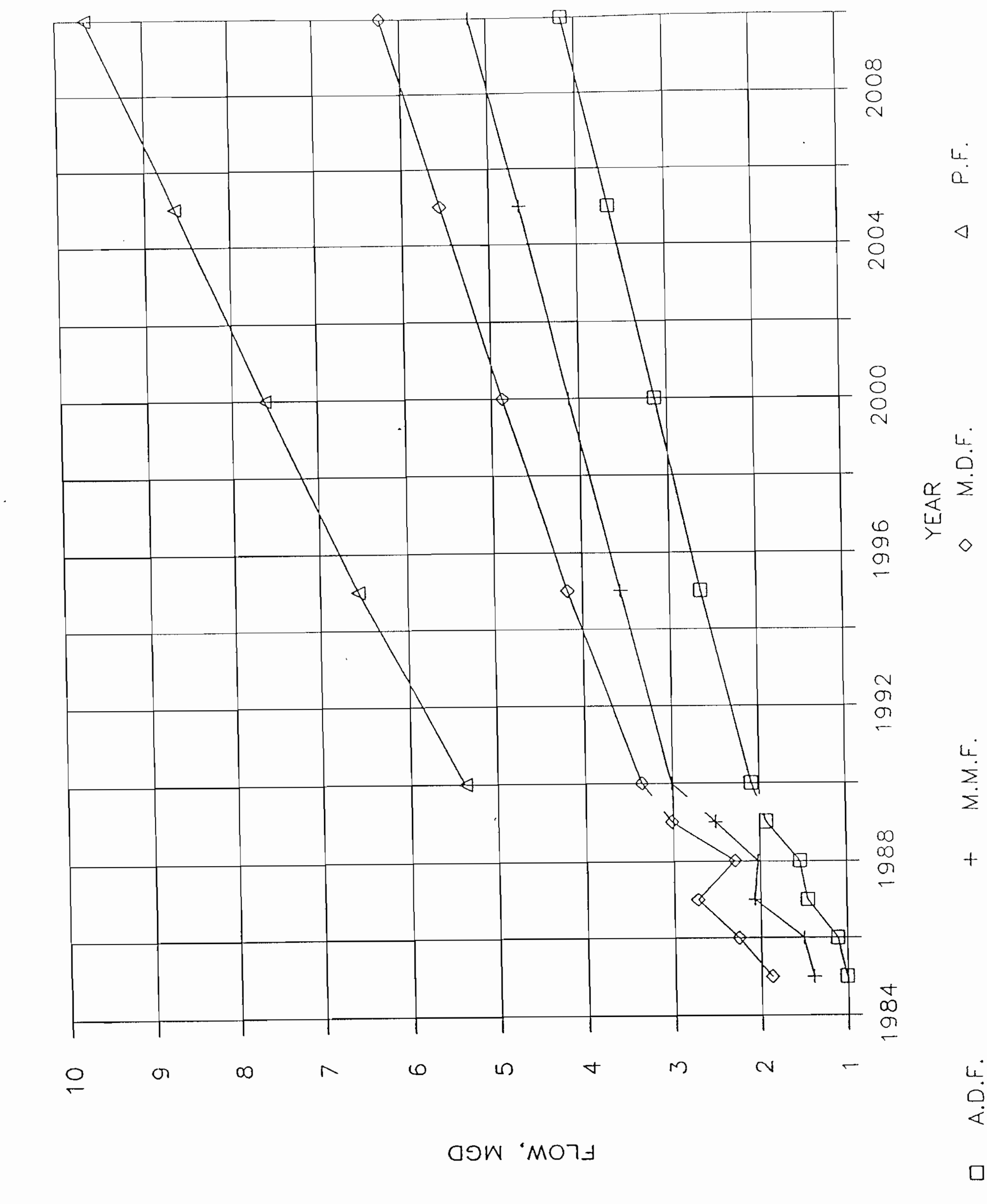
Wastewater Flow Projections

FIGURE 2-11

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**Design Wastewater Flow Projections**

FIGURE 2-12

MARC0101C

utilized for determining storage volumes and hydraulic flow capacity when raw wastewater effluent storage facilities are provide for flow equalization. Maximum daily flows may also service as the bases of design of the chlorine contact chamber volume utilizing the 15 minimum contact time criteria. Peak design flow has been estimated using the design population and a peaking factor calculated in accordance with "Ten States Standards". Peak design flow forms the basis for determining the capacity of the raw wastewater collection and transmission facilities and the treatment plant and effluent transmission system hydraulic capacities in the absence of storage.

# SECTION 3
# SDWA COMPLIANCE

## 3.01 INTRODUCTION

This section discusses the proposed changes to the Safe Drinking Water Act resulting from the June, 1986 Amendments passed by Congress. The history of regulations for public drinking waster systems is outlined herein leading to the present to provide a background for the present regulatory program. This history is followed by a summary of some of the important portions of the June, 1986 Amendments and the regulatory programs developed by EPA to implement the legislation. Finally, recommendations are presented to assist in compliance with the proposed regulations and assessing their effect upon the Marco Island Water System.

## 3.02 HISTORY

Prior to 1970, the U.S. Public Health Service (PHS) had the responsibility for protection of drinking water quality as it related to the quality of water used in interstate commerce. The PHS established the first national standard in 1914 which was a bacteriological standard applicable to any system that supplied water to an interstate common carrier. In 1925 the standard was revised to include sections on source and supply, physical and chemical characteristics including lead, copper, zinc, iron, total solids, magnesium, chloride and sulfate.

The standards were revised again in 1942 with a requirement that bacteriological samples be taken from points in the distribution system, a requirement for a minimum number of samples to be taken monthly and a manual of waterworks practice. The chemical standards were revised to add standards for lead, fluoride, arsenic and selenium; not allow salts of barium, hexavalent chromium, heavy metal glucosides, or other substances having deleterious effects in the water system; and set standards for copper, iron, manganese, zinc, chloride, sulfate, phenolic compounds, total solids and alkalinity where other more suitable water supplies were available. These standards were further modified in 1946 to make the standards generally applicable to all water supplies in the United States, published the manual of practice separately, added a maximum permissible concentration for hexavalent chromium, changed the wording to prohibit the use of barium salts, hexavalent chromium, heavy metal glucosides and other substances in water treatment processes and authorized the use of the membrane filter procedure in bacteriological examinations.

The final community water standards were set by the PHS in 1962 based upon the recommendations of an advisory committee. The major changes in the 1962 standards included a requirement for the proper operation of water systems under the supervision of qualified personnel, added a section on radioactivity, considered climate when establishing the limits for fluorides and set maximum permissible concentrations for ABS, barium, cadmium, CCE, cyanide, nitrate and silver. The 1962 standards recommended the establishment of an advisory committee on the use of the Public Health Service Drinking Water Standards. The committee continued to study the water quality requirements and in 1967 recommended several changes. These changes included the establishment of maximum permissible standards for aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, toxaphene, organic phosphates, carbonates, boron and uranyl ion. These recommendations were not promulgated since it was discovered that the original legislative base for the PHS standards was restricted to the control of communicable disease. However, the pesticide limits were issued by the Division of Water Hygiene as guidelines for use by state and local health units and water pollution control agencies.

A federal technical committee was established in 1969 by the PHS with the responsibility of preparing necessary revisions and recommendations for revision to the 1962 standards. The committee completed its work in 1971. In 1970 the responsibility for protection of drinking water quality was inherited by the U.S. Environmental Protection Agency (EPA). A 1970 study indicated that a significant number of water supplies were not meeting the 1962 PHS standards. This study served as the catalyst for the development by Congress and EPA of the Safe Drinking Water Act (SDWA) of 1974 which provided EPA with the ultimate authority to regulate all water supplies. The SDWA required EPA to set interim primary drinking water regulations (IPDWR).

The SDWA of 1974 included provisions for the establishment of recommended maximum contaminant levels (RMCL's) for each contaminant which may have an adverse effect on the health of the public. The SDWA of 1974 further required that revised national primary drinking water regulations (NPDWR) which established a maximum concentration level (MCL) or treatment technique be promulgated by September, 1976 and secondary drinking water regulations be established by December, 1977.

The IPDWR were promulgated in December, 1975 based upon the 1962 PHS standards and the report of the PHS technical committee established in 1969. The IPDWR were actually enacted in 1975 and became effective in 1977. These regulations were subsequently amended in 1977 to add radionuclides, in 1979 to add the 100 microgram per liter trihalomethane (TTHM) limit, in 1980 to add monitoring requirements for sodium and corrosion, and in 1983 to identify best available means for compliance with the TTHM regulations. These amendments to the IPDWR became effective in 1981 for systems servicing over 75,000, 1983 for systems serving 10,000 to 75,000 persons,and at the states discretion for systems less than 10,000. The IPDWR along with the corresponding 1962 PHS standards and the current Florida Department of Environmental Regulation (FDER) regulations are summarized in Table 3-1.

The National interim secondary drinking water regulations were established in July, 1979 and became effective in January, 1981. The secondary regulations specify standards for substances which are not hazardous to health and are generally related to the aesthetic quality of the water. These regulations, unlike the primary regulations, are not enforceable at the federal level, but serve as guidelines to the states. The State of Florida has adopted the secondary drinking water regulations. Table 3-2 summarizes the national interim secondary drinking water regulations, the corresponding 1962 PHS standards and the current FDER regulations.

The SDWA of 1974 anticipated the development of revised national primary drinking water regulations and the regulation of a number of additional contaminants beyond those contained in the IPDWR's. The time for development of the regulations was underestimated as evidenced by the actual dates of adoption of regulations versus those intended by the SDWA. This fact coupled with perception of Congress that the public was severely concerned over drinking water quality in the U.S. led to the enactment of the SDWA Amendments of 1986. (Public Law 99-339).

### 3.03 SDWA AMENDMENTS

The SDWA Amendments of 1986 will significantly increase regulatory requirements placed upon public water systems in the near future. These regulatory requirements will take the form of new additional regulated contaminants, more stringent permissible maximum contaminant levels, increased monitoring requirements and stricter enforcement penalties. This subsection will provide a brief summary of some of the directives contained in the SDWA Amendments of 1986 to provide an understanding of the mandates established by Congress to guide the present and near future drinking water regulation program. The significant

**TABLE 3-1**
**U.S. PUBLIC HEALTH SERVICE, U.S. EPA AND**
**FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION**
**PRIMARY DRINKING WATER STANDARDS**

| Chemical | PHS Standard 1962 | EPA NIPDWR 1975 | FDER 1989 |
|---|---|---|---|
| **Inorganics (mg/l)** | | | |
| Lead | 0.05 | 0.05 | 0.05 |
| Copper | --- | --- | --- |
| Zinc | --- | --- | --- |
| Fluoride | a | b | 4.0 |
| Arsenic | 0.05 | 0.05 | 0.05 |
| Selenium | 0.01 | 0.01 | 0.01 |
| Hexavalent chromium | 0.05 | 0.05 | 0.05 |
| Barium | 1.0 | 1.0 | 1.0 |
| Cadmium | 0.01 | 0.01 | 0.01 |
| Cyanide | 0.2 | --- | --- |
| Silver | 0.05 | 0.05 | 0.05 |
| Nitrate | --- | 10 as N | 10 as N |
| Mercury | --- | 0.002 | 0.002 |
| **Radionuclides (pci/l)** | | | |
| Radium-226 and -228 Combined | .3 | 5 | 5 |
| 5 trontium -90 | 10 | --- | --- |
| Gross alpha activity | 1000 | --- | --- |
| Gross alpha activity[1] | | 15 | 15 |
| **Pesticides (mg/l)** | | | |
| Chlorinated Hydrocarbons | | | |
| Aldrin | 0.017 | --- | --- |
| Chlordane | 0.003 | --- | --- |
| DDT | 0.042 | --- | --- |
| Dieldrin | 0.017 | --- | --- |
| Endrin | 0.001 | 0.0002 | 0.0002 |

TABLE 3-1 (Continued)
U.S. PUBLIC HEALTH SERVICE, U.S. EPA AND
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
PRIMARY DRINKING WATER STANDARDS

| Chemical | PHS Standard 1962 | EPA NIPDWR 1975 | FDER 1989 |
|---|---|---|---|
| Heptachlor | 0.018 | --- | --- |
| Heptachlor Epoxide | 0.018 | --- | --- |
| Lindane | 0.056 | 0.004 | 0.004 |
| Methoxychlor | 0.035 | 0.1 | 0.1 |
| Toxaphene | 0.005 | 0.005 | 0.005 |
| **Chlorophenoxys (mg/l)** | | | |
| 2, 4-D | --- | 0.1 | 0.1 |
| 2, 4, 5-TP Silvex | --- | 0.01 | 0.01 |
| **Disinfectant Byproducts** | --- | 100[c] | 100 |
| **Total Trihalomethanes** | --- | 100 | 100 |

Notes:

Dash = not include; NPDWR = National Interim Primary Drinking Water Regulations.

a Limits for naturally occurring and supplementation of fluoride based on table of annual average of maximum daily air temperatures.

b Effective May, 1986.

c Effective November 29, 1983 for systems serving 10,000 to 75,000 persons.

1. Including Radium-266, but excluding radon and uranium.

TABLE 3-2
U.S. PUBLIC HEALTH SERVICE, U.S. EPA AND
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
SECONDARY DRINKING WATER STANDARDS

| Chemical | PHS Standard[1] 1962 (mg/L) | EPA NISDWR 1979 (mg/L) | FDER[2] 1989 (mg/L) |
|---|---|---|---|
| Cooper | 1.0 | 1.0 | 1.0 |
| Zinc | 5.0 | 5.0 | 5.0 |
| Iron | 0.3 | 0.3 | 0.3 |
| Manganese | 0.1 | 0.05 | 0.05 |
| Magnesium | --- | --- | --- |
| Chloride | 250 | 250 | 250 |
| Sulfate | 250 | 250 | 250 |
| Phenols | 0.001 | --- | |
| Total Solids | 500 | 500 | 500 |
| ABS | 0.05 | 0.051 | |
| Arsenic | 0.01 | --- | |
| CCE | 0.2 | --- | |
| Cyanide | 0.01 | --- | |
| Nitrate | 45.0 | --- | |
| Fluoride | --- | 2.0[a] | 2.0 |
| pH | --- | 6.5-8.5 | 6.5-8.5 |
| Color | --- | 15 color units | 15 color units |
| Corrosivity | --- | Noncorrosive | Noncorrosive |
| Odor | --- | 3 TON | 3 TON |

Notes:
Dash = non included
ABS = alkly benzene sulfonate
CCE = carbon chloroform extract
NISDWR = National Interim Secondary Drinking Water Regulations
TON = threshold odor number
a *Federal Register,* April 2, 1966, effective May 2, 1986.
1 "Provisions of the 1962 Public Health Service Drinking Water Standards"
2 Chapter 17-550.320, F.A.C., January 1, 1989.

directives of the SDWA Amendments of 1986 and the corresponding section numbers are summarized below:

- o Section 1412 (a)(1) directs that all previously promulgated national interim primary drinking water regulations (NIPWR) and revised primary drinking water regulations be deemed as national primary drinking water regulations (NPDWR).

- o Section 1412 (a)(2) requires that all recommended maximum contaminant levels (RMCL) previously published be treated as maximum contaminant level goals (MCLG).

- o Section 1412 (a)(3) requires that MCLG's be published simultaneously for any new NPDWR which proposes a maximum contaminant level (MCL)

- o Section 1412 (b)(1) establishes a source list of 83 contaminants to be regulated (see Table 3-3) and a time frame for regulations summarized below:

  a. 9 contaminants within 12 month of enactment
  b. 40 contaminants within 24 months of enactment
  c. Remaining contaminants within 36 month of enactment

- o Section 1412 (b)(2) allows the EPA to substitute up to seven contaminants onto the original list of 83, if they are more likely to be protective of public health.

- o Section 1412 (b)(3) directs EPA to publish MCLG's and MCL's for each contaminant which may have an adverse affect upon health of persons and is known or anticipated to occur in public drinking water systems. This list of additional contaminants is to be published by January 1, 1988 and subsequent 3 year intervals. MCLG's and MCL's are to be published for 25 of these contaminants within 24 months of listing and for the remainder within 36 months.

- o Section 1412 (b)(4) provides for the setting of MCL's as close as is feasible to MCLG's which are to be set at a level at which no known or anticipated adverse health effects occur with an adequate margin of safety.

## TABLE 3-3
## CONTAMINANTS REQUIRED TO BE REGULATED UNDER THE 1986 SDWA AMENDMENTS

**Volatile organic chemicals**
- Benzene
- Carbon tetrachloride
- Chlorobenzene
- Dichlorobenzene
- 1,2 - Dichloroethane
- 1,1 - Dichloroethylene
- *cis*-1,2 - Dichloroethylene
- *trans*-1,2 - Dichloroethylene
- Methylene chloride
- Tetrachloroethylene
- Trichlorobezene
- 1,1,1 - Trichloroethane
- Trichloroethylene
- Vinyl chloride

**Michobiology and turbidity**
- *Giardia lamblia*
- *Legionella*
- Standard plate count
- Total coliforms
- Turbidity
- Viruses

**Inorganics**
- Aluminum
- Antimony
- Arsenic
- Asbestos
- Barium
- Beryllium
- Cadmium
- Chromium
- Copper
- Cyanide
- Fluoride
- Lead
- Mercury
- Molybdenum
- Nickel
- Nitrate
- Selenium
- Silver
- Sodium
- Sulfate
- Thallium
- Vanadium
- Zinc

**Organics**
- Acrylamide
- Adipates
- Alachlor

**Organics continued**
- Aldicarb
- Atazine
- Carbofuran
- Chlordane
- Dalapon
- Dibromochloropropane (DBCP)
- Dibromomethane
- 1,2, - Dichloropropane
- Dinoseb
- Diquat
- Endothall
- Endrin
- Epichlorohydrin
- Ethylene dibromide (EDB)
- Glyphosphate
- Hexachlorocyclopentadiene
- Lindane
- Methoxychlor
- Pentachlorophenol
- Phthalates
- Pichloram
- Polychlorinated biphenyls (PCBs)
- Polynuclear aromatic hydrocarbons (PAHs)
- Simazine
- Toluene
- 2,3,7,8, - Tetrachloriodibenzodioxin (dioxin)
- Toxaphene
- 2,4,5 - TP (Silvex)
- 1,1,2 - Trichloroethane
- Vydate
- Xylene

**Radionuclides**
- Beta particle and photoradioactivity
- Gross alpha particle activity
- Radium -226 and -228
- Radon
- Uranium

**Substituted into SDWA List of 1983**
- Aldicarb sulfone
- Aldicarb sulfoxide
- Ethylbenzene
- Heptachlor
- Heptachlor epoxide
- Nitrite
- Styrene

- o Section 1412 (b)(5) defines the term "feasible based on the use of best available technology (BAT) and defines BAT for synthetic organic compounds (SOC) as the use of granular activated carbon.

- o Section 1412 (b)(6) requires that BAT be listed for each MCL established.

### 3.04 SDWA AMENDMENTS IMPLEMENTATION

The USEPA Office of Drinking Water is responsible for implementation of the regulations mandated by the 1986 SDWA amendments. The Amendments followed the publication ion 1982 and 1983 by EPA of a list of 83 contaminants EPA believed should be controlled by setting MCL's (see Table 3-3). The Amendment directed EPA to establish MCL's for all these contaminants within three years and subsequently add an additional 25 contaminants each subsequent year. No provisions were made for EPA to refrain from regulating any of these contaminants, however, the legislation allowed for the removal and substitution of seven contaminants. The revised list including the seven substitutes included in Table 3-3. The legislation also required EPA to establish a list of contaminants known or anticipated to occur in public drinking water systems which may require regulation. These contaminants from the drinking water priority list and are as listed in Table 3-5.

The schedule set forth in the Amendments for development of the required regulations is summarized in Table 3-4. In order to meet the requirements of the legislation EPA established a six phase program for development of the regulations mandated by Congress. The original six phase program has been modified since its conception and the latest implementation schedule is summarized in Table 3-6. MCL's and MCLG's have already been promulgated for portions of the drinking water priority list under the EPA program including eight VOC's (see Table 3-7). Monitoring requirements have been established for these VOC's and summarized in Table 3-8 and for additional contaminants for which MCL's and MCLG's have not yet to be established are summarized in Table 3-9 and 3-10. These requirements are reflected in the latest (1/18/89) version of the FDER regulations (Chapter 17-550). Based upon the number of persons served by the Marco Island system the initial monitoring for these parameters was to be completed by December 31, 1988.

TABLE 3-4
**WATER QUALITY REGULATION DEVELOPMENT TIME FRAME SPECIFIED BY THE AMENDED SDWA***

| Date | Action |
|---|---|
| June 1986 | SDWA amendments enacted |
| June 1987 | Published MCLGs and promulgate NPDWRs for nine of the contaminants listed in the Mar. 4, 1982, and Oct. 5, 1983, *Federal Registers* (See Table 2) |
| | Publish proposed list of contaminants for substitution |
| August 1987 | Publish final list of contaminants to be substituted |
| December 1987 | Promulgate criteria under which filtration is required as a treatment technique for public water systems using surface sources |
| January 1988 | Publish priority list of contaminants known or anticipated to occur in public water systems that may required regulation under the SDWA |
| June 1988 | Publish MCLGs and promulgate NPDWRs for at least 40 of the contaminants listed in Table 2 |
| June 1989 | Publish MCLGs and promulgate NPDWRs for the remainder of the contaminants listed in Table 2 |
| | States must have adopted regulations to implement filtration requirements |
| | Promulgate NPDWRs requiring disinfection as a treatment technique for all public water systems |
| January 1990 | Publish proposed MCLGs and NPDWRs for at least 25 contaminants on the January 1988 priority list |
| January 1991 | Publish MCLGs and promulgate NPDWRs for the 25 contaminants proposed in January 1990 |
| | Publish updated priority list of contaminants known or anticipated to occur in public water systems |

*Some actions have slipped beyond the dates specified in the amended SDWA.

## TABLE 3-5
## DRINKING WATER PRIORITY LIST
## CONTAMINANT OR CONTAMINANT GROUP TO BE REGULATED

Aluminum
Ammonia
Boron
Bromobenzene
Bromochloroacetonitrile
Bromodichloromethane
Bromoform
Chloramine
Chlorate
Chlorine
Chlorite
Chloroethane
Chloroform
Chloromethane
Chloropicrin
*o*-Chlorotoluene
*p*-Chlorotoluene
*Cryptosporidium*
Cyanazine
Cyanogen chloride
Dibromoacetonitrile
Dibromochlormethane
Dibromomethane
Decamba
1,1, - Dichloroethane
Dichloroacetonitrile
1,3 - Dichloropropane
2,2 - Dichloropropane
1,3 - Dichloropropene
2,4 - Dinitrotoluene
ETU
Halogenated acids, alcohols, aldehydes, ketones and other nitriles
Hypochlorite ion
Isophorone
Methyltertbutylether
Metolachlor
Metribuzin
Molybdenum
Ozone by-products
Silver
Sodium
Strontium
2,4,5 - T
1,1,1,2 - Tetrachloroethane
1,1,2,2 - Tetrachloroethane
Trichloroacetonitrile
1,2,3 - Trichloropropane
Tribluralin
Vanadium
Zinc

TABLE 3-6
SCHEDULE OF USEPA DRINKING WATER QUALITY REGULATIONS

| Regulation | Action | Date* |
|---|---|---|
| **Promulgated Regulations** | | |
| VOCs (Phase 1) | Final rule | July 8, 1987 |
| | Final rule corrections | July 1, 1988 |
| Fluoride (Phase IIA) | Final rule | April 2, 1986 |
| Surface Water Treatment Rule | Final rule | June 29, 1989 |
| Total Coliform Rule | Proposed rule | November 3, 1987 |
| | Notice of options | May 6, 1988 |
| | Final rule | June 29, 1989 |
| **Proposed Regulations** | | |
| Lead and copper | Proposed rule (MCLG) | November 13, 1985 |
| | Proposed rule (MCLGs/ MCLs and treatment technique) | August 18, 1988 |
| | Final rule | (November 1990)* |
| SOCs & IOCs (Phase II) | Proposed rule | November 13, 1985 |
| | Proposed rule | May 22, 1989 |
| | Final rule | (December 1990) |
| **Anticipated Regulations** | | |
| SOCs & IOCs (Phase V) | Proposed rule | (June 1990) |
| | Final rule | (March 1992) |
| Radionuclides (Phase III) | Proposed rule | (September 1990) |
| | Final rule | (June 1992) |
| D-DBP (Phase VIa) | Proposed rule | (Late 1991) |
| | Final rule | (1993) |

*Dates in parentheses are anticipated and subject to change.

**TABLE 3-7**
**VOC (PHASE 1) REGULATIONS**

| Compound | MCLG (mg/l) | MCL (mg/l) |
|---|---|---|
| Benzene | zero | 0.005 |
| Carbon tetrachloride | zero | 0.005 |
| Para - Dichlorobenzene | 0.075 | 0.075 |
| 1,2 - Dichloroethane | zero | 0.005 |
| 1,1 - Dichloroethylene | 0.007 | 0.007 |
| 1,1,1 - Trichloroethane | 0.20 | 0.20 |
| Trichloroethylene | zero | 0.005 |
| Vinyl chloride | zero | 0.002 |

TABLE 3-8
MONITORING REQUIREMENTS OF VOCs (PHASE I)

**Initial Monitoring***

| Size of Population Served | Begin By | Complete By |
|---|---|---|
| >10,000 | January 1, 1988 | December 31, 1988 |
| 3,300-10,000 | January 1, 1989 | December 31, 1989 |
| <3,300 | January 1, 1991 | December 31, 1991 |

**Repeat Monitoring**

| Status+ | Groundwater | Surface Water |
|---|---|---|
| VOCs not detected; source judged not vulnerable to possible contamination | Repeat every five years | State discretion |
| VOCs not detected; source judged vulnerable to possible contamination | | |
| More than 500 system connections | Repeat every three years | Repeat every three years |
| Less than 500 system connections | Repeat every 5 years | Repeat every five years |
| VOCs detected | Sample quarterly | Sample quarterly |

* Sampling site and monitoring frequency depend on the type of source water.

+ States must recertify vulnerability status every three years for systems serving >500 connections, every five years for systems serving <500 connections. States may, however, change the vulnerability status at any time.

## TABLE 3-9
## ADDITIONAL CONTAIMINANTS FOR WHICH MONITORING IS REQUIRED UNDER THE VOC (PHASE 1) RULE

| List 1 | List 2 | List 3 |
|---|---|---|
| Bromobenzene | Ethylene dibromide (EDB) | Bromochloromethane |
| Bromodichloromethane | 1,2 Dibromo 3 chloropropane (DBCP) | *n*-Butylbenzene |
| Bromoform | | Dichlorodifluoromethane |
| Bromomethane | | Fluorotrichloromethane |
| Chlorobenzene | | Hexachlorobutadiene |
| Chlorodibromomethane | | Isopropylbenzene |
| Chrloroethane | | *p*-Isopropyltoluene |
| Chlroroform | | Naphthalene |
| Chloromethane | | *n*-Propylbenzene |
| *a*-Chlorotoluene | | sec-Butylbenzene |
| *p*-Chlorotoluene | | tert-Butylbenzene |
| Dibromomethane | | 1,2,3-Trichlorobenzene |
| *m*-Dichlorobezene | | 1,2,4 -Trichlorobenzene |
| *o*- Dichlorobenzene | | 1,2,4 - Trimethylbenzene |
| *trans.*1,2 Dichloroethylene | | 1,3,5 - Trimethylbenzene |
| Dichloromethane | | |
| 1,1 - Dichloroethane | | |
| 1,2 - Dichloropropane | | |
| 1,3 - Dichloropropane | | |
| 2,2 - Dichloropropane | | |
| 1,1 - Dichlorpropene | | |
| 1,3 - Dichloropropene | | |
| Ethylbenzene | | |
| Styrene | | |
| 1,1,1,2 - Tetrachloroethane | | |
| 1,1,2,2 - Tetrachloroethane | | |
| Tetrachloroethylene | | |
| 1,1,2 - Trichloroethane | | |
| 1,2,3, - Trichloropropane | | |
| Toluene | | |
| *p*-Xylene | | |
| *o*-Xylene | | |
| *m*-Xylene | | |

## TABLE 3-10
## MONITORING REQUIREMENTS FOR ADDITIONAL CONTAMINANTS UNDER THE VOC (PHASE 1) RULE

| | **Initial Monitoring** | |
|---|---|---|
| Size of Population Served | Begin By | Complete By |
| >10,000 | January 1, 1988 | December 31, 1988 |
| 3,300-10,000 | January 1, 1989 | December 31, 1989 |
| <3,300 | January 1, 1991 | December 31, 1991 |

| | **Repeat Monitoring** | |
|---|---|---|
| Sampling Conditions | Groundwater | Surface Water |
| Sample locations | At each entry point to the distribution system representative of each well | In distribution system representative of each source |
| Number of samples | One sample; confirmation sample at the discretion of the state | One sample each quarter per source for one year; confirmation samples at the discretion of the state |

**Repeat Monitoring - Every five years**

Regulations were proposed by EPA for 30 additional synthetic organic contaminants (SOC's) and 8 additional inorganic compounds (IOC's) in May, 1989. The final rule on these contaminants is scheduled for December, 1990. The proposed MCLG's and MCL's for these contaminants are listed in Table 3-12. Treatment techniques have been proposed for some contaminants in lieu of MCL's because of the lack of reliable analytical methods. Proposed initial monitoring requirements are summarized in Table 3-14 and would require sampling to be completed within 18 months after promulgation for the Marco Island system. Table 3-15 lists the best available technologies (BAT's) for these constituents as provided for in the legislation. Finally, Table 3-13 lists the proposed monitoring requirements to be implemented with the Phase II IOC and SOC regulations. The monitoring frequency requirements vary depending upon whether the raw water supply is a surface or ground water source and the vulnerability of the source as determined by the state. A vulnerability assessment will have to be performed for the Marco Island system and clarification obtained from FDER relative to the required monitoring program since both surface and ground water are utilitzed for the raw water supply. The Phase II SOC-IOC rules also provide for a list of additional contaminants for which monitoring will be required as shown in Table 3-16. Monitoring for the 29 priority I contaminants would be determined by a vulnerability analysis performed by the state. Monitoring for the remaining priority 2 contaminants will be at the discretion fo the state.

Probably one of the most controversial elements of the USEPA regulatory program is the disinection-disinfection by-products (D-DBP) rule. This rule satisfies several of the requirements of the 1986 Amendments including:

1) Regulation of contaminants on the DWPL which include disinfectants and DBP's. Contaminants regulated under this rule will satisfy a portion of the regulatory requirement to regulate 25 additional contaminants every 3 years.

2) The legislation also requires EPA to set mandatory disinfection requirements for all public water systems.

Candidate disinfectants and disinfectant by-products proposed for regulation are summarized in Table 3-18. It should be noted that individual trihalomethane species may be regulated with MCL's established under this rule in addition to existing and proposed TTHM limits.

Development of this rule began in 1989 when EPA developed a strawman proposal outlining its initial posture on the rule which is summarized in Table 3-19. Of particular interest is the

TABLE 3-11
ROUTINE SAMPLING REQUIREMENTS UNDER THE TOTAL COLIFORM RULE

| Population Served | Minimum Number of Routine Samples per Month |
|---|---|
| 8,501 - 12,900 | 10 |
| 12,901 - 17,200 | 15 |
| 17,201 - 21,500 | 20 |
| 21,501 - 25,000 | 25 |
| 25,001 - 33,000 | 30 |
| 33,001 - 41,000 | 40 |
| 41,001 - 50,000 | 50 |
| 50,001 - 59,000 | 60 |
| 59,001 - 70,000 | 70 |
| 70,001 - 83,000 | 80 |
| 83,001 - 96,000 | 90 |
| 96,001 - 130,000 | 100 |

TABLE 3-12
PROPOSED MCLGs AND MCLs FOR SOCs AND IOCs (PHASE II)

| Contaminant | Proposed MCLG mg/l | Current MCL mg/l | Proposed MCL mg/l |
|---|---|---|---|
| **Inorganics** | | | |
| Asbestos | 7 million fibers/l* | | 7 million fibers/L* |
| Barium | 5 | 1 | 5 |
| Cadmium | 0.005 | 0.01 | 0.005 |
| Chromium | 0.1 | 0.05 | 0.1 |
| Mercury | 0.002 | 0.002 | 0.002 |
| Nitrate+ | 10 (as Nitrogen) | 10 (as Nitrogen) | 10 (as Nitrogen) |
| Nitrite+ | 1 (as Nitrogen) | | 1 (as Nitrogen) |
| Selenium | 0.05 | 0.01 | 0.05 |
| **Volatile organincs (solvents)** | | | |
| *cis* -1,2,Dichloroethylene | 0.07 | | 0.07 |
| 1,2 - Dichloropropane | 0 | | 0.005 |
| Ethylbenzene | 0.7 | | 0.7 |
| Monochlorobenzene | 0.1 | | 0.1 |
| *o*-Dichlorobenzene | 0.6 | | 0.6 |
| Styrene | 0/0.1** | | 0.005/0.1** |
| Tetrachloroethylene | 0 | | 0.005 |
| Toluene | 2 | | 2 |
| *trans*-1,2 Dichloroethylene | 0.1 | | 0.1 |
| Xylenes (total) | 10 | | 10 |
| **Pesticides, herbicides, PCBs** | | | |
| Alachlor | 0 | | 0.002 |
| Aldicarb | 0.01 | | 0.01 |
| Aldicarb sulfone | 0.01 | | 0.01 |
| Aldicarb sulfoxide | 0.04 | | 0.04 |
| Atrazine | 0.003 | | 0.003 |
| Carbonfuran | 0.04 | | 0.04 |
| Chlordane | 0 | | 0.002 |
| Dibromochloropropane (DBCP) | 0 | | 0.0002 |
| 2,4-D | 0.07 | 0.1 | 0.07 |
| Ethylene dibromide (EDB) | 0 | | 0.0005 |
| Heptabhlor | 0 | | 0.0004 |
| Heptachlor expoxide | 0 | | 0.0002 |

TABLE 3-12 (Continued)
PROPOSED MCLGs AND MCLs FOR SOCs AND IOCs (PHASE II)

| Contaminant | Proposed MCLG mg/l | Current MCL mg/l | Proposed MCL mg/l |
|---|---|---|---|
| Lindane | <0.0002 | 0.004 | <0.002 |
| Methoxychlor | 0.4 | 0.1 | 0.4 |
| PCBs | 0 | | 0.0005 |
| Pentachlorophenol | 0.2 | | 0.2 |
| Toxaphene | 0 | 0.005 | 0.005 |
| 2,4,5-TP (Silvex) | 0.05 | 0.01 | 0.05 |
| **Drinking water treatment chemicals** | | | |
| Acrylamide | 0 | | treatment techniques*** |
| Epichlorohydrin | 0 | | treatment techniques*** |

* Longer than 10 micrometers.

\+ Total nitrate plus nitrate MCLG and MCL = 10 mg/l (as nitrogen).

** USEPA proposes a dual MCLG-MCL for styrene. After public comment, a single MCLG and MCL will be set.

*** Treatment technique requirement limits the amount of the chemical used to treat drinking water.

TABLE 3-13

PROPOSED (SOC-IOC) MONITORING REQUIREMENTS FOR COMMUNITY SYSTEMS

| Contaminants | Vulnerability Assessment Required | Nonvulnerable Source: Surface Water | Nonvulnerable Source: Groundwater | Vulnerable Source: Surface Water | Vulnerable Source: Groundwater |
|---|---|---|---|---|---|
| Inorganics | | | | | |
| Barium | No | Initial: annually | Initial: every three years | Not applicable | Not applicable |
| Cadmium | No | Repeat: minimum of every 10 years after three rounds completed | Repeat: minimum of every 10 years after three rounds completed and all results <50 percent of MCL | | |
| Chronium | No | | | | |
| Mercury | No | | | | |
| Selenium | No | | | | |
| Asbestos | Yes, for initial sampling | No monitoring required if initial results is ≥50 percent of MCL | No monitoring required | Initial: one time Repeat: annually if initial result is ≥50 percent of MCL | Initial: one time Repeat: every three years if initial result is ≥50 percent of MCL |
| Nitrate-Nitrite | No | Quarterly (reduced to annually if concentration is <50 percent of MCL) | Annually (quarterly if concentration is ≥50 percent of MCL) | Not applicable | Not applicable |

TABLE 3-13 (con't)

PROPOSED (SOC-IOC) MONITORING REQUIREMENTS FOR COMMUNITY SYSTEMS

| Contaminants | Vulnerability Assessment Required | Nonvulnerable Source | | Vulnerable Source | |
|---|---|---|---|---|---|
| | | Surface Water | Groundwater | Surface Water | Groundwater |
| Synthetics organics | | | | | |
| VOCs | | | | | |
| cis-1.2-Dichlori-ethylene<br>trans-1,2,-Dichloro-ethylene<br>1,2-Dichloropropane<br>0-Dichlorobenzene<br>Ethylbenzene<br>Monochlorobenzene<br>Styrene<br>Tetrachloroethylene<br>Toluene<br>Xylenes (total) | Yes, for repeat frequency | Initial: quarterly for one year<br><br>Repeat:<br>VOCs detected+-<br>quarterly<br>VOCs not<br>detected-<br>state discretion | Initial: quarterly for one year<br><br>Repeat:<br>VOCs detected+-<br>quarterly<br>VOCs not<br>detected-<br>five years | Initial: quarterly for one year<br><br>Repeat:<br>VOCs detected+-<br>quarterly<br>VOCs not<br>detected->500<br>connections-<br>every three years:<br>≤500 connections<br>-every five years | Initial quarterly for one year<br><br>Repeat:<br>VOCs detected+-<br>quarterly<br>VOCs not<br>detected->500<br>connections-<br>every three years<br>≤500 connections<br>every five years |

TABLE 3-13 (Con't)

PROPOSED (SOC-IOC) MONITORING REQUIREMENTS FOR COMMUNITY SYSTEMS

| Contaminants | Vulnerability Assessment Required | Nonvulnerable Source | | Vulnerable Source | |
|---|---|---|---|---|---|
| | | Surface Water | Groundwater | Surface Water | Groundwater |
| Pesticides, herbicides, PCBs | | | | | |
| Alachlor<br>Aldicarb<br>Aldicarb sulfone<br>Aldicarb sulfoxide<br>Atrazine<br>Carbofuran<br>Chlordane<br>Dibromochloropropane<br>2,4-D<br>Ethylene dibromide<br>Heptachlor<br>Heptachlor epoxide<br>Lindane<br>Methoxychlor<br>PCBs<br>Pentachlorophenol<br>Toxaphane<br>2,4,5-TP (Silvex) | Yes, for initial sampling | No monitoring required | No monitoring required<br><br>Repeat:<br>Detected**-<br>$>$500 connections<br>-quarterly<br>$\leq$500 connections<br>-annually<br>Not detected<br>$>$500 connections<br>-four quarterly samples every three years:<br>$\leq$500 connections<br>-four quarterly samples every five year | Initial: quarterly for one year<br><br>Repeat:<br>Detected**-<br>$>$500 connections<br>-quarterly<br>$\leq$500 connections<br>-annually<br>Not detected<br>$>$500 connections<br>-four quarterly samples every three years<br>$\leq$500 connections<br>-four quarterly samples every five years | Initial: quarterly for one year |

TABLE 3-13 (Con't)

PROPOSED (SOC-IOC) MONITORING REQUIREMENTS FOR COMMUNITY SYSTEMS

| Contaminants | Vulnerability Assessment Required | Nonvulnerable Source | | Vulnerable Source | |
|---|---|---|---|---|---|
| | | Surface Water | Groundwater | Surface Water | Groundwater |
| Additional contaminants | | | | | |
| 6 IOCs | Yes | No requirement | No requirement | One time only | One time only |
| 23 SOCs | Yes | No requirement | No requirement | Four quarterly samples for one year | Four quarterly samples for one year |
| 84 SOCs | No | No requirement | No requirement | State discretion | State discretion |

NOTE: This table is a summary of the proposed monitoring requirements. Consult the propose rule for a full description of requirements.

* Based on vulnerability assessment

+ Detected = 0.0005 mg/l

** Detected = method detection limit (MDL) as defined by USEPA

TABLE 3-14
INITIAL SAMPLING REQUIREMENTS UNDER THE PROPOSED SOC-IOC RULE (PHASE II)

| Contaminant | Population Served | Sampling Completed (Months after regulation is published in final form) |
|---|---|---|
| IOCs (except asbestos) | All sizes | 18 |
| Asbestos | All sizes (if vulnerable) | 60 |
| VOCs | >10,000 people | 18 |
| | 3,300-10,000 people | 30 |
| | <3,300 people | 54 |
| Pesticides, herbicides, and PCBs | All sizes (if vulnerable) | 48 |
| Additional (see Table 3-13) | All sizes (if vulnerable) | 48 |

TABLE 3-15
BATs SPECIFIED UNDER THE PROPOSED SOC-IOC (PHASE II) RULE

Organics

| Chemical | Treatment Technique: Granular Activated Carbon | Treatment Technique: Packed-Tower Aeration | Treatment Technique: Polymer Addition Practices |
|---|---|---|---|
| Acrylamide | | | X |
| Alachlor | X | | |
| Aldicarb | X | | |
| Aldicarb sulfone | X | | |
| Aldicarb sulfoxide | X | | |
| Atrazine | X | | |
| Carbofurnan | X | | |
| Chlordane | X | | |
| 2,4 - D | X | | |
| Dibromochloropropane (DBCP) | X | X | |
| *o*-Dichlorobenzene | X | X | |
| *cis*-1,2-Dichloroethylene | X | X | |
| *trans* 1,2-Dichloroethylene | X | X | |
| 1,2-Dichloropropane | X | X | |
| Epichlorohydrin | | | X |
| Ethylene dibromide (EDB) | X | X | |
| Ethylbenzene | X | X | |
| Heptachlor | X | | |
| Heptachlor epoxide | X | | |
| Lindane | X | | |
| Methoxychlor | X | | |
| Monochlorobenzene | X | X | |
| PCBs | X | | |
| Pentachlorophenol | X | | |
| Styrene | X | X | |
| 2,4,5 - TP (Silvex) | X | | |
| Tetrachloroethylene | X | X | |
| Toluene | X | X | |
| Toxaphene | X | | |
| Xylenes (total) | X | X | |

## TABLE 3-15 (Continued)
## BATs SPECIFIED UNDER THE PROPOSED SOC-IOC (PHASE II) RULE

### Inorganics

| Chemical | Treatment Technique | Chemical | Treatment Technique |
|---|---|---|---|
| Asbestos | Coagulation-filtration<br>Direct and diatomite filtration<br>Corrossion control | Mercury | Granular activated carbon<br>Coagulation-filtration*<br>Lime softening<br>Reverse osmosis* |
| Barium | Ion exchange<br>Lime softening<br>Reverse osmosis | Nitrate-nitrite | Ion exhange<br>Reverse osmosis |
| Cadmium | Ion exchange<br>Reverse osmosis<br>Coagulation-filtration<br>Lime softening | Selenium | Activated alumina<br>Lime softening<br>Coagulation-filtration (selenium IV only)<br>Reverse osmosis |
| Chromium | Coagulation-filtration<br>Ion exchange<br>Lime softening (chromium III only)<br>Reverse osmosis | | |

*Mercury influent concentrations $\leq$ 10 micrograms/l.

TABLE 3-16
ADDITIONAL CONTAMINANTS REQUIRED TO BE MONITORED UNDER THE PROPOSED SOC-IOC RULE (PHASE II)

| Priority I Contaminants | Priority II Contaminants | |
|---|---|---|
| Organics | Ametryn | Ethion |
| Aldrin | Aspon | Ethoprop |
| Butachlor | Atraton | Ethylparathion |
| Carbaryl | Azinphos methyl | Etridiazole |
| 2,4, DB | BCH-alpha | Famphur |
| Dalapon | BCH-beta | Fenamiphos |
| Dicamba | BCH-delta | Fenarimol |
| Dieldrin | BCH-gamma | Fenitrothion |
| Disnoseb | Bolstar | Fensulfothion |
| Hexachlorobenzene | Bromacil | Fenthion |
| Glyphosphate | Butylate | Fluridone |
| Hexachlorocyclopentadiene | Carboxin | Fonofos |
| 3-Hydroxybarbofuran | Chlorneb | Hexazinone |
| Methomyl | Chlorobenzilate | Malathion |
| Metribuzin | Chloropropham | Merphos |
| Oxamyl (vydate) | Chloropropylate | Methyl paraoxon |
| PAHs | Chlorothalonil | Methyl parathion |
| Phthalates | Chloropyrifos | Mevinphos |
| Picloram | Coumophas | MGK 264 |
| Simazine | Cycloate | MGK 326 |
| 2,3,7,8 TCDD (Dioxin) | DCPA | Molinate |
| 2,4,5-T | 4,4'-DDD | Napropamide |
| | 4,4'-DDE | Norflurazon |
| Inorganics | 4,4'-DDT | Pebulate |
| Antimony | Demeton-O | *cis*-Permethrin |
| Beryllium | Demeton-S | *trans*-Permethrin |
| Cyanide | Diazinon | Phorate |
| Nickel | Dichlofenthion | Phosmet |
| Sulfate | Dichloran | Prometon |
| Thallium | Dichlorvos | Prometryn |

TABLE 3-16 (Continued)

ADDITIONAL CONTAMINANTS REQUIRED TO BE MONITORED UNDER THE PROPOSED SOC-IOC RULE (PHASE II)

<u>Priority II Contaminants (continued)</u>

| | |
|---|---|
| Diphenamid | Pronamide |
| Diquat | Propazine |
| Disulfoton | Simetryn |
| Disulfoton sulfone | Stirofos |
| Disulfoton sulfoxide | Tebuthiuron |
| EPN | Terbacil |
| EPTC | Terbufos |
| Endosulfan I | Terbutryn |
| Endosulfan II | Triademefon |
| Endosulfan sulfate | Tricyclazole |
| Endothall | Trifluralin |
| Endrin aldehyde | Vernolate |

TABLE 3-17
TENTATIVE MCLGs AND MCLs FOR PHASE V SOCs AND IOCs
(released by USEPA prior to proposal)

| Contaminants | MCLG mg/l | MCL mg/l |
|---|---|---|
| Organics | | |
| Dalapon | 0.2 | 0.2 |
| Di(ethylhexy)adipate | 0.5 | 0.5 |
| Di(ethylhexpy)phthalate | zero | 0.004 |
| Dichloromethane (methylene chloride) | zero | 0.005 |
| Dinoseb | 0.007 | 0.007 |
| Diquat | 0.02 | 0.02 |
| Endothall | 0.1 | 0.1 |
| Endrin | 0.002 | 0.002 |
| Glyphosate | 0.7 | 0.7 |
| Hexachlorobenzene | zero | 0.001 |
| Hexachlorocyclopentadiene | 0.05 | 0.05 |
| Oxamyl (vydate) | 0.2 | 0.2 |
| PAHs (Benzo(a)pyrene)* | zero | 0.0002 |
| Picloram | 0.5 | 0.5 |
| Simazine | 0.001 | 0.001 |
| 1,2,4-Trichlorobenzene | 0.009 | 0.009 |
| 1,1,2-Trichloroethane | 0.003 | 0.005 |
| 2,3,7,8-TCDD (Dioxin) | zero | $5 \times 10^{-8}$ |
| Inorganics | | |
| Antimony | 0.003 | 0.01/0.005+ |
| Beryllium | zero | 0.001 |
| Cyanide | 0.2 | 0.2 |
| Nickel | 0.1 | 0.1 |
| Sulfate | 400 | 400 |
| Thallium | 0.0005 | 0.002/0.001+ |

TABLE 3-17 (Continued)
TENTATIVE MCLGs AND MCLs FOR PHASE V SOCs AND IOCs
(released by USEPA prior to proposal)

* USEPA is considering establishment of MCLGs and MCLs for six additional PAHs classified as probable human carcinogens: benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indenopyrene.

+ USEPA is considering proposing two MCLs based on five or 10 times the minimum detection limit.

## TABLE 3-18
## CANDIDATE DISINFECTANTS AND BY-PRODUCTS FOR REGULATION UNDER THE D-DBP RULE

**Chlorination by-products**

- Chlorophenols
  - 2-Chlorophenol
  - 2,4,-Dichlorophenol
  - 2,4,6-Trichlorophenol
- Cyanogen Chloride
- Haloacetic acids
  - Dibromoacetic acid
  - Dichloroacetic acid
  - Monobromoacetic acid
  - Monochloroacetic acid
  - Trichloroacetic acid
- Haloacetonitriles
  - Bromochloroacetonitrile
  - Dibromoacetonitrile
  - Dichloroacetonitrile
  - Trichloroacetonitrile
- Haloketones
  - 1,1,-Dichloropropanone
  - 1,1,1-Trichloropropanone
- MX {3-chloro-4-(Dichloromethyl)-5-hydroxy-2(5H)furanone}
- N-Organochloramines
- Other
  - Chloral hydrate
  - Chloropicrin
- Trihalomethanes
  - Bromodichloromethane
  - Bromoform
  - Chloroform
  - Dibromochloromethane

TABLE 3-18 (Continued)

CANDIDATE DISINFECTANS AND BY-PRODUCTS FOR REGULATION UNDER THE D-DBP RULE

---

**Disinfectants**
- Chloramine
  - Ammonia
- Chlorine
  - Hypochlorite ion
  - Hypochlorous acid
- Chlorine dioxide
  - Chlorate
  - Chlorite

**Ozonation by-products**
- Inorganics
  - Bromate
  - Chlorate
  - Hydrogen peroxide
  - Iodate
- Organics (major groups)
  - Aldehydes (formaldehyde, acetaldehyde, hexanol, and heptanal)
  - Bromine-substituted compounds
  - Expoxides
  - Ketones
  - N-Oxy compounds
  - Nitrosamines
  - Organic acids
  - Peroxides
  - Quinones (polyhydroxyphenols)

## TABLE 3-19

## KEY POINTS OF THE D-DBP STRAWMAN RULE

A. MCLGs and MCLs to be set for selected contaminants and disinfectants:
   1. Most likely
      a. Total trihalomethanes (TTHMs)
      b. Haloacetic acids
      c. Chloride dioxide, chlorite, chlorate
      d. Chlorine and chloramine
   2. Potential additional contaminants
      a. Chloropicrin
      b. Cyanogen chloride
      c. Hydrogen peroxide, bromate, iodate
      d. Formaldehyde
   3. MCL for TTHM of 50 or 25 mg/l
   4. Other MCLs based on analyses of feasibility similar to those conducted for TTHMs

B. Treatment technique requirements or guidance provided for selected surrogate parameters:
   1. MX (as a surrogate for mutagenicity)
   2. Total oxidizing substances (as a surrogate for organic peroxides and epoxides)
   3. Assimilable organic carbon (AOC) (as a surrogate for microbiological quality of oxidized waters)

C. Monitoring required based on treatment:

| Treatment Process | Monitoring Parameters Under Consideration |
|---|---|
| Chlorination | TTHMs |
| | Haloacetic acids |
| | Total organic halides |
| | Total oxidizing substances |
| | Chloropicrin |
| | Cyanogen Chloride |
| | Total Chlorine residual |

TABLE 3-19 (Continued)
KEY POINTS OF THE D-DBP STRAWMAN RULE

| Treatment Process | Monitoring Parameters Under Consideration |
|---|---|
| Chloramination | TTHMs |
| | Chloropicrin |
| | Cyanogen Chloride |
| | Total Chloramine residual |
| Chlorine dioxide | Total Oxidizing substances |
| | Chlorine dioxide |
| | Chlorite |
| | Chlorate |
| Ozonation | Formaldehyde |
| | Total oxidizing substances |
| | Bromate |
| | Iodate |
| | Hydrogen peroxide |

NOTE: Consideration is being given to possibly reducing monitoring requirements to one sample per quarter at system discretion or one per year at state discretion base on system history.

D. BAT established

1. Precursor removal techniques (50 percent removal of TTHM formation potential)
   a. Conventional treatment modifications
   b. GAC adsorption with up to 30 minutes empty bed contact time and regeneration every 3 months
   c. GAC adsorption is not universally feasible because of water quality conditions
   d. Membrane processes may not be BAT because of lack of full-scale experiences

TABLE 3-19 (Continued)
KEY POINTS OF THE D-DBP STRAWMAN RULE

2. Alternative oxidants
   a. MCL values for disinfectants must be met
   b. Chlorine dioxide with chlorite residual removal and chloramines
   c. Ozone plus chloramines
   d. Initial estimate is that a TTHM MCL of 25 mg/l is the lowest that allows continued use of free chlorine
3. By-product removal
   a. Stripping (possible for some contaminants)
   b. GAC adsorption (not for most chlorination by-products: effectiveness for ozone by-products unknown)
   c. Reducing agents for MX, total oxidizing substances, possible chloropicrin and cyanogen chloride
   d. Reducing agents or free chlorine for hydrogen peroxide
   e. Caveat regarding ozone use with possible future need for post-GAC adsorption treatment for controlling AOC or removal of other by-products.

proposed TTHM MCL which could vary between 25 and 50 micrograms per liter. At these levels the existing lime softening plant, even with a combined chlorine residual, would have difficulty complying on a regular basis since reported concentrations in the distribution system range between 40 and 60 micrograms per liter.

Additional portions of the EPA regulatory program include:

1) Total coliform rule
2) Surface water treatment rule
3) Lead and copper rule
4) Phase V SOC's and IOC's
5) Radionuclides

The total coliform rule promulgated in June, 1989 sets a MCLG for total coliforms at zero and an MCL based on the presence or absence of total coliforms. The MCL for water distribution systems analyzing less than 40 samples per month (see Table 3-11 for monitoring frequency) as is the case for Marco Island is that no more than 1 sample per month may be positive or the system would be in violation . This is a change from the current rules, under which no one sample can cause a violation and in which chloride residual monitoring can be substituted. The surface water rule established regulations for filtration, disinfection and turbidity which the present Marco Island WTP already satisfies and compliance should not be a problem. The final lead and copper rule is scheduled for final publication in November 1990. The rule will establish an MCL for lead as it enters the distribution system of 0.005 mg/l, an MCL of 1.3 mg/l for copper, and contains treatment technique requirements for optimal corrosion control to minimize the formation of lead and copper by-products. The most recent finished water sampling obtained on January 31, 1990 from the Marco Island indicated that both contaminants were below detectable limits.

The proposed Phase V rule will set regulations for 24 of the last 25 contaminants on the original list of 83. Tentative MCLG's and MCL's released by EPA are summarized in Table 3-17 for 18 of the contaminants. This rule is expected to be in final form by March, 1992. The Phase II radionuclide rule is scheduled for final rule promulgation in June, 1991. This rule will establish MCL's and MCLG's for radon-222, radium-226, radium-228, natural uranium, beta particles and photon emitters.

## 3.05 RECOMMENDATIONS FOR COMPLIANCE WITH THE SDWA

This section presents specific recommendations for activities to be performed to assist in the compliance with existing, proposed and future regulations promulgated pursuant to the SDWA Amendments of 1986. It is important to periodically obtain updated information relative to progress on the regulatory agenda, anticipated effective dates for new regulations,and proposed MCLG's and MCL's. This information will help to anticipate future treatment requirements and incorporate them into the planning process in an orderly fashion rather than on a "knee-jerk" reaction basis. This information will also be invaluable in the evaluation of proposed and future raw water supplies and selection of treatment methodologies. This is especially true relative to the proposed expansion of the lime softening plant discussed in Section 6. The method of treatment may be required to be changed to some form of reserve osmosis dependent upon the levels of organics in the raw water and the future trihalomethane MCL and disinfectant by-products rule. The following specific activities relative to compliance with SDWA are recommended for implementation.

1. Sample the raw and finished water for all proposed SOC's and IOC's for which MCL's and MCLG's have been proposed (see Table 3-12) and compare the proposed limits to determine ability to comply with proposed regulation and effectiveness of existing treatment processes.

2. Sample all proposed and future water supply sources for the presently regulated contaminants (see Table 3-7) and those proposed to be regulated in the near future, (see Tables 3-12 and 3-17)as a tool to determine the adequacy of these supplies and the ability of the existing treatment processes to remove any identified contaminants.

3. Review the latest promulgated and proposed regulations, especially the disinfectants by-products rule projected to be in final rule form by 1993 prior to the expansion of the lime softening plant in 1994 to determine the adequacy of this process to comply with these regulations based upon the raw water and finished water quality sampling results. Adjust method of treatment as required to comply with the future regulations.

4. Review the proposed additional monitoring requirements and their proposed effective dates (see Tables 3-8, 3-9, 3-10 and 3-16) and incorporate these into the future utility operating budgets.

5. Evaluate the changes in the composite finished water quality in the distribution system following placing the R.O. plant in service relative to TTHM levels and corrosivity. The stability and corrosivity of the finished water are important variables relative to compliance with the lead and copper rule and also the proposed MCL for asbestos (see Table 3-12) in consideration of the amount of AC pipe in the distribution system. Monitoring of TTHM levels will help determine the ability of meet proposed future more stringent TTHM regulations (see Table 3-19) and aid in the evaluation of the process to be utilized for expansion of the lime softening plant.

6. Determine the state criteria for supply source vulnerability and have an assessment of the existing and proposed raw water sources performed to determine the sampling requirements for these sources (see Table 3-13).

7. Work with Collier County to establish well head and supply source protection ordinances to protect these critical supply sources from potential future sources of contamination.

## 3.06 PRELIMINARY COSTS FOR SDWA COMPLIANCE

In order to determine the minimum potential cost for SDWA compliance, HAI assumed that contaminants were not detected in the first round of sampling. Moreover, we assumed that access and pollutant transport would be limited or protected from surface water sources. Thereby creating supplies classified as "not vulnerable to potential contamination". If either assumption is found to be in error after future analytical activities have been completed, their additional monitoring and facilities costs would be expected.

In subsequent sections of this report the future softening supply sources are all derived from groundwater resource development. Then the Collier surface water source becomes one of several protected sources. The future second plant source of water is to be treated with membrane technology (Reverse Osmosis) and thereby would remove potential contaminants.

Table 3-20 presents a summary of the monitoring requirements and schedule for Marco Island. Using this information, Table 3-21 was prepared to delineate the operational costs of monitoring. Note that Table 3-21 is for one point of entry. As the second plant is made operational, then similar costs for this new facility would accrue, independent of location.

## TABLE 3-20

## MONITORING REQUIREMENT TIMETABLE FOR SYSTEMS SERVICE POPULATIONS OF GREATER THAN 10,000

| Contaminent Group | Monitoring Schedule | | Monitoring Requirements | |
|---|---|---|---|---|
| | Begin By | Complete By | Initial | Repeat |
| Volatile Organic | | | | |
| Chemicals (VOCs)(1) | Jan 1, 1988 | Dec 31, 1988(1) 18 months after final regulation(2) | 4 samples/ Quarterly | Every 2 Years |
| Additional VOCs(1) | Jan 1, 1988 | Dec 31, 1988 48 months after final regulations | 1 sample/Quarter /source Year | Every 3 Years |
| Microbiology and Turbidity(2) | Ongoing | Ongoing | 30 samples/month (30,000 pop.) | Reduce to 25% by supplying $Cl_2$ Residual |
| Inorganics | Ongoing | Ongoing | 1 Sample/Year | Annually |
| Nitrate-Nitrite | | 18 months after final regulation | 1 Sample Quarter/Year | Annually |
| Lead/Copper | 3 months after final regulation | 15 months after final regulation | 1 sample/Qarter | Annually |
| Corrosion | 3 months after final regulation | 15 months after final regulation | 30 per Quarter | 30 samples annually if no contamination found |
| Organics | Ongoing | Ongoing | 1 sample/Quarter /Year | 1 sample/Year |
| TTHMS | Ongoing | Ongoing | 4 samples/Quarter | 1 sample/Quarter |
| Radionucludes | Ongoing | | 1 sample/Qarter /Year | Every 4 Years |

Assume contaminents not detected in the first sampling round.

Assume system not vulerable to possible contamination.

Asume system consists of surface and groundwater supplies.

(1) Phase I

(2) Phase II

TABLE 3-21
MONITORING REQUIREMENTS COST OF COMPLIANCE FOR SYSTEMS SERVING POPULATIONS OF GREATER THAN 10,000(4)

| Contaminant Group | Unit Sample Cost(1) | Costs Per Year(2) | | | Total Cost |
|---|---|---|---|---|---|
| | | 1st | 2nd | 3rd | |
| | | | | | |
| Volatile Organic | | | | | |
| Chemicals (VOCs) | 245.00 | 3,920.00 | --- | --- | |
| VOCs (Additional) | 245.00 | 980.00 | --- | --- | |
| Microbiology | 25.00 | 9,000.00 | 2,250.00 | 2,250.00 | |
| Inorganics | 170.00 | 170.00 | 170.00 | 170.00 | |
| Nitrates | 30.00 | 120.00 | 120.00 | 120.00 | |
| Lead/Copper | 30.00 | 120.00 | 120.00 | 120.00 | |
| Corrosion | 30.00 | 3,600.00 | 900.00 | 900.00 | |
| Organics | 1,300.00 | 5,200.00 | 1,300.00 | 1,300.00 | |
| TTHM | 200.00 | 3,200.00 | 200.00 | 200.00 | |
| Radionuclides | 385.00 | 1,540.00 | --- | --- | |
| | Totals:(3) | $27,900.00 | $5,100.00 | $5,100.00 | |

1. Unit sample cost data provided by Thornton Labs 1/9/91.
2. Cost per year based upon monitoring requirements provided in Table 3-20.
3. Estimated monitoring costs assume single point of entry (POE). A similar cost will be incurred when the second plant is operational.
4. Surface and groundwater source.

## SECTION 4
## POTABLE WATER FACILITIES

### 4.01 EXISTING RAW WATER SUPPLY AND TRANSMISSION FACILITIES

The existing raw water supply and transmission facilities consist of borrow pits, infiltration galleries, pumping equipment and transmission lines. The raw water source consists of two borrow pits and two infiltration galleries north and east of the U.S. 41 and C.R. 951 intersection. The borrow pits were the original source of supply until 1976 when the first infiltration gallery was constructed to supplement the lake supply during drought conditions. The second gallery was constructed in 1988. The rated capacity of this source of supply system is 6.23 MGD based on the existing consumptive use permit. The results of a study by Marco Island Utilities' hydrogeologist, Missimer and Associates, state as follows:

> The combined lake,infiltration gallery system is a viable source of water if it is managed properly. Modeling of the system indicates that between 6.8 and 11.0 MGD should be produced from the system without causing water quality to exceed the potable water standard of 250 mg/l of dissolved chloride. It is prudent, however to utilize the more conservative output of the solute transport model which resulted in a safe yield of about 6.8 MGD during critical dry periods. Records indicated the system has been pumped at a rate of 6.45 MGD without causing the dissolved chloride concentration to exceed 250 mg/l.

The infiltration galleries lie along the west and south line of Section 26 in an L shape. The "West Line" gallery is approximately 4,000 feet long and the "South Line" gallery is approximately 3,000 feet long. At their intersection is a pump station with a single 125 Hp, 2,000 gpm pump discharging, via 12 inch, 18 inch and 24 inch transmission lines into a 250,000 gallon ground storage tank adjacent to the borrow pits approximately a mile south of the galleries. The purpose of this tank is to blend gallery water with the borrow pit water prior to being pumped to the island. The borrow pits are two man-made lakes that were probably limestone quarries used during the construction of U.S. 41. The larger pit to the north is approximately 27 acres, the smaller pit is approximately 19 acres. The two pits are interconnected via a 48 inch culvert.

Adjacent to the small pit, is the raw water pumping station consisting of nine pumps and the storage tank. Two 60 Hp 5,000 gpm transfer pumps lift the water out of the borrow pits and into the storage tank. From the storage tank, three different sets of pumps are capable of meeting the flow requirements necessary at the water treatment plant on the island. Pairs of 600 Hp, 3,500 gpm and 400 Hp, 3,000 gpm pumps are used to pump to the island during peak demand times. During off peak times, a pair of 200 Hp, 2,300 gpm pumps are used. The backup in case of a power outage is a 200 Hp pump and one 60 Hp transfer pump which are connected to an auxiliary power generator. In addition, there is a direct drive 3,000 gpm pump powered by a 400 Hp diesel engine located on site. Thus, in case of emergency there is the capacity to pump approximately 5,000 gpm toward the island. However, the actual raw water pumping capacity is very sensitive to the "C" factor of the transmission lines which significantly impacts the system head curve due to the long length of the transmission mains. Maintenance of the pipeline in terms of pigging is required to maintain optimum system efficiency and maximize available pumping capacity.

Leaving the raw water pumping station are parallel 12 and 14-inch raw water transmission lines on the west side of C.R. 951. These lines run approximately 8.5 miles to the Big Marco River where they join into a 30-inch sub-aqueous crossing of the river and onto Marco Island approximately 9,300 feet to the site of the water treatment plant. Along this transmission line are two booster stations located on the mainland. The first booster station consists of three 250 Hp, 2,600 gpm in line pumps. The second station consists of three 200 Hp, 2,600 gpm in line pumps. Both booster stations operate intermittently only on as needed basis and can be readily bypassed. Currently, the limiting factor in the raw water supply transmission system is the transmission lines and not the main pumping facility or booster pumping stations. The small diameter of the transmission lines and the long distance to the treatment facilities create high head conditions to be overcome by the pumping facilities, thus limiting their actual capacity to less than their intended design capacity. Also along the 14 inch line, is an 8 inch tee off to the Marco Shores 0.72 MGD lime softening plant. Table 4-1 summarizes the raw water supply and transmission facilities. Figure 4-1 shows the raw water supply and transmission facilities in relation to the island.

## 4.02 EXISTING WATER TREATMENT, STORAGE AND DISTRIBUTION FACILITIES

The water treatment facilities consist of two water treatment plants. The "old" plant is a 2.0 MGD Permutit lime softening plant with a 1,400 gpm precipitator, 6 sand filters of 225 $ft.^2$ each, rated at 1.9 $gpm/ft.^2$ for a total capacity of 3.7 MGD, and a lime silo and 1,000 #/hour slaker.

TABLE 4-1
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
RAW WATER SUPPLY AND TRANSMISSION FACILITIES

## I. Raw Water Supply

| Sources | Size | Capacities |
|---|---|---|
| Infiltration Gallery #1 ("West Line") | 4,000± feet | --- |
| Infiltration Gallery #2 ("South Line") | 3,000± feet | |
| Borrow Pit #1 ("South Pit") | 19± acres | --- |
| Borrow Pit #2 ("North Pit") | 27± acres | --- |
| | | 6.8 mgd(1) |

## II. Raw Water Pumping

| Pump No. | Purpose | Capacity (gpm) | Size (HP) |
|---|---|---|---|
| 1 | Pump from infiltration galleries to 250,000 gallon blending tank | 2,000 | 125 |
| 2 | Transfer from borrow pits to 250,000 gallon tank | 5,000(2) | 60 |
| 3 | Transfer from borrow pits to 250,000 gallon tank | 5,000 | 60 |
| 4 | Pump water to island (main pump) | 3,500(2) | 600 |
| 5 | Pump water to island (main pump) | 3,500 | 600 |
| 6 | Pump water to island (main pump) | 3,000 | 400 |
| 7 | Pump water to island (main pump) | 3,000 | 400 |
| 8 | Pump water to island (off peak pump) | 2,300 | 200 |
| 9 | Pump water to island (off peak pump) | 2,300 | 200 |
| 10 | Standby Pump | 3,000(3) | 400 |

TABLE 4-1 (Con't)
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
RAW WATER SUPPLY AND TRANSMISSION FACILITIES

| Pump No. | Purpose | Capacity (gpm) | Size (HP) |
|---|---|---|---|
| 11 | Booster Station #1 | 2,600 | 250 |
| 12 | Booster Station #1 | 2,600 | 250 |
| 13 | Booster Station #1 | 2,600 | 250 |
| 14 | Booster Station #2 | 2,600 | 200 |
| 15 | Booster Station #2 | 2,600 | 200 |
| 16 | Booster Station #2 | 2,600 | 200 |

**III Raw Water Transmission Line**

| Size | Material | Location | Length (ft.)± |
|---|---|---|---|
| 12 inch | --- | From Infiltration Galleries to Borrow Pits | 6,550 |
| 18 inch | --- | From Infiltration Galleries to Borrow Pits | 4,000 |
| 24 inch | --- | From Infiltration Galleries to Borrow Pits | 750 |
| 12 inch | AC | From Raw Water Pump Station to Big Marco River | 26,000 |
| 12 inch | CI | From Raw Water Pump Station to Big Marco River | 17,700 |
| 14 inch | AC | From Raw Water Pump Station to Big Marco River | 26,000'± |

TABLE 4-1 (Con't)
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
RAW WATER SUPPLY AND TRANSMISSION FACILITIES

**III. Raw Water Transmission Line (continued)**

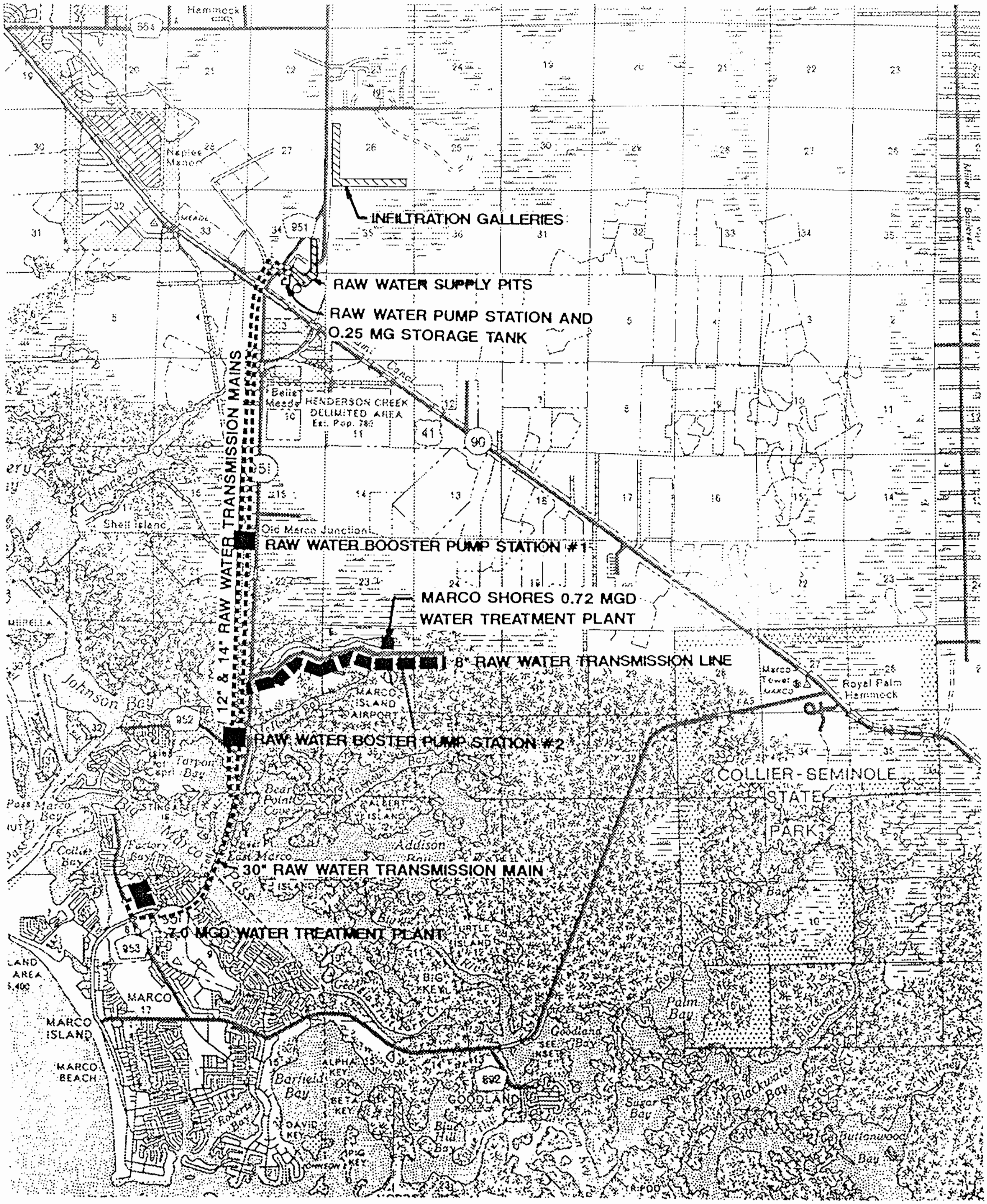
| Size | Material | Location | Length (ft.)± |
|---|---|---|---|
| 14 inch | CI | From Raw Water Pump Station to Big Marco River | 17,700 |
| 16 inch | CI | 12 and 14 inch to 30 inch at Big Marco River | 800 |
| 30 inch | CI(4) | From Big Marco River to WTP | 9,300 |

(1) Based on a solute transport model completed by Missimer and Associates.

(2) Connected to an auxiliary power generator.

(3) Driven by a 400 HP diesel engine.

(4) Ball and socket joint.

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Existing Raw Water Supply And Transmission Facilities

FIGURE 4-1

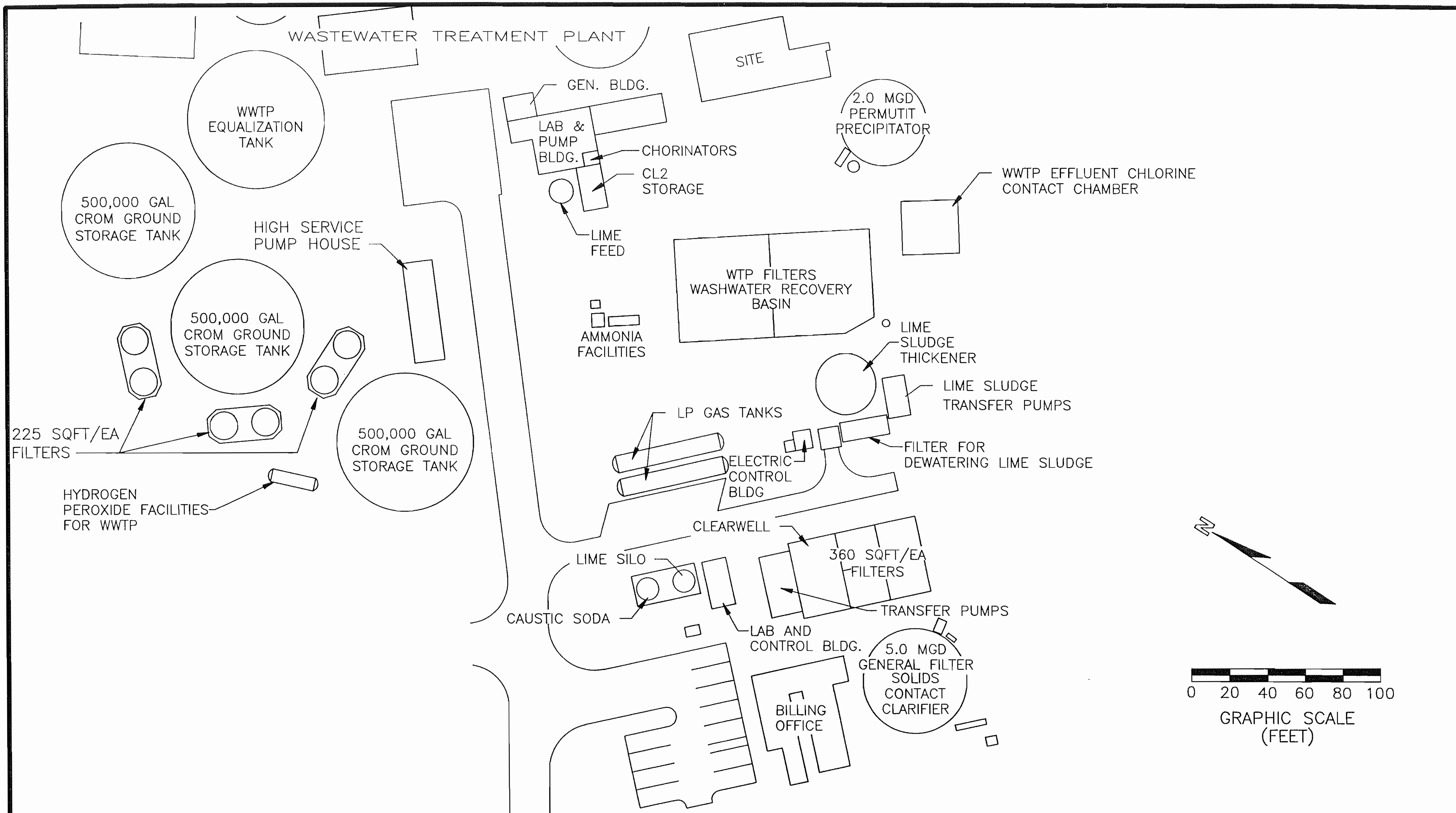
MARC0101B

The "new" plant is a 5.0 MGD General Filter lime softening plant consisting of a 3,500 gpm lime softening unit, 4 sand filters of 360 $ft.^2$ each rated at 2.4 $gpm/ft.^2$ for a total capacity of 5.0 MGD, and a lime silo and 1,000 #/hour slaker. In addition to the lime softening treatment facilities, there is disinfection by gaseous chlorination and trihalomethane (THM) control by quenching the THM formation using ammonia gas. See Table 4-2 for a complete summary of the water treatment facilities. Figure 4-2 shows a site plan of the water treatment facility.

On the same site as the water treatment facilities there are three 500,000 gallon Crom Corporation prestressed composite ground storage tanks for finished water storage. The high service pumping equipment on site consists of eight pumps varying in size from a 40 Hp, 500 gpm pump to a 125 Hp, 2,000 gpm pump. The existing high service pumping facilities have a firm nominal rated capacity of 8,200 gpm (11.8 MGD) with the largest unit out of service. The actual capacity that could typically be delivered to the system would be approximately 60-75% of the nominal rated capacity when the system head curve of the distribution system is taken into account.

In addition to the facilities at the WTP site, there are additional ground storage and high service pumping facilities located on a site in the south central portion of the island know as Unit 25 site. This site contains a one million gallon Crom storage tank and two two million gallon Crom storage tanks. The high service pumping consists of four pumps ranging in size from a 40 Hp, 500 gpm pump to 75 Hp, 1,000 gpm pump. The booster pumping station has a firm nominal rated capacity of 2,500 gpm (3.6 MGD) with the largest unit out of service. In like manner to the high service pumps, the actual capacity will be less than the rated capacity when system head effects are considered. Recently, a 12-inch transmission line was installed from the WTP to this site dedicated to filling these ground storage reservoirs. This line reportedly improved the pressure on the South Island between 15 and 20 psi . Table 4-3 summarizes the high service pumping and storage facilities. Figure 4-3 shows a site plan of the Unit 25 storage and pumping facility. There is also a small booster pumping station located on the southwest corner of South Barfield Drive and Winterberry Drive in Unit 13. This station contains a single 30 Hp, 450 gpm in line booster pump to increase the water pressure in this area.

The major water transmission lines consist of pipes 10 inches to 24 inches in diameter and are shown on Figure 4-4. The total water distribution system contains approximately 118 miles of water lines ranging in size from two inches to 24 inches. Approximately half of these lines are




**HARTMAN & ASSOCIATES, INC.**

engineers, hydrogeologists, scientists & management consultants

Existing Water Treatment Plant Site Plan

FIGURE 4-2

08000109

TABLE 4-2
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
WATER TREATMENT EQUIPMENT

**I. 2.0 MGD (1,400 gpm) Permutit Lime Softening Plant**

Precipitator

1 1,400 gpm
rated at 2 hrs detention

Filters

6 Sand Filters - 225 $ft.^2$/ea.
rated at 1.9 gpm/$ft.^2$

Lime Feed

Lime Silo and 1,000 lb./hour slaker

**II. 5.0 MGD (3,500 gpm) General Filter Lime Softening Plant**

Solids Contact Unit

1 55' diameter 3,500 gpm Contraflo
reaction basin and clarifier
rated at 1.5 gpm/$ft.^2$

Filters

4 Sand Filters - 360 $ft.^2$/ea.
rated at 2.4 gpm/$ft.^2$

Chemical Feed

Lime Silo and 1,000 lb./hour slaker
NaOH Feed

**III. Chlorination**

1 ton $CL_2$ cylinders

**IV. Ammoniation**

1 ton Ammonia cylinders

TABLE 4-3
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
STORAGE AND HIGH SERVICE PUMPING FACILITIES

## 1. WTP Location

Storage

3 - 500,000 gallon Crom Storage Tanks

| Pump No. | Pumping Purpose | Capacity (gpm) | Size (HP) |
|---|---|---|---|
| 1 | Normal Use | 2,000[1] | 125 |
| 2 | Normal Use | 2,000[1] | 125 |
| 3 | Normal Use | 2,000[1] | 125 |
| 4 | Normal Use | 1,000[1] | 75 |
| 5 | Normal Use | 1,000[1] | 75 |
| 6[2] | Normal Use | 1,000[1] | 75 |
| 7[3] | Standby | 700 | 60 |
| 8[3] | Standby | 500 | 40 |

## II. Unit 25 Location

Storage

1 - 1 mg Crom Storage Tank
2 - 2 mg Crom Storage Tank

| Pump No. | Pumping Purpose | Capacity (gpm) | Size (HP) |
|---|---|---|---|
| 1 | Normal Use | 1,000 | 75 |
| 2 | Normal Use | 1,000 | 60 |
| 3 | Standby | 1,000 | 91[4] |
| 4 | Normal Use | 500 | 40 |

TABLE 4-3 (Continued)
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
STORAGE AND HIGH SERVICE PUMPING FACILITIES

## III. Barfield and Winterberry

Pumping

1 - 30 Hp 450 gpm in line pump to boost pressures in Unit 13.

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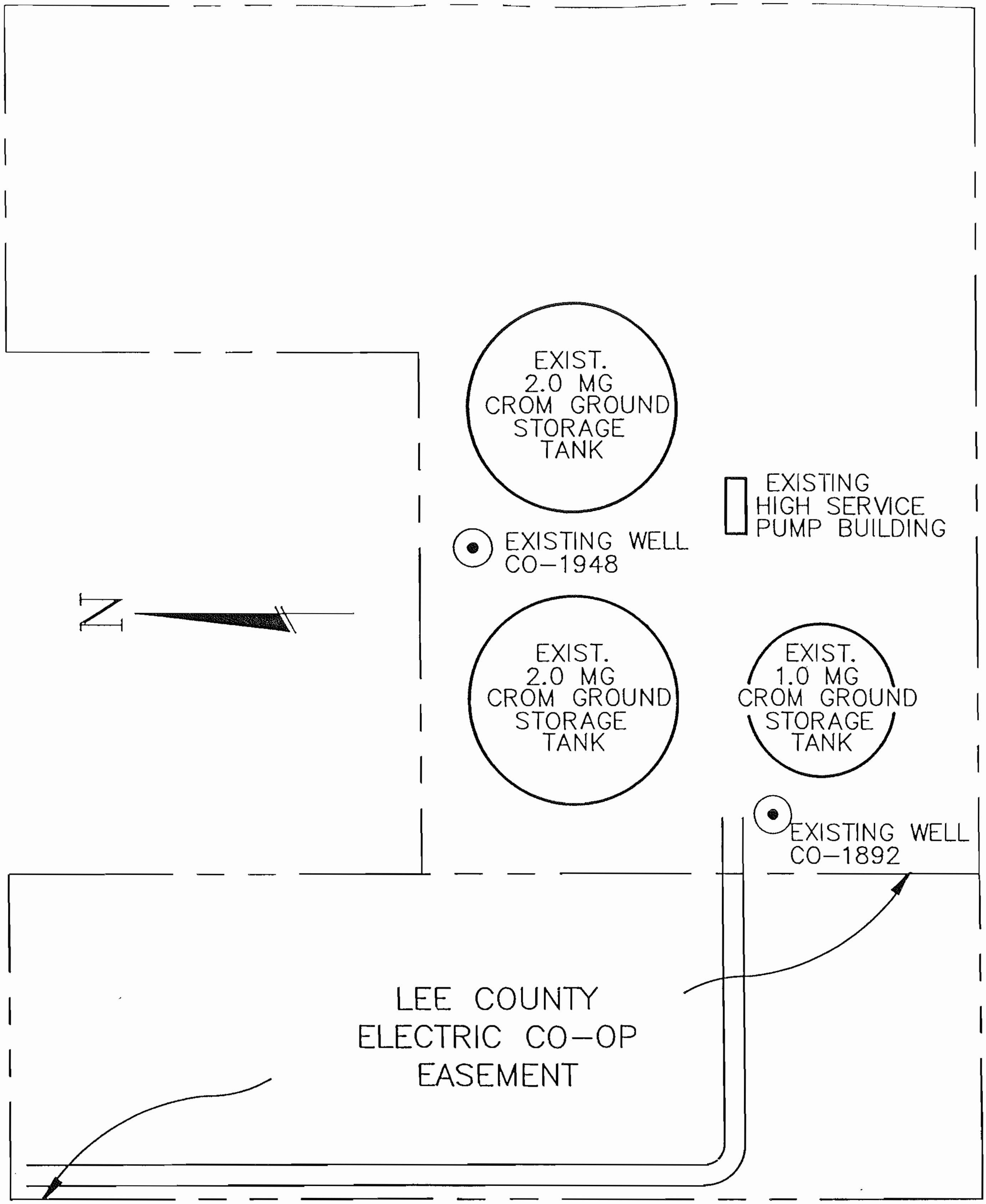
(1) Variable speed drive.
(2) LP gas engine drive also.
(3) Connected to auxiliary power.
(4) LP gas engine driven.

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Unit 25 Storage and Pumping Facility Site Plan

FIGURE 4-3

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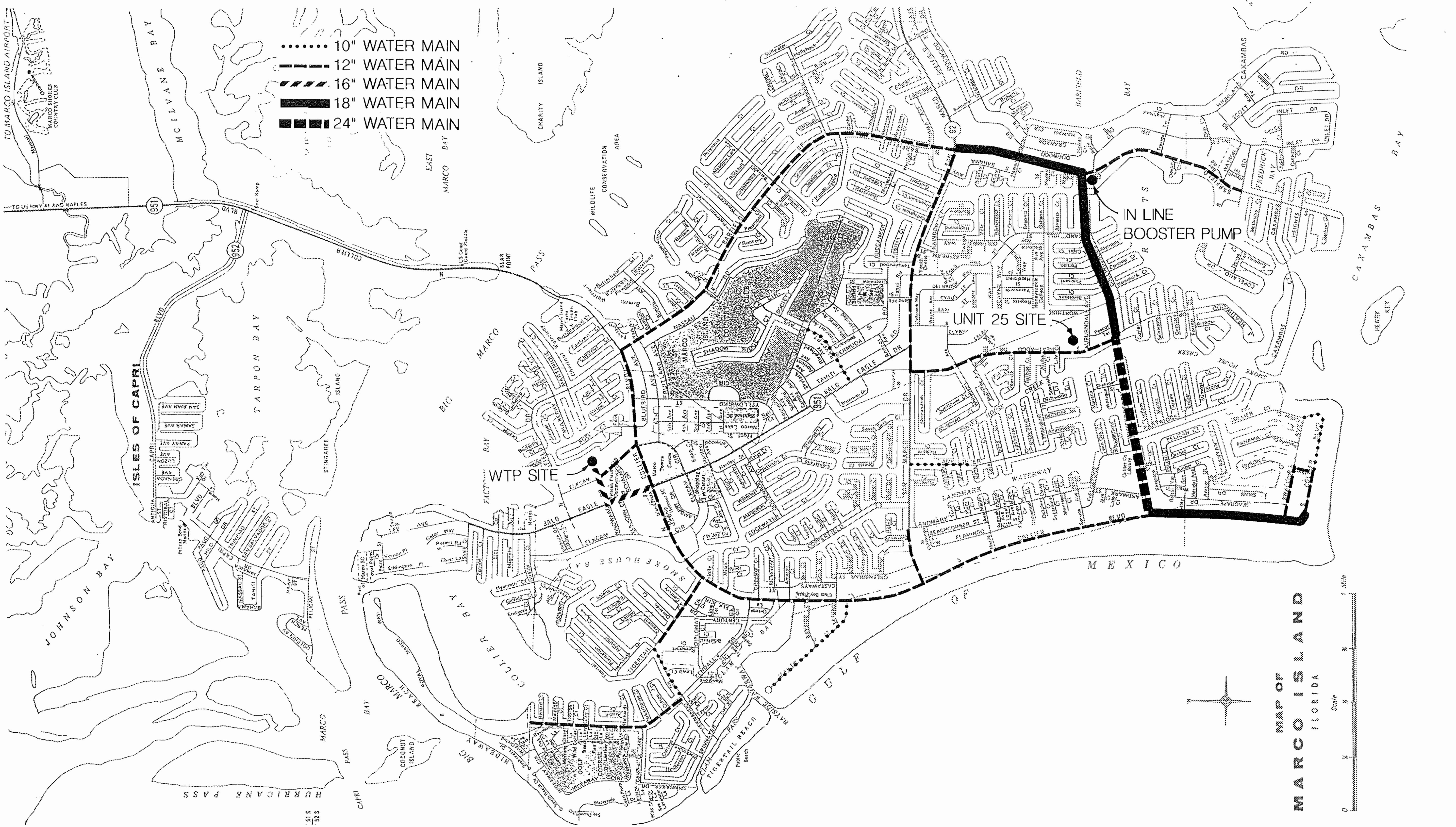


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**Major Water Transmission Lines 10 Inches and Larger**

FIGURE 4-4

PVC and any new lines installed are PVC. The original lines installed were AC pipe. There is very little cast iron or ductile iron pipe in this system. Table 4-4 shows a breakdown of the water transmission and distribution lines. Based upon a cursory review of the water transmission and distribution system map, the distribution system is adequately sized to provide reliable service for existing customers. Due to the large number of canals and cul de sacs on the island, it is difficult to provide a well "looped" system. Water transmission system deficiencies and improvements will be discussed in Section 6.

## 4.03 ONGOING WATER FACILITIES PROGRAM

Currently there is a 4.0 MGD reverse osmosis water treatment facility being designed to be constructed at the Unit 25 site. This facility will be on line by 1991. The build out capacity of this facility will be 6 MGD of R.O. capacity. Figure 4-5 shows the proposed reverse osmosis plant site plan. The supply wells for this facility will be deep wells located on the island. Missimer and Associates completed a study of the Hawthorn Aquifer Zone II on Marco Island and has determined that it has a hydraulic capacity of 8 MGD, which is the necessary raw water supply to provide 6 MGD of finished water at a 75% recovery. The report also states that there will be hydraulic impacts and water quality degradation mainly in terms of TDS at that pumping rate. Missimer states that the wells should be drilled to a depth varying between 550 and 575 feet deep.

Missimer provided two different scenarios for the wellfield design. The first is a concentrated wellfield with all wells being located on the Unit 25 site. Missimer does not recommend this design due to the enormous drawdown effects (110 feet). Their recommended wellfield design is a linear wellfield with either singular wells located on a minimum of 800 foot intervals or clusters of three to four wells located on a minimum of 3,000 foot intervals. Their recommended number of wells on the Unit 25 site, which is approximately 7.7 acres, is three wells each with a capacity of 520 gpm or a total of 1,560 gpm (2.25 MGD) of raw water production capability. The proposed site plan and well locations for Unit 25 R.O. site are shown on Figure 4-5 The five other production wells located off site are shown on Figure 4-6.

Two general areas for the new 4 MGD R.O. water treatment plant were reviewed. One area was adjacent to or in the proximity of the existing WTP and WWTP. The second area was on the Unit 25 property. The second area, on the Unit 25 property, was preferred for the following reasons:

| | Alternative Sites | |
|---|---|---|
| Consideration | WWTP/WTP | Unit 25 |
| Proximity to wellfield | distant | close |
| Well Site Acquisition | greater | less |
| Proximity to Deep Well | close | distant |
| Need for Water Transmission Mains | greater | less |
| Need for Additional Storage | yes | no |
| Ownership of Land | no | yes |
| Reliability | less | greater |

Comparatively savings in the raw water transmission system is greater than the cost of a brine disposal main. Moreover, the energy efficiency of operations is optimized for transfer brine flow pumping versus multiple manifold and varying well supply operations. It is preferable to have as many supply wells on-site as possible so that the R.O. plant emergency generator set could hard-line power the wells without significant energy losses or auxiliary power costs. New wells should not be located adjacent to the deep well injection facility. Since the deep well injection facility is most logically located at the WWTP and is permitted at that location, then R.O. supply wells would be remote to the WWTP/WTP area, yet adjacent to the Unit 25 area.

If the new R.O. WTP was to be located adjacent to the existing WTP, then the need for a new parallel supply water main would be required to Unit 25. The use of existing pumping units and the elimination of a new parallel supply line is accomplished at the Unit 25 site. Moreover, the Unit 25 site is located generally in the centroid of the demand area which would improve system reliability by not requiring north to south Island water transmission. Of course, there are many other cost saving reasons to locate a treatment plant in the general centroid of demand.

Reverse osmosis facilities require a significant amount of storage. Typical design criterion provide storage equal to or greater than the design production rate of the facility. The Unit 25 site presently has not only two (2) existing wells, but also some 5.0 MG of total storage. The 4 MGD R.O. WTP would not initially need additional storage at this location. At any other location 4.0 MG of additional storage would be required. Reverse osmosis facilities operate more efficiently at a steady or constant flow rate. In contrast softening facilities can easily handle variable flow rates in the process units.

Finally, the Unit 25 site is adequate for the R.O. plant site without land acquisition, an alternate location would require land acquisition of at least a 3.5 acre site.

From a planning and engineering standpoint, the Unit 25 site is preferred and represents the least cost implementable choice. The cost savings for the Unit 25 site includes, but is not limited to the following:

1. Differential cost between raw water transmission and brine disposal main -

    o Capital over $300,000 (SSUS Company Estimate $237,500)
    o Present worth O & M not stated

2. Auxiliary Power Costs -

    o Capital over $200,000 (5 wells southern site)
    o Present worth O & M not stated
    Note: these costs were not reflected in SSUS Company Estimates

3. Well site savings (2) -

    o Cost not estimated
    Included in #5 below.

4. Additional Water Transmission Facilities -

    o Capital approximately $700,000 (SSUS Company Estimate $736,360)
    o Present worth O & M not stated

5. Land Acquisition, Site Development and Permitting Costs
   SSUS Company estimate of $1,563,000

6. Cost of 3.5 + Acres and Site Development -

- Cost not estimated

The above identified costs favor the Unit 25 site over the northern site option.

The concentrate (waste product) from the reverse osmosis plant will be pumped back to the water/wastewater treatment plant site for disposal in an injection well. The concentrate will be pumped through the recently installed 12-inch water transmission line. The deep well is designed to dispose of 2.0 MGD of concentrate from the 6.0 MGD R.O. plant and 6.0 MGD of effluent from the wastewater treatment plant. It is proposed to be 3,300 feet deep with a 24-inch injection casing and open hole into which a 20-inch injection tubing will be installed. It is also scheduled to be completed by the end of 1991, in time for the first phase of the R.O. plant to be placed in service.

Additional ongoing water related projects are the demolition of the two small precipitators of the older Permutit plant in order to make room for additional effluent filters for the ongoing 1.0 MGD wastewater treatment plant expansion. This demolition has reduced the softening capacity of this plant from 3.0 MGD to 2.0 MGD and has already been noted in the previous facilities description and site plan.

Two raw water supply sites are being investigated off Marco Island. The first site is a 160 acre parcel located seven miles due east of the existing raw water supply in the southwest quarter of Section 35, Township 50 South, Range 27 East. This property is currently owned by Deltona Utilities and is dubbed the "160 Acre" site. The second site is property south and east of the existing raw water supply site and just north of U.S. 41 in the southeast quarter of Section 7, Township 51 South, Range 27 East. This property is owned by Sutherland Farms and has been dubbed the "Dude" site. Both of the raw water supply sites are shown in relation to the existing facilities on Figure 4-7.

An agreement has been reached between the owners of the Dude property and the utility to potentially pump 2.0 MGD average and 4.0 MGD maximum daily production from the site. Due to the regional drawdowns in the area and potential wellfield interference, the combined Dude and Collier supply are expected to safely produce approximately 8.6 MGD. Allowing 20% capacity for operational needs, an useful firm capacity of 6.9 MGD is recommended from these sources. The company should implement the Dude water supply improvement by December, 1991.

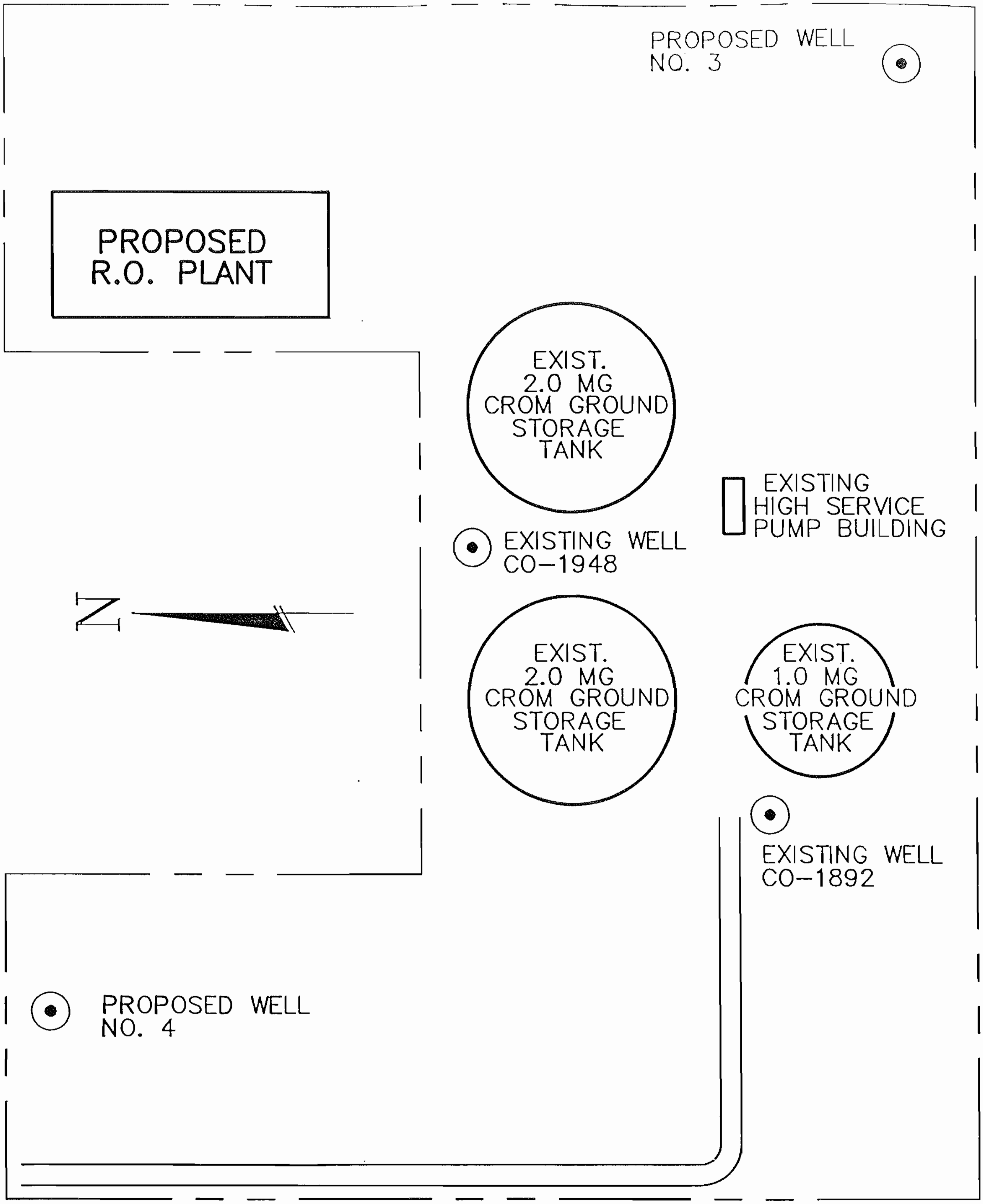
TABLE 4-4

MARCO ISLAND UTILITIES

WATER AND WASTEWATER PLAN

WATER TRANSMISSION AND DISTRIBUTION MAINS

| Material of Pipe | Diameter (inches) | Quantity (feet) |
|---|---|---|
| PVC | 4 | 158,947 |
| PVC | 6 | 134,033 |
| PVC | 8 | 44,327 |
| PVC | 10 | 3,485 |
| PVC | 12 | 15,730 |
| AC | 4 | 74,593 |
| AC | 6 | 69,607 |
| AC | 8 | 47,827 |
| AC | 10 | 9,264 |
| AC | 12 | 60,058 |
| AC | 16 | 2,140 |
| AC | 18 | 10,037 |
| AC | 24 | 5,434 |
| AC | 8 | 108 |
| CI | 12 | 2 |
| CI | 14 | 360 |
| CI | 16 | 36 |
| CI | | 635,988 |

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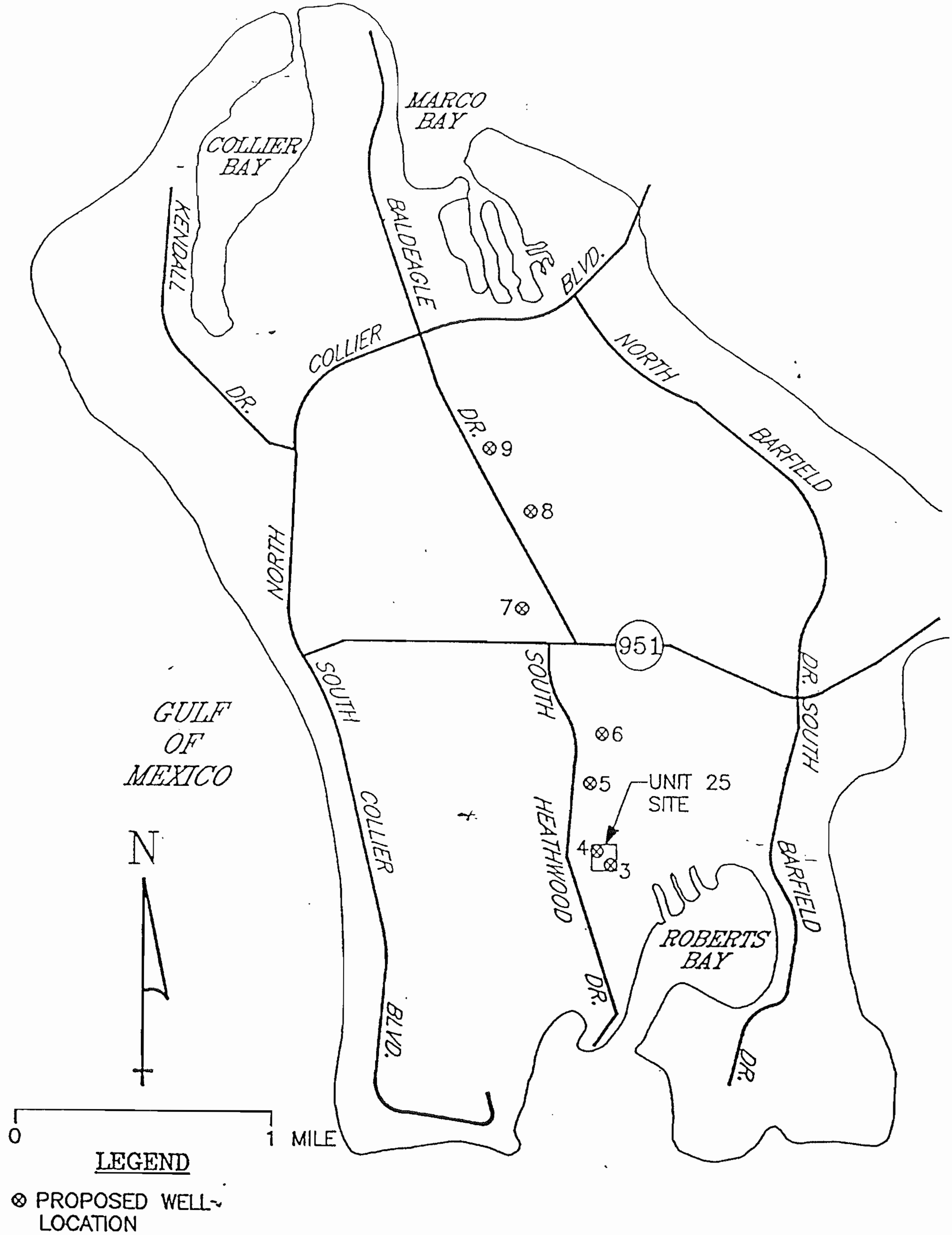
**Proposed Reverse Osmosis Plant Site**
FIGURE 4-5

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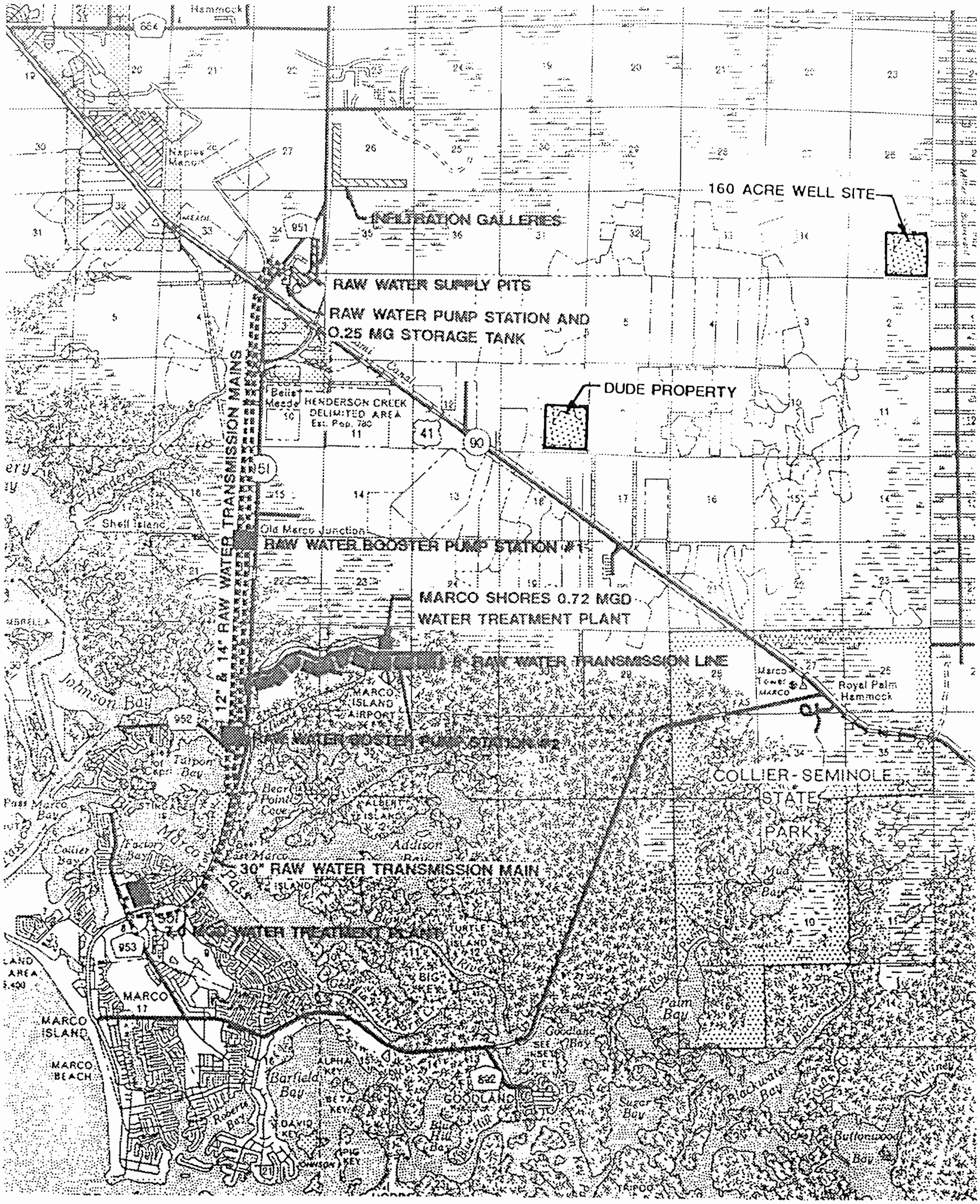
Off-Site Production Wells

FIGURE 4-6

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## Raw Water Supply Sites

FIGURE 4-7

MARC0101B

The company previously investigated the 160 acre Deltona owned site for future water supply. The Missimer report indicates that from four (4) to six (6) MGD of additional supplies may be available. This site serves as a back-up if the Collier lease cannot be renewed. Its other purpose is a more distant future raw water supply option.

The company participated on a 50%-50% cost sharing basis with Collier County regarding the recently completed water supply study. The company is continuing to cooperate with the County by participating in the water resource testing program at a site located at Manatee Road and C.R. 951. After the testing program has been completed, the company will assess the feasibility and cost-effectiveness of capital participation in a potential County regional water facility planned to be located on this site.

The Dude site is being pursued currently and a raw water transmission line to tie it into the existing facilities has been budgeted for 1991.

In addition to these raw water supplies, Marco Island Utilities has an agreement with Collier County to purchase up to 1.0 MGD of potable water to blend with the raw water. Thus the present source of supply can attain a capacity of 7.9 MGD but only at a relatively great cost ($1.50 per 1,000 gallons).

## 4.04 CAPACITY VERSUS DEMAND ANALYSIS

As stated previously, the safe yield capacity of the existing raw water supply, as determined by Missimer and Associates is 6.8 MGD. In considering the demand placed on this facility, it is also necessary to consider the raw water demand necessary at Marco Shores since it draws off the raw water lines heading towards Marco Island. Base on the past five years of flow data the maximum pumpage or raw water to Marco Shores was 463,000 gpd on December 17, 1986. The design consideration for the raw water supply is that it have the capacity to meet the annual maximum day demand. Thus the annual maximum day demand of the raw water system for Marco Island and Marco Shores, including a 5% annual growth in raw water demand for Marco Shores, is shown in Table 4-5.

Based upon Table 4-5, the raw water supply demand for 1990 is 9.34 MGD. Including the 1.0 MGD from Collier County there is currently a shortage of raw water supply capacity of 1.44 MGD. This is evidenced by the declining lake levels of the supply and the degrading water quality (increasing chlorides and total dissolved solids).

With the inclusion of the Dude property and 160 acre site to the raw water supply, the capacity will be increased assuming the Collier lease can be renewed. If not, a new supply source with a capacity of 5.7 MGD must be obtained. With the additional supply capacity, it would be recommended that 1.0 MGD Collier County interconnect continue to be used a standby, for peaking purposes and during poor raw water quality periods. Thus, the safe yield of the raw water supply could be as much as 10 MGD. This could be adequate to supply a 10 MGD lime softening plant.

The raw water pumping station currently has a reliable capacity of 8,800 gpm with one of each pair of the 3,500, 3,000 and 2,300 gpm pumps out of service. This would be more that adequate to meet the raw water feed to a 10 MGD lime softening plant operating at 20% over its rated capacity. The limiting factor in the raw water supply system is the transmission lines. To maintain a reasonable velocity in the transmission lines (approximately 5-7 feet per second), the twelve inch line and the fourteen inch line are hydraulically equivalent to a 17-inch line which would carry up to 5,000 gpm (7.2 MGD) at 7 feet per second. Thus, the current raw water transmission line capacity is approximately 5,000 gpm or 7.2 MGD. Higher capacities of 7.5 to 8.5 may be achieved with the existing booster pumps under optimum pipe conditions in terms of internal friction of "C" factor. However, as the velocity is increased, the potential for 5,000 water hammer and the cost of pumping are escalated. Therefore, before the 160 acre supply is brought on line, it will be necessary to construct a new raw water transmission line in order for the new supply to be effective. Once the new 24-inch raw water main is installed, the hydraulic restriction will be removed.

Currently, the lime softening plants are rated at 7.0 MGD. This is with the re-rating of the Permutit plant to only 2 MGD with the demolition of the old precipitators. Being able to operate these plants at a maximum of 120% of their rated capacity is possible because the filters are conservatively rated at 2.4 gpm per square foot. The maximum plant throughput would be 8.4 MGD. This falls short of the needed 9.42 MGD for the projected maximum day in 1991. With the reverse osmosis plant not coming on line until late 1991, it is probable that this upcoming "season" will be a real test of the existing water facilities and may cause water quality degradation and potential operational problems. If adequate raw water supply capacity

## TABLE 4-5
## MARCO ISLAND UTILITIES
## WATER AND WASTEWATER MASTER PLAN
## PROJECTED SOURCE OF SUPPLY DEMAND

| Year | Marco Island Maximum Day Demand (mgd)(1) | Marco Shores Maximum Day Demand (mgd(2) | Source of Supply Maximum Day Demand (mgd) |
|---|---|---|---|
| 1990 | 8.85 | .49 | 9.34 |
| 1991 | 9.42 | .51 | 9.93 |
| 1992 | 9.98 | .54 | 10.52 |
| 1993 | 10.53 | .56 | 11.09 |
| 1994 | 11.07 | .59 | 11.66 |
| 1995 | 11.59 | .62 | 12.21 |
| 1996 | 12.27 | .65 | 12.92 |
| 1997 | 12.94 | .68 | 13.62 |
| 1998 | 13.60 | .72 | 14.32 |
| 1999 | 14.27 | .75 | 15.02 |
| 2000 | 14.91 | .79 | 15.70 |

(1) See Table 2-5
(2) Assumes an annual growth in raw water demand of 5%.

is obtained and permitted for withdrawal, then a duplicate 5.0 MGD General Filter Plant could be constructed. If supplies are not obtained, then the second phase R.O. plant is required.

With the future expansion of the wastewater treatment facility, the 2 MGD Permutit plant will be demolished to make room for the new wastewater treatment plant facilities. This next phase of expansion is scheduled to occur in 1994. Thus, in 1994 the water treatment capacity should consist of the 10.0 MGD General Filter lime softening plant utilizing the existing surface water supply and the 4.0 MGD reverse osmosis plant utilizing the groundwater supply on Marco Island. This provides 14.0 MGD of water capacity. With adequate storage, this should be sufficient water treatment capacity to meet the demands. By 1994, additional raw water supply and water treatment capacity should be on line such that the demands may be met.

This option involves securing the renewal of the Collier lease, the Dude property and the 160 acre site such that a second 5.0 MGD lime softening expansion can be implemented. This option also improves the raw water supply to Marco Shores Therefore, by 1994, all three sources should be on-line to expand the lime softening plant to a total capacity of 10 MGD and this system would also provide raw water to Marco Shores. The additional raw water should also potentially provide blend water (if the R.O. wellfield water quality degrades significantly as predicted by Missimer) to the 4.0 MGD R.O. plant to be used to supplement the R.O. well supply. The total plant capacity would become 14 MGD. Later, the next 2.0 MGD Phase of the R.O. plant would be built to attain the needed 16 MGD ultimate capacity of the Island. Marco Shores will ultimately use some 3 MGD bringing the total to approximately 19 MGD.

The finished water storage requirements are to serve three purposes:

1. Provide the capacity of meet the peak hour water demands beyond the maximum day demand that the water treatment facilities are designed to produce (equalization storage).

2. Provide for the fire flow requirements established by the County fire marshall.

3. Provide capacity to meet any emergency situations that may occur related to failure of the supply works, such as a raw water transmission main break, so as to reduced the impacts of the emergency situation on the customer's required level of service

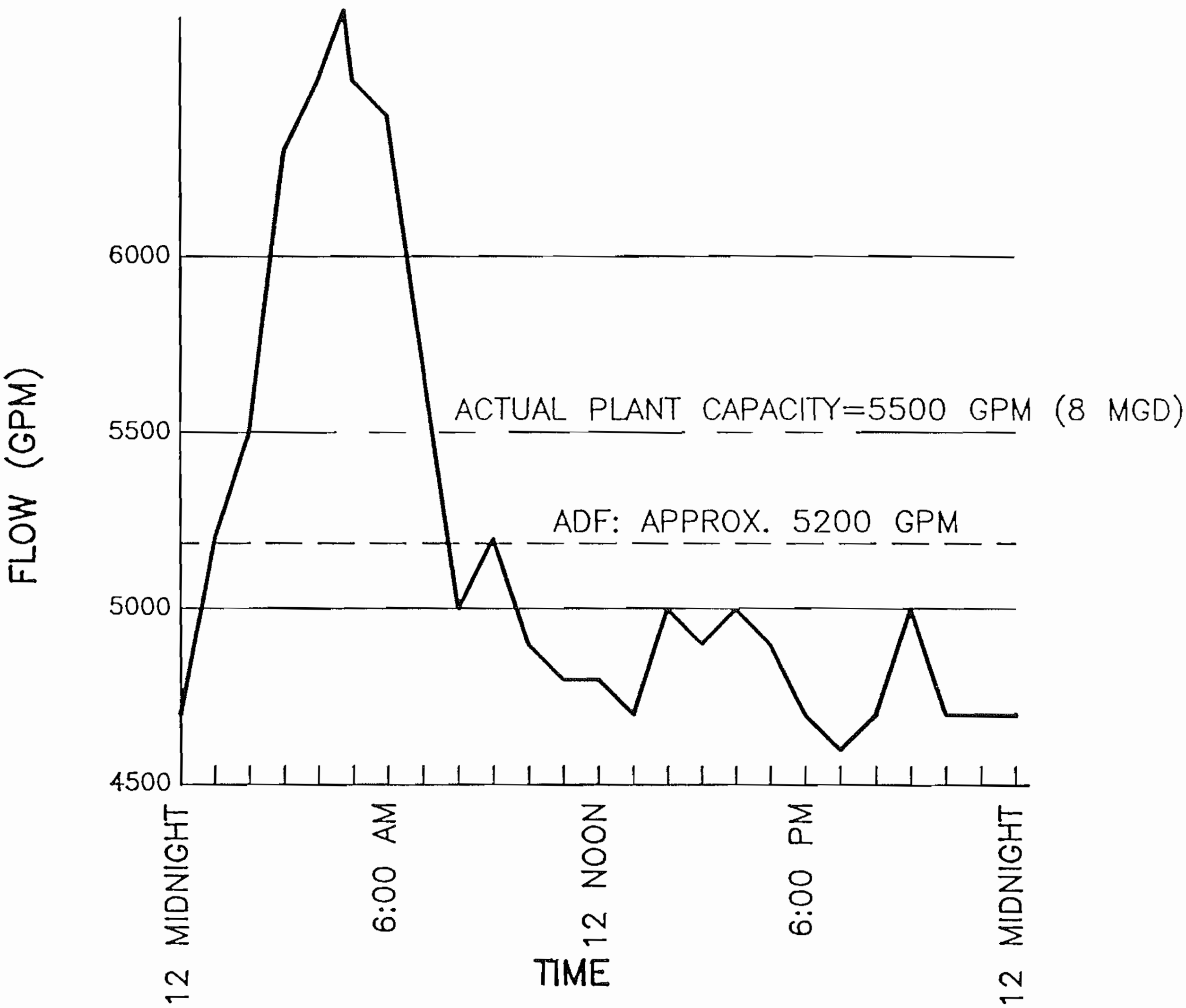
(emergency reserve). The emergency reserve is two-thirds (67%) of the average annual demand.

Figure 4-8 shows the diurnal curve for November 14, 1989, the maximum day during 1989. Based upon computing the area above and below the line shown on the drawing,, the average day demand for this day was approximately 5,200 gpm. Thus, if the plant was sized to meet this average day demand, every time the diurnal curve went above the average day demand line, the customers would be drawing from the storage tanks and every time the diurnal curve dropped below this average day demand line, the excess treated water would be filing the storage tanks. As can be seen on Figure 4-8, the entire time that the storage is emptying occurs between approximately 12:30 A.M. and 7:00 A.M. The area above the average day line during this time is equivalent to approximately 365,000 gallons of equalization storage.

The FPSC Annual Report states that the fire flow requirements is 4,500 gpm. There is no duration given. This is a very large fire flow requirement but is understandable considering the high rise towers located along the beach. If a four hour duration (240 minutes) was assumed, the needed storage volume for fire flow purposes would be approximately one million gallons.

The quantity of emergency reserve storage required is dependant upon he danger of interruption of raw water flow due to failure of the supply works and the time needed to make repairs. Failure of the works could include interruption of the power supply to pumping equipment without standby source of power, mechanical failure of pumping equipment, a break in the raw water line, or shutdowns for routine maintenance. Due to the coastal location of the Marco Island community, with the corresponding higher susceptibility to natural disasters, such as hurricanes and flooding, the vulnerability of the subaqueous piping and the relatively great distance between the existing water supply source and treatment works, the danger of interruption of the raw water supply is relatively high. Therefore, emergency reserve storage should be provided to ensure continuity of service.

The quantity of storage is dependant upon the nature of the cause of the interruption of the supply. The most serious interruption of supply would correspond to a major transmission line break. It is assumed that repair parts are on hand and that utility crews could repair any line break within 16 hours of the occurrence. It is estimated that a break or failure of the subaqueous main would require outside repair crews specializing in this work and repairs would take up to three days to complete from its occurrence. It is recommended that

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Diurnal Curve for
November 14, 1989
FIGURE 4-8

emergency reserve storage equal to the average annual daily demand be provided which should provide for most emergency situations. A larger quantity of storage may be required if the subaqueous crossing is damaged, however the larger quantity of storage that would be required is not considered to be economically feasible. Secondly, the effects of interruption of the mainland supply will be off-set in the future when the R.O. facilities are placed in service.

Table 4-6 shows projected finished water storage requirements form 1990 through 2000. The equalization storage was projected based upon the 1989 determination being approximately 6.5 percent of the annual average daily demand. Thus the projected quantities are 6.5 percent of the projected annual average daily demands. The fire flow storage remains at 1.0 million gallons throughout the planning period, due to the belief that the required fire flow is not going to exceed the 4,500 gallons per minute for a four hour duration. The emergency reserve storage, as discussed above, shall be equivalent to the projected annual average daily demand shown on Table 2-3. As is seen, the storage requirements grow from a needed 7.28 million gallons in 1990 to 12.34 million gallons int the year 2000.

The existing storage has a total nominal capacity of 6.5 million gallons. The useable storage capacity, due to vortexing at the discharge line, is reduced to approximately 5.5 million gallons. Thus, there is currently a shortage of storage of approximately 0.14 million gallons. By the end of 1994, this shortage will increase to 1.07 million gallons. It is recommended that the storage facilities be constructed in two million gallon increments. The first tank should be designed and constructed by the end of 1994 in order to meet the projected requirements. The recommended location of this tank is adjacent to the existing line softening water treatment plant site. This proposed site consist of an existing car wash and a vacant lot, both of which would have to be purchased from their respective landowners. The purpose of locating additional storage capacity at this site is to better utilize the existing water treatment plant storage, and high service pumping capacities at the water treatment plant. Currently, this site does not have storage capacity equivalent to the treatment or pumping capacities.

The second two million gallon ground storage tank is proposed either at the Unit 25 site or to be located at a new site along State Road 92 out toward Goodland. This area was selected due to the availability of land in this area, easier siting and the reduction of any potential pressure problems in this area. This is the only major area left on Marco Island. that is undeveloped. This tank should be constructed during 1997 along with 1,000 gpm of reliable high service pumping capacity (with expansion capability).

## TABLE 4-6
## MARCO ISLAND UTILITIES
## WATER AND WASTEWATER MASTER PLAN
## PROJECTED FINISHED WATER STORAGE REQUIREMENTS

| Year | Equalization Storage (MG) (1) | Fire Flow Storage (MG) (2) | Emergency Reserve Storage (MG) (3) | Total Required Storage (MG) |
|---|---|---|---|---|
| 1990 | 0.38 | 1.0 | 3.95 | 5.33 |
| 1991 | 0.41 | 1.0 | 4.23 | 5.64 |
| 1992 | 0.44 | 1.0 | 4.52 | 5.96 |
| 1993 | 0.47 | 1.0 | 4.80 | 6.27 |
| 1994 | 0.49 | 1.0 | 5.08 | 6.57 |
| 1995 | 0.52 | 1.0 | 5.35 | 6.87 |
| 1996 | 0.55 | 1.0 | 5.71 | 7.26 |
| 1997 | 0.59 | 1.0 | 6.06 | 7.65 |
| 1998 | 0.62 | 1.0 | 6.42 | 8.04 |
| 1999 | 0.66 | 1.0 | 6.78 | 8.44 |
| 2000 | 0.69 | 1.0 | 7.14 | 8.83 |

---

(1) Calculated as 6.5% of the projected annual average daily demands in Table 2-3.

(2) Calculated using a 4,500 gpm fire flow requirement and a 4 hour duration.

(3) Equivalent to two thirds (67%) of projected annual average daily demands.

The third two million gallon tank may also be constructed at either site. It is to be constructed following the expansion of the lime softening facility to provide an additional 5 million gallons per day by 2000. This construction will consist of the demolition of the three existing 500,000 gallon tanks and the construction of a second 5 million per day solids contact and clarifier unit additional gravity filters and the second ground storage tank.

If one assumes that the peak hour demand on the annual maximum day is the peak hour demand for the year, the Marco Island had a peak hour demand during 1989 of 6,700 gallons per minute. Determining a peak hour demand to annual average daily demand ratio will provide a factor which can then be used to project peak hour demands using the previously projected annual average daily demands The 6,700 gpm peak hour demand is equivalent to 9.65 MGD. During 1989, the annual average daily demand was 5.67 MGD, thus the peak hour demand to average day demand is approximately 1.7. This factor is very low, typically a system this size would probably have a peak hour demand to average daily demand ratio of approximately 2 to 4. You would especially think this to be true in a system such as this that has such a large irrigation demand. Apparently, that irrigation demand continues throughout the day which causes the variability in the demands during the day to be greatly suppressed. Table 4-7 shows the projected peak hour demand for the planning period using the peak hour demand to average daily demand ratio of 1.7.

This peak hour demands are then used to check the reliable capacity versus demand of the high service pumping equipment (Method 1). Another method (Method 2) of checking the high service pumping capacity is using the summation of one half the maximum day demand plus the fire flow requirements. The results of this method are shown in Table 4-8.

The nominal rated reliable capacity with the largest high service pump out of service at the water treatment plant is 8,200 gpm (11.8) MGD. The same type of consideration at the Unit 25 pumping station provides a reliable capacity of 2,500 gpm. The actual reliable pumping capacity, when the effects of the system head curve of the distribution system are considered, might typically be 60-75% of the rated capacity. Assuming a value of 70% , the actual total firm reliable existing high service pumping capacity is estimated to be 7,500 gpm (10.8 MGD). The capacity at the water treatment plant site should not be susceptible to power interruptions following the installation of standby power facilities to serve the entire utility site. The standby power facilities are expected to be on-line the first quarter of 1991. Based on the projections in Table 4-7, the existing high service pumping capacity is sufficient until sometime in 1992. However, additional high service capacity may be required sooner to take full advantage of the capacity of the new R.O. plant at the Unit 25 site.

TABLE 4-7
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
PROJECTED PEAK HOUR DEMANDS (METHOD 1)

| Year | Annual Average Daily Demand (mgd) | Peak Hour to Average Daily Flow Ratio | Peak Hour Demand MGD | Peak Hour Demand gpm |
|---|---|---|---|---|
| 1990 | 5.90 | 1.7 | 10.03 | 6,970 |
| 1991 | 6.32 | 1.7 | 10.74 | 7,460 |
| 1992 | 6.74 | 1.7 | 11.46 | 7,960 |
| 1993 | 7.16 | 1.7 | 12.17 | 8,450 |
| 1994 | 7.58 | 1.7 | 12.89 | 8,950 |
| 1995 | 7.99 | 1.7 | 13.58 | 9,430 |
| 1996 | 8.52 | 1.7 | 14.48 | 10,060 |
| 1997 | 9.05 | 1.7 | 15.39 | 10,690 |
| 1998 | 9.58 | 1.7 | 16.29 | 11,310 |
| 1999 | 10.12 | 1.7 | 17.20 | 11,940 |
| 2000 | 10.65 | 1.7 | 18.11 | 12,580 |

TABLE 4-8
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
PROJECTED PEAK HOUR DEMANDS (METHOD 2)

| Year | 1/2 Maximum Day Demand MGD | 1/2 Maximum Day Demand gpm | Fire Flow Requirement (gpm) | Peak Hour Demand (gpm) |
|---|---|---|---|---|
| 1990 | 4.43 | 3,080 | 4,500 | 7,580 |
| 1991 | 4.71 | 3,270 | 4,500 | 7,770 |
| 1992 | 4.99 | 3,470 | 4,500 | 7,970 |
| 1993 | 5.27 | 3,660 | 4,500 | 8,160 |
| 1994 | 5.54 | 3,850 | 4,500 | 8,350 |
| 1995 | 5.80 | 4,030 | 4,500 | 8,530 |
| 1996 | 6.14 | 4,260 | 4,500 | 8,760 |
| 1997 | 6.47 | 4,490 | 4,500 | 8,990 |
| 1998 | 6.80 | 4,720 | 4,500 | 9,220 |
| 1999 | 7.14 | 4,960 | 4,500 | 9,460 |
| 2000 | 7.46 | 5,180 | 4,500 | 9,680 |

## SECTION 5
## WASTEWATER FACILITIES

### 5.01 EXISTING WASTEWATER COLLECTION AND TRANSMISSION SYSTEM

Marco Island has both sewered and unsewered services. The unsewered areas are served by septic tanks. The sewered areas are served by Marco Island Utilities, Collier County Utilities and North Marco Island Utilities as shown in Figure 5-1. All sewered areas pump to the Marco Island Wastewater Treatment Plant.

Existing collection and transmission facilities consist of gravity sewers, lift stations and force mains. Approximately ten miles of gravity sewer and eleven miles of force mains comprise the collection system. The size and materials for the gravity sewers and force mains are shown on Table 5-1. Twenty two lift stations pump the wastewater to the Marco Island WWTP. The location and capacity of these lift stations are shown on Table 5-2. The Marco Island Utilities wastewater collection and transmission system service area is shown on Figure 5-2.

Raw wastewater enters the WWTP site via four force mains sized at 6, 8, 12 and 16 inches. This information is based on the collection area map supplied to HAI by SSU. The existing force mains are approximately hydraulically equivalent to a 20 inch force main, and are of sufficient size to carry 7.0 mgd to the WWTP. The force mains are interconnected on the plant site by the existing yard piping. Under normal operating conditions the flows from the four force mains are routed to the 500,000 gallon equalization tank and then repumped at a constant rate to the 250,000 gallon equalization tank.

### 5.02 EXISTING WASTEWATER TREATMENT FACILITIES

The existing wastewater treatment plant has a rated capacity of 2.5 mgd. The treatment processes include flow equalization, contact stabilization, clarification, filtration and disinfection. An effluent pumping station at the chlorine contact chamber pumps the treated effluent to two golf courses and/or the percolation ponds for disposal. Waste sludge from the activated sludge process is aerobically digested and then hauled from the WWTP via tanker and trucks for land application. Additionally, there are sludge drying beds which may be used to discharge sludge to during an emergency situation. The following paragraphs contain a brief description of the existing WWTP facilities site facilities. Additionally, the method of

TABLE 5-1
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
GRAVITY SEWERS AND FORCE MAINS

Gravity Sewers

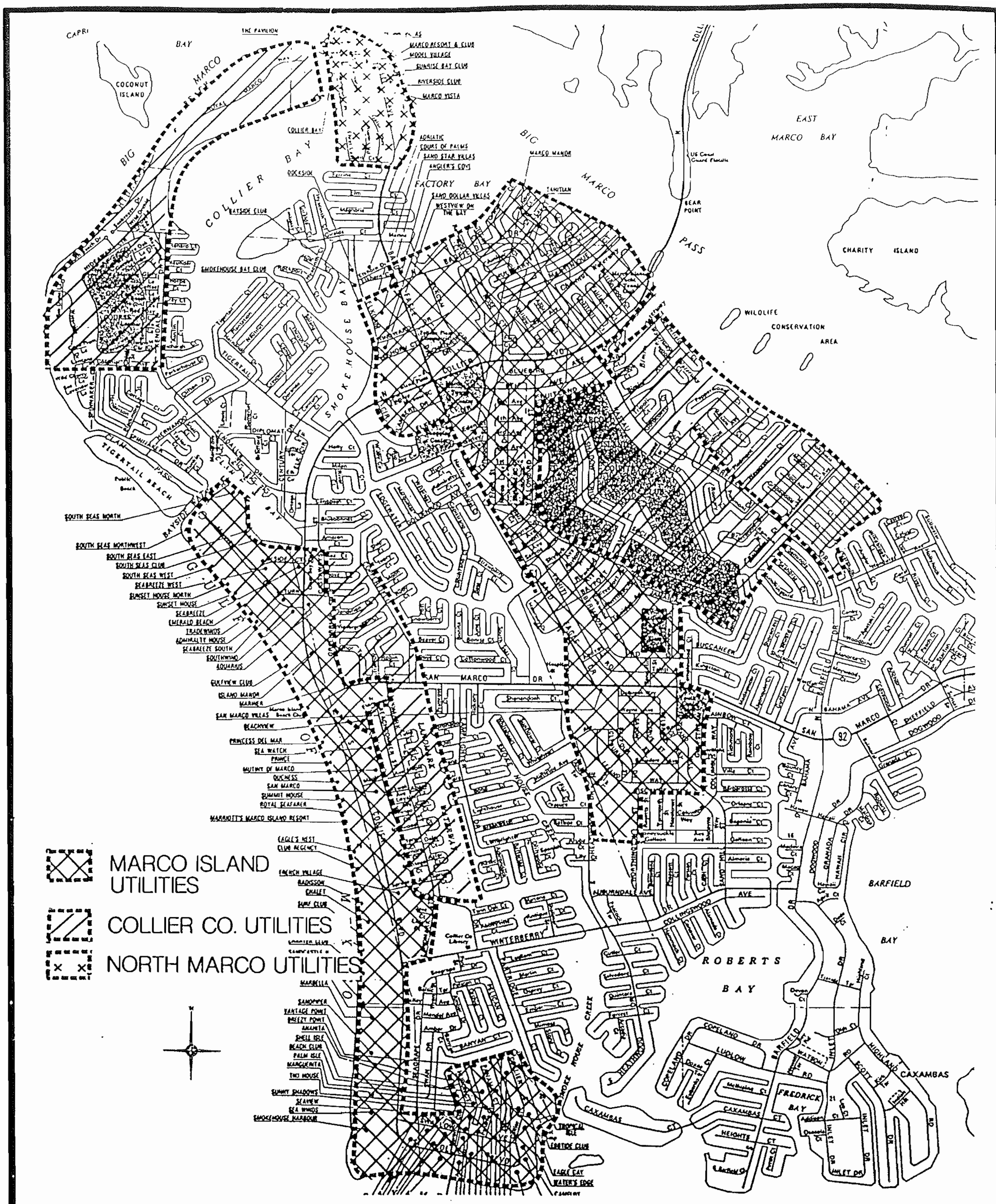
| Size Inches | Type | Length Ft. |
|---|---|---|
| 8 | PVC & VCP | 36,002 |
| 10 | PVC & VCP | 12,118 |
| 12 | VCP | 244 |
| 15 | VCP | 1,472 |

Force Mains

| Size Inches | Type | Length Ft. |
|---|---|---|
| 3 | AC | 600 |
| 4 | PVC | 7,938 |
| 6 | AC & PVC | 15,290 |
| 8 | AC & PVC | 6,350 |
| 10 | AC | 9,891 |
| 16 | AC | 16,903 |

TABLE 5-2
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
LIFT STATION SUMMARY

| Location | Capacity, gpm |
|---|---|
| 1, Block 11, Unit 1 | 240 |
| 4, Tract "G", Unit 4 | 100 |
| 4-A, Block 117, Unit 4 | 230 |
| 4-D, Block 781, Unit 4 | 150 |
| 4-E, Block 777, Unit 4 | 100 |
| 6, Saturn Ct., Unit 6 | N/A |
| 6-A, Block 223, Unit 6 | 280 |
| 6-B, Block 796, Unit 6 | 160 |
| 6-C, Block 799, Unit 6 | 160 |
| 25-A, Block 788, Unit 25 | 220 |
| 25-B, Tract "R-F", Unit 25 | 125 |
| 6-R, Seaview Ct., Unit 6 | 360 |
| 7, Block 122, Unit 7 | 150 |
| 7-A, Block 177, Unit 7 | 400 |
| 7-B, Block 184, Unit 7 | 560 |
| 10-A, Block 339, Unit 10 | 360 |
| 10-B, Block 341, Unit 10 | 135 |
| 11-C, Block 782, Unit11 | 100 |
| 22-A, Tract "K", Unit 22 | 240 |
| 1-B, Gulfview Condo | 150 |
| 15-A, Block 4, Unit 1 | 350 |

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**Wastewater Service Areas**

FIGURE 5-1

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operation and flow stream to each unit are discussed. Figures 5-2 and 5-3 show the WWTP location and existing WWTP site plan.

Raw wastewater from the 500,000 gallon equalization tank is normally pumped through a 12 inch line at a constant rate to a 250,000 gallon equalization tank. Therefore, under the existing piping arrangement, the two equalization tanks operate in series. The pumps for each tank are controlled based on the water level in each of the tanks. As the level in each tank rises, additional pumps are brought on line to increase the flow through each unit.

Following the 250,000 gallon equalization tank the raw wastewater is then repumped to an above grade flume where the plant flow is measured. From this unit the raw wastewater then flows by gravity to the plant splitter box. Raw wastewater may by-pass both equalization basins and the measuring flume and be routed directly to the plant splitter box through a 16 inch line.

The splitter box divides the flow between contact tanks No. 1 and No. 2. Each tank has a volume of 100,970 gallons. Aeration for each tank is provided by mechanical surface aerators. Mixed liquor from the contact tanks flows to a clarifier splitter box, which proportions the flow to two 40 foot and one 50 foot diameter clarifiers.

Effluent from the clarifiers is routed to the existing 675 square foot traveling bridge filter or to the polishing pond should the clarifier effluent be substandard. Following filtration the effluent is chlorinated in the chlorine contact basin. Disinfected effluent from the chlorine contact basin flows by gravity to the effluent pumping station. The effluent pumping station consists of three pumps which pump the effluent to the spray irrigation sites or to the percolation ponds via an effluent transmission main.

Settled sludge from the clarifiers is pumped to one of three reaeration tanks, or wasted to digester No.1. Reaeration tanks No. 1 and No. 2 are 100,970 gallons each, while tank 3 is 296,000 gallons. Digesters No. 1 and 2, are sized at 206,000 gallons and 131,500 gallons respectively, and operated in series. The digested sludge is then pumped from digester No. 2 to a tanker truck. The tanker truck hauls the sludge to the mainland where it is applied to agricultural lands. Waste activated sludge from the reaeration tank No.3 (normally) is returned to the splitter box or diverted to digester 1.

The major WWTP equipment items are shown on Table 5-3.

TABLE 5-3
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
MAJOR WASTEWATER TREATMENT PLANT EQUIPMENT

Equalization Tanks

One - 250,000 gallon tank
One - 500,000 gallon tank

Contact Tanks

Two - 100,970 gallon tanks

Reaeration Tanks

Two - 100,970 gallons tanks
One - 296,730 gallon tank

Clarifiers

Two - 40' diameter tanks
One - 50' diameter tank

Digesters

One - 40' diameter tank
One - 50' diameter tank

Sludge Pumps

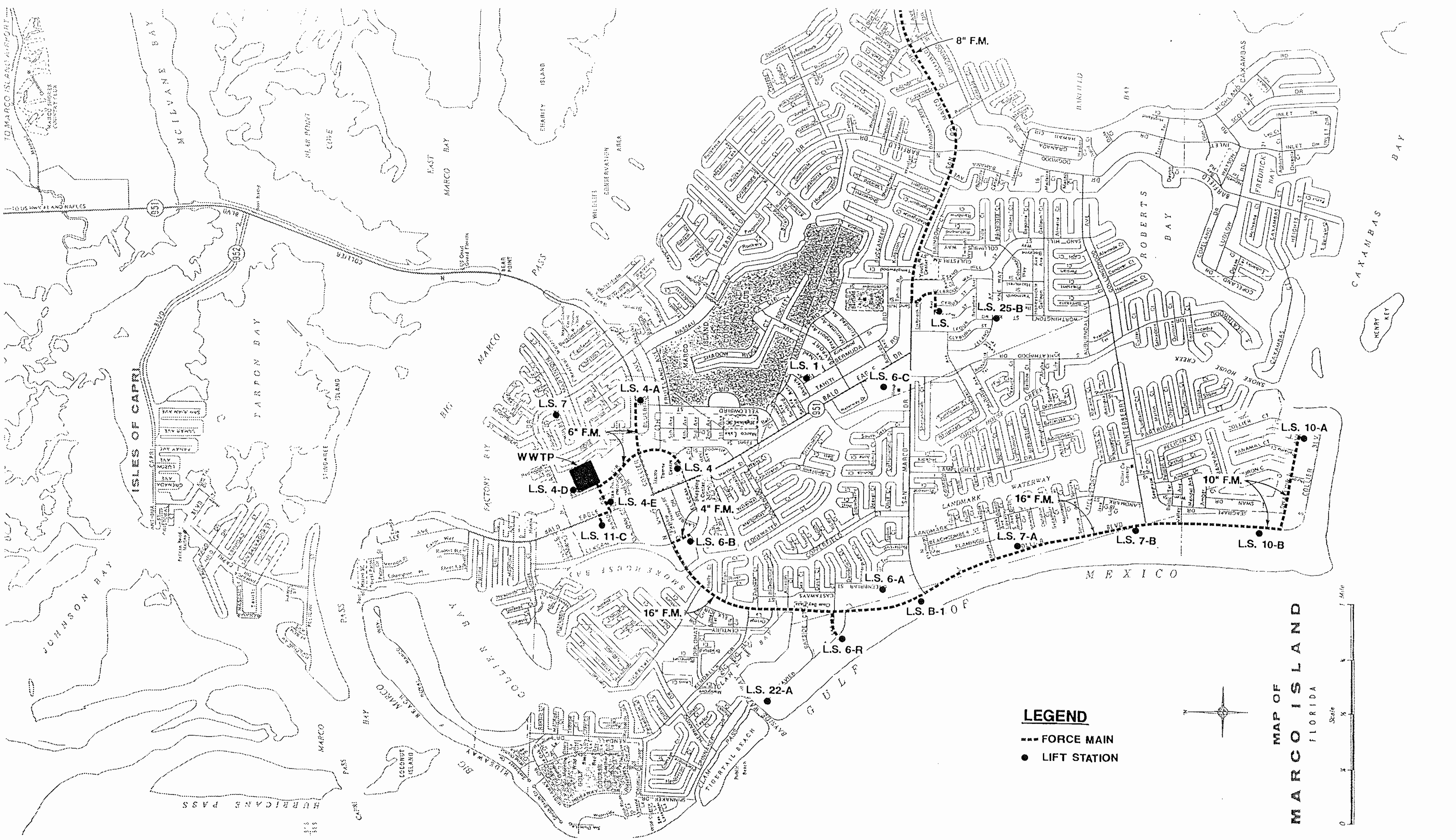
Four variable speed - 1,050 GPM at 12' TDH

Filters

One - 2.5 mgd traveling bridge filter

Chlorination

1 - ton $CL_2$ cylinders

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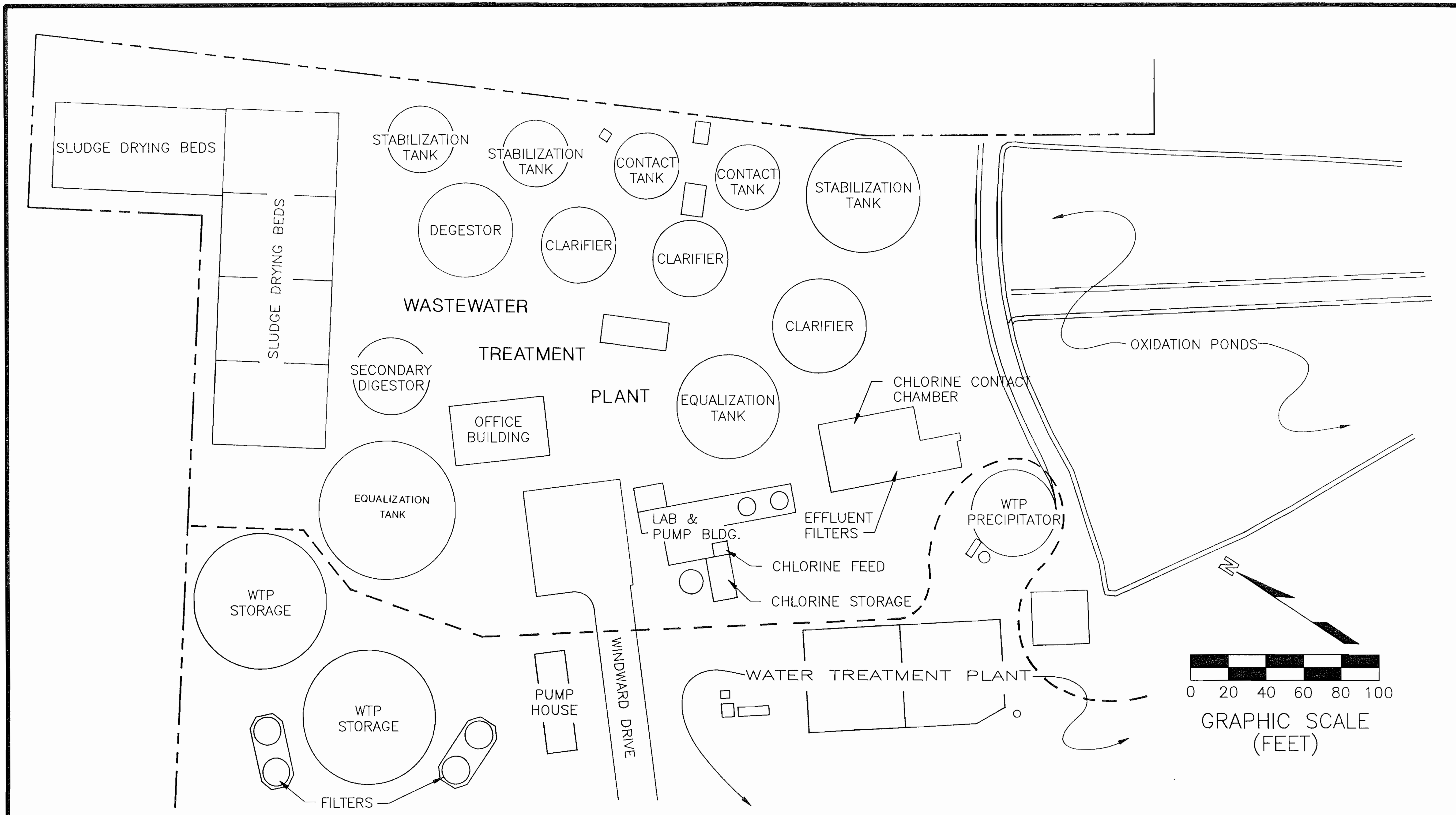
## Wastewater Collection and Treatment Facilities Map

FIGURE 5-2

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**Existing WWTP Site Plan**

FIGURE 5-3

At the present time the existing Marco Island WWTP facilities are under a Consent Order from the FDER, OGC Case No. 88-0458. The Consent Order requires that the following activities be initiated:

a. Convert existing 0.5 MG storage tank to a flow equalization tank.

b. Install air scrubbing equipment on the flow equalization tanks and raw wastewater splitter boxes.

c. Construct an interconnect between the effluent filter and effluent disposal facilities structure.

d. Install a continuous turbidity monitor on the filter effluent.

e. Install effluent booster pumps at Marco Shores.

f. Apply for permits for construction of a new effluent force main across the Marco River at C.R. 951.

Activities a., c., d., and e. have been completed. Activity b. is in progress and is expected to be completed in the next few weeks. Activity f is in the processs of being remedied by the construction taking place under the Phase I Expansion Program. This program is discussed in further detail under paragraph 5.04, Ongoing Wastewater Facilities Programs.

In addition to the facility improvements required by the Consent Order, the FDER also placed more stringent operational requirements on the WWTP. Normally a Category II, Class B facility is required to have "staffing by Class C or higher operator: 16 hours/day for 7 days/week. The lead/chief operator must be Class B, or higher", i.e. 3 Operators, 1 Class B or above and 2 Class C or above. However, under the Consent Order the facility is required to have 3 operators, 2 Class B or above and 1 Class C or above. Additionally, the facility is also required to have 24-hour certified operator staffing from November 1 through April 30. These requirements will be compared to those which are "normally" required upon completion of the phase I improvements.

## 5.03 EXISTING EFFLUENT TRANSMISSION AND DISPOSAL FACILITIES

The effluent transmission and disposal system consists of 3 effluent pumps, transmission mains, boosters pumps and percolation ponds. Effluent is spray irrigated on the Marco Island

Golf Course on the island and the Marco Shores Golf Course on the mainland. The existing golf course systems should be capable of disposing of up to 1.0 mgd of effluent based upon experience with other facilities of similar size. Although these facilities refuse to accept this amount on an annual average basis. The remaining effluent is pumped to percolation ponds on the mainland. The existing effluent transmission mains have been summarized on Table 5-4 and shown on Figure 5-4.

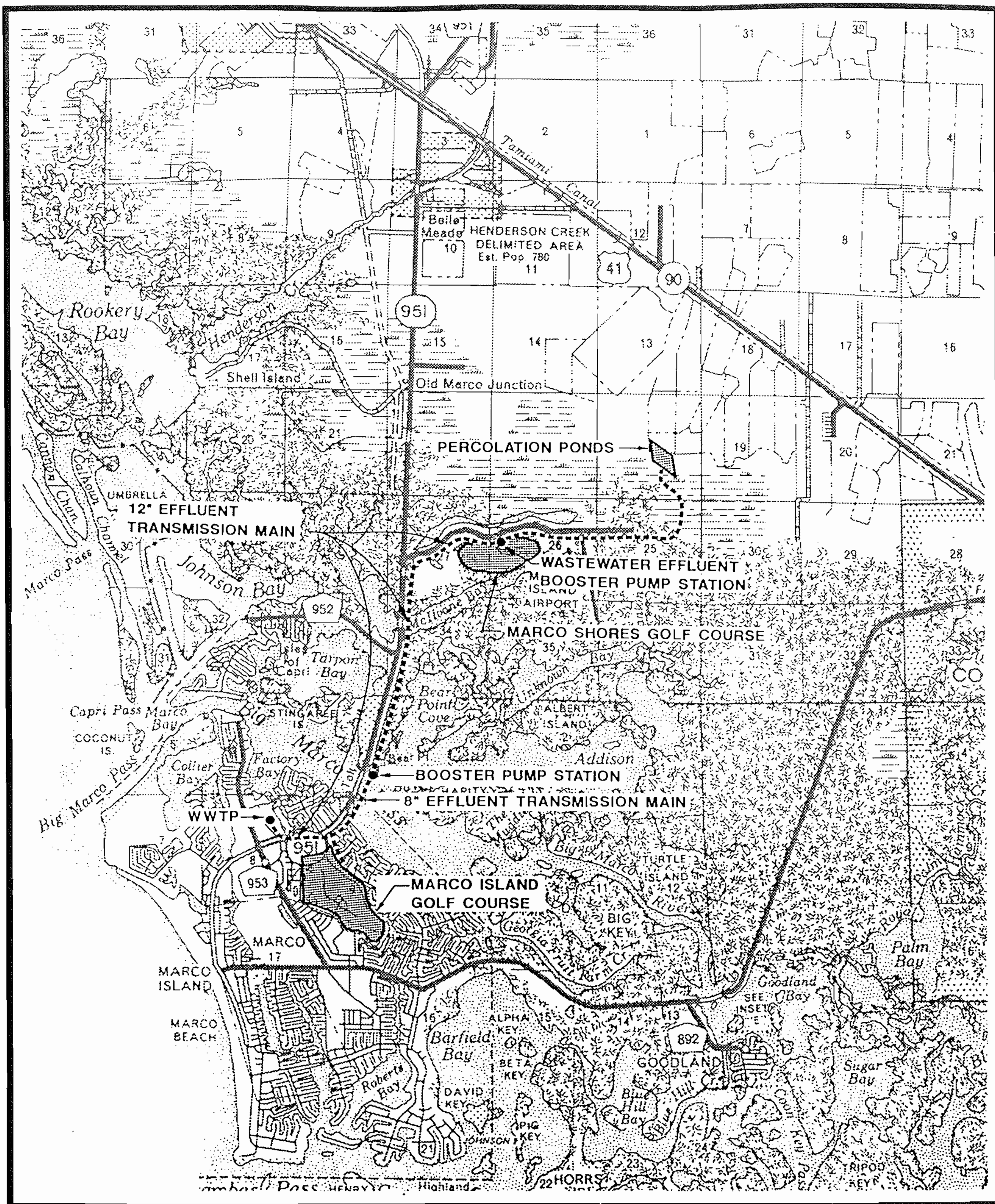
## 5.04 ONGOING WASTEWATER FACILITIES PROGRAMS

At the present time there are numerous programs under the Phase I WWTP expansion plan that are currently being designed, permitted or are under construction . These programs where outlined in the "Engineering Preliminary Design Report, Marco Island Wastewater Treatment Plant Expansion Program" for Deltona Utility Consultants, Inc. prepared by Dyer, Riddle, Mills & Precourt, Inc., December, 1989 (EPDR). Contract A, consisting of major site work and including filling in a portion of the existing pond is complete. Contract B includes a package 1.0 mgd contact stabilization WWTP with clarifier and digester, a 2.5 mgd traveling bridge filter, a 3.5 mgd chlorine contact basin expansion rated at 5.5 mgd peak flow, and three new effluent pumps. The pumping units are proposed to be constant speed, sized to handle the peak flow rate with two units on line and the third unit provided as standby. Each pumping unit will have a capacity of 2.3 mgd at 162 feet of head. Construction is underway and should be completed in a few weeks. The proposed WWTP expansion is shown on Figure 5-5. Contract C consists of the effluent disposal ponds. At the present time the design is reportedly complete. Construction is expected to take 3-5 months, following the probable permit reception in October of 1990. The proposed percolation pond expansion is shown on Figure 5-6. Contract D consists of approximately 5 miles of effluent transmission system. Construction will be split into four sections. Construction is expected to begin in December, 1990. This project must be coordinated with the proposed expansion and reconstruction of County Road 951. The effluent transmission facilities improvements for Phase I should increase the system capacity to 4.6 mgd. These facilities are shown in Figure 5-7

Other contracts listed in the EPDR report include the following: sludge thickening facilities, emergency generator set, an influent screening facility and an odor control facility. At the present time the sludge thickening facility has been designed and construction is expected to proceed concurrently with the WWTP expansion. The emergency generator set has been pre-purchased and is also expected to be installed during the WWTP expansion. The screening facility design is soon to be under construction and is expected to be finished in January, 1991.

TABLE 5-4
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
EXISTING EFFLUENT TRANSMISSION SYSTEM

| System | Capacity |
|---|---|
| **Marco Island WWTP** | |
| Effluent Pumps | 1,530 gpm |
| | |
| 6,954 L.F. of 12 inch main | |
| 1,932 L.F. of 8 inch main | |
| | |
| **Coast Guard Booster** | |
| Pump Station | 1,784 gpm @ 141' TDH |
| | |
| 14,740 L.F. of 12 inch main | |
| | |
| **Marco Shores Booster** | |
| Pump Station | 1,940 gpm @ 172' TDH |
| | |
| 20,420 L.F. of 12 inch main | |

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# Existing WW Effluent Disposal Facility

FIGURE 5-4

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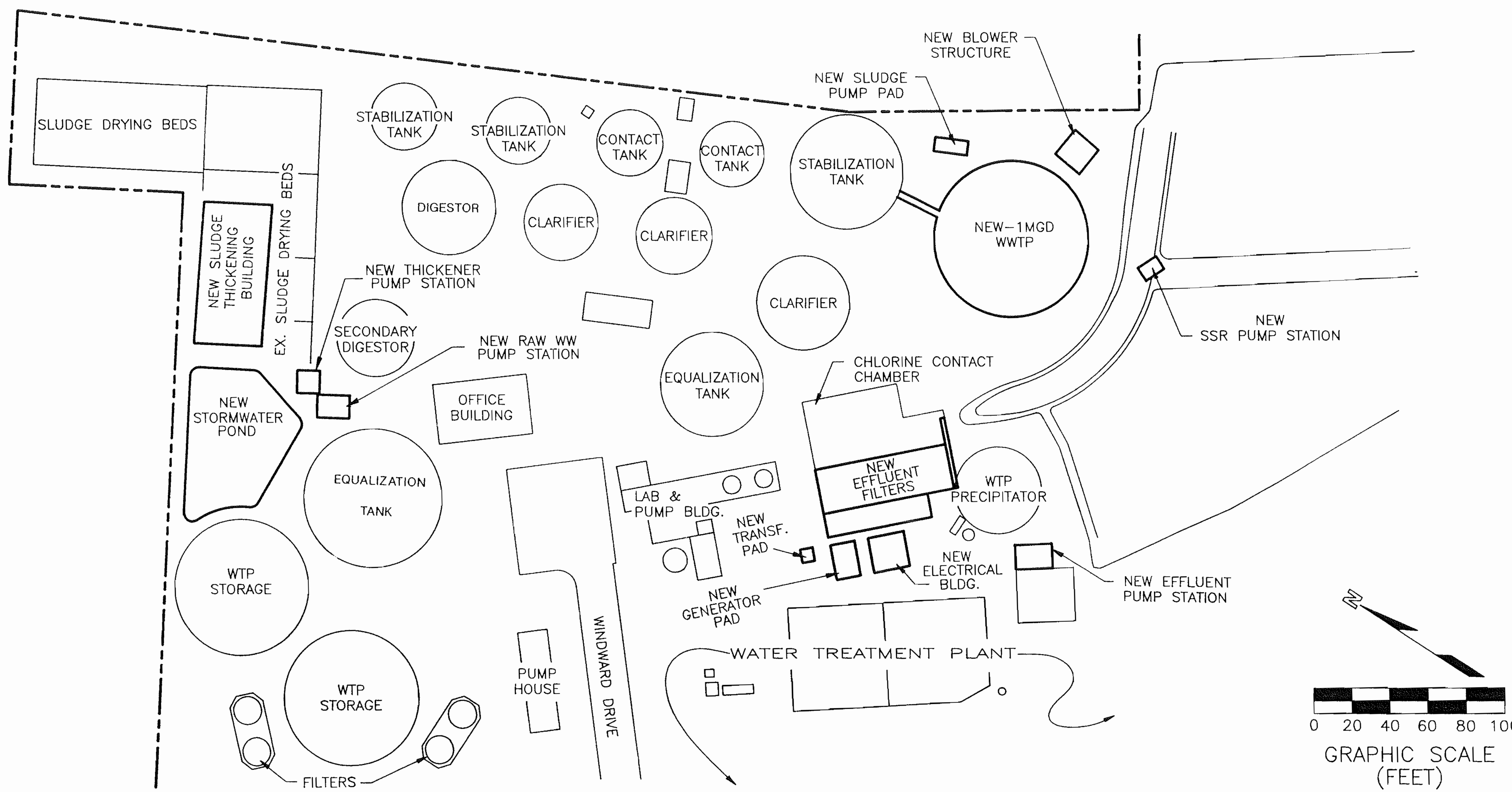


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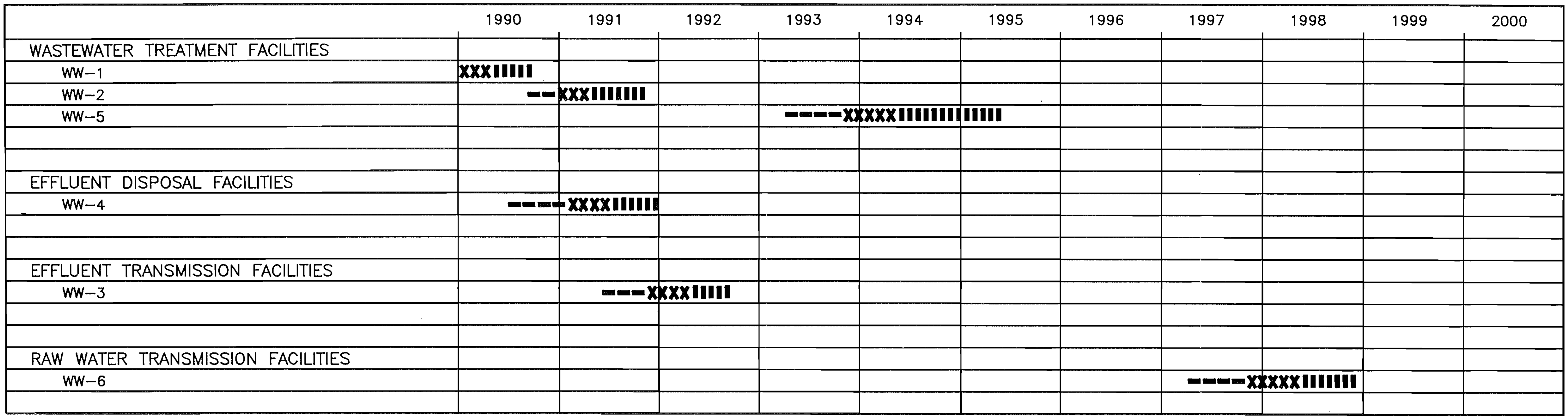
# 1 MGD Expansion Site Plan

FIGURE 5-5

# Marco Island Utilities
# Water and Wastewater Master Plan




LEGEND

---- PLANNING, PRELIMINARY AND FINAL DESIGN
XXXXX PERMITTING, BIDDING AND AWARD
IIIIIII CONSTRUCTION

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**Wastewater Capital Projects Implementation Schedule**
FIGURE 7-3

90/06000105

# Marco Island Utilities
# Water and Wastewater Master Plan

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | TOTAL PROJECT COST |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WASTEWATER TREATMENT FACILITIES** | | | | | | | | | | | |
| WW-1, WWTP SITE WORK | PERFORMED IN 1990 | | | | | | | | | | |
| WW-2, 1.0 MGD WWTP EXPANSION TO 3.5 MGD (1) | $2,155,000 | | | | | | | | | | $2,155,000 |
| WW-5, .75 MGD WWTP EXPANSION TO 4.25 MGD | | | | $1,123,000 | $700,000 | | | | | | $1,823,000 |
| **SUB-TOTAL** | $2,155,000 | | | $1,123,000 | $700,000 | | | | | | $3,978,000 |
| **EFFLUENT DISPOSAL FACILITIES** | | | | | | | | | | | |
| WW-4, 2.5 MGD PERCOLATION POND ADDITION | $750,000 | | | | | | | | | | $750,000 |
| **SUB-TOTAL** | $750,000 | | | | | | | | | | $750,000 |
| **EFFLUENT TRANSMISSION FACILITIES** | | | | | | | | | | | |
| WW-3, 16-INCH EFFLUENT TRANSMISSION MAIN | $1,290,000 | $1,400,000 | | | | | | | | | $2,690,000 |
| **SUB-TOTAL** | $1,290,000 | $1,400,000 | | | | | | | | | $2,690,000 |
| **RAW WASTEWATER TRANSMISSION FACILITIES** | | | | | | | | | | | |
| WW-6, 16-INCH FORCE MAIN | | | | | | | $50,000 | $310,000 | | | $360,000 |
| **SUB-TOTAL** | | | | | | | $50,000 | $310,000 | | | $360,000 |
| **ON-GOING WASTEWATER PROGRAMS** | | | | | | | | | | | |
| **SUB-TOTAL** | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $165,000 | $1,650,000 |
| **ANNUAL CIP BUDGET** | **$4,360,000** | **$1,565,000** | **$165,000** | **$1,288,000** | **$865,000** | **$165,000** | **$215,000** | **$475,000** | **$165,000** | **$165,000** | **$9,428,000** |

(1) Excludes 1990 costs, includes sludge facilities, odor control and auxiliary power facilities.

All cost are in December, 1990 dollars.

90/0600074

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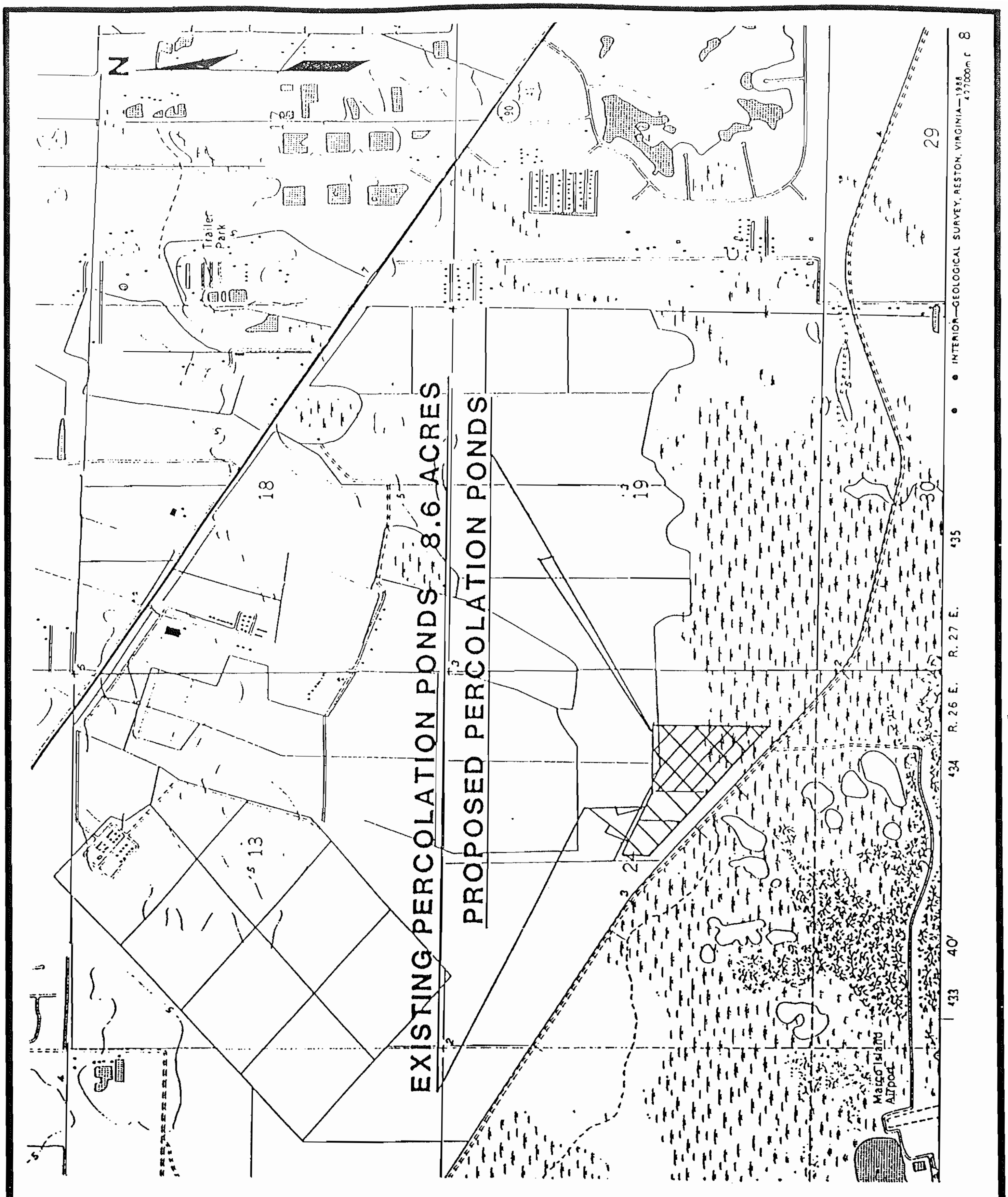
Wastewater Capital Improvements Program Budget
FIGURE 7-4

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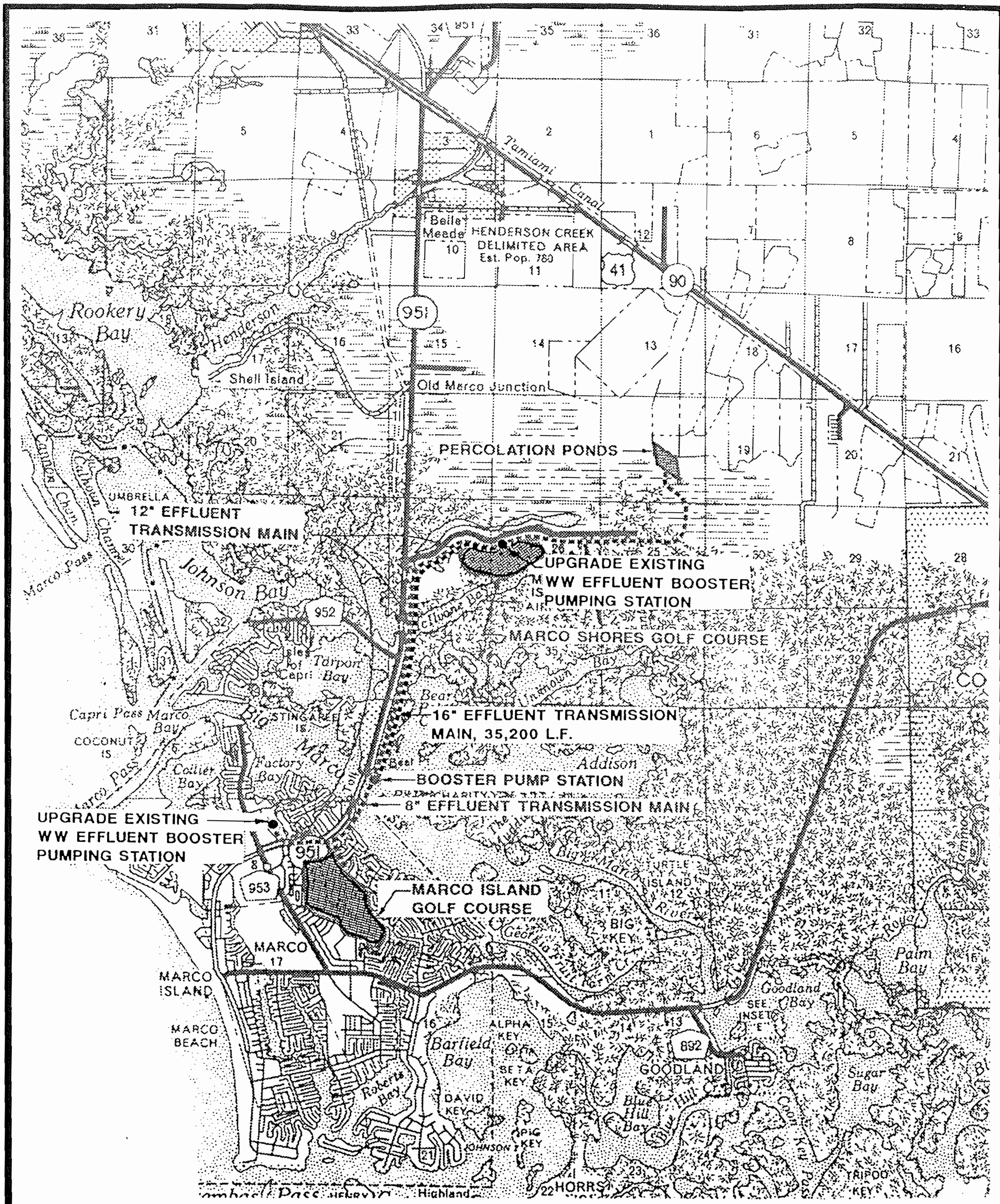
## Proposed Percolation Pond Expansion

FIGURE 5-6

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**Proposed WW Effluent Transmission System Expansion**

FIGURE 5-7

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Currently, the odor control facility design is complete and is in permitting stage. See Table 5-5 for a list of the Phase I facilities.

Future expansion of the WWTP to an ultimate capacity of 6.0 MGD is outlined in the EPDR as part of a Phase 2 expansion program. The Phase 2 expansion is proposed to consist of two 1.75 mgd oxidation ditches with internal boat clarifiers. Additionally, a 90 foot diameter aerobic digester would be required for future sludge wasting needs. The aerobic digester would be constructed utilizing the tank in which the 1 MGD package plant is being constructed. Subsequently sludge processing facilities would need to be expanded in Phase 2. Two additional gravity belt thickening units and associated equipment will be necessary for the increased sludge volume. Additional sections of the effluent transmission mains will have to be upgraded during Phase 2 in order to accommodate the peak flow of 7.9 mgd.

## 5.05 CLASS I RELIABILITY ANALYSIS

According to chapter 17-610 of the Florida Administrative Code the treated effluent being discharged to a public access area must meet the Class I reliability requirements. Since the Marco Island WWTP effluent is going to a public access golf course for disposal, it must meet the requirements set forth in this rule.

There are four areas of this rule which apply to the Marco Island WWTP Expansion. These areas have been summarized from the "Marco Island Wastewater Treatment Plant Expansion Review of Facility for Class I Reliability" by Dyer, Riddle, Mills & Precourt, Inc., dated May, 1990 (CLIR).

First, the effluent shall meet high level disinfection and not contain more than 5 milligrams per liter suspended solids prior to disinfection as well as, have a chemical feed system in times of high suspended solids. This requirement is not expected to be a problem as the plant has been designed to meet these requirements.

Secondly, the plant must meet the reliability criteria as described in MCD-05 (EPA-430-99-74-001) as well as staffing requirements. The staffing reliability is insured by employing a Class C or higher operator 24 hours 7 days a week. In addition, in order to determine if each component for each unit process meets Class I reliability an analysis of each unit has been provided herein. This analysis is in accordance with the FDER memorandum dated October 4, 1989 from Howard Rhodes titled "Implementation of Reuse Rules," which was provided in the CLIR report.

TABLE 5-5
MARCO ISLAND UTILITIES
WATER AND WASTEWATER MASTER PLAN
PHASE I FACILITIES

ITEM

1. Raw Wastewater Pumps - 3 @ 0.75 MGD each
2. 1 MGD Concrete WWTP - 96 Foot Diameter
3. 2.5 ADF MGD Concrete Filter
4. 3.5 ADF MGD Concrete Chlorine Contact Basin
5. Gravity Thickener - 1.2 Meter Belt Unit w/Building for Future Units
6. 600 KW Emergency Generator
7. Effluent Pipeline Regulating Valve
8. Percolation Ponds - 1 MGD
9. Effluent Pipeline 35,160 L.F. - 16" Pipe
10. Effluent Pumps - 3 @ 2.3 MGD Each
11. Substandard Recycle Pond - 1.0 MG

The following gives a brief description of the analysis of each of the required components.

a. Trash Removal or Comminution:

A screening facility is under design.

b. Grit Removal:

No dedicated facilities have been provided for grit removal for this plant. Grit settles in the contact tanks and is periodically removed as necessary.

c. Provision for Removal of Settled Solids:

Settled solids can be removed from each tank by draining the unit.

d. Diversion and Holding Basin:

Two equalization basins have been provided in order to equalize peak flows. Tank number one has a capacity of 250,000 gallons and tank number two has a capacity of 500,000 gallons. The combined capacity is 21% of the proposed total design flow. Diversion to the equalization basin allows the wastewater to be repumped and fully treated. This equalization capacity should be adequate for the expansion to 3.5 MGD.

e. Unit Operation Bypass:

For operations involving open basins, such as the contact, stabilization, sedimentation and chlorine contact basins, two or more units are required and have been provided. In addition, the peak wastewater flow must be handled hydraulically with the largest unit out of service.

The proposed contact basin, contact stabilization and clarification units are similar in size to the existing plants largest units. When the existing or new facilities largest unit is out of service the plant can accommodate 5 MGD hydraulically. With the addition of the new filter and chlorine contact basin, the hydraulic capacity of all units are adequate with the largest unit out of service.

f. Backup bar screen for mechanically cleaned bar screen or comminutor:

Not Applicable.

g. Back-up pumps:

Back-up pumps have been provided for all unit processes using pumps. There is sufficient pumping capacity to accommodate peak flows with one pump out of service for each component at the WWTP site.

h. Activated Sludge Aeration Basin:

The expanded facility will have a total of three contact basins and four stabilization basins. This meets the criteria for Class I reliability as back-up basins are not required. Back-up and alternate means of aeration have been provided for all units requiring mechanical aeration. The provided systems will meet Class 1 reliability standards.

Air diffusers exist only in the new plant tank. These diffusers are sectioned so that with the largest section out of service, air transfer will not be measurably impaired. Therefore, this meets the Class I reliability requirements.

i. Final Sedimentation Basins:

Final sedimentation consists of three basins in the existing plant and one basin in the proposed plant. The surface loading rate, weir loading and solids loading rate have sufficient capacity with the largest unit out of service at 75% of ADF, thus satisfying the Class I reliability requirements.

j. Chemical Flash Mixer:

Class I reliability requires the minimum of two chemical feed systems or one chemical feed system and a back-up system for suspended solids control in the clarification units. The plant presently has a polyblend polymer blending unit which is a combination mixer and pump with a back-up system available. An additional new system has been provided with the plant expansion which satisfies all the Class I reliability requirements.

k. Flocculation Basins:

Flocculation occurs in the clarification tanks.

l. Filters:

There is one existing filter and one proposed filter of equal size. Both of these are rated at 2.5 MGD average and 3.7 MGD peak flow. Based on the minimum requirements of one component out of service, the additional component must meet 75% of the average daily flow of 3.5 MGD or 2.6 MGD. Thus, the filter units can meet the Class I reliability requirements.

m. Chlorine Contact Basin:

Class I reliability requires multiple basins with the largest unit out of service having at least a capacity of 50% of the design flow. The existing unit is rated at 3.6 MGD with the new unit rated at 5.5 MGD. Fifty percent of the peak design flow is 2.6 MGD. Therefore, the chlorine contact basins meet Class I reliability standards.

n. Alternate Methods of Sludge Disposal and/or Treatment:

Sludge normally will be thickened prior to digestion. If thickening facilities are out of service the sludge can bypass the thickening facilities and be pumped to the existing digesters. Sludge is hauled using two tanker trucks. If one truck is out of service the sludge can be hauled by the remaining truck.

o. Provisions for preventing Contamination of Treated Wastewater:

All connections to the sludge facilities are designed to allow supernatant and sludge to be retreated.

p. Sludge Holding Tanks:

Not required.

q. Sludge Pumps:

The sludge pumps which pump from the clarifiers to the digestion tanks have previously been discussed under Part g.

r. Aerobic Digestion:

Aerobic sludge digestion is accomplished in two existing and one proposed aeration basin. No back-up basins are required. The two existing digesters have mechanical aerators of the floating type. A spare aerator is available should either of these aerators require repair. The proposed digestion tank is supplied by two blowers. One blower being the standby. The diffusers in this tank may have the largest one out of service and still provide sufficient oxygen transfer and not measurably impair the operation. In summary, the digestion facilities meet the requirements for Class I reliability.

s. Thickening Facility:

The proposed expansion will include a building to house one gravity thickener as part of the present and room for two additional thickeners for future expansions. With this system there will be one discharge pump for the thickened sludge. If the thickening unit or thickening pump are out of service, sludge may be hauled unthickened using the existing loading system.

t. Power Sources:

Power is available from Lee County Electric. In addition standby power is available to the plant from a proposed standby generator that meets the requirements of Class I reliability.

u. Facilities Requiring Back-up Power

The proposed generator provides standby power for the raw wastewater pumps, all the aeration facilities, clarifiers, the filtration facilities, disinfection and the critical lighting. Thus, all Class I reliability requirements have been satisfied.

Thirdly, continuous on-line monitoring for turbidity and chlorine residual are required. A standard operating protocol is required for the effluent disposal system. The proposed facility provides continuous on line monitoring of turbidity and chlorine residual. Additionally, operating protocol for the reuse system are provided as an attachment to the CLIR report.

Finally, certain effluent storage requirements where placed on the WWTP facilities. These requirements were met as sufficient alternate effluent disposal is available in the off-site percolation ponds. Additionally, a one mgd reject water storage facility has been provided in the plant expansion which is equal in capacity of the reuse system or alternate disposal options.

## 5.06 CAPACITY VERSUS FLOW ANALYSIS

The capacity of existing wastewater system components must be compared to projected wastewater flows to determine the timing and need for future facilities expansions. This capacity versus flow analysis will provide the basis for recommendations for future capital improvements recommended in the master plan. Wastewater collection and transmission facilities should be designed for peak design flows. Treatment and effluent disposal components are generally designed for annual average daily flows, however, it is recommended that maximum monthly flows be utilized for this service area due to the high seasonal flows. Flow projections were prepared in Section 2.0 and will be utilized herein for the capacity versus flow analyses.

The combined existing raw wastewater transmission piping entering the wastewater treatment plant site should have a combined equivalent size of a 20 inch line having a capacity of 7.0 MGD. This capacity will be marginal to handle the peak flow of 7.6 MGD anticipated by the end of the 10 year planning period.

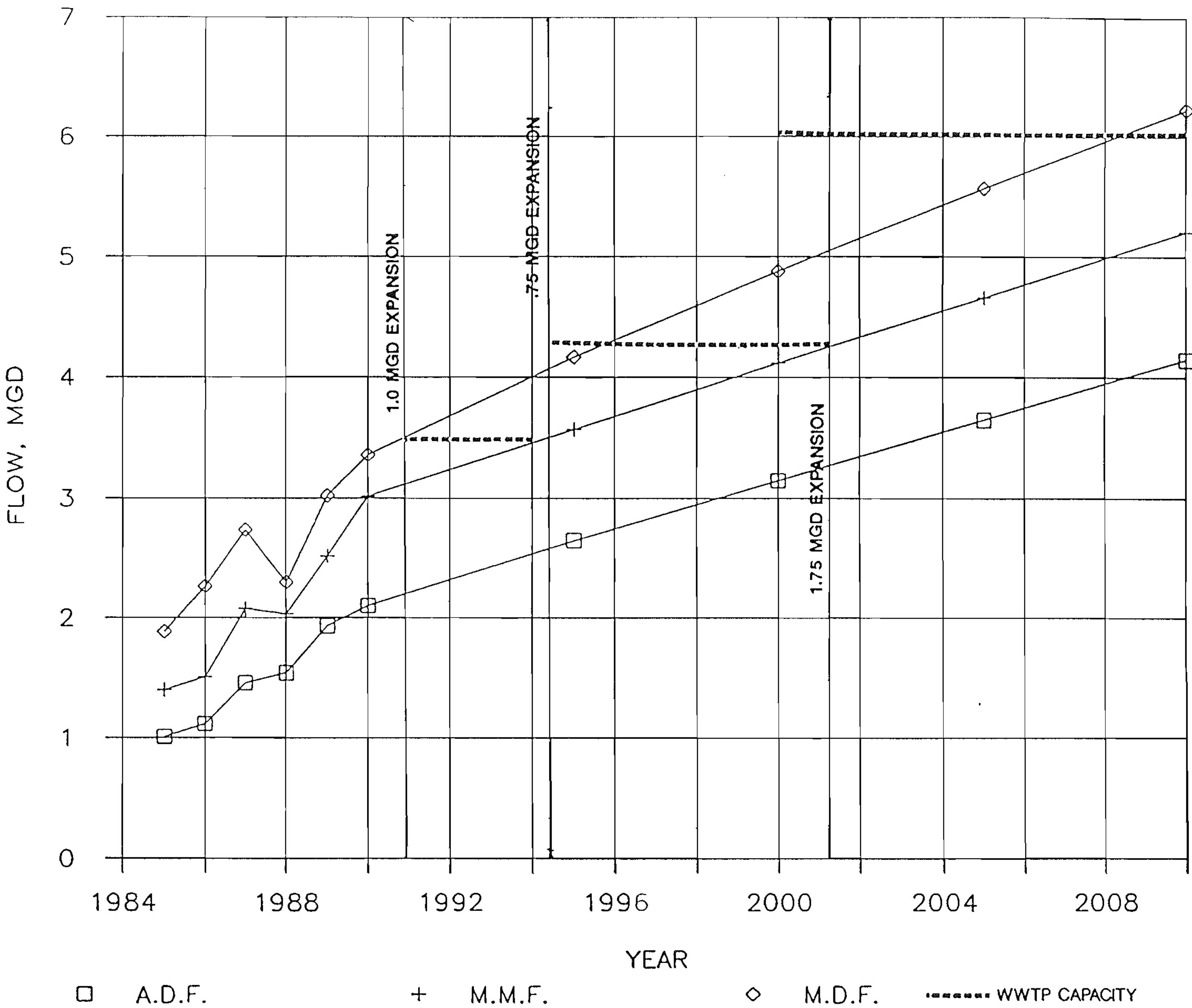
Some improvements to the wastewater transmission system may be anticipated toward the end of the 10 year planning period. The location and sizing will be determined by growth areas within the service area during the planning period and projected growth areas anticipated following the planning period. A hydraulic analysis of the transmission system should be performed to identify the required improvements, location and sizing. Even though the overall capacity of the wastewater transmission system will be adequate for most of the planning period based upon the equivalent hydraulic capacity of the force mains entering the plant site, additional transmission system improvemetns may be required during the planning period. These improvements may be a result of force mains which are inadequately sized to serve their individual service areas, sewering of developed areas presently unsewered, or changes in growth patterns anticipated to be sewered by the existing system. The capacities of individual raw wastewater pumping facilities were not examined as a part of the master plan. It is assumed that individual pumping station capacities will be adjusted by the responsible utility companies in response to changes in development conditions within each individual lift station service area.

The existing wastewater treatment plant presently has a treatment capacity of 2.5 MGD and an expansion is presently under construction which will increase the capacity to 3.5 MGD by

1991. Figure 5-8 shows the wastewater treatment capacity versus projected flow. The future expansion of the wastewater treatment plant from 3.5 to 6.0 MGD has been planned to be accomplished by the addition of two 1.75 MGD oxidation ditches with boat clarifiers. The capacity versus flow analysis indicates that the future plant will have to be expanded to 4.25 MGD by the second quarter of 1995 and to 6 MGD by the second quarter of 2002. Planning and design of the first 1.75 MGD expansion should be implemented by the third quarter 1993 in order to have these facilities on line by 1995. Planning for the next 1.75 MGD expansion is not expected to be required during the ten year planning horizon. However, if the growth rate increases significantly or if the service area is expanded by sewering areas presently on septic tanks the timing of the second phase expansion may be accelerated.

The existing effluent disposal system has a permitted capacity of 2.5 MGD and will be expanded to a permitted capacity of 3.5 MGD with the completion of the new percolation ponds in 1991. Figure 5-9 shows the effluent disposal capacity versus projected flow. Future increases of the wastewater effluent disposal capacity are expected to be accommodated by the construction of a deep well at the wastewater treatment plant site and supplemented by the construction of an effluent reuse pipeline. The deep well is currently planned to have a maximum capacity of 9.9 MGD of which 2 MGD is reserved for concentrate disposal leaving 7.9 MGD for wastewater effluent disposal. The deep well is anticipated to be completed and operational in the third quarter of 1991 and will be required to provide effluent disposal capacity at that time to insure the proper functioning of the land application systems during wet weather and for normal maintenance of the percolation pond bottoms in accordance with FDER rules and int he absence of effluent storage facilities. The capacity of the deep well in combination with the other existing effluent disposal facilities is sufficient to provide service through the end of the ten year planning horizon and beyond without the need for additional facilities based upon disposal of the projected maximum daily flow.

According to the EPDR the effluent transmission system to the off-site land disposal systems has insufficient capacity due to the sizing of the effluent transmission mains and the capacity of existing effluent pumps for the Phase I WWTP expansion to 3.5 MGD. In Phase I the effluent transmission system will be expanded to provide for the projected maximum daily flow of 4.6 MGD. These improvements have perviously been described under the Ongoing Wastewater Facilities Programs. The EPDR describes some additional improvements to be implemented to expand the effluent transmission system under the Phase II WWTP expansion to 6 MGD. This report was prepared prior to the decision to drill the deep well and site it at the WWTP site. If the deep well injection pumping facilities are designed such that they can handle peak design effluent flows and therefore the land application systems can be operated at an average daily

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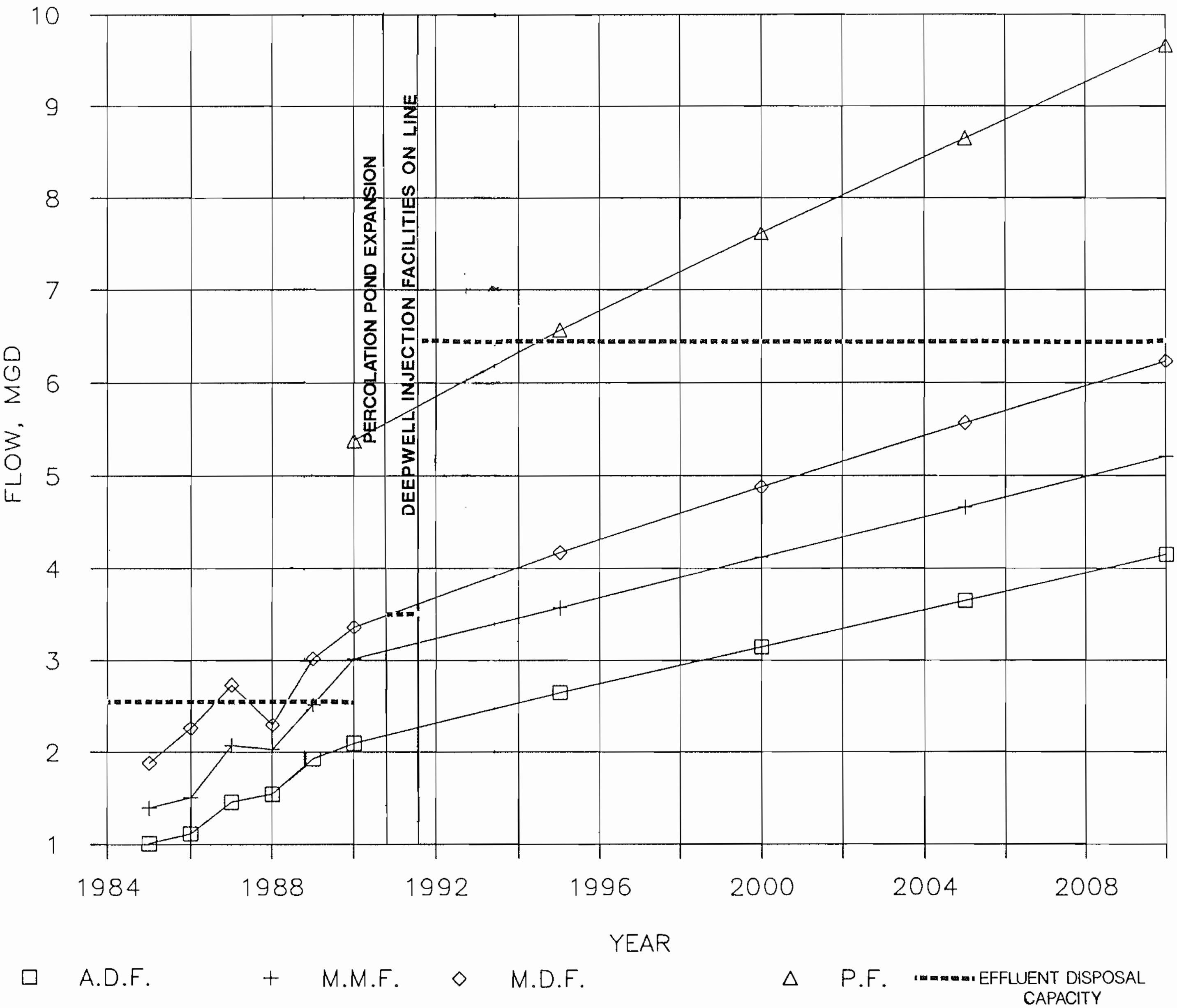
WWTP Capacity vs. Flow

FIGURE 5-8

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Effluent Disposal Capacity vs. Flow

FIGURE 5-9

flow rate, no Phase II expansion of the effluent to transmission system to land application sites will be required.

SECTION 6

WATER SYSTEM MASTER PLAN

## 6.01 GENERAL

Marco Island does not have fresh water reserves. The remote mainland water supply sites can produce a long term fresh water supply which requires softening prior to customer distribution. The existing remote mainland sites are susceptible to over pumping and water quality degradation. The link from the fresh water sites to Marco Shores and Marco Island are the long dual 12" and 14" diameter raw water transmission mains and associated repumping stations.

Presently, the water source is showing some water quality degradations due to over pumping and the transmission main is scheduled for relocation when C.R. 951 is widened. Prudent water supply planning would dictate that a new source not dependent on the C.R. 951 corridor be constructed. In this manner, reliable water supply can be provided. The only local water reserves are highly brackish (3,000 to 10,000 mg/l TDS). Therefore a demineralization technique is necessary to render this source potable. The most cost-effective method for this area is reverse osmosis. Nonetheless, a reverse osmosis plant is more expensive to build and operate than a lime softening plant. Considering economics and reliability a minimum sized reverse osmosis facility should be able to produce 60% of the annual average daily flow if an emergency situation occurred. Given the minimum sizing criteria and considering a reasonable design period, a 4.0 MGD reverse osmosis facility was selected.

Next, this new supply/treatment source should be located as close to the supply wells as possible, use to the maximum extent possible the existing facilities, and provide hydraulic input at a good transmission system location. All three criteria were met with the reverse osmosis plant location at the existing repumping station.

Considering the lower cost of fresh water treatment and the need to supply Marco Shores, it is the philosophy of this Master Plan that continued water softening with a 60% ADD capacity in reverse osmosis is the optimum blend of cost-effectiveness and system reliability/integrity. The two types of finished water complement each other. Softened water provides a buffering capacity and stability not found in aggressive membrane (R.O.) product waters. Membrane treatment removes some 99% of the organic precursors to the formation of trihalomethanes and other halogenated organics. The blend of the two waters in the system improve the distribution system's water quality for the SSU Services customer. The improved blended water quality is a significant step in assuring that not only existing, but future water quality standards are met.

## 6.02 THE 1990 - 1992 PROGRAM

Each of the water master plan programs are divided into the following facility components: (1) water resource development, (2) raw water transmission, (3) water treatment, (4) water storage and high service pumping and (5) water transmission and distribution. For the 1990 - 1992 program only, two additional sections have been added for (1) water demand reduction and (2) recommended on-going water programs. Both sections are considered to be pertinent to each program period.

### Water Demand Reduction

There are two types of water demand reduction which will improve the effectiveness of water utility operations. The first is peak dampening and the second is average unit demand reduction. Investor-owned utilities should strive to reduce the peaking usage so as to limit their system capacity needs and thus the capital requirements. If the peaks are reduced, then the percentage of installed capacity being used is used for a longer period of time and therefore is more cost-effective. To attack the peak demand problem, we must isolate the peak demand uses and customers. On Marco Island, the use is green space irrigation (lawn irrigation) and the primary customer class is residential. The potential options for this problem include:

1) Seasonal rates and charges;
2) Increasing block user rates over a reasonable flow per month, say 20,000 to 25,000 gallons per month;
3) Substitution of reclaimed effluent for potable water for outdoor irrigational use;
4) Educational programs and customer bill stuffers during seasonal peak periods;
5) Xeriscape programs to promote use of vegetation which requires less irrigation;
6) Retrofit pressure reducers to the irrigation portion of the service (do not install in the residence service line);
7) Request zoning requirements, land development requirements and other County legislative actions;
8) Require individual irrigation metering for all new units.

Development of a peak demand reduction program is beyond the scope of this plan, yet the above mentioned areas should assist the Company in its endeavors.

The second type of program is a unit demand reduction program. The preceding eight (8) items are valid for the unit demand reduction program. Additional items for consideration by the Company include:

1) Low volume fixture requirements;
2) Aspirator inserts distributed for faucets and showerheads;
3) Toilet tank inserts;
4) "Water waste" pamphlets and education program;
5) Telephone surveys of the highest 10% of residential customers to find out why these customers use so much water.

Development of an effective unit demand reduction program has both advantages and disadvantages. The advantages include delaying capital expansion costs, preservation of the environment and several others. The disadvantage may be found in lost customer revenues. Again, such a program can be developed by the Company in concert with the County, civic groups and the South Florida Water Management District.

**On-going Water Programs**

The on-going water programs which should be budgeted and performed each year involve:

1) Meter Testing and Replacement Program - Whenever a customer desires testing or after twenty (20) years of service, the customer meters should be tested or in the latter case replaced. Typically, as a meter ages it does not detect low flows accurately, tends to register slower due to the erosion of the propeller or turbine blades, or in the case of hard waters due to encrustation of the propeller or turbine blades.

   Since some of the water meters are approaching this twenty year service life on Marco Island, a water meter replacement program should be implemented. In budgeting for this program, it will be assumed that five percent of the water meters will be replaced on an annual basis. Therefore, five percent of the balance of NARUC account number 334-Meters and Meter Installations should be budgeted. Based on the balance as of December 31, 1989 in the 1989 FPSC annual report of $282,432 for this account, approximately $39,000 per year should be budgeted for this water meter replacement program.

2) Renewal and Replacement Programs - Annually approximately three (3) percent of the value of the plant in service should be budgeted for renewal and replacement capital improvements. Typical renewal and replacement program budgets are based upon the current capital investment of the water utility plant that normally needs refurbishment or replacement after a period of time. A figure of three percent of the capital investment needing renewal and replacement is commonly used. We believe the following NARUC accounts are affected by this renewal and replacement program for Marco Island Utilities:

| NARUC Account Number | Account Title | Balance as of 12/31/89 less Accumulated Depreciation |
|---|---|---|
| 311 | Pumping Equipment | $1,523,095 |
| 320 | Water Treatment Equipment | 1,844,115 |
| | Total | $3,367,210 |

Thus, allowing three percent of the net water utility plant affected by renewal and replacement, approximately $100,000 should be budgeted on an annual basis for the renewal and replacement program.

3) Leak Detection Program - Leak detection equipment should be purchased and utilized on an effective rotating basis to identify leaks in the system. An annual amount of $25,000 per year should be budgeted for the labor, operation and maintenance of the equipment for this leak detection program.

4) Valve Identification and Hydrant Maintenance Program- Cooperate with the fire district to ensure that isolation valves are identified and proper hydrant maintenance is conducted. Currently the Marco Island Fire Department maintains the approximately 340 fire hydrants on Marco Island. It is the fire department's desire that they at least share in the expense of maintaining the hydrants. An estimated amount to be budgeted for the valve and hydrant maintenance program is approximately $10,000 per year.

5) Backflow Prevention Program - Require that backflow prevention is provided where applicable for those types of customers as a requirement in the tariff. With the FDER continuing requirements of a Backflow Prevention Program, it will be necessary to budget approximately $5,000 per year to implement this program.

6) Cross Connection Control Program - This program combined with the Call "Candy" underground utility location cooperative measures should suffice to effectively control accidental cross connections to the water system. The cross connection control program should be funded with an annual budget of $10,000.

7) Water Utility Audit and Unaccounted for Water Reduction Program - Annually, biannually or triennially, a water utility audit and unaccounted for water reduction program should be conducted in accordance with the AWWA manual of practice and the FPSC guidelines. This program is estimated to require a budget of $30,000 triennially for implementation. The total cost of the on-going water programs in 1990 dollars is $199,000 per year.

**Water Resource Development**

Five (5) sources of water have been identified for use by Marco Island Utilities, Inc. One option involves the continuation of the 1.0 MGD supply service from Collier County and/or the participation with Collier County in the potential Manatee Road water supply facility. At the present time there are no investigation results available. The County service options must be evaluated at a later date versus the cost of the recommended program herein.

At some future date, the Company can make a comparative decision once the facts are known. The other four options involve the:

1) Continuation of the Collier Lease Facilities;
2) Development of the Marco Unit 25 Reverse Osmosis Well Field;
3) Development of the Dude site fresh water well field; and
4) Development of the 160 acre Deltona mainland well field parcel.

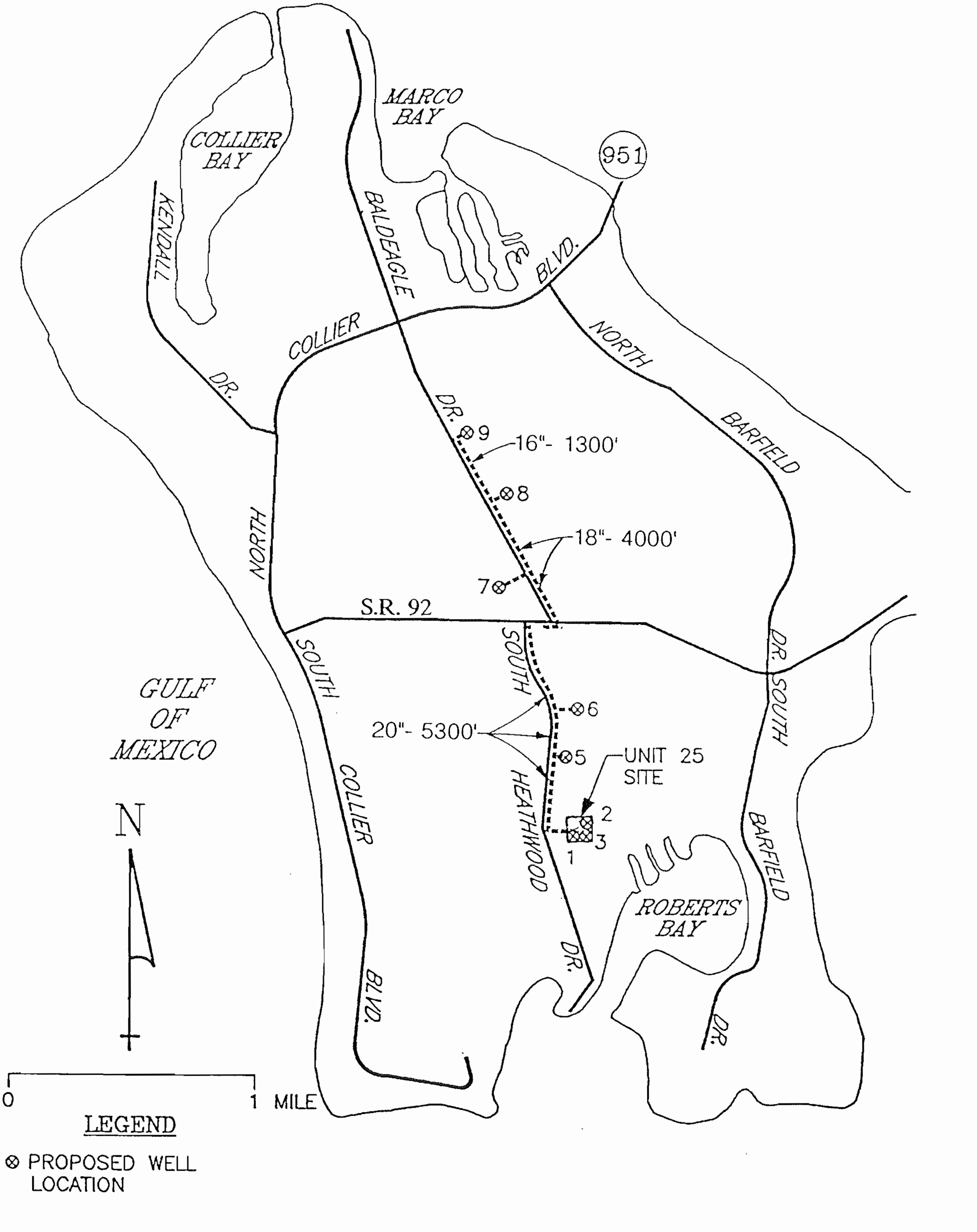
Considering the above and the water quality of the source versus pumpage, we have estimated that the safe yield of the Collier Lease property is 6.8 MGD. If adjacent supplies are developed then the amount above should be reduced in accordance with the extent of source interference.

The proposed four (4) MGD reverse osmosis facility will be supplied by 6 MGD of raw brackish water capacity. During the 1990 - 1991 period the eight deep wells (See Figure 6-1) need to be constructed and developed so that when the reverse osmosis plant is completed and ready to come on line, there is sufficient raw water supply available to make use of its entire capacity. The lease for the Collier property needs to be renegotiated and renewed as soon as possible at an estimated cost of $50,000. During 1991, the Dude property and during 1992, the 160 acre parcel, need to be permitted so as to protect their hydrogeological potential from surrounding impacts. Additional testing should be performed to assure their hydrogeological capacity.

Testing and permitting of these two (2) sites is expected to cost $118,000 in 1991 and $100,000 in 1992. The construction of the deep wells in 1991 is expected to cost $400,000 and the development of the Dude parcel in 1991 is expected to cost approximately $450,000. The total cost of the 1991-1992 water resources development program is $1,118,000.

**Raw Water Transmission**

The necessary easements and other legal concerns of installing the raw water transmission lines to tie the Dude and 160 acre parcels into the existing raw water facilities should be thoroughly investigated and all easements acquired. This is estimated to cost $50,000. During 1990 and 1991, the raw water transmission line to tie the five or more off-site deep wells into the reverse osmosis plant should be routed and constructed. The design of this raw water transmission line needs to consider the possibility in the future of utilizing the raw water transmission system coming onto the island from the mainland to feed the reverse osmosis plant if the water quality in the deep wells degrade to a point that makes the medium pressure reverse osmosis equipment obsolete in treating this raw water. Thus, a minimum 16 inch line is recommended in the remote end of the raw water transmission facilities. This raw water transmission line, as shown in Figure 6-1, will be approximately 1300 feet of 16 inch pipe, 4000 feet of 18 inch pipe and 5300 feet of 20 inch pipe and is estimated to cost approximately $447,000. In addition, the Dude property transmission line needs to be completed by 1992 at a cost of $550,000. Hopefully the C.R. 951 improvements will be underway such that the

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Proposed RO Wells and Raw Water Piping

FIGURE 6-1

new 24 inch transmission line can be constructed: approximately 27,000 feet at an estimated cost of $3,080,000. The existing raw water and booster pumps should have sufficient capacity to meet the near term future raw water supply needs following installation of the 24 inch line and reduction of the pumping heads. The total cost of the raw water transmission improvements for 1991-1992 is $4,127,000.

**Water Treatment**

During 1991, the 4.0 mgd reverse osmosis plant must be constructed in a timely fashion such that it may alleviate some of the strain placed upon the existing raw water supply and lime softening facilities. Continued top notch maintenance of the existing lime softening facilities to assure their continued long and useful life is essential. In addition, the concentrate disposal system which includes the deep injection well and pumping station as shown on Figure 6-2 should be completed in 1991 to coincide with the completion of the R.O. plant. The total estimated cost of these improvements is $11,550,000.

**Water Storage and High Service Pumping**

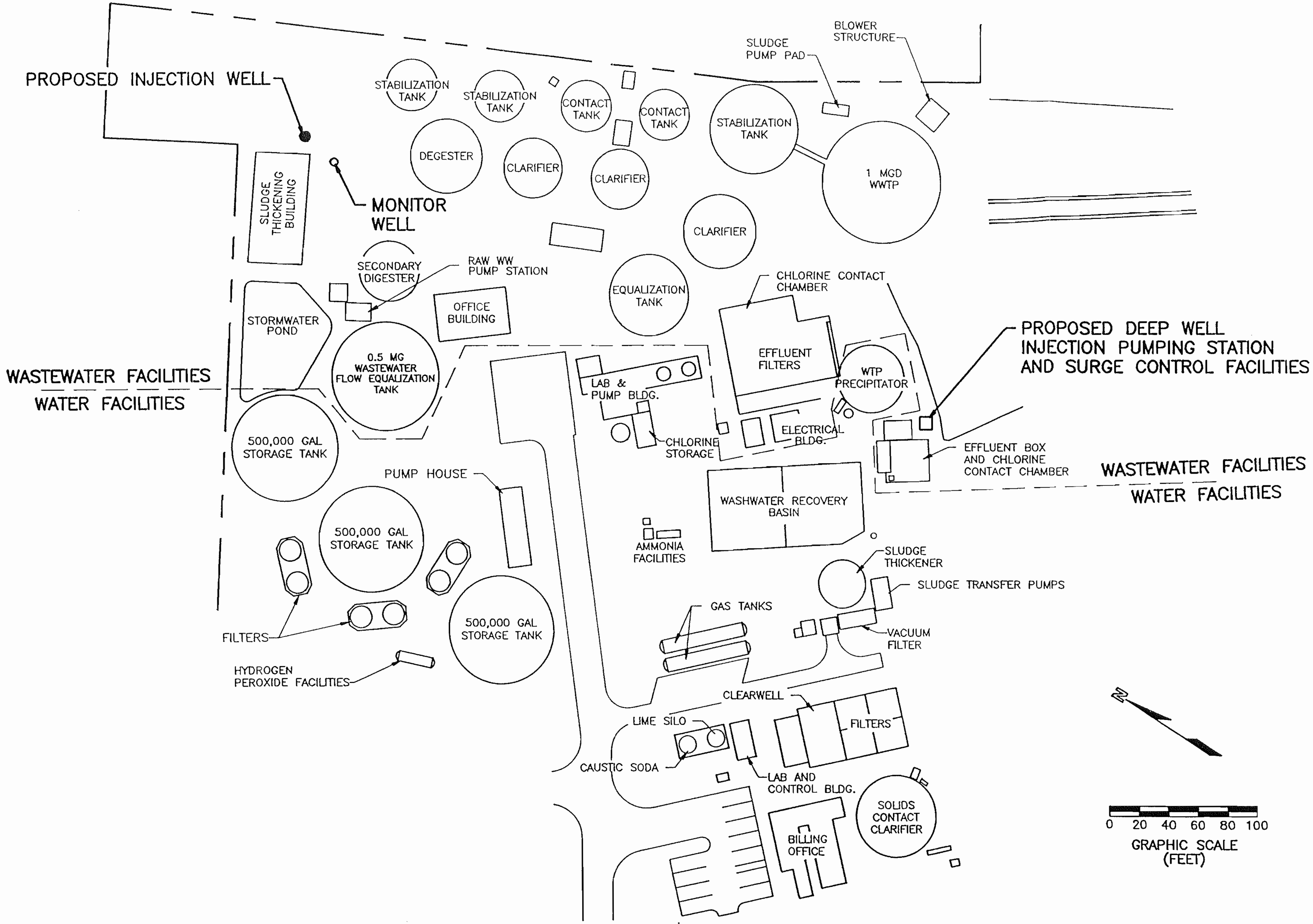
Expansion of the reliable high service pumping capacity at the reverse osmosis plant in order to make this facility as effective as possible and relieve the strain upon the lime softening facilities. A total high service pumping capacity of 4700 gpm is recommended, thus an additional 2200 gpm of reliable capacity is required at a cost of $150,000.

**Water Transmission and Distribution**

Two projects are anticipated to be constructed in this time period as shown on Figure 6-3 to improve the hydraulics of the water transmission system. These include:

1) Completing the 12 inch loop on San Marco Drive between Heathwood Drive and Landmark Street, approximately 4000 feet, the estimated cost of this improvement is $120,000 and

2) Replacing the 12 inch line leaving the water plant on Elkcam Circle with a 24 inch line and extending it down to Bald Eagle Drive in preparation for the future expansion of this plant to 10 mgd and eliminating the current hydraulic limitation leaving the water plant site. This improvement consists of approximately 3300 feet of 24 inch pipe and

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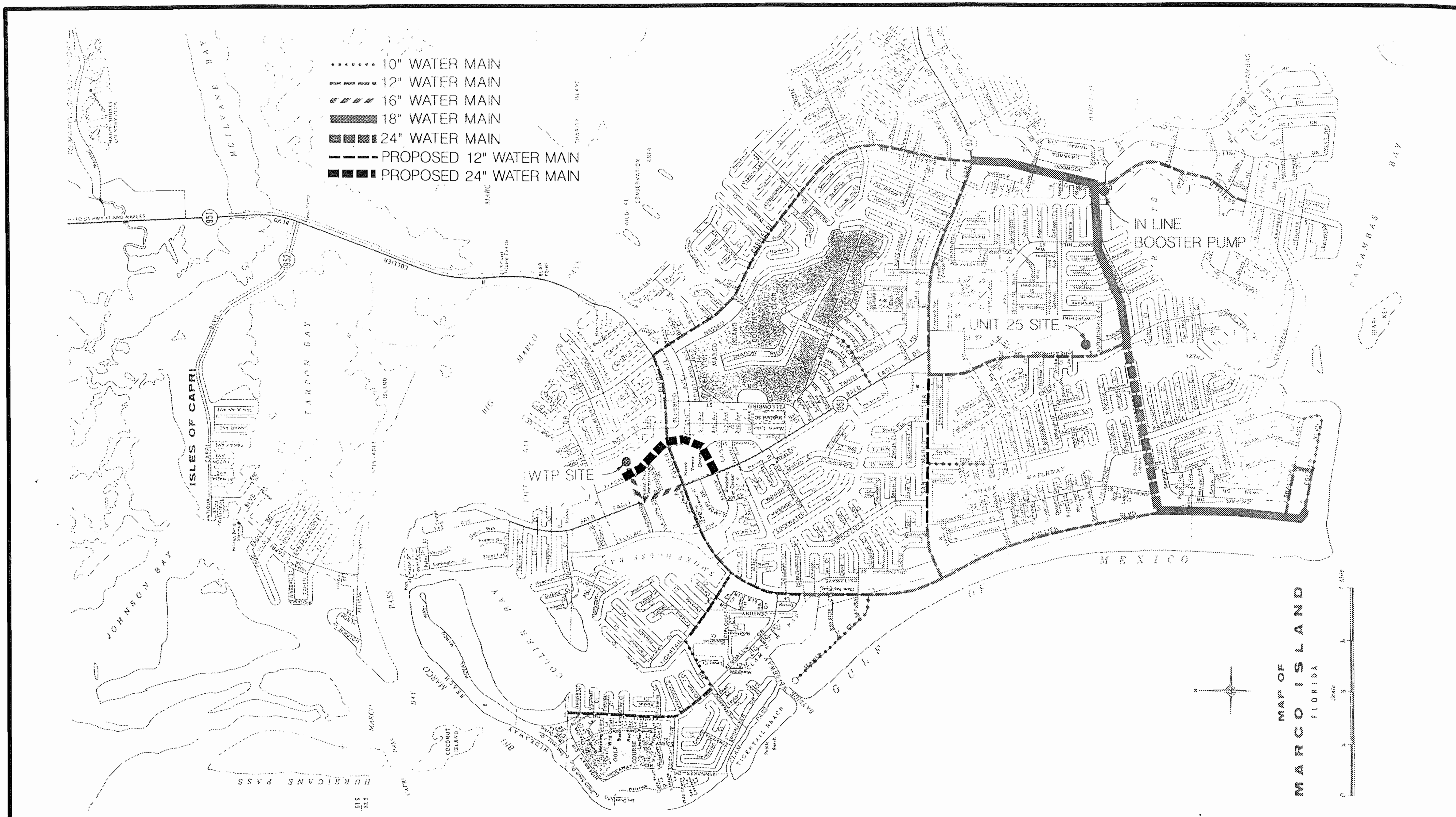
**Proposed Deep Well Injection Facilities**

**FIGURE 6–2**

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**1991-1992 Water Transmission System Improvements**

FIGURE 6-3

is estimated to cost $198,000. The total estimated cost of these transmission line improvements is $318,000.

The total cost of the 1991-1992 capital improvements projects and on-going water programs is estimated to be $17,661,000.

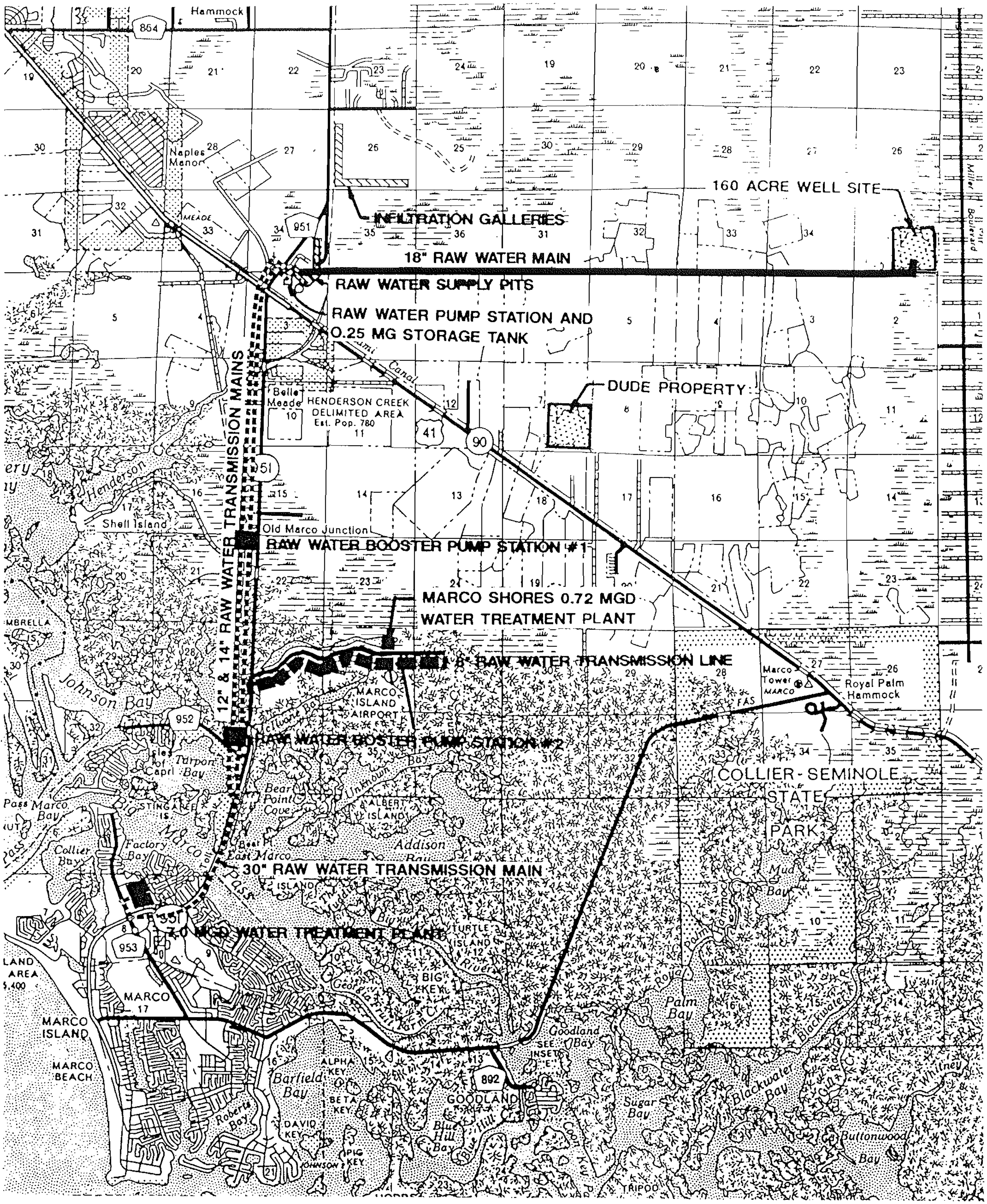
## 6.03 THE 1993 - 1995 PROGRAM

### Water Resource Development

By 1996, 160 acre parcel must be on line in order to assure having adequate raw water to supply the lime softening plant expansion. This will reduce the reliance upon the existing raw water supply. The estimated cost for the initial development of the 160 acre parcel in 1995 is $2,000,000. The utility should continue to look for additional raw water supplies and protect the existing supplies from encroachment by others.

### Raw Water Transmission

Design and begin construction in 1995 of the raw water transmission facilities as shown on Figure 6-4 necessary to tie the 160 acre parcel into the existing raw water transmission facilities: approximately 37,000 feet of 18 inch pipe (6 mgd) from the 160 acre parcel at an estimated cost of $830,000. Complete construction of the raw water transmission line from the 160 acre water supply site to the raw water pumping station at an estimated cost of $835,000 in 1996. The R.O. wellfield raw water transmission line will require extension to tie in the additional wells to serve the reverse osmosis plant. A potential layout of the four additional R.O. wells and associated transmission piping is shown in Figure 6-8. Based upon this layout approximately 14,100 feet of 8 inch and 500 feet of 10 inch raw water transmission main well be required. The estimated cost of this R.O. transmission line extension is $354,000. In addition, an interconnect of the raw water transmission line from the mainland with the transmission system from the R.O. deep wells to the reverse osmosis plant will be necessary if the deep well water quality continues to degrade. It is estimated that approximately 2000 of 16 inch line would be necessary to complete this interconnect. Also an additional brine disposal line may be required from the R.O. plant to the injection well. The estimated cost of the interconnect and brine line is $246,000. The total estimated cost of these raw water transmission line improvements to be completed by 1995 is $1,430,000.

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1993-1995 Raw Water
Transmission System Improvements

FIGURE 6-4

**Water Treatment**

Expansion of the existing General Filter water treatment plant with a mirror-image 5.0 MGD plant prior to the expansion of the wastewater plant and the demolition of the 2 mgd Permutit plant will be required to satisfy demands. This expansion needs to occur before the excess capacity at the reverse osmosis plant is no longer available. This improvement should begin in 1995 with engineering and permitting estimated to cost $500,000. See Figure 6-8 for the proposed site plan.

**Water Storage and High Service Pumping**

High service pumping needed concurrent with the expansion of the lime softening plant to make its expanded capacity useful is approximately an additional 2000 gpm at an estimated cost of $100,000. The estimate in 1995 for engineering and permitting is $10,000. In addition a 2 MG reservoir should be constructed at the lime softening plant site. Additional property adjacent to the existing plant site will need to be acquired as shown in Figure 6-5. The total estimated cost of the storage reservoir and the site acquisition is $710,000. Site acquisition and rezoning for a new storage tank should begin in 1995 at an estimated cost of $150,000. Total storage and high service pumping improvements for the 1993-1995 program is $870,000.

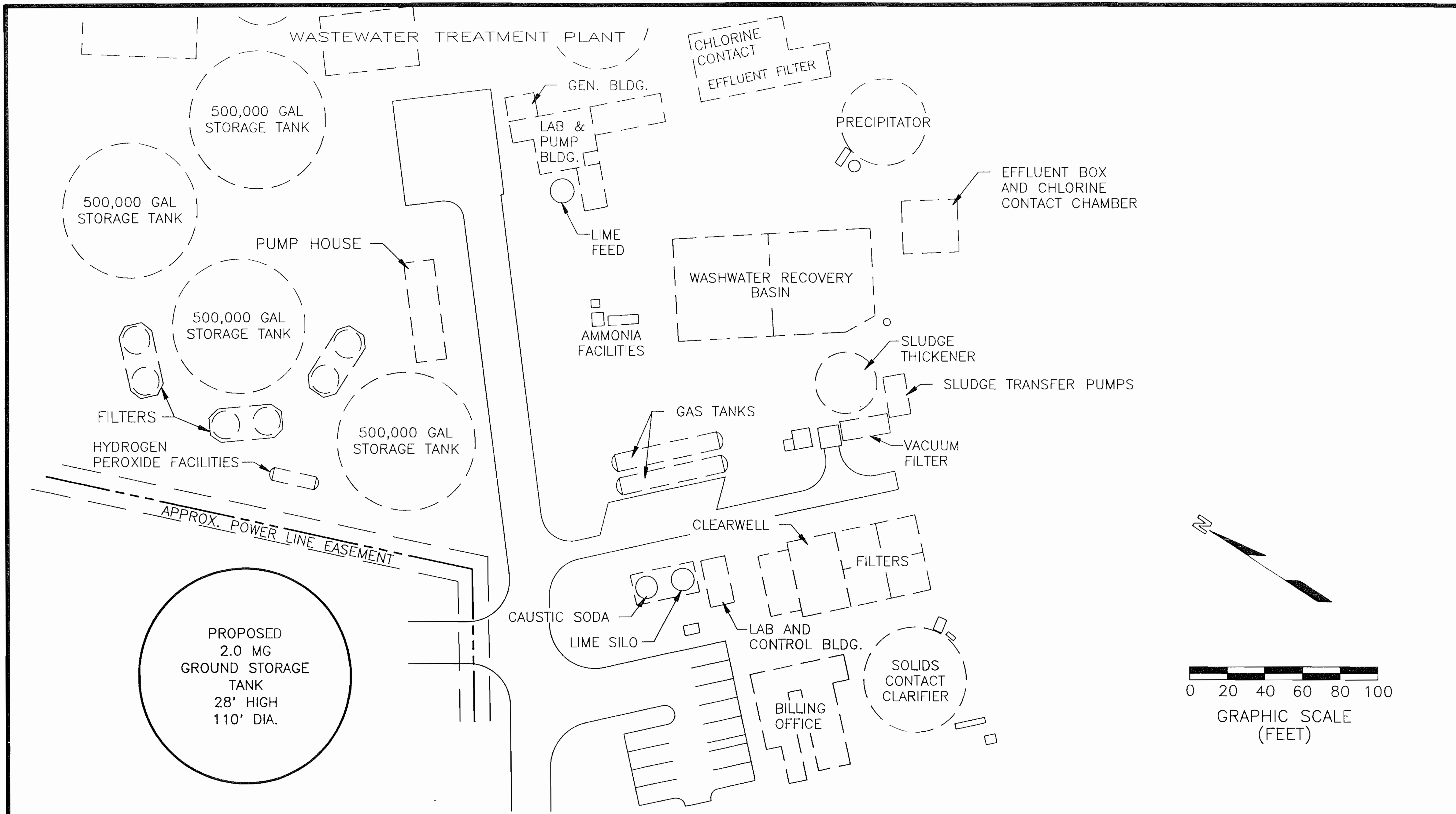
**Water Transmission and Distribution**

Recommended transmission system improvements (see Figure 6-6) to be completed during this period include:

1) Completion of the tie in along Bald Eagle Drive with a 24 inch line; approximately 6600 feet at an estimated cost of $396,000.

2) Resolution of a hydraulic block on Hernando Drive between Tigertail Court and Kendall Drive; approximately 1700 feet of 12 inch pipe at an estimated cost of $51,000.

3) Possible expansion of the transmission system out S.R. 92 toward Goodland depending upon development in the area.

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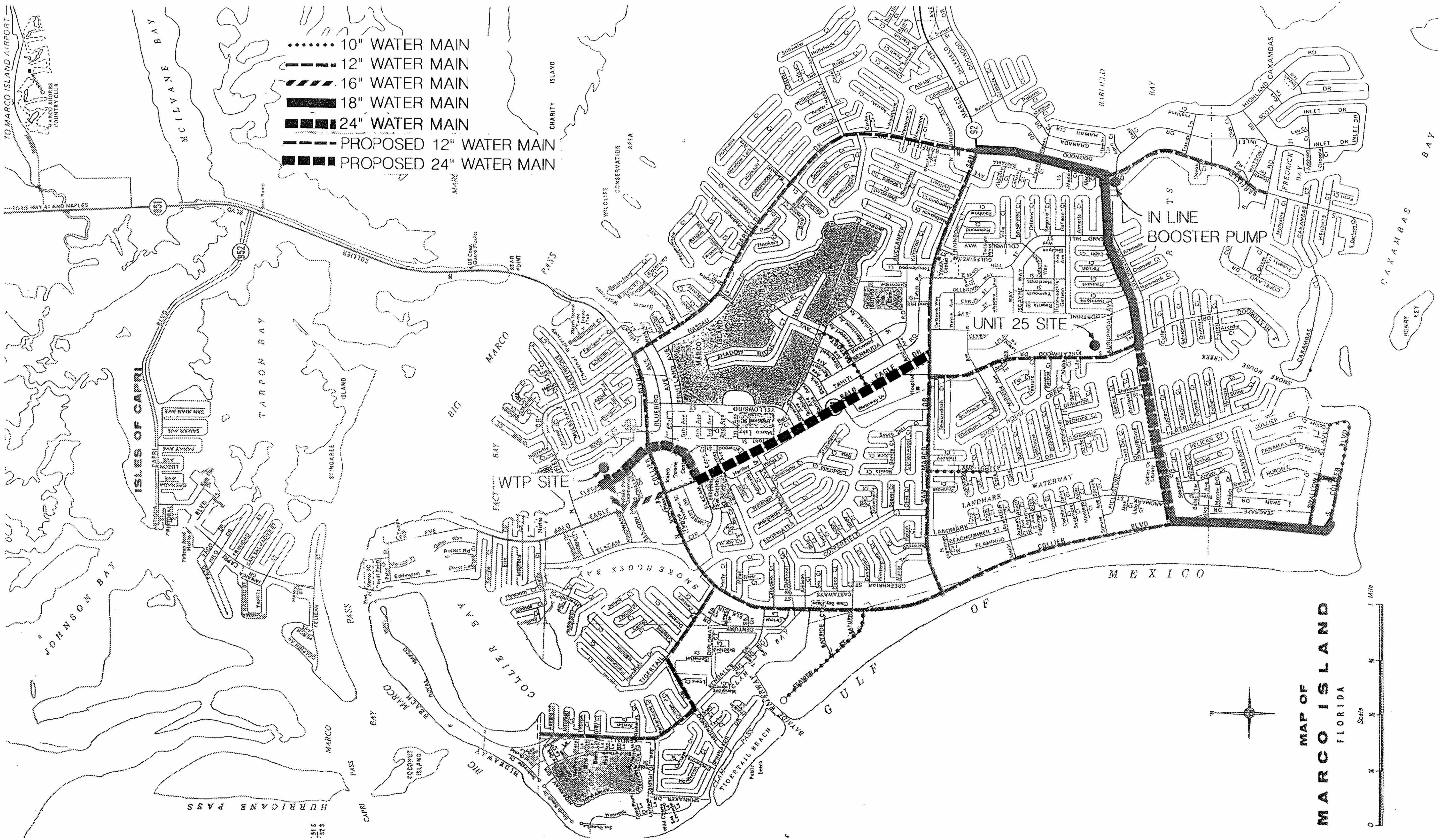
**2 MG Ground Storage Reservoir Addition**

FIGURE 6-5

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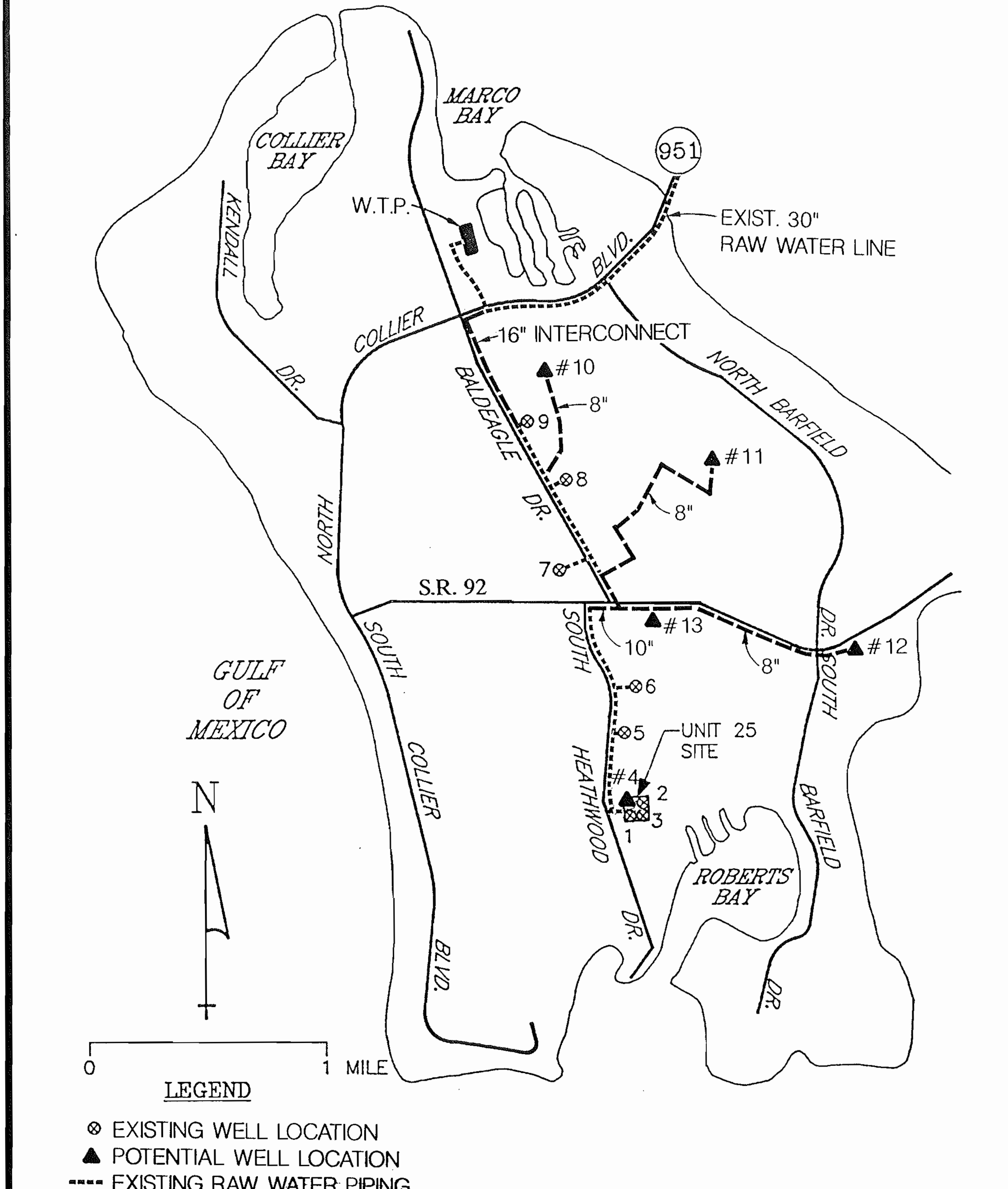
## 1993-1995 Water Transmission System Improvements

FIGURE 6-6

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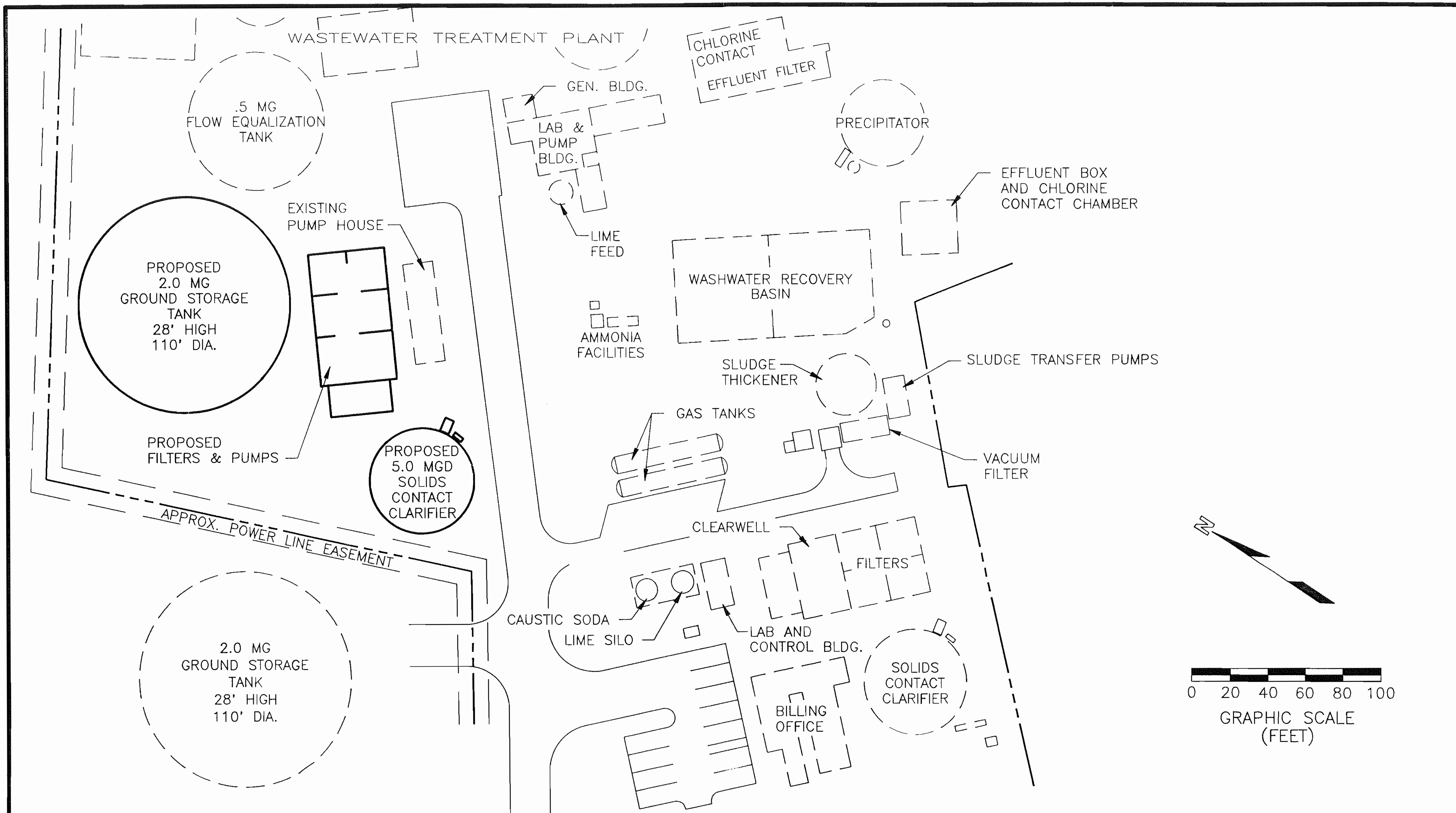
RO Wellfield and Raw Water Piping System Expansion

FIGURE 6-7

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**Water Treatment Plant Proposed Expansion**

FIGURE 6-8

The total estimated cost of the first two projects is $447,000.

The total cost of the 1993 through 1995 program is estimated to be approximately $4,044,000 including the on-going water programs.

## 6.04 THE 1996 - 2000 PROGRAM

### Water Resource Development

Complete the development of the 160 acre supply site in 1996 at an estimated cost of $800,000. Expansion of the R.O. wellfield with four additional production wells and one backup well to serve the 2 mgd reverse osmosis expansion is recommended by 2000. The future deep supply wells for the 2 MG reverse osmosis expansion are shown on Figure 6-7. Four future wells are proposed based upon the 520 gpm capacity being used for the currently proposed eight production wells. Two proposed sites are on the Marco Island Country Club Golf Course. One location is on the far north end of the golf course adjacent to the number eight fairway. The other location is at the extreme south end of the golf course adjacent to the number sixteen tee. The golf course sites were chosen for the ease of accessibility for construction and maintenance. Easements would have to be acquired from the Country Club in order to construct these wells and for access for maintenance purposes. The third proposed future well site is located adjacent to business lots located on the south side of State Road 92 east of Barfield Drive. The fourth proposed future well site is on the site of the Youth Center along State Road 92, just east of Sand Hill Street. A fifth future well is proposed at the reverse osmosis plant site. It is recommended that this well be used as a backup well only and that it only be operated when one of the other production wells on the site is not in service. These proposed future well locations are only preliminary. Once the first eight production wells have been constructed and are in operation the drawdown and water quality effects should be closely monitored to determine the negative impacts. Then, these proposed locations should be reevaluated prior to permitting and construction. The R.O. wellfield expansion should be completed by 2000 at a cost of approximately $250,000. Continued search for additional raw water supplies and protection of existing supplies from encroachment by others is recommended to ensure adequate reliable future supply.

**Raw Water Transmission**

An analysis of possible raw water transmission line routes to any possible new raw water supplies will be required prior to implementation.

**Water Treatment**

Construction of the new 5.0 mgd lime softening water treatment facility in 1996 at an estimated cost of $4,700,000. Expansion of the reverse osmosis plant to its buildout capacity of 6.0 mgd will be required sometime before the end of 2000. This expansion will provide a total of 16 mgd of water treatment plant capacity which is sufficient for the year 2000 and beyond projected annual maximum day demands. This plant expansion is estimated to cost approximately $3,000,000.

**Water Storage and High Service Pumping**

Construction of the 2000 gpm of high service pumping facilities concurrent with the lime softening facility in 1996b is estimated to cost $90,000. A 2 MG storage tank on the newly acquired site along the S.R. 92 corridor toward Goodland is recommended in 1996 at a cost of approximately $850,000 for the tank and pumping equipment. An additional 2000 gpm of high service pumping capacity at the reverse osmosis plant is necessary concurrent with the R.O. plant expansion to occur before the end of 2000 at an estimated cost of $100,000. By 2000, the three .5 MG ground storage reservoirs should be replaced with a 2.0 MG reservoir (see Figure 6-8). The estimated cost is $650,000. The total cost of the storage and high service pumping improvements for the 1996-2000 program is $1,690,000.

**Water Transmission and Distribution**

No major transmission line improvements are projected. Possible extension along S.R. 92 toward Goodland depending upon development in the area.

The total cost of the 1996 through 2000 program is estimated to be $12,270,000 with the inclusion of the on-going water programs.

The total estimated cost of the 1991 through 2000 capital improvements and on-going water programs is $33,975,000.

## 6.05 POST 2000 IMPROVEMENTS

The search for additional supplies should continue. Possible need for expansion of the raw water supply and transmission and water treatment facilities prior to 2002. Additional storage, high service pumping and water transmission and distribution improvements may be necessary depending upon the level of growth, buildout of the island and redevelopment of lower density areas.

## 6.06 IMPLEMENTATION SCHEDULE

Figure 6-9 shows the intended schedule for the major capital improvements discussed in this section.

## 6.07 CAPITAL COST ESTIMATES

Below is a summary of the preliminary capital cost estimates for all the various projects discussed in this section. All costs are in terms of 1990 dollars and the costs of future projects have been escalated to the projected item of construction.

| | | | |
|---|---|---|---|
| **I.** | **The 1990 - 1992 Program** | **Cost** | **Year** |
| A. | Water Resource Development | | |
| | 8 R.O. Deep Wells & Pumps | $400,000 | 1991 |
| | Dude Property CUP Permit and Testing | 118,000 | 1991 |
| | 160 Acre Property CUP Permit and Testing | 100,000 | 1992 |
| | Collier Property Lease Agreement Negotiation | 50,000 | 1991 |
| | Development of Dude Property Supply | 450,000 | 1991 |
| | Subtotal | $1,118,000 | |
| B. | Raw Water Transmission | | |
| | Raw Water Transmission Line Easements | $50,000 | 1991/1992 |
| | R.O. Wells Transmission Line | | |

| | | |
|---|---|---|
| 16 inch at 1300 feet | 52,000 | 1991 |
| 18 inch at 4000 feet | 180,000 | 1991 |
| 20 inch at 5300 feet | 215,000 | 1991 |
| Total | 447,000 | |
| Dude Property Transmission Line | | |
| 16 inch at 21,200 feet | 550,000 | 1991 |
| C.R. 915 Raw Water Transmission Line | | |
| 24 inch at 27,000 feet | 3,080,000 | 1992 |
| Subtotal | $4,127,000 | |

| | | | |
|---|---|---|---|
| C. | Water Treatment | | |
| | 4.0 mgd R.O. Plant & Injection Well | $11,550,000 | 1991/1992 |
| D. | Water Storage and High Service Pumping | | |
| | R.O. High Service Pumping (2200 gpm) | $150,000 | 1991 |
| E. | Water Transmission and Distribution | | |
| | San Marco Drive - 12" at 4000 feet | $120,000 | 1991/1992 |
| | Elkcam Circle - 24" at 3300 feet | 198,000 | 1991/1992 |
| | Subtotal | $318,000 | |
| F. | On-Going Water Programs | | |
| | Total Programs for 1991 | $199,000 | 1991 |
| | Total Programs for 1992 | 199,000 | 1992 |
| | Subtotal | $398,000 | |
| Total 1990 - 1992 Program Improvements | | $17,661,000 | |
| **II.** | **The 1993 - 1995 Program** | **Cost** | **Year** |
| A. | Water Resource Development | | |
| | Development of 160 Acre Parcel (6 mgd) Design and Permitting | $200,000 | 1995 |
| B. | Raw Water Transmission | | |
| | 160 Acre Parcel Raw Water Transmission Line 18 inch at 37,000 feet Design, Permitting and begin Construction | $830,000 | 1995 |

| | | | |
|---|---|---|---|
| | R.O. Deep Well Raw Water Transmission Line Expansion | | |
| | 8 inch at 14,100 feet | 339,000 | 1994 |
| | 10 inch at 500 feet | 15,000 | 1994 |
| | R.O. Deep Well/Surface Water Interconnect and Brine Line | | |
| | 16 inch | 246,000 | 1994 |
| | Subtotal | $1,430,000 | |
| C. | Water Treatment | | |
| | 5.0 MGD Lime Softening Plant | | |
| | Design and Permit | $500,000 | 1995 |
| D. | Water Storage and High Service Pumping | | |
| | 2 MG Ground Storage Reservoir & | | |
| | Site Acquisition | $710,000 | 1994 |
| | 2000 gpm at new lime softening plant | | |
| | Design and Permit | 10,000 | 1995 |
| | 2 MG Storage Tank Site & Pumping | | |
| | Site Acquisition | 150,000 | 1995 |
| | Subtotal | $870,000 | |
| E. | Water Transmission and Distribution | | |
| | Bald Eagle Drive - 24 inch at 6600 feet | $396,000 | by 1994 |
| | Hernando Drive - 12 inch at 1700 feet | 51,000 | by 1995 |
| | Subtotal | $447,000 | |
| F. | On-going Water Programs | | |
| | Total Programs for 1993 | $199,000 | 1993 |
| | Total Programs for 1994 | 199,000 | 1994 |
| | Total Programs for 1995 | 199,000 | 1995 |
| | Subtotal | $597,000 | |
| | Total 1993 - 1995 Program Improvements | $4,044,000 | |

| | 997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|
| WATER RESOURCE DEVELOPMENT | | | | |
| DEEP WELLS | | | ---- | XXXXXXIIIII |
| DUDE PARCEL | | | | |
| 160 ACRE PARCEL | | | | |
| SOURCE PROTECTION – ONGOING | | | | |
| NEW RESOURCES – ONGOING | | | | |
| RAW WATER TRANSMISSION | | | --- | ---XXXIII |
| DEEP WELLS | | | | |
| DUDE PARCEL | | | | |
| 160 ACRE PARCEL | | | | |
| 951 TRANSMISSION LINE | | | | |
| INTERCONNECT (MAY NOT BE NECES: | | | | |
| WATER TREATMENT | | | | |
| REVERSE OSMOSIS | XXIIIIII | | | |
| LIME SOFTENING | | | | |
| WATER STORAGE AND HIGH SERVIC | | | | |
| STORAGE | I | ---XX | XXIIIIIIII | |
| R.O. HIGH SERVICE PUMPING | (IIIIIIII | | | |
| L.S. HIGH SERVICE PUMPING | | | | |
| WATER TRANSMISSION AND DISTRIB | | | | |
| SAN MARCO DRIVE | | | | |
| ELKCAM CIRCLE | | | | |
| BALD EAGLE DRIVE | | | | |
| HERNANDO DRIVE | | | | |
| S.R. 92 (POSSIBLY) | | | | |

;END

- -- PLANNING, PRELIMINARY AND FINAL DESIGN
- (XX PERMITTING, BIDDING AND AWARD
- IIII CONSTRUCTION

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# Water Capital Projects Implementation Schedule

FIGURE 6–9

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| III. | The 1996 - 2000 Program | Cost | Year |
|---|---|---|---|
| A. | Water Resource Development | | |
| | Development of 160 Acre Parcel | | |
| | Construction | 800,000 | 1996 |
| | 5 R.O. Deep Wells for 2 MGD Expansion | $250,000 | 2000 |
| | Subtotal | $1,050,000 | |
| B. | Raw Water Transmission | | |
| | 160 Acre Parcel Raw Water Transmission Line | | |
| | Complete Construction | 835,000 | 1996 |
| C. | Water Treatment | | |
| | 5.0 MGD Lime Softening Plant | | |
| | Construction | 4,700,000 | 1996 |
| | 2.0 MGD R.O. Expansion | $3,000,000 | 2000 |
| | | $7,700,000 | |
| D. | Water Storage and High Service Pumping | | |
| | Lime Softening Plant High Service Pumping | | |
| | Construction | 90,000 | 1996 |
| | 2 MG Storage Tank and 1000 gpm Booster Pumping Construction | | |
| | | 850,000 | 1996/1997 |
| | 2 MG Storage Tank and Demolition | 650,000 | 1998/199 |
| | 2000 gpm at R.O. Expansion | 100,000 | 2000 |
| | Subtotal | $1,690,000 | |
| E. | Water Transmission and Distribution | | |
| | No major improvements planned | | |

F. On-Going Water Programs

| | | |
|---|---|---|
| Total Programs for 1996 | $199,000 | 1996 |
| Total Programs for 1997 | 199,000 | 1997 |
| Total Programs for 1998 | 199,000 | 1998 |
| Total Programs for 1999 | 199,000 | 1999 |
| Total Programs for 2000 | 199,000 | 2000 |
| Subtotal | $995,000 | |

| | |
|---|---|
| Total 1996 - 2000 Program Improvements | $12,270,000 |
| Total 1991 - 2000 Program Improvements | $33,975,000 |

## IV. Post 2000 Improvements

No major improvements planned. Additional raw water supply and transmission and water treatment plant capacity may be needed sometime in 2002.

## 6.08 WATER CIP SCHEDULE

Figure 6-10 shows the recommended Marco Island water capital improvements previously discussed on a yearly budget planning schedule for the planning period 1991 through 2000.

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | TOTAL PROJECT COST |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WATER RESOURCE DEVELOPMENT** | | | | | | | | | | | |
| 8 R.O. DEEP WELLS & PUMPS FOR 4 MGD – A | $400,000 | | | | | | | | | | $400,000 |
| DUDE PROPERTY CUP PERMIT AND TESTING – B | $118,000 | | | | | | | | | | $118,000 |
| 160 ACRE PARCEL CUP PERMIT AND TESTING – C | | $100,000 | | | | | | | | | $100,000 |
| COLLIER LEASE AGREEMENT NEGOTIATION | $50,000 | | | | | | | | | | $50,000 |
| DEVELOPMENT OF DUDE PROPERTY – B | $450,000 | | | | | | | | | | $450,000 |
| DEVELOPMENT OF 160 ACRE PARCEL – C | | | | | $200,000 | $800,000 | | | | | $1,000,000 |
| 5 R.O. DEEP WELLS & PUMPS FOR 2 MGD EXPANSION | | | | | | | | | | $250,000 | $250,000 |
| **SUB–TOTAL** | $1,018,000 | $100,000 | | | $200,000 | $800,000 | | | | $250,000 | $2,368,000 |
| **RAW WATER TRANSMISSION** | | | | | | | | | | | |
| RAW WATER TRANSMISSION LINE EASEMENTS | $25,000 | $25,000 | | | | | | | | | $50,000 |
| R.O. DEEP WELL RAW WATER TRANSMISSION LINE – A | $447,000 | | | | | | | | | | $447,000 |
| DUDE PROPERTY RAW WATER TRANSMISSION LINE – B | $550,000 | | | | | | | | | | $550,000 |
| 160 ACRE PARCEL RAW WATER TRANSMISSION LINE – C | | | | | $830,000 | $835,000 | | | | | $1,665,000 |
| C.R. 951 RAW WATER TRANSMISSION LINE – D | | $3,080,000 | | | | | | | | | $3,080,000 |
| R.O. DEEP WELL RAW WATER TRANSMISSION LINE EXPANSION | | | | $354,000 | | | | | | | $354,000 |
| R.O. DEEP WELL/SURFACE WATER INTERCONNECT / BRINELINE | | | | $246,000 | | | | | | | $246,000 |
| **SUB–TOTAL** | $1,022,000 | $3,105,000 | | $600,000 | $830,000 | $835,000 | | | | | $6,392,000 |
| **WATER TREATMENT** | | | | | | | | | | | |
| 4 MGD R.O. PLANT & INJECTION WELL | $10,550,000 | $1,000,000 | | | | | | | | | $11,550,000 |
| 5 MGD LIME SOFTENING PLANT | | | | | $500,000 | $4,700,000 | | | | | $5,200,000 |
| 2 MGD R.O. PLANT EXPANSION | | | | | | | | | | $3,000,000 | $3,000,000 |
| **SUB–TOTAL** | $10,550,000 | $1,000,000 | | | $500,000 | $4,700,000 | | | | $3,000,000 | $19,750,000 |
| **WATER STORAGE & HIGH SERVICE PUMPING** | | | | | | | | | | | |
| R.O. PLANT HIGH SERVICE PUMPING (2200 gpm) | $150,000 | | | | | | | | | | $150,000 |
| 2 MG STORAGE TANK & SITE (L.S.PLANT) | | | | $710,000 | | | | | | | $710,000 |
| 2 MG STORAGE TANK & DEMOLITION (L.S. PLANT) | | | | | | | | $75,000 | $575,000 | | $650,000 |
| LIME SOFTENING PLANT HIGH SERVICE PUMPING (2000 GPM) | | | | | $10,000 | $90,000 | | | | | $100,000 |
| 2 MG STORAGE TANK,SITE & PUMPING (NEW SITE) | | | | | $150,000 | $550,000 | $300,000 | | | | $1,000,000 |
| R.O. PLANT HIGH SERVICE PUMPING (2000 gpm) | | | | | | | | | | $100,000 | $100,000 |
| **SUB–TOTAL** | $150,000 | | | $710,000 | $160,000 | $640,000 | $300,000 | $75,000 | $575,000 | $100,000 | $2,710,000 |
| **WATER TRANSMISSION & DISTRIBUTION** | | | | | | | | | | | |
| San Marco Drive (4000'OF 12") | $15,000 | $105,000 | | | | | | | | | $120,000 |
| Elkcam Circle (3300' OF 24") | $20,000 | $178,000 | | | | | | | | | $198,000 |
| Bald Eagle Drive (6600' OF 24") | | | $40,000 | $356,000 | | | | | | | $396,000 |
| Hernando Drive (1700' OF 12") | | | | $7,000 | $44,000 | | | | | | $51,000 |
| **SUB–TOTAL** | $35,000 | $283,000 | $40,000 | $363,000 | $44,000 | | | | | | $765,000 |
| **ON–GOING WATER PROGRAMS** | | | | | | | | | | | |
| **SUB–TOTAL** | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | $199,000 | 1,990,000 |
| **ANNUAL CIP BUDGET** | **$12,974,000** | **$4,687,000** | **$239,000** | **$1,872,000** | **$1,933,000** | **$7,174,000** | **$499,000** | **$274,000** | **$774,000** | **$3,549,000** | **$33,975,000** |

All costs are nonescalated 1990 dollars.

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engineers, hydrogeologists, scientists & management consultants

TABLE

**Water Capital Improvements Program Budget**
FIGURE 6–10

## SECTION 7

## WASTEWATER SYSTEM MASTER PLAN

### 7.01 GENERAL

The two plant approach recommended for the water program is essential to accommodate the orderly and cost effective expansion of the wastewater treatment facilities to their anticipated ultimate capacity at the existing site. The construction of the R.O. plant facilitates the demolition of a portion of the existing water facilities without which the WWTP facilities cannot be appropriately expanded. Although a two plant approach for the wastewater treatment system was examined, there are tremendous economies associated with maximizing the effective utilization of the existing site to accommodate the ultimate raw wastewater flow.

These economies are realized as a result of use of the existing raw water transmission system, effluent transmission and effluent disposal system without significant modifications to the piping systems, avoidance of the high cost of land for the purchase of a second site, and the additional operation and staffing costs of a two plant operation. Secondly, there is the practical difficulty of identifying a vacant parcel of land on the island of sufficient acreage to site the treatment equipment, provide adequate buffers and to obtain the proper zoning for construction of the treatment plant. Therefore, investment in the R.O. treatment facilities makes sense from the standpoint of allowing the wastewater system to be expanded in a cost effective manner.

We have reviewed the reports proposed for the on-going wastewater treatment expansion program as well as the reports on the percolation pond expansion and deep well injection program. These documents, along with the flow projections and capacity versus flow analyses discussed in Section 5, form the basis for the capital improvement programs recommended herein.

### 7.02 THE 1990 - 1992 PROGRAM

Each of the wastewater master plan programs are divided into the following facility components: (1) raw wastewater transmission system, (2) wastewater treatment, (3) effluent transmission, and (4) effluent disposal. For the 1990-1992 program only, we have added one should be provided to fund the lift station study, labor, and materials for this program.

3) Infiltration and Inflow Program - Although the system does not seem to experience serious inflow and infiltration problems, the older sewers constructed of VCP can be expected to be susceptible to cracking and joint leakage as they age. Therefore, it is recommended that a regular inflow and infiltration program be established to inspect the existing sewer mains and repair cracked or leaking pipe sections to control the quantity of extraneous flow. A budget of $30,000 is recommended to annually inspect and repair segments of the gravity sewer system on a priority basis beginning with the oldest sections and those service areas suspected to have significant flow contributions from infiltration and inflow.

The total cost of the on-going wastewater improvement program is $165,000 per year.

**Raw Wastewater Transmission System**

The combined equivalent capacity of the existing wastewater force mains entering the wastewater treatment plant site are adequate to convey the peak wastewater flows generated during the initial program. Individual lift stations and force mains were not evaluated as a part of the master plan programming. It is recommended that the pump run times at the lift stations be examined and that those stations having excessive run times be evaluated for capacity upgrade by the respective utilities.

**Wastewater Treatment Facilities**

The wastewater flow projections proposed for the master plan project indicate that the permitted capacity of the existing wastewater treatment plant (2.5 MGD) will be exceeded on a maximum month basis beginning in 1990. SSUS has already implemented a program to increase the wastewater treatment plant capacity to 3.5 MGD. Construction of these facilities should be complete and ready for operation in 1991. The expansion of the WWTP to 3.5 MGD is expected to satisfy projected flows during the initial program period.

WWTP, reduce the loading on the existing ponds to allow loading, resting, and maintenance, and to provide backup disposal and storage for the golf courses during non-application periods.

The pond construction will include removal of the surface layer of organic muck, construction of a 10 foot wide by 9 to 13 foot deep trench along the perimeter backfilled with clean sand to penetrate the clay layer and backfilling of the pond bottom area to 3 feet above existing grade. The ponds are designed to be alternately loaded and rested on a seven day cycle. This cycle will provide for periodic maintenance of the pond bottom including discing of the bottom which is required to break up organic deposits and maintain effluent disposal capacity. The existing ponds will also be improved using the same trench construction method as the proposed ponds. However, the pond bottom elevations will remain the same. The estimated cost of these new effluent disposal facilities is $750,000. During this period the deep well at the WWTP site will be placed into service for disposal of the concentrate from the reverse osmosis plant. The wetwell and pumping facilities will be installed to provide for concurrent disposal of wastewater effluent. This additional capacity is required to provide a means of effluent disposal during the wet season when the other land application systems are unable to provide sufficient capacity. This additional capacity is also required to provide capacity to dispose of peak seasonal flows and whenever the land application systems are taken off line for regular routine maintenance.

The total cost of the 1990 through 1992 program is estimated to be $5,925,000 with the inclusion of the ongoing wastewater programs.

## 7.03 THE 1993 - 1995 PROGRAM

### Raw Wastewater Transmission System

The force mains comprising the raw wastewater transmission system into the plant are expected to have sufficient capacity to handle peak flow generated during this period and should not require modifications. The performance of the existing lift stations should be evaluated to determine their adequacy. This evaluation should include review of pump run times, operational deficiencies, such as sewer system backups, and pumping head. Appropriate action should be taken to correct operational deficiencies. Excessive pump run times are an indication that pumping capacity is inadequate and the pump design should be re-evaluated versus service area requirements and the pumps upsized as required.

# SECTION 7

# WASTEWATER SYSTEM MASTER PLAN

## 7.01 GENERAL

The two plant approach recommended for the water program is essential to accommodate the orderly and cost effective expansion of the wastewater treatment facilities to their anticipated ultimate capacity at the existing site. The construction of the R.O. plant facilitates the demolition of a portion of the existing water facilities without which the WWTP facilities cannot be appropriately expanded. Although a two plant approach for the wastewater treatment system was examined, there are tremendous economies associated with maximizing the effective utilization of the existing site to accommodate the ultimate raw wastewater flow.

These economies are realized as a result of use of the existing raw water transmission system, effluent transmission and effluent disposal system without significant modifications to the piping systems, avoidance of the high cost of land for the purchase of a second site, and the additional operation and staffing costs of a two plant operation. Secondly, there is the practical difficulty of identifying a vacant parcel of land on the island of sufficient acreage to site the treatment equipment, provide adequate buffers and to obtain the proper zoning for construction of the treatment plant. Therefore, investment in the R.O. treatment facilities makes sense from the standpoint of allowing the wastewater system to be expanded in a cost effective manner.

We have reviewed the reports proposed for the on-going wastewater treatment expansion program as well as the reports on the percolation pond expansion and deep well injection program. These documents, along with the flow projections and capacity versus flow analyses discussed in Section 5, form the basis for the capital improvement programs recommended herein.

## 7.02 THE 1990 - 1992 PROGRAM

Each of the wastewater master plan programs are divided into the following facility components: (1) raw wastewater transmission system, (2) wastewater treatment, (3) effluent transmission, and (4) effluent disposal. For the 1990-1992 program only, we have added one additional section for recommended on-going wastewater programs. These programs are considered to be pertinent to each program period. This section summarizes the initial capital improvements which are primarily associated with the wastewater capital improvement programs presently in progress which are required to meet immediate needs.

**On-Going Wastewater Programs**

The on-going wastewater programs which should be budgeted and performed each year involve:

1) Renewal and replacement programs - Annually approximately five (5) percent of the value of the plant in service should be budgeted for renewal and replacement capital improvements. Typical renewal and replacement program budgets are based upon the current capital investment of the wastewater facilities that normally needs refurbishment or replacement after a period of time. We believe the following NARUC accounts are affected by this renewal and replacement program for Marco Island Utilities.

| NARUC Account No. | Account Title | Balance as of 12/31/89 Less Accumulated Depreciation |
|---|---|---|
| 364 | Flow Measuring Devices | $59,229 |
| 371 | Pumping Equipment | 293,112 |
| 380 | Treatment & Disposal Equipment | 1,097,893 |
| | Total | $1,450,234 |

Thus, allowing five percent of the net wastewater utility facilities affected by renewal and replacement or approximately $75,000 should be allocated on an annual basis for the renewal and replacement program.

2) Lift Station Pump Replacement - Approximately every five to seven years the lift station pumps should be rotated and/or replaced in order to respond to changes in pumping heads over time, with some pumps requiring replacement due to growth in the lift station service area. This pump rotation and replacement program will require an update of the lift station service area flows and hydraulic analysis of the transmission system with recommendations for pump rotation and replacement. A budget allocation of $60,000 every year

should be provided to fund the lift station study, labor, and materials for this program.

3) Infiltration and Inflow Program - Although the system does not seem to experience serious inflow and infiltration problems, the older sewers constructed of VCP can be expected to be susceptible to cracking and joint leakage as they age. Therefore, it is recommended that a regular inflow and infiltration program be established to inspect the existing sewer mains and repair cracked or leaking pipe sections to control the quantity of extraneous flow. A budget of $30,000 is recommended to annually inspect and repair segments of the gravity sewer system on a priority basis beginning with the oldest sections and those service areas suspected to have significant flow contributions from infiltration and inflow.

The total cost of the on-going wastewater improvement program is $165,000 per year.

**Raw Wastewater Transmission System**

The combined equivalent capacity of the existing wastewater force mains entering the wastewater treatment plant site are adequate to convey the peak wastewater flows generated during the initial program. Individual lift stations and force mains were not evaluated as a part of the master plan programming. It is recommended that the pump run times at the lift stations be examined and that those stations having excessive run times be evaluated for capacity upgrade by the respective utilities.

**Wastewater Treatment Facilities**

The wastewater flow projections proposed for the master plan project indicate that the permitted capacity of the existing wastewater treatment plant (2.5 MGD) will be exceeded on a maximum month basis beginning in 1990. SSUS has already implemented a program to increase the wastewater treatment plant capacity to 3.5 MGD. Construction of these facilities should be complete and ready for operation in 1991. The expansion of the WWTP to 3.5 MGD is expected to satisfy projected flows during the initial program period.

The 1.0 MGD wastewater treatment plant expansion program presently under way consists of construction of the following major components:

1. One (1) MGD contact stabilization WWTP in a 96 foot diameter basin.
2. 2.5 MGD concrete automatic backwash filters.
3. 3.5 MGD concrete chlorine contact chamber addition.
4. Gravity thickener building with a 1.2 meter gravity belt thickener and room for additional future thickening equipment.
5. 1.0 MG substandard effluent holding pond.

This work has been divided up into two contracts. Contract A includes earth work, yard piping, and pond liner construction. Contract B includes construction of the treatment components summarized above.

**Effluent Transmission Facilities**

The existing effluent transmission system has a capacity of 2.2 MGD, which is 0.3 MGD less than what is needed by the existing WWTP and 1.3 MGD less than what is required by the expanded WWTP during the 1990-1992 program. In order to accommodate these demands, the plant effluent pumping station pumps and portions of the effluent transmission mains have been upsized. The proposed effluent pumps are to be constant speed with a capacity of 2.3 MGD each at 162 TDH. The pumping units are sized to handle the peak flow rate with two units on line and the third unit provided as standby. Portions of the wastewater transmission mains being replaced are 1,932 feet of 8-inch pipe and 14,700 feet of 12-inch pipe with 16-inch main along with a new Marco River Crossing. These improvements will increase the effluent transmission system's capacity to 4.6 MGD. The cost of these pumping and transmission improvements is estimated at $2,690,000.

**Effluent Disposal Facilities**

The effluent disposal facilities will be expanded during this program period concurrently with the wastewater treatment plant expansion. The effluent disposal system expansion will consist of the construction of two additional percolation ponds on the mainland on the east side of the two existing ponds as shown on Figure 5-6. The two new ponds have a combined area of 26 acres and are designed to provide an effluent disposal capacity to support the expansion of the

WWTP, reduce the loading on the existing ponds to allow loading, resting, and maintenance, and to provide backup disposal and storage for the golf courses during non-application periods.

The pond construction will include removal of the surface layer of organic muck, construction of a 10 foot wide by 9 to 13 foot deep trench along the perimeter backfilled with clean sand to penetrate the clay layer and backfilling of the pond bottom area to 3 feet above existing grade. The ponds are designed to be alternately loaded and rested on a seven day cycle. This cycle will provide for periodic maintenance of the pond bottom including discing of the bottom which is required to break up organic deposits and maintain effluent disposal capacity. The existing ponds will also be improved using the same trench construction method as the proposed ponds. However, the pond bottom elevations will remain the same. The estimated cost of these new effluent disposal facilities is $750,000. During this period the deep well at the WWTP site will be placed into service for disposal of the concentrate from the reverse osmosis plant. The wetwell and pumping facilities will be installed to provide for concurrent disposal of wastewater effluent. This additional capacity is required to provide a means of effluent disposal during the wet season when the other land application systems are unable to provide sufficient capacity. This additional capacity is also required to provide capacity to dispose of peak seasonal flows and whenever the land application systems are taken off line for regular routine maintenance.

The total cost of the 1990 through 1992 program is estimated to be $5,925,000 with the inclusion of the ongoing wastewater programs.

## 7.03 THE 1993 - 1995 PROGRAM

### Raw Wastewater Transmission System

The force mains comprising the raw wastewater transmission system into the plant are expected to have sufficient capacity to handle peak flow generated during this period and should not require modifications. The performance of the existing lift stations should be evaluated to determine their adequacy. This evaluation should include review of pump run times, operational deficiencies, such as sewer system backups, and pumping head. Appropriate action should be taken to correct operational deficiencies. Excessive pump run times are an indication that pumping capacity is inadequate and the pump design should be re-evaluated versus service area requirements and the pumps upsized as required.

**Wastewater Treatment Facilities**

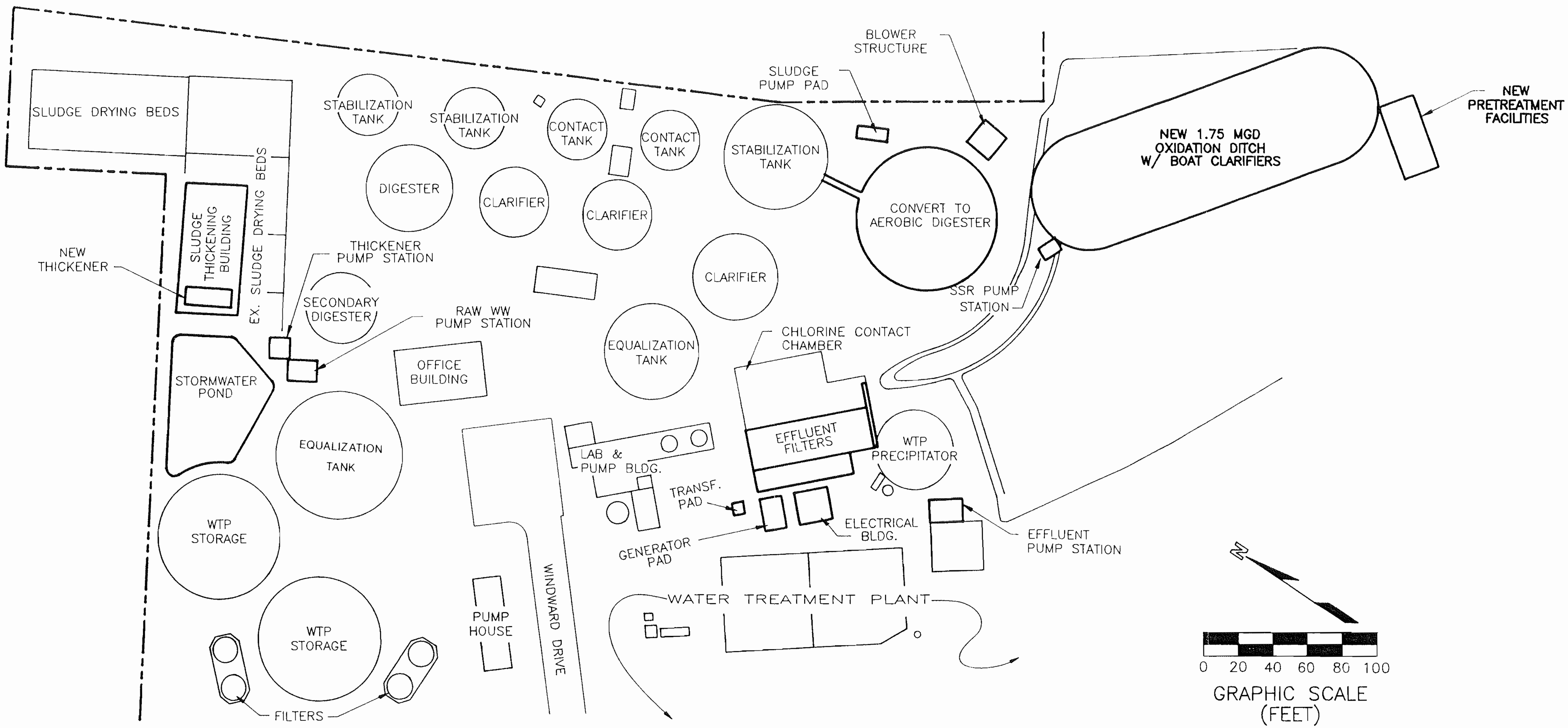
The capacity versus demand analysis performed in Section 5 indicates that the wastewater treatment facilities will have to be expanded. The expansion of the wastewater treatment facilities will be accomplished by the addition of a 1.75 MGD oxidation ditch with internal boat clarifier. The new treatment facilities will be constructed in the location of the existing oxidation pond as shown in Figure 7-1. The oxidation pond will be filled in partially to accommodate the construction of the oxidation ditch. The actual increase in total plant capacity will only be 0.75 MGD bringing the total to 4.25 MGD since the 1.0 MGD package plant is proposed to be converted to a digester.

The increase in capacity will require that additional sludge treatment and thickening facilities be provided. The aerobic digester capacity will be expanded by conversion of the existing 1.0 MGD treatment plant into an aerobic digester. The conversion will be accomplished by removal of the treatment plant equipment and internal walls and installation of a new diffused aeration system with associated piping modifications. The sludge thickening system will be expanded by installation of an additional 2 meter gravity belt thickener and associated equipment within the sludge thickening building.

It is anticipated that design activities should be initiated approximately twenty-four months prior to the time these facilities are required to be on-line. This will provide for five months for engineering design and field services, six months for permitting, bidding and award, and thirteen months for construction of the facilities, startup, testing, final inspections, and certification. The estimated cost of the oxidation ditch, sludge thickening and digester conversion is $1,823,000.

**Effluent Transmission Facilities**

The 1.75 MGD oxidation ditch expansion to the WWTP will bring the plant capacity up to 4.25 MGD. This expansion is expected to be located over the existing effluent holding pond. As the plant approaches its capacity of 4.25, the 1990-1992 improvements to the effluent transmission facilities will also be nearing their capacity. These factors coupled with the lack of any on-site effluent holding capacity eliminates the WWTP and effluent disposal facilities' ability to handle peak hourly flows. Therefore, the deep well will be the prime method for

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Wastewater Treatment Plant Expansion To 4.25 MGD

FIGURE 7–1

effluent disposal following the expansion of the wastewater treatment plant to 4.25 MGD, especially during wet weather.

**Effluent Disposal Facilities**

The capacity of the existing effluent disposal facilities plus those constructed during the 1990-1992 program should have sufficient capacity to handle the projected effluent flows. Therefore, no new effluent disposal facilities will need to be constructed during this period. However, operating data and performance of each of the facilities should be reviewed and evaluated. Appropriate modifications to the operation of the facilities should be implemented to minimize energy consumption, maximize overall system efficiency and maintain optimal performance and disposal capacity.

## 7.04 THE 1996 -2000 PROGRAM

All programs instituted during the 1993-1995 program are assumed to have been implemented and placed into service prior to the beginning of the planning period. The treatment plant and effluent disposal system are anticipated to have a minimum permitted and operational capacity of 4.25 MGD. The program required to continue to provide wastewater service in accordance with the levels of service established in the plan and in accordance with regulatory requirements are described herein. The actual flows should be compared to the projected flows to verify the timing of the recommended capital improvements.

**Wastewater Transmission System**

The force mains comprising the raw wastewater transmission system into the plant are expected to have insufficient capacity to handle the peak flow generated toward the end of this period and should require expansion. The sizing and routing of the force main should be determined based upon an analysis of the wastewater transmission system. It is anticipated that a new 12 to 16-inch diameter force main should be constructed in 1998 to provide sufficient capacity for the following 5 to 10 year planning period. For budget purposes, we have assumed the construction of 9000 feet of 16-inch force main at an estimated cost of $360,000.

**Wastewater Treatment**

The capacity versus demand analysis performed in Section 5 indicates that planning for the next expansion of the wastewater treatment should begin during the end of this planning period. The expanded facilities are expected to be required to be on-line by the second quarter of 2001. This timing could be accelerated if areas previously unsewered are added to the service area or if the per capita flow continues to increase. Therefore, the historical wastewater flows should be carefully compared to the projected flows at the beginning of the planning period and adjusted to verify the timing of the next expansion.

**Effluent Transmission Facilities**

No improvements to the effluent transmission facilities are required during the 1996-2000 program, as the deep well will be the primary means of effluent disposal for the portion of the dry weather effluent flow and all the effluent during wet weather conditions. The existing off-site transmission system has adequate capacity to utilize the golf course and percolation ponds at their rated design capacity.

**Effluent Disposal Facilities**

The combined effluent disposal capacity of the percolation ponds, golf course irrigation systems, and deep well injection system are considered to be adequate to provide sufficient effluent disposal capacity throughout the planning period. Therefore, no additional effluent disposal facilities are required during this planning period. However, the operation of all systems should be reviewed at the beginning and midway through the planning period to identify any operational deficiencies. Corrective measures should be planned and implemented during the planning period to maintain all facilities at their design capacities.

## 7.05 THE POST 2000 FACILITIES

Growth, population, and flow projections tend to be less accurate the further away in time from the base historical data you go. The most important activity to be performed at the end of the initial ten year planning period will be to review the flow projections based upon the historical data collected during the planning period. Scheduling of required capital improvements outlined herein will have to be modified in timing and capacity in accordance with the current data at the beginning of the planning period. Changes in service area size, sewering of areas served by septic tanks, changes in occupancy rates, zoning changes, and redevelopment of existing properties are expected to have the greatest affect upon the projected flows. The capital improvements noted herein will be based upon the projections stated herein and are subject to change in timing and scope as noted above.

**Wastewater Transmission Facilities**

The existing raw wastewater force mains entering the plant site have sufficient equivalent hydraulic capacity to convey the peak design flows projected thru the first five years to the year 2005. It is anticipated that the raw wastewater transmission facilities will have to be expanded in the subsequent 5 year period as their hydraulic capacity is reached. It is recommended that the performance of the individual lift stations be evaluated to determine if they are providing an adequate level of service for their collection area. The condition of the mechanical equipment should be evaluated and repair or replacement of this equipment may be anticipated during this period due to the age of the equipment.

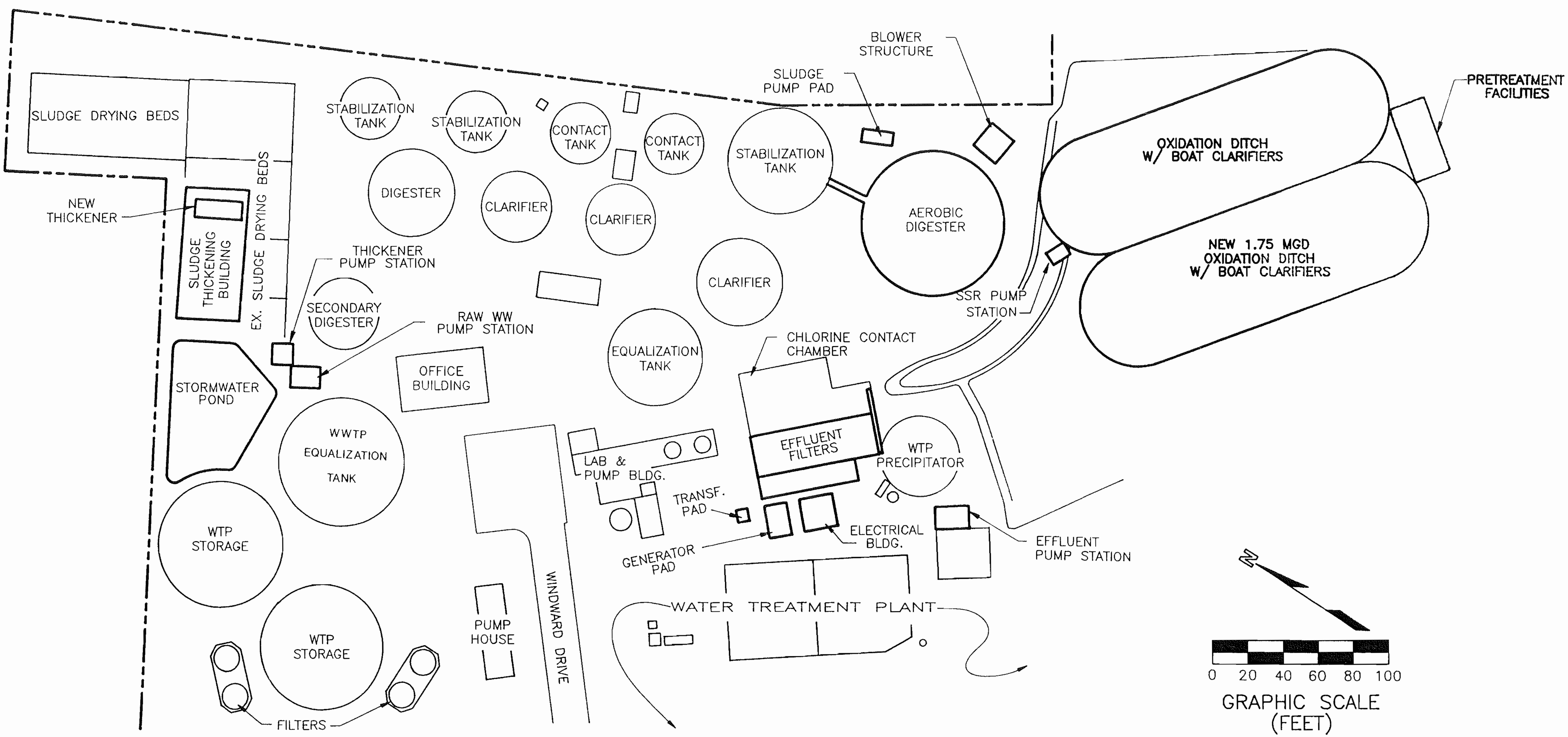
Changes within the lift station service areas which impact the tributary flow should be carefully evaluated and necessary lift station modifications or equipment replacements performed to anticipate the impact of these changes.

**Wastewater Treatment Facilities**

The capacity versus flow analysis prepared in Section 5 indicated that the wastewater treatment plant capacity will have to be increased to 6 MGD by the year 2002 (see Figure 7-2). The plant expansion will consist of the addition of the second 1.75 MGD oxidation ditch with boat clarifier. The new treatment facilities will be constructed over the remainder of the oxidation/substandard effluent holding pond.

The increase in capacity will require that additional sludge management facilities be provided. The aerobic digester constructed during the previous plan expansion has been designed to provided sufficient treatment capacity for the second 1.75 MGD expansion. The sludge thickening system will have to be expanded by installation of an additional 2 meter gravity belt thickener and associated equipment with the sludge thickening building.

The expansion of the wastewater treatment facilities to a total capacity of 6 MGD will elevate the FDER classification of the plant to a Category II, Class A facility in accordance with

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engineers, hydrogeologists, scientists & management consultants

**Wastewater Treatment Plant Expansion To 6.0 MGD**

FIGURE 7-2

Chapter 17-602, F.A.C. At that time the operator requirements for the plant will be increased to require that the plant be staffed 24 hours per day, 7 days per week. The lead operator will be also required to have an A operator license.

**Wastewater Disposal Facilities**

The combined average daily disposal capacity of the effluent disposal facilities are expected to exceed the projected average daily and maximum daily flows through the year 2010. Therefore, the construction of additional effluent disposal facilities should not be required to meet the needs of the service area for five to ten years after the end of the original ten year planning period.

## 7.06 IMPLEMENTATION SCHEDULE

The proposed wastewater capital improvements programs are summarized by project in Table 7-1. An implementation schedule was prepared showing the approximate time for design, permitting, bidding, and award and construction of the proposed improvements for the 10 year planning period. The implementation schedule is included herein as Figure 7-3.

## 7.07 CAPITAL COST ESTIMATES

Capital cost estimates were prepared for each of the wastewater system improvements described in the master plan program. All costs are presented in terms of 1990 dollars and the costs have not been escalated to reflect current dollars at the time of the improvements. The capital cost estimates for the wastewater improvements listed in Table 7-1 are presented in Table 7-2. Figure 7-4 shows the recommended Marco Island wastewater capital improvements described herein on a yearly budget planning schedule for the planning period 1990 through 2000.

Chapter 17-602, F.A.C. At that time the operator requirements for the plant will be increased to require that the plant be staffed 24 hours per day, 7 days per week. The lead operator will be also required to have an A operator license.

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TABLE 7-1

WASTEWATER CAPITAL IMPROVEMENTS PROGRAM SUMMARY

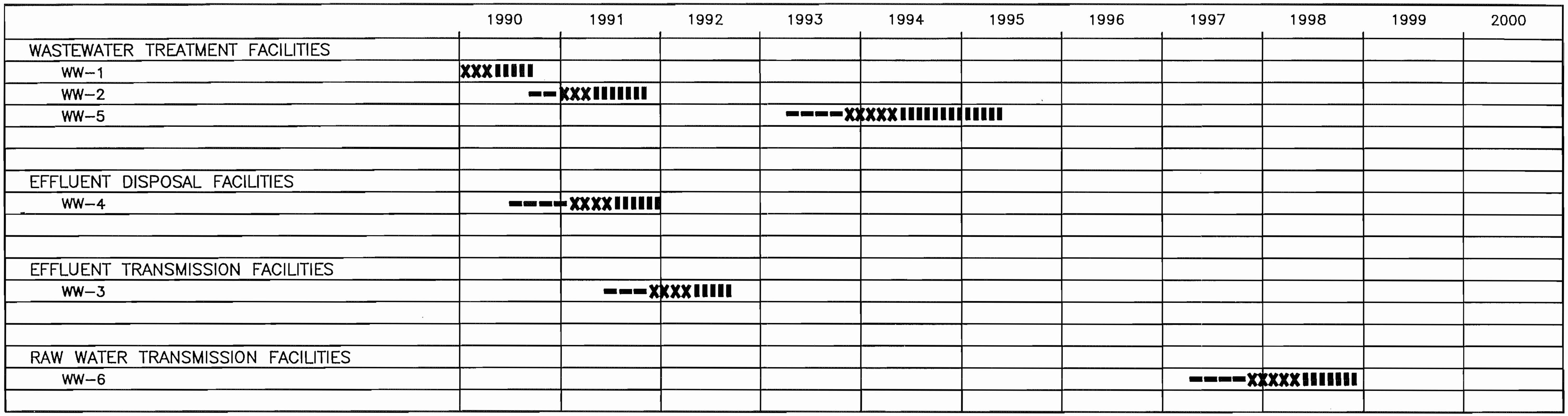
| Project No. | Year | Project Description |
|---|---|---|
| | | **1990 - 1992 Program** |
| WW - 1 | 1990 | WWTP sitework |
| WW - 2 | 1991 | 1.0 MGD WWTP Expansion |
| WW - 3 | 1991/1992 | Effluent Transmission System Improvements |
| | | 16" Effluent Main from the Coast Guard Station to the Percolation Pond site, Pressure Regulating Valve, and Marco Shores Booster Pump Expansion. |
| WW - 4 | 1991 | 2.5 MGD Percolation Pond Expansion |
| | | **1993 - 1995 Program** |
| WW - 5 | 1994/1995 | 0.75 MGD WWTP Expansion - 1.75 MGD Oxidation Ditch with boat clarifier, Convert 1.0 MGD plant to aerobic digester and add 2.0 meter Belt Thickener. |
| | | **1996 - 2000 Program** |
| WW - 6 | 1997/1998 | Raw Wastewater Transmission System Expansion - 9000 feet of 16" force main. |
| | | **Post 2000 Program** |
| WW - 7 | 2002 | 1.75 MGD WWTP Plant Expansion - 1.75 MGD Oxidation Ditch with boat clarifier, and 2. 0 meter Belt Thickener. |

## TABLE 7-2

## WASTEWATER CAPITAL IMPROVEMENTS COST ESTIMATES

| Project No. | Item | Estimated Cost |
|---|---|---|
| WW - 1 | WWTP - Site Work | $ 320,000 |
| WW - 2 | 1.0 MGD WWTP Expansion | $2,155,000 |
| WW - 3 | 16" Effluent Main | 1,550,000 |
| | Pressure Regulating Valve | 15,000 |
| | Marco Shores Booster P.S. | 25,000 |
| | Bridge Crossing | 1,100,000 |
| | **Total** | **$2,690,000** |
| WW - 4 | 2.5 MGD Percolation Pond Expansion | $750,000 |
| WW - 5 | 1.75 MGD Oxidation Ditch | $900,000 |
| | Gravity Sludge Thickener | 175,000 |
| | Aerobic Digester Conversion | 260,000 |
| | Sitework | 67,000 |
| | Yard Piping | 135,000 |
| | Electrical | 120,000 |
| | Contingency | 166,000 |
| | **Total** | **$1,823,000** |
| WW - 6 | 16" Raw WW Force Main | $ 360,000 |

# Marco Island Utilities
# Water and Wastewater Master Plan




LEGEND

---- PLANNING, PRELIMINARY AND FINAL DESIGN
XXXXX PERMITTING, BIDDING AND AWARD
IIIIIII CONSTRUCTION

**HARTMAN & ASSOCIATES, INC.**
engineers, hydrogeologists, scientists & management consultants

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**Wastewater Capital Projects Implementation Schedule**

FIGURE 7-3