TECHNICAL MEMORANDUM

September, 1985

URBAN WATER DEMAND ESTIMATES FOR MARTIN COUNTY: 1983 EXISTING AND COMMITTED, AND BUILDOUT

TECHNICAL MEMORANDUM

URBAN WATER DEMAND ESTIMATES FOR MARTIN COUNTY: 1983 EXISTING AND COMMITTED, AND BUILDOUT

SEPTEMBER, 1985

By
Stephen Opalat
Water Use Planning & Management Division
Resource Planning Department

This publication was produced at an annual cost of $243.75 or $.75 per copy to inform the public.
500 990 Produced on recycled paper.

TABLE OF CONTENTS

LIST OF TABLES

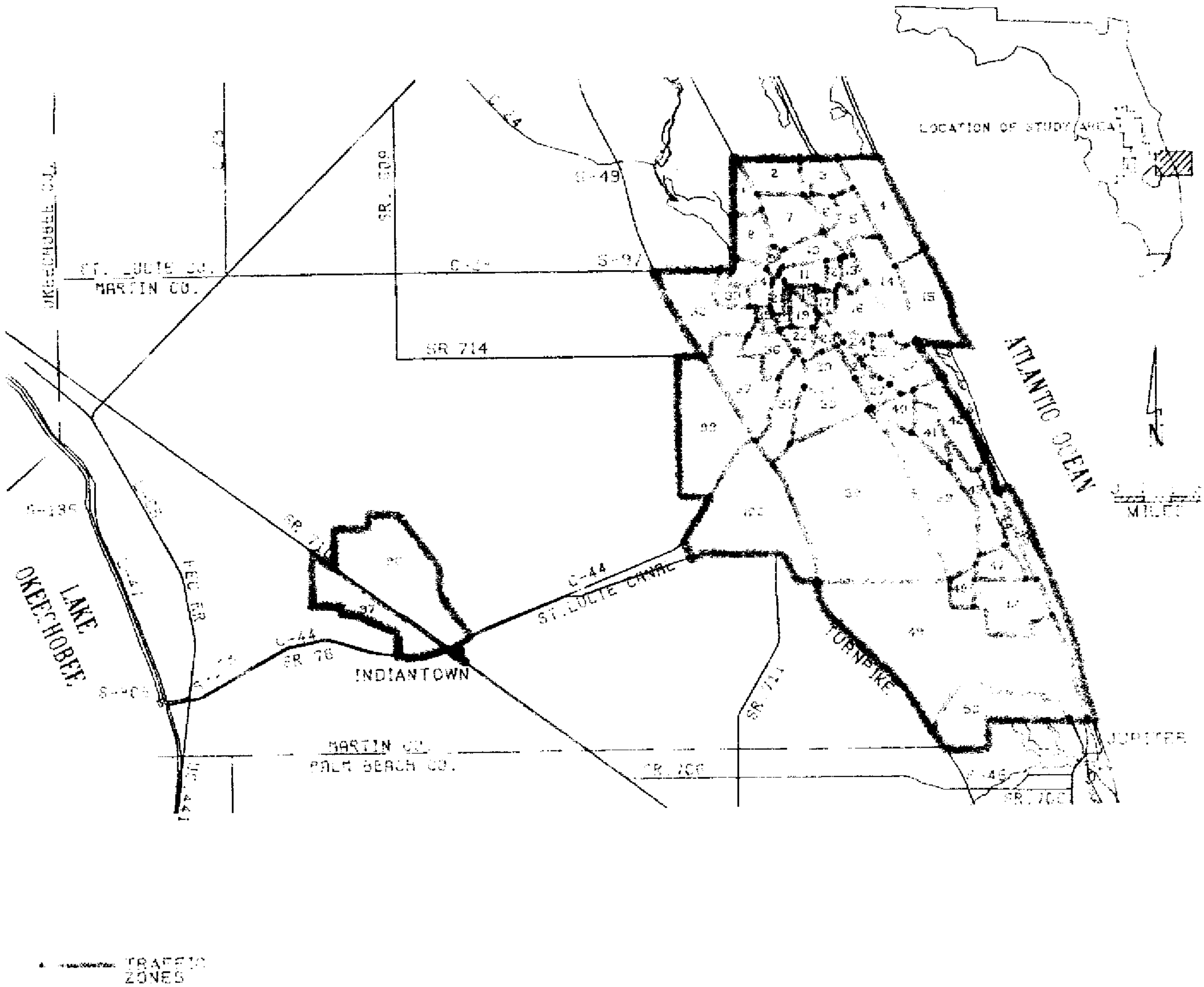
List of Figures

I. INTRODUCTION

This report presents a model which projects urban water demand using population and land use data for the area in Martin County shown in Figure 1. The model was developed with a rather unique structure compared to most water demand models which simply apply an estimated per capita consumption rate to a set of population data. The model described within this report makes use of land use acreage by type, and population projections, in order to develop water demand projections by land use type. By incorporating land use data, the model becomes sensitive to changes in the Comprehensive Plan of Martin County. Having a model which is directly tied to the Comprehensive Plan of a particular region makes it possible to use the model to assist in growth management decisions.

The model uses as its inputs land use acreage by type and population projections, both of which have been provided by the Martin County Planning Department for the traffic analysis zones (TAZs) in the study area. Water use factors are applied to these data in order to estimate urban water demand by land use type by TAZ. The results of this model are being used by the Hydrogeology Division in a model which evaluates various scenarios regarding the location of wellfields and their impacts on water levels.

Following this Introduction the second section contains an overview of the current water use characteristics of Martin County. This is followed by a section which presents the planning framework of the data used as input to the model. The fourth section contains the methodology used to develop water use and source factors which are applied to the data presented in section three in order to develop projections of urban water demand. The fifth section evaluates the performance of the model by comparing ex post estimates with actual data for some of the larger utility service areas. Finally, in



MARTIN COUNTY STUDY AREA AND COMPONENT TRAFFIC ANALYSIS ZONES (1984) MARTIN COUNTY

FIGURE 1

section six the results of the model are summarized and some suggestions for further research are discussed.

II. OVERVIEW OF PAST WATER USE IN MARTIN COUNTY

The model presented in this report was designed to estimate future urban water demand for Martin County. The first step in constructing such a model was to review historic water use characteristics for the study area. Before specifically discussing Martin County, however, it is helpful to review the general types of water use as well as the data restrictions that arise when conducting such an analysis.

Water use can best be discussed by first identifying the different types of use that exist. Basically water use can be placed into five user categories: residential, commercial, industrial, institutional, and agricultural. Along with these user classifications one can make the distinction between potable (indoor) and non-potable (outdoor) use. When water use is examined following this disaggregated structure it becomes clear that data availability plays a limiting role in the analysis. The largest void in real data exists in the area of non-potable water use, because the majority of non-potable water is self supplied and pumpage records are not maintained for the majority of private wells being used for irrigation. Typically the only real data that are available are the pumpage figures for the larger utilities (i.e., those which pump 100,000 gallons per day or more). Due to these data limitations the review of historic water use must concentrate on pumpage figures for the larger utilities, using these figures as a measure of demand. Water use must also be viewed from the supply side by examining the sources from which the water is being supplied.

Water Demand

Before developing a model for estimating water demand for a particular region it is helpful to review historic demand for that region. Table 1 shows historic demand in the form of annual pumpage for the major utilities of Martin County from 1980 through 1984. The pumpage data in Table 1 are positively correlated to time, which is reasonable since population is also positively correlated to time and water demand is directly tied to population. It is useful to adjust for population by putting the data into per capita terms. Table 2 presents the per capita figures for each of the counties in the South Florida Water Management District (SFWMD) for 1980. These data indicate that on a per capita basis Martin County is one of the more water consumptive counties in the District. The population used to calculate the per capita figures in Table 2 was permanent resident population which is often significantly smaller than peak seasonal population. Using the permanent resident population figure causes the per capita figure to be higher, and since Martin County is strongly affected by seasonal population swings, one should be cautious when using these per capita figures. Under the framework developed by the Martin County Planning Department for this study, it is assumed that all units will be occupied year-round, thus eliminating the impact of seasonal fluctuations in population. This assumption and others will be discussed further in the following section.

Although it is helpful to review historic demand in order to project future demand it should be mentioned that in the case of Martin County, caution must be used when comparing past and future conditions. Visual inspection of new development in Martin County makes apparent the changing appearance between "old" and "new" Martin County. Normally a model is

TABLE 1

Large Utility Pumpage Data
(million gallons per year)

Utility	1980	1981	1982	1983	1984
Indiantown	171.8	166.6	165.0	148.0	168.9
Indian River	15.6	18.0	18.4	21.0	29.8
Intracoastal	82.5	169.2	173.1	211.8	239.6
Hobe Sound	361.2	326.8	348.7	467.1	628.7
Beacon 21[5]	38.6	50.6	52.5	49.2	49.7
Hydratech	84.2	121.9	141.7	133.7	167.3
Sailfish	n/a	3.6	8.4	15.0	16.7
Joe's Point	1.6	3.1	7.5	13.8	16.2
Pine Lake Village	69.1	62.0	73.1	89.3	91.1
Piper's Landing	n/a	1.1[1]	8.5	9.5	12.6
Southern States	49.9	57.5	52.0	57.6	62.2
River Club	4.0	6.9	7.9	7.7	4.9[4]
Ocean Breeze	14.8	16.2	15.1	16.8	19.5
Utilities Inc.[6]	15.8	12.6	13.1	13.2	18.6
Stuart[2]	887.7	909.8	944.0	947.9	1042.8
Martin County[3]	301.8	315.4	316.6	385.1	425.8

[1]Includes only 10/81 - 12/81

[2]Does not include water sold to Southern Gulf

[3]Includes Southern Gulf pumpage

[4]excluded 7/84 - 9/84, 12/84

[5]Previously Miles Grant Utility

[6]Previously Oz Utility

TABLE 2

Per Capita Water Consumption (1980)

County	Per Capita Rate (gpcd)
Collier	287
Palm Beach	231
Dade	195
Martin	193
Broward	187
Lee	172
*Orange	169
St. Lucie	168
*Osceola	164
*Polk	162
*Charlotte	158
Monroe	157
*Highlands	156
Hendry	153
*Okeechobee	146
Glades	140

*These per capita figures apply only to the portion of the county located within the District.

Source: Technical Memorandum "A Potable Water Use Data Base for South Florida 1980" constructed for a particular region based on historical data using the premise that the "structure" of the area being modeled is relatively stable. In Martin County this does not appear to be the case; therefore, the emphasis placed on historical demands was significantly reduced. In the fourth section there is further discussion about old and new development in Martin County and how it affects water demand.

Water Supply

The structure of the groundwater flow model, for which the results of this model are inputs, is such that demands need to be classified as either utility demand or self supplied demand. In the past the District has worked with three categories of suppliers: large utilities, small utilities (less than 100,000 gpd), and self supplied, and procedures were developed for allocating demand to each of these potential suppliers.

Historically Martin County has been about 40% self supplied, 10% small systems, and 50% large utilities. Table 3 compares Martin County's non-utility pumpage to other counties in SFWMD. The figures show that in the past, Martin County has had a relatively large percentage of non-utility demand. Caution is again emphasized when using this information for future considerations about the composition of Martin County water demand. In actuality the future of Martin County, as seen by the Martin County Planning Department, is one which will be dominated by the large utility. It is assumed that by buildout the majority of private potable wells will be given up for connections to major utilities. Small utilities are projected to disappear, as they will be absorbed by the more efficient larger utility

TABLE 3
Percentage of Total Annual Pumpage by Source (1980)

County	Self Supplied/Small System (%)
*Charlotte	100.0
*Highlands	87.0
Glades	75.7
*Polk	68.4
Martin	48.6
*Okeechobee	45.1
*Osceola	39.7
St. Lucie	34.1
Hendry	29.7
Orange	29.3
Lee	15.6
Monroe	13.0
Palm Beach	6.6
Dade	3.5
Collier	2.8
Broward	2.8

*These percentages refer only to the portion of the county located within the District.

Source: Technical Memorandum "A Potable Water Use Data Base for South Florida 1980" systems. The effect of this on the water demand estimation process is discussed in section four.

Before proceeding to the next section it should be emphasized once again that data on past water use does provide some useful information about water demand and supply. However, since the future development in Martin County is proposed to be quite different than past development, one should hesitate to place emphasis on these characteristics of the past.

III. MARTIN COUNTY PLANNING FRAMEWORK

The water demand model developed for Martin County was based upon data provided by the Martin County Planning Department. The model uses these data to estimate urban water demand for two distinct development phases: 1983 existing and committed, and buildout. The term "existing and committed" refers to development that actually exists or has received preliminary approval from the County Commission, and "buildout" refers to the maximum amount of development expected under the current Comprehensive Plan.

Two sets of data were provided for each of the two development phases mentioned above. The first set of data consisted of land acreage for 14 land use types (i.e., rural ranchette, rural, estate, low, medium, mobile, and high residential uses; general, limited, commercial office residential, and waterfront commercial uses; industrial; institutional; and agricultural) by TAZ. These acreage figures were further classified as vacant, wetland, or developed. The land was considered "developed" if actual development existed or if there was committed development which had been approved by the County Commission. It should be mentioned that at buildout there will be zero acres of land in the "vacant" category for all land use types. Also note that agricultural acreage was not incorporated into the model because water use for this category is handled directly in the Hydrogeology model.

The second set of data consisted of housing unit projections by type (i.e., single-family, multi-family) by TAZ. From these data population projections were constructed by applying a persons per unit rate to the housing unit data. A factor of 2.9 persons per unit was used for single-family units and a factor of 2.0 was used for multi-family units, both of which were provided by the Martin County Planning Department. In formulating population estimates the Planning Department assumed 100% occupancy. Historically the occupancy rate for Martin County was 76% (1980 census).

Given the structure of the model it was necessary to combine the housing unit data and the land use data so that the housing units could be distributed by land use type for each TAZ. For those units not yet committed to development this distribution process was quite straightforward given the assumption that single-family units were to be allocated to areas with a density less than 5 units per acre (upa) and multi-family units were to be allocated to areas with a density equal to or greater than 5 upa. This assumption about housing units, combined with the information contained in the Martin County Comprehensive Plan regarding density transfer and maximum density, laid the framework for the allocation of new housing units projected to exist by buildout.

The units in the category of "existing and committed" had to be distributed in a slightly more complicated fashion. The first step in distributing these units was to calculate the maximum number of units which could exist in each TAZ given the land use acreage data and the maximum upa for each land use category, the latter being in accordance with the

Comprehensive Plan. Existing and committed units were then distributed in proportion to the potential maximum number of units for each land use type by TAZ. The results of this distribution process are presented in Appendix A for both development phases. Appendix A also contains the acreage data for the non-residential land use categories.

IV. WATER USE AND SOURCE FACTORS

In the previous section the general framework of the data was described. This section presents the methodology used to develop water use factors by land use type which are applied to the data set in section three in order to generate estimates of urban water demand. Also discussed in this section is the issue of what sources will supply the future water needs of Martin County.

Water Use Factors

There were four types of demand for which water use factors had to be constructed: residential potable and non-potable, and non-residential potable and non-potable. The methodology used to develop such factors for Martin County was further concerned with relating these factors to each particular land use type.

Residential Potable Water Demand

Residential potable water demand was determined to be independent of land use type, thus a factor of 100 gallons per capita day (gpcd) was applied to the population projections for the county in order to generate residential potable water demand estimates. The factor of 100 gpcd is the standard used by the Department of Environmental Regulation and is provided by the Water Pollution Control Federation in their document, "The Manual of Practice for Design and Construction of Sanitary and Storm Sewers."

Residential potable water demand estimated for Martin County are shown in Tables B.1 (1983 Existing and Committed) and B.4 (Buildout) of Appendix B.

Non-residential Potable Water Demand

Unlike residential potable water demand, it was determined that non-residential potable water demand across the different land use types. The main reason for this is the wide variation in types of development associated with the various land use types. Table 4 gives a brief description of the development characteristics of the six non-residential land use categories as described in the Comprehensive Plan of Martin County. The information in Table 4 was used along with material from Technical Information Memorandum 6.2.1 of the Department of Environmental Regulation in order to develop the water use factors for non-residential potable water demand shown in Table 5.

The next step in calculating non-residential potable water demand was to take non-residential land use acreage by type and calculate the expected square footage of building space which would exist under the Proposed Land Development Code for Martin County, taking into account such things as open space requirements and maximum building cover. For the purposes of this model it was assumed that the developer would take full advantage of planning guidelines by maintaining the minimum amount of open space and the maximum building cover. Given this assumption, the acreage data was converted to building space and the factors in Table 5 were applied in order to estimate non-residential potable water demand.

It should be noted it was necessary to make some minor adjustments to the acreage data before calculating water demand. First of all, fifty percent of total vacant acreage (e.g. for future development) of waterfront commercial and commercial office residential land uses were treated as residential with

TABLE 4

Non-residential Development Characteristics

Land Use	Description
General Commercial	Retail sales and services, trade and warehouse facilities, hotels and motels
Limited Commercial	Retail shops with small floor area, small parking lot requirements, and limited inventory
Comm. Office Res.	Business offices and financial institutions, used as a buffer between intensive comm. & res.
Waterfront Comm.	Marine related services, some restaurants & shops as approved by the Planning and Zoning Board
Industrial	Accessible to rail facilities and major arterials, includes salvage yards
Institutional	Schools, government buildings, hospitals, parks and recreational areas, and public open space

Source: Martin County Comprehensive Plan (1982)

TABLE 5

Non-residential Potable Demand Factors
(gallons/1000 sq. ft.)

Land Use	Factor
General Commercial	150
Limited Commercial	125
Comm. Office Res.	100
Waterfront Comm.	250
Industrial	100
*Institutional	175

*applied to 1/2 of the developed acres assuming the remainder to be public open space

Source: Various literature releases including memorandum 6.2.1 from the Department of Environmental Regulation development occurring at a density of 10 upa. Also, based on information provided by the Martin County Planning Department, the majority of land considered "institutional" was treated as open space, therefore no potable demands were calculated for these institutional areas.

Non-residential potable water demand estimates for Martin County are shown in Tables B.2 (1983 Existing and Committed) and B.5 (Buildout) of Appendix B.

<u>Residential Non-Potable Water Demand</u>

The structure of this water demand model, which involved linking water use with land use, played a major role in the development of residential non-potable (irrigation) water use factors. Each residential land use category was expected to have unique characteristics regarding maximum and actual density, type of irrigation system, and other relevant factors that influence irrigation practices, and which needed to be examined in great detail in order to develop water use factors by land use type. The basic methodology followed was to develop figures reflecting average irrigation area per unit by land use type and use this information along with the housing unit data provided in Appendix A to estimate total irrigation area by land use type. These data could then be used along with irrigation rate and frequency factors to provide non-potable water demand estimates.

A primary consideration influencing the development of residential water use factors had to do with the maximum density allowed for each land use category according to the Comprehensive Plan. It was assumed by Martin county that all new development would occur at these maximum densities, which are shown below.

Land Use Type	Maximum Density (upa)
Rural Ranchette	.2
Rural	.5
Estate	2.0
Low	5.0
Medium	8.0
Mobile	8.0
High	15.0
*Waterfront	10.0
*Comm. Office Res.	10.0

*This figure applies to 50% of total vacant acreage

These density figures were important because they aided in determining average lot sizes for the various land use categories and lot size was the key input in calculating irrigation area per unit by land use type.

There are two other inputs which were taken into consideration when irrigation area was calculated, both of which are based on provisions of the Comprehensive Plan of Martin County. These two provisions, open space requirements and density transfer, are of importance because they both directly affect the amount of irrigation area per unit.

Open space, as defined by the Comprehensive Plan, is comprised of permeable open surfaces, excluding principle structures and impermeable surfaces (i.e. parking lots). According to the Plan, all residential development must maintain a minimum of fifty percent of the gross land area as open space. Golf courses and wetlands can be used in calculating open space as long as the percentage of each does not exceed ten percent, thus ensuring a minimum of thirty percent of the development's upland area to be comprised of open space. In this model it was assumed that this open space would be irrigated. This provision does not apply to construction of a single-family house on a lot of record, which is a lot that was platted before April 1, 1982.

Density transfer is the other provision contained in the Comprehensive Plan which had to be incorporated into irrigation area calculations. This provision allows property owners to transfer density to the upland area of any site which contains functional wetland properties. This provision applies only to those developments submitted for review as a planned unit development and is subject to the following constraints:

a) The gross residential density of the upland property is equal to or less than two times the gross residential density of the entire parcel, and

b) The residential density of the upland property is less than 15 upa, and

c) The total number of units allowed in any development using this transfer formula shall be equal to or less than the maximum allowed on the parcel determined by the density shown on the Land Use Map, and

d) Density transferred is less than or equal to (wetland acreage x gross density).

If the above criteria are fulfilled, and a property owner takes advantage of the density transfer, then the actual lot size for each unit in that particular parcel would be smaller than one would expect since the development (upland) density would be greater than the established land use density. It was assumed in this model that property owners would, for the most part, take full advantage of this density transfer privilege and it was therefore included in the process of estimating average irrigation area per unit by land use type.

Table 6 contains the average per unit area of irrigation figures by land use type. There are two sets of numbers shown, one set for existing units, another set for committed and future units. This time distinction was made in order to reflect the changing character of development in Martin County when comparing old development with new development. For example, the land use categories of low, medium, and high are generally associated with community developments, and in the future these developments will be taking advantage of the density transfer provision described above. The use of density transfer leads to a smaller lot size per unit, therefore a smaller area per unit will require irrigation. Actual on-site inspection of both old and new housing units in each land use category verified the figures shown in Table 6.

After developing the factors of irrigated area per unit it was necessary to examine irrigation system design characteristics. The main issue of concern was what percentage of units in each land use type would have automatic irrigation systems. This was an important distinction because data indicate that those units with systems irrigate at a greater frequency than those without. The percentages shown in Table 7 were based upon a sample of units observed throughout the study area as well as information provided by the Florida Irrigation Society. The distinction between "old" and "new" refers to those systems installed before or after 1980. It was necessary to develop these two sets of figures in order to reflect the changing irrigation requirements of new development compared to old development. The percentages are higher for the newer development because the newer development is more elaborately landscaped and the turfgrass being used for lawns (St. Augustine grass) requires more irrigation than the turfgrass used by much of the older development (Bahia grass).

TABLE 6

Residential Irrigation Area Factors
(square feet/dwelling unit)

Land Use	Existing	Future
Rural Ranchette	23,500	23,500
Rural	20,000	20,000
Estate	13,500	13,500
Low	7,000	5,400
Medium	4,800	3,600
High	1,300	800
Mobile	800	1,500
Comm. Off. Res.	1,300	1,500
Waterfront Comm.	1,300	1,500

TABLE 7

Units with Automatic Irrigation Systems
(percentage)

Land Use	Existing Development (1980)	New Development (post 1980)
Rural Ranchette	25%	50%
Rural	25%	50%
Estate	75%	100%
Low	25%	90%
Medium	50%	100%
High	50%	100%
Mobile	50%	50%
Comm. Office Res.	50%	100%
Waterfront	50%	100%

The final step before estimating residential non-potable water demand involved developing assumptions about irrigation application rates and application frequency; both the Florida Irrigation Society and IFAS helped in formulating these assumptions. Sprinkler systems installed before 1980 were assumed to apply 1/2" per acre per application, and systems installed after 1980 were assumed to apply 3/8" per acre per application. This reduction in the application rate reflects the change from a jet head to a mist head.
Those that irrigate by other means (i.e., garden hose) were assumed to apply 1/4" per acre per application. The application frequency for those units with systems was assumed to average out to three times a week which is 155 applications a year. Those that irrigate by other means were assumed to concentrate their efforts during the dry season leading to a yearly figure of 60 applications.

With all the assumptions described above one could then proceed with the estimation of residential non-potable water demand. Because the various assumptions have a time element built into them it was necessary to separate the housing unit data into three categories: units developed through 1980, units developed after 1980 through 1983, and projected units not yet developed. After placing the housing units in these various categories it was simply a matter of applying the factors developed above to the housing units distributed by TAZ by land use type.

Residential non-potable water demand estimates for Martin County are shown in Tables B.1 and B.4 of Appendix B.

Non-residential Non-potable Water Demand

The procedure for estimating non-residential non-potable water demand was somewhat restricted by the data available, that being acreage figures for 1983 existing and committed, and buildout. The leading factor used to develop demands from these data was the open space requirement, similar to that which was used for residential demand estimation. General commercial, waterfront commercial, and industrial land uses are subject to a twenty percent open space requirement. Commercial office residential, and institutional development must maintain forty percent open space. Finally, limited commercial development must have thirty percent open space.

Non-potable water demands were estimated by applying the open space requirement for each land use to the acreage data thus giving an estimate of irrigated area. This area information was then used along with the application rate and frequency factors previously discussed in order to estimate non-residential non-potable water demands by land use type by TAZ.

Non-residential non-potable water demands for Martin County are shown in Tables B.3 and B.6 of Appendix B.

Water Sources

The water demand estimates in the previous section were formulated so that they could be used in the Hydrogeology Division's groundwater flow model. The structure of the groundwater flow model is such that it specifically inputs only utility supplied water from central wellfields. Self supplied water is handled differently because much of it is used for irrigation and the amount withdrawn far exceeds the amount actually consumed. To adjust for this, the model specifically inputs utility demand only and incorporates an evapotranspiration factor to account for the consumption associated with non-potable water use.

In section two information was provided about the various sources that have existed in the past in Martin County, those being private wells, small systems, and large utilities. This section is concerned with future sources in Martin County and addresses this issue for both potable and non-potable water use.

Potable Water Use

Potable water sources in the past fell into all three categories, including private wells, small systems, and large utilities. The future, however, is projected to be quite different. The planning assumption developed by Martin County for this study is that small systems will eventually be disbanded with customers hooking up to larger utilities. It is also projected by Martin County that the majority of private wells will disappear. Only developments in the lower density categories of rural ranchette and rural are assumed to remain on private wells through buildout. Exceptions to this assumption are the estate density developments in TAZ's 38 and 100 which are assumed to remain self supplied because they are outside the urban service area.

This information was incorporated into the water demand estimates in two stages. First of all, for the 1983 existing and committed estimates, adjustments were made to potable demand by subtracting out the demand attributed to private wells and small systems. The buildout estimates were also adjusted but only for those units which would still be self supplied (i.e., rural ranchette, rural, and some estate). With these assumptions the estimates presented in Appendix B were adjusted so that they represented utility demands. It should be noted that due to data limitations it was necessary to assume that all non-residential potable water was utility supplied.

Non-potable Water Use

The basic assumption made about non-potable water use was that the majority of it would be self supplied, with people taking advantage of the cost savings associated with using a private well or available surface water for irrigation. It was assumed 100% of non-potable use attributed to rural ranchette and rural would be self supplied, 95% for estate, 85% for low, medium, high, and commercial office residential, 75% for mobile, and 0% for waterfront. Non-residential non-potable water demand was assumed to be 85% self supplied.

After developing these assumptions about water sources, it was then possible to take the water demand estimates shown in Appendix B and adjust them so that they reflected utility demand.

The utility demand figures for both potable and non-potable uses are shown in Appendix C.

V. MODEL VALIDATION

In this section the water demand model described herein is used to generate water demand estimates for 1980 for two sub-areas so that these estimates can be compared to actual pumpage for 1980. The two sub-areas were chosen so that their boundaries followed those of major utility service areas. The two areas used for this analysis were the Stuart utility service area, and the service area which includes Hydratech, Intracoastal, Hobe Sound, and Miles Grant utilities.

Stuart Utility Service Area

The first step in the validation process was to take the 1983 existing and committed housing units by land use type and adjust them to the 1980 level. After completing this task it was simply a matter of applying the water use factors presented in Section IV in order to estimate water demand. These estimates were then adjusted to utility demands, taking into account both potable and non-potable self supplied. A summary of the residential water demands is shown in Table 8.

The non-residential water demands were calculated by first adjusting the 1983 existing and committed acreage to 1980 acreage. To make this adjustment it was assumed that the 1980 non-residential level of development would be the same percentage of 1983 existing and committed as was residential (i.e. 84.7%). This assumption was made because the 1980 housing unit data was based on census data and there was no real data for 1980 non-residential acres. Potable and non-potable water use factors from Section IV were applied to the 1980 acreage figures in order to estimate non-residential water demand. These demands were then adjusted to utility demands. Non-residential water demands are summarized in Table 9.

The final step was to add residential and non-residential utility demands and compare that total with the actual pumpage figure for the Stuart utility for 1980 (i.e,. 887.7 million gallons). The model estimates utility pumpage to be 1324.4 million gallons and at first it appears that the validity of the model is questionable. This discrepancy actually points out the effect of some of the planning assumptions regarding occupancy rate and persons per unit.

According to the 1980 census the occupancy rate for the city of Stuart was 80.5% and the average persons per unit was 1.8. If these factors were used with the housing unit data, utility potable water demand would decrease from 696.5 million gallons (mg) to 445.9 mg, which would reduce estimated pumpage for 1980 to 1073.8 mg.

TABLE 8

Estimated Residential Water Demand
Stuart Service Area 1980
(million gallons)

Land Use	Units	Population	Potable (mg)	Non-potable (mg)
Estate	127	368	13.5	66.1
Low	2,588	7,502	274.6	345.8
Medium	488	1,357	49.7	67.5
Mobile	447	894	32.7	10.3
High	4,617	10,281	376.3	173.1
Comm. Off. Res.	99	198	7.3	3.7
Waterfront	38	76	2.8	1.4
Totals	8,404	20,676	756.9	667.9

Adjusted Potable: 756.9 - 60.4[1] = 696.5 mg
Adjusted non-potable: = 89.9 mg

Residential Utility Demand: = 786.4 mg

[1]private wells demand

TABLE 9

Estimated Non-residential Water Demand
Stuart Service Area 1980
(million gallons)

Land Use	Acres	Potable Demand	Non-potable Demand
General	333.7	238.8	210.7
Limited	6.6	3.9	3.1
Comm. Off. Res.	54.2	25.9	34.2
Waterfront	7.3	8.7	2.3
Institutional	268.1	132.5	87.6
Industrial	148.7	70.9	46.9
Totals	818.6	480.7	381.8

Non-residential Potable Demand = 480.7 mg
Adjusted Non-potable Demand = 57.3 mg

Non-residential Utility Demand = 538.0 mg

Another source of error involved using information contained in the Martin County Comprehensive Plan regarding open space requirements and maximum building cover for non-residential development. This was a problem because the majority of the development that existed in 1980 was developed without such a plan and most likely would not conform to the present planning guidelines. Because there was very little real data about 1980 non-residential water use, it was difficult to adjust the non-residential water demand estimates for 1980.

The problem is that the model is designed to estimate future water demands for Martin County, which will be dominated by "new" development constructed under the guidelines of the Comprehensive Plan, making it difficult to adjust the model for the non-residential development for 1980. The second sub-area chosen had less non-residential acres and should therefore be a better area to use for validation purposes.

Hydratech, Intracoastal, Hobe Sound, and Miles Grant Service Area

The same procedure used for Stuart was used for this area, beginning with the residential demands which are summarized in Table 10. A minor difference in this area is that the residential potable demands were adjusted for small systems as well as private wells. The Stuart area did not contain any small systems.

Non-residential water demands were calculated using the same procedure as described previously. It was determined from the residential data that this area was 70% developed in regards to 1983 existing and committed development, therefore 70% of the 1983 existing and committed non-residential acres were assumed to be developed in 1980. A summary of the non-residential water demands is shown in Table 11.

TABLE 10

Estimated Residential Water Demand
Hydratech, Intracoastal, etc. Service Area
(million gallons)

Land Use	Units	Population	Potable (mg)	Non-potable (mg)
Rural	360	1,044	38.2	173.5
Estate	1,153	3,344	122.4	600.4
Low	3,749	10,300	377.0	501.0
Medium	1,610	4,141	151.6	222.8
Mobile	1,244	2,488	91.1	28.7
High	264	528	19.3	9.9
Comm. Off. Res.	7	14	.5	.3
Waterfront	9	18	.7	.3
Totals	8,396	21,877	800.8	1500.9

Adjusted potable: 800.8 - 399.5[1] - 88.4[2] = 312.9 mg
Adjusted non-potable: = 110.4 mg

Residential Utility Demand: = 423.3 mg

[1]private wells demand

[2]small systems demand

TABLE 11

Estimated Non-residential Water Demand
Hydratech, Intracoastal, etc. Service area
(million gallons)

Land Use	Acres	Potable Demand	Non-Potable Demand
General	122.2	87.4	77.1
Limited	25.8	15.4	12.2
Comm. Off. Res.	8.4	6.3	5.3
Waterfront	16.6	12.5	10.5
Institutional	136.6	57.0	76.0
Industrial	240.8	114.9	43.1
Totals	550.4	293.5	224.2

Non-residential Potable Demand = 293.5 mg
Adjusted Non-potable Demand = 33.6 mg

Non-residential Utility Demand = 327.1 mg

Residential and non-residential utility demands were then added together and compared to the annual pumpage figure for the combined service areas for 1980 (i.e., 600.5 mg). The estimated pumpage for the area for 1980 was 750.4 mg. Once again the estimated value is larger than the actual pumpage, but this can partially be attributed to historical deviations from the planning assumptions about occupancy rate and persons per household.

According to the 1980 census the occupancy rate for Martin County was 76% and the persons per unit was 2.03. Incorporating these factors into the residential demand estimates leads to a decrease in utility potable water demand from 312.9 mg to 173.3 mg, which would reduce estimated pumpage for 1980 to 610.8 mg.

This validation process has made apparent that the model cannot be used as is for ex post forecasting. The main reason for this relates to the assumptions made by the Martin County Planning Department regarding occupancy rate and persons per unit. These assumptions lead to a maximum estimate of population, which for future considerations may be a safe approach, but using these assumptions for historic projections introduces an upward bias, making it difficult to evaluate the accuracy of the model.

VI. SUMMARY, CONCLUSION, AND SUGGESTIONS FOR FUTURE RESEARCH

The water demand model presented in this report was developed to estimate water demand for Martin County for 1983 existing and committed, and buildout. The model uses population, housing unit, and land use data provided by the Martin County Planning Department to generate estimates of residential potable and non-potable water demand, and non-residential potable and non-potable water demand.

Prior to designing the model it was necessary to review historic water use characteristics of Martin County. It was found that in the past Martin County has had a relatively large percentage of users which were self supplied (40%) or connected to small systems (10%), leaving only 50% of the water users connected to large utility systems. The Planning Department expects this supply structure to change, with the trend leading toward the majority of users connecting to a large utility system. This was an important consideration because the demand estimates were adjusted to represent utility demand and then used as input to the Hydrogeology Division's groundwater flow model which evaluates the impact of withdrawals from central wellfields on water levels.

As it turned out, the review of historical development patterns for Martin County made it apparent that past and future development in the area are expected to be quite different, thus making it difficult to relate future water use to historic water use. With this, it was necessary to make extensive use of the various provisions in the County's Comprehensive Plan which establish guidelines for present and future development.

The data provided by the Planning Department suggest that Martin County will experience considerable growth. The present population of Martin County is 77,519 (estimated as of April 1, 1984) and is projected to grow more than 325% reaching almost 330,000 by buildout. Population projections for the County were based upon housing unit data and persons per unit factors of 2.9 and 2.0 for single-family and multi-family housing units respectively. The Martin County Planning Department assumed 100% occupancy, thus making the population projections a maximum estimate of population based on the housing unit data.

Water demands were estimated using the aforementioned population projections, as well as housing unit and land use data. The projected utility urban water demand for 1983 existing and committed was 20.9 million gallons per day (mgd) and 55.9 mgd for buildout. It should be emphasized that, due to the planning assumptions made about persons per household and occupancy rate, these demands represent maximum demands. It may be useful to use more historically based assumptions, especially regarding occupancy rate, and evaluate the impact this has on the demand estimates.

A final topic of interest which would affect water availability in Martin County is wastewater reuse. At this time Martin County has yet to format a structured policy regarding the future of wastewater reuse in the area. Due to this limiting factor it was only possible to consider potential wastewater reuse in a general fashion, looking mainly at the relationship between potential supply and demand. This analysis is presented in Appendix D.

APPENDIX A

POPULATION, HOUSING UNIT, AND NON-RESIDENTIAL ACREAGE DATA

TABLE A.1
ESTIMATED HOUSING UNIT DISTRIBUTION
EXISTING AND COMMITTED (1983)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	SINGLE FAMILY	MULTI FAMILY	POPULATION
1	0	0	1	47	52	0	0	0	0	100	0	290
2	0	0	11	0	106	0	0	0	0	11	106	244
3	0	0	0	835	85	115	0	3	10	711	337	2736
4	0	0	38	9	789	0	905	2	6	71	1678	3562
5	0	0	70	839	326	386	264	84	44	909	1104	4844
6	0	0	36	782	19	274	0	3	0	818	296	2964
7	0	0	617	476	80	168	0	11	0	1093	259	3688
8	0	0	462	380	16	0	1113	19	0	842	1148	4738
9	0	0	0	77	31	0	101	9	0	108	110	533
10	0	0	28	321	282	204	0	32	28	349	546	2104
11	0	0	0	191	0	0	77	7	0	191	84	722
12	0	0	1	284	80	0	30	0	0	365	30	1119
13	0	0	71	200	38	0	2109	73	0	706	1785	5617
14	0	0	526	0	0	0	0	0	0	526	0	1525
15	0	0	394	51	1500	0	140	0	0	394	1691	4525
16	0	0	55	260	37	0	303	7	2	315	349	1612
17	0	0	0	491	28	0	66	0	0	491	94	1612
18	0	0	0	387	199	0	232	11	0	586	243	2185
19	0	0	0	219	0	138	488	0	0	219	626	1887
2021	0	0	0	388	0	0	1492	11	0	855	1036	4552
22	0	0	0	91	75	364	274	3	36	363	480	2013
23	0	0	0	0	0	0	913	0	0	98	815	1914
24	0	0	0	0	774	0	47	0	0	689	132	2262
25	0	0	428	13	3	3	3	0	1	428	23	1287
26	0	0	331	1742	110	0	16	0	20	1309	910	5616
27	0	0	0	0	354	329	96	6	0	354	431	1889
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	392	358	0	0	0	0	750	0	2175
30	0	73	394	541	31	460	0	5	0	1008	496	3915
31	0	0	238	1267	487	0	0	0	4	238	1758	4206
32	0	430	1108	4503	0	0	0	0	0	4263	1778	15919
33	0	0	264	7	0	0	0	0	0	264	7	780
34	0	0	370	337	0	0	0	0	0	370	337	1747
35	0	0	0	203	1	0	0	0	1	203	2	593
36	0	0	19	572	95	0	0	11	0	591	106	1926
37	0	48	378	10	0	0	0	0	0	426	10	1255
38	0	7	4	123	0	346	0	0	0	134	346	1081
39	0	0	0	216	25	61	0	0	0	241	61	821
40	0	0	0	622	321	0	347	9	0	622	677	3158
41	0	0	0	1197	0	0	0	0	0	257	940	2625
42	0	0	179	521	0	0	0	0	0	221	479	1599
43	0	0	0	1313	431	1016	92	1	0	1313	1540	6888
44	0	0	431	73	0	0	0	0	0	431	73	1396
45	0	400	0	0	0	0	0	0	0	400	0	1160
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	403	0	0	0	0	0	362	41	1132
48	0	63	0	0	0	0	0	0	0	33	30	156
49	10	18	266	0	0	2	0	10	1	121	186	723
50	0	0	260	813	0	0	369	0	0	1036	406	3816
96	3	0	42	299	222	50	0	0	0	528	88	1707
97	0	0	16	26	433	0	0	0	31	364	142	1340
98	0	0	0	0	0	0	0	0	0	0	0	0
99	42	60	0	0	0	133	0	0	0	235	0	682
100	0	54	321	0	0	836	0	0	42	375	878	2844
TOTALS	55	1153	7359	21521	7388	4885	9477	317	226	27687	24694	129680

TABLE A.2
ESTIMATED HOUSING UNIT DISTRIBUTION
BUILDOUT

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	SINGLE FAMILY	MULTI FAMILY	POPULATION
1	0	0	89	1544	594	0	0	33	0	372	1888	4855
2	0	39	1498	252	1351	0	0	0	0	1537	1603	7663
3	0	0	149	1386	85	218	0	3	40	912	969	4583
4	0	0	356	92	1295	0	905	2	47	389	2308	5744
5	0	0	94	903	457	386	264	102	44	933	1317	5340
6	0	0	36	1306	129	479	0	152	0	823	1279	4945
7	0	0	617	3078	921	1063	697	160	0	1260	5276	14206
8	0	0	462	380	96	0	1237	85	0	842	1418	5278
9	0	0	0	77	31	0	225	49	0	108	274	861
10	0	0	50	353	282	237	0	112	28	371	691	2458
11	0	0	0	191	0	0	77	7	0	191	84	722
12	0	0	1	325	80	0	30	0	0	365	71	1201
13	0	0	71	200	38	0	2109	73	0	706	1785	5617
14	0	0	800	0	0	0	0	0	0	800	0	2320
15	0	0	394	118	1500	0	140	0	0	461	1691	4719
16	0	0	55	334	37	0	369	7	2	315	489	1892
17	0	0	0	636	28	0	104	0	0	491	277	1978
18	0	0	0	396	215	0	255	11	0	586	291	2281
19	0	0	0	219	0	138	1146	0	0	219	1284	3203
2021	0	0	0	388	0	0	1492	11	30	855	1066	4612
22	0	0	0	1845	145	364	274	3	36	1188	1479	6403
23	0	0	0	0	42	0	913	0	0	98	857	1998
24	0	0	0	0	1077	0	47	0	0	909	215	3066
25	0	0	428	125	11	10	10	0	2	508	78	1629
26	0	0	331	2161	342	0	23	10	33	1728	1172	7355
27	0	0	0	0	765	329	289	246	0	354	1275	3577
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	170	3503	458	0	0	537	0	1020	3648	10254
30	0	407	686	1473	31	460	280	77	0	2244	1170	8848
31	0	0	783	4565	487	0	0	164	57	872	5184	12897
32	0	674	1134	4733	0	0	0	215	0	4533	2223	17592
33	0	0	897	141	0	0	0	0	0	897	141	2883
34	0	0	613	415	0	0	0	0	0	613	415	2608
35	0	0	0	203	1	0	0	7	1	203	9	607
36	0	0	236	1675	175	0	0	110	0	808	1388	5119
37	0	1144	977	1443	0	0	0	122	0	2121	1565	9281
38	293	1787	4259	2827	0	346	0	0	0	6462	3050	24840
39	0	646	0	10329	25	61	0	305	0	1927	9439	24466
40	0	0	0	773	956	0	456	146	0	1332	999	5861
41	0	0	0	1252	779	0	0	0	0	257	1774	4293
42	0	0	2061	1598	0	0	0	0	0	2103	1556	9211
43	0	0	154	2588	2396	1059	92	171	0	2484	3976	15156
44	0	0	1244	88	0	0	0	32	0	1066	298	3687
45	0	550	0	0	0	0	0	0	0	550	0	1595
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	14	2162	0	0	0	109	0	1811	474	6200
48	0	213	0	0	0	0	0	0	0	183	30	591
49	66	113	501	0	0	2	0	17	31	507	223	1916
50	0	111	574	999	0	0	369	0	0	1508	545	5463
96	264	1601	926	4615	574	998	1143	0	0	7590	2531	27073
97	0	0	767	540	1273	0	0	0	31	1409	1202	6490
98	0	0	0	0	0	0	0	0	0	0	0	0
99	959	60	0	0	0	133	0	0	0	1097	55	3291
100	28	268	2627	0	0	961	0	0	235	2923	1196	10869
TOTALS	1610	7613	24054	62231	16676	7244	12946	3078	617	63841	72228	329595

TABLE A.3
DEVELOPED NON-RESIDENTIAL ACRES
EXISTING AND COMMITTED (1983)

TAZ	GENERAL	LIMITED	COR	WATER	INDUST.	INSTIT.	TOTAL
1	101	0	0	0	0	0	101
2	42.3	0	0	0	0	0	42.3
3	34.9	54.2	1.9	5.9	9.2	0	106.1
4	12.9	22.5	1	2.8	0	47.1	86.3
5	23.2	17	36.3	19.3	0	86.1	181.9
6	23.9	0	3.4	0	0	17.9	45.2
7	41	0	13.5	0	27.5	0.2	82.2
8	34.9	0	9.7	0	0	8.3	52.9
9	15	0	15.2	0	17.5	0	47.7
10	15.9	8.8	13.7	11.9	9.1	0	59.4
11	0	0	27.7	0	0	22.4	50.1
12	2.8	0	0.7	0	0	3.2	6.7
13	3.5	0	37.8	0	0	0	41.3
14	9.8	0	0	0	0	12.2	22
15	0	0	0	0	0	10.5	10.5
16	17	0	6.5	2.1	6	0	31.6
17	0	0	0	0	0	83.8	83.8
18	0	0	21.2	0	13.7	111.7	146.6
19	185.2	0	0	0	56.3	17.4	258.9
2021	77.2	0	18.1	0	0	6.4	101.7
22	18.8	7.8	1.1	15.1	0	62.4	105.2
23	75.6	0	0	0	82.5	27.5	185.6
24	27.9	0	0	0	4.6	71.6	104.1
25	17.9	0	1.6	21.7	0	16.5	57.7
26	0	0	0	25.7	0	2	27.7
27	25	11.4	3.7	0	73.4	28.5	142
28	9.9	0	0	0	251.3	0	261.2
29	7.8	0	18.3	0	0	0	26.1
30	15.5	2.1	4.7	0	0	29.3	51.6
31	9.4	0	0	3.1	0	0	12.5
32	0	0	0	0	52.2	0	52.2
33	0	0	0	0	0	40.3	40.3
34	0	0	0	0	0	0	0
35	5.3	0	1	15.6	0	0	21.9
36	20.9	6	22.5	0	7.6	17.5	74.5
37	0	0	0	0	0	0	0
38	0	0	0	0	0	1	1
39	0	6	1.7	0	0	0	7.7
40	22.8	0	16.7	0	14.7	0	54.2
41	0	0	0	0	0	0	0
42	0	0	0	0	0	65.2	65.2
43	58.6	6.8	1.8	0	0	1.3	68.5
44	10.1	0	0	0	0	10.1	20.2
45	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0
47	2.4	18.6	0	0	0	0	21
48	0	0	0	0	3	0	3
49	0	0	34.6	4.1	0	0	38.7
50	0	0	0	0	0	0	0
96	38.1	0	0	0	0	41.8	79.9
97	62.8	0	0	24.8	329.7	29.2	446.5
98	0	0	0	0	41.3	0	41.3
99	0	0	0	0	0	0	0
100	1.8	0	0	38.5	0	0	40.3
TOTALS	1071.1	161.2	314.4	190.6	999.6	2605.7	5342.6

TABLE A.4
DEVELOPED NON-RESIDENTIAL ACRES
BUILDOUT

TAZ	GENERAL	LIMITED	CDR	WATER	INDUST.	INSTIT.	TOTAL
1	123	0	7.3	0	0	16.5	146.8
2	58.8	0	0	0	0	66.1	124.9
3	34.9	54.2	1.9	11.9	9.2	71.8	183.9
4	26.7	22.5	1	11.1	0	107.3	168.6
5	25.2	17	39.9	19.3	0	86.1	187.5
6	31.3	0	33.2	0	0	17.9	82.4
7	101.8	0	43.4	0	134	3	282.2
8	38.6	0	22.9	0	0	8.3	69.8
9	75.5	0	23.3	0	28.1	0	126.9
10	20.3	8.8	29.7	11.9	11.1	0	81.8
11	0	0	27.7	0	0	22.4	50.1
12	2.8	0	0.7	0	0	3.2	6.7
13	3.5	0	42.8	0	0	0	46.3
14	9.8	0	0	0	0	12.2	22
15	0	0.7	0	0	0	19.4	20.1
16	20.9	0	6.5	2.1	6	0	35.5
17	0	0	0	0	0	83.8	83.8
18	0	0	21.2	0	13.7	111.7	146.6
19	209.7	0	0	0	64.6	23.2	297.5
2021	77.2	0	18.1	6	0	6.4	107.7
22	43.6	7.8	1.1	15.1	0	62.4	130
23	96.7	0	25.8	0	97.3	84	303.8
24	36	0	0	0	4.6	71.6	112.2
25	19	0	3.9	21.7	0	19	63.6
26	0	0	2.1	26.7	0	16.7	45.5
27	55.2	15.4	51.8	0	97.3	28.5	248.2
28	9.9	0	0	0	406.3	0	416.2
29	43.9	0	125.7	0	0	0	169.6
30	60.7	9.4	19.2	0	0	72.8	162.1
31	25.1	0	29.1	13.7	0	0	67.9
32	36.8	0	43	0	125.7	38.6	244.1
33	0	0	0	0	0	40.3	40.3
34	0	0	0	0	0	0	0
35	5.3	0	2.5	15.6	0	34	57.4
36	39.8	6.5	42.3	0	16.5	30.6	135.7
37	19.7	0	24.4	0	0	35.9	80
38	3	0	0	0	0	52.4	55.4
39	2.8	23.1	62.8	0	0	0	88.7
40	26	8	44.1	0	14.7	0	92.8
41	14.7	0	0	0	0	0	14.7
42	0	0	0	0	0	113.8	113.8
43	96.6	30.8	35.8	0	0	1.3	164.5
44	10.1	0	6.4	0	0	31	47.5
45	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0
47	2.4	38.3	21.9	0	0	0	62.6
48	0	0	0	0	182.8	98.1	280.9
49	0	0	36	10.1	0	0	46.1
50	0	0	0	0	0	0	0
96	104.1	0	0	0	0	41.8	145.9
97	125.9	0	0	24.8	1594.4	29.2	1774.3
98	0	0	0	0	652.9	0	652.9
99	0	0	0	0	0	71.6	71.6
100	18.4	45.5	2.4	77.1	0	0	143.4
TOTALS	1755.7	288	899.9	267.1	3459.2	1632.9	8302.8

APPENDIX B

ESTIMATED WATER DEMAND
1983 EXISTING AND COMMITTED AND BUILDOUT

TABLE B.1
ESTIMATED RESIDENTIAL WATER DEMAND 1983 EXISTING AND COMMITTED (MGY)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	NONPOT.	POP.	POTABLE	TOTAL
1	0.000	0.000	0.520	6.376	7.233	0.000	0.000	0.000	0.000	14.129	290	10.585	24.714
2	0.000	0.000	5.728	0.000	17.654	0.000	0.000	0.000	0.000	23.382	244	8.902	32.284
3	0.000	0.000	0.000	112.087	11.763	2.652	0.000	0.112	0.375	126.989	2736	99.860	226.850
4	0.000	0.000	18.942	1.504	117.571	0.000	35.574	0.088	0.264	173.944	3562	130.009	303.953
5	0.000	0.000	36.450	112.116	45.556	8.830	9.991	3.179	1.665	217.787	4844	176.810	394.597
6	0.000	0.000	18.705	107.304	2.629	6.318	0.000	0.112	0.000	135.070	2964	108.193	243.263
7	0.000	0.000	303.991	84.098	11.071	3.874	0.000	0.412	0.000	403.447	3688	134.601	538.049
8	0.000	0.000	240.014	52.241	2.261	0.000	40.535	0.833	0.000	335.884	4738	172.930	508.813
9	0.000	0.000	0.000	10.290	4.290	0.000	3.785	0.337	0.000	18.702	533	19.462	38.164
10	0.000	0.000	14.580	42.895	39.026	4.704	0.000	1.199	1.049	103.454	2104	76.800	180.254
11	0.000	0.000	0.000	25.523	0.000	0.000	2.886	0.262	0.000	28.672	722	26.349	55.021
12	0.000	0.000	0.521	37.951	11.071	0.000	1.124	0.000	0.000	50.667	1119	40.825	91.492
13	0.000	0.000	36.970	26.726	5.259	0.000	74.715	3.105	0.000	146.776	5617	205.035	351.811
14	0.000	0.000	271.463	0.000	0.000	0.000	0.000	0.000	0.000	271.463	1525	55.677	327.140
15	0.000	0.000	192.816	9.116	206.501	0.000	4.623	0.000	0.000	413.055	4525	165.148	578.203
16	0.000	0.000	28.639	34.744	5.120	0.000	11.356	0.262	0.075	80.197	1612	58.820	139.017
17	0.000	0.000	0.000	65.612	3.875	0.000	2.474	0.000	0.000	71.961	1612	58.834	130.795
18	0.000	0.000	0.000	51.715	27.540	0.000	8.695	0.412	0.000	88.362	2185	79.767	168.129
19	0.000	0.000	0.000	29.265	0.000	3.796	16.636	0.000	0.000	49.696	1887	68.879	118.575
2021	0.000	0.000	0.000	51.848	0.000	0.000	55.920	0.412	0.000	108.181	4552	166.130	274.311
22	0.000	0.000	0.000	12.160	10.379	8.394	10.270	0.112	1.349	42.665	2013	73.464	116.128
23	0.000	0.000	0.000	0.000	0.000	0.000	30.847	0.000	0.000	30.847	1914	69.868	100.716
24	0.000	0.000	0.000	0.000	106.955	0.000	1.762	0.000	0.000	108.716	2262	82.567	191.283
25	0.000	0.000	222.864	1.737	0.415	0.069	0.112	0.000	0.037	225.235	1287	46.983	272.218
26	0.000	0.000	172.006	265.384	15.821	0.000	0.594	0.000	0.912	454.717	5616	204.988	659.705
27	0.000	0.000	0.000	0.000	48.990	7.277	3.778	0.236	0.000	60.281	1889	68.934	129.215
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
29	0.000	0.000	0.000	66.028	53.919	0.000	0.000	0.000	0.000	119.947	2175	79.388	199.335
30	0.000	29.031	202.494	84.025	4.290	10.608	0.000	0.187	0.000	330.635	3915	142.905	473.540
31	0.000	0.000	123.929	249.190	70.193	0.000	0.000	0.000	0.207	443.519	4206	153.526	597.045
32	0.000	195.130	542.935	849.292	0.000	0.000	0.000	0.000	0.000	1587.357	15919	581.033	2168.390
33	0.000	0.000	136.299	0.935	0.000	0.000	0.000	0.000	0.000	137.235	780	28.455	165.690
34	0.000	0.000	190.958	60.237	0.000	0.000	0.000	0.000	0.000	251.194	1747	63.766	314.960
35	0.000	0.000	0.000	29.960	0.138	0.000	0.000	0.000	0.037	30.136	593	21.634	51.770
36	0.000	0.000	9.887	77.024	13.147	0.000	0.000	0.412	0.000	100.471	1926	70.295	170.766
37	0.000	20.913	188.144	1.336	0.000	0.000	0.000	0.000	0.000	210.394	1255	45.822	256.216
38	0.000	2.673	2.083	16.436	0.000	10.205	0.000	0.000	0.000	31.397	1081	39.442	70.839
39	0.000	0.000	0.000	32.582	3.611	1.407	0.000	0.000	0.000	37.600	821	29.963	67.563
40	0.000	0.000	0.000	102.819	46.300	0.000	12.268	0.452	0.000	161.839	3158	115.260	277.099
41	0.000	0.000	0.000	228.796	0.000	0.000	0.000	0.000	0.000	228.796	2625	95.823	324.620
42	0.000	0.000	91.622	105.442	0.000	0.000	0.000	0.000	0.000	197.064	1599	58.360	255.424
43	0.000	0.000	0.000	183.855	60.243	23.238	3.483	0.038	0.000	270.856	6888	251.401	522.257
44	0.000	0.000	219.533	9.755	0.000	0.000	0.000	0.000	0.000	229.288	1396	50.950	280.238
45	0.000	155.689	0.000	0.000	0.000	0.000	0.000	0.000	0.000	155.689	1160	42.340	198.029
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
47	0.000	0.000	0.000	53.853	0.000	0.000	0.000	0.000	0.000	53.853	1132	41.311	95.164
48	0.000	24.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24.055	156	5.683	29.738
49	4.921	7.465	133.237	0.000	0.000	0.041	0.000	0.442	0.047	146.153	723	26.386	172.539
50	0.000	0.000	135.385	108.706	0.000	0.000	13.830	0.000	0.000	257.921	3816	139.299	397.219
96	1.374	0.000	21.727	43.222	31.566	1.128	0.000	0.000	0.000	99.017	1707	62.313	161.330
97	0.000	0.000	8.277	3.756	61.565	0.000	0.000	0.000	1.193	74.792	1340	48.895	123.688
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
99	19.799	24.020	0.000	0.000	0.000	2.903	0.000	0.000	0.000	46.722	682	24.875	71.596
100	0.000	21.599	164.662	0.000	0.000	25.520	0.000	0.000	2.098	213.878	2844	103.788	317.666
TOTALS	26.094	480.573	3735.381	3447.942	1045.954	120.964	345.261	12.609	9.310	9224.087	129680	4733.331	13957.418

TABLE B.2
ESTIMATED NON-RESIDENTIAL POTABLE WATER DEMAND
EXISTING AND COMMITTED-1983 (MGY)

TAZ	GENERAL	LIMITED	COR	WATER	INDUST.	INSTIT.	TOTAL
1	72.263	0.000	0.000	0.000	0.000	0.000	72.263
2	30.265	0.000	0.000	0.000	0.000	0.000	30.265
3	24.970	32.316	0.906	7.035	4.388	0.000	69.616
4	9.230	13.415	0.477	3.339	0.000	19.658	46.118
5	16.599	10.136	17.314	23.014	0.000	35.935	102.998
6	17.100	0.000	1.622	0.000	0.000	7.471	26.192
7	29.334	0.000	6.439	0.000	13.117	0.083	48.974
8	24.970	0.000	4.627	0.000	0.000	3.464	33.061
9	10.732	0.000	7.250	0.000	8.347	0.000	26.329
10	11.376	5.247	6.535	14.190	4.341	0.000	41.688
11	0.000	0.000	13.212	0.000	0.000	9.349	22.561
12	2.003	0.000	0.334	0.000	0.000	1.336	3.673
13	2.504	0.000	18.030	0.000	0.000	0.000	20.534
14	7.012	0.000	0.000	0.000	0.000	5.092	12.103
15	0.000	0.000	0.000	0.000	0.000	4.382	4.382
16	12.163	0.000	3.100	2.504	2.862	0.000	20.629
17	0.000	0.000	0.000	0.000	0.000	34.975	34.975
18	0.000	0.000	10.112	0.000	6.535	46.619	63.266
19	132.506	0.000	0.000	0.000	26.854	7.262	166.622
2021	55.234	0.000	8.634	0.000	0.000	2.671	66.539
22	13.451	4.651	0.525	18.006	0.000	26.043	62.675
23	54.090	0.000	0.000	0.000	39.351	11.477	104.918
24	19.962	0.000	0.000	0.000	2.194	29.883	52.039
25	12.807	0.000	0.763	25.876	0.000	6.886	46.333
26	0.000	0.000	0.000	30.646	0.000	0.835	31.481
27	17.887	6.797	1.765	0.000	35.010	11.895	73.354
28	7.083	0.000	0.000	0.000	119.866	0.000	126.949
29	5.581	0.000	8.729	0.000	0.000	0.000	14.309
30	11.090	1.252	2.242	0.000	0.000	12.229	26.812
31	6.725	0.000	0.000	3.697	0.000	0.000	10.422
32	0.000	0.000	0.000	0.000	24.898	0.000	24.898
33	0.000	0.000	0.000	0.000	0.000	16.820	16.820
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	3.792	0.000	0.477	18.602	0.000	0.000	22.871
36	14.953	3.577	10.732	0.000	3.625	7.304	40.192
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000	0.417	0.417
39	0.000	3.577	0.811	0.000	0.000	0.000	4.388
40	16.313	0.000	7.966	0.000	7.012	0.000	31.290
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	27.212	27.212
43	41.927	4.054	0.859	0.000	0.000	0.543	47.382
44	7.226	0.000	0.000	0.000	0.000	4.215	11.442
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.717	11.090	0.000	0.000	0.000	0.000	12.807
48	0.000	0.000	0.000	0.000	1.431	0.000	1.431
49	0.000	0.000	16.504	4.889	0.000	0.000	21.393
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	27.260	0.000	0.000	0.000	0.000	17.446	44.705
97	44.932	0.000	0.000	29.573	157.261	12.187	243.952
98	0.000	0.000	0.000	0.000	19.699	0.000	19.699
99	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	1.288	0.000	0.000	45.910	0.000	0.000	47.197
TOTALS	766.343	96.112	149.963	227.282	476.791	363.687	2080.178

TABLE B.3
ESTIMATED NON-RESIDENTIAL NON-POTABLE WATER DEMAND
EXISTING AND COMMITTED-1983 (MGY)

TAZ	GENERAL	LIMITED	COR	WATER	INDUST.	INSTIT.	TOTAL
1	63.764	0.000	0.000	0.000	0.000	0.000	63.764
2	26.705	0.000	0.000	0.000	0.000	0.000	26.705
3	22.033	25.664	1.200	1.862	2.904	0.000	53.663
4	8.144	10.654	0.631	0.884	0.000	14.868	35.181
5	14.647	8.049	22.917	6.092	0.000	27.179	78.885
6	15.089	0.000	2.147	0.000	0.000	5.650	22.886
7	25.885	0.000	8.523	0.000	8.681	0.063	43.151
8	22.033	0.000	6.124	0.000	0.000	2.620	30.777
9	9.470	0.000	9.596	0.000	5.524	0.000	24.590
10	10.038	4.167	8.649	3.756	2.873	0.000	29.483
11	0.000	0.000	17.488	0.000	0.000	7.071	24.559
12	1.768	0.000	0.442	0.000	0.000	1.010	3.220
13	2.210	0.000	23.864	0.000	0.000	0.000	26.074
14	6.187	0.000	0.000	0.000	0.000	3.851	10.038
15	0.000	0.000	0.000	0.000	0.000	3.314	3.314
16	10.733	0.000	4.104	0.663	1.894	0.000	17.393
17	0.000	0.000	0.000	0.000	0.000	26.453	26.453
18	0.000	0.000	13.384	0.000	4.325	35.260	52.969
19	116.923	0.000	0.000	0.000	17.772	5.493	140.187
2021	48.739	0.000	11.427	0.000	0.000	2.020	62.286
22	11.869	3.693	0.694	4.767	0.000	19.698	40.721
23	47.729	0.000	0.000	0.000	26.042	8.681	82.452
24	17.614	0.000	0.000	0.000	1.452	22.602	41.668
25	11.301	0.000	1.010	6.850	0.000	5.208	24.369
26	0.000	0.000	0.000	8.113	0.000	0.631	8.744
27	15.783	5.398	2.336	0.000	23.170	8.996	55.683
28	6.250	0.000	0.000	0.000	79.327	0.000	85.577
29	4.924	0.000	11.553	0.000	0.000	0.000	16.478
30	9.786	0.994	2.967	0.000	0.000	9.249	22.996
31	5.935	0.000	0.000	0.979	0.000	0.000	6.913
32	0.000	0.000	0.000	0.000	16.478	0.000	16.478
33	0.000	0.000	0.000	0.000	0.000	12.721	12.721
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	3.346	0.000	0.631	4.924	0.000	0.000	8.902
36	13.195	2.841	14.205	0.000	2.399	5.524	38.164
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000	0.316	0.316
39	0.000	2.841	1.073	0.000	0.000	0.000	3.914
40	14.394	0.000	10.543	0.000	4.640	0.000	29.578
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	20.581	20.581
43	36.996	3.220	1.136	0.000	0.000	0.410	41.763
44	6.376	0.000	0.000	0.000	0.000	3.188	9.565
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.515	8.807	0.000	0.000	0.000	0.000	10.322
48	0.000	0.000	0.000	0.000	0.947	0.000	0.947
49	0.000	0.000	21.844	1.294	0.000	0.000	23.138
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	24.054	0.000	0.000	0.000	0.000	13.195	37.249
97	39.648	0.000	0.000	7.828	104.075	9.217	160.768
98	0.000	0.000	0.000	0.000	13.037	0.000	13.037
99	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	1.136	0.000	0.000	12.153	0.000	0.000	13.289
TOTALS	676.219	76.328	198.490	60.166	315.539	275.071	1601.812

TABLE B.4
ESTIMATED RESIDENTIAL WATER DEMAND-BUILDOUT (MGY)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	NONPOT.	POP.	POTABLE	TOTAL
1	0.000	0.000	43.564	277.542	77.932	0.000	0.000	1.794	0.000	400.832	4855	177.200	578.032
2	0.000	17.778	733.079	45.647	180.052	0.000	0.000	0.000	0.000	976.556	7663	279.710	1256.266
3	0.000	0.000	72.882	211.895	11.763	6.173	0.000	0.112	2.005	304.851	4583	167.272	472.104
4	0.000	0.000	174.489	16.538	183.574	0.000	35.574	0.088	2.493	412.756	5744	209.660	622.415
5	0.000	0.000	48.189	123.709	62.643	8.830	9.991	4.157	1.665	259.185	5340	194.899	454.084
6	0.000	0.000	18.705	202.221	16.978	13.327	0.000	8.211	0.000	259.442	4945	180.482	439.924
7	0.000	0.000	303.991	555.425	120.771	34.474	20.206	8.510	0.000	1043.378	14206	518.519	1561.897
8	0.000	0.000	240.014	52.241	12.696	0.000	44.130	4.420	0.000	353.501	5278	192.640	546.141
9	0.000	0.000	0.000	10.290	4.290	0.000	7.380	2.511	0.000	24.471	861	31.434	55.905
10	0.000	0.000	25.341	48.692	39.026	5.833	0.000	5.547	1.049	125.488	2458	89.713	215.201
11	0.000	0.000	0.000	25.523	0.000	0.000	2.886	0.262	0.000	28.672	722	26.349	55.021
12	0.000	0.000	0.521	45.378	11.071	0.000	1.124	0.000	0.000	58.094	1201	43.818	101.912
13	0.000	0.000	36.970	26.726	5.259	0.000	74.715	3.105	0.000	146.776	5617	205.035	351.811
14	0.000	0.000	405.487	0.000	0.000	0.000	0.000	0.000	0.000	405.487	2320	84.680	490.167
15	0.000	0.000	192.816	21.252	206.501	0.000	4.623	0.000	0.000	425.192	4719	172.240	597.432
16	0.000	0.000	28.639	48.148	5.120	0.000	13.270	0.262	0.075	95.515	1892	69.040	164.554
17	0.000	0.000	0.000	91.878	3.875	0.000	3.575	0.000	0.000	99.328	1978	72.193	171.521
18	0.000	0.000	0.000	53.345	29.627	0.000	9.362	0.412	0.000	92.746	2281	83.271	176.017
19	0.000	0.000	0.000	29.265	0.000	3.796	35.711	0.000	0.000	68.772	3203	116.913	185.685
2021	0.000	0.000	0.000	51.848	0.000	0.000	55.920	0.412	1.631	109.811	4612	168.320	278.131
22	0.000	0.000	0.000	329.880	19.510	8.394	10.270	0.112	1.349	369.515	6403	233.717	603.232
23	0.000	0.000	0.000	0.000	5.478	0.000	30.847	0.000	0.000	36.326	1998	72.934	109.260
24	0.000	0.000	0.000	0.000	146.478	0.000	1.762	0.000	0.000	148.240	3066	111.913	260.152
25	0.000	0.000	222.864	22.025	1.459	0.309	0.315	0.000	0.092	247.063	1629	59.466	306.529
26	0.000	0.000	172.006	341.282	46.083	0.000	0.797	0.544	1.618	562.330	7355	268.465	830.795
27	0.000	0.000	0.000	0.000	102.601	7.277	9.373	13.280	0.000	132.531	3577	130.546	263.077
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
29	0.000	0.000	83.154	629.555	66.963	0.000	0.000	29.186	0.000	808.858	10254	374.271	1183.129
30	0.000	181.281	345.323	252.847	4.290	10.608	8.117	4.101	0.000	806.567	8848	322.937	1129.505
31	0.000	0.000	390.510	846.589	70.193	0.000	0.000	8.913	3.087	1319.294	12897	470.733	1790.027
32	0.000	306.355	555.653	890.954	0.000	0.000	0.000	11.685	0.000	1764.648	17592	642.097	2406.745
33	0.000	0.000	445.925	25.208	0.000	0.000	0.000	0.000	0.000	471.133	2883	105.240	576.374
34	0.000	0.000	309.819	74.365	0.000	0.000	0.000	0.000	0.000	384.184	2608	95.181	479.365
35	0.000	0.000	0.000	29.960	0.138	0.000	0.000	0.380	0.037	30.517	607	22.145	52.661
36	0.000	0.000	116.031	276.821	23.582	0.000	0.000	5.793	0.000	422.227	5119	186.851	609.078
37	0.000	520.513	481.139	260.910	0.000	0.000	0.000	6.631	0.000	1269.193	9281	338.753	1607.946
38	156.934	814.068	2083.374	506.239	0.000	10.205	0.000	0.000	0.000	3570.819	24840	906.653	4477.472
39	0.000	294.473	0.000	1864.451	3.611	1.407	0.000	16.577	0.000	2180.518	24466	893.020	3073.538
40	0.000	0.000	0.000	130.171	129.129	0.000	15.428	7.898	0.000	282.626	5861	213.919	496.546
41	0.000	0.000	0.000	238.759	101.613	0.000	0.000	0.000	0.000	340.372	4293	156.705	497.077
42	0.000	0.000	1012.183	300.530	0.000	0.000	0.000	0.000	0.000	1312.713	9211	336.191	1648.904
43	0.000	0.000	75.328	414.808	316.557	24.708	3.483	9.277	0.000	844.161	15156	553.179	1397.341
44	0.000	0.000	617.203	12.472	0.000	0.000	0.000	1.739	0.000	631.415	3687	134.590	766.005
45	0.000	224.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	224.065	1595	58.218	282.282
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
47	0.000	0.000	6.848	372.478	0.000	0.000	0.000	5.924	0.000	385.250	6200	226.296	611.547
48	0.000	92.431	0.000	0.000	0.000	0.000	0.000	0.000	0.000	92.431	591	21.561	113.991
49	34.915	50.770	248.185	0.000	0.000	0.041	0.000	0.823	1.678	336.411	1916	69.945	406.356
50	0.000	50.598	288.975	142.398	0.000	0.000	13.830	0.000	0.000	495.801	5463	199.407	695.208
96	141.168	729.800	454.126	825.022	77.481	33.540	33.136	0.000	0.000	2294.274	27073	988.165	3282.438
97	0.000	0.000	375.621	96.862	171.135	0.000	0.000	0.000	1.193	644.812	6490	236.889	881.700
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
99	510.954	24.020	0.000	0.000	0.000	2.903	0.000	0.000	0.000	537.876	3291	120.132	658.008
100	14.997	119.149	1292.619	0.000	0.000	29.793	0.000	0.000	12.588	1469.145	10869	396.708	1865.853
TOTALS	858.968	3425.300	11901.573	10822.152	2257.481	201.618	445.827	162.669	30.561	30106.148	329595	12030.214	42136.361

TABLE B.5
ESTIMATED NON-RESIDENTIAL POTABLE WATER DEMAND
BUILDOUT (MGY)

TAZ	GENUSE	LIMUSE	CORUSE	WATUSE	INDUSE	INSTUSE	TOTAL
1	88.003	0.000	3.482	0.000	0.000	6.886	98.372
2	42.070	0.000	0.000	0.000	0.000	27.587	69.657
3	24.970	32.316	0.906	14.190	4.388	29.966	106.737
4	19.103	13.415	0.477	13.236	0.000	44.783	91.014
5	18.030	10.136	19.032	23.014	0.000	35.935	106.146
6	22.394	0.000	15.836	0.000	0.000	7.471	45.701
7	72.835	0.000	20.701	0.000	63.916	1.252	158.704
8	27.617	0.000	10.923	0.000	0.000	3.464	42.004
9	54.018	0.000	11.114	0.000	13.403	0.000	78.535
10	14.524	5.247	14.166	14.190	5.295	0.000	53.422
11	0.000	0.000	13.212	0.000	0.000	9.349	22.561
12	2.003	0.000	0.334	0.000	0.000	1.336	3.673
13	2.504	0.000	20.415	0.000	0.000	0.000	22.919
14	7.012	0.000	0.000	0.000	0.000	5.092	12.103
15	0.000	0.417	0.000	0.000	0.000	8.097	8.514
16	14.953	0.000	3.100	2.504	2.862	0.000	23.420
17	0.000	0.000	0.000	0.000	0.000	34.975	34.975
18	0.000	0.000	10.112	0.000	6.535	46.619	63.266
19	150.035	0.000	0.000	0.000	30.813	9.683	190.530
2021	55.234	0.000	8.634	7.155	0.000	2.671	73.694
22	31.195	4.651	0.525	18.006	0.000	26.043	80.419
23	69.186	0.000	12.306	0.000	46.410	35.058	162.961
24	25.757	0.000	0.000	0.000	2.194	29.883	57.834
25	13.594	0.000	1.860	25.876	0.000	7.930	49.260
26	0.000	0.000	1.002	31.839	0.000	6.970	39.810
27	39.494	9.182	24.708	0.000	46.410	11.895	131.689
28	7.083	0.000	0.000	0.000	193.798	0.000	200.881
29	31.409	0.000	59.957	0.000	0.000	0.000	91.366
30	43.429	5.605	9.158	0.000	0.000	30.384	88.576
31	17.958	0.000	13.880	16.337	0.000	0.000	48.175
32	26.329	0.000	20.510	0.000	59.957	16.110	122.906
33	0.000	0.000	0.000	0.000	0.000	16.820	16.820
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	3.792	0.000	1.192	18.602	0.000	14.190	37.777
36	28.476	3.875	20.176	0.000	7.870	12.771	73.169
37	14.095	0.000	11.638	0.000	0.000	14.983	40.716
38	2.146	0.000	0.000	0.000	0.000	21.870	24.016
39	2.003	13.773	29.954	0.000	0.000	0.000	45.731
40	18.602	4.770	21.035	0.000	7.012	0.000	51.419
41	10.517	0.000	0.000	0.000	0.000	0.000	10.517
42	0.000	0.000	0.000	0.000	0.000	47.496	47.496
43	69.115	18.364	17.076	0.000	0.000	0.543	105.097
44	7.226	0.000	3.053	0.000	0.000	12.938	23.217
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.717	22.836	10.446	0.000	0.000	0.000	34.999
48	0.000	0.000	0.000	0.000	87.192	40.943	128.135
49	0.000	0.000	17.171	12.044	0.000	0.000	29.215
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	74.481	0.000	0.000	0.000	0.000	17.446	91.926
97	90.078	0.000	0.000	29.573	760.500	12.187	892.338
98	0.000	0.000	0.000	0.000	311.422	0.000	311.422
99	0.000	0.000	0.000	0.000	0.000	29.883	29.883
100	13.165	27.128	1.145	91.938	0.000	0.000	133.376
TOTALS	1256.156	171.714	429.236	318.505	1649.976	681.506	4507.093

TABLE B.6

ESTIMATED NON-RESIDENTIAL NON-POTABLE WATER DEMAND

BUILDOUT (MGY)

TAZ	GENUSE	LIMUSE	CORUSE	WATUSE	INDUSE	INSTUSE	TOTAL
1	77.654	0.000	4.609	0.000	0.000	5.208	87.471
2	37.122	0.000	0.000	0.000	0.000	20.865	57.988
3	22.033	25.664	1.200	3.756	2.904	22.665	78.222
4	16.857	10.654	0.631	3.504	0.000	33.871	65.516
5	15.910	8.049	25.190	6.092	0.000	27.179	82.420
6	19.761	0.000	20.960	0.000	0.000	5.650	46.371
7	64.269	0.000	27.400	0.000	42.299	0.947	134.915
8	24.369	0.000	14.457	0.000	0.000	2.620	41.447
9	47.665	0.000	14.710	0.000	8.870	0.000	71.246
10	12.816	4.167	18.751	3.756	3.504	0.000	42.994
11	0.000	0.000	17.488	0.000	0.000	7.071	24.559
12	1.768	0.000	0.442	0.000	0.000	1.010	3.220
13	2.210	0.000	27.021	0.000	0.000	0.000	29.231
14	6.187	0.000	0.000	0.000	0.000	3.851	10.038
15	0.000	0.331	0.000	0.000	0.000	6.124	6.455
16	13.195	0.000	4.104	0.663	1.894	0.000	19.855
17	0.000	0.000	0.000	0.000	0.000	26.453	26.453
18	0.000	0.000	13.384	0.000	4.325	35.260	52.969
19	132.390	0.000	0.000	0.000	20.392	7.323	160.106
2021	48.739	0.000	11.427	1.894	0.000	2.020	64.080
22	27.526	3.693	0.694	4.767	0.000	19.698	56.378
23	61.050	0.000	16.288	0.000	30.714	26.516	134.568
24	22.728	0.000	0.000	0.000	1.452	22.602	46.782
25	11.995	0.000	2.462	6.850	0.000	5.998	27.305
26	0.000	0.000	1.326	8.428	0.000	5.272	15.026
27	34.849	7.292	32.703	0.000	30.714	8.996	114.555
28	6.250	0.000	0.000	0.000	128.255	0.000	134.505
29	27.715	0.000	79.358	0.000	0.000	0.000	107.074
30	38.322	4.451	12.122	0.000	0.000	22.980	77.875
31	15.846	0.000	18.372	4.325	0.000	0.000	38.543
32	23.233	0.000	27.147	0.000	39.679	12.185	102.244
33	0.000	0.000	0.000	0.000	0.000	12.721	12.721
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	3.346	0.000	1.578	4.924	0.000	10.733	20.581
36	25.127	3.078	26.705	0.000	5.208	9.659	69.778
37	12.437	0.000	15.404	0.000	0.000	11.332	39.174
38	1.894	0.000	0.000	0.000	0.000	16.541	18.435
39	1.768	10.938	39.648	0.000	0.000	0.000	52.353
40	16.415	3.788	27.842	0.000	4.640	0.000	52.685
41	9.281	0.000	0.000	0.000	0.000	0.000	9.281
42	0.000	0.000	0.000	0.000	0.000	35.923	35.923
43	60.987	14.584	22.602	0.000	0.000	0.410	98.582
44	6.376	0.000	4.041	0.000	0.000	9.786	20.203
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.515	18.135	13.826	0.000	0.000	0.000	33.476
48	0.000	0.000	0.000	0.000	57.704	30.967	88.670
49	0.000	0.000	22.728	3.188	0.000	0.000	25.916
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	65.722	0.000	0.000	0.000	0.000	13.195	78.916
97	79.485	0.000	0.000	7.828	503.296	9.217	599.827
98	0.000	0.000	0.000	0.000	206.098	0.000	206.098
99	0.000	0.000	0.000	0.000	0.000	22.602	22.602
100	11.616	21.544	1.515	24.338	0.000	0.000	59.014
TOTALS	1108.428	136.367	568.135	84.314	1091.948	515.450	3504.643

APPENDIX C

ESTIMATED UTILITY DEMAND
1983 EXISTING AND COMMITTED AND BUILDOUT

TABLE C.1
ESTIMATED RESIDENTIAL UTILITY DEMAND-1983 EXISTING AND COMMITTED (MGY)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	NONPOT.	POTABLE	TOTAL
1	0.000	0.000	0.028	2.657	1.943	0.000	0.000	0.000	0.000	4.628	2.222	6.850
2	0.000	0.000	0.312	0.000	3.018	0.000	0.000	0.000	0.000	3.331	4.522	7.853
3	0.000	0.000	0.000	47.396	3.195	0.387	0.000	0.031	0.375	51.384	0.000	51.384
4	0.000	0.000	0.974	0.348	23.648	0.000	7.225	0.017	0.264	32.476	127.645	160.121
5	0.000	0.000	1.988	47.707	12.111	1.352	2.657	0.845	1.665	68.326	61.844	130.171
6	0.000	0.000	1.018	44.002	0.714	0.922	0.000	0.031	0.000	46.687	64.357	111.044
7	0.000	0.000	15.364	16.196	3.007	0.565	0.000	0.112	0.000	35.244	103.335	138.579
8	0.000	0.000	13.053	21.366	0.490	0.000	8.919	0.173	0.000	44.001	42.080	86.081
9	0.000	0.000	0.000	4.378	1.165	0.000	1.028	0.092	0.000	6.664	17.600	24.264
10	0.000	0.000	0.795	18.253	10.600	0.687	0.000	0.326	1.049	31.710	25.702	57.412
11	0.000	0.000	0.000	10.861	0.000	0.000	0.784	0.071	0.000	11.716	26.349	38.065
12	0.000	0.000	0.028	16.149	3.007	0.000	0.305	0.000	0.000	19.490	39.552	59.041
13	0.000	0.000	2.017	11.372	1.428	0.000	18.499	0.698	0.000	34.015	200.259	234.273
14	0.000	0.000	14.637	0.000	0.000	0.000	0.000	0.000	0.000	14.637	48.353	62.990
15	0.000	0.000	9.648	1.901	35.961	0.000	0.820	0.000	0.000	48.330	155.293	203.622
16	0.000	0.000	1.562	14.784	1.391	0.000	3.085	0.071	0.075	20.968	51.815	72.783
17	0.000	0.000	0.000	27.919	1.052	0.000	0.672	0.000	0.000	29.644	57.455	87.098
18	0.000	0.000	0.000	22.006	7.480	0.000	2.362	0.112	0.000	31.960	79.024	110.984
19	0.000	0.000	0.000	12.453	0.000	1.001	3.832	0.000	0.000	17.286	49.243	66.529
2021	0.000	0.000	0.000	22.062	0.000	0.000	15.192	0.112	0.000	37.366	163.158	200.524
22	0.000	0.000	0.000	5.174	2.819	1.225	2.790	0.031	1.349	13.388	61.243	74.631
23	0.000	0.000	0.000	0.000	0.000	0.000	5.311	0.000	0.000	5.311	68.551	73.862
24	0.000	0.000	0.000	0.000	28.733	0.000	0.479	0.000	0.000	29.212	25.988	55.200
25	0.000	0.000	12.157	0.739	0.113	0.010	0.031	0.000	0.037	13.087	5.748	18.835
26	0.000	0.000	9.358	88.629	3.159	0.000	0.122	0.000	0.912	102.179	153.107	255.286
27	0.000	0.000	0.000	0.000	13.306	1.340	0.919	0.057	0.000	15.623	27.824	43.447
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	20.034	12.040	0.000	0.000	0.000	0.000	32.075	48.889	80.963
30	0.000	0.000	10.858	28.823	1.165	1.548	0.000	0.051	0.000	42.446	21.692	64.138
31	0.000	0.000	6.760	43.620	10.725	0.000	0.000	0.000	0.207	61.311	127.840	189.152
32	0.000	0.000	27.219	147.788	0.000	0.000	0.000	0.000	0.000	175.007	513.903	688.911
33	0.000	0.000	7.353	0.398	0.000	0.000	0.000	0.000	0.000	7.751	3.807	11.558
34	0.000	0.000	10.296	10.873	0.000	0.000	0.000	0.000	0.000	21.170	28.019	49.189
35	0.000	0.000	0.000	11.075	0.038	0.000	0.000	0.000	0.037	11.150	4.757	15.907
36	0.000	0.000	0.539	32.428	3.571	0.000	0.000	0.112	0.000	36.650	3.153	39.802
37	0.000	0.000	9.651	0.569	0.000	0.000	0.000	0.000	0.000	10.220	30.124	40.343
38	0.000	0.000	0.114	6.994	0.000	3.112	0.000	0.000	0.000	10.220	10.734	20.954
39	0.000	0.000	0.000	11.668	0.891	0.205	0.000	0.000	0.000	12.764	2.745	15.508
40	0.000	0.000	0.000	31.931	7.591	0.000	2.030	0.073	0.000	41.625	100.025	141.650
41	0.000	0.000	0.000	49.176	0.000	0.000	0.000	0.000	0.000	49.176	93.753	142.929
42	0.000	0.000	4.886	19.390	0.000	0.000	0.000	0.000	0.000	24.276	49.631	73.907
43	0.000	0.000	0.000	73.272	16.008	3.563	0.926	0.010	0.000	93.778	132.802	226.580
44	0.000	0.000	11.630	4.151	0.000	0.000	0.000	0.000	0.000	15.781	15.268	31.049
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33.142	33.142
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	22.915	0.000	0.000	0.000	0.000	0.000	22.915	7.487	30.402
48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	6.896	0.000	0.000	0.010	0.000	0.080	0.047	7.034	15.033	22.066
50	0.000	0.000	7.385	46.240	0.000	0.000	3.757	0.000	0.000	57.382	104.909	162.291
96	0.000	0.000	1.175	16.462	8.072	0.187	0.000	0.000	0.000	25.895	61.570	87.465
97	0.000	0.000	0.448	1.432	15.744	0.000	0.000	0.000	1.193	18.817	42.794	61.611
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
99	0.000	0.000	0.000	0.000	0.000	0.571	0.000	0.000	0.000	0.571	9.078	9.649
100	0.000	0.000	8.807	0.000	0.000	8.723	0.000	0.000	2.098	19.628	53.976	73.604
TOTALS	0.000	0.000	196.957	1015.590	234.186	25.411	81.742	3.105	9.310	1566.301	3177.403	4743.703

TABLE C.2
ESTIMATED NON-RESIDENTIAL UTILITY WATER DEMAND
EXISTING AND COMMITTED-1983 (MGY)

TAZ	GENERAL	LIMITED	COR	WATER	INDUST.	INSTIT.	TOTAL
1	81.827	0.000	0.000	0.000	0.000	0.000	81.827
2	34.270	0.000	0.000	0.000	0.000	0.000	34.270
3	28.275	36.165	1.086	7.315	4.824	0.000	77.665
4	10.451	15.013	0.572	3.471	0.000	21.888	51.395
5	18.796	11.343	20.752	23.928	0.000	40.011	114.831
6	19.363	0.000	1.944	0.000	0.000	8.318	29.625
7	33.217	0.000	7.718	0.000	14.419	0.093	55.447
8	28.275	0.000	5.545	0.000	0.000	3.857	37.677
9	12.153	0.000	8.690	0.000	9.176	0.000	30.018
10	12.882	5.872	7.832	14.754	4.771	0.000	46.111
11	0.000	0.000	15.836	0.000	0.000	10.409	26.245
12	2.268	0.000	0.400	0.000	0.000	1.487	4.156
13	2.836	0.000	21.610	0.000	0.000	0.000	24.445
14	7.940	0.000	0.000	0.000	0.000	5.669	13.609
15	0.000	0.000	0.000	0.000	0.000	4.879	4.879
16	13.773	0.000	3.716	2.604	3.146	0.000	23.238
17	0.000	0.000	0.000	0.000	0.000	38.943	38.943
18	0.000	0.000	12.120	0.000	7.183	51.908	71.211
19	150.044	0.000	0.000	0.000	29.520	8.086	187.650
2021	62.545	0.000	10.348	0.000	0.000	2.974	75.882
22	15.231	5.205	0.629	18.721	0.000	28.998	68.784
23	61.249	0.000	0.000	0.000	43.257	12.780	117.286
24	22.604	0.000	0.000	0.000	2.412	33.273	58.289
25	14.502	0.000	0.915	26.904	0.000	7.668	49.988
26	0.000	0.000	0.000	31.863	0.000	0.929	32.792
27	20.254	7.607	2.115	0.000	38.486	13.244	81.706
28	8.021	0.000	0.000	0.000	131.765	0.000	139.785
29	6.319	0.000	10.462	0.000	0.000	0.000	16.781
30	12.558	1.401	2.687	0.000	0.000	13.616	30.262
31	7.616	0.000	0.000	3.843	0.000	0.000	11.459
32	0.000	0.000	0.000	0.000	27.370	0.000	27.370
33	0.000	0.000	0.000	0.000	0.000	18.728	18.728
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	4.294	0.000	0.572	19.341	0.000	0.000	24.207
36	16.933	4.004	12.863	0.000	3.985	8.132	45.916
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000	0.465	0.465
39	0.000	4.004	0.972	0.000	0.000	0.000	4.975
40	18.472	0.000	9.547	0.000	7.708	0.000	35.727
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	30.299	30.299
43	47.476	4.537	1.029	0.000	0.000	0.604	53.647
44	8.183	0.000	0.000	0.000	0.000	4.694	12.876
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.944	12.411	0.000	0.000	0.000	0.000	14.355
48	0.000	0.000	0.000	0.000	1.573	0.000	1.573
49	0.000	0.000	19.780	5.083	0.000	0.000	24.863
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	30.868	0.000	0.000	0.000	0.000	19.425	50.292
97	50.879	0.000	0.000	30.747	172.872	13.570	268.068
98	0.000	0.000	0.000	0.000	21.655	0.000	21.655
99	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	1.458	0.000	0.000	47.732	0.000	0.000	49.191
TOTALS	867.775	107.561	179.737	236.307	524.122	404.948	2320.465

TABLE C.3
ESTIMATED RESIDENTIAL UTILITY DEMAND-BUILDOUT (MGY)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	NONPOT.	POTABLE	TOTAL
1	0.000	0.000	2.181	49.002	12.547	0.000	0.000	0.269	0.000	63.999	177.200	241.199
2	0.000	0.000	36.680	7.802	27.378	0.000	0.000	0.000	0.000	71.860	275.582	347.442
3	0.000	0.000	3.644	64.454	3.195	1.737	0.000	0.031	2.005	75.066	167.272	242.338
4	0.000	0.000	8.751	2.917	33.548	0.000	7.225	0.017	2.493	54.951	209.660	264.611
5	0.000	0.000	2.575	49.689	14.674	1.352	2.657	0.992	1.665	73.605	194.899	268.504
6	0.000	0.000	1.018	60.225	2.866	3.609	0.000	1.245	0.000	68.962	180.482	249.444
7	0.000	0.000	15.364	96.750	19.462	12.294	3.031	1.327	0.000	148.227	518.519	666.746
8	0.000	0.000	13.053	21.366	2.055	0.000	9.458	0.711	0.000	46.644	192.640	239.283
9	0.000	0.000	0.000	4.378	1.165	0.000	1.568	0.418	0.000	7.529	31.434	38.963
10	0.000	0.000	1.333	19.243	10.600	1.119	0.000	0.978	1.049	34.323	89.713	124.037
11	0.000	0.000	0.000	10.861	0.000	0.000	0.784	0.071	0.000	11.716	26.349	38.065
12	0.000	0.000	0.028	17.418	3.007	0.000	0.305	0.000	0.000	20.759	43.818	64.577
13	0.000	0.000	2.017	11.372	1.428	0.000	18.499	0.698	0.000	34.015	205.035	239.050
14	0.000	0.000	21.338	0.000	0.000	0.000	0.000	0.000	0.000	21.338	84.680	106.018
15	0.000	0.000	9.648	3.975	35.961	0.000	0.820	0.000	0.000	50.404	172.240	222.644
16	0.000	0.000	1.562	17.075	1.391	0.000	3.372	0.071	0.075	23.546	69.040	92.586
17	0.000	0.000	0.000	32.408	1.052	0.000	0.837	0.000	0.000	34.298	72.193	106.491
18	0.000	0.000	0.000	22.284	7.793	0.000	2.462	0.112	0.000	32.652	83.271	115.923
19	0.000	0.000	0.000	12.453	0.000	1.001	6.693	0.000	0.000	20.147	116.913	137.060
2021	0.000	0.000	0.000	22.062	0.000	0.000	15.192	0.112	1.631	38.997	168.320	207.316
22	0.000	0.000	0.000	59.476	4.189	1.225	2.790	0.031	1.349	69.059	233.717	302.776
23	0.000	0.000	0.000	0.000	0.822	0.000	5.311	0.000	0.000	6.133	72.934	79.067
24	0.000	0.000	0.000	0.000	34.662	0.000	0.479	0.000	0.000	35.140	111.913	147.053
25	0.000	0.000	12.157	4.207	0.269	0.102	0.061	0.000	0.092	16.887	59.466	76.353
26	0.000	0.000	9.358	101.600	7.698	0.000	0.152	0.082	1.618	120.508	268.465	388.973
27	0.000	0.000	0.000	0.000	21.348	1.340	1.758	2.014	0.000	26.460	130.546	157.006
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	4.158	116.346	13.997	0.000	0.000	4.378	0.000	138.879	374.271	513.150
30	0.000	0.000	17.999	57.677	1.165	1.548	1.218	0.638	0.000	80.245	278.163	358.408
31	0.000	0.000	20.089	145.721	10.725	0.000	0.000	1.337	3.087	180.959	470.733	651.692
32	0.000	0.000	27.855	154.908	0.000	0.000	0.000	1.753	0.000	184.517	526.509	711.026
33	0.000	0.000	22.834	4.546	0.000	0.000	0.000	0.000	0.000	27.380	105.240	132.621
34	0.000	0.000	16.239	13.288	0.000	0.000	0.000	0.000	0.000	29.528	95.181	124.709
35	0.000	0.000	0.000	11.075	0.038	0.000	0.000	0.057	0.037	11.207	22.145	33.351
36	0.000	0.000	5.846	66.575	5.136	0.000	0.000	0.919	0.000	78.477	186.851	265.327
37	0.000	0.000	24.301	44.932	0.000	0.000	0.000	0.995	0.000	70.228	213.956	284.183
38	0.000	0.000	104.178	90.706	0.000	3.112	0.000	0.000	0.000	197.996	235.677	433.673
39	0.000	0.000	0.000	324.751	0.891	0.205	0.000	2.487	0.000	328.333	824.641	1152.974
40	0.000	0.000	0.000	36.606	20.016	0.000	2.504	1.190	0.000	60.315	213.919	274.234
41	0.000	0.000	0.000	50.878	15.242	0.000	0.000	0.000	0.000	66.120	156.705	222.826
42	0.000	0.000	50.914	52.732	0.000	0.000	0.000	0.000	0.000	103.646	336.191	439.837
43	0.000	0.000	3.766	112.744	54.455	4.127	0.926	1.396	0.000	177.413	553.179	730.592
44	0.000	0.000	31.514	4.615	0.000	0.000	0.000	0.261	0.000	36.390	134.590	170.980
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32.708	32.708
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0.000	0.000	0.342	77.371	0.000	0.000	0.000	0.889	0.000	78.602	226.296	304.899
48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	12.644	0.000	0.000	0.010	0.000	0.137	1.678	14.469	49.622	64.090
50	0.000	0.000	15.065	51.998	0.000	0.000	3.757	0.000	0.000	70.820	198.242	269.062
96	0.000	0.000	22.795	150.079	14.959	12.609	4.970	0.000	0.000	205.412	790.754	996.166
97	0.000	0.000	18.815	17.344	32.180	0.000	0.000	0.000	1.193	69.532	236.889	306.421
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
99	0.000	0.000	0.000	0.000	0.000	0.571	0.000	0.000	0.000	0.571	9.519	10.090
100	0.000	0.000	65.205	0.000	0.000	10.361	0.000	0.000	12.588	88.154	77.562	165.716
TOTALS	0.000	0.000	605.267	2275.910	415.915	56.323	96.827	25.614	30.561	3506.417	10305.844	13812.261

TABLE C.4
ESTIMATED NON-RESIDENTIAL UTILITY WATER DEMAND
BUILDOUT (MGY)

TAZ	GENUSE	LIMUSE	CORUSE	WATUSE	INDUSE	INSTUSE	TOTAL
1	99.651	0.000	4.173	0.000	0.000	7.668	111.492
2	47.638	0.000	0.000	0.000	0.000	30.717	78.355
3	28.275	36.165	1.086	14.754	4.824	33.366	118.470
4	21.632	15.013	0.572	13.762	0.000	49.863	100.842
5	20.416	11.343	22.810	23.928	0.000	40.011	118.509
6	25.358	0.000	18.980	0.000	0.000	8.318	52.657
7	82.476	0.000	24.811	0.000	70.260	1.394	178.941
8	31.273	0.000	13.092	0.000	0.000	3.657	48.221
9	61.168	0.000	13.320	0.000	14.734	0.000	89.222
10	16.447	5.872	16.979	14.754	5.820	0.000	59.871
11	0.000	0.000	15.836	0.000	0.000	10.409	26.245
12	2.268	0.000	0.400	0.000	0.000	1.487	4.156
13	2.836	0.000	24.468	0.000	0.000	0.000	27.304
14	7.940	0.000	0.000	0.000	0.000	5.669	13.609
15	0.000	0.467	0.000	0.000	0.000	9.015	9.482
16	16.933	0.000	3.716	2.604	3.146	0.000	26.398
17	0.000	0.000	0.000	0.000	0.000	38.943	38.943
18	0.000	0.000	12.120	0.000	7.183	51.908	71.211
19	169.893	0.000	0.000	0.000	33.872	10.781	214.546
2021	62.545	0.000	10.348	7.439	0.000	2.974	83.306
22	35.324	5.205	0.629	18.721	0.000	28.998	88.876
23	78.344	0.000	14.749	0.000	51.017	39.036	183.146
24	29.166	0.000	0.000	0.000	2.412	33.273	64.851
25	15.393	0.000	2.230	26.904	0.000	8.829	53.356
26	0.000	0.000	1.201	33.103	0.000	7.761	42.064
27	44.722	10.276	29.613	0.000	51.017	13.244	148.872
28	8.021	0.000	0.000	0.000	213.036	0.000	221.057
29	35.567	0.000	71.860	0.000	0.000	0.000	107.427
30	49.177	6.272	10.976	0.000	0.000	33.831	100.257
31	20.335	0.000	16.636	16.985	0.000	0.000	53.957
32	29.814	0.000	24.582	0.000	65.909	17.938	138.243
33	0.000	0.000	0.000	0.000	0.000	18.728	18.728
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	4.294	0.000	1.429	19.341	0.000	15.800	40.864
36	32.245	4.337	24.182	0.000	8.651	14.220	83.636
37	15.960	0.000	13.949	0.000	0.000	16.683	46.592
38	2.431	0.000	0.000	0.000	0.000	24.351	26.781
39	2.268	15.414	35.902	0.000	0.000	0.000	53.584
40	21.064	5.338	25.211	0.000	7.708	0.000	59.321
41	11.910	0.000	0.000	0.000	0.000	0.000	11.910
42	0.000	0.000	0.000	0.000	0.000	52.884	52.884
43	78.263	20.551	20.466	0.000	0.000	0.604	119.884
44	8.183	0.000	3.659	0.000	0.000	14.406	26.247
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	1.944	25.556	12.520	0.000	0.000	0.000	40.020
48	0.000	0.000	0.000	0.000	95.848	45.588	141.436
49	0.000	0.000	20.581	12.522	0.000	0.000	33.103
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	84.339	0.000	0.000	0.000	0.000	19.425	103.764
97	102.001	0.000	0.000	30.747	835.995	13.570	982.312
98	0.000	0.000	0.000	0.000	342.336	0.000	342.336
99	0.000	0.000	0.000	0.000	0.000	33.273	33.273
100	14.907	30.360	1.372	95.589	0.000	0.000	142.228
TOTALS	1422.420	192.169	514.457	331.152	1813.768	758.824	5032.790

APPENDIX D

WASTEWATER RECLAMATION

WASTEWATER RECLAMATION

Consideration of wastewater reclamation in the Martin County Water Supply Study is important because of the potential for efficient use of the water resource coupled with appropriate and beneficial disposal of wastewater effluent. Wastewater reclamation will benefit Martin County in several major ways:

1. By providing a quality, reliable source of irrigation water for large scale landscape demands.
2. By improving the level of treatment of wastewater and by providing an approved beneficial means of disposal.
3. By creating an additional source of groundwater recharge in many areas of the county.
4. By reducing the demand on the groundwater resource by large scale landscape irrigators.

In other areas of South Florida, wastewater has become an important priority source of irrigation water. Elaborate systems have been designed for the Naples area golf courses, while wastewater has been available for large and small scale irrigators in St. Petersburg for several years.

In Palm Beach County, a number of golf courses are being scheduled to receive wastewater effluent from the Loxahatchee River Environmental Control District (ENCON). The use of reclaimed wastewater in most new systems including ENCON, Naples, and St. Petersburg is backed up by the use of deep injection wells. These wells are used during periods of wet weather when irrigation demands are extremely low and during events when the quality of effluent treatment cannot be assured (eg. physical or chemical/biological treatment plant breakdowns).

As water conservation continues to make more sense for local governments, wastewater reclamation serves as an important tool in water supply demand planning. The inclusion of wastewater reclamation potential in this study reflects a position of responsibility towards efficient management of the water resources in and by Martin County.

The values presented in this section provide projections of levels of implementation of wastewater reclamation efforts in Martin County. Because the county has not completed the Wastewater Master Plan and information is not available as to location and capacity of specific "future-build" treatment plants and service areas, this study only delineates supply-demand scenarios for localized potential systems. These scenarios are based upon existing and buildout supply calculations and have alternative levels of implementation for potential reuse systems. The intent then, of this effort, will be to assess the regional potentials for wastewater reclamation in the urban areas of Martin County.

In the implementation of any wastewater reclamation system, many factors must be taken into consideration. Factors such as soils, topography, physical location, user profiles, public reaction and sentiment, and present source (potential source), among others, all affect potential users. Factors such as treatment process, present or potential disposal, service area, transportation routes, bonded indebtedness, treatment plant age and condition, service area characteristics and collection systems, and influent characteristics among others all affect the potential supplies.

This study will draw conclusions as to the most evident of the variables in a supply-demand network for wastewater reclamation potential. Geographic location and physical proximity factors will be the basis for apparent conclusions regarding the most and least feasible networks pairing users and suppliers within geographic areas.

Methodology

In developing wastewater reclamation scenarios the first step was to identify regional areas within Martin County which might be served by integrated supply networks. The County's planning areas were investigated, but in many cases these areas were too farflung or crossed geographic barriers such as the St. Lucie Canal. Thus there was a need to modify these geographic areas to divisions that would be more suitable for the physical implementation of wastewater reclamation networks.

The county was divided into 10 reclamation (reuse) planning areas. These areas are built upon aggregations of whole Traffic Analysis Zones (TAZs). In the tables the areas and their TAZs are listed by footnote.

Populations were derived from the population figures supplied by Martin County for this study. Table D.1 (Part A) represents populations derived from existing and committed figures, as well as area populations at buildout (Part B) based upon county projections.

In both Parts A and B of Table D.1, the "Green Acres" columns provide projections of the number of potential wastewater irrigated acres on golf courses and other major irrigated landscape tracts such as parks and recreation areas, and sports playing fields. Acreages in Part "A" are based upon information supplied by the County's Planning Department and by review of planning documents such as "Applications for Development Approval" for Developments of Regional Impact. Acreage in Part "B" is derived by adding Part "A" totals and totals for "future" acres next described.

In Part "B", acreage beyond existing and committed is based upon a calculation using the ratio of golf course acreage to population. For Martin County the present ratio is approximately 17 acres per 1000 population. A figure of 20 acres per 1000 population was used to adjust the present ratio

Table D.1. ESTIMATED EXISTING AND FUTURE (BUILDOUT) DEMANDS FOR IRRIGATION OF GREEN AREAS IN MARTIN COUNTY WITH RECLAIMED WASTEWATER, BASED ON THREE LEVELS OF USE (25%, 50% and 100%) OF THE AVAILABLE SUPPLY

A. Existing and Commited Land Uses

					TARGET REUSE 25%			TARGET REUSE 50%			TARGET REUSE 100%		
Reuse Area[1]	Pop.[2]	Green Acres[3]	Potential Demand[4] (gallons)	Wastewater Flow[5] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)
A	21608	216	864000	1997587	499397	57.80	0	998793	115.60	134793	1997587	231.20	1133587
B	9612	238	952000	1079165	269791	28.34	0	539583	56.68	0	1079165	113.36	127165
C	23765	251	1004000	3854711	963678	95.98	0	1927356	191.97	923356	3854711	383.94	2850711
D	21350	499	1996000	2172024	543006	27.20	0	1086012	54.41	0	2172024	108.82	176024
E	20964	559	2236000	1803894	450973	20.17	0	901947	40.34	0	1803894	80.68	0
F	1937	339	1356000	107403	26851	1.98	0	53701	3.96	0	107403	7.92	0
G	18727	340	1360000	1534883	383721	28.21	0	767442	56.43	0	1534883	112.86	174883
H	5827	441	1764000	446737	111684	6.33	0	223369	12.66	0	446737	25.33	0
I	3047	119	476000	1130741	282685	59.39	0	565370	118.78	89370	1130741	237.55	654741
J	2844	135	540000	277188	69297	12.83	0	138594	25.67	0	277188	51.33	0

B. Buildout

					TARGET REUSE 25%			TARGET REUSE 50%			TARGET REUSE 100%		
Reuse Area[1]	Pop.[2]	Green Acres[3]	Potential Demand[4] (gallons)	Wastewater Flow[5] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)	Supply Available[6] (gallons)	% Green Demand Met[7]	Excess[8] (gallons)
A	49327	770	3081544	6786439	1696610	55.06	0	3393219	110.11	311675	6786439	220.23	3704894
B	12783	301	1205688	1584140	396035	32.85	0	792070	65.69	0	1584140	131.39	378452
C	30768	391	1564200	5150624	1287656	82.32	0	2575312	164.64	1011112	5150624	329.28	3586423
D	47626	1025	4098008	6578487	1644622	40.13	0	3289243	80.26	0	6578487	160.53	2480478
E	28809	716	2863576	3250953	812738	28.38	0	1625477	56.76	0	3250953	113.53	387377
F	12572	552	2206824	805682	201420	9.13	0	402841	18.25	0	805682	36.51	0
G	89109	1748	6990544	7657817	1914454	27.39	0	3828909	54.77	0	7657817	109.55	667273
H	14170	608	2431464	1826053	456513	18.78	0	913026	37.55	0	1826053	75.10	0
I	33563	729	2917304	6365283	1591321	54.55	0	3182642	109.10	265338	6365283	218.19	3447979
J	10869	296	1182016	577913	144478	12.22	0	288956	24.45	0	577913	48.89	0

[1] "Reuse Planning Area" comprised of county Traffic Analysis Zones (TAZ's)
- A - 1,2,3,5,6,7,8,10
- B - 4,14,15
- C - 9,11,12,13,16,17,18,19,20,21,22,23
- D - 24,25,26,27,28,29,30,31
- E - 32,33,34,35,36
- F - 37,99
- G - 38,39,40,41,42,43,44,45
- H - 46,47,48,49,50
- I - 96,97
- J - 100

[2] Existing and Committed population data from Martin County Planning Dept. Buildout based on estimates provided by Martin County.

[3] Green areas include golf courses, and other large irrigated tracts such as parks and recreational areas. Existing and Committed based on data from Martin County Planning Dept. and DRI's. Buildout based on existing and committed land use data plus an estimated 20 acres per additional thousand population.

[4] Calculated as the number of green acres x 4000 gal/day/acre (average irrigation rate of 1" per week).

[5] Based upon potable (indoor) demand supplied by utility systems

[6] Column 5 factored by (Target %) availablity

[7] Percentage of large scale irrigated acres demand met by available (factored) supply

[8] Excess gallons available for other reclamation demand in reuse area.

for trends observed in and outside of the county (such as in Palm Beach County) and the additional acreage resulting from projected public access areas such as parks and recreational areas.

The columns headed "Potential Demand" result from calculations made by multiplying the "Green Acreage" by a factor of 1 inch irrigation per week. An application rate of 1 inch per week is an established preferred rate of effluent irrigation on golf courses in south Florida.

This 1 inch of irrigation per week translates to 4,000 gallons per acre per day (average). This resultant figure is expressed as the potential irrigation demand on identified large landscape irrigation parcels within each reuse area.

The wastewater flow (potential supply) was calculated as being equal to the indoor water demand supplied by utility systems.

The target reuse scenarios are meant to demonstrate the amounts of reuse that would be achieved under alternative levels of implementation and to specify how much of that could come from traditional use patterns, such as application to golf courses. These levels of effluent use are set at 25%, 50%, and 100% of listed treatment plant output to correspond with low, medium, and high levels of implementation efforts.

Because the wastewater treatment and disposal planning process is just getting underway in Martin County as was explained in the introduction, and because the potential users could only be specified in general, it was not possible to give detailed policies and costs which would achieve the alternative levels of implementation. The most common constraint to full implementation will be cost. Under two of these scenarios, 25% and 50%, some effluent supply will be unavailable. The resulting two columns represent the percentage of demands met on identified "green acres" and the additional supply (in gallons) available for other methods of wastewater disposal in the specific reuse area. All of the water in these columns is considered to be available for gross disposal which, when netted out, will provide some recharge to local surficial aquifers.

Summary

Upon review of Parts "A" and "B" of Table D.1, it is evident that under both existing and committed and buildout conditions reclamation at the low implementation level (25%) would come close to meeting green area demand only in the Stuart area (Reuse Area C).

In an effort to both optimize groundwater recharge and to develop alternative water sources for existing and projected "green acreage" demands, reclamation efforts utilizing between 50% and 75% of available effluent should be targeted. The quantities available (see Table D.1) at these target levels represent the most promising mechanisms for recharging the groundwater system. Large scale irrigation users combined with low cost percolation pond systems will make reclamation efforts feasible in most reuse areas.

Considering the logistical problems with disposing of supplies not being used on large scale landscaping, 50-75% target programs aimed at "Green Acreage" users probably should not be designed for reuse areas E, F, H, and J. These low demand areas present reclamation opportunities only if on site reuse is practiced on large scale PUDs and similar developments.

TABLE B.4
ESTIMATED RESIDENTIAL WATER DEMAND-BUILDOUT (MGY)

TAZ	RANCH	RURAL	ESTATE	LOW	MEDIUM	MOBILE	HIGH	COR	WATER	NONPOT.	POP.	POTABLE	TOTAL
1	0.000	0.000	43.564	277.542	77.932	0.000	0.000	1.794	0.000	400.832	4855	177.200	578.032
2	0.000	17.778	733.079	45.647	180.052	0.000	0.000	0.000	0.000	976.556	7663	279.710	1256.266
3	0.000	0.000	72.882	211.895	11.763	6.173	0.000	0.112	2.005	304.831	4583	167.272	472.104
4	0.000	0.000	174.489	16.538	183.574	0.000	35.574	0.088	2.493	412.756	5744	209.660	622.415
5	0.000	0.000	48.189	123.709	62.643	8.830	9.991	4.157	1.665	259.185	5340	194.899	454.084
6	0.000	0.000	18.705	202.221	16.978	13.327	0.000	8.211	0.000	259.442	4945	180.482	439.924
7	0.000	0.000	303.991	555.425	120.771	34.474	20.206	8.510	0.000	1043.378	14206	518.519	1561.897
8	0.000	0.000	240.014	52.241	12.696	0.000	44.130	4.420	0.000	353.501	5278	192.640	546.141
9	0.000	0.000	0.000	10.290	4.290	0.000	7.380	2.511	0.000	24.471	861	31.434	55.905
10	0.000	0.000	25.341	48.692	39.026	5.833	0.000	5.547	1.049	125.488	2458	89.713	215.201
11	0.000	0.000	0.000	25.523	0.000	0.000	2.886	0.262	0.000	28.672	722	26.349	55.021
12	0.000	0.000	0.521	45.378	11.071	0.000	1.124	0.000	0.000	58.094	1201	43.818	101.912
13	0.000	0.000	36.970	26.726	5.259	0.000	74.715	3.105	0.000	146.776	5617	205.035	351.811
14	0.000	0.000	405.487	0.000	0.000	0.000	0.000	0.000	0.000	405.487	2320	84.680	490.167
15	0.000	0.000	192.816	21.252	206.501	0.000	4.623	0.000	0.000	425.192	4719	172.240	597.432
16	0.000	0.000	28.639	48.148	5.120	0.000	13.270	0.262	0.075	95.515	1892	69.040	164.554
17	0.000	0.000	0.000	91.878	3.875	0.000	3.575	0.000	0.000	99.328	1978	72.193	171.521
18	0.000	0.000	0.000	53.345	29.627	0.000	9.362	0.412	0.000	92.746	2281	83.271	176.017
19	0.000	0.000	0.000	29.265	0.000	3.796	35.711	0.000	0.000	68.772	3203	116.913	185.685
2021	0.000	0.000	0.000	51.848	0.000	0.000	55.920	0.412	1.631	109.811	4612	168.320	278.131
22	0.000	0.000	0.000	329.880	19.510	8.394	10.270	0.112	1.349	369.515	6403	233.717	603.232
23	0.000	0.000	0.000	0.000	5.478	0.000	30.847	0.000	0.000	36.326	1998	72.934	109.260
24	0.000	0.000	0.000	0.000	146.478	0.000	1.762	0.000	0.000	148.240	3066	111.913	260.152
25	0.000	0.000	222.864	22.025	1.459	0.309	0.315	0.000	0.092	247.063	1629	59.466	306.529
26	0.000	0.000	172.006	341.282	46.083	0.000	0.797	0.544	1.618	562.330	7355	268.465	830.795
27	0.000	0.000	0.000	0.000	102.601	7.277	9.373	13.280	0.000	132.531	3577	130.546	263.077
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
29	0.000	0.000	83.154	629.555	66.963	0.000	0.000	29.186	0.000	808.858	10254	374.271	1183.129
30	0.000	181.281	345.323	252.847	4.290	10.608	8.117	4.101	0.000	806.567	8848	322.937	1129.505
31	0.000	0.000	390.510	846.589	70.193	0.000	0.000	8.913	3.087	1319.294	12897	470.733	1790.027
32	0.000	306.355	555.653	890.954	0.000	0.000	0.000	11.685	0.000	1764.648	17592	642.097	2406.745
33	0.000	0.000	445.925	25.208	0.000	0.000	0.000	0.000	0.000	471.133	2883	105.240	576.374
34	0.000	0.000	309.819	74.365	0.000	0.000	0.000	0.000	0.000	384.184	2608	95.181	479.365
35	0.000	0.000	0.000	29.960	0.138	0.000	0.000	0.380	0.037	30.517	607	22.145	52.661
36	0.000	0.000	116.031	276.821	23.582	0.000	0.000	5.793	0.000	422.227	5119	186.851	609.078
37	0.000	520.513	481.139	260.910	0.000	0.000	0.000	6.631	0.000	1269.193	9281	338.753	1607.946
38	156.934	814.068	2083.374	506.239	0.000	10.205	0.000	0.000	0.000	3570.819	24840	906.653	4477.472
39	0.000	294.473	0.000	1864.451	3.611	1.407	0.000	16.577	0.000	2180.518	24466	893.020	3073.538
40	0.000	0.000	0.000	130.171	129.129	0.000	15.428	7.898	0.000	282.626	5861	213.919	496.546
41	0.000	0.000	0.000	238.759	101.613	0.000	0.000	0.000	0.000	340.372	4293	156.705	497.077
42	0.000	0.000	1012.183	300.530	0.000	0.000	0.000	0.000	0.000	1312.713	9211	336.191	1648.904
43	0.000	0.000	75.328	414.808	316.557	24.708	3.483	9.277	0.000	844.161	15156	553.179	1397.341
44	0.000	0.000	617.203	12.472	0.000	0.000	0.000	1.739	0.000	631.415	3687	134.590	766.005
45	0.000	224.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	224.065	1595	58.218	282.282
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
47	0.000	0.000	6.848	372.478	0.000	0.000	0.000	5.924	0.000	385.250	6200	226.296	611.547
48	0.000	92.431	0.000	0.000	0.000	0.000	0.000	0.000	0.000	92.431	591	21.561	113.991
49	34.915	50.770	248.185	0.000	0.000	0.041	0.000	0.823	1.678	336.411	1916	69.945	406.356
50	0.000	50.598	288.975	142.398	0.000	0.000	13.830	0.000	0.000	495.801	5463	199.407	695.208
96	141.168	729.800	454.126	825.022	77.481	33.540	33.136	0.000	0.000	2294.274	27073	988.165	3282.438
97	0.000	0.000	375.621	96.862	171.135	0.000	0.000	0.000	1.193	644.812	6490	236.889	881.700
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000
99	510.954	24.020	0.000	0.000	0.000	2.903	0.000	0.000	0.000	537.876	3291	120.132	658.008
100	14.997	119.149	1292.619	0.000	0.000	29.793	0.000	0.000	12.588	1469.145	10869	396.708	1865.853
TOTALS	858.968	3425.300	11901.573	10822.152	2257.481	201.618	445.827	162.669	30.561	30106.148	329595	12030.214	42136.361