FINAL REPORT

WOODMERE CREEK BASIN MASTER PLAN





January 1999

Sarasota County, Florida

PARSONS ENGINEERING SCIENCE, INC.

WOODMERE CREEK BASIN MASTER PLAN
FINAL REPORT

Prepared for

SARASOTA COUNTY, FLORIDA

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
SARASOTA, FLORIDA

January 1999

TABLE OF CONTENTS

Page No.

SECTION 1 INTRODUCTION
General 1-1
Project Objectives 1-1
Purpose of the Report 1-1
Authorization 1-2
Coordination with Federal, State and Local Agencies 1-2

SECTION 2 DESCRIPTION OF STUDY AREA
Basin Description 2-1
Existing Land Use Conditions 2-1
Future Land Use Conditions 2-2
Soils 2-3
Existing Conveyance System 2-5
Natural Environment 2-6
Biotic Communities and Wetlands 2-6
Threatened and Endangered Species 2-6

SECTION 3 LEGAL AND REGULATORY FRAMEWORK
Pertinent Laws and Regulations 3-1
Local Legislation 3-1
State Legislation 3-2
Federal Legislation 3-3
Levels of Service Objectives 3-3
Levels of Service for Flood Protection 3-3
Levels of Service for Water Quality 3-3

SECTION 4 HYDROLOGIC/HYDRAULIC MODEL DEVELOPMENT
Watershed Model Selection 4-1
Data Sources 4-1
Field Surveying 4-3
Hydrologic Model Development 4-3
General 4-3
Subbasin Delineations 4-4
Impervious Areas 4-5
Soil Infiltration Rates 4-5
Overland Flow Lengths, Slopes and Roughness Coefficients 4-6
Initial Rainfall Abstractions (Depression Storage) 4-6
Hydraulic Model Development 4-6
General 4-6
Stormwater Drainage Structure Inventory 4-7
Channel Cross-Section and Floodplain Identification 4-8

TABLE OF CONTENTS
(Continued)

Storage Facility Stage-Area Relationships 4-8
Model Schematic 4-9
Equivalent Conduits 4-10
Boundary Conditions 4-11
Model Calibration/Verification 4-11
General 4-11
Selection of Calibration/Verification Storm Events 4-12
Calibration Storm Event, June 24-28, 1992 4-12
Verification Storm Event, June 23, 1995 4-12
Calibration/Verification Results 4-13

SECTION 5 ANALYSIS OF FLOOD CONTROL LEVELS OF SERVICE
Assessment of Existing Flooding Conditions 5-1
Existing Conditions Model Simulations 5-2
Design Storm Events 5-3
Model Simulations for Existing Conditions 5-3
Existing Levels of Service Deficiencies and Flooding Problem Areas 5-4
Future Conditions Model Simulations 5-6

SECTION 6 WATER QUALITY MODELING AND ANALYSIS OF WATER QUALITY LEVELS OF SERVICE
Introduction 6-1
Data Requirements 6-1
Existing Land Use Conditions Pollution Loads 6-3
Future Land Use Conditions Pollution Loads 6-4
Water Quality Levels of Service 6-4

SECTION 7 RECOMMENDED IMPROVEMENTS
Introduction 7-1
Potential Development of Regional Stormwater Management Facilities 7-1
Recommended Drainage System Improvements 7-3

SECTION 8 OPERATION AND MAINTENANCE ACTIVITIES
General 8-1
Maintenance Access Considerations 8-1
Recommended Maintenance Activities 8-2
Mowing and Clearing 8-2
Erosion Control 8-2
Mosquito and Plant Control 8-3
Debris and Litter Removal 8-3
Pond Sediment Removal 8-3
Resetting of Culverts 8-3
Data Collection and Management 8-4
Supplemental Freshwater Supply Assessment 8-4

LIST OF TABLES

Table No.	Title	Follows Page No.
2.1	Hydrologic Land Use Classification System	2-1
2.2	Land Use Summary	2-1
2.3	Existing Land Use Distribution	2-2
2.4	Land Use Summary	2-2
2.5	Future Land Use Distribution	2-3
2.6	Hydrologic Soil Group Classifications	2-3
2.7	Woodmere Creek Basin Hydrologic Soil Group Distribution	2-3
2.8	Subbasin Hydrologic Soil Group Distribution	2-4
2.9	List of Protected Species Present and Potentially Present in the Woodmere Creek Watershed	2-6
3.1	Sarasota County Flooding Levels of Service Criteria	3-3
3.2	Watershed Water Quality Index Criteria	3-4
4.1	Woodmere Creek Subbasin Model Input Parameters	4-6
4.2	Existing Conditions Equivalent Pipe Roughness	4-10
4.3	SWMM RUNOFF/EXTRAN Calibration Parameter Summary	4-13
4.4	Existing Conditions Model Calibration/Verification Comparison	4-13
5.1	Woodmere Creek Basin Design Storm Events	5-3
5.2	Existing Land Use and Existing Conditions Maximum Flood Stage Summary	5-3
5.3	Flood Protection LOS Deficiencies, Existing Land Use and Existing Conditions	5-4
5.4	Future Land Use and Existing Conditions Maximum Flood Stage Summary	5-6
5.5	Comparison of Maximum Water Surface Elevations at Selected Junction Locations for Existing and Future Land Use Conditions	5-6
6.1	Woodmere Creek Basin Existing Subbasin BMP Coverages	6-2
6.2	Total Net Annual Conventional Pollutant Loads for Existing Land Use Conditions	6-3
6.3	Total Net Annual Metal Pollutant Loads for Existing Land Use Conditions	6-3
6.4	Total Net Annual Conventional Pollutant Loads Per Acre for Existing Land Use Conditions	6-3
6.5	Total Net Annual Metal Pollutant Loads Per Acre for Existing Land Use Conditions	6-3
6.6	Woodmere Creek Basin Total Annual Pollutant Loadings for Existing Land Use Conditions	6-3
6.7	Woodmere Creek Basin Total Annual Pollutant Loadings for Future Land Use Conditions	6-3
7.1	Flood Protection LOS Deficiencies, Future Land Use and Recommended Plan Improvements	7-3
7.2	Woodmere Creek Basin Master Plan Recommended Capital Improvement Projects Construction Cost Estimates	7-3
8.1	Sarasota County Canal Cleaning Frequency System	8-3

LIST OF FIGURES

Figure No.	Title	Follows Page No.
1.1	Woodmere Creek Basin Location Map	1-1
2.1	Woodmere Creek Basin Hydrologic Land Use Classification Map, Existing Land Use	2-1
2.2	Woodmere Creek Basin Hydrologic Land Use Classification Map, Future Land Use	2-2
2.3	Soils Map	2-3
2.4	Woodmere Creek Basin Hydrologic Soil Group Classification Map	2-4
4.1	Woodmere Creek Drainage Basin Subbasin Delineations and Drainage System Map	4-4
4.2	Woodmere Creek Drainage Basin Model Schematic	4-10
4.3	Woodmere Creek Calibration Storm Event Hyetograph, June 24-28, 1992 at Forked Creek Station (15-Minute Data)	4-12
4.4	Woodmere Creek Verification Storm Event Hyetograph, July 17-18, 1995 at Venice NWS (60-Minute Data)	4-13
4.5	Model Calibration Comparison, June 1992 High Water Marks	4-14
4.6	Model Verification Comparison, July 1995 High Water Marks	4-14
5.1	Sarasota County Customer Response Tracking Data in Woodmere Creek Basin	5-1
5.2	Woodmere Creek Basin Existing Land Use and Existing Conditions Flood Profiles (S-1)	5-4
5.3	Woodmere Creek Basin Existing Land Use and Existing Conditions Flood Profiles (S-2)	5-4
5.4	Woodmere Creek Basin Existing Land Use and Existing Conditions Flood Profiles (S-3)	5-4
5.5	Woodmere Creek Basin Existing Land Use and Existing Conditions Flood Profiles (S-4)	5-4
5.6	Woodmere Creek Basin Existing Conditions 100-Year Floodplain and Identified Flooding Problem Areas	5-4
6.1	Woodmere Creek Water Quality Basins	6-1
6.2A	Woodmere Creek Basin Net Annual Conventional Pollutant Loadings	6-4
6.2B	Woodmere Creek Basin Net Annual Nutrient Loadings	6-4
6.2C	Woodmere Creek Basin Net Annual Metals Loadings	6-4
7.1	Woodmere Creek Basin Recommended Capital Improvement Projects and Master Plan Conditions 100-Year Floodplain	7-3
7.2	Woodmere Creek Basin Master Plan Conditions Flood Profile Comparisons (S-1)	7-3
7.3	Woodmere Creek Basin Master Plan Conditions Flood Profile Comparisons (S-2)	7-3
7.4	Woodmere Creek Basin Master Plan Conditions Flood Profile Comparisons (S-3)	7-3
7.5	Woodmere Creek Basin Master Plan Conditions Flood Profile Comparisons (S-4)	7-3
8.1	Easement Requirements	8-2

TABLE OF CONTENTS
(Continued)

APPENDICES

Appendix	Title
A	SWMM Model Calibration and Verification Input File
B	Summary Model Outputs for Model Calibration/Verification
C	SWMM Model Design Storm Event Input File, Existing Conditions
D	Existing Conditions Summary Model Outputs for Design Storm Events
E	SWMM Model Master Plan Conditions Input File
F	Master Plan Conditions Summary Model Outputs for Design Storm Events
G	Stormwater Conveyance System Field Surveys

SECTION 1
INTRODUCTION

GENERAL

The Woodmere Creek basin is located in the southwestern portion of Sarasota County and encompasses approximately 1.9 square miles (1192 acres) which drain into Lemon Bay. The basin generally extends southward from the intersection of S.R. 776 and Jacaranda Boulevard to Manasota Beach Road. The eastern boundary extends to approximately 3,000 ft east of Englewood Road (S.R. 776) and includes the Hourglass Lake Estates and Circlewood Condominiums, as well a large portion of the Gulfview Estates residential communities. A basin location map is included as Figure 1.1. Most of the area in the Woodmere Creek basin has been developed. Approximately 70 percent of the land in the basin is devoted to residential uses. A total of 23 percent is categorized as open land and/or wetlands. The remainder of the basin is commercial and industrial development that is concentrated along the S.R. 776 corridor.

Woodmere Creek consists of a network of man-made canals and lakes that discharge to the Intracoastal Waterway at the northern limits of Lemon Bay. The discharge point is located just south of the Lemon Bay Drive and Palmetto Road intersection. According to Chapter 62-302.600 of the Florida Administrative Code (FAC) and County Ordinance 72-37, Woodmere Creek is categorized as Class III surface waters. This designation is assigned to "waters used for recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife".

The Woodmere Creek Basin Master Plan was developed pursuant to the Sarasota County Comprehensive Plan requirements and is to be used as a planning tool as well as a means to achieve the levels of service goals established with respect to flood protection and water quality levels.

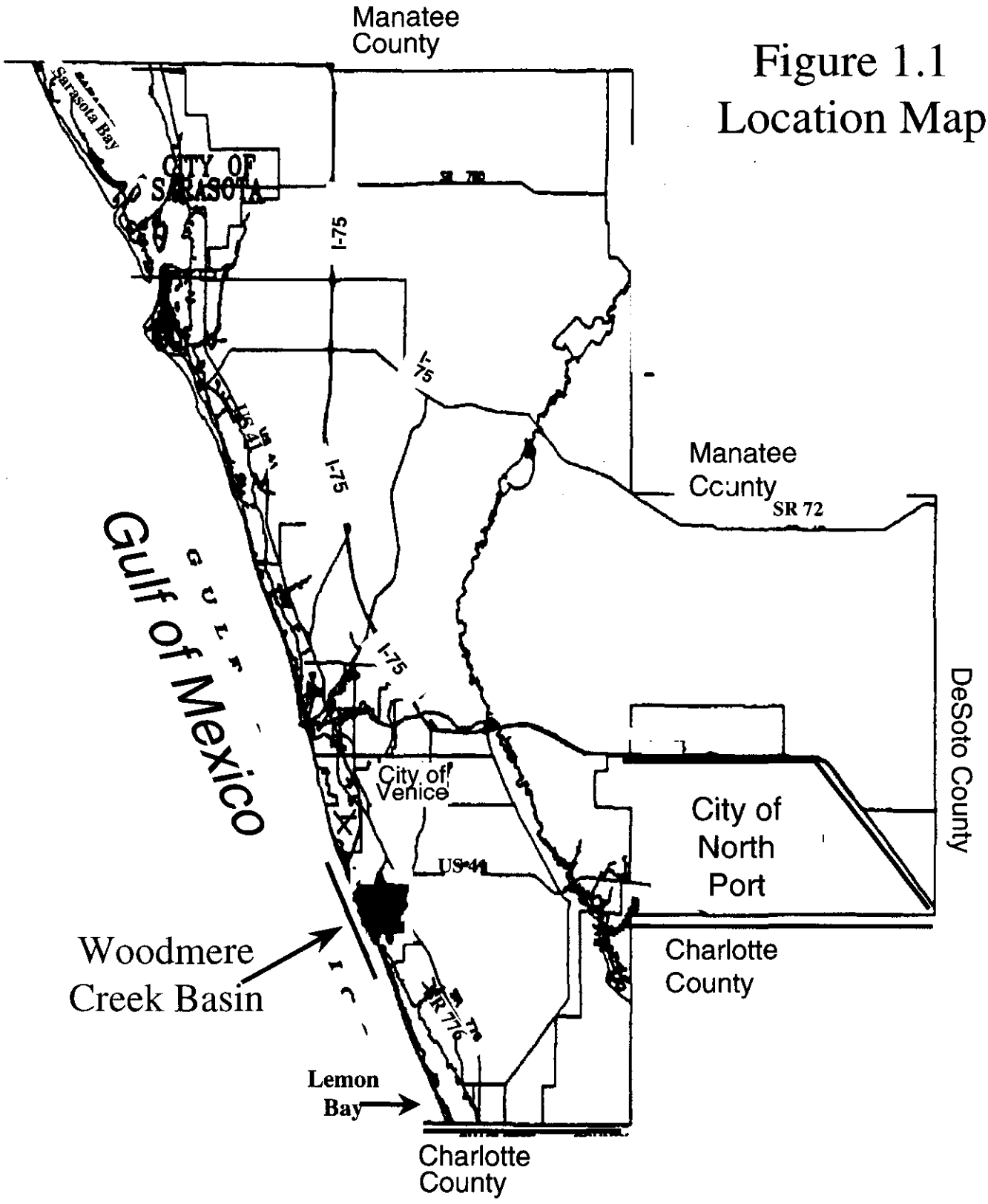
PROJECT OBJECTIVES

The objectives of the Woodmere Creek Basin Master Plan were to identify the existing and future flood protection and water quality levels of service (LOS) deficiencies throughout the Woodmere Creek Basin. Furthermore, stormwater improvements required to address the existing and projected levels of service deficiencies were developed and evaluated.

PURPOSE OF THE REPORT

To achieve the objectives of this project, the scope of services includes a series of tasks, from project management to development of this final basin master plan report.

Figure 1.1
Location Map



The purpose of this report is to describe the findings of the project, including data analysis, development of the hydrologic/hydraulic and water quality models, LOS evaluations for existing conditions, definition of problems and LOS deficiencies, evaluations of capital improvement alternatives, and improvement recommendations. The work effort included the following tasks:

Define Basin and Subbasin Characteristics. Existing available data were reviewed and evaluated to identify deficiencies in available information. Subsequently, basin and subbasin boundaries as well as land use characteristics in the study area were determined based on available maps and field investigations. A topographic survey was conducted to better define the characteristics of the stormwater system. During the field visits residents of the area were contacted to receive input regarding the perceived performance of the drainage system in terms of both water quantity and quality.

Conduct Hydrologic, Hydraulic, and Water Quality Analyses. Computer models were developed and used as tools to assess existing conditions. The models were calibrated and verified to ensure that they replicated situations observed in the field. Model schematics and flood frequency profiles were developed and are incorporated into this report.

Evaluate Existing LOS and Identify Problems. Field visits, data analysis, and computer model applications were used to identify the areas were the flood control and water quality LOS deficiencies exist. Flood complaint records on file with the County and input received from local residents were also used in this analysis as a means of identifying known problem areas. Local residents were also contacted to ensure that the computer models were replicating field conditions.

Alternatives Evaluations and Capital Improvement Plan Recommendations. Various measures to achieve the County's LOS standards were considered and evaluated using the computer model as a means of analyzing their effectiveness. These alternatives were screened and ranked based on factors of effectiveness, cost, engineering feasibility, permitting considerations, maintenance requirements, environmental impacts, land purchase requirements, and public acceptance. A capital improvement plan was developed which prioritizes the recommended drainage improvement projects and provides estimated construction costs. The master plan recommendations were presented to the community at two public meetings.

AUTHORIZATION

Preparation of the Master Plan for the Woodmere Creek Basin was authorized by Contract No. 96-346 (dated July 30, 1996) between Sarasota County and Parsons Engineering Science, Inc.

COORDINATION WITH FEDERAL, STATE, AND LOCAL AGENCIES

Work on this project has required coordination with a number of Federal, State, and local agencies including the Southwest Florida Water Management District, (SWFWMD), the U.S. Geological Survey (USGS), the Florida Department of

Environmental Protection (FDEP), the Natural Resources Conservation Service (NRCS), and the Federal Emergency Management Agency (FEMA). The Florida Department of Transportation (FDOT) was contacted in several occasions to discuss the potential impacts of the S.R. 776 expansion project. Coordination has also been necessary with various departments within the Sarasota County government, including the Transportation, Natural Resources, and Planning Departments.

SECTION 2
DESCRIPTION OF STUDY AREA

BASIN DESCRIPTION

The Woodmere Creek basin encompasses an area of 1,211 acres (approximately 1.9 square miles) in southwestern Sarasota County. Typical of south Florida conditions, the basin is characterized by flat topography, high water table, and natural depressions and wetlands. The basin land surface elevation ranges from a high of approximately 17 ft NGVD on the eastern side of Englewood Road to about 6 ft NGVD at the basin's discharge point. The main drainage system is comprised of two main channels, a northern and southern branch, which converge near the basin outfall approximately 600 feet west of Heron Road. The main (northern) channel is a man-made ditch which flows in a straight east-west path for a length of approximately 1.8 miles. The southern channel is also man-made.

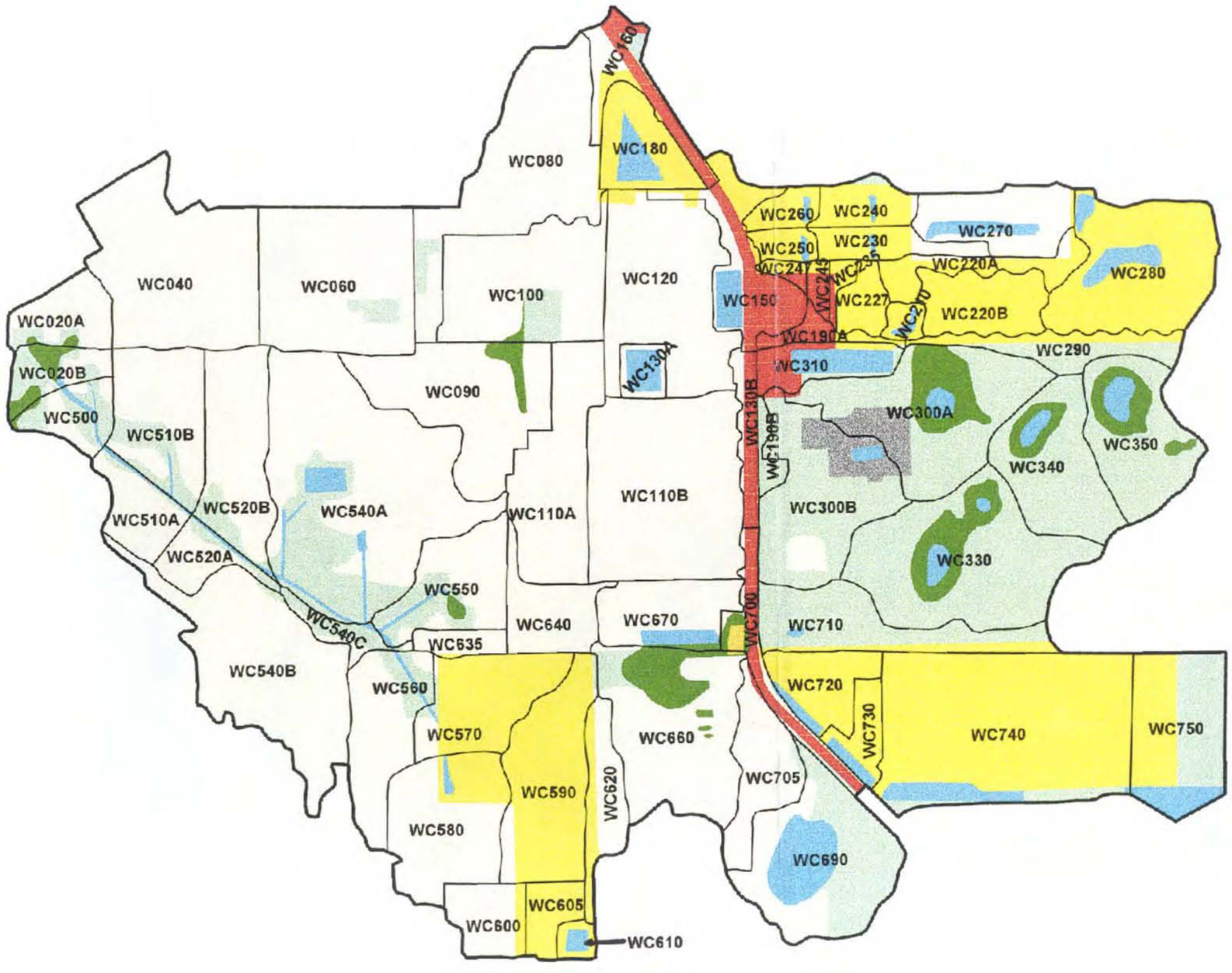
EXISTING LAND USE CONDITIONS

Existing land use conditions within the Woodmere Creek watershed were defined by the use of a land use coverage digital data file provided by Sarasota County from its Geographic Information System (GIS) database. These maps are based on the Florida Land Use and Cover Classification System (FLUCCS) and show 35 land use categories in the study area. For this study, in order to make results consistent with other master planning efforts, the FLUCCS categories were aggregated into seven categories which were considered to represent the general land use conditions in the study area. Because the low density residential category represents less than 0.5 percent of the total basin area, it was aggregated with the medium density category. In addition, the commercial and transportation categories were aggregated because Englewood Road represents the only "Major Roadway" land use type and it is also the area where the most significant commercial activitiy is concentrated. Table 2.1 provides a listing of the original 35 land use classifications as provided with the County GIS database, and the corresponding aggregated land use classifications. Figure 2.1 presents the resultant land use map of the basin with the aggregated land use classifications.

Development of the Woodmere Creek land use map also required "field-truthing" the initial product and make subsequent adjustments to the GIS database. The field-truthing consisted of examination of recent (1995) aerial photography of the basin as well as field visits to confirm that both the classifications and the areal extent are properly represented. Several adjustments were required. The majority involved the delineation of open land and wetland areas in the County's land use coverage. Table 2.2 lists the total amounts of each aggregated land use category in the Woodmere Basin. Table 2.3 presents a breakdown of land use areas within individual subbasins and the corresponding percent of total area. It can be seen that the majority of the basin (54%) is currently developed with low and medium density residential land uses.

Table 2.1
Woodmere Creek Watershed
Hydrologic Land Use Classification System

	HYDROLOGIC LAND USE CLASSIFICATION						
LAND USE CLASSIFICATION DESCRIPTION	**OPEN LAND**	**LOW AND MEDIUM DENSITY RESIDENTIAL**	**HIGH DENSITY RESIDENTIAL**	**COMMERCIAL & ROADWAY**	**INDUSTRIAL**	**WATERBODY**	**WETLAND**
RESIDENTIAL-LOW DENSITY		X					
RESIDENTIAL MEDIUM		X					
RESIDENTIAL HIGH			X				
COMMERCIAL-RETAIL SALES				X			
PROFESSIONAL SERVICES				X			
CEMETARIES	X						
INDUSTRIAL					X		
EDUCATIONAL FACILITIES				X			
RELIGIOUS				X			
GOVERNMENTAL				X			
RECREATIONAL-SWIMMING BEACH	X						
RECREATIONAL-MARINE AND FISH CAMPS	X						
RECREATIONAL-PARKS AND ZOOS	X						
COMMUNITY RECREATIONAL FACILITIES	X						
OPEN LAND	X						
CROPLAND AND PASTURELAND	X						
IMPROVED PASTURES	X						
UNIMPROVED PASTURES	X						
NURSERIES AND VINEYARDS	X						
OPEN LANDS-RURAL	X						
SHRUB AND BRUSHLAND	X						
MIXED RANGELAND	X						
UPLAND FORESTS	X						
UPLAND CONIFEROUS FORESTS	X						
HARDWOOD-CONIFEROUS MIXED	X						
STREAMS AND WATERWAYS						X	
RESERVOIRS						X	
WETLAND HARDWOOD FORESTS							X
MANGROVE SWAMPS							X
VEGETATED NON-FORESTED WETLANDS							X
SALTWATER MARSHES							X
EMERGENT AQUATIC VEGETATION							X
ROADS AND HIGHWAYS				X			
WATER SUPPLY PLANTS					X		
SEWAGE TREATMENT					X		



LEGEND

BASIN BOUNDARY

SUB-BASIN BOUNDARY

HYDROLOGIC LAND USE CLASSIFICATION

- RESIDENTIAL - LOW AND MEDIUM DENSITY
- RESIDENTIAL - HIGH DENSITY
- COMMERCIAL & ROADWAY
- INDUSTRIAL
- OPEN LAND
- WATER
- WETLAND

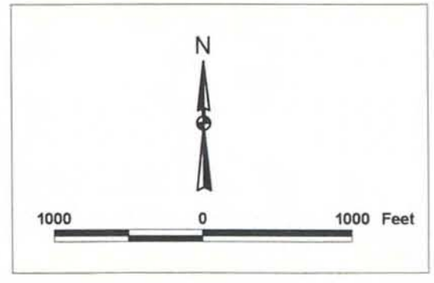


FIGURE 2.1

WOODMERE CREEK
BASIN MASTER PLAN
EXISTING HYDROLOGIC LAND USE
CLASSIFICATION MAP

PARSONS ENGINEERING SCIENCE, INC

Only 19% of the basin remains as open land and is available for future development. Some of the notable high density residential developments within the basin are the Hourglass Estates, Circlewood Condominiums, and Gulfview Estates, all located east of SR 776, and Japanese Gardens, located immediately north of the Manasota Beach Road and Belvedere Road intersection.

Table 2.2
Existing Land Use Summary

Land Use Category	Total Area (acres)	Percentage of Basin (%)
Low and Medium Density Residential	649	53.6
High Density Residential	196	16.2
Commercial and Roadway	30	2.5
Industrial	10	0.8
Open Land	227	18.7
Wetland	50	4.1
Waterbody	49	4.1
TOTAL	1211	100.0

FUTURE LAND USE CONDITIONS

One of the goals of the basin study is to evaluate both the existing and future flooding and water quality conditions within the Woodmere Creek basin. Future land use conditions within the basin were defined using information provided by the Sarasota County Planning Department and through investigations of rezoning applications. The resulting map of future land use conditions which was compiled is shown in Figure 2.2. This map represents built-out conditions within the basin. According to APOXSEE, the majority of future development within the Woodmere Creek watershed will be in the form of medium density residential land uses. The 227 acres of remaining open land, located mostly eastward of SR 776, would be converted to this land use category.

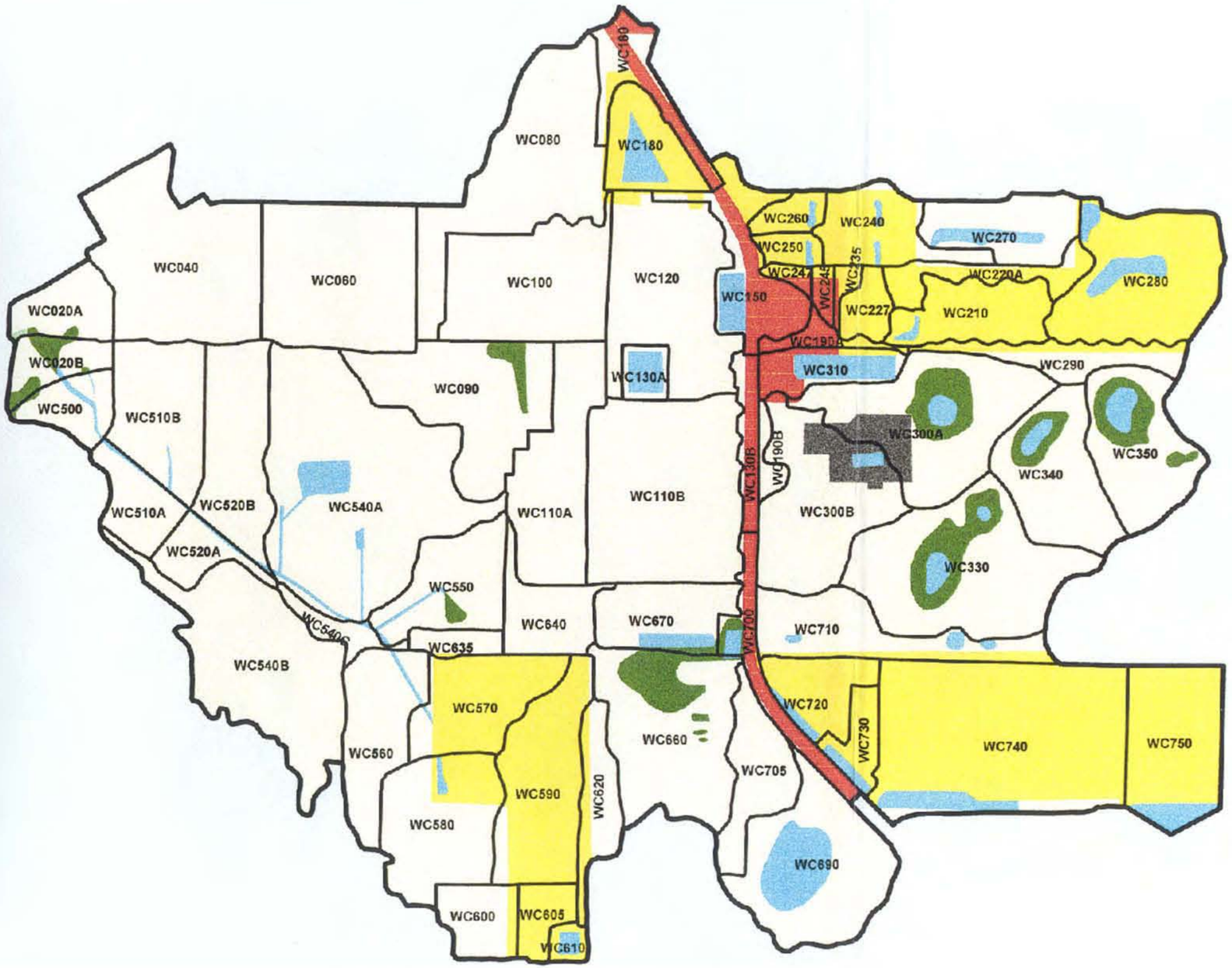
The future land use map does not consider the water features that may be constructed in the basin as stormwater management facilities. Those facilities are expected to be designed and constructed consistent with current state surface water management regulations and County land development code. However, calculations of future flooding conditions within the basin considered the hydrologic effect of those facilities.

Table 2.3
Woodmere Creek Basin
Existing Land Use Distribution

Subbasin Number	Low and Medium Density Residential		High Density Residential		Commercial and Roadway		Industrial		Open Land		Wetland		Water		Total Area (acres)	Percent Impervious
	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent		
WOODMERE CREEK																
WC020A	8.5	84%							1.2	12%	0.4	4%			10.1	15%
WC020B	2.0	26%							3.2	42%	2.5	33%			7.7	5%
WC040	42.3	100%													42.3	18%
WC060	36.2	95%							1.8	5%					38.0	17%
WC080	38.6	97%							1.4	3%					40.0	17%
WC090	27.6	86%							2.7	8%	1.8	6%			32.1	15%
WC100	22.2	70%							9.3	30%					31.5	13%
WC110A	26.2	100%													26.2	18%
WC110B	47.2	100%													47.2	18%
WC120	35.1	100%													35.1	18%
WC130A	1.8	43%											2.4	57%	4.2	65%
WC130B	1.5	25%			3.7	64%			0.6	10%					5.8	56%
WC150	3.8	22%	2.8	16%	6.5	37%			2.0	11%			2.5	14%	17.5	54%
WC160	5.8	57%			3.1	31%			1.3	12%					10.2	35%
WC180	9.6	77%											2.8	23%	12.4	37%
WC195	0.9	24%			2.7	75%			0.0	1%					3.6	64%
WC190					0.0	1%			2.5	99%					2.5	1%
WC210	1.9	81%											0.5	19%	2.4	34%
WC220A	1.3	15%	7.4	85%											8.6	37%
WC220B			13.0	100%											13.0	40%
WC227			5.1	100%											5.1	40%
WC230	2.0	27%	5.2	70%									0.2	3%	7.4	36%
WC235			1.2	70%	0.5	30%									1.7	52%
WC240	0.3	4%	6.1	86%					0.5	7%			0.3	4%	7.2	39%
WC245			0.5	24%	1.4	76%									1.9	70%
WC247			1.0	64%	0.6	36%									1.6	54%
WC250			3.1	92%									0.3	8%	3.4	45%
WC260			3.8	92%									0.3	8%	4.1	45%
WC270	12.8	83%	0.3	2%									2.4	16%	15.4	31%
WC280	28.5	89%											3.5	11%	31.9	27%
WC290	4.5	42%							6.2	58%	0.0	0%			10.6	8%
WC300A			0.0	0%	0.1	0%	4.8	13%	24.9	68%	5.3	15%	1.2	3%	36.4	10%
WC300B	2.2	7%			0.3	1%	5.3	17%	23.3	73%			0.7	2%	31.8	12%
WC310			0.7	8%	3.5	38%			1.0	11%			4.1	44%	9.3	77%
WC330									34.6	80%	7.1	16%	1.6	4%	43.3	4%
WC340									19.9	85%	2.5	11%	1.0	4%	23.4	4%
WC350									16.8	73%	4.4	19%	1.8	8%	22.9	8%
WC500	3.2	38%							5.3	62%					8.4	7%
WC510A	8.7	89%							1.1	11%					9.8	16%
WC510B	16.3	76%							4.5	21%	0.6	3%			21.4	14%
WC520A	5.4	77%							1.6	23%					7.0	14%
WC520B	19.5	86%							3.2	14%					22.6	15%
WC540A	49.0	72%									16.6	25%	2.0	3%	67.6	16%
WC540B	41.3	99%							0.4	1%					41.7	18%
WC540C	1.3	29%							3.2						4.4	5%
WC550	11.6	65%							5.4	30%	1.0	6%			18.0	12%
WC560	15.8	81%							3.6	19%					19.4	15%
WC570			18.5	98%					0.4	2%					18.9	39%
WC580	19.8	77%	5.4	21%									0.4	2%	25.6	24%
WC590	1.8	7%	24.4	92%					0.3	1%					26.4	38%

Table 2.3
Woodmere Creek Basin
Existing Land Use Distribution

Subbasin Number	Low and Medium Density Residential		High Density Residential		Commercial and Roadway		Industrial		Open Land		Wetland		Water		Total Area (acres)	Percent Impervious
	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent		
WC600	7.9	86%	1.3	14%											9.2	21%
WC605			6.3	100%											6.3	40%
WC610			1.8	69%									0.8	31%	2.6	58%
WC620	6.7	65%	3.6	35%											10.2	26%
WC635	3.7	94%	0.2	6%											4.0	19%
WC640	11.8	100%	0.0	0%											11.8	18%
WC660	26.0	73%							2.2		6.0	17%	1.6	5%	35.8	18%
WC670	12.5	84%									0.7	4%	1.8	12%	14.9	27%
WC690	10.0	30%							15.7	47%			7.9	23%	33.5	29%
WC700	0.7	7%	0.1	1%	7.2	75%					0.9	9%	0.8	8%	9.6	70%
WC705	13.6	97%							0.4	3%					14.0	17%
WC710			4.1	19%					16.6	79%			0.2	1%	20.8	9%
WC720			10.3	91%									1.0	9%	11.3	45%
WC730			5.1	81%					0.1	1%			1.1	18%	6.3	50%
WC740			55.6	88%					4.1	7%			3.6	6%	63.3	41%
WC750			9.5	53%					6.0	33%			2.5	14%	18.0	35%
Basin Total	**648.9**	**53.6%**	**196.3**	**16.2%**	**29.7**	**2.5%**	**10.1**	**0.8%**	**226.8**	**18.7%**	**49.7**	**4.1%**	**49.2**	**4.1%**	**1210.6**	**23%**



LEGEND

- BASIN BOUNDARY
- SUB-BASIN BOUNDARY

HYDROLOGIC LAND USE

- RESIDENTIAL - LOW & MEDIUM DENSITY
- RESIDENTIAL - HIGH DENSITY
- COMMERCIAL & ROADWAYS
- INDUSTRIAL
- OPEN LAND
- WATER
- WETLANDS

N

1000 0 1000 Feet

FIGURE 2.2

WOODMERE CREEK
BASIN MASTER PLAN
FUTURE HYDROLOGIC LAND USE
CLASSIFICATION MAP

PARSONS ENGINEERING SCIENCE, INC

Table 2.4 lists the basinwide totals of the individual land use categories that are expected for the built-out future land use condition. The individual subbasin breakdowns are listed in Table 2.5.

Table 2.4
Future Land Use Summary

Land Use Category	Total Area (acres)	Percentage of Basin (%)
Low and Medium Density Residential	876	72
High Density Residential	196	16
Commercial and Roadway	30	3
Industrial	10	1
Open Land	0	0
Wetland	50	4
Waterbody	49	4
TOTAL	1211	100

SOILS

According to the Natural Resources Conservation Service (NRCS), there are 30 different types of soils located in the Woodmere Creek Basin. Figure 2.3 shows the NRCS soils map of the basin by soil type. It shows that the basin soils consist predominantly of EauGallie and Myakka fine sands.

A standard method of soils classification is the hydrologic soils group. Soils are grouped into four hydrologic soil groups A through D. These groups are commonly used in hydrologic analyses to estimate infiltration rates and soil moisture capacities. Descriptions of these soil groups are:

Hydrologic Soil Group A (low runoff potential): Soils that have high infiltration rates even when thoroughly wetted and a high rate of water transmission. Typical maximum infiltration rate of 10 in/hr when dry and 0.5 in/hr when saturated.

Hydrologic Soil Group B (moderately low runoff potential): Soils that have moderate infiltration rates when thoroughly wetted and a moderate rate of water transmission. Typical maximum infiltration rate of 8 in/hr when dry and 0.4 in/hr when saturated.

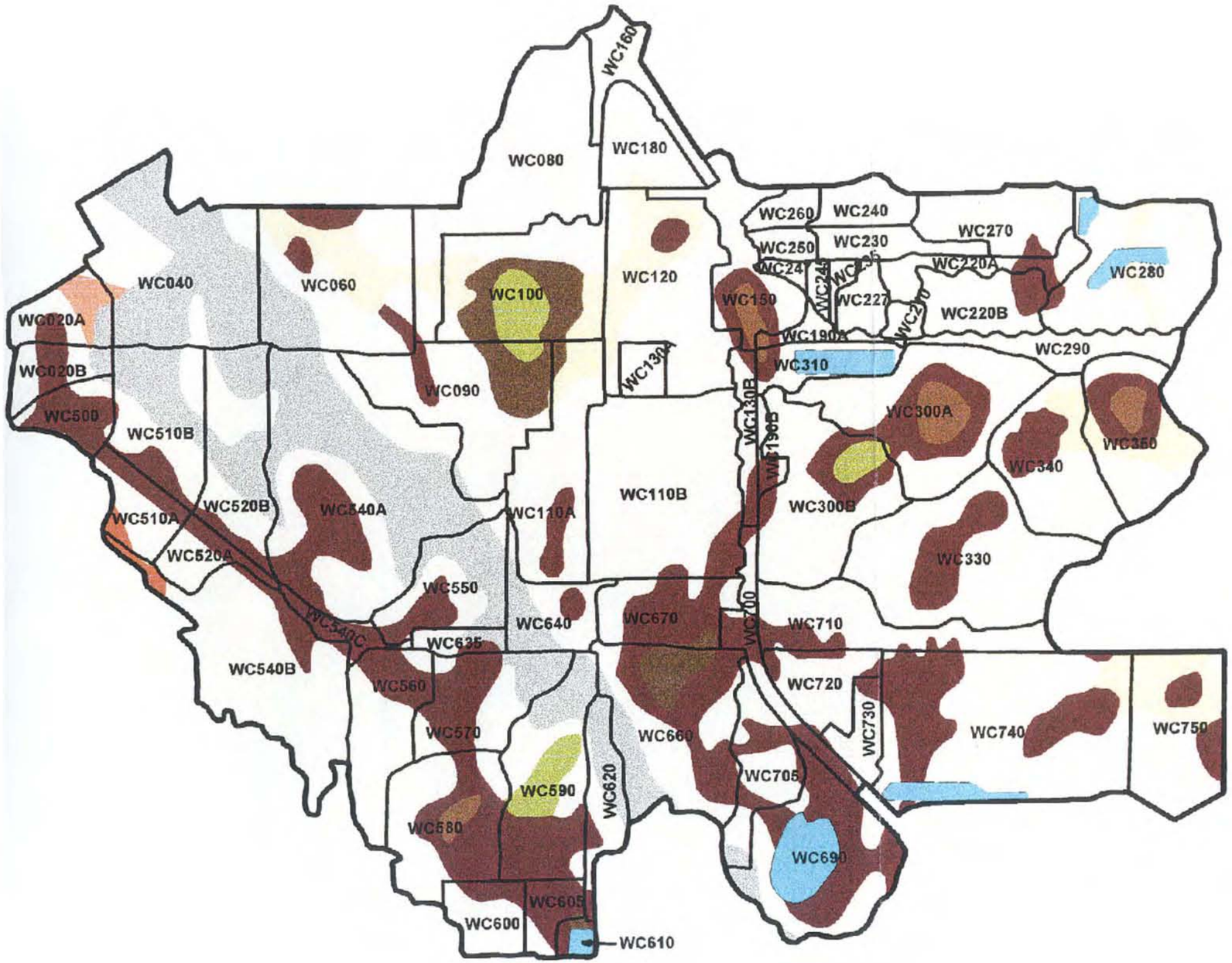
Hydrologic Soil Group C (moderately high runoff potential): Soils that have a slow infiltration rate when thoroughly wetted and a slow rate of water

Table 2.5
Woodmere Creek Basin
Future Land Use Distribution

Subbasin Number	Low and Medium Density Residential		High Density Residential		Commercial and Roadway		Industrial		Open Land		Wetland		Water		Total Area (acres)	Percent Impervious
	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent		
WOODMERE CREEK																
WC020A	9.7	96%									0.4	4%			10.1	17%
WC020B	5.2	67%									2.5	33%			7.7	12%
WC040	42.3	100%													42.3	18%
WC060	38.0	100%													38.0	18%
WC080	40.0	100%													40.0	18%
WC090	30.3	94%									1.8	6%			32.1	17%
WC100	31.5	100%													31.5	18%
WC110A	26.2	100%													26.2	18%
WC110B	47.2	100%													47.2	18%
WC120	35.1	100%													35.1	18%
WC130A	1.8	43%											2.4	57%	4.2	65%
WC130B	2.1	36%			3.7	64%									5.8	58%
WC150	5.8	33%	2.8	16%	6.5	37%							2.5	14%	17.5	56%
WC160	7.0	69%			3.1	31%									10.2	37%
WC180	9.6	77%											2.8	23%	12.4	37%
WC195	0.9	25%			2.7	75%									3.6	65%
WC190	2.5	99%			0.0	1%									2.5	19%
WC210	1.9	81%											0.5	19%	2.4	34%
WC220A	1.3	15%	7.4	85%											8.6	37%
WC220B			13.0	100%											13.0	40%
WC227			5.1	100%											5.1	40%
WC230	2.0	27%	5.2	70%									0.2	3%	7.4	36%
WC235			1.2	70%	0.5	30%									1.7	52%
WC240	0.8	11%	6.1	86%									0.3	4%	7.2	40%
WC245			0.5	24%	1.4	76%									1.9	70%
WC247			1.0	64%	0.6	36%									1.6	54%
WC250			3.1	92%									0.3	8%	3.4	45%
WC260			3.8	92%									0.3	8%	4.1	45%
WC270	12.8	83%	0.3	2%									2.4	16%	15.4	31%
WC280	28.5	89%											3.5	11%	31.9	27%
WC290	10.6	100%									0.0	0%			10.6	18%
WC300A	24.9	68%	0.0	0%	0.1	0%	4.8	13%			5.3	15%	1.2	3%	36.4	22%
WC300B	25.4	80%			0.3	1%	5.3	17%					0.7	2%	31.8	25%
WC310	1.0	11%	0.7	8%	3.5	38%							4.1	44%	9.3	79%
WC330	34.6	80%									7.1	16%	1.6	4%	43.3	18%
WC340	19.9	85%									2.5	11%	1.0	4%	23.4	20%
WC350	16.8	73%									4.4	19%	1.8	8%	22.9	21%
WC500	8.4	100%													8.4	18%
WC510A	9.8	100%													9.8	18%
WC510B	20.8	97%									0.6	3%			21.4	17%
WC520A	7.0	100%													7.0	18%
WC520B	22.6	100%													22.6	18%
WC540A	49.0	72%									16.6	25%	2.0	3%	67.6	18%
WC540B	41.7	100%													41.7	18%
WC540C	4.4	100%													4.4	18%
WC550	17.0	94%									1.0	6%			18.0	17%
WC560	19.4	100%													19.4	18%
WC570	0.4	2%	18.5	98%											18.9	40%
WC580	19.8	77%	5.4	21%									0.4	2%	25.6	24%
WC590	2.1	8%	24.4	92%											26.4	38%

Table 2.5
Woodmere Creek Basin
Future Land Use Distribution

WC600	7.9	86%	1.3	14%											9.2	21%
WC605			6.3	100%											6.3	40%
WC610			1.8	69%									0.8	31%	2.6	58%
WC620	6.7	65%	3.6	35%											10.2	26%
WC635	3.7	94%	0.2	6%											4.0	19%
WC640	11.8	100%	0.0	0%											11.8	18%
WC660	28.2	79%									6.0	17%	1.6	5%	35.8	19%
WC670	12.5	84%									0.7	4%	1.8	12%	14.9	27%
WC690	25.6	77%											7.9	23%	33.5	37%
WC700	0.7	7%	0.1	1%	7.2	75%					0.9	9%	0.8	8%	9.6	70%
WC705	14.0	100%													14.0	18%
WC710	16.6	79%	4.1	19%									0.2	1%	20.8	23%
WC720			10.3	91%									1.0	9%	11.3	45%
WC730	0.1	1%	5.1	81%									1.1	18%	6.3	51%
WC740	4.1	7%	55.6	88%									3.6	6%	63.3	42%
WC750	6.0	33%	9.5	53%									2.5	14%	18.0	41%
Basin Total	**875.6**	**72.3%**	**196.3**	**16.2%**	**29.7**	**2.5%**	**10.1**	**0.8%**	**0.0**	**0.0%**	**49.7**	**4.1%**	**49.2**	**4.1%**	**1210.6**	**26%**



LEGEND

BASIN BOUNDARY

SUB-BASIN BOUNDARY

WATER

SOIL CLASSIFICATIONS	SOIL NUMBERS
Boca and Hallandale Soils	3
Cassia Fine Sand	7
Delray Fine Sand, Depressional	8
EauGallie and Myakka Fine Sands	10
Floridana and Gator Soils, Depressional	15
Gator Muck	17
Holopaw Fine Sand, Depressional	22
Pineda Fine Sand	31
Pomello Fine Sand	33
Tavares Fine Sand	40

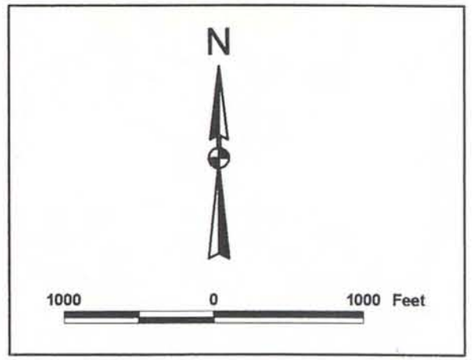


FIGURE 2.3

WOODMERE CREEK
BASIN MASTER PLAN
SOILS MAP

PARSONS ENGINEERING SCIENCE, INC.

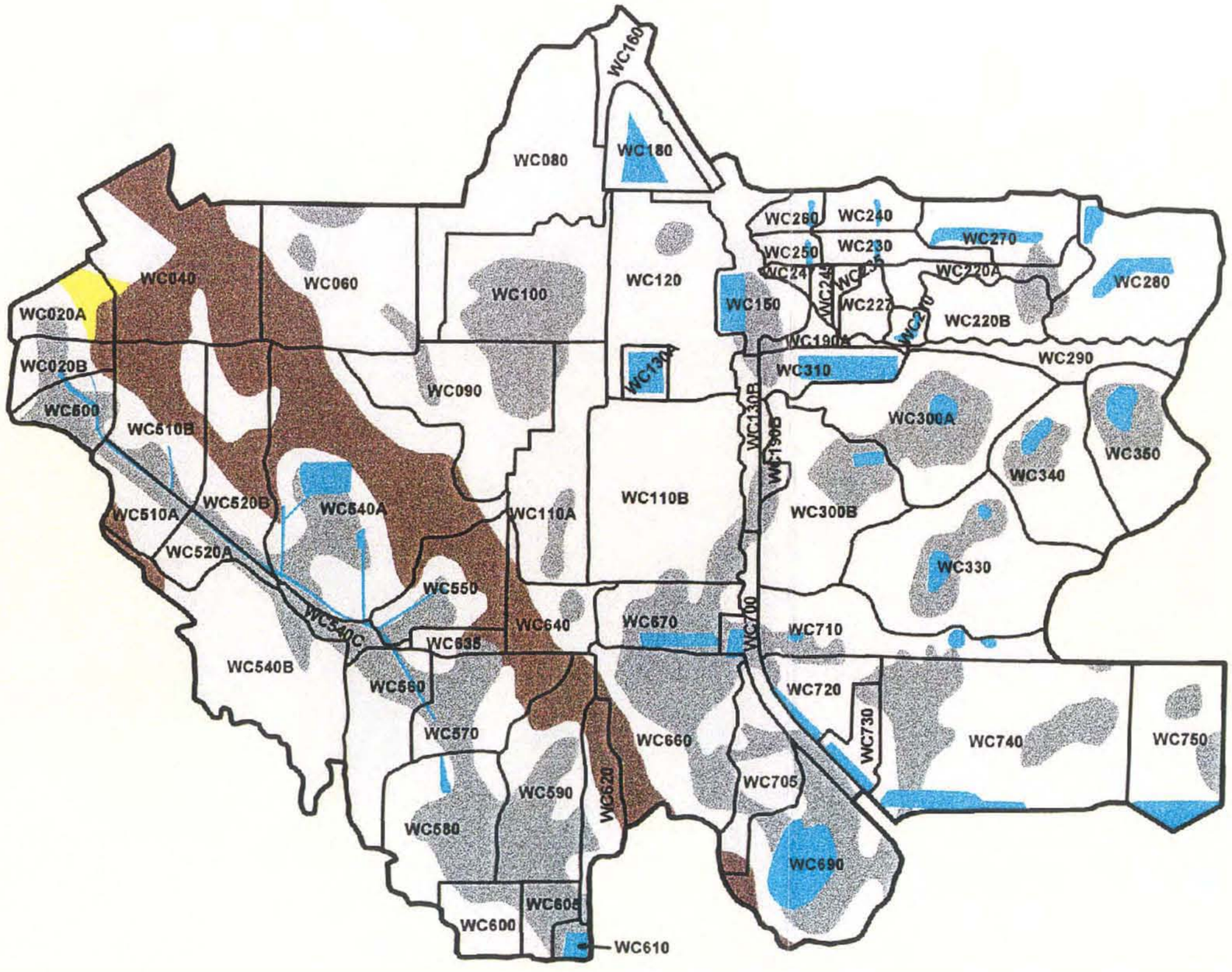
transmission. Typical maximum infiltration rate of 5 in/hr when dry and 0.25 in/hr when saturated.

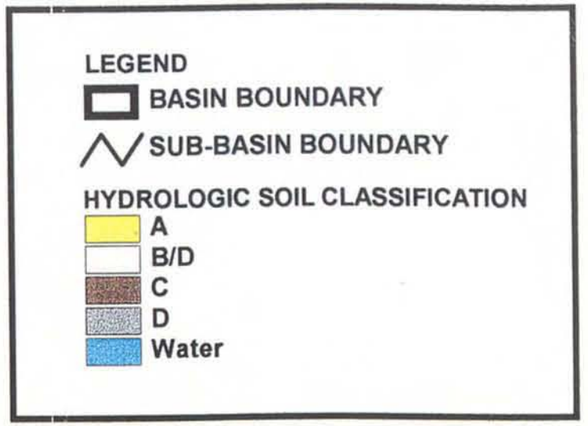
Hydrologic Soil Group D (high runoff potential): Soils having very slow infiltration rates when thoroughly wetted and a very slow rate of water transmission. Typical infiltration rate of 3 in/hr when dry and 0.10 in/hr when saturated.

In many cases in Florida, dual hydrologic soil group classifications (A/D or B/D) are assigned to soils that, during the wet season, and without the presence of efficient drainage, are saturated throughout much of the soil column due to a high surficial water table. Thus, during this time of year, infiltration is impeded and the soil acts as a D soil. However, during the rest of the year, when the water table is lower, the soil acts as an A or B soil. Table 2.6 lists the soil name and corresponding hydrologic soil group classification for each of the soil types which occur within the Woodmere Creek basin. Figure 2.4 is a map of the basin's soils by hydrologic group. The basinwide distribution of soil types, by hydrologic soil group classification, is listed in Table 2.7. It can be seen that nearly 64 percent of the watershed is comprised of soils which are classified as hydrologic soil group B/D, and nearly a quarter of the basin is either classified as D soils or is a waterbody. Table 2.8 lists the distribution of each hydrologic soil type for each individual subbasin.

Table 2.6
Hydrologic Soil Group Classification

Soil Name	Soil Number	Hydrologic Soil Group
Boca and Hallandale Sand	3	B/D
Cassia Fine Sand	7	C
Delray Fine Sand, Deppressional	8	D
Eaugallie and Myakka Fine Sands	10	B/D
Floridana and Gator Soils, depressional	15	D
Gator Muck	17	D
Holopaw Fine Sand	22	D
Pineda Fine Sand	31	B/D
Pomello Fine Sand	33	C
Tavares Fine Sand	40	A





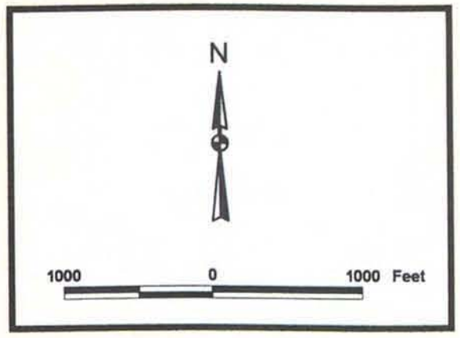


FIGURE 2.4

WOODMERE CREEK
BASIN MASTER PLAN
HYDROLOGIC SOIL GROUP
CLASSIFICATION MAP

PARSONS ENGINEERING SCIENCE, INC.

Table 2.8
Woodmere Creek Basin Hydrologic Soil Group Distribution

Subbasin	Soil Group A Area (acres)	Soil Group A Percent	Soil Group B/D Area (acres)	Soil Group B/D Percent	Soil Group C Area (acres)	Soil Group C Percent	Soil Group D Area (acres)	Soil Group D Percent	Waterbody Area (acres)	Waterbody Percent	Total Area (acres)
WOODMERE CREEK											
WC020A	3.2	32%	4.3	43%	1.3	13%	1.4	13%			10.1
WC020B			4.3	55%	1.1	14%	2.4	31%			7.7
WC040	0.4	1%	12.1	29%	29.8	70%					42.3
WC060			26.9	71%	6.2	16%	4.9	13%			38.0
WC080			39.9	100%			0.1	0%			40.0
WC090			22.1	69%	0.6	2%	9.5	29%			32.1
WC100			16.5	52%			15.1	48%			31.5
WC110A			22.4	85%	0.1	0%	3.8	14%			26.2
WC110B			43.7	93%			3.5	7%			47.2
WC120			33.1	94%			2.1	6%			35.1
WC130A			1.8	43%					2.4	36%	4.2
WC130B			4.1	70%			1.7	30%			5.8
WC150			11.8	68%			3.2	18%	2.5	12%	17.5
WC160			10.2	100%							10.2
WC180			9.6	77%					2.8	19%	12.4
WC195			3.0	84%			0.6	16%			3.6
WC190			1.4	56%			1.1	44%			2.5
WC210			1.9	81%					0.5	16%	2.4
WC220A			7.3	84%			1.4	16%			8.6
WC220B			10.7	82%			2.3	18%			13.0
WC227			5.1	100%							5.1
WC230			7.2	97%					0.2	3%	7.4
WC235			1.7	100%							1.7
WC240			6.9	96%					0.3	4%	7.2
WC245			1.9	100%							1.9
WC247			1.6	100%							1.6
WC250			3.1	92%					0.3	8%	3.4
WC260			3.8	92%					0.3	7%	4.1
WC270			12.3	80%			0.7	5%	2.4	14%	15.4
WC280			27.9	87%			0.6	2%	3.5	10%	31.9
WC290			10.6	100%							10.6
WC300A			22.4	62%			12.7	35%	1.2	3%	36.4
WC300B			23.2	73%			7.9	25%	0.7	2%	31.8
WC310			3.9	42%			1.3	14%	4.1	31%	9.3
WC330			34.3	79%			7.4	17%	1.6	4%	43.3
WC340			18.3	78%			4.1	17%	1.0	4%	23.4
WC350			15.1	66%			6.0	26%	1.8	7%	22.9
WC500			2.0	23%	0.2	2%	6.3	74%			8.4
WC510A			5.5	56%	1.1	11%	3.2	33%			9.8
WC510B			9.7	45%	8.8	41%	3.0	14%			21.4
WC520A			4.4	64%			2.5	36%			7.0
WC520B			10.4	46%	10.1	45%	2.1	9%			22.6
WC540A			23.9	35%	31.4	47%	10.3	15%	2.0	3%	67.6

Table 2.8
Woodmere Creek Basin Hydrologic Soil Group Distribution

Subbasin	Soil Group A Area (acres)	Soil Group A Percent	Soil Group B/D Area (acres)	Soil Group B/D Percent	Soil Group C Area (acres)	Soil Group C Percent	Soil Group D Area (acres)	Soil Group D Percent	Waterbody Area (acres)	Waterbody Percent	Total Area (acres)
WOODMERE CREEK											
WC540B			36.4	87%	1.5	4%	3.7	9%			41.7
WC540C			0.4	8%			4.1	92%			4.4
WC550			6.2	34%	7.9	44%	4.0	22%			18.0
WC560			12.7	65%			6.7	35%			19.4
WC570			8.1	43%	4.2	22%	6.7	35%			18.9
WC580			12.8	50%			12.4	48%	0.4	2%	25.6
WC590			7.8	30%	5.1	19%	13.5	51%			26.4
WC600			7.0	76%			2.2	24%			9.2
WC605			1.9	30%			4.4	70%			6.3
WC610							1.8	69%	0.8	31%	2.6
WC620			4.1	40%	4.8	47%	1.3	12%			10.2
WC635			2.0	49%	1.2	30%	0.8	21%			4.0
WC640			5.8	49%	4.9	41%	1.2	10%			11.8
WC660			12.4	35%	5.8	16%	16.0	45%	1.6	5%	35.8
WC670			5.0	33%			8.1	54%	1.8	12%	14.9
WC690			9.0	27%	2.0	6%	15.0	45%	7.6	23%	33.5
WC700			4.3	45%			4.5	46%	0.8	9%	9.6
WC705			9.2	66%	1.0	7%	3.9	28%			14.0
WC710			17.0	81%			3.7	18%	0.2	1%	20.8
WC720			9.3	82%			1.0	9%	1.0	9%	11.3
WC730			5.3	83%					1.1	17%	6.3
WC740			40.3	64%			19.3	30%	3.7	6%	63.3
WC750			14.2	79%			1.3	7%	2.5	14%	18.0
Basin Total	**3.6**	**0.3%**	**772.9**	**63.8%**	**128.8**	**10.6%**	**256.2**	**21.2%**	**49.1**	**4.1%**	**1210.6**

Table 2.7
Hydrologic Soil Group Distribution

Hydrologic Soil Group	Total Area (acres)	Percentage of Basin (%)
A	3.6	0.3
B/D	772.9	63.8
C	128.8	10.6
D	256.2	21.2
Waterbody	49.1	4.1

EXISTING CONVEYANCE SYSTEM

The Woodmere Creek stormwater conveyance system consists of a series of man-made canals, culvert crossings, and lakes. The system includes two main branches. The north branch runs on an east-west direction along the boundary line between Township 39 and Township 40 at Range 19. A total of five main culvert crossings exist on this branch, including the double 36-inch RCP across S.R. 776. The south branch runs on a northwest-southeast direction. It originates downstream at the confluence with the north branch and runs to approximately Colonial Road. At this point, it splits into two secondary branches. One of these branches drains the east side of the basin, including Gulfview Estates. A 30-inch RCP exists at the SR 776 crossing. The other secondary branch drains the south portion of the basin towards Manasota Beach Road, including the Japanese Gardens development.

Important components of the Woodmere Creek stormwater conveyance system are the structures and storage facilities which collect, store, and convey stormwater runoff. These include such facilities as culverts, bridges, weirs, channels, detention ponds, and wetlands. Information regarding the location, dimensions, and control elevations of these structures were collected from a variety of sources such as previous studies, construction record drawings, field measurements, and analysis of aerial topographic mapping of the basin. In addition, a significant amount of field survey was conducted as a part of this study to supplement these sources of information. The information on these structures will be stored within the County's GIS database. Appendix H contains the field surveys that were conducted as a part of this study.

Review of the configuration of the existing conveyance system revealed that about 23 percent of the Woodmere Creek basin is currently subject to stormwater treatment before it discharges to Lemon Bay. Since the basin is developed to a large extent, the existing permitting process will be effective in controlling future water quality degradation as growth continues, but will not greatly improve the current water quality status of the surface waterbodies in the watershed. At full buildout of the remaining open land areas within the basin, it is estimated that the runoff pollution control coverage will be approximately 42 percent.

NATURAL ENVIRONMENT

The existing environmental conditions within the Woodmere Creek Basin were identified during field reconnaissance conducted in May 1997. The reconnaissance involved driving all existing roads and trails, and inspecting all undeveloped areas on foot. Resources used to assist in the survey include recent aerial photography (scale: 1" = 200'), the USGS Soil Survey for Sarasota County, and the U. S. Fish and Wildlife Services National Wetland Inventory (NWI) maps.

The Woodmere Creek basin historically consisted of numerous wetlands and mesic pine flatwoods that drained into the northern end of Lemon Bay. The basin now drains to the Intracoastal Waterway, and many of the contiguous wetland areas have been fragmented, channelized, isolated, drained, and filled.

Biotic Communities and Wetlands

Several different biotic community types were identified during the field reconnaissance in the Woodmere Creek basin. These communities include freshwater marsh, shrub swamp, lakes, hardwood swamp, and estuarine stream. There are no significant areas of undisturbed upland remaining in the watershed. All of the biotic communities within the basin have experienced some degree of anthropogenic disturbance, from relatively minor impacts related to cattle grazing, to changing the entire character and function of a wetland.

The land within the watershed east of SR 776 is predominantly residential and agricultural land uses with a few light industrial areas. Five freshwater marsh wetlands in the northeastern quadrant of Section 3, Township 40 South, Range 19 East, are the only wetlands in the watershed that have not been completely altered hydrologically and functionally. These five wetlands have been impacted by drainage ditches, adjacent agricultural activity, and infestation by nuisance exotic vegetation. Species present include primrose willow (*Ludwigia peruviana*), Carolina willow (*Salix caroliniana*), cattail (*Typha* sp.), and soft rush (*Juncus effusus*).

The other wetlands within the watershed have been altered to such a degree that they bear little resemblance to their former character. Many former freshwater marshes have been excavated to increase their storage capacity, provide construction fill material, and/or create lakes within subdivisions. The former hardwood swamp areas that bordered the creek have been drained and are now dominated around the outer edges by grape vines (*Vitis* sp.), air potato (*Dioscorea bulbifera*), and Brazilian pepper (*Schinus terebinthifolius*). The canopy trees include slash pine (*Pinus elliottii*), laurel oak (*Quercus laurifolia*), red maple (*Acer rubrum*), and southern magnolia (*Magnolia virginiana*).

Threatened and Endangered Species

Despite the highly developed status of the Woodmere Creek basin, some habitat for endangered and threatened species still exists. A list of species present and potentially present in the watershed is included as Table 2.9. During the cursory site inspection, several endangered species were observed, including bald eagle, white ibis, little blue heron, Eastern indigo snake, and numerous gopher tortoises. Other species likely

Table 2.9
List of Protected Species Present and Potentially Present in the Woodmere Creek Watershed

Scientific Name	Common Name	Status Fed/State	Observed
Reptiles and Amphibians			
Alligator mississippiensis	American alligator	T(SA)/SSC	X
Drymarchon corais couperi	Eastern Indigo snake	T/T	X
Gopherus polyphemus	Gopher tortoise	--/SSC	X
Rana capito	Gopher frog	--/SSC	X
Birds			
Aphelocoma coerulescens coerulescens	Florida scrub jay	T/T	X
Egretta caerulea	Little blue heron	--/SSC	X
Egretta thula	Snowy egret	--/SSC	
Egretta tricolor	Tricolor heron	--/SSC	X
Eudocimus albus	White ibis	--/SSC	X
Falco sparverius paulus	Southern American kestrel	--/T	
Grus canadensis pratensis	Florida sandhill crane	--/T	
Haliaeetus leucocephalus	Bald eagle		X
Mycteria americana	Wood stork	T/T	X
Polyborus plancus	Crested caracara	T/T	
Mammals			
Felis concolor coryi	Florida panther	E/E	
Podomys floridanus	Florida mouse	--/SSC	
Sciurus niger shermani	Sherman's fox squirrel	--/SSC	
Plants			
Acrostichum danaeifolium	Giant leather fern	--/C	X
Callopogon multiflorus	Many-flowered grass pink	--/E	
Encyclia tampensis	Tampa butterfly orchid	--/C	X
Lilium catesbaei	Catesby's lily	--/T	
Lobelia cardinalis	Cardinal flower	--/T	
Opuntia stricta	Erect prickly pear	--/T	
Pteroglossapsis ecristata	Wild coco	--/T	
Tillandsia utriculata	Giant air plant	--/C	X

Status Codes:

- E = Endangered
- T = Threatened
- SSC = Species of Special Concern
- C = Commercially Exploited
- T(SA) = Threatened due to similarity of appearance

Sources:

US Fish and Wildlife Service
Florida Game and Fresh Water Fish Commission
Florida Department of Agriculture and Consumer Services

present include gopher frog, tricolor heron, American alligator, snowy egret, Florida scrub jay, Southeastern American kestrel, Florida sandhill crane, and wood stork.

SECTION 3
LEGAL AND REGULATORY FRAMEWORK

PERTINENT LAWS AND REGULATIONS

The legal framework guiding the development of stormwater master plans, which are directed toward flood and water quality control, encompasses local, state, and federal policies and regulations. However, in general, flood control is a local government function. Local governments are responsible for regulating land uses in the floodplains and providing the necessary drainage facilities needed to satisfy established regulations. Water quality control, because of the need to be addressed on a more regional basis, includes responsibilities at all levels of government. In addition, surface water management for water quality includes both point and non-point sources of pollution. Point sources are regulated by FDEP, whereas non-point sources are regulated by a combination of local, state, and federal programs. The following is a brief description of the most important pieces of legislation related to basin master planning in Sarasota County.

Local Legislation

The most important local policy component is the Sarasota County Comprehensive Plan (APOXSEE). In the Public Facilities/Drainage section, the Plan states that the County's stormwater Levels of Service (LOS) should be designed to reduce flooding potential caused by future development and provide performance standards to minimize impacts on existing surface water quality. Correspondingly, Policy 4.1.2 defines drainage LOS for stormwater quantity and quality. The concept of LOS will be further discussed later in this section.

The regulations governing land development to ensure conformity with APOXSEE are defined in the County's Land Development Regulations, Ordinance 94-004. This set of regulations addresses the requirements for stormwater management improvements; the protection of preservation, conservation, and buffer areas; permits for stormwater facilities, and others. This set of regulations also defines in detail the County's LOS requirements for flood protection.

Ordinance 89-117, establishing the Stormwater Environmental Utility (SEU), allows the County to develop and implement stormwater management plans, as well as to construct regional stormwater management facilities. The objective of the SEU is to manage stormwater runoff as a resource and to develop solutions to stormwater problems.

State Legislation

Relevant Florida legislation includes the Florida State Comprehensive Plan Chapter 187 F.S.; the Florida Water Resources Act, Chapter 373 F.S.; the Florida Air and Water Pollution Control Act, Chapter 403 F.S.; the State Water Policy 62-40 FAC; the Surface Water Quality Standards, Chapter 62-302 FAC; and the State Water Quality Standards, Chapters 62-3, 62-4, and 62-25 FAC.

Through the State Comprehensive Plan, Chapter 187 F.S., Florida adopted specific goals and policies to protect water resources and the natural systems in the State. The goal established in the plan is to maintain the function of the natural systems and the overall present level of surface and groundwater quality. Adopted policies encourage the development of a strict floodplain management program, as well as the protection and use of natural systems in lieu of structural alternatives. One of the goals of the implementation plan is to integrate planning capabilities into all levels of government in the State.

The Florida Water Resources Act, Chapter 373 F.S., establishes the state's policies for the Waters of the State, directs the development of the Florida Water Plan, and establishes criteria for the management and storage of surface waters. The Florida Air and Water Pollution Control Act, Chapter 403 F.S., establishes the power of the State to control and prohibit pollution of air and water resources, establish air and water quality standards, and adopt comprehensive programs for the prevention, control, and abatement of pollution.

General water policy regulations, which include resource protection and management as well as water program development, are established in 62-40 FAC. These regulations state that local governments must establish stormwater management programs that are in accordance with the State's and the Water Management Districts' stormwater quality and quantity goals. The rule describes the permit requirements for surface water management projects and directs the Districts to determine flood levels for priority floodplains, including at the minimum the 100-year flood level. Districts are encouraged to determine the 100-year flood elevation to regulate septic tanks in floodplains.

Pursuant to Chapter 373 F.S. and Chapter 62-40 FAC, SWFWMD adopted the Environmental Resource Permit (ERP) regulations, which state that off-site peak discharge for new development shall not exceed the pre-development peak, computed using the District's 25-year/24-hour duration rainfall maps and distribution. For closed drainage basins, post-development runoff volume should not exceed pre-development runoff conditions.

The criteria establishing minimum water quality standards for Florida streams are established in 62-302 FAC. These regulations also list the bodies of water that have been designated Outstanding Florida Waters, which afford special protection in terms of water quality degradation. Water quality standards for groundwater are established in 62-3 FAC. Regulation 62-4 FAC sets forth the procedures for obtaining discharge

permits from the state regulatory agencies. Specific stormwater discharge regulations, including design and performance standards for stormwater facilities and permit requirements for wetland stormwater discharge facilities, are set forth in 62-25 FAC.

Federal Legislation

The Clean Water Act, through the National Pollutant Discharge Elimination System (NPDES), administered by the U.S. Environmental Protection Agency (EPA), requires a federal permit for discharging of pollutants into Water of the United States. In 1990, regulations to control non-point source discharges from industrial facilities and municipal stormwater systems were adopted. As part of the discharge permit, municipalities are required to develop and implement comprehensive stormwater management programs. Sarasota County, in cooperation with the incorporated municipalities in the County, submitted to EPA the corresponding permit application and received its NPDES stormwater permit in 1995. This basin master plan is part of the County's efforts to meet the NPDES permit requirements. It should be mentioned that the State of Florida is in the process of achieving delegation for administering the NPDES stormwater program.

LEVELS OF SERVICE OBJECTIVES

A system that performs well under certain stormwater conditions is one that meets the levels of service (LOS) intended for it. The LOS applicable to stormwater management planning include flood protection and water quality. A stormwater system that does not perform well is one that causes unacceptable flooding that result in personal inconvenience, actual property loss or harm, or degradation of the quality of water in the receiving waterbodies. This section describes the basis for determining LOS deficiencies and objectives in the Woodmere Creek Basin. Specific deficiencies and solutions are discussed later in Sections 5 and 6 of this report.

Levels of Service for Flood Protection

As indicated previously, the levels of service for flood protection are identified in the County's Land Development Regulations, as adopted by the Board of County Commissioners. Table 3.1 shows the adopted LOS. The objective of the Master Plan is to ensure that improvements are identified to meet those LOS under existing and future conditions.

Levels of Service for Water Quality

LOS for water quality for specific drainage basins have not been established in Florida. For this study, a methodology to determine water quality LOS deficiencies and objectives was developed based on a watershed assessment procedure developed by FDEP. The FDEP watershed assessment procedure is based on criteria developed conjunctively by the Water Management Districts during workshops conducted in 1993. These water quality LOS criteria are based upon a system that considers the effectiveness and extent of BMPs within a watershed. The extent of water quality treatment within a basin or subbasin is denoted by an index with a value between 0 and 5, which is applied as

Table 3.1
Sarasota County Flooding Levels of Service Criteria

FLOODING REFERENCE (Buildings, roads, and sites)	LEVELS OF SERVICE (Flood Interval in Years)
I. BUILDINGS: Pre-FIRM (*) or Post-FIRM structures are at or above the flood water elevation.	
A. Emergency shelters and essential services	>100
B. Habitable	100
C. Employment/Service Centers	100
II. ROAD ACCESS:. Roads shall be passable during flooding. Roadway flooding less than or equal to 6 inches depth at the outside edge of pavement is considered passable.	
A. Evacuation	>100
B. Arterials	100
C. Collectors	25
D. Neighborhood	10

III. The water quantity levels of service can be adjusted to allow for greater amounts of flooding of roads and sites if the flooding does not adversely impact public health and safety, natural resources or property. The level of service for improvements to existing roadways may be adjusted based on existing conditions such as adjacent topography and economic impacts.

ACCEPTABLE FLOODING CRITERIA

	10-YR	25-YR	100-YR
ROADWAYS			
A. Evacuation	NONE	NONE	NONE
B . Arterials	NONE	NONE	6 inches
C. Collectors	NONE	6 inches	9 inches
D. Neighborhood	6 inches	9 inches	12 inches

OPEN SPACE

Flooding of open space is acceptable if it does not compromise public health and safety.

---

* FIRM = Flood Insurance Rating Map

shown in Table 3.2. A watershed water quality index is computed as the weighted average of all lands in the watershed.

In addition, as the portion of Lemon Bay receiving discharges from the Woodmere Creek basin is within the jurisdiction of the Charlotte Harbor National Estuary Program (CHNEP), this organization was contacted to determine the status of the work leading to the establishment of a Comprehensive Management Plan for the Charlotte Harbor/Lemon Bay watershed. At this point, the CHNEP has identified general planning objectives and is in the process of working with the local governments to establish pollution load reduction goals for all basins in the watershed based on the Total Maximum Daily Load (TMDL) approach. This approach has been accepted to make work consistent with the Clean Water Act, Section 303 requirements. Within the next five years, Sarasota County will work with the CHNEP to define TMDLs for Woodmere Creek. These TMDLs will represent levels of service for water quality.

Table 3.2
Watershed Water Quality Index Criteria

Index	Index Applicability Criteria
5	Undeveloped land with native vegetation which are designated and protected as preservation areas
4	Areas with an advanced level of stormwater treatment (i.e., no less than 150% of the required capacity)
3	Areas meeting state water quality treatment requirements
2	Areas with stormwater treatment facilities providing between 50 and 100 percent of state requirements
1	Areas with limited stormwater treatment facilities, between 25 and 50 percent of state requirements
0	Areas with less than 25 percent of state required treatment capacity

SECTION 4
HYDRAULIC AND HYDROLOGIC MODEL DEVELOPMENT

WATERSHED MODEL SELECTION

Perhaps the most important aspect of any drainage basin master plan is the proper representation of the current water quantity (flooding) conditions throughout the watershed. A good understanding of basinwide hydrologic and hydraulic processes is necessary to determine the most effective means of controlling flooding and protecting public safety. This section details the methods and procedures used to develop the hydraulic and hydrologic models of the Woodmere Creek basin. The model is the main tool used to assess basin flooding conditions, determine levels of service (LOS) deficiencies, and evaluate the effectiveness of stormwater management improvements in the study area. The most recent versions of the RUNOFF and EXTRAN blocks of the United States Environmental Protection Agency (EPA) Stormwater Management Model (SWMM, Version 4.31) were used for this purpose. The output from the SWMM model can be directly interfaced with existing water quality simulation models.

The hydrologic model, RUNOFF, was used to represent the rainfall, infiltration, and runoff processes over the land surface within the basin area. RUNOFF can also perform simple hydrologic routing of flow through channels, pipes, and lakes where gradients are known. Its output is delivered to EXTRAN, which is the hydraulic model. EXTRAN provides dynamic flood routing of flow through channels, lakes, and control structures such as bridges, culverts, storm sewers, weirs, pumps, and orifices. EXTRAN accounts for conservation of mass, energy, and momentum in its hydraulic algorithms, thereby representing looping, splits, flow reversals, etc. in the hydraulic system network should they occur.

DATA SOURCES

The data used for hydrologic and hydraulic model development were obtained from a number of different sources, including previous studies, field surveys, and construction record drawings. Sources of data that were utilized include:

- SWFWMD 1" =200' Scale Topographic Aerial Mapping
- Sarasota County 1" =200' Scale Aerial Photography (1995)
- FDOT Construction Plans for S.R. 776 (Englewood Rd.)
- Hydrological Report for Manasota Gardens (A.L. Vanbuskirk, Engineers and Planners, Inc.)
- Dolphins Lakes Project (Mosby Engineering Associates, Inc.)

- Walmart Surface Water Management Plan Calculations prepared for Walmart Stores (King Engineering Associates, Inc.)
- Letter of Map Revision for South Venice Subdivision (Kimley-Horn & Associates, Inc.)
- Taylor Ranch Retail Center, Drainage Map and Stormwater Calculations (Kimley-Horn & Associates, Inc.)
- Tower Estates, Hydraulic Report and Master Drainage Plan Drawing (Kimley-Horn & Associates, Inc.)
- Gulfview Estates Subdivision, Drainage Calculations (Toma and Associates, Inc.)
- Gulfview Estates Subdivision, Master Grading and Drainage Map (Toma and Associates, Inc.)
- Gulfview Estates Subdivision Unit #1, Phase 1, Pierce Road Typical Section (Edward A. Redington & Associates, Inc.)
- Gulfview Estates Subdivision, Drainage Plan (Spectra Engineering and Surveying, Inc.)
- Gulfview Estates Subdivision, New Location of Drainage Structures (Spectra Engineering and Surveying, Inc.)
- Gulfview Estates Subdivision, Phase IIIB, Record Drawing (Dufresne-Henry, Inc.)
- Hourglass Lakes, Construction Plan for Roads and Drainage, Phase I (Heinzman Engineering)
- Circlewoods of Venice Condominiums, Preliminary Plat (Emil Tiona, P.E.)
- Circlewoods of Venice, Section VII, Preliminary Plat (Steve Houghton Engineering, Inc.)
- Parcel Digital Map, GIS Data (Sarasota County)
- Existing Land Use/Land Cover Digital Map, GIS Data (Sarasota County)
- FIS Study for Unincorporated Sarasota (Gee and Jenson, Engineers)
- Field Elevation Survey Notes for Woodmere Creek (Randy Britt, PLS)
- Sarasota County Stormwater Master Plan (Camp, Dresser, and McKee, Inc.)
- Wastewater Reuse Master Plan (Sarasota County)
- Forked Creek Basin Master Plan (Parsons Engineering Science, Inc.)
- Customer Response Tracking Forms for Woodmere Basin (Sarasota County)

- Drainage Plan and Existing Conditions Survey Information (Hole, Montes and Associates)
- Survey by Wilson, Miller, Barton, and Peak, Inc. of Existing Drainage Structures and Channel Cross-Sections
- Drainage Plan for Japanese Gardens Subdivision(Cook and Lloveras Engineers-Surveyors)

FIELD SURVEYING

Field surveying work was conducted as part of this project to obtain the geometric characteristics of the open channels and existing drainage structures in the Woodmere Creek primary stormwater conveyance system. In addition, the field survey was used to collect the data associated with the existing condition of the conveyance system. These data were used as input for the hydraulic analysis. Copies of the field notes are included in Appendix H. The work consisted of:

1. Conducting a vertical-controlled survey to determine typical channel cross-sections for identified channel reaches.
2. Obtaining lengths and sizes of existing culverts, and road top elevation profiles.
3. Obtaining the geometry of existing road crossings (bridges).
4. Obtaining the geometry of existing on-line detention ponds.

HYDROLOGIC MODEL DEVELOPMENT

General

The purpose of this task was to create the basin hydrologic model input files that could be used for basin simulation. The hydrologic model used for this study is the RUNOFF block of the EPA SWMM, Version 4.31. The program simulates the rates of runoff contributed from subareas using a kinematic wave approximation. Hydrologic routing techniques can then be used to route the overland flows through pipes, culverts, and channels as required. Program results can then be saved for input to the TRANSPORT and EXTRAN blocks of the SWMM to perform the hydraulic routing in downstream reaches.

RUNOFF was originally developed in 1970 as part of the original EPA SWMM. The program has been applied many times since its inception and has gained worldwide acceptance. Over the years, the program has undergone many changes and modifications, although the main formulations and algorithms remain mostly unchanged from the original codes. Program modifications have been performed over the years to streamline program functions and expand channel routing capabilities for use in stormwater management master plan studies. A more complete documentation of the model's background and theory can be found in the SWMM User's Manual.

In addition to data from other studies in the area, hydrologic modeling data were derived from the GIS land uses and soils data for each catchment, as described in

Section 2. Hydrologic parameters required for the RUNOFF model for each subbasin include the following:

- Subbasin drainage area
- Subbasin average overland flow path length
- Subbasin average ground slope
- Percent imperviousness of the subbasin area
- Soil infiltration rates
- Depression storage volume in subbasin
- Overland flow roughness coefficient
- Rainfall and evaporation data.

A description of the methodologies used to derive each of these hydrologic parameters follows in the remainder of this section.

Subbasin Delineations

To provide the level of detail that was deemed necessary to accurately define and properly analyze the primary drainage facilities within the Woodmere Creek watershed, the basin was divided into a total of 66 discrete subbasins that range in size from 2 to 68 acres. The delineation of individual subbasins was dictated to a large extent by the primary drainage network itself and the need to properly define the contributing drainage area to individual elements of the conveyance system and storage facilities. Subbasin designations were also selected to segregate drainage areas of homogeneous land use and/or define the complete contributing drainage area of a secondary storm sewer or drainage system at its outfall to the modeled primary network.

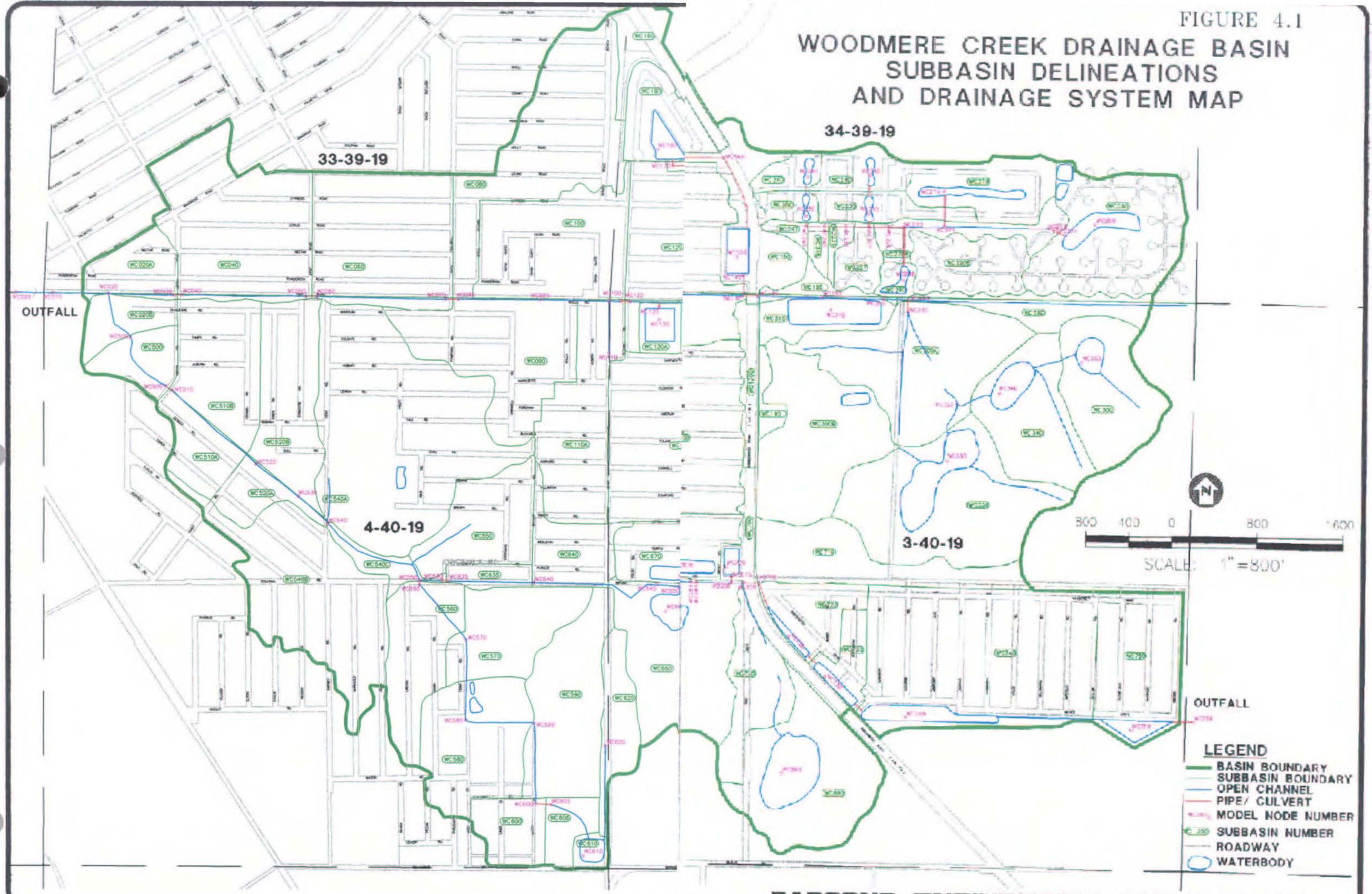
Figure 4.1 shows the delineation of the Woodmere Creek watershed into its 66 individual subbasins. The nomenclature convention for the RUNOFF model representation assigns the subbasin name corresponding to the model junction (node) that serves as the outfall for the subbasin. If more than one subbasin discharges to the same junction, a letter suffix is attached to differentiate them.

The means of defining subbasin boundaries employed a number of sources of information and methods. The principle source was 1"=200' topographic aerial photographic mapping of the watershed provided by SWFWMD. This mapping shows overland topography, thus indicating direction of overland flow. However, because much of the watershed is developed, with a variety of residential, commercial, industrial, and institutional developments, man-made secondary drainage systems comprised of swales, gutters, storm sewer systems, ditches, and detention ponds have interrupted the natural overland flow patterns within the basin and, in many cases, diverted storm runoff in directions that are not readily apparent from inspection of the topographic mapping.

Record drawings of county and state roads within the basin were also used to define the drainage facilities and contributing drainage areas that are served by these systems. Also, previous drainage studies conducted within the basin for new

FIGURE 4.1

WOODMERE CREEK DRAINAGE BASIN SUBBASIN DELINEATIONS AND DRAINAGE SYSTEM MAP



PARSONS ENGINEERING SCIENCE, INC

developments were utilized to define basin boundaries.

The final check of subbasin delineations was field reconnaissance of the watershed to confirm the initial boundaries and to inspect the drainage facilities and conditions in the basin firsthand, to investigate areas where there was no information available from the previously listed sources, and to resolve discrepancies where there was a conflict between different sources of information regarding drainage facilities.

The delineated basin and subbasin boundaries were compared with those shown in the countywide basin delineation maps provided by the Sarasota County Planning Department. Those maps were developed based on the 1983 Delineation of Drainage Basins, Sarasota County report by Camp, Dresser, and McKee, Inc. (CDM). As expected, some differences were noted. Those differences resulted from the general nature of the CDM study. The delineation work was reviewed by the County and various interested parties and accepted as the basis for the study. Subsequently, the basin delineation map was incorporated to the GIS developed for this study.

Impervious Areas

The percentage of directly connected impervious area is one of the most important parameters used by the RUNOFF model to determine the volume of stormwater runoff from a subbasin. Directly connected impervious area (DCIA) is defined as those impervious areas such as rooftops and pavement that are connected to the subbasin outfall (i.e., junction) without flow occurring over a pervious surface. For the Woodmere Creek watershed model, the land use distribution by subbasin provided the means of calculating the impervious percentage by applying global DCIA percentages to each of the land use classifications. The percent imperviousness of each of the land use categories was initially evaluated through a literature review of past SWMM applications within Florida. In addition, measurements of impervious coverage within representative samples of each land use classification were conducted using aerial photography. These efforts produced ranges of values that were used as initial estimates of impervious percentages.

Soil Infiltration Rates

Storm runoff from pervious surfaces within the Woodmere Creek watershed is dependent upon the infiltration capacity of the soils within the basin. For this RUNOFF model application, the Horton soil infiltration equation was used to represent the physical process of percolation of rainfall into the soil column. The Horton equation uses an exponential curve relationship that requires a maximum infiltration rate, a minimum infiltration rate, and a decay coefficient to define the shape of the curve. To define these infiltration parameters, it is necessary to know the locations and types of soils within the basin and their physical properties.

From the analysis conducted as part of this study, it can be seen that soils within the basin are predominantly classified as B/D. Group A soils occur on upland sand ridges and group D soils occur around natural waterbodies and wetlands. For modeling purposes, it is necessary to assign a single soil group classification to the B/D soil groups. In these instances, the undrained condition was judged to be the more appropriate case, and the soils were assigned to the D group. The Horton equation

parameters were calculated based on the soil type distribution within each subbasin. The maximum and minimum infiltration rates, as well as the values of the exponential decay coefficient, used in this study are discussed later in this section.

Overland Flow Lengths, Widths, Slopes, and Roughness Coefficients

The RUNOFF model represents a subbasin as a rectangular plane over which surface runoff is hydraulically routed. For each subbasin, an area-weighted overland flow path length and ground slope is required, and roughness coefficients for both impervious surfaces and pervious surfaces are specified for the kinematic wave formula for overland flow. The overland flow hydraulic length is the weighted average travel length of flow to the receiving node or junction. Overland flow slope is the average ground slope over the hydraulic length, calculated by dividing the difference in elevation by the hydraulic length. The basin width was determined by taking average widths in the direction of sheet flow to the basin loading point. Width, length and slope information were determined through direct measurement on the 1" =200' SWFWMD one-foot topographic aerial maps of the watershed. These parameters are presented in Table 4.1. Roughness coefficients for overland flow were initially established using literature values.

Initial Rainfall Abstractions (Depression Storage)

Depression storage is a volume of rainfall that must be filled prior to the occurrence of surface runoff on both the pervious and impervious surfaces. It represents a loss or initial abstraction caused by such phenomena as surface ponding, surface wetting, interception, and evaporation. In the RUNOFF model application for Woodmere Creek, global depression storage values were specified for impervious and pervious surfaces, by land use classification, to generate area-weighted subbasin averages in the model data input file.

HYDRAULIC MODEL DEVELOPMENT

General

As indicated previously, the hydraulic model used for this study was the EXTRAN block of the EPA SWMM, Version 4.31, which is a hydraulic flow routing model for open channel and/or closed conduit conveyance systems. This model uses a link-node (conduit-junction) representation of the drainage system in an explicit finite difference solution of gradually varied, unsteady flow. EXTRAN receives hydrograph input at specific junctions by file transfer from a hydrologic model such as RUNOFF, and/or by manual input. The model performs dynamic routing of stormwater flows through the defined storm drainage system to the points of outfall in the receiving waterbody. The program will simulate branched or looped networks; backwater due to tidal or non-tidal conditions; free-surface flow; pressure flow or surcharge; flow reversals; flow transfer by weirs, orifices, and pumping facilities; and storage in on-line or off-line facilities. Types of conduits that can be simulated include circular, rectangular, horseshoe, elliptical, and baskethandle pipes, plus trapezoidal or irregular channel cross sections. Simulation output takes the form of water surface elevations and discharges at each node and conduit within the model network, respectively.

Table 4.1
Woodmere Creek Subbasin Model Input Parameters

BASIN I.D.	BASIN AREA ac	BASIN FLOW LENGTH ft	BASIN WIDTH ft	BASIN SLOPE ft/ft	DCIA %
WC020A	10.14	400	1104	0.0113	15
WC020B	7.71	250	1342	0.0050	5
WC040	42.30	600	3071	0.0026	18
WC060	37.99	600	2758	0.0025	17
WC080	39.97	800	2176	0.0014	17
WC090	32.06	600	2328	0.0052	15
WC100	31.50	598	2296	0.0041	14
WC110A	26.18	500	2280	0.0012	18
WC110B	47.23	1000	2057	0.0012	18
WC120	35.12	750	2040	0.0025	18
WC130A	4.17	100	1816	0.0100	65
WC130B	5.78	75	3363	0.0050	56
WC150	17.53	200	3816	0.0021	54
WC160	10.18	200	2215	0.0018	35
WC180	12.37	200	2694	0.0050	37
WC190A	3.57	150	1037	0.0027	64
WC190B	2.50	149	729	0.0025	1
WC210	2.38	100	1037	0.0050	34
WC220A	8.62	150	2503	0.0020	37
WC220B	13.00	300	1888	0.0021	40
WC227	5.07	200	1104	0.0050	40
WC230	7.40	150	2149	0.0050	36
WC235	1.67	100	727	0.0050	52
WC240	7.16	250	1248	0.0024	39
WC245	1.89	100	823	0.0050	70
WC247	1.61	100	701	0.0050	54
WC250	3.38	200	736	0.0050	45
WC260	4.10	200	893	0.0043	45
WC270	15.43	200	3361	0.0036	31
WC280	31.90	300	4630	0.0048	27
WC290	10.62	100	4626	0.0021	8
WC300A	36.36	535	2960	0.0028	10
WC300B	31.78	800	1730	0.0006	12

BASIN I.D.	BASIN AREA ac	BASIN FLOW LENGTH ft	BASIN WIDTH ft	BASIN SLOPE ft/ft	DCIA %
WC310	9.31	150	2704	0.0043	77
WC330	43.32	400	4718	0.0014	4
WC340	23.37	400	2545	0.0023	4
WC350	22.91	300	3327	0.0019	8
WC500	8.45	250	1472	0.0120	7
WC510A	9.77	400	1064	0.0050	16
WC510B	21.44	600	1557	0.0050	14
WC520A	6.95	200	1514	0.0054	14
WC520B	22.62	400	2463	0.0050	15
WC540A	67.62	600	4908	0.0041	16
WC540B	41.64	600	3023	0.0023	18
WC540C	4.43	100	1930	0.0120	5
WC550	18.02	400	1962	0.0056	12
WC560	30.79	400	3353	0.0050	24
WC570	7.56	400	1098	0.0021	38
WC580	25.58	400	2786	0.0010	24
WC590	25.18	500	2194	0.0035	38
WC600	9.19	400	1001	0.0050	21
WC605	3.91	200	852	0.0050	40
WC610	6.26	100	2727	0.0050	47
WC620	10.24	250	1784	0.0039	26
WC635	3.98	50	3467	0.0050	19
WC640	11.79	400	1284	0.0069	18
WC660	35.78	500	3118	0.0032	18
WC670	14.91	300	2165	0.0042	27
WC690	33.48	400	3646	0.0014	29
WC700	9.60	100	4182	0.0050	70
WC705	14.04	200	3058	0.0021	17
WC710	20.83	400	2269	0.0010	9
WC720	11.31	300	1642	0.0044	45
WC730	6.32	150	1835	0.0047	50
WC740	63.30	800	3447	0.0045	41
WC750	18.00	400	1960	0.0030	35

EXTRAN was originally developed for the City of San Francisco in 1973. At that time, it was called the San Francisco Model, or the WRE Transport Model. In 1974, the EPA acquired this model and incorporated it into the SWMM package, calling it the Extended Transport Model, EXTRAN, to distinguish it from the TRANSPORT Model developed by the University of Florida as part of the original SWMM package. Since that time, the model has been refined, particularly in the way the flow routing is performed under surcharge conditions and in large open channel networks. Several of the enhancements that have been implemented over the years since EXTRAN was originally released are summarized below:

- Input and simulation of channels with irregular cross sections using HEC-2 data format;
- Variable stage-area relationships at storage junctions;
- Pump operating curves;
- Different boundary conditions at each system outfall;
- Flap gates in interior conduits;
- Improved output summaries and input error checking;
- Free-format data input;
- Conduit invert input in actual elevation format;
- Submerged weir flow correction algorithm;
- Two alternative flow solutions include in the model;
- "Hot start" input and output from binary files; and
- On-screen view of simulation status during execution.

In addition, minor changes were made to several algorithms for program efficiency and accuracy.

Stormwater Drainage Structure Inventory

The initial and most important step in the development of the hydraulic model of the Woodmere Creek watershed was the inventory of the drainage structures along the primary drainage system. This information provides the foundation for the model representation of the hydraulic system. The drainage facility inventory of the study area was compiled from an array of sources and methods as listed in the Data Sources section. Hydraulic data for culverts, storm sewers, bridges, control structures, and watercourse cross sections were obtained from field surveying, development plans, roadway plans, previous studies. Data collected included elevations, lengths, dimensions, construction materials, channel vegetation, structure entrance and exit conditions, and any other pertinent features. This task required a considerable amount of effort, but it was deemed necessary to develop the appropriate level of detail to accurately define the hydrologic and hydraulic conditions of the study area.

Channel Cross-Section and Floodplain Definition

The EXTRAN model data requirements for definition of the open channel reaches of the primary drainage system of the Woodmere Creek watershed include channel cross-section information that is of sufficient detail to define not only the shape of the channel within the confines of its banks, but for a sufficient distance outward from the banks into the floodplain to an upland point above the expected flood level. As has been previously noted, in addition to the field survey data there was a variety of sources of channel cross section and drainage structure data that were utilized in the formulation of the EXTRAN model. Parsons ES used what was judged to be the most current, detailed, and representative source of information available for any particular reach of the open channel system. In some cases, channel cross sections were modified on the basis of model needs and other data sources for the same channel reach in an effort to obtain the best representation. Also, the extension of channel cross-sections into the floodplain regions of the Woodmere Creek floodway was necessary for many of the surveyed cross-sections obtained from the various sources. In this way, not only conveyance but also storage in the floodplain areas was directly accounted for in the model formulation. SWFWMD one-foot contour topographic maps were used to scale off the floodplain extensions where necessary.

One of the most overlooked, but extremely important, needs of the EXTRAN model representation of open channel reaches is the selection of an appropriate channel roughness coefficient, or Manning's n, value. This value is a measure of the relative degree of hydraulic efficiency (retardance) of a channel and is dependent upon factors such as the extent and type of channel vegetation, channel bottom material, channel irregularity, channel alignment, obstructions, and depth of flow. Selection of an appropriate Manning's n value for a particular channel reach is a highly subjective procedure and requires a certain level of experience. Parsons ES personnel relied primarily upon site reconnaissance, published guides, and past modeling experience in the selection of channel and floodplain Manning's n values for the EXTRAN model representation of the Woodmere Creek open channel segments. These values were either confirmed or adjusted during the model calibration process using the high water flood marks as the basis for deriving calibrated channel and floodplain Manning's n values.

Storage Facility Stage-Area Relationships

To properly represent the hydrologic and hydraulic processes of stormwater runoff within a basin, it is important that all significant storage facilities and their hydraulic functions be defined. This is especially important in the Woodmere Creek watershed where a significant amount of the drainage throughout the basin is controlled by ponds and natural depression areas. The EXTRAN model allows the user to specify a variable stage-area relationship at any model junction (node) that defines the storage properties at that point, be it a pond, lake, wetland, or other such open surface water body.

In the development of the Woodmere Creek watershed hydraulic model, Parsons ES used, where available, record drawings and permits as a means of establishing stage-area relationships of constructed stormwater management facilities. For all others, including the natural lakes, ponds, and wetlands within the watershed, the stage-area relationships were determined by direct measurement from SWFWMD one-foot topographic maps with a planimeter. As previously discussed, floodplain storage was

directly accounted for in the model through the extension of the channel cross section definitions into the floodplain areas.

Model Schematic

The hydraulic model (SWMM/EXTRAN) of the Woodmere Creek watershed consists of a network of open channel segments, culverts, storm sewers, weirs, lakes, ponds, and wetlands that compose the primary drainage system within the basin. EXTRAN uses a conduit-junction concept to idealize the real world prototype drainage system. A junction is a discrete location in the drainage system where conservation of mass (continuity) is maintained. Conduits are the connections between junctions and are used to convey water through the system. The entire network of junctions and conduits forms the hydraulic model network and serves as the computational framework for EXTRAN.

The first step in development of a model schematic was to identify the primary drainage system and all drainage facilities within it. This task was accomplished through the research and review of all available sources of information, which have been previously described, and through field reconnaissance of the entire watershed. All such information was compiled and a watershed drainage map developed which depicts the primary drainage system. Figure 4.1 presents the drainage map of the Woodmere Creek watershed and the model junction locations that were used to define the primary drainage system of the basin. General guidelines that were followed in development of the model schematic are:

- Junctions are required at the upstream and downstream ends of any structure (e.g. culvert, weir, etc.).
- Storage elements (ponds, lakes, wetlands, etc.) are specified as junctions.
- Junctions are located at tributary confluence locations.
- Junctions are placed at locations where there is a major surface water inflow to the conveyance system.
- Points of change in channel geometry and/or slope are specified as junction locations.
- Junctions are added at locations within the network to define the hydraulic gradeline in greater detail.

When constructing a model network, names must be assigned to all junctions and conduits. This uniquely identifies specific locations within the network and establishes topology and connectivity for the hydraulic system. The two or three characters in the name follow a general ascending numerical progression from the most downstream point of the tributary to the next upstream junction, usually in increments of 10. By convention, the identification of a conduit between two junctions is the same as the name of the upstream junction. Where there is more than one such conduit, a fourth character is appended at the end to distinguish those with a common upstream junction. To complete the naming conventions, subbasins are also assigned the same name as the receiving junction for subbasin flows.

A detailed EXTRAN model schematic of the Woodmere Creek watershed is provided in Figure 4.2. This schematic represents the model hydraulic network and relational framework to the prototype watershed. Storage junctions and type of conduits are indicated as they are represented within the EXTRAN model. The Woodmere Creek watershed hydraulic model comprises a total of 82 junctions and 139 conduits in its structure, including 26 storage junctions, 36 irregular channel cross-sections, and 27 weirs.

Equivalent Conduits

For the EXTRAN model, equivalent conduits or pipes (through parallel and series equivalent pipes) were created to ensure model stability, account for local or transitional hydraulic head losses, and simplify the total number of conduits in the model. This was accomplished through established standard methods based upon the Manning's equation. This equation for the calculation of frictional loss is the sole basis within EXTRAN for the calculation of total head loss in a closed conduit. It is therefore necessary to adjust Manning's n values to provide proper accounting of entrance and exit losses at conduit transition points within the model network. Conduits were also lengthened and/or combined as necessary for model stability and Manning's roughness coefficients were adjusted to maintain equal flow for an equal head loss. Equivalent conduits are needed for one or more of the following reasons:

- Produce an equivalent conduit to account for local losses in the existing conduit (sometimes called minor losses);
- Lengthen a conduit for model stability (wave celerity criterion);
- Produce an equivalent conduit to account for several existing conduits of equal size or geometry that are in parallel;
- Produce an equivalent conduit to account for several existing conduits that are in series.

Table 4.2 lists the conduits within the Woodmere Creek watershed hydraulic model for which equivalent conduits were used. The left side of the table describes the actual number, length, and dimensions (depth and width) of the prototype conduit(s), Manning's n roughness coefficient, and the entrance and exit loss coefficients. On the far right of the table is the length and Manning's n value calculated for the equivalent conduit of identical dimensions (depth and width) that was used in the EXTRAN model. The equivalent conduit length is usually specified as 100 feet for conduits shorter than 100 feet, and the actual length is used for conduits longer than 100 feet. Also, the calculated required delta time step for the model simulation of that particular equivalent conduit, based upon the celerity of a wave of water traveling through the conduit, is listed. The table also is separated into calibration conduits and design conduits since improvements in the stormwater system have taken place since the occurrence of the calibration storm. The equivalent conduit Manning's n is determined by the equation:

$$n_{eq}=((K_{ent}+K_{ex}+(29n^2L/R^{1.33}))R^{1.33}/29/L_{eq})^{0.5}$$

FIGURE 4.2

WOODMERE CREEK DRAINAGE BASIN MODEL SCHEMATIC

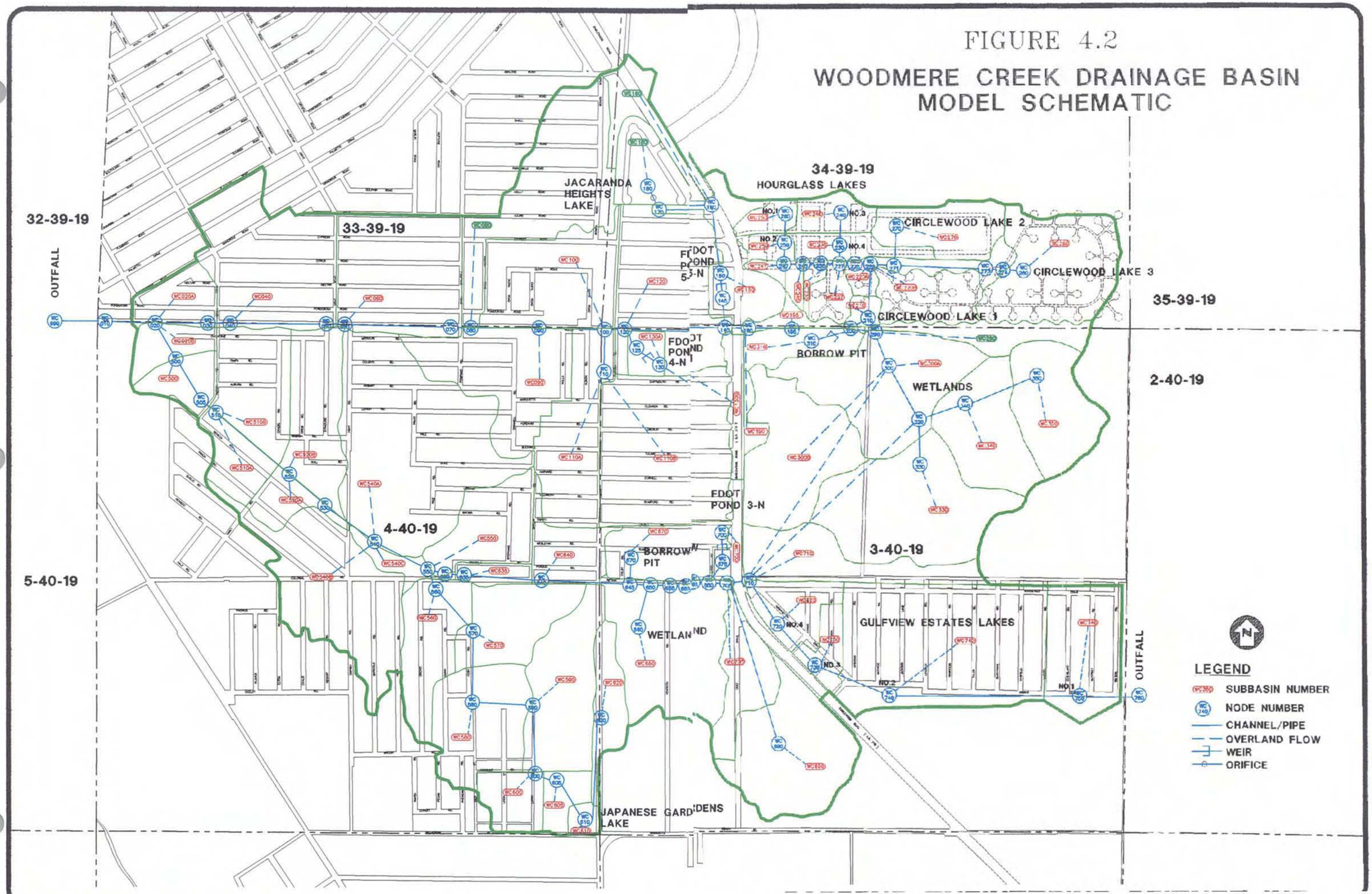


Table 4.2
Woodmere Creek Existing Conditions Equivalent Pipe Roughness

For Calibration/Verification Storm Events:

SWMM PIPE #	# IDENT. PIPES	SWMM TYPE #	TYPE	DEPTH (FT)	WIDTH (FT)	AREA PER PIPE (FT^2)	TOTAL AREA (FT^2)	LENGTH (FT)	LOCAL LOSSES ACTUAL MANNING n	LOCAL LOSSES ENT K	LOCAL LOSSES EXIT K	HEAD LOSS (FT)	HYD RADIUS PER PIPE (FT)	COMPOSITE HYD RADIUS (FT)	PIPE CAPAC. PER PIPE (CFS)	COMPOSITE PIPE CAPAC. (CFS)	EQUIV LENGTH (FT)	EQUIV. MANNING n PER PIPE	COMPOSIT EQUIV MANNING n	R'QRD DELTA TIME (SEC)
40	1	1	RCP	5.00	5.00	19.6	19.6	70	0.013	0.50	1.00	1.00	1.250	1.250	118.9	118.9	100	0.0285	0.0285	7.9
60	1	1	RCP	5.00	5.00	19.6	19.6	65	0.013	0.50	1.00	1.00	1.250	1.250	119.6	119.6	100	0.0284	0.0284	7.9
80	1	1	RCP	5.00	5.00	19.6	19.6	49	0.013	0.50	1.00	1.00	1.250	1.250	121.6	121.6	100	0.0279	0.0279	7.9
81	1	1	CMP	5.00	5.00	19.6	19.6	49	0.024	0.70	1.00	1.00	1.250	1.250	103.7	103.7	100	0.0327	0.0327	7.9
120	1	1	RCP	4.00	4.00	12.6	12.6	44	0.013	0.50	1.00	1.00	1.000	1.000	77.0	77.0	100	0.0243	0.0243	8.8
125	1	1	RCP	2.50	2.50	4.9	4.9	45	0.013	0.50	1.00	1.00	0.625	0.625	28.5	28.5	100	0.0188	0.0188	11.1
145	1	4	ERCP	2.4	3.75	7.1	7.1	181	0.013	0.50	1.00	1.00	0.719	0.719	33.7	33.7	181	0.0188	0.0188	20.5
160	1	1	RCP	4.00	4.00	12.6	12.6	888	0.013	0.50	1.00	1.00	1.000	1.000	41.7	41.7	888	0.0151	0.0151	78.2
170	1	1	RCP	2.00	2.00	3.1	3.1	404	0.013	0.50	0.50	1.00	0.500	0.500	10.3	10.3	404	0.0142	0.0142	50.3
190	1	1	RCP	3.00	3.00	7.1	7.1	142	0.013	0.50	1.00	1.00	0.750	0.750	35.7	35.7	142	0.0204	0.0204	14.4
191	1	1	RCP	3.00	3.00	7.1	7.1	142	0.013	0.50	1.00	1.00	0.750	0.750	35.7	35.7	142	0.0204	0.0204	14.4
210	1	1	CMP	3.50	3.50	9.6	9.6	43	0.024	0.90	1.00	1.00	0.875	0.875	46.5	46.5	100	0.0282	0.0282	9.4
220	1	1	CMP	3.00	3.00	7.1	7.1	356	0.024	0.50	1.00	1.00	0.750	0.750	17.7	17.7	356	0.0260	0.0260	36.2
225	1	1	CMP	1.50	1.50	1.8	1.8	161	0.024	0.50	1.00	1.00	0.375	0.375	4.2	4.2	161	0.0257	0.0257	23.2
226	1	1	CMP	1.50	1.50	1.8	1.8	161	0.024	0.50	1.00	1.00	0.375	0.375	4.2	4.2	161	0.0257	0.0257	23.2
227	1	1	CMP	2.00	2.00	3.1	3.1	155	0.024	0.50	0.50	1.00	0.500	0.500	9.2	9.2	155	0.0258	0.0258	19.3
230	1	1	CMP	1.50	1.50	1.8	1.8	22	0.024	0.90	1.00	1.00	0.375	0.375	7.9	7.9	100	0.0174	0.0174	14.4
235	1	1	CMP	2.00	2.00	3.1	3.1	253	0.024	0.50	0.50	1.00	0.500	0.500	7.4	7.4	253	0.0251	0.0251	31.5
240	1	1	CMP	1.50	1.50	1.8	1.8	80	0.024	0.90	1.00	1.00	0.375	0.375	5.4	5.4	100	0.0253	0.0253	14.4
245	1	1	CMP	2.00	2.00	3.1	3.1	131	0.024	0.50	0.50	1.00	0.500	0.500	9.9	9.9	131	0.0261	0.0261	16.3
247	1	1	CMP	1.50	1.50	1.8	1.8	207	0.024	0.50	0.50	1.00	0.375	0.375	3.8	3.8	207	0.0249	0.0249	29.8
250	1	1	CMP	1.50	1.50	1.8	1.8	21	0.024	0.90	1.00	1.00	0.375	0.375	7.9	7.9	100	0.0173	0.0173	14.4
260	1	1	CMP	1.50	1.50	1.8	1.8	81	0.024	0.90	1.00	1.00	0.375	0.375	5.4	5.4	100	0.0253	0.0253	14.4
270	1	1	CMP	1.50	1.50	1.8	1.8	258	0.024	0.50	0.90	1.00	0.375	0.375	3.4	3.4	258	0.0250	0.0250	37.1
274	1	4	CMPA	1.2	2.30	2.2	2.2	67	0.024	0.50	1.00	1.00	0.376	0.376	7.3	7.3	100	0.0229	0.0229	16.1
275	1	4	CMPA	1.5	2.50	2.9	2.9	67	0.024	0.50	1.00	1.00	0.455	0.455	10.9	10.9	100	0.0238	0.0238	14.4
280	1	1	CMP	3.50	3.50	9.6	9.6	93	0.024	0.90	1.00	1.00	0.875	0.875	39.8	39.8	100	0.0329	0.0329	9.4
300	1	1	CMP	2.00	2.00	3.1	3.1	19	0.024	0.90	1.00	1.00	0.500	0.500	15.3	15.3	100	0.0192	0.0192	12.5
510	1	1	CMP	5.00	5.00	19.6	19.6	85	0.024	0.90	1.00	1.00	1.250	1.250	91.7	91.7	100	0.0370	0.0370	7.9
560	1	1	CMP	4.50	4.50	15.9	15.9	40	0.024	0.90	1.00	1.00	1.125	1.125	81.2	81.2	100	0.0316	0.0316	8.3
605	1	1	CMP	1.8	3.00	4.3	4.3	198	0.024	0.90	1.00	1.00	0.458	0.458	10.3	10.3	198	0.0263	0.0263	25.8
635	1	4	ERCP	2.00	3.17	5.0	5.0	57	0.013	0.50	1.00	1.00	0.598	0.598	27.9	27.9	100	0.0189	0.0189	12.5
665	1	1	RCP	3.50	3.50	9.6	9.6	21	0.013	0.50	1.00	1.00	0.875	0.875	60.6	60.6	100	0.0216	0.0216	9.4
675	1	4	ERCP	2.4	3.75	7.1	7.1	30	0.013	0.50	1.00	1.00	0.719	0.719	43.5	43.5	100	0.0196	0.0196	11.3
710	1	1	RCP	2.50	2.50	4.9	4.9	134	0.013	0.50	1.00	1.00	0.625	0.625	23.8	23.8	134	0.0194	0.0194	14.9
720	1	1	RCP	1.50	1.50	1.8	1.8	248	0.013	0.50	1.00	1.00	0.375	0.375	5.8	5.8	248	0.0150	0.0150	35.6
721	1	1	RCP	1.50	1.50	1.8	1.8	248	0.013	0.50	1.00	1.00	0.375	0.375	5.8	5.8	248	0.0150	0.0150	35.6
730	1	1	RCP	1.50	1.50	1.8	1.8	86	0.013	0.50	1.00	1.00	0.375	0.375	8.1	8.1	100	0.0169	0.0169	14.4
740	1	1	RCP	1.50	1.50	1.8	1.8	86	0.013	0.50	1.00	1.00	0.375	0.375	8.1	8.1	100	0.0169	0.0169	14.4
751	1	4	ERCP	1.00	1.58	1.2	1.2	70	0.013	0.50	1.00	1.00	0.299	0.299	5.6	5.6	70	0.0178	0.0178	12.3

For Existing Condition Design Storm Events:

40	1	1	RCP	5.00	5.00	19.6	19.6	116	0.013	0.50	1.00	1.00	1.250	1.250	113.6	113.6	116	0.0277	0.0277	9.1
60	1	1	RCP	6.00	6.00	28.3	28.3	113	0.013	0.50	1.00	1.00	1.500	1.500	168.1	168.1	113	0.0309	0.0309	8.1
120	1	1	RCP	4.00	4.00	12.6	12.6	103	0.013	0.50	1.00	1.00	1.000	1.000	71.2	71.2	103	0.0259	0.0259	9.1
121	1	1	RCP	4.00	4.00	12.6	12.6	103	0.013	0.50	1.00	1.00	1.000	1.000	71.2	71.2	103	0.0259	0.0259	9.1
510	1	1	RCP	5.00	5.00	19.6	19.6	85	0.013	0.50	1.00	1.00	1.250	1.250	117.1	117.1	85	0.0314	0.0314	6.7

where;

n_{eq} = equivalent Manning's n

n = Manning's n for conduit material

L = actual length of conduit

L_{eq} = equivalent length of conduit

R = hydraulic radius of conduit at full flow

K_{ent} = entrance loss coefficient

K_{ex} = exit loss coefficient

Boundary Conditions

The EXTRAN model requires specification of hydraulic boundary condition at all outfall points of the model schematic. In the Woodmere Creek watershed application, the primary basin outlet is located at the downstream end of the Woodmere Creek channel at Lemon Bay in the Intracoastal Waterway. A constant tailwater boundary condition representing the maximum tidal water elevation of 2.5 feet National Geodetic Vertical Datum (NGVD) for all model simulations. This elevation approximates a mean high tide condition within the bay.

There is an additional boundary condition specified in the southeast corner of the watershed, where a 12"x19" ERCP culvert connects the uppermost Gulfview Estates pond to the Forked Creek basin. An elevation of 14.0 ft NGVD is specified at this boundary location based on available topographic data.

MODEL CALIBRATION AND VERIFICATION

General

Model calibration refers to the adjustment of model parameters within reasonable limitations so that the model results (i.e., streamflow and water elevations) are in reasonable agreement with a set of measured data. A reasonable range of values for the adjustment of model parameters is established through the review of literature references, and adjustments outside of those ranges are made only if some unusual hydrologic or hydraulic condition exists. Ideally, the model is calibrated to several different storm events that represent a variety of volumes, intensities, and distributions. It is also desirable to calibrate to recorded flow and stage information at different locations within the prototype watershed. The model is considered well-calibrated when the resulting stage, flow, and volume information is in reasonable agreement with the data measured at established gaging stations or intermediate points for a set of comparable independent events without any model adjustments. This latter process is called model verification.

The primary data requirement for model calibration and verification are generally measured stage and flow data at identified gaging stations within the watershed and/or high water marks for the study area. When selecting a calibration storm event, the rainfall and streamflow must be sufficiently documented in appropriate time intervals so that variations in rainfall intensity and the associated runoff can be accurately

simulated. Data should be recently acquired so that the current land use and hydraulic conditions existing in the study area are accurately represented. Additionally, to account for the non-uniform spatial distribution inherent in Florida precipitation patterns, it is desirable that rainfall data be collected at various station locations throughout the study area.

Selection of Calibration/Verification Storm Events

The type of calibration data described above was not available for the Woodmere Creek basin. However, the County surveyed high water marks recorded within the basin for two recent large storm events, June 1992 and July 1995. Corresponding rainfall data are available from USGS gages located on adjacent drainage basins. Based on these available high water mark data, the June 1992 and July 1995 storm events were selected for use in the SWMM model calibration and verification process, respectively. These storms had the advantage that both were, to a large extent, spatially distributed uniformly over the watershed.

June 24-28, 1992 (13.66 inches)

The June 1992 storm resulted in one of the most extreme flooding events on record in Sarasota County. A statistical analysis of 41 years of rainfall collected at the National Oceanic and Atmospheric Administration (NOAA) station in Venice showed that the 19.6 inches of total rainfall volume accumulated over the 3-day duration of this storm at that station is in the 99.9 percentile bracket. The precipitation gage located nearest the Woodmere Creek basin was that at Forked Creek. This record provided the 15-minute rainfall data that were used for the four-day model simulation period. The total measured rainfall over that period was 13.66 inches. The rainfall hyetograph is shown in Figure 4.3.

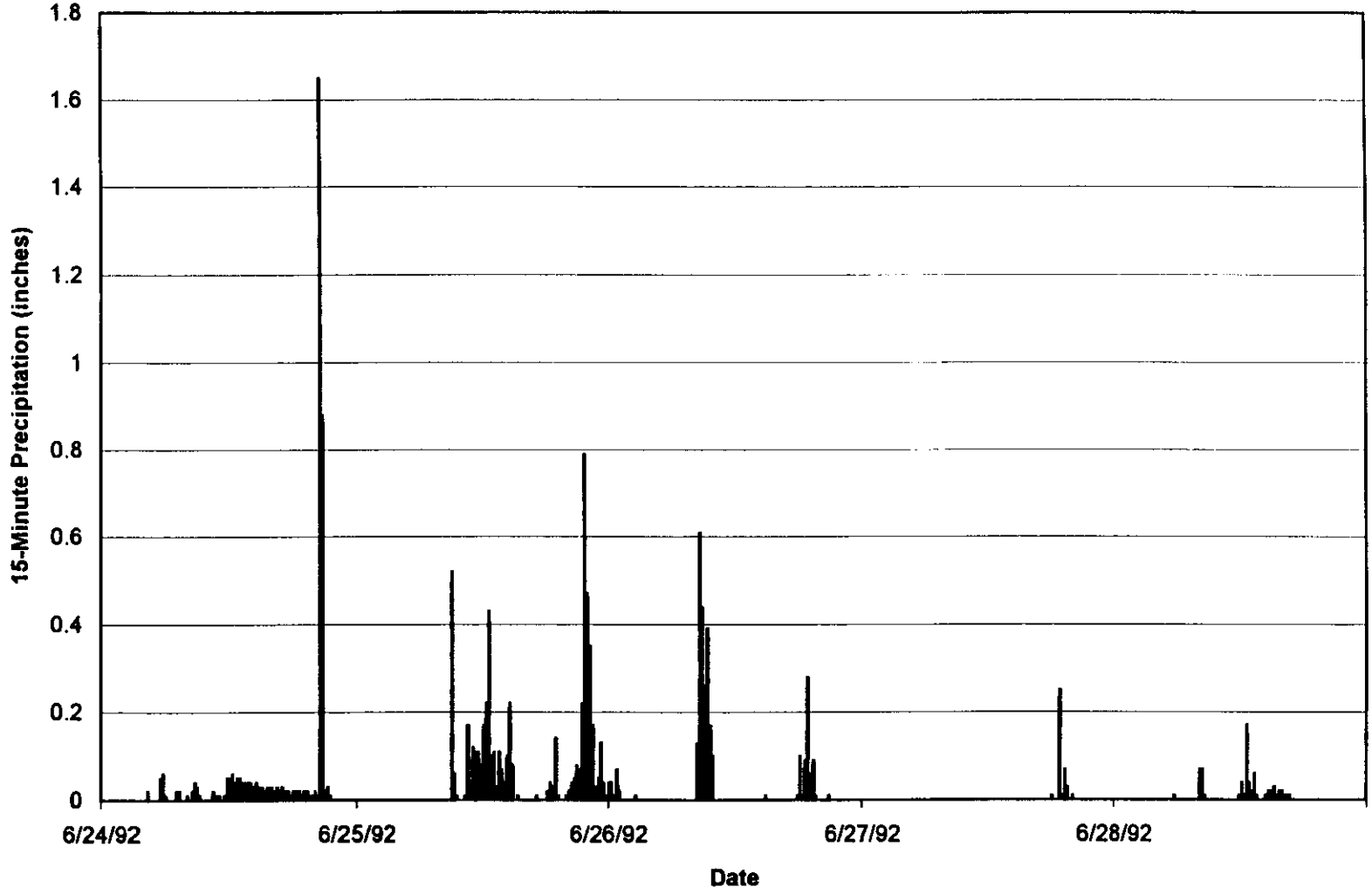
The antecedent conditions for this storm event were extremely dry, with less than 6 inches of total rainfall recorded in the previous two months. Surficial water table elevations were at near record lows due to several successive years of below normal rainfall prior to the event.

June 23, 1995 (5.10 inches)

The storm event that was used to verify the model calibration was the June 23, 1995 event. This storm event was not an ideal one for this purpose, as the cumulative rainfall depths that were reported at the various precipitation gages in the County were extremely variable. The nearest available gaging station record for this event is the SWFWMD Venice office gage, approximately 4 miles north of the Woodmere Creek basin. It reported 5.10 inches of rainfall on the 23rd of June. However, much heavier precipitation was recorded in the extreme southern end of the County. The Englewood WTP station reported a total of 14.78 inches on the 22nd and 23rd, and the North Port WTP reported 12.44 inches for these same two days. These stations are approximately 5 and 9 miles from the study area, respectively. It would be expected that the Woodmere Creek basin received a total precipitation somewhere within this range.

The antecedent conditions for this storm event were also dry, with less than 10 inches of total rainfall recorded in the prior months from January through May. This extended dry period was broken at the beginning of June, approximately 3 weeks before

Figure 4.3
Woodmere Creek Calibration Storm Event Hyetograph
June 24-28, 1992 at Forked Creek Station



the subject storm event, when a total rainfall of approximately 6.5 inches occurred over a 5-day period.

For the purpose of verification, the model was run for several different volumes of total precipitation that could be reasonably expected based on the limited observed values. The total volumes were proportioned in hourly increments according to the hourly distribution of the 3.90 inches of precipitation recorded at the Venice NWS gaging station. The hourly rainfall hyetograph for a 5.10-inch storm event according to the distribution recorded at this gaging station is shown in Figure 4.4. This event's total volume was only 37% that of the calibration storm. However, it was of much shorter duration. Therefore, there was a relatively high rainfall intensity.

Calibration/Verification Results

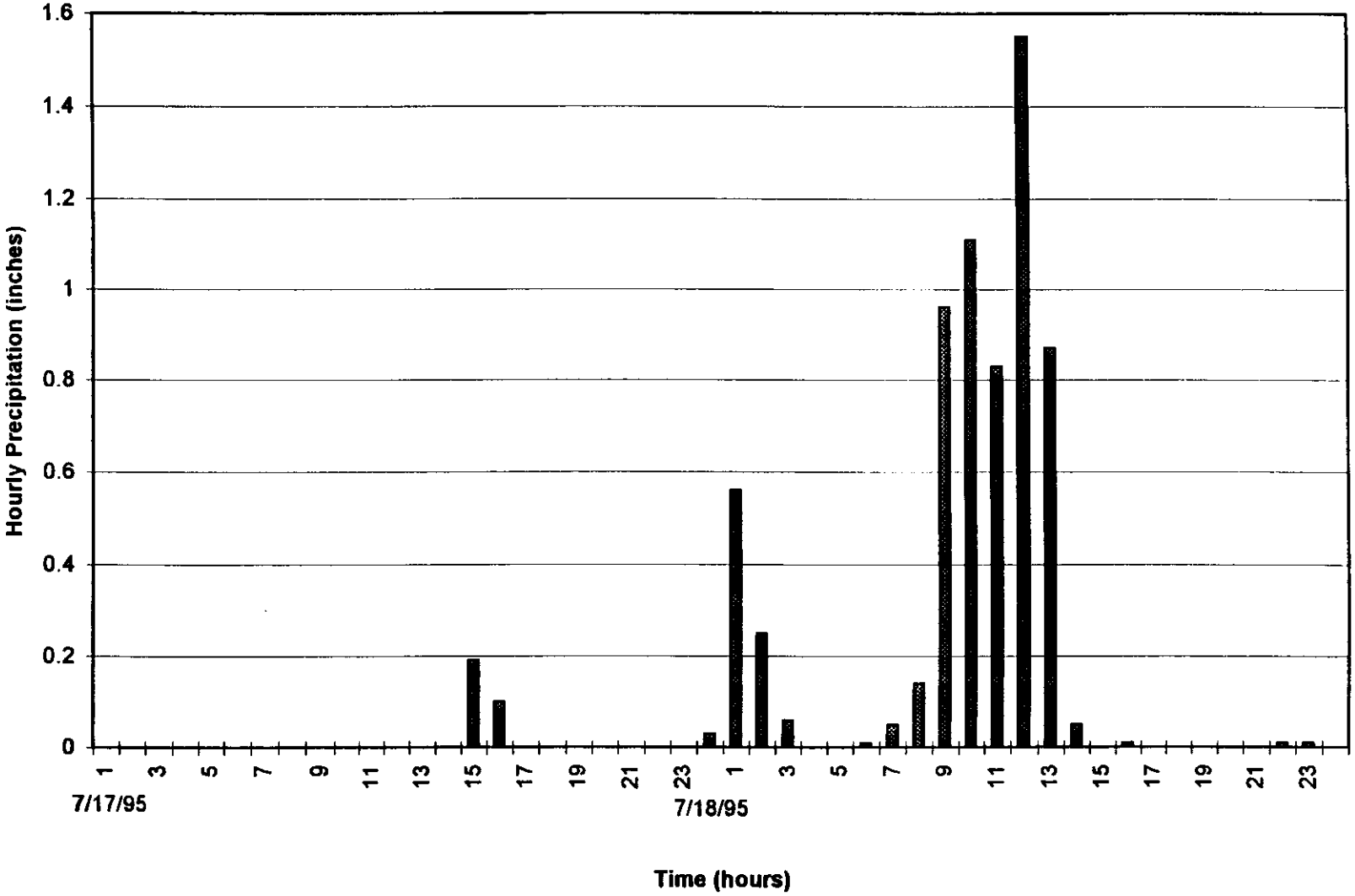
Review of SWMM model data requirements shows that most of the input data are used simply to describe the geometry and size of the hydrologic and hydraulic units of the subdivided drainage basin. These data, such as the areas, overland flow lengths, and slopes of subbasins are measured quantities and are subject to very little interpretation. Similarly, channel cross-sections, structure dimensions, invert elevations, and stage-storage relationships are direct measurements. A few of the input requirements, however, are not derived from measurable qualities of the hydrologic and hydraulic components of the prototype watershed and its drainage system. These model parameters are referred to as calibration parameters and include:

- Directly connected impervious area percentage (determined for each land use category);
- Maximum and minimum infiltration rates for pervious areas (determined for each hydrologic soil group classification);
- Pervious and impervious depression storage volumes;
- Overland flow roughness coefficients for impervious and pervious surfaces; and
- Channel and floodplain Manning's n roughness coefficients.

The most important parameters in the SWMM model which govern the volume of stormwater runoff for a storm event are the directly connected impervious area percentage, and the maximum and minimum soil infiltration rates. The other listed parameters will dictate the shape of the storm hydrograph and peak flows and flood elevations, but do not affect the volume of runoff. Directly connected impervious area will directly impact the runoff volume, and is especially critical for the smaller storm events, where the volume of pervious surface runoff is proportionately less. While total impervious area is a measurable parameter (if one were to identify and measure all impervious surfaces in the watershed such as rooftops, driveways, streets, sidewalks, and waterbodies), the percentage of these surfaces which are directly connected is not. For this reason, it is treated as a calibration parameter, within the range of established literature values.

As was previously discussed, in the SWMM model calibration and verification for the Woodmere Creek watershed, the model parameters were first approximated with

Figure 4.4
Woodmere Creek Verification Storm Event Hyetograph
July 17-18, 1995 at Venice NWS



values derived from literature research and from past model applications in the southwest Florida region. Their final values were ultimately determined through the model calibration and verification process and are presented in Table 4.3. Because the only information available in the basin to calibrate model was historical flood marks, there was insufficient data to determine runoff volumes or peak flow rates. Therefore, most of the model parameters were kept at their initial values. For the most part, the parameters which were used to calibrate the model were the channel roughness coefficients, and the global soil infiltration and DCIA parameters.

High water marks obtained throughout the basin were used to calibrate against the simulated peak flood elevations at the corresponding model junctions. For the June 1992 storm event, the recorded high water marks are compared to the model simulation peak flood elevations in Figure 4.5 and Table 4.4. The average model deviation from the measured values is 5 inches, and most of the simulation values have a variance no greater than 6 inches from the flood marks. The largest difference of about 11 inches occurred at junction WC530, located on the southern branch, north of Colonial Road. However, because this model junction is located between WC510 and WC560, the measured high water mark at WC530 should have shown an elevation between the high water mark elevations at those two nodes. The fact that the measured value is lower than that at WC510 makes this data point questionable.

As was previously discussed, the June 1995 verification storm event was not well suited for the intended purpose due to the uncertainty of the depth of rainfall that actually occurred in the Woodmere Creek basin. A total of three high water marks were obtained by the County subsequent to this storm event within the basin. Because of the shorter duration and higher rainfall intensities of the June 1995 storm event when compared to the June 1992 calibration storm event, the flood marks were higher. The SWMM model was run using the total precipitation volume of 5.10 inches that was recorded at the SWFWMD Venice office, located approximately 4 miles north of the basin. Figure 4.6 and Table 4.4 show consistently lower simulated maximum flood elevations than those observed. The average deviation is approximately 9 inches and largest of the three locations is 11 inches at junction WC110, located on a tributary ditch at the intersection of Miami and Clemson Roads. The smallest deviation is 8 inches at junction WC740, located in Gulfview Estates.

Because a much greater rainfall depth was recorded at the Englewood WTP and North Port WTP gaging stations, it would seem logical that the Woodmere Creek basin received a greater volume of rainfall than the 5.10 inches reported at the SWFWMD Venice office gage. Model sensitivity simulations were conducted and confirmed that the model would more closely match the three observed high water marks with a reasonable adjustment of the total precipitation volume. The results of a simulation of a 7.65 inch event (50% greater than 5.10 inches) yielded maximum flood elevations which averaged 4 inches above the observed flood marks. It is likely that the basin precipitation was somewhere within this range.

Table 4.3
SWMM RUNOFF/EXTRAN Calibration Parameter Summary

Calibration Parameter	Final Model Calibration Value
Directly Connected Impervious Percentage	
Low & Medium Density Residential	18%
High Density Residential	40%
Commercial & Roadway	80%
Industrial	45%
Open Land	0%
Waterbody	100%
Depression Storage	
Impervious Area	0.10 in.
Pervious Area	0.15 in.
Manning's 'n' Coefficient for Overland Flow	
Impervious Area	0.035
Pervious Area	0.250

Soil Infiltration Rates	Maximum Rate (in/hr)	Minimum Rate (in/hr)	Exponential Decay Coeff. (1/sec)
Hydrologic Soil Group A	8.0	0.40	.00083
Hydrologic Soil Group B	6.0	0.30	.00083
Hydrologic Soil Group C	4.0	0.20	.00083
Hydrologic Soil Group D	3.0	0.15	.00083

Figure 4.5
Model Calibration Comparison
June 1992 High Water Marks

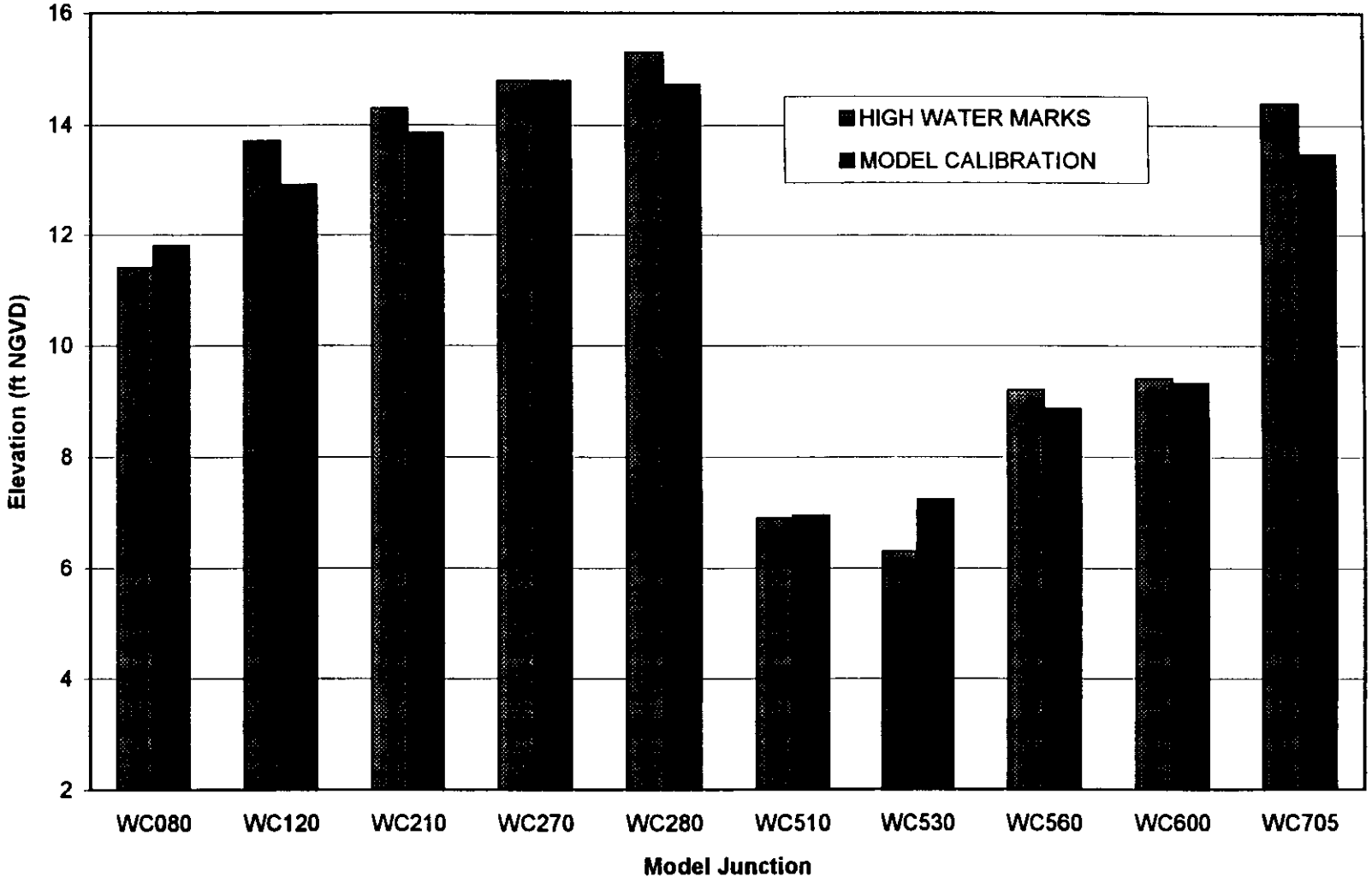
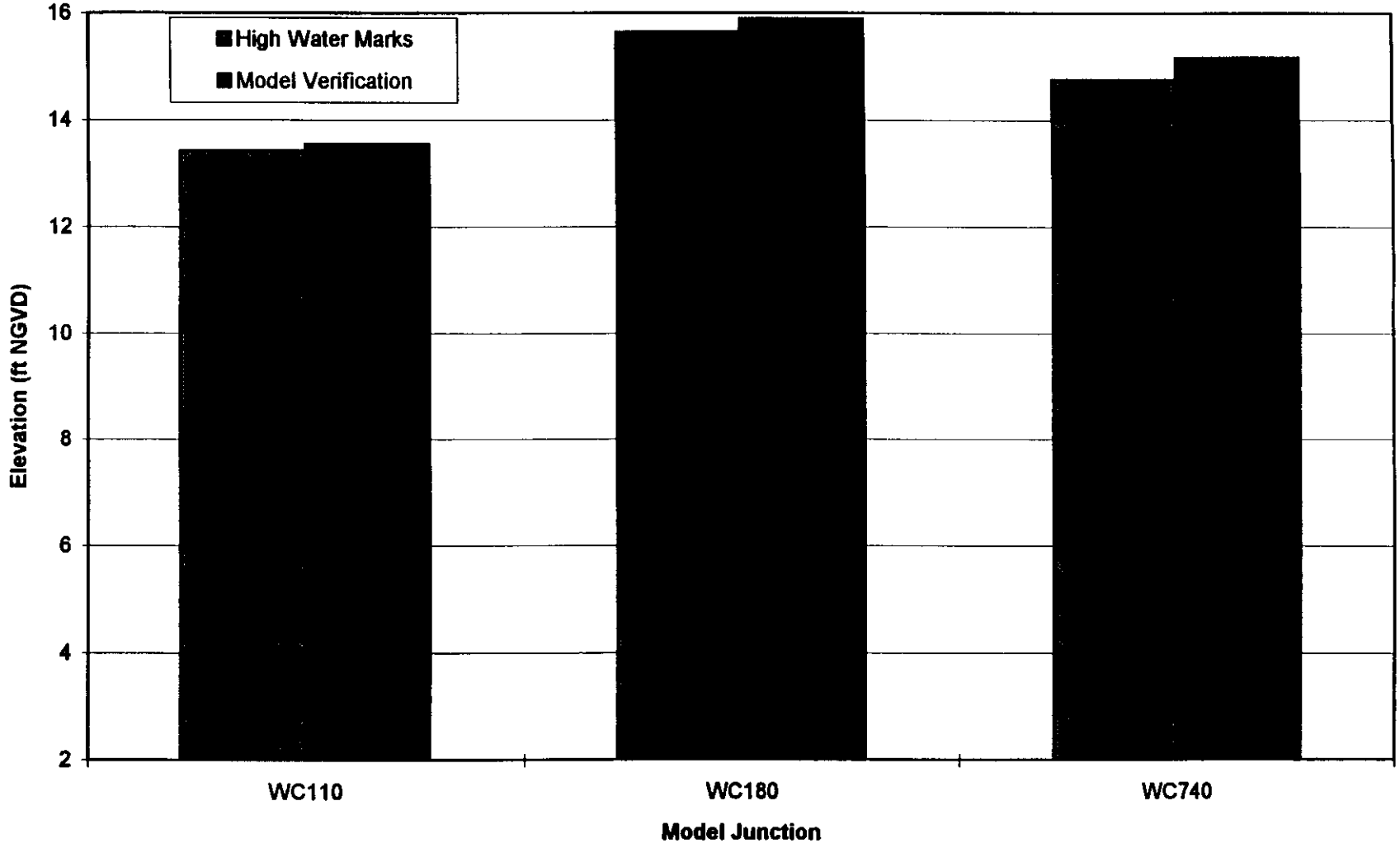


Table 4.4
Woodmere Creek Master Plan
Existing Conditions Model Calibration/Verification Comparison

Location Description	Node Location	High Water Mark ft NGVD	Model Simulation ft NGVD	Elevation Difference ft
June 1992 Storm Event High Water Elevations:				
Pompano Rd. Headwall	WC080	11.40	11.80	+0.40
Ditch Bank East of Florida Rd.	WC120	13.70	12.90	-0.80
Lake Bank	WC210	14.30	13.85	-0.45
Lake	WC270	14.80	14.80	+0.00
Lake Bank	WC280	15.30	14.74	-0.56
Heron Rd. 100' North of Seneca Rd.	WC510	6.90	6.95	+0.05
N. of Colonial Rd., West of Home #750	WC530	6.30	7.24	+0.94
Ditch Bank South of Colonial and East of Viola	WC560	9.20	8.86	-0.34
S.W. Corner of Cocoanut and Larry	WC600	9.40	9.32	-0.08
Ditch Bank W. of S.R. 776	WC705	14.40	13.47	-0.93
July 1995 Storm Event High Water Elevations:				
Top of Pipe at Intersection of Miami and Clemson	WC110	13.42	13.55	+0.13
Intersection of S.R. 776 and Jacaranda	WC180	15.64	15.89	+0.25
EOP at Intersection of Pierce and Jackson	WC740	14.76	15.17	+0.41

Figure 4.6
Model Verification Comparison
July 1995 High Water Marks



SECTION 5
ANALYSIS OF FLOOD CONTROL LEVELS OF SERVICE

Upon the successful completion of the development and calibration of the detailed hydrologic and hydraulic model of the Woodmere Creek basin primary drainage system, the next step was to apply the model to assess the performance of the basinwide drainage facilities for a given set of design storm events. Results of these simulations were then analyzed with respect to adopted flooding level of service criteria (LOS) to identify locations within the watershed where the LOS are not being met.

ASSESSMENT OF EXISTING FLOODING CONDITIONS

Existing flooding conditions in the study area were evaluated based on a review of existing information, interviews with local residents, interviews with the County's stormwater maintenance personnel, and review of citizen's complaints. As a means of assessing the current known flooding problems in the Woodmere Creek basin, Parsons ES reviewed the Customer Response Tracking database which Sarasota County has developed as a means of recording and monitoring response activities to resident's flooding-related complaints that are received. A total of seventy seven (77) Customer Response Tracking Forms were received from the Sarasota County, Transportation Department, Initial Response Team (IRT). Of the total, twenty (20) responses were for complaints outside of the Woodmere Creek basin. The remaining (57) responses were grouped into the categories of Minor Drainage Problems, Normal Maintenance Problems, Erosion Maintenance Problems, and Flooding Problems. The locations of these complaints are shown in Figure 5.1.

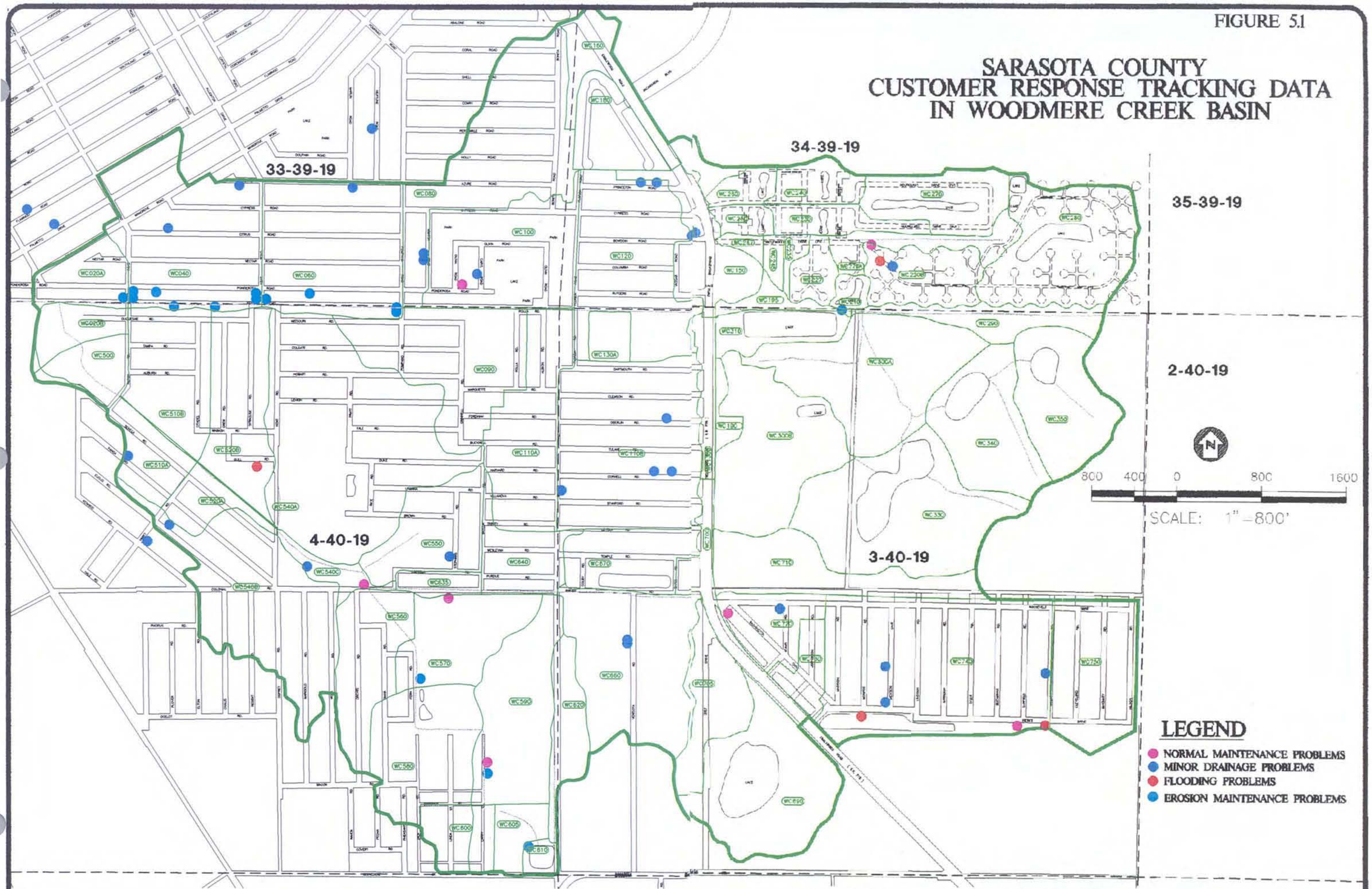
'Minor Drainage Problems' were considered as those which were not associated with the main drainage canals but with the minor drainage systems within the Woodmere Creek basin, such as road side ditches, street drains, and lot line swales. Generally, these complaints were associated with area street flooding, the majority of which were resolved through road drainage maintenance. Minor Drainage Problems occur throughout the basin and are generally located at a distance from the main canals.

'Normal Maintenance Problems' were considered as complaints that were responded to through completion of routine maintenance such as vegetative control activities and ditch and culvert cleaning. Normal Maintenance Problems also occur throughout the basin, but are somewhat concentrated in the upper reaches of the main canals. This concentration is likely due to the lower flow velocities, hence less erosion, in the upper reaches.

'Erosion Maintenance Problems' were considered as complaints requiring repair of erosion of ditch banks, culvert headwalls, and culvert failures in which there was

FIGURE 5.1

SARASOTA COUNTY
CUSTOMER RESPONSE TRACKING DATA
IN WOODMERE CREEK BASIN



PARSONS ENGINEERING SCIENCE INC

private property loss, impaired drainage, or a threat to public works such as roadways. Erosion Maintenance Problems associated with the main drainage system are concentrated along the main northern branch downstream of Pompano Road to Heron Road. Erosion of ditch banks and culvert headwalls associated with lateral drainage connections and main channel flow velocities were reported. Erosion problems are also concentrated along the southeast branch in the vicinity of Japanese Gardens. Erosion of ditch banks associated with lateral drainage is the primary problem being reported in this area.

'Flooding Problems' were considered as complaints of area and street flooding associated with the main drainage system of Woodmere Creek. Response reports generally did not indicate a resolution of the problem. Flooding Problems associated with the main drainage system were reported in the Gulfview Estates, Hourglass Lakes, and the Circlewood Condominium areas. One flooding problem was reported on the southeast branch near the extension of Osprey Road. This problem is due to the low elevation of the existing road. However, as described later in this report, the conditions at this location meet established levels of service for flood protection.

It should be noted that flooding problems are generally associated with all of the IRT Complaints, and that dividing the Customer Response Tracking Forms into the above defined categories does not imply that flooding problems are limited to those areas where the Flooding Problem complaints area located. The process of categorizing the complaints is only meant to be a guide in further assessment work.

A summary of the number of complaints by category is shown below:

Category	Number of Responses	Percent
Minor Drainage Problems	27	47.3%
Normal Maintenance Problems	8	14.0%
Erosion Maintenance Problems	18	31.6%
Flooding Problems	4	7.1%

EXISTING CONDITIONS MODEL SIMULATIONS

Upon the successful completion of the development and calibration of the detailed hydrologic and hydraulic model of the basin's primary drainage system, the next step was to apply the model to assess the performance of the basinwide drainage facilities for a given set of design storm events. Results of these simulations were then analyzed with respect to adopted flooding level of service criteria (LOS) to identify locations within the watershed where the LOS are not being met.

Design Storm Events

In accordance with the flood control criteria that have been adopted by Sarasota County, the basis for the evaluation of flooding conditions in the watershed are the 2-year, 5-year, 10-year, 25-year and 100-year return period, 24-hour duration design storm events. This type of analysis is necessary to analyze compliance with the County's levels of service for flood control. The total rainfall values per return period are listed below.

Return Period (years)	Accumulated Volume (inches)
2	4.00
5	6.00
10	7.00
25	8.00
100	10.00

The rainfall distribution ratios and the rainfall volumes associated with the design storms are shown in Table 5.1. These were determined from the SWFWMD Environmental Resource Permitting (ERP) Information Manual (February 1996). In accordance with SWFWMD design criteria, the SCS Type II Florida-Modified rainfall distribution curve was used to develop the design storm hyetographs

Model Simulations for Existing Conditions

Using the design storm events as the basis for simulations, the SWMM model was run to generate predictions of basinwide flooding conditions for the existing land use conditions and the existing drainage facilities throughout the Woodmere Creek watershed. The SWMM hydraulic model calibration data input were updated for this purpose to reflect the recent construction of new road crossings of the main channels at Heron Road (WC40 and WC510), Kent Road (WC60), Florida Road (WC120), and Englewood Road (WC190 and WC710).

It is noted that the same soil infiltration parameters were used for the design storm event simulations as derived through the model calibration and verification process. While varying antecedent moisture conditions can result in different peak flow and flood elevation responses to the same design storm event, there is no basis for quantifying how such modifications could be made from the limited amount of available information in the watershed. In addition, no significant variations are expected in the average soil infiltration rate because the available water storage capacity of the predominant D soils in this basin is limited even for dry antecedent moisture conditions. Furthermore, the sensitivity of peak flows to changes in antecedent moisture conditions is small for largely developed areas such as the Woodmere basin.

Table 5.2 shows the results of model simulations of peak flood stages at the model junction locations. This table lists both the model junctions of primary importance within the system in a sequence starting from the downstream end and the corresponding model predictions of flood elevation at those locations.

Table 5.1
Woodmere Creek Basin Design Storm Events

TIME	SCS TYPE II FLORIDA-MODIFIED 24-HOUR DURATION STORM DISTRIBUTION	WOODMERE CREEK DESIGN STORM HYETOGRAPHS				
		2-YEAR	5-YEAR	10-YEAR	25-YEAR	100-YEAR
hour	dimensionless	inches	inches	inches	inches	inches
0.0	0.000	0.000	0.000	0.000	0.000	0.000
0.5	0.006	0.024	0.036	0.042	0.048	0.060
1.0	0.006	0.024	0.036	0.042	0.048	0.060
1.5	0.007	0.028	0.042	0.049	0.056	0.070
2.0	0.006	0.024	0.036	0.042	0.048	0.060
2.5	0.007	0.028	0.042	0.049	0.056	0.070
3.0	0.007	0.028	0.042	0.049	0.056	0.070
3.5	0.008	0.032	0.048	0.056	0.064	0.080
4.0	0.007	0.028	0.042	0.049	0.056	0.070
4.5	0.008	0.032	0.048	0.056	0.064	0.080
5.0	0.009	0.036	0.054	0.063	0.072	0.090
5.5	0.009	0.036	0.054	0.063	0.072	0.090
6.0	0.009	0.036	0.054	0.063	0.072	0.090
6.5	0.010	0.040	0.060	0.070	0.080	0.100
7.0	0.011	0.044	0.066	0.077	0.088	0.110
7.5	0.012	0.048	0.072	0.084	0.096	0.120
8.0	0.012	0.048	0.072	0.084	0.096	0.120
8.5	0.014	0.056	0.084	0.098	0.112	0.140
9.0	0.016	0.064	0.096	0.112	0.128	0.160
9.5	0.017	0.068	0.102	0.119	0.136	0.170
10.0	0.020	0.080	0.120	0.140	0.160	0.200
10.5	0.025	0.100	0.150	0.175	0.200	0.250
11.0	0.032	0.128	0.192	0.224	0.256	0.320
11.5	0.050	0.200	0.300	0.350	0.400	0.500
12.0	0.299	1.196	1.794	2.093	2.392	2.990
12.5	0.112	0.448	0.672	0.784	0.896	1.120
13.0	0.038	0.152	0.228	0.266	0.304	0.380
13.5	0.028	0.112	0.168	0.196	0.224	0.280
14.0	0.022	0.088	0.132	0.154	0.176	0.220
14.5	0.019	0.076	0.114	0.133	0.152	0.190
15.0	0.016	0.064	0.096	0.112	0.128	0.160
15.5	0.015	0.060	0.090	0.105	0.120	0.150
16.0	0.013	0.052	0.078	0.091	0.104	0.130
16.5	0.012	0.048	0.072	0.084	0.096	0.120
17.0	0.011	0.044	0.066	0.077	0.088	0.110
17.5	0.011	0.044	0.066	0.077	0.088	0.110
18.0	0.009	0.036	0.054	0.063	0.072	0.090
18.5	0.010	0.040	0.060	0.070	0.080	0.100
19.0	0.008	0.032	0.048	0.056	0.064	0.080
19.5	0.009	0.036	0.054	0.063	0.072	0.090
20.0	0.008	0.032	0.048	0.056	0.064	0.080
20.5	0.007	0.028	0.042	0.049	0.056	0.070
21.0	0.007	0.028	0.042	0.049	0.056	0.070
21.5	0.007	0.028	0.042	0.049	0.056	0.070
22.0	0.007	0.028	0.042	0.049	0.056	0.070
22.5	0.007	0.028	0.042	0.049	0.056	0.070
23.0	0.006	0.024	0.036	0.042	0.048	0.060
23.5	0.006	0.024	0.036	0.042	0.048	0.060
24.0	0.005	0.020	0.030	0.035	0.040	0.050
	TOTAL RAINFALL (INCHES)	4.000	6.000	7.000	8.000	10.000

Table 5.2
Existing Land Use and Existing Conditions Maximum Flood Stage Summary

Junction Number	Junction Location	Existing Land Use & Existing Conditions Maximum Flood Stages				
		2-Year Storm Peak Elev. (ft NGVD)	5-Year Storm Peak Elev. (ft NGVD)	10-Year Storm Peak Elev. (ft NGVD)	25-Year Storm Peak Elev. (ft NGVD)	100-Year Storm Peak Elev. (ft NGVD)
999	LEMON BAY	2.50	2.50	2.50	2.50	2.50
10		2.52	2.57	2.60	2.64	2.72
20		3.61	4.80	5.27	5.70	6.48
30	HERON RD (d/s)	3.96	5.11	5.54	5.92	6.62
40	HERON RD (u/s)	6.49	9.67	10.68	11.35	12.55
50	KENT RD (d/s)	7.25	9.87	10.81	11.45	12.60
60	KENT RD (u/s)	7.80	11.36	12.56	13.29	14.42
70	POMPANO RD (d/s)	8.31	11.46	12.62	13.33	14.45
80	POMPANO RD (u/s)	8.56	12.10	13.33	14.03	14.99
90		9.68	12.27	13.41	14.05	15.00
100	FLORIDA RD (d/s)	10.55	12.54	13.53	14.13	15.08
110		12.48	13.14	13.60	14.19	15.10
120	FLORIDA RD (u/s)	10.71	12.78	13.64	14.15	15.08
125	FDOT POND 4-N OUTFALL	10.79	12.86	13.60	14.19	15.45
130	FDOT POND 4-N	12.78	12.97	13.59	14.12	15.08
140	ENGLEWOOD RD (d/s)	10.88	12.81	13.65	14.15	15.10
145	FDOT POND 5-N OUTFALL	11.35	13.14	13.85	14.32	14.90
150	FDOT POND 5-N	11.98	13.16	13.93	14.55	15.10
160	STORM SEWER AT ENGLEWOOD RD.	12.01	13.18	13.96	14.61	15.63
170	STORM SEWER AT ABALONE RD.	12.04	13.20	13.98	14.72	15.71
180	JACARANDA HEIGHTS LAKE	14.59	15.32	15.65	15.87	16.11
190	ENGLEWOOD RD (u/s)	10.96	12.95	13.70	14.30	15.47
195		11.98	13.12	13.73	14.49	15.55
200		12.36	13.30	13.94	14.72	15.59
210	CIRCLEWOOD CONDO LAKE 1	12.42	13.47	14.05	14.81	15.59
220	STORM SEWER AT CIRCLEWOOD DRIVE	13.10	14.85	15.15	15.41	15.79
225	STORM SEWER AT CIRCLEWOOD DRIVE	14.01	14.89	15.16	15.41	15.79
227	STORM SEWER AT CIRCLEWOOD DRIVE	14.26	15.02	15.18	15.42	15.79
230	HOURGLASS ESTATES LAKE 1	14.26	14.89	15.17	15.42	15.80
235	STORM SEWER AT CIRCLEWOOD DRIVE	14.66	15.10	15.24	15.42	15.78
240	HOURGLASS ESTATES LAKE 2	14.27	14.89	15.17	15.42	15.80
245	STORM SEWER AT CIRCLEWOOD DRIVE	14.69	15.13	15.27	15.42	15.77
247	STORM SEWER AT CIRCLEWOOD DRIVE	14.33	15.11	15.27	15.42	15.77
250	HOURGLASS ESTATES LAKE 3	14.33	14.89	15.16	15.42	15.79
260	HOURGLASS ESTATES LAKE 4	14.33	14.89	15.16	15.42	15.80
270	CIRCLEWOOD CONDO LAKE 2	12.97	14.25	14.98	15.42	15.80
271	STORM SEWER AT CIRCLEWOOD DRIVE	13.03	14.84	15.14	15.42	15.80
273	STORM SEWER AT CIRCLEWOOD DRIVE	12.91	14.80	15.12	15.42	15.82
274	STORM SEWER AT CIRCLEWOOD DRIVE	12.94	14.55	15.06	15.48	15.88
280	CIRCLEWOOD CONDO LAKE 3	12.94	14.56	15.06	15.49	15.92
290		12.39	13.31	13.99	14.77	15.60
300	WETLAND	12.77	14.31	14.58	14.85	15.62
310	BORROW PIT	12.90	13.18	13.45	14.49	15.55
320		15.10	15.33	15.41	15.49	15.66
330	WETLAND	15.56	15.72	15.76	15.81	15.88
340	WETLAND	15.12	15.36	15.44	15.52	15.66
350	WETLAND	15.13	15.36	15.45	15.53	15.66
500		3.71	4.93	5.41	5.85	6.66
505	HERON RD (d/s)	4.05	5.30	5.77	6.21	7.01
510	HERON RD (u/s)	5.85	7.03	7.16	7.27	7.47
520		5.99	7.24	7.45	7.66	8.12
530		6.13	7.43	7.70	7.96	8.57
540		6.30	7.72	8.07	8.43	9.06
550	COLONIAL RD (d/s)	6.37	7.76	8.12	8.50	9.19
560	COLONIAL RD (u/s)	6.72	8.79	9.38	9.63	9.78
570		6.93	8.85	9.41	9.68	9.89
580		7.40	9.01	9.52	9.79	10.04
590		7.62	9.07	9.56	9.84	10.14
600		7.63	9.07	9.56	9.84	10.14
605		7.69	8.78	9.33	9.71	10.24
610	JAPANESE GARDENS LAKE	7.50	8.79	9.34	9.71	10.24
620		10.02	10.62	10.82	10.97	11.20
630	OSCEOLA RD (d/s)	6.55	7.88	8.22	8.57	9.29
636	OSCEOLA RD (u/s)	10.01	10.25	10.31	10.36	10.44
640		10.32	10.88	11.08	11.29	11.73
645		11.27	12.16	12.46	12.71	13.20
650		11.46	12.30	12.60	12.85	13.32
655	DIRT RD. (d/s)	11.53	12.36	12.65	12.89	13.35
660	WETLAND	11.66	12.38	12.66	12.90	13.36
665	DIRT RD. (u/s)	11.78	12.93	13.39	13.71	14.01
670	BORROW PIT	11.27	12.16	12.46	12.71	13.20
675	FDOT POND 3-N OUTFALL	11.98	13.22	13.62	13.93	14.37
680		11.91	13.01	13.44	13.76	14.06
690	WETLAND	13.43	13.96	14.20	14.41	14.78
700	FDOT POND 3-N	13.20	13.52	13.70	13.99	14.40
705	ENGLEWOOD RD (d/s)	12.02	13.06	13.48	13.79	14.09
710	ENGLEWOOD RD (u/s)	12.22	13.64	14.25	14.66	15.16
720	GULFVIEW ESTATES LAKE	12.39	13.70	14.34	14.91	15.87
730	GULFVIEW ESTATES LAKE	12.69	14.02	14.57	15.14	15.87
740	GULFVIEW ESTATES LAKE	13.08	14.49	14.88	15.16	15.87
750	GULFVIEW ESTATES LAKE	12.13	14.16	14.80	15.16	15.87

Another way of looking at flooding conditions is by way of the graphical plots of the channel flood profile as it relates to the channel bottom and road crossing elevations. These flood profile plots, presented in Figures 5.2 through 5.5, provide a visual representation in which it is much easier to identify locations where structures are flooded, depths of inundation, structures and channel reaches that may be flow constrictions that cause excessive head loss, and tailwater conditions which might be the cause of structural flooding at some locations and in associated secondary systems.

Existing Levels of Service Deficiencies and Flooding Problem Areas

LOS objectives for flood protection throughout Sarasota County have been defined in the County's Land Development Regulations Ordinance No. 95-021. Table 3.1 in Section 3 of this report shows the County's LOS criteria for flood protection. These criteria provide the basis by which the model simulation results can be evaluated with respect to critical elevations along the primary drainage system, and deficiencies identified.

As a means of identifying LOS deficiencies, Table 5.3 presents a more concise listing of model junctions in areas of development along the primary drainage system and the corresponding model predictions of flood elevation at those locations. Listed are the locations and descriptions of the road crossing structures along the drainage system and the low road elevation at each structure. Note that the low road elevation does not necessarily occur at the exact location of the structure itself, since sags along the road profile, as determined from SWFWMD topographic mapping and/or roadway construction drawings, may occur several hundred feet away. The difference between peak flood elevation and low road elevation indicates the degree of the flooding condition at any particular location. This process allows determination of whether the established LOS for flood protection are being met.

As a part of this study, field survey of 110 residential structure low floor slab elevations was conducted in identified low-lying areas throughout the watershed. These data served as the basis for identifying and evaluating problems of residential structure flooding. At the bottom of Table 5.3, critical low floor slab elevations are listed with the corresponding street address and model junction location indicated. Again, the difference between the peak flood elevation and the low floor slab elevation indicates the depth of flooding at that location and allows the assessment of whether LOS criteria for structural flooding are being met.

By examination of Table 5.3, and in conjunction with County staff, Parsons ES identified four generalized flooding problem areas not meeting the established flooding LOS criteria within the Woodmere Creek basin. These problem areas, shown on Figure 5.6, are discussed in the following narratives. They are the Olivia Road, Hourglass Lakes and Circlewood Condominiums, Japanese Gardens Mobile Home Estates, and Gulfview Estates Subdivision areas. Figure 5.6 also shows the areal extent of the 100-year floodplain as defined by the model simulation resultant peak flood elevations and plotting on SWFWMD topographic mapping. The modeling results presented in Table 5.3 and Figure 5.6 generally agree with and confirm the findings of the review of the

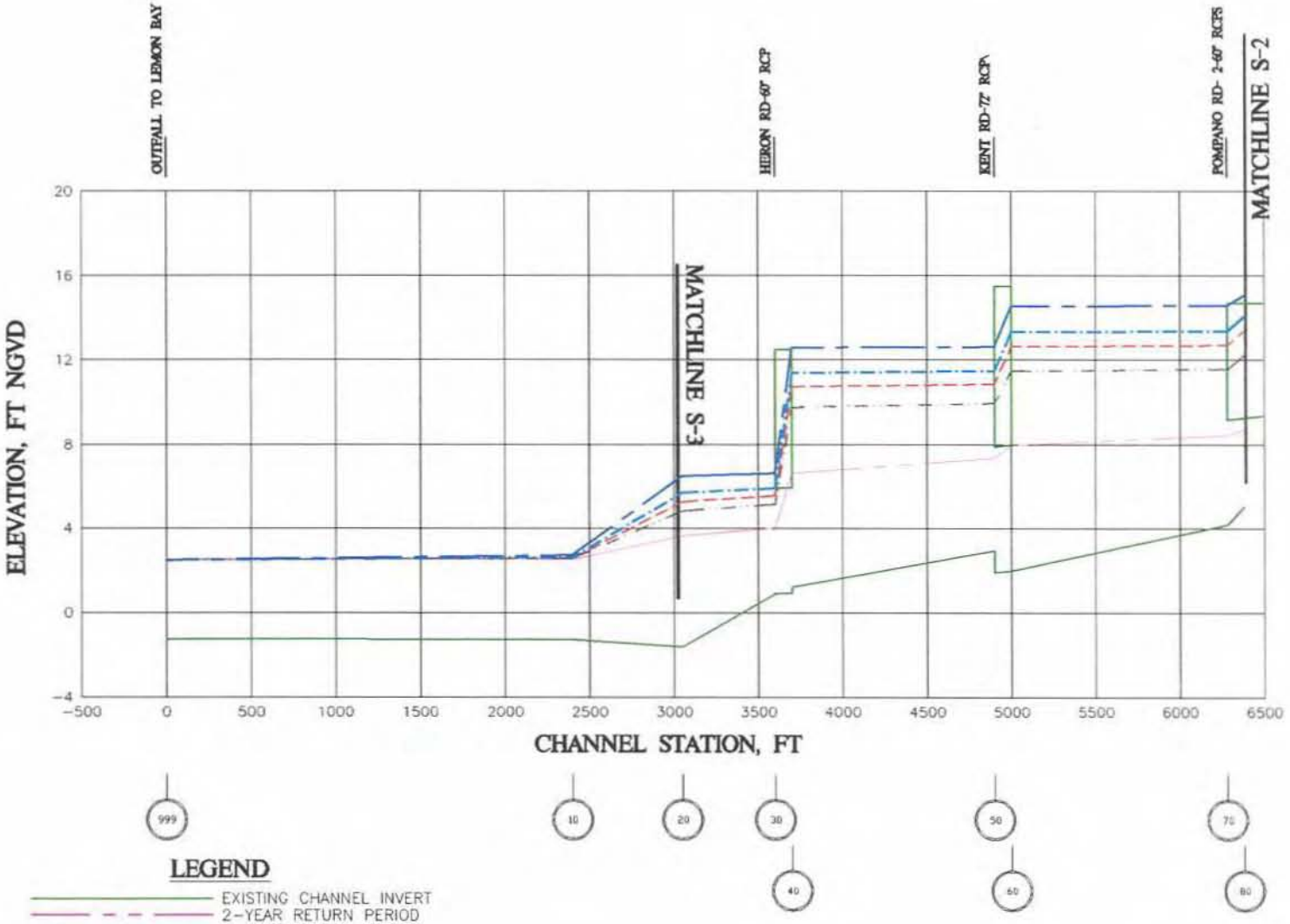
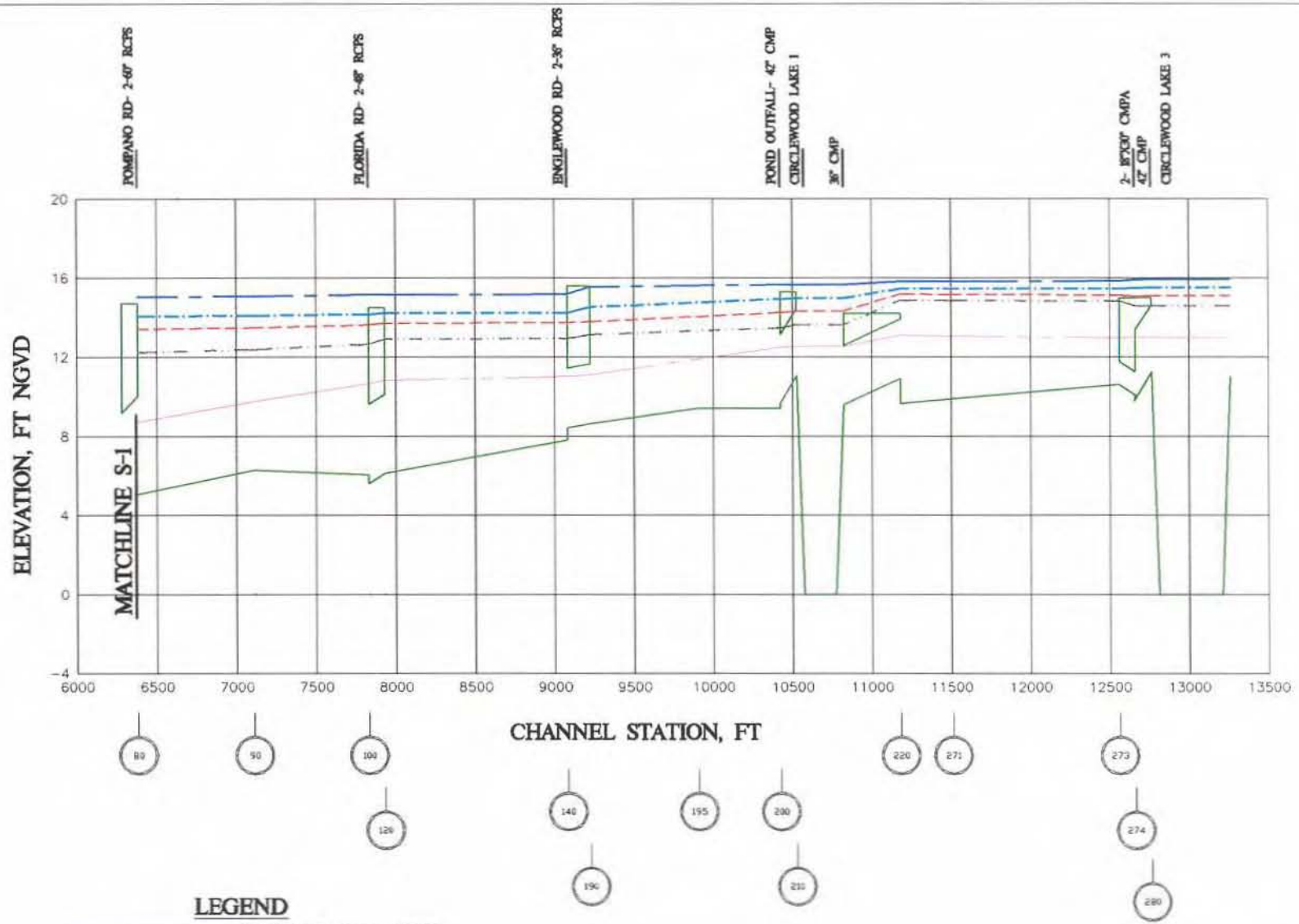


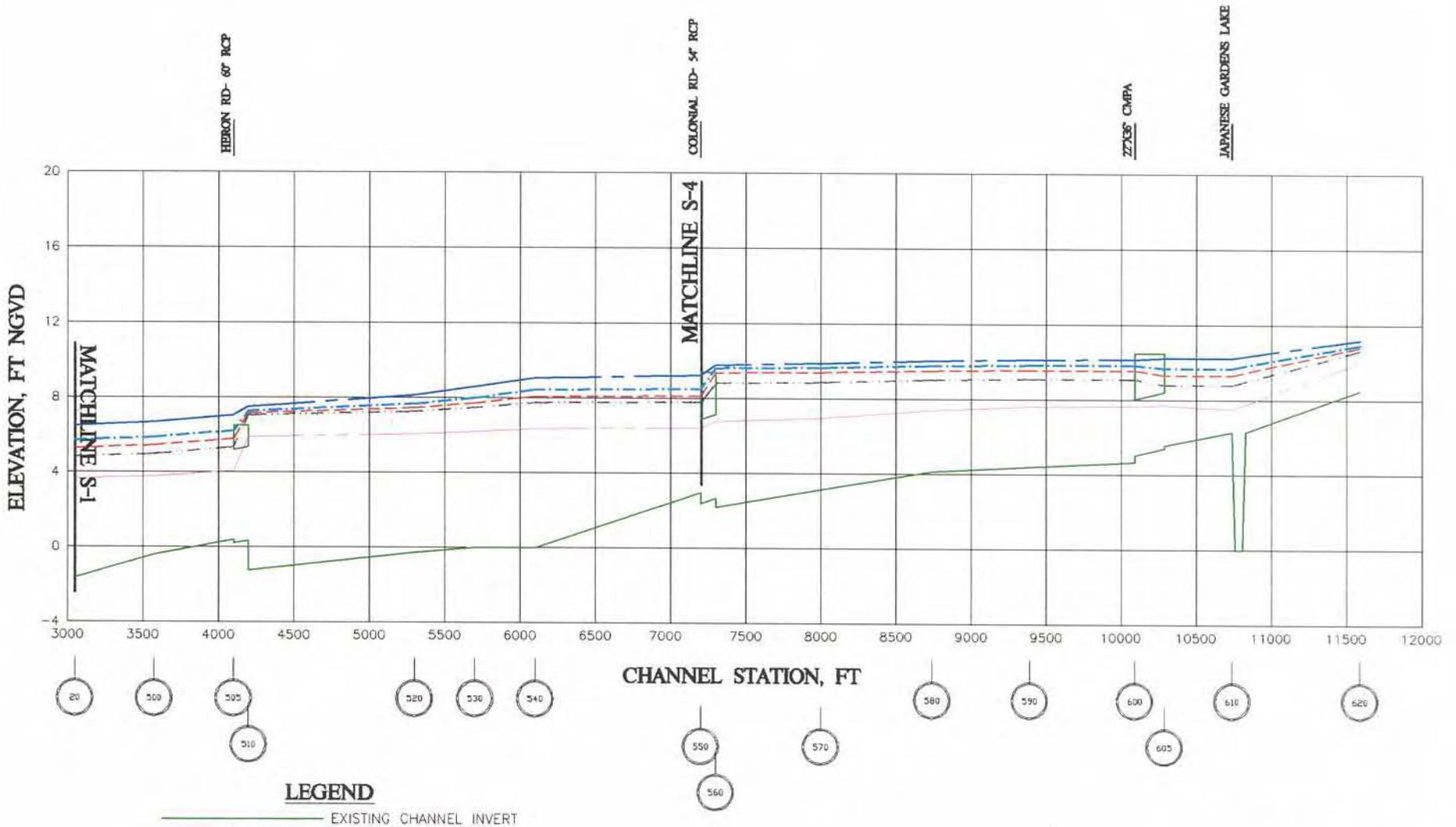
FIGURE 5.2 WOODMERE CREEK BASIN EXISTING LAND USE AND EXISTING CONDITIONS FLOOD PROFILES (S-1)

PARSONS ENGINEERING SCIENCE, INC.



PARSONS ENGINEERING SCIENCE, INC.

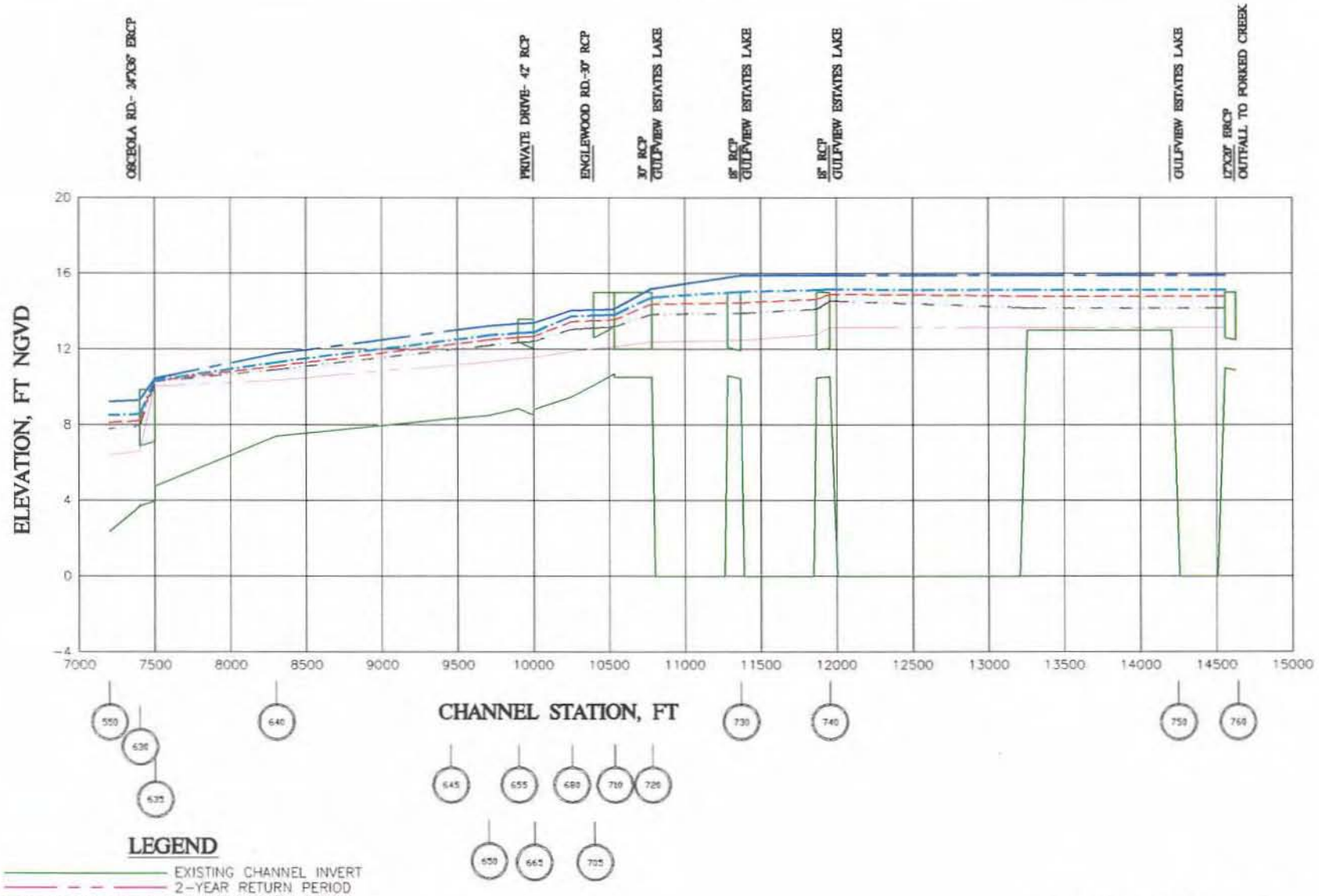
FIGURE 5.3 WOODMERE CREEK BASIN EXISTING LAND USE AND EXISTING CONDITIONS FLOOD PROFILES (S-2)



HORIZONTAL SCALE: 1"=1000'
VERTICAL SCALE: 1"=8'

PARSONS ENGINEERING SCIENCE, INC.

FIGURE 5.4 WOODMERE CREEK BASIN EXISTING LAND USE AND EXISTING CONDITIONS FLOOD PROFILES (S-3)



PARSONS ENGINEERING SCIENCE, INC.

FIGURE 5.5 WOODMERE CREEK BASIN EXISTING LAND USE AND EXISTING CONDITIONS FLOOD PROFILES (S-4)

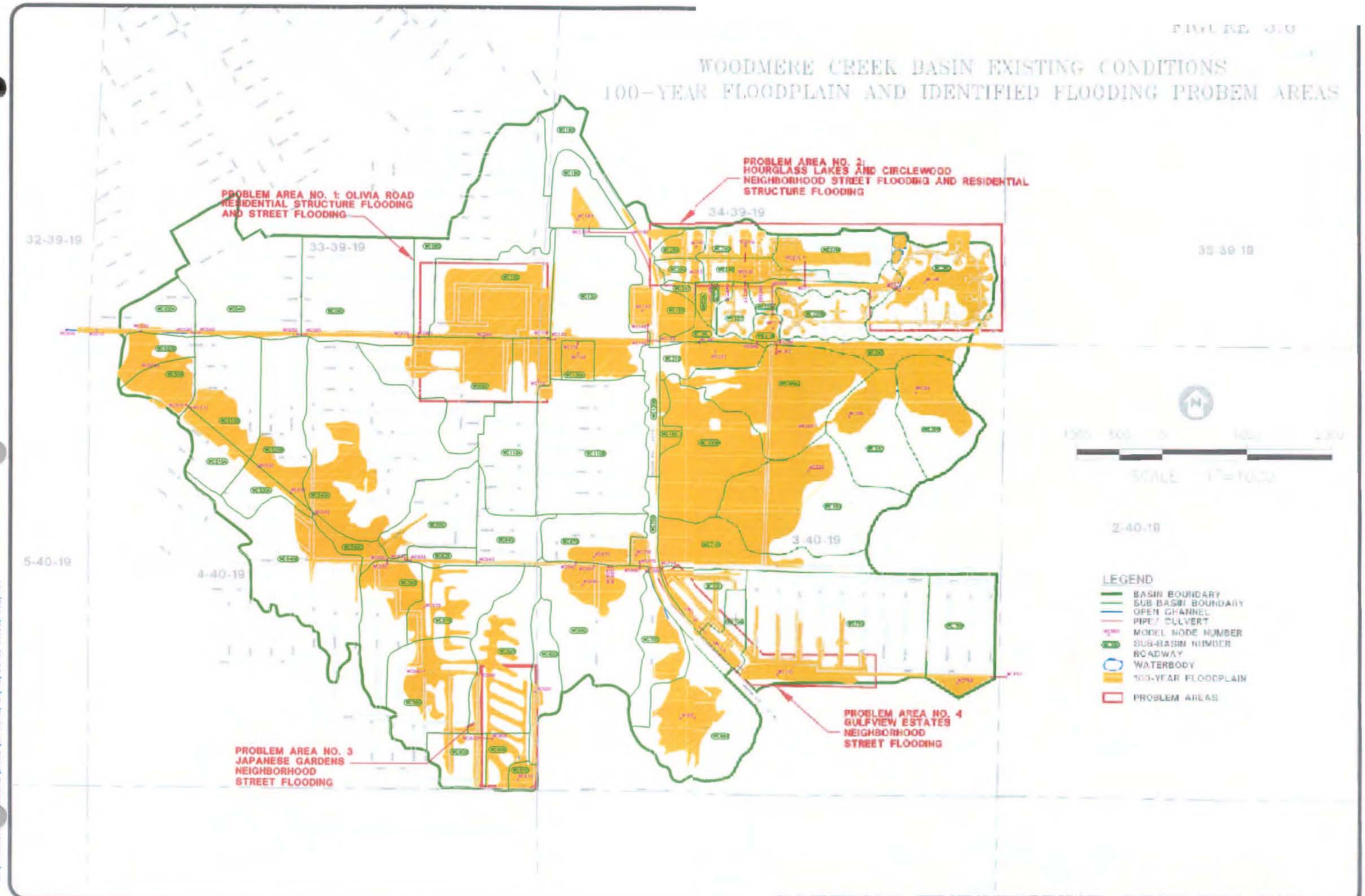
Table 5.3
Woodmere Creek Flood Protection LOS Deficiencies
Existing Land Use and Existing Drainage Conditions

Junction Number	Structure Location	Existing Structure Description	Elevation Near Node (ft NGVD)	Location Type	Low Floor Slab Elevation (ft NGVD)	Maximum Flood Elevation					Level of Service				
						2-Year Storm Peak Elev. (ft NGVD)	5-Year Storm Peak Elev. (ft NGVD)	10-Year Storm Peak Elev. (ft NGVD)	25-Year Storm Peak Elev. (ft NGVD)	100-Year Storm Peak Elev. (ft NGVD)	2-Year Storm (feet)	5-Year Storm (feet)	10-Year Storm (feet)	25-Year Storm (feet)	100-Year Storm (feet)
Road Flooding															
20	PONDEROSA RD		8.7	TOR		3.61	4.80	5.27	5.70	6.48	-5.09	-3.90	-3.43	-3.00	-2.22
40	HERON RD CULVERT	60" RCP	12.5	TOR		8.49	9.87	10.68	11.35	12.55	-6.01	-2.83	-1.82	-1.15	0.05
60	KENT RD CULVERT	72" RCP	15.5	TOR		7.80	11.36	12.56	13.29	14.42	-7.70	-4.14	-2.94	-2.21	-1.08
80	CITRUS RD		13.2	TOR		7.80	11.36	12.56	13.29	14.42	-5.40	-1.84	-0.64	0.09	1.22
80	POMPANO RD CULVERTS	60" RCP, 60" CMP	14.7	TOR		8.56	12.10	13.33	14.03	14.99	-6.14	-2.60	-1.37	-0.67	0.29
90	OLIVIA RD		12.2	TOR		9.68	12.27	13.41	14.05	15.00	-2.52	-0.07	1.21	1.85	2.80
120	FLORIDA RD CULVERTS	2-48" RCP'S	14.5	TOR		10.71	12.78	13.64	14.15	15.08	-3.79	-1.72	-0.86	-0.35	0.58
125	FDOT POND 4-N OUTFALL	30" RCP	14.5	TOB		10.79	12.86	13.60	14.19	15.45	-3.71	-1.64	-0.90	-0.31	0.95
145	FDOT POND 5-N OUTFALL	29"X45" ERCP	14.5	TOB		11.35	13.14	13.85	14.32	14.90	-3.15	-1.36	-0.65	-0.18	0.40
160	STORM SEWER AT ENGLEWOOD RD.	48" RCP	15.2	TOR		12.01	13.18	13.96	14.61	15.63	-3.19	-2.02	-1.24	-0.59	0.43
170	STORM SEWER AT ABALONE RD.	24" RCP	15.2	TOR		12.04	13.20	13.98	14.72	15.71	-3.16	-2.00	-1.22	-0.48	0.51
190	ENGLEWOOD RD CULVERTS	2-36" RCP'S	14.4	TOR		10.96	12.95	13.70	14.30	15.47	-3.44	-1.45	-0.70	-0.10	1.07
210	CIRCLEWOOD LAKE 1	42" CMP	14.2	TOR		12.42	13.47	14.05	14.81	15.59	-1.78	-0.73	-0.15	0.61	1.39
220	STORM SEWER AT CIRCLEWOOD DRIVE	36" CMP	14.8	TOR		13.10	14.85	15.15	15.41	15.79	-1.70	-0.05	0.35	0.61	0.99
225	STORM SEWER AT CIRCLEWOOD DRIVE	18" CMP	14.1	TOR		14.01	14.89	15.18	15.41	15.79	-0.09	0.79	1.08	1.31	1.69
227	STORM SEWER AT CIRCLEWOOD DRIVE	24" CMP	14.6	TOR		14.26	15.02	15.18	15.42	15.79	-0.31	0.45	0.61	0.84	1.21
230	HOURGLASS LAKE 1	18" CMP	14.1	TOR		14.26	14.89	15.17	15.42	15.80	0.16	0.79	1.07	1.32	1.70
240	HOURGLASS LAKE 2	18" CMP	14.1	TOR		14.27	14.89	15.17	15.42	15.80	0.17	0.79	1.07	1.32	1.70
245	STORM SEWER AT CIRCLEWOOD DR.	24" CMP	14.4	TOR		14.89	15.13	15.27	15.42	15.77	0.29	0.73	0.87	1.02	1.37
250	HOURGLASS LAKE 3	18" CMP	14.1	TOR		14.33	14.89	15.16	15.42	15.79	0.23	0.79	1.06	1.31	1.68
260	HOURGLASS LAKE 4	18" CMP	14.1	TOR		14.33	14.89	15.16	15.42	15.80	0.23	0.79	1.06	1.32	1.70
270	CIRCLEWOOD LAKE 2	18" CMP	14.3	TOR		12.97	14.25	14.96	15.42	15.80	-1.33	-0.05	0.66	1.12	1.50
280	CIRCLEWOOD LAKE 3	42" CMP	14.6	TOR		12.94	14.56	15.06	15.49	15.92	-1.66	-0.04	0.46	0.89	1.32
510	HERON RD CULVERT	60" RCP	6.5	TOR		5.65	7.03	7.16	7.27	7.47	-0.65	0.53	0.66	0.77	0.97
520	GULL RD		7.6	TOR		5.99	7.24	7.45	7.66	8.12	-1.61	-0.36	-0.15	0.06	0.52
530	SENECA RD		8.4	TOR		6.13	7.43	7.70	7.98	8.57	-2.27	-0.97	-0.70	-0.42	0.17
540	OSPREY RD		8.3	TOR		6.30	7.72	8.07	8.43	9.06	-2.00	-0.58	-0.23	0.13	0.76
560	COLONIAL RD CULVERT	54" CMP	9.4	TOR		6.72	8.79	9.36	9.63	9.78	-2.68	-0.61	-0.02	0.23	0.38
570	JAPANESE GARDENS		8.8	TOR		6.93	8.65	9.41	9.68	9.89	-1.87	-0.05	0.71	0.98	1.09
580	JAPANESE GARDENS		8.6	TOR		7.40	9.01	9.52	9.79	10.04	-1.40	0.21	0.72	0.99	1.24
590	JAPANESE GARDENS		9.5	TOR		7.62	9.07	9.56	9.84	10.14	-1.88	-0.43	0.06	0.34	0.64
600	JAPANESE GARDENS		9.2	TOR		7.63	9.07	9.56	9.84	10.14	-1.57	-0.13	0.36	0.64	0.94
605	JAPANESE GARDENS LAKE OUTFALL	22"X36" CMP	9.2	TOR		7.69	8.78	9.33	9.71	10.24	-1.51	-0.42	0.13	0.51	1.04
610	JAPANESE GARDENS LAKE		9.5	TOR		7.50	8.79	9.34	9.71	10.24	-2.00	-0.71	-0.16	0.21	0.74
635	OSCEOLA RD CULVERT	24" X 38" ERCP	9.9	TOR		10.01	10.25	10.31	10.36	10.44	0.16	0.40	0.46	0.51	0.59
655	VENISOTA RD		13.0	TOR		11.53	12.36	12.65	12.89	13.35	-1.47	-0.64	-0.35	-0.11	0.35
665	PRIVATE DRIVE CULVERT	42" RCP	13.6	TOR		11.78	12.93	13.30	13.71	14.01	-1.82	-0.67	-0.21	0.11	0.41
670	TEMPLE RD		14.3	TOR		11.27	12.16	12.46	12.71	13.20	-3.03	-2.14	-1.84	-1.59	-1.10
675	FDOT POND 3-N OUTFALL	29"X45" ERCP	15.0	TOB		11.98	13.22	13.62	13.93	14.37	-3.02	-1.78	-1.38	-1.07	-0.63
710	ENGLEWOOD RD CULVERT	30" RCP	15.0	TOR		12.22	13.64	14.25	14.65	15.16	-2.78	-1.36	-0.75	-0.35	0.16
720	GULFVIEW ESTATES LAKE	2-18" RCP	14.6	TOR		12.39	13.70	14.34	14.91	15.87	-2.21	-0.90	-0.26	0.31	1.27
730	GULFVIEW ESTATES LAKE	18" RCP	14.5	TOR		12.89	14.02	14.57	15.14	15.87	-1.81	-0.48	0.07	0.64	1.37
740	GULFVIEW ESTATES LAKE	18" RCP	13.5	TOR		13.06	14.49	14.88	15.16	15.87	-0.42	0.98	1.38	1.66	2.37
Residential Flooding															
90	456 OLIVIA ROAD			LFS	13.93	12.01	13.18	13.96	14.61	15.63	-1.92	-0.75	0.03	0.68	1.70
90	432 OLIVIA ROAD			LFS	13.76	12.01	13.18	13.96	14.61	15.63	-1.75	-0.58	0.20	0.85	1.87
90	388 OLIVIA ROAD			LFS	13.51	12.01	13.18	13.96	14.61	15.63	-1.50	-0.33	0.45	1.10	2.12
90	348 OLIVIA ROAD			LFS	13.75	12.01	13.18	13.96	14.61	15.63	-1.74	-0.57	0.21	0.86	1.88
90	471 PONDEROSA ROAD			LFS	13.72	12.01	13.18	13.96	14.61	15.63	-1.71	-0.54	0.24	0.89	1.91
90	421 PONDEROSA ROAD			LFS	13.57	12.01	13.18	13.96	14.61	15.63	-1.56	-0.39	0.39	1.04	2.06
230	80 DRIFTING SANDS DR.			LFS	15.51	14.26	14.89	15.17	15.42	15.80	-1.25	-0.62	-0.34	-0.09	0.29
230	82 DRIFTING SANDS DR.			LFS	15.51	14.26	14.89	15.17	15.42	15.80	-1.25	-0.62	-0.34	-0.09	0.29

13.98
13.76
13.51
13.75
13.72
13.57
15.51
15.51

TOB=TOP OF BANK
TOR=TOP OF ROAD CENTERLINE
GI=GRATE INLET ELEVATION
LFS= LOW FLOOR SLAB

WOODMERE CREEK BASIN EXISTING CONDITIONS
100-YEAR FLOODPLAIN AND IDENTIFIED FLOODING PROBEM AREAS



C:\PROJECTS\WOODMERE\DWGS\IMPROVE, 01/19/98 at 14:06, TDB, 1:1

PARSONS ENGINEERING SCIENCE, INC

Customer Response Tracking Forms that were provided by the Sarasota County Transportation Department.

Problem Area 1: Olivia Road. The model simulation results indicate that this low-lying residential area along the main northern branch of Woodmere Creek, between Pompano Road and Florida Road, has the potential to be inundated by over 2 feet of water during the 100-year design storm event. The Olivia Road area is defined as one of the more critical problems in the basin because it includes 6 instances where surveyed floor slab elevations of residential structures are lower than both the 25-year and 100-year storm event maximum flood elevations. In addition, flooding LOS criteria for road flooding are not met for the 10-, 25-, and 100-year storm events. Associated with this problem is the overtopping of Pompano Road in exceedance of LOS criteria.

Problem Area 2: Hourglass Lakes and Circlewood Condominiums. This flooding problem area includes the majority of the length of Hourglass Drive and Circlewood Drive in the residential communities of Hourglass Lakes and Circlewood Condominiums. Located in the headwaters of the northern branch of Woodmere Creek eastward of Englewood Road (SR 776), these subdivisions are served by closed storm sewer systems, and the roadways have been constructed below the natural grade. There are seven lakes that collect and store stormwater runoff prior to discharge through the storm sewer system via a single outfall to the main channel. Floodwaters have been observed to back up through the grate inlets into the roadway as well as overtop the lakes and ponds in these subdivisions. Model simulations confirm the observed flooding problems, and flooding LOS criteria for roadway flooding are violated throughout the area for virtually all storm events (see Table 5.3). There are, however, only two instances of residential structure flooding identified in the area on Drifting Sands Drive for the 100-year design storm event, despite the extent and magnitude of roadway flooding. Associated with the identified flooding problems in these areas is the overtopping of Englewood Road (SR 776) by the 100-year storm. This roadway, a designated evacuation route, has had its grade lowered during recent reconstruction, while the previous cross drains were retained. Model simulations indicate it constricts discharges from the upper basin and does not meet roadway flooding LOS criteria for an evacuation route.

Problem Area 3: Japanese Gardens Mobile Home Estates. This residential flooding problem area is located at the headwaters of the southern branch of Woodmere Creek. The Japanese Gardens mobile home community is served by a closed storm sewer system which outfalls to the creek at 6 separate locations. Significant roadway flooding in excess of LOS criteria occurs in this area due to low road grades and high tailwater elevations in the main channel system to which it discharges. It was also observed that many of the storm sewer outfalls have been damaged and constrict flows from the Japanese Gardens drainage system. The 5-year through 100-year storms are exceeding roadway flooding LOS criteria at this location, but no instances of residential flooding are indicated. Associated with this problem is the hydraulic constriction of

peak flows at the Colonial Road crossing (54" CMP) of the channel downstream of Japanese Gardens. Excessive hydraulic headlosses are indicated at this location.

Problem Area 4: Gulfview Estates. This residential community is located at the headwaters of the southeastern branch of Woodmere Creek on the east side of Englewood Road (SR 776). Stormwater runoff is conveyed by a storm sewer system to an interconnected series of 4 ponds that discharge at a single outfall to a 30" RCP culvert under Englewood Road. Flooding in excess of LOS criteria for road access are indicated by model simulations for the 100-year storm for this area. Road inundation of over 2 feet of water is expected. SR 776, an evacuation route, is not meeting the roadway flooding LOS criteria. The existing structure is being surcharged, which contributes to the upstream flooding problems. Also, the downstream Osceola Road crossing (24"x38" ERCP) is indicated to be a significant constriction of peak flows in the main channel. No residential flooding is expected.

FUTURE CONDITIONS MODEL SIMULATIONS

As one of the purposes of the current study was to evaluate the existing and future flood control and water quality conditions in the basin, future land use conditions model analyses were conducted assuming a land use configuration as described in Section 2 of this report. The future basinwide land uses by drainage subbasin are summarized therein. It is important to note that the future land use map represents built-out conditions. According to APOXSEE, low and medium density residential development is likely to become the dominant land use in the future. The drainage basin areas east of SR 776 will be the primary sites of any future development, with 227 acres of open land to be converted to residential land use. The future land use map does not include the water features that may be developed in the area as stormwater management facilities. Those facilities will be designed and constructed as needed to comply with current state surface water management regulations and the County's land development standards.

Table 5.4 lists the expected maximum stage elevations at all modeling junctions for the five design storms for the future land use conditions. Review of the computer modeling results indicate that peak stage elevations for future land use conditions do not vary significantly from the existing land use peak elevations, and the locations of identified LOS deficiencies and problem areas are identical. The average increase in maximum flood elevations throughout the system due to the construction of new development is 0.05 feet. The locations of the most significant increases, as would be expected, are in the upper basin reaches. Table 5.5 lists a comparison of maximum 100-year flood elevations for a selected set of model junction locations.

Table 5.4
Future Land Use and Existing Conditions Maximum Flood Stage Summary

Junction Number	Junction Location	Future Land Use & Existing Conditions Maximum Flood Stages				
		2-Year Storm Peak Elev. (ft NGVD)	5-Year Storm Peak Elev. (ft NGVD)	10-Year Storm Peak Elev. (ft NGVD)	25-Year Storm Peak Elev. (ft NGVD)	100-Year Storm Peak Elev. (ft NGVD)
999	LEMON BAY	2.50	2.50	2.50	2.50	2.50
10		2.52	2.57	2.60	2.64	2.72
20		3.65	4.82	5.28	5.71	6.49
30	HERON RD (d/s)	4.01	5.14	5.55	5.93	6.63
40	HERON RD (u/s)	6.62	9.76	10.74	11.40	12.58
50	KENT RD (d/s)	7.36	9.95	10.87	11.49	12.62
60	KENT RD (u/s)	7.97	11.47	12.64	13.34	14.54
70	POMPANO RD (d/s)	8.45	11.57	12.70	13.38	14.57
80	POMPANO RD (u/s)	8.70	12.23	13.41	14.07	15.04
90		9.76	12.38	13.48	14.10	15.05
100	FLORIDA RD (d/s)	10.64	12.64	13.61	14.17	15.14
110		12.48	13.14	13.67	14.23	15.17
120	FLORIDA RD (u/s)	10.61	12.89	13.71	14.22	15.14
125	FDOT POND 4-N OUTFALL	10.89	12.92	13.67	14.30	15.53
130	FDOT POND 4-N	12.78	12.97	13.65	14.21	15.14
140	ENGLEWOOD RD (d/s)	11.00	12.93	13.72	14.23	15.16
145	FDOT POND 5-N OUTFALL	11.47	13.21	13.91	14.36	14.97
150	FDOT POND 5-N	12.01	13.24	14.00	14.59	15.16
160	STORM SEWER AT ENGLEWOOD RD.	12.04	13.26	14.02	14.65	15.64
170	STORM SEWER AT ABALONE RD.	12.06	13.28	14.05	14.76	15.72
180	JACARANDA HEIGHTS LAKE	14.59	15.32	15.65	15.87	16.11
190	ENGLEWOOD RD (u/s)	11.10	13.12	13.78	14.53	15.54
195		12.08	13.29	13.83	14.70	15.61
200		12.47	13.46	14.23	14.93	15.65
210	CIRCLEWOOD CONDO LAKE 1	12.52	13.61	14.31	14.99	15.65
220	STORM SEWER AT CIRCLEWOOD DRIVE	13.10	14.86	15.16	15.45	15.80
225	STORM SEWER AT CIRCLEWOOD DRIVE	14.05	14.89	15.17	15.45	15.80
227	STORM SEWER AT CIRCLEWOOD DRIVE	14.31	15.02	15.18	15.45	15.80
230	HOURGLASS ESTATES LAKE 1	14.26	14.90	15.17	15.45	15.80
235	STORM SEWER AT CIRCLEWOOD DRIVE	14.67	15.11	15.24	15.45	15.79
240	HOURGLASS ESTATES LAKE 2	14.27	14.90	15.17	15.45	15.80
245	STORM SEWER AT CIRCLEWOOD DRIVE	14.70	15.13	15.27	15.45	15.77
247	STORM SEWER AT CIRCLEWOOD DRIVE	14.33	15.11	15.27	15.45	15.77
250	HOURGLASS ESTATES LAKE 3	14.33	14.90	15.17	15.45	15.80
260	HOURGLASS ESTATES LAKE 4	14.34	14.90	15.17	15.45	15.80
270	CIRCLEWOOD CONDO LAKE 2	13.00	14.28	15.00	15.45	15.80
271	STORM SEWER AT CIRCLEWOOD DRIVE	13.03	14.85	15.15	15.45	15.81
273	STORM SEWER AT CIRCLEWOOD DRIVE	12.95	14.81	15.12	15.46	15.83
274	STORM SEWER AT CIRCLEWOOD DRIVE	12.98	14.57	15.07	15.50	15.88
280	CIRCLEWOOD CONDO LAKE 3	12.98	14.59	15.08	15.51	15.92
290		12.51	13.47	14.29	14.97	15.65
300	WETLAND	13.17	14.45	14.66	15.05	15.67
310	BORROW PIT	12.90	13.19	13.83	14.70	15.61
320		15.18	15.36	15.46	15.53	15.71
330	WETLAND	15.62	15.75	15.79	15.83	15.91
340	WETLAND	15.20	15.41	15.49	15.57	15.72
350	WETLAND	15.20	15.42	15.50	15.58	15.72
500		3.75	4.96	5.43	5.86	6.67
505	HERON RD (d/s)	4.06	5.32	5.78	6.22	7.02
510	HERON RD (u/s)	5.90	7.04	7.16	7.27	7.48
520		6.04	7.25	7.45	7.67	8.13
530		6.17	7.45	7.71	7.99	8.58
540		6.35	7.74	8.08	8.44	9.07
550	COLONIAL RD (d/s)	6.42	7.78	8.13	8.51	9.21
560	COLONIAL RD (u/s)	6.76	8.81	9.39	9.63	9.78
570		6.96	8.87	9.42	9.68	9.89
580		7.41	9.03	9.53	9.80	10.05
590		7.62	9.09	9.57	9.85	10.14
600		7.64	9.09	9.57	9.85	10.15
605		7.70	8.79	9.34	9.71	10.24
610	JAPANESE GARDENS LAKE	7.51	8.80	9.34	9.71	10.24
620		10.02	10.62	10.82	10.97	11.20
630	OSCEOLA RD (d/s)	6.60	7.90	8.23	8.58	9.30
635	OSCEOLA RD (u/s)	10.03	10.25	10.31	10.36	10.45
640		10.35	10.90	11.10	11.31	11.75
645		11.32	12.19	12.49	12.74	13.23
650		11.51	12.34	12.63	12.87	13.35
655	DIRT RD. (d/s)	11.58	12.39	12.68	12.91	13.38
660	WETLAND	11.68	12.41	12.69	12.92	13.39
665	DIRT RD. (u/s)	11.88	13.03	13.45	13.75	14.03
670	BORROW PIT	11.32	12.19	12.49	12.74	13.23
675	FDOT POND 3-N OUTFALL	12.08	13.32	13.68	13.98	14.40
680		12.01	13.11	13.51	13.80	14.08
690	WETLAND	13.50	14.03	14.27	14.48	14.84
700	FDOT POND 3-N	13.20	13.53	13.75	14.03	14.43
705	ENGLEWOOD RD (d/s)	12.12	13.16	13.55	13.83	14.11
710	ENGLEWOOD RD (u/s)	12.38	13.83	14.39	14.75	15.19
720	GULFVIEW ESTATES LAKE	12.48	13.88	14.45	15.04	15.89
730	GULFVIEW ESTATES LAKE	12.76	14.10	14.64	15.20	15.89
740	GULFVIEW ESTATES LAKE	13.14	14.53	14.91	15.18	15.89
750	GULFVIEW ESTATES LAKE	12.19	14.16	14.80	15.17	15.89

Table 5.5
Comparison of Maximum Water Surface Elevations
at Selected Junction Locations
for Existing and Future Land Use Conditions

Junction Number	100-Year Existing Conditions Maximum Stage (ft NGVD)	100-Year Future Conditions Maximum Stage (ft NGVD)
WC090	15.00	15.05
WC190	15.47	15.54
WC210	15.59	15.65
WC560	9.78	9.78
WC610	10.24	10.24
WC655	13.35	13.38
WC710	15.16	15.19
WC720	15.87	15.89

SECTION 6
WATER QUALITY MODELING AND ANALYSIS OF WATER QUALITY LEVELS OF SERVICE

INTRODUCTION

Stormwater runoff pollution due to non-point sources for the Woodmere Creek basin was calculated using the Watershed Management Model (WMM) developed by Camp Dresser & McKee (CDM) as part of the Sarasota County National Pollutant Discharge Elimination System (NPDES) program for stormwater discharges. The model uses a spreadsheet format to estimate annual non-point source loads from direct runoff based upon runoff volumes and event mean concentrations (EMCs). The EMC is defined as the total pollutant discharged during the storm divided by the total runoff volume. Estimates of EMCs for a number of pollutants and land use categories were supplied for this study by Sarasota County.

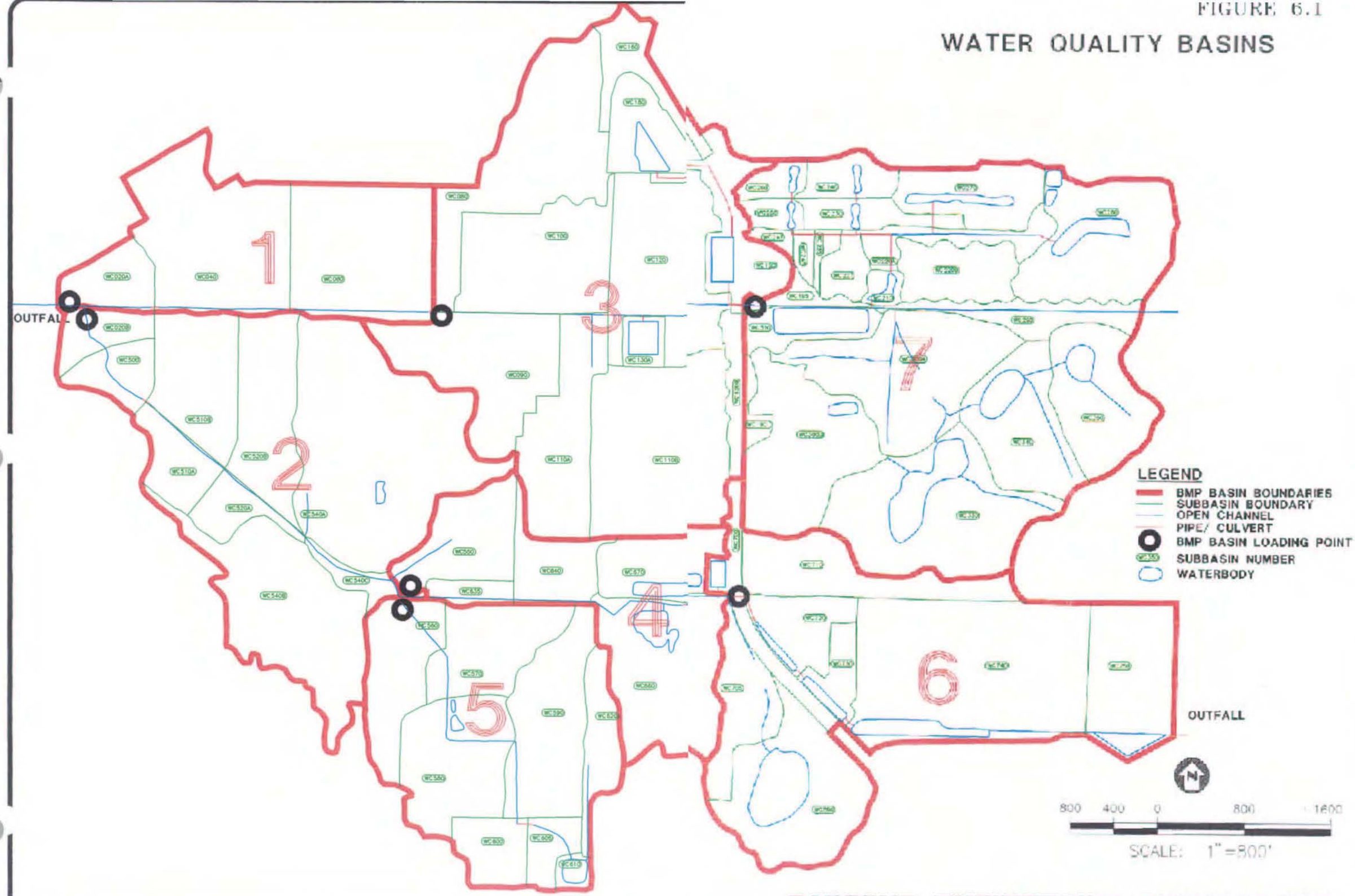
DATA REQUIREMENTS

Data required to run the WMM were collected into various database files and also input interactively during program execution. Necessary data included subbasin acreage by land use type, EMCs for each pollutant type, average annual precipitation, annual baseflow, percent impervious for each land use, best management practices (BMPs) removal efficiencies, and percentage of land serviced by BMPs. The WMM estimates annual runoff pollution loading for nutrients such as dissolved phosphorus, total phosphorus, total nitrogen, and total Kjeldahl nitrogen; heavy metals such as cadmium, copper, lead, and zinc; oxygen demand in terms of the 5-day biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD); total suspended solids; and total dissolved solids. The pollution load estimates for each subbasin are calculated based on acreages by land use category, rainfall/runoff ratios, EMCs, and the average annual rainfall. In addition, the model provides estimates of runoff pollution load reduction due to the implementation of BMPs. For the water quality analysis, the Woodmere Creek drainage basin was split into seven (7) water quality subbasins designated as BMP basins in Figure 6.1.

The first step in running the WMM was to match the existing Florida Land Use and Code Classification System (FLUCCS) codes identified in the Woodmere Creek basin with the corresponding land use categories used in the model's land use file. This was done by aggregating the FLUCCS categories into a corresponding model category. Originally, the water quality model included 12 land use types. The analysis herein was conducted assuming 8 land use types for the following reasons: a) consistency with the land use categorization utilized for the hydrologic/hydraulic analysis, b) limited extent

FIGURE 6.1

WATER QUALITY BASINS



PARSONS ENGINEERING SCIENCE, INC

of some of the land use types (e.g. the low density residential category amounts to less than 0.5 percent of the basin area), and c) similarity of EMC values (e.g. commercial and road categories).

The impervious area file required for the analysis was created by establishing percent impervious values associated with the land uses. Data were obtained from Sarasota County and the WMM User's Manual. The land use categories and corresponding values of acreage and imperviousness used in the analysis are listed below.

Land Use Category	Existing Total Area (acres)	Future Total Area (acres)	Percent Impervious
Low and Medium Density Residential	649	876	30.0
High Density Residential	196	196	50.0
Commercial and Roadway	30	30	90.0
Industrial	10	10	70.0
Open Land	227	0	0.5
Wetland	50	50	0.5
Water	49	49	100.0
TOTAL	1211	1211	

The EMC file used in this application was left as originally developed for the NPDES permit application. This will allow Sarasota County to compare estimated annual pollutant loads from the basin with loads from other watersheds within the County. It will also allow the County to set priorities when developing Capital Improvement Plans (CIPs).

The last file created for the WMM was the BMP coverage file. For that purpose, aerial photographs were inspected and the percentage of each subbasin and land use type served by existing BMPs was estimated and input to the model. Table 6.1 lists the percentages of BMP coverage which were estimated for each of the individual subbasins within the watershed. All BMPs identified within the Woodmere Creek basin are wet detention ponds. The pollutant load removal efficiencies assigned within the model for this type of facility are:

Table 6.1
Woodmere Creek Basin
Existing Subbasin BMP Coverages

Subbasin Number	Subbasin Area acres	BMP Area Covered	
		acres	%
WC020A	10.1	0.0	0
WC020B	7.7	0.0	0
WC040	42.3	0.0	0
WC060	38.0	0.0	0
WC080	40.0	0.0	0
WC090	32.1	0.0	0
WC100	31.5	0.0	0
WC110A	26.2	0.0	0
WC110B	47.2	0.0	0
WC120	35.1	0.0	0
WC130A	4.2	1.8	43
WC130B	5.8	5.2	90
WC150	17.5	10.3	59
WC160	10.2	8.9	88
WC180	12.4	9.6	77
WC195	3.6	0.0	0
WC190	2.5	0.0	0
WC210	2.4	1.9	81
WC220A	8.6	0.0	0
WC220B	13.0	0.0	0
WC227	5.1	0.0	0
WC230	7.4	2.6	35
WC235	1.7	0.0	0
WC240	7.2	6.1	86
WC245	1.9	0.0	0
WC247	1.6	0.0	0
WC250	3.4	1.6	46
WC260	4.1	3.8	92
WC270	15.4	12.8	83
WC280	31.9	28.5	89
WC290	10.6	0.0	0
WC300A	36.4	17.5	48
WC300B	31.8	5.7	18
WC310	9.3	4.3	46
WC330	43.3	0.0	0
WC340	23.4	0.0	0
WC350	22.9	0.0	0
WC500	8.4	0.0	0
WC510A	9.8	0.0	0
WC510B	21.4	0.0	0
WC520A	7.0	0.0	0
WC520B	22.6	0.0	0
WC540A	67.6	0.0	0
WC540B	41.7	0.0	0
WC540C	4.4	0.0	0
WC550	18.0	0.0	0
WC560	19.4	0.0	0
WC570	18.9	0.0	0
WC580	25.6	5.4	21
WC590	26.4	0.0	0
WC600	9.2	0.0	0
WC605	6.3	0.0	0
WC610	2.6	1.8	69
WC620	10.2	10.2	100
WC635	4.0	0.0	0
WC640	11.8	0.0	0
WC660	35.8	26.0	73
WC670	14.9	12.5	84
WC690	33.5	10.0	30
WC700	9.6	8.0	83
WC705	14.0	0.0	0
WC710	20.8	0.0	0
WC720	11.3	10.3	91
WC730	6.3	5.1	81
WC740	63.3	55.6	88
WC750	18.0	16.2	90
Total	1210.6	281.2	23%

Parameter	% Removal
Biochemical Oxygen Demand	30
Chemical Oxygen Demand	30
Total Suspended Solids	90
Total Dissolved Solids	40
Total Phosphorus	50
Dissolved Phosphorus	70
Total Kjeldahl Nitrogen	30
Nitrate + Nitrite Nitrogen	30
Total Lead	80
Total Copper	70
Total Zinc	50
Total Cadmium	80

Additional data input interactively during program execution into the model are listed below:

Annual Precipitation	57.95 in/year
Baseflow	0 in/year
Pervious Area Runoff Coefficient	0.15
Impervious Area Runoff Coefficient	0.95

EXISTING LAND USE CONDITIONS POLLUTION LOADS

A summary of the model output for the conventional non-point source conventional pollutants, nutrients, and metals for existing and future conditions is listed in Table 6.2. The gross pollutant load reflects the total estimated amount of pollutant load that is generated in the basin. However, the gross pollutant load does not reflect the total amount of pollutant that actually is discharged from the basin because a portion of it is retained in the existing stormwater treatment facilities and wetlands. Net annual pollutant load, as presented in Table 6.2, is defined as the amount of estimated pollutant discharged into the final receiving waterbody. Net load calculations take into account the mitigating effect of BMPs in the developed areas as described previously. The tables show net annual pollutant loads for each of the seven water quality subbasins that were defined within the basin for the purpose of the water quality loading analyses. This table provides the annual subbasin pollutant loads for the existing land use conditions within the watershed.

Since another important non-point source pollution load indicator is the unit loading per acre, such estimates are listed in Table 6.3 for existing and future conditions. Total annual non-point source pollutant load production in the basin by

Table 6.2
Woodmere Creek Watershed
Total Net Annual Conventional and Metal Pollutant Loads
Existing and Future Land Use Conditions

EXISTING

SUBBASIN NUMBER	BOD (lbs/yr)	COD (lbs/yr)	TSS (lbs/yr)	TDS (lbs/yr)	TOTAL-P (lbs/yr)	DISSOLVED-P (lbs/yr)	TKN (lbs/yr)	NO2&NO3 (lbs/yr)	LEAD (lbs/yr)	COPPER (lbs/yr)	ZINC (lbs/yr)	CADMIUM (lbs/yr)
WQS1	3,982	30,625	52,308	37,059	143	58	551	136	18	17	18	0.7
WQS2	6,488	49,202	75,084	63,764	216	84	892	243	23	24	35	1.0
WQS3	11,402	85,551	136,956	112,133	379	155	1,545	402	52	46	69	1.9
WQS4	2,759	20,812	26,833	28,442	88	33	382	115	8	10	18	0.4
WQS5	6,069	46,614	72,517	56,513	192	83	779	199	35	24	32	1.0
WQS6	6,935	50,314	64,143	77,399	179	76	864	280	35	23	62	0.7
WQS7	9,108	63,734	126,728	107,652	238	109	1,111	344	51	30	78	1.1
TOTAL	46,742	346,852	554,568	482,963	1,435	599	6,125	1,718	221	174	312	6.8

FUTURE

SUBBASIN NUMBER	BOD (lbs/yr)	COD (lbs/yr)	TSS (lbs/yr)	TDS (lbs/yr)	TOTAL-P (lbs/yr)	DISSOLVED-P (lbs/yr)	TKN (lbs/yr)	NO2&NO3 (lbs/yr)	LEAD (lbs/yr)	COPPER (lbs/yr)	ZINC (lbs/yr)	CADMIUM (lbs/yr)
WQS1	3,784	29,166	41,800	34,206	130	50	525	130	15	15	17	0.6
WQS2	6,871	52,645	68,164	65,318	229	87	958	259	24	26	38	1.0
WQS3	11,653	87,863	129,881	112,785	386	156	1,590	413	52	47	70	1.9
WQS4	2,875	21,875	24,031	28,809	92	34	403	120	8	10	19	0.4
WQS5	6,132	47,199	70,784	56,687	194	83	791	202	35	25	33	1.0
WQS6	7,358	54,867	41,395	76,226	194	74	955	306	21	23	61	0.7
WQS7	10,774	79,839	67,859	109,460	292	111	1,428	427	37	34	85	1.1
TOTAL	49,447	373,453	443,913	483,491	1,517	594	6,650	1,856	193	180	323	6.7

Table 6.3
Woodmere Creek Watershed
Total Net Annual Conventional and Metal Pollutant Loadings Per Acre
Existing and Future Land Use Conditions

EXISTING

SUBBASIN NUMBER	SUBBASIN AREA (acres)	BOD (lbs/yr/ac)	COD (lbs/yr/ac)	TSS (lbs/yr/ac)	TDS (lbs/yr/ac)	TOTAL-P (lbs/yr/ac)	DISSOLVED-P (lbs/yr/ac)	TKN (lbs/yr/ac)	NO2&NO3 (lbs/yr/ac)	LEAD (lbs/yr/ac)	COPPER (lbs/yr/ac)	ZINC (lbs/yr/ac)	CADMIUM (lbs/yr/ac)
WQS1	90.4	44.0	338.8	578.6	409.9	1.58	0.64	6.1	1.5	0.20	0.19	0.20	0.01
WQS2	190.6	34.0	258.1	393.9	334.5	1.13	0.44	4.7	1.3	0.12	0.13	0.18	0.01
WQS3	262.1	43.5	326.4	522.5	427.8	1.44	0.59	5.9	1.5	0.20	0.18	0.26	0.01
WQS4	84.5	32.6	246.3	317.6	336.6	1.04	0.40	4.5	1.4	0.09	0.12	0.22	0.00
WQS5	118.7	51.1	392.7	610.9	476.1	1.62	0.70	6.6	1.7	0.29	0.21	0.27	0.01
WQS6	176.8	39.2	284.6	362.8	437.8	1.01	0.43	4.9	1.6	0.20	0.13	0.35	0.00
WQS7	287.4	31.7	221.8	440.9	374.6	0.83	0.38	3.9	1.2	0.18	0.10	0.27	0.00
AVERAGE	172.9	39.5	295.5	461.0	399.6	1.2	0.5	5.2	1.4	0.18	0.15	0.25	0.01

FUTURE

SUBBASIN NUMBER	SUBBASIN AREA (acres)	BOD (lbs/yr/ac)	COD (lbs/yr/ac)	TSS (lbs/yr/ac)	TDS (lbs/yr/ac)	TOTAL-P (lbs/yr/ac)	DISSOLVED-P (lbs/yr/ac)	TKN (lbs/yr/ac)	NO2&NO3 (lbs/yr/ac)	LEAD (lbs/yr/ac)	COPPER (lbs/yr/ac)	ZINC (lbs/yr/ac)	CADMIUM (lbs/yr/ac)
WQS1	90.4	41.9	322.6	462.4	378.4	1.44	0.55	5.8	1.4	0.17	0.16	0.19	0.01
WQS2	190.6	36.0	276.2	357.6	342.7	1.20	0.46	5.0	1.4	0.13	0.14	0.20	0.01
WQS3	262.1	44.5	335.2	495.5	430.3	1.47	0.60	6.1	1.6	0.20	0.18	0.27	0.01
WQS4	84.5	34.0	258.9	284.4	340.9	1.09	0.40	4.8	1.4	0.10	0.12	0.23	0.00
WQS5	118.7	51.7	397.6	596.3	477.6	1.63	0.70	6.7	1.7	0.29	0.21	0.27	0.01
WQS6	176.8	41.6	310.3	234.1	431.1	1.10	0.42	5.4	1.7	0.12	0.13	0.35	0.00
WQS7	287.4	37.5	277.8	236.1	380.9	1.02	0.39	5.0	1.5	0.13	0.12	0.30	0.00
AVERAGE	172.9	41.0	311.2	380.9	397.4	1.3	0.5	5.5	1.5	0.16	0.15	0.26	0.01

chemical parameter, the corresponding existing removal by BMP facilities, and the net discharged load are listed in Table 6.4.

The non-point source pollutant load calculations are based strictly on land use configuration and the estimates have not been calibrated with actual sampling data. However, the results can be used to indicate the location of areas where runoff pollution control measures would be more effective.

FUTURE LAND USE CONDITIONS POLLUTION LOADS

The gross and net pollutant loading analysis conducted for projected future conditions in the basin is shown in Table 6.5. Figures 6.2A, through 6.2C graphically show the comparison between existing and future conditions net annual conventional pollutant, nutrient, and metals loadings. Loading calculations assumed that the areas to be developed would include BMPs for stormwater treatment. Removal rates were also described previously.

As indicated in Table 6.5, WMM model results show that the total Woodmere Creek basin annual non-point source pollutant loads would increase by approximately 3 to 9 percent from existing conditions, depending on the water quality parameter being considered. The largest pollutant loading increases will take place in the areas subject to future development, primarily those in the basin headwaters eastward of SR 776. Because these areas of new development will have to comply with current stormwater regulations for water quality control, the increases in net annual pollutant load listed in Table 6.5 are significantly smaller than the increases in the gross annual load. However, for these estimates to hold true, it will be necessary to implement a maintenance program that ensures that existing and new stormwater treatment facilities provide the estimated pollutant removal efficiencies.

WATER QUALITY LEVELS OF SERVICE

The Florida Department of Environmental Protection (FDEP) watershed assessment procedure, fully described in Section 3, is based on criteria developed conjunctively by the Water Management Districts during workshops conducted in 1993. These water quality LOS criteria are based upon a system that considers the effectiveness and extent of BMPs within a watershed. The extent of water quality treatment within a basin or subbasin is denoted by an index with a value between 0 and 5. A watershed water quality index is computed as the weighted average of all lands in the watershed.

The LOS assessment based on the watershed quality index considered that approximately 8 percent of the Woodmere Creek basin is wetlands and water, 19 percent is open land, and the remaining 73 percent is developed land. Most of the developed areas in the basin do not meet water quality treatment standards because construction preceded the existing stormwater regulations. Drainage areas meeting the BMP coverage criteria are generally those in the upper parts of the watershed, including Hourglass Lakes, Circlewood, Gulfview Estates, and SR 776. Drainage

Table 6.4
Woodmere Creek Basin
Total Annual Pollutant Loadings
Existing Land Use Conditions

Parameter	Gross Load	BMP Removal		Net Load
	lbs/yr	lbs/yr	%	lbs/yr
Biochemical Oxygen Demand	51,824	5,082	10%	46,742
Chemical Oxygen Demand	384,955	38,103	10%	346,852
Total Suspended Solids	743,832	189,264	25%	554,568
Total Dissolved Solids	546,675	63,712	12%	482,963
Total Phosphorus	1,696	261	15%	1,435
Dissolved Phosphorus	764	165	22%	599
Total Kjeldahl Nitrogen	6,774	649	10%	6,125
Nitrate + Nitrite Nitrogen	1,869	150	8%	1,718
Total Lead	339	118	35%	221
Total Copper	224	50	22%	174
Total Zinc	364	52	14%	312
Total Cadmium	9.3	2.5	27%	6.8

Table 6.5
Woodmere Creek Basin
Total Annual Pollutant Loadings
Future Land Use Conditions

Parameter	Gross Load	BMP Removal		Net Load
	lbs/yr	lbs/yr	%	lbs/yr
Biochemical Oxygen Demand	58,379	8,932	15%	49,447
Chemical Oxygen Demand	440,502	67,049	15%	373,453
Total Suspended Solids	777,160	333,247	43%	443,913
Total Dissolved Solids	595,402	111,911	19%	483,491
Total Phosphorus	1,991	474	24%	1,517
Dissolved Phosphorus	885	290	33%	594
Total Kjeldahl Nitrogen	7,817	1,167	15%	6,650
Nitrate + Nitrite Nitrogen	2,127	270	13%	1,856
Total Lead	386	193	50%	193
Total Copper	268	88	33%	180
Total Zinc	411	88	21%	323
Total Cadmium	11.2	4.5	40%	6.7

FIGURE 6.2A
WOODMERE CREEK BASIN NET ANNUAL CONVENTIONAL POLLUTANT LOADINGS

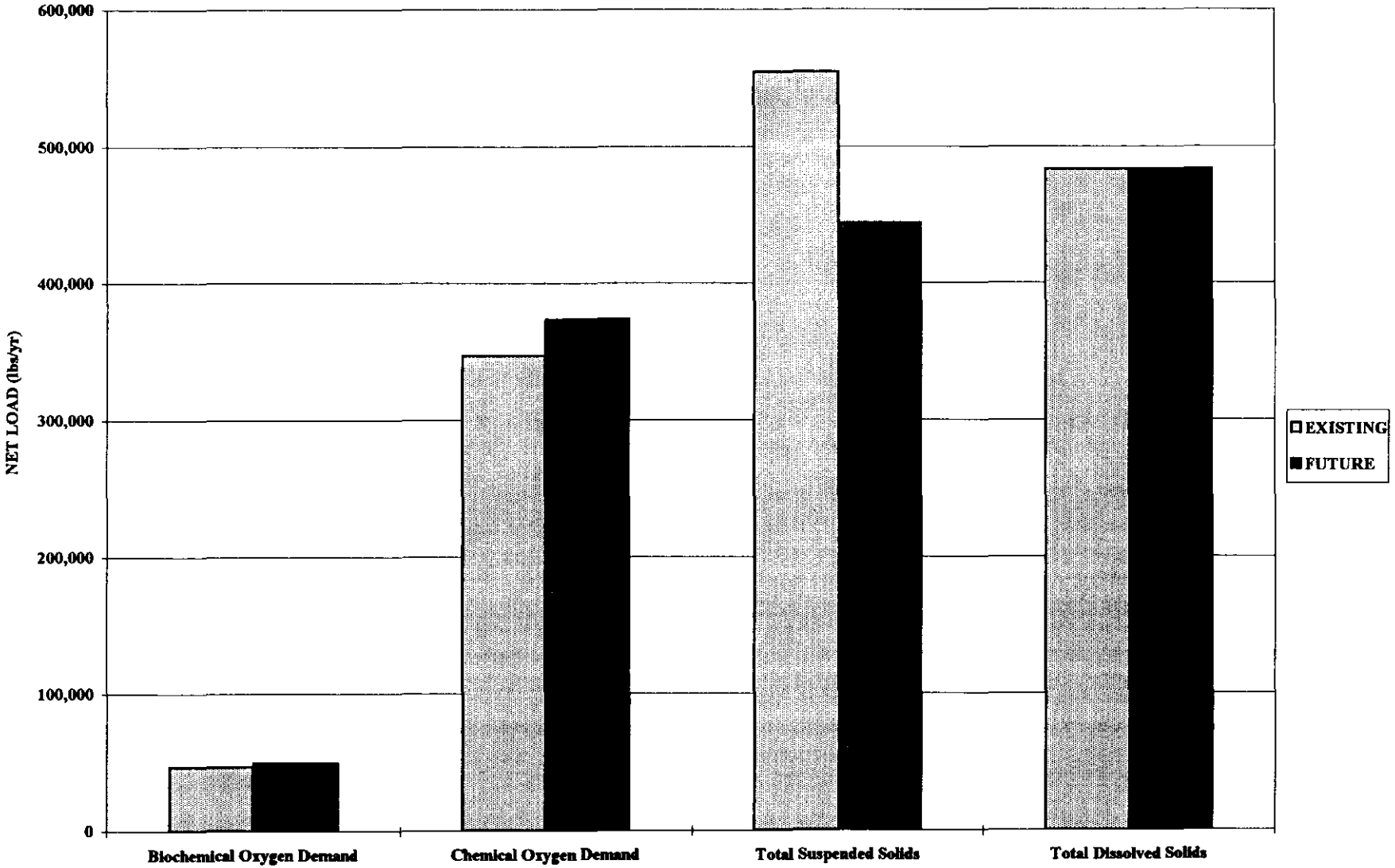


FIGURE 6.2B
WOODMERE CREEK BASIN NET ANNUAL NUTRIENT LOADINGS

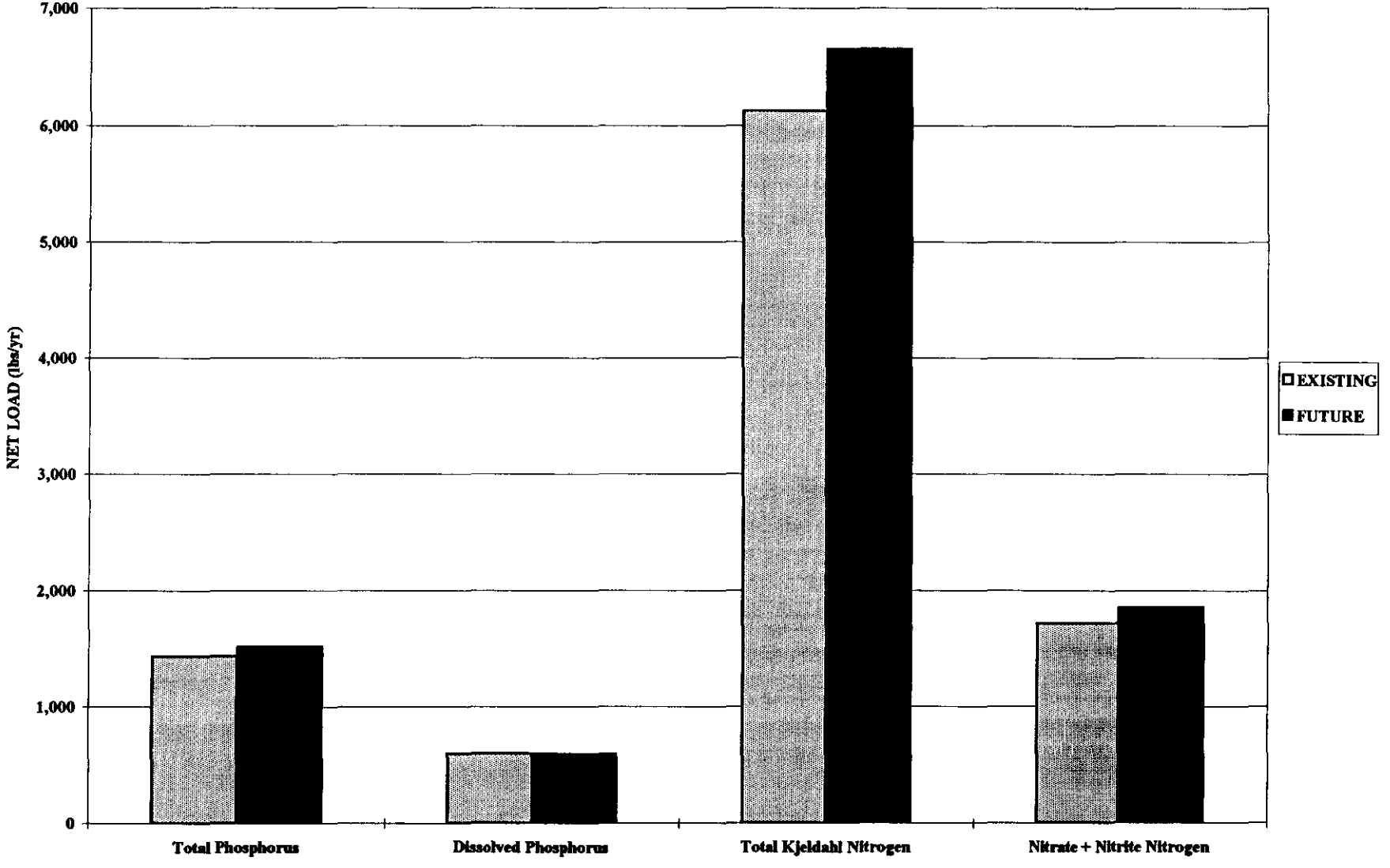
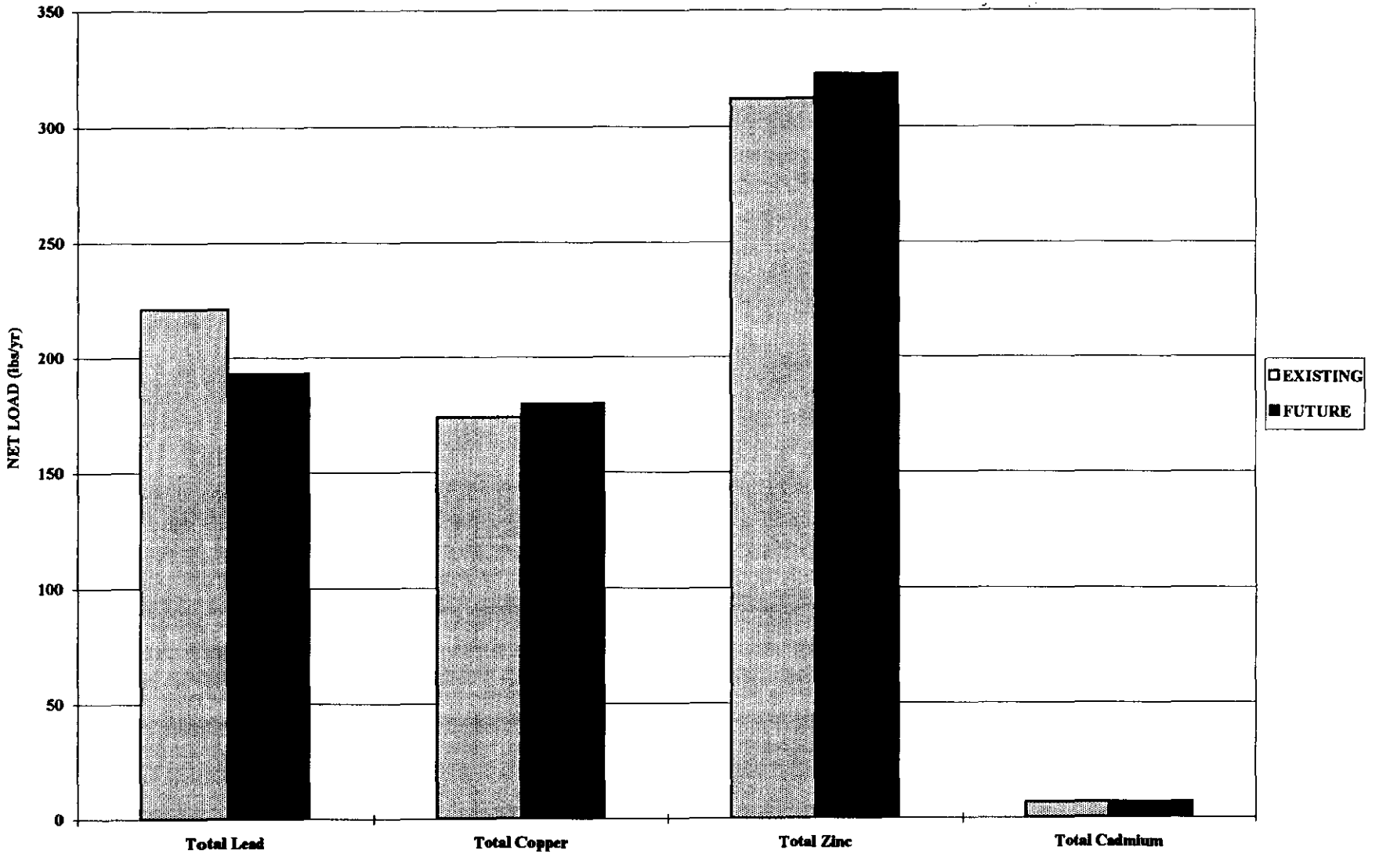


FIGURE 6.2C
WOODMERE CREEK BASIN NET ANNUAL METALS LOADINGS



areas served by these facilities represent approximately 30 percent of the total developed area in the basin, which equals about 23 percent of the total basin area. Thus, approximately one half (49%) of the total watershed drainage area receives little or no degree of treatment of stormwater runoff.

The Woodmere Creek watershed index was calculated as:

$$WQI = 0.08\ (5) + 0.19\ (5) + 0.23\ (3) + 0.49\ (0) = 2.04$$

Parsons ES considers that an acceptable water quality LOS goal is to achieve a WQI of at least 2.5 for the basin. A value of 2.04 indicates the need to improve stormwater runoff quality control. At full buildout within the basin, the calculated WQI will decrease to approximately 1.66, since the open land portions of the watershed will be converted from an index value of '5' to a value of '3'. This analysis once again points to the need to implement additional stormwater runoff quality retrofit measures within the basin to meet basinwide water quality goals.

In addition, as discussed in Section 3, the Woodmere Creek Basin discharges into the portion of Lemon Bay within the jurisdiction of the Charlotte Harbor National Estuary Program (CHNEP), Sarasota County will work with that organization to establish Total Maximum Daily Loads (TMDLs) for the creek. This approach will also fulfill the requirements of the Clean Water Act, Section 303 that is being implemented statewide by the FDEP. The TMDLs will represent levels of service for water quality.

SECTION 7
RECOMMENDED IMPROVEMENTS

INTRODUCTION

In the previous sections, existing flooding and water quality conditions and deficiencies within the Woodmere Creek watershed were identified and quantified based on the County's LOS criteria. The purpose of this section is to present analyses and recommendations for remedial measures to address the identified flooding problem areas. As indicated in Section 6, water quality issues will be better defined when Total Maximum Daily Loads (TMDLs) are established for this basin through the work currently being conducted by the Charlotte Harbor National Estuary Program. However, water quality control and environmental protection should be an important criterion in the design of the recommended projects.

The options available to the stormwater management planner for flood control can be divided into two general groups; (1) provide stormwater storage facilities to capture and detain (or retain) excess floodwater and reduce downstream peak discharge rates, or (2) provide an enhanced conveyance system, through channel and structure improvements, which increase the hydraulic efficiency of the drainage system and reduce peak flood elevations. Parsons ES examined the applicability of these alternative measures to solve the identified flooding LOS deficiencies in the Woodmere Creek watershed. The following sections provide assessments of these potential solutions and a set of recommended improvements. A proposed capital improvement project prioritization plan is also proposed for implementation of the recommended basin master plan.

POTENTIAL DEVELOPMENT OF REGIONAL STORMWATER MANAGEMENT FACILITIES

An approach that Sarasota County has considered in its entire basin master planning programs for more adequately managing stormwater systems is the development of Regional Stormwater Management Facilities (RSMFs). RSMFs are stormwater detention/retention ponds designed to provide attenuation and/or treatment of surface discharge on a regional basis or for an entire basin. Future developments upstream would purchase the right to discharge a volume of runoff depending on specific and individual characteristics. A RSMF may also be utilized for aquifer recharge, storage for water supply, wetland creation and mitigation banking, and for mitigation of floodplain impacts. Water quality treatment requirements for the future development would be provided internally at each individual development.

Benefits associated with the development of RSMF's include:

- **Solutions to Regional Problems.** Optimum results are achieved when drainage planning and design are integrated at the regional level. This approach provides local governments with adequate control of the physical components of the stormwater management facility within a basin. RSMF's also allow for better coordination early in the planning stages.

- **Solutions to Problems Associated with Volume and Peak Flow of Stormwater Runoff.** Urbanization disrupts the natural equilibrium of streams. It tends to reduce the natural flood storage capabilities and to increase both the volume of runoff and the runoff travel time. By constructing RSMF's, adequate provisions can be made to mitigate the loss of storage capacity and to reduce peak flows to the receiving waterbody.

- **Multipurpose Uses.** In addition to solving typical problems associated with stormwater runoff, RSMF's can provide drainage management strategies that meet a number of objectives, including water quality enhancement, groundwater recharge, wildlife habitat and wetland creation, control of erosion and sediment deposition, and creation of open space for recreational purposes. These facilities would also provide opportunities for supplemental fresh water supply, which is currently not an option in the basin due to its limited development.

- **Enhancement of the Natural Features and Drainageways.** The design of urban stormwater facilities generally requires that a significant amount of land be devoted to the construction of stormwater facilities. In many cases, this results in the elimination of natural features and the creation of unsightly structures designed to meet minimum regulatory requirements. Natural features can be planned, preserved and enhanced and made part of the design of RSMF's. Good designs that incorporate the use of natural features will maximize the economic and environmental benefits, particularly in combination with open space and recreational uses. These natural features include drainageways, depressions, wetlands, floodplains, permeable soils, and vegetation. These features provide natural filtration, help control the velocity of runoff, extend the time of concentration, filter sediments and other pollutants, and recycle nutrients.

- **Reduced Maintenance Costs.** Rather than multiple associations and developments being responsible for the maintenance of several stormwater facilities within a basin, it is simpler and more cost effective to establish scheduled maintenance of a single regional facility. Failure to provide proper maintenance reduces both the hydraulic capacity and pollutant removal efficiency of the system.

- **Maximum Utilization of Developable Land.** Through RSMFs, developers would be able to maximize the utilization of the proposed development for the purpose intended by minimizing the land normally set aside for the construction of stormwater management facilities (an average of 20% of total land area is utilized for detention/retention ponds).

Within the Woodmere Creek watershed, sites for potential RSMFs to alleviate the identified flooding problems are few due to the nearly fully developed nature of the basin. The only potential sites are located within the upper, undeveloped part of the basin, upstream (east) of Englewood Road. The large tract of undeveloped land between the Circlewood Condominiums and Gulfview Estates residential communities is strategically located near some of the problem areas where a RSMF could possibly be of benefit to store excess floodwater volumes. However, Parsons ES determined that this area is of marginal value for this purpose due to the presence of several wetland systems within the tract and, therefore, a natural high surficial water table. It can be seen in Figure 5.6 that much of this undeveloped land is located within the 100-year floodplain. This situation means that the amount of storage that could be obtained within a detention facility in this area would be very limited without a drawdown of the water table. It would be difficult to obtain an Environmental Resource Permit for such a facility, and initial modeling assessments indicated that there would not be much gain in terms of peak flow reduction in the lower reaches of the system. Since conveyance improvements in the lower basin would still be necessary even with a RSMF, Parsons ES focused efforts on conveyance improvements as the preferred means of attaining the County's flooding LOS standards within the Woodmere Creek watershed.

RECOMMENDED DRAINAGE SYSTEM IMPROVEMENTS

As discussed in Section 5, four generalized flooding problem areas were identified within the Woodmere Creek basin. Figure 5.6 shows the locations of these problem areas. Each was independently addressed and analyzed to determine the most effective means of alleviating the local flooding conditions. The following discussions detail the findings and recommendations. The recommended improvements were analyzed with the SWMM model to determine their effectiveness. Results of these analyses, in terms of maximum flood elevations, are documented in Table 7.1. A listing of the individual recommended capital improvement projects and their estimated construction costs are detailed in Table 7.2. The locations of the recommended improvements are shown in Figure 7.1, along with the areal extent of the 100-year floodplain that will exist with the implementation of these recommended improvements. Another way of viewing the effectiveness of the proposed master plan in the reduction of flooding elevations is illustrated in Figures 7.2 through 7.5. These figures present plots which compare the existing and master plan conditions 25-year and 100-year flood profiles.

One of the difficulties encountered in the development of a set of improvements to alleviate the identified flooding problems is the location of the problem areas. Since the main problems are located in the headwaters of the basin, conveyance improvements which hasten the removal of excess floodwaters in these areas will also aggravate the flooding conditions in the downstream reaches and tax the drainage facilities there with greater peak flows and higher flood elevations. Hence, in some cases it became necessary to replace or augment the downstream structures just to maintain the same maximum flood elevations.

Table 7.1
Woodmere Creek Flood Protection LOS Deficiencies
Existing Land Use and Recommended Master Plan Improvements

Junction Number	Structure Location	Master Plan Structure Description	Elevation Near Node (ft NGVD)	Location Type	Low Floor Slab Elevation (ft NGVD)	Maximum Flood Elevation					Level of Service				
						2-Year Storm Peak Elev. (ft NGVD)	5-Year Storm Peak Elev. (ft NGVD)	10-Year Storm Peak Elev. (ft NGVD)	25-Year Storm Peak Elev. (ft NGVD)	100-Year Storm Peak Elev. (ft NGVD)	2-Year Storm (feet)	5-Year Storm (feet)	10-Year Storm (feet)	25-Year Storm (feet)	100-Year Storm (feet)
Road Flooding															
20	PONDEROSA RD		8.7	TOR		3.90	5.28	5.83	6.29	7.20	-4.80	-3.42	-2.87	-2.41	-1.50
40	HERON RD CULVERT	8'x12' BC (new)	12.5	TOR		4.65	6.40	7.14	7.79	9.06	-7.85	-6.10	-5.36	-4.71	-3.42
60	KENT RD CULVERT	8'x12' BC (new)	15.5	TOR		6.63	8.45	9.18	9.91	11.27	-8.87	-7.05	-6.34	-5.59	-4.23
60	CITRUS RD		13.2	TOR		6.83	8.45	9.18	9.91	11.27	-6.57	-4.75	-4.04	-3.29	-1.93
80	POMPANO RD CULVERTS	8'x12' BC (new)	14.7	TOR		8.10	9.85	10.55	11.20	12.56	-6.60	-4.85	-4.15	-3.50	-2.14
90	OLIVIA RD		12.2	TOR		9.77	11.13	11.76	12.31	13.36	-2.43	-1.07	-0.44	0.11	1.16
120	FLORIDA RD CULVERTS	6'x12' BC (new)	14.5	TOR		10.71	12.17	12.86	13.40	14.31	-3.79	-2.33	-1.64	-1.10	-0.19
125	FDOT POND 4-N OUTFALL	30" RCP	14.5	TOB		10.79	12.41	12.97	13.41	14.21	-3.71	-2.09	-1.53	-1.09	-0.29
145	FDOT POND 5-N OUTFALL	29"X45" ERCP	14.5	TOB		11.42	12.95	13.55	14.15	14.74	-3.08	-1.55	-0.95	-0.35	0.24
160	STORM SEWER AT ENGLEWOOD RD.	48" RCP	15.2	TOR		12.01	13.04	13.68	14.33	15.60	-3.19	-2.16	-1.52	-0.87	0.40
170	STORM SEWER AT ABALONE RD.	24" RCP	15.2	TOR		12.04	13.06	13.70	14.44	15.69	-3.16	-2.14	-1.50	-0.76	0.49
190	ENGLEWOOD RD CULVERTS	2-60" RCP's (new)	14.4	TOR		11.01	12.35	13.09	13.86	14.41	-3.39	-2.05	-1.31	-0.74	0.01
210	CIRCLEWOOD LAKE 1	42" CMP	14.2	TOR		12.21	13.06	13.43	13.95	14.78	-1.99	-1.14	-0.77	-0.25	0.58
220	STORM SEWER AT CIRCLEWOOD DRIVE	36" CMP	14.8	TOR		13.10	14.70	14.91	15.04	15.25	-1.70	-0.10	0.11	0.24	0.45
225	STORM SEWER AT CIRCLEWOOD DRIVE	18" CMP	14.1	TOR		14.01	14.85	14.96	15.10	15.31	-0.09	0.75	0.86	1.00	1.20
227	STORM SEWER AT CIRCLEWOOD DRIVE	24" CMP	14.6	TOR		14.31	15.00	15.11	15.19	15.32	-0.26	0.43	0.54	0.62	0.75
230	HOURGLASS LAKE 1	18" CMP	14.1	TOR		14.26	14.86	14.99	15.11	15.32	-0.10	0.50	0.63	0.75	0.96
240	HOURGLASS LAKE 2	18" CMP	14.1	TOR		14.27	14.86	14.99	15.11	15.33	-0.17	0.42	0.55	0.67	0.88
245	STORM SEWER AT CIRCLEWOOD DRIVE	24" CMP	14.4	TOR		14.70	15.08	15.14	15.20	15.30	-0.30	0.08	0.14	0.20	0.30
250	HOURGLASS LAKE 3	18" CMP	14.1	TOR		14.33	14.86	14.99	15.11	15.32	-0.03	0.50	0.63	0.75	0.96
260	HOURGLASS LAKE 4	18" CMP	14.1	TOR		14.33	14.86	14.99	15.11	15.32	-0.03	0.50	0.63	0.75	0.96
270	CIRCLEWOOD LAKE 2	18" CMP	14.3	TOR		12.96	14.09	14.55	14.87	15.26	-1.34	-0.21	0.25	0.57	0.96
280	CIRCLEWOOD LAKE 3	42" CMP	14.6	TOR		12.91	14.42	14.83	15.16	15.75	-1.69	-0.18	0.23	0.56	1.15
510	HERON RD CULVERT	6'x12' BC (new)	7.5	TOR		4.65	6.06	6.78	7.41	8.17	-2.85	-1.42	-0.72	-0.09	0.67
520	GULL RD		7.8	TOR		5.22	6.62	7.20	7.74	8.49	-2.38	-0.98	-0.40	0.14	0.89
530	SENECA RD		8.4	TOR		5.57	6.99	7.54	8.03	8.77	-2.83	-1.41	-0.86	-0.37	0.37
540	OSPREY RD		8.3	TOR		5.96	7.45	8.00	8.48	9.14	-2.34	-0.85	-0.30	0.18	0.84
560	COLONIAL RD CULVERT	5'x12' BC (new)	9.4	TOR		6.11	7.57	8.13	8.61	9.37	-3.29	-1.83	-1.27	-0.79	-0.03
570	JAPANESE GARDENS		8.8	TOR		6.42	7.73	8.27	8.71	9.44	-2.38	-1.07	-0.53	-0.09	0.64
580	JAPANESE GARDENS		8.8	TOR		7.26	8.31	8.73	9.11	9.77	-1.54	-0.49	-0.07	0.31	0.97
590	JAPANESE GARDENS		9.5	TOR		7.51	8.53	8.93	9.28	9.86	-1.99	-0.97	-0.57	-0.22	0.36
600	JAPANESE GARDENS		9.2	TOR		7.52	8.54	8.93	9.28	9.90	-1.68	-0.66	-0.27	0.08	0.70
605	JAPANESE GARDENS LAKE OUTFALL	34"x53" ERCP (new)	9.2	TOR		7.52	8.46	8.95	9.38	10.06	-1.68	-0.74	-0.25	0.18	0.88
610	JAPANESE GARDENS LAKE		9.5	TOR		7.44	8.49	8.97	9.39	10.06	-2.06	-1.01	-0.53	-0.11	0.56
635	OSCEOLA RD CULVERT	54" RCP (new)	9.9	TOR		7.21	8.69	9.96	10.19	10.40	-2.64	-1.16	0.11	0.34	0.55
655	VENISOTA RD		13.0	TOR		11.38	12.33	12.64	12.89	13.31	-1.62	-0.67	-0.36	-0.11	0.31
665	PRIVATE DRIVE CULVERT	2-42" RCP (1 new)	13.6	TOR		11.45	12.65	13.12	13.49	13.96	-2.15	-0.95	-0.48	-0.11	0.36
670	TEMPLE RD		14.3	TOR		11.06	11.83	12.15	12.41	12.87	-3.22	-2.47	-2.15	-1.89	-1.43
675	FDOT POND 3-N OUTFALL	29"X45" ERCP	15.0	TOB		11.80	13.07	13.49	13.79	14.31	-3.20	-1.93	-1.51	-1.21	-0.69
710	ENGLEWOOD RD CULVERT	2-42" RCP's (new)	15.0	TOR		12.03	13.21	13.70	14.17	14.87	-2.97	-1.79	-1.30	-0.83	-0.13
720	GULFVIEW ESTATES LAKE	42" RCP (new)	14.8	TOR		12.29	13.43	13.95	14.45	15.42	-2.31	-1.17	-0.65	-0.15	0.82
730	GULFVIEW ESTATES LAKE	36" RCP (new)	14.5	TOR		12.51	13.69	14.25	14.71	15.43	-1.99	-0.81	-0.25	0.21	0.93
740	GULFVIEW ESTATES LAKE	36" RCP (new)	13.5	TOR		12.64	13.97	14.55	14.95	15.43	-0.86	0.47	1.05	1.45	1.93
Residential Flooding															
90	456 OLIVIA ROAD			LFS	13.93	9.77	11.13	11.76	12.31	13.36	-4.16	-2.80	-2.17	-1.62	-0.57
90	432 OLIVIA ROAD			LFS	13.78	9.77	11.13	11.76	12.31	13.36	-3.99	-2.63	-2.00	-1.45	-0.40
90	386 OLIVIA ROAD			LFS	13.51	9.77	11.13	11.76	12.31	13.36	-3.74	-2.38	-1.75	-1.20	-0.15
90	348 OLIVIA ROAD			LFS	13.75	9.77	11.13	11.76	12.31	13.36	-3.98	-2.62	-1.99	-1.44	-0.39
90	471 PONDEROSA ROAD			LFS	13.72	9.77	11.13	11.76	12.31	13.36	-3.95	-2.59	-1.96	-1.41	-0.36
90	421 PONDEROSA ROAD			LFS	13.57	9.77	11.13	11.76	12.31	13.36	-3.80	-2.44	-1.81	-1.26	-0.21
230	80 DRIFTING SANDS DR.			LFS	15.51	14.26	14.86	14.99	15.11	15.32	-1.25	-0.65	-0.52	-0.40	-0.19
230	82 DRIFTING SANDS DR.			LFS	15.51	14.26	14.86	14.99	15.11	15.32	-1.25	-0.65	-0.52	-0.40	-0.19

TOB=TOP OF BANK
TOR=TOP OF ROAD CENTERLINE
GI=GRATE INLET ELEVATION
LFS= LOW FLOOR SLAB

Table 7.2
Woodmere Creek Basin Master Plan
Recommended Capital Improvement Projects Construction Cost Estimates

Means Reference*	Cost Item	Unit	Amount	Unit Cost**	Total Cost
Project 1: Heron Road 8'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	650	$4.97	$3,231
022-266-0020	Soil Removal	CY	350	$2.67	$935
020-554-3000	Removal & Disposal of Exist. Culvert	LF	116	$15.00	$1,740
027-162-0450	8'x12' BC	LF	70	$480.00	$33,600
022-204-0900	Backfilling & Compaction	CY	300	$3.67	$1,101
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$2,500.00	$5,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$55,206**
Total including 40% engineering, permitting, and contingencies					**$77,288**
Project 2: Kent Road 8'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	650	$4.97	$3,231
022-266-0020	Soil Removal	CY	350	$2.67	$935
020-554-3000	Removal & Disposal of Exist. Culvert	LF	113	$18.00	$2,034
027-162-0450	8'x12' BC	LF	70	$480.00	$33,600
022-204-0900	Backfilling & Compaction	CY	300	$3.67	$1,101
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$2,500.00	$5,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$55,500**
Total including 40% engineering, permitting, and contingencies					**$77,700**
Project 3: Pompano Road 8'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	550	$4.97	$2,734
022-266-0020	Soil Removal	CY	300	$2.67	$801
020-554-3000	Removal & Disposal of Exist. Culvert	LF	120	$15.00	$1,800
027-162-0450	8'x12' BC	LF	70	$480.00	$33,600

* Source: 'Means Building Construction Cost Data', 1997

** Means Total Cost with OH and P included

Table 7.2
Woodmere Creek Basin Master Plan
Recommended Capital Improvement Projects Construction Cost Estimates

Means Reference*	Cost Item	Unit	Amount	Unit Cost**	Total Cost
022-204-0900	Backfilling & Compaction	CY	250	$3.67	$918
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$2,500.00	$5,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$54,452**
Total including 40% engineering, permitting, and contingencies					**$76,233**
Project 4: Florida Road 6'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	400	$4.97	$1,988
022-266-0020	Soil Removal	CY	220	$2.67	$587
020-554-3000	Removal & Disposal of Exist. Culvert	LF	206	$13.50	$2,781
027-162-0450	6'x12' BC	LF	70	$425.00	$29,750
022-204-0900	Backfilling & Compaction	CY	180	$3.67	$661
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$2,000.00	$4,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$49,367**
Total including 40% engineering, permitting, and contingencies					**$69,114**
Project 5: SR 778 2 - 60" RCP Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	900	$4.97	$4,473
022-266-0020	Soil Removal	CY	200	$2.67	$534
020-554-3000	Removal & Disposal of Exist. Culvert	LF	284	$11.85	$3,365
027-162-2090	60" RCP	LF	284	$150.00	$42,600
022-204-0900	Backfilling & Compaction	CY	700	$3.67	$2,569
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	600	$33.00	$19,800
	Headwalls	EA.	2	$2,000.00	$4,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$12,000.00	$12,000
	Utility Relocation	LS	1	$10,000.00	$10,000
Total					**$102,301**
Total including 40% engineering, permitting, and contingencies					**$143,222**

* Source: 'Means Building Construction Cost Data', 1997

** Means Total Cost with OH and P included

Table 7.2
Woodmere Creek Basin Master Plan
Recommended Capital Improvement Projects Construction Cost Estimates

Means Reference*	Cost Item	Unit	Amount	Unit Cost**	Total Cost
Project 6: Channel Regrading & Pond Bank Regrading					
022-274	Equipment Mobilization/Demobilization	EA.	3	$300.00	$900
022-254-0500	Excavation, Trench	CY	1200	$4.97	$5,964
022-266-0040	Soil Removal	CY	1200	$4.02	$4,824
029-316-0700	Grading & Sodding	SF	27000	$0.65	$17,550
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	2700	$2.25	$6,075
Total					**$35,973**
Total including 40% engineering, permitting, and contingencies					**$50,362**
Project 7: Heron Road 6'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	400	$4.97	$1,988
022-266-0020	Soil Removal	CY	220	$2.67	$587
020-554-3000	Removal & Disposal of Exist. Culvert	LF	85	$15.00	$1,275
027-162-0450	6'x12' BC	LF	70	$425.00	$29,750
022-204-0900	Backfilling & Compaction	CY	180	$3.67	$661
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$2,000.00	$4,000
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$47,861**
Total including 40% engineering, permitting, and contingencies					**$67,005**
Project 8: Colonial Road 5'x12' BC Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	400	$4.97	$1,988
022-266-0020	Soil Removal	CY	200	$2.67	$534
020-554-3000	Removal & Disposal of Exist. Culvert	LF	60	$14.00	$840
027-162-0450	5'x12' BC	LF	60	$400.00	$24,000
022-204-0900	Backfilling & Compaction	CY	200	$3.67	$734
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	80	$33.00	$2,640
	Headwalls	EA.	2	$1,800.00	$3,600
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$41,296**
Total including 40% engineering, permitting, and contingencies					**$57,814**

* Source: 'Means Building Construction Cost Data', 1997

** Means Total Cost with OH and P included

Table 7.2
Woodmere Creek Basin Master Plan
Recommended Capital Improvement Projects Construction Cost Estimates

Means Reference*	Cost Item	Unit	Amount	Unit Cost**	Total Cost
Project 9: Japanese Gardens 34"x53" ERCP Replacement & New Headwalls					
022-274	Equipment Mobilization/Demobilization	EA.	3	$300.00	$900
022-254-0500	Excavation, Trench	CY	370	$4.97	$1,839
022-266-0020	Soil Removal	CY	70	$2.67	$187
020-554-3000	Removal & Disposal of Exist. Culvert	LF	198	$11.85	$2,346
027-162-3550	34"x53" ERCP	LF	198	$145.00	$28,710
022-204-0900	Backfilling & Compaction	CY	300	$3.67	$1,101
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	55	$33.00	$1,815
	Endwalls	EA.	6	$400.00	$2,400
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$45,058**
Total including 40% engineering, permitting, and contingencies					**$63,081**
Project 10: Osceola Road 54" RCP Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	3	$300.00	$900
022-254-0500	Excavation, Trench	CY	1250	$4.97	$6,213
022-266-0020	Soil Removal	CY	1150	$2.67	$3,071
020-554-3000	Removal & Disposal of Exist. Culvert	LF	57	$11.85	$675
027-162-2090	54" RCP	LF	57	$132.00	$7,524
022-204-0900	Backfilling & Compaction	CY	100	$3.67	$367
029-316-0700	Grading & Sodding	SF	50000	$0.65	$32,500
025-104-1050	Pavement Restoration	SY	55	$33.00	$1,815
	Headwalls	EA.	2	$800.00	$1,600
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$59,774**
Total including 40% engineering, permitting, and contingencies					**$83,684**
Project 11: Private Road 42" RCP Addition					
022-274	Equipment Mobilization/Demobilization	EA.	2	$300.00	$600
022-254-0500	Excavation, Trench	CY	90	$4.97	$447
022-266-0020	Soil Removal	CY	10	$2.67	$27
027-162-2070	42" RCP	LF	21	$86.50	$1,817
022-204-0900	Backfilling & Compaction	CY	80	$3.67	$294
029-316-0700	Grading & Sodding	SF	500	$0.65	$325
	Headwall	EA.	2	$800.00	$1,600

* Source: 'Means Building Construction Cost Data', 1997

** Means Total Cost with OH and P included

Table 7.2
Woodmere Creek Basin Master Plan
Recommended Capital Improvement Projects Construction Cost Estimates

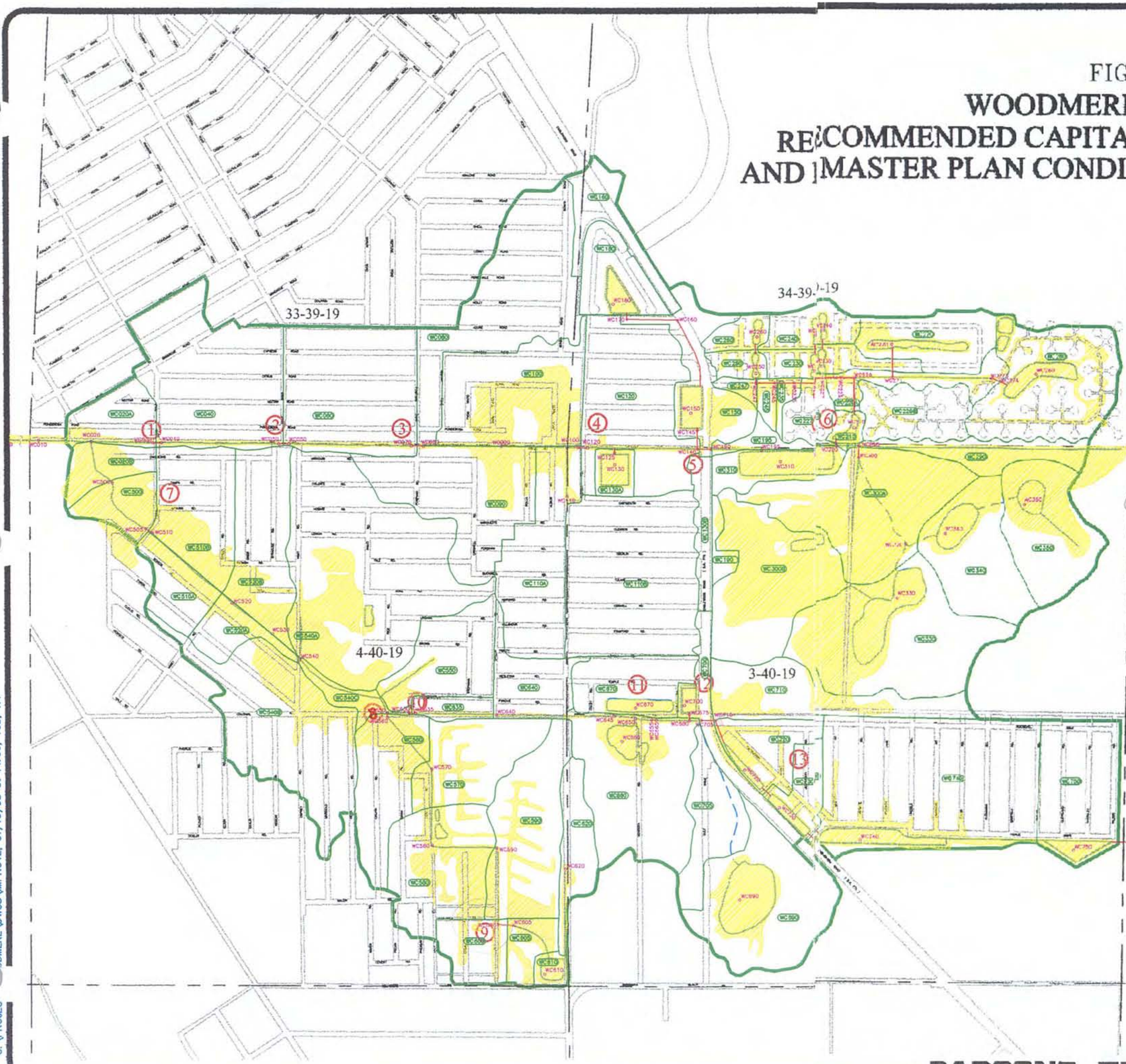
Means Reference*	Cost Item	Unit	Amount	Unit Cost**	Total Cost
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
Total					**$6,219**
Total including 40% engineering, permitting, and contingencies					**$8,707**
Project 12: SR 776 2 - 42" RCP Replacement					
022-274	Equipment Mobilization/Demobilization	EA.	4	$300.00	$1,200
022-254-0500	Excavation, Trench	CY	800	$4.97	$3,976
022-266-0020	Soil Removal	CY	50	$2.67	$134
020-554-3000	Removal & Disposal of Exist. Culvert	LF	134	$10.50	$1,407
027-162-2070	42" RCP	LF	268	$86.50	$23,182
022-204-0900	Backfilling & Compaction	CY	750	$3.67	$2,753
029-316-0700	Grading & Sodding	SF	1000	$0.65	$650
025-104-1050	Pavement Restoration	SY	450	$33.00	$14,850
	Headwall	EA.	2	$800.00	$1,600
	Floating Silt Barriers	LF	60	$11.00	$660
	Staked Silt Barriers	LF	200	$2.25	$450
	Traffic Maintenance	LS	1	$12,000.00	$12,000
	Utility Relocation	LS	1	$10,000.00	$10,000
Total					**$72,861**
Total including 40% engineering, permitting, and contingencies					**$102,005**
Project 13: Gulfview Estates Pond Outfall Replacements					
022-274	Equipment Mobilization/Demobilization	EA.	3	$300.00	$900
022-254-0500	Excavation, Trench	CY	750	$4.97	$3,728
022-266-0020	Soil Removal	CY	50	$2.67	$134
020-554-2930	Removal & Disposal of Exist. Culvert	LF	668	$7.50	$5,010
027-162-2070	42" RCP	LF	248	$86.50	$21,452
027-162-2060	36" RCP	LF	172	$74.50	$12,814
022-204-0900	Backfilling & Compaction	CY	700	$3.67	$2,569
029-316-0700	Grading & Sodding	SF	2000	$0.65	$1,300
025-104-1050	Pavement Restoration	SY	135	$33.00	$4,455
	Headwall	EA.	6	$600.00	$3,600
	Floating Silt Barriers	LF	180	$11.00	$1,980
	Staked Silt Barriers	LF	600	$2.25	$1,350
	Traffic Maintenance	LS	1	$1,500.00	$1,500
	Utility Relocation	LS	1	$2,500.00	$2,500
Total					**$63,291**
Total including 40% engineering, permitting, and contingencies					**$88,607**
TOTAL MASTER PLAN INCLUDING 40% ENGINEERING, PERMITTING, AND CONTINGENCIES:					**$964,824**

* Source: 'Means Building Construction Cost Data', 1997

** Means Total Cost with OH and P included

FIGURE 7.1

WOODMERE CREEK BASIN
RECOMMENDED CAPITAL IMPROVEMENT PROJECTS AND MASTER PLAN CONDITIONS 100-YEAR FLOODPLAIN



1000 500 0 1000 2000

SCALE: 1"=1000'

CAPITAL IMPROVEMENT PROJECTS

1) REPLACE HERON ROAD 60" RCP CULVERT WITH 8'X12' BC
2) REPLACE EXISTING KENT ROAD 72" RCP CULVERT WITH 8'X12' BC
3) REPLACE EXISTING POMPANO ROAD 2-60" RCP CULVERTS WITH 8'X12' BC
4) REPLACE EXISTING FLORIDA ROAD 2-48" RCP CULVERTS WITH 6'X12' BC
5) REPLACE EXISTING ENGLEWOOD ROAD 2-36" RCP CULVERTS WITH 2-60" RCPS
6) REGRADE 1200' OF CHANNEL FROM ENGLEWOOD ROAD TO POND OUTFALL AND EXCAVATE LOWER POND BANKS FOR TWO PONDS IN HOURGLASS LAKES AND CIRCLEWOODS CONDOMINIUMS
7) REPLACE EXISTING HERON ROAD 60" RCP CULVERT WITH 6'X12' BC
8) REPLACE EXISTING COLONIAL RD. 54" CMP CULVERT WITH 5'X12' BC
9) REPLACE EXISTING JAPANESE GARDENS 22"X36" CMPA OUTFALL WITH 34"X53" ERCP AND PROVIDE STORM SEWER OUTFALLS TO CHANNEL WITH NEW ENDWALLS.
10) REPLACE EXISTING OSCEOLA ROAD 24"X38" ERCP CULVERT WITH 54" RCP AND REGRADE UPSTREAM CHANNEL.
11) ADD NEW 42" RCP TO EXISTING 42" RCP AT PRIVATE ROAD CROSSING AND PROVIDE WITH NEW HEADWALLS
12) REPLACE EXISTING ENGLEWOOD ROAD 30" RCP WITH 2-42" RCPS
13) REPLACE EXISTING GULFVIEW ESTATES 2-18" RCP POND OUTFALL WITH 42" RCP AND REPLACE TWO EXISTING 18" RCP POND INTERCONNECTIONS WITH 36" RCP EACH

LEGEND

- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- OPEN CHANNEL
- PIPE/ CULVERT
- MODEL NODE NUMBER
- SUB-BASIN NUMBER
- ROADWAY
- WATERBODY
- 100-YEAR FLOODPLAIN (MASTER PLAN CONDITIONS)
- LOCATION OF IMPROVEMENT

C:\PROJECT\...DMERE\DWGS\IMPROVE, 01/19/98 at 14:06, TGB, 1:1

PARSONS ENGINEERING SCIENCE, INC

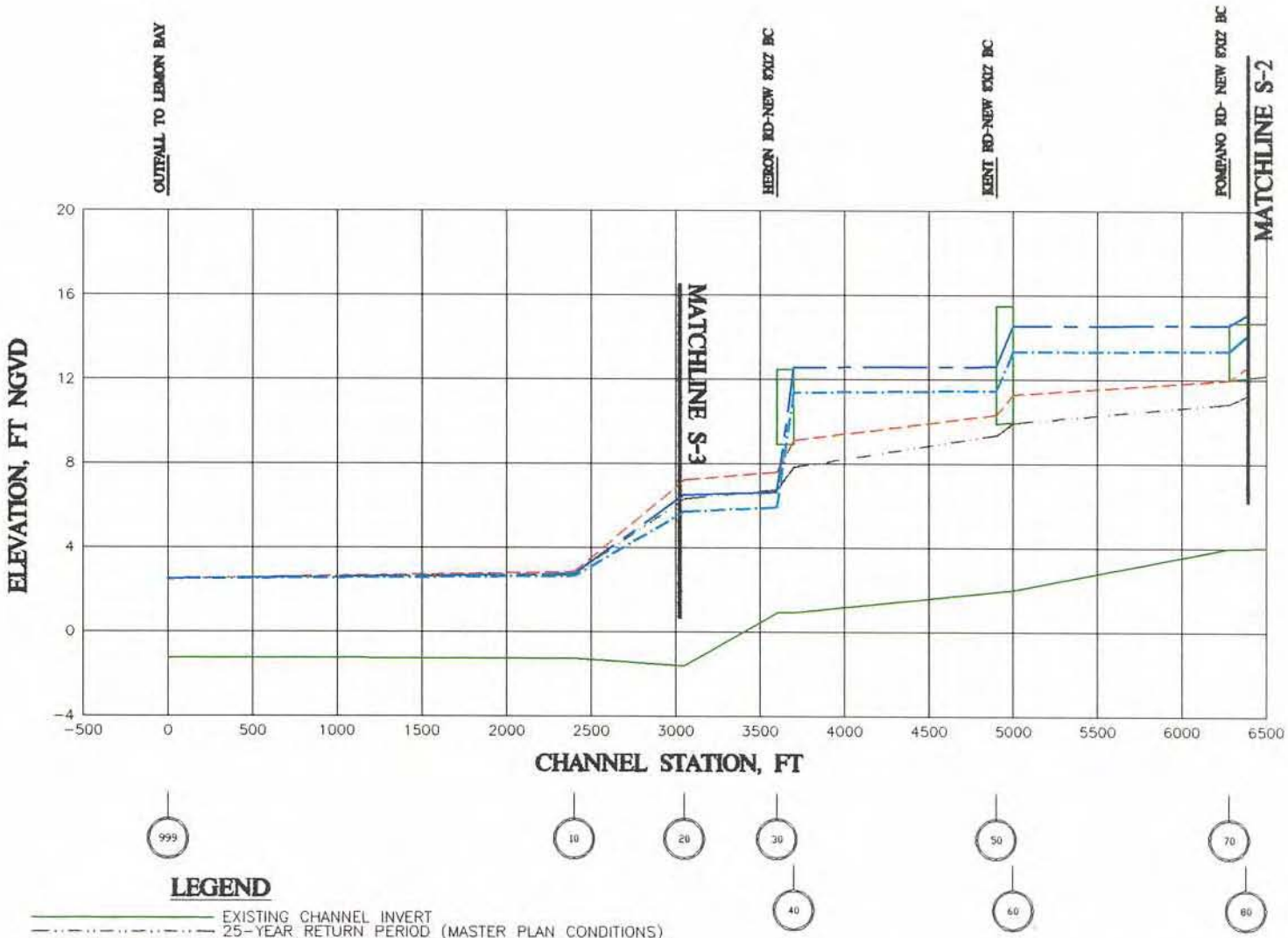
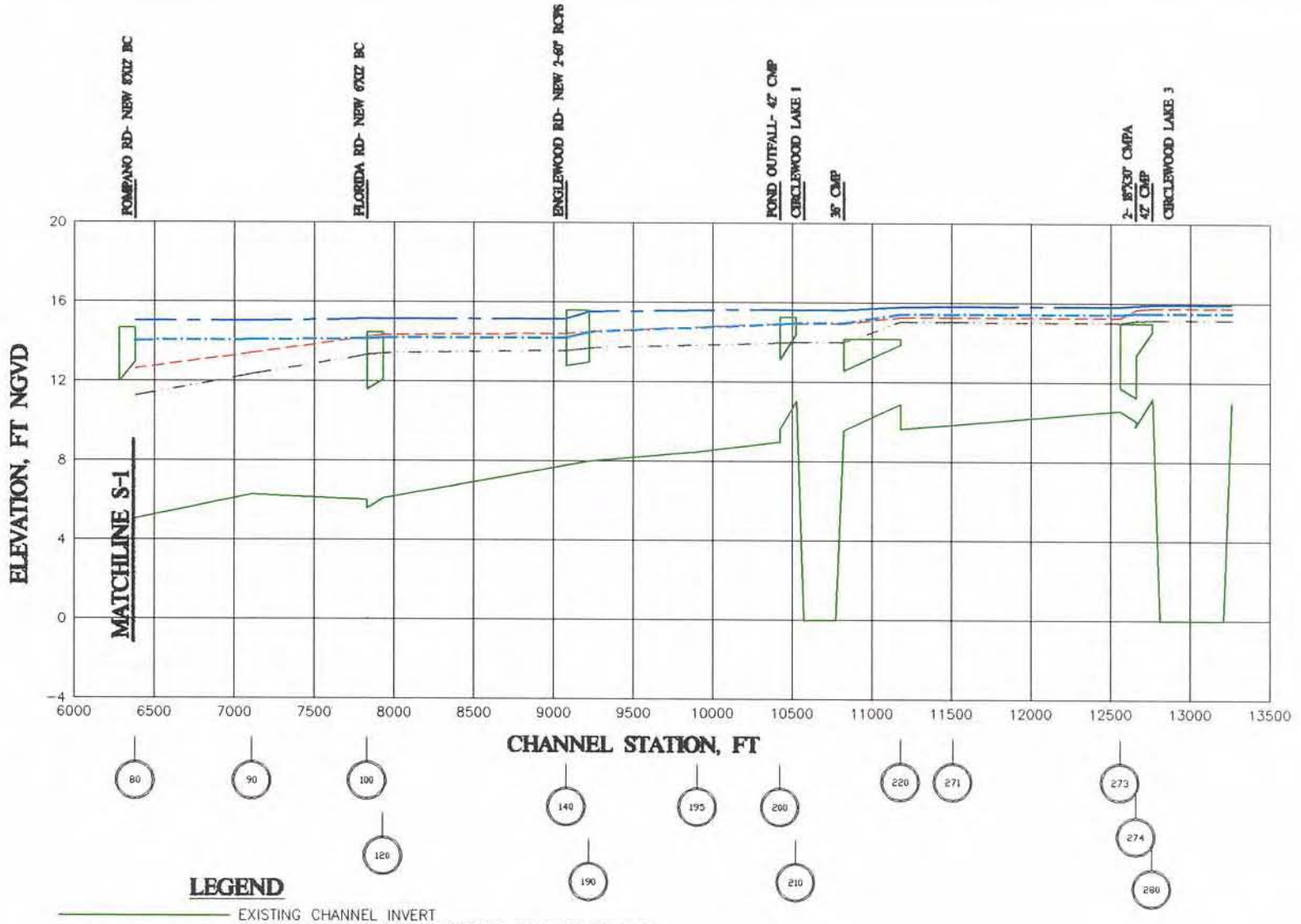


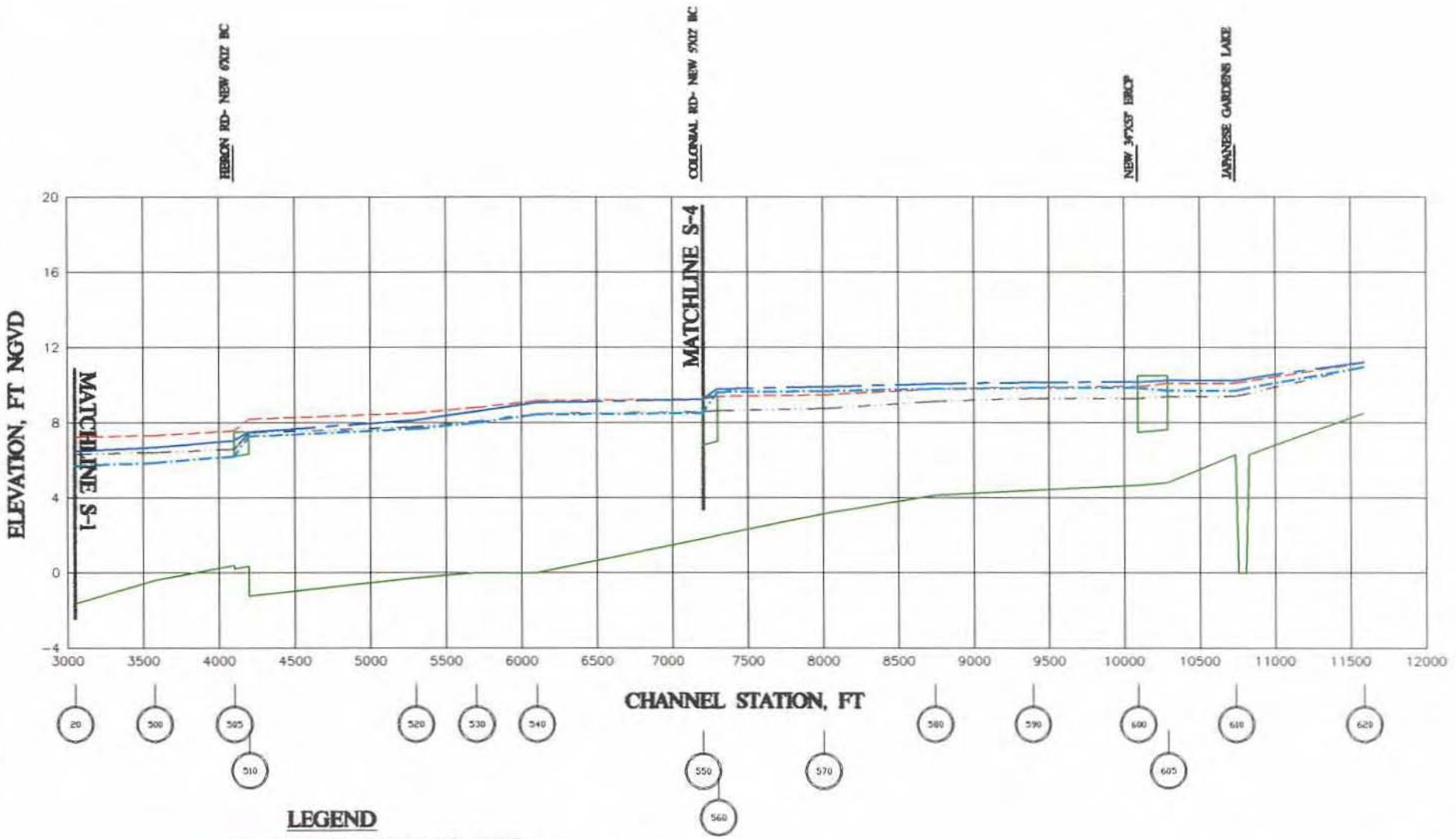
FIGURE 7.2 WOODMERE CREEK BASIN MASTER PLAN CONDITIONS
FLOOD PROFILE COMPARISONS (S-1)

PARSONS ENGINEERING SCIENCE, INC.



PARSONS ENGINEERING SCIENCE, INC.

FIGURE 7.3 WOODMERE CREEK BASIN MASTER PLAN CONDITIONS
FLOOD PROFILE COMPARISONS (S-2)



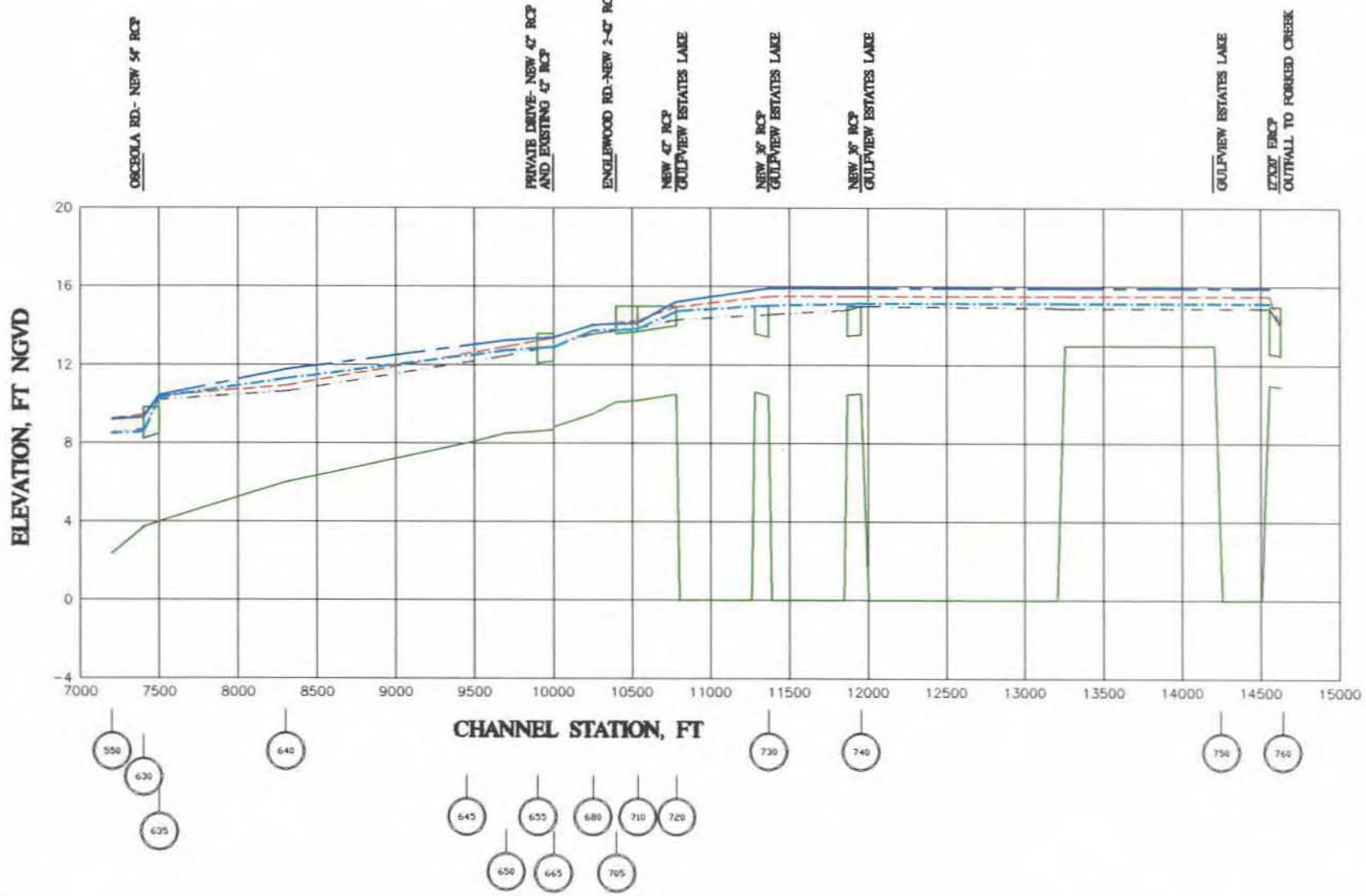
LEGEND

- EXISTING CHANNEL INVERT
- 25-YEAR RETURN PERIOD (MASTER PLAN CONDITIONS)
- 100-YEAR RETURN PERIOD (MASTER PLAN CONDITIONS)
- 25-YEAR RETURN PERIOD (EXISTING CONDITIONS)
- 100-YEAR RETURN PERIOD (EXISTING CONDITIONS)

HORIZONTAL SCALE: 1"=1000'
VERTICAL SCALE: 1"=8'

PARSONS ENGINEERING SCIENCE, INC.

FIGURE 7.4 WOODMERE CREEK BASIN MASTER PLAN CONDITIONS
FLOOD PROFILE COMPARISONS (S-3)



LEGEND

- EXISTING CHANNEL INVERT
- 25-YEAR RETURN PERIOD (MASTER PLAN CONDITIONS)
- 100-YEAR RETURN PERIOD (MASTER PLAN CONDITIONS
- 25-YEAR RETURN PERIOD (EXISTING CONDITIONS)
- 100-YEAR RETURN PERIOD (EXISTING CONDITIONS)

HORIZONTAL SCALE: 1"=1000'
VERTICAL SCALE: 1"=8'

PARSONS ENGINEERING SCIENCE, INC.

FIGURE 7.5 WOODMERE CREEK BASIN MASTER PLAN CONDITIONS FLOOD PROFILE COMPARISON (S-4)

Problem Area 1: Olivia Road

This low-lying area adjacent to the main northern branch of Woodmere Creek between Pompano Road and Florida Road will require a reduction of the 100-year maximum flood elevation by approximately 1.8 feet to meet the flooding LOS criteria for residential structures and neighborhood street flooding. Olivia Road is lower than the surrounding areas, with a low street grade elevation of 12.2 ft NGVD indicated on the SWFWMD aerial topographic map. Also, the County field survey of the residential structures in this area located one low floor slab elevation of 13.5 ft NGVD in the area, and 5 additional structures below elevation 14.0 ft NGVD.

To meet the LOS criteria in this problem area, it will be necessary for the downstream road crossings at both Pompano Road and Kent Road to pass the 100-year peak flow without overtop, since the roadtop grades at these structures are 14.7 and 15.5 ft NGVD, respectively. Model analyses indicate that the existing culverts at these crossings and at the Heron Road crossing are undersized and must be replaced with much larger structures to reduce the large head losses at these locations and alleviate the Olivia Road flooding problem. The recommended solution is to replace each of the three existing structures with an 8'x12' concrete box culvert.

The estimated total construction cost for these improvements is $231,200. Table 7.2 provides a detailed itemized listing of the estimated construction costs associated with each individual project.

Problem Area 2: Hourglass Lakes and Circlewood Condominiums

The flooding problems identified within the Hourglass Lakes and Circlewood developments are created by a number of factors. The primary cause is in the grade of the streets within the developments. These roads (Hourglass Drive and Circlewood Drive) were constructed as much as a foot or more below the natural grade of the surrounding land, with elevations ranging from approximately 14.1 to 14.8 ft NGVD throughout much of the developments. The residential structures themselves are elevated above road grade, and only two instances of residential flooding were identified for the 100-year storm event. Since it would be impractical to regrade the entire development to raise the roadways, the only recourse is to address the other factors that contribute to the problems, the drainage system.

In addition to the LOS deficiencies in Hourglass Lakes and Circlewood, it was noted that the recent reconstruction of SR 776 (Englewood Road) has resulted in a lower road grade at both of the Woodmere Creek crossings. This has resulted in an exceedance of LOS criteria for an evacuation route at these locations (see Table 5.5). Similar to the approach used for the Olivia Road flooding problem area, the replacement of the existing culverts at Florida Road and SR 776 are necessary components of any plan to alleviate the identified flooding problems here. The recommended improvements are a 6'x12' concrete box culvert at Florida Road and double 60" RCP culverts under SR 776. In addition, regrading of 1200 linear feet of the main channel upstream (eastward) of SR 776 to the Circlewood Lake No.1

(Junction WC210) outfall is recommended. This proposed minor regrading would lower the channel bottom approximately 0.5 feet and establish maintainable 2:1 sideslopes within the existing bank limits.

The final measure that is recommended to alleviate the chronic flooding conditions for this problem area involves the lowering of pond banks to allow entrapped excess floodwaters to escape the confines of the development. The Hourglass Lakes and Circlewood storm drainage systems discharge at a single location via the outfall at Circlewood Lake No. 1 (Junction WC210). This lake has a bank elevation of approximately 15.5 ft NGVD around its entire perimeter, including the upstream (northern) side at the storm sewer system inflow. Hence, any excess floodwater volumes within the development which can't be conveyed in the closed storm sewer system are impounded in the roadways up to the pond bank elevation before they can exit, no matter what the tailwater conditions in the main channel are at the time. It is therefore proposed that the banks of this lake be lowered to elevation 14.4 ft NGVD for a 100' length on the southern end and for a 50' length on the northern end to alleviate this problem. In addition, it is recommended the 50'-long northern and southern banks of the dry retention pond located south of Circlewood Drive at Junction WC245 be lowered to elevation 14.5 ft NGVD for similar purposes.

Model simulations indicated that the residential flooding problem within the Hourglass Lakes and Circlewood Condominiums subdivisions would be eliminated by the recommended improvements. However, LOS deficiencies due to road flooding will persist (see Table 7.1). The 100-year maximum flood elevation at SR 776 is lowered approximately 0.9 feet, and those within the developments are reduced approximately 0.5 feet. Further reductions to meet LOS criteria would require improvements that encompass virtual replacement of the existing storm sewer systems within these subdivisions. The cost of these measures would be very substantial and would likely exceed the cost of expected flood damages due to road flooding in the area.

The estimated total construction cost for the proposed improvements is $262,700. Table 7.2 provides a detailed itemized listing of the estimated construction costs associated with each individual project.

Problem Area 3: Japanese Gardens Mobile Home Estates

The indicated flooding problems within the Japanese Gardens Mobile Home Estates are another case where the low points in the roadways have been constructed below the natural grade of surrounding areas. The residential low floor slab elevations are generally a foot or more above the local streets and no residential flooding was identified. It is necessary in this problem area to lower the tailwater elevations within the southern Woodmere Creek branch in addition to providing improvements for the storm sewer outfalls of the subdivision.

The recommended improvements include the replacement of the existing culverts for the downstream road crossings at Heron Road and Colonial Road. The Heron Road replacement is a 6'x12' concrete box culvert, and the Colonial Road replacement is a

5'x12' concrete box culvert. At the Heron Road structure, it will be necessary to raise the existing road grade by approximately 1.0 feet to accommodate the structure and elevate it above flood stages. It is noted that maximum flood elevations for the 25-year and 100-year events will actually increase in this portion of the channel due to the increase in peak flow that results from upstream improvements. However, flooding LOS criteria are not exceeded, and the new structure will be able to pass up to the 25-year event without overtop. Also, flooding elevations for the 2-, 5-, and 10-year events at the new structure are lower for the master plan conditions.

Within Japanese Gardens, the recommended measures include the inspection, repair and construction of headwalls for the 6 separate storm sewer outfalls that serve the mobile home park where they outfall to the main channel. The main outfall structure (WC605) is to be replaced by a 34"x53" ERCP. With these improvements, the 100-year maximum flood elevations in Japanese Gardens will be reduced approximately 0.2 to 0.3 feet. Greater reductions are realized for the smaller storm events, however, and the main benefit will be that no street flooding will occur at any depth for storms smaller than the 25-year storm event, based on the portions of the drainage system which were analyzed.

The estimated total construction cost for these improvements is $187,900. Table 7.2 provides a detailed itemized listing of the estimated construction costs associated with each individual project.

Problem Area 4: Gulfview Estates

Gulfview Estates is another residential subdivision where the local street grade has been constructed below the natural grade of the surrounding area. The development, located in the headwaters of the southeastern branch of Woodmere Creek upstream (east) of SR 776, slopes from north to south, and stormwater runoff is collected in an interconnected series of 4 ponds at its southern perimeter. The main roads on this southern boundary, Washington Drive and Pierce Drive, are graded at elevations as low as 13.5 ft NGVD. The lowest surveyed residential floor slab in the development is 15.9 ft NGVD. Therefore, the flooding problem in this location is defined by the street flooding that occurs during the 100-year storm event. No residential flooding is indicated.

Associated with this problem area is the Osceola Road crossing of the main southeastern branch of Woodmere Creek. The existing 24"x38" ERCP at this location is greatly undersized and doesn't pass even the 2-year storm event without overtop. The recommended improvement for the Osceola Road culvert is replacement with a 54" RCP culvert and regrading of the upstream 1950 linear feet of channel at a 0.5' to 1.5' lower elevation. This will allow the road crossing to pass up to the 10-year storm event without overtop.

In addition, it is necessary to provide enhanced capacity at an upstream private road crossing. It is proposed that another 42" RCP be constructed parallel to the existing culvert of the same size at this crossing.

At SR 776, the recommended improvement is replacement of the existing culvert with double 42" RCPs. This, in conjunction with the replacement of the Gulfview Estates drainage system outfall culverts with a single 42" RCP, and replacement of the pond interconnections with 36" RCPs, will lower the 100-year flood elevation in the community by approximately 0.5 feet and attain the County's flooding LOS criteria for evacuation routes. However, the LOS criteria for neighborhood road access will not be attained. Similarly to the conditions at the Hourglass Lakes and Circlewood area, Further reductions to meet LOS criteria would require improvements whose cost would likely exceed the cost of expected flood damages due to road flooding in the area. An option that could be implemented is the raising of the local roads to a minimum of 14.5 ft NGVD.

The estimated total construction cost for the proposed improvements is $283,000. Table 7.2 provides a detailed itemized listing of the estimated construction costs associated with each individual project.

SECTION 8
OPERATION AND MAINTENANCE ACTIVITIES

GENERAL

During the public meetings conducted during the development of this plan, it became apparent that the public perception is that many of the flooding problems in the Woodmere Creek basin are caused by lack of adequate maintenance. In review of the County's Customer Response Tracking Database, the majority of the complaints that have been received to date relate to problems with maintenance of local systems in the residential areas of the basin.

In 1994, Sarasota County implemented a comprehensive stormwater maintenance program based on the recognition that it is cost efficient to have a stormwater facility well-maintained and ready to convey the runoff from the next storm with minimal damage to surrounding property and the environment. It has been recognized that a stormwater management facility must be monitored, inspected and regularly maintained to insure effective operation and long life of existing structures. In addition, it is Sarasota County's objective to operate the system in such a way that it will sustain the aesthetic values of the community. Poor operation and inadequate maintenance not only reduce the usefulness of facilities but also can cause the facility to become an eyesore, nuisance, health hazard, or failure - all unacceptable to the public. For that purpose, a major reorganization of the Operations Division has taken place and computerized maintenance support systems have been developed.

MAINTENANCE ACCESS CONSIDERATIONS

In Sarasota County, a large number of canals are not maintained by the County on a regular basis due to the lack of legal access to conduct maintenance activities. Our research revealed that no right-of-way or maintenance easements exist along approximately 4,000 feet of the Ponderosa Ditch (Canal No. 28-393) east of Englewood Road (SR-776), and for approximately 3,350 feet of the southeast branch (County Canal No. 35-448) from it's confluence with the Ponderosa Ditch (Canal No. 28-393) upstream to the west boundary of the County owned park parcel approximately 320 feet upstream of the Kent Road crossing. Maintenance access in these areas has been subject to the landowners' wishes. South of the County owned park parcel adjacent to the Colonial Road and Viola Road intersection there is approximately 2,460 feet of the southeast branch (County Canal No. 35-448) where access for maintenance is available via adjacent road right-of-way of park property, however, the canal itself is not within an easement or right-of-way.

It is recommended that the County implement a program to acquire the necessary easements to properly maintain and operate stormwater management facilities. This is especially important in flood sensitive areas were the potential for flooding is high. Table 8.1 and Figure 8.1 depict existing and additional easements or right-of-way required. The additional easements or right-of-way required is based on the guidelines in Appendix C13 of the Sarasota County Land Development Regulations (Ordinance No. 95-021).

RECOMMENDED MAINTENANCE ACTIVITIES

The following is a description of recommended maintenance activities regarding mowing and clearing, erosion control, mosquito and plant control, debris and litter removal, and pond sediment removal.

Mowing and Clearing

The mowing of grass and clearing of channels is the main type of maintenance work performed by maintenance crews. Usually, this activity constitutes the largest routine maintenance expense. Mowing should periodically be performed to side slopes, embankments, emergency spillways, and other grassed areas of stormwater and conveyance facilities to prohibit wood growth and control weeds. Where possible, the use of water-tolerant, pest tolerant, and slow growing grasses is recommended. However, to preserve/restore the functional value of the original vegetation, planting of wetland species would be more appropriate. The creation of longitudinal wetland/sloughs would provide opportunities for water quality control.

Erosion Control

Erosion and local scour can result in channel degradation and the undermining of the structural stability of the embankments. In addition, it results in the loss of channel bed materials. Excessive suspended sediment in streams may result in undesirable environmental impacts, aesthetic problems, and high maintenance cost. Practice has shown that it is impossible to fully control erosion at bends in channels, under bridges, along embankments and spillways. However, the use of proper control measures in areas of high velocities and poor soil stability, erosion will normally not be a problem.

Erosion protection should be addressed during the design phase of each project recommended in this study. Several varieties of natural and man-made materials are available for erosion control. Side slopes designed on a 3:1 minimum slope and planted with native vegetation would provide adequate protection. For steeper Side slopes, the use of erosion protection aids such as mats and plastic grids would help stabilize the banks' soils. Other materials that provide armor protection (riprap, gabions, soil-cement, etc.), as well as retard walls to reduce velocities and rigid and flexible channel linings should also be considered. This option should be considered for the reach of Ponderosa Ditch (Canal No. 28-393) west (downstream) of Englewood Road (SR-776), and for the southeast branch (County Canal No. 35-448) northwest (downstream) of Colonial Road. Erosion in these reaches, particularly adjacent to culvert crossings has caused problems in the past due to bank erosion.

Table 8.1
Woodmere Creek Basin
Easement Requirements and Maintenance Activities

Canal I.D.	Description	From	To	R/W Problems	Access Problems	Easm't Problems	Non-Maintained	Length (Feet)	Top Width (Feet)	Existing Easement or R/W Width (Feet)	Easement or R/W Width Required (Feet) (2)	Additional Easement or R/W Width Required (Feet)	Additional Easement or R/W Area Needed per Reg's (Acres)	See Note	Acquisition Priority	Additional Easement or R/W Area Recommended (Acres)	Method of Maintenance	Frequency of Maintenance	Contract	Last Maintenance Date	Next Maintenance Date
28-156	Ponderosa Ditch	Lemon Bay	Lemon Bay Drive				X	2,000	(1)	50	85	35	1.6		1	1.6					
28-392	Ponderosa Ditch	Lemon Bay Drive	400 Ft. D/S of Heron Road					795	50	15	100	85	1.6	(6)	3	0.0	H/C	A	X	Apr-98	
28-392	Ponderosa Ditch	400 Ft. D/S of Heron Road	County Park at Grinnell Rd.					3,200	45	50	100	50	3.7	(6)	3	0.0	H/C	A	X	Apr-98	
28-392	Ponderosa Ditch	County Park at Grinnell Rd.	160' east of Florida Rd					275	45	15	100	85	0.5	(6)	3	0.0	H/C	A	X	Apr-98	
28-392	Ponderosa Ditch	160' east of Florida Rd	SR 776 - Englewood Road					1,000	45	50	100	50	1.1	(6)	3	0.0	H/C	A	X	Apr-98	
28-393	Ponderosa Ditch	SR 776 (Englewood Road)	East End of Poderosa Ditch	X	X	X		4,100	30		80	80	7.5	(5)	2	7.5	H/C	A	X	May-98	Jun-99
35-448	Southeast Branch	Confluence w/ Ponderosa Ditch	West Boundary of County Park	X	X	X		3,350	32		82	82	6.3		1	6.3					
35-448	Southeast Branch	West Boundary of County Park	South Boundary of County Park					1,400	32	County Property			0.0		4	0.0	H/C and CMC	A/Q	X	Jun-98	Sep-99
35-448	Southeast Branch	South Boundary of County Park	Larry Street / Cocoanut St.					2,070	24	(3)	73	73	3.5		2	3.5	H/C and CMC	A/Q	X	Jun-98	Sep-99
35-448A	Lateral "A"	Confluence w/ Southeast Branch	Brown Road					950	15	County Property			0.0		4	0.0	SM P/C	B		1995	
35-449	East Lateral	Confluence w/ Southeast Branch	Venisota Rd.	X	X	X		2,360	23		73	73	4.0	(4)	1	4.0	H/C	A		May-98	Jul-99
35-449	East Lateral	Venisota Rd.	SR 776 (Englewood Road)					650	23	32	73	41	0.6	(4)	2	0.6	CMC	Q			
							Totals =	22,150					30.39			23.48					

Notes:

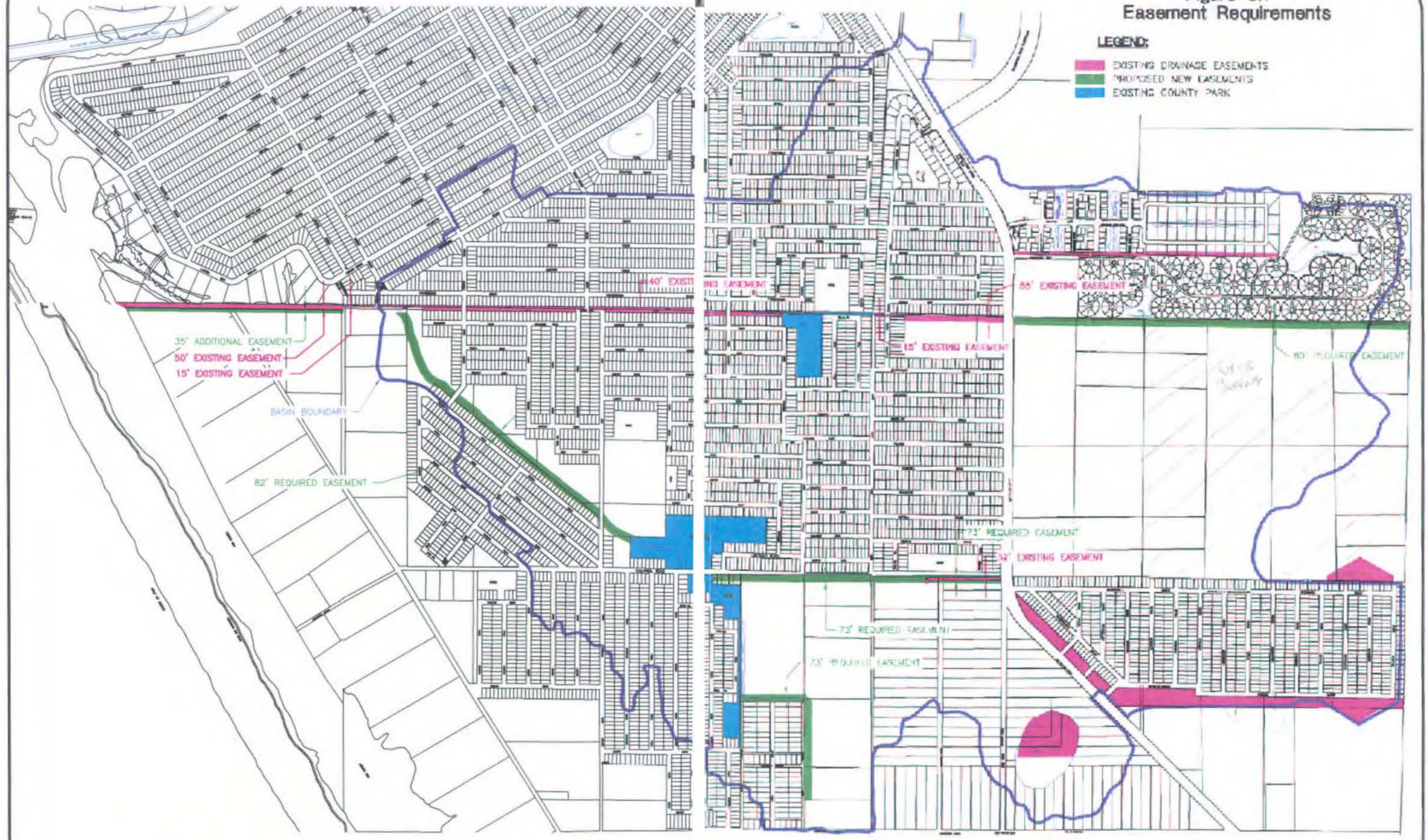
(1) Tidal Reach with undefined channel which is not regularly maintained.
(2) Required Right-of-Way (R/W) or Easement width is based on Appendic C13 of the Sarasota Count Land Development Regularions
(3) Access for maintenance is available via existing road R/W or County Park property, however, the canal in this reach is not within an easement or R/W.
(4) The Existing Colonial Road R/W may provide a portion of the area indicated depending on the actual location of the canal.
(5) Additional Easemwnt or R/W along the north side of the canal adjacent to Circle Woods of Venice Condo. may not be logically feasible due to existing development. In this case, the additional indicated width would be reduced to 56 ft. for a distance of 3,430 ft., assuming maintenance of the canal only from the south side.
(6) The canal within this reach is generally contained within existing drainage easements or road R/W and is being maintained by hand cleaning methods. The logical feasibility of obtaining the additional area indicated to meet County standards needs to be weighted against adverse impacts to existing development.

Method of Maintenance:
P/C = Prison Crew
H/C = Hand Cleaning
MW = Contract Mowing
CMC = County Mowing Crew

Frequency of Maintenance
A = Annually
B = Once Every Two (2) Years
C = Once Every Three (3) Years
Q = Qarterly

Acquisition Priority
1 Easement or R/W Required
2 Additional Easement or R/W Feasible
3 Additional Easement or R/W Not Logically Feasible
4 No Additional Easement or R/W Required

Figure 8.1
Easement Requirements



PARSONS ENGINEERING SCIENCE, INC.

Mosquito and Plant Control

Nuisance control is one of the most frequent maintenance items demanded by local residents. Odors, mosquitoes, weeds, and growth of undesirable vegetation are all potential problems in stormwater facilities. Sarasota County has created a group in the maintenance section to deal exclusively with this problem. Plant control is conducted such that channels are maintained at 90-day intervals. Spraying is done using chemicals such as Rodeo. These practices should be initiated once the easements are acquired. To the extent possible, plant control should include removal of sprayed vegetation.

Debris and Litter Removal

As part of periodic mowing operations, debris and litter should be removed from stormwater detention facilities. Particular attention should be paid to floatable debris that can eventually clog the control structure or riser. It is usually more efficient to control these materials before they enter the stormwater system. Debris and litter does not appear to be a serious problem in the study area at this time. This is due to the currently large undeveloped conditions in the upper basin areas and predominately residential nature of the land use within the basin. The problem could become serious in the future if adequate steps are not taken now.

Pond Sediment Removal

If properly designed, wet ponds will eventually accumulate enough sediment to significantly reduce storage capacity, which can reduce the pollutant removal performance of the pond. A sediment clean-out cycle of ten to twenty years is recommended. The costs associated with sediment removal can be staggering and can range between $6.00 to $23.00/cubic yard due to size of pond, accessibility, the proximity of the disposal site and the method used to remove and transport the sediments.

Similarly, the various inlet/outlet and riser works in a pond will deteriorate and must be repaired or replaced. Structures should be inspected at least at once annually. Porous pavement and exfiltration trenches may require more frequent inspections.

Sarasota County does not presently have a pond maintenance program in place to address these issues. Furthermore, the associated costs are not being considered at the planning stages. It is recommended that a pond assessment study be conducted, not only in the Woodmere Creek basin but throughout the County. Subsequently, if necessary a pond maintenance program should be developed.

Resetting of Culverts

One of the problems reported for minor drainage systems such as roadside swales and driveway culverts, is that a number of existing culverts in the study area have been set against the normal direction of flow. Detailed investigation of the minor drainage systems within the Woodmere Creek basin is beyond the scope of the assessment. Additional investigation to assess the extent and severity of the problems within the minor drainage systems maybe warranted. Prior to resetting of the culverts, a capacity

analysis should be performed and the pipes resized to handle upstream flow in accordance with County requirements.

Data Collection and Management

The County has developed a detailed canal inventory data base with established frequency of maintenance for each canal maintained by the County. The canal inventory data base includes:

- Canal Identification Number
- Access, Right-of-Way, and Easement Availability
- Length Maintained (Feet)
- Canal Top Width (Feet)
- Area Maintained (Acres)
- Method of Maintenance
- Frequency of Maintenance
- Last Date Maintained
- Next Date to be Maintained

The current canal inventory data base indicates the canals in the Woodmere Creek basin have a frequency of maintenance classification of "A" (Annually), "B" (Once Every Two (2) Years), or "Q" (Quarterly).

The canal inventory database developed does not presently include drainage structure information., however, the database is still being developed. Not all of the necessary structure data such as age, condition, dimensions, and elevations may be readily available at the present time but may be incorporated and periodically updated as data become available.

Supplemental Freshwater Supply Assessment

The recommended stormwater improvements have been be evaluated on a conceptual level in terms of providing an alternative or supplemental freshwater supply source. Recommended improvements are primarily limited to replacement of existing culverts. No stormwater retention storage areas are recommended which could potentially provide a supplemental freshwater supply source. Potential supplies could provide a freshwater supply for irrigation water, process water, and other potential uses in conjunction with the County's wastewater reuse program. However, the County's Utility Department has not identified a viable need for providing a supplemental freshwater supply in the Woodmere Creek basin. The County's Wastewater Reuse Master Plan currently does not include the Woodmere Creek basin area. Current and project treated wastewater supplies available have identified uses north of the Woodmere Creek basin in the Venice and East Venice areas.