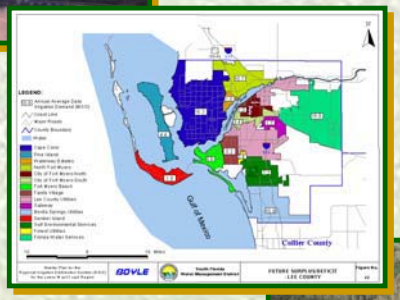
Feasibility Study for the Regional Irrigation Distribution System (RIDS) Sub-Region 1 For the Lower West Coast Region Project C-12368

South Florida Water Management District



December 2004

BOYLE

Master Plan for the
Regional Irrigation Distribution System (RIDS)
Sub-Region 1
For the Lower West Coast Region
Project C-12368

South Florida Water Management District
(SFWMD)

December 2004

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EXECUTIVE SUMMARY

The objective of the Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region is to develop the preliminary design information for the preferred alternative to supply enough water to meet all or a portion of the projected (year 2020) urban irrigation demand associated with Sub-region 1. Although the area has been progressive in developing alternative supply sources including reclaimed water, these sources will not be adequate to meet future demands. Also, because utilities in this sub-region have their own discrete infrastructure, there has been no optimization of the resource on a regional basis.

The RIDS project was one of the recommendations identified in the District's *Lower West Coast Water Supply Plan* (Water Supply Plan) completed in April 2000. The Water Supply Plan recommended the RIDS to evaluate the "feasibility of constructing regional irrigation water distribution system(s) and other options to meet the growing urban irrigation demands of this area".

The RIDS Master plan was completed in 2002. The Master Plan study area comprised the coastal area (western portion) of the Lower West Coast Region. It included the service areas of the Cities of Cape Coral, Fort Myers, and Naples, and the franchise areas for Lee County Utilities, Collier County Utilities, Florida Water Services, Gulf Environmental Services, and Bonita Springs Utilities.

The completion of the RIDS Master Plan resulted in the recommendation to develop a feasibility study for each sub-region to enhance the existing information, refine the recommended projects, provide more detailed cost estimates and develop basis of design information.

This feasibility study covers the Bonita Springs Utilities/Collier County/City of Naples service area.

To determine the amount of water from alternative sources that will be necessary for future urban irrigation water, an evaluation of water demands was performed. The demand analysis was determined on a temporal basis. The current average demand for this sub-region is approximately 86 MGD. Urban irrigation demand for the Year 2020 was projected at 132 MGD. Currently, the stakeholder utilities provide 17.5 MGD of reclaimed water for urban irrigation to this sub-region.

Alternative sources of supply were determined to address the urban irrigation demands. Additional allocations from resources that are currently stretched, such as groundwater, will be minimized. Therefore, an inventory of potential sources of supply was conducted and prioritized to address future irrigation water needs in the study area. These potential sources of supply are:

- Reclaimed wastewater from municipal wastewater treatment plants
- Water recovered during the dry season from reclaimed water aquifer storage and recovery (ASR) systems recharged during the wet season
- Surface water from streams, rivers, abandoned borrow pits, and canal systems having salinity control structures
- Water recovered during the dry season from surface water ASR systems recharged during the wet season
- Groundwater withdrawal adjacent to surface water sources such as mining pits

These sources provided a total future flow of 111.5 MGD to offset potable water demands and future groundwater withdrawals.

In order to develop a preliminary cost estimate associated with the projects, various potential projects were analyzed on a sub-regional basis. The costs consider the cost of financing the initial project capital costs, including assumptions about potential grant funding, and annual operations and maintenance expenses. These costs are then divided by the expected production of irrigation water resources for the identified projects to determine the unit cost of the irrigation water resources for each sub-region. In order to calculate the cost per gallon, it was assumed that the total annual production of each project would be approximately equal to 180 days of production based on the project capacity measured on an average daily basis. The unit costs for the development of the irrigation water resources as identified herein range from $1.06 to $4.28 per one thousand gallons depending on the project.

It was determined that the preferred alternative is eligible for several different funding options including:

- EPA Grants - $2M/Year
- District Grants - $1M/Year
- Governor's Program Grants - $500K/Year
- SRF Loan - Balance of Capital

It was determined through consensus that individual interlocal agreements on a project-by-project basis, rather than focusing on the RIDS projects as a whole (i.e., Authority or regional utility), would be utilized as an institutional framework.

Implementation of the RIDS will require additional phases to design, finance and construct the improvements. Assuming Phase 1 included the Master Plan and Phase 2 includes the Feasibility Study, subsequent phases include the following:

- **Phase 3 Engineering Design –** Includes design, permitting and bidding of projects.
- **Phase 4 Construction –** Construction and startup of projects.

INTRODUCTION

The objective of the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region Feasibility Study is to provide alternative water supply projects to supply enough water to meet the projected (year 2020) urban irrigation demand for Sub-region 1. Although the area has been progressive in developing alternative supply sources including reclaimed water, these sources will not be adequate to meet future demands. Also, because many of the stakeholders utilities have their own discrete infrastructure, there has been no optimization of the resource on a regional basis.

The RIDS project was one of the recommendations identified in the District's *Lower West Coast Water Supply Plan* (Water Supply Plan) completed in April 2000. The Water Supply Plan recommended the RIDS to evaluate the "feasibility of constructing regional irrigation water distribution system(s) and other options to meet the growing urban irrigation demands of this area".

The purpose of this report is to present the results of the RIDS Sub-region I Feasibility Study.

A series of memoranda were submitted throughout the course of the study in order to ensure that all utilities, local government agencies, project team members, the District and other stakeholders were aware of and involved in the progress of the project.

STUDY AREA DEFINITION

This RIDS Feasibility Study area generally comprises the coastal area (western portion) of the Bonita Springs / Collier County / Naples service areas. The study area is presented in Figure 1.

The study area was developed from the following sources:

- Master plans
- Comprehensive land use plans
- Future growth areas (large developments)

Generally, the study area follows the limits of the projected 2020 wastewater service areas and contains approximately 191,405 acres, primarily comprised of residential areas, with smaller portions of commercial uses.

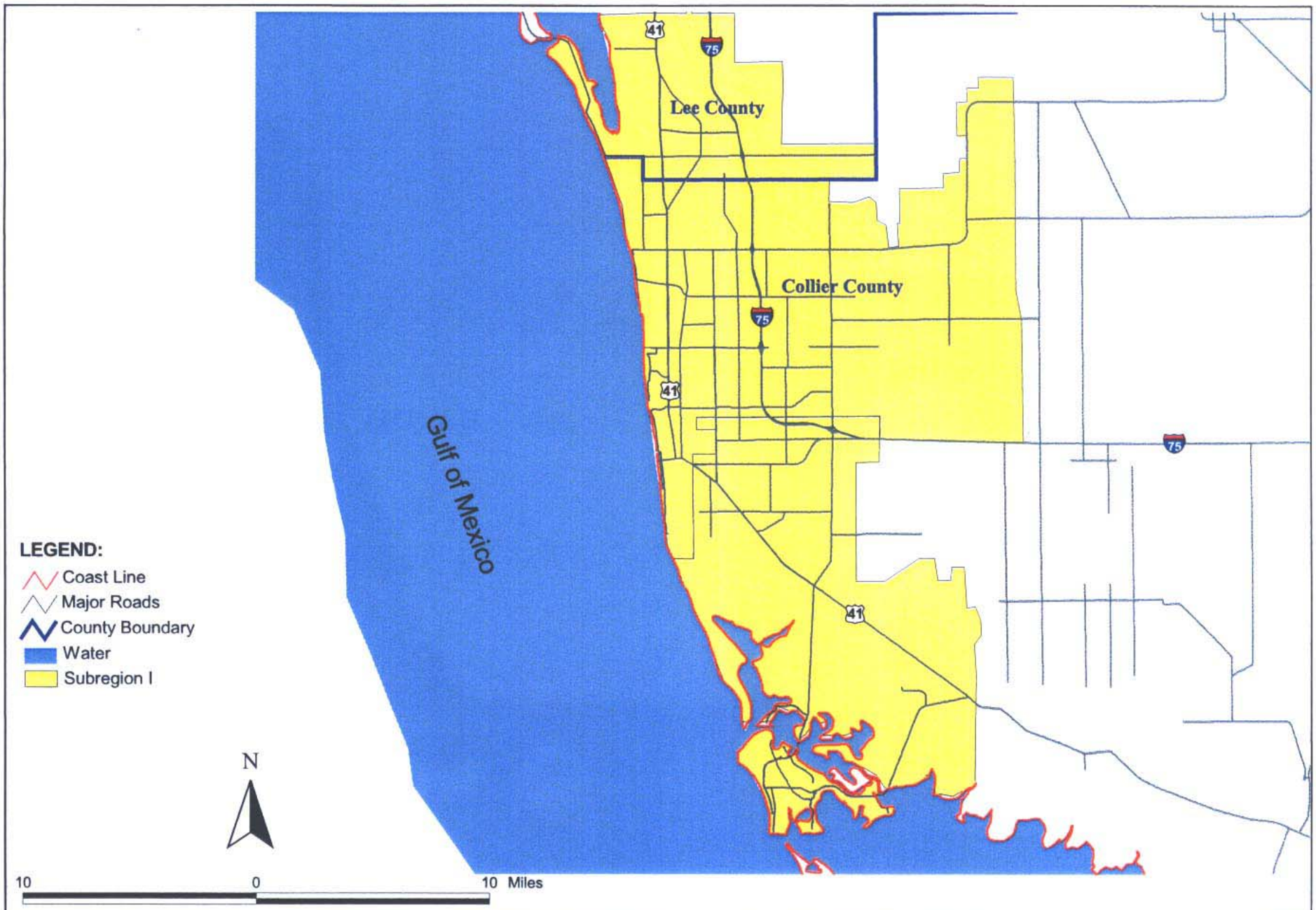
Service Area Population Projections

Permanent population projections for each service area were developed from a variety of sources including utility-supplied data. Where population projections were not extended through 2020 a linear regression was performed using the available data. Table 1 presents current and future population projections and their sources.

Table 1
Population Projections

Facility/Service Area	Population		Source
	'99/'00	2020	
Collier Co. North/Pelican Bay	61,694	137,912	2001 Collier Co. Master Plan Report
Collier Co. South	64,829	145,705	2001 Collier Co. Master Plan Report
Golden Gate	20,951	20,951	2001 Collier Co. Master Plan Report
Marco Island Utilities	12,670	18,806	2001 Collier Co. Master Plan Report
Naples	31,926	36,931	2002 Reclaimed Water Master Plan
Miscellaneous Collier Co.	21,692	47,557	2001 Collier Co. Master Plan Report
Bonita Springs	33,900	63,808	2001 Bonita Springs Tech Memo 3
Total	**247,662**	**471,670**	

The population projections above indicate a 90% increase between 2000 and 2020.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	SUBREGION 1 - STUDY AREA	Figure 1

FACILITIES INVENTORY

Existing and future (2000 and 2020) wastewater treatment/reclamation facilities and associated infrastructure within the study area were inventoried. The purpose of the inventory includes:

- Identify existing treatment and infrastructure
- Identify reclaimed water transmission infrastructure
- Determine current wastewater flows
- Determine existing reuse and disposal mechanisms and how much reclaimed water/effluent is distributed to each

The basis for the inventory came from local governments, utilities, the Water Supply Plan and the RIDS Master Plan.

Flows were generated from Monthly Operating Reports (MORs) submitted for each facility to FDEP in accordance with their permits and from monitoring data provided by the facilities.

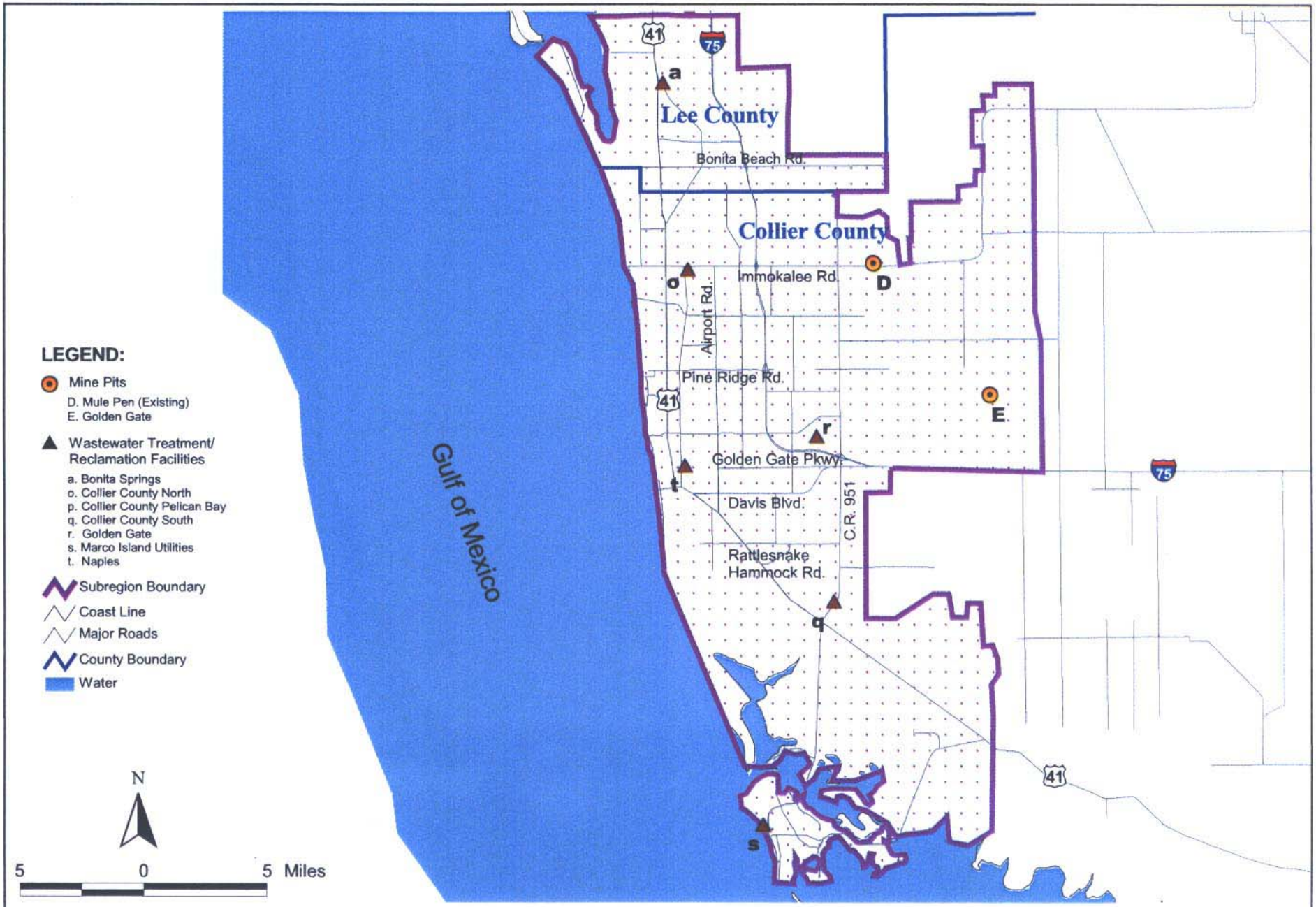
Wastewater Treatment/Reclamation Facilities

There are 6 wastewater treatment plants/reclamation facilities of significance in the study area. The facility locations are shown in Figure 2 for the study area. Table 2 summarizes the facility information.

The reclaimed water/effluent from the wastewater treatment/reclamation facilities is reused for urban irrigation, commercial uses, and groundwater recharge via percolation ponds, or disposed of via injection wells or discharged to surface water. Table 3 presents the reuse and disposal information from the facilities. Also, Table 4 displays the existing reclaimed water users for the study area.

Table 2
Wastewater Treatment/Reclamation Facility Summary

Facility Name	Stakeholder	Service Area Acreage	Permitted Capacity (MGD)	Annual Average Daily Flow (MGD)	Maximum Monthly Flow (MGD)	Minimum Monthly Flow (MGD)
Collier County North/Pelican Bay	Collier County Utilities	54,374	9.5	8.6	9.6	7.4
Collier County South	Collier County Utilities	78,290	8.0	6.4	8.4	5.8
Golden Gate	Florida Governmental Utility Authority	2,750	1.0	0.9	1.5	0.8
Marco Island	Florida Water Services	7,368	3.5	2.7	3.4	1.9
Naples	City of Naples Utilities	12,055	10.0	6.8	7.8	5.6
Bonita Springs	Bonita Springs Utilities	36,568	4.3	2.6	3.2	2.1
Total		**191,405**	**36.3**	**28.0**	**33.9**	**23.6**



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	SUBREGION 1 EXISTING FACILITIES	Figure 2

Table 3
Reuse and Disposal Summary

Facility Name	Disposal Method	Annual Average Daily Flow (MGD)	Maximum Monthly Flow (MGD)	Minimum Monthly Flow (MGD)
Sub-Region 1				
Collier Co. North/Pelican Bay	Reuse	6.6	8.6	4.1
	Surface Water	0.3	1.6	-
	Deep Well Injection	0.3	1.7	-
Collier Co. South	Reuse	3.0	5.0	1.0
	Surface Water	2.3	5.9	0.6
	Deep Well Injection	0.4	2.2	0.0
Golden Gate	Reuse	0.9	1.5	0.8
	Surface Water	-	-	-
	Deep Well Injection	-	-	-
Marco Island Utilities	Reuse	1.2	1.8	0.3
	Percolation Ponds	-	-	-
	Deep Well Injection	0.8	1.8	0.0
Naples	Reuse	3.8	5.1	2.2
	Surface Water	3.0	4.6	1.5
	Deep Well Injection	-	-	-
Bonita Springs	Reuse	2.0	2.3	1.5
	Wet Weather	0.3	0.8	-
	Deep Well Injection	-	-	-
Total Disposal				
	Reuse	**17.5**	**24.3**	**9.9**
	Surface Water	**5.6**	**12.1**	**2.1**
	Deep Well Injection	**1.5**	**5.7**	**0.0**

Table 4
Existing Reclaimed Water Users

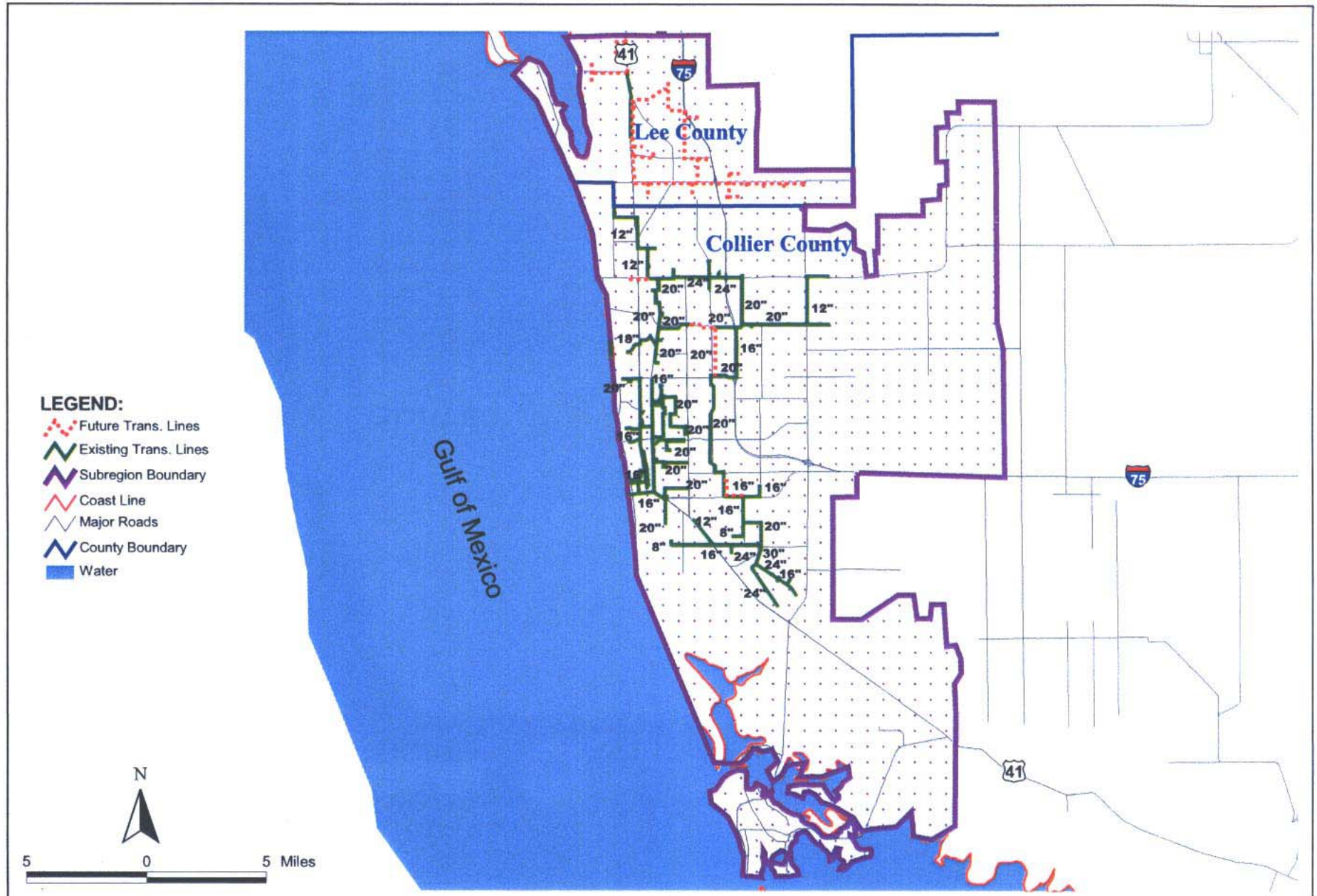
	Existing User	Reuse Demand (MGD)
Sub-Region 1		
Collier Co. North/Pelican Bay		
	Aston	0.05
	Audubon	0.80
	Autumn Woods	0.20
	Bermuda Green	0.02
	Calusa Bay	0.10
	Charleston Sq.	0.02
	Beachwalk Residents Assoc.	0.11
	Collier's Reserve	0.40
	Imperial	0.70
	Palm River	0.70
	Pelican Bay	4.09
	Pelican Marsh	2.60
	St. Croix	0.10
	Tract 21	0.80
	Veteran's Park	0.04
	Vineyards Utility	3.00
	Subtotal	**13.7**
Collier Co. South		
	Countryside/PCP Venture	0.55
	Foxfire Community Assoc. of Collier Co., Inc.	0.97
	Glades Country Club Apts.	1.90
	Hibiscus Golf Club	0.50
	Lakewood Community Services Assoc., Inc.	1.00
	Lakewood Country Club of Naples, Inc.	0.41
	Lely Development District & GC	2.20
	Riviera Golf Club of Naples, Ltd.	0.66
	Royal Palm Country Club	1.00
	Windstar	0.42
	Subtotal	**9.6**
Golden Gate	NI	
Marco Island Utilities	NI	
Naples	Small and Bulk Users	3.8
Bonita Springs		
	Brooks of Bonita Springs	2.24

	Existing User	Reuse Demand (MGD)
	Sweetwater Ranch	0.08
	Fountain Lakes	0.52
	Marsh Landing	0.02
	Woodside Lakes	0.08
	Allendale	0.04
	Eldorado Acres	0.03
	Gulf Atlantic	0.96
	Pelican Landing	2.41
	Bonita Bay	2.69
	Cedar Creek	0.73
	Highland Woods	0.79
	Bonita Fairways	0.75
	Vanderbilt Lakes	0.16
	Woods Edge	0.17
	Spanish Wells	1.22
	Imperial Harbor	0.07
	Bonita Golf Estates	1.34
	Woodbridge Wells	0.04
	Southern Pines	0.04
	Bollt Bonita Excavation	0.04
	Citrus Park	0.23
	Bonita Farms	0.00
	Spruce Run	0.22
	Hunters Ridge	0.81
	Worthington	1.01
	Quail West	0.57
	The Parklands	0.15
	Corkscrew Growers	0.00
	Subtotal	**17.4**
Total Existing Reuse Demand =		**44.6**

*NI denotes no information

Reclaimed Water Transmission Facilities

Existing reclaimed water transmission facilities were identified. Primarily, the focus was on larger pipelines; therefore, distribution systems and smaller lines may not be shown on the maps. Figure 3 presents the existing reclaimed water transmission facilities for the study area.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	RECLAIMED WATER TRANSMISSION LINES SUBREGION 1	Figure 3

Existing Potable Water Supply Facilities

The locations of existing potable water infrastructure including treatment plants, wellfields, surface water intakes and potable water ASR wells were determined. Figure 4 presents the existing potable water infrastructure facilities for the study area.

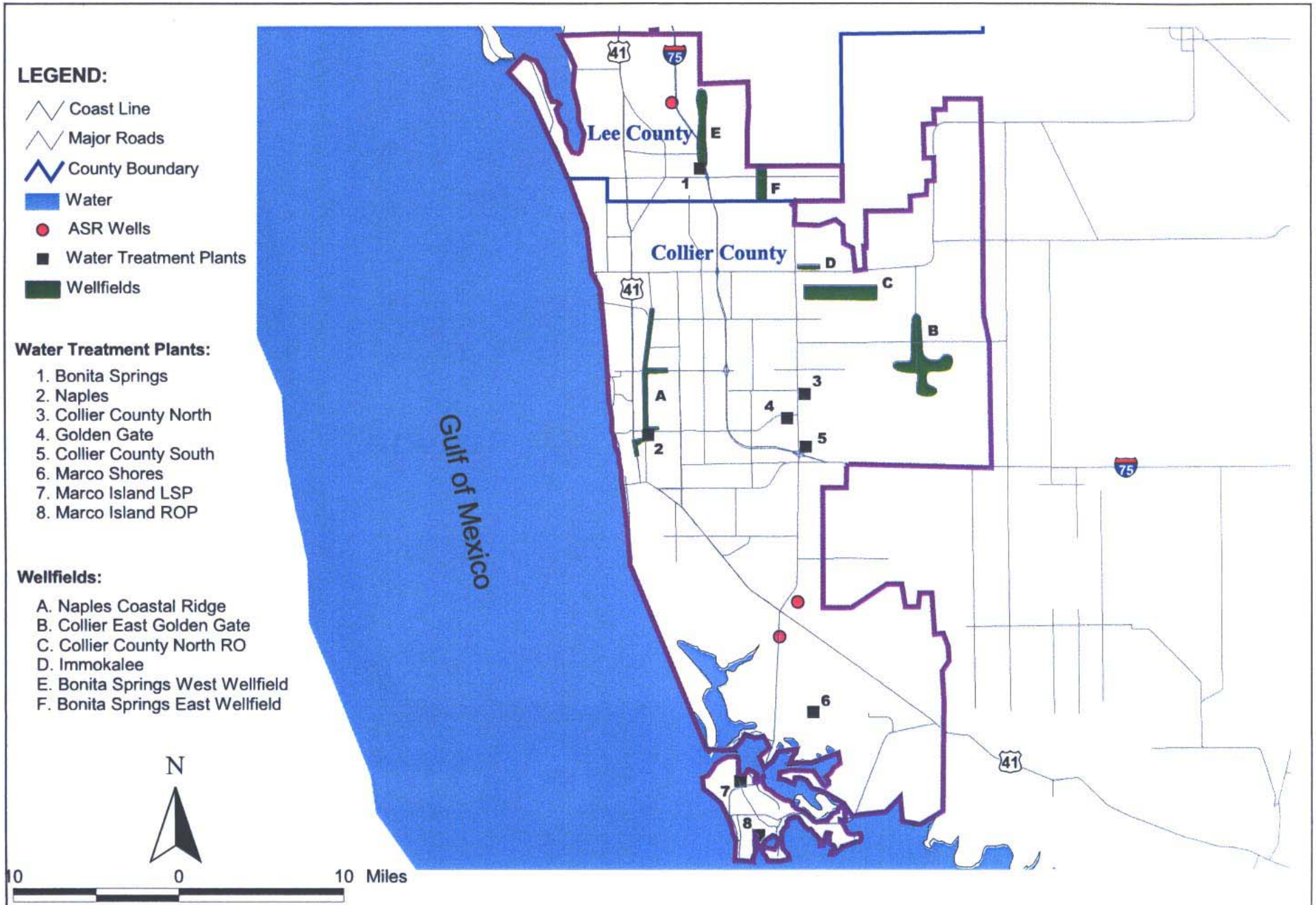
Three reverse osmosis (RO) wellfields were inventoried in the area. Collier County North Water Treatment Plant RO system located in North Collier County consists of 14 existing production wells completed in the Lower Hawthorn Aquifer (LHA)/Upper Floridan Aquifer (UFA) and two permitted proposed wells. Collier County South Water Treatment Plant RO system is predominantly a Mid-Hawthorn Aquifer (MHA) system, but there are four permitted proposed MHA/LHA wells, some of which are under construction at this time. Bonita Springs' RO wellfield consists of eight wells, two of which have been installed.

Existing ASR Systems

Three existing UFA ASR systems were inventoried in the area. Florida Water Services' Marco Lakes surface water ASR system, located in south Collier County, uses three existing ASR wells and has six additional permitted ASR wells. Existing wells are completed in the LHA, with the ASR storage interval between 740 and 790 feet below land surface (BLS). In this system, filtered and disinfected surface water is injected. Recovered water is returned to the surface water reservoir, where it is fully treated along with other plant flows.

Collier County Utilities' Manatee Road potable water ASR system is located in south Collier County, two miles south of the Marco Lakes ASR system. It consists of one ASR well completed in the LHA (650-750 feet BLS).

Bonita Springs Utilities San Carlos Estates potable water ASR system is located in south Lee County. Testing of this system was aborted and the well has been converted to an RO supply well. The well is completed in the LHA (659-721 feet BLS).



Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	EXISTING WATER SUPPLY, WELLFIELD AND ASR LOCATIONS IN SUBREGION I	Figure 4

URBAN IRRIGATION WATER DEMANDS

In order to determine the amount of alternative water sources that will be necessary for future urban irrigation water, an evaluation of service area water demands was performed. This evaluation has revealed that significant increases in urban irrigation demands are projected through 2020. It was concluded that in some areas, historically used groundwater sources and reclaimed water might not be sufficient to support these demands. In addition, the seasonality of demands and potential supplies limits the use of some sources. There is 100 percent utilization of reclaimed water supplies in some portions of this project area during the dry months, while there is a surplus during the wet season. It was determined that sufficient sources of water do exist in the study area to offset a portion of the projected irrigation demands, mainly from surface water and reclaimed water expansions. It is clear that storage will be an integral component of this project to span the gap between the seasonal variability of wet weather surpluses and dry season deficits.

The urban irrigation water demands were developed using the modified Blaney-Criddle (B-C) model as provided by the District. The B-C methodology is explained in Attachment A. The demands were generated for the 1-in-10 year drought event, Table 5.

The B-C modeling analysis, included as Attachment B, used the following input variables to determine the urban irrigation water demands:

- Rainfall Station: Naples or Ft. Myers
- Irrigation System: Sprinkler
- Crop: Turf Grass
- Soil Type: Collier, 0.4 and Lee, 0.8 (based on Figures C-8 and C-4 from the Management of Water Use Permitting Information Manual, Vol. III)

Table 5
1-in-10 Year Drought Rainfall Values (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Collier	1.5	1.6	0.1	0.7	3.0	5.6	6.8	7.2	7.5	3.6	1.2	1
Lee	1.3	1.7	0.3	0.7	2.9	7.2	6.8	7.4	8	2.4	1.2	1.3
Average	1.4	1.65	0.2	0.7	2.95	6.4	6.8	7.3	7.75	3	1.2	1.15

Reclaimed water service areas were assumed to follow wastewater service areas. Figures 5 and 6 delineate the existing and projected future wastewater/reclaimed water service areas for the study area.

Monthly urban irrigation demands were projected based on irrigable acreage of each service area. There are two main components of the irrigable area including developed (residential and to a lesser extent, commercial) and open space areas (typically golf courses). Based on experience in Cape Coral and other reuse systems, a factor of 0.075 developed irrigable acres per capita was used for the regions. Open space irrigable areas were then added to the developed irrigable areas for each service area. As shown in Tables 6 and 7, this methodology resulted in total irrigable acreages of between 10 and 63 percent of the total acreages, depending on service area. These percentages are reasonable for the land use types encountered, namely, mixed-use areas, primarily residential with un-developable areas not requiring significant irrigation needs such as wetlands, surface water, and retail/commercial areas.

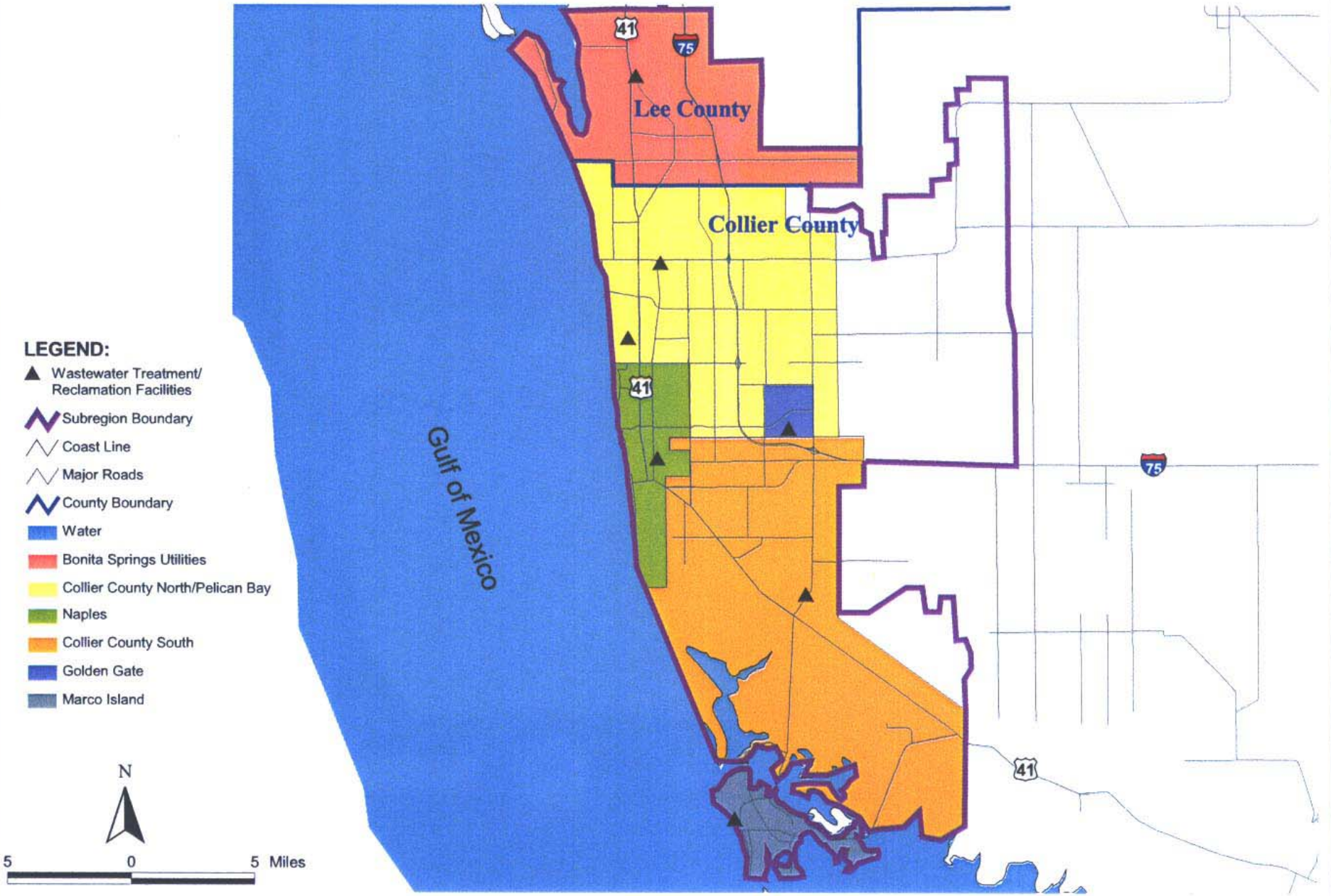
Table 6
Irrigable Acreage – Current

Facility Inventory	Total Acreage	Developed Irrigable Acreage	Open Space Irrigable Acreage	Total Irrigable Acreage
Collier Co. North & Pelican Bay	54,374	4,627	3,170	7,797
Collier Co. South	78,290	4,862	4,198	9,060
Golden Gate	2,750	1,571	163	1,734
Marco Island Utilities	7,368	950	265	1,215
Naples	12,055	2,394	974	3,368
Bonita Springs	36,568	2,543	1,022	3,565
Total	**191,405**	**16,950**	**9,790**	**26,740**

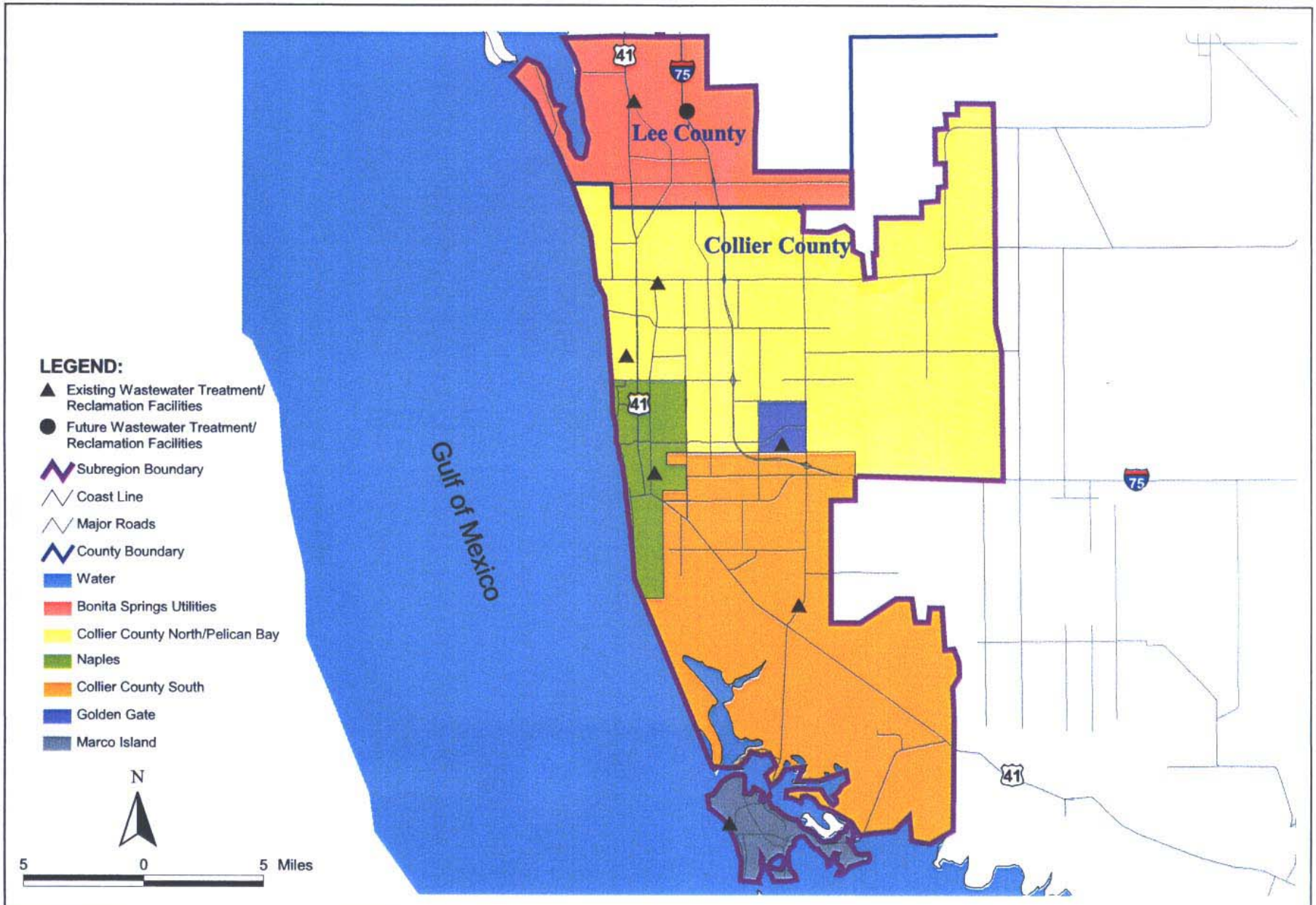
Table 7
Irrigable Acreage – Future

Facility Inventory	Total Acreage - Future	Developed Irrigable Acreage	Open Space Irrigable Acreage	Total Irrigable Acreage
Collier Co. North & Pelican Bay	109,861	10,343	5,346	15,690
Collier Co. South	86,251	10,928	4,198	15,126
Golden Gate	2,750	1,571	163	1,734
Marco Island Utilities	7,368	1,410	361	1,772
Naples	12,055	2,770	974	3,744
Bonita Springs	36,568	4,786	1,022	5,808
Total	**254,850**	**31,808**	**12,064**	**43,872**

Urban irrigation water demands were estimated monthly for each service area, which required a modification to the B-C method. The B-C method does not realistically predict irrigation demands for the wet season (July through October) in Southwest Florida. With heavy local rainfall and an elevated water table, irrigation demands historically decrease during this time. For the wet season, reuse factors (ratio of monthly reuse demand to annual average reuse demand) were determined for each service area, with the exception of those not having a reuse flow; an average factor was then used. Therefore, the average demand as predicted by the B-C model was used for non-wet season months. The reuse factors were applied to these non-wet season demands to obtain the wet season demands. This methodology is described more thoroughly in Attachment A.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	EXISTING WASTEWATER SERVICE AREAS SUBREGION 1	Figure 5



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	FUTURE WASTEWATER SERVICE AREAS SUBREGION 1	Figure 6

Tables 8 and 9 present these monthly demands for each service area. Figures 7 and 8 show the annual average demands spatially.

Current and future annual average irrigation demands for the Study Area are 86 and 132 MGD respectively. These numbers predict a 53% increase between 2000 and 2020. Considering areas such as Bonita Springs and much of Collier County are anticipating substantial growth, these estimates appear reasonable. However, the projected demands were more significant than expected. It is important to note that future water conservation efforts such as xeriscape landscaping, irrigation hours, and other mandatory ordinances were not taken into consideration for this analysis. Significant conservation efforts have been in effect for some time; therefore, demand projections are not expected to vary significantly.

Table 8
Urban Irrigation Demand Estimate - Current

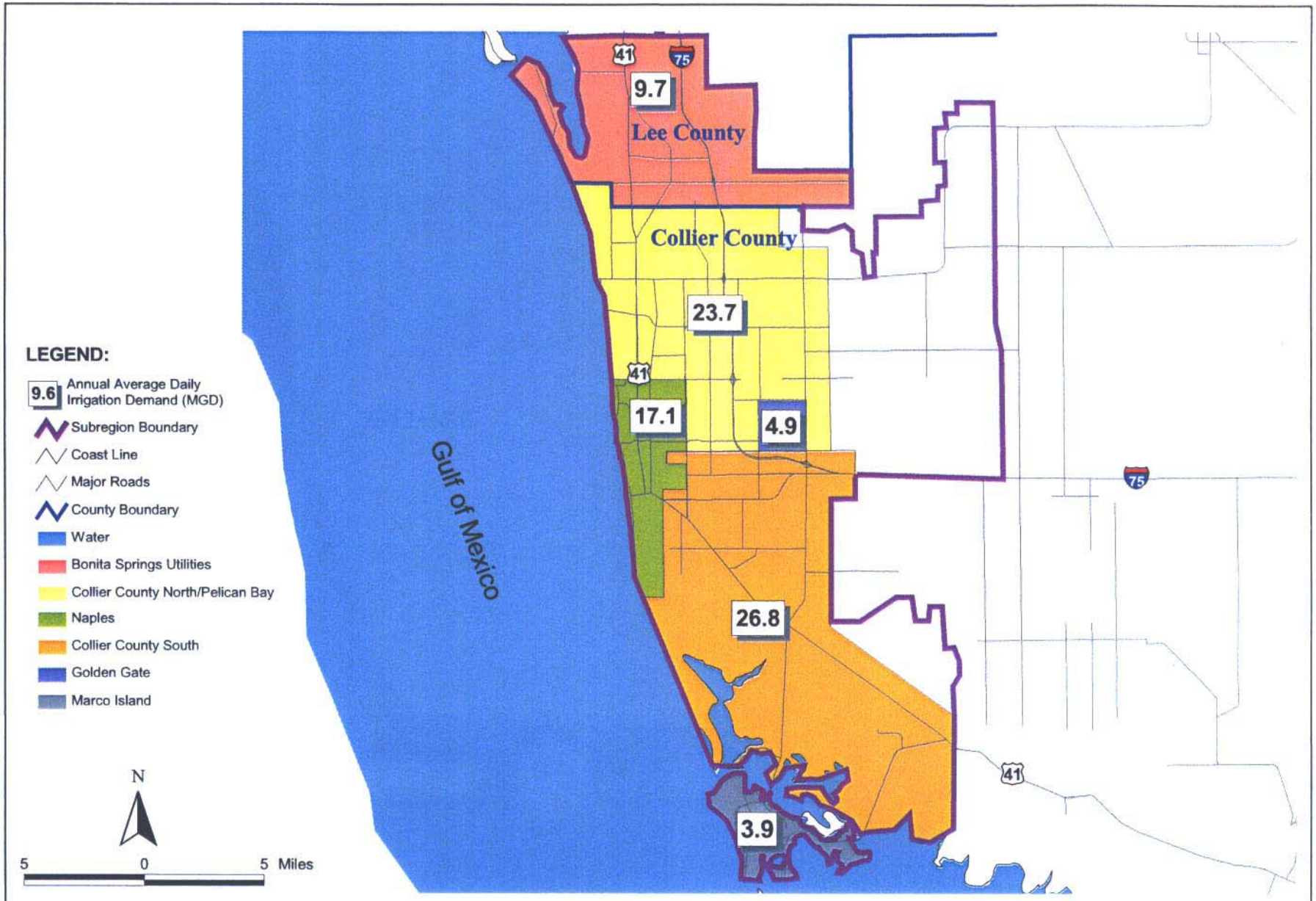
Facility	Monthly Irrigation Demand (MGD) [1]												Annual Average
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	(MGD)
1-in-10 Drought Rainfall (in)	1.4	1.7	0.2	0.7	3.0	6.4	6.8	7.3	7.8	3.0	1.2	1.2	3.4
Collier Co. North	9.5	12.4	27.7	35.8	37.5	35.3	21.8	23.4	26.2	20.7	20.3	13.5	23.7
Collier Co. South	11.9	15.5	34.6	44.7	46.9	44.1	26.1	19.7	11.4	25	25.3	16.8	26.8
Golden Gate	1.8	2.4	5.4	6.9	7.3	6.8	5	4.5	7.6	4.4	3.9	2.6	4.9
Marco Island Utilities	1.5	1.9	4.2	5.5	5.8	5.4	4	3.6	6	3.5	3.1	2.1	3.9
Naples	6.8	8.8	19.7	25.4	26.7	25.1	17.4	17.4	17.2	17	14.4	9.6	17.1
Bonita Springs	4	4.8	11.6	15.8	16.6	12.4	8.3	9.9	10.7	8.6	8.2	4.9	9.7
Total Monthly Demand (MGD)	**35.5**	**45.8**	**103.2**	**134.1**	**140.8**	**129.1**	**82.6**	**78.5**	**79.1**	**79.2**	**75.2**	**49.5**	**86.1**

[1] B-C results used for January through June and October through December. Factors of current reuse demand to annual average reuse demand were applied to the average of the B-C results for January through June and October through December.

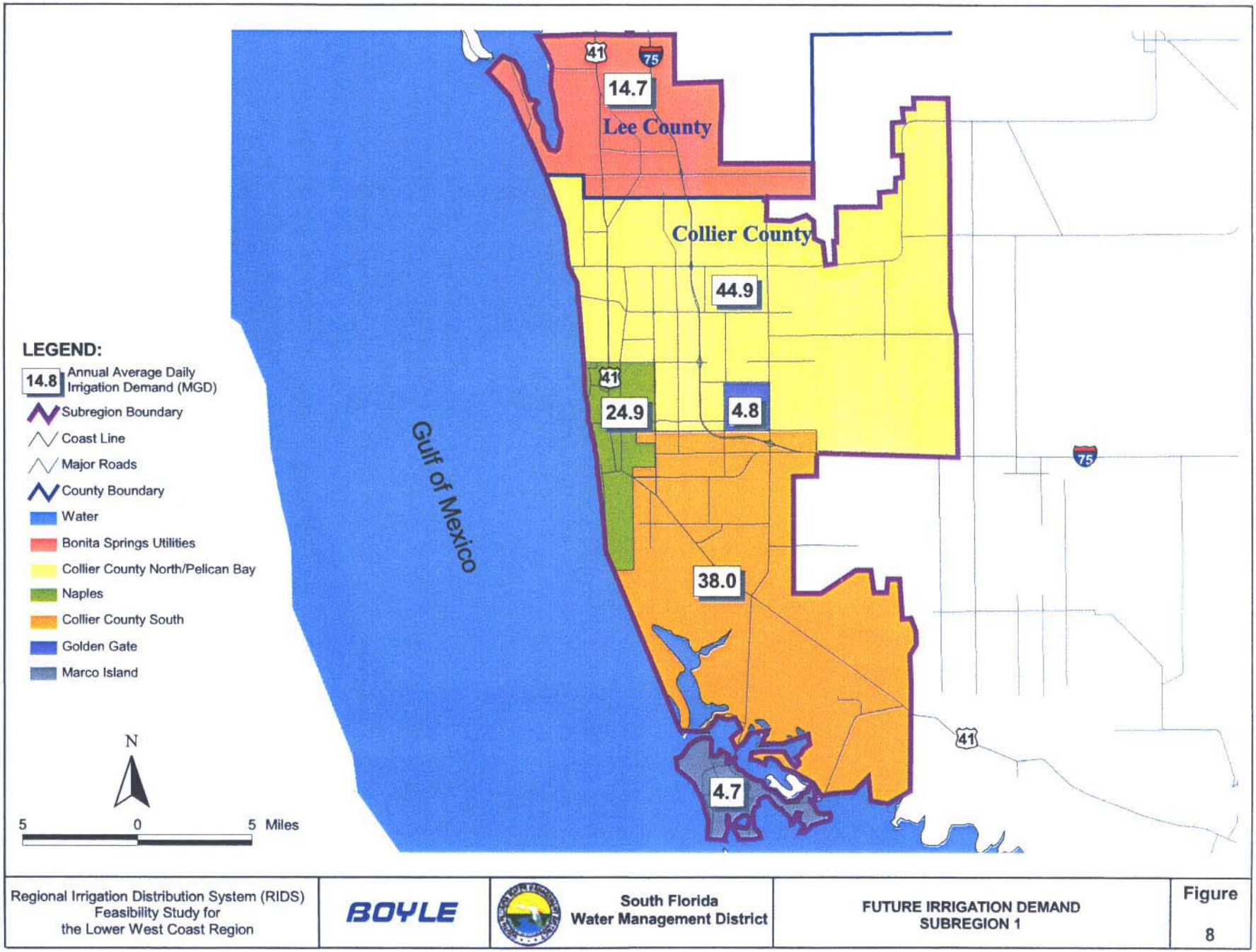
Table 9
Urban Irrigation Demand Estimate – Future (Year 2020)

Facility	Monthly Irrigation Demand (MGD) [1]												Annual Average
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	(MGD)
1-in-10 Drought Rainfall (in)	1.4	1.7	0.2	0.7	3.0	6.4	6.8	7.3	7.8	3.0	1.2	1.2	3.4
Collier Co. North	18.1	23.6	52.5	67.8	71.2	67	41.2	44.4	49.8	39.3	38.4	25.6	44.9
Collier Co. South	16.9	21.9	48.9	63.1	66.3	62.4	37	27.9	16.2	35.3	35.8	23.8	38.0
Golden Gate	1.8	2.4	5.2	6.8	7.1	6.7	4.9	4.4	7.5	4.3	3.8	2.6	4.8
Marco Island Utilities	1.8	2.3	5.1	6.6	7	6.5	4.8	4.3	7.3	4.2	3.8	2.5	4.7
Naples	9.9	12.8	28.6	37	38.8	36.5	25.2	25.3	25	24.8	20.9	13.9	24.9
Bonita Springs	6.1	7.3	17.7	24.1	25.4	18.9	12.7	15.2	16.3	13.2	12.5	7.5	14.7
Total Monthly Demand (MGD)	**54.6**	**70.3**	**158**	**205.4**	**215.8**	**198**	**125.8**	**121.5**	**122.1**	**121.1**	**115.2**	**75.9**	**132.0**

[1] B-C results used for January through June and October through December. Factors of current reuse demand to annual average reuse demand were applied to the average of the B-C results for January through June and October through December.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	CURRENT IRRIGATION DEMAND SUBREGION 1	Figure 7



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	FUTURE IRRIGATION DEMAND SUBREGION 1	Figure 8

POTENTIAL URBAN IRRIGATION WATER SOURCES

An inventory of potential sources of irrigation water supply was conducted to address future irrigation water needs in the Study Area. These potential sources of supply were:

- Reclaimed wastewater from municipal wastewater treatment plants
- Water recovered during the dry season from reclaimed water aquifer storage and recovery (ASR) systems recharged during the wet season
- Surface water from streams, rivers, abandoned borrow pits, and canal systems having salinity control structures
- Water recovered during the dry season from surface water ASR systems recharged during the wet season
- Groundwater from irrigation supply wells

Reclaimed Water

Current and projected 2020 reclaimed water availability is presented in Tables 10 and 11. This source is equivalent to the projected wastewater flows. The values were generated by dividing monthly wastewater flows by service area populations. The resulting per capita wastewater generation factors were multiplied by the projected 2020 populations; allowing temporal variability to be accounted for in the future projections.

Reclaimed Water ASR Systems

Reclaimed water ASR is becoming more accepted with established regulations for obtaining the necessary permits throughout Florida. There are several reclaimed water ASR systems currently permitted and in some stage of startup and testing. Reclaimed water ASR is considered the best method for optimizing existing irrigation water supplies and balancing storage needs.

To determine the projected irrigation shortfalls that could be met by reclaimed water ASR systems, it was assumed the mean wet season wastewater flow for each utility would be injected for a period of 120 days and later recovered at an 75% efficiency rate for a period of 180 days. The 75% efficiency factor reflects the loss of some injected water through diffusion and dispersion with native groundwater in the storage aquifer. In this study it was assumed the UFA, which contains brackish native groundwater, would be used as the storage aquifer. The net result is the dry season recovery rate would be approximately 50% of the wet season mean injection rate in MGD, if recovery to a dissolved chloride concentration of 350 mg/l is permitted by SFWMD. The remaining dry season irrigation deficits would be met by supplemental sources of supply. Potential year 2020 mean dry season reclaimed water ASR recovery for the Study Area is 23 MGD, excluding contributions from the Marco Island WWTP, which are not anticipated to contribute to the system.

Table 10
Existing Monthly Average Wastewater Flows

Facility	Monthly Flows (MGD)												Annual Average (MGD)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Collier Co. North/ Pelican Bay	9.6	10	10.4	9.1	7.7	7.1	6.9	7.8	8.6	8.4	9.1	8.9	8.6
Collier Co. South	6.7	7	6.9	6.4	5.5	5.4	5.6	6.3	7.5	6.5	6.6	6.3	6.4
Golden Gate	0.9	0.8	0.8	0.8	0.8	0.8	1	0.9	1.5	0.9	0.8	0.9	0.9
Marco Island Utilities	2.5	3.1	3.4	2.7	3	3.1	2.9	3.2	1.9	2.1	2.1	2	2.7
Naples	6.7	6.9	7.3	6.8	5.6	5.8	7.8	7.1	6.8	6.7	6.8	6.7	6.8
Bonita Springs	2.9	3.2	3.1	2.9	2.3	2.1	2.5	2.4	3.1	2.4	2.3	2.4	2.6
Total Monthly Flow (MGD)	**29.3**	**31**	**31.9**	**28.7**	**24.9**	**24.3**	**26.7**	**27.7**	**29.4**	**27**	**27.7**	**27.2**	**28.0**

Table 11
Projected Year 2020 Monthly Average Wastewater Flows

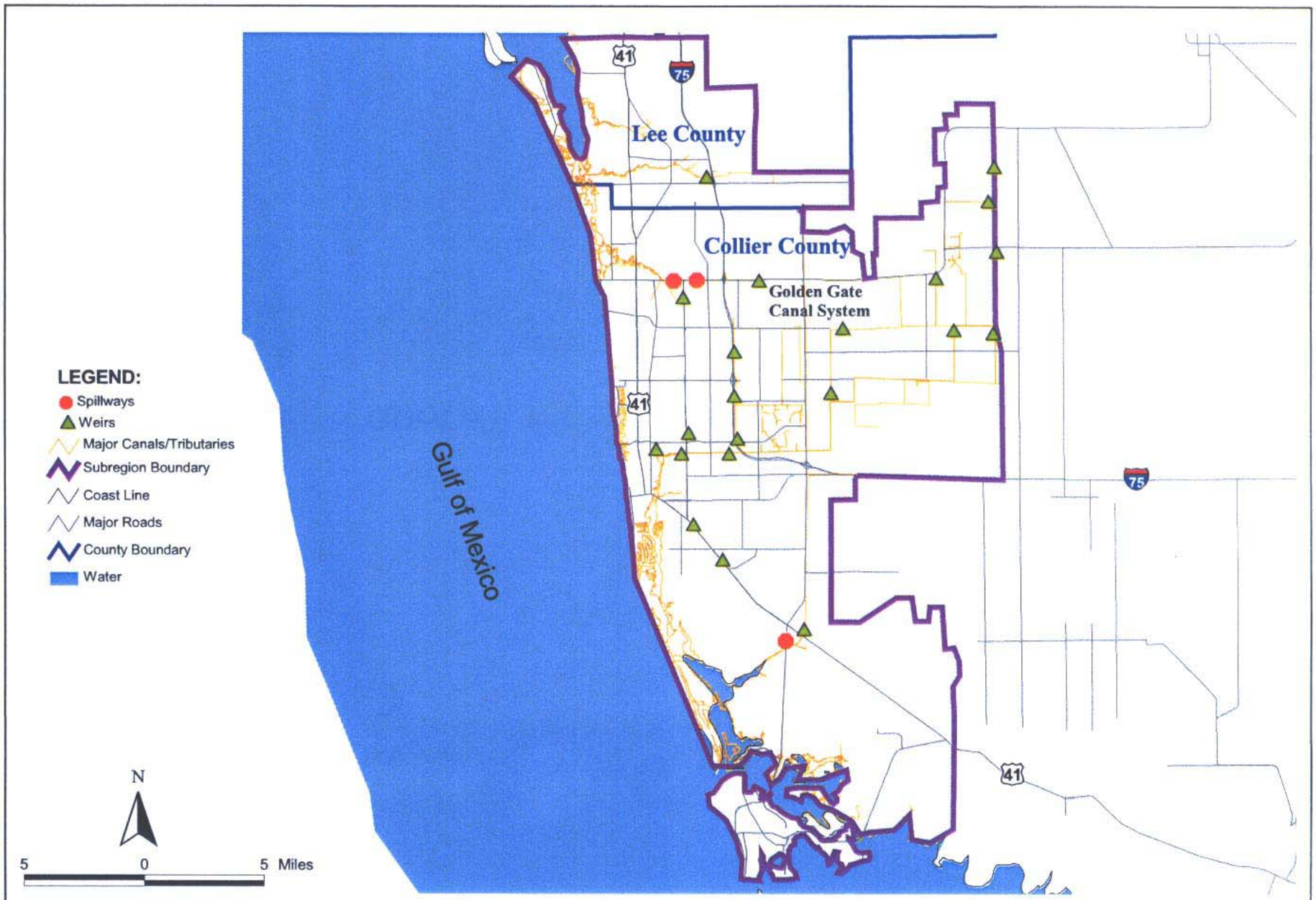
Facility	Monthly Flows (MGD)												Average (MGD)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Collier Co. North	20.2	21.1	21.9	19.2	16.2	15	14.7	16.5	18.2	17.8	19.1	18.9	18.2
Collier Co. South	14.2	14.7	14.7	13.5	11.5	11.4	11.9	13.2	15.9	13.7	13.9	13.2	13.5
Golden Gate	0.9	0.8	0.8	0.8	0.8	0.8	1	0.9	1.5	0.9	0.8	0.9	0.9
Marco Island Utilities	3.8	4.8	5.1	4	4.5	4.8	4.4	4.8	2.8	3.2	3.2	3.1	4.0
Naples	10.5	10.9	11.4	10.7	8.7	9.1	12.2	11.1	10.7	10.5	10.6	10.5	10.6
Bonita Springs	5.4	6	5.8	5.4	4.3	4	4.6	4.6	5.8	4.5	4.4	4.5	4.9
Total Monthly Flow (MGD)	**55**	**58.3**	**59.7**	**53.6**	**46**	**45.1**	**48.8**	**51.1**	**54.9**	**50.6**	**52**	**51.1**	**52.2**

Surface Water

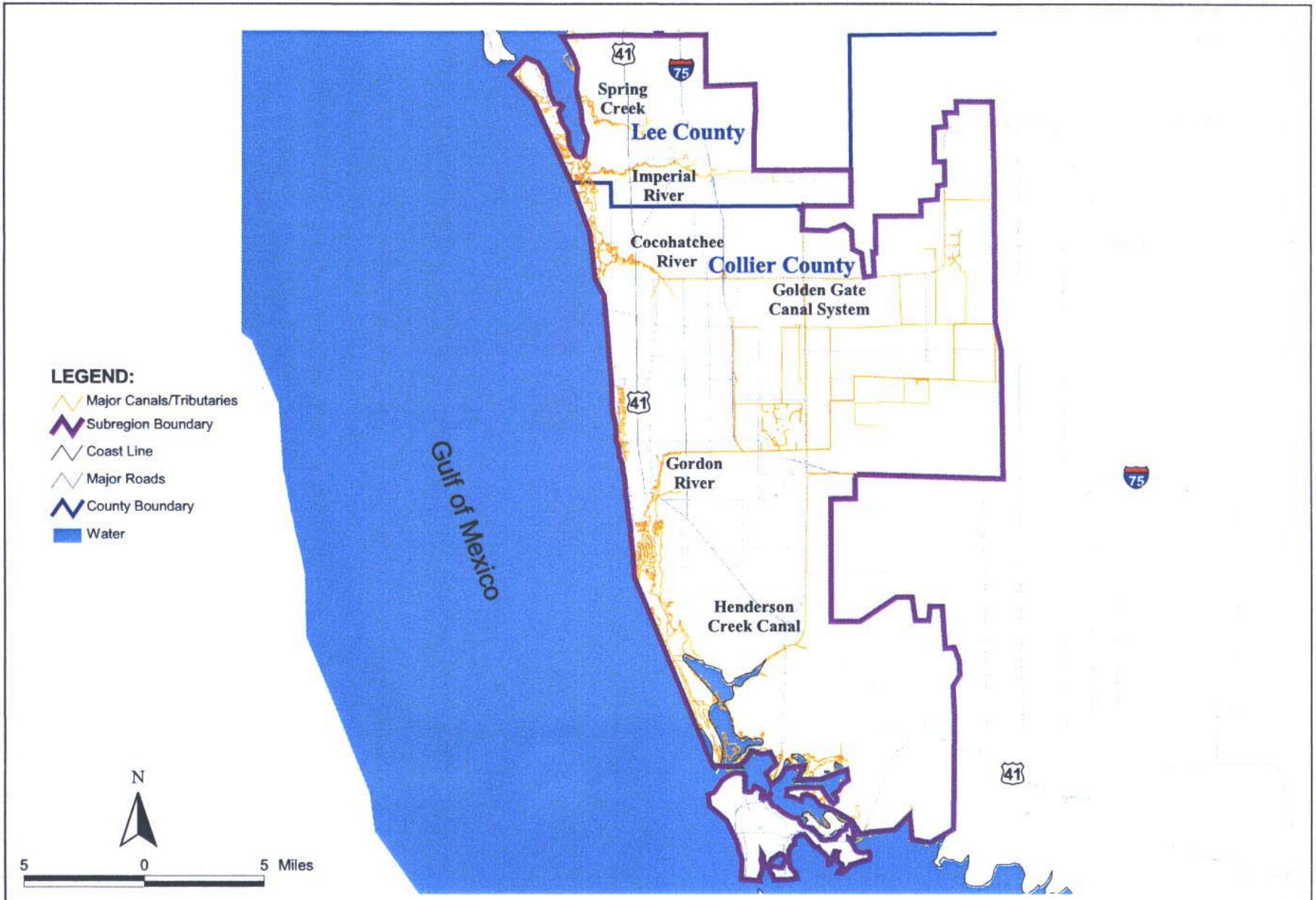
Figures 9 and 10 present the surface water bodies and major control structures within the study area. Flow for eight of the surface water bodies is measured and recorded by either the United States Geological Survey (USGS) or the District. Surface water stage data is available for one of the remaining two surface water bodies. Nine of the 10 surface water bodies inventoried have salinity control structures. This means these water bodies could be used as dry season sources of supply, if flow rates are deemed to be adequate. Available record flow data was tabulated and analyzed for the surface water bodies. Summaries of these tabulations and analyses are provided in Attachment C. An inventory of these streams, rivers, and canals in the sub-region is presented in Table 12.

In a typical year, the four-month period of highest surface water flow occurs from July through October. This represents an approximate one-month delay from the four-month period of highest rainfall (i.e., June through September). Therefore, in the analyses of the surface water flow data for this study, the wet season is considered to be July through October, and the dry season is considered to be the six-month period of December through May. The months of November and June are considered transitional and were not integrated into the statistical analyses.

To evaluate the potential use of surface water systems, a mean dry season flow of 20 MGD was set as a limiting factor. This would provide for 2 MGD if a 10% diversion rate for irrigation purposes were permitted. The remaining 90% of flow would support environmental needs. Based on these criteria, only two surface water bodies have potential for use as dry season sources of supply. These are the Golden Gate Canal system and the Faka Union Canal system. However, drought condition flow evaluations indicate the Golden Gate and Faka Union Canal systems would not be reliable sources during 1-in-10 year drought events. It should also be noted the Comprehensive Everglades Restoration Plan (CERP) will likely curtail future allocations from the Caloosahatchee River. The District has indicated that surface water should not be considered as potential dry season supplemental water source for the RIDS because of the CERP and ongoing shortages. Therefore, use of surface water as a supplemental irrigation source is limited to recovery from surface water ASR systems recharged during the wet season.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	SURFACE WATER RESOURCES STRUCTURES SUBREGION 1	Figure 9



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	MAJOR WATER BODIES SUBREGION 1	Figure 10

Table 12
Summary of USGS and SFWMD Stream Flow Data

Water Body	Gauge Location	Period of Record	Mean Wet Season Flow (MGD)	Mean Dry Season Flow (MGD)	1-in-10 Year Dry Season Flow (MGD)	Utility Service Area
Golden Gate Canal System	17th Ave SW	1965-84	208	60	4	Collier County Utilities
Golden Gate Canal System	Airport Rd.	1964-84	394	82	2	Collier County Utilities
Faka Union Slough	0.5 miles north US 41	1978-99	342	64	0	Collier County Utilities
Cocohatchee River	Willoughby Acres Bridge	1969-99	45	7	1	Collier County Utilities
Imperial River*	Orr Road	1941-54, 1988-2000	146	17	7	Bonita Springs Utilities
Henderson Creek Canal	Near US 41	1968-99	29	5	0	Florida Water Ser./CCU
Spring Creek*	Old US 41	1989-2000	12	2	0	Bonita Springs Utilities
Gordon River	SR 886	1972-84, 1991-99	1	1	0	City of Naples
Okaloacoochee Slough	Near Sunniland	1979-80	N/A	N/A	N/A	Collier County Utilities
Kehl Canal	Near Bonita Garden Rd.	Unknown	Est. 117[1]	Est. 14[1]	0[2]	Bonita Springs Utilities

[1] Estimated as 80% of Downstream Flow at Orr Road on Imperial River
[2] From CH_2MHill, 2002 Report to Bonita Springs Utilities (rounded to nearest whole number)
*=No salinity control structure

Surface Water ASR Systems

Using the previously established criteria of a minimum wet season flow of 20 MGD and a diversion rate of 20% to a surface water ASR system, six potential surface water ASR systems were identified. These systems are presented in Table 13.

Table 13
Summary of Potential Surface Water ASR Systems

Irrigation Supply Source	*Pumping Station Location*	**Mean Dry Season Recovery Rate (MGD)[2]**	**Average Dry Season Surface Water Flow (MGD)[3]**	**Utility Service Area**
Golden Gate Canal System	17th Ave SW	21	15	Collier County Utilities
Golden Gate Canal System	Airport Rd.	39	18	Collier County Utilities
Faka Union Slough	0.5 miles north US 41	34	7	Collier County Utilities
Cocohatchee River	Willoughby Acres Bridge	5	1	Collier County Utilities
Imperial River*	Kehl Canal	12	1	Bonita Springs Utilities
Henderson Creek Canal	Near US 41	3[1]	2[1]	Florida Water Ser./CCU

[1] Source currently being used for municipal potable or reuse system.
[2] Based on 20% diversion of wet season surface water flow to ASR system for 120 days and 75% recovery efficiency for 180 days.
[3] Based on 10% diversion of dry season surface water flow.
* = No salinity control structure.

The storage aquifer for the potential surface water ASR systems was again (as in the case of reclaimed water ASR systems) assumed to be the UFA. A minimum distance of two miles from existing and permitted municipal RO supply wells and potable water ASR systems was used in the site selection process. In most cases the location selected for a surface water ASR system was adjacent to a control structure. For the Kehl Canal system, the ASR wellfield would be located 1 mile southwest of the Kehl Canal Weir at the Palmyra Country Club to maintain the desired 2-mile setback from the planned Bonita Springs East RO wellfield.

Groundwater

Groundwater is currently used as a supplemental irrigation source for reuse water by Collier County Utilities. Collier County Utilities uses Lower Tamiami Aquifer wells at its Pelican Bay wellfield and is utilizing water-table aquifer wells at Mule Pen Quarry to further supplement this system. The future use of water-table aquifer horizontal well systems located in road rights-of-way is potentially feasible. However, the use of vertical wells withdrawing from freshwater aquifers, constructed by municipalities, to provide supplemental water for irrigation purposes will likely be discouraged by the District. Because

the year 2020 supplemental irrigation water needs can likely be met within the study area by the alternative discussed herein, a more detailed evaluation of groundwater sources of supply is not provided as part of this study. However, as indicated above, the potential does exist for utilizing surficial aquifer horizontal wells as a supplemental RIDS source in selected locations. Also, horizontal wells constructed at select golf courses and other locations could be utilized as an injection water source for Floridan Aquifer ASR wells. This may serve to more efficiently utilize a resource that would otherwise be pumped from wet areas and stormwater systems and ultimately discharged to tidal water bodies during the wet season.

STORAGE AND DISTRIBUTION OPTIONS

Storage is the most critical part of the RIDS to optimize current sources and to balance supply and demand. ASR systems are considered an integral part of potential storage. A minimum distance of two miles from existing and permitted municipal RO supply wells and potable water ASR systems was used in the site selection process. Also, a semi-regional approach for reclaimed water ASR systems was utilized to maximize the recharge capacity of such systems while providing siting flexibility.

Aquifer Suitability for Surface and Reclaimed Water ASR

The data used in this investigation come from several sources including Water Resource Solutions (WRS) in-house database, SFWMD, Florida Geological Survey, Florida Department of Environmental Protection, Bureau of Geology, consultant reports, and publications.

Because of its extensive use in coastal areas of the region, the study did not consider the MHA system as a potential ASR storage interval, but rather was focused on the UFA, starting from the LHA down through the Ocala. Data from existing ASR systems, existing RO systems, and available wells which provide some information about the UFA were evaluated and used to delineate locations for potential surface water and reclaimed water ASR systems.

A total of 113 deep wells were inventoried in the area (Attachment D). Wells with either lithological or geophysical log information were reviewed to delineate the hydrostratigraphy of the area. A hydrostratigraphic database is provided (Attachment E). As shown, information for 84 wells, regarding shallow aquifers (from MHA to Water Table Aquifer) was obtained from the recently completed SFWMD "Lower West Coast Potentiometric Mapping Project" (WRS, 2003). Four cross-sections showing the hydrostratigraphy of the area were generated. A map showing lines of cross-section is provided and the cross-sections are provided as Attachment F. A subsurface structure contour map on top of Suwannee Formation is also provided. As seen on the cross-sections some zones of the LHA/UFA may potentially be suitable for ASR. Criteria for selecting potential ASR zones include confinement above and below, a thickness of between 40 and 100 feet, and a lack of nearby users of the zone. Site-specific subsurface testing will be needed to demonstrate the feasibility of the potential aquifer zones at each location.

Planned ASR Systems

The following ASR systems are either planned or have been identified as potential systems by municipalities in the Study Area. Some of these may be in concert with the RIDS, if they are constructed.

- Collier County North Reclamation Facility (Pelican Bay Wellfield)

- Kehl Canal Surface Water ASR System
- Pelican Landing Reclaimed Water ASR System
- Bonita Bay Reclaimed Water ASR System
- West Water Reclamation Facility

Potential Surface Water and Reclaimed Water ASR Systems

Based on the RIDS Master Plan evaluation of surface water flows and the present detailed subsurface evaluation, five potential surface water ASR systems have been identified. These are:

- Golden Gate Canal at 17th Ave.
- Golden Gate Canal at Airport Rd.
- Faka Union Slough
- Cocohatchee River
- Kehl Canal

It should be noted that Imperial River and Henderson Creek Canal potential surface water ASR systems have been removed from the original list proposed in the RIDS Master Plan. This is because the Henderson Creek Canal already has an ASR system while the Imperial River has no salinity control structure.

Integrating the hydrostratigraphic information with the capacities of the planned and existing infrastructure for the reclaimed water facilities in the sub-region, eight potential reclaimed water ASR systems were identified. These potential reclaimed water ASR systems are:

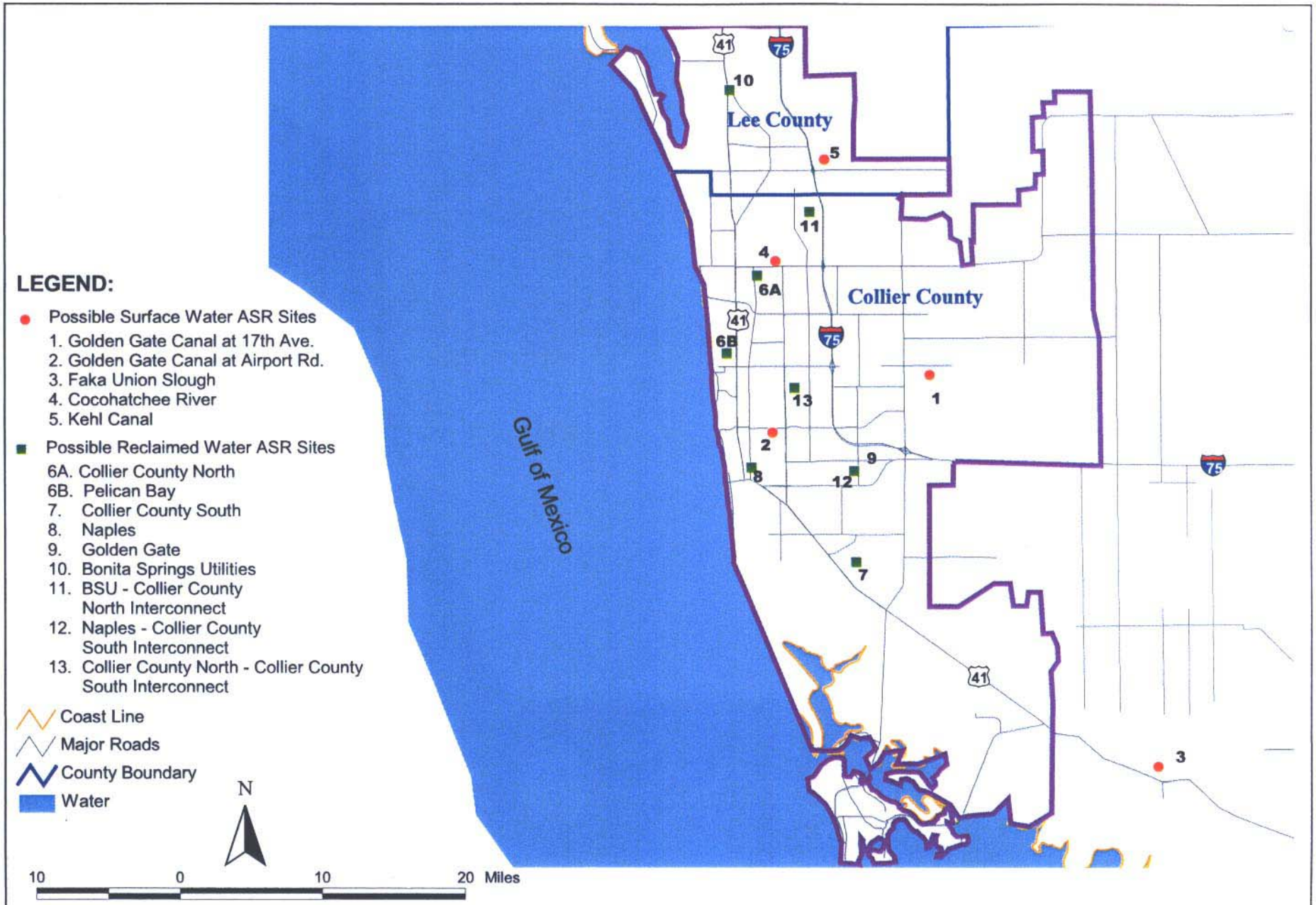
- Collier County North/Pelican Bay Area
- Collier County South Water Reclamation Facility
- Naples Wastewater Treatment Plant
- Golden Gate Wastewater Treatment Plant
- Bonita Springs Utilities West Water Reclamation facility
- BSU – Collier County North Interconnection
- Naples – Collier County South Interconnection
- Collier County North – Collier County South Interconnection

Details on these potential surface water and reclaimed water ASR systems are presented and ranked in Table 14. The rankings were based on the system's potential to significantly contribute to a RIDS. The ranking considered capacity, proximity to existing infrastructure, and potential for success as discussed herein. System locations are shown on Figure 11.

Table 14
Collier County – Bonita Springs Sub-Region
Summary of Ranked Potential Surface Water & Reclaimed Wastewater ASR Systems

ASR SITE #	DESCRIPTION	LOCATION (QTR S-T-R)	PTD (ft)	MEAN DRY SEASON RECOVERY RATE (MGD)	ULTIMATE # WELLS	POTENTIAL STORAGE ZONES	OVERALL RANK
Surface Water ASR Systems							
1	Golden Gate Canal at 17th Ave.	SW 14-49S-26E	950	20.0	28	SU I, II, III	2
2	Golden Gate Canal at Airport Rd.	NE 35-49S-25E	1000	25.0	35	LH I, II, III: SU I, II, III	1
3	Faka Union Slough	SE 04-52S-28E	950	25.0	35	LH I, II: SU I-IV	10
4	Cocohatchee River	SW 24-48S-25E	1100	5.0	8	LH I; SU I-V	11
5	Kehl Canal	SW 31-47S-26E	1200	12.0	18	SU II & III	9
Reclaimed Water ASR Systems							
6A	Pelican Bay	NW 26-48S-25E	1100	8.1	13	LH I & II; SU I-V	7
6B	Collier County North	NE 09-49S-25E	1100				
7	Collier County South	C 20-50S-26E	900	6.6	11	LH III; SU I-III	8
8	Naples	N/2 03-50S-25E	95	5.4	14	LH I-III; SU I-III	6
9	Golden Gate	N/2 33-49S-26E	95	0.5	2	LH I, II, IV; SU I-III	13
10	Bonita Springs Utilities	SE 16-47S-25E	1200	2.4	5	LH I & II; SU I-III	12
11	BSU - Coll. Cnty North Interconnect*	C 13-48S-25E	1100	10.5	15	LH I & II; SU I-V	5
12	Naples - Coll. Cnty South Interconnect*	C 05-50S-26E	1000	12.0	18	LH I-III; SU I-IV	3
13	Coll. Cnty North - Coll. Cnty South Interconnect*	C 13-49S-25E	1050	14.7	21	LH I-III; SU I-III	4

QTR S-T-R = Quarter Section-Township-Range
PTD = Proposed Total Depth
MGD = Million Gallons Per Day
LH = Lower Hawthorn portion of Upper Floridan Aquifer System
SU = Suwannee portion of Upper Floridan Aquifer System
I = Zone I
*ASR recovery rates for the interconnect options are redundant with the other reclaimed water ASR options, i.e., not all of the potential reclaimed water ASR systems need be constructed to maximize the resources.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	POSSIBLE SURFACE AND RECLAIMED WATER ASR SITES SUBREGION I	Figure 11

SUPPLY AND DEMAND ANALYSIS

In order to determine the amount of alternative water sources required to meet projected irrigation demands, a comparison of future urban irrigation supply and demand was made. Irrigation water surpluses and deficits were identified both geographically and temporally in the defined study area and integrate the potential storage options to be identified in the subsequent subtask. The demands developed previously in the memorandum were compared to the existing and projected supplies, including reclaimed water, groundwater, surface water and surface and reclaimed water ASR. The subsequent surplus or deficit is identified for each service area. Tables 15 and 16 present the surplus/deficit summary for each service area. Figures 12 and 13 display the surplus and deficit information derived from this analysis.

A list of potential end users for the RIDS has been determined based on information received from local governments and review of information from the Lee County and Collier County planning departments. This includes existing and planned new golf courses, large green space areas, and future large planned residential developments. Table 17 presents the list of potential users.

Also, a summary of the existing agricultural users within the study area is provided as Attachment G. Nearly 600 MGD is currently utilized for agricultural irrigation during the dry season in the study area. Most of this water is derived from surficial and intermediate aquifer wells.

Table 15
Surplus/Deficit Analysis – Current

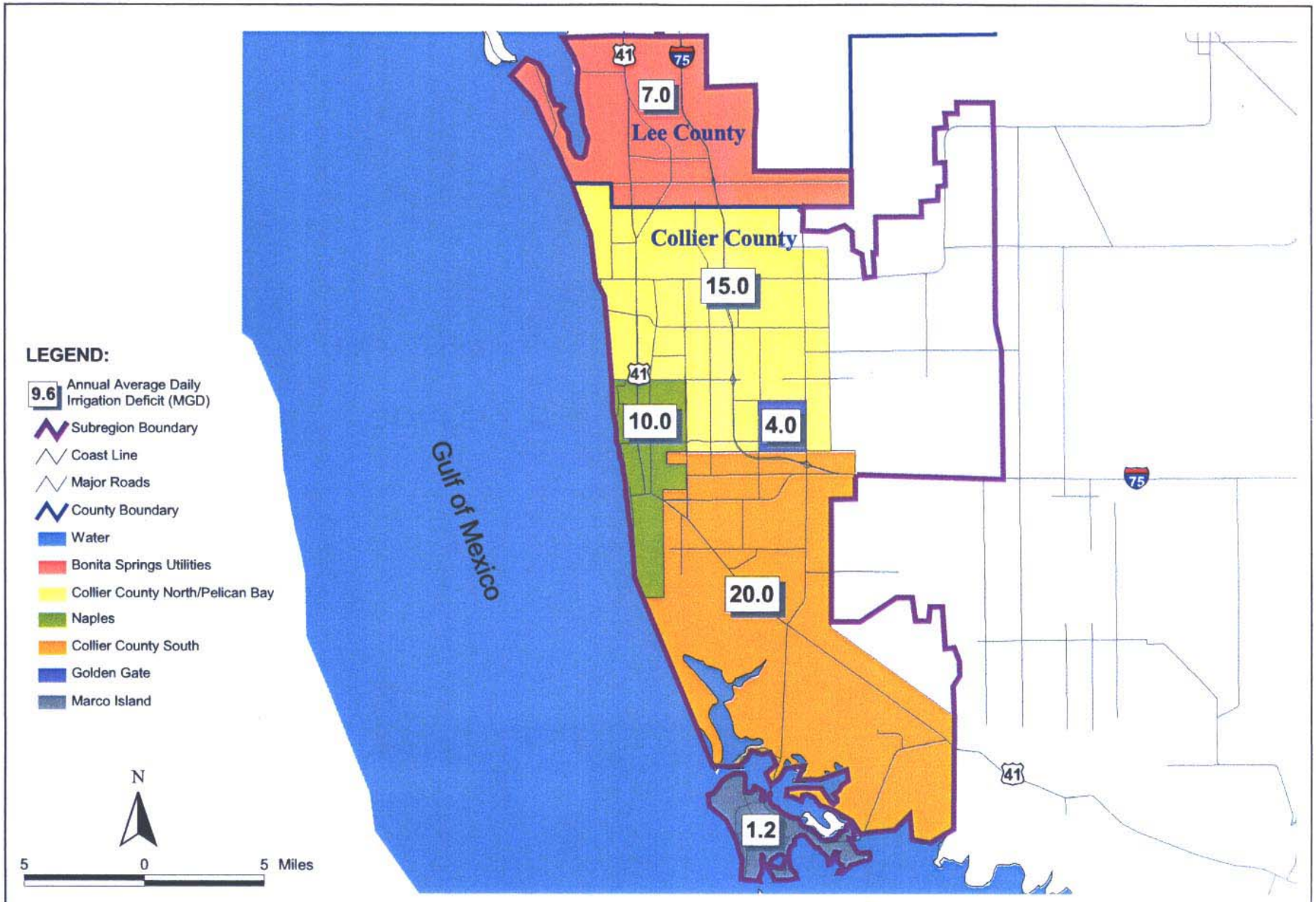
Facility	Monthly Surplus/Deficit (MGD)												Annual Average (MGD)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Collier Co. North	0.10	(2.40)	(17.30)	(26.70)	(29.80)	(28.20)	(14.90)	(15.60)	(17.60)	(12.30)	(11.20)	(4.60)	(15.0)
Collier Co. South	(5.20)	(8.50)	(27.70)	(38.30)	(41.40)	(38.70)	(20.50)	(13.40)	(3.90)	(18.50)	(18.70)	(10.50)	(20.0)
Golden Gate	(0.90)	(1.60)	(4.60)	(6.10)	(6.50)	(6.00)	(4.00)	(3.60)	(6.10)	(3.50)	(3.10)	(1.70)	(4.0)
Marco Island Utilities	1.00	1.20	(0.80)	(2.80)	(2.80)	(2.30)	(1.10)	(0.40)	(4.10)	(1.40)	(1.00)	(0.10)	(1.2)
Naples	(0.10)	(1.90)	(12.40)	(18.60)	(21.10)	(19.30)	(9.60)	(10.30)	(10.40)	(10.30)	(7.60)	(2.90)	(10.0)
Bonita Springs	(1.10)	(1.60)	(8.50)	(12.90)	(14.30)	(10.30)	(5.80)	(7.50)	(7.60)	(6.20)	(5.90)	(2.50)	(7.0)
Total Monthly Flow (MGD)	**(6.20)**	**(14.80)**	**(71.30)**	**(105.40)**	**(115.90)**	**(104.80)**	**(55.90)**	**(50.80)**	**(49.70)**	**(52.20)**	**(47.50)**	**(22.30)**	**(58)**

Note: Numbers in parenthesis ( ) indicate deficits.

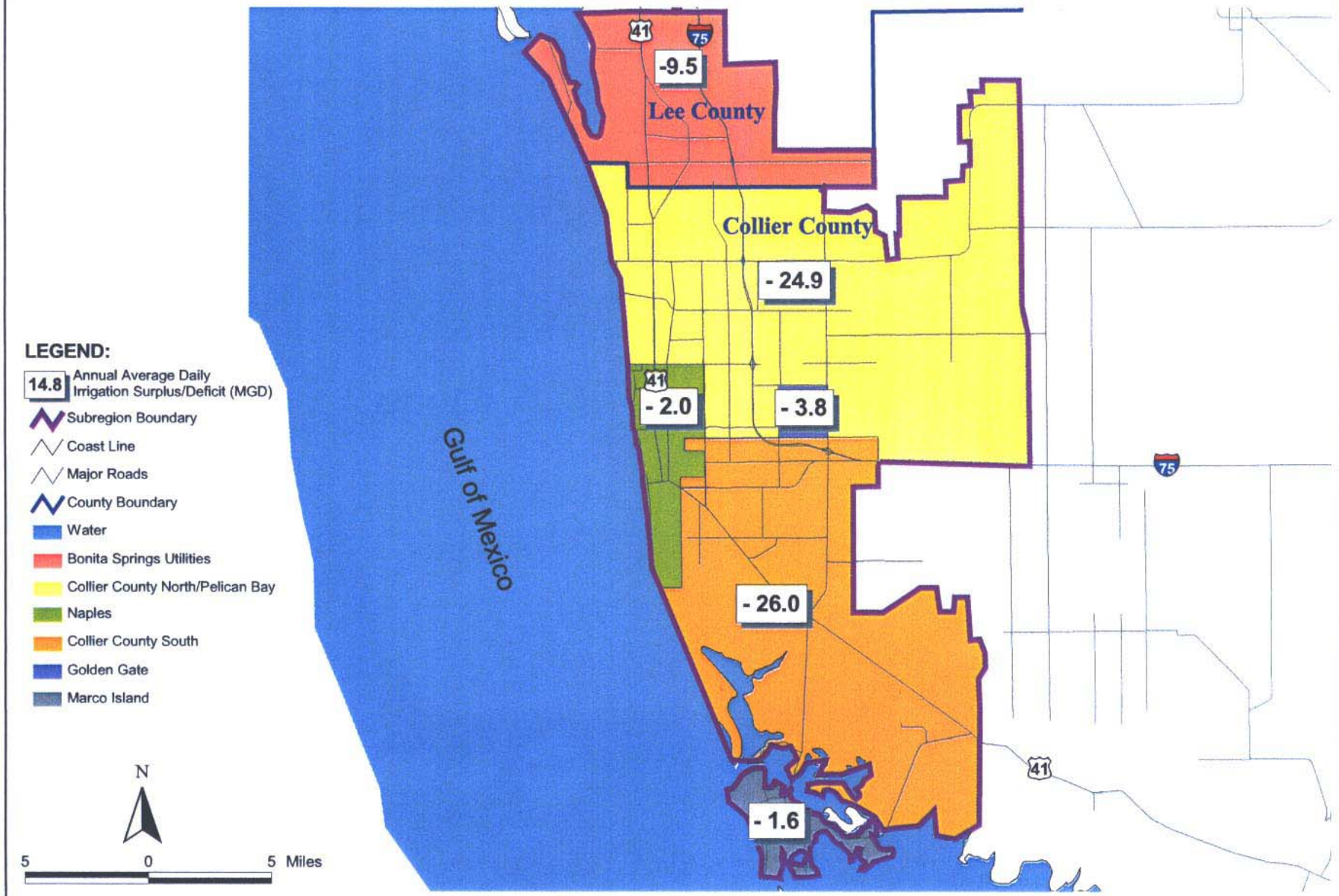
Table 16
Surplus/Deficit Analysis – Projected Year 2020

Facility	Monthly Surplus/Deficit (MGD)												Annual Average (MGD)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Sub-Region 1													
Collier Co. North	(12.0)	(13.4)	(17.4)	(8.3)	0.1	(36.7)	(39.9)	(37.1)	(31.7)	(45.2)	(45.8)	(11.2)	(24.9)
Collier Co. South	(12.8)	(14.3)	(18.7)	(8.9)	0.1	(38.5)	(40.7)	(38.5)	(32.2)	(47.1)	(48.7)	(11.9)	(26.0)
Golden Gate	(1.4)	(1.4)	(1.6)	(1.0)	0.0	(5.2)	(6.6)	(5.9)	(10.0)	(5.7)	(5.6)	(1.3)	(3.8)
Marco Island Utilities	(1.0)	(0.9)	(1.2)	(0.6)	0.0	(1.0)	(1.8)	(1.3)	(2.8)	(3.9)	(4.1)	(1.1)	(1.6)
Naples	(1.6)	(1.8)	(2.3)	(0.9)	0.0	(3.2)	(0.8)	(1.7)	(1.2)	(4.5)	(4.9)	(1.3)	(2.0)
Bonita Springs	(4.1)	(4.3)	(5.8)	(3.0)	0.0	(13.4)	(11.5)	(15.2)	(14.9)	(18.6)	(18.8)	(4.4)	(9.5)
Total Monthly Flow (MGD)	**(32.8)**	**(36.1)**	**(47.0)**	**(22.8)**	**0.3**	**(98.0)**	**(101.3)**	**(99.7)**	**(92.8)**	**(125.0)**	**(127.9)**	**(31.2)**	**(67.9)**

Note: Numbers in parenthesis ( ) indicate deficits.



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	CURRENT IRRIGATION DEMAND DEFICITS SUBREGION 1	Figure 12



Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region	BOYLE	South Florida Water Management District	PROJECTED FUTURE IRRIGATION DEMAND DEFICITS SUBREGION 1	Figure 13

Table 17
Potential Major Irrigation Water Users

	Potential User	Reuse Demand (MGD)
Sub-Region 1		
Collier Co. North/Pelican Bay		
	Grey Oaks	1.55
	Quail Creek, Quail Village	1.37
	Quail West	1.16
	Subtotal	**4.08**
Collier Co. South		
	Fiddler's Creek Golf Course	1.61
	Fiddler's Creek Subdivision	1.21
	Subtotal	**2.81**
Golden Gate	NI	
Marco Island Utilities	NI	
Naples	Small and Bulk Users	7.25
Bonita Springs		
	Brooks of Bonita Springs	4.49
	Gulf Atlantic	1.41
	Pelican Landing	3.17
	Bonita Bay	3.48
	Highland Woods	1.01
	Spanish Wells	1.39
	Bonita Golf Estates	1.12
	Worthington	1.01
	The Parklands	1.74
	Corkscrew Growers	1.72
	Subtotal	**20.54**
Total Potential Reuse Demand		**34.7**

*NI denotes no information

DESIGN ALTERNATIVES

Design alternatives were developed to provide an alternative source of supply of irrigation water and to store it to maximize its use. The design alternatives included:

- Surface water source and ASR storage
- Reclaimed water source and ASR storage
- Interconnects between utilities

The following presents the criteria for the alternatives.

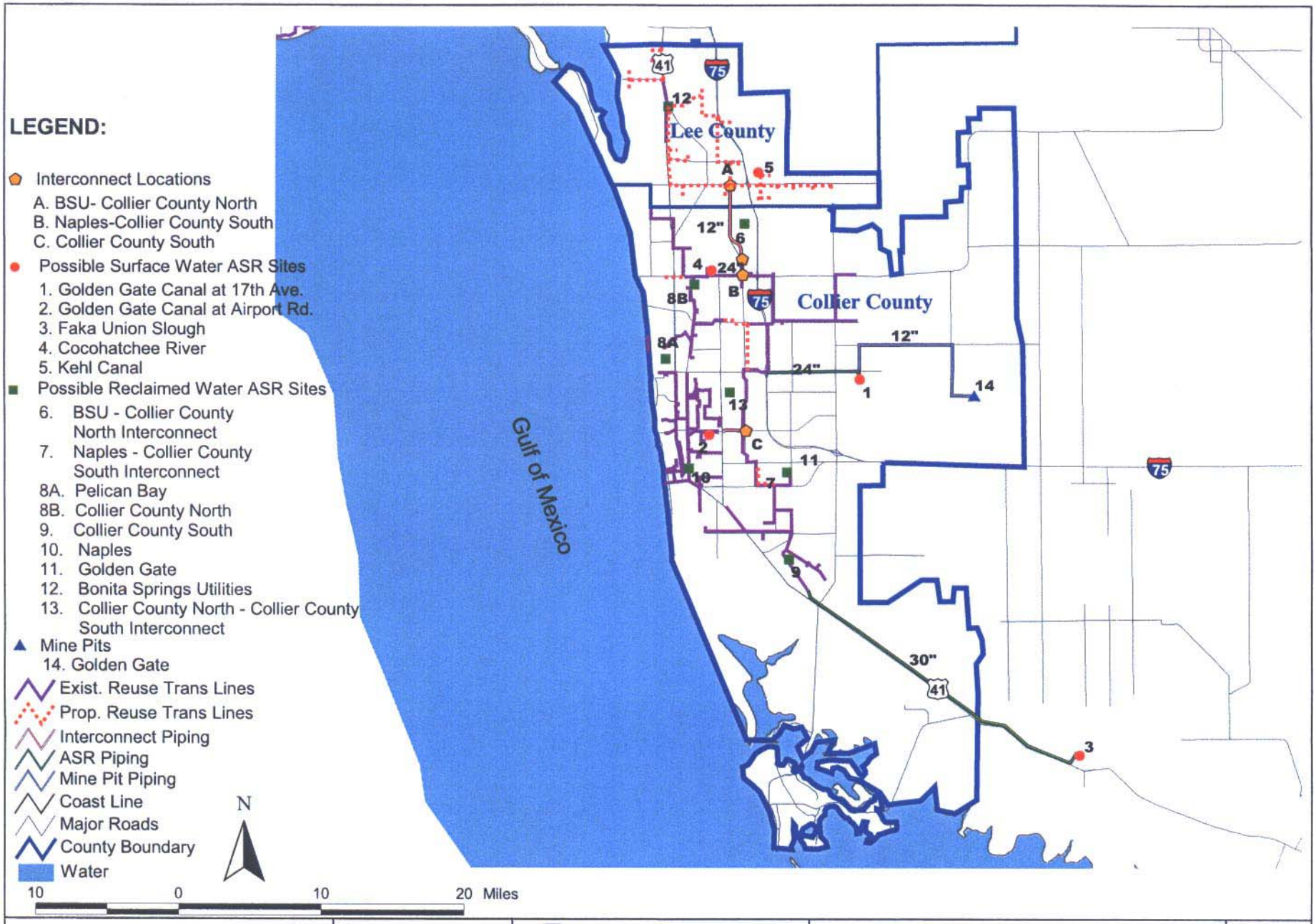
All alternatives within the sub-region have been generally located and are shown in Figure 14. Together, these options may generate up to 111.5 MGD of additional irrigation water resources for the area, during the dry season.

Surface Water Systems

Several surface water sources were evaluated in the Master Plan and then confirmed as part of this feasibility study. A key for utilizing surface water is to be able to optimize its use by collecting during the wet season and then storing it in ASR wells for use during the dry period of the year. Therefore, our discussion of surface water will focus on recovery from the integrated surface water and ASR storage system.

The surface water ASR systems were evaluated using available data regarding the expected site-specific geology for each potential ASR site. In some cases there was no information available for that particular site. In which case the nearest well available to the site was used to determine the most likely geology for the area. This information was obtained from the data compiled for the Lower West Coast Potentiometric Mapping Project performed by WRS for the SFWMD.

According to the data compiled, three shallow geology scenarios are possible. The first one represents sites with a thickness of the Holocene – Pleistocene sand greater than 20 feet. This type of scenario can be found in all potential sites except for the Golden Gate Canal at 17th Ave, and for the Golden Gate Canal at Airport Road. The second possible shallow geology scenario is presented in these two sites with the Holocene – Pleistocene sand thickness less than 5 feet and a section of the Tamiami Limestone that could be as deep as 30 feet. A third scenario is one where the Holocene-Pleistocene sand section is between 5 and 20 feet thick. The Holocene – Pleistocene sand thickness for each potential ASR system are as follows:



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	SELECTED DESIGN ALTERNATIVE SUBREGION I	Figure 14

Table 18
ASR Wells Potential Sand Thickness

Potential ASR system	Holocene – Pleistocene Sand Thickness (ft)
Golden Gate Canal at 17th Ave.	5
Golden Gate Canal at Airport Rd.	5
Faka Union Slough	25
Cocohatchee River	20
Kehl Canal	24

Four possible types of intake systems were identified, each is applicable for certain shallow geological scenarios.

1. Horizontal well (Type I). This type of extraction is applicable to the first scenario and the exact depth and construction details should be based on site-specific geology. A cross-sectional view of this type of intake system is provided as Figure 15.

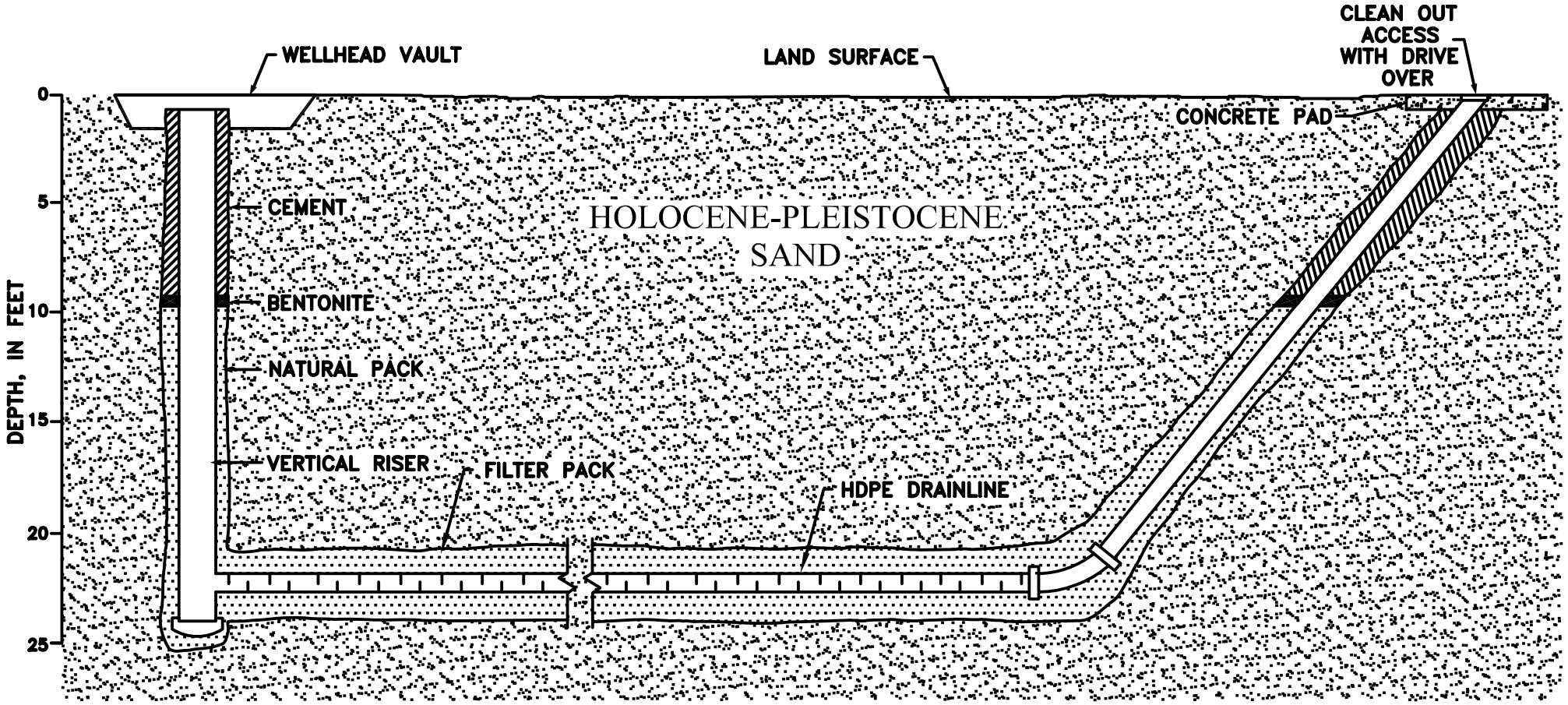
2. Shallow vertical well alignment (Type II) completed in the Tamiami Limestone. This system is applied to the second scenario. The collection wells in this alignment will have to be manifolded together and connected to a centrifugal pumping withdrawal system. A cross-sectional view of this intake system is provided as Figure 16.

3. Open trench with screen covering (Type III). This system is applied to the second scenario. Site-specific geology and the expected extraction volume requirements will determine the trench dimensions. A cross-sectional view of this intake system is provided as Figure 17.

4. Trench filled with sand (Type IV). This system applied to the second scenario. Site-specific geology and the expected extraction volume requirements will determine the trench dimensions. The cross-sectional view of this intake system is provided as Figure 18.

The recommendation to use a particular intake system type, or types, at each surface water ASR site was predicated on achieving the maximum filtration of the surface water prior to injection. Generally, a properly designed intake system can be expected to achieve a three-log cycle removal of pathogens and viruses, and produce a feedwater with a very low turbidity. Although this level of removal will produce water disinfected to very close to drinking water quality standards (4 total coliforms per 100 mL) additional disinfection will be required.

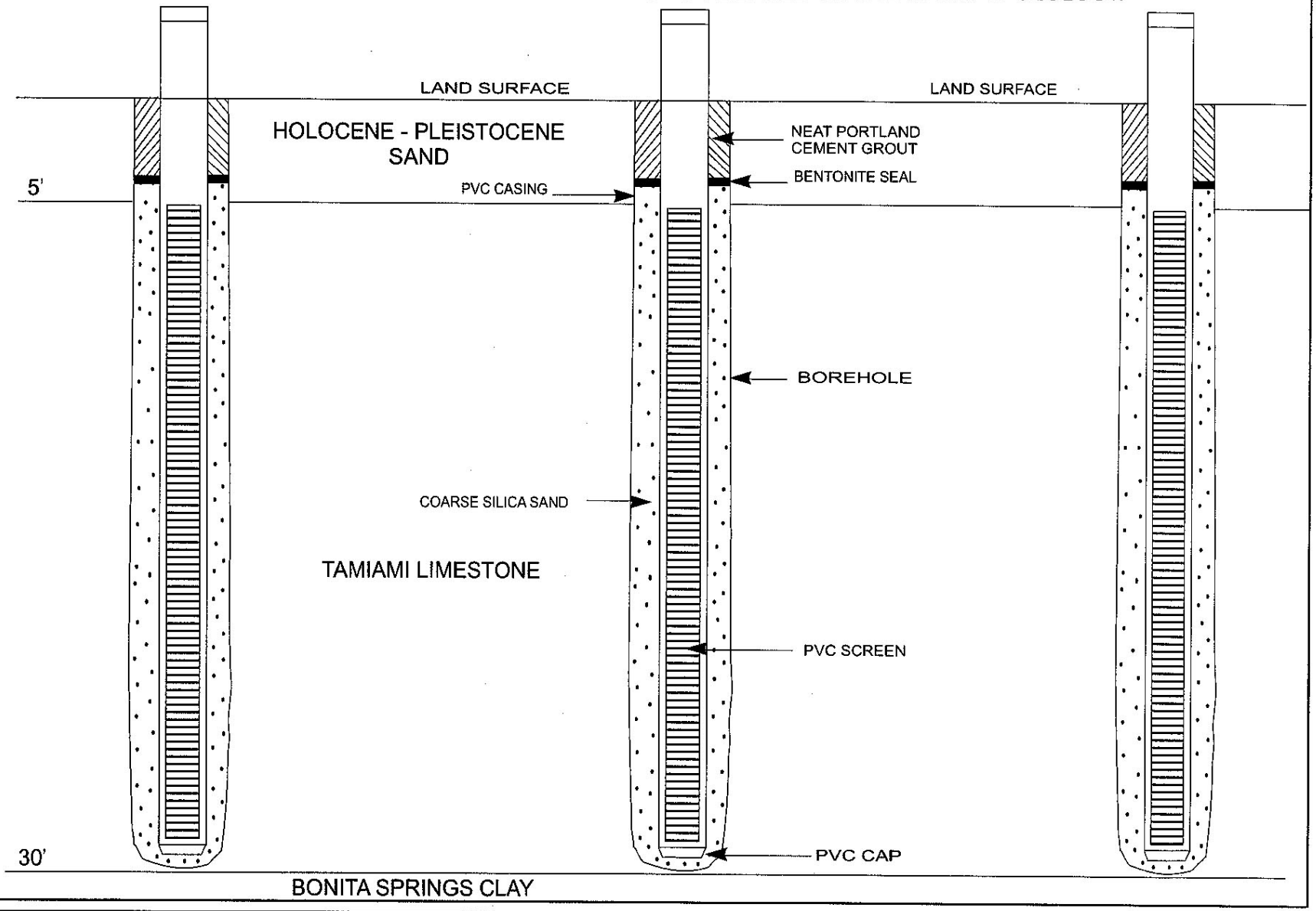
The configuration of the ASR systems was designed using the information described above and the optimum number of wells for each site. Each proposed configuration tried to achieve the best distribution of wells to optimize ASR recovery by concentrating the wells to reduce mixing between the injected water with the native water. The ASR system configurations for each potential site are provided as Figures 19, 20, 21, 22 and 23.



NOTE: EXACT DEPTH AND CONSTRUCTION DETAILS OF HORIZONTAL WELL SYSTEM TO BE BASED ON SITE-SPECIFIC GEOLOGY

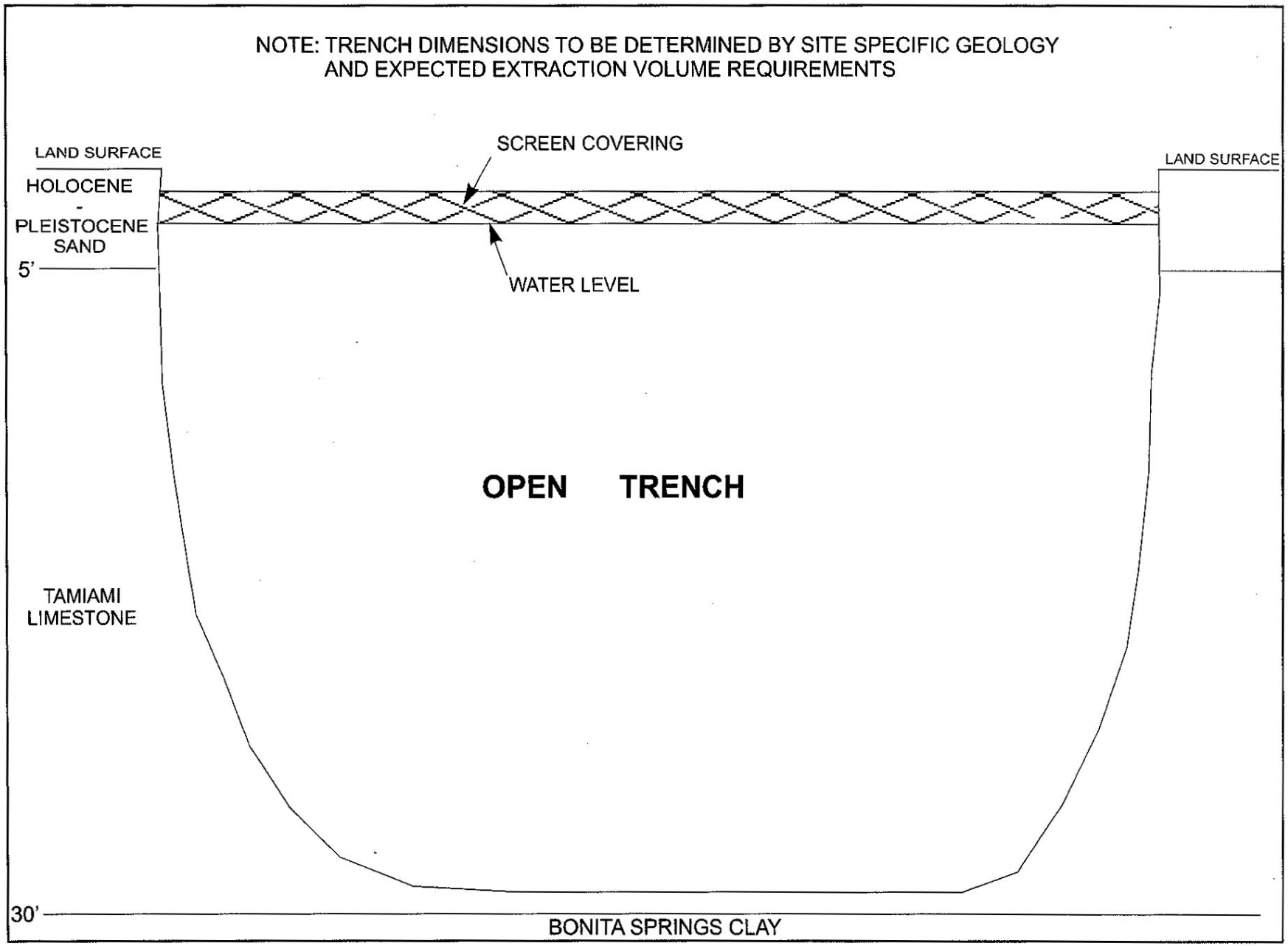
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-01444SR1-1
	PROJECT NUMBER: 01-04445.H0	DATE: 10/05/05

FIGURE 15. CROSS-SECTIONAL VIEW OF HORIZONTAL WELL FOR INTAKE SYSTEM TYPE I.



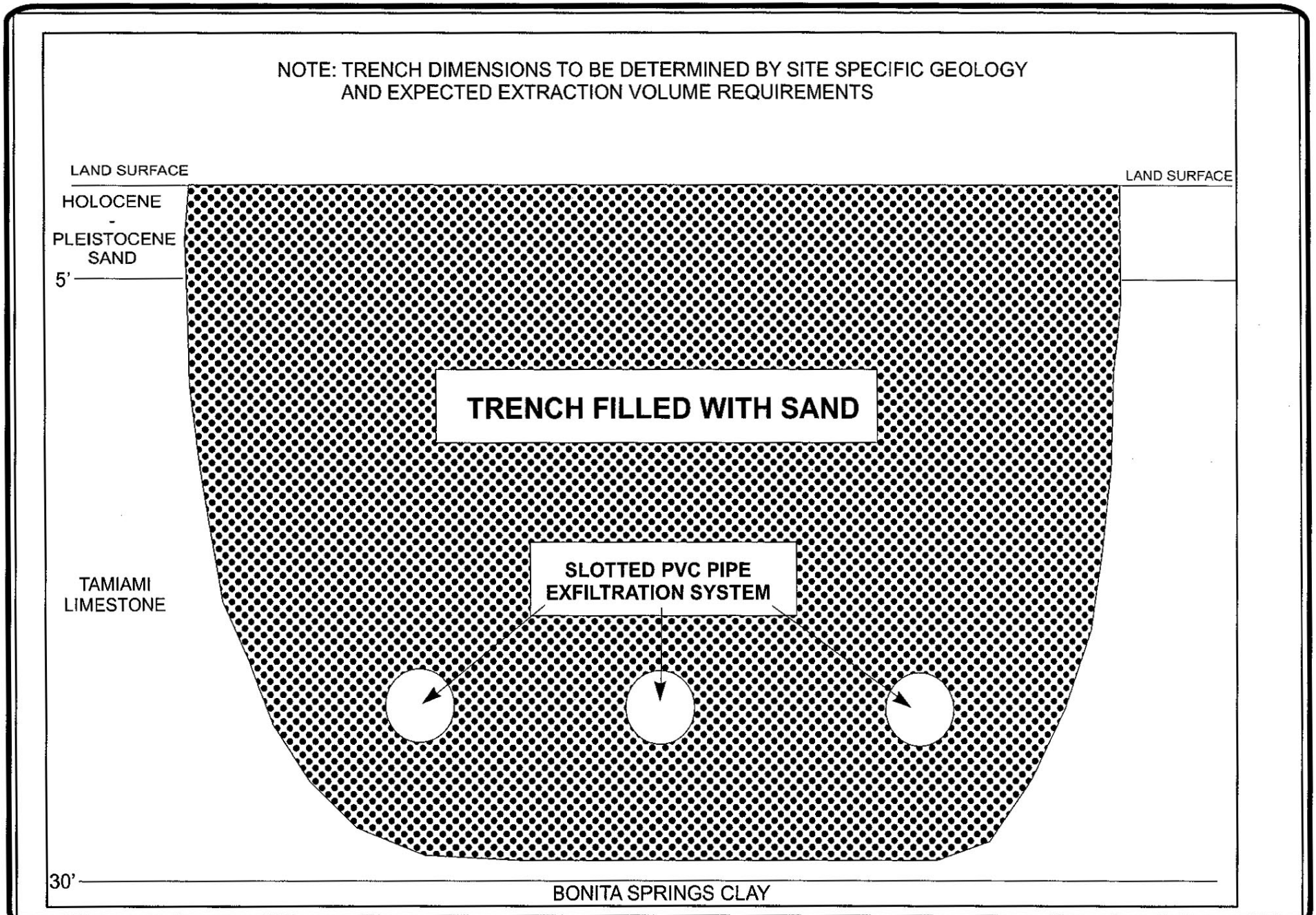
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/3/03

FIGURE 16- Cross sectional view of shallow vertical wells alignment for intake system Type II.



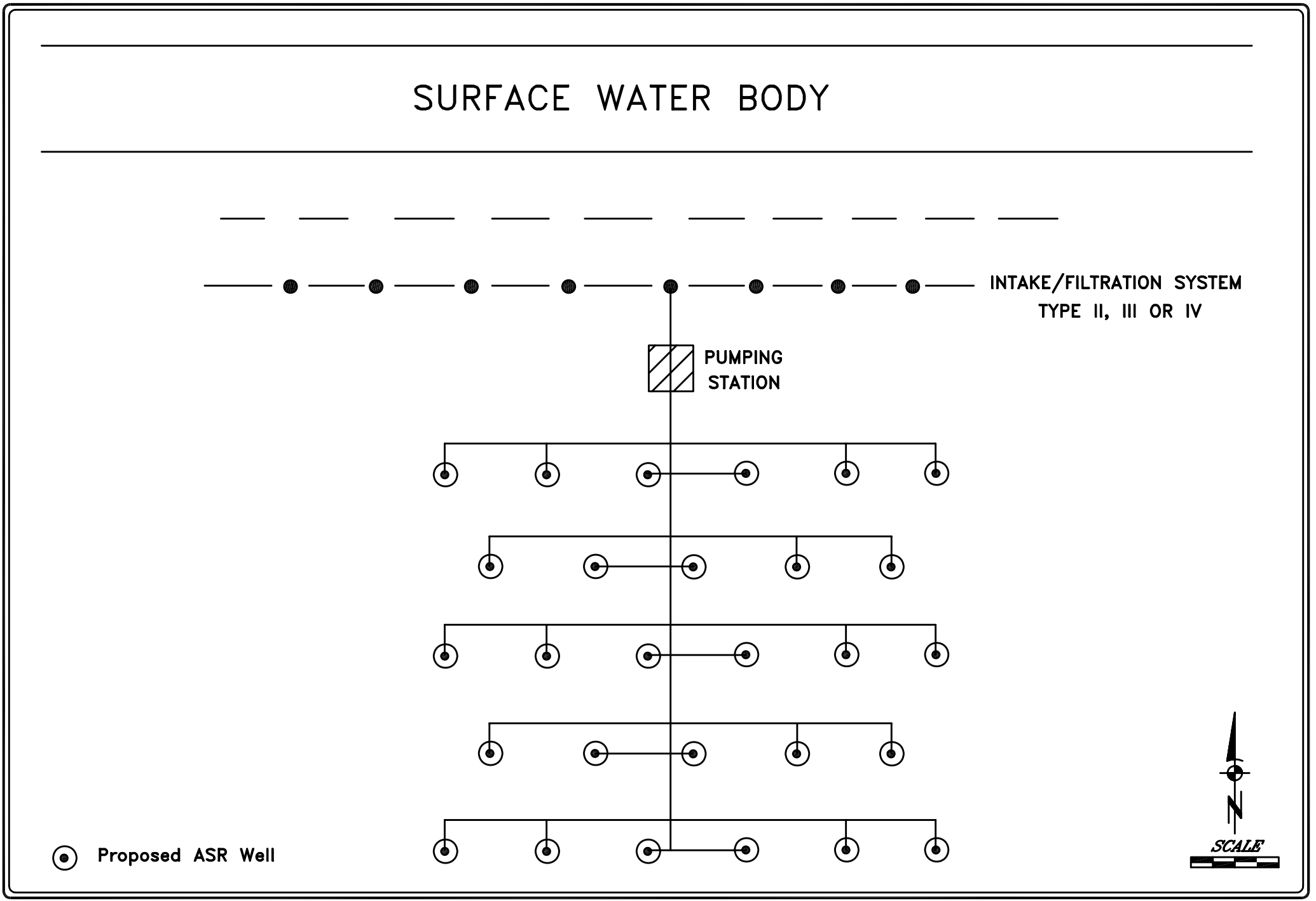
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/3/03

FIGURE 17- Cross sectional view of open trench with screen covering for intake system Type III.



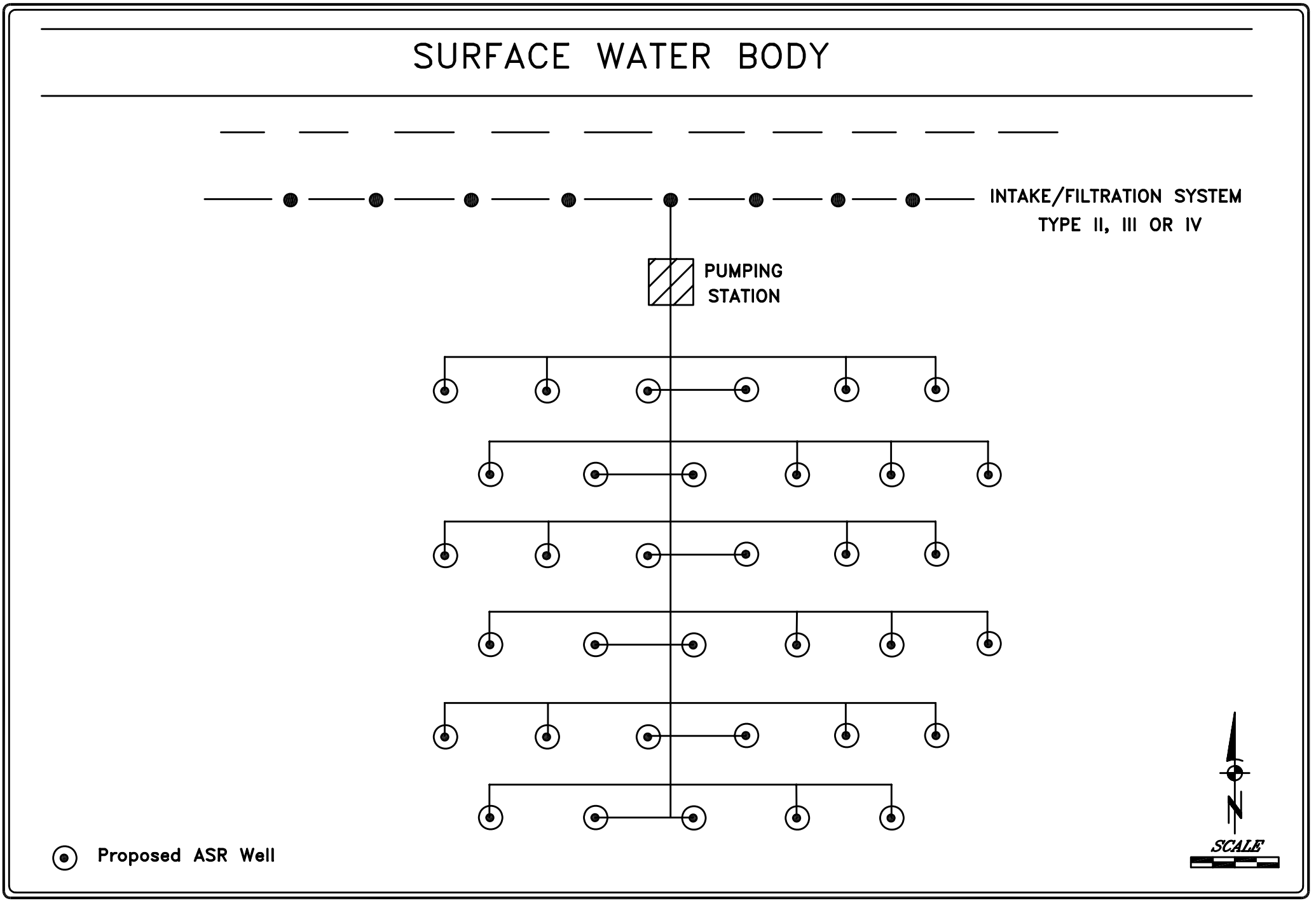
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/3/03

FIGURE18- Cross sectional view of trench filled with sand for intake system Type IV.



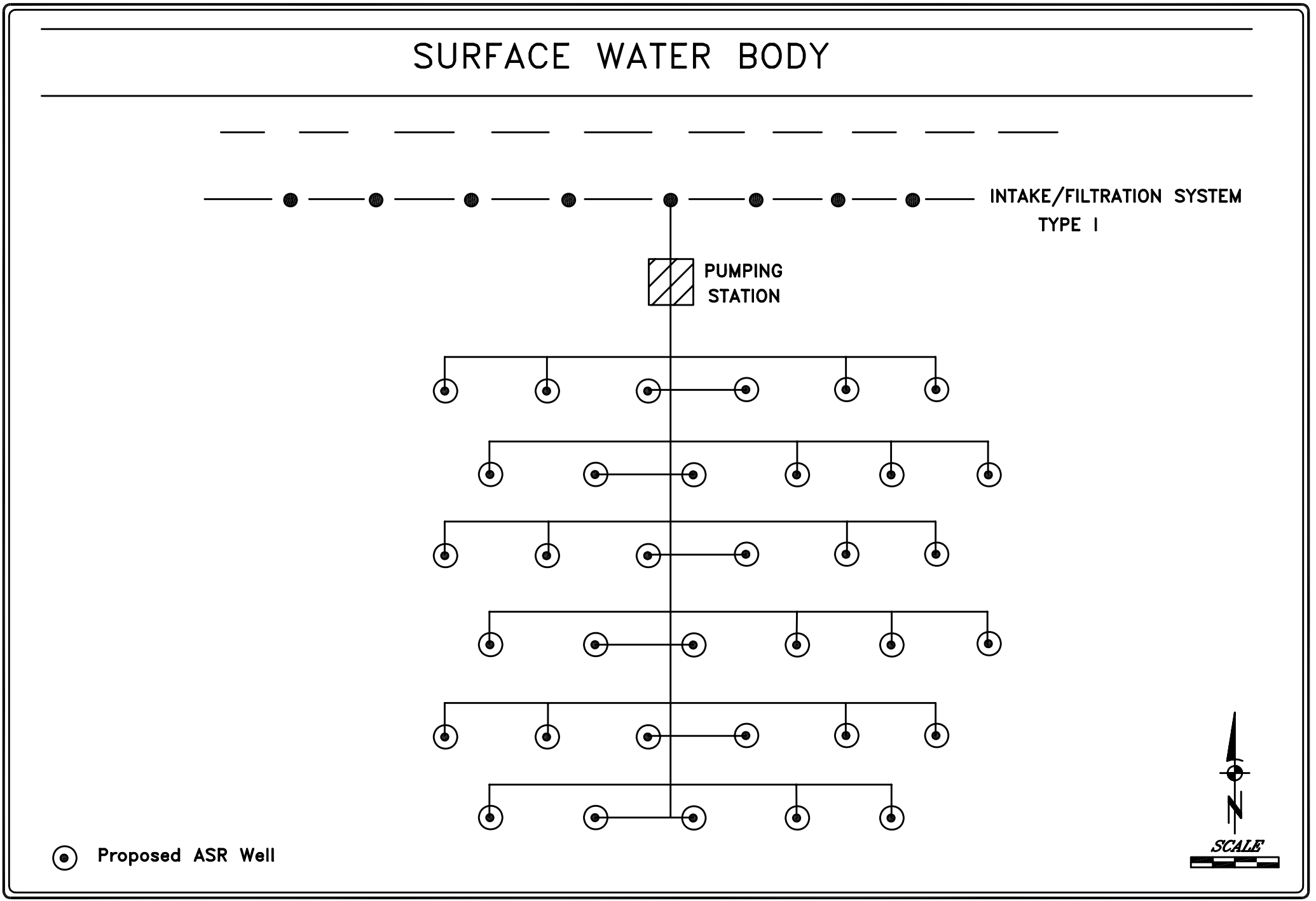
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 19– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR GOLDEN GATE CANAL AT 17th AVE.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

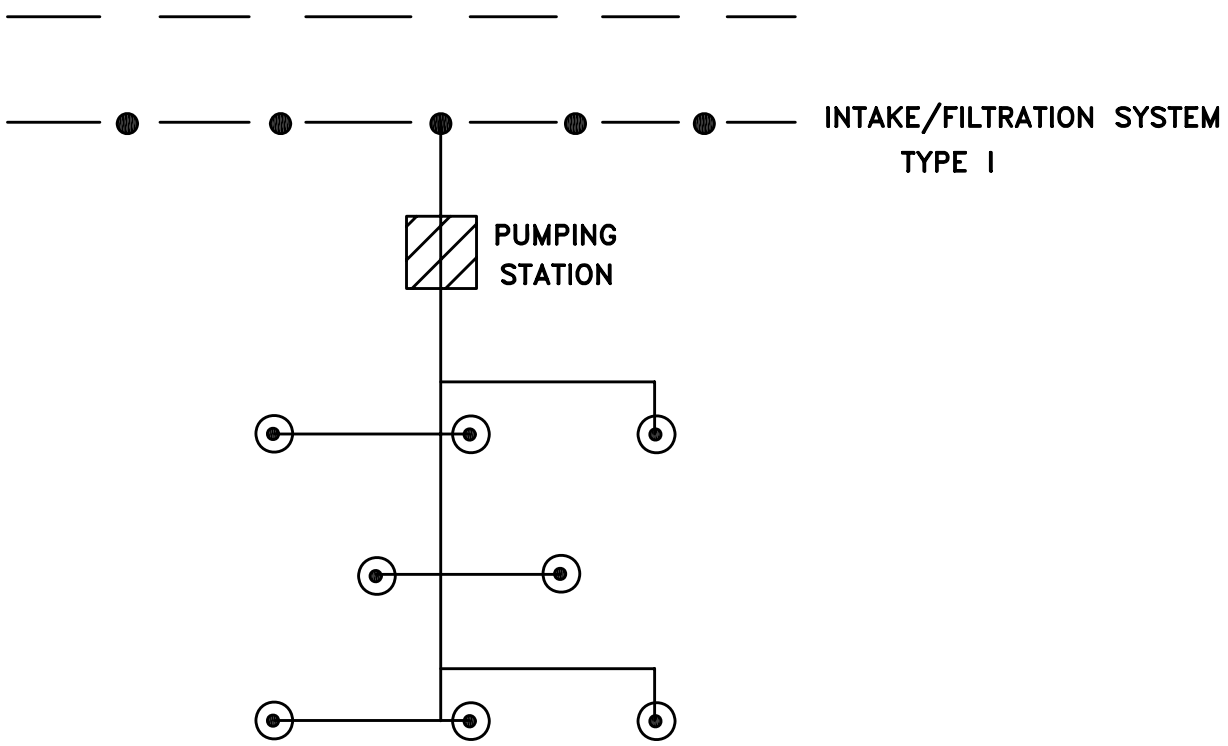
FIGURE 20– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR GOLDEN GATE CANAL AT AIRPORT ROAD.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 21– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR FAKA UNION SLOUGH.

SURFACE WATER BODY



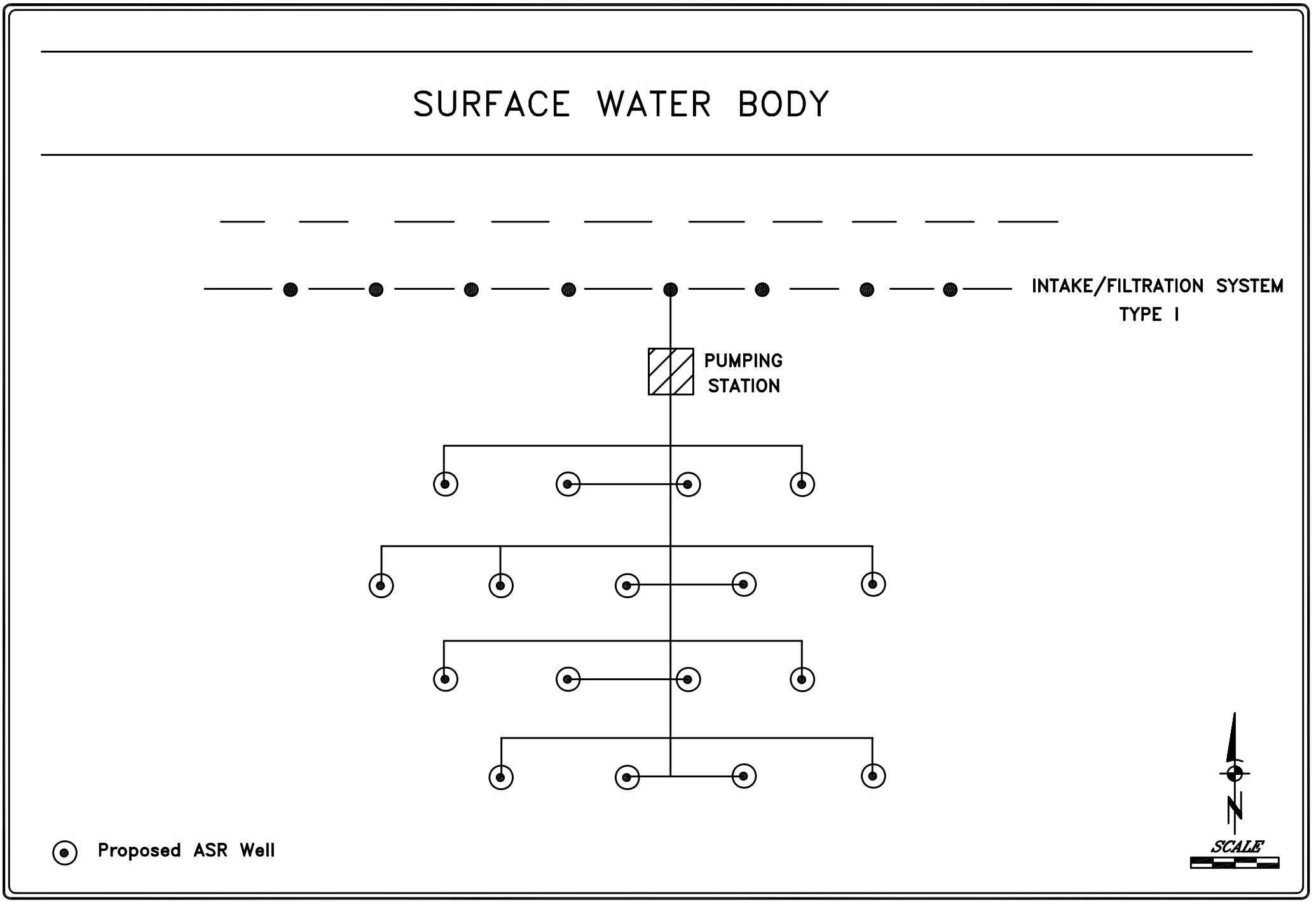
Proposed ASR Well

N

SCALE

Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 22- PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR COCOHATCHEE RIVER.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 23- PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR KEHL CANAL.

Each ASR well will be constructed with a 16-inch diameter final casing, either of fiberglass or PVC construction, with a discrete open hole interval selected based on test well drilling. A typical ASR wellhead configuration plan view is shown on Figure 24 and a typical ASR subsurface sectional view (prior to installing submersible pump equipment) is shown on Figure 25. A pH adjustment system, utilizing either hydrochloric or carbonic acid, will be needed for the ASR wellfield. The storage capacity for the pH adjustment system chemicals will be dependent upon the number of ASR wells in each ASR wellfield.

In this sub-region, five locations for surface water ASR were sited, which could provide up to 87 MGD of irrigation water.

Reclaimed Water Systems

There is a great deal of opportunity to maximize the use of reclaimed water in a RIDS program. The stakeholder utilities have growing reuse programs and plan to continue to expand. In order to offset the disposal of highly treated water during the wet season, ASR storage will be used to store the water during the wet season for use during the dry period of the year.

The reclaimed water ASR systems were configured with the optimum number of wells for each site. Configurations were selected to optimize ASR recovery by concentrating wells to reduce mixing between the injected water and the native water. The configurations for each potential site are provided as Figures 26, 27, 28, 29, 30, 31, 32, and 33.

Each ASR well will be constructed as described above for the surface water ASR systems. A typical ASR wellhead configuration plan view is shown on Figure 24 and a typical ASR subsurface sectional view (prior to installing submersible pump equipment) is shown on Figure 25. It is assumed an existing reclaimed water pumping station may be modified to provide the required injection pressures and rates.

There are nine possible reclaimed water ASR sites that provide 23 MGD of irrigation water.

Interconnects / Transmission Lines

The concept of interconnects between utilities was developed in the Master Plan. These interconnects are the key to providing a system with a regional benefit, not just for the local utility. There are also ransmission lines necessary to bring water from supply sources to the existing distribution system.

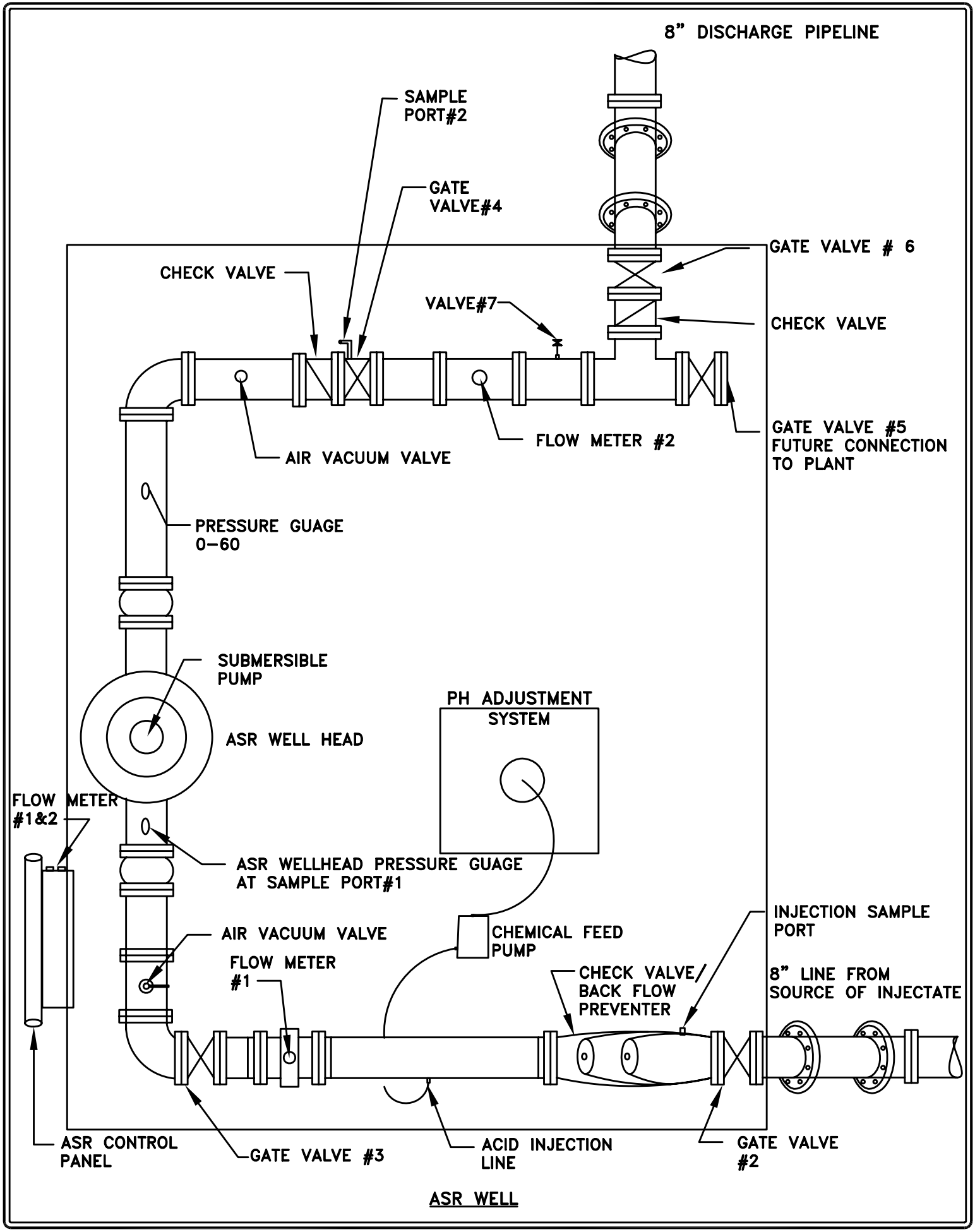
Interconnects / transmission lines were located based on several criteria including:

- Existing reuse transmission system locations
- Geographic proximity between systems
- Potential piping routes or corridors
- Areas of demand

The conceptual location of and costing for the interconnects included piping, booster pump stations and ASR storage. There are three likely interconnects including Bonita Springs / North Collier County, Naples / South Collier and North Collier / South Collier. These would allow water to be shared between two systems. Also, there are two transmission piping segments including a 12-inch pipe from the

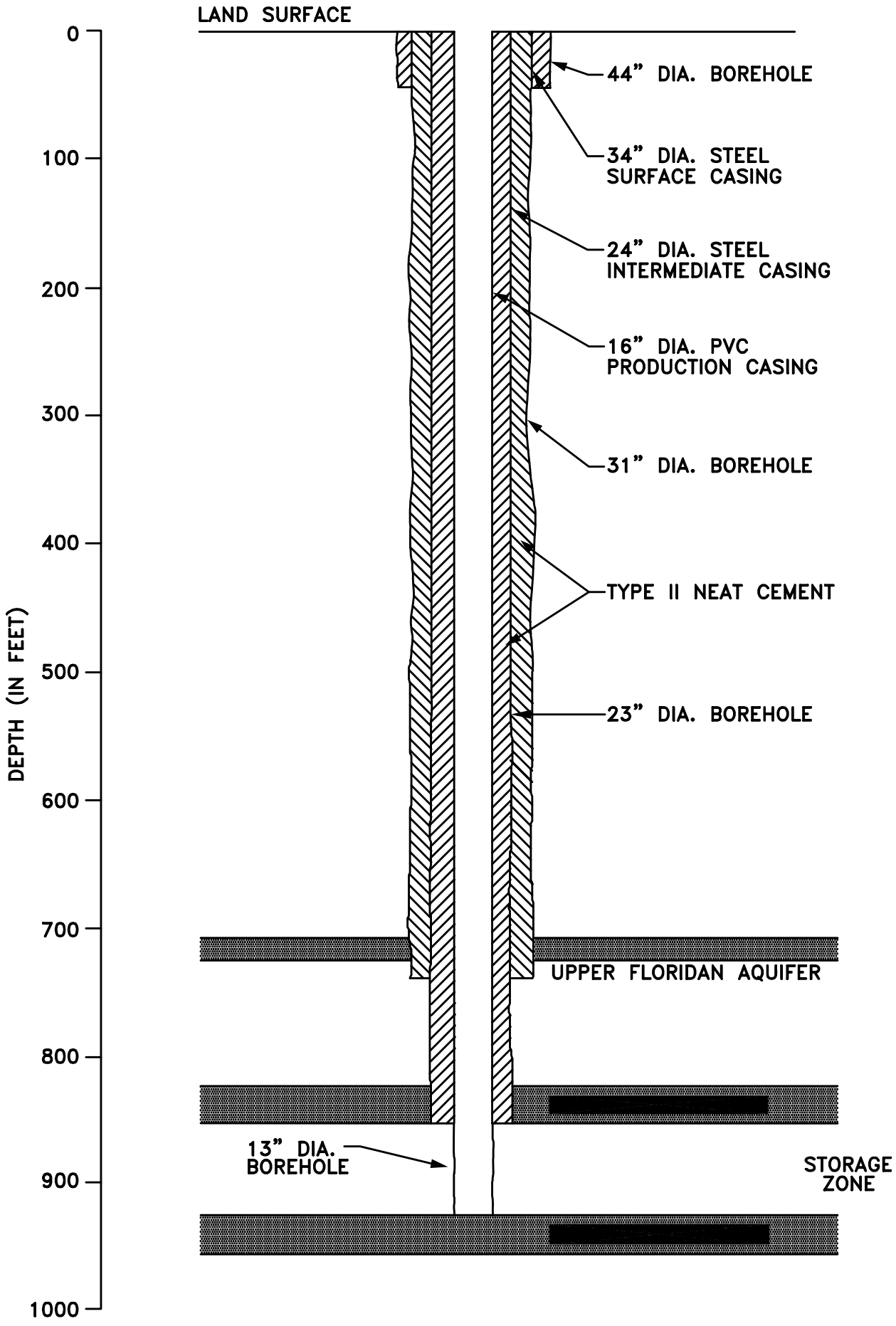
Golden Gate Mine Pit to the Golden Gate Canal (at 17th Avenue) ASR system and a 30-inch pipe from Faka Union to the County's system in the Lely area. Refer to Figure 24 for the interconnect locations.

Interconnected systems do have water quality issues due to treatment types, disinfection types, piping materials, etc. This will be considered prior to the actual installation of the interconnects so that the utilities can proactively address the issue.



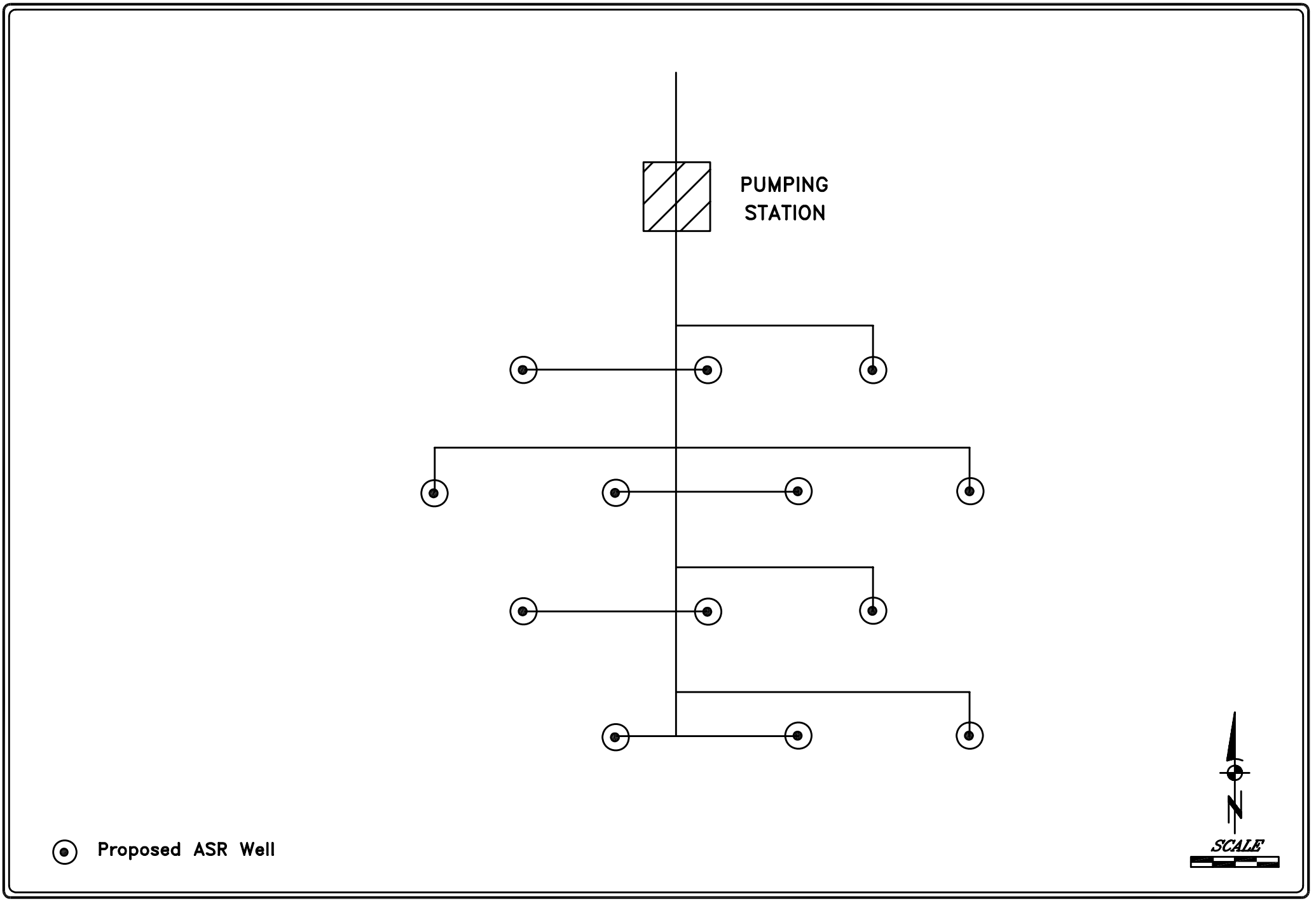
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445R10-1
	PROJECT NUMBER: 01-04445.HO	DATE: 10/22/03

FIGURE 24. PLAN VIEW OF ASR WELL PAD.



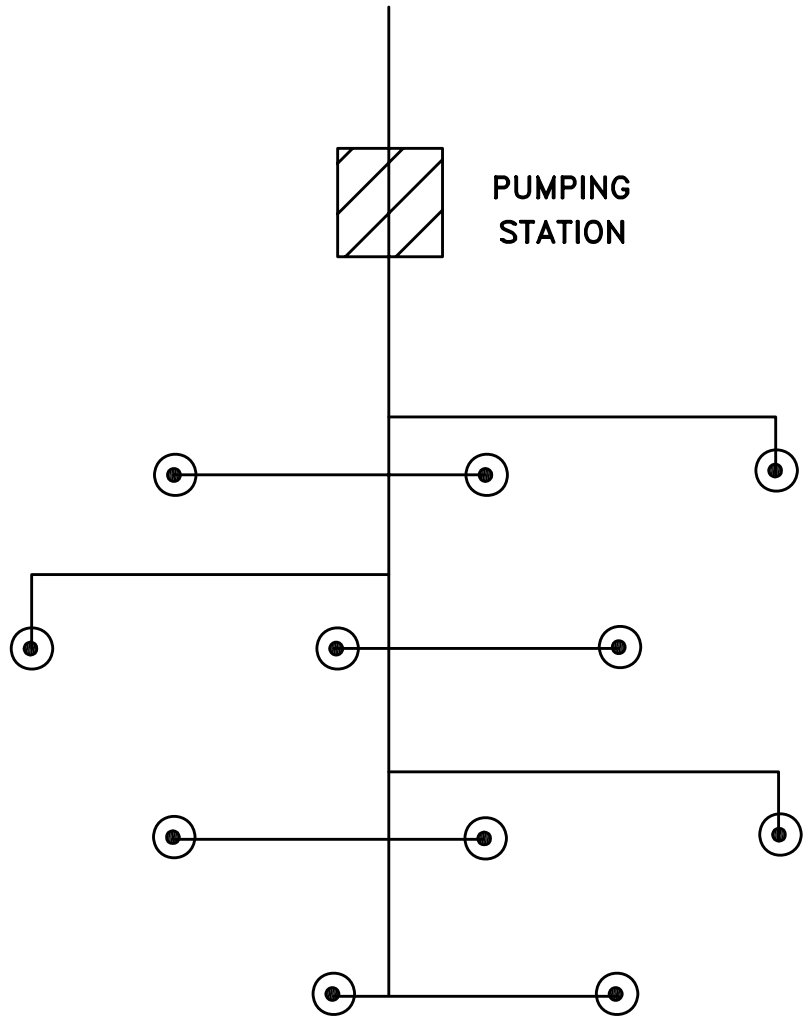
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445R11-1
	PROJECT NUMBER: 01-04445.HO	DATE: 10/22/03

FIGURE 25. GENERAL ILLUSTRATION OF CONSTRUCTION DETAILS FOR ASR WELL.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 26– PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR PELICAN BAY/COLLIER COUNTY NORTH



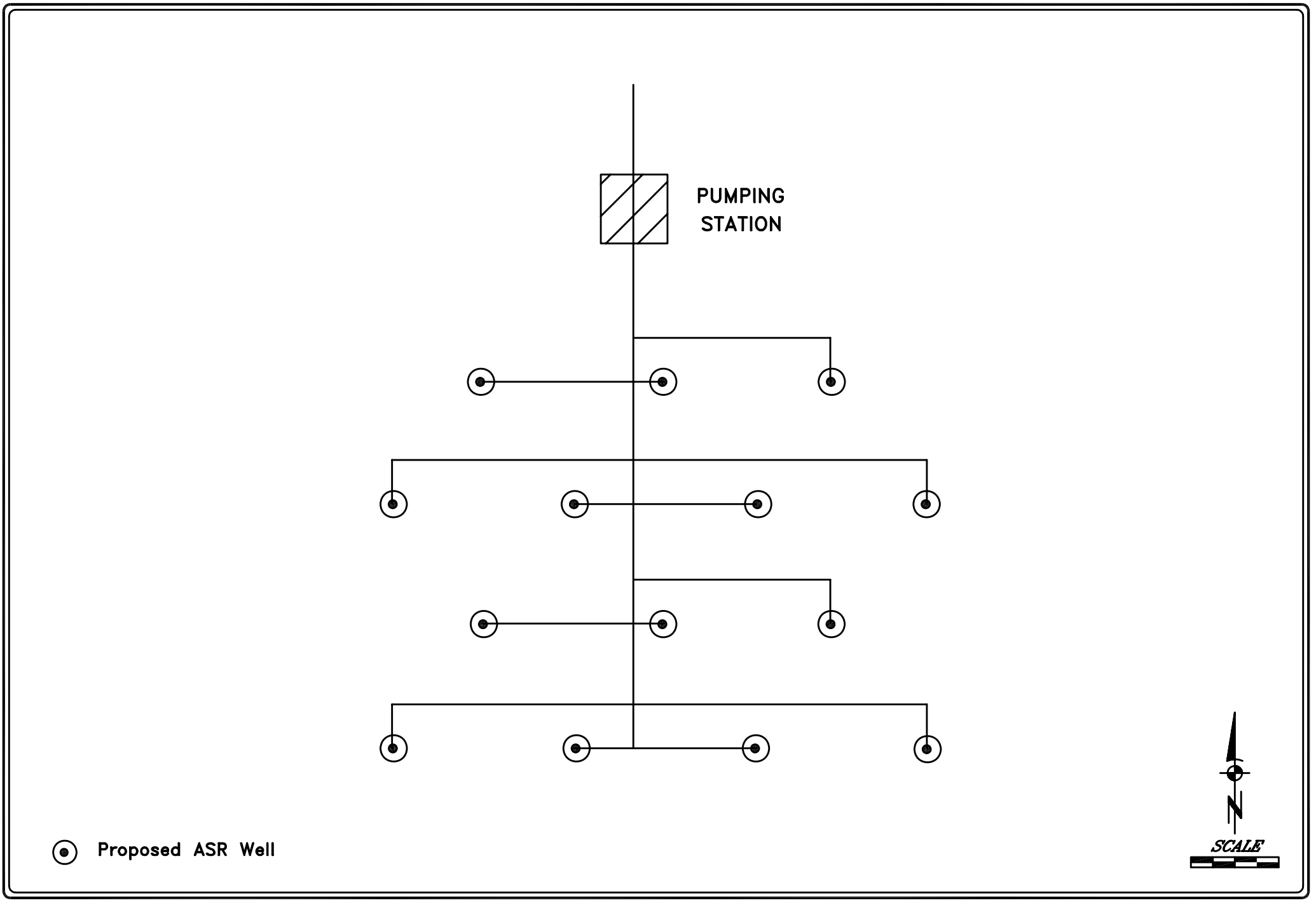
Proposed ASR Well

N

SCALE

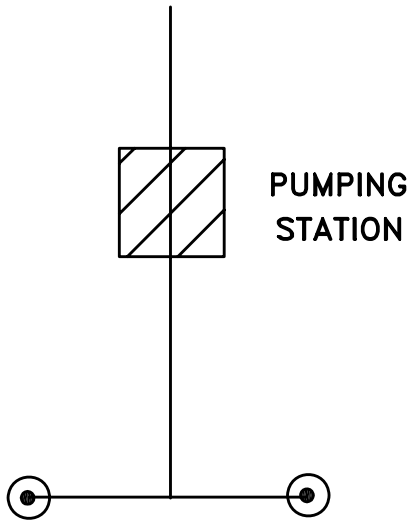
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 27- PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR COLLIER COUNTY SOUTH



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 28– PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR NAPLES



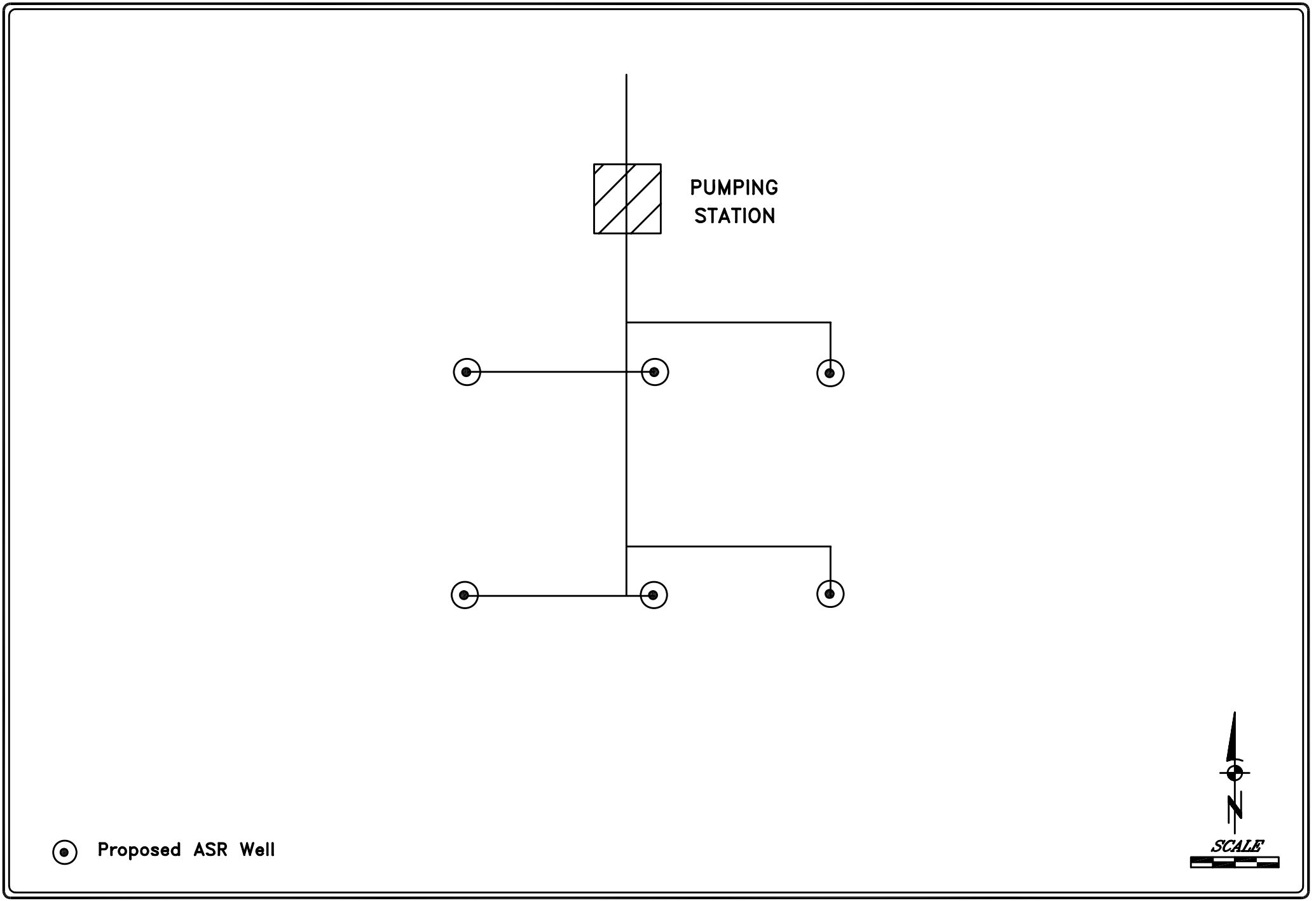
Proposed ASR Well

N

SCALE

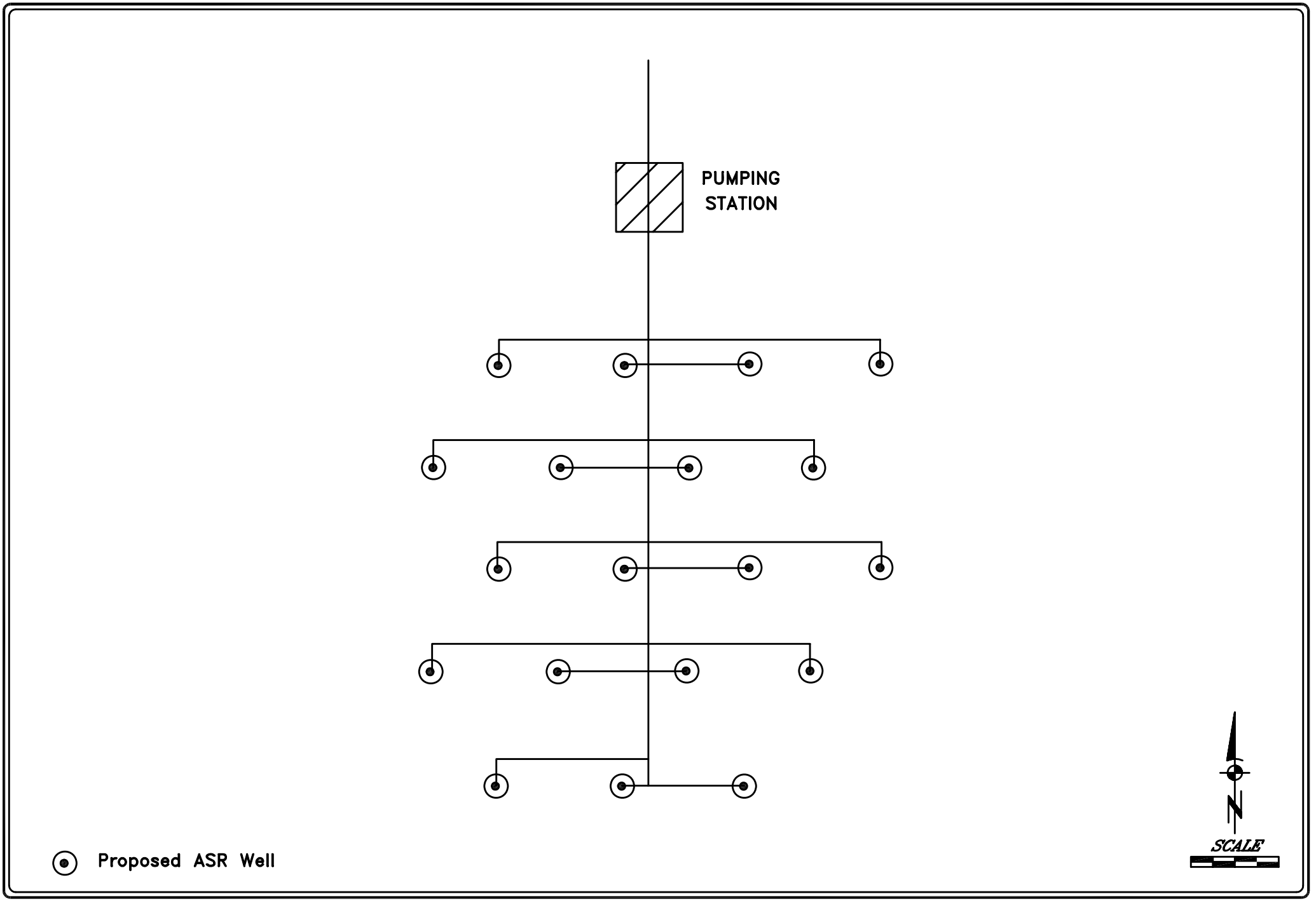
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 29– PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR GOLDEN GATE.



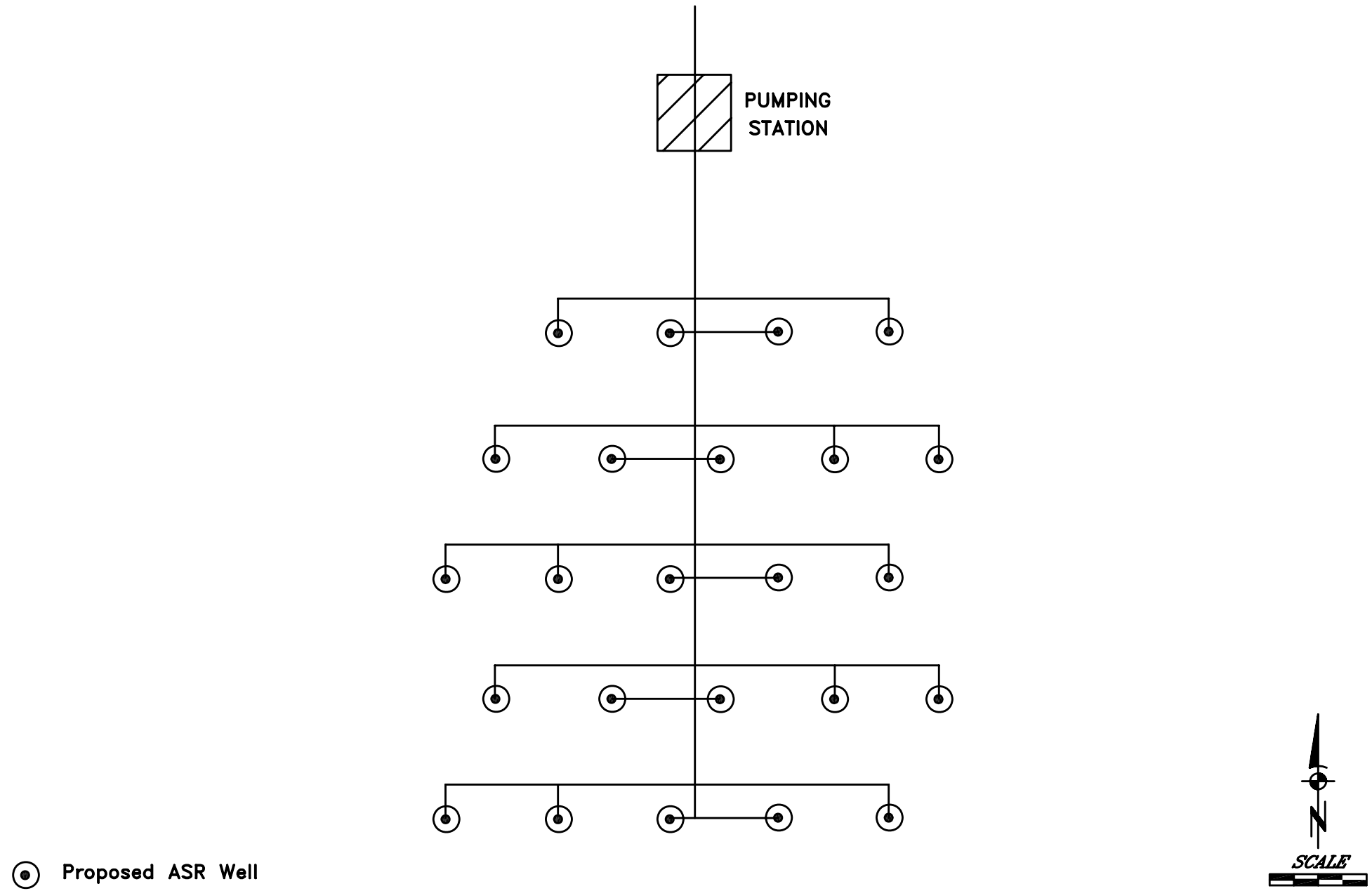
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 30– PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR BONITA SPRINGS UTILITIES.



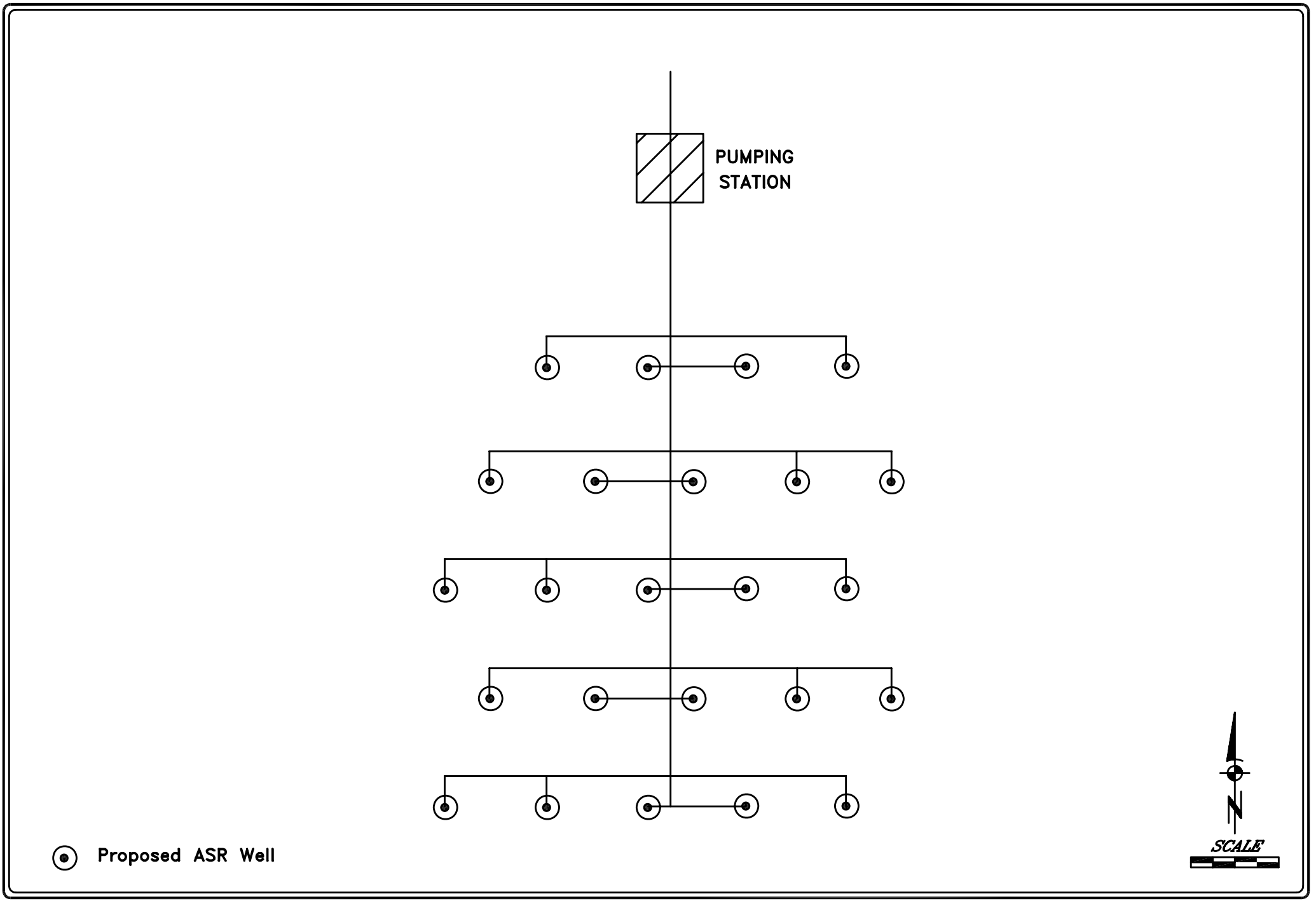
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 31- PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR BONITA SPRINGS UTILITIES - COLLIER COUNTY NORTH INTERCONNECTION



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 32– PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR NAPLES – COLLIER COUNTY SOUTH INTERCONNECTION.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 33- PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR COLLIER COUNTY NORTH - COLLIER COUNTY SOUTH INTERCONNECTION.

COST ANALYSIS

Preliminary cost estimates for the identified alternatives were developed including capital and operation and maintenance (O&M) costs. The costs consider financing the initial project capital costs, including assumptions about potential funding sources, and annual operations and maintenance expenses. Projected annual costs were divided by the projected annual benefits to obtain unit costs for each alternative. The range of costs were $1.06 (for a volume of 2.6 billion gallons per year) to $4.28 (for 90 million gallons per year) per thousand gallons. The unit cost for the overall alternatives is approximately $1.80 per thousand gallons. This cost was based on FDEP's State Revolving Fund (SRF) loan structures and assumed no grant funding. These cost estimates include estimated construction costs for the various wells, pumping stations and pipelines that make up the projects, including engineering and contingencies. The cost summary is included as Attachment A.

To estimate the debt service for each project the following assumptions and considerations were used:

- The initial project costs will be financed over a twenty (20) year period at a rate of 3.5%;
- The cost to be financed includes administrative fees equal to two percent (2%) of the initial project capital costs as required by the terms and conditions of the SRF Loan Program;
- The cost to be financed includes funding of a loan repayment reserve equal to three percent (3%) of the initial project capital costs being borrowed as required by the terms and conditions of the SRF Loan Program, and
- The cost to be financed includes thirty-six (36) months of capitalized interest based upon construction funding draws during the assumed project engineering and construction period.
- Total capital costs for each sub-region include debt service and an allowance for debt service coverage equal to 25% of the annual debt service.
- The allowance for debt service coverage is based upon the SRF Loan Program's minimum debt service coverage requirement of 15% adjusted upward to also reflect the need for funding capital renewals and replacements that may occur during the term of the loan agreement.

The annual operations and maintenance costs for each alternative included:

- The cost of electricity for pumping;
- General maintenance of the facilities;
- Submersible pump maintenance;
- Adjustment of injection rates and measurement of water quality;
- Weekly water sample procurement for laboratory analysis;
- Semiannual calibration of flowmeters and gauges;
- Preparation of monthly regulatory reports; and
- Cost for chemicals, pretreatment, and filtration prior to injection.

The annual operations and maintenance costs were added to the annual capital related financing costs to estimate the total costs for each project and sub-region. The cost per thousand gallons for each sub-region was divided by the total annual production of each alternative to obtain unit costs. It was assumed alternatives would serve provide an irrigation water benefit for only 180 days per year.

It is important to note preexisting deficiencies at the treatment plants considered in this study were not included in the analysis. It was assumed all plants would be providing the appropriate treatment to meet primary and secondary standards.

INSTITUTIONAL FRAMEWORK

The decision was made during the Master Plan to utilize interlocal agreements to oversee design, construction, development, funding and operation of systems resulting from the RIDS program. In practice, various types of interlocal agreements have been used to own, operate, and govern regional utility water supply and wastewater treatment projects. These range from the formation of a separate and distinct entity such as a utility authority to arrangements where one party is the prime sponsor with respect to financing and operations and the other regional participants are enjoined through a contractually binding bulk sales agreement or capacity entitlement and cost sharing arrangement.

There are two primary interlocal agreements that are anticipated:

- Bonita Springs Utilities to Collier County
- City of Naples to Collier County

The advantages of the project-by-project or sub-regional approach is that individual arrangements can be developed that are flexible in dealing with ownership and operating issues in a way that satisfies all of the jurisdictions involved. This type of institutional approach may ensure more active and better participation among the involved parties. Also, it is anticipated that the project cost would be lower because there would be very little redundant administrative and operating costs. The utility representatives that are participating in developing the Master Plan strongly favor a project-by-project or sub-regional approach to the development of irrigation water resources.

FUNDING SOURCES AND OPTIONS

Introduction

As a regional project with far reaching impact, the RIDS program requires concerted efforts by all parties involved for funding. The project stakeholders currently have substantial, ongoing programs to implement water, wastewater and reclaimed water programs; therefore, they have incurred significant debt service. With estimated costs of more than $300 Million, the stakeholders are expecting funding assistance in order to implement the program.

This document will emphasize the steps necessary to get the priority projects funded, and will serve as a guideline for future RIDS efforts.

Critical Issues

- **Program Identity:** As funding is sought for these projects, it is imperative that the program be accurately and consistently identified to image it appropriately. IT should be imaged as an Alternative Water Supply Program with regional benefits. Also, projects within stakeholder Capital Improvement Plans often fail to identify the project as pertaining to RIDS. Projects listed on the District alternative water supply list, the Florida Department of Environmental Protection (FDEP) State Revolving Fund (SRF) Fundable List, and the State and Federal Government budgets should be integrated and identified as RIDS to create an identity for the program.

- **Uniform Approach:** To date, Federal and State funding efforts have been minimal, primarily due to the lack of a uniform approach. Stakeholders and the District must coordinate together to achieve the type of funding support the program requires.

- **Detailed Schedule:** The timing of funding cycles and legislative opportunities must be identified for all parties.

Proposed Resolutions

- An identity for the program must be created. To achieve this, a point person should be identified by the District and given the support required to move the program forward. Identification of the program as a major initiative by the District both in the media and on the website would aid in recognition.

- A unified approach must be taken. A project team or steering committee should be set up consisting of the District point person and a representative from each of the stakeholders. Other members would include the federal and state lobbyists; a representative of the District's funding department, the consulting engineer, and the funding specialist.

- A presentation package is required to assist in the timing and uniformity of the project team's actions. The project team should utilize this document for all discussions and funding requests.

This section lists the available sources of funding for the RIDS program.

Florida Department of Environmental Protection (FDEP) State Revolving Fund Loan Program – Wastewater and Stormwater

The State Revolving Fund Loan Program (SRF) provides low-interest loans for planning, designing, and constructing water pollution control facilities. Federal Capitalization Grants and State match appropriations of 20% have funded the SRF. It is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The FDEP solicits project information each year. The information is used to establish project priorities for the following annual cycle. Funds are made available for Pre-construction Loans and Construction Loans. The loan terms include a 20-year amortization and low interest rates, which represent a 40% discount off bond rates.

Pre-construction loans are available to all communities and provide up-front disbursements for administrative services, project planning and project design.

Construction loans are also available to all communities and provide for construction costs and technical services during construction.

Approximately $120M/yr is available. The current interest rate is approximately 3.00%.

FDEP State Revolving Fund Loan Program – Drinking Water

The Drinking Water State Revolving Fund (SRF) Program provides low-interest loans for planning, designing, and constructing public water facilities. Federal Capitalization Grants and State match appropriations of 20% have funded the SRF. It is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The Department solicits project information each year from January 1 to February 15. The information is used to establish the project priority list for the following annual cycle. Funds are made available for Pre-construction Loans to rate-based public water systems, Construction Loans of $75,000 minimum or more, and Pre-construction Grants and Construction Grants to financially disadvantaged communities.

The loan terms include a 20-year (30-year for financially disadvantaged communities) amortization and low interest rates, which represent a 40% discount off bond rates. Small community assistance is available for communities having populations less than 10,000. Each year 15% of the funds are reserved exclusively for their use. In addition, small communities may qualify for loans from the unreserved 85% of the funds.

Approximately $40M/yr is available. The current interest rate is approximately 3.00%.

SFWMD Alternative Water Supply Grant Program

In 1995, the Florida Legislature enacted the Alternative Water Supply Grant Program to increase the potential for the development of alternative water supplies in the state and to help utilities develop cost-effective reclaimed water supplies.

The Program is a cost share program that provides a portion of funding for alternative water supply projects built by local, county, or private water purveyors. To be considered for the program, a project must be consistent with the local government plan and must be located in a Water Resource Caution Area. Funding support is limited to capital or infrastructure costs for alternative water supply systems.

The available funds vary annually as determined during the District's budget process.

SFWMD Water Resource Development Program

Water resource development projects are generally regional in nature and are primarily the responsibility of the District. Each water management district is required to include in its annual budget the amount needed for the fiscal year to implement water resource development projects as prioritized in its regional water supply plans.

The traditional source of funding has been ad valorem taxes. Projects are ranked and prioritized along with projects in all other regional water supply plans during annual District budget preparation and funded, as money is available. Priority considerations for a project include availability of a cost-share partner and if a project makes 'new' water available. Sustainability of the regional system is also an important consideration.

State Funds - The Water Quality Improvement and Water Restoration Grant Program (Section 403.885 F.S.)

Amount of funds available will vary by year. In 2003, no projects were funded. In 2004, $100M worth of projects were funded.

Projects eligible for the funding must address such criteria as resolving violations of state water quality standards, preventing drainage and flood control problems, resolving public health threats and protecting the environment. Financial capability of the local government is also a deciding factor.

The program includes grants covering wastewater, stormwater, surface water restoration and water management projects.

Currently, funds are requested through a Community Budget Issue Request/Special Appropriation Process. The FDEP will review the request and make recommendations as to appropriateness of the project to the program.

Federal Funds – EPA State and Tribal Assistance Grants

The United States Environmental Protection Agency makes funds available for special water supply projects through its State and Tribal Assistance Grant (STAG) program.

The projects must be included in an appropriation bill passed by the Senate and House.

Approximately $2M/yr per project in grant funds is typically available for projects the size of RIDS.

Local Funds – Developer Contributions/Impact Fees/User Fees (Rates)

Revenue derived from the collection of impact fees could be used to fund portions of the project. Additionally, requirements could be placed on developers to provide or construct portions of the system within particular developments reducing the total cost of the distribution system.

Revenue generated through rates is normally used for O&M costs.

Bonds

Issuance of bonds could provide for project funding; however, due to the costs of issuance, interest rates, coverage and other financial considerations, this would be a last resort option.

Funding Strategy

As depicted in Figure 4-1, it is recommended that the base funding for the RIDS project be the FDEP SRF program loans. The low interest rates (approximately 3.00%) and repayment terms (20 years) make them the most attractive form of overall financing.

The SRF program provides for the flexibility to draw funds only when needed and allows for application of grant funds when received. Unlike bond funds, there is no arbitrage or pre-payment penalties.

After this base funding is secured, it is recommended that district, state, and federal grant funds be sought and secured to negate the use of borrowed funds where possible.

A significant increase in the District's Water Management and Planning budget would be required to support further development of the program as well as dedication of revenues to provide grants for construction funding.

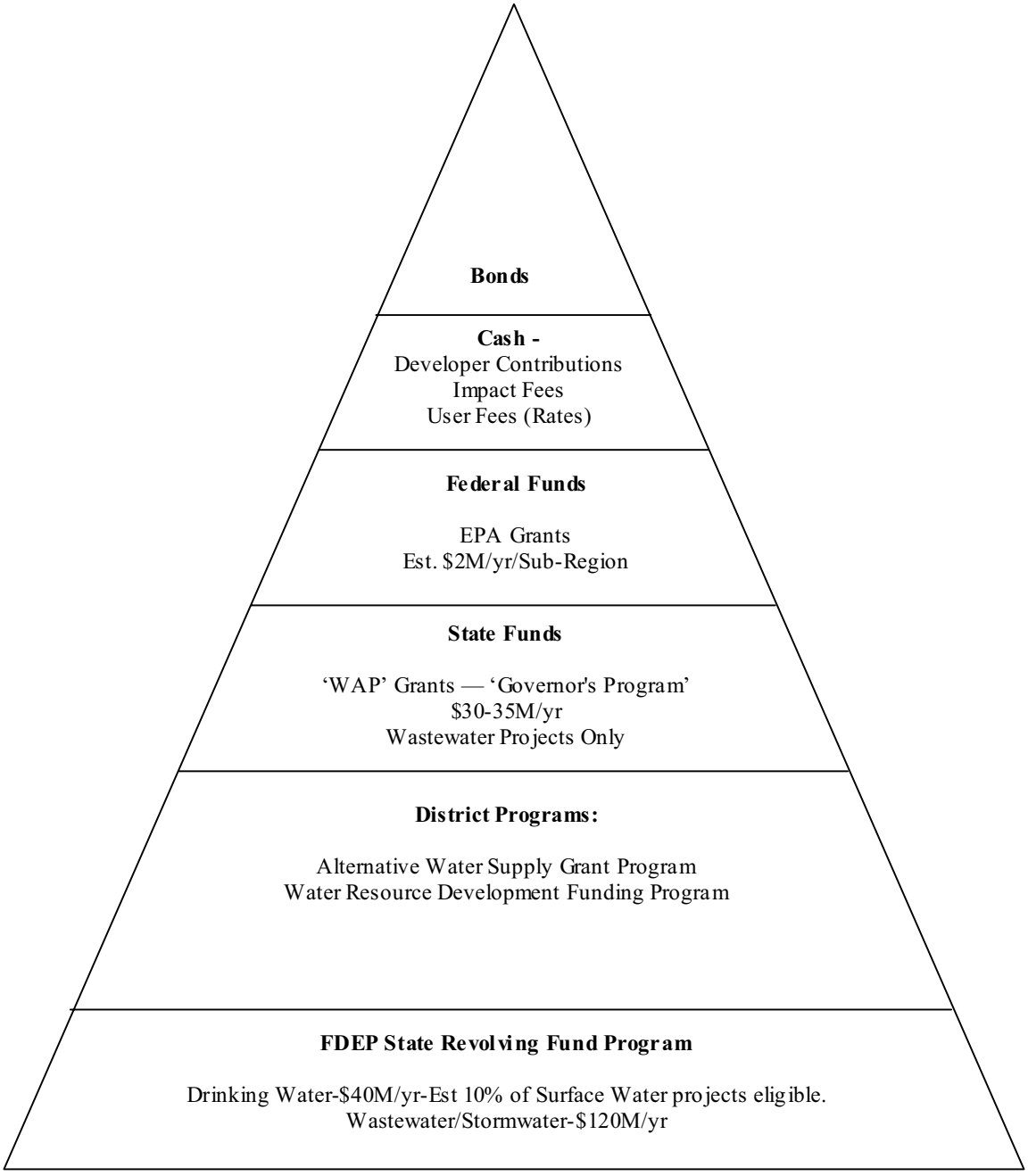
Cash reserves in the form of Developer Contributions and Impact Fees would be considered the third level of funding with bond proceeds considered the least attractive form of funding due to financing costs.

It is assumed that user fees (rates) will pay for Operating and Maintenance costs.

Project Timing and Phasing

It is assumed that the project would be phased to provide system resources based on need. Consideration should also be given to phasing of the service areas as individual areas' economics/demographics may allow them to better "compete" for funding versus other areas or the total project as a whole.

Funding Strategy



Priority Projects

In order to meet the critical issues presented previously, a funding workshop was held with all of the stakeholders and the District. It was determined that "Priority Projects" would be necessary to initiate momentum for the program and to properly image it amongst the legislators, funding agencies regulators. The following table presents a summary of the priority projects as agreed to by the stakeholders and the potential funding sources for them.

RIDS Priority Projects

Project Name	Capital Cost	Typical Funding Sources			
		EPA (STAG)	SFWMD	State (CBIR)	SRF
Sub Region 1 (Collier County, Naples and Bonita Springs)					
BSU - Kehl Canal Surface Water ASR	$ 23,000,000	$ 2,300,000	$ 2,300,000	$ 1,150,000	$ 17,250,000
Collier - BSU Interconnect	$ 3,000,000	$ 300,000	$ 300,000	$ 150,000	$ 2,250,000
Collier - BSU Reclaimed Water ASR	$ 20,000,000	$ 2,000,000	$ 2,000,000	$ 1,000,000	$ 15,000,000
Subtotal	$ 46,000,000	$ 4,600,000	$ 4,600,000	$ 2,300,000	$ 34,500,000
Sub Region 2 (Cape Coral, North Ft. Myers and Waterway Estates)					
Cape Coral - Gator Slough Surface Water ASR	$ 27,000,000	$ 2,700,000	$ 2,700,000	$ 1,350,000	$ 20,250,000
Cape Coral - Everest Pkwy Reclaimed Water ASR	$ 22,000,000	$ 2,200,000	$ 2,200,000	$ 1,100,000	$ 16,500,000
Cape Coral - North South Transfer Station Surface Water ASR	$ 19,000,000	$ 1,900,000	$ 1,900,000	$ 950,000	$ 14,250,000
Subtotal	$ 68,000,000	$ 6,800,000	$ 6,800,000	$ 3,400,000	$ 51,000,000
Sub Region 3 (City of Ft. Myers and Lee County)					
Ft Myers - Central WWTP and South WWTP Interconnect	$ 19,500,000	$ 1,950,000	$ 1,950,000	$ 975,000	$ 14,625,000
Ft Myers - Reclaimed Water Pipeline East of I-75	$ 6,500,000	$ 650,000	$ 650,000	$ 325,000	$ 4,875,000
Lee - Ft. Myers Beach/ Ft. Myers Village ASR system	$ 14,000,000	$ 1,400,000	$ 1,400,000	$ 700,000	$ 10,500,000
Subtotal	$ 40,000,000	$ 4,000,000	$ 4,000,000	$ 2,000,000	$ 30,000,000
TOTAL	$ 154,000,000	$ 15,400,000	$ 15,400,000	$ 7,700,000	$ 115,500,000

Notes:

1. Project Costs are from the Boyle Engineering Funding Report for SFWMD, dated 12/14/04.
2. EPA Participation through STAG requests is dependant upon adequate preparation. $2 million per project is typical for projects of similar scope.
3. SFWMD (AWS) participation has typically been maximized at $200,000, and is considered to be included in applicable projects.
4. Future funds availability from EPA, State, and WMD are uncertain. All funding options will be utilized in order to minimize Stakeholder funds required.

5. Initial funding estimates have been broken down as 10% Federal, 10% SFWMD, and 5% State.

Funding Examples

Shown below are project funding examples from other Districts. The dollar amounts shown for Federal, State, and District sources provided to indicate the type of funding that might be available.

Funding Examples

Project Name	Project Type	Year	Total Project Cost	Total Federal Funding	Total District Cost	Total Basin Cost	Total Governing Board Cost
Tampa Water Resource Recovery	New Water Sources Initiative	FY 2005	4,392,000	3,642,000	750,000	375,000	375,000
Peace River Option	New Water Sources Initiative	FY 2005	65,989,692	574,000	20,755,155	10,377,578	10,377,577
Manatee Agricultural Reuse Supply (MARS)	New Water Sources Initiative	FY 2005	30,821,940	7,256,000	11,981,145	5,990,660	5,990,485
Hillsborough County Central Reuse System	New Water Sources Initiative	FY 2005	7,000,000		3,294,841	1,584,390	1,710,451
Hillsborough Co Northwest Reuse System Ph 1	New Water Sources Initiative	FY 2005	11,100,000		5,406,232	2,685,232	2,721,000
Peace River Regional Reservoir Expansion	New Water Sources Initiative	FY 2005	29,800,000		14,900,000	7,453,980	7,446,020
Peace River Facility Expansion	New Water Sources Initiative	FY 2005	76,200,000	9,000,000	24,200,000	12,225,000	11,975,000
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2005	10,072,312		4,965,712	2,486,268	2,479,444
Facilitating Agricultural Resource Mgmt Systems	Water Supply & Resource Development	FY 2005	6,453,039		6,353,039	4,295,089	2,057,950
Charlotte Co Regional Reclm Wtr Expansion	Water Supply & Resource Development	FY 2005	5,803,245		2,903,745	1,451,898	1,451,847
Manatee Co FPL / Piney Point MARS Storage	Water Supply & Resource Development	FY 2005	8,000,000		4,000,000	2,000,000	2,000,000
TBRRAP-N, Tampa Reclaimed Wtr Pipeline - Ph I	Water Supply & Resource Development	FY 2005	42,774,874	12,372,750	21,406,098	10,703,440	10,702,658
TBRRAP-N, Tampa Reclaimed Wtr Pipeline - Ph II	Water Supply & Resource Development	FY 2005	42,300,000		21,150,000	10,575,000	10,575,000
Central Sarasota Co Regional Reuse Sys Project	New Water Sources Initiative	FY 2004	4,008,608		2,004,304	1,002,152	1,002,152
North Pinellas Reuse Interconnections	New Water Sources Initiative	FY 2004	3,172,300		1,586,150	793,075	793,075
W. Pasco Infrastructure Improvement-Starkey/N. Pasco	Water Supply & Resource Development	FY 2004	30,000,000		15,000,000	7,500,000	7,500,000
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2004	10,067,144		4,960,544	2,480,894	2,479,650
Facilitating Agricultural Resource Mgmt Systems	Water Supply & Resource Development	FY 2004	3,267,271		3,167,271	2,304,016	863,255
Central Sarasota Reuse	New Water Sources Initiative	FY 2003	4,008,608		2,004,304	1,002,152	1,002,152
NW Reuse Expansion	New Water Sources Initiative	FY 2003	10,884,000		5,442,000	272,100	272,100
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2003	9,564,786		4,708,186	2,353,536	2,354,650
Tampa's Howard Curren WWTP Regional Reclaimed to New Tampa	Water Supply & Resource Development	FY 2003	15,000,000		7,500,000	3,750,000	3,750,000
Tampa's Howard Curren WWTP Regional Reclaimed to Pasco	Water Supply & Resource Development	FY 2003	15,000,000		5,000,500	2,481,000	2,500,000

Below shows various projects identified from this District in its "Alternative Water Supply" (AWS) program, which could hopefully be a source for some of the projects identified in the RIDS Engineering document. The SFWMD Budget for Major Projects includes an additional $21,687,996.

Alternative Water Supply (AWS) Identified Projects

Applicant	Project Title	SFWMD Funding	Total Project Cost	% Funded by SFWMD
City of Pahokee	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
City of South Bay	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
City of Belle Glade	Lake Region Water Treatment Plant Project	$200,000	$675,000	30%
City of Clewiston*	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
South Shore Water Association*	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
Palm Beach County	Century Village Reuse	$200,000	$1,065,000	19%
Town of Manalapan	Floridan Aquifer Wells	$100,000	$842,242	12%
Village of Wellington	Village Park & Water Reclamation Facility #2	$100,000	$672,000	15%
South Central Regional Wastewater Treatment & Disposal Board	Reuse Plant Expansion (phased project)	$100,000	$12,600,000	1%
Jupiter Utilities	RO Treatment Plant Expansion	$100,000	$3,500,000	3%
Jupiter Utilities	Floridan Aquifer Wells	$100,000	$2,742,000	4%
Village of Tequesta	RO Expansion	$100,000	$1,120,000	9%
City of Hollywood*	Reclaimed Water System Expansion	$100,000	$480,000	21%
City of Miami Beach	Normandy Shores Golf Club	$200,000	$935,000	21%
City of North Miami Beach	Nanofiltration Concentrate Treatment	$100,000	$634,000	16%
Miami-Dade Water and Sewer Dept.	Ultra Violet Disinfection – West Wellfield	$200,000	$2,053,000	10%
Miami-Dade Water and Sewer Dept.	Ultra Violet Disinfection – Southwest Wellfield	$100,000	$2,149,000	5%
Florida Keys Aqueduct Authority	Blending ASR Well	$200,000	$1,334,715	15%
City of Fort Myers	Central WWTF Reclaimed Water Extension	$200,000	$3,127,000	6%
City of Fort Myers	RO Expansion	$100,000	$9,800,000	1%
Cape Coral	Reclaimed Water Supplemental Source	$100,000	$998,000	10%
City of Naples	Reclaimed Water System Expansion	$100,000	$13,600,000	1%
Collier County	ASR Expansion	$100,000	$1,260,100	8%
Bonita Springs	San Carlos ASR Wells	$100,000	$974,199	10%
Bonita Springs	New RO Wellfield	$100,000	$2,800,000	4%
Bonita Springs	RO Treatment	$100,000	$24,000,000	0%
Martin County Utilities	North Reclaimed Water System Expansion	$100,000	$570,000	18%
Martin County Utilities	Tropical Farms RO Wellhead	$100,000	$750,000	13%
South Martin Regional Utility	Reclaimed Water System Expansion	$100,000	$540,000	19%
Fort Pierce Utility Authority	Reclaimed Water System	$100,000	$3,150,000	3%
Port St. Lucie Westport Reuse	Westport Reclaimed Water System	$100,000	$1,202,760	8%
City of Kissimmee	Stormwater Reuse	$200,000	$5,200,000	4%
Orange County Utilities Department	Ginn Property Reuse	$100,000	$816,248	12%
City of St. Cloud	Reclaimed Water System Expansion	$100,000	$758,898	13%
Total		$4,500,000	$102,345,162	4%

Shown below is the funding that was obtained for the Manatee County Agricultural Reuse System project.

Manatee County ASR/Reuse Demonstration Program Funding Worksheet

Manatee County ASR/Reuse Demonstration Program Funding Worksheet							
	Total	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	Total
Project Cost	14,824,724	4,295,000	2,632,431	2,632,431	2,632,431	2,632,431	14,824,724
EPA (Original)	4,295,000	2,093,383	1,283,047	918,571	-	-	4,295,000
SWFWMD (Ag. Reuse)	6,740,970	1,670,395	1,267,644	1,267,644	1,267,644	1,267,644	6,740,970
SWFWMD (ASR)	325,000	325,000	-	-	-	-	325,000
Subtotal	11,360,970	4,088,778	2,550,691	2,186,214	1,267,644	1,267,644	11,360,970
Balance of Project Costs	3,463,754	206,222	81,740	446,217	1,364,787	1,364,787	3,463,754
EPA (Amendment)	1,900,000	-	-	446,217	1,364,787	88,996	1,900,000
County Funds (Required)	1,563,754	206,222	81,740	0	0	1,275,791	1,563,754
Subtotal	3,463,754	206,222	81,740	446,217	1,364,787	1,364,787	3,463,754
Grand Total	**14,824,724**	**4,295,000**	**2,632,431**	**2,632,431**	**2,632,431**	**2,632,431**	**14,824,724**

Notes:

1. Project Costs were utilized from the SWFWMD Grant Agreements dated 12/6/94.
2. EPA Participation through the Original Agreement is 48.74% of $8,812,147 up to a maximum of $4,295,000.
3. SWFWMD (Ag. Reuse) participation is 50% of $14,024,724 up to a maximum of $6,740,970.
4. SWMWMD (ASR) participation is 50% of $650,000 (of the $800,000 project) up to a maximum of $325,000.
5. The project EPA Amendment amount is based on discussions with Mario Machado of EPA. Participation is expected to be 95%.
6. Future funds availability from EPA is uncertain. All funds will be utilized in order to minimize County funds required.

Similar results are possible for the RIDS program.

Funding Schedule

A proposed funding schedule is below. This schedule is typical of the annual funding cycles. For State and Federal appropriations, it is imperative that efforts be started now.

The funding consultant is prepared to initiate a CBIR for the District to help get the first funding success with the State and to initiate the entire program.

Specific Recommendations/Summary

Leadership from the District will ensure success of the RIDS Program. This has been the key to the successes of other District's efforts around the state. The immediate assignment of a high-level person from the District, perhaps a board member, is critical to funding successes.

All stakeholders need direction and support from the District. They need to buy into the funding plan for the program and to be certain their actions are consistent with those of the District in attempts to secure funding.

FUNDING SCHEDULE

Task Name	Start	Finish
STATE APPROPRIATIONS	**Thu 11/11/04**	**Thu 7/28/05**
Information Document	Thu 11/11/04	Fri 12/10/04
Legislative Discussions	Mon 11/29/04	Tue 12/28/04
Prep Required Documents	Tue 11/30/04	Tue 12/28/04
CBIR Senate	Wed 12/1/04	Thu 12/30/04
CBIR House	Wed 12/1/04	Thu 12/30/04
DEP Review Period	Wed 12/1/04	Mon 1/31/05
Lobby Effort	Wed 12/1/04	Mon 5/2/05
Follow Up	Mon 5/2/05	Thu 7/28/05
FEDERAL APPROPRIATIONS	**Wed 12/1/04**	**Thu 12/29/05**
Information Document	Wed 12/1/04	Thu 12/30/04
Legislative Discussions	Fri 12/3/04	Mon 1/3/05
Prep Required Documents	Fri 12/3/04	Mon 1/3/05
CBIR Senate	Wed 12/1/04	Thu 12/30/04
CBIR House	Wed 12/1/04	Thu 12/30/04
EPA Review Period	Wed 12/1/04	Mon 1/31/05
Lobby Effort 1st Session	Wed 1/5/05	Wed 3/30/05
Follow Up	Tue 2/1/05	Fri 4/29/05
Lobby Effort 2nd Session	Thu 9/1/05	Tue 12/20/05
Follow Up	Mon 10/3/05	Thu 12/29/05
SRF CYCLE	**Mon 12/13/04**	**Tue 6/7/05**
RFI	Tue 12/14/04	Mon 12/20/04
FDEP Hearing	Wed 1/5/05	Tue 1/11/05
Facilities Plan	Wed 1/12/05	Wed 4/13/05
Capital Financing Plan	Mon 12/13/04	Mon 3/14/05
Public/Dedicated Revenue Meeting & Approvals	Fri 3/11/05	Mon 3/28/05
State Environmental Review & Approval Process	Mon 3/28/05	Fri 5/20/05
FFONSI/CEN	Mon 3/28/05	Fri 5/20/05
Site Planning	Mon 5/23/05	Tue 6/7/05
SFWMD FUNDING	**Mon 1/3/05**	**Mon 10/31/05**
Identify Source	Mon 1/3/05	Fri 1/28/05
Request Funding	Mon 1/3/05	Thu 3/31/05
SFWMD Ranks Eligibility	Mon 5/2/05	Thu 6/30/05
District Board Reviews list	Mon 8/1/05	Wed 8/31/05
Agreements Executed	Mon 10/3/05	Mon 10/31/05

Project: Table 25 RIDS Schedule draft
Date: Mon 12/13/04

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

The process must be identified for all concerned in sufficient detail to allow any party to take advantage of funding opportunities when they arise.

The program must be given a high profile within the District in all actions and publications. This will reinforce the intent to implement the program.

RIDS is a worthwhile program that can address water supply needs in a multi-jurisdictional area for years to come. These issues cannot be ignored by any of the interested parties. With the leadership of the South Florida Water Management District, this program can succeed in addressing these needs.

ASSESSMENT OF CURRENT POLICIES, PROCEDURES, AND REGULATIONS

There are numerous regulatory issues that apply to the RIDS program. Emerging policies and regulations are evolving for projects like ASR and surface water withdrawals. The RIDS is on the leading edge of some of these applications, it is appropriate to assess how specific regulations may affect this initiative.

Surface water ASR is currently being evaluated for the Comprehensive Everglades Restoration Program (CERP). There will ultimately need to be a determination made by FDEP on the water quality criteria for the injection of surface water into ASR wells for use. The difference between the degree of treatment to meet Primary and Secondary drinking water quality as defined by the Safe Drinking Water Act and incorporated into FAC 62-550, and the minimum criteria for injection wells, is substantial in terms of costs impacts to the overall program. The USEPA has indicated a willingness to allow recharge water that contains Coliform bacteria for the CERP ASR demonstration program. It may not be unreasonable for them to also consider a water quality criterion that slightly exceeds the primary standards for turbidity as long as fundamentally, the turbidity and resulting particles are not a clogging problem for the wells.

Further, there is the need to allow for natural attenuation of bacteria and other microbiota (viruses and protozoa) within the ASR storage zone such that discrepancies between the Safe Drinking Water Act (SDWA) and the EPA underground injection control program requirements are reconciled. With these water quality issues resolved there is great potential for lower technology processes to meet water quality goals within a more reasonable expectation of costs and complexity of the systems.

In this manner, the main criteria would be turbidity and/or particle size consistent with protection of the ASR well and disinfection to meet a Coliform reduction standard based on daily sampling in which no more than one sample is positive for Total Coliform and no single sample exceeds 4 total Coliforms per 100 mL.

If there is agreement for relaxed treatment requirements for disinfection, wherein the water quality requirements are only to meet a Coliform level of not more than 4 colonies/100mL sample, then the following will suffice:

- A treatment system to meet particulate removals consistent with protecting the injection system (not plugging the well).
- Corrosion control to prevent the injected water causing a corrosive atmosphere to the receiving formation will be sufficient.

However, the concern of disinfecting minimally for Coliforms while preventing Disinfection By-Products remain a concern; therefore, the following methods may be appropriate:

- Bankfiltration systems followed by either a UV disinfection or a low tech solid chemical chlorine/ammonia feed system to provide some limited free chlorine for bacteria and virus inactivation followed by chloramines for further disinfection contact time without a major production of DBPs.

- Slow-sand filtration systems followed by the same level of disinfection as described above (chlorine/ammonia).

The RIDS has assumed the use of bankfiltration systems for source water for ASR in lieu of more costly technologies, such as membranes.

The following presents a collection of regulations that will apply to the RIDS projects:

Florida Department of Environmental Protection (FDEP) Regulations

The FDEP, an agency established by the State of Florida to govern over environmental issues within the State of Florida, has prepared regulations pertaining to water use, reuse, and other relevant aspects of the RIDS project.

Chapter 62-40, FAC – Water Resource Implementation Rule

Chapter 62-40, FAC, contains FDEP policies on water resources in Florida and establishes a cooperative relationship with the Water Management Districts in water resource issues. Under the general water policy provisions, reclaimed water is specifically identified as an integral part of water management programs. FDEP also encourages the use of water of the lowest acceptable quality for the purpose intended. Under the water use guidelines, it is stated that no water use permit shall be granted by the Water Management District unless the applicant demonstrates a reasonable beneficial use for that water.

Chapters 62-520 & 522, FAC – Ground Water

The relevant chapters on the subject of ground water focus on protecting the present and future most beneficial uses of ground waters of the state. To ensure their protection, classifications for ground waters of the State have been established. Appropriate water quality designations are outlined in these chapters.

Chapter 62-520, FAC, contains the minimum criteria for ground water and classification descriptions ranging from G-1 (which has the most stringent regulations), to G-IV (the least stringent). This chapter also includes a list of exemptions for each class of ground water.

Chapter 62-522, FAC, discusses ground water monitoring and permitting. This includes recharging aquifers with surface water and reclaimed water ASR. An allowable zone of discharge is expressed for each classification, and monitoring requirements and exemptions are also discussed.

Chapter 62-528, FAC – Underground Injection Control

The Underground Injection Control Program (UIC) is a delegated federal program authorized under the EPA Safe Drinking Water Act. It is under this program that ASR wells are permitted. All wells included in the RIDS would fall under the Class V category, and would most likely be in Group 7 (Aquifer Storage and Recovery System Wells).

Aquifer Storage and Recovery

As indicated above, FDEP rules contained in Chapter 62, Section 528 of the Florida Administrative Code (FAC), govern the permitting and operation of ASR wells. Subsection 300 is of special interest in the permitting of surface water and reclaimed water ASR wells. This portion of the regulations deals

with aquifer exemptions. Such exemptions may be needed for certain injection water quality parameters, such as color, which do not meet Secondary Drinking Water Standards. Minor exemptions are fairly straightforward for aquifers, which have total dissolved solids (TDS) concentrations between 3,000 and 10,000 milligrams per liter (mg/L).

Consumptive Use Permitting

After construction of a viable ASR pilot project and conducting cycle testing, a water use permit for the established system and any planned expansion should be obtained from the District. This may be a modification of any existing permit for a particular utility, or a new permit for either an existing utility or for a new sub-regional entity. The main purpose for obtaining a water use permit for an ASR system is the same as that for obtaining any other water use permit in the State; namely it establishes the prior rights of the permittee to those applicants which may want to use an aquifer in the area in the future.

Well Construction

Regulations regarding construction and testing of ASR wells are contained in FAC Chapter 62, Section 528. In addition to obtaining an FDEP Class V well construction permit, a well construction permit must also be obtained from the agency that permits wells in a particular jurisdiction. In portions of Lee County, it is the Lee County Water Resources Department. In other parts of Lee County, it is a local government, such as the City of Cape Coral. If those entities are the permittee (i.e., the owner of the well), the District is the permitting agency. A similar situation applies to ASR wells constructed in Collier County.

Chapter 62-600, FAC – Wastewater Facilities

Chapter 62-600, FAC, discusses planning for wastewater facilities design and expansion and goes into some detail discussing minimum treatment standards, disinfection, pH, and other design and operational criteria. It also details the required treatment levels for all types of disposal, including discharge to surface waters, reuse and land application, and disposal by underground injection. It is expected that many of these rules will come into play during the design and construction of the RIDS infrastructure.

Chapter 62-604, FAC – Collection Systems and Transmission Facilities

This chapter imparts information on basic design principles that should be upheld, including details on fencing, siting, and special crossings. A requirement for uninterrupted service and a procedural outline for abnormal events are also included in this chapter.

Chapter 62-610, FAC, Part I – Reuse of Reclaimed Water and Land Application

Reuse is defined as the deliberate application of reclaimed water, in compliance with FDEP and water management district rules, for a beneficial purpose. The first part of this rule provides design, operation, and maintenance criteria for land application systems, surface water discharge projects involving reuse for ground water discharge, indirect potable use, or other beneficial purposes. For all new or expanded reuse or land application projects, a preliminary design report must be submitted to FDEP. Any exceptions to this are noted in this rule.

South Florida Water Management District (SFWMD) Regulations

Formed by Florida State Legislature in 1949, the Central and Southern Florida Flood Control District (FCD) resulted from the need to respond to drought and flood conditions in south Florida. The main responsibility of the FCD through 1972 was to act as local sponsor for the U.S. Army Corps of Engineers construction project.

In accordance with south Florida's changing demand for, and perception of, water resources management, the Florida State Legislature enacted the Water Resources Act in 1972. This act divided the state into five regional districts, naming one of them as the South Florida Water Management District (SFWMD). This act (Chapter 373, Florida Statutes) also greatly expanded the previous responsibilities of the FCD. Watersheds and other natural, hydrologic, and geographic features determine the districts' boundaries.

Today, the District operates and maintains the structures and conveyances built by the FCD. These consist of 1,800 miles of canals and levees, 25 major pumping stations, and about 200 large and 2,000 small water control structures.

The District spans 16 counties and includes vast areas of agricultural lands, water conservation areas, and areas of rapid urban growth and development.

Minimum Flows and Levels

To help determine the amount of water that is available for human use from a particular source, the District must, by act of the Florida Legislature, determine the water body's minimum flow and level (MFL). An MFL is the limit at which further withdrawals will cause significant harm to the water resources of the area and the related natural environment. Lakes and aquifers will have minimum levels set. Minimum flows will be set for rivers and streams. The District uses this information, as well as other information particular to a proposed withdrawal, when determining how much water an applicant may be allowed to withdraw from the water body.

Currently, the only surface water body that falls under the District's Priority List for establishing MFLs is the Caloosahatchee River and Estuary. In this case, a minimum mean monthly flow of 300 cubic feet per second (cfs) has been deemed necessary to maintain sufficient salinities downstream of the Franklin Locks (also known as S-79) in order to prevent a MFL exceedance. A MFL exceedance occurs during a 365-day period, when: (a) a 30-day average salinity concentration exceeds 10 parts per thousand, or (b) a single, daily average salinity exceeds a concentration of 20 parts per thousand. Exceedance of either parameter for two consecutive years is considered a violation.

All Minimum Aquifer Level (MAL) regulations in the Lower West Coast Region apply only to the Lower Tamiami, Sandstone, and mid-Hawthorn aquifers. Decisions on MALs in regard to the water table aquifer are pending. As all proposed ASR systems for the RIDS will be in the Floridan aquifer, these regulations do not apply to this project.

U.S. Army Corps of Engineers (ACOE)

The ACOE regulatory program includes the review of dredge and fill activities in waters of the United States, the construction in navigable waters and the disposal of dredge material in offshore locations. Section 404 of the Clean Water Act requires that permits be received for the deposition of fill in waters

or adjacent wetlands of the United States, the construction of revetments, groynes, levees, dams or weirs, and the placement of riprap. Section 10 of the Rivers and Harbors Act of 1899 requires that permits be obtained for activities that affect navigable waters. The ACOE also has Memoranda of Agreement (MOA) with other federal agencies such as the U.S. Fish and Wildlife Service (FWS) and the U.S. Department of Environmental Protection. These agreements allow for the agencies to provide input during the review process on issues such as federally listed wildlife species and wetland impacts associated with the projects under review. In determining whether to issue a permit, the ACOE must also comply with other requirements, including Section 7 of the Endangered Species Act of 1973 (50 CFR Part 402), the National Environmental Policy Act of 1969, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act and other applicable federal laws.

Illustrated in Table 19 are the possible constraints by federal and state regulations broken down by RIDS alternative.

Table 19
Regulatory Constraints by Alternative

Source	Regulatory Agency	Constraint
Surface Water	FDEP	Safe Drinking Water Act – Disinfection Byproducts (DBPs), Surface Water Treatment Rules, Primary and Secondary Drinking Water Standards; Permitting and Construction of Public Water System; Regulation of Wells
	SFWMD	Water Use Permit (WUP) Minimum Flows and Levels (MFLs) Reservations
Surface Water ASR	FDEP	Safe Drinking Water Act – Disinfection Byproducts (DBPs), Surface Water Treatment Rules, Primary and Secondary Drinking Water Standards; Permitting and Construction of Public Water System; Regulation of Wells; Underground Injection Control (UIC)
	SFWMD	WUP MFLs Reservations
Reclaimed Water	FDEP	Wastewater Facilities, Collection Systems and Transmission Facilities, Reuse of Reclaimed Water and Land Application
Reclaimed Water ASR	FDEP	Wastewater Facilities, Collection Systems and Transmission Facilities, Reuse of Reclaimed Water and Land Application, Primary and Secondary Drinking Water Standards, Regulation of Wells, UIC
	SFWMD	WUP

Collier County Regulations

Collier County is at the forefront of Florida municipalities in incorporating reclaimed infrastructure in new developments as well as retrofitting existing neighborhoods. Collier County is also among the first in the state to incorporate reclaimed water ASR into their capital improvements list. In addition, the Big Cypress Basin is an integral part of improving and maintaining the delicate water balance in this region of the state.

Collier County's Municipal Code, Section 3.8.2.3.25, states that a complete water distribution and transmission system to include provisions for separate potable and reuse water lines for all subdivisions and developments.

For other information on Collier County regulations, refer to the Collier County Municipal Code, Big Cypress Basin Board documents, SFWMD, and FDEP regulations.

Big Cypress Basin

Further definition of water management roles were established in 1976 as a result of a legislative amendment resulting in the establishment of two basin boards within the newly named South Florida Water Management District. The basins were named the Okeechobee Basin and the Big Cypress Basin.

The Big Cypress Basin (BCB) was officially created on January 1, 1977. The Big Cypress Basin Board presently has responsibility for operation, maintenance, and providing planning and capital improvements to 163 miles of primary canals and 40 water control structures. The BCB encompasses the portion of the RIDS that is located in Collier County.

BCB has the following programs:

Water Management Planning

The Basin is responsible for preparing engineering plans for the development of water resources within the basin.

Restoration Projects

The Basin is currently working on three major restoration projects. The Southern Golden Gate Estates Hydrologic Restoration is slated for funding under the CERP. The Lake Trafford and Tamiami Trail Flow Enhancement projects are being sponsored by a cooperative agreement with the ACOE under the funding initiative of the Water Resources Development Act of 1996.

Hydromonitoring

The Basin maintains an extensive monitoring network of rainfall, evaporation, surface and ground water levels, streamflow, and water quality.

Construction

The Basin's construction program facilitates and enhances the water resources within the region. Construction projects include retrofitting existing structures as well as new construction.

Operation and Maintenance

Maintenance work in the canals, involve shoal and debris removal, control of aquatic and terrestrial vegetation. Operation and maintenance of water control structures involves routine maintenance and timely operation of structures. Administration of canal right-of-way permits is coordinated under this program.

Lee County Regulations

Lee County does not have a basin board; therefore the majority of water rules and regulations are determined by the District, FDEP, or federal rules. However, Lee County is proactive in that both existing and new developments must use reclaimed water for irrigation over potable wherever feasible and within the utility service area.

Lee County Municipal Code, Sec. 10-354 -Reuse Water System

This portion of the Municipal Code states that, wherever feasible, the irrigation of grassed or landscaped areas must be provided for through the use of a second water distribution system supplying treated wastewater effluent or reuse water. All proposed developments should be designed to maximize the use of reclaimed water whether located in the utility service area or from an on-site wastewater treatment facility.

For other information on Lee County regulations, refer to the Lee County Municipal Code, SFWMD, and FDEP regulations.

BENEFITS AND INCENTIVES

The benefits of the RIDS program are very positive in terms of additional water sources in a high growth area such as the lower west coast of Florida. Overall, the RIDS optimizes existing reclaimed water supplies, maximizes surface water use, diversifies supply sources, reduces water shortage declarations, offsets potable water usage, reduces disposal volumes, and offsets groundwater withdrawals. Along with these obvious benefits, the following table (Table 20) presents incentives for this sub-region:

Table 20
Benefits and Incentives by Sub-region

Naples, South Collier, and Marco Island
1. Meet increasing demands
2. Will allow water to be shared between utilities for beneficial reuse
3. Promote reduction of on-site septic systems, increasing reclaimed water supply
4. Allow growth to continue in the region by providing a supplemental supply of irrigation water
5. Reduce reliance on surface water discharge
6. Will allow expansion of reclaimed water systems and infrastructure
7. The region will be able to utilize or store close to 100% of reclaimed water on an annual basis
8. Interconnect with Collier County will allow Naples to send additional reclaimed water for beneficial reuse
9. Reduce disposal of effluent discharge to the Gordon River

PREFERRED ALTERNATIVE

Table 21 presents the preferred alternative and describes the projects that make up the alternative. The projects include surface water ASR, reclaimed water ASR, and interconnects. Table 21 also presents the supply benefit that each project is estimated to provide.

Table 21
Sub-regional Alternatives Summary

No.	Alternatives	Benefit or Recovery Capacity (MGD)	No. of Wells	Infrastructure needed
1.	Golden Gate Canal ASR – 17th Ave.	20	28	Intake system, pumping station, ASR wells and chemical treatment system
2.	Golden Gate Canal ASR – Airport Road	25	35	Intake system, pumping station, ASR wells and chemical treatment system
3.	Faka Union Canal ASR	25	35	Intake system, pumping station, ASR wells and chemical treatment system
4.	Cocohatchee River ASR	5	8	Intake system, pumping station, ASR wells and chemical treatment system
5.	Kehl Canal ASR	12	18	Intake system, pumping station, ASR wells and chemical treatment system
6.	North Collier \ Bonita Springs Interconnect	10.5	15	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 9 and 13.
7.	Naples \ South Collier Interconnect	12	18	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 10 and 11.
8A/8B.	Pelican Bay and Collier County North	8.1	13	Pumping station, ASR wells, and chemical treatment system
9.	Collier County South	6.6	11	Pumping station, ASR wells, and chemical treatment system
10.	Naples	5.4	14	Pumping station, ASR wells, and chemical treatment system
11.	Golden Gate	0.5	2	Pumping station, ASR wells, and chemical treatment system
12.	Bonita Springs Utilities	2.4	5	Pumping station, ASR wells, and chemical treatment system
13	North Collier / South Collier Interconnect	14.7	21	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 9 and 10.
14.	Golden Gate Mine Pit	1.5	0	Intake, pumping station, and chemical treatment system
	Total Benefit or Recovery Capacity	**148.7**	**223**	Total does not include redundant benefit from the Interconnect Alternatives 6, 7 and 8.

Figure 14 presents the ASR system locations and interconnect routes**.**

ALTERNATIVE SELECTION

Each of the projects shown in Table 21 were evaluated to best meet the supply needs of this sub-region and to determine the feasibility of its implementation using the criteria described below. Each selection criterion is scored between 1 and 5, for each project, with the higher score resulting in a higher priority. The scoring is shown on Table 23. The prioritized projects will then be used in the implementation strategy. The following provides a brief description of each evaluation criterion.

Capacity Benefit

Evaluates the amount of supplemental water (benefit) that each project will provide to offset potable or ground water use for urban irrigation. The benefit is estimated in million of gallons per day. The capacity benefit ranking was based on the range of supply provided as shown below:

From 1 MGD to 4 MGD Rank = 1

From 5 MGD to 9 MGD Rank = 2

From 10 MGD to 14 MGD Rank = 3

From 15 MGD to 19 MGD Rank = 4

Greater than 20 MGD Rank = 5

Permittability

All of the projects included in the recommended alternative are permittable and there are several precedents for each in the region and throughout the State. Some projects, such as interconnects are much easier to permit than the others, which is reflected in the scoring.

Proximity to Existing Infrastructure

There is an extensive network of existing infrastructure throughout the sub-region that will provide a means of transmission from the new sources of supply to the areas of need. Some projects are close to the existing transmission system, making implementation more economical. For example, a transmission system 1,000 feet would result in 5. Larger distances will result in lower scores.

Unit Cost

A unit cost was calculated for each of the projects, as shown in Table 22. The unit cost includes the construction, land acquisition, of the project, engineering, pilot testing and operation and maintenance (O&M). Currently, the technology required for surface water ASR includes bank-filtration, pH adjustment, and chlorine/chloramines disinfection.

Table 22
Project Unit Cost

Project	Cost per 1000 gallons
1. Golden Gate Canal – 17th Ave.	$1.31
2. Golden Gate Canal - Airport Rd.	$1.17
3. Faka Union Slough	$1.63
4. Cocohatchee River	$1.58
5. Kehl Canal	$1.31
6. N. Collier/BSU Interconnect	$1.24
7. S. Collier/Naples Interconnect	$1.12
8A. Pelican Bay / 8B. Collier County North	$1.17
9. Collier County South	$1.20
10. Naples	$1.31
11. Golden Gate	$4.28
12. Bonita Springs Utilities	$1.72
13. N. Collier Cty/S. Collier Cty Interconnect	$1.06
14. Golden Gate Mine Pits	$2.91

Shown below is the ranking of the unit cost based on price ranges. The final ranking is presented in Table 23.

From $1.00-$1.25 Rank = 5

From $1.26-$1.50 Rank = 4

From $1.51-$1.75 Rank = 3

From $1.76 - $2.00 Rank = 2

From $2.01-$Up Rank = 1

Participation Interest

Some of the stakeholders in the RIDS have expressed more interest and participated more extensively than others. As this is primarily a voluntary program for the stakeholders, their anticipated participation is scored accordingly.

Funding Ability

The projects included in the preferred alternative are fundable through SRF loans and should be eligible for a number of state and federal grants. Funding has been directed towards projects with regional benefits and those that offset potable use and groundwater pumpage, i.e., alternative sources of supply. The availability of state and federal grant programs has been based on legislative and congressional approval; therefore, a funding strategy based on the latest programs will be provided for the preferred alternative in the final report.

Consistency with Master Plan

The stakeholders have developed or are developing master plans to improve and expand their system. The development of the RIDS has integrated the plans of the stakeholders. Therefore, this criterion evaluates how each of the projects could be integrated to the improvements planned.

Table 23
Project and Criteria Evaluation

Supply Projects		Capacity Benefit	Permit-ability	Proximity to Existing Infrastructure	Unit Cost	Participation Interest	Funding Ability	Consistency with Master Plans	Total Points	Rank
1	Golden Gate Canal Surface Water ASR – 17th Ave.	4	3	1	4	4	4	4	24	7
2	Golden Gate Canal Surface Water ASR – Airport Road	5	3	5	5	4	4	4	30	2
3	Faka Union Canal Surface Water ASR	5	3	3	2	2	2	3	20	9
4	Cocohatchee River Surface Water ASR	2	3	5	2	4	4	4	24	7
5	Kehl Canal Surface Water ASR	3	3	1	4	5	4	5	25	6
6	North Collier \ Bonita Springs Interconnect	3	5	1	3	5	5	5	29	3
7	Naples \ South Collier Interconnect	3	5	5	3	3	5	5	31	1
8	Pelican Bay and Collier County North Reclaimed Water ASR	3	3	5	4	4	4	4	27	4
9	Collier County South Reclaimed Water ASR	2	3	5	4	4	4	4	26	5
10	Naples Reclaimed Water ASR	2	3	5	3	1	4	2	20	9
11	Golden Gate Reclaimed Water ASR	2	3	1	1	3	4	3	17	10
12	Bonita Springs Utilities Reclaimed Water ASR	1	3	1	2	5	4	5	21	8
13	North Collier / South Collier Interconnect	1	5	5	5	5	5	5	31	1
14	Golden Gate Mine Pit	1	4	1	1	2	3	2	14	11

RECOMMENDED IMPLEMENTATION STRATEGY

The supply projects presented in Table 23 were prioritized based on the project criteria evaluation. The implementation strategy for the projects was based on the following:

- Funding availability – Assume maximum funding of $40 million per year
- Program horizon of 2020
- Regulatory approval
- Design, bidding, construction and testing schedules
    - Two (2) years for interconnects
    - Four (4) years for ASR systems except for Faka Union (5 years)

Table 24 presents the proposed implementation for the projects starting in 2005. The project implementation is started in the order of ranking.

Table 24
Project Implementation Strategy

Rank	Project No.	Name	Est. Implementation Time (Yrs.)	Total Project Cost ($M)	Construction Yearly Cost ($M)															
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	13	North Collier / South Collier Interconnect (1)	4	23	3.4	7.9	6.8	4.5	-	-	-	-	-	-	-	-	-	-	-	-
2	2	Naples \ South Collier Interconnect (1)	4	20	3.0	6.9	5.9	3.9			-	-	-	-	-	-	-	-	-	-
3	7	Golden Gate Canal Surface Water ASR – Airport Road (1)	4	43	-	-	6.5	15.2	13.0	8.7	-	-	-	-	-	-	-	-	-	-
4	6	North Collier \ Bonita Springs Interconnect (2)	4	20	-	-	-	-	3.9	6.8	4.9	3.9	-	-	-	-	-	-	-	-
5	8	Pelican Bay and Collier County North Reclaimed Water ASR (1)	4	14	-	-	-	-	2.1	4.9	4.2	2.8	-	-	-	-	-	-	-	-
6	9	Collier County South Reclaimed Water ASR (1)	4	12	-	-	-	-	1.8	4.1	3.5	2.4	-	-	-	-	-	-	-	-
7	5	Kehl Canal Surface Water ASR (1)	4	24	-	-	-	-	-	3.6	8.4	7.2	4.8	-	-	-	-	-	-	-
8	1	Golden Gate Canal Surface Water ASR – 17th Ave. (2)	4	40	-	-	-	-	-	-	-	8.0	13.9	10.0	8.0	-	-	-	-	-
9	4	Cocohatchee River Surface Water ASR (1)	4	13	-	-	-	-	-	-	-	1.9	4.4	3.8	2.5	-	-	-	-	-
10	12	Bonita Springs Utilities Reclaimed Water ASR (1)	4	7	-	-	-	-	-	-	-	-	-	1.0	2.3	2.0	1.3	-	-	-
11	3	Faka Union Canal Surface Water ASR (2)	5	65	-	-	-	-	-	-	-	-	-	-	6.5	16.3	16.3	13.0	13.0	-
12	10	Naples Reclaimed Water ASR (1)	4	11	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.8	3.2	2.2
13	11	Golden Gate Reclaimed Water ASR (1)	4	4	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.3	1.1	0.8
14	14	Golden Gate Mine Pit	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.7	3.7
TOTAL				301	9.9	23.1	22.7	20.1	13.7	23.4	21.0	26.1	23.1	14.7	19.3	18.2	19.8	18.1	21.1	6.6

Note:
(1) Cost distribution for 4 year construction-ASR projects: 1st year = 15%, 2nd =35%, 3rd = 30%, and 4th = 20% of the total cost of the project.
(2) Cost distribution for 4 year construction-ASR projects with pipelines: 1st year = 20%, 2nd =35%, 3rd = 25%, and 4th = 20% of the total cost of the project. The project that takes 5 years is distributed from 1st to 5th year = 10%, 25%, 25%, 20% and 20% respectively.

DESIGN STANDARDS

The design and implementation of the projects identified as the preferred alternative will be performed in accordance with industry standards, regulatory requirements, and local government standards. This section presents the accepted industry resources and which elements apply to the proposed projects.

American Water Works Association (AWWA)

The following are AWWA standards that will be applicable to the facilities in the proposed projects:

- A97-100 - Groundwater and Well
- C104, C105, C110, C111, C115, C116, C150, C151, and C153 - Ductile Iron Pipe and Fittings
- C200, C203, C205, C205, C206, C207, C208 - Steel Pipe
- C500, C501, C504, C540 - Valves and Hydrants
- C600s - Disinfection Facilities
- C900s - Plastic Pipe
- C901, C906 - HDPE Pipes

Florida Department Of Environmental Protection (FDEP)

The following are FDEP regulations (Florida Administrative Code) that are applicable to the facilities that are being considered:

- 62-40 - Water Policy
- 62-520 - Ground Water Classes, Standards, and Exemptions
- 62-521 - Wellhead Protection
- 62-522 - Ground Water permitting and Monitoring Requirements
- 62-524 - New Potable Water Well Permitting in Delineated Areas
- 62-528 - Underground Injection Control
- 62-531 - Water Well Contractors
- 62-532 - Water Well Permitting and Construction Requirements
- 62-550 - Drinking Water Standards, Monitoring, and Reporting
- 62-600 - Domestic Wastewater Facilities (Reuse requirements)
- 62-650 - Water Quality Based Effluent Limitations
- 62-520 - Ground Water Classes, Standards, and Exemptions

Class I reliability, as defined by the US EPA and stated in FDEP's regulations refers to reliability of mechanical, electrical, and fluid systems. For major equipment items (pumps, blowers, etc.), the

capacity and operations should be designed for the maximum design flows with the largest unit out of service.

United States Environmental Protection Agency (US EPA)

The Class V - Underground Injection Control Study, Volume 21-Aquifer Recharge and Aquifer Storage and Recovery Well, September 1999. This document presents best management practices for aquifer storage and recovery (ASR) wells.

Ten States Standards / Recommended Standards for Water Works Great Lakes-Upper Mississippi River Board (2003 Edition)

These standards include design guidelines for :

- Treatment – Part 4
- Pumping Facilities – Part 6
- Finished Water Storage – Part 7
- Distribution System Piping and Appurtenances – Part 8

ASR WELL STANDARDS

Criteria and standards for Class V wells are addressed in Chapter 62-528 FAC. ASR systems are categorized Class V Group 7. For these wells, standards of design and construction are required prior to requesting any construction permit. In order to be able to operate the well, it will be necessary to demonstrate that the well operation will not adversely affect any underground sources of drinking water (USDW). Approval to operate the system by the FDEP will be subject to operating and reporting requirements, such as drinking water standards.

Surface water sources are a major part of the RIDS program. Therefore, ASR wells receiving surface water are a Under Direct Influence (UDI) of surface water, which will require more extensive sampling and monitoring requirements. This needs to be considered from a cost and operations standpoint.

Siting and Construction Requirements

Specific construction standards for Class V wells have not been enacted by Florida because of the variety of Class V wells and their uses. Instead, the state requires the well to be designed and constructed for its intended use, in accordance with good engineering practices, and approves the design and construction through a permit. The state can apply any of the criteria for Class I wells to the permitting of Class V wells, if it determines that without such criteria the Class V well may cause or allow fluids to migrate into a USDW and cause a violation of the state's primary or secondary drinking water standards, which are contained in Chapter 62-550 of the FAC. However, if the injectate meets the primary and secondary drinking water quality standards and the minimum criteria contained in Rule 62-520-400 of the FAC, Class I injection well permitting standards will not be required.

Class V wells are required to be constructed so that their intended use does not violate the water quality standards in Chapter 62-520 FAC at the point of discharge, provided that the drinking water standards of 40 CFR Part 42 (1994) are met at the point of discharge.

Water Quality

The following are federal rules and programs that regulate ASR well water quality:

- Total Trihalomethane Rule (TTHMs)
- Surface Water Treatment Rule
- Total Coliform Rule
- Interim Enhanced Surface Water Treatment
- Stage 1 Disinfection Byproducts Rule
- Radon Rule
- Ground Water Rule

These water quality requirements are applicable to all to ASR well projects.

Siting and Construction

In order to determine the location and spacing of the wells the following should be considered:

- Background basin hydrology and natural recharge sources and location
- Pumping patterns
- Discharge areas
- Proposed storage area

Although Florida has not enacted standards for Class V wells, good engineering practices are required to approve construction permits for the wells. If the water to be injected shall meet the following requirements:

- Primary and Secondary Water Quality Standards (Chapter 62-550 FAC)
- Minimum criteria in Rule 62-520-400 of FAC- Ground Water Classes, Standards, and Exemptions/ Minimum Criteria for Ground Water

If the above standards are not met and if it is determined that the Class V criteria may allow stored water to migrate into USDW, the FDEP will require that Class I well criteria be met for the design and construction of the well.

Operation requirements

Class V wells are required to operate in a manner that does not present a hazard to USDW and to meet the water quality standards presented in Rule 62-520 FAC. The following operating and maintenance practices are recommended by Pyne (1995) for successful operations of ASR wells:

- Periodic change in operating mode
- Backflushing to waste during recharge

- Trickle flow of chlorinated water
- Calibration of pressure gauges
- Monitoring
- Annual water accounting or water balance
- Periodic review of operating water quality data

Monitoring

Only wells with injectate being treated by a permitted drinking water facility in accordance with rules 62-528.615(1)(a)2 FAC do not require monitoring. None of the injectate for the proposed projects in this Sub-Region is expected to originate from drinking water treatment facility; thus, monitoring requirements will be included in the permits.

PROPOSED PROJECTS DESCRIPTION AND EXISTING INFRASTRUCTURE

As described in this and previous technical memoranda, a group of projects for urban irrigation were evaluated and selected to mitigate the irrigation demand. Table 25 shows the list of theses proposed projects and the expected facilities needed. The amount of benefit or recovery will determine the capacity necessary for the pipes and pumps.

Table 25
Proposed Sub-regional Projects Summary

No.	Alternatives	Benefit or Recovery Capacity (MGD)	No. of Wells	Infrastructure needed
1.	Golden Gate Canal ASR – 17th Ave.	20	28	Intake system, pumping station, ASR wells and chemical treatment system
2.	Golden Gate Canal ASR – Airport Road	25	35	Intake system, pumping station, ASR wells and chemical treatment system
3.	Faka Union Canal ASR	25	35	Intake system, pumping station, ASR wells and chemical treatment system
4.	Cocohatchee River ASR	5	8	Intake system, pumping station, ASR wells and chemical treatment system
5.	Kehl Canal ASR	12	18	Intake system, pumping station, ASR wells and chemical treatment system
6.	North Collier \ Bonita Springs Interconnect	10.5	15	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 9 and 13.
7.	Naples \ South Collier Interconnect	12	28	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 10 and 11.
8A/8B.	Pelican Bay and Collier County North	8.1	13	Pumping station, ASR wells, and chemical treatment system
9.	Collier County South	6.6	11	Pumping station, ASR wells, and chemical treatment system
10.	Naples	5.4	14	Pumping station, ASR wells, and chemical treatment system
11.	Golden Gate	0.5	2	Pumping station, ASR wells, and chemical treatment system
12.	Bonita Springs Utilities	2.4	5	Pumping station, ASR wells, and chemical treatment system

No.	Alternatives	Benefit or Recovery Capacity (MGD)	No. of Wells	Infrastructure needed
13	North Collier / South Collier Interconnect	14.7	21	Pumping station, ASR wells, chemical treatment system and interconnect piping. Not exclusive of Alternatives 9 and 10.
14.	Golden Gate Mine Pit	1.5	0	Intake, pumping station, and chemical treatment system
	Total Benefit or Recovery Capacity	**111.5**		Total does not include redundant benefit from the Interconnect Alternatives 6, 7 and 8.

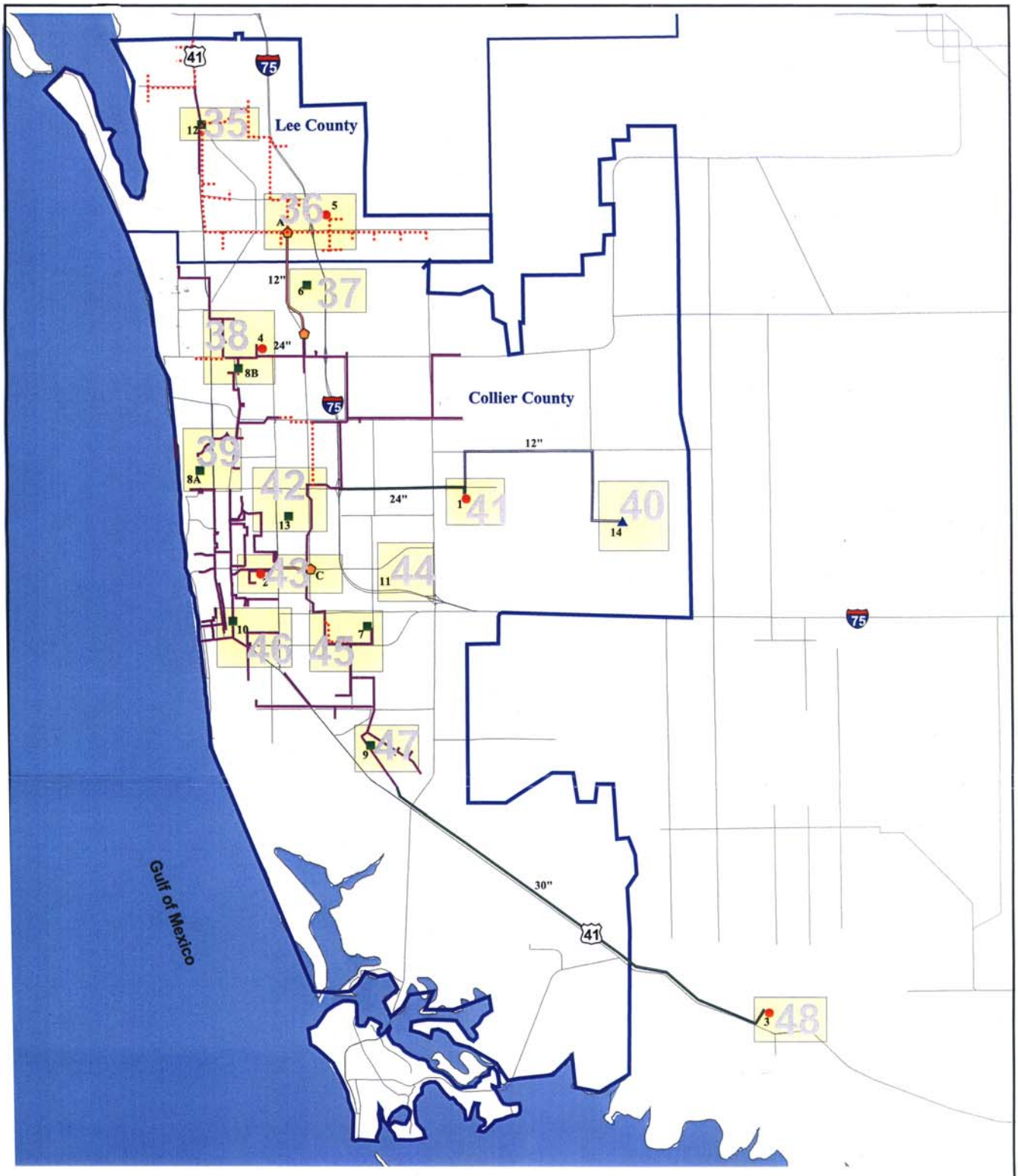
The locations of the projects listed above are presented in a series of figures, which are located in the Figure No. 34. The Index figure shows a general map of the Sub-region 1 projects. This figure serves as an index to locate the figure number where the proposed projects are shown. Interconnects including BSU- Collier County North, Collier County South, and Naples-Collier County are labeled A, B, and C on this figure. Proposed locations are based on general locations and do not include land use, survey, property assessment or any other property-specific considerations.

Figure35 presents Project No. 12, the BONITA SPRINGS UTILITIES RECLAIMED WATER ASR. The proposed location of this project is near the intersection of Old US 41 and US 41, and across from the Bonita Springs Utilities Wastewater Treatment Plant. Currently, a reclaimed water pipeline conveys treated wastewater from the WWTP. The ASR well system will be connected to the existing reclaimed water system.

Figure 36 presents Project No. 5, KEHL CANAL ASR and the north portion of the BSU - COLLIER COUNTY NORTH Interconnect. The proposed location for the project is near Grande Road, North of Bonita Beach Road, and east of I-75. It also shows the location of the proposed BSU-Collier County Interconnect. The interconnect will be located west of I-75 on Livingston Road, south of Bonita Beach Road. The interconnect extends South along Livingston Road to Immokalee Road.

Project No. 6, - BSU COLLIER COUNTY NORTH RECLAIMED WATER ASR Site is shown on Figure 37. The proposed location for this project is west of I-75 and east of Livingston Rd., just South of the Lee County and Collier County border. The 12-inch interconnect that will run north to south on Livingston Road, will transfer the water from the ASR wells. The COLLIER COUNTY SOUTH Interconnect is also shown on this figure. This project has been labeled B for identification purposes. This project's location is North of Immokalee Road, and at the east end of Piper Blvd. An existing 24-inch transmission line is also shown in this figure.

Figure 38, shows two projects. Project 4 - COCOHATCHEE RIVER ASR wells and Project 8B - COLLIER COUNTY NORTH RECLAIMED WATER ASR. The proposed location for Project 4 is located near the Cocohatchee Canal, north of Immokalee Rd, and east of Wading Bird Circle. The recovered water will discharge into an existing 24-inch reclaimed water transmission line along Immokalee Road. Project 8B is located near the Collier Co. North WWTP, east of Goodlette Rd., south of Immokalee Rd. The recovered water will discharge into an existing 20-inch reclaimed water transmission line.



LEGEND:

- Interconnect Locations
  - A. BSU- Collier County North
  - B. Collier County South
  - C. Naples-Collier County South
- Possible Surface Water ASR Sites
  1. Golden Gate Canal at 17th Ave.
  2. Golden Gate Canal at Airport Rd.
  3. Faka Union Slough
  4. Cocohatchee River
  5. Kehl Canal
- Possible Reclaimed Water ASR Sites
  6. BSU - Collier County North Interconnect
  7. Naples - Collier County South Interconnect
  - 8A. Pelican Bay
  - 8B. Collier County North
  - 9. Collier County South
  - 10. Naples
  - 11. Golden Gate
  - 12. Bonita Springs Utilities
  - 13. Collier County North - Collier County South Interconnect
- Mine Pits
  - 14. Golden Gate
- Exist. Reuse Trans Lines
- Prop. Reuse Trans Lines
- Interconnect Piping
- ASR Piping
- Mine Pit Piping
- Coast Line
- Major Roads
- County Boundary
- Water

N

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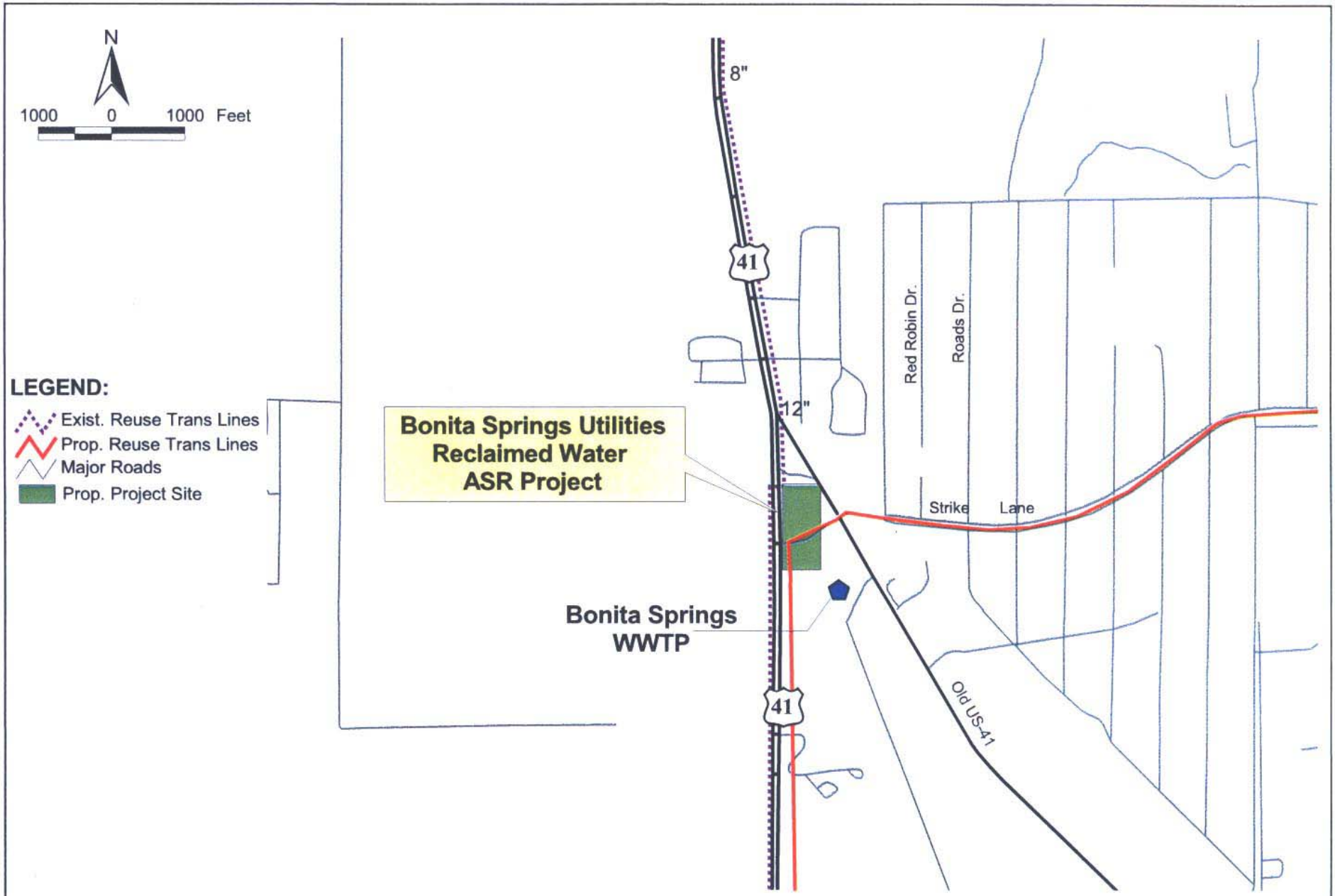
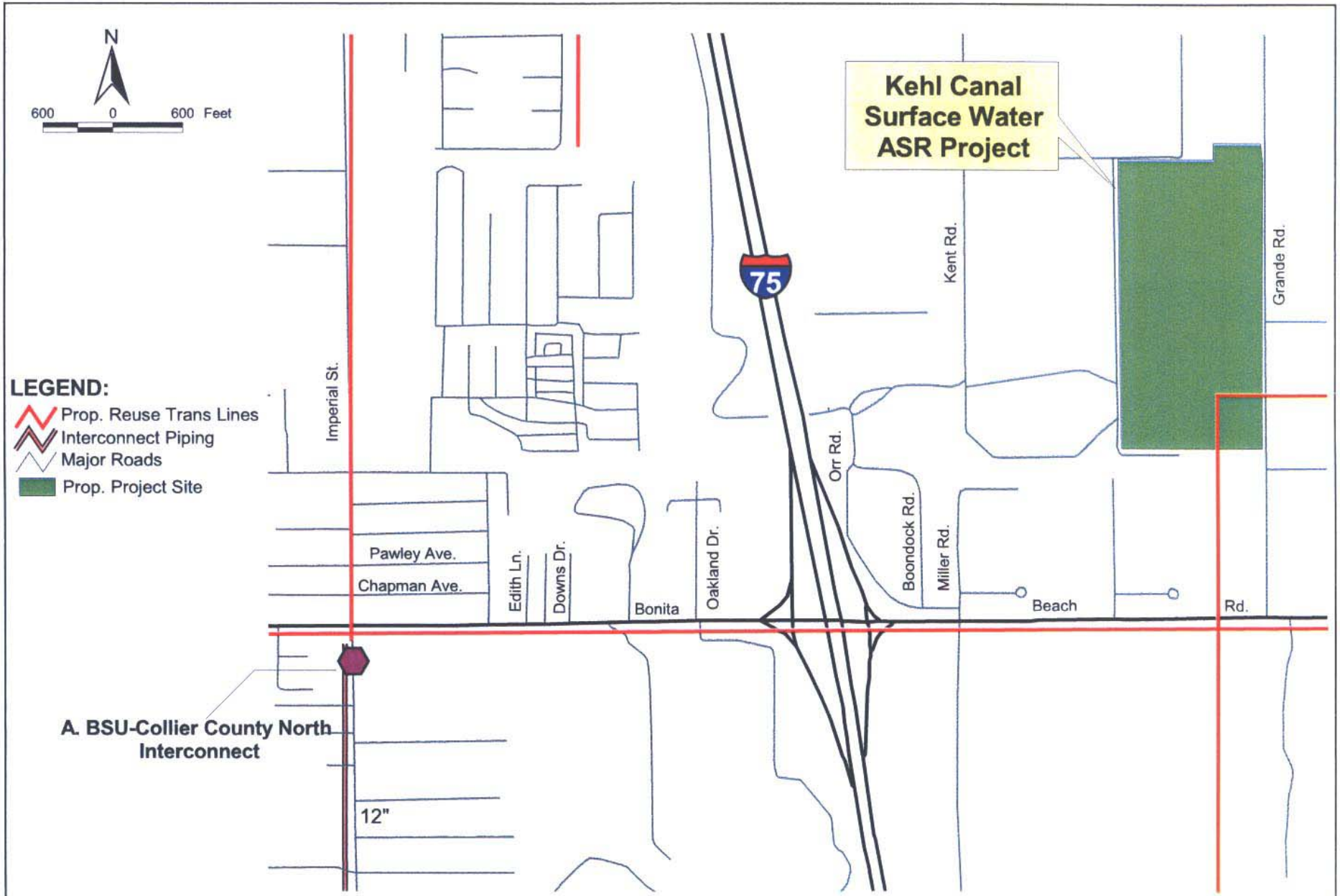
1 Figure Number

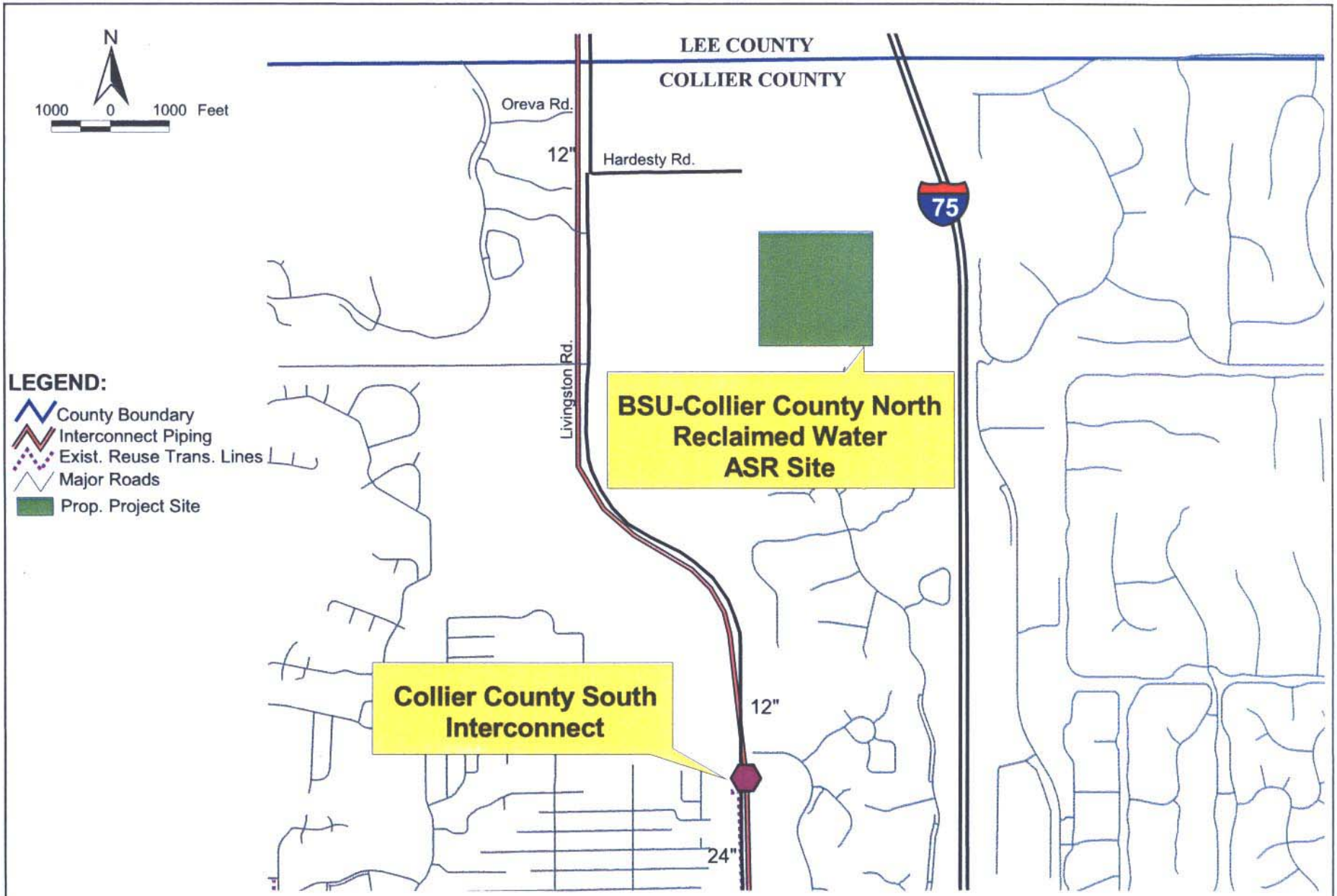
Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	ALTERNATIVE PROJECTS INDEX SHEET SUBREGION I	FIGURE 34



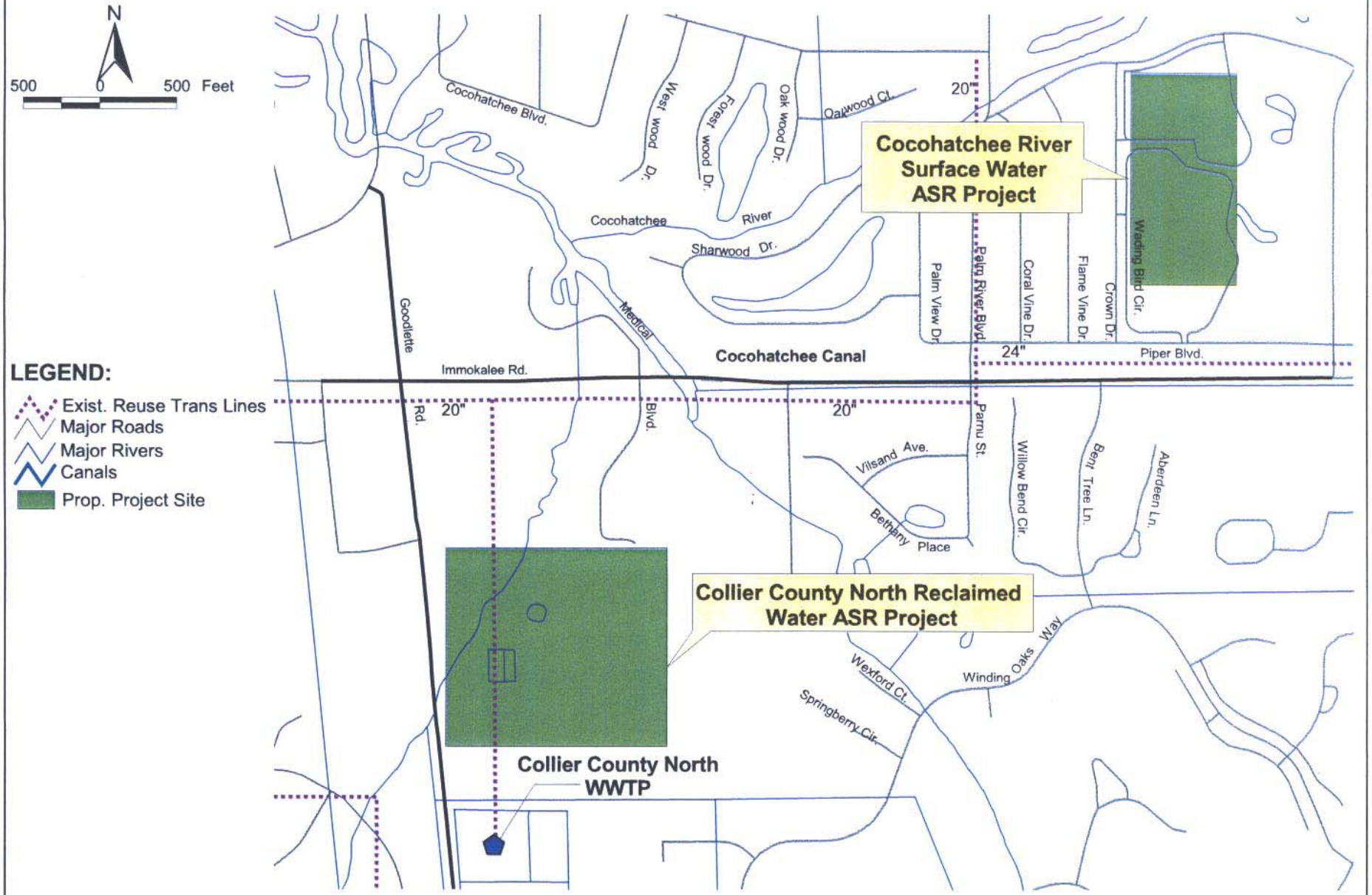
Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	12. BONITA SPRINGS UTILITES RECLAIMED WATER ASR SITE - SUBREGION I	Figure 35



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	5. KEHL CANAL SURFACE WATER ASR SITE - SUBREGION I	Figure 36



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	6. BSU-COLLIER COUNTY NORTH RECLAIMED WATER ASR SITE - SUBREGION I	Figure 37



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	4. COCOHATCHEE RIVER SURFACE WATER & 8B. COLLIER COUNTY NORTH RECLAIMED WATER ASR SITE - SUBREGION I	Figure 38

The proposed location for Project No. 8A- PELICAN BAY RECLAIMED WATER ASR is presented on Figure 39. The project will be located west of US-41 /Tamiami Trail, near the Pelican Bay WWTP, south of Watergate Way.

Figure 40 presents Project 14- GOLDEN GATE MINE PITS is proposed to be located south of Frangipani Avenue and the Golden Gate Canal. A 12-inch pipeline will convey the recovered water to the distribution system.

Figure 41 presents Project 1-GOLDEN GATE CANAL AT 17TH AVENUE, a surface water ASR project that is proposed to be located south of White Boulevard, west of 31st Street SW and east of 39th Street SW. It is also located near the Cypress Canal. The project will receive water from the 12-inch transmission line from the mine pits project and a new 24-inch pipeline will interconnect with the existing system near Pine Ridge Road and I-75.

Figure 42 presents Project 13 - NORTH COLLIER COUNTY / SOUTH COLLIER COUNTY ASR wellfield, which will be located east of Livingston Road South, between Pine Ridge Road and Vanderbilt Drive.

Figure 43 shows two projects. Project 2 - GOLDEN GATE CANAL AT AIRPORT ROAD Surface Water ASR and Project 7- NAPLES-COLLIER COUNTY SOUTH. Project 2 is located west of Airport Road North and south of Golden Gate Parkway. The proposed location for Project 7 is at the southeast corner of Livingston Road South and Golden Gate Parkway.

Figure 44 presents Project 11-GOLDEN GATE RECLAIMED WATER ASR. The proposed location of this project is south of the Golden Gate WWTP, north of I-75 and east of Santa Barbara Blvd.

Figure 45 shows Project 10-NAPLES – COLLIER COUNTY SOUTH Reclaimed Water ASR. This project is proposed to be located south of Radio Road, north of Davis Boulevard and east of Santa Barbara Boulevard.

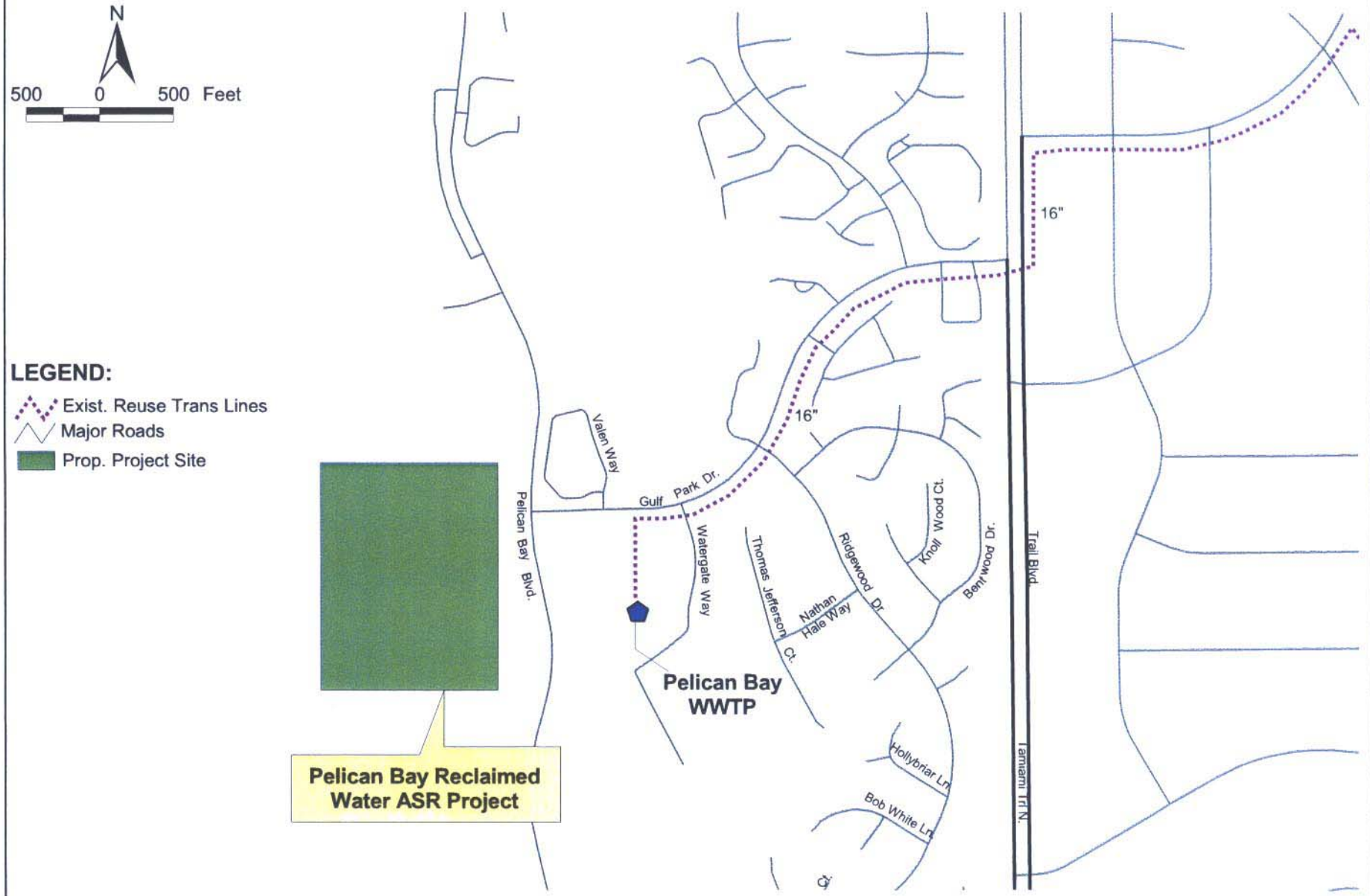
Figure 46 presents Project 10 - Naples Reclaimed Water ASR. The location of this proposed project would be south of the Naples WWTP (located north of 5th Ave. N.), east of Goodlette Road North and west of North Road.

Figure 47 shows Project 9 - Collier County South Reclaimed Water ASR. This project would be located east of the Collier County WWTP, North of Tamiami Trail (US-41), and south of Lely High School Road.

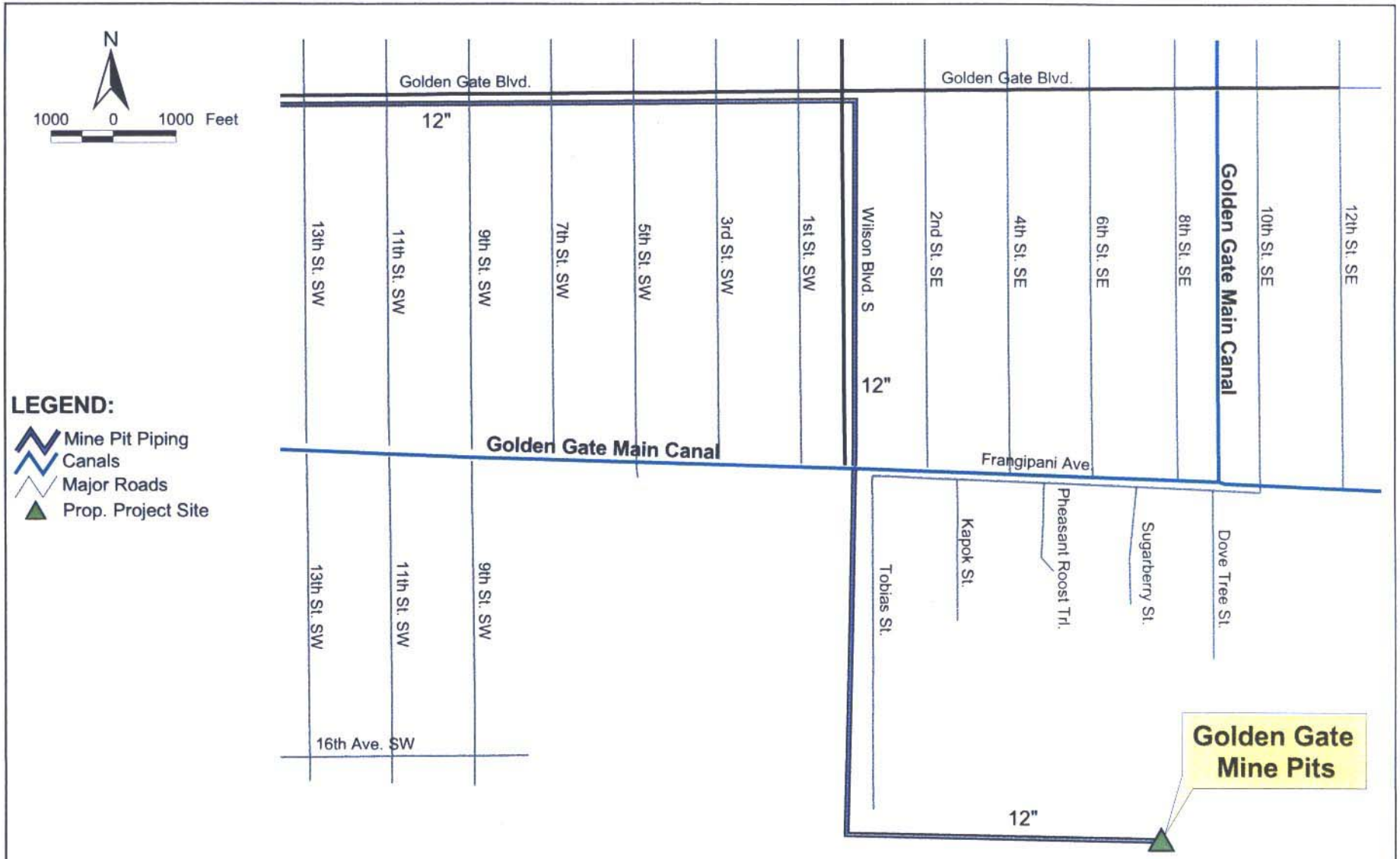
Figure 48 presents Project 3 - FAKA UNION SLOUGH Surface Water ASR. This project's location would be west of the Faka Union Canal, north of the Tamiami Canal and Tamiami Trail (US-41).

Existing Infrastructure

Currently Naples, Collier County and Bonita Springs Utilities have existing reclaimed water distribution systems. The proposed projects will use the existing and proposed infrastructure as much as practically possible.

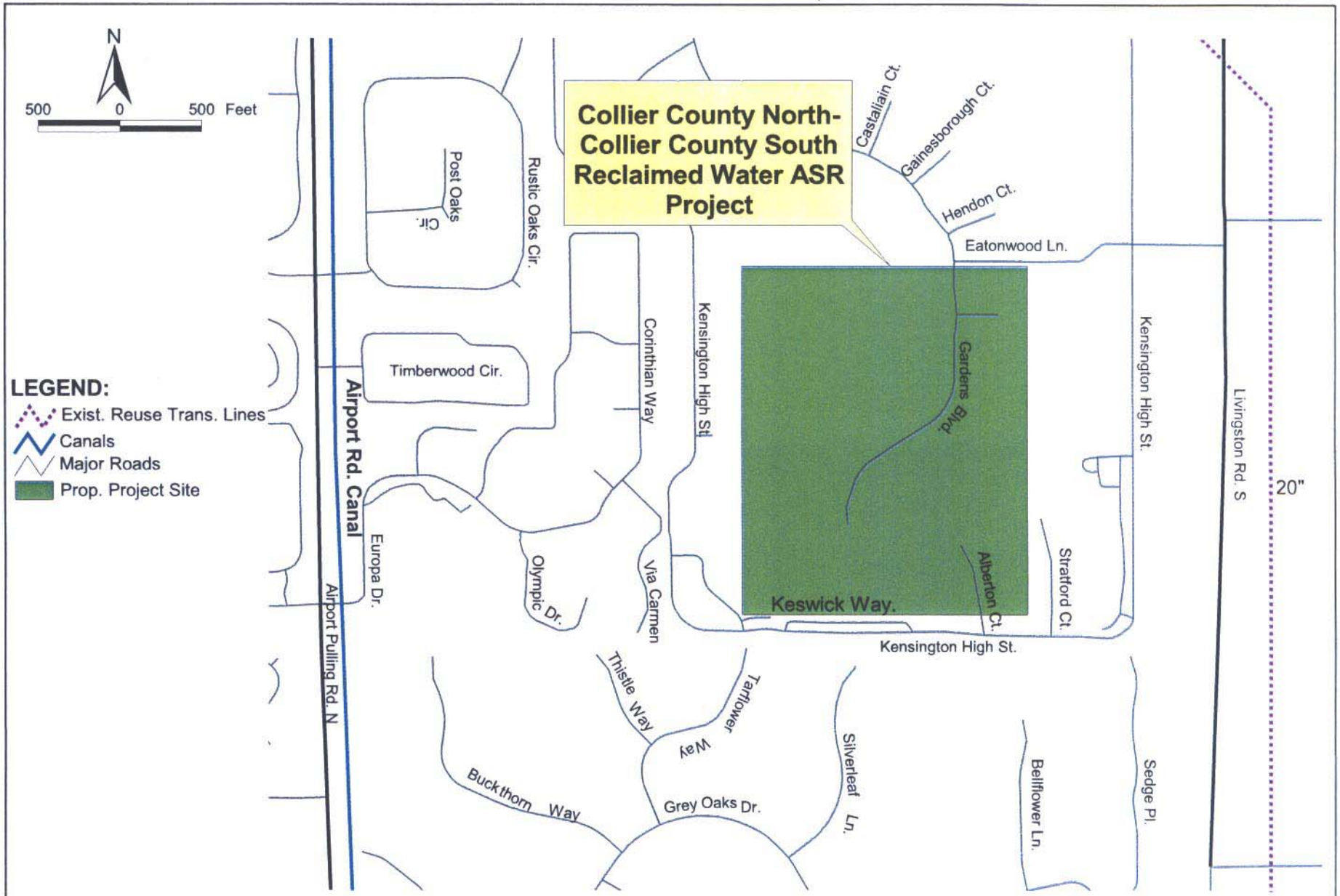


Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	8A. PELICAN BAY RECLAIMED WATER ASR SITE - SUBREGION I	Figure 39

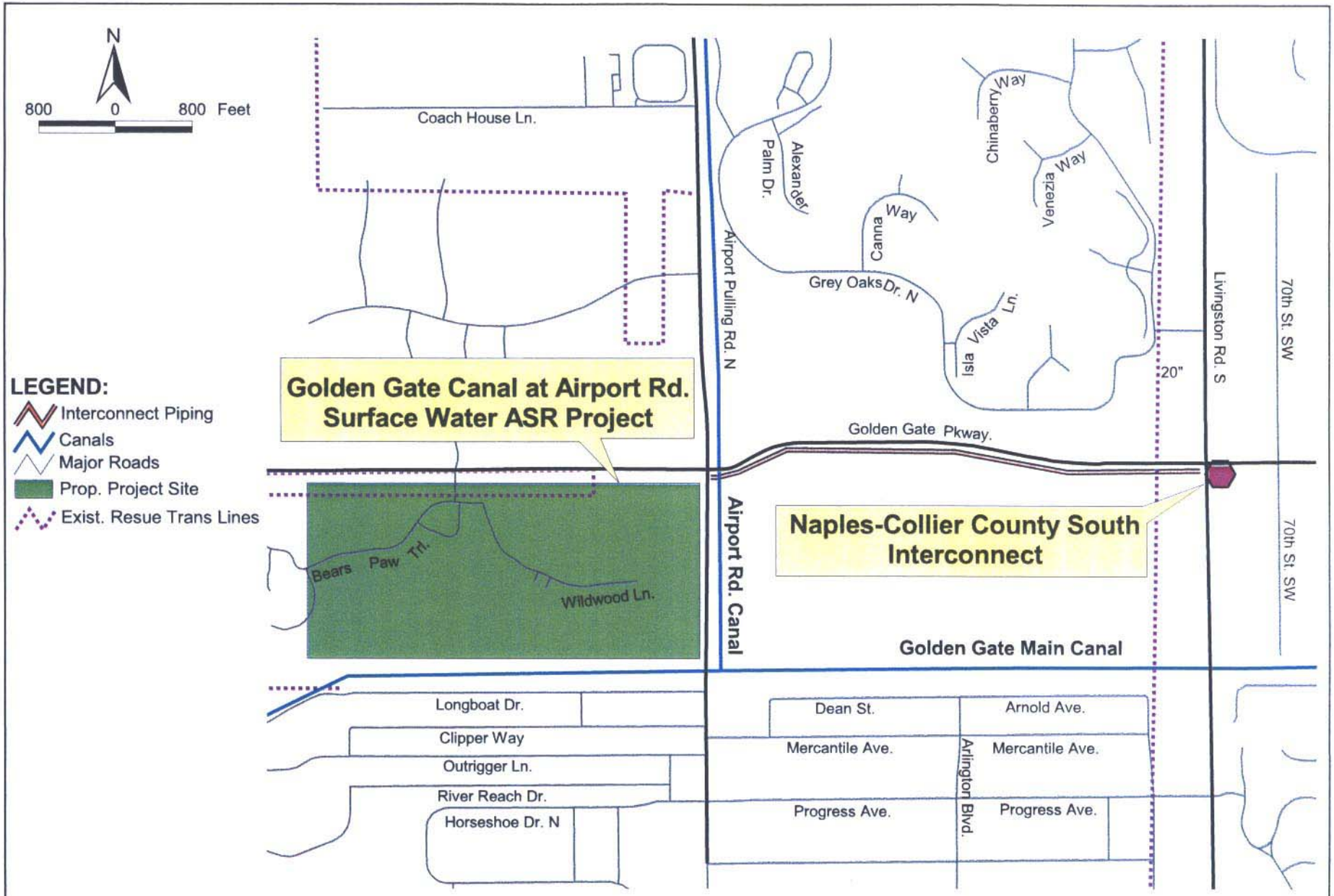


Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	14. GOLDEN GATE MINE PITS SUBREGION I	Figure 40

Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	1. GOLDEN GATE CANAL AT 17th AVE. SURFACE WATER ASR SITE - SUBREGION I	Figure 41

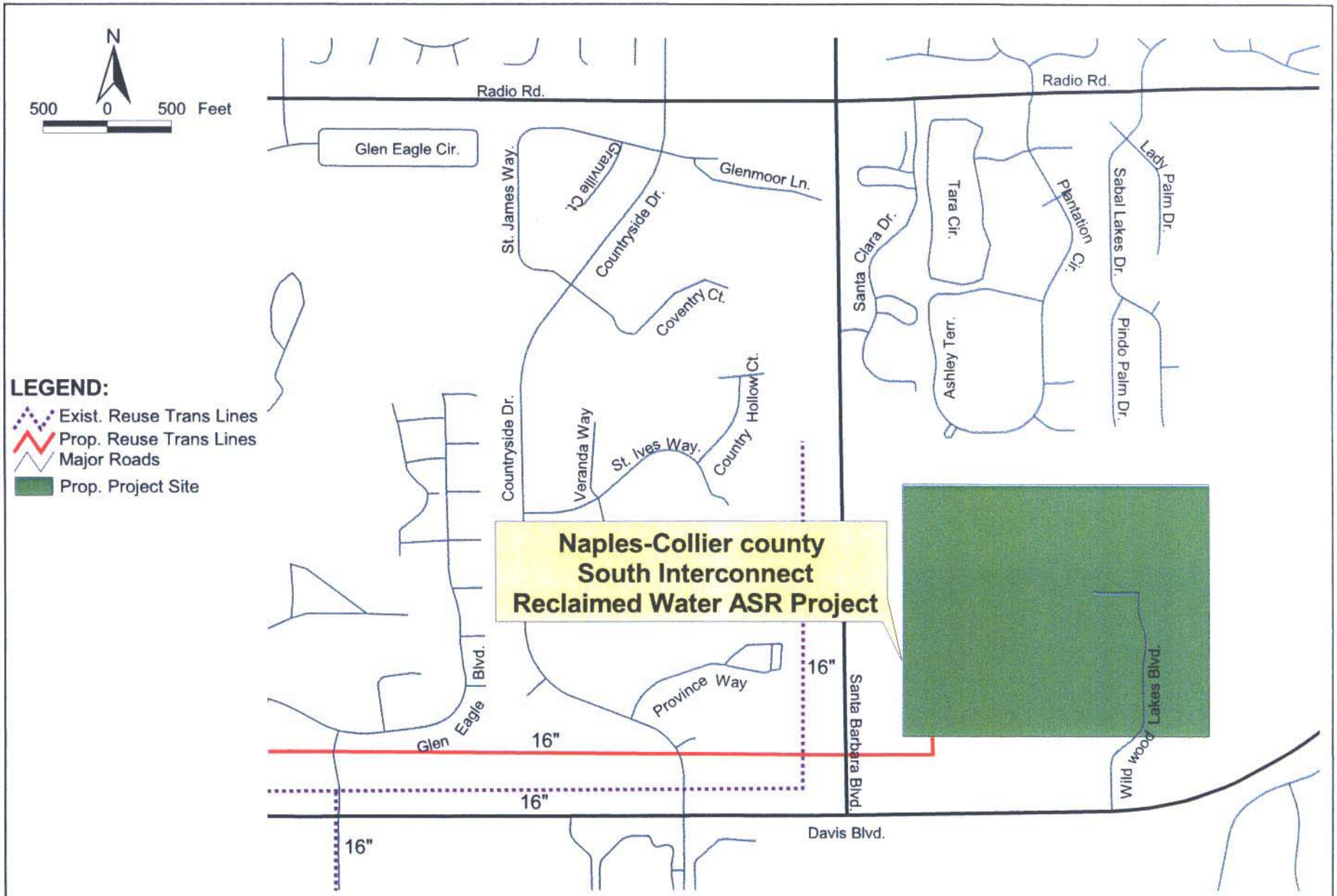


Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	13. COLLIER COUNTY NORTH/SOUTH RECLAIMED WATER ASR SITE - SUBREGION I	Figure 42

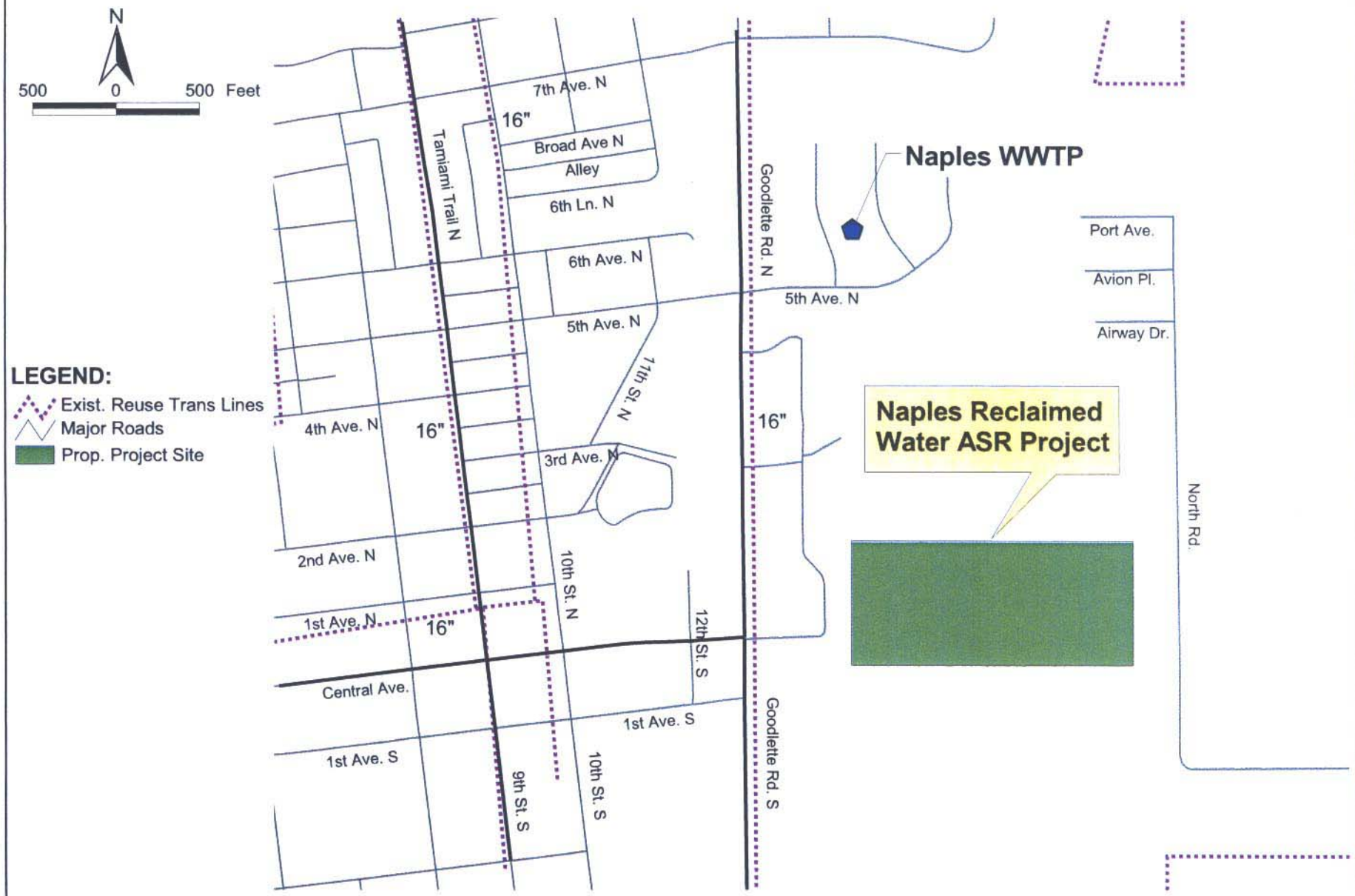


Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	2.GOLDEN GATE CANAL AT AIRPORT RD. SURFACE WATER ASR SITE C. NAPLES-COLLIER COUNTY SOUTH INTERCONNECT SUBREGION I	Figure 43

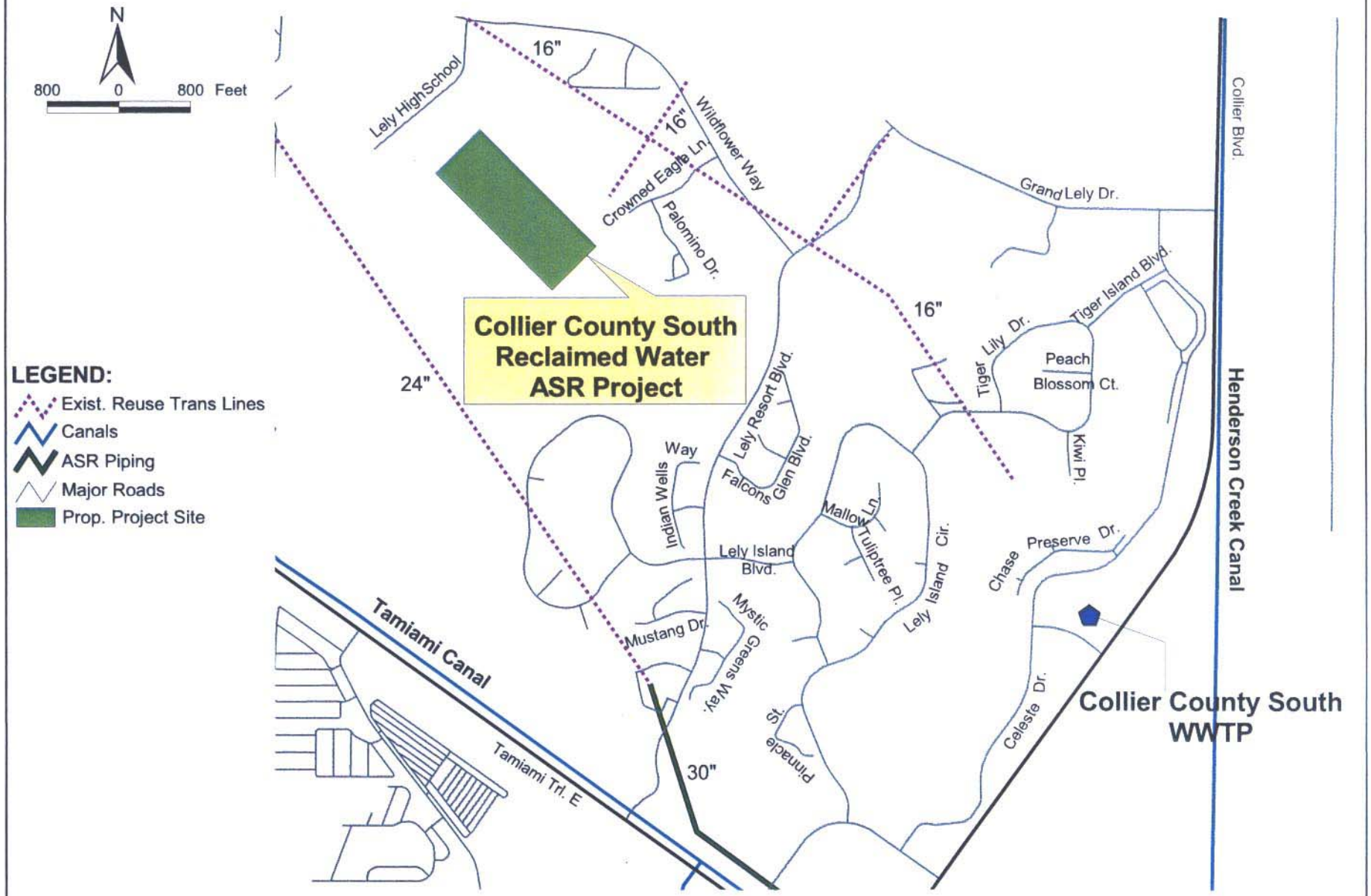
Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	11. GOLDEN GATE RECLAIMED WATER ASR SITE - SUBREGION I	Figure 44



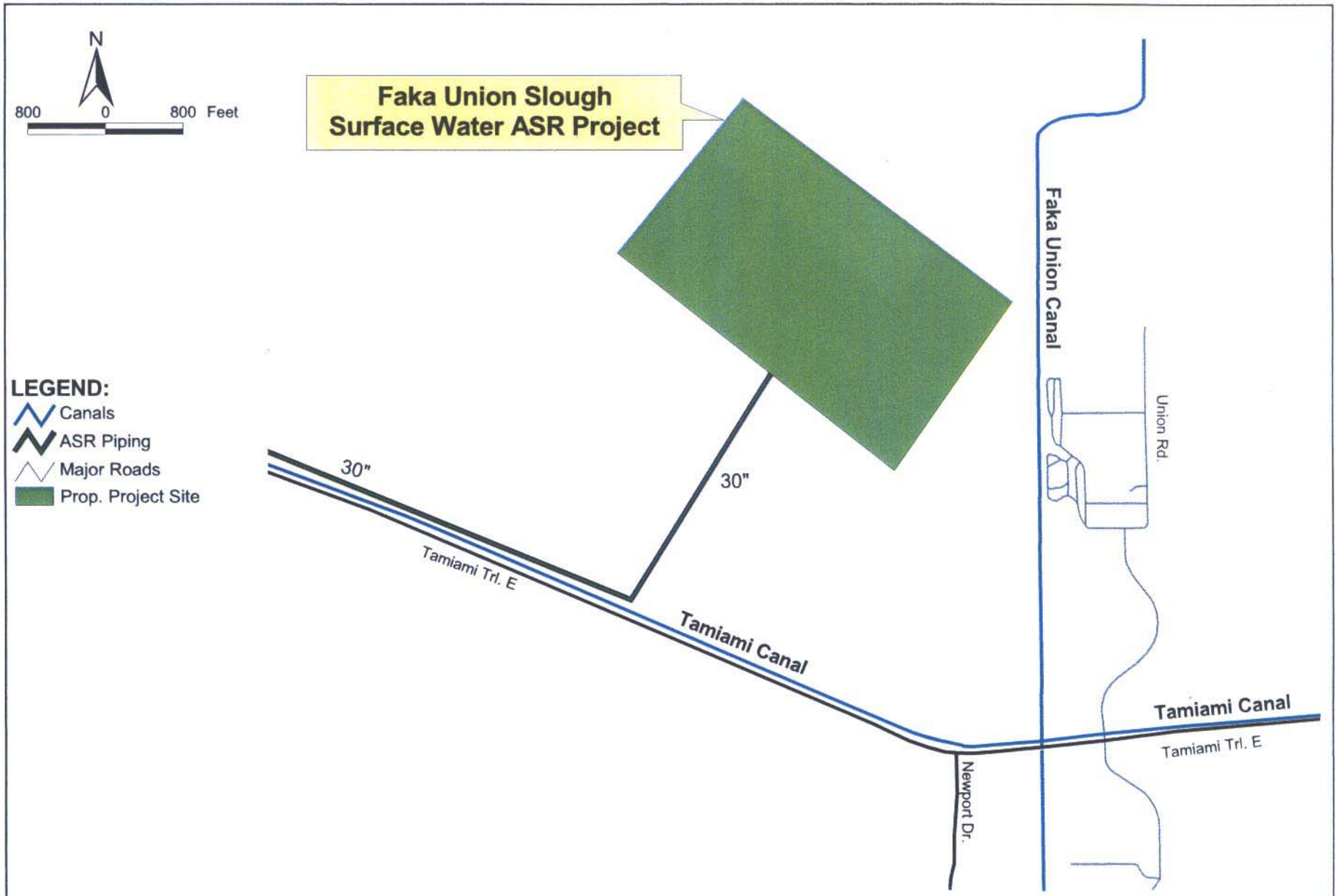
Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	7. NAPLES-COLLIER COUNTY SOUTH RECLAIMED WATER ASR SITE - SUBREGION I	Figure 45



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	10. NAPLES RECLAIMED WATER ASR SITE SUBREGION I	Figure 46



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	9.COLLIER COUNTY SOUTH RECLAIMED WATER ASR SITE - SUBREGION I	Figure 47



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	3. FAKA UNION SLOUGH SURFACE WATER ASR SITE - SUBREGION I	Figure 48

PROPOSED INFRASTRUCTURE

Surface Water Projects Design Criteria

The proposed surface water ASR projects are Golden Gate Canal - 17th Avenue, Golden Gate Canal - Airport Road, Faka Union Slough, Cocohatchee River, and Golden Gate Mine Pits. The typical facilities for this type of projects are as follows:

- Horizontal well to provide in-bank filtration,
- Pump stations,
- pH adjustment, and
- Pre- and post- ASR well disinfection.

The typical flow path illustrating these facilities is shown on Figure 49. This figure conceptually presents the horizontal well, which will be constructed near the surface water source. From this point, the pH is adjusted with CO_2, prior to disinfection and injection into the ASR well. Water recovered from the well will then be disinfected before it is sent to the irrigation system.

Figure 50 illustrates how the horizontal wells and injection pumping are located in relation to one another.

Figure 51 presents how the injection well pump station will be configured. A minimum of two pumps will be used at each pump station. Piping size depends on each projects capacity requirement. This figure also shows the anticipated locations of power pole connections, meters, valves, and sample taps.

Figure 52 presents the layout of a typical ASR well. Figures 53 and 54 show horizontal well installation methods. The specific method used will depend on subsurface conditions at each project location.

Reclaimed Water Projects Design Criteria

The reclaimed water ASR projects include Pelican Bay / Collier County North, Collier County South, Naples, Golden Gate, and Bonita Springs Utilities. The typical facilities for this type of project are similar to the surface water ASR project except for the horizontal well. The reclaimed water will be treated effluent from the wastewater treatment plant, however, prior to injection, the pH will be adjusted with CO_2 and disinfected. High service pumps from the treatment plant could be used to transport the injectate to the ASR Well. This system is presented in Figure 55.

Interconnects

Interconnects will supplement the irrigation needs through resources available in either side of the interconnect. The proposed interconnect projects are Bonita Springs Utilities - Collier County North, Naples - Collier County South, and Collier County South.

PIPELINE DIAMETERS AND MATERIALS

Preliminary piping arrangements for the ASR well system are shown in Figure 51. Piping and valving arrangements allow for isolation, directing of flow for recharge/injection, or recovery, flow measurements, and control of recharge and recovery flow rates. Typical piping and valve sizes are 8-

inch diameter; however, the final sizes will be determined during design. Pipe diameters will depend on the requirements of each project.

Pipe materials for the design and construction of the pipeline to connect the horizontal well, pumping, ASR well, disinfection and distribution should be PVC or ductile iron.

PUMPS AND TREATMENT EQUIPMENT DESCRIPTIONS

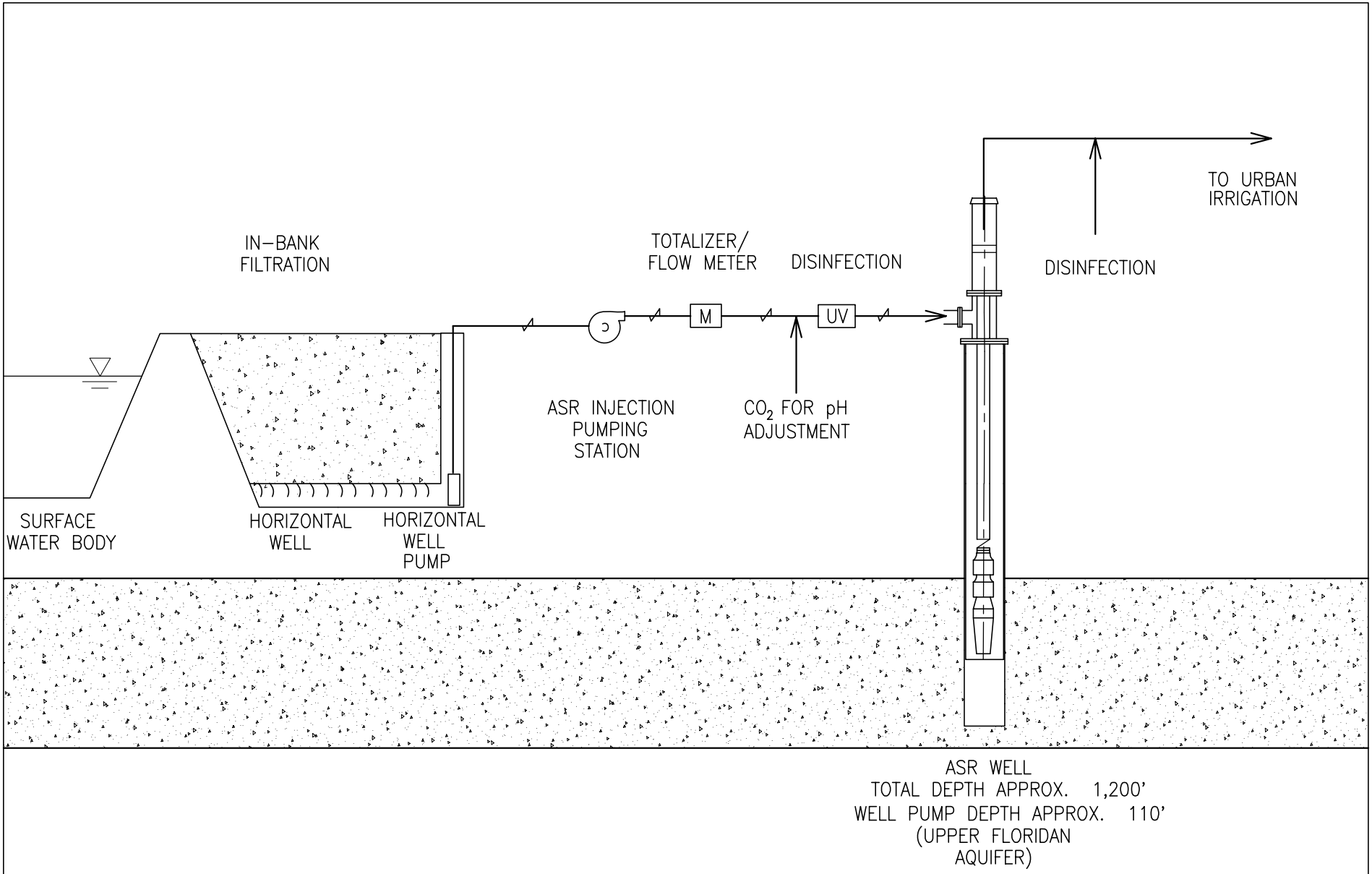
The typical ASR well system will include pumps, pipes, valves, meters, instrumentation and disinfection equipment. This section includes a preliminary selection of each type of equipment, which will be confirmed during the design phase.

Pumps

For reliability, all pumping systems will be designed for firm capacity, meaning that the capacity is met with the largest pump out of service. For the surface water projects, there will be three types of pumps as shown in Figure 49: horizontal well pumps, injection pumps, and recovery pumps. For reclaimed water projects, the horizontal well pumps are not necessary. In addition, the injection well pumps are may not be necessary if it is determined that the WWTP's effluent pumps can be used for this purpose. For the preliminary selection of equipment for this Feasibility Study, the capacities needed are estimated based on the typical layout and pressure requirements from other ASR wells projects.

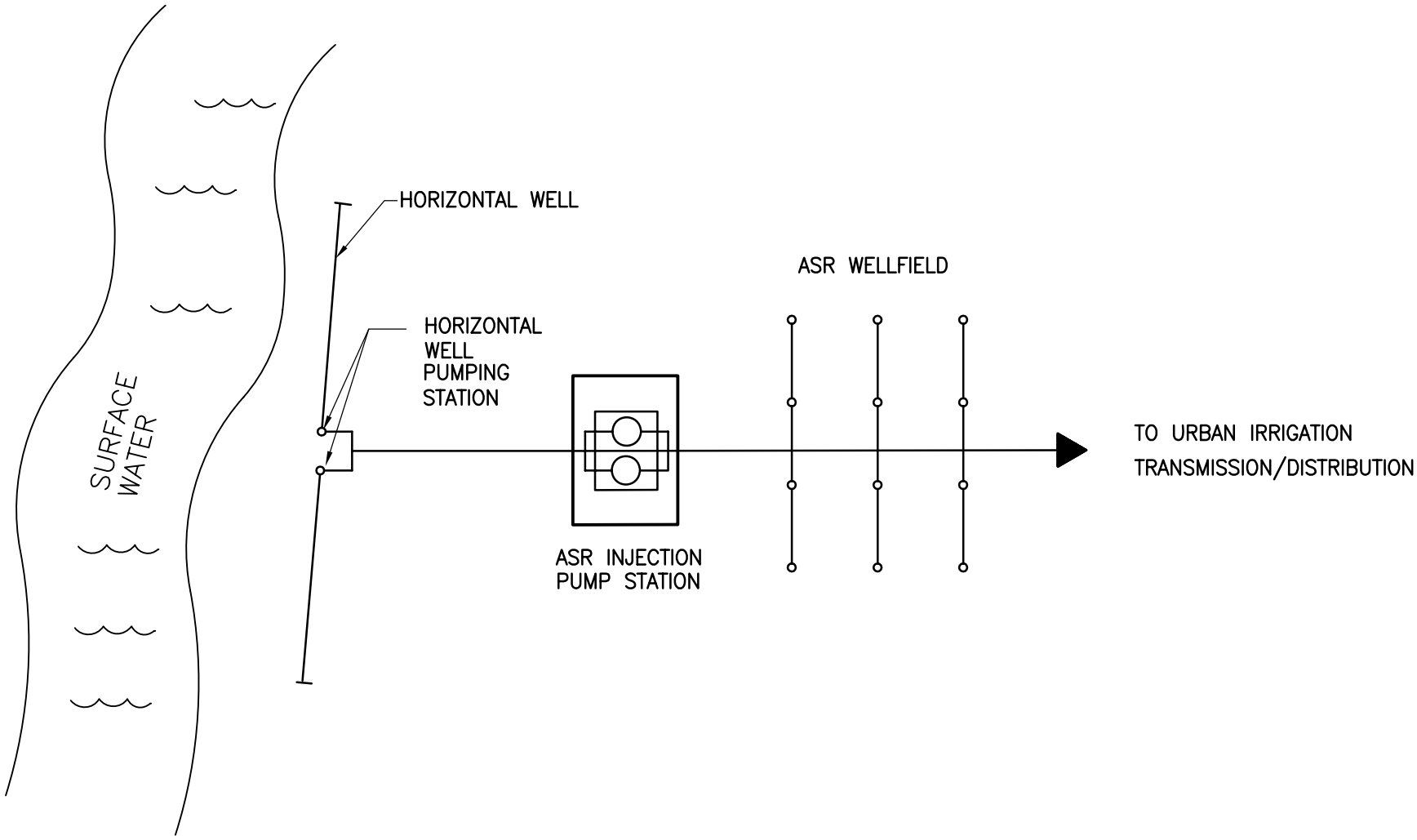
Horizontal Well Pumps

As shown on Figures 49 and 50 the horizontal wells will require submersible pumps to extract the filtered surface water. Table 26 presents the ASR well projects for surface water sources and the anticipated pump characteristics. Pump capacities are based on potential of withdrawal benefit from the source. The depth of the sump will vary depending on the surface geologicalconditions of the project site. A typical depth is about 1 foot below the invert of the pipe, about 20 feet below ground. The total discharge head (TDH) required is calculated based on this depth and approximately 5 feet for minor losses Thus, the TDH for this type of well will be 25 feet. This type of pump is typically recommended for minimal turbulence and the entrance velocity should not be greater than 3.5 ft/s. The horizontal well layout allows the surface water to be filtered through the shallow soils. The pumps will operate based on a pressure transducer on the slotted high-density polyethylene (HDPE).Sample pump curves are included in Attachment I for the above list of pumps.

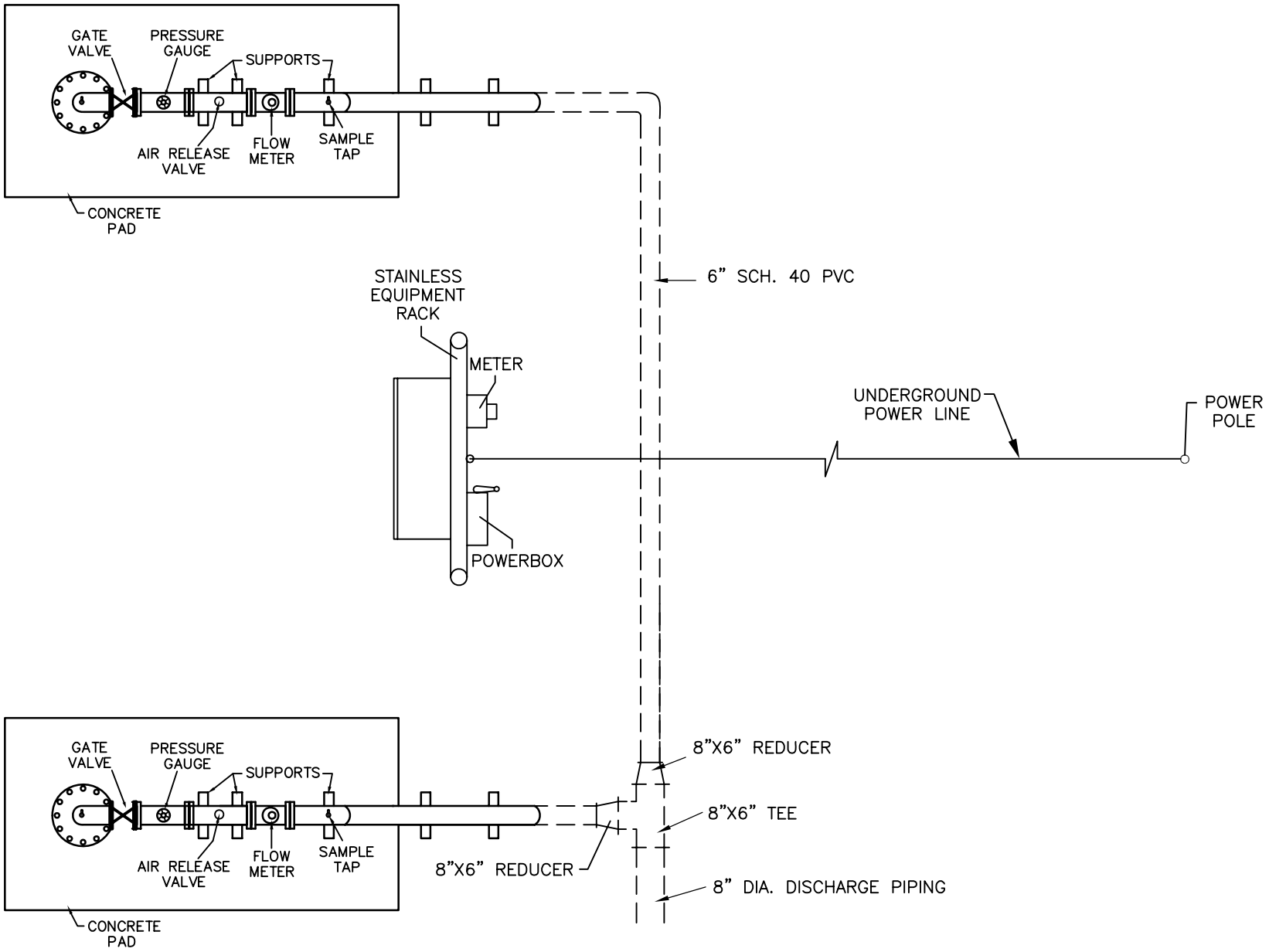


Not to Scale
For Conceptual Purposes Only

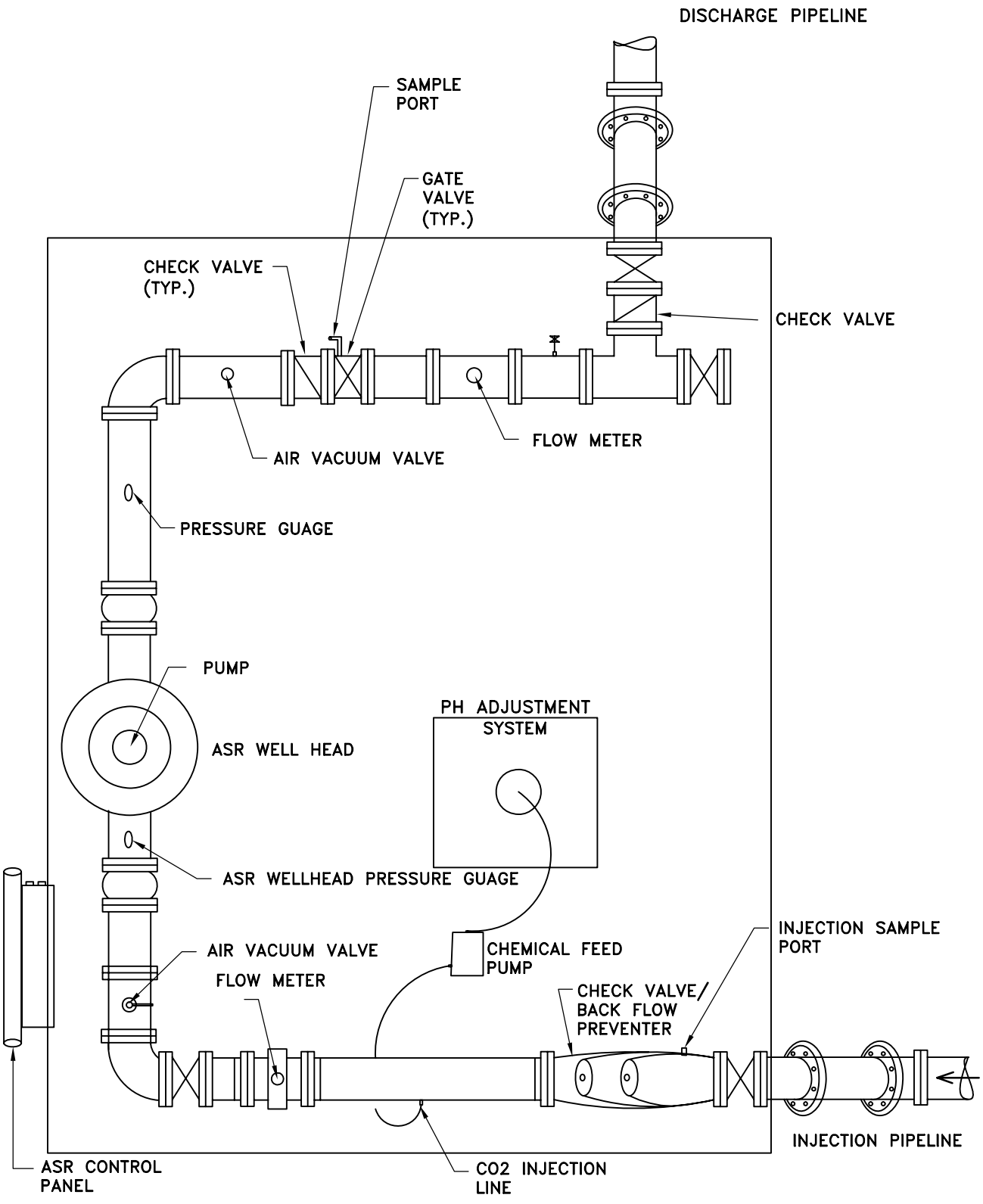
Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE	South Florida Water Management District	Typical Surface Water ASR System Process Flow Schematic	Figure 49



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Surface Water ASR System Layout	Figure 50



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Withdrawal Pumping Station	Figure 51



ASR WELL

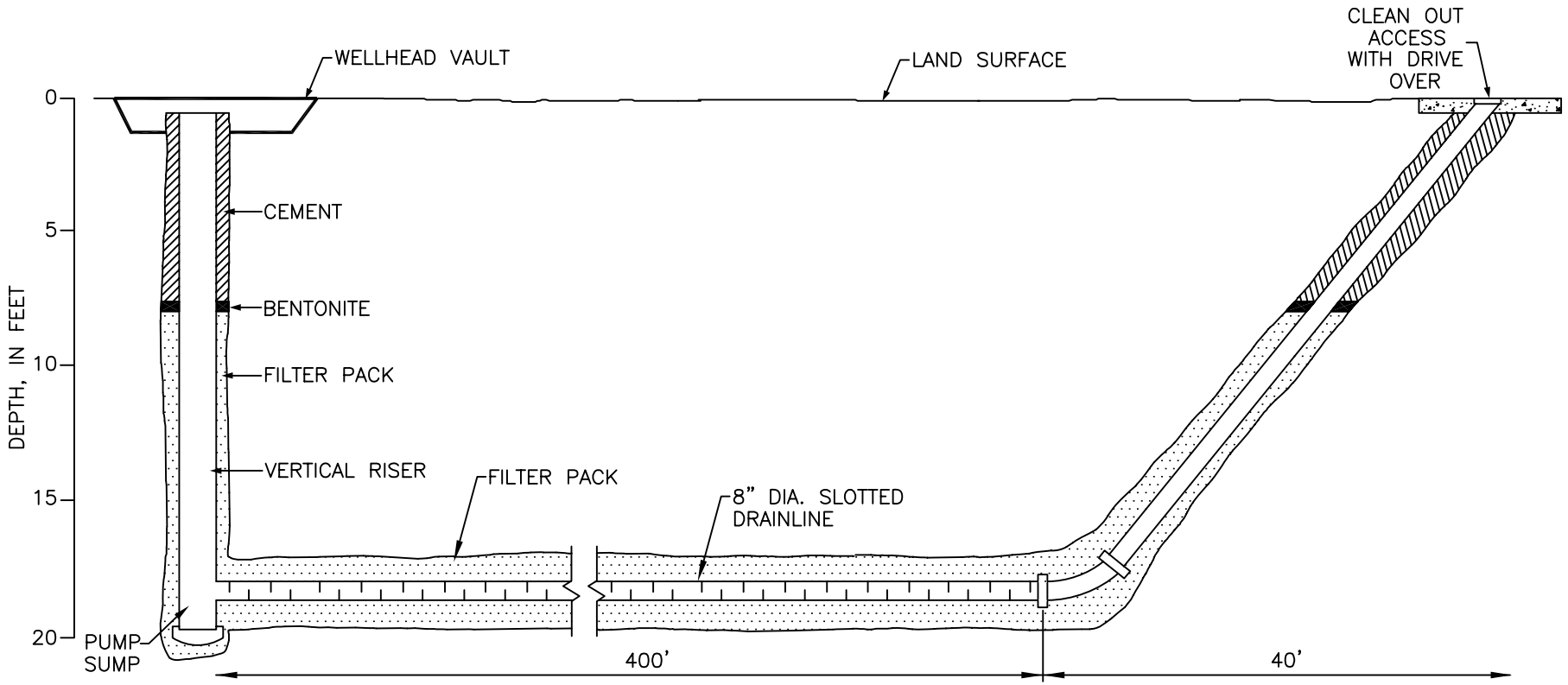
Figure 52

Typical ASR Well Layout

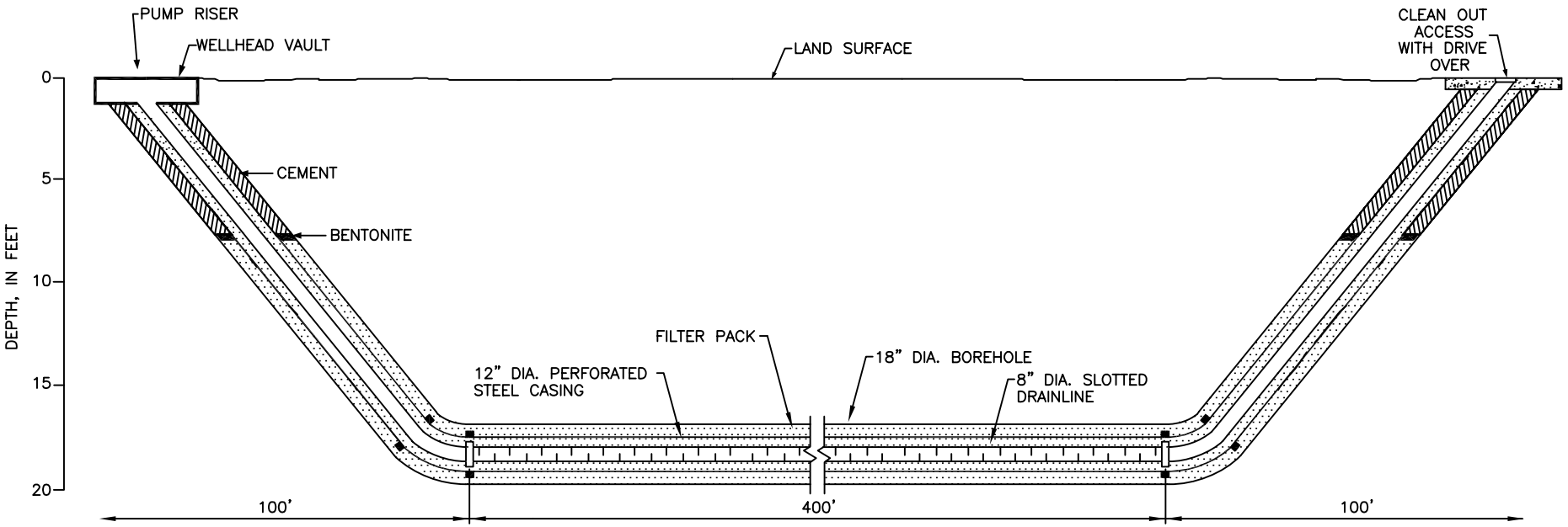
South Florida Water Management District

BOYLE

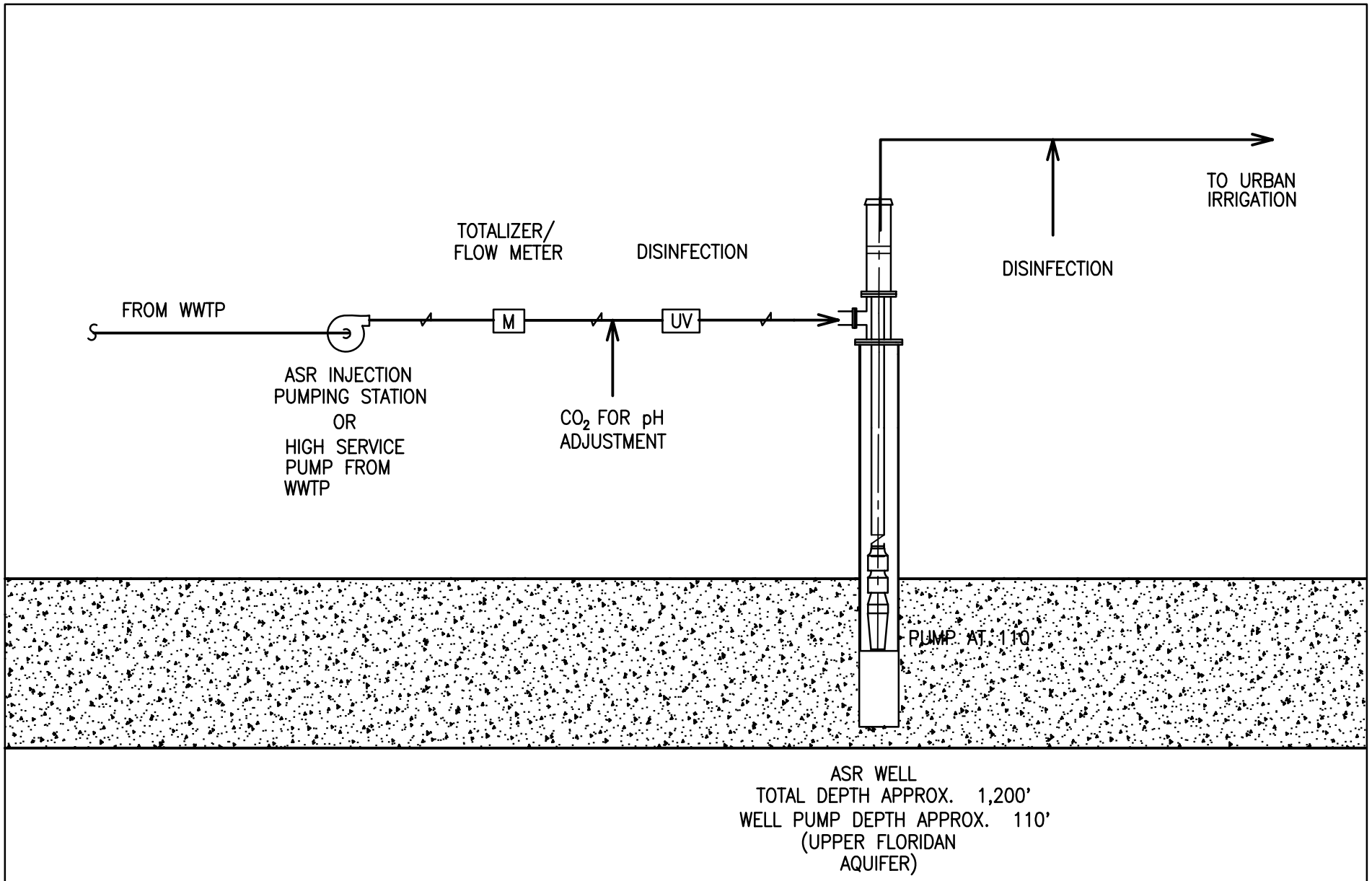
Regional Irrigation Distribution System (RIDS) Feasibility Study



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Cross-Section Installation Method A (Directional Drilled)	Figure 53



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Cross-Section Installation Method B	Figure 54



Not to Scale
For Conceptual Purposes Only

Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Reclaimed Water ASR System Process Flow Schematic	Figure 55

Table 26
Horizontal Well Pump Characteristics

Project No.	Project Name	Type of ASR Project	Benefit (MGD)	No. of Wells	Pump Capacity (MGD)	Pump Capacity
1	Golden Gate – 17th Ave.	Surface Water	20	28	29	19,841
2	Golden Gate Canal ASR – Airport Road	Surface Water	25	35	36	24,802
3	Faka Union Canal ASR	Surface Water	25	35	36	24,802
4	Cocohatchee River ASR	Surface Water	5	8	7	4,960
5	Kehl Canal ASR	Surface Water	12	17	17	11,905

Injection Pumps

In some cases, the high service pumps from WWTP reclaimed water systems may be used to inject the effluent into the ASR well. Injection pumps may be necessary for others. In situations in which injection pumps are necessary, vertical turbine pumps will be used. The vertical turbine pumps will be installed in a wet well. Table 14 presented an estimate of the depth of each ASR well, but the final depth will be evaluated based on subsurface geological conditions at each site. The TDH for each pump is based on the anticipated pressure of injection plus some headloss. Using an estimated injection pressure of 60 psi, the TDH for these pumps will be 65 psi. The total flow for the surface water ASR systems is the same amount that was withdrawn from the horizontal wells. For the injection pump stations, multiple pumps will be used to assure reliability, using the firm capacity concept for selection. Table 27 presents the list of projects, and the injection pump capacities/characteristics.

Table 27
Injection Pump Characteristics

Project No.	Project Name	Type of ASR Project	Benefit (MGD)	No. of Wells	Pump Capacity (MGD)	Pump Capacity (GPM)	No.of Pumps
1	Golden Gate-17th Ave.	Surface Water	20	28	28.57	19,841.27	4
2	Golden Gate Canal ASR – Airport Road	Surface Water	25	35	35.71	24,801.59	4
3	Faka Union Canal ASR	Surface Water	25	35	35.71	24,801.59	4
4	Cocohatchee River ASR	Surface Water	5	8	7.14	4,960.32	3
5	Kehl Canal ASR	Surface Water	12	17	17.14	11,904.76	4
6	North Collier/Bonita Springs Interconnect	Reclaimed Water	10.5	19	15.00	10,416.67	4
7	Naples/South Collier Interconnect	Reclaimed Water	12	24	17.14	11,904.76	4
8A/8B	Pelican Bay and Collier County North	Reclaimed Water	8.1	12	11.57	8,035.71	2
9	Collier County South	Reclaimed Water	6.6	10	9.43	6,547.62	3
10	Naples	Reclaimed Water	5.4	9	7.71	5,357.14	3
11	Golden Gate	Reclaimed Water	0.5	2	0.71	496.03	2
12	Bonita Springs Utilities	Reclaimed Water	2.4	5	3.43	2,380.95	2
13	North Collier/South Collier Interconnect	Reclaimed Water	14.7	21	21.00	14,583.33	4

For the injection pumps, sample pump curves are included in Attachment J.

Recovery Pumps

Each well will have its own recovery pump system. For all the projects, the estimated flow for each well will be 0.75 MGD (521 GPM). It is anticipated that pumps for all wells will be located at approximately 110 feet deep and 10 feet is added for friction losses; therefore, the total TDH will be 120 feet. Table 28 presents the projects and the anticipated characteristics of the pumps. Each pump should be constructed of 316 stainless steel since it will be used to pump water from an aquifer zone, which contains background brackish water quality.

Table 28

Recovery Well Pump

Project No.	Project Name	No. of Pumps	Type of ASR Project	Benefit (MGD)	No.of wells	Well Capacity (MGD)	Well Capacity (GPM)
1	Golden Gate -17th Ave	2	Surface Water	20	28	0.71	496
2	Golden Gate Canal ASR – Airport Road	2	Surface Water	25	35	0.71	496
3	Faka Union Canal ASR	2	Surface Water	25	35	0.71	496
4	Cocohatchee River ASR	2	Surface Water	5	8	0.63	434
5	Kehl Canal ASR	2	Surface Water	12	17	0.71	490
6	North Collier \ Bonita Springs Interconnect	2	Reclaimed Water	10.5	19	0.55	384
7	Naples \ South Collier Interconnect	2	Reclaimed Water	12	24	0.50	347
8A/8B.	Pelican Bay and Collier County North	2	Reclaimed Water	8.1	12	0.68	469
9	Collier County South	2	Reclaimed Water	6.6	10	0.66	458
10	Naples	2	Reclaimed Water	5.4	9	0.60	417
11	Golden Gate	2	Reclaimed Water	0.5	2	0.25	174
12	Bonita Springs Utilities	2	Reclaimed Water	2.4	5	0.48	333
13	North Collier / South Collier Interconnect	2	Reclaimed Water	14.7	21	0.70	486

Attachment K presents pre-selected pump curves that can meet capacity requirements for the horizontal wells, injection and recovery pumps.

Treatment

Ultraviolet Disinfection (UV)

In order to meet the Primary Drinking Water Standards, UV disinfection may be necessary. The need for any treatment and disinfection will be determined based on a pilot study at each site. This type of disinfection is considered operator friendly, as it has no residual; no chemicals to store, minimal contact time, and it requires a smaller footprint than other disinfection methods. The recommended UV system will be a closed vessel, medium pressure, and high intensity type system. According to the Recommended Standards for Water Works (2003 Edition), the Policy Statement on UV Light for treatment of Public Water Supplies states that the UV system shall meet the Class A criteria under ANSI/NSF Standard 55 (See Attachment L).

Chlorine Disinfection

Chlorine disinfection may be considered, but current and emerging disinfection byproduct regulations may result in chlorine not being viable. Chlorine disinfection can be evaluated to develop site-specific information related to microbial inactivation and disinfection by-product formation similar to that done for ozone and UV. In view of the organic content of the project source water, chlorine demand and subsequent disinfection by-product formation will be high. Chloramination may be able to reduce demand and disinfection by-product formation; however, significantly greater contact time will be necessary to achieve disinfection comparable to free chlorine. Because chlorine disinfection has not been tested, it cannot be stated at this time whether or not it is a viable disinfection process. Once the appropriate evaluations have been performed, chlorine disinfection can be compared and contrasted with ozone and UV. If chlorine disinfection is able to meet water quality objectives (and this level varies depending on requirements mandated by EPA or FDEP), this process may have a competitive advantage in that disinfection could be achieved via a solid (tablet type) chemical feed/contact system. Such a system would be relatively simple to maintain and operate.

It is of importance to note that chloramination has been tested on highly colored surface water and found to be suitable for meeting the coliform standard. This procedure was evaluated for disinfection for another ASR project in South Florida that proposed to store highly colored surface water.

CONTROL REQUIREMENTS

The permit will require proper system operation and monitoring. The operation and control of the ASR well system needs to be monitored for the following parameters:

- Pressure at the wellhead during injection/recharge
- Pressure at the wellhead during recovery
- Water level
- Flow rates during injection and recovery
- Conductivity during recovery (to estimate TDS)
- Pump motor status (on/off)
- Open/close position of each motor operated valve
- Abnormal conditions alarm (high motor temperature, high/low pressure, high/low flow)

Control panels for the well should be free standing within a NEMA 4X cabinet to include the following:

- Local/Off/Remote switch
- Lock out Stop switch
- Indicator light for pump/motor status
- Indicator of monitored parameters
- PLC and auxiliary hardware

If remote control of the ASR well is needed, a remote telemetry unit (RTU) can transmit an operator directive or provide information about the selected parameters.

GENERAL CIVIL REQUIREMENTS

Structures

Local codes and requirements - Standard Florida Building Code (Wind Speed = 150 Mile per Hour).

Electrical

Final design also will be performed in coordination and communication with Florida Power & Light Company (FPL). Electrical service will be extended from the existing electrical distribution system that currently serves nearby systems. The electrical power needs will be estimated to include motor horsepower (HP), motor operated valves, lighting, and instrumentation controls. Emergency power will be provided by a back-up generators located either at the treatment plants (for reclaimed water projects) or on-site for surface water projects). Each well will have a control panel. All electrical equipment will have nameplates to identify each item with its respective service or function. The nameplates will include the name of the equipment being served and its associated component number.

The Following are the electrical standards and codes that will be used to design and construct the proposed facilities:

- National Electrical Code (NEC)
- American National Standards Institute (ANSI)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)
- Occupational Safety and Health Administration (OSHA)
- American Society for Testing Material (ASTM)
- Underwriters' Laboratories, Inc. (UL)
- Local codes and standards

TECHNICAL SPECIFICATIONS

Division 1 – General Requirements

01025	MEASUREMENT AND PAYMENT
01040	CONSTRUCTION COORDINATION
01065	PERMITS AND FEES
01070	GENERAL ABBREVIATIONS
01200	PROJECT MEETINGS
01300	SUBMITTALS
01326	SCHEDULE (CPM)

01370 SCHEDULE OF VALUES

01380 CONSTRUCTION PHOTOGRAPHS

01410 TESTING LABORATORY SERVICES

01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01600 MATERIAL AND EQUIPMENT

01667 SYSTEM START UP AND TESTING

01700 CONTRACT CLOSEOUT

01730 OPERATION AND MAINTENANCE MANUALS

Division 2 – Site Work

02210 SAND CEMENT RIP-RAP

02221 EXCAVATING, BACKFILLING AND COMPACTION

02232 LIME ROCK BASE

02270 EROSION AND SEDIMENT CONTROL

02486 FINISH GRADING AND GRASS

02822 CHAIN LINK FENCE AND GATES

Division 3 - Concrete

03100 CONCRETE FORMWORK

03201 CONCRETE REINFORCEMENT

03260 CONCRETE JOINTS AND WATERSTOPS

03300 CONCRETE

03345 CONCRETE FINISHING AND CURING

03800 LEAKAGE TESTING OF HYDRAULIC STRUCTURES

Division 5 - Metals

05050 BOLTS, WASHERS, DRILLED ANCHORS, AND EYEBOLTS

05121 MISCELLANEOUS STRUCTURAL STEEL AND ALUMINUM

05515 LADDERS, STAIRS, AND STAIR NOSINGS

05520 HANDRAILS AND SAFETY CHAINS

05530 GRATING, COVER PLATES, AND ACCESS HATCHES

Division 9 - Finishes

09900 PAINTING AND COATING

Division 11 - Equipment

11210 HORIZONTAL END SUCTION CENTRIFUGAL PUMPS
11214 VERTICAL TURBINE PUMPS
11215 VERTICAL TURBINE PUMPS-WATER WELLS
11240 CO_2 FEED SYSTEM
11281 FABRICATED STAINLESS-STEEL SLIDE GATES
11375 ULTRAVIOLET DISINFECTION SYSTEM

Division 13 – Special Construction

13226 UNDERDRAIN AND COLLECTION SYSTEM

Division 15 – Mechanical

15000 PIPING SCHEDULE & GENERAL PIPING REQUIREMENTS
15041 DISINFECTION OF PIPING AND STRUCTURES
15044 PRESSURE TESTING OF PIPING
15056 DUCTILE-IRON PIPE
15064 PVC DISTRIBUTION PIPE (AWWA C900)
15100 MANUAL, CHECK, AND PROCESS VALVES
15108 AIR-RELEASE AND VACUUM-RELIEF VALVES
15121 MISCELLANEOUS PIPE FITTINGS AND ACCESSORIES
15122 FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS
15132 PRESSURE GAUGES
15142 WALL PIPES, SEEP RINGS, AND PENETRATIONS
15155 MAGNETIC FLOWMETER
15190 EQUIPMENT, PIPING, DUCT & VALVE IDENTIFICATION

Division 16 - Electrical

16015 ELECTRICAL REFERENCE SYMBOLS
16020 WORK INCLUDED
16025 CODES, FEES, & STANDARDS
16035 ACCEPTANCE TESTING
16040 IDENTIFICATION
16050 SPECIAL REQUIREMENTS
16110 RACEWAYS AND CONDUITS

16120 WIRES AND CABLES
16130 OUTLET BOXES
16134 PANEL BOARDS
16140 WIRING DEVICES
16150 ELECTRIC MOTORS
16160 MOTOR CONTROLS
16170 DISCONNECTS
16180 OVERCURRENT PROTECTIVE DEVICES
16190 SUPPORTING DEVICES
16410 ELECTRIC SERVICE
16450 GROUNDING
16460 TRANSFORMERS
16501 LIGHTING FIXTURES
16709 SURGE SUPPRESSION EQUIPMENT
16850 INSTRUMENTATION, CONTROL AND TELEMETRY SYSTEM
16910 CONTROL PANELS

Reference:

1. Pumping station Design Robert Sanks, Second Edition, 1998.
2. Wastewater Technology Fact Sheet Ultraviolet Disinfection, EPA September 1999.
3. Water Ten State Standards

CONCLUSIONS AND RECOMMENDATIONS

The RIDS Master Plan concludes that developing improvements on a sub-regional basis would be the most beneficial way to develop alternative water supply to offset potable water demands. Table 29 presents a summary of the selected alternatives for each sub-region. Figure 34 illustrates the RIDS alternative options for the lower west coast study area.

Table 29
Sub-regional Alternative Summary

Alternatives	Benefit (MGD)	Capital Cost ($)	Unit Cost ($ / 1,000 gal) [1]
Golden Gate Canal ASR – 17th Ave.	20	39,810,000	$1.31
Golden Gate Canal ASR – Airport Road	25	43,400,000	$1.17
Faka Union Canal ASR	25	65,010,000	$1.63
Cocohatchee River ASR	5	12,500,000	$1.58
Kehl Canal ASR	12	23,000,000	$1.27
North Collier \ Bonita Springs Interconnect	10.5	22,850,000	$1.41
Naples \ South Collier Interconnect	12	24,810,000	$1.35
Pelican Bay and Collier County North	8.1	14,040,000	$1.17
Collier County South	6.6	11,800,000	$1.20
Naples	5.4	10,790,000	$1.31
Golden Gate	0.5	3,760,000	$4.28
Bonita Springs Utilities	2.4	6,630,000	$1.72
North Collier / South Collier Interconnect	14.7	22,540,000	$1.06
Golden Gate Mine Pit	1.5	7,440,000	$2.91
Total Benefit or Recovery Capacity	**111.5**	308,380,000	

[1] Unit costs assume grant funding assistance

Implementation of the RIDS will require additional phases to plan, design, finance and construct the improvements. Assuming Phase 1 included the Master Plan, and Phase 2 included the Feasibility Study, subsequent phases include the following:

- **Phase 3 Engineering Design –** Includes design, permitting and bidding of projects.
- **Phase 4 Construction –** Construction and startup of projects.

Project phases will be implemented on a sub-regional basis as developed in the RIDS Master Plan.

ATTACHMENT A

The B-C methodology

ATTACHMENT A
BLANEY-CRIDDLE METHODOLOGY

The basic B-C formula states that the consumptive use (U) is equal to a seasonal consumptive use factor coefficient (k), times a monthly consumptive use factor (f), therefore U=k*f. F is a function of the mean monthly temperature in degrees Fahrenheit (t) times the monthly percent of daytime hours (p), divided by 100, expressed as f=t*p/100. K is a factor relating the plant water usage for a specific species. K factors are generated under experimental conditions where F and U are measured under tightly controlled conditions. This analysis uses a modified B-C method beginning with a modified (k) factor, explained in Appendix B.

Here, the coefficient (k) is equal to a climatic coefficient, which is related to the mean air temperature (kt), times a coefficient reflecting the growth stage of the crop (kc), (k=kt x kc). In order to approximate evapotranspiration, the following calculations must first be completed:

$f(m) = (t(m) \times p(m))/100,$
$kt(m) = (0.0173 \times t(m)) - 0.314,$
$kt\ f\ (m) = f(m) \times kt(m),$
$U(m) = kt\ f\ (m) \times kc\ (m),$ where,

m = month of year
f(m) = monthly evapotranspiration factor
r(m) = average monthly temperature, (provided)
p(m) = monthly percentage of annual daylight hours, (provided)
kt(m) = kt
U(m) = monthly evapotranspiration
kc(m) = monthly crop coefficient, (provided)

The effective rainfall for crop evapotranspiration is calculated as a function of the 1-in-10 year drought rainfall as:

$Rt(1) = (0.70917 \times (Rt(m)^{(0.82416)})) - 0.11556,$
$U1(m) = 10^{(0.01226 \times U(m))}$
$F1 = 0.531747 + (0.295154 \times D) - (0.057697 \times D^2) + (0.003804 \times D^3)$
$Re(m) = Rt1(m) \times U1(m) \times F1,$ where

Rt1(m) = monthly effective rainfall factor considering 1-in-10 monthly rainfall
Rt(m) = 1-in-10 monthly rainfall, (provided)
U1(m) = monthly effective rainfall factor considering monthly evapotranspiration
F1 = soil factor
D = net depth of application
Re(m) = monthly effective rainfall

After the monthly evapotranspiration, U(m), and the monthly 1-in-10 effective rainfall, Re(m), have been determined, the monthly supplemental crop requirement, Sup(m), is calculated as:

Sup(m) = U(m) – Re (m) for each month of the year

Finally, the irrigation quantity needed to supply the supplemental crop requirement Sup(m) is determined by:

Q(m) = Sup(m) x Ka x A, where

Ka = allocation coefficient multiplier for the irrigation system specified
A = irrigated acreage for the crop

ATTACHMENT B

The B-C Models Results

Collier County N. & Pelican Bay - Current

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Naples
Irrigation System:	Sprinkler
Irrigated Acreage:	7797.00
Crop:	Turf Grass
Soil Type:	0.40
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.88	1.93	0.96	2.05	4.42	8.17	8.36	8.18	8.69	4.09	1.56	1.32	51.61
Evapotranspiration (inches)	1.93	2.21	3.76	5.09	6.66	7.44	7.88	7.51	6.47	5.00	3.22	2.26	59.43
Average Effective Rainfall (inches)	0.77	0.80	0.45	0.99	2.14	3.78	3.95	3.79	3.77	1.82	0.70	0.56	23.52
1-in-10 Effective Rainfall (inches)	0.62	0.67	-0.04	0.34	1.51	2.75	3.30	3.42	3.34	1.61	0.53	0.41	18.46
Average Irrigation (inches)	1.16	1.41	3.31	4.10	4.52	3.66	3.93	3.72	2.70	3.18	2.52	1.70	35.91
1-in-10 Irrigation (inches)	1.31	1.54	3.80	4.75	5.15	4.69	4.58	4.09	3.13	3.39	2.69	1.85	40.97

1-in-10 Annual Supplemental Crop Requirement = 40.97 Inches

Annual Supplemental Crop Water Use:

40.97 inches X 7797 Acres X 1.33 X 0.02715 MG/AC-IN = 11534.93 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.15 Inches

Maximum Monthly Supplemental Crop Water Use:

5.15 inches X 7797 Acres X 1.33 X 0.02715 MG/AC-IN = 1449.96 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

Collier County South - Current

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Naples
Irrigation System:	Sprinkler
Irrigated Acreage:	9060.00
Crop:	Turf Grass
Soil Type:	0.40
Multipiler	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.88	1.93	0.96	2.05	4.42	8.17	8.36	8.18	8.69	4.09	1.56	1.32	51.81
Evapotranspiration (inches)	1.93	2.21	3.76	5.09	6.66	7.44	7.88	7.51	6.47	5.00	3.22	2.26	59.43
Average Effective Rainfall (inches)	0.77	0.80	0.45	0.99	2.14	3.78	3.95	3.79	3.77	1.82	0.70	0.56	23.52
1-in-10 Effective Rainfall (inches)	0.62	0.67	-0.04	0.34	1.51	2.75	3.30	3.42	3.34	1.61	0.53	0.41	18.46
Average Irrigation (inches)	1.16	1.41	3.31	4.10	4.52	3.66	3.93	3.72	2.70	3.18	2.52	1.70	35.91
1-in-10 Irrigation (inches)	1.31	1.54	3.80	4.75	5.15	4.69	4.58	4.09	3.13	3.39	2.69	1.85	40.97

1-in-10 Annual Supplemental Crop Requirement = 40.97 inches

Annual Supplemental Crop Water Use:

40.97 inches X 9060 Acres X 1.33 X 0.02715 MG/AC-IN = 13403.42 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.15 inches

Maximum Monthly Supplemental Crop Water Use:

5.15 inches X 9060 Acres X 1.33 X 0.02715 MG/AC-IN = 1684.83 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

Golden Gate - Current

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Naples
Irrigation System:	Sprinkler
Irrigated Acreage:	1734.00
Crop:	Turf Grass
Soil Type:	0.40
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.88	1.93	0.96	2.05	4.42	8.17	8.36	8.18	8.69	4.09	1.58	1.32	51.61
Evapotranspiration (inches)	1.93	2.21	3.76	5.09	6.66	7.44	7.88	7.51	6.47	5.00	3.22	2.26	59.43
Average Effective Rainfall (inches)	0.77	0.80	0.45	0.99	2.14	3.78	3.95	3.79	3.77	1.82	0.70	0.56	23.52
1-in-10 Effective Rainfall (inches)	0.62	0.67	-0.04	0.34	1.51	2.75	3.30	3.42	3.34	1.61	0.53	0.41	18.46
Average Irrigation (inches)	1.16	1.41	3.31	4.10	4.52	3.66	3.93	3.72	2.70	3.18	2.52	1.70	35.91
1-in-10 Irrigation (inches)	1.31	1.54	3.80	4.75	5.15	4.69	4.58	4.09	3.13	3.39	2.69	1.85	40.97

1-in-10 Annual Supplemental Crop Requirement = 40.97 inches

Annual Supplemental Crop Water Use:

40.97 inches X 1734 Acres X 1.33 X 0.02715 MG/AC-IN = 2565.29 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.15 inches

Maximum Monthly Supplemental Crop Water Use:

5.15 inches X 1734 Acres X 1.33 X 0.02715 MG/AC-IN = 322.46 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

Marco Island Utilities - Current

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Naples
Irrigation System:	Sprinkler
Irrigated Acreage:	1055.00
Crop:	Turf Grass
Soil Type:	0.40
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.88	1.93	0.96	2.05	4.42	8.17	8.36	8.18	8.69	4.09	1.56	1.32	51.61
Evapotranspiration (inches)	1.93	2.21	3.76	5.09	6.66	7.44	7.88	7.51	6.47	5.00	3.22	2.26	59.43
Average Effective Rainfall (inches)	0.77	0.80	0.45	0.99	2.14	3.78	3.95	3.79	3.77	1.82	0.70	0.56	23.52
1-in-10 Effective Rainfall (inches)	0.62	0.67	-0.04	0.34	1.51	2.75	3.30	3.42	3.34	1.61	0.53	0.41	18.46
Average Irrigation (inches)	1.16	1.41	3.31	4.10	4.52	3.66	3.93	3.72	2.70	3.18	2.52	1.70	35.91
1-in-10 Irrigation (inches)	1.31	1.54	3.80	4.75	5.15	4.69	4.58	4.09	3.13	3.39	2.69	1.85	40.97

1-in-10 Annual Supplemental Crop Requirement = 40.97 inches

Annual Supplemental Crop Water Use:

40.97 Inches X 1055 Acres X 1.33 X 0.02715 MG/AC-IN = 1560.77 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.15 inches

Maximum Monthly Supplemental Crop Water Use:

5.15 inches X 1055 Acres X 1.33 X 0.02715 MG/AC-IN = 196.19 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

ATTACHMENT C

USGS and SFWMD Stream Flow Data

SURFACE WATER BODY: GOLDEN GATE CANAL SYSTEM (17 Ave SW)
GAGE STATION LOCATION: SW 1/4 SW 1/4 SEC. 13 T 49 S R 26 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1977										161	66	69
1978	74	95	181	80	66	91	214	485	257	124	61	49
1979	96	71	37	17	48	94	113	178	428	367	122	189
1980	113	146	69	33	49	40	142	188	233	147	94	83
1981	54	81	53	24	20	175	275	297	276	174	75	32
1982	13	7	5	4	16	527	278	531	432	486	230	115
1983	99	360	334	299	139	199	499	524	810	300	193	137
1984	130	96	165	97	49	122	401	295	379			
MEAN	83	122	121	79	55	178	274	357	402	251	120	96

DRY SEASON: 92.7
WET SEASON: 321

SURFACE WATER BODY: GOLDEN GATE CANAL SYSTEM (Airport Rd)
GAGE STATION LOCATION: NE 1/4 NE 1/4 SEC. 35 T 49 S R 25 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1964										251	140	97
1965	84	77	91	56	46	209	426	609	635	555	347	157
1966	135	200	198	157	130	392	1092	932	693	564	219	128
1967	111	145	173	84	48	296	565	744	588	934	298	212
1968	120	144	173	77	161	598	1280	592	740	362	.41.2	181
1969	127	125	132	103	85	576	646	514	469	529	426	211
1970	181	180	641	328	258	514	446	417	567	297	133	80
1971	46	67	21	2.4	1.5	118	444	785	1265	534	254	137
1972	79	107	62	88	168	594	562	488	894	524	260	243
1973	241	216	171	121	34	123	530	1174	1232	524	346	238
1974	224	138	61	19	22	693	1159	1195	958	315	105	188
1975	53	30	14	0.4	1.9	90	368	430	529	460	205	96
1976	34	19	17	21	631	704	443	462	569	211	100	44
1977	44	55	19	0.3	53	546	670	711	827	248	46	94
1978	98	130	266	84	112	296	426	683	449	161	77	66
1979	172	110	84	43	156	199	227	389	803	688	238	338
1980	215	299	236	98	111	105	331	350	613	345	222	153
1981	72	116	79	55	37	226	290	740	951	299	99	51
1982	22	12	13	20	90	637	603	681	599	630	235	158
1983	209	461	425	270	114	233	759	653	1079	459	307	134
1984	120	100	183	121	104	244	732	456	451			

MEAN	119	136	153	87	118	370	600	650	746	445	214	150

DRY SEASON: 127
WET SEASON: 610

SURFACE WATER BODY: FAKA CANAL
GAGE STATION LOCATION: NE1/4 NE 1/4 SEC. 9T 52 S R 28 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1970	222	217	661	392	87.9	308	659	636	621	403	221	126
1971	76.3	51.8	21.6	0.10	0	115	255	738	200	881	259	69.5
1972	25.8	83.0	29.9	10.3	57.3	479	317	296	414	321	206	131
1973	96.0	47.8	9.8	4.50	0	3.0	537	762	1115	438	38.0	12.3
1974	14.4	10.3	0.14	0	7.09	274	932	1215	1043	297	47.2	47.9
1975	9.5	0.45	0	0	0	7.83	602	851	589	758	274	69.6
1976	1.00	1.00	1.35	1.00	32.5	352	249	100	128	316	154	84.5
1977	171	78.8	17.2	1.00	1.00	225	261	242	373	332	62.0	95.8
1978	137	169	238	112	122	282	356	567	520	417	128	71.8
1979	100	66.2	27.9	0.63	71.1	62.4	77.0	158	484	143	124	113
1980	82.5	97.2	92.9	82.0	51.3	45.6	124	299	687	277	156	114
1981	73.0	92.6	69.8	26.8	18.0	11.8	118	671	916	305	158	97.1
1982	42.6	13.2	53.7	26.1	105	724	417	691	932	1050	300	141
1983	136	410	432	330	36.4	301	522	370	385	835	504	301
1984	237	129	123	39.1	48.1	198	237	237	387		830	283
1985	28.7	0.79	0	0	0	63.7	557	759	746	541	315	147
1986	97.7	48.6	54.7	16.1	-0.30	202	305	362	484	567	522	439
1987	595	450	391	196	60.7	422	598	379	497	496	650	434
1988	137	63.9	17.7	-0.12	-0.15	-0.02	125	490	644		119	41.0
1989	1.61	-0.04	0.02	0	-0.04	-0.40	83.7	122	422	384	201	161
1990	71.2	21.8	-0.36	-0.33	-1.64	150	276	373	392	408	167	60.8
1991	262	142	70.1	60.8	209	581	1021	847	827	523	243	80.6
1992	32.2	33.2	55.5	32.5	0.18	175	537	712	846	401	125	64.0
1993	128	111	105	51.4	14.1	155	234		389	457	184	50.2
1994	39.1	60.3	28.5	17.2	2.55	91.0	203	585	889	638	458	627
1995	582	375	144	77.7	106	886	735	993	1606	1749	666	141
1996	69.7	17.0	19.6	16.8	59.1	320	371	378	255	541		
1997					119	292	560	566	269	174	32.1	
1998	191	156	226	36.4	-2.24	6.28	111	611	906	540	750	343
1999	199	43.6	-0.48	-3.86	-3.11	217	530	549	1030	1189	657	191
MEAN	133	103	99.7	52.6	40.0	231.63	397	537	633	549	295	162

DRY SEASON: 98.4
WET SEASON: 529

SURFACE WATER BODY: COCOHATCHEE CANAL
GAGE STATION LOCATION: SE 1/4 SW 1/4 SEC. 23 T 48 S R 25 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968										27.1	35.6	8.80
1969	12.3	11.4	9.88	10.0	5.87	9.51	71.7	52.3	66.9	71.3	49.2	17.4
1970	10.4	6.81	67.7	24.3	4.11	17.5	19.3	42.1	75.3	17.4	3.74	2.57
1971	1.07	0.61	0.02	4.64	4.53	6.11	29.7	75.7	152	92.9	26.9	13.1
1972	9.92	11.6	8.76	7.07	12.2	41.2	38.9	34.2	73.5	41.4	15.7	9.92
1973	8.51	7.98	6.26	2.69	4.17	15.6	24.9	239	278	45.7	7.98	2.92
1974	1.60	4.17	1.67	0	0	20.3	183	175	137	20.2	2.95	2.30
1975	1.48	1.04	1.23	0.95	1.52	4.48	15.0	46.5	56.5	34.7	16.8	7.76
1976	5.58	4.80	4.17	2.77	5.08	28.3	38.8	26.0	34.3	18.5	4.80	1.36
1977	7.64	8.43	4.46	1.08	1.79	13.1	27.4	53.4	98.5	27.3	7.33	8.10
1978	5.01	7.69	11.7	7.04	6.36	10.1	51.3	149	63.8	9.43	2.42	2.42
1979	8.49	13.4	13.4	6.79	16.0	6.96	4.90	10.6	94.9	78.3	22.9	32.9
1980	31.9	30.7	18.7	8.64	8.21	7.74	14.9	42.4	106	50.9	16.6	13.4
1981	5.81	5.57	5.06	3.44	3.91	13.1	27.5	103	128	26.6	7.89	2.77
1982	2.00	1.67	1.55	1.09	1.94	80.9	71.3	137	154	6.14	4.83	3.77
1983	3.61	4.69	4.89	4.54	3.37	3.44	4.89	5.67	6.29	75.7	56.6	31.6
1984	22.7	13.1	30.0	18.0	10.2	36.3	133	53.6	73.5			
1994							107	170	191	87.7	43.8	53.2
1995	41.5	35.6	16.5	9.39	10.2	23.2	62.0	182	22.8	355	98.7	28.7
1996	26.3	11.4	14.5	11.5	3.02	30.1	20.2	50.3	51.8	85.5	8.47	1.46
1997	1.54	1.23	1.12	1.50	1.51	3.90	21.7	23.0	13.7	12.8	1.41	26.8
1998	16.2	46.8	44.9	8.51	0.01	2.13	10.7	24.8	62.8	23.6	57.5	17.3
1999	11.4	6.23	3.81	9.18	0.35	8.06	62.7	126	111	43.7	34.3	29.0
2000	29.6	29.9	29.1	29.0	29.1	29.1	28.0	29.9	36.0	30.7	28.4	29.4
2001	30.5	30.2	4.97	0.71	0	2.21	39.5	57.7	209			
MEAN	12.8	12.8	13.2	7.51	5.80	18.0	46.2	79.5	95.7	55.8	24.1	15.1

DRY SEASON: 11.2
WET SEASON: 69.3

SURFACE WATER BODY: IMPERIAL RIVER
GAGE STATION LOCATION: SE 1/4 SW 1/4 SEC. 31 T 47 S R 26 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940						6.50	43.0	104	928	107	11.5	3.35
1941	86.3	141	50.2	207	55.4	59.4	342	238	203	108	31.3	7.85
1942	72.1	8.60	25.1	3.56	1.79	128	164	20.8	179	16.2	1.73	1.51
1943	1.46	1.29	1.18	1.15	1.15	93.6	315	241	153	72.1	3.40	1.90
1944	1.46	1.34	1.21	1.15	1.11	2.17	1.84	117	107	94.1	15.2	2.10
1945	1.73	1.18	1.05	0.90	0.82	71.8	287	404	333	125	20.0	2.25
1946	1.81	1.25	1.09	0.91	0.94	7.89	90.5	197	207	129	176	22.3
1947	2.79	1.77	45.8	11.0	2.44	332	274	402	1021	351	113	74.0
1948	38.4	23.6	2.19	1.47	1.18	1.30	97.5	125	366	374	21.2	2.44
1949	1.55	0.82	0.86	0.74	1.36	132	171	245	217	392	63.4	4.11
1950	1.64	1.23	0.93	1.16	0.72	0.86	126	38.1	191	7.01	2.16	1.75
1951	1.25	1.07	0.99	0.91	0.86	0.61	127	236	117	809	44.1	3.13
1952	1.32	1.52	1.69	1.02	0.91	2.35	104	118	174	234	67.2	8.37
1953	7.05	21.4	1.44	1.54	0.91	16.6	84.3	139	457	350	73.9	18.1
1954	4.21	1.36	1.45	1.40	1.37	2.67	75.2	86.4	129	119		
1987		48.6	76.5	80.6		117	111	150	102	338	376	219
1988	88.5	43.3	43.3	11.5	9.16	7.55	25.8	211	324	45.1	16.3	10.8
1989	7.44	6.88	8.34	7.35	6.49	7.20	28.6	67.7	128	37.2	13.6	12.8
1990	8.98	7.40	4.96	3.92	3.98	12.2	20.1	101	61.5	53.2	19.1	12.2
1991	31.9	20.5	13.6	19.8	51.3	92.9	471	466	248	278	85.6	28.0
1992	14.0	17.2	14.4	13.1	10.6	104	569	383	283	172	26.1	12.6
1993	18.5	14.7	40.4	38.6	9.34	9.08	31.8	41.1	174	204	98.2	32.1
1994	40.2	44.5	33.0	11.9	10.3	26.9	54.3	233	375	351	162	179
1995	185	127	50.7	23.8	17.9	94.0	192	709	1178	1097	387	87.1
1996	66.0	24.1	14.6	13.6	11.5	53.5	62.8	105	86.0	144	39.8	19.1
1997	13.7	12.0	9.11	7.93	6.39	9.02	132	198	81.9	49.6	14.6	97.1
1998	90.7	184	226	68.1	16.7	12.6	25.9	74.2	158	129	283	131
1999	78.2	32.4	14.4	9.54	8.10	39.7	457	422	481	566	223	65.1
2000	28.5	17.4	15.3	11.5	8.05	7.83	14.9	92.7	295			
MEAN	33.1	28.8	25.0	19.8	8.92	50.1	155	206	302	241	88.5	39.2

DRY SEASON: 25.8
WET SEASON: 226

SURFACE WATER BODY: HENDERSON CREEK CANAL (SFWMD)
GAGE STATION LOCATION: SE 1/4 NE 1/4 SEC. 3 T 51 S R 26 E
STAFE (FEET, NGVD)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1983							0.74	0.88	1.19	1.04	0.72	
1984	0.46	0.32		0.58	0.51	0.76	0.89	0.90	1.10	1.03	0.87	0.65
1985	0.57				0.68	0.65	1.13	1.21	1.08	1.29	1.07	0.65
1986	0.51	0.58	0.39	0.88	1.08	1.05	1.00	1.23	1.46	1.33	1.12	0.91
1987	0.89	0.74	1.12	0.81	0.91	1.05	1.23	1.17	1.22	1.02	1.27	0.94
1988	0.61	0.64	0.61	0.93	0.81	0.91	0.91	1.03	1.41	1.27	1.13	0.13
1989	0.76	0.64	0.41	0.40	0.63	1.03	1.19	1.27	1.42	1.18	1.09	0.69
1990	0.60	0.66	1.01	0.93	1.20	1.12	1.24	1.59	1.44	1.40	1.28	0.99
1991	1.13	0.86	1.07	1.21	1.38	1.43	1.54	1.58	2.13	1.64	1.40	0.98
1992	1.09	1.16	0.89	1.12	1.19	1.57	1.40	1.56	1.76	1.86	1.34	1.15
1993	1.12	1.23	1.03	1.18	1.29	1.27	1.37	1.48	1.57	1.63	1.12	1.05
1994	0.74	0.88	1.00	0.91			1.11	1.46	1.58	1.57	1.31	1.23
1995	0.92	0.65	0.95	1.18	1.30		1.40	2.20	2.08	2.21	1.18	1.03
1996	0.73	0.36	0.65	0.88	0.96	1.07	1.16	1.25	1.37	1.49	1.12	0.72
1997	0.64		1.08	1.16	1.09	1.23	1.25	1.35	1.49	1.35	1.08	0.93
1998	0.81	1.13	0.94	0.99	1.17	1.10	1.15	1.23	1.65	1.30	1.18	0.99
1999	1.01	1.16	1.05	1.27	1.25	1.13	1.28	1.51	2.06	1.54	1.34	1.04
2000	1.80	1.87	1.07	1.11	1.10	1.21	1.47	1.40	1.74	1.53	1.32	0.88
MEAN	0.85	0.86	0.88	0.97	1.03	1.11	1.19	1.35	1.54	1.43	1.16	0.88

DRY SEASON: 0.91
WET SEASON: 1.38

ATTACHMENT D

Hydrostratigraphy Assessment of Inventoried Wells

TABLE 7- SUMMARY OF INVENTORIED WELLS. COLLIER COUNTY / BONITA SPRINGS SUBREGION

WRS NUMBER	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft)	CASED DEPTH (ft)	DIS. CHLOR. (mg/l)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
CO-2836					MC-5064	NE SE 25-49S-26E	492625	760	635				LH		COLLIER COUNTY'00	MI
CO-2400		W-17405	I75-TW	C-1111		SW SW 29-49S-26E	492629	2694	905	10,200	25,400	SUW (1,158 - 1,185')		TEST		SFWMD
										14,300	35,700	OCA (1,287 - 1,318')				
										17,000	45,000	OCA (1,469 - 1,524')				
										16,300	45,100	AP (1,851 - 1,901')				
CO-2838			CR-75			SE NE 34-49S-26E	492634	1470								FGS
CO-2081				C-1103		SW NW 35-49S-26E	492635	1616	540	2,000		SUW (940 - 1,030')		TEST	COLLIER COUNTY ASR TW	WRS
										13,300		OCA (1,290 - 1,616')				
CO-2846					MC-5002	NW SW 18-49S-28E	492818	860	398						COLLIER COUNTY	MI
CO-2403	P-775	W-12995				NW SE 26-49S-28E	492826	13349	3620			P&A 5/30/75		PET TW	TRIBAL'75 #26-4 Collier Co.	BOG
CO-2897		W-14534	C-2020D			NW NE 03-50S-26E	502603	540						TEST		FGS
CO-2617		W-9409				NE SW 11-50S-26E	502611	750				Collier County		CORE	Humble Oil & Ref Comp Core Test #18	BOG
CO-2622						SW SE 20-50S-26E	502620	3200	2640			IW		INJ	COLLIER COUNTY South County WWTP	WRS
CO-2623						SW SE 20-50S-26E	502620	1950	1820			DZMW		MONITOR	COLLIER COUNTY South County WWTP	WRS
CO-2905	P-130	W-2420		C-726		SE NW 27-50S-26E	502627	12600	4512			P&A 8/27/51		PET TW	HORC'51 #1 Collier Co.	BOG
CO-2616		W-8925				NE SW 32-50S-26E	502632	1380						CORE	HORC #36 CT	FGS
CO-2256	P-134	W-2686				SE SW 34-50S-26E	502634	5895	4422			P&A 3/10/52		PET TW	HORC'52 #2 Collier Co.	BOG
CO-2594						SW SE 34-50S-26E	502634	780	736	2,449	6,860		LH	ASR	FWS Marco Lakes ASR # 2	WRS
CO-2595						SW SE 34-50S-26E	502634	780	736	2,774	8,860		LH	ASR	FWS Marco Lakes ASR # 3	WRS
CO-706		W-14601	C-2022D	C-680		NW NW 06-50S-28E	502806	1000	240		6,918			TEST		FGS
CO-2918		W-10223		C-926		NW NE 23-50S-28E	502823	1370						CORE	HORC #34 CT	FGS
CO-2427						NW NE 03-51S-26E	512603	817	745			DZMW	LH	MONITOR	FWS Marco Lakes	WRS
CO-2428						NW NE 03-51S-26E	512603	790	745			ASR # 1	LH	ASR	FWS Marco Lakes ASR # 1	WRS
CO-2080				C-1102		SE NE 10-51S-26E	512610	1608	360	4,000		LH (650 - 770')	LH	MONITOR	Col. Cty Manatee Rd, Backplugged to 750'	WRS
										10,000		SUW (970 - 1,010')				
										17,000		OCA (1,220-1,270')				
										18,000		AP (1,330 - 1,610')				
CO-2615	P-663	W-12046		C-759		E/2 NE 24-51S-26E	512624	13803	3661			P&A 7/31/73		PET TW	WEINER'73 #1 Collier-Read Co.	BOG
CO-2966			CR-41A			NE SE 32-51S-26E	512632	778								FGS
CO-1545		W-14921	C-2028D			NW SW 33-51S-26E	512633	800						PET TW		FGS
CO-2952		W-8993				C 13-51S-27E	512713	1500						CORE	HORC'75 #102 CT	SFWMD
CO-2962			CR-42A			SE NW 34-51S-27E	512734	874								FGS
CO-703		W-14922	C-2029D	C-916		SW NW 36-51S-27E	512736	880	360	1,540	5,626			TEST		SFWMD
CO-1769				C-1101		NW NE 08-52S-26E	522608	800	390	6,550	21,600	390 - 800'	MH		Backplugged to 500'	WRS
CO-2271						NW NE 08-52S-26E	522608	3354				IW	MP	INJ	FLORIDA WATER SERVICES Marco Is.	WRS
CO-2272				C-1105		NW NE 08-52S-26E	522608	1970		15,000	39,000	SUW (1,000 - 1,089')		MONITOR	FLORIDA WATER SERVICES Marco Is.	WRS
										19,000	44,600	OCA (1,490 - 1,600')				
CO-2433						SE SW 10-52S-26E	522610	900	352			Backplugged to 507	MH	P.S	FL WTR SERVICES RO-15	WRS
CO-2540						NW NE 15-52S-26E	522615	500	341				MH	P.S	FL WTR SERVICES RO-17	WRS
CO-2109						SW NW 16-52S-26E	522616	546	415	4,600			MH	P.S	SSU RO-6	WRS
CO-2112						NW SW 16-52S-26E	522616	547	392				MH	P.S	SSU RO-5	WRS
CO-2305						NE NW 16-52S-26E	522616	810	405	5500 (750-810')		Backplugged to 546	MH	P.S	SSU # RO-9	WRS
CO-2429						SW NE 16-52S-26E	522616	760	350			Backplugged to 500	MH	P.S	FL WTR SERVICES RO-11	WRS
CO-2977			CR-77A			NW NW 16-52S-26E	522616	810								FGS
CO-2108						NE SE 17-52S-26E	522617	565	380				MH	P.S	SSU RO-1	WRS
CO-2307						NW SW 17-52S-26E	522617	545	410				MH	MONITOR	SSU MW-1	WRS
CO-2978		W-4937				NW SW 19-52S-26E	522619	413						TEST	ELGIN GULF TEST RANGE'59	FGS
CO-2407	P-778	W-12838		C-794		SE NW 12-52S-27E	522712	8670	12840			P&A 10/17/75		PET TW	BASS ENTERPRISES'75 #12-2 Collier Co.	BOG
CO-702		W-14920	C-2030D	C-914		NE SW 13-52S-28E	522813	1220		2,900	9,566			TEST		SFWMD

ATTACHMENT E

Summary of TOPS of Geologic Units in Inventoried Wells

TABLE 8 - SUMMARY OF TOPS OF GEOLOGIC UNITS IN INVENTORIED WELLS, COLLIER COUNTY / BONITA SPRINGS SUBREGION

WRS NUMBER	(QTR QTR S-T-R)	LOCATION		SORT CODE	TOTAL DEPTH (ft)	CASED DEPTH (ft)	Hol/Pleist-Pinec. Ls Thickness	Bonita Springs Top	Ochopee Top	Peace River Top	Arcadia Top	Lower Hawthorn Top	Suwanee Top	Ocala Top	Avon Park Top	DATA SOURCE
		LAT.	LONG.													
LM-786	SW SW 04-47S-25E	26°24'27"	81°49'11"	472504	809	294	30	30	NP	50	212	505	715	NDE	NDE	SFWMD
LM-3049	NW SW 16-47S-25E	26°22'53"	81°49'10"	472516	660	336	38	38	97	140	206	514	NDE	NDE	NDE	WRS
LM-1980	SE SE 17-47S-25E	26°22'43"	81°49'18"	472517	1306		45	45	85	112	200	530	712	1135	NDE	WRS
LM-1980A	SE SE 17-47S-25E	26°22'43"	81°49'18"	472517	660	350	45	45	85	112	200	530	NDE	NDE	NDE	WRS
LM-2041	SE SE 17-47S-25E	26°22'43"	81°49'21"	472517	620	360	36	36	100	110	215	535	NDE	NDE	NDE	WRS
LM-470	SW NE 35-47S-25E	26°20'22"	81°46'42"	472535	535	396	35	35	50	105	250	NDE	NDE	NDE	NDE	USGS
LM-7173	SW NW 13-47S-26E	26°23'07"	81°40'24"	472613	1460		80	80	90	150	280	560	790	1220	NDE	FGS
LM-635	NE NE 19-47S-26E	26°22'16"	81°44'25"	472619	585		60	60	90	150	195	550	NDE	NDE	NDE	USGS
LM-650	SE SE 29-47S-26E	26°20'45"	81°43'24"	472629	1420		45	45	70	150	220	525	710	1170	NDE	USGS
LM-7179	NW SE 36-47S-26E	26°20'13"	81°39'53"	472636	520		65	65	95	150	270	NDE	NDE	NDE	NDE	FGS
CO-2705	NW SE 09-47S-28E	26°24'03"	81°31'16"	472809	11987	11987	NL	NL	NL	NL	NL	525	720	1060	1380	BOG
CO-2708	NE NE 16-47S-28E	26°23'38"	81°31'06"	472816	12050	12050	?	?	?	120	355	535	780	1090	1365	BOG
CO-2255	SW SW 19-47S-28E	26°22'11"	81°33'34"	472819	12210	4249	35	35	45	118	280	560	750	1130	1460	BOG
CO-2710	NE 21-47S-28E	26°22'38"	81°31'12"	472821	15234	11750	30	NP	30	60	349	590	740	1110	1440	BOG
CO-2711	NE SW 21-47S-28E	26°22'17"	81°31'34"	472821	12120	11906	18	18 (E)	30 (E)	107 (E)	310 (E)	560	750	1040	1380	BOG
CO-2712	SE SW 24-47S-28E	26°22'10"	81°28'40"	472824	520		NP	Surf	4	90	355	NDE	NDE	NDE	NDE	FGS, SFWMD
CO-2834	SW SE 21-48S-25E	26°16'20"	81°48'24"	482521	587	478	30	30	103	200	374	562	NDE	NDE	NDE	MI
CO-3698	SE 27-48S-25E	26°15'46"	81°47'20"	482527	3250		30	30	50	150	330	605	746	1229	1690	WRS
LM-640	NW NW 05-48S-26E	26°19'52"	81°44'20"	482605	525		30	30	60	165	345	NDE	NDE	NDE	NDE	USGS
CO-2317	SW SE 35-48S-26E	26°14'44"	81°40'47"	482635	3370	2492	28	28	33	160	310	620	830	1260	1535	WRS
CO-2318	SW SE 35-48S-26E	26°14'44"	81°40'47"	482635	1930		25	25	33	206	326	630	810	1270	1570	WRS
CO-3689	SW SE 35-48S-26E	26°14'38"	81°40'48"	482635	801	705	25	25	26	200	380	700	NDE	NDE	NDE	MI
CO-3690	SE SE 35-48S-26E	26°14'38"	81°40'33"	482635	784	730	8	NP	8	235	420	725	NDE	NDE	NDE	MI
CO-2752	SE SE 36-48S-26E	26°14'42"	81°39'40"	482636	977	775	42	NP	42	180	390	770	NDE	NDE	NDE	MI
CO-2753	SW SW 36-48S-26E	26°14'41"	81°40'15"	482636	891	744	42	NP	42	182	335	738	NDE	NDE	NDE	MI
CO-3692	SW SE 36-48S-26E	26°14'38"	81°39'59"	482636	1070	790	40	NP	40	155	445	780	925	NDE	NDE	MI
CO-3693	E/2 SE 36-48S-26E	26°14'38"	81°39'42"	482636	975	740	4	NP	4	165	480	805	925	NDE	NDE	MI
CO-2760	SE SE 31-48S-27E	26°14'43"	81°38'30"	482731	951	735	37	NP	37	139	380	725	895	NDE	NDE	MI
CO-2761	SE SW 31-48S-27E	26°14'41"	81°39'00"	482731	952	780	38	38	40	120	398	768	885	NDE	NDE	MI
CO-3694	SW SW 31-48S-27E	26°14'39"	81°39'18"	482731	1071	700	2	NP	2	146	420	770	885	NDE	NDE	MI
CO-3695	SW SE 31-48S-27E	26°14'40"	81°38'47"	482731	1011	750	NP	NP	Surf	167	390	755	855	NDE	NDE	MI
CO-2763	SW SW 32-48S-27E	26°14'42"	81°38'17"	482732	906	725	30	30	50	100	382	722	872	NDE	NDE	MI
CO-3696	SE SW 32-48S-27E	26°14'42"	81°38'02"	482732	1254		30	30	50	90	382	706	870	NDE	NDE	MI
CO-3697	SW SE 32-48S-27E	26°14'42"	81°37'47"	482732	950		31	31	63	95	402	695	885	NDE	NDE	MI
CO-2764	SE SE 34-48S-27E	26°15'02"	81°35'47"	482734	800	682	72	72	120	220	392	690	NDE	NDE	NDE	MI
CO-2263	NW NW 03-48S-28E	26°20'08"	81°30'44"	482803	11900	4265	NL	NL	NL	NL	300	500	700	900	1190	FGS
CO-2765	NW SW 09-48S-28E	26°18'54"	81°31'51"	482809	927	294	20	20	42	70	289	515	744	NDE	NDE	MI
CO-3121	SE NW 09-48S-28E	26°18'57"	81°31'00"	482809	1370		40	40	50	70	340	590 ?	750 ?	1000	1360	BOG
CO-2766	C SE 13-48S-28E	26°17'50"	81°28'06"	482813	12075	4404	30	?	?	?	330 ?	510 ?	690 ?	1050	1380	BOG
CO-3122	SW 16-48S-28E	26°17'45"	81°31'32"	482816	1020		30	30	45	90	340	540	700	980	NDE	BOG
CO-451	SW SW 17-48S-28E	26°17'38"	81°32'43"	482817	460		18	18	30	100	265	NDE	NDE	NDE	NDE	USGS
CO-2265	NE NW 23-48S-28E	26°17'23"	81°29'34"	482823	12206	5110	70	NP	70	200	340	583	700	900	1180	BOG
CO-3123	NW NW 33-48S-28E	26°15'45"	81°31'39"	482833	1419		NP	NP	Surf	90	400	550 ?	700 ?	1040	1340	BOG
CO-1625	SE NE 09-49S-25E	26°13'10"	81°48'06"	492509	652		30	NP	30	162	322	645	NDE	NDE	NDE	Geraghty & Miller
CO-87	SE NE 09-49S-25E	26°13'16"	81°48'04"	492509	640		30	30	35	185	340	640 ?	NDE	NDE	NDE	Gee & Jenson
CO-2835	SW SW 23-49S-26E	26°11'03"	81°41'10"	492623	810	640	NL	NL	NL	NL	NL	638	760	NDE	NDE	MI
CO-2400	SW SW 29-49S-26E	26°10'12"	81°43'51"	492629	2694	905	NP	Surf	10	175	305	560	750	1235	1650	SFWMD
CO-2838	SE NE 34-49S-26E	26°09'44"	81°41'10"	492634	1470		?	?	?	?	280	620	800	1300	NDE	FGS
CO-2081	SW NW 35-49S-26E	26°09'52"	81°41'07"	492635	1616	540	15	15	30	170	285	618	790	1280	1616	WRS
CO-2846	NW SW 18-49S-28E	26°12'10"	81°33'19"	492818	860	398	4	NP	4	135	394	605	755 ?	NDE	NDE	MI
CO-2897	NW NE 03-50S-26E	26°09'11"	81°41'31"	502603	540		NP	Surf	5	173	293	NDE	NDE	NDE	NDE	FGS

TABLE 8 - SUMMARY OF TOPS OF GEOLOGIC UNITS IN INVENTORIED WELLS. COLLIER COUNTY / BONITA SPRINGS SUBREGION

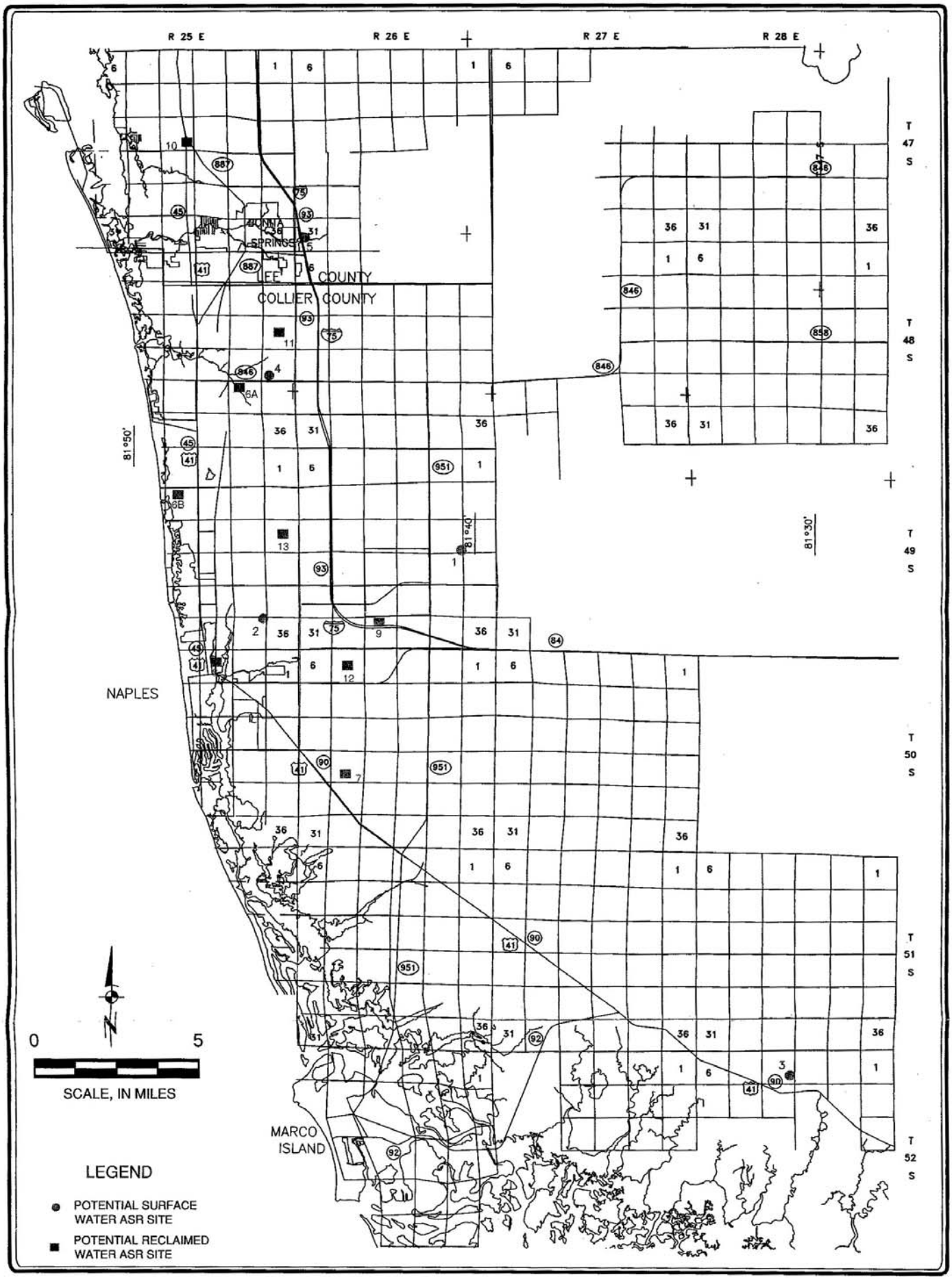
WRS NUMBER	(QTR QTR S-T-R)	LOCATION		SORT CODE	TOTAL DEPTH (ft)	CASED DEPTH (ft)	Hol/Pleist-Plnec. Ls Thickness	Bonita Springs Top	Ochopee Top	Peace River Top	Arcadia Top	Lower Hawthorn Top	Suwanee Top	Ocala Top	Avon Park Top	DATA SOURCE
		LAT.	LONG.													
CO-2617	NE SW 11-50S-26E	26°07'47"	81°40'48"	502611	750		NP	NP	Surf	160	290	610	NDE	NDE	NDE	BOG
CO-2622	SW SE 20-50S-26E	26°05'45"	81°43'30"	502620	3200	2640	20	20	30	130	270	620	870	1160	1560	WRS
CO-2623	SW SE 20-50S-26E	26°05'30"	81°43'45"	502620	1950	1820	NP	NP	Surf	90	290	620	870	1195	1535	WRS
CO-2905	SE NW 27-50S-26E	26°05'21"	81°41'51"	502627	12600	4512	NP	NP	Surf	115	265	565	775	1285	1630	BOG
CO-2616	NE SW 32-50S-26E	26°04'22"	81°43'41"	502632	1380		NP	Surf	30	140	290	680	880	1170	NDE	FGS
CO-2256	SE SW 34-50S-26E	26°04'02"	81°41'48"	502634	5895	4422	NP	NP	Surf	110	280	660	890	1340	1680	BOG
CO-2594	SW SE 34-50S-26E	26°04'03"	81°41'38"	502634	780	736	NP	NP	Surf	120	280	670	NDE	NDE	NDE	WRS
CO-2595	SW SE 34-50S-26E	26°04'02"	81°41'33"	502634	780	736	NP	NP	Surf	120	280	650	NDE	NDE	NDE	WRS
CO-706	NW NW 06-50S-28E	26°08'43"	81°32'50"	502806	1000	240	20	20	40	185	340	680	870	NDE	NDE	FGS
CO-2918	NW NE 23-50S-28E	26°05'55"	81°28'45"	502823	1370		NP	NP	Surf	210	420	675	880	1350	NDE	FGS
CO-2427	NW NE 03-51S-26E	26°03'53"	81°41'36"	512603	817	745	5	NP	5	163	293	665	NDE	NDE	NDE	WRS
CO-2428	NW NE 03-51S-26E	26°03'55"	81°41'37"	512603	790	745	5	NP	5	165	295	670	NDE	NDE	NDE	WRS
CO-2080	SE NE 10-51S-26E	26°02'48"	81°41'46"	512610	1608	360	15	NP	15	203	300	660	765	1105	1350	WRS
CO-2615	E/2 NE 24-51S-26E	26°00'55"	81°39'26"	512624	13803	3661	?	?	?	?	320	580	760	1306	1602	BOG
CO-2966	NE SE 32-51S-26E	25°58'57"	81°42'52"	512632	778		?	?	?	?	360	630 ?	NDE	NDE	NDE	FGS
CO-1545	NW SW 33-51S-26E	25°58'57"	81°42'52"	512633	800		40	40	60	200	350	650	NDE	NDE	NDE	FGS
CO-2962	SE NW 34-51S-27E	25°59'10"	81°35'55"	512734	874		5 ?	NP ?	5 ?	85 ?	335 ?	610 ?	NDE	NDE	NDE	FGS
CO-703	SW NW 36-51S-27E	25°59'07"	81°34'08"	512736	880	360	10	NP	10	80	330	615	780	NDE	NDE	SFWMD
CO-1769	NW NE 08-52S-26E	25°57'33"	81°43'24"	522608	800	390	20	20	40	156	330	685	NDE	NDE	NDE	WRS
CO-2271	NW NE 08-52S-26E	25°57'33"	81°43'26"	522608	3354		30	NP	30	180	340	710	855	1210	1610	WRS
CO-2272	NW NE 08-52S-26E	25°57'33"	81°43'26"	522608	1970		40	NP	40	120	NL	690	?	?	?	WRS
CO-2433	SE SW 10-52S-26E	25°56'15"	81°41'05"	522610	900	352	48	NP	48	122	338	600	838	NDE	NDE	WRS
CO-2540	NW NE 15-52S-26E	25°56'08"	81°40'54"	522615	500	341	40	40	50	170	331	NDE	NDE	NDE	NDE	WRS
CO-2109	SW NW 16-52S-26E	25°56'11"	81°42'47"	522616	546	415	42	NP	42	178	373	NDE	NDE	NDE	NDE	WRS
CO-2112	NW SW 16-52S-26E	25°55'28"	81°42'38"	522616	547	392	40	40	50	190	345	NDE	NDE	NDE	NDE	WRS
CO-2305	NE NW 16-52S-26E	25°56'25"	81°42'42"	522616	810	405	41	NP	41	173	330	710	NDE	NDE	NDE	WRS
CO-2429	SW NE 16-52S-26E	25°55'48"	81°42'01"	522616	760	350	49	NP	49	157	340	618	NDE	NDE	NDE	WRS
CO-2977	NW NW 16-52S-26E	25°56'25"	81°42'42"	522616	810		?	?	?	?	340 ?	620 ?	NDE	NDE	NDE	FGS
CO-2108	NE SE 17-52S-26E	25°55'34"	81°42'50"	522617	565	380	42	42	48	170	330	NDE	NDE	NDE	NDE	WRS
CO-2307	NW SW 17-52S-26E	25°55'37"	81°43'39"	522617	545	410	40	40	50	160	345	NDE	NDE	NDE	NDE	WRS
CO-2978	NW SW 19-52S-26E	25°54'30"	81°43'43"	522619	413		NP	NP	Surf	150 ?	348	NDE	NDE	NDE	NDE	FGS
CO-2407	SE NW 12-52S-27E	25°57'18"	81°33'45"	522712	8670	12840	NL	NL	NL	NL	NL	645	820	1020	NL	BOG
CO-702	NE SW 13-52S-28E	25°56'23"	81°28'08"	522813	1220		10	NP	10	103	372	645	830	NDE	NDE	SFWMD

TABLE 7 - SUMMARY OF INVENTORIED WELLS. COLLIER COUNTY / BONITA SPRINGS SUBREGION

WRS NUMBER	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft)	CASED DEPTH (ft)	DIS. CHLOR. (mg/l)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
LM-7604					LH-1	NE SW 02-47S-25E	472502	775	375			PERMIT # 36-03331	MH/LH	IRR		SFWMD
LM-786			WA-143	L-1569		SW SW 04-47S-25E	472504	809	294	777	3,900	P&A 9/23/81				SFWMD
LM-7627					ML-5052	NW SE 08-47S-25E	472508	640	340			Permit # 36-03745	MH/LH	IRR	WCI Communities LP	SFWMD
LM-6958						NE NE 14-47S-25E	472514	721	659			PERMIT # 36-00008	LH	ASR	BSU SAN CARLOS ASR	FDEP
LM-3049						NW SW 16-47S-25E	472516	660	336	1,500		PERMIT # 36-00433	MH/LH	IRR	PELICAN LANDING	WRS
LM-1980						SE SE 17-47S-25E	472517	1306				P&A		IRR	PELICAN LANDING	WRS
LM-1980A						SE SE 17-47S-25E	472517	660	350	960		PERMIT # 36-00433	MH/LH	IRR	PELICAN LANDING	WRS
LM-2041						SE SE 17-47S-25E	472517	620	360	960			MH/LH	MONITOR	PELICAN LANDING	WRS
LM-470				L-2310		SW NE 35-47S-25E	472535	535	396	1,860	6,600		MH	IRR		USGS
LM-7173		W-9324		L-6413		SW NW 13-47S-26E	472613	1460						TEST		FGS
LM-635			W-11	L-605		NE NE 19-47S-26E	472619	585						TEST		USGS
LM-650				L-645		SE SE 29-47S-26E	472629	1420						TEST		USGS
LM-643				L-991		SE SW 36-47S-26E	472636	533						TEST		USGS
LM-7179		W-16942	LE-18		W-33	NW SE 36-47S-26E	472636	520						TEST		FGS
CO-2695	P-1030	W-14891				NE NE 01-47S-27E	472701	11858	3820			BHL SW NE; P&A 4/9/81		PET TW	NRM'81 #1-1 Audubon Society	BOG
CO-2704	P-1208	W-16122				E/2 NW 04-47S-28E	472804	11850	4190			P&A 2/1/88		PET TW	SABINE'88 #4-2 Collier Co.	BOG
CO-2705	P-401	W-8748	CR-73	C-742		NW SE 09-47S-28E	472809	11987	11987			Producing Oil Well		PET TW	MOBIL'69 #1 Barron Collier, Jr.	BOG
CO-2706	P-849	W-13487				SE NW 09-47S-28E	472809	11901	3773			P&A 11/5/76		PET TW	KANABA'76 #9-2 Barron Collier	BOG
CO-2708	P-477	W-10985		C-764	LR-85	NE NE 16-47S-28E	472816	12050	12050			P&A 11/13/71		PET TW	EXCHANGE'71 #1 E. Ball et al	BOG
CO-2255	P-103	W-2103		C-708		SW SW 19-47S-28E	472819	12210	4249			P&A 7/27/49		PET TW	HORC'49 #1-E Gulf Coast Realty	BOG
CO-2710	P-1275	W-16883				NE 21-47S-28E	472821	15234	11750			P&A 12/31/92		PET TW	MAERSK ENERGY'92 #1 Collier Resources	BOG
CO-2711	P-86	W-1883		C-710		NE SW 21-47S-28E	472821	12120	11906			P&A 10/23/48		PET TW	HORC'48 #1-C Gulf Coast Realty	BOG
CO-2712		W-15531	C-2040			SE SW 24-47S-28E	472824	520								FGS, SFWMD
CO-2715				C-983		SE SW 24-47S-28E	472824	520	480	770	4,070		MH			USGS
CO-2834					MC-5094	SW SE 21-48S-25E	482521	587	478				MH/LH	P.S	Old Collier Golf Course TP Well	MI
CO-3698					IW-1	SE 27-48S-25E	482527	3250					UF	INJ	NCWRF IW-1	WRS
LM-640				L-600		NW NW 05-48S-26E	482605	525						TEST		USGS
CO-2317		W-16884		C-1107		SW SE 35-48S-26E	482635	3370	2492			IW	UF	INJ	COLLIER COUNTY North County WTP	WRS
CO-2318				C-1108		SW SE 35-48S-26E	482635	1930		2,100	7,100	SUW (900 - 995')	UF	MONITOR	COLLIER COUNTY North County WTP	WRS
										2,140	6,490	SUW (1,010 - 1,050')				
										8,900	20,900	OCA (1,300 - 1,331')				
										20,800	39,000	AP (1,815 - 1,930')				
CO-3689					RO-1	SW SE 35-48S-26E	482635	801	705	2,260		RO-1	LH	P.S	COLLIER COUNTY North County WTP	MI
CO-3690					RO-2	SE SE 35-48S-26E	482635	784	730	2,600		RO-2	LH	P.S	COLLIER COUNTY North County WTP	MI
CO-3691					RO-3	SW SE 35-48S-26E	482635	800	720			RO-3	LH	P.S	COLLIER COUNTY North County WTP	MI
CO-2752					RO-7	SE SE 36-48S-26E	482636	977	775	2,440		RO-7		P.S	COLLIER COUNTY North County WTP	MI
CO-2753					RO-4	SW SW 36-48S-26E	482636	891	744	2,820		RO-4	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-3692					RO-5	SW SE 36-48S-26E	482636	1070	790	2,220		RO-5	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-3693					RO-6	E/2 SE 36-48S-26E	482636	975	740	3,200		RO-6	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-608				C-236		NW SE 13-48S-27E	482713	875		785				IRR		USGS
CO-2760					RO-11	SE SE 31-48S-27E	482731	951	735	2,940		RO-11	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-2761					RO-9	SE SW 31-48S-27E	482731	952	780	3,100		RO-9	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-3694					RO-8	SW SW 31-48S-27E	482731	800	700	2,840		P&A			COLLIER COUNTY North County WTP	MI
CO-3695					RO-10	SW SE 31-48S-27E	482731	1011	750	3,080		RO-10	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-2762					RO-15	SE SE 32-48S-27E	482732	900	725			RO-15	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-2763					RO-12	SW SW 32-48S-27E	482732	906	725			RO-12	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-3696					RO-13	SE SW 32-48S-27E	482732	1254				RO-13	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-3697					RO-14	SW SE 32-48S-27E	482732	950				RO-14	LH/SU	P.S	COLLIER COUNTY North County WTP	MI
CO-2764					MC-5004	SE SE 34-48S-27E	482734	800	682						COLLIER COUNTY North County	MI
CO-2263	P-98	W-1885		C-234		NW NW 03-48S-28E	482803	11900	4265			P&A 3/16/49		PET TW	HORC'49 #D-1 Gulf Coast Realties	FGS
CO-2765					MC-5001	NW SW 09-48S-28E	482809	927	294						COLLIER COUNTY North County	MI
CO-3121		W-8975				SE NW 09-48S-28E	482809	1370				Collier Company		CORE	Humble Oil & Ref Comp Core Test #84	BOG
CO-2766	P-282	W-5229				C SE 13-48S-28E	482813	12075	4404			P&A 1/13/60		PET TW	HORC'60 #B-2 Gulf Coast Realty	BOG
CO-2769	P-365	W-7661				SE SE 16-48S-28E	482816	13345	3802			P&A 5/18/66		PET TW	GULF AMERICAN'66 #1 East Gate Land	BOG
CO-3122		W-8968				SW 16-48S-28E	482816	1020				Collier Company		CORE	Humble Oil & Ref Comp Core Test #77	BOG
CO-451				C-683		SW SW 17-48S-28E	482817	460		60	770			TEST		USGS
CO-2265	P-64	W-1820		C-712		NE NW 23-48S-28E	482823	12206	5110			P&A 5/7/48		PET TW	HORC'48 #B-1 Gulf Coast Realty	BOG
CO-2274			CR-78			NW NW 23-48S-28E	482823	4120								FGS
CO-2775	P-368	W-8185				SE NE 28-48S-28E	482828	13300	3810			P&A 4/28/66		PET TW	GULF AMERICAN'66 #1 Golden Gate	BOG
CO-3123		W-8979	F-88B			NW NW 33-48S-28E	482833	1419				Collier Company		CORE	Humble Oil & Ref Comp Core Test #88	BOG
CO-1625				C-575		SE NE 09-49S-25E	492509	652							PELICAN BAY	Geraghty & Miller
CO-87						SE NE 09-49S-25E	492509	640						TEST	PELICAN BAY'77	Gee & Jenson
CO-2833	P-974	W-14308				SW SE 19-49S-26E	492619	12016	3800			P&A 7/31/79		PET TW	HUGHES& HUGHES'79 #19-4 Collier Co.	BOG
CO-2835					MC-5066	SW SW 23-49S-26E	492623	810	640				LH	MONITOR	COLLIER COUNTY'00	MI

ATTACHMENT F

Potential Surface and Reclaimed Water ASR Sites

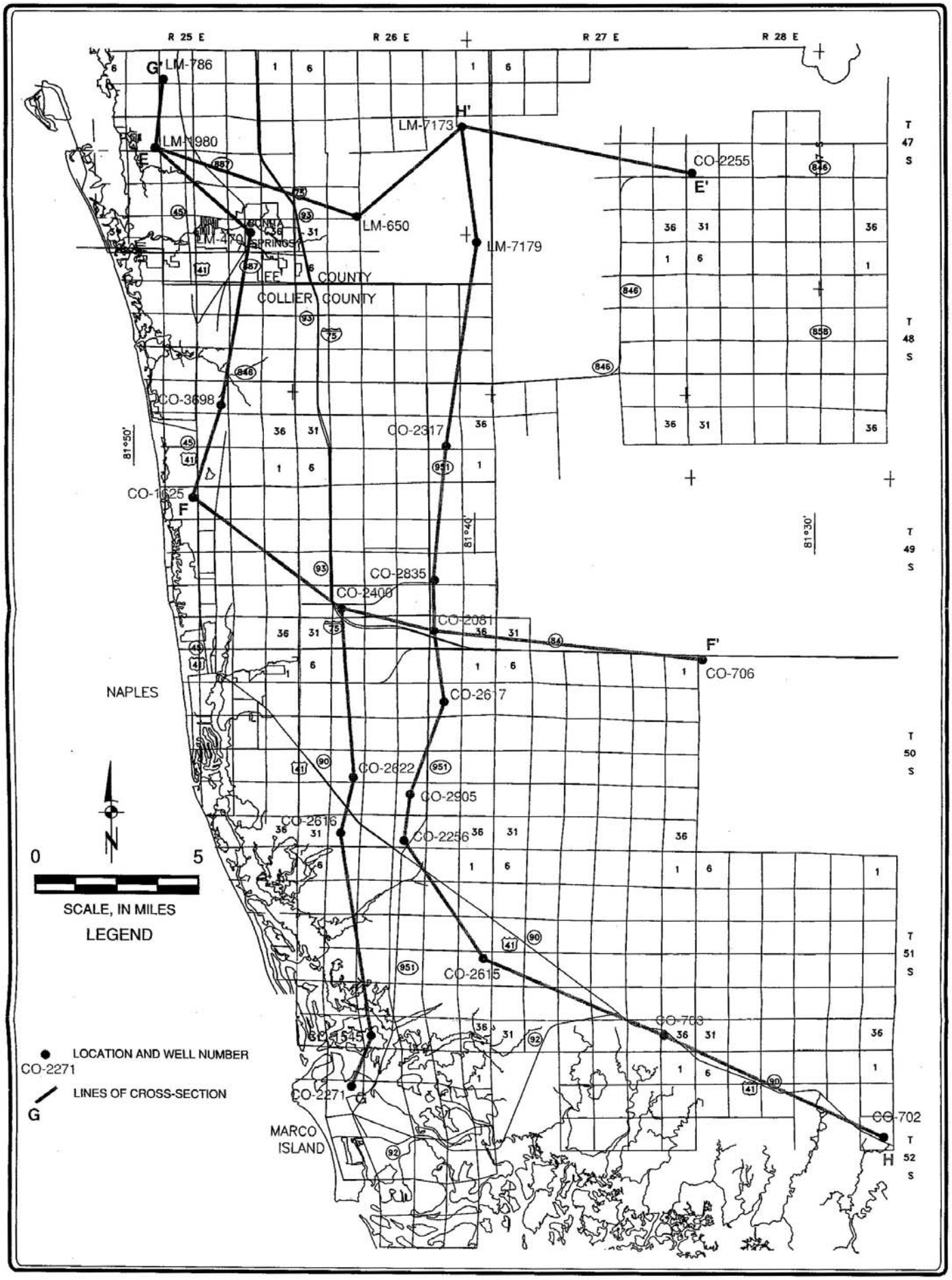


Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 06/04/2003

FIGURE 3- MAP SHOWING POTENTIAL SURFACE AND RECLAIMED WATER ASR SITES

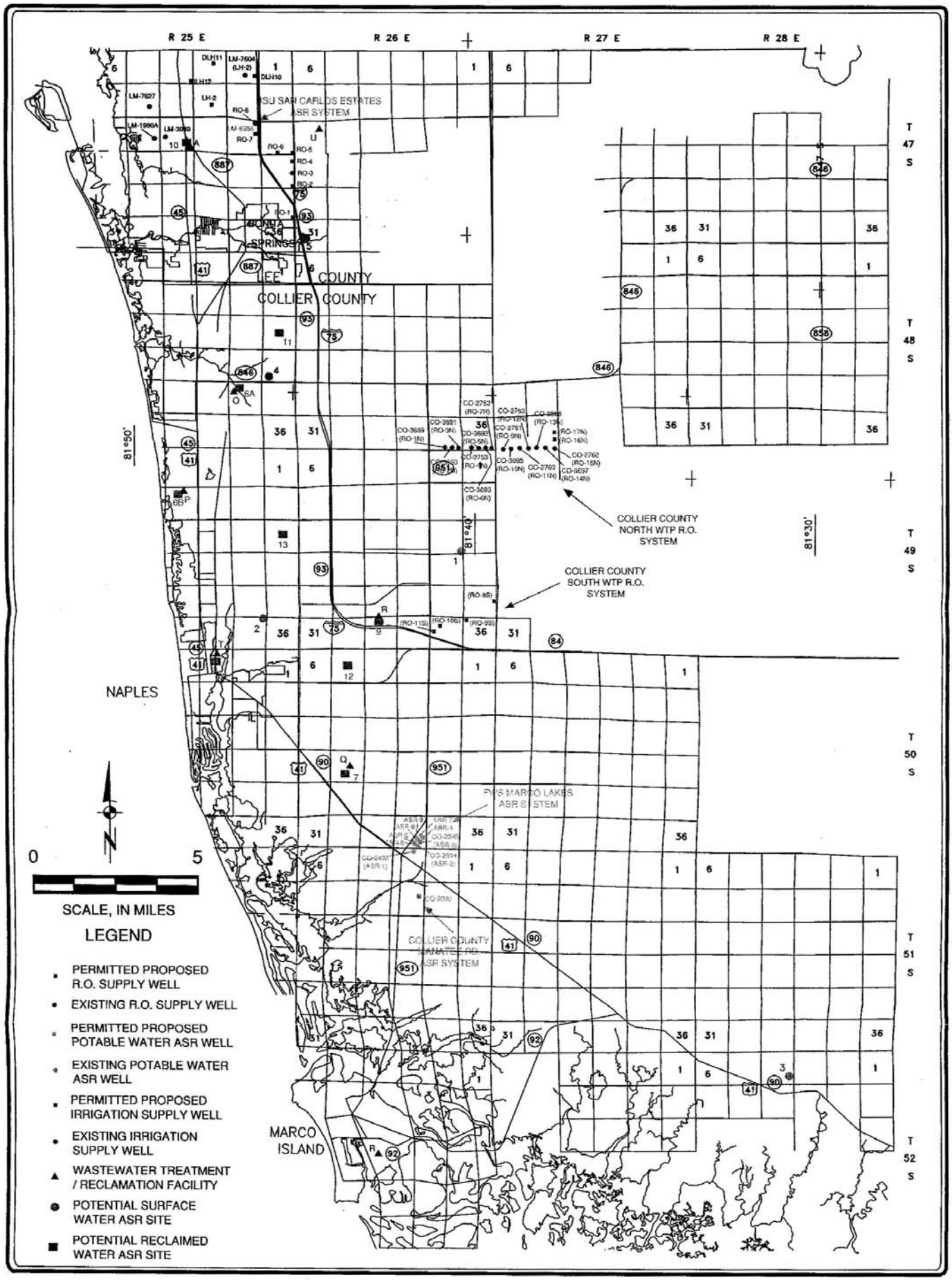
ATTACHMENT G

Cross Section



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 06/04/2003

FIGURE 4- MAP SHOWING LINES OF CROSS SECTION



Water Resource Solutions	PROJECT NAME: RIDS PHASE II
	PROJECT NUMBER: 01-04445.HO DATE: 06/04/2003

FIGURE 10- MAP SHOWING EXISTING AND PERMITTED PROPOSED UPPER FLORIDAN AQUIFER WELLS, WASTEWATER TREATMENT / RECLAMATION FACILITIES, AND POTENTIAL SURFACE AND RECLAIMED WATER ASR SITES.

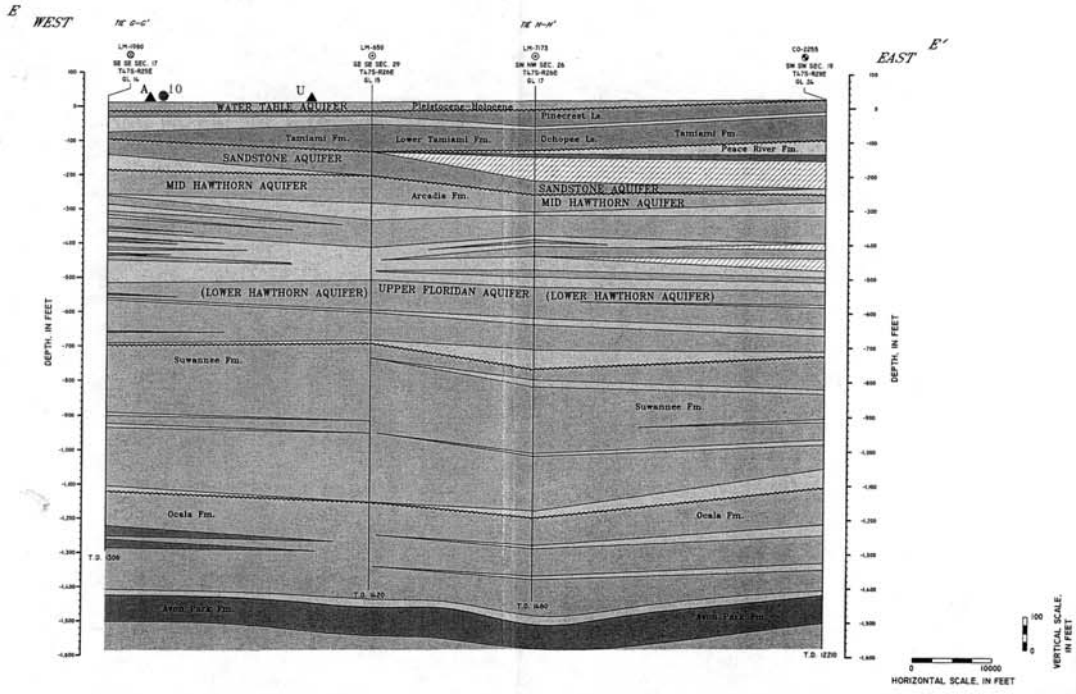


FIGURE 5
CROSS-SECTION E-E'
RIDS-PHASE II PROJECT

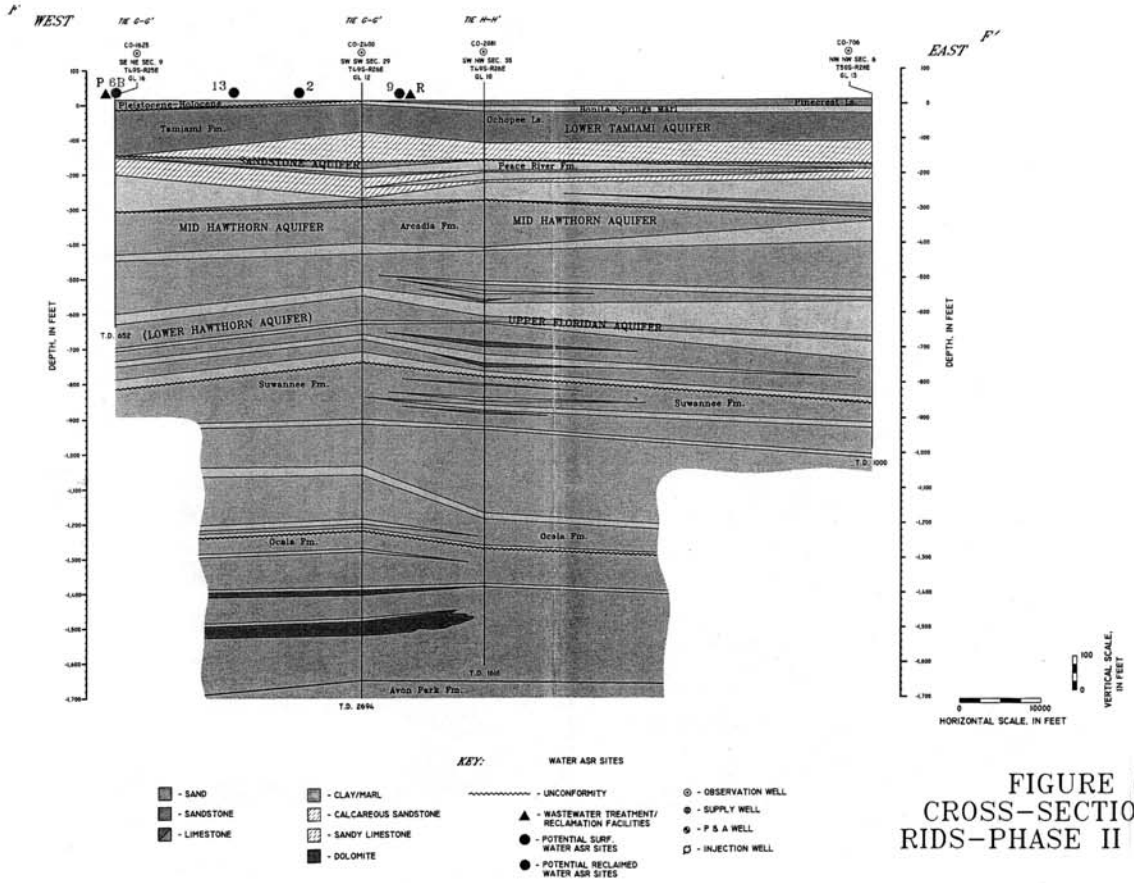
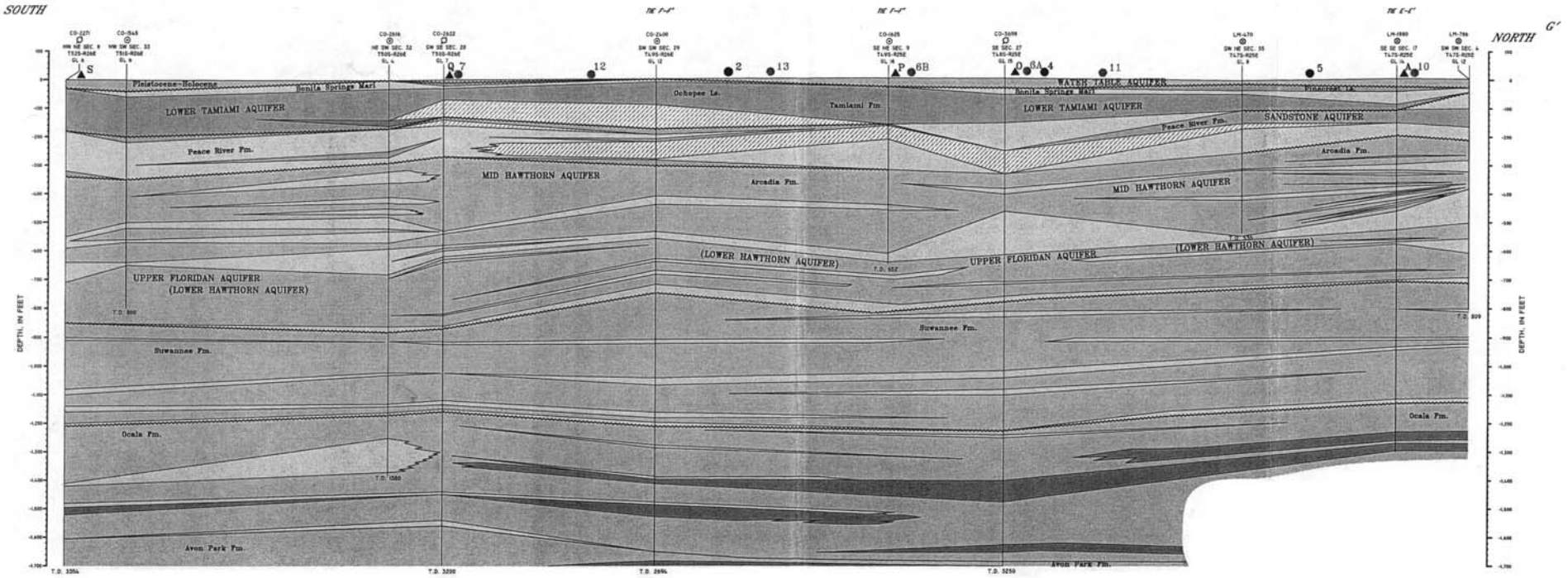


FIGURE 6
CROSS-SECTION F-F'
RIDS-PHASE II PROJECT



KEY:

- SAND
- SANDSTONE
- LIMESTONE
- CLAY/MARL
- CALCAREOUS SANDSTONE
- SANDY LIMESTONE
- DOLOMITE
- UNCONFORMITY
- WASTEWATER TREATMENT/ RECLAMATION FACILITIES
- POTENTIAL SURF. WATER ASR SITES
- POTENTIAL RECLAIMED WATER ASR SITES
- OBSERVATION WELL
- SUPPLY WELL
- P & A WELL
- INJECTION WELL

FIGURE 7
CROSS-SECTION G-G'
RIDS-PHASE II PROJECT

HORIZONTAL SCALE, IN FEET
0 10000
VERTICAL SCALE, IN FEET
0 100

Water Resource Solutions
07/02/03

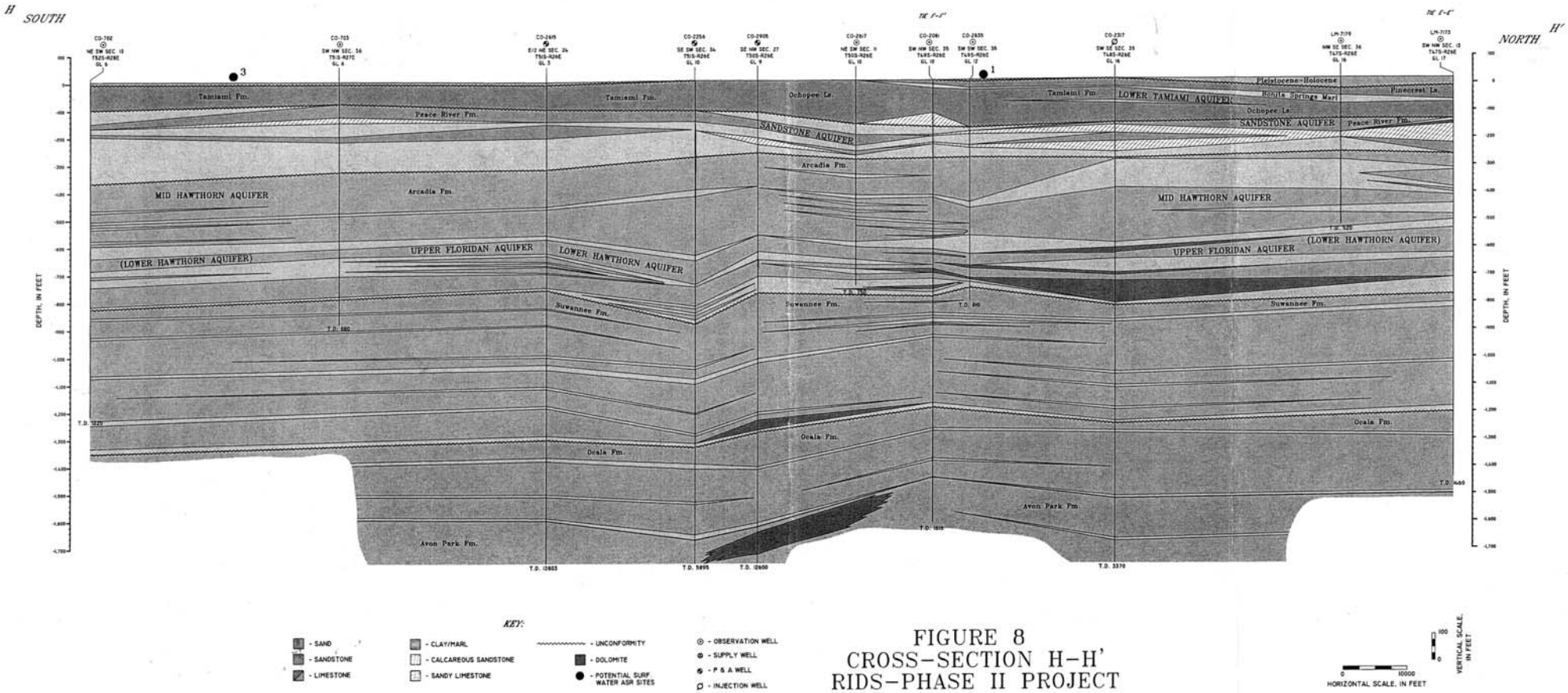


FIGURE 8
CROSS-SECTION H-H'
RIDS-PHASE II PROJECT

ATTACHMENT H

Cost Analysis

RDS
SUBREGION 1
PROPOSED PROJECTS

Itemized Capital Costs ($M)												
Name of Project	Type	Number of Wells	Wells	Pumping Station	Intake System Const. Cost	Land Acquisition Cost	Pipelines	Engineering, Administration and Legal	Estimated Pilot Project Cost	Total	Annual Operations and Maintenance	Estimated Benefit (MGD)
1A. Golden Gate Canal - 17th Ave.- Intake & Pump Station	Surface Water ASR			$ 2,300,000	$2,500,000			$960,000		$7,200,000		
1B. Golden Gate Canal - 17th Ave.- Well and Pipeline		28	$15,400,000			$1,400,000		$3,080,000	1,850,000	$27,170,000		
1C. Golden Gate Canal - 17th Ave.- Transmission Lines							$3,620,544	$724,109		$5,440,000		
										$39,810,000	$840,000	20.0
2A. Golden Gate Canal - Airport Rd.- Intake & Pump Station	Surface Water ASR			$ 3,000,000	$3,000,000			$1,200,000		$9,000,000		
2B. Golden Gate Canal - Airport Rd.-Well and Pipeline		35	$19,250,000			$1,750,000	$683,000	$3,986,600	1,850,000	$34,400,000		
										$43,400,000	$1,050,000	25.0
3A. Faka Union Slough-Intake & Pump	Surface Water ASR			$ 3,000,000	$3,000,000			$1,200,000		$9,000,000		
3B. Faka Union Slough-Well Pipline		35	$19,250,000			$1,750,000		$3,850,000	1,850,000	$33,380,000		
3C. Faka Union Slough-Transmission Line							$15,085,680	$3,017,136		$22,630,000		
										$65,010,000	$1,050,000	25.0
4A. Cocohatchee River- Intake & Pump Station	Surface Water ASR			$ 900,000	$1,000,000			$380,000		$2,850,000		
4B. Cocohatchee River- Well & Pipeline		8	$4,400,000			$400,000	$156,000	$911,200	1,850,000	$9,650,000		
										$12,500,000	$210,000	5.0
5A. Kehl Canal-Intake & Pump Station	Surface Water ASR			$ 1,700,000	$1,700,000			$680,000		$5,100,000		
5B. Kehl Canal-Well & Pipeline		17	$9,350,000			$850,000	$332,000	$1,936,400	1,850,000	$17,900,000		
										$23,000,000	$504,000	12.0
6A. N. Collier/BSU Interconnect- Pump Station	Reclaimed Water ASR			$ 1,600,000	NA	NA		$320,000		$2,400,000		
6B. N. Collier/BSU Interconnect-Well & Pipeline		19	$10,450,000					$2,090,000	1,400,000	$17,430,000		
6C. N. Collier/BSU Interconnect-Transmission Line							$2,011,392	$402,278		$3,020,000		
										$22,850,000	$441,000	10.5
7A. S. Collier/Naples Interconnect- Pump Station	Reclaimed Water ASR			$ 1,700,000	NA	NA		$340,000		$2,550,000		
7B. S. Collier/Napies Interconnect-Well & Pipeline		24	$13,200,000				$468,000	$2,733,600	1,400,000	$22,260,000		
										$24,810,000	$504,000	12.0
8A. Pelican Bay / 8B. Collier County North-Pump Station	Reclaimed Water ASR			$ 1,350,000	NA	NA		$270,000		$2,030,000		
8A. Pelican Bay / 8B. Collier County North-Well & Pipeline		12	$6,600,000				$234,000	$1,366,800	1,400,000	$12,010,000		
										$14,040,000	$340,200	8.1
9A. Collier County South- Pump Station	Reclaimed Water ASR			$ 1,000,000	NA	NA		$200,000		$1,500,000		
9B. Collier County South-Well & Pipeline		10	$5,500,000				$195,000	$1,139,000	1,400,000	$10,300,000		
										$11,800,000	$277,200	6.6
10A. Naples- Pump Station	Reclaimed Water ASR			$ 900,000	NA	NA		$180,000		$1,350,000		
10B. Naples-Well & Pipeline		9	$4,950,000				$176,000	$1,025,200	1,400,000	$9,440,000		
										$10,790,000	$226,800	5.4
11A. Golden Gate- Pump Station	Reclaimed Water ASR			$ 200,000	NA	NA		$40,000		$300,000		
11B. Golden Gate-Well & Pipeline		2	$1,100,000				$39,000	$227,800	1,400,000	$3,460,000		
										$3,760,000	$21,000	0.5
12A. Bonita Springs Utilities- Pump Station	Reclaimed Water ASR			$ 400,000	NA	NA		$80,000		$600,000		
12B. Bonita Springs Utilities-Well & Pipeline		5	$2,750,000				$98,000	$569,600	1,400,000	$6,030,000		
										$6,630,000	$100,800	2.4
13A. Coll Cnty N./Coll. Cnty S. Intr.- Pump Station	Reclaimed Water ASR			$ 1,900,000	NA	NA		$380,000		$2,850,000		
13B. Coll Cnty N./Coll. Cnty S. Intr.- Well & Pipeline		21	$11,550,000				$410,000	$2,392,000	1,400,000	$19,690,000		
										$22,540,000	$617,400	14.7
14A. Golden Gate Mine Pits - Intake & Pump Station	Surface Water			$ 150,000	$1,000,000	$250,000		$230,000	-	$2,040,000		
14B. Golden Gate Mine Pits - Transmission Line							$3,600,000	$720,000		$5,400,000		
										$7,440,000	$63,000	1.5
TOTALS		225	$123,750,000	$ 20,100,000	$12,200,000	$6,400,000	$27,108,616	$36,631,723	$20,450,000	$308,380,000	$6,245,400	111.5

The benefit for project 6, 7 and 13 are redundant from other ASR projects; therefore, they are not included in the total benefit.
Wells: $550,000 per well except for the pit wells that are shallow wells and are $150,000.
Pump Station Cost: Derived from Construc. Cost of Service Water P.S. figure 29-6 from the Pumping Station Handbook.
Intake cost: For the first 5 MGD the cost is $1M. For additional cost greater than 5 MGD the cost is $ 100k per MGD.
Land Cost $50,000/well. 500 ft well separation minimum
Pipes: $4/diameter.lf
Engineering = 20% of capital cost. Doesn't include the land cost.
Total has a contingency of 25%
O & M for Surface ASR= 0.14cents/1000 gals X10 months X 30 days/month
O & M Reclaimed ASR or Mine Pits = $1,5000* # wells +$8,000 * Estimated benefit (MGD)

RIDS
SUBREGION 1
PROPOSED PROJECTS

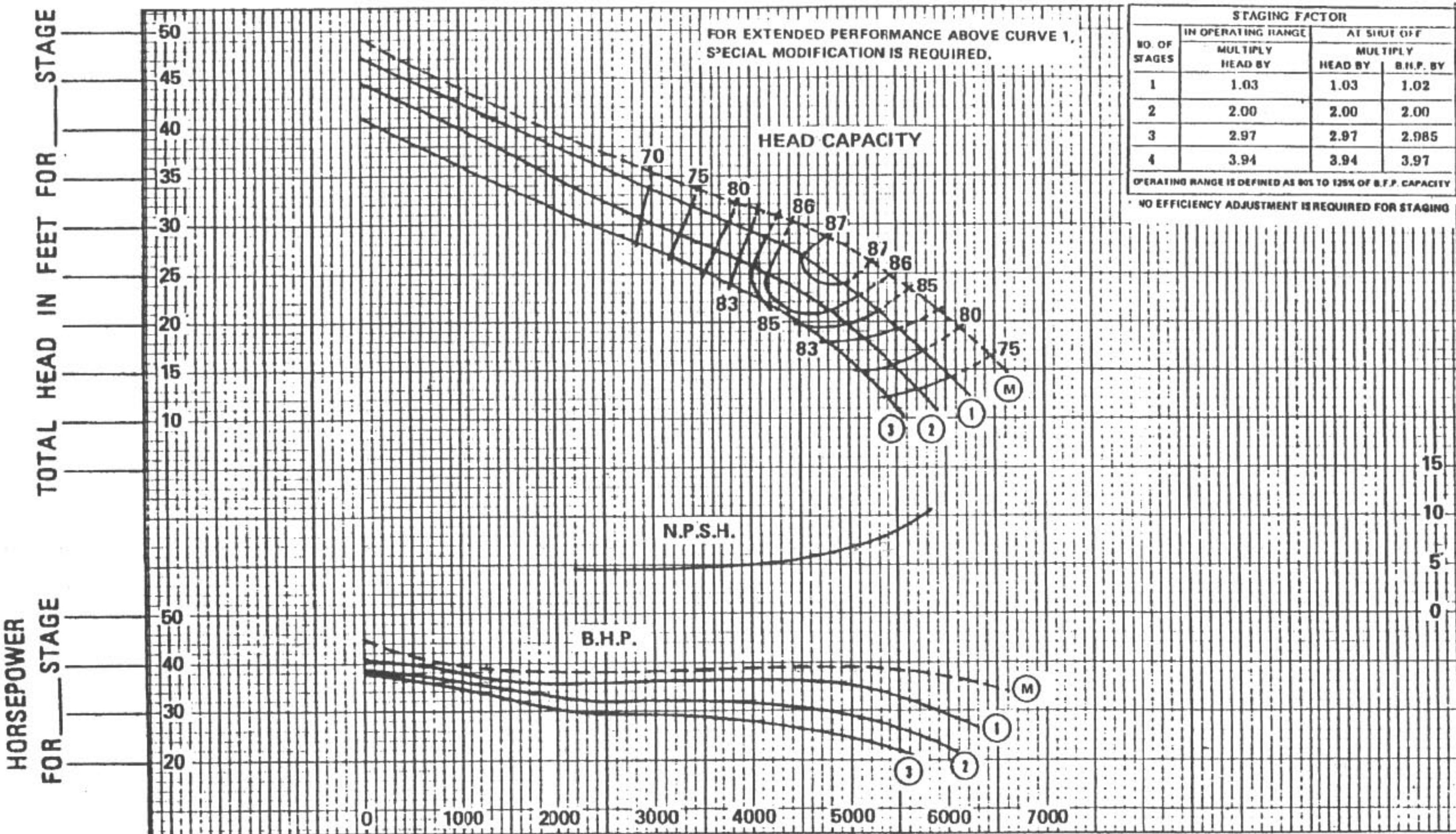
Name of Project	Amount Funded by SRF	3.00% Loan Repayment Reserve	2.00% Loan Service Fee	0.00% Surety Costs (%)	$ - Underwriters Discount	25% Fiscal Year 1	75% FY 2	100% FY 3	Principal Amount of Loan	Annual Debt Service	Debt Service Coverage(1)	Annual O & M Costs (2)	Total Annual Costs	Daily Benefit (1000 gal /day)	Average Days Per Year	Annual Benefit (1000 gal)	Cost per 1000 gallons
1C. Golden Gate Canal - 17th Ave.-Transs	**$39,810,000**	$1,194,300	$796,200	$0.00	$ -	$174,000	$697,000	$1,219,000	$43,890,500	$3,088,200	$772,050	**$840,000**	$4,700,250	20,000	180	3,600,000	$1.31
2B. Golden Gate Canal - Airport Rd.-Well	**$43,400,000**	$1,302,000	$868,000	$0.00	$ -	$190,000	$760,000	$1,329,000	$47,849,000	$3,366,700	$841,675	**$1,050,000**	$5,258,375	25,000	180	4,500,000	$1.17
3C. Faka Union Slough-Transmission Line	**$65,010,000**	$1,950,300	$1,300,200	$0.00	$ -	$284,000	$1,138,000	$1,991,000	$71,673,500	$5,043,000	$1,260,750	**$1,050,000**	$7,353,750	25,000	180	4,500,000	$1.63
4B. Cocohatchee River- Well & Pipeline	**$12,500,000**	$375,000	$250,000	$0.00	$ -	$55,000	$219,000	$383,000	$13,782,000	$969,700	$242,425	**$210,000**	$1,422,125	5,000	180	900,000	$1.58
5B. Kehl Canal-Well & Pipeline	**$23,000,000**	$690,000	$460,000	$0.00	$ -	$101,000	$403,000	$704,000	$25,358,000	$1,784,200	$446,050	**$504,000**	$2,734,250	12,000	180	2,160,000	$1.27
6C. N. Collier/BSU Interconnect-Transmis	**$22,850,000**	$685,500	$457,000	$0.00	$ -	$100,000	$400,000	$700,000	$25,192,500	$1,772,600	$443,150	**$441,000**	$2,656,750	10,500	180	1,890,000	$1.41
7B. S. Collier/Naples Interconnect-Well &	**$24,810,000**	$744,300	$496,200	$0.00	$ -	$109,000	$434,000	$760,000	$27,353,500	$1,924,600	$481,150	**$504,000**	$2,909,750	12,000	180	2,160,000	$1.35
Pelican Bay / 8B. Collier County North	**$14,040,000**	$421,200	$280,800	$0.00	$ -	$61,000	$246,000	$430,000	$15,479,000	$1,089,100	$272,275	**$340,200**	$1,701,575	8,100	180	1,458,000	$1.17
9B. Collier County South-Well & Pipeline	**$11,800,000**	$354,000	$236,000	$0.00	$ -	$52,000	$207,000	$361,000	$13,010,000	$915,400	$228,850	**$277,200**	$1,421,450	6,600	180	1,188,000	$1.20
10B. Naples-Well & Pipeline	**$10,790,000**	$323,700	$215,800	$0.00	$ -	$47,000	$189,000	$330,000	$11,895,500	$837,000	$209,250	**$226,800**	$1,273,050	5,400	180	972,000	$1.31
11B. Golden Gate-Well & Pipeline	**$3,760,000**	$112,800	$75,200	$0.00	$ -	$16,000	$66,000	$115,000	$4,145,000	$291,600	$72,900	**$21,000**	$385,500	500	180	90,000	$4.28
12B. Bonita Springs Utilities-Well & Pipelir	**$6,630,000**	$198,900	$132,600	$0.00	$ -	$29,000	$116,000	$203,000	$7,309,500	$514,300	$128,575	**$100,800**	$743,675	2,400	180	432,000	$1.72
13B. Coll Cnty N./Coll. Cnty S. Intr.- Well &	**$22,540,000**	$676,200	$450,800	$0.00	$ -	$99,000	$394,000	$690,000	$24,850,000	$1,748,500	$437,125	**$617,400**	$2,803,025	14,700	180	2,646,000	$1.06
14B. Golden Gate Mine Pits - Transmissio	**$7,440,000**	$223,200	$148,800	$0.00	$ -	$33,000	$130,000	$228,000	$8,203,000	$577,200	$144,300	**$63,000**	$784,500	1,500	180	270,000	$2.91
0	**$308,380,000**	$9,251,400	$6,167,600	$0.00	$ -	$1,349,000	$5,397,000	$9,444,000	$339,989,000	$23,922,000	$5,980,500	**$6,245,400**	$36,147,900	111,500	180	20,070,000	$1.80
TOTALS		Duration of Loan		20	yrs												
0		SRF Interest Rate		3.50%													

ATTACHMENT I

Horizontal Well Pump – Sample Curves

VERTICAL TURBINE PUMPS
Model 20HH - 885 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026



NO. OF STAGES	STAGING FACTOR: IN OPERATING RANGE — MULTIPLY HEAD BY	AT SHUT OFF — MULTIPLY HEAD BY	AT SHUT OFF — MULTIPLY B.H.P. BY
1	1.03	1.03	1.02
2	2.00	2.00	2.00
3	2.97	2.97	2.985
4	3.94	3.94	3.97

OPERATING RANGE IS DEFINED AS 80% TO 125% OF B.E.P. CAPACITY

* NO EFFICIENCY ADJUSTMENT IS REQUIRED FOR STAGING

HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on:	1	4600653	11-5/16" x 14-3/4"	57403
	2	4600653	10-5/16" x 14-5/16"	57652
Proper flow to pump suction Proper submergence Fluid free of gas, air & abrasives	3	4600653	9-5/8" x 14-3/32"	57803
Proper lateral setting of impeller	M	4600653	FULL DIAMETER EXTENDED PERFORMANCE	57426

Customer ____________________

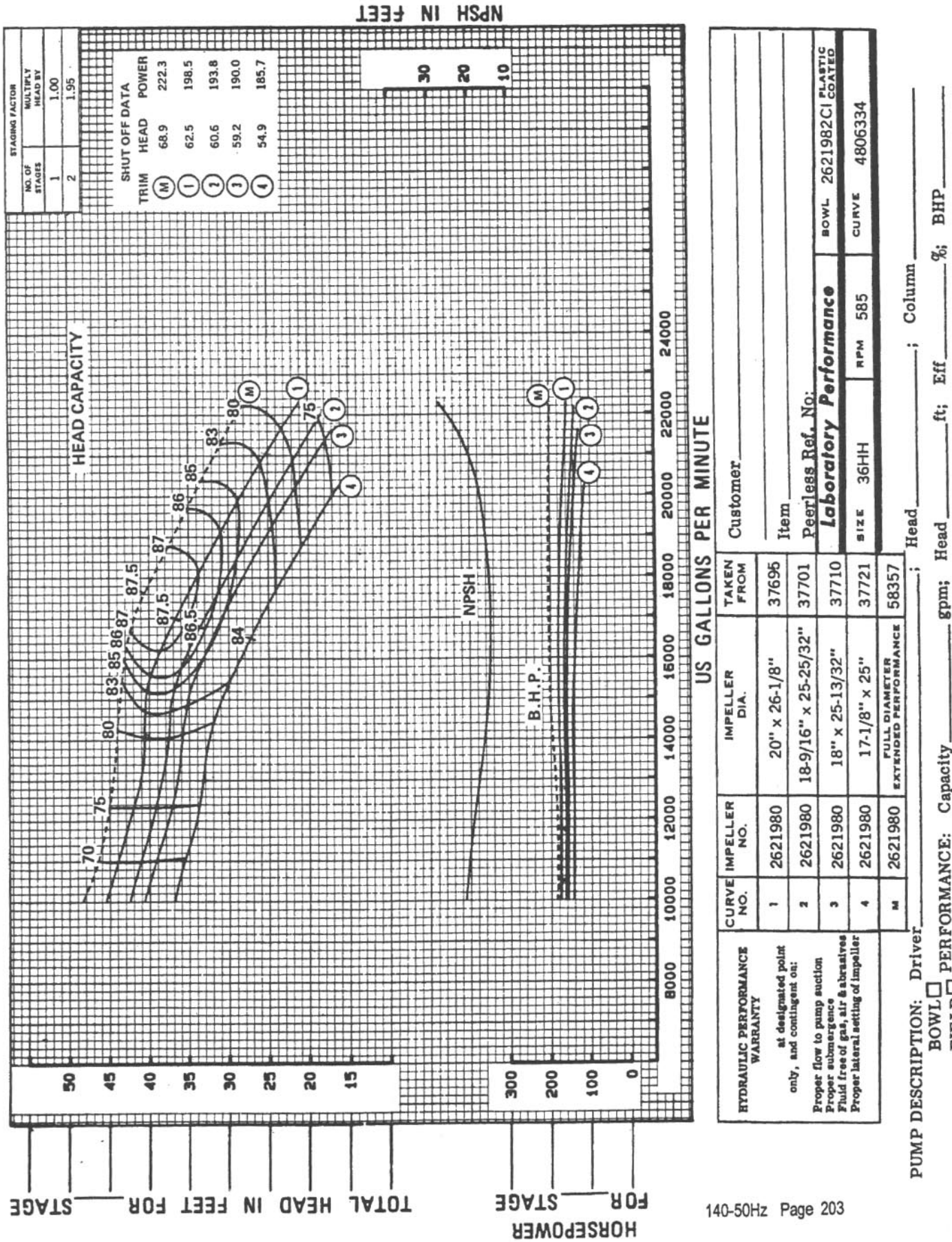
Item ____________________

Peerless Ref. No:

Laboratory Performance		BOWL 4600117 C.I. PLASTIC COATED
SIZE 20HH	RPM 885	CURVE 4806221

PUMP DESCRIPTION: Driver ____________________; Head ____________________; Column ____________________

GUARANTEED BOWL☐ FIELD☐ PERFORMANCE: Capacity __________ gpm; Head __________ ft; Eff __________ %; BHP __________



HYDRAULIC PERFORMANCE WARRANTY at designated point only, and contingent on:	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Proper flow to pump suction Proper submergence Fluid free of gas, air & abrasives Proper lateral setting of impeller	1	2621980	20" x 26-1/8"	37695
	2	2621980	18-9/16" x 25-25/32"	37701
	3	2621980	18" x 25-13/32"	37710
	4	2621980	17-1/8" x 25"	37721
	M	2621980	FULL DIAMETER EXTENDED PERFORMANCE	58357

Customer_____

Item_____

Peerless Ref. No:

Laboratory Performance

SIZE 36HH RPM 585 CURVE 4806334 BOWL 2621982CI PLASTIC COATED

PUMP DESCRIPTION: Driver_____; Head_____; Column_____

BOWL☐ PERFORMANCE: Capacity_____ gpm; Head_____ ft; Eff_____ %; BHP_____

FIELD☐

ATTACHMENT J

Injection Well Station – Sample Curves

Horsepower for _____ Stages

Total Head in Feet for _____ Stages

Total Head in Feet per Stage

Horsepower per Stage

U.S. GALLONS PER MINUTE

CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
LOWER	1	1

NOTE: ANY CHANGE IN EFFICIENCY AFFECTS EITHER THE HEAD OR HORSE POWER CORRESPONDINGLY

Staging Factor

No. of Stages	Multiply Head By:
1	1.0
2	1.9
3	2.8

Also apply efficiency factor

HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on:	1	2620664	$23^{1}/_{16}$" × $28^{13}/_{16}$"	36722
Proper flow to pump suction Proper submergence Fluid free of gas, air & abrasives Proper lateral setting of impeller	2	2620664	$25^{5}/_{32}$" × $27^{23}/_{32}$"	36756
	3	2620664	$24^{7}/_{32}$" × $25^{13}/_{16}$"	36768
	4	2620664	$23^{7}/_{32}$" × $24^{13}/_{16}$"	33656
	5	2620664	$22^{5}/_{16}$" × $23^{7}/_{8}$"	33666

Customer _____

Item _____

Peerless Ref. No: _____

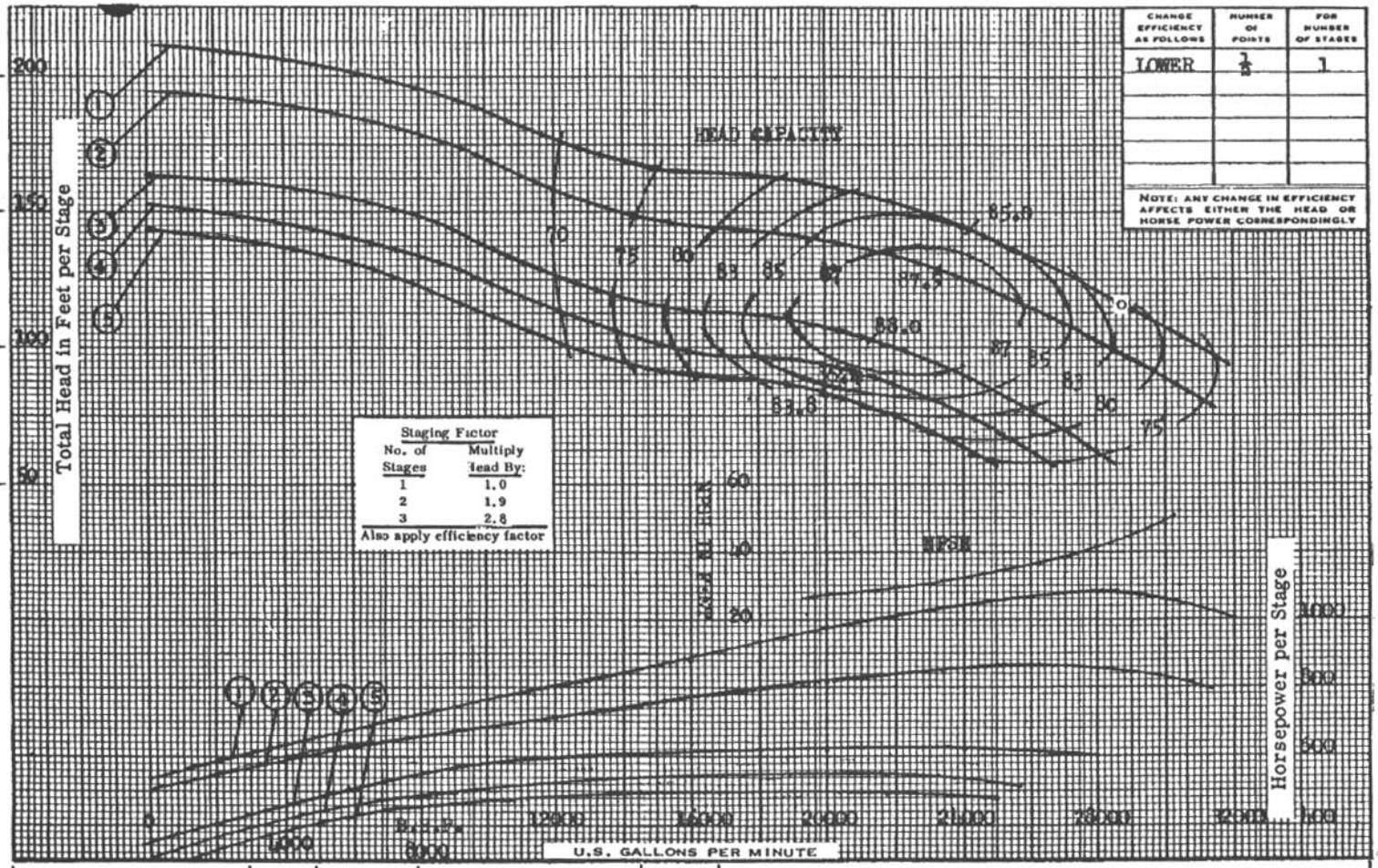
Laboratory Performance

SIZE	36HXB	RPM	885	BOWL	2619972
				CURVE	2840652

PUMP DESCRIPTION: Driver _____; Head _____; Column _____

GUARANTEED FIELD ☐ BOWL ☐ PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____ %; BHP _____

Total Head in Feet for ____ Stages



CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
LOWER	1	1

NOTE: ANY CHANGE IN EFFICIENCY AFFECTS EITHER THE HEAD OR HORSE POWER CORRESPONDINGLY

Staging Factor	
No. of Stages	Multiply Head By:
1	1.0
2	1.9
3	2.8

Also apply efficiency factor

Horsepower for ____ Stages

HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on: Proper flow to pump suction; Proper submergence; Fluid free of gas, air & abrasives; Proper lateral setting of impeller	1	2620664	$28\frac{1}{16}$" x $28\frac{13}{16}$"	36722
	2	2620664	$26\frac{5}{32}$" x $27\frac{23}{32}$"	36756
	3	2620664	$24\frac{7}{32}$" x $25\frac{13}{16}$"	36768
	4	2620664	$23\frac{7}{32}$" x $24\frac{13}{16}$"	33656
	5	2620664	$22\frac{9}{16}$" x $23\frac{7}{8}$"	33666

Customer _____

Item _____

Peerless Ref. No: _____

Laboratory Performance BOWL 2619972 CF PLASTIC COATED

SIZE 36HXB | RPM 885 | CURVE 2840652

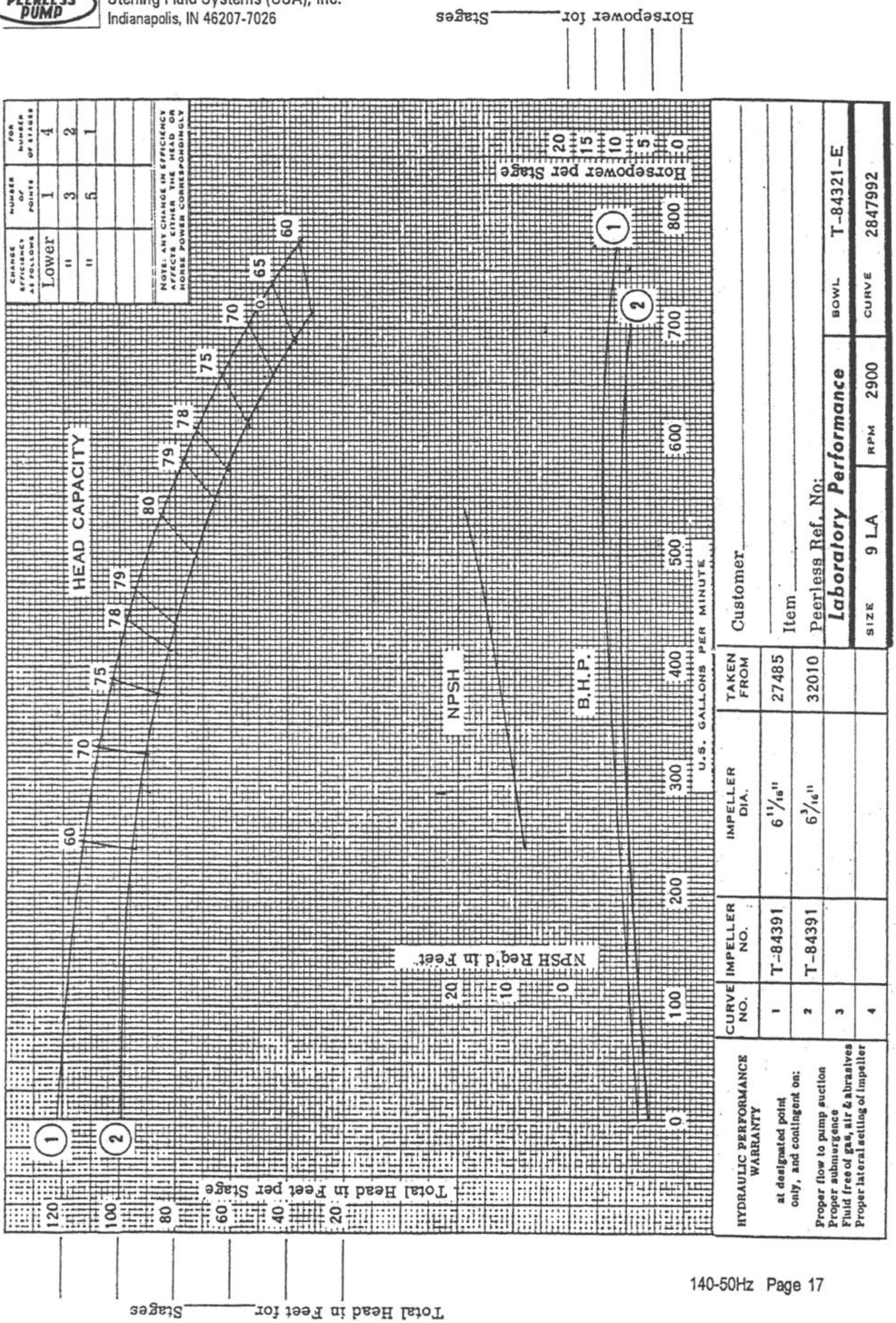
PUMP DESCRIPTION: Driver _____; Head _____; Column _____

GUARANTEED BOWL ☐ FIELD ☐ PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____ %; BHP _____

Injection

ATTACHEMENT K

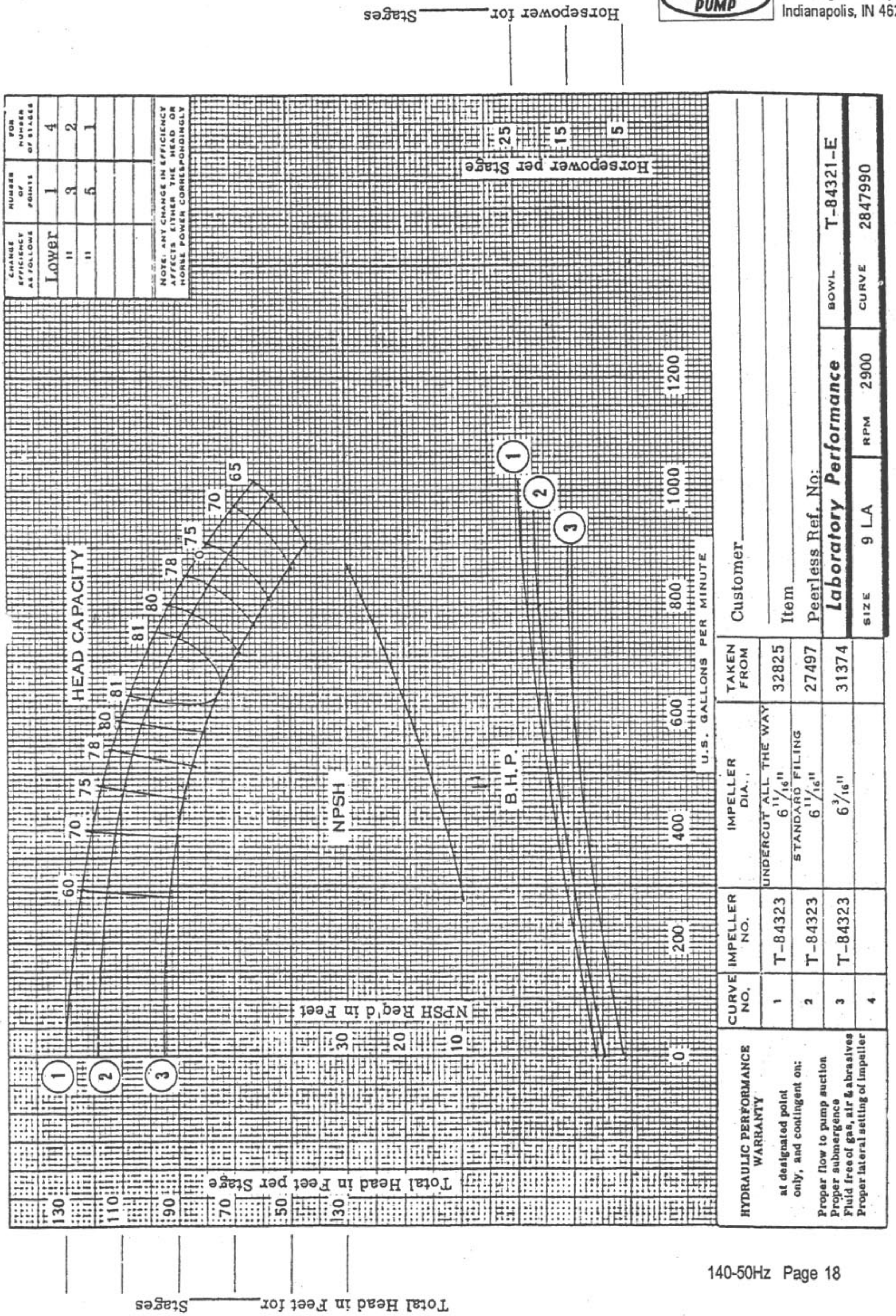
Recovery Pump – Sample Curves



PUMP DESCRIPTION: Driver ____; Head ____; Column ____
BOWL ☐ PERFORMANCE: Capacity ____ gpm; Head ____ ft; Eff ____ %; BHP ____
FIELD ☐

VERTICAL TURBINE PUMPS

STERLING PEERLESS PUMP
Sterling Fluid Systems (USA), Inc.
Indianapolis, IN 46207-7026



CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
Lower	1	4
"	3	2
"	5	1

NOTE: ANY CHANGE IN EFFICIENCY AFFECTS EITHER THE HEAD OR HORSE POWER CORRESPONDINGLY

HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
at designated point only, and contingent on:	1	T-84323	UNDERCUT ALL THE WAY 6 11/16"	32825
Proper flow to pump suction	2	T-84323	STANDARD FILING 6 11/16"	27497
Proper submergence Fluid free of gas, air & abrasives	3	T-84323	6 3/16"	31374
Proper lateral setting of impeller	4			

Customer ______

Item ______

Peerless Ref. No: ______

Laboratory Performance

SIZE	9 LA	RPM	2900	BOWL	T-84321-E
				CURVE	2847990

PUMP DESCRIPTION: Driver ______; Head ______; Column ______

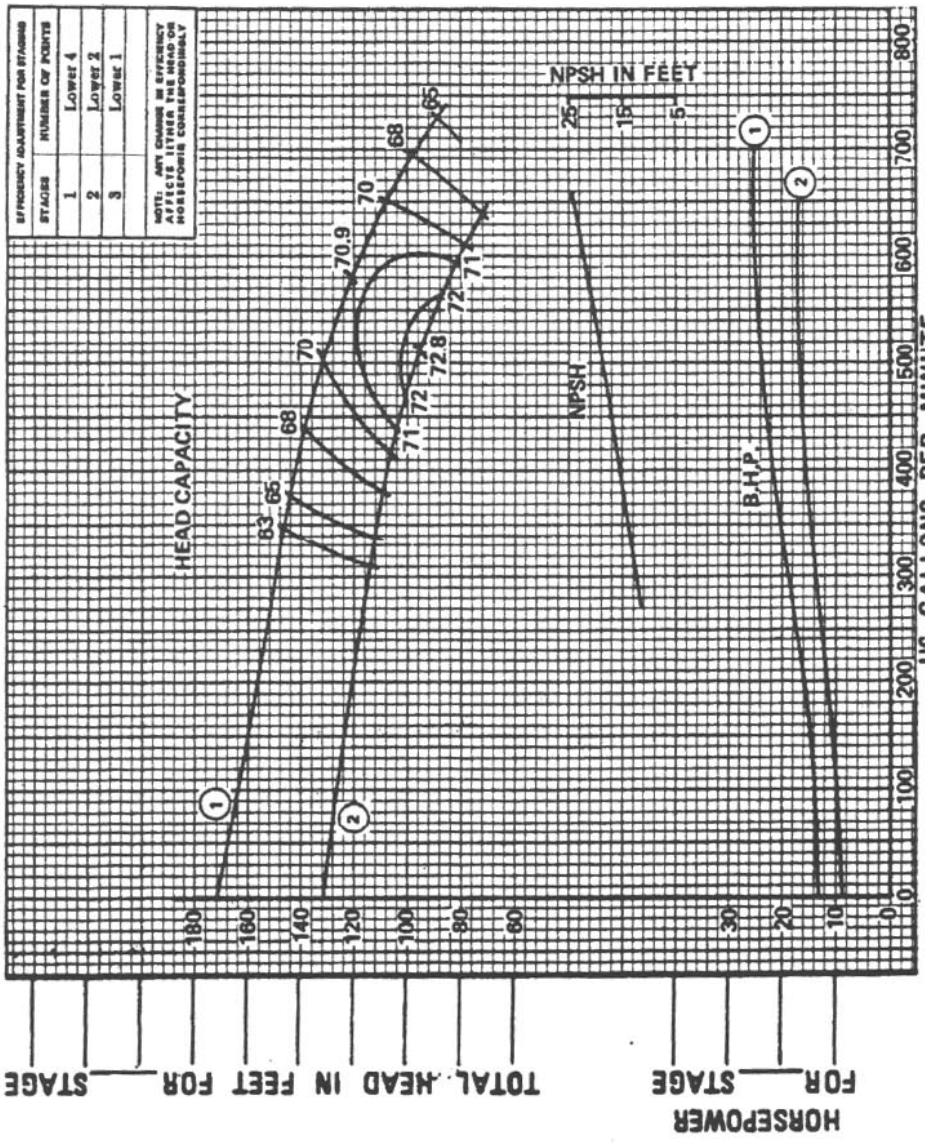
BOWL ☐ FIELD ☐ PERFORMANCE: Capacity ______ gpm; Head ______ ft; Eff ______ %; BHP ______

VERTICAL TURBINE PUMPS
Model 9LA - 3460 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026

2 POLE 60 HERTZ PERFORMANCE

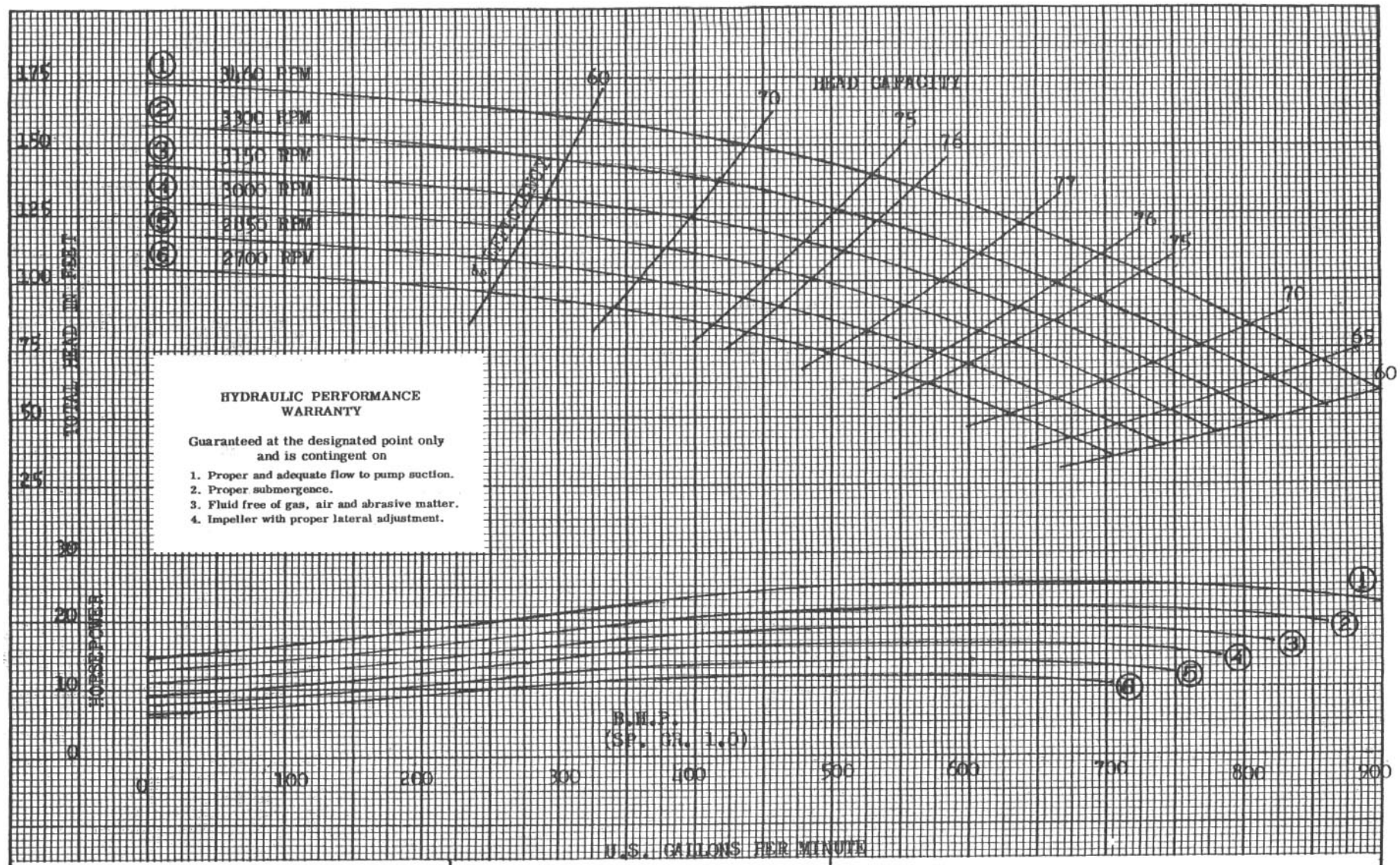
Capacity _____ gpm
Head _____ Feet
BHP _____
EFFICIENCY _____ %
DRIVER _____
_____
HEAD _____
_____
COLUMN _____
_____
_____
_____



CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	T84391	6-11/16	55739
2	T84391	6-1/16	55763
3			
4			

Customer _____
Item _____
Peerless Ref. No:
Laboratory Performance

SIZE	9LA	RPM	3460	BOWL	2604262 CIE
				CURVE	4806273



HYDRAULIC PERFORMANCE WARRANTY

Guaranteed at the designated point only and is contingent on

1. Proper and adequate flow to pump suction.
2. Proper submergence.
3. Fluid free of gas, air and abrasive matter.
4. Impeller with proper lateral adjustment.

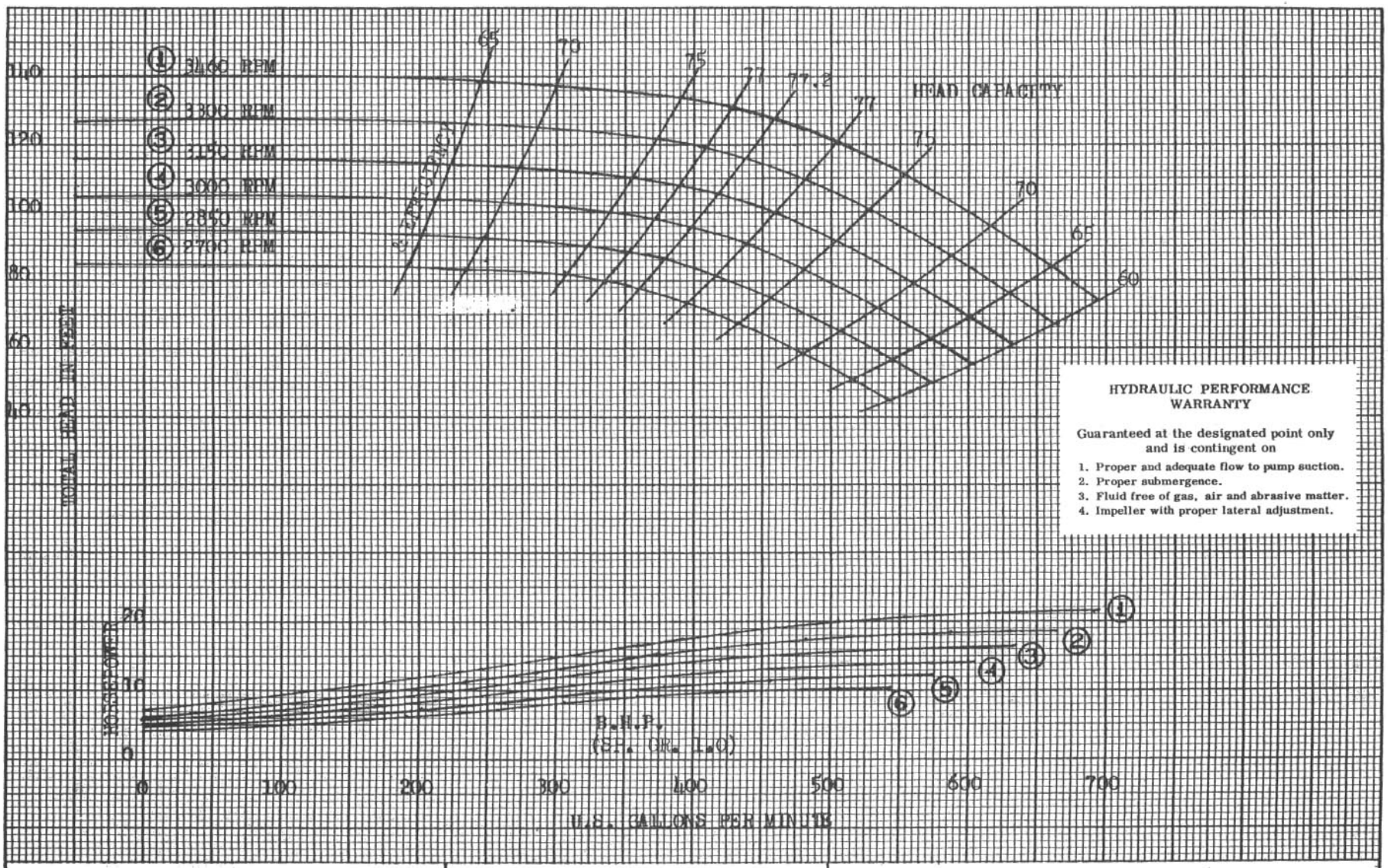
Impeller No 2605074 (brz or ci)
Impeller Dia (full) 6-11/16"
Bowl No 2604660
Reduce efficiency for special material bowls and impellers.

PEERLESS PUMP

TYPE HP HYDRO-LINE PUMPS

Per-Stage Performance (7 stages min)

Size 10LA Curve No. 2847617



Impeller No 2620632 (brz or ci)
Impeller Dia (full) 5-15/16"
Bowl No 2620763
Reduce efficiency for special material bowls and impellers.

PEERLESS PUMP

TYPE HP HYDRO-LINE PUMPS

Per-Stage Performance (7 stages min)

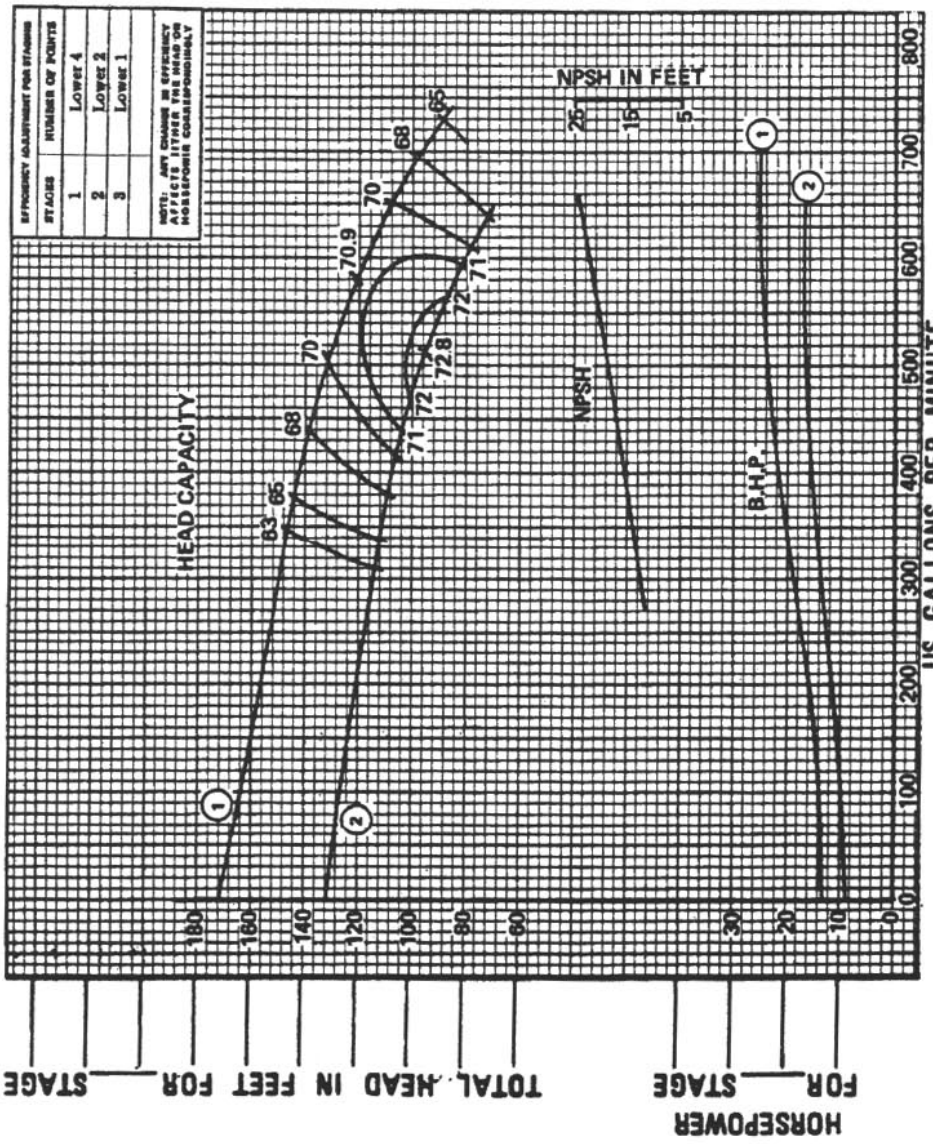
Size 8LB Curve No. 2847616

VERTICAL TURBINE PUMPS
Model 9LA - 3460 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026

2 POLE 60 HERTZ PERFORMANCE

Capacity ____ gpm
Head ____ Feet
BHP ____
EFFICIENCY ____ %
DRIVER _____
HEAD _____
COLUMN _____



EFFICIENCY ADJUSTMENT FOR STAGING	
STAGES	NUMBER OF POINTS
1	Lowest 4
2	Lowest 2
3	Lowest 1

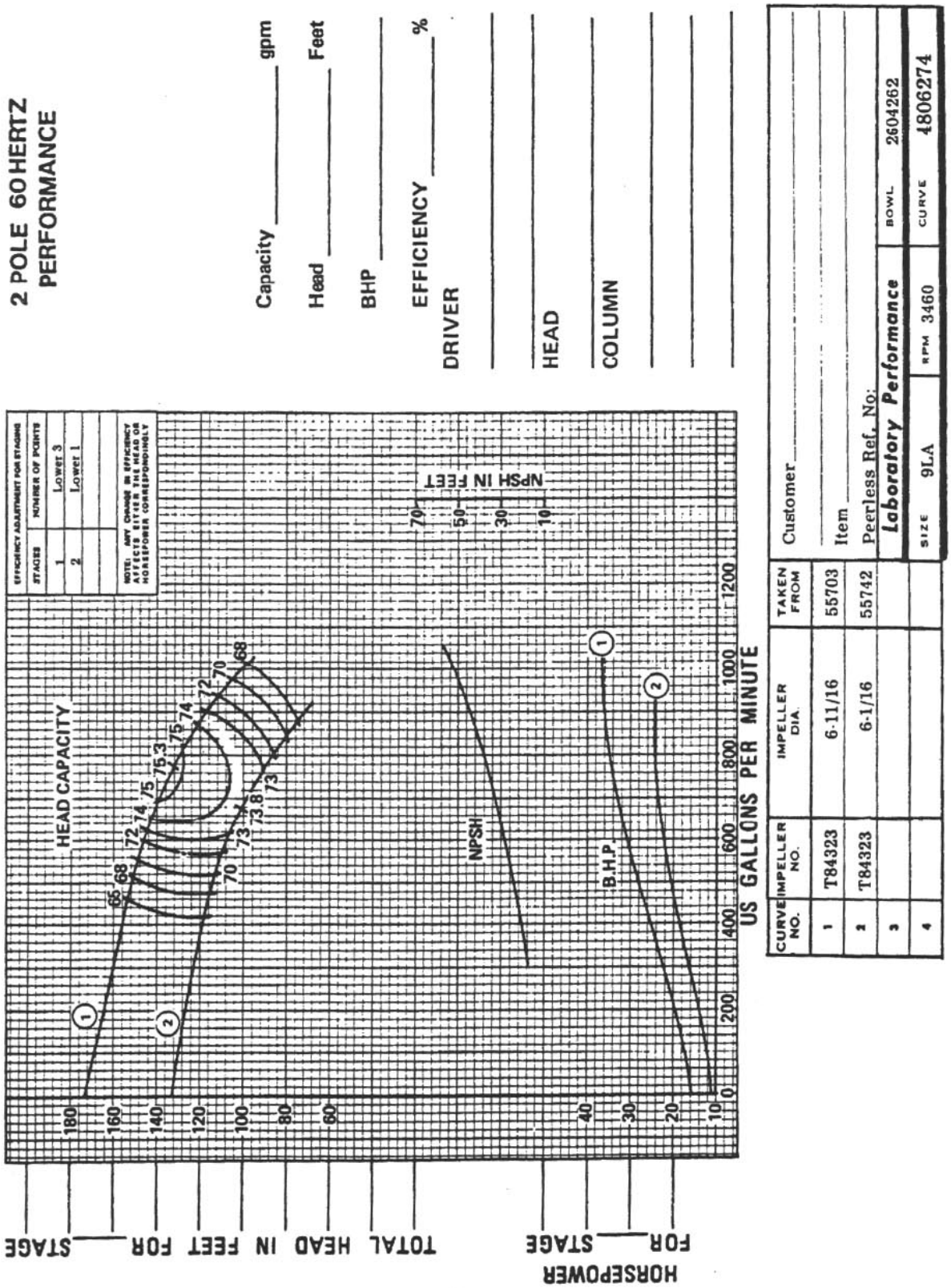
NOTE: ANY CHANGE IN EFFICIENCY AFFECTS EITHER THE HEAD OR HORSEPOWER CORRESPONDINGLY

CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	T84391	6-11/16	55739
2	T84391	6-1/16	55763
3			
4			

Customer _____
Item _____
Peerless Ref. No: _____

Laboratory Performance

SIZE	9LA	RPM	3460	BOWL	2604262 CIE
				CURVE	4806273



CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	T84323	6-11/16	55703
2	T84323	6-1/16	55742
3			
4			

ATTACHMENT L

Public Statement on Ultraviolet (UV) Light for Treatment of Public Water Supplies

Recommended Standards For Water Works

2003 Edition

Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers

Illinois Indiana Iowa Michigan Minnesota Missouri
New York Ohio Ontario Pennsylvania Wisconsin

POLICY STATEMENT
ON
ULTRA VIOLET LIGHT
FOR TREATMENT OF PUBLIC WATER SUPPLIES

Ultra Violet (UV) Light treatment devices may be used to treat bacteriologically unsafe groundwater from drinking water wells. However, reviewing authorities expect water system owners to take all steps possible to obtain a naturally safe water source before considering treatment. A naturally safe water source provides the best long-term public health protection and there is no reliance on a treatment device to assure safe water. There must be a determination that the bacteriologically unsafe water is not due to the influence of surface water.

Recent research has demonstrated the effectiveness of UV as a primary disinfectant. While this policy statement does not specifically cover UV treatment for surface water or groundwater under the direct influence of surface water, it is not the intent of this policy to discourage such use. Portions of this policy are applicable to the treatment of effectively filtered surface water. The reviewing authority shall be contacted regarding use of UV treatment for these applications.

When a naturally safe groundwater source is not available, or the system owner wishes to provide UV treatment for other reasons, the following criteria shall be considered. Supplemental disinfection to provide a residual in the water distribution system may be required by the approval authority. When UV light treatment devices are used for non-health related purposes the UV device may provide doses less than indicated in the following criteria.

A. CRITERIA FOR UV WATER TREATMENT DEVICES

1. UV water treatment devices must comply with criteria approved by the reviewing authority or Class A criteria under ANSI/NSF Standard 55 - Ultraviolet Microbiological Water Treatment Systems; each UV water treatment device shall meet the following standards;

    a. Ultraviolet radiation at a wavelength of 253.7 nanometers shall be applied at a minimum dose of 40 millijoules per square centimeter (mJ/cm^2) at the failsafe set point at the end of lamp life;

    b. The UV device shall be fitted with a light sensor to safely verify that UV light is being delivered into the reactor;

    c. The UV light assembly shall be insulated from direct contact with the influent water by a quartz (or high silica glass with similar optical and strength characteristics) lamp jacket to maintain proper operating lamp temperature;

    d. The design and installation of the UV reactor shall ensure that the manufacturer's maximum rated flow and pressure cannot be exceeded;

    e. The UV assemblies shall be accessible for visual observation, cleaning and replacement of the lamp, lamp jackets and sensor window/lens;

    f. A narrow band UV monitoring device shall be provided that is sensitive to germicidal UV light. It shall be accurately calibrated so that it indicates the true irradiance (mJ/cm^2) at 253.7 nanometers and be installed at the location critical for that unit. The device shall trigger an audible alarm in the event the sensor or lamp fails or if insufficient dosage is detected as defined in item "a" above;

g. An automatic shutdown valve shall be installed in the water supply line ahead of the UV treatment system that will be activated whenever the water treatment system loses power or is tripped by a monitoring device when the dosage is below its alarm point of 40 mJ/cm^2. When power is not being supplied to the UV unit the valve shall be in a closed (fail-safe) position.

h. The UV housing shall be stainless steel 304 or 316L;

2. A flow or time delay mechanism wired in series with the well or service pump shall be provided to permit a sufficient time for tube warm-up per manufacturer recommendations before water flows from the unit upon startup. Where there are extended no-flow periods and fixtures are located a short distance downstream of the UV unit, consideration should be given to UV unit shutdown between operating cycles to prevent heat build-up in the water due to the UV lamp:

3. A sufficient number (required number plus one) of parallel UV treatment systems shall be provided to assure a continuous water supply when one unit is out of service;

4. No bypasses shall be installed;

5. All water from the well shall be treated. The well owner may request a variance to treat only that portion of the water supply that is used for potable purposes provided that the daily average and peak water use is determined and signs are posted at all non-potable water supply outlets.

6. The well or booster pump(s) shall have adequate pressure capability to maintain minimum water system pressure after the water treatment devices;

B. PRETREATMENT

The reviewing authority will determine pre and post treatment on a specific case basis depending on raw water quality. See Section G for raw water quality limitations. If coliform bacteria or other microbiological organisms are present in the untreated water, a 5 micron filter shall be provided as minimum pretreatment.

C. PROCESS CONTROL WATER QUALITY MONITORING

Total coliform monitoring and other parameters required by the reviewing authority will be used to evaluate UV treatment effectiveness. The minimum monitoring frequency will be as follows:

Startup and 2 weeks after start up - one raw and one treated sample.
Monthly thereafter - raw and treated.

Monitoring for additional parameters or total coliform on an increased frequency may be required by the reviewing authority.

D. ONLINE MONITORING, REPLACEMENT PARTS

UV light intensity of each installed unit shall be monitored continuously. Treatment units and the water system shall automatically shutdown if the UV dosage falls below the required output of 40 mJ/cm^2. Water systems that have source water exceeding 5 NTU turbidity may be required to install an online turbidimeter ahead of the UV water treatment device. An automatic shutdown valve shall be installed and operated in conjunction with the turbidimeter. Each owner shall have available on site at least one replacement lamp, a 5 micron replacement filter and, where applicable, a replacement cyst reduction filter and any other components necessary to keep the treatment system in service.

E. SEASONAL OPERATIONS

UV water treatment devices that are operated on a seasonal basis shall be inspected and cleaned prior to use at the start of each operating season. The UV water treatment system including the filters shall be disinfected prior to placing the water treatment system back into operation. A procedure for shutting down and starting up the UV treatment system shall be developed for or by each owner based upon manufacturer recommendations and submitted in writing to the review authority.

F. RECORD KEEPING AND ACCESS

A record shall be kept of the water quality test data, dates of lamp replacement and cleaning, a record of when the device was shutdown and the reason for shutdown, and the dates of prefilter replacement.

The reviewing authority shall have access to the UV water treatment system and records.

Water system owners will be required to submit operating reports and required sample results on a monthly or quarterly basis as required by the reviewing authority.

G. RAW WATER QUALITY CHARACTERISTICS

The water supply shall be analyzed for the following water quality parameters and the results shall be included in the UV application. Pretreatment is required for UV installations if the water quality exceeds any of the following maximum limits. When an initial sample exceeds a maximum limit, a check sample shall be taken and analyzed.

Parameter	Maximum
UV 254nm Absorption	20 percent at 1 cm
Dissolved Iron	0.3 mg/L
Dissolved Manganese	0.05 mg/L
Hardness	120 mg/L*
Hydrogen sulfide (if odor is present)	Non-Detectable
Iron Bacteria	None
pH	6.5 to 9.5
Suspended Solids	10 mg/L
Turbidity	1.0 NTU
Total Coliform	1,000/100 ML
E. Coli	**
Cryptosporidium	**
Giardia	**

* A higher hardness may be acceptable to the reviewing authority if experience with similar water quality and reactors shows there are no treatment problems or excessive maintenance required.

** These organisms may indicate that the source is either a surface water or ground water under the direct influence of surface water and may require additional filtration pretreatment. Consult the reviewing authority for guidance.

Raw water quality shall be evaluated and pretreatment equipment shall be designed to handle water quality changes. Variable turbidity caused by rainfall events is of special concern.

Adopted April, 2003