Special Publication SJ98-SP12

LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

Orange County, Florida

Volume 1

MARCH 1997

This report was jointly funded by Orange County, the St. Johns River Water Management District (SJRWMD) and the City of Apopka. County, District and City staff provided both information and assistance in a number of areas, including both data collection and technical review. Without their assistance, the Report preparation would have been much more difficult.

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Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

EXECUTIVE SUMMARY

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Lakes McCoy, Coroni and Prevatt Drainage Basin Study
Orange County, Florida

EXECUTIVE SUMMARY

Purpose of Study

In November of 1995, Orange County, the City of Apopka, and St. Johns River Water Management District (SJRWMD) commissioned a study of the Lakes McCoy, Coroni, and Prevatt watershed. The intent of this study was to develop a Stormwater Management Master Plan for the lakes and associated primary drainage systems, including an assessment of water quantity and quality. Based upon these assessments, capital improvements were identified to alleviate flooding problems and enhance water quality.

Although the main focus was the primary systems, the study was extended to include stormwater management and conveyance facilities upstream of the lakes which have an impact upon the flood elevations in the primary water bodies of interest. As a result, problem areas and potential improvements were identified throughout the watershed.

Study Area

The study area comprises approximately 3,673 acres, or roughly 5.7 square miles, of northwestern Orange County including incorporated areas of the City of Apopka. More specifically, the study area extends from U.S. 441 and State Road 436 northward to an abandoned railroad bed in Wekiwa Springs State Park. The approximate eastern limit of the study area is Thompson Road. The western extent of the study area lies approximately one-half (½) mile west of Park Avenue/Rock Springs Road.

Drainage patterns in this area are generally from west to east and from south to north. In the southwestern portion of the watershed lie two (2) lakes, Dream Lake and Buchan Pond, which drain eastward to Lake McCoy via culverts and ditches. Lake McCoy discharges northward to Lake

Coroni at Sandpiper Street. Lake Coroni, in turn, outfalls northward under Welch Road to Lake Prevatt by means of a series of culverts and ditches. The outfall for Lake Prevatt is a natural stream known as Carpenter Branch within Wekiwa Springs State Park. Carpenter Branch converges with Rock Springs Run on its way to the Wekiva River.

Study Approach

In order to assess the function of the drainage features within the Lakes McCoy, Coroni, and Prevatt watershed, the hydrology and hydraulics of the existing systems were modeled using state of the art computer analysis techniques. Extensive field work was performed to define the limits of the watershed and to determine the key drainage features to be included in the computer modeling. The most current information was used to define land uses, initial water elevations, flood storage, and drainage structures. Sources included aerial maps, topographic maps, lake level records, parcel maps, construction plans, and drainage calculations provided by Orange County, St. Johns River Water Management District, and the City of Apopka. Where information could not be obtained otherwise, survey was performed.

Ultimately, a comprehensive computer model of the study area was developed using the assimilated data. Multiple simulations were executed to assess the performance of the existing systems under a variety of conditions. Although the levels of the primary lakes within the watershed vary considerably, the most critical conditions were found to occur when Lakes McCoy, Coroni, and Prevatt were at the normal high water elevations (slightly above their respective overflow elevations) prior to the arrival of a large storm. These conditions were used for all subsequent analyses, as the performance during excessively "wet" periods is most critical.

Based upon the analyses performed, anticipated peak flood elevations were determined. The analyses were also used to uncover problems areas within the watershed. Several additional deficiencies were discovered during the field work phase of the project. The computer model was then utilized to evaluate possible solutions to alleviate these problems. As a result of the analyses performed for this study, the following structural and non-structural improvements are recommended:

Flood Protection	*Water Quality*	*Localized Flooding*
1) Retrofit the Dream Lake Outfall System *2) Construct a Lake McCoy Control Structure* *3) Reinvestigate the Rhapsody Oaks Development to restore the historical drainage pattern and flood storage* *4) Regulate the volume of runoff into the existing wetland system east of Rock Springs Road and south of Welch Road* *5) Update the Base Flood Elevation for South Lake McCoy to regulate future development* *6) Update the Base Flood Elevation for Buchan Pond to regulate future development* *7) Revise/Establish the Base Flood Elevations for Lake Coroni and Lake Prevatt*	*1) Retrofit the Park Avenue Stormwater Pond (located on Votaw Road) to treat ½ inch of runoff from approximately 250 acres* *2) Initiate a Water Quality Monitoring Program (LAKEWATCH)* *3) Repair the bleed-down device within the Wekiva Park Subdivision*	*1) Improve the outfall system for an unnamed pond west of Ustler Road* *2) Upgrade two culverts under Rock Springs Road (to be coordinated by Orange County with the design of the future widening improvements)* *3) Upgrade the culverts under Brook Forest Court within the Wekiva Glen Subdivision*
The combination of improvements should reduce flooding and improve the quality of life for the residents within the watershed.		

Water Quality Assessment

As part of the Stormwater Management Master Plan for the study area, Orange County's scope provides for an evaluation of existing water quality within the lake systems. This existing water quality evaluation, which is entitled "Lake McCoy, Lake Coroni, and Lake Prevatt SWMMP Historical Water Quality Report", was completed by sub-consultants for PEC/Professional Engineering Consultants and is included within Volume I, Section 4 - Supporting Documentation (Attachment "A"), of this report.

Data samples were taken sporadically over the past twenty-six (26) years, in part due to the fact that the lakes are dry for extended periods of time. During the period of record, a considerable amount of development has also occurred within the watershed, and the City of Apopka has ceased the discharge of wastewater effluent to the lake system. In essence, the available water quality data for the lakes within the study area was insufficient to make any meaningful assessment of water quality and its relative improvement or degradation.

Because there is no current water quality data for this drainage system, other than from Lake Prevatt and Dream Lake, prior to completing the evaluation of modifications to meet the new NPDES conditions, the following additional water quality data collection is recommended.

- Lake McCoy - collect samples for the analysis of BOD, total phosphorus, chlorophyll A, and total nitrogen to determine whether the lake continues to be nutrient-rich. At a minimum, collect samples at Stations 3 (southern most station) and 8 (northern station at lake discharge point). Oxygen measurements should be made and correlated with the temperature, pH, and chloride content. If nutrient-rich, the discharge from this lake could have a negative impact on all downstream water bodies and contribute to algal blooms in Lakes Coroni and Prevatt.

- Lake Coroni - Collect a sample at the discharge end of the lake and evaluate it for the potential presence of nutrients, coliforms, and algae. Oxygen measurements should be made and correlated with the temperature, pH, and chloride content.

- *Dream Lake - Collect a sample at the discharge end of the lake and evaluate it for nutrients, bacteria and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this lake as a source of nutrients to the system.*

- *Buchan Pond - Collect a sample at the discharge end of the pond and evaluate it for nutrients, bacteria and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this pond as a source of nutrients to the system.*

- *Lake Prevatt - All water quality parameters should be monitored at the discharge end of this lake. In particular, all the nutrients, bacteria, and algae measurements that have been made in the past should be repeated for a current correlation of the conditions. Additionally, the mid-point of this lake should be monitored to determine whether the flow is completely mixed at this point in the drainage system.*

- *Wekiva River - At a minimum, the historical water quality data for the river should be collected and reviewed. Also, samples should be collected from both upstream and downstream of the Lake Prevatt discharge to the river. All of the Lake Prevatt parameters should be analyzed.*

- *The FDEP Class III surface water criteria analytical detection limits should be used on all future chemical analysis for the system. Also, all sample collection should be consistent with the FDEP quality assurance requirements (Chapter 62-160 FAC).*

- *All of the samples collected from the various points of discharge or areas of continuous flow (i.e., Wekiva River) should be made by flow weighted 24-hour composites. Samples collected from the center of Lake Prevatt should be vertical grabs from one-foot intervals to the bottom. Because of the expected shallowness of Lake McCoy's southern station (Station 3), a surface grab should be collected at this point. In-situ water quality parameters such as DO, pH, and temperature should be monitored throughout the sample collection phase (i.e., 24-hours, vertical column).*

- *Finally, the development in the watershed should be examined against the available monitoring data. The development patterns may explain some of the apparent variations in the data that were made available to this project. The impacts of the physical changes in the watershed may be observed in the data, and the correlation may enhance the estimates of impacts on the system of the various proposed and evaluated alternatives.*

Drainage Well Issues

One (1) existing drainage well is located within the southwest portion of the study area in sub-basin DLO1. The drainage well is situated in a pond which lies northwest of the intersection of Old Dixie Highway and Hawthorne Avenue. This pond collects runoff from approximately forty (40) acres which includes U.S. 441 (Main Street) and the adjacent commercial development. Although an in-depth investigation of this existing drainage well was included within the scope of this basin study, several points of interest should be noted.

- *Based upon field investigations conducted during the development of this basin study, it appears, based upon visual inspection, that the water quality within the pond in sub-basin DL01 could be classified as poor.*

- *Based upon PEC/Professional Engineering Consultants previous involvement with state agencies including the Florida Department of Environmental Protection (FDEP) and the Environmental Protection Agency (EPA), very limited modifications/improvements to existing drainage wells are allowed by permit. Therefore, it is anticipated that the only permittable modifications/improvements which could be made to this existing drainage well to improve water quality would be additional skimmers and/or bar screens (trash racks).*

- *The possibility of "capping" the existing drainage well, coupled with providing a structural outfall from the pond through the proposed Rhapsody Oaks development to the north could be investigated. This analysis should be investigated utilizing the modeling information contained within this report to insure that potential impacts, both volumetric and rate, to the watershed as a whole are quantified. Additionally, special attention would have to be provided with respect to flood elevations for the pond within sub-basin DL01, as well as, the potential impact to existing drainage systems which outfall to this lake.*

Assumptions

Within this drainage basin study, the assumption was made that all hydraulic reaches are well maintained and free of silt or debris. Based on field observations, this assumption is valid in most cases. In particular, no obstruction to flow were observed in the primary drainage systems which convey runoff between the lakes. Nonetheless, some structures may have persistent siltation problems in spite of good maintenance. The effect of major siltation problems should be considered in evaluating flood elevations shown within this drainage basin study due to the fact that the results shown assume one hundred (100) percent operating efficiency of the structure.

Two (2) points of interest regarding the delineations of existing land use should be noted. First of all, areas that have been approved for development, yet are not currently developed ("built-out"), were assumed to be fully developed in the existing condition (e.g., Pines of Wekiva - Tract "G" and Parkview Subdivision). Secondly, areas that are primarily composed of a single land use were considered to be homogeneous. For example, largely undeveloped tracts of land with sparse single family residences were considered undeveloped. Conversely, vacant lots in primarily developed areas were usually included as developed land. The rationale in both of the above cases is that a relatively small deviation in land use has little effect on the hydrologic characteristics of the overall tract of land.

Lakes McCoy, Coroni and Prevatt
Drainage Basin Study
Orange County, Florida

INTRODUCTION

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Lakes McCoy, Coroni and Prevatt Drainage Basin Study

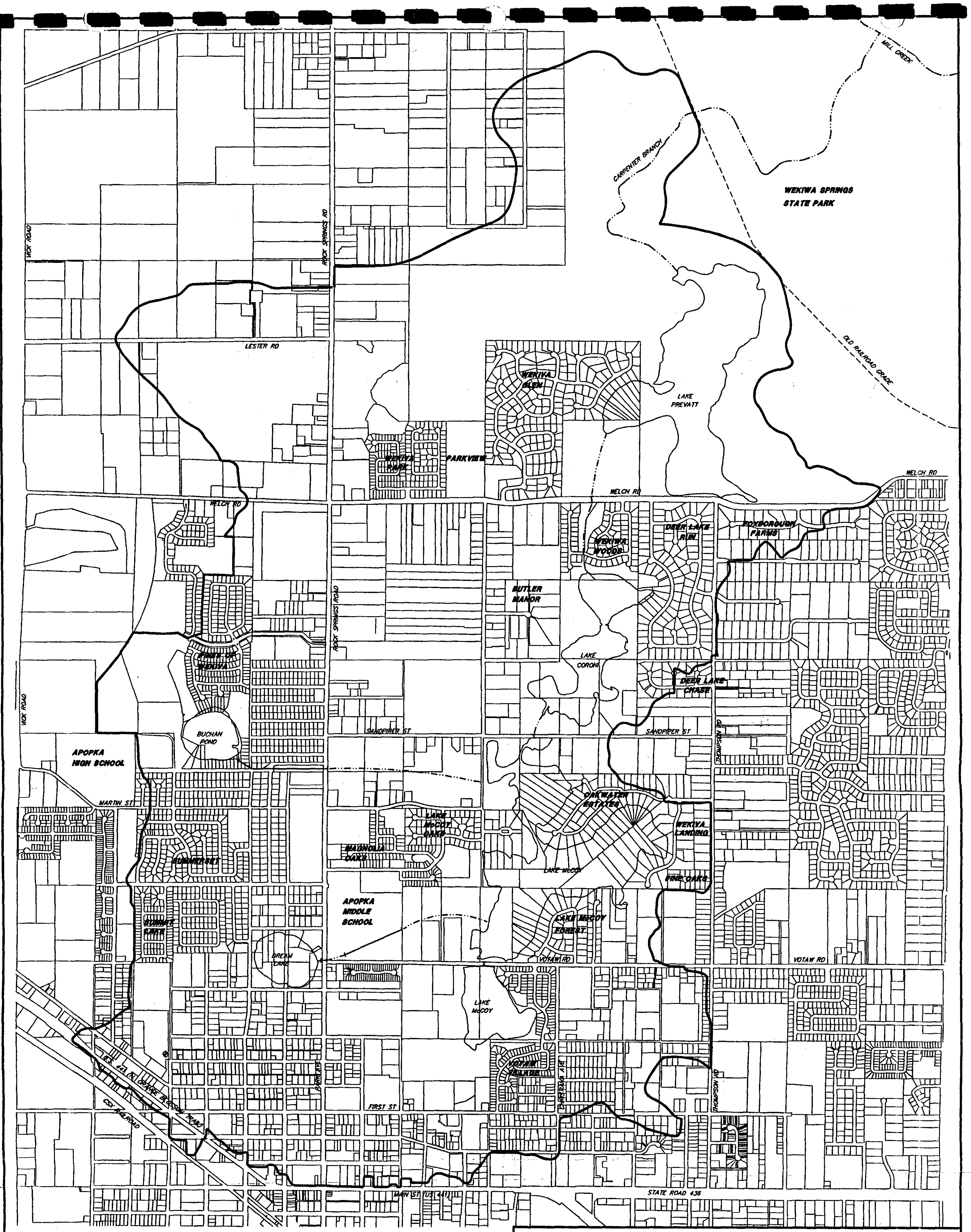
Orange County, Florida

SECTION 1.0
INTRODUCTION

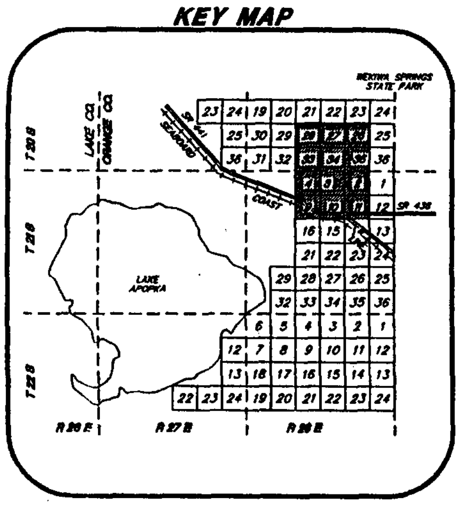
1.1 GENERAL

Throughout the Lakes McCoy, Coroni and Prevatt Drainage Basin Study, reference made to the "study area" will mean the watershed boundaries of the Lakes McCoy, Coroni and Prevatt Drainage Basin Study currently being investigated by PEC/Professional Engineering Consultants. The study area comprises approximately 3,673 acres, or roughly 5.7 square miles, of northwestern Orange County and incorporated areas of the City of Apopka within Sections 26, 27, 28, 33, 34, and 35 of Township 20 South, Range 28 East, and Sections 2, 3, 4, 9, 10, and 11 of Township 21 South, Range 28 East. Of the total study area, the Lakes McCoy, Coroni and Prevatt Basins comprise approximately 1,972; 350; and 1,090 acres, respectively. An additional 261 acres, which enters Carpenter Branch to the north of Lake Prevatt, rounds out the total study area.

The study area extends from U.S. 441 and State Road 436, northward to an abandoned railroad bed in Wekiwa Springs State Park. The approximate limit of the study to the east is Thompson Road. The western extent of the study area lies approximately ½ mile to the west of Park Avenue/Rock Springs Road. The general drainage pattern within the study area is from the outer perimeter of the study area eastward and westward to the main lakes. The lakes are interconnected via a series of ditches and culverts such that runoff discharges northward from Lake McCoy to Lake Coroni and thence to Lake Prevatt. Whereupon, Lake Prevatt discharges via Carpenter Branch to Rock Springs Run and the Wekiva River. Refer to Figure 1-1 for the general location of the study area relative to the Orange County and the City of Apopka geographics.



KEY MAP



LEGEND

▬	DRAINAGE BASIN DIVIDE
—··—··—	DITCHES/STREAM
├──┤	CULVERTS
◈	DRAINWELL

FIGURE 1–1
LOCATION MAP

LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

SCALE: 1" = 1600'

400 0 400 800 1600 2400

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1.2 PURPOSE AND SCOPE

The primary purpose of this investigation was the development of a Stormwater Management Master Plan (SWMMP) for the study area. Although this investigation identifies areas where structural improvements are required to reduce existing flooding, the scope of this investigation was such that quantification of flood elevations is directed primarily to Lakes McCoy, Coroni and Prevatt. The investigation was extended to include other significant water bodies which could either impact flood elevations within Lakes McCoy, Coroni and Prevatt, or represent areas of potential flooding. Thus, it was not the intent of this study to quantify flood stages throughout the entire study area (eg, stormwater ponds associated with existing subdivisions), but rather to analyze the primary stormwater management and conveyance facilities which have an impact on the flood elevations within the primary water bodies of interest. The information contained within this basin study can be utilized to supplement floodplain information which is currently not contained within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM's).

In order to accomplish the goals and objectives of the project scope of services, this drainage basin study was divided into two (2) distinct phases. Phase I involved data collection and inventory, while Phase II involved the analysis and assessment of the existing drainage facilities. More specifically, Phases I and II of this drainage basin study were accomplished by the following three (3) defined tasks. Task 1 consisted of data collection involving the compilation and review of all pertinent data relating to the study area. Task 2 consisted of analyzing the study area under existing conditions; estimating of current flood stages and flow rates; and identifying system deficiencies relative to allowable limits of flooding. Task 3 consisted of the analysis of the study area incorporating the recommended drainage improvements and estimating the flood stages, flow rates, and anticipated reduction in flooding.

1.3 DATA COLLECTION

The development of this study was initiated with a search of documents, records, studies, surveys, aerial photographs, construction plans, and related information available from Orange County; the City of Apopka; Federal agencies (FEMA and SCS); State agencies (SJRWMD and FDOT); and other consulting engineers. The purpose of this activity was to gain an understanding of drainage patterns within the study area, to determine the location of principal drainage structures, and to *develop a preliminary framework for the study. Based on the information compiled, field review and survey requirements were evaluated.*

As the study progressed, additional information was obtained as deemed necessary. Ultimately, all readily available information related to each sub-basin within the study area was acquired. The data collected and evaluated for each sub-basin within the study area included previous engineering studies; Florida Department of Transportation (FDOT), City of Apopka, and Orange County drainage calculations and/or construction plans; aerial and topographic maps; drainage calculations and/or construction plans for private developments; and other relevant data. A listing of data sources obtained during the Data Collection Task has been provided within Section 1.9 - Listing of Data Sources of this report.

In conjunction with the information obtained from the above sources, extensive field review was performed. The field reviews served many purposes, the first of which was to verify the extents of the overall drainage area. Subsequent field visits enabled PEC staff to verify and refine sub-basin delineations and to verify drainage structure information obtained from the previously mentioned sources. Field inspections were also useful in establishing land use delineations throughout the study area. Finally, observations made during and after heavy rainfall were used to gauge whether the final analyses seemed reasonable.

Following the data search and the initial field work, the scope of services with regard to survey were refined. Information which could not be obtained otherwise was surveyed by PEC's subconsultant Jones, Hoechst & Associates, Inc. The Orange County Survey Department also provided supplemental surveys of several significant drainage features. The surveys of ditch cross sections, road profiles, and drainage structures completed the drainage infrastructure inventory for the study area. All field survey notes have been provided in Volume II, Section 5 of this report.

Where possible, information obtained from the previously discussed activities was checked for correlation between sources. Because the opportunity for such verification was limited, it was necessary to assume that the information provided on all sources was based on a consistent datum. Also, it was necessary to assume that information contained in calculations, construction plans, and "as-built" drawings prepared by others was correct. Having made these assumptions, the assimilated data was used to generate sub-basin delineations; land use delineations; soil type *delineations; and an inventory of drainage structures, conveyance facilities, retention/detention systems (stormwater ponds), and other collection systems. The above information was utilized to develop a computer model of the existing drainage systems in the study area. This model was then used to simulate the hydrologic/hydraulic response of the existing systems for a variety of storms. Further discussions of the modeling parameters and methodology are provided elsewhere in this report.*

In several instances, drainage structures within the sub-basins were not included within the engineering analysis because their overall function within the sub-basin was not critical. As mentioned previously, it is not the intent of this basin study to evaluate the performance of the secondary systems, but rather to assess the overall performance of the primary drainage systems.

1.4 STUDY AND DESIGN CRITERIA

1.4.1 General

The primary objective of this drainage basin study was the determination of flood elevations and associated floodplain limits for Lakes McCoy, Coroni and Prevatt, as well as any other significant water bodies within the study area (eg, Dream Lake and Buchan Pond). This information will not only supplement the floodplain limits depicted within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM's), but will also be utilized to determine problem areas where flood levels are such that structural damage may occur. In order to ascertain the severity of flooding for identified problem areas, several design storm events were analyzed in an effort to determine existing levels of flood protection within the study area, as well as, the magnitude of storm which will cause potential flooding.

1.4.2 Design Storm Events

Four (4) distinct storm events, which include the 2.33- (mean annual), 10-, 25-, and 100-year, 24-hour rainfall events, were analyzed for this drainage basin study. The computer model utilized in the analysis of the study area computed peak flood stages and discharge hydrographs at discrete points within the existing drainage system. Existing levels of flood protection and capacity for each structure were evaluated based on the computer simulations. Problem areas within each portion *of the drainage system were identified based on deficiencies in meeting the required level of flood protection, often referred to as the structure or basin level of service.*

1.4.3 Level of Service

A level of service designation is a relative assessment of a system's overall performance, based upon the hydraulic performance of the individual drainage elements (e.g., culverts, channels, storm sewers, ponds, etc.) contained throughout the sub-basin. Levels of service reflect the impact of flood stage and duration on the safety of the public-at-large and potential property damage. Prioritization of facility improvement funding, operations and maintenance, and regulatory enforcement of development programs can be properly and efficiently addressed once a level of service standard is established.

The level of service standard for the study area was specified as the 25-year, 24-hour storm event for primary conveyance facilities (eg, existing culverts under Sandpiper Street), while flood protection for the 100-year, 24-hour storm event was evaluated for all existing and proposed structures.

1.5 MAPPING EFFORT

As part of this drainage basin study, various mapping exercises were performed. The mapping played a key role in preparation of hydrologic parameters for the computer model, and provided a base for graphically delineating results and areas for recommended improvement. In addition to the mapping effort, a detailed drainage inventory was conducted to determine locations, sizes and pertinent information on culverts, channels and other drainage structures within the study area.

The mapping effort for this project consisted of producing four (4) exhibits. These exhibits include the Drainage Basin/Floodplain Map (Exhibit No. 1), the Existing Land Use Map (Exhibit No. 2), the Existing Soils Map (Exhibit No. 3), and the ICPR Node-Reach Diagram (Exhibit No. 4).

The overall limits of the study area, as well as the sub-basin breakdown within the study area, are shown on the Drainage Basin/Floodplain Map (Exhibit No. 1). The Drainage Basin/Floodplain Map has been provided as an AutoCAD overlay to an aerial raster map. Aerial images, which were flown in the Spring of 1995, were obtained from Spacecoast Micro Map Corporation in digital format. The *coverage of each image was approximately one (1) section (e.g., Section 34, Township 20 south, Range 28 east) or one (1) square mile. The individual sections were georeferenced by PEC to State Plane Coordinates based upon horizontal control points provided by the Orange County Survey Department (Refer to Section 5 - Project Correspondence). The twelve (12) sections, which provide complete coverage of the drainage study area, were then "spliced" together to form the aerial raster base map utilized for Exhibit No. 1.*

The importance of georeferencing the aerial raster map was threefold. First of all, the individual sections could not be spliced to form a reasonably accurate overall map without some degree of control with regard to horizontal and rotational alignment. Secondly, without horizontal reference points, the scale of each section would be somewhat different from adjacent sections; thus, no consistent scaling of the overall map could be achieved. Finally, most of the drainage basins and floodplain limits were mapped using aerial topographic maps created by others for Orange County and St. Johns River Water Management District (SJRWMD). These maps were correctly registered to State Plane Coordinates; thereby, making it possible to define the extents of the drainage basins and floodplains in "real world" coordinates.

The three (3) remaining maps have been superimposed on a base map of the roads and land parcels. The original parcel map was provided by the Orange County Geographic Information Systems (GIS) Department. Road names were entered manually by PEC because the information could not be transferred in digital format from the County's system. However, when this map was compared to other sources, it was determined that the parcel map was not accurately georeferenced to State Plane Coordinates. Discrepancies of up to 150 feet were noted. Because information was to be transferred between the parcel map and the aerial raster map described previously, it was necessary to modify the parcel map based upon the horizontal control points provided by the Orange County Survey Department. Although it was possible to "warp" the overall Existing Parcel Map to acceptable limits, some error resulted for parcels, lots, etc. which had to be enlarged or reduced in size to "fit" following the "warping" procedure.

Following the adjustments to the parcel map, a desirable level of consistency was achieved with regard to having the source maps and the two base maps georeferenced to State Plane Coordinates. It was then possible to develop the Existing Land Use Map using the Orange County and SJRWMD aerial topographic maps, the aerial raster map, and the adjusted parcel map. Orange

County aerial tax maps and field verifications were also utilized. The existing land uses within the study area, as well as, a tabulation and description of the land use coding classification system are shown on the Existing Land Use Map (Exhibit No. 2). This information has been provided on the adjusted parcel map and includes basin divides for reference.

The mapping of soil types in digital format was obtained from both the Orange County GIS Department and the SJRWMD GIS Department. The maps obtained from these sources were identical. Upon comparing this soils map to the georeferenced sources and base maps, considerable discrepancies were noted. The soils map was then plotted on a transparent overlay to match the scale of the SCS Soil Survey of Orange County, issued August 1989. While the general shapes of the soil delineations were evident, it was apparent that the soil overlay was not georeferenced to provide the minimum allowable accuracy. Due to the complexity of the soil type delineations within the study area, it was not possible to "warp" the soil type delineations as was done to the parcel map. Therefore, soil type delineations were digitized by PEC/Professional Engineering Consultants from the Soil Conservation Service (SCS) Soil Survey of Orange County. Rather than delineating each individual soil type, PEC's mapping effort was limited to delineating hydrologic soil groups (HSG) as defined by the Soil Conservation Service. The resultant delineations are provided on the Existing Soils Map (Exhibit No. 3).

The connectivity of the ICPR (Interconnected Channel and Pond Routing) model for the study area is shown on the ICPR Node-Reach Diagram (Exhibit No. 4). The adjusted parcel map was used as the base map for this Exhibit which illustrates the basin divides, ICPR nodal designations, and ICPR drainage structure/reach flowpaths.

1.6 ENGINEERING ANALYSIS

A detailed hydrologic/hydraulic engineering analysis was performed for the study area. This analysis included development of an extensive computer model to simulate/predict the hydrologic/hydraulic responses (e.g., runoff rates, flood stages and duration of flooding) of the existing drainage system during 24-hour duration rainfall events of 2.33- (mean annual), 10-, 25- and 100-year frequency.

1.6.1 Method of Analysis - Interconnected Channel and Pond Routing (ICPR)

The Interconnected Channel and Pond Routing model (ICPR, Version 1.4) developed by Streamline Technologies located in Winter Park, Florida was used to simulate synthetic storm events. This computer program continuously tracks rainfall rates, infiltration rates into the soil column, available storage capacity of the soil, surface flow rates throughout the study area, changes in surface storage, and flood levels as a function of time.

ICPR simulates single storm events utilizing a two-step process. The first step consists of a hydrologic analysis of the areas contributing stormwater runoff to various points of concentration within the drainage system. Although three (3) methods are available for computing runoff hydrographs within ICPR, the Soil Conservation Service (SCS) unit hydrograph approach was selected for investigation of the study area drainage system. The SCS method utilizes soil storage and infiltration rates to calculate stormwater runoff rates throughout a single storm event. SCS requirements include a rainfall distribution for the storm event being simulated and various parameters describing the physical features of the drainage sub-basins (e.g., drainage area, curve number, time of concentration, and peak rate factor).

The second step of the modeling process involves moving stormwater runoff through the various drainage systems within the study area. This is accomplished by hydrodynamically routing the runoff hydrographs computed in the first step through the drainage system. ICPR is used to model natural channels, prismatic channels and in-line ponds, as well as overbank flooding. Complex water control structures, culverts, drop structures, weirs, gates and orifices are included in a manner which enables simulation of discharge under time-varying tailwater conditions, including submerged and reverse flows. Water surface elevations and flow rates throughout the study area are calculated by ICPR during the storm event being analyzed.

Problem areas within each portion of the study area drainage system are identified within the **Existing Conditions** section of this report, based on level of service standards. Recommended improvements are also suggested, with anticipated results substantiated by the computer model.

1.6.2 Hydrology

1.6.2.1 Drainage Basin Identification

As mentioned previously, the Lakes McCoy, Coroni and Prevatt Drainage Basins are identified throughout this report as the "study area". This area was subdivided into eight (8) basins with respect to the significant water bodies and conveyance systems. In order to account for flood storage and peak rate attenuation upland of the major features, the basins were further divided into sub-basins. The following nomenclature was utilized to identify the seventy-two (72) sub-basins within the study area:

MS-*	refers to sub-basins which drain to the southern portion of Lake McCoy
DL-*	refers to sub-basins which drain to Dream Lake
BP-*	refers to sub-basins which drain to Buchan Pond
PA-*	refers to sub-basins which drain to the existing Park Avenue drainage system and stormwater pond located directly west of Lake McCoy on the north side of Votaw Road.
MN-*	refers to sub-basins which drain to the northern portion of Lake McCoy
LC-*	refers to sub-basins which drain to Lake Coroni
LP-*	refers to sub-basins which drain to Lake Prevatt
CB-*	refers to sub-basins which drain to Carpenter Branch

Refer to Exhibit No. 1 for a delineation of the study area drainage basins and sub-basins.

1.6.2.2 Topography

The topographic relief of the study area generally falls from the outer limits of the Basin toward Lakes McCoy, Coroni, and Prevatt. At the lakes, the elevations decrease from south to north. A high elevation of approximately 160 feet occurs in the southwestern portion of the study area. In contrast, the normal high water elevations reported in the Orange County Lake Index for Lakes McCoy, Coroni, and Prevatt are 61.5 feet, 58.4 feet, and 56.5 feet, respectively.

1.6.2.3 Soils

1.6.2.3.1 General

Hydrologic analysis of each sub-basin includes a thorough investigation of the soil types within the Basin. The investigation completed for this drainage basin study included the review of the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey for Orange County dated August 1989. Based upon information contained within the SCS Soil Survey, portions of the study area lie within four (4) general soil units. In general, the southern limits of the study area consist of Candler-Urban Land-Tavares; the middle portion of the study area, in the vicinity of the lake systems, consists of Tavares-Zolfo-Millhopper; a small portion of the study area west of Lake McCoy consists of Smyrna-Pomello-Immokalee; and the outer boundaries of the study area consist of Candler. These general soil groups are described within the SCS Soil Survey as follows.

> ***Candler***
>
> *This soil unit is characterized by "nearly level to strongly sloping, excessively drained soils that are sandy throughout.*
>
> *The soils in this map unit are in broad upland areas and on ridges. Lakes, ponds, and sinkholes are common is some areas. These soils are extensive in the northwest part of Orange County on the Mount Dora Ridge and the Lake Wales Ridge. They extend from the Lake County line to just south of the City of Apopka and south of Johns Lake to the Osceola County line.*
>
> *The natural vegetation is bluejack oak, live oak, and turkey oak. The understory includes chalky bluestem, lopsided indiangrass, hairy panicum, and pineland threeawn.*
>
> *Most soils in this map unit are used for citrus crops. In some areas, they are used for improved pasture or for homesite and urban development."*

Candler-Urban Land-Tavares

This soil unit is associated with "nearly level to strongly sloping, excessively drained and moderately well drained soils that are sandy throughout; many areas have been modified for urban use.

The soils in this map unit are in broad upland areas and on ridges. Lakes, ponds, and sinkholes are common is some areas. These soils are scattered in the western half of Orange County on the Mount Dora Ridge and the Orlando Ridge.

The existing natural vegetation is bluejack oak, live oak, and turkey oak. The understory includes chalky bluestem, lopsided indiangrass, hairy panicum, pineland threeawn and annual forbs.

Most of the acreage in this map unit is used for houses, large buildings, shopping centers, golf courses, and related urban uses. Part of the cities of Apopka and Orlando have been developed on the soils in this map unit. Natural vegetation thrives only in small areas scattered throughout the map unit. Farming is of little importance because of the extensive urban development. Numerous nurseries produce plants for landscaping."

Tavares-Zolfo-Millhopper series

Soils in this map unit are typically "nearly level to gently sloping, moderately well drained and somewhat poorly drained soils; some are sandy throughout and do not have a subsoil; some are sandy throughout and have an organic-stained subsoil; some are sandy to a depth of more than 40 inches and are loamy below.

The soils in this map unit are on low ridges and knolls in the upland areas and on the flatwoods, and they are in slightly higher areas adjacent to the flatwoods. Scattered sinkholes and numerous lakes and ponds are in this map unit. These soils are extensive in the western half of Orange County on the Mount Dora Ridge, the Orlando Ridge, and Lake Wales Ridge and in scattered areas of the Osceola Plain. Tavares and Millhopper soils are nearly level to gently sloping and are moderately well drained. Tavares soils are on low *ridges and knolls in upland areas. Millhopper soils are on low ridges and knolls on the flatwoods. Zolfo soils are nearly level and are somewhat poorly drained. They are in broad, slightly higher areas adjacent to the flatwoods.*

The natural vegetation is bluejack oak, turkey oak, live oak, water oak, laurel oak, slash pine, and longleaf pine. The understory includes creeping bluestem, lopsided indiangrass, grassleaf goldaster, and pineland threeawn.

In most areas, the soils in this map unit are used for citrus crops or pasture or for homesite and urban development. In some areas these soils are used for cultivated crops."

Smyrna-Pomello-Immokalee

This soil unit is indicative of "nearly level to gently sloping, poorly drained, and moderately well drained soils that are sandy throughout; some have an organic-stained subsoil at a depth of less than 30-inches; some have an organic-stained subsoil at a depth of 30 to 50-inches. They are on the flatwoods and on low ridges and knolls on the flatwoods.

The soils in this map unit are in the broad flatwood areas interspersed with low ridges and knolls. Shallow depressions and poorly defined drainageways are scattered throughout some areas. These soils are scattered throughout the county but are most extensive on the Osceola Plain in an area south and east of Union Park, in an area south of Lake Pickett, and in the area of Christmas extending north to the Seminole County line.

In areas of Smyrna and Immokalee soils, the natural vegetation is longleaf pine and slash pine. The understory includes saw palmetto, pineland threeawn, inkberry, and running oak. In areas of Pomello soils, the natural vegetation is mostly longleaf pine, sand pine, and slash pine. The understory includes wax myrtle, saw palmetto, fetterbush, creeping bluestem, chalky bluestem, pineland threeawn, and running oak.

In most areas, the soils in this map unit have been left in native vegetation. A few areas are used for cultivated crops, improved pasture, or citrus crops or for homesite and urban development."

1.6.2.3.2 Hydrologic Soil Classification (HSG)

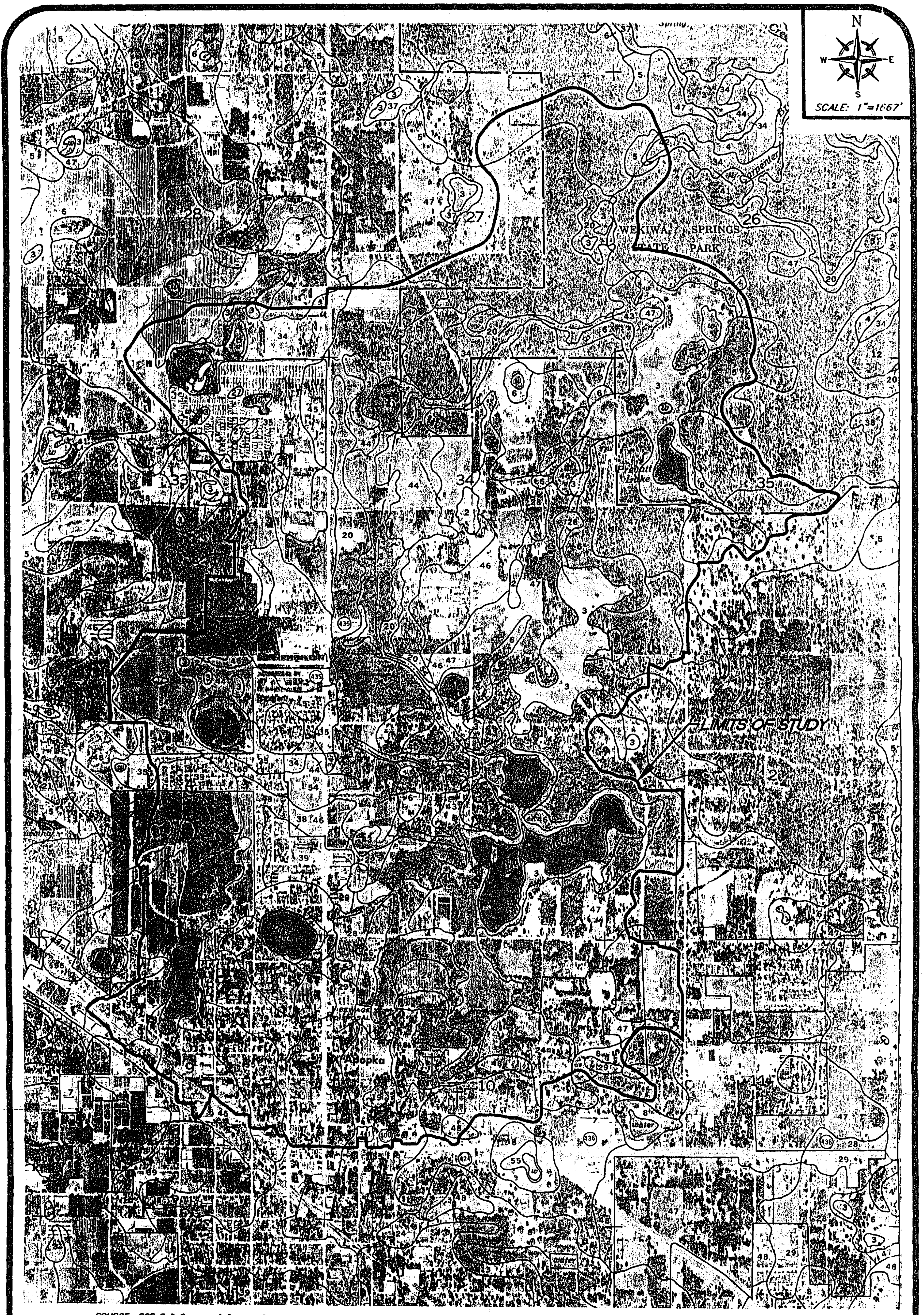
SCS classifies soils according to their runoff producing characteristics by one (1) of four (4) hydrologic soil groups (HSG), A, B, C, or D. The chief consideration is the inherent capacity of bare soil to permit infiltration. Slope and vegetative cover are not considered for soil hydrologic grouping, but they are utilized within the SCS Unit Hydrograph Method to predict runoff. Group A soils have high infiltration rates when thoroughly wet and a corresponding low runoff potential. Group A soils are primarily deep, well-drained sandy soils. Group D soils, by contrast, are soils characterized as having very slow infiltration rates and a corresponding high runoff potential. Typically, a clay layer, a permanent high water table, or shallow soils over nearly impervious bedrock are found at or near the surface.

It should be noted that several soil types are given a dual B/D hydrologic soil classification. In this case the first classification (B) applies to the drained condition when the groundwater table is well below the surface. The second classification (D) applies to the undrained condition, which would normally occur in a rural, flat basin during the wet season, when the groundwater table is at or near the ground surface. Urbanization tends to increase the depth to the water table through construction of storm sewers and ditches which reduce the amount of water supplying the shallow groundwater table. However, within this drainage basin study, the majority of the B/D group soils are within undeveloped areas, and therefore given a soil group D classification.

The SCS Soil Survey of Orange County (August 1989) annotated with the limits of the study area is provided as Figure 1-2. The individual soil types SCS has identified within the study area are tabulated in Table 1-1. This table also indicates the hydrologic soil group of each soil and the percentage of each soil group found within the study area.

1.6.2.4 Land Use

For the purpose of delineating land uses throughout the study area, PEC utilized the Florida Land Use, Cover and Forms Classification System (FLUCCS) developed by the Florida Department of Transportation (FDOT). In general, this land use, vegetation cover and land form classification system is arranged in hierarchical levels with each level containing subcategories of increasing specificity. The various categories and subcategories listed and defined therein reflect the types of data and information which can be extracted from aerial photography of various types and scales from the current generation of airborne and satellite imaging systems.



SOURCE: SCS Soil Survey of Orange County, Issued August 1989, Sheets 7 and 11

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FIGURE 1-2
SOIL CONSERVATION SERVICE SOIL SURVEY
LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

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ORANGE COUNTY, FLORIDA
P.N. : OC-070/1.0
(filename: OC-070TB.WK4)
DATE : 08-Jan-97
CHECKED : David W. Hamstra, P.E.
SUBJECT : TABULATION OF ON-SITE SOILS

TABLE 1-1

SOIL NUMBER	SOIL NAME	HYDROLOGIC SOIL GROUP	SOIL BREAKDOWN	
			AREA (ac)	PERCENT
1	Arents, nearly level	A		
2	Archbold fine sand, 0 to 5 percent slopes	A		
4	Candler fine sand, 0 to 5 percent slopes	A		
5	Candler fine sand, 5 to 12 percent slopes	A		
6	Candler-Apopka fine sand, 5 to 12 percent slopes	A		
7	Candler - Urban land complex, 0 to 5 percent slopes	A		
8	Candler - Urban land complex, 5 to 12 percent slopes	A		
24	Millhopper - Urban land complex, 0 to 5 percent slopes	A		
28	Florahome fine sand, 0 to 5 percent slopes	A		
29	Florahome - Urban land complex, 0 to 5 percent slopes	A		
38	St Lucie fine sand, 0 to 5 percent slopes	A		
39	St Lucie - Urban land complex, 0 to 5 percent slopes	A		
46	Tavares fine sand, 0 to 5 percent slopes	A		
47	Tavares - Millhopper fine sands, 0 to 5 percent slopes	A		
48	Tavares - Urban land complex, 0 to 5 percent slopes	A		
SUB-TOTAL	Type "A" Soils		2039.3	55.5%
22	Lochloosa fine sand	C		
34	Pomello fine sand, 0 to 5 percent slopes	C		
35	Pomello - Urban land complex, 0 to 5 percent slopes	C		
43	Seffner fine sand	C		
54	Zolfo fine sand	C		
55	Zolfo - Urban land complex	C		
SUB-TOTAL	Type "C" Soils		686.8	18.7%
15	Felda fine sand, frequently flooded	B/D		
19	Hontoon Muck	B/D		
20	Immokalee fine sand	B/D		
27	Ona - Urban land complex	B/D		
37	St. Johns fine sand	B/D		
40	Samsula Muck	B/D		
41	Samsula-Hontoon-Basinger assoc., depressional	B/D		
42	Sanibel Muck	B/D		
44	Smyrna fine sand	B/D		
45	Smyrna - Urban land complex	B/D		
SUB-TOTAL	Type "B/D" Soils		444.5	12.1%
3	Basinger fine sand, depressional	D		
16	Floridana fine sand, frequently flooded	D		
SUB-TOTAL	Type "D" Soils		502.6	13.7%
TOTALS			3673.2	100.0%

Source: USDA SCS Soil Survey of Orange County
Issued August 1989
Sheets 7 and 11

In order to implement the FDOT land use, cover and forms classification system, the land use within each Basin was delineated utilizing the following sources:

1) Orange County aerial topographic maps dated April 1993 (1 inch equals 200 feet);
2) SJRWMD aerial topographic maps dated December 1990 (1 inch equals 200 feet);
3) Orange County aerial tax maps dated February 1994 (1 inch equals 300 feet);
4) The aerial raster map for the study area dated Spring 1995; and
5) The adjusted parcel map.

The delineation of land uses within each Basin was both verified and supplemented through field investigation where sufficient detail was not provided by the aerial maps. The results contained within the completed drainage basin study reflect the land uses which were prevalent within the Basin at the time of the study. Thus, in the future, it will be possible, and may be necessary, to ascertain changes to systems which could have resulted from a change in land use within each Basin.

The existing land uses within the study area are depicted on the Existing Land Use Map (Exhibit No. 2). A breakdown of the individual land uses identified within the study area is provided in Table 1-2. This table also indicates the percentage of each land use found within the study area. Table 1-3 indicates the correlation between land use, soil type and curve number.

1.6.2.5 Basin Areas and Curve Numbers

The data takeoff function was largely automated through the use of VALENCE, a computer program developed by Streamline Technologies located in Winter Park, Florida. This program allows easy manipulation of large geographically dependent databases. Existing land use, soils, and drainage basins are digitized, or sent electronically, to the computer and then processed by VALENCE which stores the data files for subsequent manipulation. Each information type is stored as a separate layer and registered to State Plane coordinates.

Land use, soil, and drainage basin delineation data is initially entered into the database as a system of lines. These lines connect at various points and form polygons which are identified by "seeding" them with identification names. For example, a series of lines are used to outline the drainage divides for a particular basin. A name is then placed within this polygon which uniquely identifies the basin. VALENCE converts line and polygon information into a system of small cells, the size of

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ORANGE COUNTY, FLORIDA
P.N. : OC-070/1.0
(filename: OC-070TB.WK4)
DATE : 08-Jan-97
CHECKED : David W. Hamstra, P.E.
SUBJECT : TABULATION OF FDOT LAND USE CLASSIFICATION

TABLE 1-2

FDOT LAND-USE CLASSIFICATION NUMBER	FDOT LAND-USE CLASSIFICATION DEFINITION	LAND USE BREAKDOWN	
		AREA (ac)	PERCENT
111A	Residential, Low Density, < 2 DU/Acre, Fixed Single Family Units, 2-Acre Lots	78.1	2.1%
111B	Residential, Low Density, < 2 DU/Acre, Fixed Single Family Units, 1-Acre Lots	137.7	3.7%
111C	Residential, Low Density, < 2 DU/Acre, Fixed Single Family Units, 1/2-Acre Lots	387.9	10.6%
121A	Residential, Medium Density, 2 - 5 DU/Acre, Fixed Single Family Units, 1/3-Acre Lots	248.5	6.8%
121B	Residential, Medium Density, 2 - 5 DU/Acre, Fixed Single Family Units, 1/4-Acre Lots	124.2	3.4%
121C	Residential, Medium Density, 2 - 5 DU/Acre, Fixed Single Family Units, 1/5-Acre Lots	178.2	4.9%
122	Residential, Medium Density, 2 - 5 DU/Acre, Mobile Home Units, 1/5-Acre Lots	9.3	0.3%
131	Residential, High Density, > 6 DU/Acre, Fixed Single Family Units, 1/8-Acre Lots	11.4	0.3%
132	Residential, High Density, > 6 DU/Acre, Mobile Home Units, 1/8-Acre Lots	99.7	2.7%
133	Residential, High Density, > 6 DU/Acre, Multiple Dwelling Units, 1/4-Acre Lots	26.0	0.7%
140	Commercial & Services	82.3	2.2%
148	Cemeteries	28.8	0.8%
171	Educational Facilities	43.6	1.2%
172	Religious	12.1	0.3%
174	Medical and Health Care	21.5	0.6%
175	Governmental	16.2	0.4%
186	Community Recreational Facilities	59.0	1.6%
191	Undeveloped Land within Urban Areas	73.2	2.0%
211	Improved Pasture	71.9	2.0%
212	Unimproved Pasture	47.1	1.3%
213	Woodland Pasture	71.0	1.9%
221	Citrus Groves (active)	1.8	0.0%
240	Nursery	121.5	3.3%
320	Shrub and Brushland	56.9	1.5%
330	Mixed Rangeland	12.6	0.3%
400	Upland Forest, Tree Canopy > 50%	954.9	26.0%
510	Streams and Waterways	3.9	0.1%
520	Lakes	283.0	7.7%
530A	Reservoirs (Dry Stormwater Ponds)	18.0	0.5%
530B	Reservoirs (Wet Stormwater Ponds)	34.1	0.9%
600	Wetlands	132.2	3.6%
740	Disturbed Land	0.7	0.0%
813	Bus and Truck Terminals	7.7	0.2%
814A	Roads and Highways (Paved)	178.1	4.8%
814B	Roads and Highways (Unpaved)	18.5	0.5%
817	Long Distance Gas Transmission Lines (easement)	10.7	0.3%
831	Electrical Power Facilities (substation)	9.3	0.3%
833	Water Supply Plants	1.4	0.0%
834	Wastewater Treatment Plants	0.2	0.0%
TOTALS		3673.2	100.0%

SOURCE: Florida Land Use, Cover, and Forms Classification System
Florida Department of Transportation (FDOT)
September 1986

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ORANGE COUNTY, FLORIDA
P.N. : OC-070/1.0
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DATE : 08-Jan-97
CHECKED : David W. Hamstra, P.E.
SUBJECT : TABULATION OF RUNOFF CURVE
NUMBERS BASED ON EXISTING LAND USE

TABLE 1-3

FDOT LAND USE CLASSIFICATION		SCS COVER DESCRIPTION	CURVE NUMBER FOR HYDROLOGIC SOIL GROUP (1)			
NUMBER	DEFINITION		A	B	C	D
111A	Residential <2 DU/ac Fixed Single Family	2 acre lot	46	65	77	82
111B	Residential <2 DU/ac Fixed Single Family	1 acre lot	51	68	79	84
111C	Residential <2 DU/ac Fixed Single Family	1/2 acre lot	54	70	80	85
121A	Residential 2-5 DU/ac Fixed Single Family	1/3 acre lot	57	72	81	86
121B	Residential 2-5 DU/ac Fixed Single Family	1/4 acre lot	61	75	83	87
121C	Residential 2-5 DU/ac Fixed Single Family	1/5 acre lot	65	78	85	88
122	Residential 2-5 DU/ac Mobile Home Units	1/5 acre lot	65	78	85	88
131	Residential >6 DU/ac Fixed Single Family	1/8 acre lot	77	85	90	92
132	Residential >6 DU/ac Mobile Home Units	1/8 acre lot	77	85	90	92
133	Multiple Dwelling Units	1/4 acre lot	61	75	83	87
140	Commercial and Services	commercial and business	89	92	94	95
148	Cemeteries	open space (good cond.)	39	61	74	80
171	Educational Facilities	(2)	69	80	86	89
172	Religious	(2)	69	80	86	89
174	Medical and Health Care	(3)	80	87	91	93
175	Govenmental	commercial and business	89	92	94	95
186	Community Recreational Facilities	(4)	42	63	75	81
191	Undeveloped Land within Urban Areas	open space (good cond.)	39	61	74	80
211	Improved Pasture	pasture, good cond.	39	61	74	80
212	Unimproved Pasture	pasture, good cond.	39	61	74	80
213	Woodland Pasture	pasture, good cond.	39	61	74	80
221	Citrus Grove (active)	woods/grass, fair cond.	43	65	76	82
240	Nursery	(2)	69	80	86	89
320	Shrub and Brushland	brush, good cond.	30	48	65	73
330	Mixed Rangeland	range, good cond	39	61	74	80
400	Upland Forest	woods, good cond.	30	55	70	77
510	Streams and Waterways	N/A	100	100	100	100
520	Lakes	N/A	100	100	100	100
530A	Reservoirs (Dry Stormwater Ponds)	grass, good cond.	39	61	74	80
530B	Reservoirs (Wet Stormwater Ponds)	N/A	95	95	95	95
600	Wetlands	wetlands (5)	98	98	98	98
740	Disturbed Land	open space (poor cond.)	68	79	86	89
813	Bus and Truck Terminals	open space (poor cond.)	68	79	86	89
814A	Roads and Highways (Paved)	(2)	69	80	86	89
814B	Roads and Highways (Unpaved)	dirt	72	82	87	89
817	Long Distance Gas Transmission Lines (esmt.)	open space (good cond.)	39	61	74	80
831	Electrical Power Facilities (substation)	(2)	69	80	86	89
833	Water Supply Plants	(2)	69	80	86	89
834	Wastewater Treatment Plants	(2)	69	80	86	89

NOTES:

1 – Technical Release 55, Soils Conservation Service, June 1986 (second edition)
2 – Based on 50% impervious area and 50% grass cover, good condition
3 – Based on 70% impervious and 30% grass cover, good condition
4 – Based on 5% impervious and 95% grass cover, good condition
5 – Technical Publication #85-5, Table 2 (SJRWMD, July 1985)

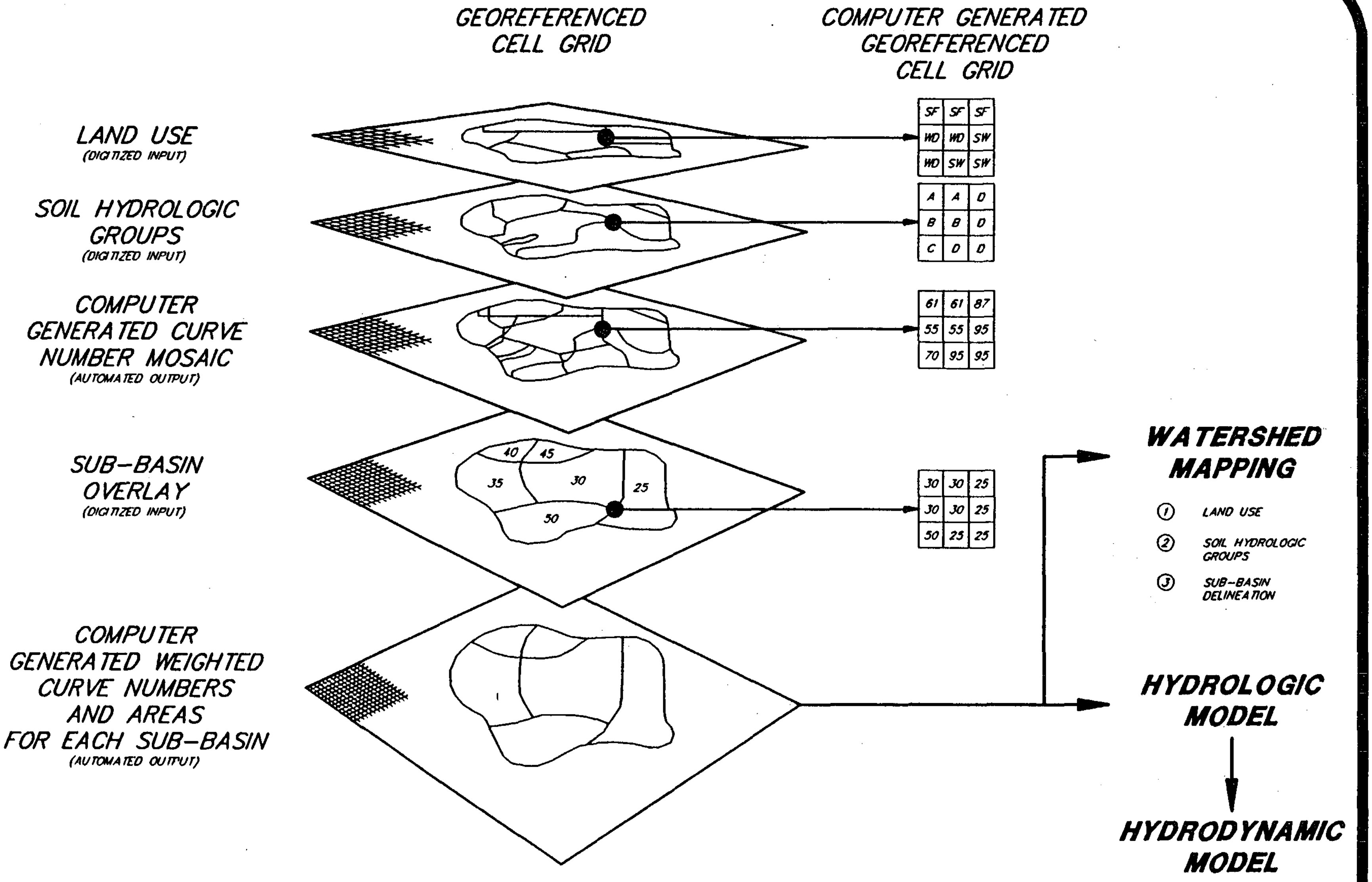
which are defined by the user. In the case of this drainage basin study, each cell was only five (5) feet long by five (5) feet wide (i.e., 25 square feet in area) and tied to a fixed position on the ground. Attributes for drainage basins, soil types and land uses were assigned to each cell in the database.

Once the line and polygon "seeds" are converted to cells, VALENCE can manipulate the data in a number of ways. Areas can be calculated by simply adding cells with similarly defined attributes. The total number of cells is then multiplied by the cell area (i.e., 25 square feet) to obtain the area of the basin. In addition to area breakdowns, VALENCE can perform area-weighted averages.

By superimposing drainage basins with soil and land use delineations, VALENCE can calculate weighted runoff curve numbers for each drainage basin. Areas and curve numbers can be sent directly to computer data files for subsequent hydrograph generation. A schematic of this process is represented on Figure 1-3 Each cell has a land use designation as well as a soils designation. VALENCE is instructed to retrieve land use information from a particular cell in one layer and soils information from the same cell in another layer. The program utilizes these two (2) pieces of information to determine the corresponding curve number from a separate table which correlates curve numbers for different land uses and soil types. Each basin is comprised of thousands of cells, each having a different curve number. VALENCE utilizes these individual cells to automatically calculate the average runoff curve number for the entire basin. When combined with the soils information tabulated in Table 1-1, Tables 1-2 and 1-3 provide all the information required by VALENCE to calculate the weighted runoff curve numbers. Refer to Volume II, Section 1 of this report for VALENCE print-outs of computed drainage areas and weighted runoff curve numbers under existing conditions.

1.6.2.6 Time of Concentration

In addition to basin drainage area and curve number, the time of concentration is utilized within the SCS Unit Hydrograph Method to determine runoff rates. Times of concentration are computed by determining the path of longest travel time within each of the delineated basins. Flow velocities are estimated from land slopes and land cover conditions. By definition, the time of concentration is the time it takes runoff to travel from the hydraulically most distant part of a watershed to a point of



SF	SF	SF
WD	WD	SW
WD	SW	SW

A	A	D
B	B	D
C	D	D

61	61	87
55	55	95
70	95	95

30	30	25
30	30	25
50	25	25

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FIGURE 1-3

RUNOFF CURVE NUMBERS AND AREAS WITH VALENCE

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ORANGE COUNTY, FLORIDA

interest within the watershed, and is typically composed of segmented travel times. The equation for the cumulative basin time of concentration is as follows:

$$T_c = T_1 + T_2 + \ldots + T_n$$

where:

T_c = *the time of concentration in minutes*
$T_1, T_2, \ldots T_n$ = *travel times in minutes along consecutive flow path segments, which differ by land cover category or flow path slope.*

Travel times for this drainage basin study will be estimated using two (2) methods as outlined in the SCS TR-55 manual (Second Edition, June 1986). The first method will consist of the application of the kinematic wave equation for sheet flow for the first 300 feet of overland flow path. The kinematic wave equation and definition of the variables within the equation are provided below.

$$\text{Time of Travel (hr)} = \frac{0.007\ (nL)^{0.8}}{(P_2)^{0.5}\ (S)^{0.4}}$$

where:

n = *Manning's Roughness Coefficient*
L = *Overland Flow Length in feet (maximum of 300 feet)*
P_2 = *2-year, 24-hour rainfall in inches*
S = *Land Slope in foot/foot*

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The shallow concentrated flow equation and definition of the variables within the equation are provided below.

$$\text{Travel Time (hr)} = \frac{L}{3600V}$$

Where:

L = *Overland Flow Length in feet*
V = *Average Velocity in feet per second (TR-55, Figure 3-1)*
3600 = *Conversion Factor from seconds to hours*

For specific cases where the time of concentration calculation also includes a travel time component consisting of pipe and/or ditch flow an average velocity based upon the type of reach (i.e., ditch or pipe) was assumed. When combined with the distance for the flow path, the travel time was computed. It should be noted that compared to the travel time computed for overland flow paths, this component of the total time of concentration is normally negligible.

1.6.2.7 Rainfall Distribution, Rainfall Depth, and Peaking Factor

A unit hydrograph is the runoff response of a given basin (in terms of runoff rate versus time) that would result from one inch of rainfall excess (ie, runoff). This assumption is predicated on the fact that each basin has a characteristic unit hydrograph that is a unique function of its physical configuration. The unit hydrograph method requires that the rainfall event be divided into discrete increments over fixed time intervals. Infiltration is subtracted at each incremental value, with the remaining value representing the rainfall excess (runoff). Each rainfall excess increment is then applied to the basin's unit hydrograph to obtain a response for the discrete time interval. Responses for all rainfall increments are then distributed in sequence to produce a basin runoff hydrograph.

To implement this procedure, a rainfall distribution must be specified for the desired storm event as a function of time for the basin's unit hydrograph. The St. Johns River Water Management District (SJRWMD) allows several methods for distributing rainfall throughout the duration of the design storm. Amongst the accepted methods, SJRWMD typically allows the use of rainfall distributions specified by local government entities. The City of Apopka Land Development Code does not indicate a rainfall distribution; however, the City defers to SJRWMD criteria for much of the design of stormwater management systems. Orange County specifies that the rainfall distribution is to be in accordance with the distribution adopted and published by the County. In order to satisfy all of the above agencies, the Orange County rainfall distribution was selected for all computer simulations conducted as part of this drainage basin study. Graphical representations of the Orange County rainfall distribution in the form of a dimensionless distribution and a hyetograph for a 24-hour storm event are shown on Figures 1-4 and 1-5, respectively.

Rainfall amounts for storm frequencies of 24-hour duration were taken from both the Orange County Subdivision Regulations and the St. Johns River Water Management District (SJRWMD) isopluvial maps for the Central Florida area, and are tabulated within Table 1-4.

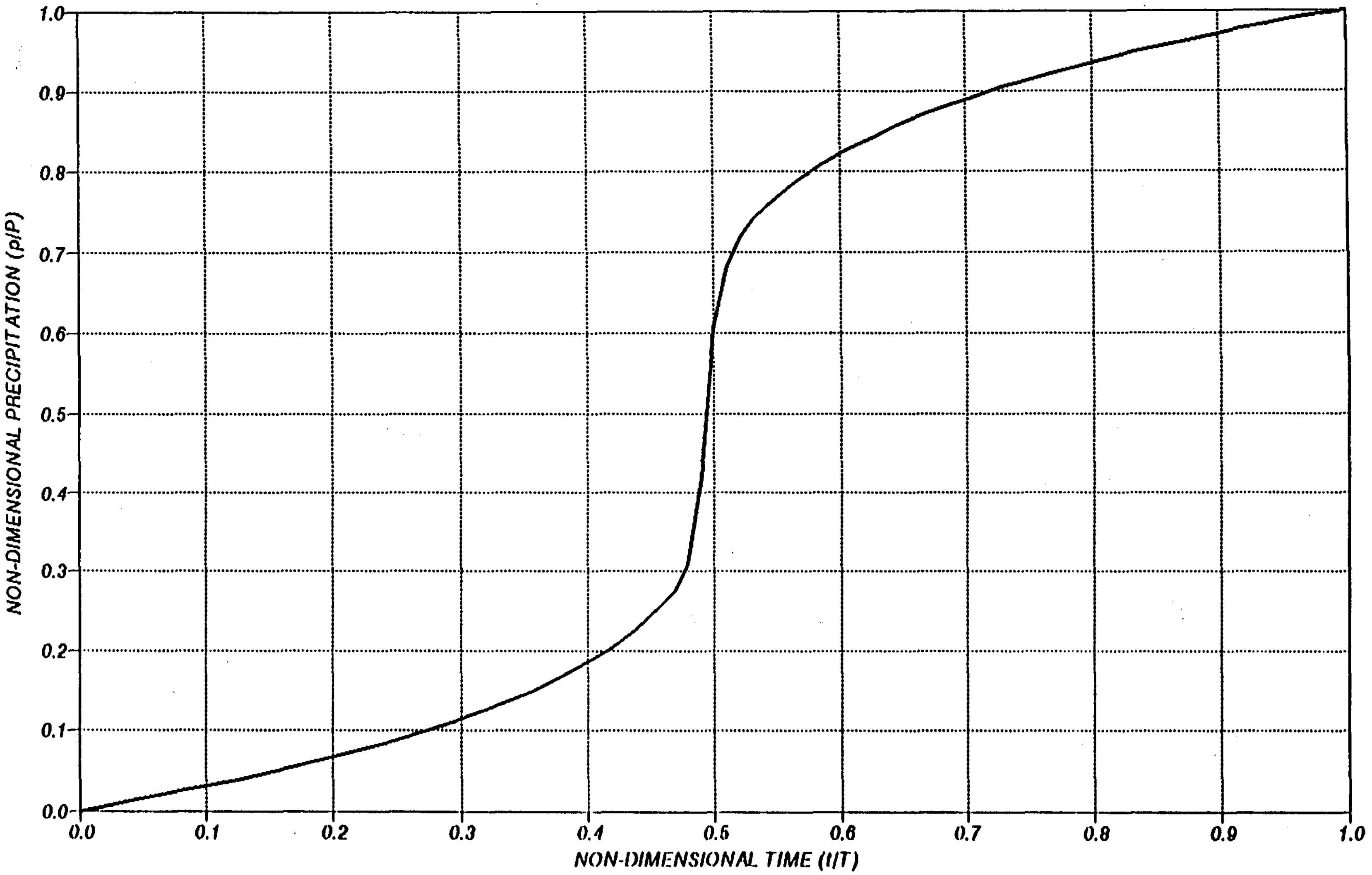

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FIGURE 1-4
ORANGE COUNTY RAINFALL DISTRIBUTION
LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

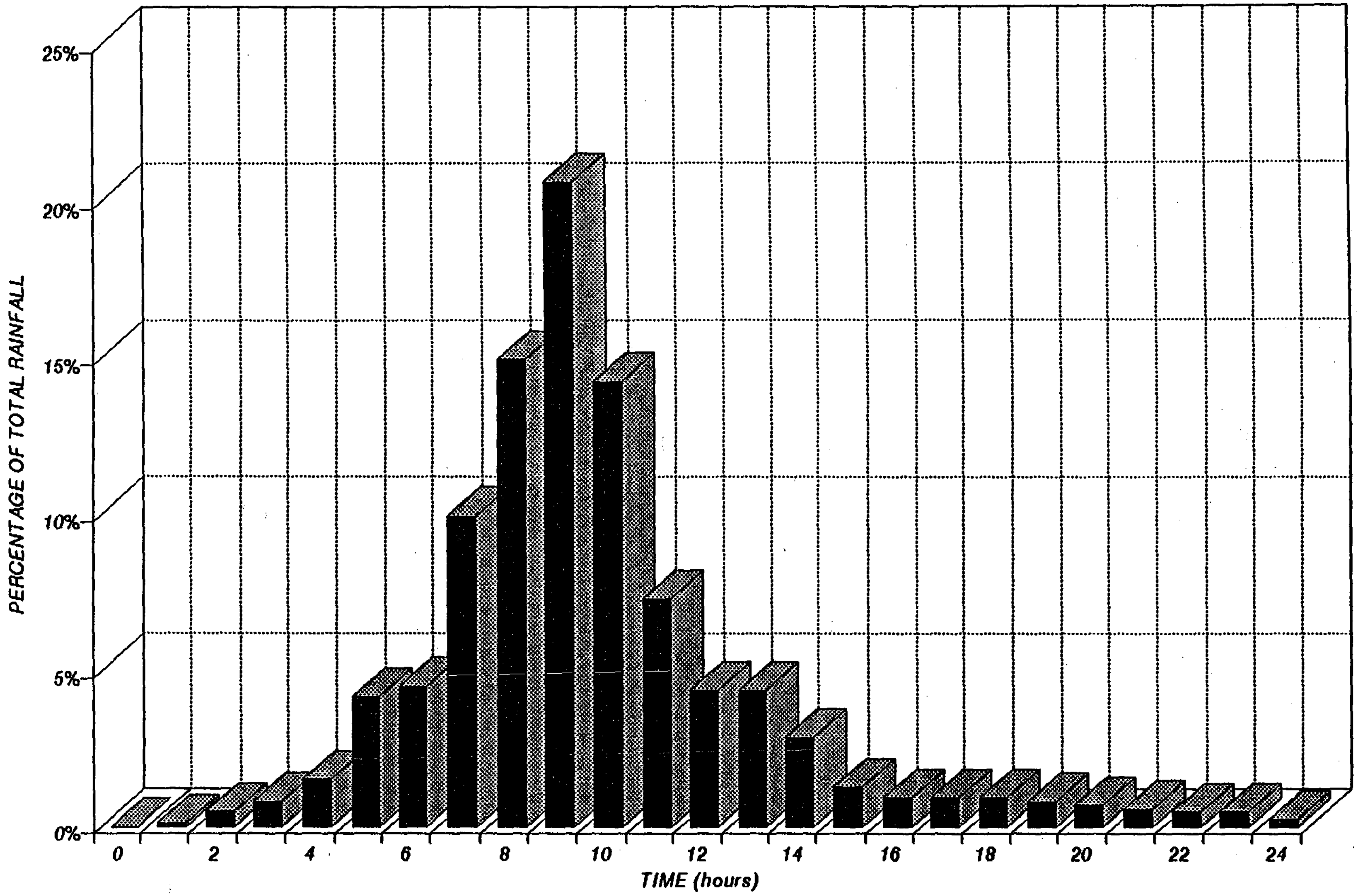

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FIGURE 1-5
ORANGE COUNTY 25-YEAR, 24-HOUR HYETOGRAPH
LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

Table 1-4
Design Storm Event Rainfall Depths

Frequency	*Duration*	*Rainfall Amount*	*Source*
2.33-Year	*24-Hour*	*4.5 inches*	*SJRWMD*
10-Year	*24-Hour*	*7.5 inches*	*Orange County*
25-Year	*24-Hour*	*8.6 inches*	*Orange County*
100-Year	*24-Hour*	*10.6 inches*	*Orange County*

For this drainage basin study, peak rate factors (K) of 256, 323 and 484 were used in conjunction with the SCS unit hydrograph method. Graphical representations of the 256, 323 and 484 peak rate factors are shown on Figures 1-6,1-7, and 1-8, respectively, while Table 1-5 provides a summary for the selection of appropriate peak rate factors, as contained within a document entitled "Procedure For Selection of SCS Peak Rate Factors For Use in MSSW Permit Applications", St. Johns River Water Management District (SJRWMD), April 1990.

Table 1-5
SCS Peak Rate Factors

Site Conditions	*Peak Factor K*
Represents watersheds with very mild slopes, recommended by SCS for watersheds with average slope of 0.50 percent or less. Significant surface storage throughout the watershed. Limited on-site drainage ditches. Typical ecological communities include: North Florida flatwoods, freshwater marsh and ponds, swamp hardwoods, cabbage palm flatlands, cypress swamp and similar vegetative communities.	*256-284*
Intermediate peak rate factor representing watersheds with moderate surface storage in some locations due to depressional areas, mild slopes and/or lack of existing drainage features. Typical ecological communities include: Oak Hammock, upland hardwood hammock, mixed hardwood and similar vegetative communities.	*323*
Standard peak rate factor developed for watersheds with little or no surface storage. Represents watersheds with moderate to steep slopes and/or significant drainage works. Typical ecological communities include: Long leaf pine, turkey oak hills and similar vegetative communities.	*484*

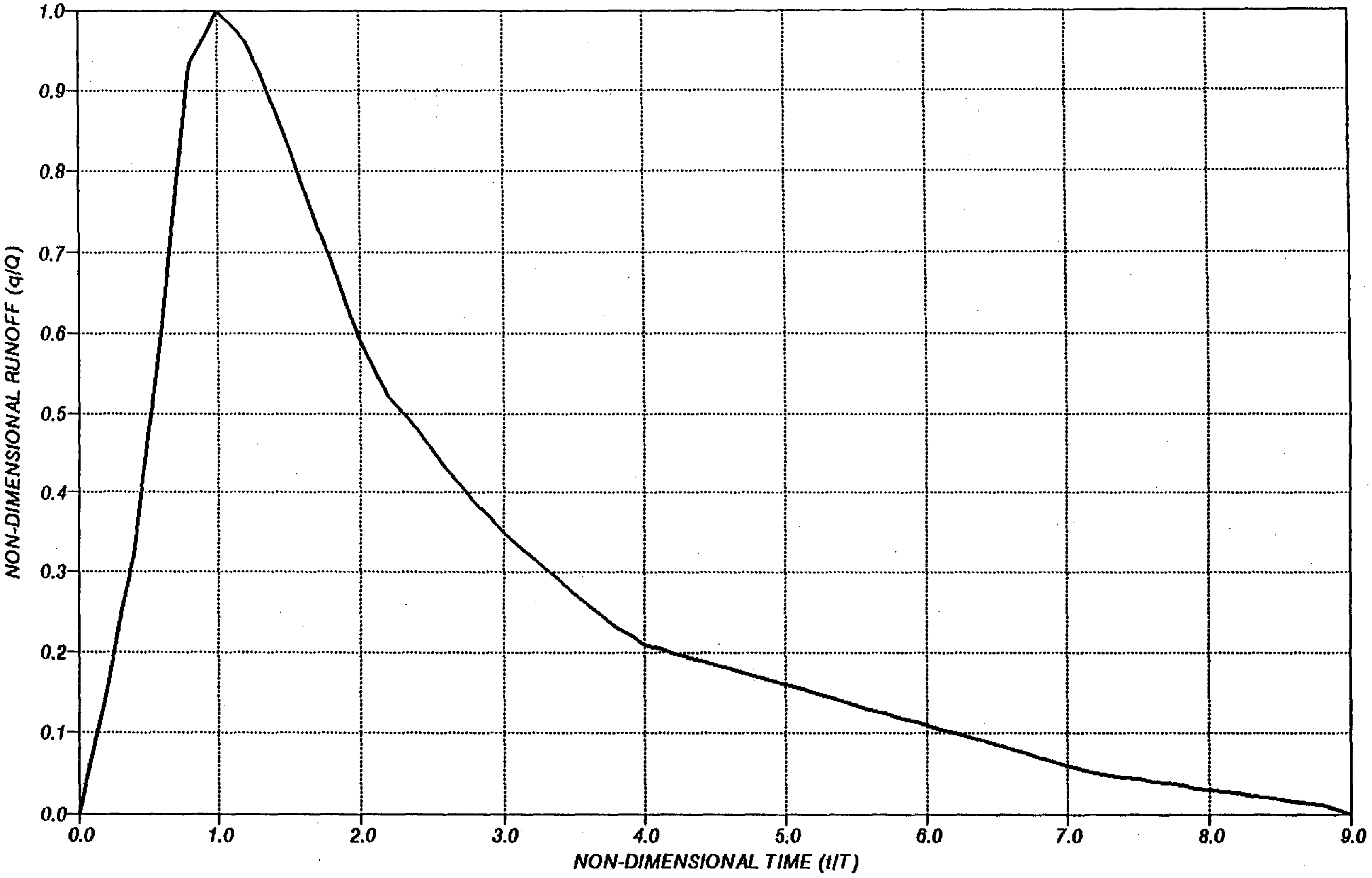

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FIGURE 1-6
SCS UNIT HYDROGRAPH - 256 PEAKING FACTOR

LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

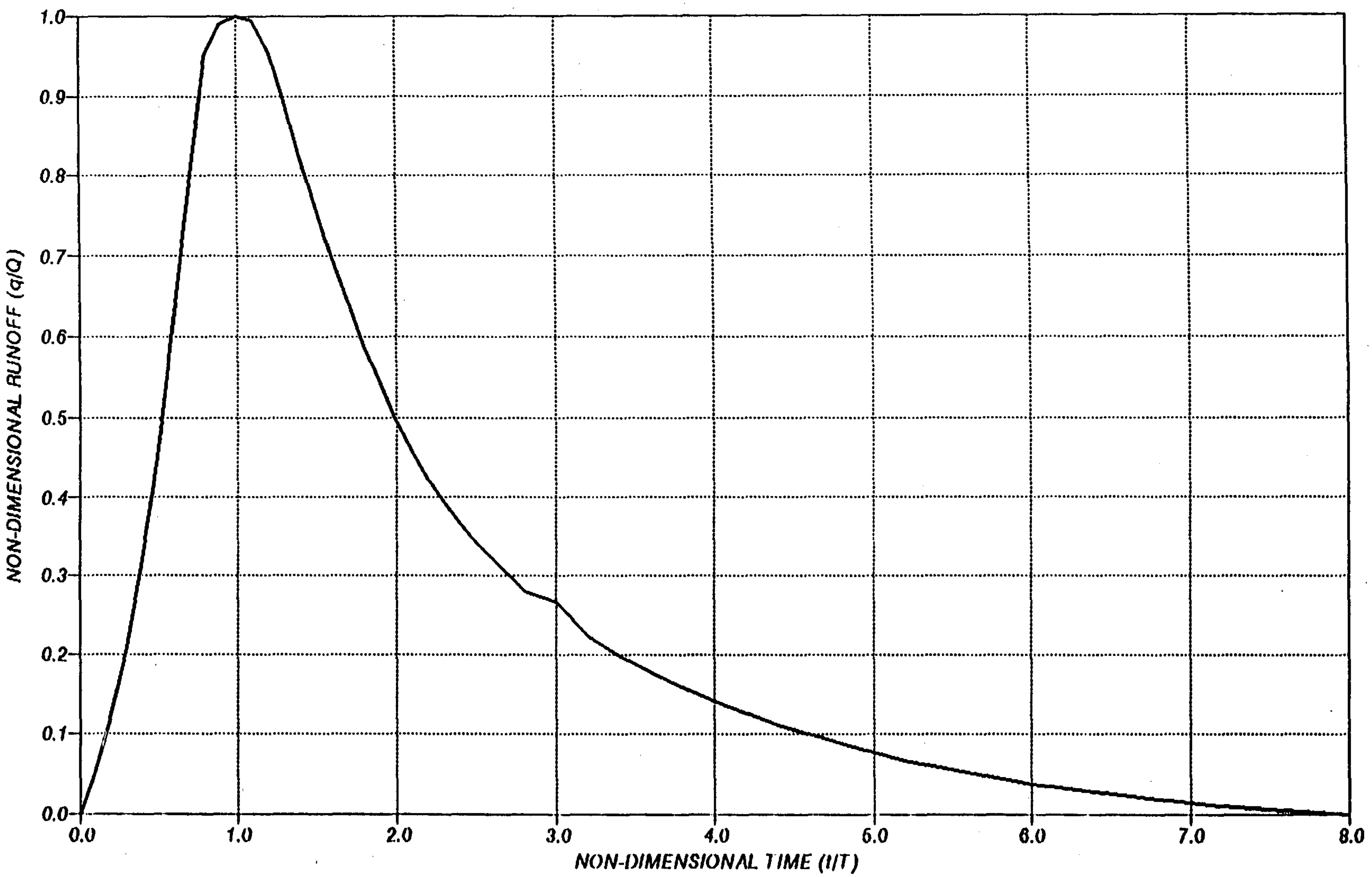

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FIGURE 1-7
SCS UNIT HYDROGRAPH – 323 PEAKING FACTOR
LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

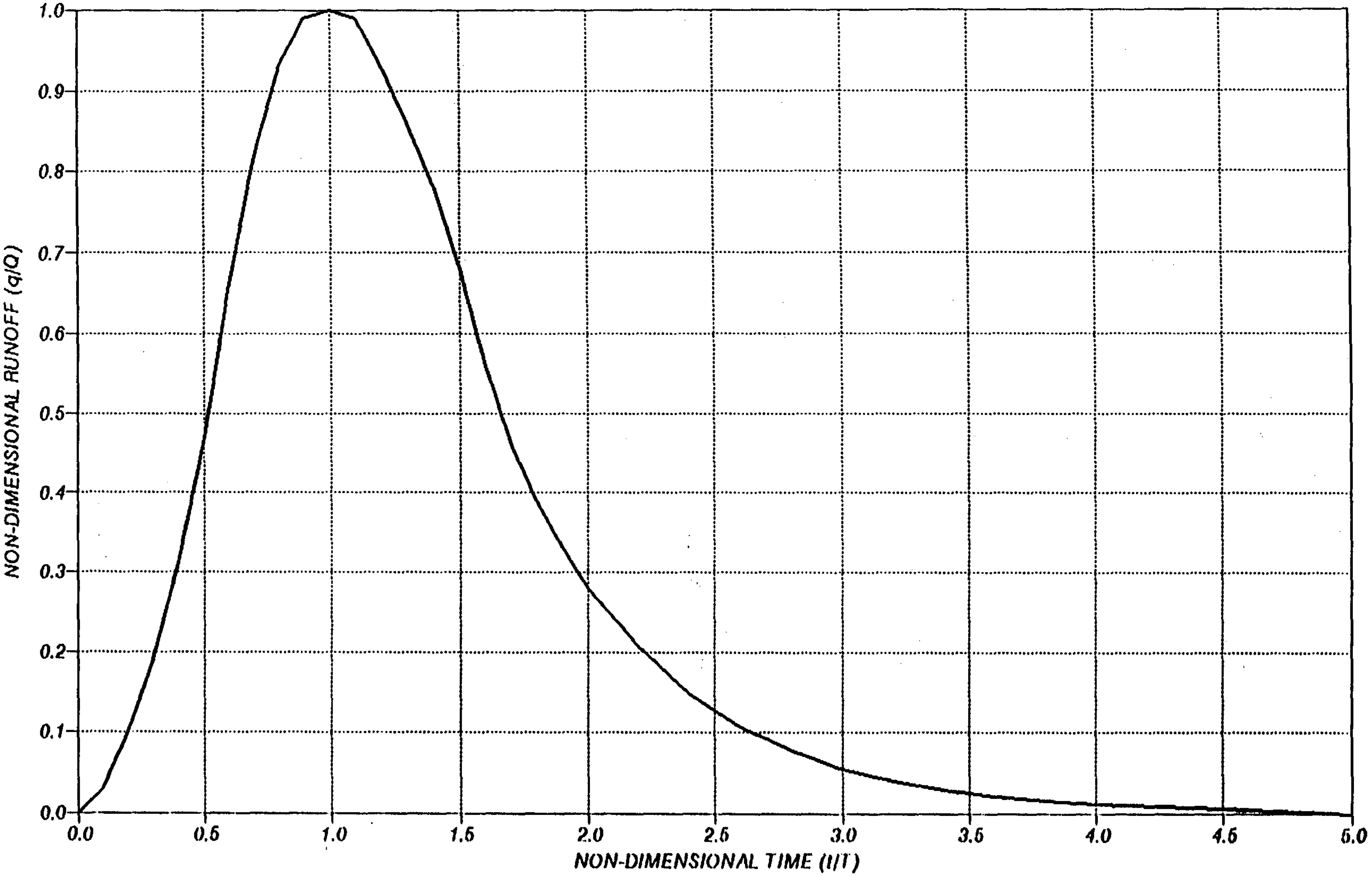

FIGURE 1-8
SCS UNIT HYDROGRAPH – 484 PEAKING FACTOR

LAKES McCOY, CORONI AND PREVATT
DRAINAGE BASIN STUDY

1.6.3 Hydraulics

1.6.3.1 Interconnected Channel and Pond Routing (ICPR)

As mentioned previously, ICPR was used to simulate the hydrodynamic behavior of the study area drainage system. This model requires a spatial network consisting of nodes and reaches. Nodes are used to identify specific locations along a drainage system for which stage elevations are to be computed. They can also be used to identify ponds, lakes or other depressions in the system (e.g., wetlands) within which impounding of water (storage) occurs. Data requirements for nodes include initial elevations and stage-area, or stage-storage, relationships for any location where impounding of water occurs.

Initial stages were estimated from field surveys, from water surface elevations shown on aerial photogrammetry, from the Orange County Lake Index, from construction plans, or assumed. Water control structures and culverts were also utilized as guidelines for estimating initial elevations. The method used to determine the initial water elevation for each sub-basin is discussed in the sub-basin descriptions in Section 2 of this report.

Stage-area relationships for most depressions and lakes within this drainage basin study were planimetered from the Orange County and SJRWMD aerial topographic maps. Stage-area or Stage-storage relationships for most stormwater ponds within this drainage basin study were taken from construction plans and/or drainage calculations. Otherwise, the relationships were estimated based upon the information available.

Reaches are used to connect nodes, thus providing connections where water is to flow. Types of reaches allowed by ICPR include trapezoidal, parabolic and irregular section channels; weirs, gates and orifices; culverts; drop (control) structures; and various types of rating curves. Numerous geometric configurations can be used to simulate weirs and culverts including circular, elliptical, arch and rectangular cross sections. ICPR allows for the construction of very complex networks through the use of the various reaches described above. Looped systems, as well as diverging (e.g., flow leaving a single node in two (2) or more different directions) systems, can also be modeled. ICPR solves the equations of flow for the entire network at each time step in the simulation. This approach allows realistic influences of tailwater, on both structure and channel hydraulics, and also provides for the dynamic allocation of flood plain storage. This aspect is critical for systems with storage and tailwater influenced characteristics similar to the study area drainage system.

The data required to adequately describe the major structural features within the study area was obtained from a variety of sources. The primary sources of reach information were the construction plans and/or drainage calculations amassed during the data collection phase of the project. In several instances information regarding a specific reach varied amongst the sources. In which case, observations made during the field reviews were used as a guide in determining which data to use. Where information was otherwise unavailable, survey data was collected by the survey subconsultant, Jones, Hoechst & Associates, Inc., or by the Orange County Survey Department. Items surveyed included culverts, weirs, control structures, roadway profiles, and channel cross sections. For channel reaches, manning's roughness coefficients ("n") were determined from field inspections.

Boundary conditions (i.e., tailwater relationships) can also be specified at node locations by assigning a stage-time relationship in lieu of a stage-area, or stage-storage, relationship. Typically, this boundary condition represents the primary outfall from the Basin, or the terminus of the hydraulic analysis. The boundary condition for this particular study is discussed below.

1.6.3.2 Boundary Condition

The terminus of this drainage basin study is the existing double 36-inch culverts at the intersection of Carpenter Branch and the old railroad bed northeast of Lake Prevatt. The boundary condition (i.e., tailwater relationship) downstream of this reach was assumed as a constant tailwater elevation of 48.1 feet, which corresponds to the crown of the existing pipes at the outlet end. This assumption of a constant tailwater elevation is predicated on the following facts:

- *the existing topography downstream of the abandoned railroad bed (terminus of study area) is steep enough that an impedance of flow at the outlet end of the culverts will not occur;*
- *the twin 36-inch culverts under the abandoned railroad bed (terminus of study area) operate under an inlet controlled scenario, due to their conveyance capacity relative to the design discharge at this point; and*
- *a sensitivity analysis was performed to determine the impact a varying tailwater elevation will have upon the study area drainage system. The results of this analysis indicate that the study area drainage system is independent of the tailwater elevation downstream of the existing twin 36-inch culverts under the abandoned railroad bed (terminus of study area).*

1.6.3.3 Channel Rating Curves

In order to accurately simulate the conveyance characteristics of four (4) of the channels within the study area, a program entitled HEC-RAS (River Analysis System), Version 1.1 was utilized. HEC-RAS was developed at the Hydrologic Engineering Center (HEC) by the U.S. Army Corps of Engineers as a part of the HEC's "Next Generation" (NEXGEN) of hydrologic and hydraulic engineering software. HEC-RAS was designed specifically to develop Steady and Unsteady flow water surface profiles for natural and man-made channels, taking into account obstructions and hydraulic structures within the channels such as bridges, piers, culverts, weirs, etc. The program is also capable of utilizing movable boundary conditions to simulate sediment transport. HEC-RAS is also fully capable of conducting mixed flow regime computations (i.e., hydraulic jumps), modeling of multiple bridge openings, and the evaluation of floodway encroachments for flood insurance studies. The program utilizes a graphical user interface (Windows) to allow the user to interact with the program. HEC-RAS was used primarily to determine a stage versus discharge relationship (rating curve) for the four (4) channels evaluated. It was also used to perform sensitivity analyses of each channel to determine the degree to which the water surface profile is dependant upon tailwater conditions. In each of the cases modeled using HEC-RAS, the water surface profile proved to be dependant upon the conveyance capacity of the channel cross section as opposed to tailwater. Thus, the rating curve results from HEC-RAS were useful for input directly into ICPR. Modeling of these channels in this manner not only provides more accurate results of the water surface profile within the channel, but also produced computational stability and greatly reduced the time required to perform the ICPR simulations.

Stage versus discharge relationships were used within the ICPR model to simulate the following channel reaches:

- *Carpenter Branch outfall channel from Lake Prevatt,*
- *the outfall channel from the Parkview Subdivision,*
- *the channel which transects the northwest corner of the Wekiva Glen Subdivision, and*
- *the outfall channel from the wetland south of Welch Road and east of Rock Springs Road.*

Refer to Volume II, Section 2 of this report for copies of the HEC-RAS analyses. More detailed descriptions of each of these channel reaches are provided in Section 2 of this report.

1.6.3.4 Node and Reach Designations

The nodes (drainage structures and water bodies) and reaches (conveyance systems) identified within this drainage basin study are designated by an eight (8) digit alpha-numeric coding system as follows:

ICPR Node/Reach	*LC01N01W*	*References primary drainage basin nomenclature as previously discussed (i.e., in this case Lake Coroni).*
ICPR Node/Reach	*LC01N01W*	*References Sub-Basin 01 of the primary drainage basin (i.e., in this case Lake Coroni).*
ICPR Node/Reach	*LC01N01W*	*"N" specifies a node within ICPR, whereas, "R" specifies a reach within ICPR.*
ICPR Node/Reach	*LC01N01W*	*Specifies node or reach number within ICPR.*
ICPR Node/Reach	*LC01N01L*	*Specifies node type with ICPR as indicated below.*
	LC01R01C	*Specifies reach type within ICPR as indicated below.*

REACHES		*NODES*
B = Bridge (natural channel bottom)	*S = Pond control structure*	*D = Dummy*
C = Culvert	*X = Channel cross section*	*L = Lake*
R = Roadway overtopping	*A = Stage versus discharge rating curve*	*P = Pond*
O = Overtopping		*W = Wetland/ Depression*

1.6.3.5 Modeling Assumptions

Within this drainage basin study, the assumption was made that all hydraulic reaches are well maintained and free of silt or debris. Based on field observations, this assumption is valid in most cases. Nonetheless, some structures may have persistent siltation problems in spite of good maintenance. The effect of major siltation problems should be considered in evaluating flood elevations shown within this drainage basin study due to the fact that the results shown assume one hundred (100) percent operating efficiency of the structure.

1.7 CRITERIA FOR PRIORITIZATION OF PROBLEM AREAS

Stormwater runoff and flooding is one of the major problems faced by many governments and municipalities. The problem is an expensive one requiring a large public and private outlay of money and time, and the effect on the community is one of great consequence. In an effort to appropriate resources efficiently, both in terms of time and money, standards need to be determined for the identification of the types and severity of drainage problems. These standards should also allow governments and municipalities to distribute its limited resources in such a manner that flood prevention benefits would be maximized, as well as provide a ranking system delineating those areas needing immediate attention and those problems which can be delayed until the more severe problems are corrected. However, many factors must also be considered to develop a ranking or prioritization system, which include:

- *in some cases it may be a more efficient use of manpower and resources to concentrate on two (2) or more problems in one area rather than several problems scattered throughout the study area;*
- *some problems may be interrelated and it would be best to work on these problems simultaneously; and*
- *due to proposed development or road construction, it may be necessary to correct certain problems with lower priorities than other problems.*

In addition to the lack of drainage structure performance standards and improvement prioritization, no comprehensive source of engineering design guidance is available for much of the study area. As a result, floodplains could be altered due to building developments; no linkage between the *review of development projects and existing or proposed regulations is possible; and actual drainage problem areas are not clearly identified or quantified. When sufficient design documentation for a Basin is available, development within areas where natural constraints are present, such as poor drainage and flooding, can be discouraged. Additionally, drainage facility improvements, where feasible, can be recommended to be concurrent with the proposed development.*

The three (3) primary sources of problem area identification for this drainage basin study are as follows:

1. *Consultation with Orange County, the City of Apopka and the St. Johns River Water Management District (SJRWMD). Due to the fact that several personnel within the aforementioned departments at the County and City have a substantial history with the study area, their input regarding drainage related problems was invaluable. Consultation with County and City representatives, who are also aware of any on-going resident complaints, was more straight-forward, simplistic and encompassing than taking surveys from residents within the study area;*

2. *Field observation by Professional Engineering Consultants (PEC) staff. During the development of this drainage basin study, PEC staff physically walked the majority of the study area; and*

3. *Results obtained through the computer simulation of existing conditions.*

1.8 PRELIMINARY CONSTRUCTION COST ESTIMATES

Preliminary construction cost estimates for the recommended improvements within the study area are included within Section 3 of this report. It should be noted that these estimates provide an order of magnitude quantification, in that they do not provide an all inclusive quantification of the costs which may be incurred to construct the recommended improvements, but rather the most significant costs which are anticipated to be incurred.

1.9 LISTING OF DATA SOURCES

MISCELLANEOUS REPORTS AND MAPS

1. *City of Apopka Drainage Master Plan, Boyle Engineering Corporation, undated.*

2. *City of Apopka Comprehensive Plan, Drainage Master Plan, dated June 1977.*

3. *USGS Topographic Quadrangle, Apopka, Florida, 1960/Photorevised 1980, 1" = 2,000'.*

4. *USGS Topographic Quadrangle, Forest City, Florida, 1959/Photorevised 1980, 1" = 2,000'.*

5. *Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for the City of Apopka, Panel No. 5, dated October 1981.*

6. *Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Orange County, Panel Nos. 100 and 125, dated December 1981.*

7. *Soil Conservation Service (SCS) Soil Survey for Orange County, Florida, issued August 1989.*

8. *Federal Emergency Management Agency (FEMA) Flood Insurance Study for Orange County, Florida, December 1989.*

9. *SJRWMD Aerial Photography with Contours, Lake Apopka and Johns Lake, KUCERA International, Sections 4 and 9, Township 21 South, Range 28 East, 1"=200', December 1990.*

10. *SJRWMD Aerial Photography with Contours, Lake Apopka and Johns Lake, KUCERA International, Section 33, Township 20 South, Range 28 East, 1"=200', December 1990.*

11. *Orange County Aerial Photography with Contours, Continental Aerial Surveys, Inc., Sections 2, 3, 10, and 11, Township 21 South, Range 28 East, April 1993.*

12. *Orange County Aerial Photography with Contours, Continental Aerial Surveys, Inc., Sections 34 and 35, Township 20 South, Range 28 East, April 1993.*

ENGINEERING STUDIES, CALCULATIONS AND STORMWATER PERMITS

1. *Drainage Calculations for Deer Lake Run, L.T. Ray and Associates, undated.*
2. *Drainage Calculations for Pines of Wekiva Phase 1, The Schemmer Associates, January 1988.*
3. *St. Johns River Water Management District (SJRWMD) Conceptual Permit Application for The Pines of Wekiva P.U.D., The Schemmer Associates, January 1988.*
4. *Drainage Calculations for Rhapsody Oaks Subdivision, R.H. Wilson and Associates, March 1989.*
5. *Drainage Calculations for Parkview at Wekiva Park P.U.D., Donald W. McIntosh Associates, October and November 1989.*
6. *St. Johns River Water Management District (SJRWMD) Permit Application and Drainage Calculations for Oak Leaf (Deer Lake Chase) Subdivision, Davidson Paymayesh Engineering, December 1989.*
7. *Whispering Woods (Wekiwa Woods) Subdivision Stormwater Management Design, Site Engineering and Planning, September 1990.*
8. *Stormwater Management Design Calculations for Apopka Middle School, GAI Consultants, January 1992.*
9. *Master Drainage Analysis for Apopka 9th Grade Center, John B. Webb and Associates, January 1993.*
10. *St. Johns River Water Management District (SJRWMD) MSSW Permit Application for Pines of Wekiva Tract "D", CCL Consultants, January 1993.*

11. St. Johns River Water Management District (SJRWMD) Stormwater Discharge Facility Permit Application for the Pines of Wekiva Tract "F", T.E. Knowles and Associates, January 1993.

12. Drainage Synopsis for Pines of Wekiva Tract "B", CCL Consultants, May 1994.

13. Drainage Calculations for Pines of Wekiva Tract "B", CCL Consultants, June 1994.

14. Supplemental Stormwater Calculations for Wekiva Park, Hollis Engineering, March 1995.

CONSTRUCTION PLANS AND SURVEYS

1. Construction Plans for State Road 500 (Drainwell Details at Ustler Pond), Florida Department of Transportation, 1958.

2. Construction Plans for State Road 435 (Rock Springs Road), Florida Department of Transportation, 1979.

3. Construction Plans for Thompson Road, Orange County Engineering Department, May 1980.

4. Construction Plans for Wekiva Glen, Post, Buckley Schuh & Jernigan, March 1981.

5. Construction Plans for Summerset Unit 2, Hoepner and Associates, March 1981.

6. Construction Plans for Pine Oaks Subdivision, Lochrane Engineering, October 1981.

7. Construction Plan "As-Builts" for Wekiva Landing Subdivision, Briskey Engineering Company, November 1981.

8. Construction Plans for Votaw Village, Harling Locklin and Associates, August 1986.

9. Construction Plans for Foxborough Farms, Dyer, Riddle Mills and Precourt, November 1986.

10. Surveys of "As-Built" residences in Votaw Village Subdivision, Bowyer-Singleton & Associates, November 1986 through November 1988.

11. *Topographic survey for Wekiva Park Subdivision, Bowyer-Singleton & Associates, March 1987.*

12. *Construction Plans for Palm Isle Mobile Home Park, Dyer Riddle, Mills and Precourt, April 1987.*

13. *Construction Plan "As-Builts" for Oakwater Estates Subdivision, GAI Consultants, June 1987.*

14. *Construction Plans for "As-Builts" for Oaks on the Lake Subdivision, Conklin Porter and Holmes Engineers, June 1987.*

15. *Construction Plans for Deer Lake Run Subdivision, L.T. Ray and Associates, December 1987.*

16. *Development Plan and Master Drainage Plan for Pines of Wekiva, The Schemmer Associates, January 1988.*

17. *Construction Plans for Florida Hospital Apopka, Mizo-Hill & Co., February 1988.*

18. *Construction Plans for Lake McCoy Oaks Subdivision, Florida Engineering, May 1988.*

19. *Construction Plans for Rhapsody Oaks, R.H. Wilson and Associates, June 1988 and October 1995.*

20. *Surveys of "As-Built" residences in Votaw Village Subdivision, Michael E. Petulla, PLS, October 1988 and November 1988.*

21. *Construction Plans for Summit Lake Stormwater Management (Dream Lake Outfall), R.H. Wilson and Associates, November 1988.*

22. *Construction Plans for Summit Lake Heights, R.H. Wilson and Associates, April 1989.*

23. *Construction Plans for Musselwhite Multi-Family, Harling Locklin and Associates, July 1989.*

24. *Construction Plans for Rock Springs Road Force Main, Hollis Engineering, September 1989.*

25. Construction Plans for Parkview Subdivision at Wekiva Park, Donald W. McIntosh Associates, September 1989 and July 1995.

26. Summit Lake Basin Stormwater Management, R.H. Wilson and Associates, November 1989.

27. Summit Lake Heights; 5 acre Lake Discharge To Dream Lake, R.H. Wilson and Associates, November 1989.

28. Construction Plans for Whispering Woods (Wekiwa Woods) Subdivision, Site Engineering and Planning, August 1990 and June 1994.

29. Construction Plans for Florida Hospital Apopka, T.E. Knowles and Associates, July 1991.

30. Surveys of "As-Built" residences in Votaw Village Subdivision, Logan & Gabioud Surveying, October 1991 through August 1992.

31. Construction Plans for Grossenbacher Drive, City of Apopka Engineering Division, December 1991.

32. Construction Plans for Pines of Wekiva Tract "E" Second Phase of Construction, CCL Consultants, March 1992.

33. Construction Plans for Votaw Road Storm Sewer Outfall to Lake McCoy, Dyer, Riddle, Mills and Precourt, April 1992.

34. Construction Plans for Greenwood Gorge, Dyer, Riddle, Mills and Precourt, April 1992.

35. Development Plans for Pines of Wekiva Tract "F", T.E. Knowles and Associates, July 1992.

36. Construction Plans for Wekiva Park Phase 1, Hollis Engineering, November 1992.

37. Construction Plans for the Pines of Wekiva, CCL Consultants, January 1993.

38. Construction Plans for the Oaks of Summit Lake, R.H. Wilson and Associates, January 1993.

39. Construction Plans for Miscellaneous Roadway Improvements (Alabama Street, Monroe Avenue, Edgewood Avenue and First Street), City of Apopka Engineering Division, April 1993.

40. Construction Plans for Wekiva Park Block "B", Hollis Engineering, June 1993.

41. Construction Plans for Florida Power Corporation Welch Road Substation, Seminole Engineering, June 1993.

42. Construction Plans for Welch Road Improvements, Hollis Engineering, August 1993.

43. Construction Plans for Pines of Wekiva Section I, II and III Phase 2 Tract "B" (Quail Hollow), CCL Consultants, June 1994.

44. Construction Plans for Rock Springs Road South, Hollis Engineering, June 1994.

45. Construction Plans for Apopka 9th Grade Center, John B. Webb and Associates, July 1994.

46. Construction Plans for Magnolia Oaks Subdivision, Tawill Engineering, November 1994.

47. Construction Plans for Wekiva Park P.U.D., Weir Modification, Hollis Engineering, March 1995.

48. Surveys of "As-built" residences in Votaw Village Subdivision, Herx & Associates, May 1995 through September 1995.

49. Construction Plans for Wekiva Village, Avid Engineering, April 1995.

50. Construction Plans for Sandpiper Street, WBQ Design & Engineering, March 1996.

Lakes McCoy, Coroni and Prevatt
Drainage Basin Study
Orange County, Florida

EXISTING CONDITIONS

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Lakes McCoy, Coroni, and Prevatt Drainage Basin Study
Orange County, Florida

SECTION 2.0
EXISTING CONDITIONS

2.1 DESCRIPTION OF THE DRAINAGE BASIN

As mentioned previously, reference to the "study area" within this document shall be taken to be synonymous with the Lakes McCoy, Coroni, and Prevatt Drainage Basin. The study area is bounded on the south by U.S. 441 and State Road 436 and reaches northward to an abandoned railroad bed in Wekiwa Springs State Park. The eastern drainage divide is approximately Thompson Road. On the west, the boundary meanders midway between Park Avenue/Rock Springs Road and Vick Road. The area within these limits encompasses approximately 3,673 acres, or 5.7 square miles, of northwest Orange County and the City of Apopka. Of this area, roughly half has been developed.

The limits of the watershed were determined based upon topography and drainage features which define the path of stormwater runoff. The sections which follow describe the topographic features, drainage basins, existing drainage facilities, and land uses within the study area. This information forms the basis for the hydrologic and hydraulic investigations and recommended drainage improvements to be initiated.

2.2 EXISTING DRAINAGE FACILITIES

As will be described in greater detail in subsequent sections, surface water runoff is conveyed via overland flow, storm sewer systems, ditches, streams, and culverts, throughout the study area. In order to quantify the existing flooding conditions for each of the primary drainage features which receive and store stormwater runoff, it was necessary to subdivide the study area into eight (8) basins. For the most part, these basins have been delineated with respect to the following significant water bodies:

- *Lake McCoy South - the wetland portion of the lake located south of Votaw Road;*
- *Dream Lake - located west of Park Avenue, between Myrtle Street and Laurel Street;*
- *Buchan Pond - located north of Grossenbacher Drive and west of Lake Avenue;*
- *The Park Avenue Drainage System - which collects runoff from approximately 250 acres including Park Avenue and three (3) neighborhoods to the west of the Park Avenue;*
- *Lake McCoy North - located between Votaw Road and Sandpiper Street;*

- *Lake Coroni - located between Sandpiper Street and Welch Road;*
- *Lake Prevatt - located north of Welch Road in Wekiwa Springs State Park; and*
- *Carpenter Branch - the outfall stream from Lake Prevatt in Wekiwa Springs State Park.*

The upper reaches of the drainage basin are located in the southwestern portion of the study area, topographically 50 feet or more above the main lake system. In particular, Dream Lake, Buchan Pond, and the Park Avenue drainage system are located in this area. Runoff from these basins discharges eastward to Lake McCoy via pipes, ditches, and/or streams. The northern and southern portions of Lake McCoy, which are separated by Votaw Road, are connected by a culvert under the roadway. To the north, the lakes are connected by culverts and ditches such that Lake McCoy discharges to Lake Coroni which in turn discharges to Lake Prevatt. From Lake Prevatt, runoff discharges via Carpenter Branch to Rock Springs Run and the Wekiva River. The terminus of this study is at an abandoned railroad bed which crosses Carpenter Branch in Wekiwa Springs State Park.

Significant flood storage and attenuation of the peak rate of runoff is provided upland of these primary drainage features. For example, large storage volumes are also provided in:

- *the wetland north of the Wekiva Park development (north of Welch Road and east of Rock Springs Road);*
- *the wetland south of Welch Road and east of Rock Springs Road;*
- *the wetland at the location of the proposed Rhapsody Oaks subdivision; and*
- *the unnamed lake west of Ustler Road and north of Sandpiper Street.*

In addition to the above natural storage areas, retention and detention ponds have been constructed to serve the developments throughout the study area. Where sufficient information was available, the computer model of the study area was designed to include all storage areas which provide some level of flood control or peak rate attenuation. In order to quantify the area contributing runoff to each storage area, it was necessary to further reduce the basins into sub-basins. The nomenclature used to identify the sub-basins is explained in Section 1.6.3.4. Refer to Exhibit No. 1 for a complete delineation of drainage basins and sub-basins within the study area.

2.3 EXISTING LAND USE

Present day land uses within the study area include residential, commercial, institutional, industrial, transportation, watercourses, wetlands, pasture land, cropland, and woodland, with almost half of the study area being undeveloped. The land uses were delineated using current aerial maps *obtained from Orange County and SJRWMD, the aerial raster base map developed by PEC, and the adjusted Orange County parcel map. The delineations were refined based on field observations.*

The land uses were classified utilizing the Florida Department of Transportation (FDOT) Land Use, Forms, and Cover Classification System: A Technical Manual (September 1985). The delineation of land use has been previously discussed within the Section 1.6.2.4 of this study and is graphically presented on Exhibit No. 2, Existing Land Use Map.

Two (2) points of interest regarding the delineations of existing land use should be noted. First of all, areas that have been approved for development, yet are not currently developed ("built-out"), were assumed to be fully developed in the existing condition (e.g., Pines of Wekiva - Tract "G" and Parkview Subdivision). Secondly, areas that are primarily composed of a single land use were considered to be homogeneous. For example, largely undeveloped tracts of land with sparse single family residences were considered undeveloped. Conversely, vacant lots in primarily developed areas were usually included as developed land. The rationale in both of the above cases is that a relatively small deviation in land use has little effect on the hydrologic characteristics of the overall tract of land.

2.4 FLOODPLAINS

A floodplain is defined as the normally dry land area adjoining rivers, streams, lakes, bays, wetlands or oceans which may be covered by water in times of flooding, and/or during extreme storm events. To reduce the potential for losses at such times, Orange County, the City of Apopka, and SJRWMD have enacted regulations which are designed to protect human life and property through the restriction of floodplain uses which could be dangerous to the public welfare in periods of flood or which might contribute to the severity of flood conditions. These regulations control the alteration of floodplains and waterways; regulate filling, grading or dredging which may increase flood damage; and prevent or regulate flood barrier construction which will divert flood waters from their natural course.

The Federal Government sponsors the National Flood Insurance Program (NFIP) through the Federal Insurance Administration (FIA) which is administered by the Federal Emergency Management Agency (FEMA). FEMA is responsible for providing Flood Insurance Rate Maps (FIRM) which delineate areas susceptible to flooding. The Flood Insurance Rate Map (FIRM) for the City of Apopka (1981) and Orange County (1986) were combined to include the entire study area. Based upon these maps, the flood elevations of Dream Lake, Buchan Pond, and Lake McCoy are 117 feet, 140 feet, and 65 feet, respectively. The flood extents of Lake Coroni and Lake Prevatt were identified as Zone "A" for which elevations have not been established.

Additional information regarding 100-year flood elevations is published in the Orange County Lake Index. The elevations reported therein were consistent with those determined by FEMA with the exception of Lake Prevatt, for which a 100-year flood elevation of 57.8 feet was listed.

As a result of this study, flood elevations for the 2.33- (mean annual), 10-, 25- and 100-year storm events were determined for the major water bodies within the study area. These flood elevations will supplement and/or update the previously published flood information. A comparison of the existing 100-year flood elevations determined in this study with those previously published is provided in Table 2-1.

Table 2-1
Comparison of Published versus Calculated Flood Elevations

Water Body	100-Year Flood Elevation (feet)		
	FEMA	Orange County Lake Index	PEC Study
Dream Lake	117.0	117.0	118.3
Buchan Pond	140.0	140.0	140.7
South Lake McCoy	65.0	65.1	66.5
North Lake McCoy	65.0	65.1	64.9
Lake Coroni	N/A	N/A	64.8
Lake Prevatt	N/A	57.8	60.5

Graphical depiction of the floodplain limits and elevations obtained during the existing conditions computer simulation are presented on Exhibit No. 1. This information will serve to:

- *provide an easily understandable means of explaining to the general public the identified drainage problem areas;*
- *provide a mechanism by which Orange County, the City of Apopka, and SJRWMD can better regulate floodplain and floodway impacts by future development or improvements;*
- *substantiate budget requests that are submitted for capital improvements within the study area; and*

- *provide a history of the current flooding and drainage problems within the study area, thus providing a basis for determining whether efforts to correct existing problems are effective.*

2.5 SUB-BASIN HYDROLOGY

2.5.1 Sub-Basin Runoff Curve Numbers

As mentioned previously, runoff curve numbers for drainage sub-basins within the study area were calculated utilizing a computer program entitled VALENCE. Results of the VALENCE analysis for existing conditions are summarized in Table 2-2 of this basin study. A copy of the VALENCE output has been provided in VOLUME II (Calculations), Section 1 of this basin study. Refer to Exhibit No. 2 for a graphical depiction of the sub-basin and land use boundaries. Exhibit No. 3 provides a representation of the hydrologic soil groups (A, B/D, C, and D) in relation to the sub-basin boundaries.

2.5.2 Sub-Basin Times Of Concentration

Drainage sub-basin times of concentration for existing conditions were calculated utilizing the methods previously discussed in Section 1.6.2.6. The time of concentration for each sub-basin has been summarized in Table 2-2. Time of concentration calculations are detailed in Table 2-3.

2.5.3 Hydrograph Peaking Factor

Hydrograph peaking factors were discussed in Section 1.6.2.7. The peaking factors assigned to each sub-basin are tabulated in Table 2-2

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ORANGE COUNTY, FLORIDA
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CHECKED : David W. Hamstra, P.E.
SUBJECT : TABULATION OF HYDROLOGIC BASIN PARAMETERS -- EXISTING CONDITIONS

TABLE 2-2

Sub-Basin Number	To Node	Drainage Area		Curve Number	Time of Concentration	SCS Peak Factor
		(acres)	(sq. mi.)		(minutes)	
BUCHAN POND						
BP01	BP01N01P	40.4	0.06	72	20	323
BP02	BP02N01P	14.2	0.02	80	20	323
BP03	BP03N01P	16.9	0.03	84	20	323
BP04	BP04N01P	26.1	0.04	85	20	323
BP05	BUCHAN	43.0	0.07	85	63	256
SUB-TOTALS		140.6	0.22	81		
CARPENTER BRANCH						
CB01	CARPENTR	261.5	0.41	41	150	256
SUB-TOTALS		261.5	0.41	41		
DREAM LAKE						
DL01	DL01N01P	40.3	0.06	88	60	484
DL02	DL02N01W	34.5	0.05	82	64	323
DL03	DL03N01P	44.3	0.07	69	30	323
DL04	DREAM	34.2	0.05	60	28	323
DL05	DREAM	100.6	0.16	63	56	323
SUB-TOTALS		253.9	0.40	70		
LAKE CORONI						
LC01	LC01N01L	45.7	0.07	54	133	256
LC02	LC02N01P	21.2	0.03	52	51	323
LC03	LC03N01P	33.7	0.05	49	75	256
LC04	LC04N01P	23.3	0.04	58	35	323
LC05	LC05N01P	30.4	0.05	55	36	323
LC06	LC06N01P	25.2	0.04	54	37	323
LC07	LC07N01P	7.7	0.01	54	20	323
LC08	CORONI-S	58.6	0.09	55	41	256
LC09	CORONI-N	104.3	0.16	62	64	256
SUB-TOTALS		350.1	0.55	56		

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TABLE 2-2

Sub-Basin Number	To Node	Drainage Area		Curve Number	Time of Concentration	SCS Peak Factor
		(acres)	(sq. mi.)		(minutes)	
LAKE PREVATT						
LP01	LP01N01W	95.1	0.15	77	56	256
LP02	LP02N01D	43.5	0.07	80	67	256
LP03	LP03N01P	23.6	0.04	91	62	323
LP04	LP04N01D	62.6	0.10	87	60	323
LP05	LP05N01P	19.8	0.03	83	40	323
LP06A	LP06N01P	18.1	0.03	93	10	484
LP06B	LP06N01P	42.2	0.07	89	20	323
LP07	LP07N01W	80.1	0.13	84	180	256
LP08	LP08N01W	28.9	0.05	81	72	256
LP09	LP09N01P	17.1	0.03	83	20	323
LP10	LP10N02D	24.1	0.04	70	101	256
LP11	LP11N01L	13.5	0.02	57	20	323
LP12	LP13N01W	26.9	0.04	62	107	256
LP13	LP13N01W	9.5	0.01	41	15	256
LP14	LP14N01P	20.2	0.03	53	35	323
LP15	PREVATT	24.5	0.04	52	49	256
LP16	PREVATT	540.4	0.84	57	130	256
SUB-TOTALS		1090.1	1.70	68		
NORTH LAKE McCOY						
MN01	MN01N01D	0.6	0.00	69	10	323
MN02	MN02N01P	8.3	0.01	69	20	484
MN03	MN03N01P	13.5	0.02	51	50	256
MN04	McCOY-N	7.4	0.01	54	39	323
MN05	McCOY-N	8.0	0.01	54	38	323
MN06	McCOY-N	16.1	0.03	60	60	323
MN07	MN07N01P	77.6	0.12	51	81	256
MN08	MN08N01P	4.7	0.01	54	24	323

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TABLE 2-2

Sub-Basin Number	To Node	Drainage Area (acres)	Drainage Area (sq. mi.)	Curve Number	Time of Concentration (minutes)	SCS Peak Factor
MN09	MN09N01P	20.0	0.03	51	41	323
MN10	MN10N01P	14.0	0.02	48	59	323
MN11	MN11N01P	5.9	0.01	54	20	323
MN12	MN12N01D	71.7	0.11	62	64	256
MN13	MN13N01W	87.9	0.14	84	81	256
MN14	MN14N01D	65.2	0.10	76	83	256
MN15	MN15N01D	32.5	0.05	69	64	323
MN16	MN16N01D	6.6	0.01	81	29	323
MN17	MN17N01D	5.4	0.01	83	20	323
MN18	MN18N01W	61.7	0.10	66	49	256
MN19	MN19N01P	14.1	0.02	85	20	323
MN20	McCOY-N	346.5	0.54	73	86	323
MN21	MN21N01L	13.5	0.02	54	53	256
SUB-TOTALS		881.2	1.38	69		
SOUTH LAKE McCOY						
MS01	MS01N01W	91.5	0.14	70	55	323
MS02	MS02N01P	14.7	0.02	74	25	323
MS03	MS03N01P	62.6	0.10	68	65	323
MS04	MS04N01P	3.7	0.01	57	24	323
MS05	MS05N01P	2.6	0.00	60	18	323
MS06	McCOY-S	91.1	0.14	55	75	323
MS07	MS07N01P	23.1	0.04	65	14	323
MS08	MS08N01P	12.1	0.02	63	24	323
MS09	McCOY-S	88.2	0.14	67	50	323
SUB-TOTALS		389.6	0.61	65		
PARK AVENUE DRAINAGE SYSTEM						
PA01	PA05NO1P	75.0	0.12	70	99	323
PA02	PA02NO1P	51.4	0.08	62	46	323

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TABLE 2-2

Sub-Basin Number	To Node	Drainage Area		Curve Number	Time of Concentration	SCS Peak Factor
		(acres)	(sq. mi.)		(minutes)	
PA03	PA05NO1P	63.9	0.10	64	81	323
PA04	PA05NO1P	111.5	0.17	73	105	323
PA05	PA05NO1P	4.4	0.01	95	10	484
SUB-TOTALS		306.2	0.48	69		
TOTALS		3673.2	5.74	65.4		

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: (filename: OC070-TC.WK4)
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DATE : January 8, 1997

SUBJECT : CALCULATION OF EXISTING CONDITIONS TIMES OF CONCENTRATION

TABLE 2-3

SUB-BASIN I.D.	FLOW PATH	SHEET FLOW									SHALLOW CONCENTRATED FLOW								CHANNEL FLOW								TOTAL TIME OF CONC.		BASIN I.D.
		I.D.	SURFACE DESC.	("n")	FLOW LENGTH (feet)	2-yr, 24-hr RAINFALL (inch)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	TRAVEL TIME (hour)	I.D.	PAVED OR UNPAVED	FLOW LENGTH (feet)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	VEL. (fps)	TRAVEL TIME (hour)	I.D.	FLOW AREA (sf)	W.P. (feet)	CHANNEL SLOPE (foot/foot)	("n")	VEL. (fps)	FLOW LENGTH (feet)	TRAVEL TIME (hour)	(hour)	(min.)	
BUCHAN POND																													
BP01	Assumed																										0.33	20	BP01
BP02	Assumed																										0.33	20	BP02
BP03	Assumed																										0.33	20	BP03
BP04	Assumed																										0.33	20	BP04
BP05	TC2	AB	Dense Grass	0.24	50	4.70	152.50	152.00	0.0100	0.15	CD	Unpaved	130	151.00	150.00	0.0077	1.4	0.03	EF	Piped w/assumed velocity =				3.00	200.00	0.02	1.04	63	BP05
		BC	Dense Grass	0.24	250	4.70	152.00	151.00	0.0040	0.78	DE	Unpaved	450	150.00	145.00	0.0111	1.7	0.07											
CARPENTER BRANCH																													
CB01	TC1	AB	Dense Woods	0.80	300	4.70	69.00	67.00	0.0067	1.92	BC	Unpaved	2100	67.00	52.00	0.0071	1.4	0.43	CD	Stream w/assumed velocity =				3.00	1700.00	0.16	2.51	150	CB01
DREAM LAKE																													
DL01	TC2	AB	Dense Grass	0.24	120	4.70	156.50	156.00	0.0042	0.43	CD	Paved	400	153.50	152.60	0.0022	1.0	0.12	DE	Piped w/assumed velocity =				3.00	1000.00	0.09	1.00	60	DL01
		BC	Dense Grass	0.24	180	4.70	156.00	153.50	0.0139	0.36																			
DL02	TC2	AB	Dense Grass	0.24	300	4.70	154.00	152.80	0.0040	0.90	BC	Unpaved	170	152.80	151.00	0.0106	1.7	0.03									1.06	64	DL02
											CD	Paved	460	151.00	150.00	0.0022	0.9	0.13											
DL03	Assumed																										0.50	30	DL03
DL04	TC1	AB	Dense Grass	0.24	130	4.70	156.90	156.00	0.0069	0.37									BC	Piped w/assumed velocity =				3.00	1030.00	0.10	0.47	28	DL03
DL05	TC1	AB	Dense Grass	0.24	70	4.70	153.00	152.70	0.0043	0.27	CD	Unpaved	70	150.50	150.00	0.0071	1.4	0.01	FG	Piped w/assumed velocity =				3.00	100.00	0.01	0.94	56	DL04
		BC	Dense Grass	0.24	230	4.70	152.70	150.50	0.0096	0.51	DE	Unpaved	430	150.00	138.00	0.0279	2.7	0.04											
											EF	Paved	850	138.00	121.00	0.0200	2.9	0.08											
LAKE CORONI																													
LC01	TC1	AB	Dense Grass	0.24	100	4.70	106.20	105.80	0.0040	0.37	CD	Unpaved	330	104.80	102.00	0.0085	1.5	0.06									2.21	133	LC01
		BC	Dense Woods	0.80	200	4.70	105.80	104.80	0.0050	1.56	DE	Unpaved	170	102.00	101.00	0.0059	1.2	0.04											
											EF	Unpaved	350	101.00	100.20	0.0023	0.8	0.13											
											FG	Unpaved	150	100.20	99.00	0.0080	1.4	0.03											
											GH	Unpaved	150	99.00	98.00	0.0200	2.3	0.02											
											HI	Unpaved	160	98.00	83.00	0.0813	4.6	0.01											
LC02	TC2	AB	Dense Grass	0.24	300	4.70	101.50	99.80	0.0057	0.78	BC	Unpaved	120	99.80	99.00	0.0067	1.3	0.03									0.85	51	LC02
											CD	Unpaved	120	99.00	97.00	0.0167	2.1	0.02											
											DE	Unpaved	90	97.00	93.00	0.0444	3.4	0.01											
											EF	Unpaved	80	93.00	92.00	0.0125	1.8	0.01											
											FG	Unpaved	20	92.00	91.50	0.0250	2.6	0.00											
LC03	TC1	AB	Dense Grass	0.24	300	4.70	102.50	101.50	0.0033	0.97	BC	Unpaved	300	101.50	101.00	0.0017	0.7	0.13	FG	Piped w/assumed velocity =				3.00	700.00	0.06	1.25	75	LC03
											CD	Unpaved	300	101.00	98.00	0.0100	1.6	0.05											
											DE	Unpaved	120	98.00	95.00	0.0250	2.6	0.01											
											EF	Unpaved	380	95.00	70.50	0.0645	4.1	0.03											
LC04	TC1	AB	Dense Grass	0.24	300	4.70	74.00	69.00	0.0167	0.51									BC	Piped w/assumed velocity =				3.00	720.00	0.07	0.58	35	LC04
LC05	TC1	AB	Dense Grass	0.24	270	4.70	76.50	72.20	0.0159	0.48	BC	Paved	230	72.20	71.50	0.0030	1.1	0.06	CD	Piped w/assumed velocity =				3.00	800.00	0.07	0.61	36	LC05
LC06	TC3	AB	Dense Grass	0.24	180	4.70	83.00	81.00	0.0111	0.40	BC	Paved	380	81.00	78.00	0.0079	1.8	0.06	CD	Piped w/assumed velocity =				3.00	1820.00	0.17	0.62	37	LC06
LC07	Assumed																										0.33	20	LC07
LC08	TC1	AB	Woods	0.40	300	4.70	80.00	72.20	0.0260	0.64	BC	Unpaved	490	80.00	61.00	0.0388	3.2	0.04									0.68	41	LC08
LC09	TC1	AB	Dense Grass	0.24	50	4.70	101.20	101.00	0.0040	0.21	CD	Unpaved	120	98.20	95.00	0.0267	2.6	0.01									1.06	64	LC09
		BC	Woods	0.40	250	4.70	101.00	98.20	0.0112	0.78	DE	Unpaved	430	95.00	72.00	0.0535	3.7	0.03											
											EF	Unpaved	250	72.00	62.00	0.0400	3.2	0.02											
											FG	Unpaved	90	62.00	58.00	0.0444	3.4	0.01											
LAKE PREVATT																													
LP01	TC2	AB	Dense Grass	0.24	300	4.70	136.00	134.20	0.0060	0.76	BC	Unpaved	400	134.20	132.00	0.0055	1.2	0.09									0.93	56	LP01
											CD	Paved	500	132.00	128.00	0.0080	1.8	0.08											
LP02	TC1	AB	Dense Grass	0.24	300	4.70	130.00	129.00	0.0033	0.97	BC	Unpaved	990	129.00	117.00	0.0121	1.8	0.15									1.12	67	LP02

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TABLE 2-3

		SHEET FLOW									SHALLOW CONCENTRATED FLOW								CHANNEL FLOW										
SUB-BASIN I.D.	FLOW PATH	I.D.	SURFACE DESC.	("n")	FLOW LENGTH (feet)	2-yr, 24-hr RAINFALL (inch)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	TRAVEL TIME (hour)	I.D.	PAVED OR UNPAVED	FLOW LENGTH (feet)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	VEL. (fps)	TRAVEL TIME (hour)	I.D.	FLOW AREA (sf)	W.P. (feet)	CHANNEL SLOPE (foot/foot)	("n")	VEL. (fps)	FLOW LENGTH (feet)	TRAVEL TIME (hour)	TOTAL TIME OF CONC. (hour)	(min.)	BASIN I.D.
LP03	TC1	AB	Dense Grass	0.24	250	4.70	136.00	135.20	0.0032	0.85	CD	Paved	970	135.00	129.00	0.0062	1.6	0.17									1.04	62	LP03
		BC	Paved Road	0.01	50	4.70	135.20	135.00	0.0040	0.02																			
LP04	TC1	AB	Dense Grass	0.24	70	4.70	129.50	129.00	0.0071	0.22	DE	Unpaved	135	127.30	126.00	0.0096	1.6	0.02	HI	Ditch w/assumed velocity =				3.00	395.00	0.04	1.00	60	LP04
		BC	Dense Grass	0.24	170	4.70	129.00	128.00	0.0059	0.49	EF	Unpaved	210	126.00	123.00	0.0143	1.9	0.03											
		CD	Dense Grass	0.24	60	4.70	128.00	127.30	0.0117	0.16	FG	Unpaved	255	123.00	119.00	0.0157	2.0	0.04											
											GH	Unpaved	20	119.00	117.50	0.0750	4.4	0.00											
LP05	TC1	AB	Woods	0.40	300	4.70	118.50	111.00	0.0250	0.65	BC	Unpaved	230	111.00	105.00	0.0261	2.6	0.02									0.67	40	LP05
LP06a	Assumed																										0.17	10	LP06a
LP06b	Assumed																										0.33	20	LP06b
LP07	TC3	AB	Dense Woods	0.80	300	4.70	99.40	98.70	0.0023	2.92	BC	Unpaved	300	98.70	97.00	0.0057	1.2	0.07									2.99	180	LP07
LP08	TC1	AB	Woods	0.40	50	4.70	107.50	107.00	0.0100	0.22	CD	Unpaved	320	106.00	105.00	0.0031	0.9	0.10	DE	Ditch w/assumed velocity =				3.00	1030.00	0.10	1.20	72	LP08
		BC	Dense Grass	0.24	250	4.70	107.00	106.00	0.0040	0.78																			
LP09	Assumed																										0.33	20	LP09
LP10	TC4	AB	Dense Woods	0.80	170	4.70	100.60	100.00	0.0035	1.57									BC	Ditch w/assumed velocity =				4.00	1500.00	0.10	1.68	101	LP10
LP11	Assumed																										0.33	20	LP11
LP12	TC1	AB	Woods	0.40	300	4.70	107.80	105.50	0.0077	1.04	BC	Unpaved	250	105.50	103.70	0.0072	1.4	0.05	EF	Ditch w/assumed velocity =				3.00	1900.00	0.18	1.79	107	LP12
											CD	Unpaved	600	103.70	102.50	0.0020	0.7	0.23											
											DE	Paved	600	102.50	102.00	0.0008	0.6	0.28											
LP13	Assumed																										0.25	15	LP13
LP14	TC2	AB	Dense Grass	0.24	250	4.70	76.00	73.00	0.0120	0.50	CD	Paved	290	73.00	70.00	0.0103	2.1	0.04	DE	Piped w/assumed velocity =				3.00	450.00	0.04	0.58	35	LP14
LP15	TC1	AB	Dense Grass	0.24	150	4.70	75.00	74.00	0.0067	0.42	CD	Unpaved	200	69.80	67.00	0.0140	1.9	0.03	FG	Piped w/assumed velocity =				3.00	100.00	0.01	0.82	49	LP15
		BC	Dense Grass	0.24	150	4.70	74.00	69.80	0.0280	0.24	DE	Unpaved	50	67.00	65.00	0.0400	3.2	0.00											
											EF	Paved	340	65.00	64.50	0.0015	0.8	0.12											
LP16	TC1	AB	Dense Woods	0.80	200	4.70	91.40	90.00	0.0070	1.36	CD	Unpaved	40	88.00	87.00	0.0250	2.6	0.00									2.17	130	LP16
		BC	Dense Woods	0.80	100	4.70	90.00	88.00	0.0200	0.51	DE	Unpaved	680	87.00	81.80	0.0076	1.4	0.13											
											EF	Paved	1350	81.80	82.50	0.0143	2.4	0.15											
LAKE McCOY-NORTH																													
MN01	Assumed																										0.17	10	MN01
MN02	Assumed																										0.33	20	MN02
MN03	TC1	AB	Dense Grass	0.24	300	4.70	112.00	110.00	0.0067	0.73	BC	Unpaved	340	110.00	109.00	0.0029	0.9	0.11									0.84	50	MN03
MN04	TC1	AB	Dense Grass	0.24	130	4.70	76.00	75.00	0.0077	0.35	DE	Paved	650	71.00	69.50	0.0023	1.0	0.18									0.65	39	MN04
		BC	Dense Grass	0.24	80	4.70	75.00	71.00	0.0500	0.11																			
MN05	TC1	AB	Woods	0.40	100	4.70	76.50	73.00	0.0350	0.24	EF	Paved	560	72.00	69.00	0.0054	1.5	0.10									0.63	38	MN05
		BC	Dense Grass	0.24	110	4.70	73.00	72.00	0.0091	0.29																			
MN06	TC1	AB	Dense Grass	0.24	100	4.70	85.00	80.00	0.0500	0.14	CD	Unpaved	240	79.50	69.00	0.0438	3.4	0.02									0.99	60	MN06
		BC	Dense Grass	0.24	200	4.70	80.00	79.50	0.0025	0.78	DE	Unpaved	140	69.00	66.00	0.0214	2.4	0.02											
											EF	Unpaved	160	66.00	65.00	0.0063	1.3	0.03											
MN07	TC2	AB	Dense Grass	0.24	300	4.70	97.00	96.00	0.0033	0.97	BC	Unpaved	220	98.00	95.00	0.0045	1.1	0.06									1.34	81	MN07
											CD	Unpaved	480	95.00	83.00	0.0250	2.6	0.05											
											DE	Unpaved	200	83.00	82.00	0.0050	1.1	0.05											
											EF	Unpaved	100	82.00	79.00	0.0300	2.8	0.01											
											FG	Unpaved	330	79.00	78.00	0.0030	0.9	0.10											
											GH	Unpaved	340	78.00	75.00	0.0088	1.5	0.06											
											HI	Unpaved	310	75.00	70.00	0.0161	2.0	0.04											
MN08	TC2	AB	Dense Grass	0.24	200	4.70	83.50	79.00	0.0225	0.33	BC	Paved	280	79.00	78.00	0.0036	1.2	0.06	CD	Piped w/assumed velocity =				3.00	150.00	0.01	0.40	24	MN08
MN09	TC1	AB	Woods	0.40	250	4.70	87.00	80.00	0.0280	0.54	CD	Unpaved	450	75.50	66.00	0.0211	2.3	0.05									0.68	41	MN09
		BC	Woods	0.40	50	4.70	80.00	75.50	0.0900	0.09																			
MN10	TC1	AB	Dense Grass	0.24	100	4.70	85.00	81.00	0.0400	0.15	DE	Unpaved	200	77.50	75.00	0.0125	1.8	0.03	HI	Piped w/assumed velocity =				3.00	190.00	0.02	0.99	59	MN10
		BC	Woods	0.40	100	4.70	81.00	78.00	0.0300	0.25	EF	Unpaved	80	75.00	70.00	0.0625	4.0	0.01											
		CD	Woods	0.40	100	4.70	78.00	77.50	0.0050	0.51	FG	Unpaved	120	70.00	67.50	0.0208	2.3	0.01											
											GH	Paved	50	67.50	67.00	0.0100	2.0	0.01											
MN11	Assumed																										0.33	20	MN11

PEC/ PROFESSIONAL ENGINEERING CONSULTANTS, INC.
engineers planners surveyors
Suite 1680 Eola Park Centre 200 East Robinson Street Orlando, Florida 32801 407/422-8062

PROJECT : LAKES McCOY, CORONI, AND PREVATT DRAINAGE BASIN STUDY
P.N. : 'OC-070/1.0
: (filename: OC070-TC.WK4)
CHECKED : David W. Hamstra, P.E.
DATE : January 8, 1997

SUBJECT : CALCULATION OF EXISTING CONDITIONS TIMES OF CONCENTRATION

TABLE 2-3

		SHEET FLOW									SHALLOW CONCENTRATED FLOW								CHANNEL FLOW										
SUB-BASIN I.D.	FLOW IPATH	I.D.	SURFACE DESC.	("n")	FLOW LENGTH (feet)	2-yr, 24-hr RAINFALL (inch)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	TRAVEL TIME (hour)	I.D.	PAVED OR UNPAVED	FLOW LENGTH (feet)	UPPER EL. (feet)	LOWER EL. (feet)	CALC'D SLOPE (foot/foot)	VEL. (fps)	TRAVEL TIME (hour)	I.D.	FLOW AREA (sf)	W.P. (feet)	CHANNEL SLOPE (foot/foot)	("n")	VEL. (fps)	FLOW LENGTH (feet)	TRAVEL TIME (hour)	TOTAL TIME OF CONC. (hour)	(min.)	BASIN I.D.
MN12	TC2	AB	Woods	0.40	150	4.70	149.00	147.70	0.0087	0.57	CD	Unpaved	750	145.00	134.00	0.0147	2.0	0.11									1.07	64	MN12
		BC	Dense Grass	0.24	150	4.70	147.70	145.00	0.0180	0.28	DE	Unpaved	550	134.00	122.00	0.0218	2.4	0.06											
											EF	Unpaved	250	122.00	120.00	0.0080	1.4	0.05											
MN13	TC1	AB	Dense Woods	0.80	300	4.70	119.50	114.00	0.0183	1.28	BC	Unpaved	470	114.00	106.00	0.0170	2.1	0.06									1.34	81	MN13
MN14	TC2	AB	Dense Woods	0.80	300	4.70	125.00	118.00	0.0233	1.16	BC	Unpaved	700	118.00	100.00	0.0257	2.6	0.08									1.39	83	MN14
											CD	Unpaved	270	100.00	98.00	0.0074	1.4	0.05											
											DE	Unpaved	400	98.00	96.00	0.0050	1.1	0.10											
MN15	TC1	AB	Dense Grass	0.24	300	4.70	157.50	156.00	0.0050	0.82	BC	Unpaved	300	156.00	153.50	0.0083	1.5	0.06									1.06	64	MN15
											CD	Paved	1400	153.50	138.00	0.0111	2.1	0.18											
MN16	TC1	AB	Dense Grass	0.24	250	4.70	139.30	135.80	0.0140	0.47	BC	Paved	150	135.80	134.00	0.0120	2.2	0.02									0.49	29	MN16
MN17	TC1	AB	Dense Grass	0.24	150	4.70	137.00	133.00	0.0267	0.24	BC	Unpaved	600	133.00	125.00	0.0133	1.9	0.09									0.33	20	MN17
MN18	TC3	AB	Dense Grass	0.24	50	4.70	125.00	123.00	0.0400	0.09	DE	Unpaved	790	117.20	101.00	0.0205	2.3	0.09	EF	Ditch w/assumed velocity =				3.00	670.00	0.06	0.82	49	MN18
		BC	Dense Grass	0.24	200	4.70	123.00	119.00	0.0200	0.34																			
		CD	Dense Woods	0.80	50	4.70	119.00	117.20	0.0360	0.23																			
MN19	Assumed																										0.33	20	MN19
MN20	TC4	AB	Dense Woods	0.80	300	4.70	112.00	106.50	0.0183	1.28	BC	Unpaved	840	106.50	72.00	0.0411	3.3	0.07	CD	Ditch w/assumed velocity =				3.00	800.00	0.07	1.43	86	MN20
MN21	TC1	AB	Woods	0.40	250	4.70	83.10	80.00	0.0124	0.74	BC	Unpaved	150	80.00	73.00	0.0467	3.5	0.01									0.89	53	MN21
											CD	Unpaved	800	73.00	64.00	0.0113	1.7	0.13											
LAKE McCOY-SOUTH																													
MS01	TC2	AB	Dense Grass	0.24	300	4.70	122.30	120.50	0.0060	0.76	BC	Unpaved	60	120.50	120.00	0.0083	1.5	0.01	FG	Ditch w/assumed velocity =				3.00	630.00	0.06	0.92	55	MS01
											CD	Unpaved	30	120.00	119.00	0.0333	2.9	0.00											
											DE	Unpaved	250	119.00	118.00	0.0040	1.0	0.07											
											EF	Unpaved	100	118.00	115.00	0.0300	2.8	0.01											
MS02	TC1	AB	Dense Grass	0.24	200	4.70	127.00	123.80	0.0160	0.37	BC	Paved	750	123.80	90.00	0.0451	4.3	0.05									0.42	25	MS02
MS03	TC2	AB	Dense Grass	0.24	30	4.70	124.50	123.00	0.0500	0.05	CD	Unpaved	200	121.80	121.20	0.0030	0.9	0.06	DE	Piped w/assumed velocity =				3.00	1880.00	0.17	1.08	65	MS03
		BC	Dense Grass	0.24	270	4.70	123.00	121.80	0.0044	0.79																			
MS04	TC1	AB	Dense Grass	0.24	60	4.70	119.25	118.00	0.0208	0.13	CD	Unpaved	120	104.00	93.00	0.0917	4.9	0.01									0.39	24	MS04
		BC	Dense Grass	0.24	240	4.70	118.00	104.00	0.0583	0.26																			
MS05	TC1	AB	Dense Grass	0.24	300	4.70	117.00	98.00	0.0633	0.30	DE	Unpaved	80	98.00	82.00	0.2000	7.2	0.00									0.30	18	MS05
MS06	TC1	AB	Dense Grass	0.24	300	4.70	97.50	96.30	0.0040	0.90	BC	Unpaved	130	96.30	96.00	0.0023	0.8	0.05	EF	Piped w/assumed velocity =				3.00	1250.00	0.12	1.25	75	MS06
											CD	Unpaved	470	96.00	88.00	0.0170	2.1	0.06											
											DE	Paved	700	88.00	84.00	0.0057	1.5	0.13											
MS07	TC1	AB	Dense Grass	0.24	100	4.70	87.00	81.00	0.0600	0.13	BC	Paved	550	81.00	76.00	0.0091	1.9	0.08	CD	Piped w/assumed velocity =				3.00	280.00	0.03	0.23	14	MS07
MS08	TC1	AB	Dense Grass	0.24	120	4.70	73.20	72.00	0.0100	0.30	BC	Paved	360	72.00	68.00	0.0111	2.1	0.05	CD	Piped w/assumed velocity =				3.00	600.00	0.06	0.40	24	MS08
MS09	TC3	AB	Dense Grass	0.24	300	4.70	123.00	121.00	0.0067	0.73	BC	Unpaved	140	121.00	120.00	0.0071	1.4	0.03									0.83	50	MS09
											CD	Unpaved	580	120.00	80.00	0.0690	4.2	0.04											
											DE	Unpaved	180	80.00	75.00	0.0278	2.7	0.02											
											EF	Unpaved	180	75.00	65.00	0.0556	3.8	0.01											
PARK AVENUE SYSTEM																													
PA01	TC2	AB	Dense Grass	0.24	300	4.70	137.80	137.00	0.0027	1.06	BC	Unpaved	860	137.00	125.00	0.0140	1.9	0.13	DE	Piped w/assumed velocity =				3.00	4300.00	0.40	1.65	99	PA01
											CD	Paved	150	125.00	124.80	0.0013	0.7	0.06	EF	Piped w/assumed velocity =				9.00	2100.00	0.06			
PA02	TC3	AB	Dense Grass	0.24	200	4.70	160.20	159.00	0.0060	0.55	BC	Paved	620	159.00	157.50	0.0024	1.0	0.17	CD	Piped w/assumed velocity =				9.00	1550.00	0.05	0.77	46	PA02
PA03	TC1	AB	Dense Grass	0.24	100	4.70	135.00	134.00	0.0100	0.26	DE	Unpaved	600	132.20	125.00	0.0120	1.8	0.09	FG	Piped w/assumed velocity =				3.00	2900.00	0.27	1.35	81	PA03
		BC	Dense Grass	0.24	20	4.70	134.00	133.00	0.0500	0.04	EF	Paved	150	125.00	124.80	0.0013	0.7	0.06	GH	Piped w/assumed velocity =				9.00	2100.00	0.06			
		CD	Dense Grass	0.24	180	4.70	133.00	132.20	0.0044	0.57																			
PA04	TC2	AB	Dense Grass	0.24	300	4.70	149.50	148.70	0.0027	1.06	BC	Unpaved	300	148.70	146.50	0.0073	1.4	0.06	EF	Piped w/assumed velocity =				3.00	1250.00	0.12	1.75	105	PA04
											CD	Paved	1500	146.50	142.00	0.0030	1.1	0.37	FG	Piped w/assumed velocity =				9.00	2100.00	0.06			
											DE	Paved	650	142.00	134.00	0.0123	2.3	0.08											
PA05	Assumed																										0.17	10	PA05

REFERENCE:

URBAN HYDROLOGY FOR SMALL WATERSHEDS
TECHNICAL RELEASE 55, SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
JUNE 1986

2.5.4 Description of Sub-Basins

The sections which follow provide a narrative summary for each of the seventy-two (72) sub-basins located within the study area including descriptions of: topography, sub-basin boundaries, drainage patterns, major water features, outfall structures, land uses, and flooding conditions.

2.5.4.1 Lake McCoy South Basin

The major drainage feature in this basin is the portion of Lake McCoy south of Votaw Road. The area included in this basin is bounded by Votaw Road on the north, Park Avenue on the west, and U.S. 441 on the southwest. To the east and southeast, the drainage basin boundary is too irregular to describe. Refer to Exhibit No. 1 for a depiction of the Lake McCoy South Basin (approximately 390 acres).

The Lake McCoy South Basin was divided further into nine (9) sub-basins to account for flood storage upstream of the lake and differing hydrologic parameters. Sub-basins within this basin, such as MS01 and MS04, are identified using the prefix "MS." Descriptions of each sub-basin including storage areas and outfall structures are provided in the sections which follow.

2.5.4.1.1 Sub-Basin MS01

Sub-basin MS01 is located in the southwest portion of the Lake McCoy South drainage basin and is defined by the area draining to the depressional wetland east of Florida Hospital (Node MS01N01W). The area is bounded to the west by Park Avenue, to the south by Third Street, and to the north by the development on Myrtle Street. The eastern boundary runs from the intersection of Third Street and Forest Avenue northward to Sunbelt Living Center just east of the depressional wetland.

The general pattern of runoff is from south to north with elevations ranging from 138 feet near the intersection of Park Avenue and Third Street to approximately 91 feet in the depressional wetland east of the hospital. Because nearly the entire sub-basin is developed, most runoff is conveyed to the wetland via storm sewer. Several small ponds are located within the sub-basin; however, these have not been included in the analysis because an insignificant volume is provided an construction plans were not readily available. The elevation versus area relationship for the wetland east of Florida Hospital was taken from the Orange County Aerial Topographic Maps. The outfall from this wetland area is a 36-inch culvert which discharges northward to a stormwater pond on the south side of Votaw Road (Node MS02N01P). Information regarding this culvert was obtained from the Musselwhite Multi-Family Development plans. These plans also show a swale/ditch at the east end *of Myrtle Street which would act as a high level overflow to the existing stormwater pond (Node MS02NO1P). However, a private park has been built at this location and no ditch was evident during field inspections.*

2.5.4.1.2 Sub-Basin MS02

Sub-basin MS02 encompasses the area draining to the existing stormwater pond on the south side of Votaw Road (Node MS02N01P), west of Lake McCoy South . This area is primarily comprised of the multi-family and high density single-family residential units between Myrtle Street and Lovell Lane, with some pasture land to the southeast of the pond also contributing runoff. In addition to direct runoff from the sub-basin, the outfall from the wetland in Sub-basin MS01 discharges into the existing stormwater pond in Sub-basin MS02.

A majority of the sub-basin drains eastward along Myrtle Street and Lovell Lane from a high point of 127 feet to an elevation of 80 feet at the pond. Small ponds are located at the east end of each of these roads. However, these ponds were not included in the computer modeling because they are insignificant in relation to Lake McCoy South and plans for the development along Lovell Lane could not be located.

Orange County Aerial Topographic Maps were used to determine the elevation versus area relationship of the existing stormwater pond (Node MS02N01P). The pond outfall to Lake McCoy South consists of a 36-inch culvert welded to a riser consisting of half a 48-inch culvert. The sizes and lengths of the outfall structure were measured during field investigations. Elevations of the weir overflow and pipe inverts were estimated based on the water level in the pond shown on the above mentioned topographic maps.

2.5.4.1.3 Sub-Basin MS03

Sub-basin MS03 is comprised of the area which drains to the upper end of Greenwood Gorge (Node MS03N01P). The area is bounded on the west by Park Avenue, on the south by Main Street (U.S. 441), and on the east by McGee Avenue. The northern boundary runs along Third Street to the intersection with Forest Avenue, then to the intersection of First Street and Highland Avenue, and then meanders through the Greenwood Cemetery. The sub-basin is entirely developed with the primary land uses being commercial, residential, and cemetery. Elevations range from 139 feet at Park Avenue to 86 feet at the bottom of Greenwood Gorge. Most runoff is conveyed to the ravine via storm sewer, although some areas within the cemetery runoff via overland flow.

The southwestern portion of this sub-basin previously drained to a drainwell on Highland Avenue, just north of Main Street (U.S. 441). Within the last four (4) years, the drainwell was taken out of service and a storm sewer system was constructed to redirect runoff to the Greenwood Gorge. At the same time, three (3) dams were constructed across the ravine to offset the increased drainage area by providing water quality treatment and detention. The Sub-basin MS03 divide crosses Greenwood Gorge at the first of the three (3) drainage structures constructed across the ravine.

The outfall from Sub-basin MS03 is to the northeast to the middle segment of Greenwood Gorge (MS04N01P). At low flows, a 30-inch culvert with a type "E" riser (control) structure provides the outlet. During extreme rainfall, flows are also conveyed through a spillway. The drainage structure information and the elevation versus area relationship for the upper segment of Greenwood Gorge was obtained from construction plans for the structures in Greenwood Gorge designed by Dyer, Riddle, Mills, and Precourt.

2.5.4.1.4 Sub-Basin MS04

As mentioned in the previous section, three (3) drainage structures were constructed across Greenwood Gorge to provide water quality treatment and detention. Sub-basin MS04 consists of the area which drains directly to the middle segment of the ravine (MS04N01P) via overland flow. This section of Greenwood Gorge also receives runoff discharged from the upstream Sub-basin MS03.

The extents of Sub-basin MS04 lie entirely within the Greenwood Cemetery. The grade in this area is relatively steep with elevations falling from 119 feet to 82 feet within approximately 600 feet. The sub-basin is small in relation to the overall study area. It has been included in order to account for storage in the middle section of the ravine.

The outfall from the middle segment of the Greenwood Gorge is to the northeast into the lower segment of the ravine (MS05N01P). Like the upstream reach, the outfall for low flows is provided by a 30-inch culvert with a type "E" riser (control) structure and large flows are conveyed by a spillway over the dam across the ravine. The elevation versus area relationship and the drainage structure information was obtained from the construction plans prepared by Dyer, Riddle, Mills, and Precourt for the structures in Greenwood Gorge.

2.5.4.1.5 Sub-Basin MS05

Sub-basin MS05 consists of the small area which drains directly to the lower segment of Greenwood Gorge (MS05N01P) via overland flow. The entire sub-basin lies within the Greenwood Cemetery and is characterized by relatively steep grades ranging from 115 feet to 74 feet. Although the sub-basin is small, it has been included to account for the storage provided in the lower segment of the ravine.

The runoff from this sub-basin, along with the inflow from the upstream sub-basins (MS03 and MS04), discharges to Lake McCoy South. Low flows are conveyed by a 30-inch culvert with a type "E" riser (control) structure. Large flows from extreme rainfall events are conveyed over a spillway in the dam across the ravine. Information regarding the drainage structures and elevation versus area relationship was obtained from the Dyer, Riddle, Mills and Precourt construction plans for the structures in Greenwood Gorge.

2.5.4.1.6 Sub-Basin MS06

Sub-basin MS06 comprises the southeast portion of the Lake McCoy South drainage basin. The sub-basin is defined by the area draining to the Christiana Avenue storm sewer system. On the west, the sub-basin divide runs northward along McGee Avenue to First Street, then eastward past Votaw Village Subdivision, then northward to Magnolia Street, then eastward again to Christiana Avenue, and northward along the west side of Christiana Avenue nearly to Votaw Road. Elsewhere, the sub-basin boundary is difficult to describe. Refer to any of the four (4) exhibits for a depiction of the MS06 sub-basin limits.

The general pattern of runoff is from the sub-basin boundary where elevations reach as high as 122 feet, toward the center of the sub-basin along the roadways to Christiana Avenue where the low point is approximately 72 feet. At Christiana Avenue, runoff is collected in a storm sewer system and piped directly to Lake McCoy South. No significant storage is provided within the sub-basin and the storm sewer system has not been modeled. The sub-basin was called out separately from Lake McCoy South in order to account for the different hydrologic parameters (time of concentration and curve number).

2.5.4.1.7 Sub-Basin MS07

Sub-basin MS07 consists of the portion of the Votaw Village Subdivision which drains to the existing south stormwater pond (MS07N01P) in the development. Starting at the southwest corner of the sub-basin, the boundary runs eastward along First Street past Votaw Village, then northward to Magnolia Street, then eastward again to Christiana Avenue, and northward along Christiana Avenue. To the west, the sub-basin is bounded by the Greenwood Cemetery and Lake McCoy South. Elevations in this area range from 117 feet in the southwest corner of the subdivision to 67 feet adjacent to the pond.

The general drainage pattern is toward the streets in the subdivision where runoff is intercepted by storm sewer and conveyed to the existing pond. The pond was designed to provide water quality treatment and peak rate attenuation of runoff prior to discharging to Lake McCoy South. The outfall control structure for this pond consists of a weir overflow as described in the construction plans for Votaw Village prepared by Harling, Locklin and Associates. The dimensions of the pond were also taken from these construction plans.

2.5.4.1.8 Sub-Basin MS08

Sub-basin MS08 consists of the portion of the Votaw Village Subdivision which drains to the existing north stormwater pond (MS08N01P) in the development. The area is bounded by Votaw Road on the north, Christiana Avenue to the east, and Lake McCoy South on the southwest. Slopes in the sub-basin are moderate, with elevations varying from 76 feet near Christiana Avenue to 66 feet adjacent to the pond.

Because the area is entirely developed, runoff is conveyed to the existing pond by storm sewer systems. The pond then provides water quality treatment and attenuation of the peak runoff rate prior to discharging to Lake Mccoy South. The construction plans for the Votaw Village Subdivision, prepared by Harling, Locklin, and Associates, provided the information regarding the overflow weir control structure and the elevation versus area relationship for the pond.

2.5.4.1.9 Sub-Basin MS09

Sub-basin MS09 is defined by the area draining directly to Lake McCoy South. The sub-basin is bounded on the north by Votaw Road, on the east by Votaw Village Subdivision, and on the south by the Greenwood Cemetery. The western boundary runs east of Highland Avenue from the Greenwood Cemetery, to the Sunbelt Living Center, and then northward to Votaw Road. As the major feature in the Basin, Lake McCoy South receives the runoff from all upstream sub-basins designated with an MS prefix in addition to the direct runoff from Sub-basin MS09.

Lake McCoy South comprises roughly half of the basin area and lies adjacent to Votaw Road and the Votaw Village Subdivision. To the west of the lake, slopes are relatively steep, rising to an elevation of 123 feet in the Greenwood Cemetery just east of Highland Avenue. For this study, the normal high water elevation for this portion of the lake was set at 62.3 feet, which is 6-inches above the surveyed invert of the existing outfall pipe under Votaw Road. The existing outfall consists of a 30-inch pipe under Votaw Road to Lake McCoy North. This reach was surveyed by Jones, Hoechst, and Associates, Inc. (JHA) in conjunction with this study. JHA also surveyed the lowpoint along the roadway centerline. This information was utilized to describe the connection between the *northern and southern portions of Lake McCoy. The elevation versus area relationship of Lake McCoy South was taken from the Orange County Aerial Topographic Maps.*

2.5.4.2 Dream Lake Basin

The major drainage feature in this Basin is Dream Lake, which is located west of Park Avenue, east of Lake Avenue, south of Laurel Street, and north of Myrtle Street. The Dream Lake Basin encompasses much of the southwest portion of the study area from Summit Street south to U.S. 441 (North Orange Blossom Trail). Exhibit No. 1 depicts the extents of the Dream Lake Basin (approximately 254 acres).

The Basin was subdivided into five (5) sub-basins which are identified with the prefix "DL" (i.e., DL01, DL02, etc.) Descriptions of the storage in each sub-basin and the connectivity between sub-basins are provided in the sections which follow. Sub-basins DL01, DL02, and DL03 were included because each provides significant flood storage upstream of Dream Lake.

2.5.4.2.1 Sub-Basin DL01

Sub-basin DL01 is located in the southwest portion of the Dream Lake Basin and the overall study area. The sub-basin is defined as the area draining to the existing pond (DL01N01P) located north of Old Dixie Highway and west of Hawthorne Avenue and which is referred to as the Ustler Pond by some sources. Refer to any of the four (4) exhibits for a depiction of the DL01 sub-basin.

The DL01 sub-basin includes much of the commercial development along U.S. 441 (North Orange Blossom Trail) from Washington Avenue to west of Bradshaw Road. According to previous studies, this area drains directly to Ustler Pond via the storm sewer system along U.S. 441. Other areas drain to the pond via overland flow and flow along the roadways.

In general, the slopes in this sub-basin are minimal, with the greatest change occurring in the vicinity of Ustler Pond (from 152 feet down to 144 feet). Elevations along the northern perimeter of the pond are the lowest. Jones, Hoechst & Associates, Inc. (JHA) surveyed the dirt path separating the pond from the depressional area to the north in Sub-basin DL02. The profile of this path was modeled as a broad crested overflow between the two storage areas with a low point elevation of 147.7 feet. The elevation versus area relationship for this pond was taken from the St. Johns River Water Management District (SJRWMD) Aerial Topographic Maps. For areas above elevation 147 feet, the basin divide was used to close the area.

During the work on this project, JHA surveyed a water level in the pond of 144.1 feet. Immediately following JHA's survey work, PEC staff learned that the pond was controlled by a drainwell and observed the water level in the pond to be slightly above the overflow level of the drainwell. The actual discharge elevation of the drainwell was not surveyed. Subsequent to the initial draft of this report, R.H. Wilson and Associates provided Florida Department of Transportation construction plans which included drainage well details. Based upon this information, the drainwell is located in a structure which has a floor elevation of 144.5 feet and the overflow elevation of the drainwell is approximately three (3) inches above the floor of the structure at elevation 144.75 feet. It should be noted that following the discovery of the drainwell, the water level in Ustler Pond was observed to be at or above the inlet elevation of the drainwell.

The drainwell located at Ustler Pond (node DL01N01P) was modeled as an outfall to the aquifer using a rating curve. A detailed drainwell capacity analysis was beyond the scope of this study. Therefore, the orifice equation was used to model the discharge capacity of the twelve (12) inch drainwell. The primary function of the drainwell is to control the water level in the pond between storm events. Following Orange County's practice of setting the normal high water elevation six (6) inches above the outlet elevation, an elevation of 145.25 feet was used as the initial stage in Ustler Pond. This elevation is well above the water elevation surveyed by JHA.

2.5.4.2.2 Sub-Basin DL02

Sub-basin DL02 is located in the Dream lake Basin just north of sub-basin DL01 and includes the proposed Rhapsody Oaks Subdivision site. The depressional area (DS02N01W) located on this site is the defining water feature of the sub-basin. The drainage area extends to New Hampshire Avenue on the west and beyond Washington Avenue on the east. The northern divide runs along the berm of the existing stormwater pond which was constructed to serve the Oaks of Summit Lake Subdivision. To the south, the sub-basin extends as far as U.S. 441. Originally, the area south of Magnolia Street was thought to drain to sub-basin DL01; however, on at least two (2) separate occasions, PEC staff observed runoff from Hawthorne Avenue and Magnolia Street flowing northward into the depressional area in sub-basin DL02. Elevations in the sub-basin range from 156 feet at New Hampshire Avenue and 154 feet at U.S. 441 (North Orange Blossom Trail) to 141 feet at the bottom of the depressional area.

Runoff from the undeveloped areas reaches the depressional area via overland flow. Runoff from the developed areas to the southeast flows along the roadways to the depression. In addition, the Ustler Pond in Sub-basin DL01 (Node DL01N01P) will overflow into the depressional area during large storm events.

The elevation versus area relationship for the depressional area (Node DL02N01W) was taken from the construction plans for the proposed Rhapsody Oaks Subdivision prepared by R.H. Wilson and Associates. For areas which extend beyond the sub-basin, the sub-basin boundary was used to close the area at each elevation. The normal high water level in this depressional area was estimated/assumed to be halfway between the control elevations of Ustler Pond (upstream) and the Oaks of Summit Lake pond (downstream). Sources suggest that the water level in this depressional area is controlled by one or more drainwells; however, PEC was unable to locate any such structures and the construction plans for the proposed Rhapsody Oaks Subdivision do not indicate their existence.

The overflow for this depressional area is northward to the existing stormwater pond in sub-basin DL03 (Node DL03N01P) via overtopping of the pond berm. Based on construction plans for the Oaks of Summit Lake Subdivision prepared by R.H. Wilson and Associates, the pond berm is at elevation 148 feet. This elevation has been used for the connection between the depression (Node DL02N01W) and the downstream pond (Node DL03N01P).

2.5.4.2.3 Sub-Basin DL03

Sub-basin DL03 is located west of Dream Lake and is comprised of the area draining to the existing stormwater pond at the west end of Myrtle Street (Node DL03N01P). This pond was constructed to serve the Oaks of Summit Lake Subdivision which extends northward to Summit Street and westward to New Hampshire Avenue. Some of the existing homes to the east on Washington Avenue also drain toward the existing pond. Elevations range from 160 feet near Summit Street to 148 adjacent to the pond.

At present, only the Phase I portion of the Oaks of Summit Lake Subdivision has been constructed in the northern portion of the sub-basin. Runoff from this area is collected in the existing storm sewer system and piped directly to the existing stormwater pond. For this study, all of the Oaks of Summit Lake has been modeled as developed area. Runoff from other areas currently reaches the pond via overland flow. During large storms, runoff will also discharge into the pond from the depressional area (Node DL02N01W) to the south. The elevation versus storage relationship for the pond was taken from calculations prepared by R.H. Wilson and Associates. The calculated storage correlated well with the actual area of the constructed pond shown on Exhibit No. 1. The normal high water level in the pond was taken to be the current design control elevation of the pond. A drop structure and culvert outfall to Dream Lake was constructed along with the pond. Information regarding the control elevation, geometry of the outfall structure, pipe sizes, pipe lengths, and inverts were obtained from construction plans prepared by R.H. Wilson and Associates.

2.5.4.2.4 Sub-Basin DL04

Sub-basin DL04 is primarily comprised of a subdivision located northwest of Dream Lake. The subdivision is bounded on the north by Summit Street, on the west by the Summit Oaks Subdivision, and on the east by Dream Lake Drive. To the south, the sub-basin includes some undeveloped lands. Elevations range from 160 feet in the northwest corner of the sub-basin to 140 feet adjacent to the two (2) existing stormwater ponds in the southeast portion of the sub-basin.

The general drainage pattern is toward the streets in the subdivision where runoff is intercepted by storm sewer and conveyed to the existing ponds. Runoff from the undeveloped lands to the south flows overland toward these ponds. The ponds presumably provide water quality treatment and peak rate attenuation prior to discharging to Dream Lake via a drop (control) structure and culvert system. During the data collection phase of this project, PEC was unable to obtain construction plans or drainage calculations which would provide information regarding the outfall control structure or the elevation versus area relationships of the ponds. Thus, PEC was unable to include the existing ponds in the routing model. Because the ponds are very small in relation to Dream Lake, their exclusion from the routing model was anticipated to have minimal impact. The sub-basin was included as a separate contributory area to Dream Lake in order to account for the variations in curve number and time of concentration.

2.5.4.2.5 Sub-Basin DL05

Sub-basin DL05 encompasses the areas which drain directly to Dream Lake. The approximate extents of the sub-basin are Summit Street to the north, Oak Street to the south, Washington Avenue to the west, and Park Avenue to the east. Elevations in this area range from 155 feet on Summit Street to 115 feet at the water's edge. Although the sub-basin is almost entirely developed, most runoff reaches Dream Lake via flow along the roadways in the sub-basin. A few storm sewer systems have been constructed on the roads adjacent to the lake. Runoff is also piped to Dream Lake from upstream sub-basins DL03 and DL04.

The primary outfall from the lake is a 24-inch culvert under Park Avenue. To the east of the road, discharge from Dream Lake is conveyed via a series of ditches and culverts toward Lake McCoy North. Survey subconsultant Jones, Hoechst and Associates, Inc. (JHA) provided most of the information regarding this outfall. The secondary high level overflow for Dream Lake is Park Avenue itself. Once into Park Avenue, runoff will either enter the storm sewer system along the roadway or flow across the roadway and down Votaw Road. If the storm sewer system has capacity to accept additional runoff, it will be directed to the pond adjacent to Lake McCoy in sub-basin PA05. Otherwise, runoff will flow directly to Lake McCoy North. Because the capacity of the storm sewer *near Dream Lake is unknown, the latter possibility was modeled. The road profile, which was obtained from F.D.O.T. construction plans for Park Avenue, circa 1979, was used to physically describe this overflow.*

The elevation versus area relationship for Dream Lake was taken from St. Johns River Water Management District (SJRWMD) Aerial Topographic Maps. The water level shown on these maps is 114.1 feet. This roughly corresponds to the Orange County Lake Index which lists a normal high water elevation of 114.5 feet for Dream Lake. Orange County generally sets the normal high water elevation six (6) inches above the outlet elevation and JHA survey indicates that the highest invert on the culvert under Park Avenue is at elevation 113.74 feet, which is a good correlation between sources. However, JHA also surveyed a water elevation of 115.1 feet in Dream Lake at a time when very little outflow was noted. Upon further review of the survey by JHA, it was noted that the invert of the next pipe downstream of Park Avenue was 114.5 feet. Following Orange County's practice of setting the normal high water elevation six (6) inches above the outlet elevation, an elevation of 115.0 feet was used as the initial stage in Dream Lake. This elevation correlates well with the water elevation surveyed by JHA.

2.5.4.3 Park Avenue Drainage Basin

This drainage basin is comprised of the areas which drain to the existing storm sewer system along Park Avenue. The extents of this system are from Main Street (U.S. 441) north to Nancy Lee Lane. At Votaw Road, the system outfalls eastward to the existing stormwater pond on the north side of the road, west of Lake McCoy. This pond (Node PA05N01P) in turn discharges to Lake McCoy via a drop (control) structure and culvert outfall. This basin (approximately 306 acres) was included separately in order to analyze the possibility of improving water quality treatment and peak rate attenuation for a large portion of untreated development. Five (5) sub-basins are included in this basin and are identified with the prefix "PA" (i.e., PA01, PA02, etc.). Refer to Exhibit No.1 for a graphical depiction of these sub-basins. Descriptions of each sub-basin are provided in the sections which follow.

2.5.4.3.1 Sub-Basin PA01

Sub-basin PA01 consists of the area on the west side of Park Avenue and north of Grossenbacher Drive which contributes runoff to the Park Avenue storm sewer system. The approximate limit of the sub-basin on the west is Lake Avenue. To the north, the sub-basin divide is near Nancy Lee Lane. Elevations range from 147 feet at the west end of Nancy Lee Lane to 125 feet at Park Avenue. In general, drainage is eastward to Park Avenue via runoff along the roadways. Although a few small ponds are located in this sub-basin, none provide an appreciable amount of flood *storage relative to the overall study area and construction plans were not readily available. Therefore, these existing stormwater ponds have not been included in the analyses contained in this report. Rather, all runoff from this sub-basin has been directed to the pond on the north side of Votaw Road, west of Lake McCoy (Node PA05N01P).*

2.5.4.3.2 Sub-Basin PA02

Sub-basin PA02 consists of the area in the Summerset Subdivision which drains to the existing stormwater pond at the southwest corner of Lake Avenue and Martin Street (Node PA02N01P). The sub-basin is bounded on the north by Martin Street, on the south by Summit Street, and on the east by Lake Avenue. To the west, the sub-basin extends to the limits of the Summerset Subdivision. Elevations range from 160 feet in the southwest portion of the subdivision to 150 feet adjacent to the pond.

The existing pond in this sub-basin was designed to retain the 100-year runoff volume from the Summerset Subdivision. Construction plans for the subdivision obtained by PEC depicted what appeared to be only a first phase of the pond rather than the "as-built" pond. Therefore, the elevation versus area relationship for the pond was taken from the St. Johns River Water Management District Aerial Topographic Maps. Because the pond was intended to contain the runoff from all but the most extreme rainfalls, no outfall structures were constructed. Nonetheless, an outfall reach was included in the analyses contained in this report to simulate overtopping of the pond which would flow along Martin Street to the Park Avenue storm sewer system. A lag time of 0.60 hours was applied to the hydrograph for this sub-basin to account for the time it would take for any overflow from the Summerset Subdivision pond to reach the existing stormwater pond on Votaw Road adjacent to Lake McCoy.

2.5.4.3.3 Sub-Basin PA03

Sub-basin PA03 is comprised of the area west of Park Avenue which drains to the roadway between Votaw Road and Grossenbacher Drive. The western extent of the sub-basin is at Lake Avenue, just east of Summerset Subdivision. Elevations range from 147 feet at Lake Avenue to 125 feet at Park Avenue. Consequently, the general drainage pattern is from west to east along the roadways toward Park Avenue. At Park Avenue, runoff is intercepted by the storm sewer system and routed to the existing stormwater pond on Votaw Road.

No significant storage is provided in this sub-basin. Therefore, all runoff from this sub-basin has been directed to the existing stormwater pond on the north side of Votaw Road, west of Lake McCoy (Node PA05N01P).

2.5.4.3.4 Sub-Basin PA04

Sub-basin PA04 consists of the area west of Park Avenue and south of Votaw Road which drains to the storm sewer system along Park Avenue. The southern extent of the sub-basin is Main Street (U.S. 441). To the west, the sub-basin extends as far as Hawthorne Avenue. Refer to Exhibit No. 1 for a depiction of the sub-basin. The general drainage pattern in the sub-basin is from west to east and from south to north along the roadways with elevation falling from 154 feet at the westernmost point to 118 feet at Park Avenue and Votaw Road. At Park Avenue, runoff is intercepted in the roadway storm sewer system and conveyed to the existing stormwater pond (Node PA05N01P) on Votaw Road. Because the sub-basin has no significant storage upland of this pond, the runoff hydrograph was routed directly to the pond.

2.5.4.3.5 Sub-Basin PA05

Sub-basin PA05 was delineated to include direct rainfall on the existing pond (Node PA05N01P) located north of Votaw Road and west of Lake McCoy. This pond serves as the outfall for the Park Avenue storm sewer system. As such, it receives runoff from roughly 250 acres of developed area, for which little other treatment is provided. As mentioned previously, the Park Avenue Drainage Basin, which drains to this pond, was included as a separate basin in order to analyze the possibility of improving water quality treatment and attenuation of the peak rate of runoff.

Based on Florida Department of Transportation (FDOT) construction plans for the widening of Park Avenue (circa 1979), the pond was intended to have a dry bottom at elevation 61.9 feet. Apparently, the pond was also intended to recover via percolation, as evidenced by a lack of any drawdown device such as an orifice in the outfall structure or underdrains. However, for the duration of this study, the pond has been wet, with the water level consistently at or near the overflow elevation of the outfall structure and close to the top-of-bank. According to the FDOT plans, the elevation of the top of the structure is 67.0 feet and the pond top-of-bank is 69.0 feet. Thus, at present, the pond provides little more treatment than containment of some floating trash and debris. Even its function in this capacity is limited because much of the aluminum skimmer is missing. Because the available volume is limited, the pond also has little ability to attenuate runoff from the upstream basin.

The top of the drop structure outfall has been used as an initial water elevation in the analyses contained in this report. All other information regarding the pond and outfall structure was obtained from the above referenced FDOT construction plans.

2.5.4.4 Buchan Pond Drainage Basin

The defining drainage feature in this basin is Buchan Pond, which is located northwest of the intersection of Lake Avenue and Grossenbacher Drive. Most of the area contributing runoff to Buchan Pond is located to the north and west within the Pines of Wekiva, P.U.D. Several detention ponds have been constructed in this development to provide water quality treatment and attenuation of runoff prior to discharge to Buchan Pond. Accordingly, the basin has been further divided into five (5) sub-basins, four (4) of which are defined by detention ponds within the Pines of Wekiva P.U.D. and one (1) which includes Buchan Pond itself. These sub-basins are identified on the Exhibits and throughout the calculations with the prefix "BP" (i.e., BP01 through BP05). Descriptions of the storage in each sub-basin and the connectivity between sub-basins are provided in the sections which follow. Refer to Exhibit No. 1 for a depiction of the Buchan Pond Drainage Basin and the sub-basins therein (approximately 141 acres).

2.5.4.4.1 Sub-Basin BP01

Sub-basin BP01 consists of the portion of the Pines of Wekiva development which drains to the existing detention pond adjacent to Lake Avenue (Node BP01N01P) northeast of Buchan Pond. This pond was identified as Pond No. 3 in the Pines of Wekiva construction plans.

The entire sub-basin is developed as single-family residences. The drainage pattern is typical of development of this type; runoff flows toward the streets in the subdivision where it is intercepted by storm sewer and conveyed to the existing detention pond. In this instance, runoff drains from the northern portion of the subdivision, where elevations are approximately 150 feet, southward to the existing pond which is controlled at an elevation of 139 feet.

The existing stormwater pond (Node BP01N01P) in this sub-basin was designed to provide water quality treatment and attenuation of runoff prior to discharging to Buchan Pond. Construction plans prepared by Schemmer Associates were used to define the elevation versus area relationship for the pond, the drop structure and culvert outfall to Buchan Pond, and the control elevation of the pond.

2.5.4.4.2 Sub-Basin BP02

Sub-basin BP02 is defined as the area draining to the Pines of Wekiva Upper Pond No. 2. The designation for the pond in this study is Node BP02N01P. Presently, only a portion of the sub-basin has been developed as a single-family residential subdivision. Construction plans have been *approved for additional residential development in the remainder of the sub-basin; therefore, the entire area was considered as developed for this study.*

The variation in elevation throughout this sub-basin is relatively minor with high elevations of approximately 150 feet and low elevations adjacent to the pond of 147 feet. The control water elevation in the existing pond is 143 feet. As with most recent development, a majority of the runoff is conveyed to the pond via storm sewer systems. The existing stormwater pond (Node BP02N01P) provides water quality treatment and peak rate attenuation of runoff from the sub-basin prior to discharging via a drop (control) structure and culvert outfall to the existing stormwater pond in sub-basin BP04 (a.k.a., Node BP04N01P and Pines of Wekiva Lower Pond No. 2). Construction plans prepared by Schemmer Associates and CCL Consultants were used to identify the dimensions of the pond and outfall control structure.

2.5.4.4.3 Sub-Basin BP03

The Apopka Ninth Grade Center encompasses all of sub-basin BP03. This sub-basin is located in the western portion of the Pines of Wekiva P.U.D. and to the north of Apopka High School. The elevations on the school site range from a high near 150 feet at the buildings to 147.5 feet adjacent to the ponds.

The site is served by two (2) existing dry bottom stormwater ponds located at the north and south ends of the site. The ponds are interconnected on both the west and east sides of the school by storm sewer collection systems. The outfall control structure for both ponds is located on the storm sewer system east of the school and consists of a weir overflow in a modified type "J" manhole. From this manhole, an outfall pipe extends eastward to the existing pond in sub-basin BP04 (a.k.a., Node BP04N01P and Pines of Wekiva Lower Pond No. 2). For the purpose of this study, the two (2) ponds on the school site were combined and treated as one storage node (Node BP03N01P) and the outfall control structure was modeled as a drop structure and culvert. The initial water elevation was taken to be the bottom of the north pond, which was the lower of the two, because the ponds were observed to be dry during field investigations shortly after heavy rains. All of the information used to model the systems in Sub-basin BP03 was obtained from construction plans and drainage calculations prepared by John B. Webb & Associates.

2.5.4.4.4 Sub-Basin BP04

Sub-basin BP04 is comprised of the area draining to the Pines of Wekiva Lower Pond No. 2. At present, the portion of the development east of this existing stormwater pond (Node BP04N01P) has been developed with single-family residences. The area to the west of the pond has been approved for similar development. For this study, the entire sub-basin was considered as developed. Runoff from the existing and proposed subdivisions will be conveyed to the pond via storm sewer systems. In addition to direct runoff from Sub-basin BP04, the existing pond receives runoff discharged from upstream ponds in Sub-basins BP02 and BP03. The existing stormwater pond (Node BP04N01P) provides water quality treatment for sub-basin BP04, as well as, attenuation of the peak rate of runoff for all upstream drainage areas before discharging to Buchan Pond. Construction plans for the Pines of Wekiva, Phase I, prepared by Schemmer Associates were used to define the elevation versus area relationship of the pond (Node BP04N01P). Likewise, these plans were referenced to obtain information regarding the drop structure and culvert outfall to Buchan Pond, as well as, the control water level of the pond.

2.5.4.4.5 Sub-Basin BP05

The area draining directly to Buchan Pond describes sub-basin BP05. The extents of the sub-basin include Buchan Pond and the athletic field to the west of the water body. The boundaries are Lake Avenue to the east, Grossenbacher Drive to the south, Apopka High School to the southwest, Apopka Ninth Grade Center to the northwest, and the subdivisions in the Pines of Wekiva P.U.D. to the north. Elevations in this area range from 153 feet at the Apopka High School baseball field to approximately 137 feet at the water's edge of Buchan Pond.

Buchan Pond comprises over half of the sub-basin. Most of the remaining area drains to Buchan Pond via overland flow. The exception is one (1) small water quality pond; however, it has been ignored since it provides an insignificant volume of storage.

The elevation versus area relationship for Buchan Pond was taken from St. Johns River Water Management District (SJRWMD) Aerial Topographic Maps. The outfall control structure, which discharges to the Grossenbacher Drive drainage system in Sub-basin MN15 was surveyed by subconsultant Jones, Hoechst, & Associates, Inc. (JHA). JHA's survey indicated an overflow weir elevation of 137.16 feet. Following Orange County's practice of setting the normal high water elevation six (6) inches above the outfall elevation; the initial stage in Buchan Pond was set at 137.7 feet.

2.5.4.5 Lake McCoy North Basin

The major drainage feature in this basin is the portion of Lake McCoy north of Votaw Road. The Lake McCoy North Basin (approximately 881 acres) includes all of the study area bounded by Votaw Road, Sandpiper Street, Park Avenue, and Thompson Road. Within these limits, the Basin was divided into fourteen (14) sub-basins. Outside of these limits, seven (7) other areas are included *in the basin. One (1) sub-basin lies south of Votaw Road, between Christiana Avenue and Thompson Road. Three (3) are located west of Park Avenue along Grossenbacher Drive, and three (3) other sub-basins are located between Sandpiper Street and Welch Road, adjacent to Park Avenue. The sum of all areas in the Lake McCoy North Basin comprises approximately 24 percent of the total study area.*

In addition to the twenty-one (21) sub-basins included in the Lake McCoy North Basin, all of the previously discussed basins drain to this lake. For instance, the Lake McCoy South Basin is connected to Lake McCoy North with an existing culvert under Votaw Road. Dream Lake discharges to Lake McCoy North via a series of ditches and culverts which run through the Apopka Middle School site. Runoff from the Park Avenue Drainage Basin is conveyed to an existing pond located north of Votaw Road adjacent to Lake McCoy North, which discharges to the lake. And, Buchan Pond outfalls to the Grossenbacher Drive storm sewer system which discharges toward Lake McCoy North via a culvert under Park Avenue. The total area draining to Lake McCoy North, including all upstream Basins, makes up approximately 63 percent of the total study area.

Descriptions of the storage areas and outfall structures located in each sub-basin within the Lake McCoy North basins are provided in the sections which follow. The extents of each sub-basin are illustrated on Exhibit No. 1.

2.5.4.5.1 Sub-Basin MN01

Sub-basin MN01 encompasses the small area on the northeast corner of Park Avenue and Votaw Road that drains to the open ditch associated with the Dream Lake outfall. This sub-basin was included in the model only to account for the downstream impacts on the outfall pipe from Dream Lake. As mentioned in the description of Sub-basin DL05, the primary outfall from Dream Lake to Sub-basin MN01 is a 24-inch culvert under Park Avenue. The upstream and downstream inverts of this culvert were surveyed by Jones, Hoechst, and Associates, Inc. (JHA) as 113.72 feet and 113.74 feet, respectively. The outfall culvert leaving Sub-basin MN01 is also 24-inches in diameter. However, the upstream invert on this culvert was surveyed by JHA as 114.49 feet. Thus, the culvert leaving this sub-basin actually controls Dream Lake nine (9) inches higher than would the culvert under Park Avenue. This distinction is important because the nine (9) inch increase in the normal high water elevation of Dream Lake results in a loss of approximately 12.8 acre-feet of flood storage in the lake. This reduction in flood storage results in higher peak flood stages in Dream Lake for all of the storm events analyzed.

2.5.4.5.2 Sub-Basin MN02

Sub-basin MN02 consists of the portion of the Apopka Middle School site draining to the three (3) existing stormwater ponds on the south side of the school. This area is located on the northeast corner of Park Avenue and Votaw Road and extends eastward to the school athletic field. Elevations in this sub-basin vary from 128 feet (approximately 900 feet north of Votaw Road) to 118 feet adjacent to the ponds.

As mentioned above, the sub-basin includes three (3) existing dry bottom stormwater ponds located on the south side of the school. Runoff reaches these ponds via overland flow and storm sewer systems. The storm sewer system is configured such that the three (3) existing ponds are interconnected. The outfall for all three (3) ponds is located in the southernmost pond and consists of a drop structure and culvert which connects to the Dream Lake outfall pipe downstream of Sub-basin MN01. For this study, it was assumed that the existing ponds would act as one. Thus, the three (3) ponds were combined and treated as one storage area (Node MN02N01P). Information regarding the stage versus area relationships of the ponds was obtained from drainage calculations for the school site prepared by GAI Consultants. These calculations also provided the information regarding the outfall structure and the invert of the Dream Lake outfall pipe at the point of connection in the junction manhole designated as Node MN02N02D.

2.5.4.5.3 Sub-Basin MN03

Sub-basin MN03 includes the Apopka Middle School athletic field and a portion of the Orange County School Bus Depot located north of Votaw Road. Runoff from these areas drains to a small stormwater pond (Node MN03N01P) at the southeastern corner of the school athletic field via overland flow. Elevations in this sub-basin vary from 116 feet in the school bus depot to approximately 106 feet at the outfall from the pond.

The Dream Lake outfall pipe runs through this sub-basin and discharges to a stream just east of the athletic field. Jones, Hoechst, and Associates, Inc. (JHA) surveyed this outfall pipe at the last two (2) manholes, which lie adjacent to the existing pond and at its outlet. The existing stormwater pond in sub-basin MN03 discharges to the Dream Lake outfall pipe at each of the last two (2) manholes. The upstream manhole, designated as Node MN03N02D in this study, is located in the existing pond and has a three (3) foot weir cut in one side at elevation 105.94 feet to allow for outflow from the pond. At the east end of the pond, a trapezoidal weir was constructed at elevation 105.95 feet to provide a second outfall. On the downstream side of this weir, a flume was constructed to direct runoff into the last manhole on the Dream Lake outfall pipe which has been designated as Node MN03N03D. The elevations and geometry of these weirs was surveyed by PEC using elevations *surveyed by JHA as benchmarks. The elevation versus area relationship of the pond (Node MN03N01P) was taken from Orange County Aerial Topographic Maps.*

The information surveyed by JHA also was used to model the Dream Lake outfall through this sub-basin. The model includes the culvert reaches from Node MN02N02D to Node MN03N02D to Node MN03N03D to the outlet end at a stream just east of the Apopka Middle School athletic field. It should be noted that significant erosion has occurred at the outlet from the Dream Lake outfall pipe to the stream east of this sub-basin and that the energy dissipator at this location has structurally failed.

2.5.4.5.4 Sub-Basin MN04

Sub-basin MN04 consists of the portion of the Lake McCoy Forest Subdivision draining to the existing pond at the end of Songbird Way. This area is located north of Votaw Road, immediately east of Lake McCoy. The general drainage pattern is toward the streets in the subdivision, where roadside swales and storm sewer systems intercept runoff and convey it to the existing pond. During the data collection phase of this project, PEC obtained construction plans from the Orange County archives for the Lake McCoy Forest Subdivision. However, these plans did not reflect "as built" conditions with regard to pond size, pond location, and the number of ponds in the subdivision. Thus, Sub-basin MN04 was included simply as direct runoff to Lake McCoy North. Because the pond in this area is very small in relation to Lake McCoy North and the overall study area, its exclusion has minimal impact on the results of the study.

2.5.4.5.5 Sub-Basin MN05

Sub-basin MN05 is mostly comprised of the portion of the Lake McCoy Forest Subdivision draining to the existing pond at April Lane and Songbird Way. This area is located between Lake McCoy and Votaw Road, just east of Sub-basin MN04. Runoff drains from the homesites, where elevations are as high as 76 feet, toward the roadways. At the roads, swales and storm sewer systems convey runoff toward the existing pond where surrounding elevations are 68 feet. As outlined in the description of Sub-basin MN04, the construction plans for the Lake McCoy Forest Subdivision on file in the Orange County archives did not reflect "as-built" conditions. In fact, these plans do not show a pond in this sub-basin. For lack of other information, runoff from Sub-basin MN05 was modeled as direct runoff to Lake McCoy North. Because the pond in this area provides minimal storage in relation to Lake McCoy and the overall study area, its exclusion has minimal impact on the results of this study.

2.5.4.5.6 Sub-Basin MN06

Sub-basin MN06 consists of the area draining to the ponds in the Oaks-on-the-Lake Subdivision. This area includes the subdivision itself and adjacent lands to the east. In the subdivision, runoff from the lots drains along the roadway where it is intercepted in storm sewer systems and conveyed to existing ponds. The area to the east of the subdivision drains to the northern existing pond via overland flow. This pond provides water quality treatment and peak rate attenuation prior to discharging to Lake McCoy North. A second pond is located at the entrance to the subdivision.

The "as-built" construction plans for the Oaks-on-the-Lake Subdivision prepared by Conklin, Porter, and Holmes (CPH) were obtained from the Orange County drawing archives. However, the plan set was not complete and some information regarding the outfall control structure from the northern pond was not available. Due to insufficient information, the ponds were not included in the analyses contained in this report. Rather, the sub-basin hydrograph was routed directly to Lake McCoy North. Because the storage volume provided in these ponds is small and most runoff is discharged to Lake McCoy, their exclusion has a negligible impact on the overall study area.

2.5.4.5.7 Sub-Basin MN07

Sub-basin MN07 is located in the southeast portion of the Lake McCoy North Basin and is defined by the area draining to the depression southeast of the intersection of Votaw Road and Christiana Avenue (Node MN07N01W). The area is bounded to the west by Christiana Avenue, to the north by Votaw Road, and to the east by Thompson Road. The southern boundary meanders from Christiana Avenue to Thompson Road as shown on Exhibit No. 1.

The general pattern of runoff is westward and northward from the high areas near Thompson Road and Lisa Lane (elevation 105 feet) to the low area (elevation 69 feet) southeast of Votaw Road and Christiana Avenue. As shown on Exhibit No. 2, land uses in the sub-basin are varied, with multi-family and single-family residences, nurseries, open lands, pasture lands, and wood land. Despite some development, no roads other than Votaw Road, Thompson Road, and Christiana Avenue are paved, and no storm sewer has been constructed. Runoff is conveyed to the depressional area via overland flow and flow along the unpaved roads.

The elevation versus area relationship was taken from Orange County Aerial Topographic Maps. The storage provided in the sub-basin is minimal; however, the sub-basin was included separately to account for the variation in hydrologic parameters (i.e., time of concentration, runoff curve number, and peak rate factor). The outfall from the depressional area was difficult to define. Based on field observations and Orange County Aerial Topographic Maps, runoff discharges to Votaw Road *just east of Christiana Avenue at an elevation of approximately 70 feet. Once into Votaw Road, it was assumed that runoff would be intercepted in the roadway storm sewer system and conveyed to Lake McCoy North.*

2.5.4.5.8 Sub-Basin MN08

Sub-basin MN08 consists of the area which drains to an existing stormwater pond (Node MN08N01P) at the end of Pine Oaks Court. For the most part, the contributory drainage area is confined to the Pine Oaks Subdivision located just west of Thompson Road and south of the Wekiva Landing Subdivision. Runoff from this area gets to the existing pond via overland flow and storm sewer systems.

The sub-basin and pond are small in relation to most of the sub-basins in the study area. Nonetheless, it was included because construction plans were available and the pond was designed to retain at least some volume of runoff. The elevation versus area relationship was taken from the construction plans for the Pine Oaks Subdivision prepared by Lochrane Engineering. Discharge from the pond to Lake McCoy North occurs when the pond overtops the berm. The elevation at which overtopping occurs was also taken from these construction plans.

2.5.4.5.9 Sub-Basin MN09

Sub-basin MN09 is comprised of the area draining to an existing stormwater pond in the Wekiva Landing Subdivision (Node MN09N01P). The sub-basin includes a portion of the Wekiva Landing Subdivision and the low-density residential development to the east of this subdivision. The area is bounded by Oak Point Circle on the north, Thompson Road on the east, Pine Oaks Subdivision on the south, and Wekiva Landing Drive on the west. Elevations range from 90 feet at Oak Point Circle to 66 feet adjacent to the pond.

Runoff is conveyed to the existing pond by swales along the roadway and via overland flow. The existing pond (Node MN09N01P) provides water quality treatment and peak rate attenuation of runoff from the sub-basin prior to discharging via a drop (control) structure and culvert outfall to Lake McCoy North. Construction plans "as-builts" prepared by Briskey Engineering Company for the Wekiva Landing Subdivision were used to identify the elevation versus storage relationship and the outfall control structure dimensions. These plans were also used to define the high level overflow from the pond, over Wekiva Landing Drive, to Lake McCoy North.

2.5.4.5.10 Sub-Basin MN10

Sub-basin MN10 consists of the area contributing runoff to the existing east pond in the Oakwater Estates Subdivision (Node MN10N01P). This area is located on Oakpoint Circle which is situated south of Sandpiper Street and west of Thompson Road. The sub-basin includes a portion of the Oakwater Estates Subdivision and adjacent lands to the north. Elevations range from as high as 85 feet north of the subdivision to 66 feet adjacent to the pond.

The subdivision is developed with low density, single-family residences. Consistent with most recent development of this type, runoff flows toward the streets where it is intercepted by storm sewer systems and conveyed to an existing detention pond. The pond provides water quality treatment and attenuation of the peak rate of runoff prior to discharging to Lake McCoy North via a drop structure and culvert outfall. The dimensions of the pond and outfall control structure were identified using the construction plans for the Oakwater Estates Subdivision prepared by GAI Consultants.

2.5.4.5.11 Sub-Basin MN11

Sub-basin MN11 is defined by the area contributing runoff to the existing western pond in the Oakwater Estates Subdivision (Node MN11N01P). This area is located south of Sandpiper Street and west of Thompson Road along Oakpoint Circle on a peninsula extending into Lake McCoy North. The drainage area is comprised entirely of low density, single-family residences within the Oakwater Estates Subdivision. The variation in elevation is slight, ranging from approximately 70 feet abutting some homes to 66 feet adjacent to the pond.

The pattern of runoff is typical of current residential development. Runoff flows toward the streets where it is picked up by storm sewer systems and conveyed to the existing detention pond. The pond then functions to furnish water quality treatment and peak rate attenuation of stormwater runoff from the sub-basin. Discharge to Lake McCoy North is by means of a drop structure and culvert outfall. The construction plans for Oakwater Estates prepared by GAI Consultants were referenced for dimensions of the pond and outfall control structure.

2.5.4.5.12 Sub-Basin MN12

Sub-basin MN12 is located southwest of the intersection of Welch Road and Rock Springs Road, with the roadways being the north and east boundaries, respectively. The southern boundary runs along the south side of Nancy Lee Lane from Rock Springs Road to the Pines of Wekiva Subdivision. The property boundary for this development makes up much of the western sub-basin boundary from Nancy Lee Lane to Welch Road.

Elevations in this area vary from 150 feet near the Pines of Wekiva property boundary to 120 feet bordering Rock Springs Road. Consequently, the drainage pattern is from the western boundary eastward to Rock Springs Road. At the roadway, runoff is intercepted by a roadside ditch that conveys it toward double 36-inch culverts under Rock Springs Road. These culverts outfall to a ditch in Sub-basin MN13 that conveys runoff eastward to an existing wetland. Culvert information was surveyed by Jones, Hoechst and Associates. The elevation versus area relationship for the roadside ditch and adjacent low areas was taken from St. Johns River Water Management District Aerial Topographic Maps.

2.5.4.5.13 Sub-Basin MN13

Sub-basin MN13 is situated southeast of the intersection of Welch Road and Rock Springs Road. The area is bounded on the north and west, respectively, by these roadways. On the south, the sub-basin divide runs just north of the Apopka Assembly of God Church. The eastern boundary lies approximately 1,400 feet east of Rock Springs Road. The water feature that defines this area is a shallow wetland (Node MN13N01W) which lies along the eastern sub-basin boundary.

The sub-basin is primarily undeveloped, with the natural elevations falling off eastward from 128 feet abutting Rock Springs Road to 103 feet in the wetland. Surveyed elevations in the wetland were obtained from construction plans for the Florida Power Corporation Substation at the intersection of Welch Road and Rock Springs Road. When compared to the Orange County Aerial Topographic Maps, significant discrepancies in elevations were observed. Following field investigation, it seemed likely that the Orange County maps were unreliable due to the density of the tree canopy in the wetland. Based on several aerial photographs, the densely forested wetland in this sub-basin encompasses approximately 18 acres. Using the surveyed bottom elevation and the areal extents determined from photographs, the elevation versus area relationship was estimated to account for the attenuation in the wetland.

Outflow from the wetland (Node MN13N01W) is split, particularly during large storms. During periods of low flow, the majority of runoff flows southward to Sub-basin MN14 via an existing drainage ditch. Cross sections of this ditch were surveyed at 200 foot intervals by Orange County in April 1996. From the surveyed information, a rating curve of channel discharge versus wetland water elevation was developed using the U.S. Army Corps of Engineers HEC-RAS, Version 1.1 computer program. HEC-RAS is described in Section 1.6.3.3 of this report and the program input/output for the channel in Sub-basin MN13 is provided in Volume II, Section 2 of this report.

The secondary outfall for the wetland (Node MN13N01W) is to the east to Sub-basin LP08. For small storms, the outflow in this direction is conveyed through a single 18-inch driveway culvert along Welch Road. The information regarding this culvert was obtained from construction plans for improvements to Welch Road prepared by Hollis Engineering. During large storms, runoff is expected to sheet flow into Sub-basin LP08. Elevations adjacent to the east side of the wetland were surveyed by Orange County in order to define this overflow.

2.5.4.5.14 Sub-Basin MN14

Sub-basin MN14 consists of the area draining to an existing cross culvert under Sandpiper Street located approximately 550 feet west of Ustler Road. The sub-basin is bounded on the west by Rock Springs Road. To the north and east the sub-basin divide runs parallel to the ditch/stream that starts at the Apopka Assembly of God Church and flows to the existing cross culvert under Sandpiper Street. The southern sub-basin divide lies just south of Sandpiper Street. Refer to Exhibit No. 1 for a depiction of the sub-basin boundaries.

Elevations in Sub-basin MN14 vary from 126 feet at Rock Springs Road to approximately 76 feet at the cross culvert location on Sandpiper Street. Thus, the general pattern of runoff is eastward, with most runoff being conveyed by the ditch/stream along the north and east sub-basin boundary. Runoff discharged from the wetland in Sub-basin MN13 also enters this stream just east of the Assembly of God Church. Where the stream crosses Sandpiper Street, a 48-inch cross culvert was provided to convey runoff southward to Sub-basin MN18. Information regarding this culvert was surveyed by Jones, Hoechst and Associates, Inc. for this study. In order to include this culvert in the hydraulic model of the study area, a "dummy node" or assumed storage node was used at the upstream end of the culvert. This node was designated as MN14N01D in the model.

2.5.4.5.15 Sub-Basin MN15

Sub-basin MN15 is defined as the area which drains to existing inlets at the intersection of Lake Avenue and Grossenbacher Drive. The area is bounded by Grossenbacher Drive on the north, Lake Avenue on the east, and Martin Street on the south. The western boundary lies midway between O'Leary Court and O'Shea Court. Elevations in this area range from 157 feet at the southwest portion of the sub-basin to 138 feet at the intersection of Grossenbacher Street and Lake Avenue.

The general drainage pattern is from west to east along the roadways to the above mentioned intersection. At the intersection, runoff is intercepted by existing inlets on all four corners. Runoff from Sub-bas p-1Xin MN15 is joinebbatywhich discharges from Buchan Pond and the combined flow is conveyed eastward in the Grossenbacher Drive outfall system designed by the City of Apopka. Storage at this location is negligible and has been modeled as a "dummy node." Information regarding the outfall pipe to Sub-basin MN16 was obtained from the construction plans prepared by *the City of Apopka. This sub-basin has been included separately so that the Grossenbacher Drive outfall system could be incorporated into the hydraulic model in order to determine if the system restricts the outflow from Buchan Pond.*

2.5.4.5.16 Sub-Basin MN16

Sub-basin MN16 is comprised of the area that drains to an existing detention pond at the north end of Ryan Avenue which discharges to the outfall pipe along Grossenbacher Drive. This area includes the block of residences between Lake Avenue and Ryan Avenue north of Martin Street and the Grossenbacher Drive right-of-way. Refer to Exhibit No. 1 for the limits of the sub-basin.

This sub-basin has been included in order to model the point source contribution to the outfall pipe along Grossenbacher Drive. The storage provided in the existing stormwater pond is insignificant in relation to the overall study area and would have very little effect upon the flow rate in the outfall pipe; therefore, it has not been modeled. Rather, the node MN16N01D has been modeled as a "dummy node" where runoff discharged from Sub-basin MN15 can be combined with runoff from Sub-basin MN16. From this node, the outfall pipe continues eastward into Sub-basin MN17. Information regarding this pipe was taken from the City of Apopka construction plans for Grossenbacher Drive.

2.5.4.5.17 Sub-Basin MN17

Sub-basin MN17 consists of the area that drains to the existing pond/ditch system located at Grossenbacher Drive and Park Avenue. Refer to Exhibit No. 1 for a depiction of the extents of this sub-basin.

As with Sub-basins MN15 and MN16, this sub-basin has been included in order to model the outfall system along Grossenbacher Drive. Storage in the existing pond and ditch at this location is minimal and has been disregarded. Rather, a "dummy node" designated Node MN17N01D has been modeled. At this point, runoff from the sub-basin is combined with that discharged from the upstream basins via the outfall pipe along Grossenbacher Drive. Discharge from this node is by means of an existing 36-inch cross culvert under Park Avenue to Sub-basin MN18. The FDOT construction plans for the widening of Park Avenue were used to obtain the information regarding this cross culvert.

2.5.4.5.18 Sub-Basin MN18

Sub-basin MN18 is located between Park Avenue and Ustler Road south of Sandpiper Street and north of Tanglewilde Drive. The sub-basin is defined by the area draining to an existing pond/wetland system (Node MN18N01W) on the west side of Ustler Road. Elevations drop significantly in this area from 125 feet at Park Avenue to below 65 feet in the pond abutting Ustler Road.

In addition to the direct runoff from this sub-basin, runoff discharged from upstream sub-basins also reaches the existing pond/wetland system. In particular, runoff discharged from sub-basins MN12, MN13, and MN14 enters sub-basin MN18 just west of Ustler Road via the culvert under Sandpiper Street. To the west, runoff which discharges from Buchan Pond and Sub-basins MN15, MN16, and MN17 enters Sub-basin MN18 by means of a 36-inch culvert under Park Avenue. From Park Avenue eastward, runoff is conveyed in a stream to a small pond which discharges to another small pond which in turn discharges to the pond/wetland adjacent to Ustler Road. This flowpath has not been included in the model for the following reasons:

- *the culvert under Park Avenue is the factor controlling the discharge from the upstream sub-basins west of the road;*
- *the small ponds provide an insignificant amount of storage in relation to the overall study area; and*
- *information to adequately describe the stream, the ponds, and the connections between ponds was unavailable.*

As outlined above, the pond and wetland west of Ustler Road receive runoff from a large area to the north and west. Including the Buchan Pond Basin, the contributory area is approximately 470 acres. In relation to this area, the storage provided in the existing pond/wetland system at Ustler Road is negligible. Nonetheless, this storage area was included in the model to determine the expected flood levels in the area. The elevation versus area relationships was taken from Orange County Aerial Topographic Maps and the initial water elevation was set at the normal high water level of Lake McCoy North.

The outfall from this sub-basin is to Lake McCoy North by means of a large elliptical corrugated metal culvert under Ustler Road. The size, length, and inverts of this culvert were surveyed by Jones, Hoechst and Associates.

2.5.4.5.19 Sub-Basin MN19

Sub-basin MN19 consists of the area in the Magnolia Oaks Subdivision which drains to the large existing dry retention pond recently constructed just south of Tanglewilde Drive (Node MN19N01P). This area was delineated based upon construction plans for the subdivision prepared by Tawill Engineering. Refer to Exhibit No. 1 for a delineation of the sub-basin.

Sub-basin MN19 has been included as a separate sub-basin because the pond was designed to retain the entire volume of runoff for all but the most extreme rainfalls. The elevation versus area relationship for this existing pond was also taken from the construction plans for the Magnolia Oaks Subdivision. The initial elevation was taken to be the bottom of the pond. Because the pond was designed for retention of up to a 100-year storm, no outfall structure was constructed. Nor was any emergency overflow included in the pond design. Nonetheless, an outfall reach was included in the analyses contained in this report to simulate overtopping of the pond berm to Lake McCoy North.

2.5.4.5.20 Sub-Basin MN20

Sub-basin MN20 includes Lake McCoy North and all areas east of Park Avenue and north of Votaw Road that drain directly to the lake. As the major feature in the basin, Lake McCoy North also receives the runoff from all upstream sub-basins described in the previous sections. In addition, all of the previously discussed sub-basins within the Lake McCoy South, Dream Lake, Park Avenue, and Buchan Pond Drainage Basins ultimately discharge to Lake McCoy North.

Lake McCoy North and the associated wetlands comprise roughly 35 percent of Sub-basin MN20. The remainder of the area is comprised of a variety of developed and undeveloped land uses which drain to the lake via storm sewer systems, ditches, streams, and overland flow. Some of the areas included in this sub-basin such as the Post Office at Park Avenue and Tanglewilde Drive are served by small ponds upland of the lake. However, these areas have been included in Sub-basin MN20 because construction plans were not readily available and the ponds were considered inconsequential in relation to the lake area.

The elevation versus area relationship for Lake McCoy North was taken from Orange County Aerial Topographic Maps. The elevations on the maps did not extend below 63 feet; whereas, the normal high water level published in the Orange County Lake Index is 61.5 feet. Because this elevation was used as the initial water level in the lake, it was necessary to extrapolate areas at elevations 61 feet and 62 feet. The outfall from Lake McCoy North is an existing channel which discharges northward to Sandpiper Street. Orange County surveyed this channel, as well as, a temporary rock weir structure which has been constructed across this channel in order to control the lake level higher.

The channel has been modeled based on this survey; however, this weir has been omitted from the analysis because it is not considered a permanent feature.

As mentioned above, the normal high water elevation for Lake McCoy is listed in the Orange County Lake Index as 61.5 feet. Based on lake records, the water elevation is often well below this level and was reported to have been nearly dry during several periods. To model the system with the initial lake level at a lower elevation results in lower peak stages and discharge rates due to the additional storage provided by the lake. The analyses contained in this report have been started at the level set by Orange County in order to model worst case conditions.

2.5.4.5.21 Sub-Basin MN21

South of Sandpiper Street lies a low area that receives the runoff discharged from Lake McCoy North and in turn discharges northward to Lake Coroni. This area also receives direct runoff from the sparsely developed area south of Sandpiper Street which has been designated Sub-basin MN21. Refer to Exhibit No. 1 for a graphical representation of the sub-basin.

Runoff in this sub-basin generally flows toward Sandpiper Street via overland flow and then flows along the roadway to the low area. Elevations range from 85 feet in the eastern portion of the sub-basin to 59 feet at the culvert outfall to Lake Coroni.

The elevation versus area relationship in Sub-basin MN21 was taken from Orange County Aerial Topographic Maps. The initial water elevation was assumed at the upstream invert of the culverts under Sandpiper Street. Information regarding these culverts was surveyed by Jones, Hoechst, and Associates, Inc. (JHA). During large storms, water levels will rise above the existing elevation of Sandpiper Street. JHA also surveyed elevations along the profile of Sandpiper Street which were used to account for roadway overtopping in the analyses contained in this report.

2.5.4.6 Lake Coroni Basin

The defining drainage feature in this basin is Lake Coroni, which is located east of Ustler Road, south of Welch Road, west of Thompson Road, and north of Sandpiper Street. Most of the area draining to this lake falls within the confines of the above roads. The exceptions are two (2) sub-basins which lie, at least partly, to the west of Ustler Road. Refer to Exhibit No. 1 for a graphical representation of the Lake Coroni Basin (approximately 350 acres).

Aside from Lake Coroni, several other storage areas are located in the basin. All except one (1) *are existing detention ponds which have been constructed to provide water quality treatment and peak rate attenuation of runoff from the developments which have been constructed around the lake. In order to account for the flood storage and attenuation furnished by these storage areas upland of the lake, the Basin was further partitioned into nine (9) sub-basins. These sub-basins are identified throughout this report, in the calculations, and on the Exhibits with the prefix "LC" to indicate their location in the Lake Coroni Basin. Descriptions of the storage in each sub-basin and the connectivity between sub-basins are supplied in the sections which follow.*

2.5.4.6.1 Sub-Basin LC01

Sub-basin LC01 is defined as the area draining to the unnamed lake on the west side of Ustler Road, north of Sandpiper Street. This area is comprised primarily of undeveloped land and agricultural lands including nurseries. Consequently, runoff is via overland flow to the existing unnamed lake. The runoff pattern is from the northern portion of the sub-basin where the high elevation is 107 feet southward to the lake where elevations are near 80 feet.

The water body in this sub-basin has been referred to as a lake as it appears to be a natural feature, with the exception of a berm which has been constructed along Ustler Road. The elevation versus area relationship for this lake was taken from Orange County Aerial Topographic Maps. The outfall from the lake is an existing drop structure with a flashboard weir at elevation 83.28 feet and a 15-inch culvert under Ustler Road. Below the flashboard weir the concrete block control structure has a knockout near the upstream invert of the culvert which would allow for drawdown to near the pipe invert at elevation 80.7 feet. East of Ustler Road runoff will continue to flow directly to Lake Coroni. The elevations listed above are from the Jones, Hoechst, and Associates, Inc. (JHA) survey of the lake outfall. This survey also noted that the outlet end of the culvert under Ustler Road is located in a sump and partially buried. Based on JHA survey notes, the downstream invert of the culvert is 78.88 feet; however, adjacent ground at the outlet is higher such that discharge to Lake Coroni will not occur until the water level exceeds 81.1 feet. Based on this controlling factor, the initial water level in the lake was started at elevation 81.6 feet in accordance with Orange County's practice of setting the normal high water level six (6) inches above the outfall elevation.

For the duration of the study, the water level in this lake was below the level of the outfall structure. In late January of 1996, JHA surveyed the water elevation at 78.1 feet which is 3.5 feet lower than the assumed initial water elevation. Even after heavy rains in April of 1996, the water level was well below the upstream invert of the outfall culvert. Thus, it should be noted that the initial water level used for this lake is not necessarily indicative of the actual normal water level for this lake.

2.5.4.6.2 Sub-Basin LC02

Sub-basin LC02 is located in the western portion of the Lake Coroni Basin along Ustler Road and is defined as the area contributing runoff to an existing pond in the Butler Manor Subdivision. To the west of Ustler Road, the sub-basin is primarily agricultural land and nurseries. East of the road, the land use is low density, single-family residential. Elevations generally fall from west to east, and from north to south, with a high point elevation near 106 feet occurring at the western boundary and an elevation of 88 feet at the top-of-bank of the pond.

Runoff flows toward Ustler Road and Robin E. Lane where it is intercepted by storm sewer systems and conveyed to the Butler Manor stormwater pond. The existing pond then provides water quality treatment and attenuation of the peak rate of runoff prior to discharging via a swale to Lake Coroni. Rather than modeling a swale outfall from the pond, this overflow was approximated using a stage versus discharge rating curve. Information regarding the dimensions of the Butler Manor pond and outfall swale were obtained from "as-built" construction plans prepared by Lochrane Engineering.

2.5.4.6.3 Sub-Basin LC03

Sub-basin LC03 is situated south of Welch Road, between Ustler Road and Lake Coroni. The area includes the western portion of the Wekiwa Woods Subdivision and approximately 25 acres of off-site area to the west of the development. The existing dry-bottom pond (Node LC03N01P) located in this subdivision adjacent to the northwest portion of Lake Coroni is the defining drainage feature of the sub-basin.

Elevations in this area range from 103 feet at Ustler Road to 64 feet at the top edge of the pond. Accordingly, the runoff pattern is from west to east, primarily by overland flow. At the Wekiwa Woods Subdivision, runoff is intercepted by storm sewer systems and conveyed to the existing pond. It should be noted that a single inlet with a 15-inch culvert was all that was provided to collect runoff from the off-site area west of Wekiwa Woods. During large storms, off-site runoff will likely flow between the houses along Sablewood Drive. As a second note, some additional storage is provided upland of Wekiwa Woods by the existing ponds which serve the retirement home west of the subdivision; however, these ponds have not been included because construction plans were not readily available and they provide a relatively small storage volume.

The dry-bottom stormwater pond in the Wekiwa Woods subdivision was designed to provide water quality treatment and peak rate attenuation of stormwater runoff. Discharge from this pond to Lake Coroni is by means of a drop (control) structure and culvert outfall. Construction plans for the subdivision prepared by Site Engineering were utilized to determine the dimensions of the pond and *the outfall control structure. The initial water level in the pond was taken to be the pond bottom, because the pond was observed to be dry even within a few days after heavy rainfall.*

2.5.4.6.4 Sub-Basin LC04

Sub-basin LC04 is primarily composed of the area within the Wekiwa Woods Subdivision which drains to an existing dry-bottom stormwater pond along the north side of Lake Coroni (Node LC04N01P). The area is bounded on the north by Welch Road, on the east by the Deer Lake Run Subdivision, on the south by Lake Coroni, and on the west by the Lake Coroni outfall ditch. Elevations in this area range from 78 feet near Welch Road to 64 feet abutting the pond.

The subdivision is developed with low density, single-family residences. Like most development of this type, runoff flows toward the streets where it is intercepted by storm sewer systems and conveyed to the existing detention pond. This existing pond furnishes water quality treatment and peak rate attenuation of stormwater runoff from the subdivision. The pond in this sub-basin discharges to Lake Coroni by means of a drop (control) structure and culvert outfall. The pond elevation versus area relationship and the outfall control structure dimensions were obtained from construction plans for the Wekiwa Woods Subdivision prepared by Site Engineering. During this study, the pond was observed to be dry, even within a few days of heavy rainfall. Therefore, the initial water elevation was taken to be at the bottom of the pond.

2.5.4.6.5 Sub-Basin LC05

Sub-basin LC05 consists of the portion of the Deer Lake Run Subdivision which drains to the existing stormwater pond at the subdivision entrance on Thompson Road (Node LC05N01P). The area also includes a section of Thompson Road and a few residential lots east of the road. Elevations in this area vary from 83 feet at the high points on Thompson Road to 64 feet at the bottom of the pond. Refer to Exhibit No. 1 for a delineation of Sub-basin LC05.

The general pattern of runoff is toward the roadways where it is intercepted in storm sewer systems and routed to the existing pond. The pond (Node LC05N01P) in this sub-basin consists of a natural depression. Originally, this depression had no outfall. During the development of the Deer Lake Run Subdivision, a culvert was installed to connect the depression to the pond in Sub-basin LC06. Information regarding the dimensions of the pond and outfall pipe was obtained from construction plans for the Deer Lake Run Subdivision prepared by L.T. Ray and Associates. Although the existing pond (Node LC05N01P) was observed to be dry throughout the duration of this study, the initial water elevation in the pond was taken to be the highest invert on the outfall pipe to the pond in Sub-basin LC06.

2.5.4.6.6 Sub-Basin LC06

Sub-basin LC06 consists of the area draining to an existing dry-bottom stormwater pond adjacent to Lake Coroni in the Deer Lake Run Subdivision. The general location of this area is west of Thompson Road, south of Welch Road, and east of Lake Coroni. For an exact location of the sub-basin limits, refer to Exhibit No. 1.

Elevations in this area range from 85 feet in the southern portion of the sub-basin to 67.5 feet at the pond top-of-bank. Runoff from the residential development in the sub-basin is collected at the roads and conveyed to the pond via storm sewer systems. In addition to direct runoff from Sub-basin LC06, the pond in this sub-basin also receives runoff from the pond (Node LC05N01P) in Sub-basin LC05 via a culvert connection. Water quality treatment and peak rate attenuation for the combined runoff is provided in both ponds. Discharge to Lake Coroni is by means of a drop structure and culvert outfall in the pond (Node LC06N01P) in Sub-basin LC06. The dimensions of the pond and control structure were obtained from construction plans for the Deer Lake Run Subdivision prepared by L.T. Ray and Associates. The initial water elevation was taken to be the bottom of the dry-bottom pond.

2.5.4.6.7 Sub-Basin LC07

Sub-basin LC07 consists of the area in the Deer Lake Chase Subdivision which drains to an existing dry-bottom retention pond in the southwest corner of the development. The sub-basin is generally located west of Thompson Road, north of Sandpiper Street, and south of the Deer Lake Run Subdivision.

The area is relatively small, but has been included as a separate sub-basin because the existing pond was designed to retain the entire volume from all but the most extreme rainfalls. The elevation versus area relationship for the dry pond was taken from drainage calculations prepared by Davidson-Paymayesh Engineering. Because the pond was intended to retain the runoff for up to a 100-year storm, no outfall structure was constructed. Nor was any emergency overflow provided in the event the pond were to overtop. Nonetheless, an outfall reach was included in the analysis to simulate overtopping of the berm to Lake Coroni. The above mentioned drainage calculations for the Deer Lake Chase Subdivision were referenced to determine the pond top-of-bank. Likewise, the calculations were used to determine the pond bottom elevation at which the initial water elevation was set.

2.5.4.6.8 Sub-Basin LC08

At low water elevations, Lake Coroni is separated by an access berm constructed over a gas pipeline which transects the lake. The computer model of the study area was designed to include this divide between the southern and northern portions of the lake. Sub-basin LC08 consists of the area that drains directly to Lake Coroni south of the gas easement (Node LC08N01L). This area is bounded by Ustler Road on the west, Sandpiper Street on the south and the gas easement to the northeast. On the north side, the sub-basin divide lies to the north of an unpaved road named Ruta de Arbol.

Elevations in this area vary from 98 feet near Ustler Road to 57 feet southwest of the gas easement. Because the sub-basin is sparsely developed, runoff to the lake is by overland flow. In addition to direct runoff from within Sub-basin LC08, this portion of Lake Coroni receives runoff, if any, discharged from Sub-basins LC01 and LC02 and from Lake McCoy at Sandpiper Street. Discharge northward occurs via a pair of existing 24-inch culverts under the berm over the gas pipeline. When the water level reaches approximately elevation 60.3 feet, the berm will be overtopped as well and the water level will equalize with that in the northern portion of the lake. Information regarding the pipes under the berm and the elevation of the berm were surveyed by Jones, Hoechst, and Associates, Inc. (JHA) for this study.

The elevation versus area relationship of the portion of Lake Coroni in Sub-basin LC08 was obtained from Orange County Aerial Topographic Maps. For areas where the contours extend beyond the sub-basin, the sub-basin boundaries were used to close the area so as not to account for the same storage in more than one sub-basin. The normal water level for Lake Coroni was set based upon the outfall from the northern portion of the lake. Refer to the description of Sub-basin LC09 for this information.

2.5.4.6.9 Sub-Basin LC09

As described in the previous section, Lake Coroni is separated by an access berm which was constructed over a gas easement which runs through the lake. Because the computer model of the study area was designed to include this divide in the lake, distinct sub-basins were necessary for the southern and northern portions of the lake. The northern portion of Lake Coroni is the defining water feature of Sub-basin LC09. This area is bounded by Sub-basins LC02, LC03, LC04, LC06, LC07, and LC08. For a graphical representation of the sub-basin, refer to Exhibit No. 1.

Elevations to the west of the lake are as high as 101 feet and the bottom elevation of the lake is at 51 feet. Runoff to Lake Coroni in Sub-basin LC09 is by overland flow across the relatively steep *land. In addition to direct runoff from Sub-basin LC09, the northern portion of Lake Coroni receives any runoff discharged from Sub-basins LC03, LC04, LC05, LC06, LC07 and LC08. Furthermore, all discharge from the southern portion of Lake Coroni is northward. During large storms, the berm across the lake becomes entirely submerged and the two halves of Lake Coroni become one.*

The elevation versus area relationship for the portion of Lake Coroni north of the gas easement was obtained from Orange County Aerial Topographic Maps. Where contours extend beyond the sub-basin, the sub-basin boundary was used to close the area. The outfall from Lake Coroni consists of a ditch and a single 60-inch culvert under Paradise Isle Drive. Construction plans prepared by Site Engineering indicate that the culvert at this location was set at the bottom of the ditch as it existed prior to development. Orange County surveyed this culvert and measured upstream and downstream inverts of 58.66 feet, and 58.78 feet, respectively. Based on the higher of these elevations, the initial water level was started at elevation 59.3 feet, in keeping with Orange County's standard of setting the normal high water elevation of a lake six (6) inches above the outfall elevation. The Orange County Lake Index reports a lower normal high water level of 58.4 feet apparently based upon the invert of the pipes under Welch Road to the north.

According to lake level records, the water level in Lake Coroni varies considerably. At times, the lake bed is completely dry and is used as pasture land. During periods of heavy rainfall, the lake sits near the normal high water level. As mentioned above, the initial water level in the computer model was set based upon the outfall elevation from the lake. This method has been used to provide an analysis of worst case conditions. A lower water level in Lake Coroni leaves more storage available and results in lower peak flood elevations and peak discharge rates.

2.5.4.7 Lake Prevatt Drainage Basin

The defining drainage feature in this Basin is Lake Prevatt, which is located north of Welch Road, in the eastern portion of the Basin. To account for peak rate attenuation and flood storage in drainage features such as ponds and wetlands upland of Lake Prevatt, the Basin was subdivided into seventeen (17) sub-basins. Twelve (12) of these sub-basins are located north of Welch Road and west of Lake Prevatt. The other five (5) sub-basins are located south of Welch Road. These sub-basins are identified on the Exhibits and throughout the report and calculations with the prefix "LP" to indicate their location in the Lake Prevatt Basin. Refer to Exhibit No. 1 for a depiction of the Lake Prevatt Basin and the sub-basins therein. Descriptions of the storage in each sub-basin and the connectivity between sub-basins are provided in the sections which follow.

The Lake Prevatt Basin is the largest of the eight (8) basins (approximately 1,090 acres), comprising over twenty-nine (29) percent of the total study area. In addition to the area which drains directly *to Lake Prevatt, the entire study area, with the exception of the Carpenter Branch Basin, drains through the lake via hydraulic connections to Lake Coroni.*

2.5.4.7.1 Sub-Basin LP01

Sub-basin LP01 is located in the extreme western portion of the Lake Prevatt Basin and is defined as the area draining to an existing depressional wetland system (Node LP01N01W) at the west end of Lester Road. In the middle of this wetland, lies a wastewater effluent percolation pond. This area (percolation pond) which is depicted on Exhibit No. 1, was not included in the area of Sub-basin LP01. Otherwise, the area draining to this wetland is composed of agricultural and residential land uses, with the largest single land use being high-density mobile home units located southeast of the wetland. Elevations in the sub-basin vary from 140 feet west of the wetland to 127 feet at the wetland fringe.

The St. Johns River Water Management District Aerial Topographic Maps did not extend far enough northward to provide coverage of the entire wetland area. Consequently, the elevation versus area relationship was estimated/assumed based upon the southern half of the wetland shown on these maps and the northern half shown on the U.S.G.S. Apopka Quadrangle Map. Based on the U.S.G.S. map, the wetland naturally drained northward to another basin outside the study area by means of a small stream. At some time in the past, a ditch was constructed along the south side of Lester Road to convey runoff eastward toward Rock Springs Road and into the Lake Prevatt Basin. This outfall ditch was well described by survey performed by Jones, Hoechst, and Associates. Based upon field investigations, the ditch along Lester Road is considerably larger than the natural outfall. In addition, water was observed to be flowing continuously in the existing drainage ditch; whereas, no discharge was observed at the northern outfall, even following a heavy rainfall. Thus, the flow capacity of the natural outfall from this wetland was considered to be negligible and was not included in the computer model of the study area.

The ditch along Lester Road also controls the water level in the wetland. Thus, the initial water level in the wetland (Node LP01N01W) was taken to be at the upstream invert of the ditch.

2.5.4.7.2 Sub-Basin LP02

Sub-basin LP02 is located west of Rock Springs Road on the north and south sides of Lester Road. To the north of Lester Road, the land use is agricultural. South of the road, the land use consists of high density mobile home units. Elevations in this area range from 130 feet in the mobile home park to 117 feet adjacent to Rock Springs Road. The sub-basin was delineated with respect to the area which drains to the existing double 36-inch culverts under Rock Springs Road at Lester Road.

The outfall ditch along Lester Road also conveys runoff from Sub-basin LP01 to these culverts. And, the existing mobile home park stormwater pond in Sub-basin LP03 discharges to this location adjacent to Rock Springs Road via ditches and culverts. Within Sub-basin LP02, the only storage is in the ditches along Lester Road and Rock Springs Road. This storage is minimal and has been modeled as a "dummy node" upstream of the double 36-inch culverts. Information regarding the culverts under Rock Springs Road and the road profile in the vicinity was surveyed by Jones, Hoechst, and Associates for this project.

2.5.4.7.3 Sub-Basin LP03

Sub-basin LP03 is defined as the area which contributes runoff to an existing stormwater pond (Node LP03N01P) located in a trailer park west of Rock Springs Road and south of Lester Road. The sub-basin consists entirely of high-density, mobile home units in a relatively flat area. Elevations vary from 136 feet in the southern extreme of the sub-basin to 128 feet adjacent to the pond in the northern portion of the sub-basin. As a result, the pattern of runoff is from south to north primarily along the roadways to the pond.

The elevation versus area relationship of the pond (node LP03N01P) was taken from St. Johns River Water Management District Aerial Topographic Maps. Where contours extended beyond the sub-basin, the sub-basin divide was used to close the area. The outfall from the pond is eastward toward Rock Springs Road via a series of culverts and ditches . At Rock Springs Road, runoff flows northward in the roadside ditch to the existing double 36-inch culverts under the road in Sub-basin LP02. Because the outfall drops over ten (10) feet between the existing pond and Rock Springs Road, only the first culvert at the pond outlet was included in the computer model to control the discharge rate. The dimensions and inverts of this culvert were surveyed by Orange County. The initial water level in the pond was set six (6) inches above the upstream invert of the culvert at elevation 126.24 feet.

2.5.4.7.4 Sub-Basin LP04

Sub-basin LP04 consists of the mostly developed area northwest of the intersection of Welch Road and Rock Springs Road. These roads make up the southern and eastern boundaries of the sub-basin, respectively. To the west and north, the area is bounded by Sub-basins LP03 and LP02, respectively. Although mostly developed, runoff is primarily via overland flow from the western portion of the sub-basin, where elevations are as high as 137 feet, toward Rock Springs Road at approximately 120 feet.

The sub-basin was defined with respect to the area draining to an existing single 36-inch culvert under Rock Springs Road, just north of the Wekiva Plaza development. The storage in Sub-basin LP04 at the upstream end of this culvert consists of the roadside ditch along Rock Springs Road. The actual storage provided in this ditch is negligible and difficult to quantify; thus, it has been modeled as a "dummy node." On the other hand, information regarding the culvert under the roadway has been based upon actual measurements surveyed by Jones, Hoechst, and Associates, Inc.

2.5.4.7.5 Sub-Basin LP05

Sub-basin LP05 consists of the undeveloped portion of the Wekiva Park development which presently drains to an existing northern detention pond. This area is generally located east of Rock Springs Road, north of Wekiva Plaza, south of Lester Road and west of the Wekiwa Springs State Park boundary. Refer to Exhibit No. 1 for a graphical delineation of the sub-basin.

Elevations in this sub-basin fall off from a high point of 120 feet at Rock Springs Road eastward toward the existing pond which is controlled at 96.0 feet. Because construction plans for development in this sub-basin have not been approved, the area has been treated as undeveloped land in this study. Consequently, runoff to the pond is by overland flow.

The existing stormwater pond (Node LP05N01P) is designed to work together with the other stormwater pond (Node LP06N01P) in the Wekiva Park development to provide water quality treatment and attenuation of the peak rate of runoff prior to discharging to the wetland located at the southwest corner of Wekiwa Springs State Park. The connection between these ponds consists of a 24-inch equalizer pipe. The outfall to the wetland is located in the pond in Sub-basin LP06B and will be discussed later.

The elevation versus storage relationship for the pond (Node LP05N01P) was taken from drainage calculations for the Wekiva Park development prepared by Hollis Engineering. These calculations were also referenced for information regarding the equalizer pipe between the Wekiva Park ponds.

2.5.4.7.6 Sub-Basins LP06A and LP06B

Both Sub-basins LP06A and LP06B contribute runoff to the existing stormwater pond (Node LP06N01P) in the Wekiva Park development at the southeast corner of Wekiwa Springs State Park. Sub-basin LP06A consists of the Wekiva Plaza commercial development on the northeast corner of Welch Road and Rock Springs Road. Sub-basin LP06B is comprised of the residential development immediately to the east of Wekiva Plaza. The existing pond is included in Sub-basin

LP06B. Both areas are nearly built out and drain to the existing pond (Node LP06N01P) via storm sewer systems. The sub-basins were delineated separately only to account for differing hydrologic parameters such as runoff curve number, time of concentration, and peaking factor. Refer to Exhibit No. 1 for a depiction of these sub-basins.

As mentioned in the discussion of Sub-basin LP05, the existing stormwater ponds in Sub-basins LP05 and LP06B are designed to work together to provide water quality treatment and peak rate attenuation. To this end, these ponds are connected via a 24-inch equalizer pipe. The outfall for both ponds is located in the pond in Sub-basin LP06B. This outfall consists of a weir which is essentially trapezoidal in shape and discharges to a wetland located on the southwest corner of the Wekiwa Springs State Park boundary. The elevation versus storage relationship for the pond in Sub-basin LP06B was taken from drainage calculations for the Wekiva Park development prepared by Hollis Engineering. The dimensions of the outfall structure were also based on these calculations and a construction plan for the modification to the weir. The initial water elevation in the pond was taken to be at the weir overflow elevation, because the pond was not observed to draw down below that elevation for the duration of this study.

2.5.4.7.7 Sub-Basin LP07

Sub-basin LP07 is comprised of the area that drains directly to an existing wetland system (Node LP07N01W) located at the southwest corner of Wekiwa Springs State Park. Almost half of this sub-basin is within the State Park boundaries. Of the areas outside the Park, most is undeveloped with the exception of a few nurseries and a commercial site. As a result, most runoff to the wetland is via overland flow, although some shallow ditches are located outside the Park. The sub-basin limits are delineated on Exhibit No. 1.

In addition to the area within the sub-basin boundaries, sub-basins LP01, LP02, LP03, LP04, LP05, LP06A, and LP06B all discharge to the wetland (Node LP07N01W) in Sub-basin LP07. Overall, this wetland is receiving the runoff from 385 acres in the western portion of the Lake Prevatt Basin. The outfall from this area is eastward into a stream which runs through the Wekiva Glen Subdivision via double 24-inch culverts under the gas pipeline easement that runs to the east of the sub-basin. Information regarding these culverts for use in the computer model was obtained from a 1987 survey prepared by Bowyer, Singleton and Associates (BSA) for the Wekiva Park development. Using the culvert inverts shown on this survey, PEC performed a supplemental survey of the profile along the gas pipeline easement in the vicinity of the outfall. This information was used to model a second, high-level overflow from the wetland.

The Orange County Aerial Topographic Maps and the above mentioned BSA survey were referenced regarding storage provided in the existing wetland system. Based on the Orange County maps, the wetland provides little to no storage, with bottom elevations ranging from 99 feet at the western edge of the wetland to near 98 feet in the center. The BSA survey, on the other hand, shows elevations below 97 feet at the southwestern fringe of the wetland. When considering this discrepancy, it seems likely that the aerial maps are less reliable than the site specific survey performed by BSA. Yet, the BSA survey only provided elevations at the wetland fringe. Therefore, it was necessary to estimate/assume the wetland elevation versus area relationship based upon the elevations surveyed by BSA and the area of the wetland taken from aerial photographic maps.

As mentioned above, the BSA survey terminated at the edge of the wetland and showed low elevations near 97 feet. Little storage was assumed below this elevation. However, to the east of the wetland, the outfall pipes discharge at elevation 92.8 feet and the berm overflow elevation is below 95 feet. Thus, the storage available in the wetland for attenuation of the peak rate of runoff would appear to be minimal. This condition may very well represent actual conditions; however, to better define the storage provided in the wetland (Node LP07N01W), a detailed topographic survey would be necessary.

2.5.4.7.8 Sub-Basin LP08

Sub-basin LP08 is located south of Welch Road and west of Ustler Road. The sub-basin is defined by the area draining to the existing double 24-inch culverts under Welch Road. The area is primarily undeveloped and agricultural land with relatively flat slopes. The range of elevations is from 107 feet in the southern extreme of the sub-basin to approximately 102 feet in the depressional areas near Welch Road and runoff is primarily by overland flow and shallow ditches. In addition to runoff from the sub-basin itself, some runoff enters the sub-basin from the existing wetland system (Node MN13N01W) to the west.

Storage is provided in existing depressions and ponds throughout the sub-basin. An estimate of the available storage was derived from the Orange County Aerial Topographic Maps. The outfall to the north is via double 24-inch culverts under Welch Road. On the north side of the road, a ditch conveys runoff to a 30-inch culvert which in turn runs northward along the Wekiva Park Subdivision to a ditch at the Wekiwa Springs State Park boundary. This ditch also serves as the outfall for the proposed Parkview Subdivision which will be discussed in the next section. This system is modeled to include the 24-inch culverts under Welch Road in series with the 30-inch culvert to the north of the road. Information regarding the double 24-inch culverts was obtained from construction plans for improvements to Welch Road prepared by Hollis Engineering. The 30-inch culvert was described on construction plans for the Wekiva Park Subdivision, also prepared by Hollis Engineering.

During extreme rainfalls, a significant volume of runoff is expected to enter Sub-basin LP08 from the existing wetland system to the west (Node MN13N01W) by overland flow. Should this occur, the outfall pipes under Welch Road will be unable to convey enough runoff and overtopping of Ustler Road, to the east, is expected. An assumed overflow has been included in the model to simulate this occurrence.

2.5.4.7.9 Sub-Basin LP09

Sub-basin LP09 is comprised of the proposed Parkview Subdivision located in the Wekiva Park development between Welch Road and Wekiwa Springs State Park. This area is presently undeveloped, yet has been included as developed because the proposed construction has been approved.

The subdivision is approved for low density, single-family residential development. As with most recent development of this type, the site will be graded such that runoff is toward the streets where it will be intercepted in storm sewer systems and routed to a proposed detention pond. The pond will furnish water quality treatment and peak rate attenuation of runoff from the subdivision. In this instance the pond will discharge by means of a drop structure and culvert outfall to a ditch along the north property line. This ditch will then convey runoff from the subdivision and from Sub-basin LP08 eastward and then northward through the Wekiva Glen Subdivision. The dimensions of the pond and the outfall structure were taken from the most recent plans for the Parkview Subdivision prepared by Donald W. McIntosh Associates.

2.5.4.7.10 Sub-Basin LP10

Sub-basin LP10 is located in the northwestern portion of the Wekiva Glen Subdivision and is defined as the area draining to the existing stream through this subdivision upstream of the triple culverts under Brook Forest Court. The sub-basin includes part of the subdivision, wooded sections of Wekiwa Springs State Park, and open space over the gas pipeline easement which bisects the sub-basin. Elevations in this area range from 100 feet in the State Park to 87 feet in the stream at Brook Forest Court.

The main feature in this sub-basin is the ditch/stream that conveys runoff from the upstream areas, through the Wekiva Glen Subdivision, and onward to Lake Prevatt. All of the previously discussed sub-basins in the Lake Prevatt Basin (LP01 through LP09) drain to the lake via this flow path as follows. At the upstream end, runoff from Sub-basins LP08 and LP09 is intercepted in a ditch which runs eastward along the boundary between the proposed Parkview Subdivision and Wekiwa Springs State Park. A "dummy node" (LP10N01D) was placed at the upstream end of this ditch, where *inflow occurs, to model the tailwater impact of the ditch on upstream stormwater management systems. Where this ditch meets the boundary of the Wekiva Glen Subdivision, it makes a ninety (90) degree turn northward and runs to the confluence with the outfall from the wetland in Sub-basin LP07. Another "dummy node" (LP10N02D) was modeled at the location of this confluence. From this point, the runoff from all upstream sub-basins flows northward through Wekiva Glen in what appears to be the general location of a natural stream. In the northeast corner of the Wekiva Glen Subdivision, this stream crosses under Brook Forest Court via triple 38-inch by 24-inch elliptical culverts. From this road, the stream flows generally northeast to Lake Prevatt.*

An attempt was made to model the ditch/stream in this sub-basin in the computer routing model of the overall study area. However, the model had problems with instability in this reach, likely due to the ten (10) foot drop in the channel over a relatively short distance. As an alternative, a HEC-RAS analysis of the stream was performed and the results of the analysis were used to model stage versus discharge relationships in place of modeling the actual channels (refer to Volume II, Section 2).

Elevations were previously surveyed at cross sections along the ditch/stream by Bowyer, Singleton and Associates for the Wekiva Park development. These cross-sections were used to perform the HEC-RAS analysis of the system. The analysis of the ditch/stream was set up such that the tailwater condition was based upon the elevation versus discharge relationship for the existing triple culverts at Brook Forest Court. The program then calculated water surface profiles back to the confluence point at Node LP10N02D based upon the range of flows which would be expected in the stream. The water surface profile versus flow rate relationship calculated by HEC-RAS at this location was then used as a stage versus discharge relationship at "dummy node" LP10N02D. In the same HEC-RAS analysis, the upper portion of the system was analyzed for the range of flows expected in the ditch upstream of the confluence point. Likewise, the water surface elevation versus flow rate relationship calculated by HEC-RAS at the upstream end of the ditch was used to model a stage versus discharge rating curve at "dummy node" LP10N01D.

A sensitivity analysis of the HEC-RAS model was performed to determine the degree to which water surface elevation versus flow rate relationships at Nodes LP10N01D and LP10N02D were dependent upon tailwater conditions at the next downstream node. Based on this analysis, the water surface profile of the ditch/stream is regulated by the conveyance capacity of the cross section rather than tailwater. This is especially true for the relationship at Node LP10N01D. A three (3) foot increase in the water surface elevation at the next downstream node (Node LP10N02D) had no impact at all on the water surface elevation versus flow rate relationship at LP10N01D. Thus, use of these stage versus discharge relationships should accurately simulate the conveyance of runoff in the existing *ditch/stream. The U.S. Army Corps of Engineers HEC-RAS program is described in Section 1.6.3.3 and the program input/output for this analysis is provided in Volume II, Section 2 of this report.*

At the outfall from the sub-basin, the triple culverts under Brook Forest Court were modeled using information from the previously mentioned survey prepared by Bowyer, Singleton and Associates and from the construction plans for the Wekiva Glen Subdivision prepared by Post, Buckley, Schuh, and Jernigan (PBS&J). Roadway overtopping was also modeled based upon the road profile for Brook Forest Court from the Wekiva Glen construction plans prepared by PBS&J. Storage in the stream just upstream of this location was taken from Orange County Aerial Topographic Maps.

2.5.4.7.11 Sub-Basin LP11

Within the northern portion of the Wekiva Glen Subdivision lies a small lake in a natural depression. The area which drains to this depression defines Sub-basin LP11. The sub-basin is composed entirely of low density, single-family residences within Wekiva Glen. The drainage pattern is typical of recent residential development; runoff flows toward the streets and then along the right-of-way until it is intercepted by storm sewer systems, and piped to the lake.

Based upon Orange County Aerial Topographic Maps, elevations in the sub-basin vary from 101 feet at the south end to 78 feet at the water's edge. The Post, Buckley, Schuh, and Jernigan (PBS&J) construction plans for Wekiva Glen indicate a similar range of elevations. The elevation versus area relationship for the lake was taken from the topography on these plans because it was based on site specific survey. However, these plans do not indicate a water level in the lake. Thus, for lack of other information, the water elevation of 78.1 feet shown on the Orange County maps was used as a starting water elevation.

Both of the above sources indicate that the lake will not overflow from the sub-basin until the water elevation reaches 84.8 feet. The entire runoff volume from a 100-year storm only raises the lake level from 78.1 feet to 82.6 feet. Thus, the Sub-basin LP11 has been considered as landlocked within the study area.

2.5.4.7.12 Sub-Basin LP12

Sub-basin LP12 is located immediately south of Welch Road near Ustler Road. The area consists of agricultural and low density residential land. To the west of Ustler Road, runoff flows eastward from a high point of 107 feet to depressional areas along the west side of Ustler Road at elevation 102 feet. The depressional areas fill and discharge eastward over the roadway. To the east of

Ustler Road, runoff flows generally northeast toward Welch Road where elevations fall below 90 feet.

Little storage is provided in Sub-basin LP12. As mentioned above, a few depressional areas are located on the west side of Ustler Road. However, the storage provided in these areas is minimal in relation to the study area and difficult to quantify using the Orange County Aerial Topographic Maps. Therefore, the runoff hydrograph from the sub-basin was directed to Sub-basin LP13.

2.5.4.7.13 Sub-Basin LP13

The outfall from Lake Coroni to Lake Prevatt consists of a series of culverts and ditches. The actual control for Lake Coroni is a 60-inch culvert under Paradise Isle Drive. Beyond this road, runoff flows northward in an existing drainage ditch to Welch Road. Existing double 36-inch culverts under Welch Road then convey runoff to Lake Prevatt. Sub-basin LP13 consists of the wooded area between Paradise Isle Drive and Welch Road.

At most times, the ditch running through this sub-basin is dry because the water level in Lake Coroni is far below the outfall level. During periods of low flow, runoff is conveyed northward and is mostly confined to the ditch. This condition was observed on only one occasion during this study, in April of 1996. During extreme rainfalls, much of the wooded area adjacent to the ditch is expected to be inundated. The elevation versus area relationship for this area was taken from the Orange County Aerial Topographic Maps. The double 36-inch culverts which convey runoff under Welch Road were surveyed by Orange County.

2.5.4.7.14 Sub-Basin LP14

Sub-basin LP14 consists of the portion of the Deer Lake Run Subdivision that drains to the existing stormwater ponds at the subdivision entrance on Welch Road. The land use in this area is low density, single-family residential. Elevations in this sub-basin vary from 83 feet to 65 feet adjacent to the ponds. The general pattern of runoff is toward the roadways where it is intercepted in storm sewer systems and conveyed to the existing ponds. The ponds then provide water quality treatment and peak rate attenuation of runoff from the subdivision prior to discharging to Lake Prevatt.

The two (2) existing dry-bottom stormwater ponds located east of the entrance road are designed to function as an off-line system. Runoff from the sub-basin is piped to a diversion structure located between the ponds. Initially, all runoff is directed to the pond closer to the entrance road via a pipe at the bottom of the structure. Once this pond is full, a weir overflow at the top of the diversion structure allows discharge to the second pond. The outfall from this pond is via a drop structure and culvert outfall to the Welch Road right-of-way. The dimensions of both ponds and both control *structures were taken from construction plans for the Deer Lake Run Subdivision prepared by L.T. Ray and Associates. The initial water elevations in both ponds were taken to be the bottom elevations of the respective pond.*

2.5.4.7.15 Sub-Basin LP15

Sub-basin LP15 consists of a portion of the Foxborough Farms Subdivision located east of Thompson Road and immediately south of Welch Road. The subdivision consists of low density, single-family residences. Consistent with development of this type, runoff occurs via overland flow from the lots toward the streets, where it is intercepted in roadside swales and storm sewer systems and conveyed to an existing stormwater pond. Elevations in this sub-basin range from a high of 82 feet to 60 feet adjacent to the pond.

During the data collection phase of this project, PEC obtained construction plans from the Orange County archives for the Foxborough Farms Subdivision. However, some of the information regarding pond grading and the outfall did not seem to correspond to conditions observed in the field. For lack of other information, the pond was not included in the analysis contained in this report. Rather, the sub-basin hydrograph was routed directly to Lake Prevatt. Because the Foxborough Farms pond provides minimal storage in relation to Lake Prevatt, its exclusion has minimal impact on the results of this study.

2.5.4.7.16 Sub-Basin LP16

Sub-basin LP16 includes all areas which drain directly to Lake Prevatt. Most of the area is located within the boundary of the Wekiwa Springs State Park. Hence, most of the sub-basin is heavily wooded and runoff is by overland flow. The exceptions are a few developed residential areas, such as those adjacent to Welch Road at the southern extent of the sub-basin and the Wekiva Glen Subdivision in the western portion of the sub-basin. In these areas, runoff is toward the roadways where it is intercepted by storm sewer systems and piped directly to the lake.

In addition to direct runoff in Sub-basin LP16, Lake Prevatt receives the runoff from all of the previously discussed basins and sub-basins in the study area. The lake then discharges northward via Carpenter Branch to Rock Springs Run and the Wekiva River. Although the study area has been extended beyond this outfall, the control for Lake Prevatt is at the entrance to this stream where the channel elevation was surveyed to be 56.6 feet. In keeping with Orange County's practice of setting the normal high water elevation six-(6) inches above the outfall elevation the starting water level of the lake was taken to be 57.1 feet. A further discussion of Carpenter Branch and the modeling of this outfall is provided in the subsequent section.

Elevations in the sub-basin range from above 100 feet in the Wekiva Glen Subdivision, to approximately 57 feet at the normal high water level of Lake Prevatt. According to lake level records, the level of the lake varies considerably, with periods in which the water level is near elevation 50 feet and most of the lake bed is dry (refer to Volume I, Section 4 - Supporting Documentation). Starting the computer simulation with a lower initial water elevation would provide more storage and the resultant peak lake level and discharge rates would be lower. Thus, the starting elevation of Lake Prevatt was taken to be at 57.1 feet in order to model worst case conditions.

The Orange County Aerial Topographic Maps did not provide complete coverage of Lake Prevatt. Therefore, it was necessary to extrapolate the elevation versus area relationship. For the area which is covered, this relationship was taken from the Orange County Aerial Topographic Maps. These maps were then compared to other maps which show the entire lake to determine what percentage of the lake was covered by the Orange County maps. Based on this percentage, the area at each elevation was increased to reflect the entire lake area.

2.5.4.8 Carpenter Branch Basin

Carpenter Branch Basin is a natural channel located in Wekiwa Springs State Park which serves as the outfall for Lake Prevatt to Rock Springs Run and the Wekiva River. The terminus of the study area is located on this stream where it intersects an old railroad bed approximately one-half (½) mile north of Lake Prevatt. The Carpenter Branch Basin is located in the northernmost portion of the study area and consists of the area which contributes runoff directly to Carpenter Branch between the outfall from Lake Prevatt and the old railroad bed (approximately 262 acres).

The majority of this Basin is located in Wekiwa Springs State Park; therefore, it is mostly undeveloped. The few areas outside the Park that are developed are comprised of low density residential and agricultural land uses. Runoff from these areas is primarily via overland flow. Elevations in the Carpenter Branch Basin vary from approximately 110 feet near Rock Springs Road to 45 feet at the outfall under the old railroad bed.

The actual outfall control for the study area is the far upstream reach of Carpenter Branch where it leaves Lake Prevatt. Based on the U.S.G.S. Forest City Quadrangle Map, the elevation of the stream falls off relatively quickly from the lake. Jones, Hoechst and Associates, Inc. (JHA) surveyed the channel and measured a centerline elevation of 56.6 feet just downstream of Lake Prevatt. Approximately 1,000 feet downstream, JHA surveyed a channel low point of 52.2 feet. Further downstream, the outfall at the old railroad bed consists of double 36-inch culverts. At this location, JHA determined the upstream invert of these culverts to be 45.5 feet and measured a road *overtopping elevation of 49.5 feet. A HEC-RAS analysis of Carpenter Branch was performed for the first 1,000 feet of the stream and the tailwater elevation was varied as a sensitivity check. This analysis indicated that the conveyance at the upstream end of the channel was independent of the tailwater. Thus, the discharge capacity versus lake elevation relationship developed with the HEC-RAS analysis was used as the outfall control condition for Lake Prevatt. A further discussion of HEC-RAS is provided in Section 1.6.3.3 and the program input and output for the Carpenter Branch analysis is provided in Volume II, Section 2 of this report.*

It should be noted that the Carpenter Branch Basin and the culverts at the old railroad bed were included in this study at the request of Wekiva Springs State Park Manager, Peter Scalco. Mr. Scalco was concerned about the culverts under the old railroad grade because the Park Service had to replace them following Tropical Storm Gordon in November of 1994.

2.6 ADICPR FLOOD ROUTING RESULTS AND SUMMARY OF EXISTING DRAINAGE STRUCTURE INFORMATION

The adICPR flood routing results for existing conditions are provided in Table 2-4. Tables 2-5, 2-6, 2-7, and 2-8 provide a listing of the drainage structure information which was utilized within the adICPR model for the simulation of the drainage system within the study area. It should be noted that the flood routing results which are tabulated within these tables are taken directly from the adICPR flood routing results which are provided within Volume II (Calculations), Section 3 of this basin study. Overtopping elevations were obtained from a variety of sources including Jones, Hoechst, and Associates survey, Orange County survey, PEC survey, St. Johns River Water Management District (SJRWMD) aerial topographic maps, and Orange County aerial topographic maps.

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TABLE 2-4

Node	PEAK CONDITIONS							
	Mean Annual		10-year/24-hour		25-year/24-hour		100-year/24-hour	
I.D.	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)
DREAM LAKE BASIN								
DL01N01P	148.04	13.32	148.29	51.13	148.33	62.57	148.39	79.06
DL02N01W	146.37	0.00	148.03	2.41	148.13	25.68	148.27	71.08
DL03N01P	144.63	0.23	145.63	6.11	146.61	15.63	148.07	33.80
DL03N02D	139.10	4.76	140.36	6.11	141.24	15.62	142.59	33.48
DREAM	115.54	4.54	116.71	8.13	117.36	11.07	118.27	37.46
BUCHAN POND BASIN								
BP01N01P	140.59	5.21	141.65	19.95	142.03	26.52	142.68	37.72
BP02N01P	144.44	2.53	144.81	12.69	144.91	16.17	145.08	22.53
BP03N01P	145.74	2.82	146.21	14.29	146.34	18.58	146.60	24.22
BP04N01P	140.46	11.19	141.58	45.76	141.95	58.54	142.57	78.90
BUCHAN	138.42	7.12	139.60	17.80	140.02	22.08	140.70	29.00
SOUTH LAKE McCOY BASIN								
MS01N01W	85.30	29.75	92.23	56.53	93.84	60.58	96.33	66.30
MS02N01P	82.01	34.17	83.28	65.04	83.63	70.56	84.24	78.80
MS03N01P	87.55	18.34	90.50	44.14	93.08	50.14	94.26	77.11
MS04N01P	83.06	18.97	86.23	42.92	87.69	48.27	90.27	73.88
MS05N01P	76.07	19.48	78.43	42.43	79.16	48.36	80.39	74.33
MS07N01P	64.71	0.24	65.80	9.27	66.23	14.68	66.92	24.88
MS08N01P	62.84	0.00	65.40	0.62	66.10	0.88	66.57	2.72
McCOY-S	63.59	7.39	65.39	22.81	66.09	31.47	66.53	165.77
PARK AVENUE DRAINAGE BASIN								
PA02NO1P	145.14	0.00	148.24	0.00	149.36	0.00	150.08	15.80
PA05NO1P	68.11	63.84	73.02	104.97	75.25	121.07	80.74	141.48
NORTH LAKE McCOY								
MN01N01D	115.51	3.04	116.43	8.15	116.83	11.07	117.33	14.83
MN02N01P	114.93	2.83	115.55	7.04	115.78	8.72	116.19	11.27
MN02N02D	113.32	3.92	114.04	9.80	114.30	12.29	114.82	16.92
MN03N01P	106.08	1.18	106.27	5.11	106.33	6.92	106.44	10.50

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TABLE 2-4

Node I.D.	PEAK CONDITIONS							
	Mean Annual		10-year/24-hour		25-year/24-hour		100-year/24-hour	
	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)
MN03N02D	95.48	4.17	96.77	11.28	97.64	14.15	99.66	19.47
MN03N03D	87.68	4.83	88.78	14.57	89.21	18.65	90.08	26.20
MN07N01P	70.03	5.76	70.12	24.06	70.16	32.72	70.25	50.11
MN08N01P	68.55	0.00	72.00	0.17	72.01	1.16	72.04	3.85
MN09N01P	65.00	0.01	65.76	6.20	65.99	11.52	66.04	17.44
MN10N01P	63.79	0.00	64.96	2.53	65.19	4.25	65.59	8.08
MN11N01P	64.29	0.08	65.01	2.02	65.28	3.02	65.66	5.65
MN12N01D	119.00	60.28	119.00	60.28	119.00	60.28	119.31	71.09
MN13N01W	103.34	18.69	104.32	52.14	104.61	70.19	104.85	137.51
MN14N01D	72.51	31.94	74.31	77.31	75.12	99.27	77.09	147.94
MN15N01D	134.72	13.44	135.76	31.49	136.13	39.12	136.80	53.65
MN16N01D	128.65	16.40	129.77	37.35	130.18	46.01	130.93	62.54
MN17N01D	121.59	18.94	122.99	42.40	123.61	51.90	125.22	69.96
MN18N01W	64.10	61.26	65.54	153.76	65.62	191.33	65.76	264.21
MN19N01P	102.55	0.00	105.03	0.00	105.96	0.00	106.06	6.48
McCOY-N	62.75	50.27	63.82	179.16	64.10	247.43	64.85	415.08
MN21N01L	61.79	50.40	63.37	179.51	63.68	247.96	64.81	412.64
LAKE CORONI BASIN								
LC01N01L	82.23	0.00	83.45	1.66	83.64	4.97	84.00	10.53
LC02N01P	87.85	1.53	88.08	9.22	88.17	12.28	88.35	18.35
LC03N01P	62.87	0.00	63.44	8.81	63.65	12.02	66.12	14.35
LC04N01P	61.35	0.00	62.89	5.01	63.63	6.14	64.79	10.71
LC05N01P	65.38	3.59	67.06	11.96	67.72	13.80	69.01	15.78
LC05N02D	65.38	3.58	66.95	11.43	67.44	12.91	68.34	14.96
LC05N03D	65.38	3.38	66.84	9.60	67.17	10.65	67.68	15.10
LC06N01P	65.38	0.00	66.81	10.94	67.10	17.28	67.50	33.76
LC07N01P	68.92	0.00	71.56	0.00	72.01	0.60	72.04	4.40
CORONI-S	60.87	50.31	62.89	139.46	63.63	194.61	64.80	306.77
CORONI-N	60.87	24.56	62.89	84.48	63.63	106.83	64.79	125.40

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TABLE 2-4

Node	PEAK CONDITIONS							
	Mean Annual		10-year/24-hour		25-year/24-hour		100-year/24-hour	
I.D.	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)	Stage (ft)	Flow (cfs)
LAKE PREVATT BASIN								
LP01N01W	122.64	38.75	123.08	88.74	123.12	100.37	123.73	132.00
LP02N01D	114.32	61.89	117.08	133.55	117.33	157.89	117.46	205.69
LP03N01P	127.26	6.42	128.04	12.53	128.27	14.01	128.72	16.54
LP04N01D	118.28	38.03	120.04	72.43	120.10	84.97	120.17	107.65
LP05N01P	98.54	6.52	99.29	10.63	99.56	11.89	100.05	14.01
LP06N01P	98.48	32.56	99.05	68.32	99.24	81.71	99.54	106.63
LP07N01W	95.62	150.39	95.97	307.92	96.07	363.76	96.25	469.76
LP08N01W	101.64	12.23	102.67	25.86	102.75	31.55	103.17	68.83
LP08N02D	101.49	12.18	102.30	20.13	102.36	20.72	102.68	23.01
LP09N01P	98.46	2.90	98.95	15.73	99.40	17.98	100.36	21.93
LP10N01D	97.38	12.17	98.15	35.84	98.21	38.43	98.33	44.00
LP10N02D	93.08	167.86	93.99	357.22	94.21	418.26	94.60	534.36
LP10N03P	92.34	163.41	93.23	357.24	93.33	418.23	93.48	534.77
LP11N01L	79.69	0.00	81.09	0.00	81.64	0.00	82.64	0.00
LP13N01W	59.56	24.56	61.50	84.43	62.39	106.43	63.64	126.65
LP14N01P	64.12	0.35	64.35	9.86	64.40	13.00	64.50	19.54
LP14N02P	60.56	0.00	62.80	4.56	63.34	7.64	63.84	17.58
PREVATT	58.23	22.58	59.35	110.08	59.77	154.47	60.47	248.41
CARPENTER BRANCH								
CARPENTR	48.22	22.57	49.61	117.71	49.75	166.56	49.97	276.16

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TABLE 2-5

CHANNEL SECTIONS

REACH I.D.	FROM NODE	TO NODE	SECTION DESCRIPTION	FLOW LINE ELEV.		OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
				U/S (ft)	D/S (ft)		10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
LP01R01X	LP01N01W	LP02N01D	Trapezoidal	121.30	111.30	127.00	123.08 YES	123.12 YES	123.73 YES
MN20R01X	MCCOY-N	MN21N01L	Irregular	60.30	60.20	65.00	63.82 YES	64.10 YES	64.85 YES

Total Number of Channel Sections = 2

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TABLE 2-6

CROSS CULVERT SECTIONS

REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	RISE (in)	SPAN (in)	MATERIAL TYPE	CULVERT LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
DL03R02C	DL03N02D	DREAM	1	1,048	30	30	RCP	SUMMIT LAKE TO DREAM LAKE	149.80	140.36 YES	141.24 YES	142.59 YES
DL05R01C	DREAM	MN01N01D	1	99	24	24	RCP	DREAM LAKE OUTFALL UNDER PARK AVENUE	118.11	116.71 YES	117.36 YES	118.27 NO
MN01R01C	MN01N01D	MN02N02D	1	220	24	24	RCP	DREAM LAKE OUTFALL EAST OF PARK AVENUE	118.00	116.43 YES	116.83 YES	117.33 YES
MN02R02C	MN02N02D	MN03N02D	1	880	24	24	CMP	DREAM LAKE/APOPKA MIDDLE OUTFALL	118.00	114.04 YES	114.30 YES	114.82 YES
MN03R02C	MN03N02D	MN03N03D	1	120	24	24	CMP	DREAM LAKE/APOPKA MIDDLE OUTFALL	108.00	96.77 YES	97.64 YES	99.66 YES
MN03R04C	MN03N03D	MCCOY-N	1	60	24	24	CMP	DREAM LAKE/APOPKA MIDDLE OUTFALL	103.00	88.78 YES	89.21 YES	90.08 YES
MS01R01C	MS01N01W	MS02N01P	1	305	36	36	CMP	WETLAND OUTFALL E. END OF MYRTLE ST.	97.00	92.23 YES	93.84 YES	96.33 YES
MS09R01C	MCCOY-S	MCCOY-N	1	228	30	30	RCP	LAKE MCCOY INTERCONNECT	65.90	65.39 YES	66.09 NO	66.53 NO
MN13R01C	MN13N01W	LP08N01W	1	32	18	18	CMP	SIDE DRAIN SOUTH OF WELCH RD.	104.70	104.32 YES	104.61 YES	104.85 NO
MN15R01C	MN15N01D	MN16N01D	1	392	42	42	RCP	BUCHAN POND OUTFALL (GROSSENBACHER)	137.70	135.76 YES	136.13 YES	136.80 YES
MN16R01C	MN16N01D	MN17N01D	1	743	42	42	RCP	BUCHAN POND OUTFALL (GROSSENBACHER)	133.00	129.77 YES	130.18 YES	130.93 YES

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TABLE 2-6
CROSS CULVERT SECTIONS

REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	RISE (In)	SPAN (In)	MATERIAL TYPE	CULVERT LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
MN17R01C	MN17N01D	MN18N01W	1	79	36	36	RCP	BUCHAN POND OUTFALL (UNDER PARK AVENUE)	125.00	122.99 YES	123.61 YES	125.22 NO
MN18R01C	MN18N01W	MCCOY-N	1	82	36	60	CMP	CROSS CULVERT UNDER USTLER ROAD	65.30	65.54 NO	65.62 NO	65.76 NO
MN12R01C	MN12N01D	MN13N01W	2	120	36	36	RCP	ROCK SPRINGS ROAD CROSS CULVERT	122.00	119.00 YES	119.00 YES	119.31 YES
MN14R01C	MN14N01D	MN18N01W	1	59	48	48	RCP	CROSS CULVERT UNDER SANDPIPER STREET	77.00	74.31 YES	75.12 YES	77.09 NO
MN21R01C	MN21N01L	CORONI-S	2	60	24	38	CMP	NORTH LAKE MCCOY OUTFALL	62.81	63.37 NO	63.68 NO	64.81 NO
LC08R01C	CORONI-S	CORONI-N	1	50	24	24	DIP	CULVERT UNDER GAS EASEMENT	60.30	62.89 N/A	63.63 N/A	64.80 N/A
LC08R02C	CORONI-S	CORONI-N	1	50	24	24	DIP	CULVERT UNDER GAS EASEMENT	60.30	62.89 N/A	63.63 N/A	64.80 N/A
LC05R01C	LC05N01P	LC05N02D	1	293	24	38	RCP	DEER LAKE RUN POND "C" OUTFALL	69.00	67.06 YES	67.72 YES	69.01 NO
LC05R02C	LC05N02D	LC05N03D	1	312	24	38	RCP	DEER LAKE RUN POND "C" OUTFALL	70.40	66.95 YES	67.44 YES	68.34 YES
LC05R03C	LC05N03D	LC06N01P	1	488	34	53	RCP	DEER LAKE RUN POND "C" OUTFALL	70.40	66.84 YES	67.17 YES	67.68 YES
LP02R01C	LP02N01D	LP07N01W	1	97	36	36	RCP	ROCK SPRINGS ROAD CROSS CULVERT	117.22	117.08 YES	117.33 NO	117.46 NO
LP02R02C	LP02N01D	LP07N01W	1	97	36	36	RCP	ROCK SPRINGS ROAD CROSS CULVERT	117.22	117.08 YES	117.33 NO	117.46 NO

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TABLE 2-6
CROSS CULVERT SECTIONS

REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	RISE (In)	SPAN (In)	MATERIAL TYPE	CULVERT LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
LP03R01C	LP03N01P	LP02N01D	1	35	24	24	CMP	TRAILER PARK POND	128.90	128.04	128.27	128.72
								POND OUTFALL PIPE		YES	YES	YES
LP04R01C	LP04N01D	LP07N01W	1	85	36	36	RCP	ROCK SPRINGS ROAD	120.00	120.04	120.10	120.17
								CROSS CULVERT		NO	NO	NO
LP05R01C	LP05N01P	LP06N01P	1	215	24	24	RCP	EQUALIZER BETWEEN	100.50	99.29	99.56	100.05
								WEKIVA PARK PONDS		YES	YES	YES
LP08R01C	LP08N01W	LP08N02D	2	66	24	24	RCP	CROSS CULVERTS	103.00	102.67	102.75	103.17
								UNDER WELCH ROAD		YES	YES	NO
LP08R03C	LP08N02D	LP10N01D	1	1,170	30	30	RCP	WELCH ROAD OUTFALL	103.00	102.30	102.36	102.68
								THRU WEKIVA PARK		YES	YES	YES
LP07R01C	LP07N01W	LP10N02D	2	40	24	24	DIP	WETLAND OUTFALL	94.90	95.97	96.07	96.25
								TO WEKIVA GLEN		N/A	N/A	N/A
LP10R03C	LP10N03P	PREVATT	3	100	24	38	RCP	OUTFALL THRU WEKIVA	92.60	93.23	93.33	93.48
								GLEN SUBDIVISION		NO	NO	NO
LC09R01C	CORONI-N	LP13N01W	1	88	60	60	RCP	PARADISE ISLE DRIVE	66.00	62.89	63.63	64.79
								CROSS CULVERT		YES	YES	YES
LP13R01C	LP13N01W	PREVATT	1	130	36	36	RCP	CROSS CULVERT	66.50	61.50	62.39	63.64
								UNDER WELCH ROAD		YES	YES	YES
LP13R02C	LP13N01W	PREVATT	1	130	36	36	RCP	CROSS CULVERT	66.50	61.50	62.39	63.64
								UNDER WELCH ROAD		YES	YES	YES
CB01R01C	CARPENTR	TW	2	20	36	36	CMP	CROSS CULVERTS	49.50	49.61	49.75	49.97
								UNDER OLD TRAM BED		NO	NO	NO

Total Number of Cross Culverts = 34

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TABLE 2-7

CULVERT AND WEIR RISER SECTIONS

REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	SPAN (in)	RISE (in)	MATERIAL TYPE	RISER LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
DL03R01S Crest 1: El.=144.50, L=1.7' Crest 2: El.=147.00, L=12'	DL03N01P	DL03N02D	1	672	30	30	RCP	SUMMIT LAKE OUTFALL TO DREAM LAKE	148.00	145.63 YES	146.61 YES	148.07 NO
MS02R01S Crest 1: El.=80.00, L=4'	MS02N01P	MCCOY-S	1	40	36	36	CMP	POND OUTFALL SOUTH OF VOTAW RD.	84.00	83.28 YES	83.63 YES	84.24 NO
MS03R01S Crest 1: El.=87.00, L=15'	MS03N01P	MS04N01P	1	58	30	30	CMP	UPPER GREENWOOD GORGE	95.00	90.50 YES	93.08 YES	94.26 YES
MS04R01S Crest 1: El.=82.50, L=15'	MS04N01P	MS05N01P	1	65	30	30	CMP	MIDDLE GREENWOOD GORGE	91.00	86.23 YES	87.69 YES	90.27 YES
MS05R01S Crest 1: El.=75.50, L=15'	MS05N01P	MCCOY-S	1	46	30	30	CMP	LOWER GREENWOOD GORGE	81.00	78.43 YES	79.16 YES	80.39 YES
PA05R01S Crest 1: El.=67.00, L=21.8'	PA05N01P	MCCOY-N	1	315	42	42	RCP	PARK AVE POND OUTFALL	69.00	73.02 NO	75.25 NO	80.74 NO
BP01R01S Crest 1: El.=139.85, L=2.75' Crest 2: El.=143.00, L=15'	BP01N01P	BUCHAN	1	130	36	36	RCP	PINES OF WEKIVA POND 3 OUT.	144.00	141.65 YES	142.03 YES	142.68 YES
BP02R01S Crest 1: El.=144.25, L=10'	BP02N01P	BP04N01P	1	80	36	36	RCP	PINES OF WEKIVA POND 2 OUT.	147.00	144.81 YES	144.91 YES	145.08 YES
BP03R01S Crest 1: El.=145.50, L=8'	BP03N01P	BP04N01P	1	774	30	30	RCP	APOPKA HIGH 9TH GRADE OUTFALL	147.50	146.21 YES	146.34 YES	146.60 YES

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ORANGE COUNTY, FLORIDA
P.N. : OC-070/1.0
(filename: OC-070TB.WK4)
DATE : 08-Jan-97
CHECKED : David W. Hamstra, P.E.

SUBJECT : TABULATION OF EXISTING CONDITIONS DRAINAGE STRUCTURE INFORMATION AND adICPR FLOOD ROUTING RESULTS

TABLE 2-7

CULVERT AND WEIR RISER SECTIONS

REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	SPAN (in)	RISE (in)	MATERIAL TYPE	RISER LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
BP04R01S Crest 1: El.=139.75, L=6.17'	BP04N01P	BUCHAN	1	140	60	38	RCP	PINES OF WEKIVA POND 2 OUT.	144.00	141.58 YES	141.95 YES	142.57 YES
BP05R01S Crest 1: El.=137.16, L=4'	BUCHAN	MN15N01D	1	315	30	30	RCP	BUCHAN POND OUTFALL	140.50	139.60 YES	140.02 YES	140.70 NO
MN02R01S Crest 1: El.=114.20, L=1.5'	MN02N01P	MN02N02D	1	42	30	19	RCP	APOPKA MIDDLE SCHOOL	118.00	115.55 YES	115.78 YES	116.19 YES
MN09R01S Crest 1: El.=65.00, L=15'	MN09N01P	MCCOY-N	1	100	15	15	RCP	WEKIVA LANDING POND	65.88	65.76 YES	65.99 NO	66.04 NO
MN10R01S Crest 1: El.=64.4, L=2' Crest 2: El.=65.5, L=10'	MN10N01P	MCCOY-N	1	278	24	24	RCP	OAKWATER ESTATES POND 2 OUT.	66.00	64.96 YES	65.19 YES	65.59 YES
MN11R01S Crest 1: El.=64.2, L=1' Crest 2: El.=65.5, L=10'	MN11N01P	MCCOY-N	1	258	15	15	RCP	OAKWATER ESTATES POND 1 OUT.	66.00	65.01 YES	65.28 YES	65.66 YES
LC01R01S Crest 1: El.=83.28, L=7.6'	LC01N01L	CORONI-S	1	78	15	15	RCP	OUTFALL UNDER USTELER RD.	85.00	83.45 YES	83.64 YES	84.00 YES
LC03R01S Crest 1: El.=63.0, L=10'	LC03N01P	CORONI-N	1	32	15	15	RCP	WEKIWA WOODS POND 2 OUT.	64.00	63.44 YES	63.65 YES	66.12 NO
LC04R01S Crest 1: El.=62.52, L=10'	LC04N01P	CORONI-N	1	30	15	15	RCP	WEKIWA WOODS POND 1 OUT.	64.00	62.89 YES	63.63 YES	64.79 NO

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TABLE 2-7
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REACH I.D.	FROM NODE	TO NODE	NUMBER OF PIPES	LENGTH (ft)	SPAN (in)	RISE (in)	MATERIAL TYPE	RISER LOCATION	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
										10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
LC06R01S Crest 1: El.=66.0, L=5' Crest 2: El.=67.25, L=15'	LC06N01P	CORONI-N	1	45	36	36	RCP	DEER LAKE RUN POND B OUT.	67.50	66.81 YES	67.10 YES	67.50 YES
LP09R01S Crest 1: El.=98.36, L=30'	LP09N01P	LP10N01D	1	30	24	24	RCP	PARKVIEW POND OUTFALL	99.00	98.95 YES	99.40 NO	100.36 NO
LP14R02S Crest 1: El.=61.48 L=1' Crest 2: El.=63.5, L=14'	LP14N02P	PREVATT	1	40	24	24	RCP	DEER LAKE RUN LOWER POND A	65.00	62.80 YES	63.34 YES	63.84 YES

Total Number of Culvert and Weir Riser (Drop) Structures = 21

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TABLE 2-8
WEIR SECTIONS

REACH I.D.	FROM NODE	TO NODE	WEIR TYPE	LOCATION I.D.	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
						10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
DL01R010 CREST EL = 147.70	DL01N01P	DL02N01W	IRREG	EXISTING DIRT ROAD	150.00	148.29 YES	148.33 YES	148.39 YES
MS03R03S CREST EL = 93.60	MS03N01P	MS04N01P	TRAP	UPPER GREENWOOD GORGE	95.00	90.50 YES	93.08 YES	94.26 YES
MS04R02S CREST EL = 89.70	MS04N01P	MS05N01P	TRAP	MIDDEL GREENWOOD GORGE	91.00	86.23 YES	87.69 YES	90.27 YES
MS05R02S CREST EL = 79.80	MS05N01P	MCCOY-S	TRAP	LOWER GREENWOOD GORGE	81.00	78.43 YES	79.16 YES	80.39 YES
DL02R010 CREST EL = 148.00 CREST L = 200'	DL02N01W	DL03N01P	RECT	BETWEEN WETLAND AND POND	149.00	148.03 YES	148.13 YES	148.27 YES
MS07R01S CREST EL = 64.60 CREST L = 2.35'	MS07N01P	MCCOY-S	RECT	VOTAW VILLAGE SOUTH POND	66.50	65.80 YES	66.23 YES	66.92 NO
MS08R01S CREST EL = 64.30 CREST L = 0.90'	MS08N01P	MCCOY-S	RECT	VOTAW VILLAGE NORTH POND	66.00	65.40 YES	66.10 NO	66.57 NO
MN03R03S CREST EL = 105.95	MN03N01P	MN03N03D	TRAP	ATHLETIC FIELD OVERFLOW	108.00	106.27 YES	106.33 YES	106.44 YES
LP06R01S CREST EL = 97.50	LP06N01P	LP07N01W	TRAP	WEKIVA PARK POND	100.00	99.05 YES	99.24 YES	99.54 YES
DL05R02R CREST EL = 118.11	DREAM	MCCOY-N	IRREG	PARK AVE. DOWN VOTAW RD.	118.11	116.71 YES	117.36 YES	118.27 NO
MN09R02R CREST EL = 65.88	MN09N01P	MCCOY-N	IRREG	WEKIVA LANDING	65.88	65.76 YES	65.99 NO	66.04 NO
MN21R02R CREST EL = 62.81	MN21N01L	CORONI-S	IRREG	SANDPIPER STREET	62.81	63.37 NO	63.68 NO	64.81 NO
LP07R02R CREST EL = 94.90	LP07N01W	LP10N02D	IRREG	DIRT ROAD TO WEKIVA GLEN	94.90	95.97 N/A	96.07 N/A	96.25 N/A

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TABLE 2-8
WEIR SECTIONS

REACH I.D.	FROM NODE	TO NODE	WEIR TYPE	LOCATION I.D.	OVERTOPPING ELEVATION (ft)	PEAK STAGE (ft)		
						10-YR ADEQUATE	25-YR ADEQUATE	100-YR ADEQUATE
MN03R01S CREST EL = 105.94 CREST L = 3'	MN03N01P	MN03N02D	RECT	ATHLETIC FIELD OVERFLOW	108.00	106.27 YES	106.33 YES	106.44 YES
MN13R02O CREST EL = 104.70 CREST L = 300	MN13N01W	LP08N01W	RECT	WETLAND SOUTH OF WELCH RD.	104.70	104.32 YES	104.61 YES	104.85 NO
LP10R04R CREST EL = 92.60	LP10N03P	PREVATT	IRREG	WEKIVA GLEN SUBDIVISION	92.60	93.23 NO	93.33 NO	93.48 NO
LP08R02R CREST EL = 102.50 CREST L = 30'	LP08N01W	LP13N01W	RECT	USTLER ROAD TO EAST	102.50	102.67 NO	102.75 NO	103.17 NO
LP14R01S CREST EL = 64.09 CREST L = 25'	LP14N01P	LP14N02P	RECT	DEER LAKE RUN POND A	65.00	64.35 YES	64.40 YES	64.50 YES

Total Number of Weir Structures = 18

2.7 IDENTIFICATION OF PROBLEM AREAS

The following discussion will provide a summary of the problem areas identified within each basin for the existing drainage facilities which were analyzed within the adICPR model for ***Existing Conditions*** *(refer to Volume II (Calculations), Section 3).*

Despite the apparent level of detail, the main focus of this study was the lake system. Areas upland of these lakes have been included solely to account for the effects of flood storage and peak rate attenuation on the main lake system (e.g., existing stormwater ponds and wetland systems). Thus, some findings in areas upland of the main system are to be considered preliminary. More detailed analysis of secondary drainage systems may be necessary in some areas to refine the analyses herein.

2.7.1 Lake McCoy South Basin

Based upon the results of the Existing Conditions Analysis, few problem areas are evident In the Lake McCoy South Basin. The main focus of the analysis in this Basin was the portion of Lake McCoy south of Votaw Road which is located in Sub-basin MS09. Upland of the lake, the drainage systems included in the model were shown to function fairly well. A general description of these stormwater management systems follows the discussion of the existing conditions at the lake.

The 100-year flood elevation reported by FEMA for Lake McCoy is 65.1 feet. Construction adjacent to Lake McCoy South in the Votaw Village Subdivision was based upon this elevation. And, Votaw Road, which separates the northern and southern portions of Lake McCoy, was constructed with a low point at elevation 65.9 feet. However, the calculations in this study indicate that the flood elevation of Lake McCoy South will be 66.5 feet, which is approximately 1.4 feet higher than the published elevation. The higher flood elevation is a result of having only a single 30-inch culvert as the outfall under Votaw Road.

The City of Apopka required surveys, which included the finished floor elevations, for homes constructed in Votaw Village. The City furnished PEC with these surveys (refer to Volume II, Section 5) and a comparison was made to the calculated flood elevation. Based on the surveys received from the City, all homes in Votaw Village were constructed one (1) foot or more above the 100-year flood elevation determined in this study. Thus, no dwelling structures should experience flooding for up to the 100-year, 24-hour storm event. On the other hand, South Lake McCoy will overtop Votaw Road for the 25-year, 24-hour (8.6 inches of rainfall) and larger storms. The depth of flooding over the roadway for a 100-year storm is expected to be roughly 0.6 feet (7 inches) at the low point *along the centerline. The duration of flooding for a 100-year storm would be approximately 17 hours. Because other routes are available, flooding of this road is not considered critical.*

The 100-year flood elevation in Lake McCoy South could be reduced below the existing profile of Votaw Road by installing new, larger culverts under the roadway without significantly increasing flood stages or flowrates downstream. However, because no dwelling structures or businesses are threatened under existing conditions, this improvement has not been included as a recommendation. ***It is recommended that the normal high water level and the 100-year flood elevation of the south portion of Lake McCoy be published separately from the elevations reported for the portion of the lake north of Votaw Road. The normal high water level should be based upon the culvert outfall under Votaw Road and the 100-year flood elevation should be based upon the analysis performed for this study.***

The wetland area (Node MS01N01W) in Sub-basin MS01 may overflow into the park at the east end of Myrtle Street during extreme storms. Based on construction plans for the Musselwhite multi-family development, a small ditch was to be provided through this park as a high level overflow to the existing pond in Sub-basin MS02 (Node MS02N01P). However, this overflow channel was not evident during field inspections. Considering that the park was apparently not constructed with regard to the construction plans obtained by PEC, the actual elevation at which the wetland overtops into the park is unknown. Even if overtopping does occur, no dwelling structures will be inundated. Thus, no action is recommended.

The existing stormwater pond (Node MS02N01P) in Sub-basin MS02 is expected to overtop during large storm events. Should this occur, the overflow will simply bypass the outfall structure and discharge to Lake McCoy South via the same outfall channel along the south side of Votaw Road. No structures will be endangered: therefore, no corrections are necessary.

Sub-basins MS03, MS04, and MS05 are comprised of the areas draining to the three (3) segments of the Greenwood Gorge located in the Greenwood Cemetery. As mentioned in the sub-basin descriptions, three (3) dams were constructed across the gorge to provide water quality treatment and peak rate attenuation of runoff from these sub-basins. The calculations in this study indicate that these drainage features will function properly for up to the 100-year storm.

Sub-basin MS06 drains directly to Lake McCoy South via a collection system along Christiana Avenue. The function of secondary drainage systems such as this were beyond the scope of this study.

Sub-basins MS07 and MS08 were defined with respect to the two (2) existing stormwater ponds in the Votaw Village Subdivision. The calculations in this study indicate that both of these ponds will overtop during extreme storms because the water level in Lake McCoy South is higher than anticipated. Should the flood elevation in the lake be reduced by installing larger culverts under Votaw Road, water levels would not be expected to exceed the top-of-bank elevations of these existing ponds. As mentioned above, this improvement has not been included as a recommendation because no dwelling structures or businesses are threatened under existing conditions.

2.7.2 Dream Lake Basin

In the Dream Lake Basin, three (3) areas of concern were noted. First, the outfall from the existing pond in Sub-basin DL01 must be maintained; whereas, the proposed Rhapsody Oaks Subdivision has not been designed to accommodate stormwater runoff from this area. Second, the site of the proposed Rhapsody Oaks Subdivision presently provides storage for a large volume of runoff and the development would eliminate this storage. Finally, the outfall from Dream Lake has been altered such that it is difficult for the lake to draw down to the normal high water level set by Orange County.

As outlined in the description of Sub-basin DL01, the existing pond located north of Old Dixie Highway and west of Hawthorne Avenue receives the stormwater runoff from over forty (40) acres of mostly developed area along U.S. 441 (North Orange Blossom Trail). The water level in this pond, which is sometimes referred to as Ustler Pond, is controlled by a drainwell near elevation 144.75 feet. Based upon observation by PEC staff, the drainwell appears to be no larger than twelve (12) inches in diameter. Thus, the flow capacity is limited such that the drainwell functions as little more than a drawdown device for controlling the water level in the pond between storm events. At elevation 147.7 feet, Ustler Pond discharges northward into an existing depressional area on the site of the proposed Rhapsody Oaks Subdivision in Sub-basin DL02.

Prior to the development of the Oaks of Summit Lake Subdivision and construction of the associated pond at the west end of Myrtle Street, the area in Sub-basins DL02 and DL03 drained to a depressional area between Washington Avenue and New Hampshire Avenue. Sources suggest that the water level in this depression was also controlled by one or more drainwells. This area had only a high level overflow to Dream Lake, approximately at elevation 148.5 feet. Based on site specific topographic information supplied on the construction plans for the Oaks of Summit Lake and Rhapsody Oaks Subdivisions, the depressional area provided approximately 47 acre-feet of storage below this elevation. At elevation 147.7 feet, Ustler Pond in Sub-basin DL01 is hydraulically connected to this depressional area. Combined with the storage in Ustler Pond, roughly 54 acre-feet of flood storage was provided upland of Dream Lake prior to any discharge of runoff occurring from Sub-basins DL01, DL02, and DL03 at elevation 148.5 feet.

Following the development of the Oaks of Summit Lake Subdivision, a stormwater pond was constructed at the west end of Myrtle Street in the northern portion of the depressional area. In addition, an outfall pipe was constructed from the pond to Dream Lake. With this modification, the drainage pattern was altered as follows. During large storms, Ustler Pond overflows at elevation 147.7 feet northward into the remaining depressional area on the site of the proposed Rhapsody Oaks Subdivision in Sub-basin DL02. When runoff from this overflow and direct runoff from Sub-basin DL02 cause the depression to fill above elevation 148 feet, discharge occurs to the existing pond in Sub-basin DL03 via overflow of the pond berm. Thus, Ustler Pond and the remaining depressional area still provide retention of the volume of runoff contained below elevation 148 feet. The existing pond in Sub-basin DL03 (Node DL03N01P) then discharges to Dream Lake by means of the outfall control structure which is set at elevation 144.5 feet. This is the current configuration of the drainage systems in Sub-basins DL01, DL02, and DL03. Because the Rhapsody Oaks Subdivision has not received approval from the City of Apopka, this condition was included in the Existing Conditions Analysis of the study area.

Because construction of the Rhapsody Oaks Subdivision is proposed in the existing depressional area in Sub-basin DL02, additional routing analyses were performed for the Dream Lake Basin. An analysis of conditions prior to the construction of the Oaks of Summit Lake Subdivision was conducted to determine whether the stormwater management pond and outfall to Dream Lake had a significant impact on the Basin. A proposed conditions analysis was also performed to predict the effect of construction of the Rhapsody Oaks Subdivision. These routing analyses have not been included in this report.

When compared to the pre-development conditions in the Basin, the systems constructed for the Oaks of Summit Lake Subdivision appear to have had the effect of increasing the peak stage anticipated in Dream Lake for the 10-year, 24-hour and 25-year, 24-hour storms by roughly 0.3 feet. The proposed development of the Rhapsody Oaks Subdivision in accordance with the current construction plans would further alter the drainage in the upper reaches of the Dream Lake Basin. The construction plans prepared by R.H. Wilson and Associates indicate that the remaining depressional area would be entirely filled to make way for high density residential development. Compared to current conditions, this would eliminate roughly 23 acre-feet of storage. In the process, the natural direction of discharge from Sub-basin DL01 would also be altered. Preliminary modeling indicates that Ustler Pond does not have the storage capacity to retain the entire volume of runoff from Sub-basin DL01 without potentially flooding adjacent roadways and structures. Because the proposed subdivision would still be lower than the surrounding land on all other sides of Ustler Pond, runoff would be expected to discharge northward, through the subdivision, to the existing pond (Node DL03N01P) in Sub-basin DL03. Calculations on file at the St. Johns River Water Management District indicate that this pond was not designed to accommodate runoff from all of the off-site areas *in Sub-basins DL01 and DL02. Between the off-site areas which have not been included in the design and the reduction in flood storage, preliminary calculations indicate that the flood stage in Dream Lake for the 10-year, 24-hour and 25-year, 24-hour storms would be approximately one (1) foot higher than prior to development in Sub-basins DL02 and DL03.*

For all scenarios analyzed, the peak 100-year stage in Dream Lake exceeds 118.2 feet, thereby indicating that the lake will overflow into Park Avenue. At this level, Dream Lake may also cause flooding of some structures along Park Avenue. As indicated in the description of Sub-basin DL05, the initial water elevation in Dream Lake has been set at 115 feet in the ICPR model, although the Orange County Lake Index lists a normal high water elevation of 114.5 feet. The initial water level has been set higher in keeping with Orange County's practice of setting the normal high water level six (6) inches above the overflow elevation of the outfall system. The outfall pipe under Park Avenue has an invert elevation of 113.7 feet; however, the actual pipe controlling Dream Lake higher is the outfall for the next downstream sub-basin, MN01. The invert of the pipe at this location is 114.5 feet. Jones, Hoechst, and Associates, Inc. (JHA) surveyed the invert elevations of the pipes on the Dream Lake outfall, as well as, a water elevation in Dream Lake of 115.1 feet at a time when very little outflow was noted. This surveyed water elevation provides further justification for the initial water level modeled for Dream Lake.

Lowering the outfall pipe from sub-basin MN01 such that the lake will be controlled at the published normal high water level will reduce the flood stages in Dream Lake for all storm events analyzed. For the mean annual (2.33-year/24-hour), 10-year/24-hour, and 25-year/24-hour storms, the peak stage in Dream Lake will be reduced by roughly 0.6 feet. The difference for the 100-year/24-hour storm is not as pronounced due to roadway overtopping.

The recommended improvements with regard to the Dream Lake Basin are:

- ***Reinvestigate the Rhapsody Oaks Subdivision to assure that off-site runoff from Ustler Pond and elsewhere in Sub-basin DL02 is accommodated in the stormwater management system.***

- ***Reinvestigate the stormwater management facility located at the west end of Myrtle Street with respect to its ability to attenuate the runoff from Sub-basins DL01, DL02, and DL03 such that the peak level of Dream Lake will not be increased for any design storm. The water quality treatment provided in this stormwater pond should also be reinvestigated in lieu of the additional area draining to the pond.***

- ***Remove and replace the segment of the Dream Lake outfall pipe which has caused the water level in Dream Lake to stay above the published normal high water elevation. The new pipe should be placed at a lower elevation such that the pipe under Park Avenue is the controlling factor. The pipe which would require replacement is actually located in Sub-basins MN01 and MN02. Refer to Section 3.2.1 for a detailed discussion of the recommended improvements.***

It should be noted that the intent of this study was not to serve as review of any particular development. Rather, the purpose was to determine any deficiencies in the existing drainage systems within the study area. PEC was also directed to include areas for which construction plans have been approved in the proposed condition. In this case, the proposed Rhapsody Oaks Subdivision was to be included in the study because the St. Johns River Water Management District has approved the project and the City of Apopka approval was pending. Upon attempting to include the proposed development based upon current construction plans, some of the above potential problems became apparent. Therefore, rather than including the proposed development, the area was modeled in its existing condition.

2.7.3 Park Avenue Drainage Basin

Only two (2) existing stormwater ponds are located within the Park Avenue Drainage Basin. One is located in Sub-basin PA02 and serves the Summerset Subdivision. The other is located on the north side of Votaw Road adjacent to Lake McCoy and receives runoff from all of the sub-basins which drain to the Park Avenue stormsewer system.

The existing pond in Summerset Subdivision (Node PA02N01P) was designed to retain the entire runoff volume from all but the most extreme storms. Of the storms analyzed in this study, only the 100-year, 24-hour storm (10.6 inches of rainfall) will produce enough runoff to fill the pond and result in overtopping to the Park Avenue stormsewer system. Although the pond is expected to overflow in a 100-year storm, runoff will be conveyed toward Park Avenue along Martin Street. Because existing dwelling structures and businesses will not be affected, no improvements are recommended.

The existing pond along Votaw Road was constructed in conjunction with the widening of Park Avenue by the Florida Department of Transportation (FDOT) in 1979. Currently, Orange County is responsible for operation and maintenance of the pond. Excluding the area which drains to the existing pond in the Summerset Subdivision, this pond (Node PA05N01P) was designed to receive the runoff from roughly 250 acres west of Park Avenue via the existing storm sewer system along this road. As outlined in the description of Sub-basin PA05, this pond was apparently intended to

function as a dry-bottom pond with a bottom elevation at 61.9 feet. A drop structure and culvert overflow to Lake McCoy was provided at elevation 67.0 feet and the pond top-of-bank was constructed to elevation 69.0 feet. For the duration of this study, water has been standing in this pond at or near the overflow elevation, within two (2) feet of the top-of-bank. Thus, the ability of the pond to provide water quality treatment or peak rate attenuation of runoff is extremely limited. Currently, the pond provides little more treatment than containment of some trash and debris, and the pond is expected to overtop during all of the storms analyzed in this study.
It is recommended that the existing pond be converted to a wet detention pond with a second outfall structure to Lake McCoy. *The proposed improvement will provide approximately one-half (½) inch of water quality treatment for the 250 acres of urban land draining to the pond and will keep the pond from overtopping in all but the 100-year storm. This improvement will provide only minimal attenuation of the peak rate of runoff. Refer to Section 3.2.2 for a detailed discussion of the recommended improvements.*

Expansion of the pond to provide additional water quality treatment and peak rate attenuation was considered. The existing pond is bounded by a private residence to the west and Votaw Road to the south. Based upon the recommendations of the environmental subconsultant, Lotspeich and Associates, Inc., the areas to the north and east of the pond are good quality wetlands the removal of which would not be warranted for construction of a water quality pond (refer to Section 4 - Supporting Documentation). Thus, expansion of the existing pond was not considered a viable recommendation.

2.7.4 Buchan Pond Drainage Basin

The Buchan Pond Drainage Basin is comprised of five (5) sub-basins. Four (4) of these sub-basins were delineated with respect to stormwater management ponds which have been constructed in the Pines of Wekiva, P.U.D. Sub-basin BP05 includes the major drainage feature in the Basin, Buchan Pond.

The results of the Existing Conditions Analysis contained in this study indicate that none of the existing ponds in the Pines of Wekiva development will experience water levels that will overtop the pond berm for up to the 100-year, 24-hour storm. During field investigations it was noted that the vertical volume recovery structures (VVRS) in the existing ponds located in Sub-basins BP02 and BP04 are in poor condition. The filter fabric has deteriorated and the gravel filter media has been washed out. In the draft of this report it was recommended that the City of Apopka and St. Johns River Water Management District take the measures necessary to have the entity responsible for the ponds make corrective repairs. The City of Apopka acted upon the recommendation and the structures were repaired by the developer.

It has been suggested that development in this basin has resulted in an increase in runoff to downstream areas in sub-basin MN18. While the cumulative volume of runoff discharging from the area may have increased due to development, the peak discharge rate is unlikely to have increased. The development upland of Buchan Pond has provided stormwater detention ponds specifically for the purpose of limiting the peak discharge rate in accordance with the regulations of St. Johns River Water Management and the City of Apopka. In addition, construction plans for the outfall from Buchan Pond indicate that the pipe was replaced with a smaller pipe at approximately the same elevation within the last seven years. This change would have the effect of reducing the rate of discharge from Buchan Pond. Quanification of pre-development conditions for comparison to the Existing Conditions analysis was beyond the scope of this study. Although, it should be noted that peak discharge from Buchan Pond is 29.0 cfs for a 100-year, 24-hour storm, which is only fourteen (14) percent of the runoff reaching the downstream properties in sub-basin MN18.

The 100-year flood elevation of Buchan Pond published in the Orange County Lake Index is 140.0 feet. The calculations in this study indicate that the 100-year flood elevation of Buchan Pond is slightly higher at 140.7 feet. This elevation may result in some flooding into Lake Avenue adjacent to Buchan Pond. The flood elevation could only be lowered by increasing the discharge capacity. However, this is not feasible because downstream areas would receive more runoff. ***It is recommended that a normal high water level for Buchan Pond be established based upon the existing structure controlling this water body. It is also recommended that the published 100-year flood elevation be updated to reflect the elevation of 140.7 feet determined in this study. Proposed development adjacent to Buchan Pond along Grossenbacher Drive and Lake Avenue should be required to construct above this elevation in accordance with applicable regulations.***

2.7.5 Lake McCoy North Basin

The major drainage feature in this basin is the portion of Lake McCoy north of Votaw Road. In addition to the lake, the Basin was subdivided into twenty-one (21) sub-basins. A general description of the function of the drainage systems throughout the Basin follows.

At the northeast corner of Park Avenue and Votaw Road, the Dream Lake outfall pipe conveys runoff eastward toward Lake McCoy North. In this area, Sub-basins MN01, MN02, and MN03 contribute runoff to this existing conveyance system. Descriptions of these sub-basins have been provided in previous sections of this report. Based upon the results of the Existing Conditions Analysis, no problems are evident with regard to the hydraulic capacity of the existing Dream Lake outfall. However, two (2) areas of concern have been noted. First, the upstream invert on the segment of the outfall between Sub-basins MN01 and MN02 is approximately nine (9) inches higher than the *invert of the upstream culvert under Park Avenue. The consequence is that Dream Lake is controlled higher than the published normal high water elevation which results in a loss of flood storage in the lake. A recommended improvement to this segment of the Dream Lake outfall pipe has been included in the discussion of the Dream Lake Basin. The second area of concern is at the outlet end of the Dream Lake outfall pipe. Just east of the Apopka Middle School athletic field in Sub-basin MN03, the Dream Lake outfall discharges to a stream which flows to Lake McCoy North. At this location, an end wall was constructed to control erosion and dissipate the velocity of runoff discharging from the outfall pipe. However, the last segment of the outfall pipe was constructed at a steep grade and the resultant high velocities have caused erosion and structural failure of the existing end wall. The outlet end of the pipe is several feet above the stream bed; therefore, more erosion is expected.* ***It is recommended that the last segment of the Dream Lake outfall be reconstructed to include a drop manhole, a pipe outfall at the existing stream bed, and an energy dissipating end treatment for the pipe (refer to Section 3.2.1).***

To the southeast of Lake McCoy North lie three (3) sub-basins that were delineated with respect to small stormwater management ponds in the Lake McCoy Forest and Oaks-on-the-Lake Subdivisions. These ponds were not included in the model of the study area due to insufficient information. Rather, the runoff hydrographs for Sub-basins MN04, MN05, and MN06 were routed directly to Lake McCoy North. Thus, no comment can be made with regard to the existing ponds in these sub-basins.

Sub-basin MN07 is located south of Votaw Road between Christiana Avenue and Thompson Road. To the east of Christiana Avenue is a small, wooded depressional area which collects runoff prior to overflowing to Votaw Road where it is presumed that runoff is intercepted in the stormsewer system. The function of secondary drainage systems such a this were beyond the scope of this study.

Sub-basins MN08 and MN09 are located between Lake McCoy North and Thompson Road. As outlined in the sub-basin descriptions previously provided in this report, each of these sub-basins includes a small stormwater pond. Because information regarding these ponds was readily available, they were included in the analysis of the study area. Based upon the results of the analysis, the ponds in both of these sub-basins will overtop their banks and flow over Wekiva Landing Drive to Lake McCoy North for the 25-year, 24-hour and larger storms. Overtopping of the roadway is not expected to occur for the 10-year, 24-hour storm and no dwelling structures will be endangered due to overtopping of the ponds for any of the storms analyzed. Thus, no improvements are recommended.

Sub-basins MN10 and MN11 are located in the northeast portion of the Lake McCoy Basin. These sub-basins were delineated with respect to the two (2) existing stormwater management ponds constructed in the Oakwater Estates Subdivision. The results of the Existing Conditions Analysis contained in this study indicate that neither of the existing ponds in the Oakwater Estates Subdivision will experience water levels that will overtop the pond berm for up to the 100-year, 24-hour storm. Therefore, no improvements are recommended in these sub-basins.

Sub-basins MN12 and MN13 are located south of Welch Road, on the west and east sides of Rock Springs Road, respectively. Currently, minimal storage is provided in Sub-basin MN12 west of Rock Springs Road. Double 36-inch culverts under the road appear to be more than adequate to pass the runoff from this sub-basin eastward to the existing wetland system in Sub-basin MN13. In this wetland, the peak rate of runoff from Sub-basins MN12 and MN13 is attenuated prior to being discharged. The primary direction of discharge from the wetland in Sub-basin MN13 seems to be southward to Sandpiper Street via an existing drainage ditch through Sub-basin MN14. A secondary outlet exists eastward to Sub-basin LP08 via a driveway culvert and the ditch along the south side of Welch Road. At high water elevations, runoff is also expected to overflow the wetland area and sheet flow eastward into Sub-basin LP08 resulting in a shallow floodplain across the sub-basin. The results of the Existing Conditions analysis indicate that overflow to sub-basin LP08 will only occur for extreme rainfall events such as the 100-year storm (10.6 inches of rainfall). However, because the storage provided in this wetland was estimated based on limited information, the results in this area are questionable. Overflow to the east may occur for lesser storm events if the storage has been overestimated. Also, because the capacity of the outfall ditch is limited, the wetland is sensitive to the volume of runoff from sub-basins MN12 and MN13 and will be more likely to overflow eastward into sub-basin LP08 given additional runoff volume. ***It is recommended that all future development in Sub-basins MN12 and MN13 be required to limit the post-development volume of discharge to the pre-development volume of runoff for 24 hours following a storm. This criteria should be met for all storms up to the 100-year storm. The existing requirements regarding the peak rate of discharge should also apply.*** *A detailed topographic survey of the entire wetland and surrounding areas would be necessary to refine this portion of the model.*

Sub-basin MN14 lies along the east side of Park Avenue between Sub-basin MN13 and Sandpiper Street. Runoff from this sub-basin and upstream sub-basins is conveyed via a stream to an existing 48-inch culvert under Sandpiper Street approximately 550 feet west of Ustler Road. The results of the Existing Conditions analysis indicate that this culvert will pass the runoff from the upstream sub-basins for up to the 25-year storm (8.6 inches of rainfall) (refer to Table 2-6). Discharge into the roadway is expected to be minor for the 100-year storm (10.6 inches of rainfall), in which case runoff will flow along Sandpiper Street toward Lake McCoy North. Because no dwelling structures or businesses will be jeopardized, no improvements are recommended.

As described previously in this report, the drainage system along Grossenbacher Drive conveys runoff discharged from Buchan Pond and runoff from Sub-basins MN15 and MN16 eastward to Park Avenue. The results of the Existing Conditions analysis indicate that this conveyance system can pass the runoff for up to the 100-year storm without surcharging. At Park Avenue, the runoff from Sub-basin MN17 enters the system and all flows are conveyed under the road through a 36-inch culvert. Based upon the results of the analysis, this culvert will pass the runoff from all upstream sub-basins for up to the 25-year storm. A 100-year storm will result in some flooding into Park Avenue for roughly one (1) hour. No residential or business structures will be affected; therefore, no improvements are recommended.

Sub-basin MN18 is located east of Park Avenue, west of Ustler Road, north of Tanglewilde Drive and south of Sandpiper Street. Runoff from this area flows eastward toward an existing wetland/pond adjacent to Ustler Road. In addition to the direct runoff from this sub-basin, runoff discharged from upstream sub-basins also reaches the pond/wetland. In particular, runoff from sub-basins to the north enters Sub-basin MN18 just west of Ustler Road via the 48-inch culvert under Sandpiper Street. To the west, runoff enters Sub-basin MN18 by means of a 36-inch culvert under Park Avenue. Overall, the pond/wetland in Sub-basin MN18 receives runoff from approximately 470 acres to the north and west. Runoff is then discharged eastward via an existing culvert under Ustler Road. The Existing Conditions analysis indicates that Ustler Road will be overtopped during the 10-year (7.5 inches of rainfall) and larger storms. In fact, evidence of flow over the roadway was observed at some locations following heavy rainfall. Although the road is shown to overtop, Ustler Road is an unpaved road adjacent to the wetland fringe of Lake McCoy and is not a critical route. No dwelling structures are endangered. Therefore, no improvement is recommended.

The existing pond in Magnolia Oaks Subdivision adjacent to Tanglewilde Drive (Node MN19N01P) was designed to retain the entire runoff volume from Sub-basin MN19 for all but the most extreme storms. Of the storms analyzed in this study, only the 100-year, 24-hour storm (10.6 inches of rainfall) will produce enough runoff to fill the pond and result in overtopping of the pond berm to the wetland adjacent to Tanglewilde Drive. Although conveyance along Tanglewilde Drive is reportedly inadequate, the pond in Sub-basin MN18 does not appear to be a contributing factor considering it will not any contribute runoff for most storms. Because existing dwelling structures will not be flooded as a result of the pond overtopping, no improvements are recommended. It should be noted that analysis of the conveyance system along Tanglewilde Drive was beyond the scope of this study.

The main focus of the analysis in this Basin is the portion of Lake McCoy north of Votaw Road. The area draining directly to this lake has been designated Sub-basin MN20. In addition to direct runoff from these sub-basins, Lake McCoy North receives the runoff from Sub-basins MN01 through MN19, as well as, runoff discharged from the Lake McCoy South, Dream Lake, Park Avenue, and Buchan

Pond Drainage Basins. In turn, Lake McCoy discharges north to Sub-basin MN21 via an existing ditch and thence to Lake Coroni by means of culverts under Sandpiper Street. The 100-year flood elevation calculated in the Existing Conditions analysis for Lake McCoy North is 64.9 feet. Although somewhat lower, this elevation correlates well to the 100-year flood elevation of 65.1 feet reported for the lake by FEMA. Based upon the Orange County Aerial Topographic Maps, all structures adjacent to the lake appear to have been constructed above the published flood elevation. Thus, no improvements to the conveyance capacity of the outfall from the lake are necessary.

During field reviews it was noted that a makeshift weir was constructed across the outfall channel between Lake McCoy and Sandpiper Street in an apparent attempt to keep the lake level high. Orange County surveyed the elevation of this blockage as approximately 61.4 feet. The normal high water elevation of Lake McCoy North published in the Orange County Lake Index is 61.5 feet. Typically, Orange County sets the normal high water elevation six (6) inches above the outfall elevation. ***Because the makeshift weir across the channel would tend to control the lake higher, it is recommended that it be removed. In its place, a permanent weir at elevation 61.0 is recommended upstream of the culverts at Sandpiper Street in Sub-basin MN21 to control the level of Lake McCoy (refer to Section 3.2.3 for a detailed discussion of the recommended improvement).***

As mentioned above, double culverts under Sandpiper Street convey runoff under the roadway to Lake Coroni. Based on the Existing Conditions analysis, floodwaters will overtop the road for the 10-year and larger storms because the water elevation downstream in Lake Coroni will be at or above the existing road elevation. In the worst case, the road will be under a foot or more of water for roughly two (2) days following a 100-year storm.

Construction plans for the paving of Sandpiper Street have been prepared for Orange County by WBQ Design & Engineering, Inc. . Based upon these plans, the proposed profile of Sandpiper Street will be raised and the size of the culverts under the road will be increased to pass the 10-year peak flowrate without overtopping the road. The proposed condition has been included in the recommended improvements adICPR analyses.

2.7.6 Lake Coroni Basin

This Basin is defined by the area which contributes runoff to Lake Coroni. Seven (7) sub-basins were identified within this Basin to account for flood storage and attenuation of runoff upland of Lake Coroni. Two (2) other sub-basins were delineated based upon the area draining directly to Lake Coroni. The function of the drainage features in each sub-basin is discussed below.

Sub-basin LC01 was defined based on the area draining to the small lake located west of Ustler Road and north of Sandpiper Street. The outfall from this lake is eastward to Lake Coroni via an existing drop structure and 15-inch culvert under Ustler Road. The Existing Conditions analysis indicates that the lake will not overtop the berm constructed along Ustler Road and that the discharge from this lake is expected to be small, with a maximum discharge of approximately 10.5 cfs for the 100-year storm. As noted in the description of this sub-basin, the outlet end of the culvert outfall from this lake is located in a sump and is partially buried. ***It is recommended that the outfall be improved by regrading downstream of the outlet to provide a swale. An easement would also need to be obtained for the outfall to Lake Coroni (refer to Section 3.2.4).***

Sub-basins LC02, LC03, LC04, LC05, LC06, and LC07 were delineated with respect to existing stormwater management ponds located within the subdivisions which have been constructed around Lake Coroni in the past ten (10) years. No problems are apparent based on the results of the Existing Conditions analysis. Although, for the 100-year storm, the existing ponds in Sub-basins LC03 and LC04 are shown to exceed the top-of-bank elevation of the ponds at 64.0 feet because the flood level of Lake Coroni is 64.8 feet. No dwelling structures are in danger of being flooded by the ponds in these sub-basins

Sub-basins LC08 and LC09 are comprised of the area that drains directly to Lake Coroni. This area was divided into two (2) sub-basins to account for the access berm over the gas pipeline easement which bisects the lake. For all of the storm events modeled in the Existing Conditions analysis, the water level in Lake Coroni rises above the elevation of this berm and the two halves of the lake act as one. The analysis indicates that the 100-year flood elevation of Lake Coroni is 64.8 feet. Based on the Orange County Aerial Topographic Maps, no dwelling structures have been constructed within the 100-year flood plain of Lake Coroni. One (1) barn has been constructed within the 100-year flood plain. However, no improvements can eliminate flooding of this structure because it was constructed with a floor elevation of 59.43 feet, which is only slightly above the published normal high water elevation of Lake Coroni (58.4 feet). An equipment storage building on another property is also located within the floodplain. Orange County surveyed the structures on the property at 607 Sandpiper Street and determined that the floor elevation of the equipment storage building is 61.98 feet. As a comparison, the mean annual storm (4.5 inches of rainfall) is expected to result in a lake level of 60.87 feet and a 10-year, 24-hour storm (7.5 inches of rainfall) should cause the lake to rise to an elevation of 62.89 feet. Once again, no improvements can be made which will prevent flooding of this structure. The home on this property was also surveyed and the finished floor elevation was measured to be 65.88 feet. The 100-year flood elevation of Lake Coroni was determined to be 64.8 feet; therefore, this home is over one (1) foot above the anticipated flood level.

It is recommended that the normal high water level and the 100-year flood elevation of Lake Coroni be updated to reflect existing conditions. The normal high water level should be based upon the culvert outfall under Paradise Isle Drive and the 100-year flood elevation should be based upon the analysis performed for this study.

2.7.7 Lake Prevatt Drainage Basin

Lake Prevatt, which is the defining drainage feature in this Basin, is located north of Welch Road in Wekiwa Springs State Park. The Basin was subdivided into seventeen (17) sub-basins to account for all areas which provide some level of flood storage or peak rate attenuation. A general description of the function of the drainage systems throughout the Basin follows.

In the far western extent of the Lake Prevatt Basin lies Sub-basin LP01, which drains to a depressional wetland located at the west end of Lester Road. As discussed previously, this wetland naturally discharged northward beyond the limits of this study area. Runoff was diverted into the Lake Prevatt Basin with the construction of a ditch along the south side of Lester Road which conveys runoff eastward to Rock Springs Road in Sub-basin LP02. Other than the diversion of the runoff from this 95 acre sub-basin toward Lake Prevatt, no problems associated with drainage were noted in Sub-basin LP01.

Sub-basins LP02 and LP04 were delineated with respect to the areas which drain to the cross culverts under Rock Springs Road. In Sub-basin LP02, double 36-inch culverts just south of Lester Road provide an outlet for the runoff from Sub-basins LP01, LP02, and LP03. The single 36-inch culvert farther to the south provides the outlet for Sub-basin LP04. The culverts at both locations discharge to ditches which convey runoff eastward to the existing wetland system located at the southwest corner of Wekiwa Springs State Park in Sub-basin LP07. The Existing Conditions analysis indicates that overtopping of Rock Springs Road will occur at the location of the double 36-inch culverts in Sub-basin LP02 for the 25-year and larger storms. The single 36-inch culvert in Sub-basin LP04 does not have the capacity to pass the anticipated peak runoff from a 10-year or larger storm without overtopping the roadway. Refer to Table 2-6 for the expected depth of overtopping at these locations. ***Orange County has recently awarded the design contract for the widening of Rock Springs Road in this area. It is recommended that the results of this study be utilized as a reference for the drainage design of this project.***

Sub-basin LP03 was included separately to account for the storage provided in the existing stormwater pond (LP03N01P). Based on the St. Johns River Water Management District Aerial Topographic Maps and the Existing Conditions analysis, the peak stage in this pond will probably stay within the limits of the pond for up to the 25-year storm. A 100-year storm may overflow the *banks of the pond resulting in shallow flooding of the surrounding lots for a short period of time. The manufactured homes on these sites were observed to be built above the ground elevation; therefore, flooding into residences is not anticipated.*

Sub-basins LP05, LP06A, and LP06B consist of the developed and undeveloped portions of the Wekiva Park development which drain to the two (2) existing stormwater ponds in these sub-basins. The ponds constructed in Sub-basins LP05 and LP06B are interconnected by a 24-inch culvert and discharge via an overflow weir to the existing wetland system in Sub-basin LP07. Under current conditions, with Sub-basin LP05 in the undeveloped condition, the analysis contained in this study indicates that the water level in these ponds will not exceed the top-of-bank elevation. Consequently, the ponds will not flood adjacent residential and business structures. For the duration of this project, the water level in these ponds was not observed to draw down below the weir elevation. Thus, the ponds do not provide the intended water quality treatment. ***It is recommended that the City of Apopka and St. Johns River Water Management District take the measures necessary to have the entity responsible for the ponds make repairs.***

Sub-basin LP07 consist of the area draining to the wetland located at the southwest corner of Wekiwa Springs State Park. In addition to direct runoff from the sub-basin, this wetland receives the runoff discharged from all of the previously discussed sub-basins in the Lake Prevatt Basin. The outfall from the wetland is then eastward via double 24-inch culverts under a gas pipeline access easement to a stream which flows through the Wekiva Glen Subdivision. The Existing Conditions analysis indicates that the wetland provides little attenuation of runoff because the outfall to the east does not cause water to be impounded in the wetland. As a result, the expected water level in this wetland should not impact adjacent development. It should be noted that the storage provided in this wetland was estimated based on limited information; therefore, the resultant flood elevations are questionable. A detailed topographic survey of the entire wetland and surrounding areas would be necessary to refine this portion of the model.

Sub-basin LP08 lies to the south of Welch Road and west of Ustler Road. Runoff from this sub-basin drains northward under Welch Road via double 24-inch culverts. On the north side of the road, runoff is conveyed northward by means of a 30-inch culvert along the existing Wekiva Park development. This system appears to be adequate to convey just the runoff from Sub-basin LP08. However, the Existing Conditions analysis indicates that overflow from the wetland to the west in Sub-basin MN13 may occur for large storms. In which case, the system will not be able to pass the floodwaters northward. Rather, it is expected that Ustler Road will be overtopped and runoff will continue eastward along Welch Road. Because the analysis is questionable with regard to flood elevations in the wetland in Sub-basin MN13, no physical improvements in Sub-basin LP08 are recommended at this time.

Sub-basin LP09 is comprised of the proposed Parkview Subdivision located in the Wekiva Park development between Welch Road and Wekiwa Springs State Park. This area is presently undeveloped, yet has been included as developed because the proposed construction has been approved. The analysis contained in this study indicates that the proposed pond in the Parkview Subdivision will overtop for the 25-year and larger storms. ***Although no structures are likely to be affected should pond overtopping occur, the reviewing agencies should reinvestigate the proposed design of the pond in the Parkview Subdivision.***

The main drainage feature in Sub-basin LP10 is a ditch/stream that carries runoff from upstream sub-basins northward through the Wekiva Glen Subdivision. Triple elliptical culverts are provided at Brook Forest Court where the road crosses this stream. These features are described in Section 2.5.3.7.10 of this report. The Existing Conditions analysis indicates that for all storms larger than the mean annual storm (4.5 inches of rainfall) the culverts at Brook Forest Court will be unable to convey the anticipated flowrates in the stream without overtopping the road. Thus, the stream will experience high water levels upstream of these culverts due to the restriction in capacity. At the culverts, the 100-year flood stage in the stream is expected to be 93.5 feet. Upstream, at the location of the inflow from Sub-basin LP07, the 100-year flood elevation of the stream is expected to be 94.6 feet. ***It is recommended that the finished floor elevations of the homes adjacent to the stream be compared to the 100-year flood elevations anticipated upstream of the triple culverts. Should the adjacent residences be threatened by floodwaters, replacement of the culverts is recommended.***

Sub-basin LP11 consists of the area draining to a land locked lake in a natural depression located in the Wekiva Glen Subdivision. The 100-year flood elevation calculated for this lake would not inundate any of the adjacent homes. However, the initial water elevation in this area was based on the water elevation shown on the Orange County Aerial Topographic Maps for lack of other information. Thus, the 100-year flood elevation determined for this lake is a not reliable indicator of the maximum possible flood elevation in this depressional area.

Although some localized flooding can be expected in the low areas along the west side of Ustler Road, no flood elevation were determined in Sub-basin LP12. The primary focus of this study was the main lake system. A detailed analysis of secondary drainage in this area would be necessary to design an outfall from this area to eliminate localized flooding without impacting downstream properties.

North of Paradise Isle Drive, the outfall for Lake Coroni is an existing ditch that flows northward toward Welch Road. At Welch Road, double 36-inch culverts convey runoff to Lake Prevatt. Sub-basin LP13 consists of the wooded area which drains directly to this ditch between Paradise Isle

Drive and Welch Road. At most times, the ditch running through this sub-basin is dry because the water level in Lake Coroni is far below the outfall level. During periods of low flow, runoff is conveyed northward and is mostly confined to the ditch. This condition was observed on only one occasion during this study, in April of 1996. During extreme rainfalls, much of the wooded area adjacent to the ditch is expected to be inundated. Based on approved construction plans by Site Engineering and Planning, Inc., the finished floor elevations of adjacent home sites in the Wekiwa Woods Subdivision are shown to be well above the calculated flood elevation in this sub-basin.

Sub-basin LP14 consists of the portion of the Deer Lake Run Subdivision that drains to the two (2) existing stormwater ponds at the subdivision entrance on Welch Road. The Existing Conditions analysis indicates that the water level in these ponds will not exceed the top-of-bank elevation for up to the 100-year storm (10.6 inches of rainfall). Thus, no dwelling structures are in danger of being flooded by the ponds in this sub-basin.

Sub-basin LP15 was delineated with respect to the area draining to the existing pond adjacent to Welch Road in the Foxborough Farms Subdivision. During the data collection phase of this project, PEC obtained construction plans from the Orange County archives for the Foxborough Farms Subdivision. However, some of the information regarding pond grading and the outfall to Lake Prevatt did not seem to correspond to conditions observed in the field. Due to insufficient information, the pond in this Sub-basin was not included in the model of the study area. Rather, the runoff hydrograph for Sub-basin LP15 was routed directly to Lake Prevatt. Thus, no comment can be made with regard to the function of the pond in this sub-basin.

Sub-basin LP16 consists of the area that drains directly to Lake Prevatt. In addition to direct runoff in Sub-basin LP16, Lake Prevatt receives the runoff from all of the previously discussed basins and sub-basins in the study area. The lake then discharges northward via Carpenter Branch to Rock Springs Run and the Wekiva River.

The normal high water level of Lake Prevatt published in the Orange County Lake Index is 56.5 feet. As noted above, the outfall from Lake Prevatt is via Carpenter Branch. Jones, Hoechst, and Associates, Inc. surveyed cross sections of the upper reach of this stream near Lake Prevatt. In particular, a cross section of the stream was surveyed at the outfall from the lake. The lowest point surveyed on this cross section was at elevation 56.6 feet. In keeping with Orange County's standard of setting the normal high water level six (6) inches above the outfall elevation, the initial water level in Lake Prevatt was considered to be 57.1 feet for the analysis contained in this study.

The 100-year flood elevation reported in the Orange County Lake Index for Lake Prevatt is 57.8 feet. The Existing Conditions analysis indicates that a peak 100-year flood elevation of 60.5 feet can be *expected for Lake Prevatt. Construction adjacent to the lake is limited to the Wekiva Glen Subdivision and Welch Road. Based upon the topography shown on the "as-built" construction plans for the Wekiva Glen Subdivision, the lots adjacent to Lake Prevatt are above the 100-year flood elevation. However, finished floor elevations of the homes constructed on these lots are not provided on the plans. The City of Apopka provided surveys of several of the homes constructed adjacent to Lake Prevatt within Wekiva Glen. All of the surveys obtained indicated that the homes had been constructed well above the anticipated 100-year flood elevation. However, surveys were not available for four (4) of the homes constructed along the lake. In a few places, the 100-year storm may result in minor flooding in the vicinity of Welch Road for a short duration. Otherwise, the lake should not affect the roadway.*

The finished floor elevations of all homes constructed adjacent to Lake Prevatt should be verified for comparison with the 100-year flood elevation determined in this study. It is also recommended that the normal high water level for Lake Prevatt be re-established based upon the surveyed cross sections of the Carpenter Branch which controls this water body. In addition, the 100-year flood elevation of Lake Prevatt should be updated based upon the analysis performed for this study. The Orange County Lake Index should also be revised to indicate that Lake Prevatt is in the Wekiva River Basin.

2.7.8 Carpenter Branch Basin

Carpenter Branch Basin is a natural channel located in Wekiwa Springs State Park which serves as the outfall for Lake Prevatt to Rock Springs Run and the Wekiva River. As mentioned previously, the actual control for Lake Prevatt is the upper end of Carpenter Branch at the outfall from the lake. The Carpenter Branch Basin was included in this study to evaluate the double 36-inch culverts located where this stream meets the old railroad bed approximately one-half (½) mile northeast of Lake Prevatt in Wekiva Springs State Park.

Jones, Hoechst, and Associates, Inc. (JHA) surveyed the culverts at this location and determined the upstream invert of these culverts to be 45.5 feet. JHA also measured a road overtopping elevation of 49.5 feet. Based on the results of the analyses contained in this study, the 10-year (7.5 inches of rainfall) and larger storms will result in a rate of discharge to Carpenter Branch in excess of the capacity of the double 36-inch culverts under the old railroad bed. As a result, the railroad bed will be overtopped. It should be noted that this analysis is based on the condition that Lakes McCoy, Coroni, and Prevatt are all at or near their respective overflow elevations prior to the occurrence of such a storm. Records indicate that the water level in all three (3) lakes fluctuates considerably and during some periods the lakes are dry or nearly dry. Should a large storm occur *at a time when the lakes are well below the normal high water levels, the expected discharge to Carpenter Branch, if any, would be substantially less.*

The Wekiwa Springs State Park manager, Peter Scalco, called a meeting on April 2, 1996 to bring attention to high water levels within the Park. In particular, high water was observed within Lake Prevatt and in Carpenter Branch upstream of the twin 36-inch culverts under the old railroad bed. Mr. Scalco expressed concern that the railroad bed would be overtopped and the culverts would be washed-out, as occurred following Tropical Storm Gordon in November of 1994. Based upon records kept by the City of Apopka, the cumulative rainfall in the days immediately preceding the meeting was approximately 5.3 inches. The water levels in Dream Lake, Buchan Pond, Lake McCoy, and Lake Prevatt were observed to be at or above the overflow elevations in the weeks prior to this rainfall. Only Lake Coroni was below the overflow elevation. The water elevations observed In Lake Prevatt and Carpenter Branch on April 2, 1996 were within six (6) inches of the levels predicted by the routing model for the mean annual storm (4.5 inches of rainfall). As mentioned above, the predicted water levels for larger storms will result in overtopping at the old railroad bed. ***In order to lessen the probability of overtopping at this location, it will be necessary to increase the size of the conveyance structures.***

2.8 PUBLIC INVOLVEMENT MEETING

On Thursday, October 3, 1996, a public meeting was held to present the results of the Draft Engineering Report and to discuss the recommendations presented above. Approximately seventy (70) people were in attendance. Roughly sixty (60) were residents of the study area and the remaining ten (10) were representing the public sector (City of Apopka, Orange County, SJRWMD) The sections which follow discuss the issues raised by the attendees.

2.8.1 King Property

The King family owns property between Sandpiper Street and Tanglewilde Drive, west of Ustler Road. At the public meeting, the King's voiced concerns over recurrent flooding on their property. The following items were brought up during and after the meeting as causes of their problems:

- *Continual development within the upstream areas, specifically the Pines of Wekiva Subdivision;*
- *Alterations to the Buchan Pond outfall control structure; and*
- *The City of Apopka drains their water supply system tanks into the Buchan Pond outfall system.*

The King's also voiced opposition to the recommendations associated with the Dream Lake outfall system and the Lake McCoy control structure.

The King family properties are located within sub-basin MN18. In addition to direct runoff from the sub-basin, runoff enters this area from west of Park Avenue and from north of Sandpiper Street. Runoff from the area to the west of Park Avenue is from the Buchan Pond Basin and three (3) sub-basins, MN15, MN16, and MN17, which drain to the Buchan Pond outfall along Grossenbacher Drive. The combined discharge from these area enters sub-basin MN18 by means of a 36-inch culvert under Park Avenue. From Park Avenue, runoff is conveyed eastward in a stream to a small pond which discharges to another small pond which in turn discharges to an existing wetland/pond adjacent to Ustler Road. It has been suggested that development west of Park Avenue has resulted in an increase in runoff to this stream in sub-basin MN18. As outlined in Section 2.7.4, the peak discharge rate from Buchan Pond is expected to be equal to or less than the discharge rate prior to the construction of the Pines of Wekiva development. Furthermore, the alterations to the Buchan Pond outfall control structure within the last seven (7) years would have reduced the discharge because a the outfall was replaced with a smaller pipe. The neighborhoods in MN15, MN16, and MN17 have been in existence for at least 12 years, so no increase in runoff would be expected in these areas. Finally, the water supply tanks on Grossenbacher Drive contain treated drinking water, which is not discharged to the Buchan Pond outfall system. In conclusion, PEC was unable to uncover any conditions west of Park Avenue which could account for an increase in the discharge rate to the King's property.

It should be noted that peak discharge from the areas west of Park Avenue account for only thirty-two (32) percent of the runoff reaching the downstream properties in sub-basin MN18. The remaining sixty-eight (68) percent of the runoff discharged to sub-basin MN18 is from approximately 225 acres to the north of Sandpiper Street in sub-basins MN12, MN13, and MN14. Runoff from these sub-basins enters sub-basin MN18 just west of Ustler Road via a 48-inch culvert under Sandpiper Street. No substantial development has occurred within sub-basins MN12, MN13, and MN14. The few sites which have been developed within the past ten years have been required to provide detention ponds to control the rate of discharge. Therefore, no substantial increase in runoff from these sub-basins would be expected.

The King's have indicated that at least one (1) structure has been inundated by floodwaters; however, no homes have been affected. Because no dwelling structures are endangered and the flow paths can not be altered without impacting other property owners, no improvements have been recommended. However, it may be necessary to conduct a more detailed analysis focusing on the drainage problems in this area.

Improvements to the Dream Lake outfall system will in no way affect the King's property. Likewise, the proposed weir on the Lake McCoy outfall is intended only to provide a structural control to maintain the published normal high water level and will not increase flood levels on the King's property. Therefore, these improvements are still recommended. Orange County will investigate potential impacts further during the design of these improvements.

2.8.2 Wekiwa Springs State Park

Mr. Peter Scalco, the Wekiwa Springs State Park manager, was concerned that the recommendations regarding the Dream Lake outfall system would impact Lake Prevatt and the Park. Mr. Scalco also suggested that the St. Johns River Water Management District (SJRWMD) and/or Orange County revise their regulations in order to regulate the post-development annual volume of runoff to pre-development conditions.

As outlined in Section 2.7.2, the recommended improvement to the Dream Lake outfall consists of lowering the outfall pipe such that the lake can be controlled at the published normal high water level. This improvement is necessary to reclaim flood storage within the lake and reduce the peak flood stages. The downstream impact will amount to a one-time discharge of excess water which has been stored in the lake above the normal high water level. The maximum volume of water which would be released to Lake McCoy is 12.8 acre-feet. This entire volume of water would raise the level of Lake Prevatt by less than two (2) inches. If Lake Coroni is below the overflow level, which is usually the case, Lake Prevatt may receive none of the discharged water. Following the improvement, the volume of water discharged for any given storm event will be the same as for the existing conditions.

In one portion of the study area, it has been recommended that Orange County and/or City of Apopka require controls on volume as well as peak rate of discharge. This recommendation has been included to prevent potential impacts to downstream properties which became obvious during the course of this study. However, it was beyond the scope of this study to determine the impacts of future development within the overall study area. Therefore, PEC can not make an informed recommendation regarding volume control throughout the study area at this time.

2.8.3 Edenfield Property (607 East Sandpiper Street)

Mr. Ronald Edenfield, who resides at 607 East Sandpiper Street, was extremely upset that nothing was suggested to improve the outfall conditions from Lake Coroni. Mr. Edenfield's concern is that an equipment storage building on his property is inundated every few years. Both Mr. Edenfield and another resident on the lake believe that lowering the existing culverts under the gas easement and

Paradise Isle Drive will improve drainage. Mr. Edenfield also indicated that the outfall ditch north of Welch Road needs to be regraded to improve the outfall from Lake Coroni.

Subsequent to the public meeting, Orange County surveyed the equipment storage building and the home on Mr. Edenfield's property. It was determined that the storage building was constructed with a floor elevation of 61.98 feet and the home has a finished floor elevation of 65.88 feet. As a comparison, the mean annual storm (4.5 inches of rainfall) is expected to result in a lake level of 60.87 feet, a 10-year, 24-hour storm (7.5 inches of rainfall) should cause the lake to rise to an elevation of 62.89 feet. Thus, no improvements can be made which will prevent flooding of this structure. The 100-year flood elevation of Lake Coroni was determined to be 64.8 feet; therefore, Mr. Edenfield's home is over one (1) foot above the anticipated flood level.

A similar situation has been encountered on an adjacent property. A barn on the Ricketson property, which is located immediately north of the Edenfield property, has been inundated frequently as has much of the property. Based upon survey by Orange County, the floor elevation of this structure is 59.43 feet. When compared to the anticipated flood elevations listed above and the overflow elevation of the lake at 58.78 feet, it is apparent that no improvements can be made which will eliminate flooding of the barn or the property.

Calculations were performed to determine whether lowering the culverts under the gas easement and Paradise Isle Drive would provide any substantial relief. Based upon PEC analyses, alterations to these culverts will not significantly lower the anticipated peak flood elevations. Although, lowering the culvert under Paradise Isle Drive would allow runoff to discharge from the lake on a more frequent basis. Only extreme alterations to the entire outfall from Lake Coroni to Lake Prevatt will have any impact on flood elevations in Lake Coroni.

The existing ditch between Lake Coroni and Lake Prevatt represents a significant improvement over the natural conditions. Additional improvements to the outfall from Lake Coroni can not be recommended for the following reasons:

- *The lake exhibits a significant groundwater recharge capacity which is a priority of Orange County and the St. Johns River Water Management District. In fact, most of the runoff from areas upstream of Lake Coroni never reaches Lake Prevatt. Discharge from the lake occurs infrequently, only as a result of large storms. Lowering the level at which Lake Coroni discharges would reduce the volume of runoff stored in the lake which would recharge the groundwater.*

- *Lowering the level at which the lake discharges would also result in more frequent discharge to Lake Prevatt. The Wekiwa Springs State Park manager, Mr. Peter Scalco, has expressed concerns over the potential for damage to natural systems as a result of increases in runoff discharged to the Park. Therefore, more frequent discharge is not desirable.*

- *During large storms, the peak rate and volume of runoff discharged from Lake Coroni to Lake Prevatt would be increased. As mentioned above, increases in runoff to Lake Prevatt in Wekiwa Springs State Park is unwanted.*

- *The resultant increase in discharge rate and volume to Lake Prevatt would result in higher flood levels. Several homes in Wekiva Glen Subdivision are located adjacent to Lake Prevatt. An increase in the 100-year flood level may endanger some of these existing structures.*

As noted above, Mr. Edenfield also asserted that the ditch north of Welch Road needs to be maintained to assure discharge to Lake Prevatt. At the end of March 1996, City of Apopka records indicate that the area received approximately 5.3 inches of rainfall. On April 2, 1996, PEC staff observed that Lake Coroni had risen to a level above the outfall elevation at Paradise Isle Drive and water was flowing freely at this point. At Welch Road, water was also flowing with no evidence of a constriction downstream. Nonetheless, conditions at this location should be monitored to insure that no constrictions occur. Records provided by Orange County indicate that the County has an easement over the ditch north of Welch Road.

2.8.4 School Bus Parking Facility

Mr. Chris Smith (426 Tanglewilde Drive) recommended that the stormwater runoff from the Orange County school bus parking facility be incorporated as a water quality improvement. This site is located on the north side of Votaw Road to the east of Apopka Middle School. Presently, no water quality treatment is provided on the property and sediment laden runoff from the unimproved site discharges directly to Votaw Road. As a minimum, some form of sedimentation control should be instituted. Due to its location, runoff from this site could be directed to either the Dream Lake outfall system or the existing stormwater pond in sub-basin PA05. The possibility of providing water quality improvements on this site should be investigated during the design of the improvements to these systems. Coordination with the Orange County School Board will be necessary.

2.8.5 Tanglewilde Drive

Several complaints about the secondary conveyance system along Tanglewilde Drive were raised during the public meeting. As noted previously in this report, the intent of this study was to *determine flood elevations in the primary water features within the study area, Lakes McCoy, Coroni and Prevatt. The investigation was extended to include other significant water bodies which could impact flood elevations within Lakes McCoy, Coroni and Prevatt. Thus, it was not the intent of this study to quantify flood stages throughout the entire study area (eg, stormwater ponds associated with existing subdivisions or secondary drainage systems), but rather to analyze the primary stormwater management and conveyance facilities which have an impact on the flood elevations within the primary water bodies of interest.*

Orange County Maintenance staff were present at the public meeting and stated that they have continued to work directly with the residents in this area. If complaints persist, the secondary system along this road could be analyzed in depth. Orange County has indicated that additional investigations in this area will be conducted as a follow-up to this report.

2.8.6 Votaw Village

Mr. Greg Orleman, a resident of Votaw Village Subdivision, provided a picture showing standing water in the rear yard of his home at 222 Cervidae Drive. The home is located on Lake McCoy south of Votaw Road and the rear portion of the property may be located below the normal high water level of the lake. PEC staff noted that the rear yard of the subject property was wet while the water level was at the invert of the culvert outfall under Votaw Road. The City of Apopka provided surveys of homes in Votaw Village along Lake McCoy South which indicate the finished floor elevations. Mr. Oreleman's home is more than one (1) foot above the anticipated 100-year flood elevation of Lake McCoy South.

2.8.7 Adoption of Base Flood Elevations

Several residents expressed concern that adopting "new" base flood (100-year) elevations would result in additional flooding and/or less maintenance. The residents were assured that the "new" base flood elevations are based upon existing conditions and the flood elevations are not increasing as a result of any of the recommended improvements. Adoption of the "new" base flood elevations is recommended so that present and future residents in the study area will be informed of anticipated flood levels. It will also provide a basis by which the impact of future development in the study area can be measured.

Prior to this study, the 100-year flood elevation for Lake Coroni had not been determined. The published 100-year flood elevation of Lake Prevatt was 2.7 feet below the level determined for existing conditions. And, the published 100-year flood elevation of Lake McCoy was 1.4 feet below the existing flood level determined for the portion of the lake south of Votaw Road. Updating the *flood elevations for these areas is necessary to ensure that residents are provided with the most current information.*

It should be noted that no existing homes were found to be endangered by the anticipated 100-year flood levels in Lake McCoy South, Lake McCoy North , Lake Coroni, Lake Prevatt, or Buchan Pond. Some structures on Dream Lake may be threatened by existing conditions. For this reason, several of the recommendation made in this report are aimed at improving conditions and/or preventing further increases in the flood elevation of Dream Lake.

2.9 ENVIRONMENTAL CONSIDERATIONS

Although a detailed study of all the environmental considerations within the study area was not included as part of this basin study, several points should be mentioned based on previous water quality analyses prepared by others, and the field observations conducted during the development of this study.

2.9.1 Pollution Abatement (Water Quality Treatment) Issues

Although pollution abatement (water quality treatment) within the individual sub-basins within the study area will have a dramatic impact on water quality within the lake systems, the current scope of services for this basin study does not provide for quantifying pollution abatement (water quality treatment) currently being provided within independent sub-basins of the study area (e.g., the performance of existing stormwater ponds).

2.9.2 Existing Lake Water Quality

As part of the Stormwater Management Master Plan for the study area, Orange County's scope also provides for an evaluation of existing water quality within the lake systems. This existing water quality evaluation, which is entitled "Lake McCoy, Lake Coroni, and Lake Prevatt SWMMP Historical Water Quality Report", was completed by sub-consultants for PEC/Professional Engineering Consultants and is included within Volume I, Section 4 - Supporting Documentation (Attachment "A"), of this report. The following excerpt provides a brief summary, as well as the recommendations which were made within the aforementioned water quality evaluation report. For more detailed information regarding the water quality evaluation, or for tabulations of the historical water quality parameters within the lakes, please refer to the previously mentioned report.

Begin Excerpt

Conclusions

The existing database indicates that Lake McCoy has been congested with algae in the past. Additionally, because of the past drought conditions in Florida that may have resulted in periods of no discharge from Lake McCoy, some of the available nutrients may have settled into the lake bottom and now are released by dissolution. In the event of major storm flow through this lake, bottom scouring could release these nutrients to the downgradient lakes, increasing the potential for enrichment and algae blooms in Lake Coroni and Lake Prevatt. This may be of particular concern because the Wekiva River (receiving water) is classified by the FDEP as an "Outstanding Florida Water" and is afforded special protection under these criteria. The special protection includes water quality degradation by nutrient enrichment.

In recent history (between 1981 and 1995), Lake Prevatt has shown evidence of conditions that will support biological growth. Although the quality of Lake Prevatt has not been documented at the same level of biological activities as measured in Lake McCoy in the late 1960's and early 1970's, it is possible that Lake Prevatt will achieve similar levels as previously shown upgradient.

It is possible that the levels observed in Lake Prevatt are consistent with the data set available for Lake McCoy. The lake volumes and flow rates were not available in the database to allow a general evaluation of whether the recent data directly correlate to the water mass monitored in Lake McCoy during the 1960's and 1970's.

Additionally, it should be noted that the presence or absence of pesticides in the subject lakes was never assessed during any of the water quality sampling events. These compounds are also regulated by the FDEP surface water criteria and may be of concern based on the past and present land usage of the drainage basin (i.e., agricultural).

Finally, the water quality and its relative improvement or degradation cannot be assessed without evaluation of the physical changes in the watershed during the monitoring period. For example, the nutrient levels that were observed in Lake McCoy could have been a result of a rural runoff pattern that no longer exists because of residential development. Such factors should be evaluated for their resulting effects on the water quality in the lakes.

Recommendations

Because there is no current water quality data for this drainage system, other than from Lake Prevatt and Dream Lake, prior to completing the evaluation of modifications to meet the new NPDES conditions, additional water quality data collection is recommended as follows:

- *Lake McCoy - collect samples for the analysis of BOD, total phosphorus, chlorophyll A, and total nitrogen to determine whether the lake continues to be nutrient-rich. At a minimum, collect samples at Stations 3 (southern most station) and 8 (northern station at lake discharge point). Oxygen measurements should be made and correlated with the temperature, pH, and chloride content. If nutrient-rich, the discharge from this lake could have a negative impact on all downstream water bodies and contribute to algal blooms in Lakes Coroni and Prevatt.*

- *Lake Coroni - Collect a sample at the discharge end of the lake and evaluate it for the potential presence of nutrients, coliforms, and algae. Oxygen measurements should be made and correlated with the temperature, pH, and chloride content.*

- *Dream Lake - Collect a sample at the discharge end of the lake and evaluate it for nutrients, bacteria and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this lake as a source of nutrients to the system.*

- *Buchan Pond - Collect a sample at the discharge end of the pond and evaluate it for nutrients, bacteria and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this pond as a source of nutrients to the system.*

- *Lake Prevatt - All water quality parameters should be monitored at the discharge end of this lake. In particular, all the nutrients, bacteria, and algae measurements that have been made in the past should be repeated for a current correlation of the conditions. Additionally, the mid-point of this lake should be monitored to determine whether the flow is completely mixed at this point in the drainage system.*

- *Wekiva River - At a minimum, the historical water quality data for the river should be collected and reviewed. Also, samples should be collected from both upstream and downstream of the Lake Prevatt discharge to the river. All of the Lake Prevatt parameters should be analyzed.*

- *The FDEP Class III surface water criteria analytical detection limits should be used on all future chemical analysis for the system. Also, all sample collection should be consistent with the FDEP quality assurance requirements (Chapter 62-160 FAC).*

- *All of the samples collected from the various points of discharge or areas of continuous flow (i.e., Wekiva River) should be made by flow weighted 24-hour composites. Samples collected from the center of Lake Prevatt should be vertical grabs from one-foot intervals to the bottom. Because of the expected shallowness of Lake McCoy's southern station (Station 3), a surface grab should be collected at this point. In-situ water quality parameters such as DO, pH, and temperature should be monitored throughout the sample collection phase (i.e., 24-hours, vertical column).*

Finally, the development in the watershed should be examined against the available monitoring data. The development patterns may explain some of the apparent variations in the data that were made available to this project. The impacts of the physical changes in the watershed may be observed in the data, and the correlation may enhance the estimates of impacts on the system of the various proposed and evaluated alternatives."

End Excerpt

2.9.3 <u>Drainage Well Issues</u>

As mentioned previously within separate sections of this report, there is one (1) existing drainage well located within Sub-Basin DL01 of the study area. Although an in-depth investigation of this existing drainage well was not accomplished as part of this basin study, several points of interest should be noted:

- *based upon field investigations conducted during the development of this basin study, it appears, based upon visual inspection, that the lake water quality within Sub-Basin DL01 entering the drainage well could be classified as poor;*

- *based upon PEC/Professional Engineering Consultants previous involvement with state agencies including the Florida Department of Environmental Protection (FDEP) and the Environmental Protection Agency (EPA), very limited modifications/improvements to existing drainage wells are allowed by permit. Therefore, it is anticipated that the only permittable modifications/improvements which could be made to this existing drainage well to improve water quality would be skimmers and/or bar screens (trash racks); and*

- *the possibility of "capping" the existing drainage well, coupled with providing a structural outfall from the lake within Sub-Basin DL01 through the Rhapsody Oaks development located within Sub-Basin DL02, could be investigated. This analysis should be investigated utilizing the modeling information contained within this report to insure that potential impacts, both volumetric and rate, to the basin as a whole are quantified. Additionally, special attention would have to be provided with respect to flood elevations for the lake within Sub-Basin DL01, as well as the potential impact to existing drainage systems which outfall to this lake.*

Lakes McCoy, Coroni and Prevatt
Drainage Basin Study
Orange County, Florida

RECOMMENDED IMPROVEMENTS

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Lakes McCoy, Coroni, and Prevatt Drainage Basin Study
Orange County, Florida

Section 3.0
RECOMMENDED IMPROVEMENTS

3.1 GENERAL

The primary objective of this Study is to develop a Stormwater Management Master Plan (SWMMP), which addresses known problem areas and proposes improvements to eliminate and/or reduce the adverse impacts. This section of the Study addresses the recommended improvements to those known problem areas as previously discussed in Section 2.8. The recommended improvements associated with the SWMMP takes into account the following:

- ***Initial Cost.*** *This includes the cost for land acquisition, final engineering, permitting, construction costs, construction administration, and other incidental costs to implement the recommended improvement.*
- ***Ecological Impacts.*** *This addresses the potential impacts the recommended improvements would have on the environmentally sensitive areas (wetland systems) within the Study area.*
- ***Water Quality Impacts.*** *The provision of water quality (surface water and/or groundwater) and/or for stormwater before discharging to receiving water bodies would be assessed, particularly since the basins within the Study area eventually discharges to the Wekiva River, an Outstanding Florida Water.*
- ***Implementation Considerations.*** *This addresses the practicality of implementing the recommended improvements. This includes considering construction methods as well as capital costs and long term reliability.*
- ***Social Acceptability.*** *The Study will assess public acceptability in the implementation of the recommended improvements. This includes recognizing public perception and addressing specific public needs and/or concerns. Two (2) public workshops will be conducted to gain public input from the results of the Existing Conditions evaluation and discussion of the Recommended Improvements.*

- ***Reliability.*** *The long term reliability of the recommended improvements will be addressed taking into consideration the future development and urbanization of the Study area. The northwest portion of Orange County is currently and is projected to experience steady growth, particularly with the future construction of major roadway corridors (e.g., Western Beltway, Vick Road, and Rock Springs Road widening). The Study will address long term needs to accommodate the projected growth.*

- ***Operation and Maintenance Costs.*** *The design function of the hydraulic structures and stormwater management facilities are dependent on continual operation and maintenance by County and/or City forces. The costs associated with O&M will be considered in the recommended improvements.*

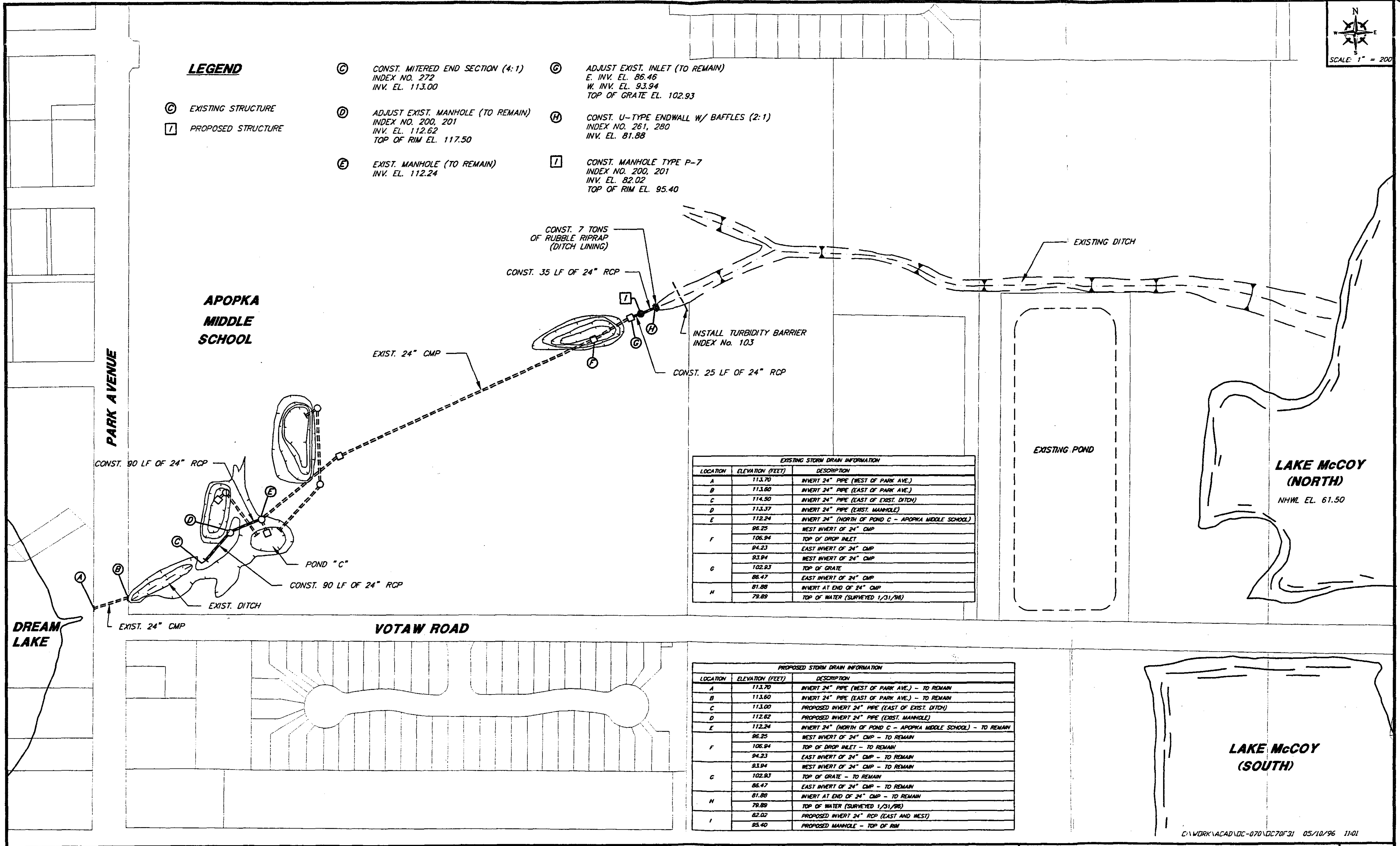
3.2 DESCRIPTION OF RECOMMENDED SUB-BASIN IMPROVEMENTS

Rather than repeating sub-basin information for which no improvements are proposed, only those sub-basins for which specific improvements are proposed will be discussed.

3.2.1 Sub-Basin DL-05

Sub-Basin DL-05 consists of the area surrounding and including the Dream Lake outfall system. The outfall system from Dream Lake consists of a series of culverts and pipes in combination with ditches that connect to Lake McCoy (north). The outfall system begins on the west side of Park Avenue from a 24-inch corrugated metal pipe (CMP), which crosses underneath Park Avenue and discharges to a grassed swale within the Apopka Middle School. This swale extends east and connects to 24-inch CMP's in series across the Apopka Middle School limits to an open ditch. This pipe system provides the outfall for the stormwater management system within the Apopka Middle School. The open ditch flows in a northeasterly direction where it connects with another ditch from the northwest, then due east to Lake McCoy (refer to Figure 3-1).

The problems encountered within the existing outfall system are with the existing pipe profiles. Dream Lake is currently controlled at elevation 115.0, according to survey data. This elevation is six (6) inches above the published Normal High Water Level (NHWL) of elevation 114.5, as referenced in the Orange County Lake Index. At elevation 115.0, the flood storage for Dream Lake is reduced, which could potentially result in significant flooding depths for low-lying areas west of Park Avenue. With elevated lake levels throughout the Study area since Tropical Storm "Gordon" (November 1994), it can be reasonably expected that more than usual flooding instances will occur during the wet season. The pipe culvert underneath Park Avenue has upstream (west) and downstream (east) invert elevations of 113.7 and 113.6, respectively. The next downstream pipe



LEGEND

Ⓒ EXISTING STRUCTURE

☐ PROPOSED STRUCTURE

Ⓒ CONST. MITERED END SECTION (4:1)
INDEX NO. 272
INV. EL. 113.00

Ⓓ ADJUST EXIST. MANHOLE (TO REMAIN)
INDEX NO. 200, 201
INV. EL. 112.62
TOP OF RIM EL. 117.50

Ⓔ EXIST. MANHOLE (TO REMAIN)
INV. EL. 112.24

Ⓖ ADJUST EXIST. INLET (TO REMAIN)
E. INV. EL. 86.46
W. INV. EL. 93.94
TOP OF GRATE EL. 102.93

Ⓗ CONST. U-TYPE ENDWALL W/ BAFFLES (2:1)
INDEX NO. 261, 280
INV. EL. 81.88

I CONST. MANHOLE TYPE P-7
INDEX NO. 200, 201
INV. EL. 82.02
TOP OF RIM EL. 95.40

EXISTING STORM DRAIN INFORMATION

LOCATION	ELEVATION (FEET)	DESCRIPTION
A	113.70	INVERT 24" PIPE (WEST OF PARK AVE.)
B	113.60	INVERT 24" PIPE (EAST OF PARK AVE.)
C	114.50	INVERT 24" PIPE (EAST OF EXIST. DITCH)
D	113.37	INVERT 24" PIPE (EXIST. MANHOLE)
E	112.24	INVERT 24" (NORTH OF POND C - APOPKA MIDDLE SCHOOL)
F	96.25	WEST INVERT OF 24" CMP
	106.94	TOP OF DROP INLET
	94.23	EAST INVERT OF 24" CMP
G	93.94	WEST INVERT OF 24" CMP
	102.93	TOP OF GRATE
	86.47	EAST INVERT OF 24" CMP
H	81.88	INVERT AT END OF 24" CMP
	79.89	TOP OF WATER (SURVEYED 1/31/96)

PROPOSED STORM DRAIN INFORMATION

LOCATION	ELEVATION (FEET)	DESCRIPTION
A	113.70	INVERT 24" PIPE (WEST OF PARK AVE.) - TO REMAIN
B	113.60	INVERT 24" PIPE (EAST OF PARK AVE.) - TO REMAIN
C	113.00	PROPOSED INVERT 24" PIPE (EAST OF EXIST. DITCH)
D	112.62	PROPOSED INVERT 24" PIPE (EXIST. MANHOLE)
E	112.24	INVERT 24" (NORTH OF POND C - APOPKA MIDDLE SCHOOL) - TO REMAIN
F	96.25	WEST INVERT OF 24" CMP - TO REMAIN
	106.94	TOP OF DROP INLET - TO REMAIN
	94.23	EAST INVERT OF 24" CMP - TO REMAIN
G	93.94	WEST INVERT OF 24" CMP - TO REMAIN
	102.93	TOP OF GRATE - TO REMAIN
	86.47	EAST INVERT OF 24" CMP - TO REMAIN
H	81.88	INVERT AT END OF 24" CMP - TO REMAIN
	79.89	TOP OF WATER (SURVEYED 1/31/96)
I	82.02	PROPOSED INVERT 24" RCP (EAST AND WEST)
	95.40	PROPOSED MANHOLE - TOP OF RIM

		REV.	DATE	DESCRIPTION	APP'D BY
DESIGNED BY:	GAT	1			
DRAWN BY:	KN	2			
CHECKED BY:	DWH	3			
		4			
APPROVED BY:	DWH	5			
		6			

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LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-1
RECOMMENDED IMPROVEMENT
DREAM LAKE OUTFALL

JOB No. DC-070
DATE MAY 1996
SHEET 1 OF 1

has an existing invert elevation of 114.5, which is controlling the NHWL in Lake McCoy at elevation 115.0. At the outfall of the existing pipe system to the existing ditch, the pipe slopes are steep, which has resulted in extensive erosion at the outlet end of the pipe system. Erosion control measures at the outlet were observed to be in poor condition.

The recommended improvement for the Dream Lake Outfall has two (2) elements. These improvements are depicted in Figure 3-1 of this report. The first improvement element is on the downstream end of the open ditch immediately east of the Park Avenue culvert. This improvement consists of replacing approximately 180 feet of 24-inch corrugated metal pipe with concrete pipe and vertically realigning the pipe profile. The upstream pipe invert would be lowered from elevation 114.5 to elevation 113.0. The downstream pipe invert would remain at the existing elevation of 112.24. The existing manhole between the pipe length to be removed and replaced would be adjusted to match the proposed pipe profile grade. This would result in a lowering of the Dream Lake NHWL closely to match the published elevation of 114.5 (as referenced in the Orange County Lake Index). Lowering the NHWL by six (6) inches in Dream Lake to elevation 114.5 results in an additional 8.6 acre-feet of volume available for the storage of excess stormwater runoff entering the lake. This is a significant consideration, taking into account the projections for above normal rainfall for the coming wet season.

The second element of the Dream Lake Outfall improvements is to reduce the velocities of water exiting the pipe outfall to the existing ditch. The existing pipe gradient is greater than 7-percent, which results in pipe velocities greater than 10 feet per second (fps). The result of the high pipe exit velocities is extensive erosion of the natural ditch downstream and subsequent failure of the pipe end treatment. To reduce the pipe velocities for this segment of the outfall system, a manhole is proposed to be constructed between the segment of pipe proposed to be replaced. The manhole will be used to "dissipate" the flow energy in the inflow pipe. The concept of "plunging" flow into a manhole is commonly used for steep gradient conditions. Approximately 60 feet of existing 24-inch corrugated metal pipe will be replaced with a 24-inch concrete pipe. The pipe profile from the proposed manhole will be reduced from 7-percent to 0.4-percent, significantly reducing the exit velocity. The end treatment for the replaced pipe will consist of a concrete U-type endwall, with baffles. The baffles act further to dissipate the flow energy before entering the existing ditch. The end treatment will be supplemented with rubble riprap in the existing ditch to provide additional protection of the ditch system.

Refer to Table 3-1 for an Engineer's probable cost estimate for the recommended improvements associated with the Dream Lake Outfall to serve Sub-Basin DL-05.
Insert Table 3-1

3-5

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PROJECT : LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY
ORANGE COUNTY, FLORIDA
P.N. : OC-70/1.0
(filename: OC70COST.WK4)
CHECKED : David W. Hamstra, P.E.
DATE : 07-Jan-97

SUBJECT : ENGINEER'S PRELIMINARY PROBABLE COST OF CONSTRUCTION
DREAM LAKE OUTFALL

TABLE 3-1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	UNIT AMOUNT
1. Remove Existing 24" CMP	1	l.s.	$5,000.00	$5,000.00
2. Pipe Conc Culv (Classs III)(24" SS)	240	l.f.	$29.00	$6,960.00
3. MES (Conc. Pipe Round)(24" SD)	1	each	$520.00	$520.00
4. Conc. Class I (Endwalls)	2.52	c.y.	$465.00	$1,171.80
5. Reinforcing Steel (Roadway)	108	lbs.	$0.60	$64.80
6. Manholes (P-7)(>10')	1	each	$3,000.00	$3,000.00
7. Manholes (Adjust Existing)	1	each	$1,000.00	$1,000.00
8. Inlets (Adjust Existing)	1	each	$1,000.00	$1,000.00
9. Sodding (Bahia)	265	s.y.	$1.20	$318.00
10. Pipe Desilting (24" SS)	1,040	l.f.	$9.00	$9,360.00
11. Riprap (Rubble)(Ditch Lining)	7	ton	$20.00	$140.00
12. Erosion Control	1	l.s.	$1,000.00	$1,000.00

SUB-TOTAL		$29,534.60
Mobilization (10 percent)	===>>>	$2,953.46
TOTAL		$32,488.06
Contingencies (20 percent)	===>>>	$6,497.61
Surveying/Engineering/Permitting/Construction Administration (15 percent)	===>>>	$4,873.21
GRAND TOTAL		$43,858.88

NOTES:

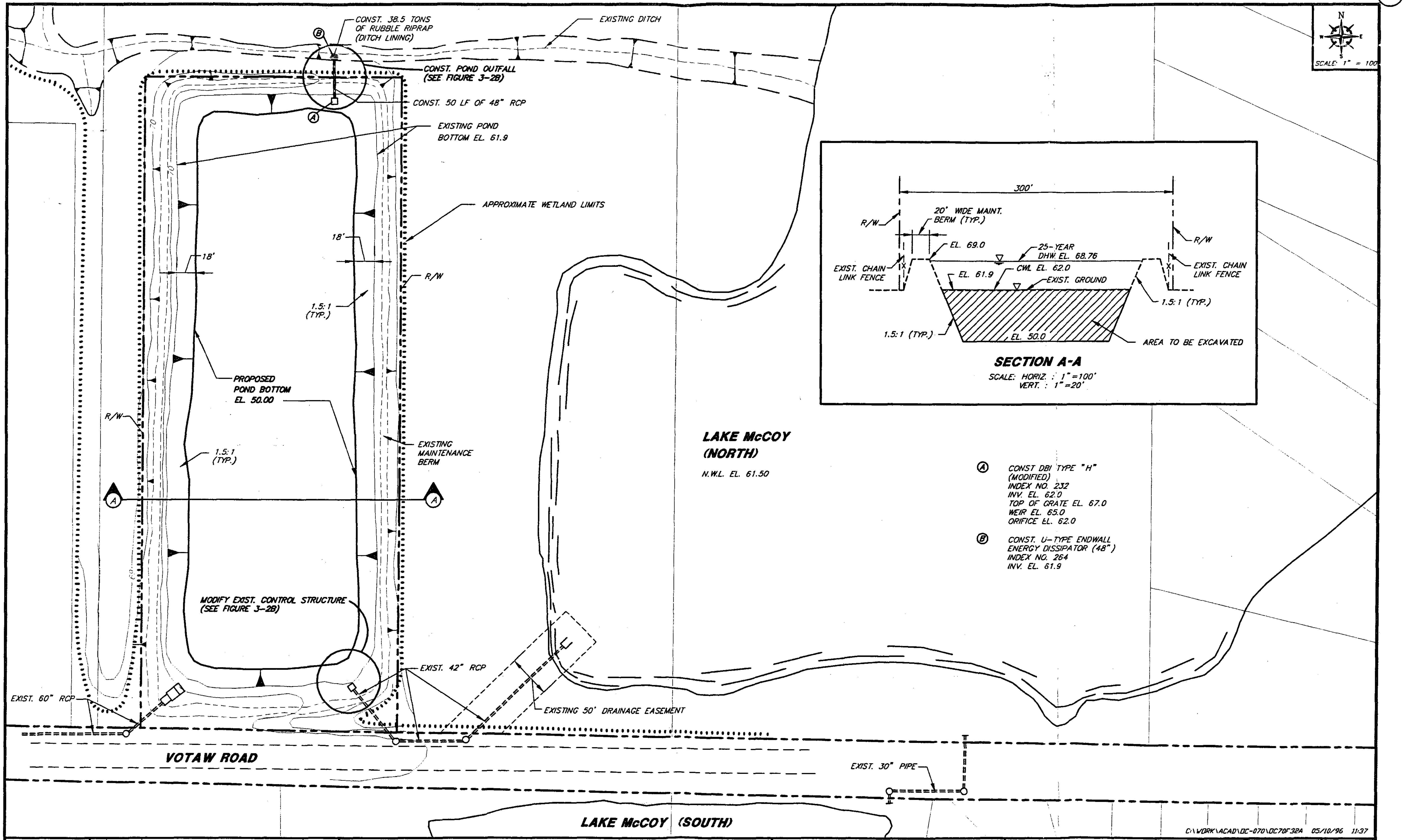
1. This cost estimate does not include those costs which pertain to right-of-way or drainage easement acquisition for the installation of the drainage improvements or utility adjustment.
2. The unit costs for the storm sewer pipe and structures are based on the Florida Department of Transportation Summary of Average Construction Costs Manual (July 1994 to June 1995). These unit prices should be used with caution due to the fact that they represent bulk averages.

3.2.2 Sub-Basins PA-01, PA-02, PA-03, PA-04, and PA-05

These five (5) sub-basins are characterized as primarily single-family residential developments on the west side of Park Avenue between Main Street (US 441) and Nancy Lee Lane. These sub-basins encompass a total area of approximately 250 acres and are drained by existing curb and guttered streets and curb inlets. The collected stormwater runoff is then conveyed by storm sewer pipes to an existing stormwater management facility (pond) on the north side of Votaw Road, east of Park Avenue (refer to Figure 3-2a). The pond (referenced as the Park Avenue Pond) was constructed in the 1980's by the Florida Department of Transportation, which has relinquished operation and maintenance of the facility to Orange County. The pond was originally designed as a "dry" bottom retention pond, with the only means of evacuating impounded stormwater by infiltration to the soil column and eventually into the underlying surficial aquifer. No other positive outfall for the pond was provided.

Recent observations indicate that the pond system does not recover the designed storage volume as originally intended. This is likely attributed to the deposition of fines into the soil column, effectively "blocking" the voids in the soil, resulting in permanently impounding water in the pond. The water level in the pond was surveyed at elevation 67.0, which is approximately five (5) feet above the pond bottom elevation of 61.9. This results in a significant decrease in storage volume in the existing pond for large storm events. In addition, the normal high water level (NHWL) elevation in Lake McCoy (north) (elevation 61.5) is only approximately six (6) inches below the designed pond bottom elevation of 61.9. The vertical relationship between the Lake McCoy NHWL and the pond bottom suggests that the pond probably cannot evacuate the stored water as originally designed. This is due to the lack of vertical separation between the seasonal high ground water level and the pond bottom. It is likely that water level fluctuations above the Lake McCoy NHWL (and the pond bottom) results in the void space in the soil column being occupied by groundwater, resulting in no positive outfall for the pond. The pond's inability to evacuate stormwater results in a water quality liability for the contributing basins, and causing the localized flooding of secondary (storm sewer) systems connected to the pond.

Geotechnical and shallow subsurface evaluations of areas north of the Park Avenue pond were conducted by L.J. Nodarse & Associates, Inc. The purpose of the geotechnical study was to evaluate soil and groundwater conditions encountered in the field. The results were compiled in a report which is included in Volume I, Section 4 - Supporting Documentation (Attachment "C") of this Study. The results of L.J. Nodarse & Associates evaluation is that the groundwater table was encountered approximately 0.4-feet below existing ground adjacent to the Park Avenue pond (Boring No. HA-7). The estimated seasonal high water level would be at or slightly above the ground. This



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LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-2A
RECOMMENDED IMPROVEMENT
PARK AVENUE POND

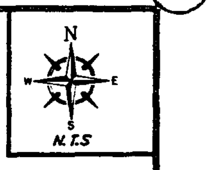
JOB No. OC-070
DATE MAY 1996
SHEET 1 OF 2

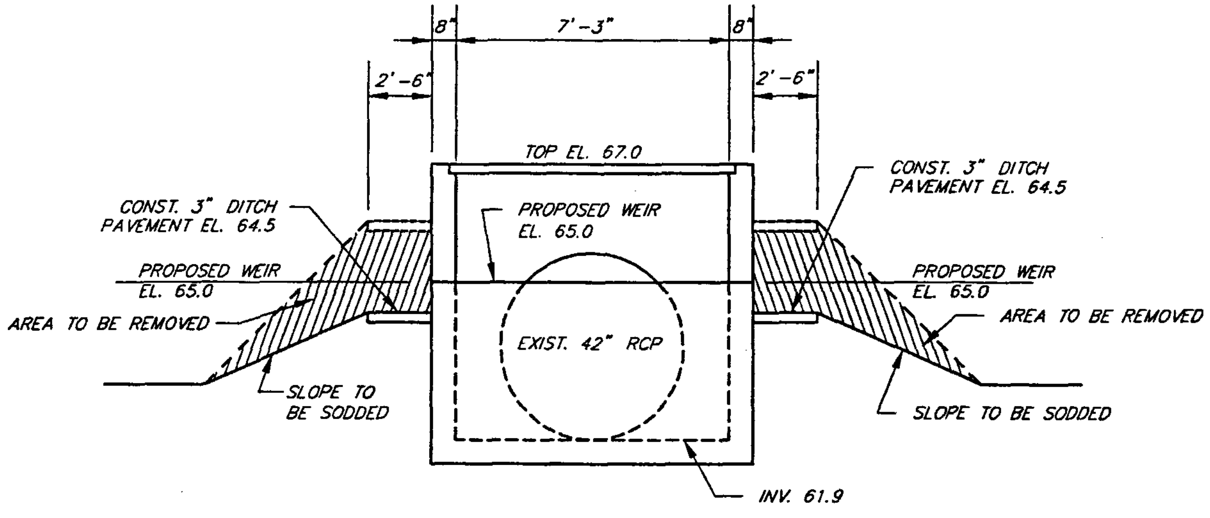
supports the viability of converting the existing pond to a wet detention pond, with the control water level set at the seasonal high water level, which is estimated at elevation 62.0.

The recommended improvement associated with these sub-basins is to convert the existing pond to a true wet detention pond. Figures 3-2a and 3-2b illustrates the location and the control structure details of the recommended improvement, respectively. This would require the excavation of the pond bottom from elevation 61.9 to elevation 50.0 to provide at a minimum, 14-days of residence time for the stormwater runoff entering the pond. In addition, a six (6) inch bleed-down diameter orifice would be constructed at elevation 62.0 (0.5-feet above the NHWL for Lake McCoy) to allow the pond to recover within the prescribed time of 48 to 60 hours (Refer to Volume I, Section 4 - Supporting Documentation - Attachment "D"). This criterion is according to the St. Johns River Water Management District (SJRWMD) performance standard for wet detention ponds. This results in the pond providing approximately 0.5-inches of water quality treatment over the ***entire*** *contributing basin area encompassing approximately 250 acres. The bleed-down device would be housed in an FDOT Type "H" ditch bottom inlet at the northeast corner of the pond. This allows for the maximum hydraulic length for stormwater entering the pond to settle out some suspended solids and heavy metals entrained in the water column. The proposed control structure would outfall via a 48-inch diameter pipe into an existing ditch along the north property boundary of the pond, which discharges to Lake McCoy. The end treatment of the pipe outfall would consist of a U-Type endwall with a concrete impact dissipator (FDOT Index No. 264), supplemented with rubble riprap in the existing ditch to reduce any erosion caused by the outfall.*

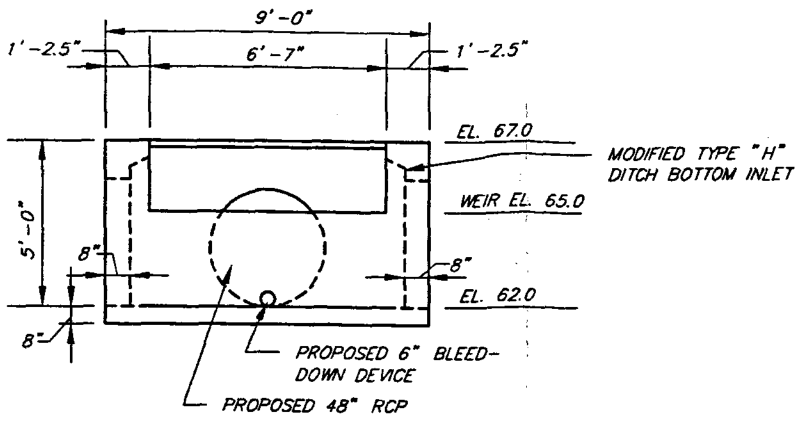
The placement of the bleed-down device in the existing pond outfall structure would not be an optimum design and would be subject to "short circuiting" the hydraulic length from the pond inflow to the pond outfall. The existing control structure would be modified to provide an overflow weir at elevation 65.0. This is an important element because under current conditions, the pond would overtop its banks (elevation 69.0) for storm events greater than the mean annual (2.33-year) storm event. The proposed control structure would also have overflow weirs at elevation 65.0, with the top of grate set at elevation 67.0. Construction of the new control structure, coupled with the modification of the existing structure, results in the pond containing stormwater volume for storm occurrences less than and including the 25-year frequency, 24-hour duration event. Any storm event beyond the 25-year, 24-hour storm would simply overtop the pond berms and sheet flow into Lake McCoy.

An evaluation of the Orange County parcel north of the pond site for the possible expansion of the pond was conducted by Lotspeich and Associates, Inc. The purpose of this study was to conduct a preliminary site assessment of the extent and quality of jurisdictional wetlands. Lotspeich's assessment was that the existing wetlands consist of moderate to good quality forested wetlands





MODIFICATION OF EXIST. CONTROL STRUCTURE
FRONT VIEW
N.T.S



PROPOSED CONTROL STRUCTURE
FRONT VIEW
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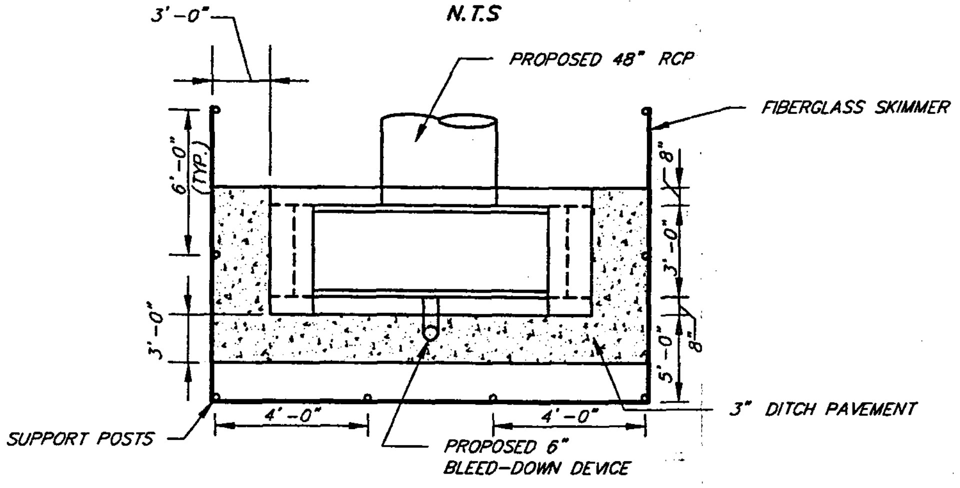

PROPOSED CONTROL STRUCTURE
TOP VIEW
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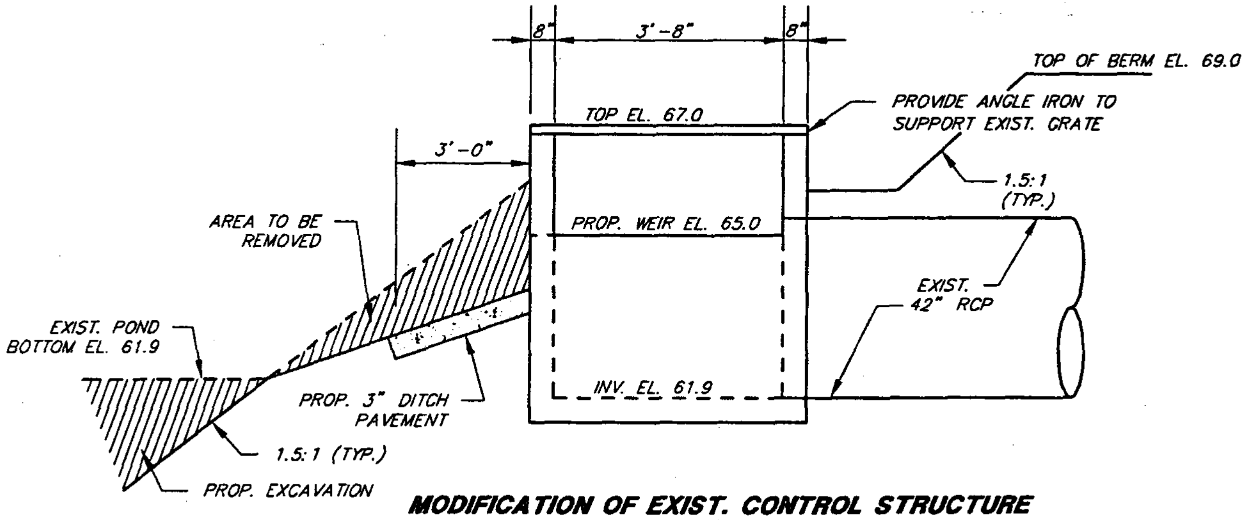
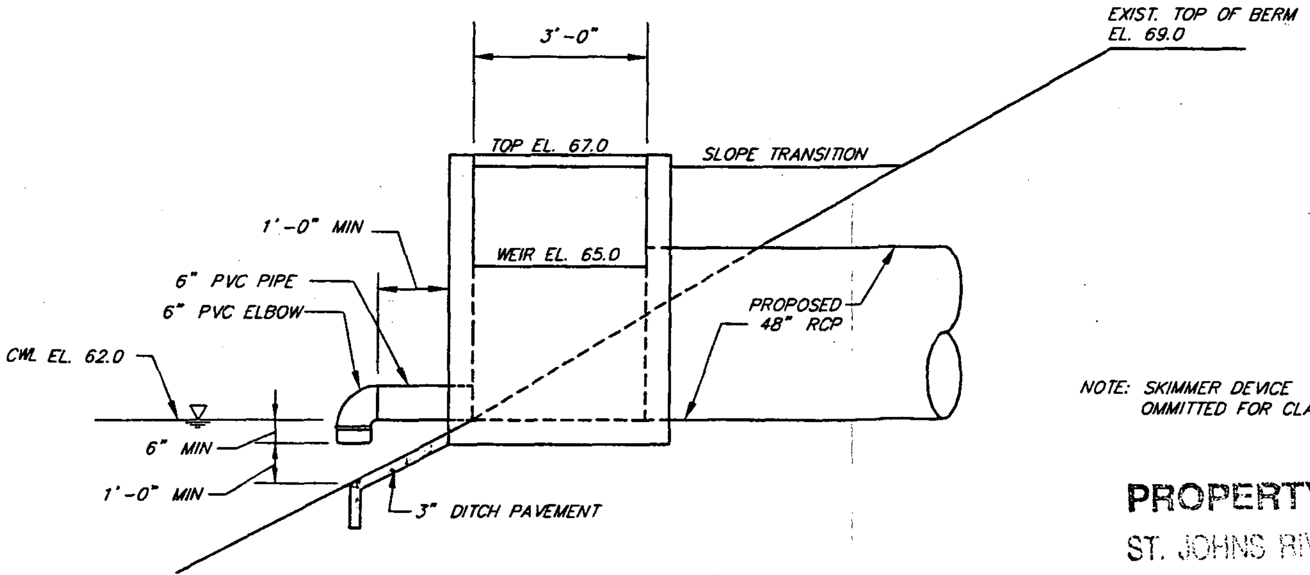


MODIFICATION OF EXIST. CONTROL STRUCTURE
SIDE VIEW
N.T.S



NOTE: SKIMMER DEVICE OMMITTED FOR CLARITY.

PROPOSED CONTROL STRUCTURE
SIDE VIEW
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LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-2B
RECOMMENDED IMPROVEMENT PARK AVENUE POND DETAILS

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DATE MAY 1996
SHEET 2 OF 2

associated with Lake McCoy (refer to Volume I, Section 4 - Supporting Documentation - Attachment "B"). Impacts to these wetland for the enlargement of the existing pond would have to permitted through the SJRWMD and the U.S. Army Corps of Engineers (ACOE). It is probable that mitigation will be required for any impacts to these functional wetlands. The option of expanding the pond into these wetlands was not a consideration in the recommended improvements due to the potential mitigation consequences for the wetland impacts and the costs associated with the mitigation efforts.

The ecological effects of retrofitting the existing pond are that stormwater from the most heavily urbanized portions of the contributing basins would be treated before discharging into Lake McCoy. The quality of water entering Lake McCoy would be significantly better than what is currently discharging to the lake. The construction associated with the retrofit program would not result in the displacement of any environmentally sensitive wetland areas adjacent to the pond. Conversion to a wet detention system may provide a foraging area for wading birds. The sheer size of the pond would also provide a habitat area for aquatic species.

The operation and maintenance of a wet detention pond are significantly less than the existing so called "dry" facility, because most of the pond facility is open water. The area to be mowed would be significantly reduced. The control structures would require minimal maintenance, with most of the upkeep directed to controlling any vegetation that may obstruct flow at the bleed-down device. The pond would need to be periodically maintained, particularly after a large storm event, to assure that the hydraulic function of the pond control structures is maintained and that any erosion control measures at the outfall are intact.

Refer to Table 3-2 for an Engineer's probable cost estimate for the recommended improvements associated with the Park Avenue pond to serve Sub-Basins PA-01 through PA-05.

3.2.3 Sub-Basin MN-21

Sub-basin MN-21 contains the Lake McCoy Outfall consisting of two (2) arch corrugated metal pipes (CMP) under Sandpiper Street, which discharges to Lake Coroni. Sandpiper Street is currently an unpaved roadway but is scheduled to be paved by Orange County in the future. The outfall for Lake McCoy functions to pass low flows through the CMP's for smaller frequency events (less than the 2.33-year frequency storm event) and weir flow (roadway overtopping) for the larger storm events (greater than the 2.33-year frequency storm event). The proposed recommended improvements do not address the resizing of the existing culverts under Sandpiper Street and the raising of the roadway profile. To properly size the culvert(s) under Sandpiper Street, the roadway profile would have to be raised above the 100-year flood elevation of Lake Coroni and Lake McCoy.

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PROJECT : LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY
ORANGE COUNTY, FLORIDA
P.N. : OC-70/1.0
(filename: OC70COST.WK4)
CHECKED : David W. Hamstra, P.E.
DATE : 07-Jan-97

SUBJECT : ENGINEER'S PRELIMINARY PROBABLE COST OF CONSTRUCTION
PARK AVENUE POND

TABLE 3-2

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	UNIT AMOUNT
1. Excavation (Regular)	57,860	c.y.	$4.50	$260,370.00
2. Traffic Control	1	l.s.	$5,000.00	$5,000.00
3. Turbidity Barrier (Floating)	40	l.f.	$8.00	$320.00
4. Inlet Modification	1	each	$1,000.00	$1,000.00
5. Pipe Conc Culv (Class III)(48" SS)	50	l.f.	$72.00	$3,600.00
6. Inlet (Special)(< 10')(DT Bot - Type H)	1	each	$3,300.00	$3,300.00
7. Conc. Class I (Endwalls)	20.36	c.y.	$465.00	$9,467.40
8. Reinforcing Steel (Roadway)	2,000.00	lbs	$0.60	$1,200.00
9. Riprap (Rubble)(Ditch Lining)	38.5	ton	$20.00	$770.00
10. Ditch Pavt Conc. (3")	13.5	s.y.	$20.00	$270.00
11. Fence (Reset Exist.)(Type B)	20	l.f.	$7.00	$140.00
12. Sodding (Bahia)	4,700	s.y.	$1.20	$5,640.00
13. Erosion Control	1	l.s.	$1,000.00	$1,000.00

SUB-TOTAL		$292,077.40
Mobilization (10 percent)	===>>>	$29,207.74
TOTAL		$321,285.14
Contingencies (20 percent)	===>>>	$64,257.03
Surveying/Engineering/Permitting/Construction Administration (15 percent)	===>>>	$48,192.77
GRAND TOTAL		$433,734.94

NOTES:

1. This cost estimate does not include those costs which pertain to right-of-way or drainage easement acquisition for maintenance or access to the proposed facilities or utility adjustments.
2. The unit costs for the storm sewer pipe and structures are based on the Florida Department of Transportation Summary of Average Construction Costs Manual (July 1994 to June 1995). These unit prices should be used with caution due to the fact that they represent bulk averages.
3. The unit cost for Excavation (Regular) consists of excavation and utilization or disposal of all materials necessary for the construction of the pond.
4. This cost estimate does not include those costs associated with the dewatering activities for the excavation of the existing pond. It will be the Contractor's responsibility to evaluate the need to apply for a general or individual Consumptive Use Permit (CUP) to the St. Johns River Water Management District prior to beginning construction.

The 100-year flood stage for Lake Coroni and Lake McCoy are elevation 64.81 and 64.83, respectively. The existing roadway overtopping for Sandpiper is elevation 62.81. Approximately 1,300 feet of the roadway profile would have to be raised above the 100-year flood elevations of Lake McCoy and Lake Coroni.

The recommended improvement for the Lake McCoy Outfall is to construct a weir structure at the existing culverts on the upstream (south) side of Sandpiper Street. This weir structure functions to control the normal high water level (NHWL) in Lake McCoy at 61.5. The weir structure would have a crest elevation of 61.0 and would be attached to a concrete straight endwall (Index No. 150) constructed at the culvert ends. Figure 3-3 illustrates the location of the recommended improvements and the details for the weir structure and the concrete endwall construction.

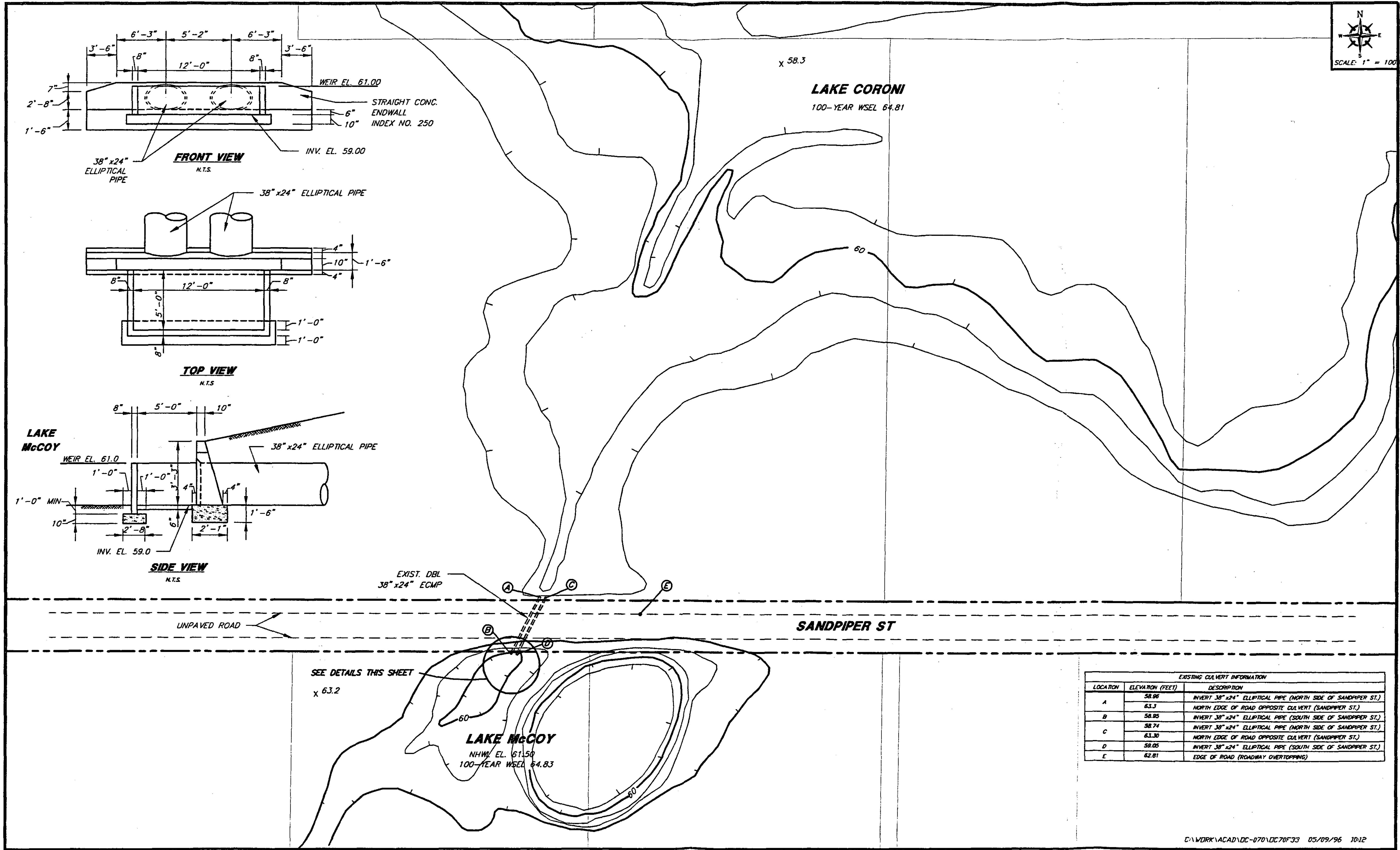
Refer to Table 3-3 for an Engineer's probable cost estimate for the recommended improvements associated with the Lake McCoy Outfall to serve Sub-Basin MN-21.

3.2.4 Sub-Basin LC-01

Sub-basin LC-01 is within the Lake Coroni basin with it's primary surface feature being a depressional area west of Ustler Road. This depressional area is drained by a 15-inch reinforced concrete pipe (RCP) under Ustler Road, and eventually drains to Lake Coroni. Figure 3-4 illustrates the location and details for the recommended improvement. The 15-inch pipe is in moderate structural condition with an endwall (with 45-degree wingwalls) on the west side of Ustler Road and no end treatment on the east side of Ustler Road. The downstream (east) end of the 15-inch culvert is a "sumped" condition, which means that the culvert invert is lower than the adjacent ground elevation. The downstream side of the culvert has an invert at elevation 78.85 and the ground elevation immediately east of the culvert end is at elevation 80.2. The existing ground currently controls the hydraulic performance of the culvert due to the sumped condition.

To provide a better hydraulic connection between the existing 15-inch culvert and Lake Coroni, a ditch with sufficient gradient is proposed to be constructed from the culvert end. The ditch is to have a three (3) foot bottom width, with 2:1 (horizontal to vertical) side slopes. The ditch is to be encompassed in a 15-foot wide drainage easement for construction and maintenance access. Sodding will be provided for the ditch limits to prevent erosion downstream. A concrete mitered end section is to also be constructed at the downstream culvert end to prevent any erosion of the roadway embankment.

Refer to Table 3-4 for an Engineer's probable cost estimate for the recommended improvements associated with the pipe outfall under Ustler Road to serve Sub-Basin LC-01.



EXISTING CULVERT INFORMATION		
LOCATION	ELEVATION (FEET)	DESCRIPTION
A	58.96	INVERT 38" x24" ELLIPTICAL PIPE (NORTH SIDE OF SANDPIPER ST.)
	63.3	NORTH EDGE OF ROAD OPPOSITE CULVERT (SANDPIPER ST.)
B	58.95	INVERT 38" x24" ELLIPTICAL PIPE (SOUTH SIDE OF SANDPIPER ST.)
C	58.74	INVERT 38" x24" ELLIPTICAL PIPE (NORTH SIDE OF SANDPIPER ST.)
	63.30	NORTH EDGE OF ROAD OPPOSITE CULVERT (SANDPIPER ST.)
D	59.05	INVERT 38" x24" ELLIPTICAL PIPE (SOUTH SIDE OF SANDPIPER ST.)
E	62.81	EDGE OF ROAD (ROADWAY OVERTOPPING)

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LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-3
RECOMMENDED IMPROVEMENT
LAKE McCOY OUTFALL

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PROJECT : LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY
ORANGE COUNTY, FLORIDA
P.N. : OC-70/1.0
(filename: OC70COST.WK4)
CHECKED : David W. Hamstra, P.E.
DATE : 07-Jan-97

SUBJECT : ENGINEER'S PRELIMINARY PROBABLE COST OF CONSTRUCTION
LAKE McCOY OUTFALL

TABLE 3-3

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	UNIT AMOUNT
1. Excavation (Regular)	20	c.y.	$4.50	$90.00
2. Remove Existing CMP	1	l.s.	$5,000.00	$0.00
3. Asphaltic Concrete Type S (2")	27	s.y.	$3.50	$0.00
4. Limerock Base (6")	27	s.y.	$5.00	$0.00
5. Stabilization Type B	27	s.y.	$1.50	$0.00
6. Curb and Gutter (Conc.)(Ribbon)	20	l.f.	$7.00	$0.00
7. Pipe Conc. Culv (Class HE III)(24"x38")	120	l.f.	$54.00	$0.00
8. Conc. Class I (Endwalls)(North)	3.58	c.y.	$465.00	$0.00
9. Conc. Class I (Endwalls)(South)	7.75	c.y.	$465.00	$3,603.75
10. Sodding (Bahia)	30	s.y.	$1.20	$36.00
11. Traffic Control	1	l.s.	$500.00	$500.00
12. Erosion Control	1	l.s.	$1,000.00	$1,000.00

SUB-TOTAL		$5,229.75
Mobilization (10 percent)	===>>>	$522.98
TOTAL		$5,752.73
Contingencies (20 percent)	===>>>	$1,150.55
Surveying/Engineering/Permitting/Construction Administration (15 percent)	===>>>	$862.91
GRAND TOTAL		$7,766.18

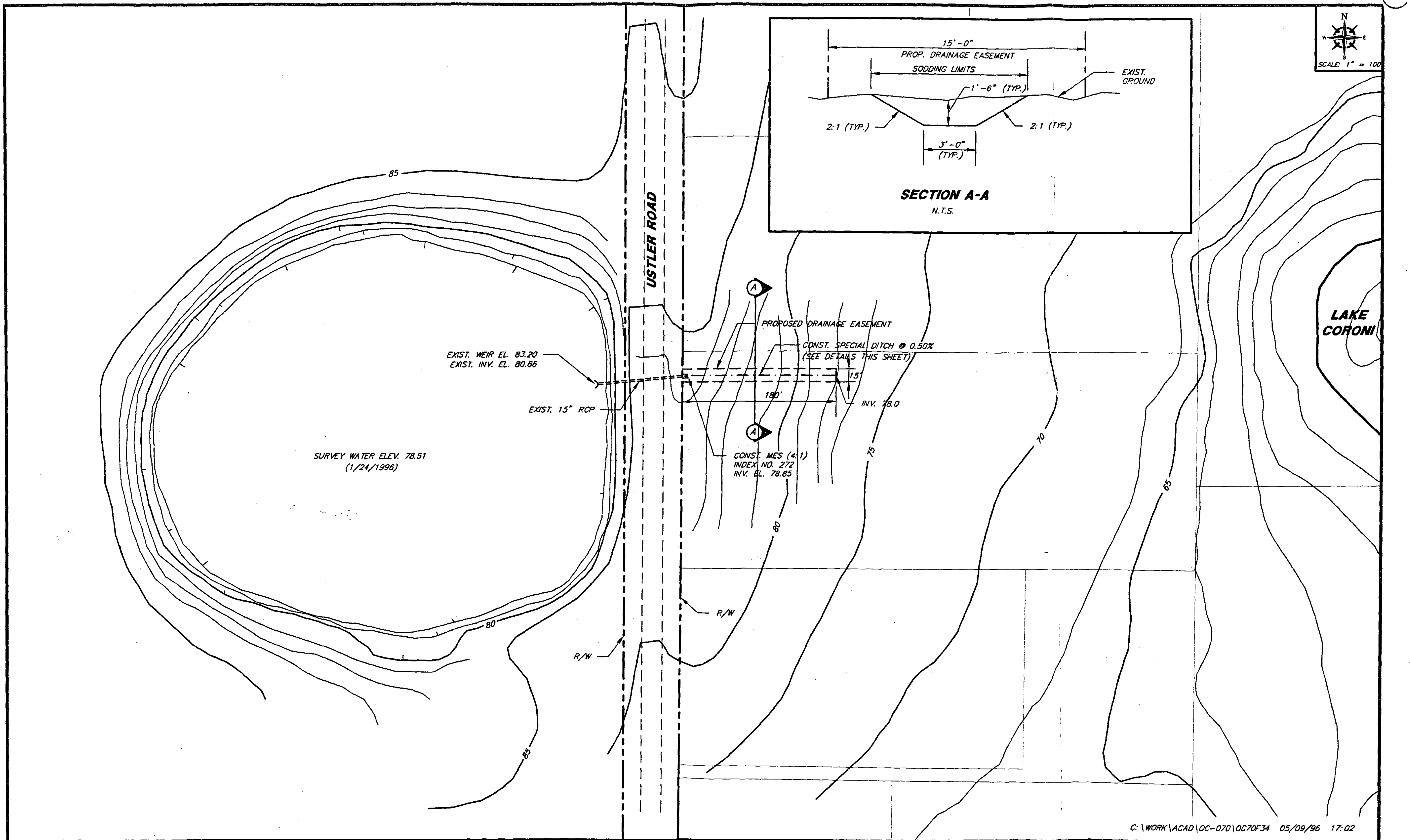
NOTES:

1. The unit costs for the storm sewer pipe and structures are based on the Florida Department of Transportation Summary of Average Construction Costs Manual (July 1994 to June 1995). These unit prices should be used with caution due to the fact that they represent bulk averages.

2. The unit cost for Excavation (Regular) consists of excavation and utilization or disposal of all materials necessary for the construction of the pond.

3. The quantity for Item No. 9 (Class I Concrete, Endwalls) includes the proposed weir structure to be constructed with the south endwall of the existing double CMP pipes.

4. Items No. 2 through 8 would be costs associated with the Roadway Improvements for Sandpiper Street, currently under design by WBQ, Inc. for Orange County Public Works. These costs were omitted for the Lake McCoy Outfall improvements.



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LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-4
RECOMMENDED IMPROVEMENT
USTLER ROAD (SUB-BASIN LC01 OUTFALL)

JOB No. OC-070
DATE MAY 1996
SHEET 1 OF 1

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PROJECT LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY
ORANGE COUNTY, FLORIDA
P.N. OC-70/1.0
(filename: OC70COST.WK4)
CHECKED David W. Hamstra, P.E.
DATE 07-Jan-97

SUBJECT ENGINEER'S PRELIMINARY PROBABLE COST OF CONSTRUCTION
USTLER ROAD (SUB-BASIN LC-01 OUTFALL)

TABLE 3-4

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	UNIT AMOUNT
1. Excavation (Lateral Ditch)	75	c.y.	$5.00	$375.00
2. MES (Conc Pipe Round)(15" CD)	1	each	$400.00	$0.00
3. Sodding (Bahia)	300	s.y.	$1.20	$360.00
4. Erosion Control	1	l.s.	$1,000.00	$1,000.00
5. Drainage Easement	0.062	acre	$50,000.00	$3,100.00

SUB-TOTAL		$4,835.00
Mobilization (10 percent)	===>>>	$483.50
TOTAL		$5,318.50
Contingencies (20 percent)	===>>>	$1,063.70
Surveying/Engineering/Permitting/Construction Administration (15 percent)	===>>>	$797.78
GRAND TOTAL		$7,179.98

NOTES:

1. The unit costs for the storm sewer pipe and structures are based on the Florida Department of Transportation Summary of Average Construction Costs Manual (July 1994 to June 1995). These unit prices should be used with caution due to the fact that they represent bulk averages.

2. The unit cost for Excavation (Lateral Ditch) consists of excavation and utilization or disposal of all materials necessary for the construction of the proposed ditch.

3.2.5 Sub-Basins BP-02 and BP-04

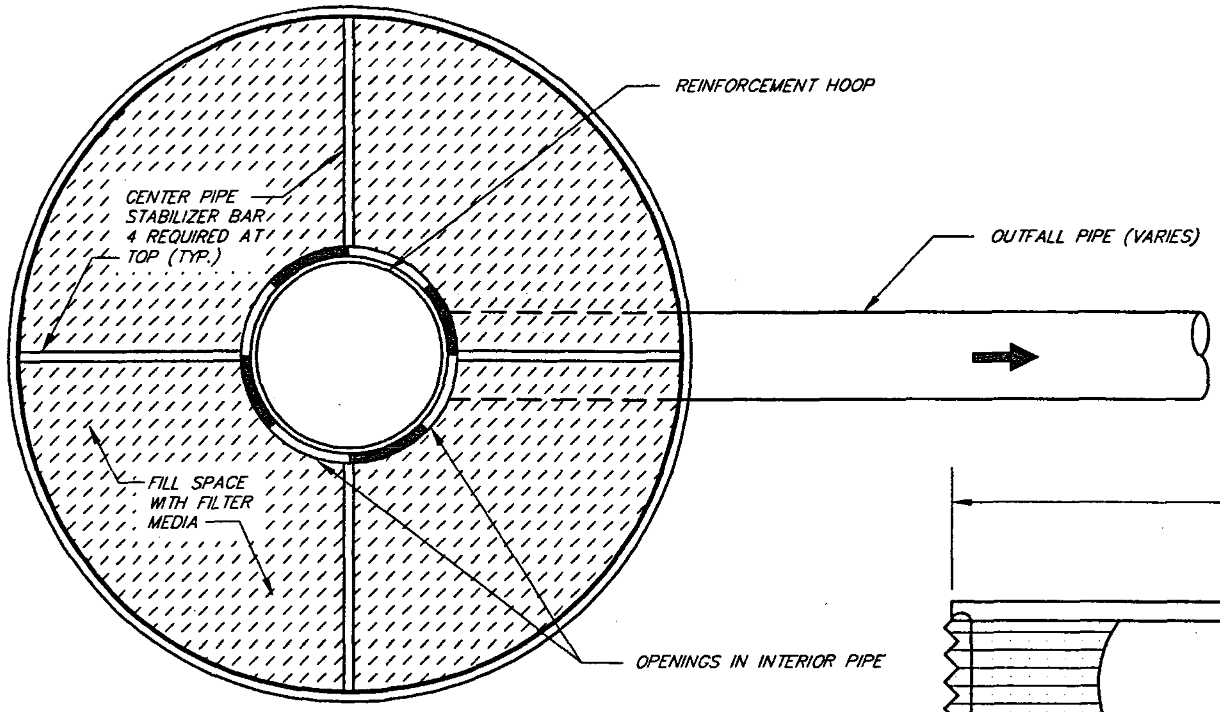
Sub-basins BP-02 and BP-04 consist of the basins encompassing the Pines of Wekiva development. These two (2) basins each have existing stormwater ponds that provide water quality before discharging to receiving water body (Buchan Pond) using Vertical Volume Recovery Structures (VVRS). Figure 3-5 illustrates a typical Vertical Volume Recovery Structure similar to those within the Pines of Wekiva development. Vertical Volume Recovery Structures are filtration systems consisting of two (2) concentrically and vertically placed aluminum perforated pipes, with a minimum recommended annular space of 24-inches for the interior pipe. The exterior pipe size varies, according to the amount of filter media needed to provide treatment of the required water quality volume. These pipes are set on a concrete slab with an outfall pipe set at the bottom of the VVRS and a locking hinged cap to secure the filter media. The filter media consists of an aggregate material typically specified by a geotechnical engineer. The interior perforated pipe usually has openings cut out, which function as weirs to control the release of stormwater to the VVRS outfall pipe. The interior perforated pipe is also wrapped with a filter fabric to prevent the passage of the filter media aggregates through the pipe perforations and the weir openings.

During field observations, it was noted that some of the VVRS in the existing ponds had failed. The failure mode consisted of the rupturing of the filter fabric around the weir opening of the interior perforated pipe, causing the filter media to be deposited into the VVRS outfall. This breach in the filter fabric and the filter media essentially renders the VVRS as non-functioning. Stormwater entering the VVRS is not filtered through the aggregate as designed. Instead it flows directly to the breached area and into the VVRS outfall, with no water quality treatment provided.

It is recommended that the Owner and/or Maintenance Entity of the ponds be responsible for restoring the Vertical Volume Recovery Structures to their design function. As-built certifications of the restored VVRS's would be required to be submitted to the SJRWMD compliance staff to assure that the structures have been fully restored to their design function. No Engineer's Cost Estimate was prepared for this recommended improvement since the cost to restore the VVRS's would be the responsibility of the Owner/Maintenance Entity of the ponds.

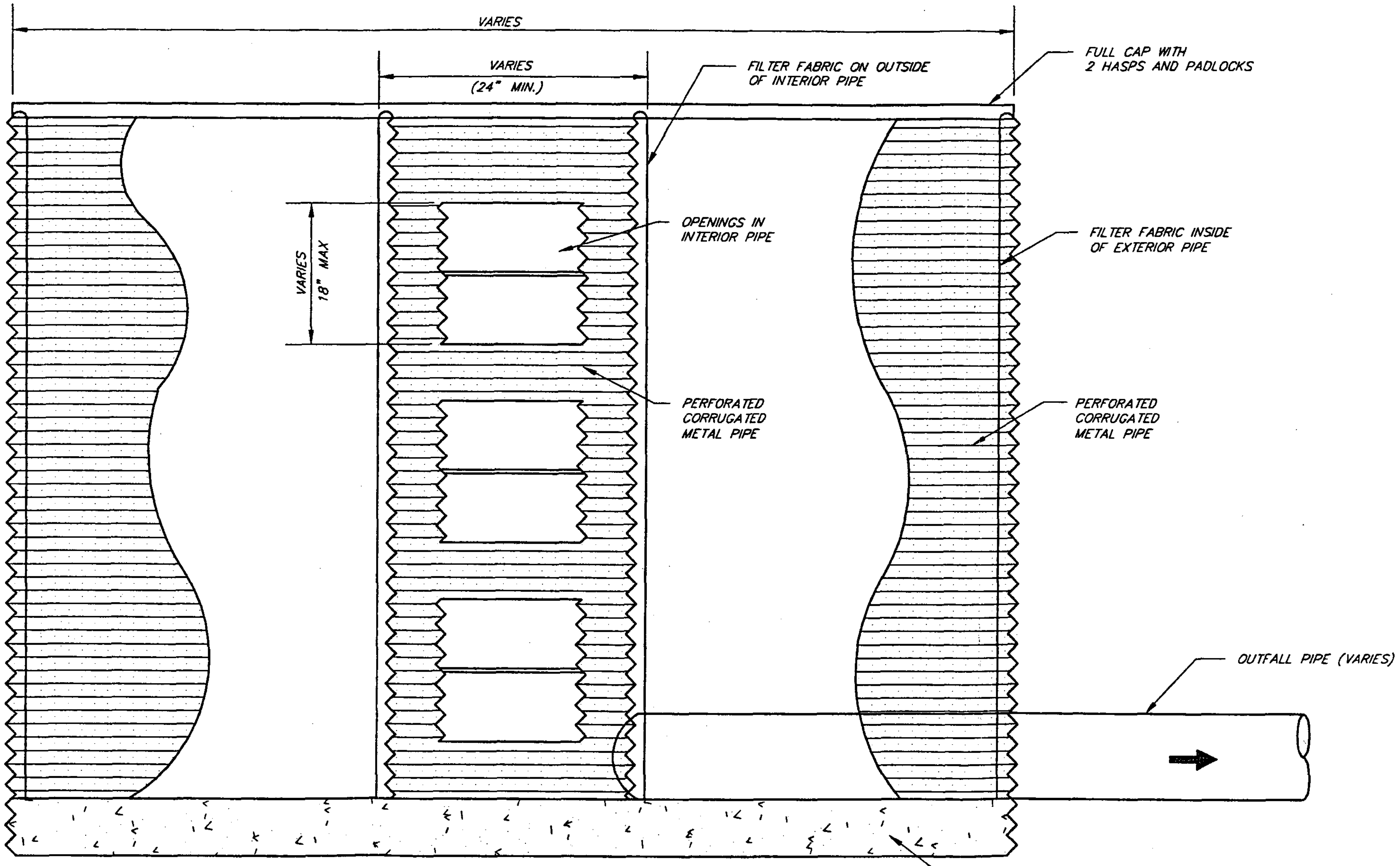
N

N.T.S



PLAN VIEW

N.T.S



PROFILE VIEW

N.T.S

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PEC PROFESSIONAL ENGINEERING CONSULTANTS, INC.
engineers planners surveyors
Suite 1560 Eola Park Centre 200 East Robinson Street, Orlando, Florida 32801 407/422-8062

LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY

FIGURE 3-5
TYPICAL VERTICAL VOLUME RECOVERY STRUCTURE (VVRS)

JOB No. OC-070
DATE MAY 1996
SHEET 1 OF 1

3.2.6 Sub-Basins MN-12 and MN-13

These sub-basins are in the Lake McCoy (north) basin and discharge to a wetland system located in Sub-Basin MN-13, south of Welch Road, east of Rock Springs Road. This wetland system discharges to the south by means of an existing drainage ditch for storm events less that the 25-year frequency, 24-hour duration storm event. For storms exceeding the 25-year frequency, 24-hour duration storm event, the wetland also discharges east and eventually to a culvert under Welch Road. This wetland is classified as forested wetlands adjacent to pine flatwood uplands. It appears that several ditches have been constructed in the past which may have altered the hydrologic regime of the wetland system. Lotspeich and Associates evaluated this wetland for the potential preservation by Orange County. Their assessment of the wetland is that it is of moderate quality with limited opportunities for enhancement because of the lack of significant depressional storage to restore the hydrologic regime. This is an important consideration since a lack of depressional storage indicate a lack of stormwater flood storage.

The recommended improvement for these sub-basins is considered non-structural and regulatory, since specific sub-basin stormwater management criterion is proposed. Since the wetland system is volume sensitive, it is proposed that any new developments in the sub-basins discharging to the wetland system be required to provide stormwater management facilities (ponds) to accommodate the difference in pre-development and post-development runoff volume for all storms up to the 25-year, 24-hour storm event. Developers would have to demonstrate that the existing hydrology of the wetland is not adversely altered by the proposed development. Volume recovery can be accomplished by vertical evacuation into the soil column, or if the soil conditions restrict any vertical evacuation, by detention for a sufficient period of time to mitigate adverse impacts to the flood stages in the wetland system. The post-development volumetric discharge at Hour 24.0 (assuming a storm event begins at Hour 0.0) would be required to be equal or less that the pre-development volumetric discharge for proposed detention systems The City of Apopka would be responsible for enforcing the special basin criterion, which would supersede both Orange County's regulations and the SJRWMD regulations (Wekiva River Hydrologic Basin criteria) since it would be the most restrictive of the three overlapping jurisdictional agencies.

3.2.7 Sub-Basins LP-02 and LP-04

Sub-Basins LP-02 and LP-04 are in the Lake Prevatt basin, located on the west side of Rock Springs Road, north of Welch Road. The Orange County Comprehensive Plan identifies Rock Springs Road as a major collector, requiring four (4) lanes between Welch Road and Ponkan Road by the year 2010. Future traffic projections indicate approximately 23,000 vehicles per day (VPD) will use this corridor. Effects of proposed new roadway facilities such as the Western Beltway and the Apopka

Bypass will increase the potential for urbanization within these two (2) sub-basins, subsequently altering the drainage patterns and conditions for upstream and downstream receiving water bodies. Currently Sub-basin LP-02 drains under Rock Springs Road to Lake Prevatt by means of two (2) 36-inch reinforced concrete pipes (RCP). Sub-basin LP-04 drains under Rock Springs Road to Lake Prevatt via a single 36-inch RCP. The Sub-basin LP-02 culverts under Rock Springs Road can convey stormwater runoff generated for storms up to and including the 10-year frequency, 24-hour duration storm event. For storm events greater than the 10-year storm, Rock Springs Road overtops. The Sub-basin LP-04 culvert under Rock Springs Road can only convey runoff generated for storms up to and including the 2.33-year (mean annual) frequency, 24-hour duration storm event. All other storms exceeding the 2.33-year event will result in Rock Springs Road overtopping.

These are significant drainage considerations for the future widening of Rock Springs Road. The culverts would need to be resized to pass the selected design frequency storm without any roadway overtopping occurrences. The City of Apopka intends to proceed with the design and construction of widening improvements to Rock Springs Road from Welch Road northward to Ponkan Road. Although a design contract has not yet been awarded, it is recommended that the results from this Study supplement the drainage design for the segment of the Rock Springs Road widening project encompassing Sub-Basins LP-02 and LP-04.

3.2.8 Sub-Basin MS-09

*Sub-Basin MS-09 encompasses the area surrounding and including Lake McCoy, south of Votaw Road. The lake is controlled by an existing pipe system in series under Votaw Road. This pipe system consists of a 30-inch RCP connected to a 30-inch CMP by two (2) manholes on the south side of Votaw Road. The surveyed upstream invert (on south side of Votaw Road) of the existing culvert is at elevation 61.8. The Orange County standard for the establishment of Normal High Water Level (NHWL) is six (6) inches above the invert elevation of a culvert structure. Using the County standard, the NHWL should be at elevation 62.3. The established NHWL for Lake McCoy is 61.5 according to the Orange County Lake Index. Establishing the NHWL at 62.3 results in a 100-year water surface elevation of 66.5, according to the evaluations in this Study. The elevation determined from this Study is 1.5-feet above the effective 100-year water surface elevation of 65.0, according to the Flood Insurance Rate Map (FIRM) panel 120180/0005C, City of Apopka **Flood Insurance Study**, October 23, 1981. The 100-year water surface elevation of 65.0 was established by the U.S. Army Corps of Engineers, Jacksonville District, who were the Flood Insurance Study contractors for the Federal Emergency Management Agency. The re-establishment of the 100-year flood elevation (or Base Flood Elevation - BFE) to elevation 66.5 would not have any affect on the Minimum Habitable Floor elevation of 68.0. The current County and City of Apopka standard still satisfies the National Flood Insurance Program (NFIP) minimum standard of setting the finished floor* *elevation one (1) foot above the effective BFE. The rise in the 100-year water surface elevation in Lake McCoy would also redesignate areas that were previously outside of the FEMA designated Special Flood Hazard Area (SFHA) to be within the SFHA.*

It is recommended that the City of Apopka and Orange County utilize the results of this Study to further evaluate the need to re-establish the NHWL at elevation 62.3 and the 100-year water surface elevation at 66.5 for Lake McCoy, south of Votaw Road. The final decision to officially re-establish the 100-year water surface elevation in Lake McCoy (south) through FEMA would still be up to the communities (Orange County and the City of Apopka) participating in the NFIP and enforcing flood plain management standards.

3.2.9 Sub-Basin BP-05

*Sub-basin BP-05 encompasses the area surrounding and including Buchan Pond, west of Lake Avenue and north of Grossenbacher Drive. Buchan Pond is controlled by a drop structure which connects to the Grossenbacher Drive drainage system. The Grossenbacher drainage system then discharges to an existing wetland/pond system on the west side of Ustler Road, which is controlled by a single 60-inch by 36-inch elliptical pipe culvert under Ustler Road. This pipe culvert then discharges to Lake McCoy, north of Votaw Road. Buchan Pond has the same situation as Lake McCoy (MS-09), south of Votaw Road regarding the establishment of an official NHWL and the re-establishment of the 100-year water surface elevation, based on surveyed information and detailed hydrologic and hydraulic routings contained in this Study. Buchan Pond does not have an established NHWL according to the Orange County Lake Index. The 100-year flood elevation has been established by FEMA at elevation 140.0, documented in the City of Apopka **Flood Insurance Study**.*

Buchan Pond is controlled by a drop structure with a weir crest elevation of 137.2 (surveyed at elevation 137.16). According to the Orange County standards for establishing NHWL, the NHWL for Buchan Pond should be six (6) inches above the control structure elevation of 137.2. This results in a NHWL elevation of 137.7. The flood routing for this Study uses elevation 137.7 as the initial water level in the Buchan Pond. The evaluation for the 100-year, 24-hour storm event resulted in an elevation of 140.7, which is 0.7-feet above the FEMA established BFE of 140.0. The Minimum Habitable Floor Elevation for Buchan Pond is elevation 141.0 according to the Orange County Lake Index. From the results of the Study, the Minimum Habitable Floor Elevation does not meet the County or the City of Apopka's standard of a minimum one (1) foot above the established BFE.

It is recommended that the City of Apopka and Orange County utilize the results of this Study to further evaluate the need to establish a NHWL and to re-establish the 100-year water surface

Elevation at for Buchan Pond. The City and the County may also evaluate the need to elevate the Minimum Habitable Floor Elevation to a minimum of one (1) foot above the 100-year flood elevation of 140.7 determined by this Study. The final decision to officially re-establish the 100-year water surface elevation in Buchan Pond through FEMA would still be up to the communities (Orange County and the City of Apopka) participating in the NFIP and enforcing flood plain management standards.

3.2.10 Sub-Basin LP10

This sub-basin is located in the Lake Prevatt basin, more specifically within the Wekiva Glen Subdivision. LP10N03P is a node located upstream of Brook Forest Court and is drained by three (3) 38-inch x 24-inch horizontal elliptical concrete pipes (Reach LP10R03C), which discharge to Lake Prevatt. Brook Forest Court terminates at a cul-de-sac on the west side of the culverts. Approximately six (6) residences use the cul-de-sac for access. Under existing conditions, Brook Forest Court is overtopped by the stormwater runoff generated from occurrences greater than the 2.33-year, 24-hour storm event. The overtopping elevation for Brook Forest Court is at elevation 92.6, which is at the roadway profile above the existing culverts. The 10-, 25- and 100-year storm events result in a depth of flooding over Brook Forest Court of 0.6-feet, 0.7-feet and 0.9-feet respectively.

It is recommended that Orange County and the City of Apopka survey the finished floor elevations to determine if there is sufficient clearance between the floor elevations and the 100-year flood elevation of 93.5 determined by this Study. If there is sufficient clearance between the finished floor elevations of the homes and the 100-year flood elevation, the County and the City may opt to keep the existing structures in place. Additional erosion control measures on the upstream side of the culverts may be provided to control any susceptibility for structural failure from the depth of flood waters from larger storm events. The length of flooding duration should also be considered to account for any structural damage that may occur at the culverts and the roadway for the various storms evaluated.

A preliminary evaluation to determine an "ultimate" size of culvert structure under Brook Forest Court was conducted. This was done to provide the County and the City of Apopka an indication of the capital expenditures that would be required to replace the existing culvert to meet current design standards. Orange County requires that the 25-year frequency be used for this type of culvert crossing. A double 7-foot x 3-foot reinforced concrete box structure was selected and evaluated for the 25- and 100-year, 24-hour storm event. The preliminary flood routings indicate that this size culvert would pass the 25- and 100-year discharges without overtopping Brook Forest Court. Table 3-5 tabulates a preliminary cost estimate for the replacement of the existing culverts with an *"ultimate" structure. Note that this hydraulic evaluation was not included as part of the recommended improvements for this sub-basin. The County and the City could use this preliminary cost estimate to decide whether the cost of reducing the projected flood levels would be justified.*

3.2.11 Sub-Basins LP-05 and LP-06

These two sub-basins are within the Lake Prevatt basin, more specifically within the Wekiva Park Subdivision north of Welch Road. Each basin has a stormwater management facility (pond), which are interconnected by a culvert. These pond systems could be considered to function as a single pond and are regulated by a control structure in the Sub-Basin LP-06 pond. This system discharges to a wetland system in Sub-Basin LP-07, which eventually discharges to Lake Prevatt via the existing triple 38-inch x 24-inch elliptical pipes under Brook Forest Court in the Wekiva Glen Subdivision. A permit modification was conducted by Hollis Engineering, Inc. in 1995 (Permit No. 4-095-0353AM3) to install two additional bleed-down pipes. Before the permit modification, it was determined that the pond would not recover one-half of the required pollution abatement volume within 48 to 60 hours. Additional 6-inch and 4-inch PVC pipes were installed to assist in drawing down the pollution abatement volume to meet the SJRWMD's performance standards for wet detention ponds.

During the Study, it was observed that water was flowing at all times over the riprap spillway (elevation 97.50) and that the bleed-down pipes may not be functioning. No significant amounts of rainfall had fallen in the Study area before conducting the field observations. It is recommended that the City of Apopka, Orange County, and the SJRWMD review the performance of this pond for compliance with its original design and permitted function. No cost estimates are included with this recommendation, since any work associated with the restoration of the pond to its design function will be the responsibility of the Owner/Maintenance Entity of the facility.

3-2

PEC/ PROFESSIONAL ENGINEERING CONSULTANTS, INC.
engineers planners surveyors
Suite 1560 Eola Park Centre 200 East Robinson Street Orlando, Florida 32801 407/422-8062

PROJECT : LAKES McCOY, CORONI AND PREVATT DRAINAGE BASIN STUDY
ORANGE COUNTY, FLORIDA
P.N. : OC-70/1.0
(filename: OC70COST.WK4)
CHECKED : David W. Hamstra, P.E.
DATE : 07-Jan-97

SUBJECT : ENGINEER'S PRELIMINARY PROBABLE COST OF CONSTRUCTION
DOUBLE 7' X 3' RCB (ULTIMATE CULVERT SIZE)
UNDER BROOK FOREST COURT (WEKIVA GLEN SUBDIVISION)

TABLE 3-5

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	UNIT AMOUNT
1. Excavation (Regular)	50	c.y.	$4.50	$225.00
2. Remove 38" x 24" HERCP	1	l.s.	$8,000.00	$8,000.00
3. Remove Existing Pavement	55	s.y.	$5.00	$275.00
4. Traffic Control	1	l.s.	$5,000.00	$5,000.00
5. Turbidity Barrier (Floating)	40	l.f.	$8.00	$320.00
6. Limerock Base (6")	55	s.y.	$5.00	$275.00
7. Asphaltic Concrete Type S (1-1/4")	55	s.y.	$2.50	$137.50
8. Stabilization Type B	55	s.y.	$1.50	$82.50
9. Conc. Class II (Culverts)	140.19	c.y.	$480.00	$67,291.20
10. Reinforcing Steel (Roadway)	14,241.00	lbs	$0.60	$8,544.60
11. Guard Rail	60.00	l.f.	$11.00	$660.00
12. Riprap (Rubble)(Ditch Lining)	50.0	ton	$20.00	$1,000.00
13. Inlet (DT Bot)(Type D)(< 10')	2.0	each	$1,500.00	$3,000.00
14. Concrete Curb (Flush)	40	l.f.	$7.00	$280.00
15. Sodding (Bahia)	4,700	s.y.	$1.20	$5,640.00
16. Erosion Control	1	l.s.	$1,000.00	$1,000.00

SUB-TOTAL		$101,730.80
Mobilization (10 percent)	===>>>	$10,173.08
TOTAL		$111,903.88
Contingencies (20 percent)	===>>>	$22,380.78
Surveying/Engineering/Permitting/Construction Administration (15 percent)	===>>>	$16,785.58
GRAND TOTAL		$151,070.24

NOTES:

1. This cost estimate does not include those costs which pertain to right-of-way or drainage easement acquisition for maintenance or access to the proposed facilities or utility adjustments.

2. The unit costs for the storm sewer pipe and structures are based on the Florida Department of Transportation Summary of Average Construction Costs Manual (July 1994 to June 1995). These unit prices should be used with caution due to the fact that they represent bulk averages.

3. The unit cost for Excavation (Regular) consists of excavation and utilization or disposal of all materials necessary for the construction of the box culverts.

4. This cost estimate does not include those costs associated with the dewatering activities for the excavation for the box culvert. It will be the Contractor's responsibility to evaluate the need to apply for a general or individual Consumptive Use Permit (CUP) to the St. Johns River Water Management District prior to beginning construction.

Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

SUPPORTING DOCUMENTATION

Prepared By:
PEC/Professional Engineering Consultants, Inc.
200 East Robinson Street, Suite 1560
Orlando, Florida 32801

Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

ATTACHMENT "A"

STORMWATER MANAGEMENT MASTER PLAN

WATER QUALITY DATA ANALYSIS

Prepared By:
Lotspeich and Associates, Inc.
422 West Fairbanks Avenue, Suite 201
Winter Park, Florida 32789

Lotspeich and Associates, Inc.
ECOLOGICAL CONSULTANTS

6 February 1996
L&A File No. 95061.41
L&A Doc: \AHJHD\95061B06.let

Mr. David Hamstra
Professional Engineering Consultants, Inc.
200 East Robinson Street, Suite 1560
Orlando, Florida 32801

RE: **Stormwater Management Master Plan For**
Lake McCoy, Lake Coroni, and Lake Prevatt Drainage Basins
Water Quality Data Analysis

Dear Mr. Hamstra:

Enclosed is the report on the water quality data analysis for the above referenced project. The analysis is based on the available data obtained by Lotspeich and Associates, Inc. (L&A) from Orange County Environmental Protection Department (OCEPD). Although the scope identifies other potential sources for background information on the water quality of the study area, only the OCEPD water quality data was provided for use in this assessment.

JPL Engineering, as subconsultant to L&A, conducted the assessment and prepared the report. L&A provided coordination and quality control for the document.

Please review and call me if you wish to discuss any aspect of the report or project.

Sincerely,

LOTSPEICH AND ASSOCIATES, INC.

Carolyn R Schultz

Carolyn R. Schultz
Research Scientist III

CRS\amh

Enclosure(s) (1)

cc: Carol S. Lotspeich, L&A
Laura Jackson, JPL Engineering

422 West Fairbanks Avenue, Suite 201, Winter Park, Florida 32789 (407)740-8482 FAX (407) 645-1305

LAKE McCOY, LAKE CORONI, AND LAKE PREVATT SWMMP HISTORICAL WATER QUALITY REPORT

During November 1995, the development of a Stormwater Management Master Plan (SWMMP) for the City of Apopka's Lake McCoy, Lake Coroni, and Lake Prevatt drainage basin was initiated by Orange County. The development of the SWMMP includes the evaluation of all feasible non-structural approaches to stormwater management and the identification of areas where structural improvements are required to reduce existing and future flooding in the drainage basin. In conjunction with these evaluations, the water quality requirements for the basin must be evaluated to determine the feasibility of achieving them while implementing the proposed drainage improvements. All discharges from the drainage basin must be in accordance with the new Orange County NPDES Master Stormwater Permit.

Project Scope

Orange County retained the services of Professional Engineering Consultants, Inc. (PEC) to evaluate various modifications that would enhance the drainage within the Lake McCoy system. As part of the project's scope of work, an evaluation of existing water quality data is required. Lotspiech & Associates, Inc. (L&A), a member of the PEC team, was assigned the task of providing environmental services for this project including the water quality assessment. JPL Engineering (JPL) was retained by L&A to complete the evaluation of the available water quality data for the drainage basin.

The source of water quality data used by JPL during this assessment was provided by the Orange County's Environmental Protection Department (OCEPD). Information on the physical characteristics of the drainage basin was not made available for this assessment.

The surface water bodies examined for this report include Lakes McCoy, Coroni, Prevatt, and Dream, because a historic database was available for each of these. No water quality data were available for Buchan Pond or the Wekiva River, so there is no assessment of the current or past water quality and potential runoff impacts on either of these water bodies. However, Buchan Pond and the Wekiva River were included in the assessment of potential data gaps during the development of the recommendations. Additionally, the available database did not appear to represent the natural background conditions of the subject lakes.

The OCEPD water quality data was used as the basis to evaluate and to identify contaminants of potential concern to the project. The water quality assessment compared the available data for the four surface water bodies to the current FDEP surface water quality criteria (Chapter 62-302 FAC). However, because several parameters covered by the FDEP criteria are based on background data, no comparisons regarding these parameters were made.

Under these criteria, the lakes are regarded as "Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife, Predominately Fresh Waters." A copy of the criteria tables for the FDEP surface water quality classifications (Chapter 62-302.530 FAC) are provided in Appendix A. Also, these criteria are applicable to the Wekiva River, which is the receiving water body for the drainage basin. The Wekiva River is listed by the FDEP under Chapter 62-302.700 FAC as an "Outstanding Florida Waters" and is afforded special protection under those criteria.

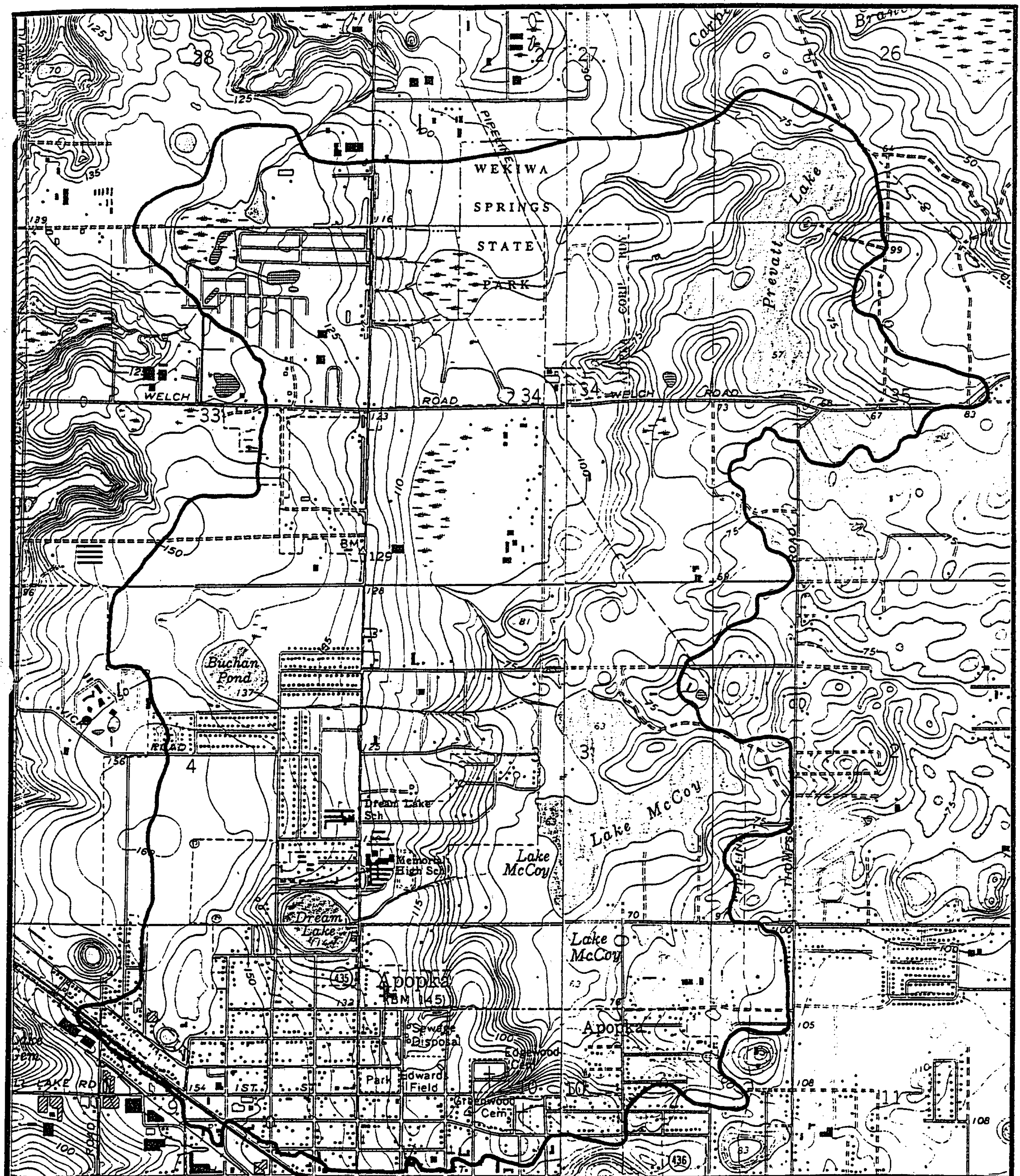
Further, the summarized database was examined for indications of degradation (i.e., eutrophication) that could have resulted from stormwater runoff associated with the current and past land uses. Compounds including nitrogen and phosphorus (nutrients) were used to assess this form of degradation. Also, parameters indicative of water quality decline, such as dissolved oxygen, bacteria, and chlorophyll A, were examined. The results of this assessment are presented in the following sections of this report.

Description of Project Area

The existing 4,000-acre drainage system consists of five drainage sub-basins that range in size from approximately 100 acres to over 1,000 acres. The boundary of the entire drainage basin extends from US 441 and State Road 436 on the south to Lake Prevatt on the north, and from North Park Avenue on the west to Thompson Road on the east (see Figure 1).

The drainage sub-basins are designated as Lake McCoy, Buchan Pond, Dream Lake, Lake Coroni, and Lake Prevatt. Lakes McCoy, Coroni, and Prevatt are connected by a series of culverts and ditches that flow in a northerly direction and ultimately discharge to the Wekiva River. Additionally, Buchan Pond and Dream Lake discharge to Lake McCoy through a series of culverts, ditches, and storm sewers.

The stormwater runoff in this system originates from a variety of land uses including intense commercial, low to medium density residential, plant nurseries, and farms. Additionally, the sub-basins receive runoff from unpaved streets and older residential communities without the benefit of stormwater management ponds.



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Winter Park, FL 32789-5079 FAX (407) 645-1305

DWG No. : 95061B5.DWG
Prepared by : JGS

Stormwater Management Master Plan for Lakes McCoy, Coroni, and Prevatt Drainage Basins
Orange County, Florida

Job No. : 95061
Date : 5 Feb 1996

USGS Topographic Survey and Basin Limits

North
Not to Scale
Figure 1

Current Project Site Conditions

On January 24, 1996, a tour of the watershed was completed by vehicle. The site visit was made with the aid of a set of 1994 Orange County aerials for the drainage basin. The tour included the accessible areas of Lakes McCoy, Coroni, Dream, Prevatt, and Buchan Pond. The discharge point to the Wekiva River could not be observed. All four lakes and Buchan Pond were observed to have residential development along the shorelines. However, Lake Prevatt had development only on the western and southern shorelines. The flow gradient was observed throughout the drainage system. The observed flow was generally from the south to the north, with the final discharge from the system into the Wekiva River.

The southern portion of Lake McCoy is surrounded by the Votaw Village residential subdivision. This portion of the lake appeared to be impacted by emergent vegetative growth. The water depth appeared relatively shallow and was covered by nuisance vegetation (i.e., duck weed). An odor indicative of decaying vegetative matter was noted in this area. The disposal of yard waste (i.e., cut grass) was observed along portions of the shoreline. Also, the current water level appeared to have encroached on some of the home owners back yards.

Unlike the southern portion, the northern segment of Lake McCoy is mostly open surface water with patches of emergent grasses in the center and along the shoreline. Evidence of nuisance vegetation, including filamentous algae, duck weed, and water hyacinth, were observed in this portion of the lake. The water was relatively clear along the shoreline and the sediments were sand. The maintenance of most of the homeowners' yards was noted to extend to the lake's shoreline. The discharge rate from Lake McCoy to Lake Coroni under Sandpiper Street appeared to be significant as evidenced by a swift current. Also, a small un-named pond located on the east side of the discharge ditch was observed to have high water levels. The pond appeared to be very turbid and capable of discharging to the Lake McCoy drainage ditch during a heavy storm event.

Historically, Lake Coroni is typically dry and void of standing water, with the exception of a grass marsh system along the northern shoreline. During the site visit, standing water was present and the water levels appeared to be elevated. Access to this lake was restricted by private land owners and the general conditions could only be observed from a distance along Sandpiper Street. It was noted that a pipeline right-of-way bisects the center of the water body.

Lake Prevatt was viewed from the Wekiva Glen Subdivision and the nearby Camp Thunderbird facility. The lake contained a healthy population of emergent vegetation including torpedo grass, pickerelweed, and water lily. Obvious nuisance vegetation was not observed. Several species of water fowl were observed along the lake's shoreline. The general clarity of the water along the shoreline was good and the bottom was easily seen. The sediments appeared to be sandy with a layer of detritus and some filamentous algae. The northern portion of Lake Prevatt abuts to a dense wetland system which is associated with the Wekiva River.

Evaluation of Water Quality Data

The water quality data provided by the OCEPD included both typed and hand written summary sheets for the subject lakes (see Appendix B). For the purposes of this report, the historical data were re-summarized and are included as Tables 1 through 7. Additionally, the tables include a comparison of the historical data to the FDEP Class III surface water quality criteria.

The available information included data from six water quality sampling stations located in Lake McCoy. The sampling points were denoted by the OCEPD as Stations 3 through 8. The samples were collected at regular intervals (approximately monthly) at three of the Lake McCoy stations (3, 4, and 5) between 1969 to 1971. Sporadic sampling events occurred at these three stations in 1972, 1973, and 1981. The remaining three stations had data from only one event in 1971.

Lakes Coroni, Prevatt, and Dream have only one sampling station. The reported data for Lake Coroni consisted of one sampling event in 1971. The most recent data were from the Lake Prevatt station and included a quarterly sampling frequency between 1987 and 1989 and between 1991 and early 1995. The database for Dream Lake includes seven events between 1970 and 1994. No samples were collected between 1977 and 1994.

Diagrams illustrating the location of the water quality stations were not provided for this study. However, the OCEPD indicated that all of the sampling points, with the exception of Lake McCoy, were located at the geographic center of the water body. The sampling points for Lake McCoy are located at the center of the five identified sections or lobes. From this information it is presumed, for example, that Station 8 is located in the center of the Lake McCoy's northern lobe (see Figure 1).

TABLE 1

LAKE McCOY – SOUTH (STATION 3)

Parameter	Date	01/13/69	02/24/69	03/24/69	04/07/69	05/20/69	10/07/69	12/02/69	01/12/70	02/10/70	03/09/70	04/06/70	05/04/70	Average	Chp. 62-302 FAC, C-III FW
	Units														
Alkalinity	mg/l as CaCO3	4.8	126.0	124.5	126.0	77.6	64.0	94.0	75.0		94.0	84.0	99.0	88.3	Shall not be depressed below 20
Ammonia	mg/l NH3-N	0.4	12.1	9.8	11.8	6.2		4.3	2.7	2.4	5.1	4.6	5.8	5.9	Complex Rule, Nutrients
BOD	mg/l									14.0	16.0	12.0	21.0	15.8	Complex Rule
Chlorides	mg/l	9.0	52.0	40.0	53.0	24.0	25.0	45.0	36.0		32.0	32.0	35.0	34.8	10% above BG, Complex Rule
Conductance	umhos/cm								390	420	370	360	400	388	50% above BG, Complex Rule
DO	mg/l	7.8	0.6	0.8	0.6		2.9	1.1	3.0	2.7	3.9		0.2	2.4	Shall not be < 5, Complex Rule
TC	col/100ml	7		40	23						3000	2800		1174	< 1000, Complex Rule
TN	mg/l	1.1	16.2	11.7	14.9	8.9		6.3	7.3	4.3	1.2	1.6	2.2	6.87	Complex Rule, Nutrients
TP	mg/l	1.0	8.6	6.4	32.5	18.8	12.5	47.3	15.3	16.7	16.7	20.3	30.7	18.9	Complex Rule, Nutrients
pH	SU	6.0	7.2	7.2	6.9	6.6	7.8	7.1	7.2		7.3	7.3	7.8	7.12	Complex Rule, based on BG
Temperature	degree C	14.5	16.0	20.0	21.0	23.0	27.0	16.5	14.5	12.0	18.0	22.0	23.0	19.0	
Turbidity	NTU								4.8	1.8	7.0	4.2	15.0	6.6	<29 above BG

KEY:

BG = Natural Background
TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)
FC = Fecal Coliform
TC = Total Coliform
BOD = Biochemical Oxygen Demand
DO = Dissolved Oxygen
TP = Total Phosphorus

TABLE 2
LAKE McCOY – MIDDLE (STATION 4)

Parameter	Date	01/21/6	02/24/6	03/24/6	04/07/6	05/20/6	06/17/6	10/07/6	12/02/6	01/12/7	02/10/7	03/09/7	04/06/7	04/12/7	01/03/7	06/21/7	Average	Chp. 62-302 FAC, C-III FW
	Units																	
Alkalinity	mg/l as CaCO3	40.0	65.0	43.0	52.0	77.6	92.0	50.0	58.0	74.0		90.0	107.0	65.0	47.0	23.1	63.1	Shall not be depressed below 20
Ammonia	mg/l NH3-N		1.3	0.3	0.1	1.3	1.6		1.2	0.9	5.2	4.2	7.6		0.2		2.2	Complex Rule, Nutrient
BOD	mg/l	0.4	1.0				3.1	32.0	7.5			10.0	19.0	6.7			10.0	Complex Rule
Chlorides	mg/l	27.0	40.0	22.0	32.0	26.0	36.0	24.0	31.0	32.0		35.0	37.0	23.0	23.0		30.2	10% above BG, Complex Rule
Chlorophyll a	mg/m3										25.0						25.0	
Conductance	umhos/cm									370	390	380	410	278	231		340	50% above BG, Complex Rule
DO	mg/l	3.6	1.4	0.4	0.4		6.5	2.8	0.6		5.9	1.5	6.5	13.2			4.1	Shall not be <5, Complex Rule
TC	col/100ml		45	27	30	50						400	1200				292	<1000, Complex Rule
TN	mg/l	1.53	3.62	2.36	1.69	9.95	4.65	2.06	23.32	0.15	11.97	8.45	11.23	1.90		1.01	6.01	Complex Rule, Nutrients
TP	mg/l	7.6	9.3	7.9	13.3	16.1	16.3	10.4	30.9	12.7	16.1	17.9	23.2	20.2		6.6	15.3	Complex Rule, Nutrients
pH	SU	6.90	7.06	7.25	6.70	6.40	6.60	7.60	6.80	7.30		7.35	6.60	7.65	7.22	7.90	7.12	Complex Rule, Based on BG
Secchi	meters										1.2			0.2	0.6	0.9	0.74	
Temperature	degree C	16.5	15.5	20.0	21.0	23.0	32.0	27.0	15.0	14.0	12.0	18.0	22.0	26.0	21.0	26.0	20.6	
Turbidity	NTU									2.2	11.0	40.0	5.2	9.0	4.6	7.2	11.3	<29 above BG

KEY:	BG = Natural Background	FC = Fecal Coliform	BOD = Biochemical Oxygen DemandTP = Total Phosphorus
	TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)	TC = Total Coliform	DO = Dissolved Oxygen

TABLE 3
LAKE McCOY – NORTH (STATION 5 & BW 41)

Parameter	Date	01/13/69	02/24/69	03/24/69	04/07/69	05/20/69	06/16/69	07/28/69	08/11/69	09/08/69	10/07/69	12/02/69		Avg. 1969	Chp. 62–302 FAC, C–III FW
	Units														
Alkalinity	mg/l as CaCO3	22.1	39.5	43.0		59.4	68.0	60.0	49.0	47.0	55.0	54.0		49.7	Shall not be depressed below 20
Ammonia	mg/l NH3–N	0.16						0.30	0.20		0.10			0.20	Complex Rule, Nutrients
BOD	mg/l	1.4		0.80	1.4			4.0						1.9	Complex Rule
Chlorides	mg/l	16.0	26.0	31.0	37.0	30.0	32.0		21.0	22.0	25.0	28.0		26.8	10% above BG, Complex Rule
Chlorophyll a	mg/m3							55.9			343.0			199.5	
Conductance	umhos/cm														50% above BG, Complex Rule
Copper	ug/l														<1.52
DO	mg/l	7.40	7.50	1.40	2.40	1.00		7.40	6.30	5.90	7.70	6.40		5.3	Shall not be <5, Complex Rule
Temperature	degree C	14.0	16.0	21.0	22.0	29.5	31.0	28.0	29.0	28.0	28.0	17.0		24.0	
Hardness	mg/l as CaCO3														
Iron	mg/l														<1.0
TC	col/100ml	1	2	7	1				5000	900	26000			4559	<1000, Complex Rule
FC	col/100ml														<200, Complex Rule
TN	mg/l	0.84	1.41	1.05	1.79	3.94	1.92	0.63	2.44	1.53	2.49	1.87		1.81	Complex Rule, Nutrients
TP	mg/l	0.075	5.8	7.9	12.5	13.3	7.9	13.0	11.9	9.3	9.1	21.8		10.2	Complex Rule, Nutrients
pH	SU	7.00	7.20	7.00		7.25	7.60	7.30	7.10	6.80	7.80	7.40		7.25	Complex Rule, based on BG
Secchi	meters														
Turbidity	NTU														<29 above BG

Parameter	Date	01/12/70	02/10/70	03/09/70	04/06/70	05/04/70	06/29/70	07/13/70	08/10/70	09/21/70	10/05/70	11/02/70	12/14/70	Avg. 1970	Chp. 62–302 FAC, C–III FW
	Units														
Alkalinity	mg/l as CaCO3	56.0		48.0	52.0	72.0	62.0	54.0	92.0	39.0	56.0	71.0		60.2	Shall not be depressed below 20
Ammonia	mg/l NH3–N	0.80	0.90	0.11	0.21	0.82	0.09							0.49	Complex Rule, Nutrients
BOD	mg/l	1.1					9.0	9.4	12.0	3.4	5.5	4.5		6.4	Complex Rule
Chlorides	mg/l	25.0		26.0	24.0	27.0	20.0	24.0	22.0	24.0	24.0			24.0	10% above BG, Complex Rule
Chlorophyll a	mg/m3	20.9	25.0		262	125		71.4			73.8		11.50	84.2	
Conductance	umhos/cm	260	245	225	240	260	260	250	270	221	238	247		247	50% above BG, Complex Rule
Copper	ug/l														<1.52
DO	mg/l	5.4	5.0	15.7	11.6	15.4	11.8	11.7	12.8	4.5	5.9	5.4		9.6	Shall not be <5, Complex Rule
Temperature	degree C	15.0	13.0	17.0	23.0	27.0	29.0	29.0	28.0	32.0	28.0	25.0		24.2	
Hardness	mg/l as CaCO3														
Iron	mg/l														<1.0
TC	col/100ml							2500	1200					1850	<1000, Complex Rule
FC	col/100ml														<200, Complex Rule
TN	mg/l	1.52	2.35	2.54	2.99	4.11	2.18	2.06	2.56	2.84	2.48	2.02		2.51	Complex Rule, Nutrients
TP	mg/l	15.2	7.4	9.1	11.8	13.7	12.0	13.7		12.7	10.0	7.8		11.3	Complex Rule, Nutrients
pH	SU	7.80		7.55	7.50	7.65	8.10	7.40	8.30	7.30	7.40	7.40		7.64	Complex Rule, based on BG
Secchi	meters	1.22	1.22		0.61	0.46		0.46			0.30		1.07	0.76	
Turbidity	NTU	1.2	1.2	12.0	6.1	20.0	25.0	10.0	16.0	20.5	16.3	14.0		12.9	<29 above BG

KEY:

BG = Natural Background

TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)

FC = Fecal Coliform

TC = Total Coliform

BOD = Biochemical Oxygen Demand

DO = Dissolved Oxygen

TP = Total Phosphorus

Avg. = Average

TABLE 3
LAKE McCOY – NORTH (STATION 5 & BW 41)

Parameter	Date	01/11/71	02/08/71	03/08/71	04/12/71	05/10/71	06/07/71	07/12/71	07/13/71	08/10/71	09/08/71	10/12/71	Avg. 1971	01/03/72	02/08/72	03/06/72	Chp. 62–302 FAC, C–III FW
	Units																
Alkalinity	mg/l as CaCO3	61.0	55.0	56.0	71.0	64.0	66.0	36.0	54.3	118	43.0		62.4	50.0	33.7		Shall not be depressed below 20
Ammonia	mg/l NH3–N	0.19		0.61			0.07			0.53	0.48	0.92	0.47			0.05	Complex Rule, Nutrients
BOD	mg/l	11.9	7.8		5.1		7.1	8.4	9.4				8.3				Complex Rule
Chlorides	mg/l	34.0	25.0	20.0	22.0	32.0	25.0	15.0	24.0	16.0	21.0	24.0	23.5	25.0	31.0		10% above BG, Complex Rule
Chlorophyll a	mg/m3	36.9	44.5	17.4	31.8		62.3	57.1			63.3	73.0	48.3	57.1			
Conductance	umhos/cm	244	249	264	265	343	367	261		250	264	285	279	221			50% above BG, Complex Rule
Copper	ug/l																<1.52
DO	mg/l	16.1	10.0	7.0	7.6	5.3		8.8	11.7				9.5				Shall not be <5, Complex Rule
Temperature	degree C	18.5	19.0		22.5	27.0	27.0	31.0	29.0	28.0	28.5	24.5	25.5	21.0		22.5	
Hardness	mg/l as CaCO3																
Iron	mg/l																<1.0
TC	col/100ml				1700			2000	25	21000	2000		5345		1800		<1000, Complex Rule
FC	col/100ml																<200, Complex Rule
TN	mg/l	1.79	1.97	2.79	1.85	0.30	4.11			3.40			2.32			2.39	Complex Rule, Nutrients
TP	mg/l	10.5		12.0	15.8	4.1	15.0	1.1	13.7	0.9	7.1	6.2	8.6			5.75	Complex Rule, Nutrients
pH	SU	7.15	7.55	7.20	7.90	8.00	8.50	5.95	7.40	7.45	7.13		7.42	7.46		6.00	Complex Rule, based on BG
Secchi	meters	0.91		1.22	0.46		0.46						0.76	0.46		0.30	
Turbidity	NTU	21.0	8.0	3.0	9.0	9.0	3.0		10.0				9.0	5.4		6.0	<29 above BG

Parameter	Date	03/06/72	05/02/72	06/21/72	08/08/72	Avg. 1972	06/04/73	Avg. 1973	07/16/80	Avg. 1980	01/26/81	04/14/81	Avg. 1981	Culm. Avg.			Chp. 62–302 FAC, C–III FW
	Units																
Alkalinity	mg/l as CaCO3				27.0	36.90	59.0				6.1	6.1	6.1	52.9			Shall not be depressed below 20
Ammonia	mg/l NH3–N				0.08	0.07	0.20				0.16	0.09	0.13	0.34			Complex Rule, Nutrients
BOD	mg/l										4.90	5.60	5.3	5.93			Complex Rule
Chlorides	mg/l				21.0	25.7	29.0	29.0			19.0	24.0	21.5	24.8			10% above BG, Complex Rule
Chlorophyll a	mg/m3		17.6	31.6	37.1	35.9	44.1	44.1			19.0	76.2	47.6	69.1			
Conductance	umhos/cm				260	251	280	280			195	214	205	256			50% above BG, Complex Rule
Copper	ug/l				0.04	0.04					<1.0	<1.0	<1.0	0.01			<1.52
DO	mg/l						2.9	2.9			9.3	6.4	7.9	7.9			Shall not be <5, Complex Rule
Temperature	degree C		24.0		29.0	24.1	27.0	27.0			13.0	24.0	18.5	24.2			
Hardness	mg/l as CaCO3				53.5	53.5	51.7	51.7						52.6			
Iron	mg/l										<0.05	<0.05	<0.05	<0.05			<1.0
TC	col/100ml	1200			5400	2800	180	180	<100	<100	<20	38	19.0	3379			<1000, Complex Rule
FC	col/100ml								22	22	<20	24	12.0	15.3			<200, Complex Rule
TN	mg/l				1.31	1.85	2.48	2.48			1.93	4.82	3.4	2.26			Complex Rule, Nutrients
TP	mg/l				6.08	5.92	2.76	2.76			0.03	0.07	0.05	9.1			Complex Rule, Nutrients
pH	SU				7.30	7.59	6.90	6.90			6.20	6.10	6.15	7.36			Complex Rule, based on BG
Secchi	meters		1.37		0.61	0.69	0.86	0.86			0.18		0.18	0.72			
Turbidity	NTU		5.1		4.2	5.2	5.0	5.0			2.8	9.1	6.0	9.7			<29 above BG

KEY:

BG = Natural Background

TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)

FC = Fecal Coliform

TC = Total Coliform

BOD = Biochemical Oxygen Demand

DO = Dissolved Oxygen

TP = Total Phosphorus

Avg. = Average

TABLE 4

LAKE McCOY – NORTH (MID) STATION 6

Parameter	Date	09/09/71	Average	Chp. 62–302 FAC, C–III FW
	Units			
Alkalinity	mg/l as CaCO3	7.0	7.0	Shall not be depressed below 20
Ammonia	mg/l NH3–N	1.77	1.77	Complex Rule, Nutrients
Chlorides	mg/l	20.0	20.0	10% above BG, Complex Rule
Conductance	umhos/cm	235	235	50% above BG, Complex Rule
TN	mg/l			Complex Rule, Nutrients
TP	mg/l	8.75	8.75	Complex Rule, Nutrients
pH	SU	7.30	7.30	Complex Rule, based on BG
Temperature	degree C	27.0	27.0	
Turbidity	NTU			<29 above BG

LAKE McCOY – NORTH (EAST SHORE) STATION 7

Parameter	Date	09/09/71	Average	Chp. 62–302 FAC, C–III FW
	Units			
Alkalinity	mg/l as CaCO3	6.0	6.0	Shall not be depressed below 20
Ammonia	mg/l NH3–N	1.54	1.54	Complex Rule, Nutrients
Chlorides	mg/l	19.0	19.0	10% above BG, Complex Rule
Conductance	umhos/cm	206	206	50% above BG, Complex Rule
TN	mg/l			Complex Rule, Nutrients
TP	mg/l	5.26	5.26	Complex Rule, Nutrients
pH	SU	7.50	7.50	Complex Rule, based on BG
Temperature	degree C			
Turbidity	NTU	4.0	4.0	<29 above BG

LAKE McCOY – FAR NORTH (MID) STATION 8

Parameter	Date	09/09/71	Average	Chp. 62–302 FAC, C–III FW
	Units			
Alkalinity	mg/l as CaCO3	4.0	4.0	Shall not be depressed below 20
Ammonia	mg/l NH3–N			Complex Rule, Nutrients
Chlorides	mg/l	16.0	16.0	10% above BG, Complex Rule
Conductance	umhos/cm	127	127	50% above BG, Complex Rule
TN	mg/l			Complex Rule, Nutrients
TP	mg/l	2.26	2.26	Complex Rule, Nutrients
pH	SU	6.25	6.25	Complex Rule, based on BG
Temperature	degree C	27.0	27.0	
Turbidity	NTU	4.0	4.0	<29 above BG

KEY:
BG = Natural Background
TP = Total Phosphorus
TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)

TABLE 5
DREAM LAKE – MIDDLE (STATION BW 20)

Parameter	Date	04/28/70	08/24/71	07/01/75	09/09/75	06/22/77	03/03/94	03/10/94	Average	Chp. 62–302 FAC, C–III FW
	Units									
Alkalinity	mg/l as CaCO3	36.0	45.3		47.2				42.8	Shall not be depressed below 20
Ammonia	mg/l NH3–N	0.27	0.56		0.05		0.16		0.26	Complex Rule, Nutrients
BOD	mg/l	11.0			2.0		0.30		4.4	Complex Rule
Chlorides	mg/l	13.0	18.3		17.0				16.1	10% above BG, Complex Rule
Chlorophyll a	mg/m3	60.6	31.0		22.3		5.0	22.2	28.2	
Conductance	umhos/cm	240	240		280				253	50% above BG, Complex Rule
DO	mg/l	15.1			8.5				11.8	Shall not be <5, Complex Rule
TC	col/100ml			14200	1300	170	54	50	3155	<1000, Complex Rule
FC	col/100ml			285	50	28	8	24	79	<200, Complex Rule
TN	mg/l	2.36	1.43				11.60		5.13	Complex Rule, Nutrients
TP	mg/l	0.030	0.770				0.100		0.300	Complex Rule, Nutrients
pH	SU	9.45	7.13		7.20				7.93	Complex Rule, Based on BG
Secchi	meters		2.7		1.2				2.0	
Turbidity	NTU				4.0				4.0	<29 above BG
Temperature	degree C	26.0	26.4		29.0				27.1	

KEY:

BG = Natural Background
TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)
BOD = Biochemical Oxygen Demand
DO = Dissolved Oxygen
FC = Fecal Coliform
TC = Total Coliform
TP = Total Phosphorus

TABLE 6

LAKE CORONI (STATION BW 17)

Parameter	Date	08/23/71	Average	Chp. 62-302 FAC, C-III FW
	Units			
Alkalinity	mg/l as CaCO3	36.0	36.0	Shall not be depressed below 20
Ammonia	mg/l NH3-N	0.12	0.12	Complex Rule, Nutrients
Chlorides	mg/l	11.0	11.0	10% above BG, Complex Rule
Conductance	umhos/cm	195	195	50% above BG, Complex Rule
TN	mg/l	1.48	1.48	Complex Rule, Nutrients
TP	mg/l	0.91	0.91	Complex Rule, Nutrients
pH	SU	7.08	7.08	Complex Rule, based on BG
Temperature	degree C	30.0	30.0	
Secchi	meters	0.76	0.76	
Chlorophyll a	mg/m3	27.4	27.4	

KEY: BG = Natural Background TP = Total Phosphorus

TN = Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)

TABLE 7
LAKE PREVATT (STATION BW 52)

Parameter	Date	02/10/87	06/10/87	Avg. 1987	02/08/88	05/16/88	08/16/88	11/02/88	Avg. 1988	02/13/89	06/09/89	Avg. 1989	09/11/91	12/02/91	Avg. 1991	Chp. 62-302 FAC, C-III FW
	Units															
Alkalinity	mg/l as CaCO3	19.1	25.5	22.3	19.8	19.6	18.8	23.1	20.3	14.4	17.9	16.2	30.0	21.0	25.5	Shall not be depressed below 20
Aluminum	mg/l		<0.01	<0.01	0.17	0.71	0.51	0.15	0.39				<0.5		<0.5	
Ammonia	mg/l NH3-N	<0.05	<0.04	<0.05	<0.04	<0.04	1.23	0.05	0.32	<0.01	0.08	0.04	0.05	0.04	0.05	Complex Rule, Nutrients
Arsenic	ug/l												<5		<5	<50
BOD	mg/l		3.00	3.00	4.60		11.70	5.30	7.20	6.30		6.30	7.20	6.30	6.75	Complex Rule
Cadmium	ug/l		31.00	31.00	<1	10.00	<1	1.00	2.75				0.20		0.20	<0.1
Chlorides	mg/l												9.0	8.0	8.5	10% above BG, Complex Rule
Chlorophyll a	mg/m3	67.3	42.1	54.7	18.1	63.1	167.0	55.7	76.0	45.5	41.3	43.4	82.3	83.1	82.7	
Conductance	umhos/cm	88	130	109	190	105	46	140	120	132	123	128	113	106	110	50% above BG, Complex Rule
Copper	ug/l		27.0	27.0	17.0	38.0	21.0	20.0	24.0				4.8		4.8	<1.52
DO	mg/l	9.00	2.90	5.95	6.90	6.30	4.30	3.60	5.28	5.50	7.00	6.25	11.00	3.00	7.00	Shall not be <5, Complex Rule
Temperature	degree C	16.0	26.5	21.3	19.0	27.4	29.0	20.6	24.0	15.2	21.4	18.3	26.9	21.9	24.4	
Hardness	mg/l as CaCO3		18.9	18.9	18.0	22.9	16.8	25.7	20.9				35.1		35.1	
Iron	mg/l		0.11	0.11	0.04	0.06	0.08	0.07	0.06				0.03		0.03	<1.0
Lead	ug/l		24.0	24.0	7.0	<1		70.0	25.7				0.5		0.5	<1.0
Mercury	ug/l												<0.2		<0.2	<0.012
Nickel	ug/l		3.0	3.0	2.7	3.0	1.1	<10	1.7				<40		<40	<4.12
TC	col/100ml	<20	60	30	100	265	800	590	439	470	50	260	210	90	150	<1000, Complex Rule
FC	col/100ml	<20	9	4.5	34	55	600	70	187	4	40	22	20	100	60	<200, Complex Rule
TN	mg/l		0.63	0.63	0.72	1.13	1.83	0.74	1.11	0.71	2.10	1.41	1.89	2.23	2.06	Complex Rule, Nutrients
TP	mg/l	0.115	0.101	0.11	0.074	0.090	0.161	0.060	0.10	0.094	0.092	0.09	0.142	0.058	0.10	Complex Rule, Nutrients
pH	SU	7.30	6.90	7.10	6.40	6.40	6.70	6.30	6.45	6.80	6.80	6.80	6.40	6.50	6.45	Complex Rule, based on BG
Secchi	meters		0.6	0.6		0.5		0.9	0.7	0.5	0.3	0.4				
Selenium	ug/l												<5		<5	<5.0
Turbidity	NTU	3.30	2.80	3.05	2.80	10.20	12.50	3.60	7.28	4.30	5.80	5.05	1.60	1.80	1.70	<29 above BG
Zinc	ug/l		99.0	99.0		43.0	28.0	21.0	30.7				<5		<5	<3.72

KEY:

BG - Natural Background
TN - Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)
FC - Fecal Coliform
TC - Total Coliform
BOD - Biochemical Oxygen Demand
DO - Dissolved Oxygen
TP - Total Phosphorus
Avg. - Average

TABLE 7
LAKE PREVATT (STATION BW 52)

Parameter	Date	03/02/92	06/24/92	09/09/92	09/16/92	11/18/92	Avg. 1992	03/01/93	06/08/93	09/08/93	11/17/93	Avg.1993	02/23/94	05/31/94	08/23/94	11/01/94	Avg. 1994	02/14/95	Cum. Avg	Chp. 62-302 FAC, C-III FW
	Units																			
Alkalinity	mg/l as CaCO3	13.0	14.0	34.0		29.0	22.5	25.0	25.0	27.0	25.0	25.3	28.0	34.0	51.0	42.0	38.9	20.6	25.5	Shall not be depressed below 20
Aluminum	mg/l	<0.5	<0.5	<0.5			<0.5			<0.5	<0.5	<0.5	<0.5		<0.5		<0.5		0.10	
Ammonia	mg/l NH3-N	0.03	0.03	0.02		0.07	0.04	0.06	0.05	0.02	0.13	0.07	0.04	0.05	0.09	0.03	0.05	0.06	0.10	Complex Rule, Nutrients
Arsenic	ug/l	<5	<5	<5			<5	<5				<5							<5	<50
BOD	mg/l	3.00	3.30	3.30		2.70	3.08	6.90	6.50	6.00	1.40	5.20	2.70	11.40		12.90	9.00	2.50	5.60	Complex Rule
Cadmium	ug/l	0.10	0.50	0.70			0.43	0.30				0.30							4.40	<0.1
Chlorides	mg/l	10.0	15.0	14.0		16.0	13.8	15.0				15.0							12.4	10% above BG, Complex Rule
Chlorophyll a	mg/m3	5.4	24.6	14.1		7.6	12.9	9.4	7.1	11.6	7.9	9.0	6.9	40.9	6.2	76.8	32.7	4.9	35.8	
Conductance	umhos/cm	95	109	136		215	139	123	133	109	114	120	92	161	201		158	95	126	50% above BG, Complex Rule
Copper	ug/l	0.8	0.8	1.0			0.9	<0.02		<0.02	<0.02	<0.02	30.0		8.0		19.0		12.0	<1.52
DO	mg/l	2.60	2.10	2.40		4.10	2.80	5.40	3.40	3.00	4.10	3.98	3.25	4.11	6.23		4.53	9.55	4.90	Shall not be <5, Complex Rule
Temperature	degree C	17.4	27.4	26.5		17.6	22.3	14.6	29.2	25.5	20.6	22.6	23.7	20.0	28.6	25.2	24.4	19.9	23.1	
Hardness	mg/l as CaCO3	23.9	26.0	44.9			31.6	40.1		42.5	36.2	39.6	32.1		78.9		55.5		33.0	
Iron	mg/l	0.10	0.21	0.10			0.14	0.10		0.08	<0.03	0.06	0.07		0.01		0.04		0.10	<1.0
Lead	ug/l	<0.5	<0.5	<0.5			<0.5	5.6		5.0	4.3	4.9	3.5		2.0		2.8		9.4	<1.0
Mercury	ug/l	<0.2	<0.2	<0.2			<0.2	<0.2				<0.2							<0.2	<0.012
Nickel	ug/l	<40	<40	<40			<40	<40		<40	<40	<40	<40		<40		<40		0.7	<4.12
TC	col/100ml	410	900	800	7700	960	2134	660	800	272	420	543	260	2	260	34	139	72	971	<1000, Complex Rule
FC	col/100ml	<2	260	600	10	22	176	6	230	220	620	269	22	12	40	2	19	21	128	<200, Complex Rule
TN	mg/l	2.11	2.90	1.15		1.48	1.91	1.32	1.26	1.08	1.12	1.20	1.39	1.93	0.63	1.20	1.29	1.02	1.40	Complex Rule, Nutrients
TP	mg/l	0.006	0.119	0.024		0.120	0.07	0.032	0.104	0.091	0.013	0.06	0.023	0.149	0.022	0.061	0.07	0.026	0.100	Complex Rule, Nutrients
pH	SU	6.10	6.10	6.10		6.20	6.13	5.20	6.50	6.40	6.30	6.35	6.70	6.80	7.10	7.00	6.90	6.56	6.60	Complex Rule, based on BG
Secchi	meters		0.9			1.3	1.1								2.0	2.5	2.25	1.5	1.1	
Selenium	ug/l	<5	<5	9.00			3.00	<5				<5							1.80	<5.0
Turbidity	NTU	0.70	2.20	1.80		1.10	1.48	1.20	1.50		2.80	1.83	1.10	11.80	1.10	4.00	4.50	0.80	3.60	<29 above BG
Zinc	ug/l	<5	15.0	8.0			7.7	9.0		14.0	6.0	9.7	<5		<5		<5		10.7	<3.72

KEY:

BG – Natural Background
TN – Total Nitrogen (sum of nitrite, nitrate, ammonia, organic nitrogen)
FC – Fecal Coliform
TC – Total Coliform
BOD – Biochemical Oxygen Demand
DO – Dissolved Oxygen
TP – Total Phosphorus
Avg. – Average

Lake McCoy

The data for Lake McCoy were primarily obtained between 1969 and 1973. Information on the physical characteristics of the drainage basin during this monitoring period was not made available. The upper end (southern) of Lake McCoy, as represented by the data displayed in Table 1 (i.e., Station 3), was monitored between January 1969 and May 1970. There are no other data available for this monitoring point.

The researchers primarily monitored Station 3 for pH, alkalinity, chlorides, dissolved oxygen (DO), biochemical oxygen demand (BOD), and nutrients. During the monitoring period (1969 to 1970), DO measurements were routinely made. The DO measurements ranged from 0.2 to 7.8 mg/l and averaged 2.4 mg/l. Additionally, BOD measurements were added during 1970 and ranged between 12 and 21 mg/l and appear elevated. The DO during this time frame appears to have been routinely depressed below the current FDEP Class III criteria (> 5.0 mg/l) and may be the associated with the elevated BOD. The nutrients (total nitrogen and total phosphorous) also appear to be elevated, averaging 6.87 and 18.9 mg/l respectively.

Data for Station 8 (Table 4), which is presumed to be located in the middle of the far North lobe of Lake McCoy (at the discharge end of the lake), were developed during a single September 1971 sampling event. Chlorides, alkalinity, specific conductance, total phosphorous, pH, and turbidity were monitored. The alkalinity (4.0 mg/l) during this event appears to be depressed below the current water quality criteria of 20 mg/l and total phosphorous was measured at 2.26 mg/l.

The most extensive data set for Lake McCoy was developed at Station 5, which is presumed to be the geographical center of the lake. Sampling at this site was completed approximately monthly between January 1969 and October 1971, and sporadically in 1972 and one time in 1973. Sampling resumed at this location in January 1981 and April 1981. No data were available after 1981.

Beginning in January 1969, the parameters monitored included alkalinity, BOD, chlorides, DO, total nitrogen, total phosphorous, pH, total and fecal coliforms, chlorophyll A, temperature, and ammonia. In January 1970 turbidity was added to the parameter list. Based on the selected parameters, it is apparent that the researchers were focused on the effects of biological growth (bacteria and algae) and their growth response to available nutrients (i.e.,total nitrogen, total phosphorous, ammonia) and oxygen (DO and BOD).

The data, as shown on Table 3, suggest that algae growth in the lake was a problem during the period 1969 through 1973. This is indicated by DO values above the theoretical saturation limit, suggesting the measurements reflect oxygen contribution from an algal mass. This can be demonstrated by the data from March 1970 to August 1970 where the DO ranged from 11.6 to 15.7 mg/l, and the water temperature ranged from 17 to 29 °C. Under the theoretical saturation limit for oxygen, these DO measurements should have ranged from 7.8 to 9.7 mg/l. Also, chlorophyll A, an indicator of algal growth, fluctuated between 71.4 to 262 mg/m^3 during this time frame. The nutrients available during 1969 through 1973 were sufficient to support an elevated algal mass. Total nitrogen was present at concentrations ranging from 0.30 to 4.11 mg/l and total phosphorous was present at concentrations ranging from 0.075 to 21.8 mg/l.

In addition to the nutrients associated with algae, the early researchers also evaluated the presence of coliform in Lake McCoy. As shown on Table 3, the total and fecal coliform counts at Station 5 frequently exceeded the current water quality standard in 1969 and 1970. The exceedences of the current standard, however, were not consistent and the available data do not show a pattern that can be attributed to seasonal changes in the lake.

Between 1972 and 1973 sporadic monitoring was completed in Lake McCoy. The results indicated that total coliforms continued to exceed the current water quality criteria at Station 5. During this period, the researchers continued to evaluate coliforms (total and fecal), chlorophyll A (attributed to algae), nutrients, temperature, turbidity, and transparency (measured using a Secchi disk and used as an indirect measurement of the algae presence in the lake). These parameters indicate the researchers continued to be interested in the presence of algae and coliforms in Lake McCoy.

There are no data available from Lake McCoy since April 1981. During 1981, Station 5 showed a decrease in the coliform and total phosphorous levels that had predominated during the early 1970s. However, the chlorophyll A levels measured during April 1981 (76.2 mg/m^3) continued to indicate that an elevated algal mass was present in the lake. The total nitrogen levels appear to be consistent with the earlier data. Also, the alkalinity (6.1 mg/l) seems to have been depressed below the current FDEP Class III criteria of 20 mg/l.

From the water quality data compiled by the researchers during the late 1960's and early 1970's, it appears that Lake McCoy was nutrient-rich, which resulted in an increased biological growth of algae. It is likely that the lake was experiencing conditions consistent with an eutrophic to hypereutrophic state. However, because there have been no data collected since 1981 (15 years), no statements regarding the lake's current water quality and tropic conditions can be made from the available database.

Dream Lake

Dream Lake, which discharges to Lake McCoy, was monitored sporadically between 1970 and 1994, but no samples were collected between June 1977 and March 1994. Table 5 contains a summary of all available data for Dream Lake.

Between April 1970 and September 1975, the researchers monitored alkalinity, ammonia, BOD, chlorides, specific conductance, DO, total nitrogen and phosphorous, pH, total and fecal coliforms, chlorophyll A, turbidity ,and temperature. In 1977 and 1994 the parameters evaluated included BOD (one time only), total nitrogen, total phosphorous, total and fecal coliforms, chlorophyll A, and ammonia.

It appears that the BOD of this lake dropped between 1970 and 1994. In 1994 the total nitrogen (11.6 mg/l) was approximately 6 times the average level measured between 1970 and 1971 (1.90 mg/l). The 1994 total phosphorous measurement (0.10 mg/l), however, was one-fourth the previous average (0.40 mg/l). Coliforms and chlorophyll A had decreased substantially between 1970 and 1994. Ammonia was essentially at the same levels throughout the monitoring period.

Lake Coroni

The data for Lake Coroni were developed during a single sampling event in August 1971 (see Table 6). At that time, the apparent water quality in Lake Coroni was good, but the nutrient levels may have been showing signs of enrichment. There have been no measurements of this lake's quality since 1971, and there is no information available pertaining to possible changes in the water shed that could have impacted the 1971 water quality.

The Central Florida area has been the subject of periodic drought conditions, some severe from the mid 1970's until recently when rainfall amounts appear to have resumed more normal accumulation rates. Also, record amounts of rainfall were recorded with the appearance of the 1995 tropical storm season (i.e., Tropical Storm Jerry). Because of this, it is believed that there has not been a routine discharge from Lake McCoy to Lake Coroni, nor was there a routine discharge from Lake Coroni to Lake Prevatt in the past 20 years. It is possible that, with the resumption of normal rainfall conditions, the discharge from Lake McCoy to Lake Coroni may contain unusually high concentrations of certain compounds as a result of "flushing" from the upper lake. However, the current effect, if any, of Lake McCoy on Lake Coroni cannot be determined or assumed from the available Lake Coroni database.

Lake Prevatt

The Lake Prevatt data are the most current for this drainage system. The lake has been monitored by Orange County on a quarterly basis from February 1987 until February 1995. In addition to the parameters that have been monitored in the other lakes, metals including arsenic, cadmium, copper, iron, lead, mercury, nickel, selenium, and zinc were evaluated at this station. The data for this lake are presented in Table 7.

The data show that for 8 of the 12 sampling events between February 1987 and June 1992 the lake's alkalinity was depressed below the current FDEP Class III criteria (20 mg/l) and averaged 17.1 mg/l. From September 1992 through February 1995, the alkalinity has been in compliance, and the results average approximately 10 mg/l above the criteria (average 31.2 mg/l).

Mercury has a detection limit of 0.2 mg/l, which is an order of magnitude above the criteria level. Mercury was not detected at the method detection limit; however, compliance with the FDEP Class III criteria cannot be demonstrated with the existing information. Also, cadmium, lead and zinc have exceeded the criteria several times during the study period. Selenium exceeded the FDEP Class III criteria one time, on September 9, 1992.

Chlorides were monitored between September 1991 and March 1993. During this time the concentration ranged from 8 to 16 mg/l. Hardness ranged from 16.82 mg/l to 78.89 mg/l. The pH monitored during the study period ranged from 6.1 to 7.3. The lake's DO has been below the FDEP criteria (5 mg/l) ranging from 2.1 mg/l to 4.11 mg/l several times (13) since February 1987. The BOD ranged between 1.4 and 12.9 mg/l.

The nutrient levels and chlorophyll A in Lake Prevatt suggest a healthy algal population. The total nitrogen ranges from 0.71 to 2.9 mg/l, with an average of 1.41 mg/l. The total phosphorous concentrations range from 0.013 to 0.161 mg/l, with an average of 0.079 mg/l. The chlorophyll A values range from 4.6 mg/l to 167.0 mg/l, and average 40.2 mg/l. Coliform counts in Lake Prevatt also have been monitored in excess of the FDEP Class III criteria. Total coliforms have been measured as high as 7,700 colonies/100 ml, while fecal coliform has been recorded at 620 colonies/100 ml.

Data Interpretation Limitations

The data available to this project were supplied by Orange County and were developed from sampling events between 1969 and 1995. The generated data were apparently collected, at least initially, to assess biological growth in Lake McCoy. However, during the monitoring program, the list of parameters evaluated was changed, with some parameters added and others eliminated from the database. Additionally, there is a large gap in the monitoring with no analytical results available from 1981 through 1995.

Lake Prevatt, which is the lowermost lake (northern) in the system, was monitored from 1987 through early 1995. There are no data from this lake from 1969 through 1981. Therefore, no correlation can be made between the observed quality in Lake Prevatt and the historical data collected from Lake McCoy.

During the Orange County monitoring program, the analytical techniques used to evaluate the various parameters were changed. Theses changes resulted in different detection limits. The change in methods makes it difficult to correlate the data for individual parameters, particularly at the lower concentrations. Also, some of the data were not quantified and the reported detection limits do not conform to the FDEP Class III surface water criteria requirements. No data indicative of the natural background conditions for the lakes or the receiving water body (i.e., Wekiva River) were provided for this assessment. This report has, therefore, only summarized the obvious exceedences and patterns that are apparent in the data sets and has not attempted to state whether the data demonstrate trends in water quality, either in improvement or in degradation.

Conclusions

The existing database indicates that Lake McCoy has been congested with algae in the past. Additionally, because of the past drought conditions in Florida that may have resulted in periods of no discharge from Lake McCoy, some of the available nutrients may have settled into the lake bottom and now are released by dissolution. In the event of major storm flow through this lake, bottom scouring could release these nutrients to the downgradient lakes, increasing the potential for enrichment and algae blooms in Lake Coroni and Lake Prevatt. This may be of particular concern because the Wekiva River (receiving water) is classified by the FDEP as an "Outstanding Florida Water" and is afforded special protection under these criteria. The special protection includes water quality degradation by nutrient enrichment.

In recent history (between 1981 and 1995), Lake Prevatt has shown evidence of conditions that will support biological growth. Although the quality of Lake Prevatt has not been documented at the same level of biological activities as measured in Lake McCoy in the late 1960s and early 1970s, it is possible that Lake Prevatt will achieve similar levels as previously shown upgradient.

It is possible that the levels observed in Lake Prevatt are consistent with the data set available for Lake McCoy. The lake volummes and flow rates were not available in the database to allow a general evaluation of whether the recent data directly correlate to the water mass monitored in Lake McCoy during the 1960s and 1970s.

Additionally, it should be noted that the presence or absence of pesticides in the subject lakes was never assessed during any of the water quality sampling events. These compounds are also regulated by the FDEP surface water criteria and may be of concern based on the past and present land usage of the drainage basin (i.e., agricultural).

Finally, the water quality and its relative improvement or degradation cannot be assessed without evaluation of the physical changes in the watershed during the monitoring period. For example, the nutrient levels that were observed in Lake McCoy could have been a result of a rural runoff pattern that no longer exists because of residential development. Such factors should be evaluated for their resulting effects on the water quality in the lakes.

Recommendations

Because there is no current water quality data from this drainage system, other than from Lake Prevatt and Dream Lake, prior to completing the evaluation of modifications to meet the new NPDES conditions, additional water quality data collection is recommended as follows:

- Lake McCoy - collect samples for the analysis of BOD, total phosphorous, chlorophyll A, and total nitrogen to determine whether the lake continues to be nutrient-rich. At a minimum, collect samples at Stations 3 (southern most station) and 8 (northern station at lake discharge point). Oxygen measurements should be made and correlated with the temperature, pH, and chloride content. If nutrient-rich, the discharge from this lake could have a negative impact on all downstream water bodies and contribute to algal blooms in Lakes Coroni and Prevatt.

- Lake Coroni - Collect a sample at the discharge end of the lake and evaluate it for the potential presence of nutrients, coliforms, and algae. Oxygen measurements should be made and correlated with the temperature, pH, and chloride content.

- Dream Lake - Collect a sample at the discharge end of the lake and evaluate it for nutrients, bacteria, and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this lake as a source of nutrients to the system.

- Buchan Pond - Collect a sample at the discharge end of the pond and evaluate it for nutrients, bacteria, and algae. Oxygen measurements should be correlated against temperature, pH, and chloride content. These data will be used to eliminate this pond as a source of nutrients to the system.

- Lake Prevatt - All water quality parameters should be monitored at the discharge end of this lake. In particular, all the nutrients, bacteria, and algae measurements that have been made in the past should be repeated for a current correlation of the conditions. Additionally, the mid-point of this lake should be monitored to determine whether the flow is completely mixed at this point in the drainage system.

- Wekiva River - At a minimum, the historical water quality data for the river should be collected and reviewed. Also, samples should be collected from both upstream and downstream of the Lake Prevatt discharge to the river. All of the Lake Prevatt parameters should be analyzed.

- The FDEP Class III surface water criteria analytical detection limits should be used on all future chemical analysis for the system. Also, all sample collection should be consistent with the FDEP quality assurance requirements (Chapter 62-160 FAC).

- All of the samples collected from the various points of discharge or areas of continuous flow (i.e., Wekiva River) should be made by flow weighted 24-hour composites. Samples collected from the center of Lake Prevatt should be vertical grabs from one-foot intervals to the bottom. Because of the expected shallowness of Lake McCoy's southern station (Station 3), a surface grab should be collected at this point. In-situ water quality parameters such as DO, pH, and temperature should be monitored throughout the sample collection phase (i.e., 24-hours, vertical column).

Finally, the development in the watershed should be examined against the available monitoring data. The development patterns may explain some of the apparent variations in the data that were made available to this project. The impacts of the physical changes in the watershed may be observed in the data, and the correlation may enhance the estimates of impacts on the system of the various proposed and evaluated alternatives.

APPENDIX A

①

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class I: Potable Water Supply	Class II: Shellfish Propagation or Harvesting	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife		Class IV: Agricultural Water Supplies	Class V: Navigation, Utility, and Industrial Use
				Predominantly Fresh Waters	Predominantly Marine Waters		
(1) Alkalinity	Milligrams/L as $CaCO_3$	Shall not be depressed below 20		Shall not be depressed below 20		≤ 600	
(2) Aluminum	Milligrams/L		≤ 1.5		≤ 1.5		
(3) Ammonia (un-ionized)	Milligrams/L as NH_3	≤ 0.02		≤ 0.02			
(4) Antimony	Micrograms/L	≤ 14.0	≤ 4,300	≤ 4,300	≤ 4,300		
(5) (a) Arsenic (total)	Micrograms/L	≤ 50	≤ 50	≤ 50	≤ 50	≤ 50	≤ 50
(5) (b) Arsenic (trivalent)	Micrograms/L measured as total recoverable Arsenic		≤ 36		≤ 36		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(6) Bacteriological Quality (Fecal Coliform Bacteria)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 5 samples taken over a 30 day period.	MPN shall not exceed a median value of 14 with not more than 10% of the samples exceeding 43, nor exceed 800 on any one day.	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.		
(7) Bacteriological Quality (Total Coliform Bacteria)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	≤ 1,000 as a monthly avg., nor exceed 1,000 in more than 20% of samples examined during any month, nor exceed 2,400 at any time, using either MPN or MF counts.	Median MPN shall not exceed 70, and not more than 10% of the samples shall exceed an MPN of 230.	≤ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; ≤ 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period, using either the MPN or MF counts.	≤ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; ≤ 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period, using either the MPN or MF counts.		
(8) Barium	Milligrams/L	≤ 1					
(9) Benzene	Micrograms/L	≤ 1.18	≤ 71.28 annual avg.	≤ 71.28 annual avg.	≤ 71.28 annual avg.		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(10) Beryllium	Micrograms/L	≤ 0.0077 annual avg.	≤ 0.13 annual avg.	≤ 0.13 annual avg.	≤ 0.13 annual avg.	≤ 100 in waters with a hardness in mg/L of $CaCO_3$ of less than 250 and shall not exceed 500 in harder waters	
(11) Biological Integrity	Per cent reduction of Shannon-Weaver Diversity Index	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of background levels as measured using organisms retained by a U. S. Standard No. 30 sieve and collected and composited from a minimum of three Hester-Dendy type artificial substrate samplers of 0.10 to *0.15 m^2 area each,* incubated for a period of four weeks.	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U. S. Standard No. 30 sieve and collected and composited from a minimum of three natural substrate samples, taken with *Ponar type samplers* with minimum sampling area of 225 cm^2.	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U. S. Standard No. 30 sieve and collected and composited from a minimum of three Hester-Dendy type artificial substrate *samplers of 0.10 to* 0.15 m^2 area each, incubated for a period of four weeks.	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U. S. Standard No. 30 sieve and collected and composited from a minimum of three natural substrate samples, taken with *Ponar type samplers* with minimum sampling area of 225 cm^2.		
(12) BOD *(Biochemical Oxygen Demand)*		Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established *for each class and, in no case, shall it be great enough to produce nuisance conditions.*					
(13) Boron	Milligrams/L					≤ 0.75	
(14) Bromates	Milligrams/L		≤ 100		≤ 100		
(15) Bromine (free molecular)	Milligrams/L		≤ 0.1		≤ 0.1		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(16) Cadmium	Micrograms/L See Note (3)	Cd ≤ $e^{(0.7852[\ln H]-3.49)}$;	≤ 9.3	Cd ≤ $e^{(0.7852[\ln H]-3.49)}$	≤ 9.3		
(17) Carbon tetrachloride	Micrograms/L	≤ 0.25 annual avg.; 3.0 max	≤ 4.42 annual avg.	≤ 4.42 annual avg.	≤ 4.42 annual avg.		
(18) Chlorides	Milligrams/L	≤ 250	Not increased more than 10% above normal background. Normal daily and seasonal fluctuations shall be maintained.		Not increased more than 10% above normal background. Normal daily and seasonal fluctuations shall be maintained.		*In predominantly marine waters,* not increased more than 10% above normal background. Normal daily and seasonal fluctuations shall be maintained.
(19) Chlorine (total residual)	Milligrams/L	≤ 0.01	≤ 0.01	≤ 0.01	≤ 0.01		
(20) (a) Chromium (trivalent)	Micrograms/L measured as total recoverable Chromium See Note (3).	Cr (III) ≤ $e^{(0.819[\ln H]+1.561)}$		Cr (III) ≤ $e^{(0.819[\ln H]+1.561)}$		Cr (III) ≤ $e^{(0.819[\ln H]+1.561)}$	In predominantly fresh waters, ≤ $e^{(0.819[\ln H]+1.561)}$.
(20) (b) Chromium (hexavalent)	Micrograms/L	≤ 11	≤ 50	≤ 11	≤ 50	≤ 11	In predominantly fresh waters, ≤ 11. In predominantly marine waters, ≤ 50

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

③

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(21) Chronic Toxicity (see definition in Section 62-302.200(3), F.A.C. and also see below, "Substances in concentrations which...")							
(22) Color, etc. (see also Minimum Criteria, Odor, Phenols, etc.)	Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds attributable to domestic wastes, industrial wastes, and other wastes					Only such amounts as will not render the waters unsuitable for agricultural irrigation, livestock watering, industrial cooling, industrial process water supply purposes, or fish survival.	
(23) Conductance, Specific	Micromhos/cm	Shall not be increased more than 50% above background or to 1275, whichever is greater		Shall not be increased more than 50% above background or to 1275, whichever is greater		Shall not be increased more than 50% above background or to 1275, whichever is greater	Shall not exceed 4,000
(24) Copper	Micrograms/L See Note (3).	$Cu \leq e^{(0.8545[\ln H]-1.465)}$	≤ 2.9	$Cu \leq e^{(0.8545[\ln H]-1.465)}$	≤ 2.9	≤ 500	≤ 500
(25) Cyanide	Micrograms/L	≤ 5.2	≤ 1.0	≤ 5.2	≤ 1.0	≤ 5.0	≤ 5.0
(26) Definitions (see Section 62-302.200, F.A.C.)							
(27) Detergents	Milligrams/L	≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(28) 1,1-Dichloroethylene (1,1-dichloroethene)	Micrograms/L	≤ 0.057 annual avg.; ≤ 7.0 max	≤ 3.2 annual avg.	≤ 3.2 annual avg.	≤ 3.2 annual avg.		
(29) Dichloromethane (methylene chloride)	Micrograms/L	≤ 4.65 annual avg.	≤ 1,580 annual avg.	≤ 1,580 annual avg.	≤ 1,580 annual avg.		
(30) 2,4-Dinitrotoluene	Micrograms/L	≤ 0.11 annual avg.	≤ 9.1 annual avg.	≤ 9.1 annual avg.	≤ 9.1 annual avg.		
(31) Dissolved Oxygen	Milligrams/L	Shall not be less than 5.0. Normal daily and seasonal fluctuations above this level shall be maintained.	Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.	Shall not be less than 5.0. Normal daily and seasonal fluctuations above these levels shall be maintained.	Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.	Shall not average less than 4.0 in a 24-hour period and shall never be less than 3.0.	Shall not be less than 0.3, fifty percent of the time on an annual basis for flows greater than or equal to 250 cubic feet per second and shall never be less than 0.1. Normal daily and seasonal fluctuations above these levels shall be maintained.
(32) Dissolved Solids	Milligrams/L	≤ 500 as a monthly avg.; ≤ 1,000 max				—	—
(33) Fluorides	Milligrams/L	≤ 1.5	≤ 1.5	≤ 10.0	≤ 5.0	≤ 10.0	≤ 10.0
(34) "Free Froms" (see Minimum Criteria in Section 62-302.500, F.A.C.)							

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(35) "General Criteria" (see Section 62-302.510, F.A.C. and individual criteria)							
(36) (a) Halomethanes (Total trihalomethanes) (total of bromoform, chlorodibromomethane, dichlorobromomethane, and chloroform). Individual halomethanes shall not exceed (b)1. to (b)5. below.	Micrograms/L	≤ 100					
(36) (b) 1. Halomethanes (individual): Bromoform	Micrograms/L	≤ 4.3 annual avg.	≤ 360 annual avg.	≤ 360 annual avg.	≤ 360 annual avg.		
(36) (b) 2. Halomethanes (individual): Chlorodibromomethane	Micrograms/L	≤ 0.41 annual avg.	≤ 34 annual avg.	≤ 34 annual avg.	≤ 34 annual avg.		
(36) (b) 3. Halomethanes (individual): Chloroform	Micrograms/L	≤ 5.67 annual avg.	≤ 470.8 annual avg.	≤ 470.8 annual avg.	≤ 470.8 annual avg.		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(36) (b) 4. Halomethanes (individual): Chloromethane (methyl chloride)	Micrograms/L	≤ 5.67 annual avg.	≤ 470.8 annual avg.	≤ 470.8 annual avg.	≤ 470.8 annual avg.		
(36) (b) 5. Halomethanes (individual): Dichlorobromo-methane	Micrograms/L	≤ 0.27 annual avg.	≤ 22 annual avg.	≤ 22 annual avg.	≤ 22 annual avg.		
(37) Hexachlorobutadiene	Micrograms/L	≤ 0.45 annual avg.	≤ 49.7 annual avg.	≤ 49.7 annual avg.	≤ 49.7 annual avg.		
(38) Imbalance (see Nutrients)							
(39) Iron	Milligrams/L	≤ 0.3	≤ 0.3	≤ 1.0	≤ 0.3	≤ 1.0	
(40) Lead	Micrograms/L See Note (3).	$Pb \leq e^{(1.273[\ln H]-4.705)}$.	≤ 5.6	$Pb \leq e^{(1.273[\ln H]-4.705)}$.	≤ 5.6	≤ 50	≤ 50
(41) Manganese	Milligrams/L		≤ 0.1				
(42) Mercury	Micrograms/L	≤ 0.012	≤ 0.025	≤ 0.012	≤ 0.025	≤ 0.2	≤ 0.2
(43) Minimum Criteria (see Section 62-302. 500, F.A.C.)							
(44) Mixing Zones (See Section 62-4.246, F.A.C.)							
(45) Nickel	Micrograms/L See Note (3).	$Ni \leq e^{(0.846[\ln H]+1.1645)}$	≤ 8.3	$Ni \leq e^{(0.846[\ln H]+1.1645)}$	≤ 8.3	≤ 100	

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(46) Nitrate	Milligrams/L as N	≤ 10 or that concentration that exceeds the nutrient criteria					
(47) Nuisance Species		Substances in concentrations which result in the dominance of nuisance species: none shall be present.					
(48) (a) Nutrients		The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C.					
(48) (b) Nutrients		In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.					
(49) Odor (also see Color, Minimum Criteria, Phenolic Compounds, etc.)	Threshold odor number		Shall not exceed 24 at 60 degrees C as a daily average.				Odor producing substances: only in such amounts as will not unreasonably interfere with use of the water for the designated purpose of this classification.
(50) (a) Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 10.0
(50) (b) Oils and Greases		No undissolved oil, or visible oil defined as iridescence, shall be present so as to cause taste or odor, or otherwise interfere with the beneficial use of waters.					
(51) Pesticides and Herbicides							
(51) (a) 2,4,5-TP	Micrograms/L	≤ 10					
(51) (b) 2-4-D	Micrograms/L	≤ 100					

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(51) (c) Aldrin	Micrograms/L	≤ .00013 annual avg.; 3.0 *max*	≤ .00014 annual avg.; 1.3 *max*	≤ .00014 annual avg.; 3.0 *max*	≤ .00014 annual avg.; 1.3 *max*		
(51) (d) Beta-hexachlorocyclohexane (b-BHC)	Micrograms/L	≤ 0.014 annual avg.	≤ 0.046 annual avg.	≤ 0.046 annual avg.	≤ 0.046 annual avg.		
(51) (e) Chlordane	Micrograms/L	≤ 0.00058 annual avg.; 0.0043 max	≤ 0.00059 annual avg.; 0.004 max	≤ 0.00059 annual avg.; 0.0043 max	≤ 0.00059 annual avg.; 0.004 max		
(51) (f) DDT	Micrograms/L	≤ 0.00059 annual avg.; 0.001 max	≤ 0.00059 annual avg.; 0.001 max	≤ 0.00059 annual avg.; 0.001 max	≤ 0.00059 annual avg.; 0.001 max		
(51) (g) Demeton	Micrograms/L	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1		
(51) (h) Dieldrin	Micrograms/L	≤ 0.00014 annual avg.; 0.0019 max	≤ 0.00014 annual avg.; 0.0019 max	≤ 0.00014 annual avg.; 0.0019 max	≤ 0.00014 annual avg.; 0.0019 max		
(51) (i) Endosulfan	Micrograms/L	≤ 0.056	≤ 0.0087	≤ 0.056	≤ 0.0087		
(51) (j) Endrin	Micrograms/L	≤ 0.0023	≤ 0.0023	≤ 0.0023	≤ 0.0023		
(51) (k) Guthion	Micrograms/L	≤ 0.01	≤ 0.01	≤ 0.01	≤ 0.01		
(51) (l) Heptachlor	Micrograms/L	≤ 0.00021 annual avg.; 0.0038 max	≤ 0.00021 annual avg.; 0.0036 max	≤ 0.00021 annual avg.; 0.0038 max	≤ 0.00021 annual avg.; 0.0036 max		
(51) (m) Lindane (g-benzene hexachloride)	Micrograms/L	≤ 0.019 annual avg.; 0.08 max	≤ 0.063 annual avg.; 0.16 max	≤ 0.063 annual avg.; 0.08 max	≤ 0.063. annual avg.; 0.16 max		
(51) (n) Malathion	Micrograms/L	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1		
(51) (o) Methoxychlor	Micrograms/L	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03		
(51) (p) Mirex	Micrograms/L	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(51) (q) Parathion	Micrograms/L	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04		
(51) (r) Toxaphene	Micrograms/L	≤ 0.0002	≤ 0.0002	≤ 0.0002	≤ 0.0002		
(52) (a) pH (Class I and Class IV Waters)	Standard Units	Shall not vary more than one unit above or below natural background provided that the pH is not lowered to less than 6 units or raised above 8.5 units. If natural background is less than 6 units, the pH shall not vary below natural background or vary more than one unit above natural background. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below background.					
(52) (b) pH (Class II Waters)	Standard Units	Shall not vary more than one unit above or below natural background of coastal waters as defined in Section 62-302.520(3)(b), F.A.C., or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided that the pH is not lowered to less than 6.5 units or raised above 8.5 units. If natural background is less than 6.5 units, the pH shall not vary below natural background or vary more than one unit above natural background for coastal waters or more than two-tenths unit above natural background for open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of coastal waters or more than two-tenths unit below natural background of open waters.					
(52) (c) pH (Class III Waters)	Standard Units	Shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal waters as defined in Section 62-302.520(3)(b), F.A.C. or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided that the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units, in predominantly fresh waters or 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit below natural background of open waters.					
(52) (d) pH (Class V Waters)	Standard Units	Not lower than 5.0 nor greater than 9.5 except certain swamp waters which may be as low as 4.5.					
(53)(a) Phenolic Compounds: Total		Phenolic compounds other than those produced by the natural decay of plant material, listed or unlisted, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.					

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(53) (b) Phenolic Compounds: Total	Micrograms/L	1. The total of all chlorinated phenols, and chlorinated cresols, except as set forth in (c) 1. to (c) 4. below, shall not exceed 1.0 unless higher values are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. 2. The compounds listed in (c) 1. to (c) 6. below shall not exceed the limits specified for each compound.					1. The total of the following Phenolic compounds shall not exceed 50: a) Chlorinated phenols; b) Chlorinated cresols; and c) 2,4-dinitrophenol.
(53) (c) 1. Phenolic Compound: 2-chlorophenol	Micrograms/L	≤ 120	< 400 See Note (4).	< 400 See Note (4).	< 400 See Note (4).	< 400 See Note (4).	
(53) (c) 2. Phenolic Compound: 2,4-dichlorophenol	Micrograms/L	< 93 See Note (4).	< 790 See Note (4).	< 790 See Note (4).	< 790 See Note (4).	< 790 See Note (4).	
(53) (c) 3. Phenolic Compound: Pentachlorophenol	Micrograms/L	≤ 30 max; ≤ 0.28 annual avg; $\le e^{(1.005[pH]-5.29)}$	≤ 7.9	≤ 30 max; ≤ 8.2 annual avg; $\le e^{(1.005[pH]-5.29)}$	≤ 7.9	≤ 30	
(53) (c) 4. Phenolic Compound: 2,4,6-trichlorophenol	Micrograms/L	≤ 2.1 annual avg.	≤ 6.5 annual avg.	≤ 6.5 annual avg.	≤ 6.5 annual avg.	≤ 6.5 annual avg.	
(53) (c) 5. Phenolic Compound: 2,4-dinitrophenol	Milligrams/L	≤ 0.0697 See Note (4).	≤ 14.26 See Note (4).	≤ 14.26 See Note (4).	≤ 14.26 See Note (4).	≤ 14.26 See Note (4).	
(53) (c) 6. Phenolic Compound: Phenol	Milligrams/L	≤ 0.3	≤ 0.3	≤ 0.3	≤ 0.3	≤ 0.3	≤ 0.3
(54) Phosphorus (Elemental)	Micrograms/L		≤ 0.1		≤ 0.1		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(55) Phthalate Esters	Micrograms/L	≤ 3.0		≤ 3.0			
(56) Polychlorinated Biphenyls (PCBs)	Micrograms/L	≤ 0.000044 annual avg.; 0.014 max	≤ 0.000045 annual avg.; 0.03 max	≤ 0.000045 annual avg.; 0.014 max	≤ 0.000045 annual avg.; 0.03 max		
(57) (a) Polycyclic Aromatic Hydrocarbons (PAHs). Total of: Acenaphthylene; Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoranthene; Benzo-(ghi)perylene; Benzo(k)fluoranthene; Chrysene; Dibenzo-(a,h)anthracene; Indeno(1,2,3-cd)pyrene; and Phenanthrene	Micrograms/L	≤ 0.0028 annual avg.	≤ 0.031 annual avg.	≤ 0.031 annual avg.	≤ 0.031 annual avg.		
(57) (b) 1 ~~5~~. (Individual PAHs): Acenaphthene	Milligrams/L	< 1.2 See Note (4).	< 2.7 See Note (4).	< 2.7 See Note (4).	< 2.7 See Note (4).		
(57) (b) 2 ~~4~~. (Individual PAHs): Anthracene	Milligrams/L	< 9.6 See Note (4).	< 110 See Note (4).	< 110 See Note (4).	< 110 See Note (4).		
(57) (b) 3 ~~4~~. (Individual PAHs): Fluoranthene	Milligrams/L	< 0.3 See Note (4).	< 0.370 See Note (4).	< 0.370 See Note (4).	< 0.370 See Note (4).		
(57) (b) 4 ~~2~~. (Individual PAHs): Fluorene	Milligrams/L	< 1.3 See Note (4).	< 14 See Note (4).	< 14 See Note (4).	< 14 See Note (4).		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(57) (b) 5 ~~3~~. (Individual PAHs): Pyrene	Milligrams/L	< 0.96 See Note (4).	< 11 See Note (4).	< 11 See Note (4).	< 11 See Note (4).		
(58) (a) Radioactive substances (Combined radium 226 and 228)	Picocuries/L	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5
(58) (b) Radioactive substances (Gross alpha particle activity including radium 226, but excluding radon and uranium)	Picocuries/L	≤ 15	≤ 15	≤ 15	≤ 15	≤ 15	≤ 15
(59) Selenium	Micrograms/L	≤ 5.0	≤ 71	≤ 5.0	≤ 71		
(60) Silver	Micrograms/L	≤ 0.07	≤ 0.05	≤ 0.07	≤ 0.05		
(61) Specific Conductance (see Conductance, Specific, above)							
(62) Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals		None shall be present.					
(63) 1,1,2,2-Tetrachloroethane	Micrograms/L	≤ 0.17 annual avg.	≤ 10.8 annual avg.	≤ 10.8 annual avg.	≤ 10.8 annual avg.		

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Parameter	Units	Class I	Class II	Class III: Fresh	Class III: Marine	Class IV	Class V
(64) Tetrachloroethylene (1,1,2,2-tetrachloroethene)	Micrograms/L	≤ 0.8 annual avg., ≤ 3.0 max	≤ 8.85 annual avg.	≤ 8.85 annual avg.	≤ 8.85 annual avg.		
(65) Thallium	Micrograms/L	< 1.7	< 6.3	< 6.3	< 6.3		
(66) Thermal Criteria (See Section 62-302.520)							
(67) Total Dissolved Gases	Percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures	≤ 110% of saturation value	≤ 110% of saturation value	≤ 110% of saturation value	≤ 110% of saturation value		
(68) Transparency	Depth of the compensation point for photosynthetic activity	Shall not be reduced by more than 10% as compared to the natural background value.	Shall not be reduced by more than 10% as compared to the natural background value.	Shall not be reduced by more than 10% as compared to the natural background value.	Shall not be reduced by more than 10% as compared to the natural background value.		
(69) Trichloroethylene (trichloroethene)	Micrograms/L	≤ 2.7 annual avg., ≤ 3.0 max	≤ 80.7 annual avg.	≤ 80.7 annual avg.	≤ 80.7 annual avg.		
(70) Turbidity	Nephelometric Turbidity Units (NTU)	≤ 29 above natural background conditions	≤ 29 above natural background conditions	≤ 29 above natural background conditions	≤ 29 above natural background conditions	≤ 29 above natural background conditions	≤ 29 above natural background conditions
(71) Zinc	Micrograms/L See Note (3).	$Zn \le e^{(0.8473[\ln H]+0.7614)}$	≤ 86	$Zn \le e^{(0.8473[\ln H]+0.7614)}$	≤ 86	≤ 1,000	≤ 1,000

Notes: (1) "Annual avg." means the maximum concentration at average annual flow conditions (see Section 62-4.020(1), F.A.C.); (2) "Max" means the maximum not to be exceeded at any time; (3) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (4) Criteria are protective of human health not of aquatic life.

Specific Authority: 403.061, 403.062, 403.087, 403.504, 403.704, 403.804, F.S.
Law Implemented: 403.021, 403.061, 403.087, 403.088, 403.141, 403.161, 403.182, 403.502, 403.702, 403.708, F.S.
History: New 1-28-90, Formerly 17-3.065, Amended 2-13-92, 6-17-92, 4-25-93, Formerly 17-302.530, Amended 1-23-95.

62-302.600 Classified Waters.

(1) The surface waters of the State of Florida are classified as Class III - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife, except for certain waters which are described in this section. A water body may be designated as an Outstanding Florida Water or an Outstanding National Resource Water in addition to being classified as Class I, Class II, or Class III. A water body may also have special standards applied to it. Outstanding Florida Waters and Outstanding National Resource Waters are listed in Rule 62-302.700, F.A.C.

(2) Unless otherwise specified, the following shall apply:

(a) The landward extent of a classification shall coincide with the landward extent of waters of the state, as defined in FAC Rules 62-301.400.

(b) Water quality classifications shall be interpreted to include associated water bodies such as tidal creeks, coves, bays and bayous.

(3) Exceptions to Class III:

(a) All secondary and tertiary canals wholly within agricultural areas are classified as Class IV and are not individually listed as exceptions to Class III. "Secondary and tertiary canals" shall mean any wholly artificial canal or ditch which is behind a control structure and which is part of a water control system that is connected to the works (set forth in Section 373.086, F.S.) of a water management district created under Section 373.069, F.S., and that is permitted by such water management district pursuant to Section 373.103, Section 373.413, or Section 373.416, F.S. Agricultural areas shall generally include lands actively used solely for the production of food and fiber which are zoned for agricultural use where county zoning is in effect. Agricultural areas exclude lands which are platted and subdivided or in a transition phase to residential use;

Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

ATTACHMENT "B"

WETLAND EVALUATION REPORT

Prepared By:
Lotspeich and Associates, Inc.
422 West Fairbanks Avenue, Suite 201
Winter Park, Florida 32789

Lotspeich and Associates, Inc.
ECOLOGICAL CONSULTANTS

3 April 1996
L&A File No. 95061.41
L&A Doc: \JMHD\95061d03.LET

Mr. David Hamstra
Professional Engineering Consultants, Inc.
200 E Robinson Street, Suite 1560
Orlando, Florida 32801

RE: **Stormwater Management Master Plan for Lakes McCoy, Coroni, and Prevatt**
Existing Conditions and Recommendations on Proposed Improvements to Lake McCoy Drainage Basin
Orange County, Florida

Dear Mr. Hamstra:

Pursuant to your request, Lotspeich and Associates, Inc. (L&A) has completed a preliminary site assessment of the above referenced project area. The purpose of the site review was to determine the extent and quality of potentially jurisdictional wetlands in the vicinity of the stormwater pond (Orange County Pond) located north of Votaw Road and west of Lake McCoy. L&A also evaluated the potential preservation value of a parcel south of Welch Road and east of C.R. 435 (Rock Springs Road). This letter report provides a brief summary of existing ecological conditions, the approximate extent of potentially jurisdictional wetlands, and recommendations regarding proposed improvements. An approximate wetland line is depicted on the attached aerial photocopy. The findings reported below are the opinion of the writer and should not be considered binding upon any jurisdictional governmental agency with potential regulatory authority over the project area. These findings reflect conditions on-site at the time of the investigation and do not preclude the possibility that on-site conditions may change in the future. No subsurface or hazardous materials evaluations were conducted.

EXISTING CONDITIONS

The Orange County Pond is surrounded by potentially jurisdictional wetlands. A wetland forested mixed community occurs to the east of the pond and adjacent to Lake McCoy. This forested wetland is dominated by a canopy of sweetgum (*Liquidambar styraciflua*) and pond pine (*Pinus serotina*). Understory species include Carolina willow (*Salix caroliniana*), elderberry (*Sambucus canadensis*), and primrose willow (*Ludwigia peruviana*). Soils are classified by the Natural Resource Conservation Service (NRCS) as Basinger fine sands, depressional.

422 West Fairbanks Avenue, Suite 201, Winter Park, Florida 32789 (407)740-8482 FAX (407) 645-1305

The wetland forested mixed community adjacent to the northern and northeastern portions of the pond is dominated by a canopy of red maple (*Acer rubrum*), water oak (*Quercus nigra*), laurel oak (*Quercus laurifolia*), and cabbage palm (*Sabal palmetto*) with occasional sweetgum and pond pine. Understory species observed include swamp fern (*Blechnum serrulatum*), cinnamon fern (*Osmunda cinnamomea*), and scattered saw palmetto (*Serenoa repens*). Soils in this area are classified as Basinger fine sands, depressional. Additionally, a small stream flows above the northern boundary of the pond which serves as the outfall of Dream Lake into Lake McCoy.

Wetlands surrounding the pond are of good quality. The system appears to saturate and/or inundate at an interval frequent enough to maintain the hydrologic regime. Only occasional pockets of encroachment by species such as grapevine were observed on the outer edge of the system.

Potentially jurisdictional wetlands extend approximately 500 feet north of the pond to a berm that extends east from a stormwater pond at the end of Lake McCoy Drive to Lake McCoy. This berm is approximately 12 feet wide and 3 feet high. No culverts were observed in the berm. The area north of the berm consists of a wetland forested mixed community and seepage slopes. Vegetative species observed in these areas include water and laurel oaks, pignut hickory (*Carya glabra*), cabbage palm, and saw palmetto. Soil types varied from gray, sandy soils to hydric soils classified by NRCS as Basinger fine sands, depressional.

The parcel located south of Welch Road is characterized by pine flatwoods adjacent to a flowway and wetland forested mixed community. Ground elevations decrease from west to east. The wetland area is dominated by a canopy of pond pine, sweetbay (*Magnolia virginiana*), red maple, and loblolly bay (*Gordonia lasianthus*). The understory is predominantly saw palmetto and elderberry. Portions of this area are covered with dense grapevine (*Vitis* sp.). Other species observed include Carolina willow, cinnamon fern, and royal fern (*Osmunda regalis*). This system appears to have been disturbed somewhat by adjacent development and ditching. Soils are variable throughout with sandier soils occurring in the higher elevations to the west. Soils in the wetland are classified by NRCS as Basinger fine sands, depressional, and in the adjacent flatwoods as Immokalee fine sand. A deep cut ditch exists just south of the recently constructed power supply station. This ditch appears to convey stormwater from ponds west of the parcel to the flowway.

PROPOSED BASIN IMPROVEMENTS

It is my understanding that two primary recommendations are being considered for improvements to the stormwater management in the basin. These options and our recommendations are as follows:

1. Expand the Lake McCoy pond or create an additional pond.

   The existing pond is surrounded by moderate to good quality forested wetlands. The Orange County parcel located to the north of the pond also consists of moderate to good quality forested wetlands associated with Lake McCoy. It appears that wetland impacts will occur whether the existing pond is enlarged or an additional pond is created on the other parcel. The extent of wetlands will need to be field flagged and verified by the St. Johns River Water Management District (SJRWMD), the U.S. Army Corps of Engineers (USACE), and Orange County Environmental Protection Department prior to permitting. Any proposed wetland impacts will require permits from these agencies. Mitigation would most likely be required to compensate for the proposed impacts.

2. Preservation of Wetlands in Parcel Located South of Welch Road

   Wetlands located in this parcel are moderate quality forested wetlands adjacent to pine flatwoods. Opportunities for enhancement to this system are limited based on our field evaluation and review of the blueline aerial photography. It does appear that several ditches have been constructed in the past in the vicinity of this parcel which may have altered the hydrology of the wetland over time. The wetlands potentially could be enhanced by filling or plugging ditches draining the system. Treated stormwater could also be directed to the wetlands in order to enhance the existing hydrologic regime. However, the hydrology of the wetland does not appear unduly depressed, making the benefits of enhancement efforts questionable.

   Preservation of this system could have local and regional ecological benefits. Locally, the protection of this wetland would prevent further encroachment by development into this natural flowway. The additional purchase of the adjacent uplands that lie within the floodplain could eliminate potential future flooding problems associated with inadequate compensatory storage or drainage design. This would also protect degradation of the wetland functions and wildlife habitat from secondary impacts that could result from upland development. Regionally, the purchase of this wetland system could add a small piece to the Wekiva Springs ecosystem. The wetland flowway, as it continues north of Welch Road, is contiguous to and flows into the boundaries of Wekiva Springs State Park. However, Welch Road and recent development has separated this property from direct connection to the park. The parcel still has value as preservation as it is in good condition and could function as a "satellite" or stepping stone to the park for wildlife, in particular migration birds and insects.

As described above, most of the study area consists of potentially jurisdictional forested wetlands. Most stormwater management improvements considered for the project area would impact wetlands and require permits from federal, state, and local agencies. Some potential exists for preserving and/or enhancing the parcel located south of Welch Road.

If you have any questions regarding this letter or need additional information, please contact me at (407) 740-8482.

Sincerely,

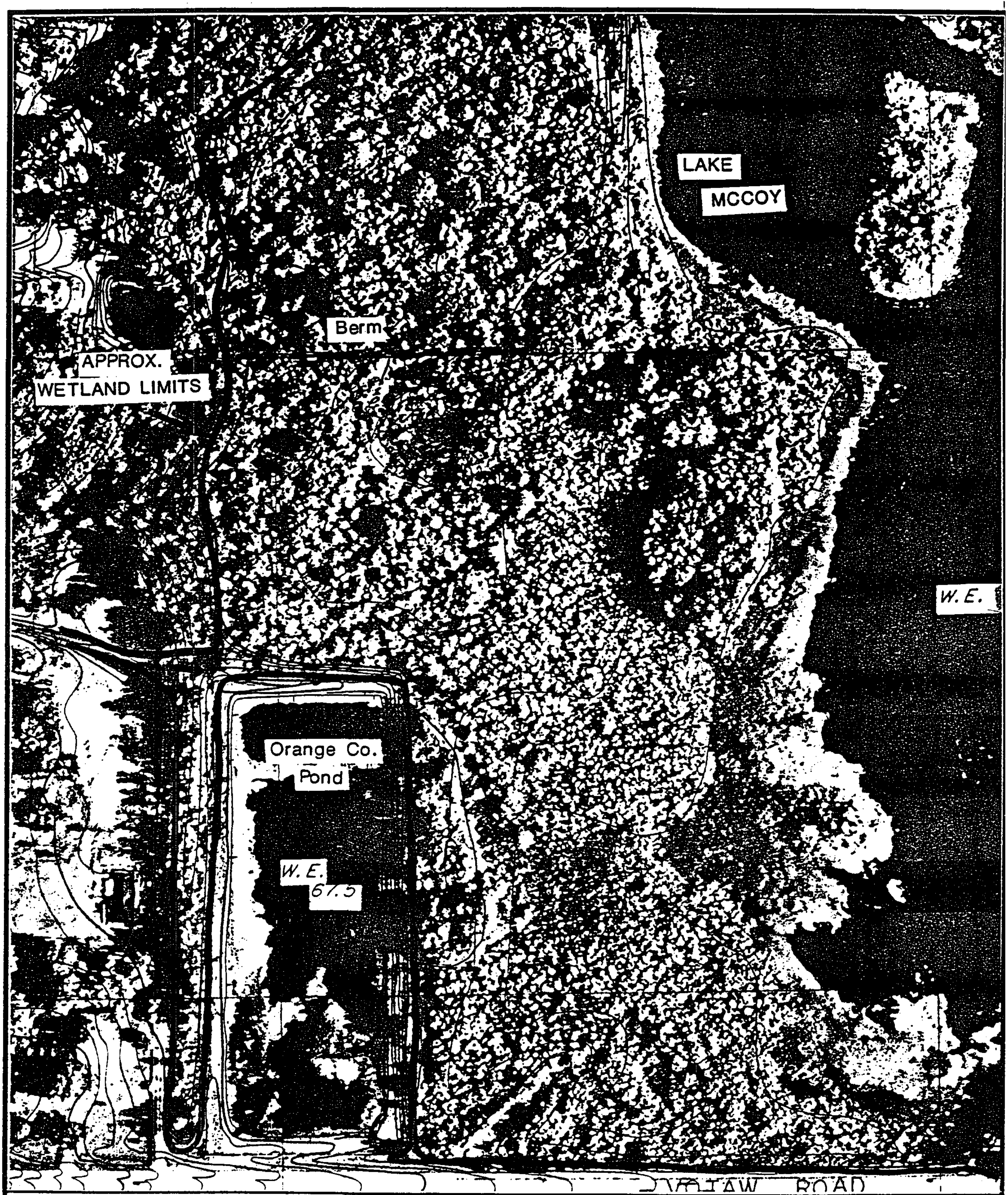
LOTSPEICH AND ASSOCIATES, INC.

Ann M. Hague for

Carolyn Schultz
Project Manager

Enclosure(s) (1)

cc: Carol S. Lotspeich, L&A
Alicia E. Oller, L&A



Lotspeich and Associates, Inc.
ECOLOGICAL CONSULTANTS
422 W. Fairbanks Ave., Suite 201 (407) 740-8482
Winter Park, FL 32789-5079 FAX (407) 645-1305

SWMMP for Lakes
McCoy, Coroni, & Prevatt
Orange County, Florida

Wetland Location Map

NORTH

SCALE: 1" = 200'

EXHIBIT 1

DWG No. :95061d08.DWG

Prepared by CRS

Job No. :95061.41

Date :8 April 1996

Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

ATTACHMENT "C"

GEOTECHNICAL REPORT

Prepared By:
LJ Nodarse & Associates, Inc.
807 South Orlando Avenue, Suite A
Winter Park, Florida 32789

Report for Subsurface Exploration and Geotechnical Engieering Evaluation, Proposed Stormwater Retention Area Modification, Lake McCoy, Orange County, Florida.

LJ Nodarse
& Associates, Inc.

April 19, 1996
Project No. 95-G-0451

TO: PROFESSIONAL ENGINEERING CONSULTANTS, INC.
200 East Robinson Street
Orlando, Florida 32801

ATTN: Mr. David Hamstra, P.E.

RE: Report for Subsurface Exploration and Geotechnical Engineering Evaluation
Proposed Stormwater Retention Area Modification
Lake McCoy
Orange County, Florida

Dear Mr. Hamstra:

At your request and per our proposal dated September 13, 1995, L.J. Nodarse and Associates, Inc. (LJN) has completed a shallow subsurface exploration and geotechnical engineering evaluation for the above referenced project. The purpose of this study was to obtain geotechnical data to assist in the design and construction of the proposed pond. This report presents an evaluation of the soil and groundwater conditions encountered.

Based on the information provided by Professional Engineering Consultants, Inc. (PEC) we understand that the proposed project will consist of enlarging the existing stormwater retention pond which is located along the west side of Lake McCoy, north of Votaw Road as shown in **Figure 1**. The existing pond will be enlarged to the north.

SCOPE OF FIELD WORK

The scope of our field work consisted of performing a total of 7 hand auger borings to depths ranging between 4 to 7 feet below existing grade. The approximate locations at which the borings were performed are shown on the attached **Figure 1**.

The hand auger boring procedure consisted of manually turning a 3 inch diameter, 6 inch long sampler into the soil until it is full. The sampler is then retrieved and the soils in the sampler are visually examined and classified. The procedure is repeated until the desired termination depth is achieved or shallow groundwater levels cause collapse of the borehole. Samples of representative strata were obtained for further visual examination and classification in our laboratory.

SOIL AND GROUNDWATER CONDITIONS

The soil types encountered at the boring locations are presented in the form of soil profiles on the attached **Figure 2**. The stratification presented is based on visual classification of the recovered soil samples and the interpretation of the field logs by a Geotechnical Engineer. Stratification boundaries between soil types should be considered approximate as the actual transition between soil types may be gradual.

In general, the borings encountered surficial layers of fine sand with small roots "topsoil" (stratum 1) and organic silty fine sand (stratum 3). Below this the borings revealed layers of fine sand (stratum 2) and slightly silty fine sand (stratum 4). As an exception, boring HA-6 encountered a surficial layer of silty fine sand (stratum 5).

At the time of our study (April, 1995) , the groundwater table was encountered at depths ranging between 0.4 and 4.0 feet below existing ground surface. Based on the SCS soil survey map for Orange County, the southern portion of the site is mapped as Basinger fine sand (#3) and the northern portion is mapped as Tavares Millhopper fine sand (#47). The Basinger series has a seasonal high water table above the surface for 6 to 9 months or more each year and is within 11 inches of the surface for the rest of the year. The Tavares soil series has a seasonal high water table at a depth of 40 to 72 inches for more than 6 months and recedes to 80 inches during extended dry periods. A seasonal high water table in Millhopper soil is at a depth of 40 to 60 inches for 1 to 4 months, and it recedes to a depth of 60 to 72 inches for 2 to 4 months. During periods of heavy rainfall, the water table is at 30 to 40 inches.

Based on the soil strata encountered, the groundwater levels measured in April, 1996 and the research information obtained from the soil survey, we estimate that the normal seasonal high groundwater levels will occur at depths shown adjacent to the soil profile on **Figure 2**. The depth of the groundwater table varies. This variation can be attributed in part to ground surface topography. We would be pleased to provide you with elevations of groundwater table if ground surface elevations are provided to us.

It should be noted that the estimated seasonal high groundwater levels do not provide assurance that groundwater levels will not exceed these estimated levels during a given year in the future. Should impediments to surface water drainage exist on the site or should rainfall intensity and duration or total rainfall quantities exceed normally anticipated rainfall quantities, groundwater levels may exceed the normal seasonal high estimates.

CLOSURE

LJN appreciates the opportunity to be of service to you on this project. If you should have any questions concerning the contents of this report, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,

L.J. NODARSE & ASSOCIATES, INC.

Gabi Stephan
Project Engineer

Leila Jammal Nodarse, P.E.
President 4/15/96
FL Registration No. 38675

95-G-0451.REP:GS/jm

APPENDIX

FIGURES

LOCATION PLAN

SCALE IN FEET

0 150 300 600

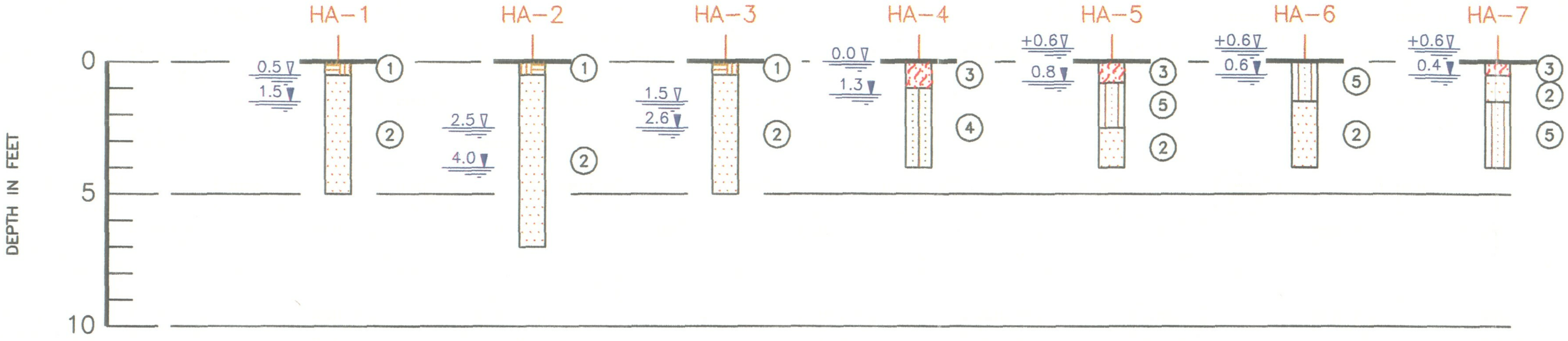
LEGEND

⌖	APPROXIMATE LOCATION OF HAND AUGER BORING
③	USDA – SCS SOIL DESCRIPTION BASINGER FINE SAND, DEPRESSIONAL
(47)	USDA – SCS SOIL DESCRIPTION TAVARES–MILLHOPPER FINE SANDS, 0 TO 5 PERCENT SLOPES

GEOTECHNICAL ENGINEERING EVALUATION
PROPOSED IMPROVEMENTS TO LAKE McCOY
STORMWATER RETENTION AREA
ORANGE COUNTY, FLORIDA

LJ Nodarse & Associates, Inc.
Geotechnical, Environmental & Materials Engineers

DRAWN: SW	SCALE: NOTED	PROJ. NO: 95G–0451
CHKD: GS	DATE: 4–17–96	FIGURE: 1



SOIL PROFILES

SCALE IN FEET

0 2.5 5 10

LEGEND

▦	①	GRAYISH-BROWN FINE SAND WITH SMALL ROOTS (TOPSOIL), (SP)
▨	②	GRAYISH-BROWN TO BROWN FINE SAND, (SP)
▨	③	DARK GRAYISH-BROWN ORGANIC SILTY FINE SAND, (SM)
▥	④	DARK BROWN TO REDDISH-BROWN SLIGHTLY SILTY FINE SAND, (SP-SM)(SM)
▥	⑤	DARK REDDISH-BROWN SILTY FINE SAND, (SM)
(SP)		UNIFIED SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL EXAMINATION
1.5 ▼		DEPTH TO GROUNDWATER LEVEL IN FEET: 4-9-96
0.5 ▽		ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL IN FEET

GEOTECHNICAL ENGINEERING EVALUATION
PROPOSED IMPROVEMENTS TO LAKE McCOY
STORMWATER RETENTION AREA
ORANGE COUNTY, FLORIDA

LJ Nodarse & Associates, Inc.
Geotechnical, Environmental & Materials Engineers

DRAWN: SW	SCALE: NOTED	PROJ. NO: 95G-0451
CHKD: GS	DATE: 4-17-96	FIGURE: 2

ATTACHMENT "D"

VOTAW ROAD

STORMWATER POND

RETROFIT CALCULATIONS

①

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS
RETROFIT OF PARK AVENUE DETENTION POND

1. DETERMINE TOTAL AREA CONTRIBUTING TO EXISTING FDOT POND

TOTAL PROJECT AREA CONTRIBUTING TO POND = 250.0 ACRES
TOTAL AREA = 250. 0 ACRES (EXCLUDING POND AREA AT CONTROL WATER LEVEL)

2. DETERMINE PERCENT IMPERVIOUSNESS

TOTAL AREA TO BE TREATED = 250.0 ACRES
TOTAL IMPERVIOUS DRAINAGE AREA = 135.0 ACRES (Assume 1/4 acre lots, 54% impervious)
TOTAL PERVIOUS DRAINAGE AREA = 115.0 ACRES

$$\text{PERCENTAGE IMPERVIOUSNESS} = \frac{\text{TOTAL IMPERVIOUS AREA}}{\text{TOTAL DRAINAGE AREA}}$$

$$\text{PERCENTAGE IMPERVIOUSNESS} = \frac{\text{135 ACRES}}{\text{250 ACRES}} = 54\%\ (0.540)$$

3. STAGE STORAGE RELATIONSHIP FOR PROPOSED WET DETENTION POND

EFFECTIVE VOLUME / STAGE-STORAGE RELATIONSHIP

ELEVATION	SURFACE AREA	AVG. VOL.	ACC. VOL.
62.00	3.437	0.000	0.000
63.00	3.504	3.471	3.471
64.00	3.572	3.538	7.009
65.00	3.640	3.606	10.615
66.00	3.707	3.674	14.288
67.00	3.775	3.741	18.029
68.00	3.842	3.809	21.838
69.00	3.910	3.876	25.714

POLLUTION ABATEMENT VOLUME (PAV) AVAILABLE (TO EL. 65.0) = 10.615 ACRE-FEET
TREATMENT VOLUME DISTRIBUTED OVER CONTRIBUTING BASIN

$$\text{VOLUME} = \frac{\text{POLLUTION ABATEMENT VOLUME AVAILABLE}}{\text{CONTRIBUTING DRAINAGE AREA}}$$

$$\text{VOLUME} = \frac{\text{10.615 ACRE-FEET}}{\text{250 ACRES}} \quad \frac{\text{(12 INCHES)}}{\text{(1 - FOOT)}} = \quad \text{0.5095 INCHES}$$

BY CONVERTING THE EXISTING "DRY" DETENTION POND TO A "WET" POND AND ESTABLISHING A CONTROL WATER LEVEL (CWL) FOR THE BLEED-DOWN ORIFICE AT ELEVATION 62.00, A BASIN AVERAGE OF 0.50-INCHES OF WATER QUALITY TREATMENT CAN BE PROVIDED. THE POTENTIAL FOR EXPANDING THE POND BEYOND ITS CURRENT CONFIGURATION IS INFEASIBLE DUE TO THE POTENTIAL FOR ADVERSE IMPACTS TO ADJACENT ENVIRONMENTALLY SENSITIVE AREAS.

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

4. STAGE STORAGE RELATIONSHIP FOR RETROFIT OF EXISTING FDOT POND (CONVERT FROM EXISTING DRY BOTTOM POND TO WET DETENTION POND)

PERMANENT POOL VOLUME / STAGE-STORAGE RELATIONSHIP

ELEVATION	SURFACE AREA	AVG. VOL.	ACC. VOL.
50.00	2.597	0.000	0.000
51.00	2.667	2.632	2.632
52.00	2.737	2.702	5.334
53.00	2.807	2.772	8.106
54.00	2.877	2.842	10.948
55.00	2.947	2.912	13.860
56.00	3.017	2.982	16.842
57.00	3.087	3.052	19.894
58.00	3.157	3.122	23.016
59.00	3.227	3.192	26.208
60.00	3.297	3.262	29.470
61.00	3.367	3.332	32.802
61.90	3.430	3.059	35.861
62.00	3.437	0.343	36.204

5. DETERMINE RUNOFF COEFFICIENT

TOTAL CONTRIBUTING DRAINAGE AREA = 250 ACRES
IMPERVIOUS AREA = 135 ACRES PERVIOUS AREA = 115 ACRES

RUNOFF COEFFICIENTS

IMPERVIOUS AREA RUNOFF COEFFICIENT = 0.95
PERVIOUS AREA RUNOFF COEFFICIENT = 0.20

$$\text{COMPOSITE RUNOFF COEFFICIENT} = \frac{[(A1)(C1) + (A2)(C2)]}{A1 + A2}$$

WHERE: A1 = IMPERVIOUS AREA, ACRES
A2 = PERVIOUS AREA, ACRES
C1 = IMPERVIOUS AREA RUNOFF COEFFICIENT
C2 = PERVIOUS AREA RUNOFF COEFFICIENT

A1 = 135 ACRES C1 = 0.95
A2 = 115 ACRES C2 = 0.20

$$\text{COMPOSITE RUNOFF COEFFICIENT} = \frac{[(135)(0.95) + (115)(0.20)]}{135 + 115}$$

COMPOSITE RUNOFF COEFFICIENT = 0.61

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

6. CALCULATE PERMANENT POOL VOLUMES

THE PERMANENT POOL IS THAT PORTION OF A POND WHICH IS DESIGNED TO HOLD WATER AT ALL TIMES (i.e., BELOW THE CONTROL ELEVATION). TYPICALLY THE PERMANENT POOL IS SIZED TO PROVIDE AT LEAST A TWO-WEEK (14-DAY) RESIDENCE TIME DURING THE WET SEASON (JUNE THROUGH OCTOBER).

IMPORTANT POLLUTANT REMOVAL PROCESSES WHICH OCCUR WITHIN THE PERMANENT POOL INCLUDE: UPTAKE OF NUTRIENTS BY ALGAE, ADSORPTION OF NUTRIENTS AND HEAVY METALS INTO BOTTOM SEDIMENTS, BIOLOGICAL OXIDATION OF ORGANIC MATERIALS AND SEDIMENTATION. UPTAKE BY ALGAE IS PROBABLY THE MOST IMPORTANT PROCESS FOR THE REMOVAL OF NUTRIENTS. SEDIMENTATION AND ADSORPTION INTO BOTTOM SEDIMENTS IS LIKELY THE PRIMARY MEANS OF REMOVING HEAVY METALS.

SINCE ONE OF THE MAJOR BIOLOGICAL MECHANISMS FOR POLLUTANT REMOVAL IN A WET DETENTION BASIN IS PHYTOPLANKTON GROWTH, THE AVERAGE HYDRAULIC RESIDENCE TIME OF THE POND MUST BE LONG ENOUGH TO ENSURE ADEQUATE ALGAL GROWTH. A RESIDENCE TIME OF TWO WEEKS IS CONSIDERED TO BE THE MINIMUM DURATION THAT ENSURES ADEQUATE OPPORTUNITY FOR ALGAL GROWTH.

RESIDENCE TIME OF A POND IS DEFINED AS THE AVERAGE TIME REQUIRED TO RENEW THE WATER VOLUME (PERMANENT POOL VOLUME) IN THE POND AND CAN BE EXPRESSED AS:

$$RT = PPV/FR \qquad (29\text{-}1)$$

WHERE:
RT = RESIDENT TIME (DAYS)
PPV = PERMANENT POOL VOLUME (ACRE-FEET)
FR = AVERAGE FLOW RATE (ACRE-FEET/DAY)

SOLVING EQUATION 29-1 FOR THE PERMANENT POOL VOLUME (PPV) GIVES:

$$PPV = (RT)(FR) \qquad (29\text{-}2)$$

THE AVERAGE FLOW RATE DURING THE WET SEASON (JUNE - OCTOBER) IS EXPRESSED AS FOLLOWS:

$$FR = \frac{DA\ C\ R}{WS} \qquad (29\text{-}3)$$

WHERE:
DA = DRAINAGE AREA TO POND (ACRES)
C = RUNOFF COEFFICIENT
R = WET SEASON RAINFALL DEPTH (INCHES) (SEE FIGURE 29-1 ON FOLLOWING PAGE)
WS = LENGTH OF WET SEASON (DAYS) (JUNE - OCTOBER = 153 DAYS)

SUBSTITUTING EQUATION 29-3 INTO EQUATION 29-2 GIVES:

$$PPV = \frac{DA\ C\ R\ RT}{WS\ CF} \qquad (29\text{-}4)$$

WHERE: CF = CONVERSION FACTOR = 12 INCHES/FT

Reference: Applicants Handbook - Regulation of Stormwater Management Systems, Chapter 40C-42, F.A.C. Page 29-1, St. Johns River Water Management District, Palatka, Florida

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

6. CALCULATE PERMANENT POOL VOLUMES (Cont.)

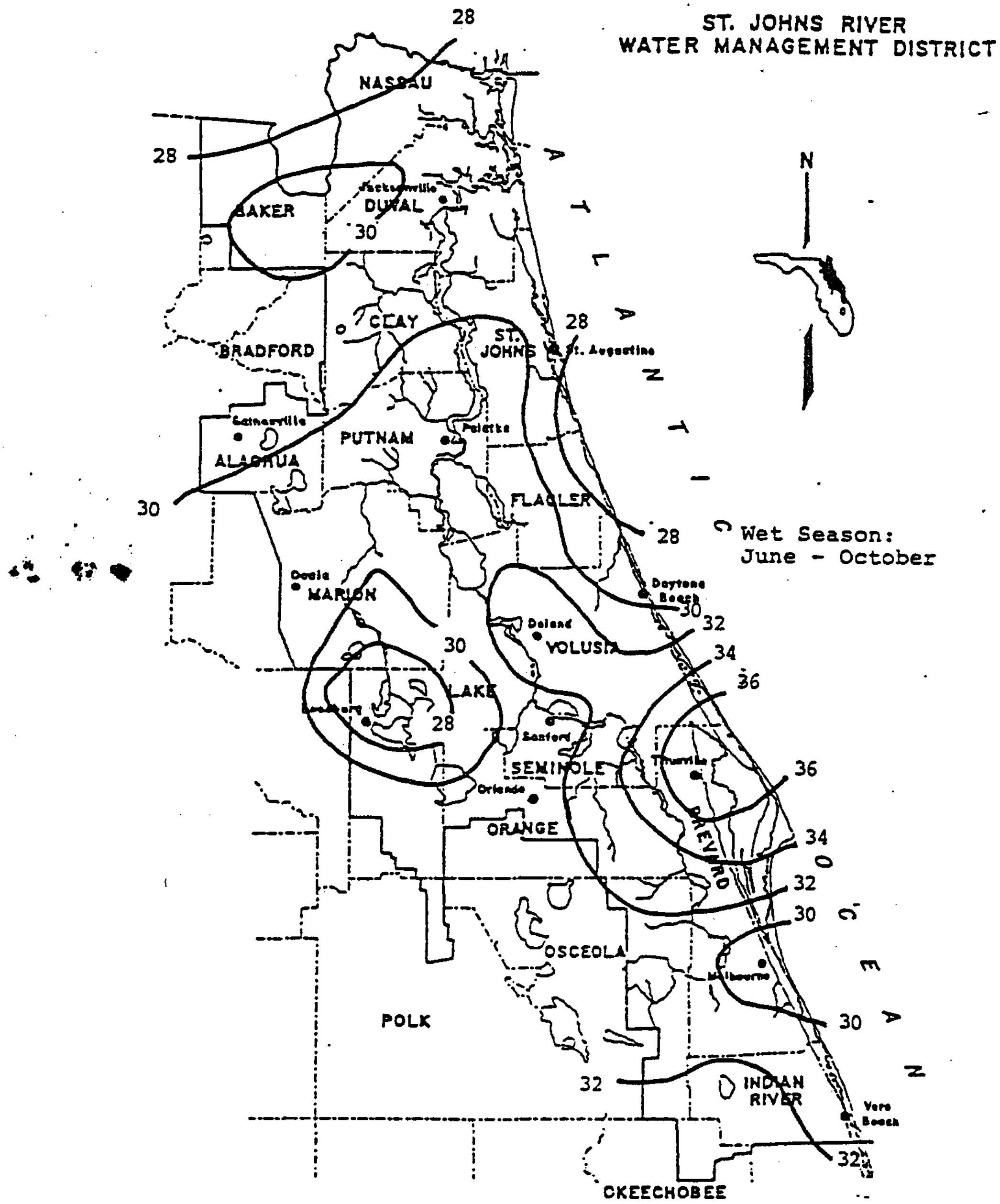


FIGURE 29-1 WET SEASON NORMAL RAINFALL, INCHES

Reference: Applicants Handbook - Regulation of Stormwater Management Systems, Chapter 40C-42, F.A.C.
St. Johns River Water Management District, Palatka, Florida

⑤

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

6. CALCULATE PERMANENT POOL VOLUMES (Cont.)

SOLVE FOR REQUIRED PERMANENT POOL VOLUME (PPV) ASSUMING A MINIMUM 14-DAY RESIDENCE TIME (LITTORAL ZONE OPTION).

FROM EQUATION 29-4, THE PERMANENT POOL VOLUME IS COMPUTED AS:

$$PPV = \frac{DA\ C\ R\ RT}{WS\ CF}$$

WHERE:
DA = 250 ACRES (SEE SECTION 1)
C = 0.61 (SEE SECTION 5)
R = 31-INCHES (SEE FIGURE 29-1, Applicant's Handbook, Regulation of Stormwater Management Systems, Chapter 40C-42, F.A.C., SJRWMD).
WS = 153 DAYS (JUNE - OCTOBER WET SEASON)
RT = 14 DAYS (Minimum required for wet ponds with littoral zones)

$$PPV = \frac{(250)(0.61)(31)(14)}{(153)(12)} = 36.048 \text{ ACRE-FEET}$$

PERMANENT POOL VOLUME AVAILABLE = 36.204 ACRE-FEET (SEE SECTION 4)

COMPUTE ACTUAL RESIDENCE TIME FOR PROPOSED WET DETENTION POND

REWRITING EQUATION 29-4

$$RT = \frac{PPV\ WS\ CF}{DA\ C\ R}$$

WHERE:
DA = 250 ACRES (SEE SECTION 1)
C = 0.61 (SEE SECTION 5)
R = 31-INCHES (SEE FIGURE 29-1, Applicant's Handbook, Regulation of Stormwater Management Systems, Chapter 40C-42, F.A.C., SJRWMD).
WS = 153 DAYS (JUNE - OCTOBER WET SEASON)
PPV = 36.204 ACRE-FEET (BELOW CWL ELE. 62.00)

$$RT = \frac{(36.204)(153)(12)}{(250)(0.61)(31)}$$

RT = 14.06 DAYS (APPROXIMATE TO 14-DAYS)

POND PPV AVAILABLE > MINIMUM REQUIRED - 14 DAY (SJRWMD)

SINCE THE GEOTECHNICAL AND ENVIRONMENTAL EVALUATION FOR THIS POND INDICATES THAT EXPANSION OF THE FACILITY WOULD NOT BE VIABLE, A VARIANCE OF THE SJRWMD'S PERFORMANCE CRITERIA WOULD HAVE TO BE REQUESTED TO ALLOW THE WET POND TO BE CONSTRUCTED WITHOUT LITTORAL ZONES. IN LIGHT OF RESTORING THE WATER QUALITY ASPECTS OF THE POND BY CONVERTING IT TO A WET DETENTION FACILITY, THIS VARIANCE REQUEST WOULD LIKELY BE GRANTED BY THE DISTRICT.

7. DETERMINE CONTROL DEVICE BLEED-DOWN VOLUME

GRAVITY CONTROL DEVICES SHALL NORMALLY "BE DESIGNED SO THAT BLEED DOWN DEVICES INCORPORATING DIMENSIONS SMALLER THAN THREE INCHES MINIMUM WIDTH OR LESS THAN 20 DEGREES FOR "V" NOTCHES SHALL INCLUDE A DEVICE TO ELIMINATE CLOGGING. EXAMPLES INCLUDE BAFFLES, GRATES, AND PIPE ELBOWS".

(REFERENCE: 40C-42.026(5)(h), FAC - SPECIFIC DESIGN AND PERFORMANCE CRITERIA MANAGEMENT AND STORAGE OF SURFACE WATERS, PERMIT INFORMATION MANUAL, ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

ALLOW. VOLUME TO BE RELEASED = (0.5) (TREATMENT VOLUME)
ALLOW. VOLUME TO BE RELEASED = (0.5) (10.615 ACRE-FEET) = 5.308 AF

8. SIZE CONTROL WEIR (BLEED-DOWN DEVICE)

(ASSUME V-NOTCH CONFIGURATION)

COMPUTE V-NOTCH ANGLE

V-NOTCH ANGLE = 2(ARCTAN(0.492V/H^2.5)

WHERE:
V = VOLUME TO BE RELEASED, 48-HOURS (1/2 OF PAV)
H = HEAD ON VERTEX OF NOTCH, FEET
BLEED-DOWN CONTROL WATER LEVEL (CWL) = ELE. 62.00
POLLUTION ABATEMENT LEVEL = ELE. 65.00

H = POLLUTION ABATEMENT ELE. - CWL ELE.
H = 65.00 - 62.00 = 3.00 FEET
V = 5.308 ACRE-FEET

V-NOTCH ANGLE = 2(ARCTAN[(0.492*5.308) / 3.00^2.5)
V-NOTCH ANGLE = 2(ARCTAN[(0.1675))
V-NOTCH ANGLE = 2(9.51)
V-NOTCH ANGLE = 19 DEGREES < 20 DEGREES (Does Not Conform to SJRWMD Criteria)
TRY AN ALTERNATIVE BLEED-DOWN DEVICE.

9. SIZE CONTROL ORIFICE (BLEED-DOWN DEVICE)

(ASSUME CIRCULAR ORIFICE CONFIGURATION)

SIZE CONTROL ORIFICE OPENING DIMENSION USING FALLING HEAD EQUATION (EQ. 4-19 HANDBOOK OF HYDRAULICS, E.F. BRATER & H.W. KING, McGRAW-HILL BOOK COMPANY)

$$a = \frac{2A\left(\sqrt{h1} - \sqrt{h2}\right)}{Ct\ \sqrt{2g}}$$

WHERE:
a = AREA OF ORIFICE, SQUARE FEET
A = AVERAGE POND SURFACE AREA, SQUARE FEET
h1 = INITIAL HEAD ON ORIFICE, FEET
h2 = FINAL HEAD ON ORIFICE, FEET
C = DISCHARGE COEFFICIENT, (0.60 FOR ORIFICE)
g = GRAVITATIONAL CONSTANT, (32.2)
t = DRAWDOWN TIME, SECONDS

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

9. SIZE CONTROL ORIFICE (BLEED-DOWN DEVICE) (Cont.)

EFFECTIVE TREATMENT VOLUME / STAGE-STORAGE

ELEVATION	SURFACE AREA	AVG. VOL.	ACC. VOL.
62.00	3.437	0.000	0.000
63.00	3.504	3.471	3.471
64.00	3.572	3.538	7.009
65.00	3.640	3.606	10.615
66.00	3.707	3.674	14.288
67.00	3.775	3.741	18.029
68.00	3.842	3.809	21.838
69.00	3.910	3.876	25.714

DESIGN PARAMETERS

CONTROL WATER LEVEL (CWL) = ELE. 62.00
TOP OF TREATMENT VOLUME = ELE. 65.00
VOLUME TO BE BLED DOWN = 5.308 ACRE-FEET (1/2 OF REQ'D TREATMENT VOLUME)
DRAWDOWN TIME = 48-HOURS = 172,800 SECONDS

AREA @ h1 = POND SURFACE AREA AT TOP OF TREATMENT VOLUME

AREA @ h1 = 3.640 ACRES (ELEVATION 65.00)

AREA @ h2 = POND SURFACE AREA AT ELEVATION WHERE BLEED-DOWN VOLUME IS RELEASED.

VOLUME @ h2 = TOTAL RETENTION VOLUME - ALLOWABLE VOLUME RELEASE
VOLUME @ h2 = 10.615 - 5.308 = 5.307 ACRE-FEET

$$\text{ELE. @ } h2 = \frac{[\text{VOL. @ } h2 - \text{VOL. } A]}{[\text{VOL. } B - \text{VOL. } A]} (\text{ELE. } B - \text{ELE. } A) + \text{ELE. } A$$

VOLUME @ h2 = 5.307 ACRE-FEET
VOLUME AT A = 3.471 ACRE-FEET (ELE. 63.00)
VOLUME AT B = 7.009 ACRE-FEET (ELE. 64.00)

$$\text{ELE. @ } h2 = \frac{[5.307 - 3.471]}{[7.009 - 3.471]} (64.00 - 63.00) + 63.00$$

ELE. @ h2 = 63.52

9. SIZE CONTROL ORIFICE (BLEED-DOWN DEVICE) (Cont.)

$$\text{AREA @ h2} = \frac{[\text{ELE. @ h2 - ELE. A}]}{[\text{ELE. B - ELE. A}]} \quad (\text{AREA @ B - AREA @ A}) + \text{AREA @ A}$$

ELE. @ h2 = 63.52
ELE. @ A = 63.00 AREA @ A = 3.504 ACRES
ELE. @ B = 64.00 AREA @ B = 3.572 ACRES

$$\text{AREA @ h2} = \frac{[\ 63.52 - 63.00\ ]}{[\ 64.00 - 63.00\ ]} \quad (3.572 - 3.504) + 3.504$$

AREA @ h2 = 3.539 ACRES

10. DETERMINE ORIFICE SIZE

$$\text{AVERAGE AREA} \quad \frac{\text{AREA @ h1 + AREA @ h2}}{2}$$

AREA @ h1 = 3.640 ACRES
AREA @ h2 = 3.539 ACRES

$$\text{AVERAGE AREA} \quad \frac{(\ 3.640 + 3.539\ )}{2}$$

AVERAGE AREA 3.590 ACRES = 156,359 SQUARE FEET

h1 = (TOP OF TREATMENT VOLUME) - (BOTTOM OF POLLUTION ABATEMENT VOLUME)

WHERE: TOP OF TREATMENT VOLUME = ELE. 65.00
BOTTOM OF POLLUTION ABATEMENT VOLUME (CWL) = 62.00

h1 = 65.00 - 62.00 = 3.00 FEET

h2 = (TOP OF TREATMENT VOLUME) - (ELEVATION WHERE BLEED-DOWN VOLUME HAS BEEN RELEASED)

h2 = 65.00 - 63.52 = 1.48 FEET

<u>SOLVE FOR ORIFICE AREA</u>

$$a = \frac{2A(\sqrt{h1} - \sqrt{h2}\ )}{Ct\ \sqrt{2g}}$$

A = 156,359 SQUARE FEET
h1 = 3.00 FEET
h2 = 1.48 FEET
C = 0.60 (DISCHARGE COEFFICIENT FOR CIRCULAR ORIFICE)
t = 172,800 SECONDS (48-HOURS)
g = 32.2 (GRAVITATIONAL CONSTANT)

LAKE McCOY RECOMMENDED IMPROVEMENTS
WATER QUALITY CALCULATIONS (PARK AVENUE POND)

10. DETERMINE ORIFICE SIZE (Cont.)

$$a = \frac{2(156{,}359)(\ 3.00\ -\ 1.48\ )}{(0.60)(172{,}800)(\ 2(32.2)\ )}$$

a = 0.194 SQUARE FEET

SOLVE FOR ORIFICE DIAMETER

$a = (PI*D\text{^}2)/4$ $\quad$ $D = [\,(4a)/PI]\text{^}0.5$

WHERE: D = ORIFICE DIAMETER, FEET

$D = [4(0.194)/3.1416]\text{^}0.5$

D = 0.497 FEET
D = 5.96399 INCHES

USE ORIFICE DIAMETER EQUIVALENT TO 6-INCHES

11. DETERMINE ACTUAL DRAWDOWN TIME FOR 6-INCH DIAMETER ORIFICE

D = 6 INCH
D = 6 INCH = 0.5000 FEET

$a = (PI*D\text{^}2)/4$
a = 0.19635 SQUARE FEET

$$a = \frac{2A\,(\sqrt{h1}\ - \sqrt{h2}\ )}{Ct\ \sqrt{2g}}$$

A = 156,359 SQUARE FEET
h1 = 3.00 FEET
h2 = 1.48 FEET
C = 0.60 (DISCHARGE COEFFICIENT FOR CIRCULAR ORIFICE)
t = 172,800 SECONDS (48-HOURS)
g = 32.2 (GRAVITATIONAL CONSTANT)
a = CROSS-SECTIONAL AREA OF ORIFICE, SQUARE FEET

REWRITING FORMULA TO SOLVE FOR t

$$t = \frac{2A\,(\sqrt{h1}\ - \sqrt{h2}\ )}{Ca\quad 2g}$$

$$t = \frac{2(156{,}359)(\sqrt{3.00}\ - \sqrt{1.48}\ )}{(0.6)(0.19635)[\sqrt{(2)(32.2)}\,]}$$

t = 170,512 SECONDS

t = 47.36 HOURS - ROUND UP TO 48-HOURS

THEREFORE THE ORIFICE SIZE OF 6-INCHES DIA. CONFORMS TO THE REQUIREMENTS OF BLEEDING DOWN ONE-HALF OF THE WATER QUALITY VOLUME WITHIN 48 TO 60 HOURS.

12. DRAWDOWN ANALYSIS

THE DRAWDOWN ANALYSIS UTILIZED ADVANCED INTERCONNECTED POND ROUTING (ADICPR) TO CHECK THE ORIFICE SIZE DETERMINED USING THE FALLING HEAD EQUATIONS USED IN SECTION 9 AND 10 (REFERENCE: HANDBOOK OF HYDRAULICS, Brater and King, McGraw-Hill Book Company) OF THIS WATER QUALITY CALCULATION DOCUMENT. THIS WAS ACCOMPLISHED BY DEACTIVATING THE INFLOW HYDROGRAPHS TO THE POND AND SETTING THE INITIAL STAGE IN THE POND TO THE WATER QUALITY ELEVATION OF 65.00. THE FLOOD ROUTING WAS THEN PERFORMED TO ALLOW ONLY THE ORIFICE TO DRAWDOWN THE REQUIRED WATER QUALITY VOLUME.

THE FOLLOWING ATTACHMENT IS A NODE STAGE/VOLUME/FLOW REPORT WHICH SUMMARIZES THE DRAWDOWN CURVE FOR THE BLEED-DOWN ORIFICE OVER A 60-HOUR SIMULATION PERIOD.

THE REQUIRED VOLUME RELEASE WITHIN THE 48 TO 60-HOUR PERIOD IS 5.307 ACRE-FEET FOR THE POND. THE ELEVATION WHERE ONE-HALF THE TREATMENT VOLUME IS TO BE RECOVERED IS ELEVATION 63.52 THERE IS A SLIGHT DISPARITY IN THE VOLUME COMPUTED FOR THE POND BETWEEN THE MANUAL CALCULATIONS AND THE ADICPR CALCULATIONS. THE MANUAL CALCULATIONS INDICATE A VOLUME OF 10.78 ACRE-FEET AT ELEVATION 65.00, WHERE ADICPR DETERMINED 11.83 ACRE-FEET AT THE SAME ELEVATION. FOR CONSISTENCY, THE VOLUME RECOVERY TIME FOR THE ADICPR MODEL WILL BE DETERMINED TO BE ONE-HALF OF THE POLLUTION ABATEMENT VOLUME (P.A.V.) AT ELEVATION 63.52. THIS TRANSLATES TO A VOLUME OF 5.926 ACRE-FEET. THE ADICPR RESULTS ARE SUMMARIZED IN THE FOLLOWING TABLE

TIME (hrs)	*STAGE (ft)*	*VOLUME (af)*	*OUTFLOW (cfs)*
49.75	*63.52*	*5.96*	*1.07*

THE RECOVERY TIME OF 47.36-HOURS IN THE MANUAL CALCULATIONS IS CLOSELY SIMULATED BY THE ADICPR MODEL, WHICH DETERMINED A RECOVERY TIME OF 49.75-HOURS (USING ONE-HALF OF THE VOLUME UP TO THE POLLUTION ABATEMENT ELEVATION (PAV) OF 65.00).

13. CONCLUSIONS

THE ADICPR DRAWDOWN ANALYSIS MODEL CLOSELY SIMULATES THE PERFORMANCE OF THE 6" DIAMETER ORIFICE TO EVACUATE ONE-HALF OF THE WATER QUALITY VOLUME WITHIN 48 TO 60 HOURS, PURSUANT TO THE SJRWMD PERFORMANCE STANDARDS OUTLINED IN 40C-42.026(5)(b), FLORIDA ADMINISTRATIVE CODE (F.A.C.) ALTHOUGH THE RESULTS FROM THE COMPUTER SIMULATION ARE NOT IDENTICAL TO THE MANUAL CALCULATIONS, THE RESULTS FROM THE ADICPR MODEL INDICATES THE REASONABLE ACCURACY OF THE METHODOLOGIES USED IN DETERMINING THE DRAWDOWN ORIFICE SIZE FROM THE MANUAL CALCULATIONS. THE COMPARATIVE RESULTS INDICATE THAT A SIX (6) INCH DIAMETER ORIFICE IS SUFFICIENT TO DRAWDOWN THE REQUIRED WATER QUALITY VOLUME WITHIN THE PRESCRIBED TIME FRAME.

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    LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
    MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                          NODAL STAGE/VOLUME/FLOW REPORT
                          ==============================

  NODE ID: PA05N01P
                                        |<-------  INFLOW  ------->|
       TIME      STAGE     VOLUME     RUNOFF   OFFSITE     OTHER   OUTFLOW
      (hrs)       (ft)      (af)      (cfs)     (cfs)      (cfs)    (cfs)
    --------  --------  --------  --------  --------  --------  --------
         .00     65.00     11.38       .00       .00       .00      1.57
         .25     64.99     11.34       .00       .00       .00      1.56
         .50     64.98     11.31       .00       .00       .00      1.56
         .75     64.97     11.28       .00       .00       .00      1.56
        1.00     64.96     11.25       .00       .00       .00      1.56
        1.25     64.96     11.21       .00       .00       .00      1.55
        1.50     64.95     11.18       .00       .00       .00      1.55
        1.75     64.94     11.15       .00       .00       .00      1.55
        2.00     64.93     11.12       .00       .00       .00      1.55
        2.25     64.92     11.09       .00       .00       .00      1.54
        2.50     64.91     11.05       .00       .00       .00      1.54
        2.75     64.90     11.02       .00       .00       .00      1.54
        3.00     64.89     10.99       .00       .00       .00      1.54
        3.25     64.89     10.96       .00       .00       .00      1.53
        3.50     64.88     10.93       .00       .00       .00      1.53
        3.75     64.87     10.90       .00       .00       .00      1.53
        4.00     64.86     10.86       .00       .00       .00      1.53
        4.25     64.85     10.83       .00       .00       .00      1.52
        4.50     64.84     10.80       .00       .00       .00      1.52
        4.75     64.83     10.77       .00       .00       .00      1.52
        5.00     64.83     10.74       .00       .00       .00      1.52
        5.08     64.82     10.73       .00       .00       .00      1.52
        5.17     64.82     10.72       .00       .00       .00      1.51
        5.25     64.82     10.71       .00       .00       .00      1.51
        5.33     64.81     10.70       .00       .00       .00      1.51
        5.42     64.81     10.69       .00       .00       .00      1.51
        5.50     64.81     10.68       .00       .00       .00      1.51
        5.58     64.81     10.66       .00       .00       .00      1.51
        5.67     64.80     10.65       .00       .00       .00      1.51
        5.75     64.80     10.64       .00       .00       .00      1.51
        5.83     64.80     10.63       .00       .00       .00      1.51
        5.92     64.79     10.62       .00       .00       .00      1.51
        6.00     64.79     10.61       .00       .00       .00      1.51
        6.08     64.79     10.60       .00       .00       .00      1.51
        6.17     64.79     10.59       .00       .00       .00      1.50
        6.25     64.78     10.58       .00       .00       .00      1.50
        6.33     64.78     10.57       .00       .00       .00      1.50
        6.42     64.78     10.56       .00       .00       .00      1.50
        6.50     64.77     10.55       .00       .00       .00      1.50
        6.58     64.77     10.54       .00       .00       .00      1.50
        6.67     64.77     10.53       .00       .00       .00      1.50
        6.75     64.77     10.52       .00       .00       .00      1.50
        6.83     64.76     10.51       .00       .00       .00      1.50
        6.92     64.76     10.50       .00       .00       .00      1.50
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   LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
   MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                             NODAL STAGE/VOLUME/FLOW REPORT
                             ==============================

 NODE ID: PA05N01P
                                           |<-------  INFLOW  ------->|
      TIME      STAGE     VOLUME     RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)       (ft)       (af)      (cfs)     (cfs)     (cfs)     (cfs)
   --------  --------  --------  --------  --------  --------  --------
      7.00     64.76     10.49       .00       .00       .00      1.50
      7.08     64.76     10.48       .00       .00       .00      1.50
      7.17     64.75     10.47       .00       .00       .00      1.49
      7.25     64.75     10.46       .00       .00       .00      1.49
      7.33     64.75     10.45       .00       .00       .00      1.49
      7.42     64.74     10.44       .00       .00       .00      1.49
      7.50     64.74     10.43       .00       .00       .00      1.49
      7.58     64.74     10.42       .00       .00       .00      1.49
      7.67     64.74     10.41       .00       .00       .00      1.49
      7.75     64.73     10.40       .00       .00       .00      1.49
      7.83     64.73     10.39       .00       .00       .00      1.49
      7.92     64.73     10.38       .00       .00       .00      1.49
      8.00     64.72     10.37       .00       .00       .00      1.49
      8.08     64.72     10.36       .00       .00       .00      1.49
      8.17     64.72     10.34       .00       .00       .00      1.48
      8.25     64.72     10.33       .00       .00       .00      1.48
      8.33     64.71     10.32       .00       .00       .00      1.48
      8.42     64.71     10.31       .00       .00       .00      1.48
      8.50     64.71     10.30       .00       .00       .00      1.48
      8.58     64.70     10.29       .00       .00       .00      1.48
      8.67     64.70     10.28       .00       .00       .00      1.48
      8.75     64.70     10.27       .00       .00       .00      1.48
      8.83     64.70     10.26       .00       .00       .00      1.48
      8.92     64.69     10.25       .00       .00       .00      1.48
      9.00     64.69     10.24       .00       .00       .00      1.48
      9.08     64.69     10.23       .00       .00       .00      1.48
      9.17     64.69     10.22       .00       .00       .00      1.47
      9.25     64.68     10.21       .00       .00       .00      1.47
      9.33     64.68     10.20       .00       .00       .00      1.47
      9.42     64.68     10.19       .00       .00       .00      1.47
      9.50     64.67     10.18       .00       .00       .00      1.47
      9.58     64.67     10.17       .00       .00       .00      1.47
      9.67     64.67     10.16       .00       .00       .00      1.47
      9.75     64.67     10.15       .00       .00       .00      1.47
      9.83     64.66     10.14       .00       .00       .00      1.47
      9.92     64.66     10.13       .00       .00       .00      1.47
     10.00     64.66     10.12       .00       .00       .00      1.47
     10.08     64.66     10.11       .00       .00       .00      1.47
     10.17     64.65     10.10       .00       .00       .00      1.46
     10.25     64.65     10.09       .00       .00       .00      1.46
     10.33     64.65     10.08       .00       .00       .00      1.46
     10.42     64.64     10.07       .00       .00       .00      1.46
     10.50     64.64     10.06       .00       .00       .00      1.46
     10.58     64.64     10.05       .00       .00       .00      1.46
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  LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
  MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                      NODAL STAGE/VOLUME/FLOW REPORT
                      ==============================

NODE ID: PA05N01P
                                |<-------  INFLOW  ------->|
      TIME     STAGE    VOLUME    RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)      (ft)      (af)     (cfs)     (cfs)     (cfs)     (cfs)
  --------  --------  --------  --------  --------  --------  --------
     10.67     64.64     10.04       .00       .00       .00      1.46
     10.75     64.63     10.03       .00       .00       .00      1.46
     10.83     64.63     10.02       .00       .00       .00      1.46
     10.92     64.63     10.01       .00       .00       .00      1.46
     11.00     64.63     10.00       .00       .00       .00      1.46
     11.08     64.62      9.99       .00       .00       .00      1.46
     11.17     64.62      9.98       .00       .00       .00      1.45
     11.25     64.62      9.97       .00       .00       .00      1.45
     11.33     64.61      9.96       .00       .00       .00      1.45
     11.42     64.61      9.95       .00       .00       .00      1.45
     11.50     64.61      9.94       .00       .00       .00      1.45
     11.58     64.61      9.93       .00       .00       .00      1.45
     11.67     64.60      9.92       .00       .00       .00      1.45
     11.75     64.60      9.91       .00       .00       .00      1.45
     11.83     64.60      9.90       .00       .00       .00      1.45
     11.92     64.60      9.89       .00       .00       .00      1.45
     12.00     64.59      9.88       .00       .00       .00      1.45
     12.08     64.59      9.87       .00       .00       .00      1.45
     12.17     64.59      9.86       .00       .00       .00      1.44
     12.25     64.58      9.85       .00       .00       .00      1.44
     12.33     64.58      9.84       .00       .00       .00      1.44
     12.42     64.58      9.83       .00       .00       .00      1.44
     12.50     64.58      9.82       .00       .00       .00      1.44
     12.58     64.57      9.81       .00       .00       .00      1.44
     12.67     64.57      9.80       .00       .00       .00      1.44
     12.75     64.57      9.79       .00       .00       .00      1.44
     12.83     64.57      9.78       .00       .00       .00      1.44
     12.92     64.56      9.77       .00       .00       .00      1.44
     13.00     64.56      9.76       .00       .00       .00      1.44
     13.08     64.56      9.75       .00       .00       .00      1.44
     13.17     64.55      9.74       .00       .00       .00      1.43
     13.25     64.55      9.73       .00       .00       .00      1.43
     13.33     64.55      9.72       .00       .00       .00      1.43
     13.42     64.55      9.71       .00       .00       .00      1.43
     13.50     64.54      9.70       .00       .00       .00      1.43
     13.58     64.54      9.69       .00       .00       .00      1.43
     13.67     64.54      9.68       .00       .00       .00      1.43
     13.75     64.54      9.67       .00       .00       .00      1.43
     13.83     64.53      9.66       .00       .00       .00      1.43
     13.92     64.53      9.65       .00       .00       .00      1.43
     14.00     64.53      9.64       .00       .00       .00      1.43
     14.08     64.53      9.63       .00       .00       .00      1.43
     14.17     64.52      9.62       .00       .00       .00      1.42
     14.25     64.52      9.61       .00       .00       .00      1.42
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          LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
          MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                                 NODAL STAGE/VOLUME/FLOW REPORT
                                 ==============================

        NODE ID: PA05N01P
                                                |<-------  INFLOW  ------->|
             TIME       STAGE     VOLUME     RUNOFF   OFFSITE     OTHER   OUTFLOW
            (hrs)        (ft)       (af)      (cfs)     (cfs)     (cfs)     (cfs)
          --------   --------   --------   --------  --------  --------  --------
             14.33      64.52       9.60        .00       .00       .00      1.42
             14.42      64.51       9.59        .00       .00       .00      1.42
             14.50      64.51       9.58        .00       .00       .00      1.42
             14.58      64.51       9.57        .00       .00       .00      1.42
             14.67      64.51       9.57        .00       .00       .00      1.42
             14.75      64.50       9.56        .00       .00       .00      1.42
             14.83      64.50       9.55        .00       .00       .00      1.42
             14.92      64.50       9.54        .00       .00       .00      1.42
             15.00      64.50       9.53        .00       .00       .00      1.42
             15.08      64.49       9.52        .00       .00       .00      1.42
             15.17      64.49       9.51        .00       .00       .00      1.41
             15.25      64.49       9.50        .00       .00       .00      1.41
             15.33      64.49       9.49        .00       .00       .00      1.41
             15.42      64.48       9.48        .00       .00       .00      1.41
             15.50      64.48       9.47        .00       .00       .00      1.41
             15.58      64.48       9.46        .00       .00       .00      1.41
             15.67      64.47       9.45        .00       .00       .00      1.41
             15.75      64.47       9.44        .00       .00       .00      1.41
             15.83      64.47       9.43        .00       .00       .00      1.41
             15.92      64.47       9.42        .00       .00       .00      1.41
             16.00      64.46       9.41        .00       .00       .00      1.41
             16.08      64.46       9.40        .00       .00       .00      1.40
             16.17      64.46       9.39        .00       .00       .00      1.40
             16.25      64.46       9.38        .00       .00       .00      1.40
             16.33      64.45       9.37        .00       .00       .00      1.40
             16.42      64.45       9.36        .00       .00       .00      1.40
             16.50      64.45       9.35        .00       .00       .00      1.40
             16.58      64.45       9.34        .00       .00       .00      1.40
             16.67      64.44       9.33        .00       .00       .00      1.40
             16.75      64.44       9.32        .00       .00       .00      1.40
             16.83      64.44       9.31        .00       .00       .00      1.40
             16.92      64.43       9.30        .00       .00       .00      1.40
             17.00      64.43       9.29        .00       .00       .00      1.40
             17.08      64.43       9.28        .00       .00       .00      1.39
             17.17      64.43       9.27        .00       .00       .00      1.39
             17.25      64.42       9.27        .00       .00       .00      1.39
             17.33      64.42       9.26        .00       .00       .00      1.39
             17.42      64.42       9.25        .00       .00       .00      1.39
             17.50      64.42       9.24        .00       .00       .00      1.39
             17.58      64.41       9.23        .00       .00       .00      1.39
             17.67      64.41       9.22        .00       .00       .00      1.39
             17.75      64.41       9.21        .00       .00       .00      1.39
             17.83      64.41       9.20        .00       .00       .00      1.39
             17.92      64.40       9.19        .00       .00       .00      1.39
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    LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
    MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)

                              NODAL STAGE/VOLUME/FLOW REPORT
                              ==============================

  NODE ID: PA05N01P
                                        |<-------  INFLOW  ------->|
      TIME      STAGE     VOLUME    RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)       (ft)       (af)     (cfs)     (cfs)     (cfs)     (cfs)
   --------  --------   --------  --------  --------  --------  --------
      18.00     64.40       9.18       .00       .00       .00      1.39
      18.08     64.40       9.17       .00       .00       .00      1.38
      18.17     64.40       9.16       .00       .00       .00      1.38
      18.25     64.39       9.15       .00       .00       .00      1.38
      18.33     64.39       9.14       .00       .00       .00      1.38
      18.42     64.39       9.13       .00       .00       .00      1.38
      18.50     64.39       9.12       .00       .00       .00      1.38
      18.58     64.38       9.11       .00       .00       .00      1.38
      18.67     64.38       9.10       .00       .00       .00      1.38
      18.75     64.38       9.09       .00       .00       .00      1.38
      18.83     64.38       9.08       .00       .00       .00      1.38
      18.92     64.37       9.07       .00       .00       .00      1.38
      19.00     64.37       9.06       .00       .00       .00      1.38
      19.08     64.37       9.06       .00       .00       .00      1.37
      19.17     64.36       9.05       .00       .00       .00      1.37
      19.25     64.36       9.04       .00       .00       .00      1.37
      19.33     64.36       9.03       .00       .00       .00      1.37
      19.42     64.36       9.02       .00       .00       .00      1.37
      19.50     64.35       9.01       .00       .00       .00      1.37
      19.58     64.35       9.00       .00       .00       .00      1.37
      19.67     64.35       8.99       .00       .00       .00      1.37
      19.75     64.35       8.98       .00       .00       .00      1.37
      19.83     64.34       8.97       .00       .00       .00      1.37
      19.92     64.34       8.96       .00       .00       .00      1.37
      20.00     64.34       8.95       .00       .00       .00      1.37
      20.08     64.34       8.94       .00       .00       .00      1.36
      20.17     64.33       8.93       .00       .00       .00      1.36
      20.25     64.33       8.92       .00       .00       .00      1.36
      20.33     64.33       8.91       .00       .00       .00      1.36
      20.42     64.33       8.90       .00       .00       .00      1.36
      20.50     64.32       8.90       .00       .00       .00      1.36
      20.58     64.32       8.89       .00       .00       .00      1.36
      20.67     64.32       8.88       .00       .00       .00      1.36
      20.75     64.32       8.87       .00       .00       .00      1.36
      20.83     64.31       8.86       .00       .00       .00      1.36
      20.92     64.31       8.85       .00       .00       .00      1.36
      21.00     64.31       8.84       .00       .00       .00      1.36
      21.08     64.31       8.83       .00       .00       .00      1.35
      21.17     64.30       8.82       .00       .00       .00      1.35
      21.25     64.30       8.81       .00       .00       .00      1.35
      21.33     64.30       8.80       .00       .00       .00      1.35
      21.42     64.30       8.79       .00       .00       .00      1.35
      21.50     64.29       8.78       .00       .00       .00      1.35
      21.58     64.29       8.77       .00       .00       .00      1.35
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    LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
    MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                             NODAL STAGE/VOLUME/FLOW REPORT
                             ==============================

  NODE ID: PA05N01P
                                         |<-------  INFLOW  ------->|
     TIME      STAGE     VOLUME    RUNOFF   OFFSITE     OTHER    OUTFLOW
    (hrs)       (ft)       (af)     (cfs)     (cfs)     (cfs)      (cfs)
  --------  --------  --------  --------  --------  --------  --------
     21.67     64.29      8.76       .00       .00       .00      1.35
     21.75     64.29      8.76       .00       .00       .00      1.35
     21.83     64.28      8.75       .00       .00       .00      1.35
     21.92     64.28      8.74       .00       .00       .00      1.35
     22.00     64.28      8.73       .00       .00       .00      1.35
     22.08     64.28      8.72       .00       .00       .00      1.34
     22.17     64.27      8.71       .00       .00       .00      1.34
     22.25     64.27      8.70       .00       .00       .00      1.34
     22.33     64.27      8.69       .00       .00       .00      1.34
     22.42     64.27      8.68       .00       .00       .00      1.34
     22.50     64.26      8.67       .00       .00       .00      1.34
     22.58     64.26      8.66       .00       .00       .00      1.34
     22.67     64.26      8.65       .00       .00       .00      1.34
     22.75     64.26      8.64       .00       .00       .00      1.34
     22.83     64.25      8.63       .00       .00       .00      1.34
     22.92     64.25      8.63       .00       .00       .00      1.34
     23.00     64.25      8.62       .00       .00       .00      1.34
     23.08     64.25      8.61       .00       .00       .00      1.33
     23.17     64.24      8.60       .00       .00       .00      1.33
     23.25     64.24      8.59       .00       .00       .00      1.33
     23.33     64.24      8.58       .00       .00       .00      1.33
     23.42     64.24      8.57       .00       .00       .00      1.33
     23.50     64.23      8.56       .00       .00       .00      1.33
     23.58     64.23      8.55       .00       .00       .00      1.33
     23.67     64.23      8.54       .00       .00       .00      1.33
     23.75     64.23      8.53       .00       .00       .00      1.33
     23.83     64.22      8.52       .00       .00       .00      1.33
     23.92     64.22      8.52       .00       .00       .00      1.33
     24.00     64.22      8.51       .00       .00       .00      1.33
     24.08     64.22      8.50       .00       .00       .00      1.32
     24.17     64.21      8.49       .00       .00       .00      1.32
     24.25     64.21      8.48       .00       .00       .00      1.32
     24.33     64.21      8.47       .00       .00       .00      1.32
     24.42     64.21      8.46       .00       .00       .00      1.32
     24.50     64.20      8.45       .00       .00       .00      1.32
     24.58     64.20      8.44       .00       .00       .00      1.32
     24.67     64.20      8.43       .00       .00       .00      1.32
     24.75     64.20      8.42       .00       .00       .00      1.32
     24.83     64.19      8.42       .00       .00       .00      1.32
     24.92     64.19      8.41       .00       .00       .00      1.32
     25.00     64.19      8.40       .00       .00       .00      1.32
     25.25     64.18      8.37       .00       .00       .00      1.31
     25.50     64.17      8.34       .00       .00       .00      1.31
     25.75     64.17      8.32       .00       .00       .00      1.31
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LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                      NODAL STAGE/VOLUME/FLOW REPORT
                      ==============================

NODE ID: PA05N01P
                                          |<-------  INFLOW  ------->|
     TIME      STAGE     VOLUME    RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)      (ft)      (af)      (cfs)     (cfs)     (cfs)     (cfs)
   --------  --------  --------  --------  --------  --------  --------
     26.00     64.16      8.29       .00       .00       .00      1.31
     26.25     64.15      8.26       .00       .00       .00      1.30
     26.50     64.14      8.24       .00       .00       .00      1.30
     26.75     64.14      8.21       .00       .00       .00      1.30
     27.00     64.13      8.18       .00       .00       .00      1.30
     27.25     64.12      8.15       .00       .00       .00      1.29
     27.50     64.11      8.13       .00       .00       .00      1.29
     27.75     64.11      8.10       .00       .00       .00      1.29
     28.00     64.10      8.08       .00       .00       .00      1.29
     28.25     64.09      8.05       .00       .00       .00      1.28
     28.50     64.09      8.02       .00       .00       .00      1.28
     28.75     64.08      8.00       .00       .00       .00      1.28
     29.00     64.07      7.97       .00       .00       .00      1.28
     29.25     64.06      7.94       .00       .00       .00      1.27
     29.50     64.06      7.92       .00       .00       .00      1.27
     29.75     64.05      7.89       .00       .00       .00      1.27
     30.00     64.04      7.86       .00       .00       .00      1.27
     30.25     64.04      7.84       .00       .00       .00      1.26
     30.50     64.03      7.81       .00       .00       .00      1.26
     30.75     64.02      7.79       .00       .00       .00      1.26
     31.00     64.01      7.76       .00       .00       .00      1.26
     31.25     64.01      7.73       .00       .00       .00      1.25
     31.50     64.00      7.71       .00       .00       .00      1.25
     31.75     63.99      7.68       .00       .00       .00      1.25
     32.00     63.99      7.66       .00       .00       .00      1.25
     32.25     63.98      7.63       .00       .00       .00      1.24
     32.50     63.97      7.61       .00       .00       .00      1.24
     32.75     63.97      7.58       .00       .00       .00      1.24
     33.00     63.96      7.55       .00       .00       .00      1.23
     33.25     63.95      7.53       .00       .00       .00      1.23
     33.50     63.94      7.50       .00       .00       .00      1.23
     33.75     63.94      7.48       .00       .00       .00      1.23
     34.00     63.93      7.45       .00       .00       .00      1.22
     34.25     63.92      7.43       .00       .00       .00      1.22
     34.50     63.92      7.40       .00       .00       .00      1.22
     34.75     63.91      7.38       .00       .00       .00      1.22
     35.00     63.90      7.35       .00       .00       .00      1.21
     35.25     63.90      7.33       .00       .00       .00      1.21
     35.50     63.89      7.30       .00       .00       .00      1.21
     35.75     63.88      7.28       .00       .00       .00      1.21
     36.00     63.88      7.25       .00       .00       .00      1.20
     36.25     63.87      7.23       .00       .00       .00      1.20
     36.50     63.86      7.20       .00       .00       .00      1.20
     36.75     63.86      7.18       .00       .00       .00      1.20
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   LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
   MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)

                             NODAL STAGE/VOLUME/FLOW REPORT
                             ==============================

 NODE ID: PA05N01P
                                        |<-------  INFLOW  ------->|
      TIME      STAGE      VOLUME     RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)       (ft)       (af)      (cfs)     (cfs)      (cfs)     (cfs)
   --------   --------   --------   --------  --------  --------  --------
      37.00      63.85       7.15        .00       .00       .00      1.19
      37.25      63.84       7.13        .00       .00       .00      1.19
      37.50      63.84       7.10        .00       .00       .00      1.19
      37.75      63.83       7.08        .00       .00       .00      1.19
      38.00      63.82       7.05        .00       .00       .00      1.18
      38.25      63.82       7.03        .00       .00       .00      1.18
      38.50      63.81       7.01        .00       .00       .00      1.18
      38.75      63.80       6.98        .00       .00       .00      1.18
      39.00      63.80       6.96        .00       .00       .00      1.17
      39.25      63.79       6.93        .00       .00       .00      1.17
      39.50      63.78       6.91        .00       .00       .00      1.17
      39.75      63.78       6.88        .00       .00       .00      1.17
      40.00      63.77       6.86        .00       .00       .00      1.16
      40.25      63.76       6.84        .00       .00       .00      1.16
      40.50      63.76       6.81        .00       .00       .00      1.16
      40.75      63.75       6.79        .00       .00       .00      1.16
      41.00      63.74       6.76        .00       .00       .00      1.15
      41.25      63.74       6.74        .00       .00       .00      1.15
      41.50      63.73       6.72        .00       .00       .00      1.15
      41.75      63.72       6.69        .00       .00       .00      1.15
      42.00      63.72       6.67        .00       .00       .00      1.14
      42.25      63.71       6.65        .00       .00       .00      1.14
      42.50      63.70       6.62        .00       .00       .00      1.14
      42.75      63.70       6.60        .00       .00       .00      1.14
      43.00      63.69       6.58        .00       .00       .00      1.13
      43.25      63.69       6.55        .00       .00       .00      1.13
      43.50      63.68       6.53        .00       .00       .00      1.13
      43.75      63.67       6.51        .00       .00       .00      1.13
      44.00      63.67       6.48        .00       .00       .00      1.12
      44.25      63.66       6.46        .00       .00       .00      1.12
      44.50      63.65       6.44        .00       .00       .00      1.12
      44.75      63.65       6.41        .00       .00       .00      1.12
      45.00      63.64       6.39        .00       .00       .00      1.11
      45.25      63.63       6.37        .00       .00       .00      1.11
      45.50      63.63       6.34        .00       .00       .00      1.11
      45.75      63.62       6.32        .00       .00       .00      1.11
      46.00      63.62       6.30        .00       .00       .00      1.10
      46.25      63.61       6.27        .00       .00       .00      1.10
      46.50      63.60       6.25        .00       .00       .00      1.10
      46.75      63.60       6.23        .00       .00       .00      1.10
      47.00      63.59       6.21        .00       .00       .00      1.09
      47.25      63.59       6.18        .00       .00       .00      1.09
      47.50      63.58       6.16        .00       .00       .00      1.09
      47.75      63.57       6.14        .00       .00       .00      1.09
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    LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
    MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)


                        NODAL STAGE/VOLUME/FLOW REPORT
                        ==============================

  NODE ID: PA05N01P
                                     |<-------  INFLOW  ------->|
      TIME      STAGE     VOLUME     RUNOFF   OFFSITE     OTHER   OUTFLOW
     (hrs)       (ft)      (af)       (cfs)    (cfs)      (cfs)    (cfs)
    --------  --------  --------  --------  --------  --------  --------
       48.00     63.57      6.12       .00       .00       .00      1.08
       48.25     63.56      6.09       .00       .00       .00      1.08
       48.50     63.55      6.07       .00       .00       .00      1.08
       48.75     63.55      6.05       .00       .00       .00      1.08
       49.00     63.54      6.03       .00       .00       .00      1.07
       49.25     63.54      6.01       .00       .00       .00      1.07
       49.50     63.53      5.98       .00       .00       .00      1.07
       49.75     63.52      5.96       .00       .00       .00      1.07
       50.00     63.52      5.94       .00       .00       .00      1.06
       50.25     63.51      5.92       .00       .00       .00      1.06
       50.50     63.51      5.90       .00       .00       .00      1.06
       50.75     63.50      5.87       .00       .00       .00      1.06
       51.00     63.49      5.85       .00       .00       .00      1.05
       51.25     63.49      5.83       .00       .00       .00      1.05
       51.50     63.48      5.81       .00       .00       .00      1.05
       51.75     63.48      5.79       .00       .00       .00      1.05
       52.00     63.47      5.77       .00       .00       .00      1.04
       52.25     63.46      5.74       .00       .00       .00      1.04
       52.50     63.46      5.72       .00       .00       .00      1.04
       52.75     63.45      5.70       .00       .00       .00      1.04
       53.00     63.45      5.68       .00       .00       .00      1.03
       53.25     63.44      5.66       .00       .00       .00      1.03
       53.50     63.44      5.64       .00       .00       .00      1.03
       53.75     63.43      5.62       .00       .00       .00      1.03
       54.00     63.42      5.59       .00       .00       .00      1.02
       54.25     63.42      5.57       .00       .00       .00      1.02
       54.50     63.41      5.55       .00       .00       .00      1.02
       54.75     63.41      5.53       .00       .00       .00      1.02
       55.00     63.40      5.51       .00       .00       .00      1.01
       55.25     63.40      5.49       .00       .00       .00      1.01
       55.50     63.39      5.47       .00       .00       .00      1.01
       55.75     63.38      5.45       .00       .00       .00      1.01
       56.00     63.38      5.43       .00       .00       .00      1.00
       56.25     63.37      5.41       .00       .00       .00      1.00
       56.50     63.37      5.39       .00       .00       .00      1.00
       56.75     63.36      5.36       .00       .00       .00      1.00
       57.00     63.36      5.34       .00       .00       .00       .99
       57.25     63.35      5.32       .00       .00       .00       .99
       57.50     63.34      5.30       .00       .00       .00       .99
       57.75     63.34      5.28       .00       .00       .00       .99
       58.00     63.33      5.26       .00       .00       .00       .98
       58.25     63.33      5.24       .00       .00       .00       .98
       58.50     63.32      5.22       .00       .00       .00       .98
       58.75     63.32      5.20       .00       .00       .00       .98
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    Advanced Interconnected Channel & Pond Routing (adICPR Ver 1.40)
            Copyright 1989, Streamline Technologies, Inc.

    LAKE MCCOY - DRAWDOWN ANALYSIS FOR 6" ORIFICE (FDOT POND)
    MAY 7, 1996 ... RECOMMENDED IMPROVEMENT (WET DETENTION)

                             NODAL STAGE/VOLUME/FLOW REPORT
                             ==============================

  NODE ID: PA05N01P
                                           |<-------  INFLOW  ------->|
       TIME     STAGE    VOLUME    RUNOFF   OFFSITE     OTHER   OUTFLOW
      (hrs)      (ft)     (af)     (cfs)     (cfs)      (cfs)     (cfs)
    -------- -------- -------- -------- -------- -------- --------
      59.00     63.31     5.18       .00       .00       .00       .97
      59.25     63.31     5.16       .00       .00       .00       .97
      59.50     63.30     5.14       .00       .00       .00       .97
      59.75     63.30     5.12       .00       .00       .00       .97
      60.00     63.29     5.10       .00       .00       .00       .96
      60.25     63.28     5.08       .00       .00       .00       .96
      60.50     63.28     5.06       .00       .00       .00       .96
      60.75     63.27     5.04       .00       .00       .00       .96
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Lake McCoy, Lake Coroni, Lake Prevatt
Drainage Basin Study
Orange County, Florida

PROJECT CORRESPONDENCE

Prepared By:
PEC/Professional Engineering Consultants, Inc.
200 East Robinson Street, Suite 1560
Orlando, Florida 32801

DRAFT

August 30, 1994

TO: Commissioner Tom Staley, District 2

FROM: M. Krishnamurthy, Ph.D., P.E., Manager, Stormwater Management

SUBJ: Lake McCoy, Lake Coroni, Wekiva Woods Subdivision Area Drainage Complaint

As you requested, our staff investigated the flooding complaints in the Lake McCoy, Lake Coroni and Wekiva Woods Subdivision areas. We have compiled the following formation for your use:

LAKE	**NORMAL HIGH WATER ELEVATION (NHWE)**		**100-YEAR FLOOD ELEVATION**
MCCOY	61.5	61.5	65.1
CORONI	58.4	59.2	65.1
PREVATT	56.5	56.0	57.8

Under flooding conditions, water flows from Lake McCoy to Lake Coroni via culverts under Sandpiper Road. It then flows to Lake Prevatt through culverts under Welch Road and Paradise Isle Drive in the Wekiva Woods Subdivision. The retention ponds for the Wekiva Woods Subdivision discharge into Lake Coroni.

If the water level in Lake Coroni is less than elevation 58.9, the flow of water from Welch Road can be reversed and flow towards Lake Coroni until the water level in Lake Coroni reaches elevation 58.9.

Preliminary research indicates that Orange County has a 40' drainage canal easement from Lake Prevatt to Lake McCoy. However, Orange County Highway Maintenance Crews maintain only the culverts under the streets and not the canal easement.

Staff in the Public Works Division are planning to do the following tasks:

1. Check the invert elevations of the culverts.
2. Determine whether there is any blockage between Sandpiper Road, the Gas Easement, Paradise Isle Drive, and Welch Road.
3. Schedule the canal for cleaning if any blockage is found.

I hope this information is sufficient for your use. If you need addition information, or have any further questions, please call me at 6-7990.

MK/mhf

cc: Linda W. Chapin, Orange County Chairman
Howard Tipton, Assistant County Administrator
George W. Cole, P.E., Director, Public Works Division
William P. Baxter, P.E., Deputy Director, Public Works Division
Mark V. Massaro, P.E., Acting Manager, Highway Maintenance

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT MEMORANDUM

TO: Project File OC-070 (1-1.0)

FROM: Walt Phillips, P.E. WP

DATE: November 13, 1995

SUBJECT: Stormwater Management Master Plan - Lake McCoy, Lake Coroni, and Lake Prevatt Drainage Basins - Kick-off Meeting

PRESENT: Dr. M. Krishnamurthy, Orange County Stormwater Management Department
Deodat Budhu, Orange County Stormwater Management Department
Tom Ziegler, St. Johns River Water Management District (SJRWMD)
Danny Quick, City of Apopka
David Hamstra, PEC/Professional Engineering Consultants
Walt Phillips, PEC/Professional Engineering Consultants

LOCATION: Orange County Public Works, 4200 South John Young Parkway

TIME: Thursday, November 2, 1995 at 3:30 p.m.

DISCUSSION:

1. Dr. Krishnamurthy and Deodat Budhu presented an introduction to the project with particular attention to concerns regarding the outfall from Lake McCoy to Lake Coroni. Some background was provided regarding problems in this portion of the study area, the Orange County easement between the lakes, and the normal water level in Lake McCoy. Dr. Krishnamurthy indicated that the focus of the project is to find the optimum engineering design such that a balance can be achieved between adequate flood protection and maintaining a desirable normal water level in Lake McCoy.

2. Dan Quick expanded upon this idea, indicating that the balance needs to be found such that areas both upstream and downstream of Lake McCoy will be adequately protected from flooding. In addition to addressing stormwater management in the lake system, Dan Quick noted that two (2) other areas should be addressed in this study.

    - The owner of the "King Property", which is located in the outfall path of Buchan Pond *between S.R. 435 and Lake McCoy, has complained during numerous public meetings that development in the upstream portion of the basin is resulting in inundation of the property. The study should include an assessment of whether the claim may be justified and what may be done to alleviate the problem.*

- *A drainage ditch which conveys off-site runoff through the Wekiva Glen Subdivision has been reported to back up during large storms. The study should include a cursory investigation of this area. It is believed that conditions within the Wekiva Springs State Park may have an influence on this situation.*

Dan also stated that he is not aware of any localized flooding within the basin associated with inadequate conveyance of the secondary system (inlets and stormsewer pipes).

3. *David Hamstra inquired whether the outfall from Dream Lake was also of concern to the City of Apopka. Dan Quick stated that Dream Lake outfall system functions properly as long as the outfall pipe is maintained. Reports of problems in this area had been received in the past. However, since the outfall pipe in the vicinity of the Elementary School was cleaned, problems have not been reported during the last two (2) wet seasons.*

4. *Dr. Krishnamurthy provided further background into the study area. Points introduced include the following:*

   - *The water level in Lake McCoy has been a point of controversy in the past. At one time, the Orange County Lake Advisory Board set the normal water level at 65.0 feet. It appears that the Lake McCoy outfall was man-made during the 1960's.*

   - *Mr. Clyde Ricketson, who owns property adjacent to Lake Coroni, has complained of flooding and claims that damages have been caused by failure of Orange County to maintain the existing canals and related easements.*

   - *Orange County has a chronology of aerial photographs some of which show standing water in Lake Coroni.*

   - *Some residents on Lake Coroni have complained that the outfall to the north is improperly graded such that runoff flows into the lake rather than downstream. The problem appears to be the result of having set the invert of the existing 60-inch culvert under Paradise Isle Drive above the invert of the downstream culverts under Welch Road.*

Orange County
Orlando, Florida
Interoffice Memo

May 18, 1994

TO: Dr. M. Krishnamurthy, P.E., Manager, Stormwater Management Department

FROM: Donald D. Jacobovitz, P.E., Assistant Manager, Highway Maintenance

SUBJ: **Drainage Problems in Ustler Road Vicinity**

We have had flooding complaints for some time now in the vicinity of Ustler Road, Tanglewood Street and Sandpiper Street in Apopka. The property owners, the King's, just west of Ustler Road, have repeatedly complained of flooding at the east end of their property and erosion at the west end of their property. We have installed erosion control and cleaned out the pipe providing relief to the east side of their property, but they are still complaining of flooding.

Now the neighbor to the west of them has complained of flooding. When we checked his complaint, we found that someone had damned the water going onto the King's property and had removed a pipe under Ustler Lane. This was the direct cause of his flooding.

The flooding in this area seems to be exacerbated from the viewpoint of the homeowners of the subdivision by Lake Coronia. Their lake level is significantly lower than normal, and no water is coming from Lake McCoy north across Sandpiper Street to Lake Coronia. The King's say that Commissioner Staley may have blocked the water flow on his property adjacent to Lake McCoy. They feel that this is causing the water to flood onto their property and preventing it from getting to Lake Coronia.

A drainage study is scheduled for sometime in the future for this area. Please expedite this study. We would like to alleviate the obvious flooding problems in this area as soon as possible.

DDJ/vm

cc: George W. Cole, P.E., Director, Public Works Division
William P. Baxter, P.E., Deputy Director, Public Works
Fred B. Dybdahl, P.E., Manager, Highway Maintenance

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT MEMORANDUM

TO: Project File OC-070 (1-1.0)

FROM: Walt Phillips, P.E. WP

DATE: January 4, 1996

SUBJECT: Telephone Conversation

This afternoon, I spoke with Peter Scalco, the Park Manager of the Wekiva Springs State Park, regarding gaining access to the park for our field review. Mr. Scalco was aware of our study and indicated that we may enter the park as long as we check in at the main ranger station located at the park entrance.

During our conversation, Mr. Scalco stated that the two main concerns with regard to the Park are the flows from Lake Prevatt via Carpenter Branch and the inflow from the new developments north of Welch Road and east of Rock Springs Road. According to Mr. Scalco, Carpenter Branch is normally dry; however, last year during Tropical Storm Gordon the flow was enough to wash out the old railroad bed downstream of the lake. In addition, problems have been recurring just upstream of the park boundary on the tributary to Lake Prevatt which conveys flows from the above mentioned developments.

END OF MEMO
OC-070.M02

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PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 1

TO: Mr. Deodat Budhu, P.E.,
Senior Manager

FROM: David W. Hamstra, P.E., DWH
Project Manager

DATE: January 29, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 08/20/95 TO 01/27/96

1. On Wednesday, August 23, 1995, PEC (David Hamstra and Walt Phillips) attended a 10:00 a.m. Scoping Meeting with Orange County staff (Dr. M. Krishnamurthy and Deodat Budhu).

2. On Wednesday, August 30, 1995, PEC received a Draft Contract and Scope of Services from Orange County's Purchasing and Contracts Department.

3. During the month of September, 1995, PEC (David Hamstra) prepared and submitted three (3) versions of the proposed Scope of Services and Fee Estimate to Orange County (Deodat Budhu) for review and approval.

4. On Thursday, October 12, 1995, PEC received three (3) original contracts from Orange County to be signed and returned. On Thursday, October 12, 1995, PEC signed and returned all three (3) copies to Orange County (Martha Kiser).

5. On Thursday, October 12, 1995, PEC (David Hamstra) received a letter from Orange County's Stormwater Management Department (Deodat Budhu), dated October 11, 1995, regarding a formal Notice to Proceed.

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Enterprise Department (Juan Belgodere) regarding PEC's M/WBE utilization and reporting requirements.

7. On Monday, October 30, 1995, PEC (David Hamstra) revised and resubmitted the work schedule to Deodat Budhu.

8. On Thursday, November 2, 1995, PEC (David Hamstra and Walt Phillips) attended a 3:30 p.m. Kick-Off Meeting with Dr. M. Krishnamurthy, Deodat Budhu, Tom Ziegler (SJRWMD), and Danny Quick (City of Apopka).

9. On Monday, November 13, 1995, PEC (Walt Phillips) prepared and mailed a Project Memorandum to Orange County, SJRWMD, and the City of Apopka documenting the November 2, 1995 Kick-Off Meeting.

10. On Tuesday, November 14, 1995, PEC (David Hamstra) prepared and mailed a letter to Juan Belgodere regarding PEC's negotiated contracts with the three (3) M/WBE firms under contract.

11. On Monday, November 20, 1995, PEC (David Hamstra and Walt Phillips) prepared and mailed a letter to Deodat Budhu requesting various information and documents (7 items).

12. On Wednesday, November 22, 1995, PEC (David Hamstra) received portions of the requested information and documents (4 out of 7 items) from Orange County (Deodat Budhu). The remaining information (3 out of 7 items) was a listing of names and numbers of contact people.

13. On Monday, December 4, 1995, PEC (David Hamstra) received portions of the requested information and documents (3 out of 5 items) from the City of Apopka (Danny Quick).

14. The week of December 11, 1995, PEC (Walt Phillips) contacted the SJRWMD GIS Department and was informed by Jim Cameron to make another formal request in order to obtain a listing of available information.

15. The week of December 11, 1995, PEC (Walt Phillips) reviewed the collected information and documentation to date.

16. The week of December 11, 1995, PEC (Walt Phillips) conducted two (2) site visits to verify the collected data and began delineating the limits of the overall watershed.

- *The design work for paving Sandpiper Road is underway. Deodat Budhu will check the County's list of roads proposed for paving to determine if other roads within the basin are included. The possibility of paving other streets in the basin may be included as a recommendation if improvements to water quality will be realized.*

- *Orange County aquired an easement between Lake McCoy and Lake Coroni in order to build a channel between the lakes; however, the work did not proceed. This easement is to be used in the design of drainage improvements between these lakes.*

5. *Dan Quick indicated that the water quality detention basins and broad crested weirs within the cemetary were installed approximately three (3) years ago in order to take the Highland Avenue drainwell off-line.*

6. *Dr. Krishnamurthy initiated a discussion of the level of flood protection which should be provided within the study area. It was agreed that it is desirable to protect residential structures (not yards) from the 100-year storm as a minimum. It was also determined that the level of flood protection which can be reasonably provided will be more easily addressed as the project progresses and results of some of the analyses become available. David Hamstra indicated that the initial work (eg. existing conditions analyses) will be performed for the 10-year/24-hour, 25-year/24-hour, and 100-year/24-hour storms in accordance with the approved scope of work. Tom Zeigler noted that the design of any improvements must meet the Wekiva Basin criteria of SJRWMD.*

7. *PEC will make a written request for background information, previous studies, normal water elevations, survey data, water quality data, digital information, etc. to Deodat Budhu.*

8. *David Hamstra informed the County, City, and SJRWMD that PEC will develop a rating curve for the Prevatt Lake outfall (Carpenter Branch) and assume an existing dirt road and culvert as the tailwater condition. PEC will utilize ICPR, Version 2.0 to perform the hydrologic and hydraulic modeling.*

9. *Tom Zeigler indicated that Aisa Ceric in the District's Palatka office has a dynamic water quality model in the form of a Microsoft Excel spreadsheet which may be of use in this project. Aisa may be reached at (904) 329-4339 or through Tom Zeigler. He also stated that GIS information such as land uses (eg., 1994 LANDSAT data) in the basin may be available from the District. The person to contact regarding this information is Jim Cameron at (904) 329- 4500, Extension 4189.*

10. *Dan Quick stated that the City of Apopka also has some information in digital format which may be useful in this project. He is the person to contact (889-1718) in order to obtain this information. Dan also indicated that any proposed stormwater improvements identified in the City's Master Plan would be funded by the City's Capital Improvement Program.*

11. *Deodat Budhu indicated that all work performed by the surveyors must be recorded in the field books which will be provided by the County. At the completion of the project, the field books shall be returned to the County.*

12. *During the meeting, Deodat Budhu supplied the following to PEC:*

    - *1994 and 1995 drainage inquiries/complaints from Orange County's Maintenance Facility located within the Apopka/Zellwood area; and*
    - *Drainage easement documents and accompanying property appraisers maps in the Lake McCoy, Lake Coroni, and Prevatt Lake vicinity .*

13. *It was agreed that PEC will bill the County monthly for work performed. PEC will be required to submit a one (1) page status report with each invoice. The County will request payment from St. Johns River Water Management District and the City of Apopka at the following three (3) milestones in the project:*

    - *at the completion of the existing conditions analysis,*
    - *at the completion of the proposed solutions analysis, and*
    - *at the completion of the prooject.*

14. *The next project meeting is scheduled for Wednesday, February 14, 1996 at 1:00 pm at Orange County Public Works, 4200 John Young Parkway. At this meeting, the existing conditions analyses will be presented by PEC and possible solutions will be identified and discussed.*

END OF MEMO
OC-070.M01

cc: All Present
Leila Jammal Nodarse, L.J. Nodarse & Associates, Inc.
Evin Jones, Jones, Hoechst, & Associates, Inc.
Carolyn Schultz, Lotspeich and Associates, Inc.
Craig Batterson, PEC

17. On Friday, December 15, 1995, PEC (Walt Phillips) received a copy of the Orange County Horizontal Control Book, Volume 3, from the Orange County Survey Section.

18. On Friday, December 15, 1995, PEC (Walt Phillips) received a fax transmission from Orange County (Paul Akins) containing a listing of state plane coordinates.

19. The week of December 18, 1995, PEC (Walt Phillips and Troy Tarbox) conducted three (3) site visits to verify the collected data and continue delineating the limits of the overall watershed, as well as the drainage sub-basins.

20. The week of December 18, 1995, PEC (Walt Phillips) contacted the Orange County Environmental Protection Department (Linda Jennings) to request water quality data. Linda stated that PEC would have to send a written request to her directly or have PEC come down and do it ourselves.

21. On Wednesday, December 20, 1995, PEC (David Hamstra) received portions of the requested information and documents (2 out of 5 items) from the SJRWMD (Tom Ziegler).

22. The week of January 1, 1996, PEC (Walt Phillips and Troy Tarbox) conducted two (2) site visits to continue delineating the sub-basin delineation and develop a scope of survey services.

23. On Thursday, January 4, 1996, PEC (David Hamstra) submitted Minority/ Women Business Enterprise Quarterly Report No. 1 to Juan Belgodere.

24. On Thursday, January 4, 1996, Lotspeich and Associates, Inc. (Carolyn Schultz) requested from Orange County Environmental Protection Department (Rick Baird) copies of the Water Quality Data.

25. On Friday, January 5, 1996, PEC (Walt Phillips) received a listing of GIS information available from SJRWMD.

26. The week of January 8, 1996, PEC (Walt Phillips) conducted three (3) site visits to finalize the sub-basin delineation.

27. On Monday, January 8, 1996, PEC (Walt Phillips) prepared and mailed a letter to the SJRWMD (Jim Cameron) requesting GIS digital information.

28. On Monday, January 8, 1996 and Wednesday, January 10, 1996, PEC (Troy Tarbox) met with the SJRWMD-Orlando Service Center (Lillian Oquendo) to

review the permitted projects within the watershed. On Thursday, January 11, 1996, PEC (Troy Tarbox) prepared and mailed a letter to Lillian requesting that all reproduction costs be waived.

29. On Thursday, January 11, 1996, PEC (Troy Tarbox) prepared and mailed a letter to Orange County (Deodat Budhu) requesting digital files (e.g., parcel maps, land use, soils, etc.).

30. On Friday, January 12, 1996, PEC (Walt Phillips) transmitted aerial maps with preliminary basin divides to Lotspeich and Associates, Inc.

31. The week of January 15, 1996, PEC (Walt Phillips) began marking-up aerial maps with basin and sub-basin limits associated with the five (5) water bodies.

32. On Thursday, January 18, 1996, PEC (Walt Phillips) prepared and delivered a survey request to Jones, Hoechst & Associates, Inc. (Evin Jones).

33. On Thursday, January 18, 1996, PEC (Troy Tarbox) went to the City of Apopka to review and obtain various construction plans.

34. The week of January 22, 1996, PEC (Walt Phillips and Lisa Steele) began preparing the digital base maps and basin divide layers.

35. On Tuesday, January 23, 1996, PEC (Troy Tarbox) went to Orange County to obtain the requested digital files and to review construction plans.

TASKS TO BE COMPLETED

1. Follow-up with SJRWMD regarding the digital GIS/AutoCAD files.

2. Coordinate with Orange County regarding the future culverts under Sandpiper Road.

3. Follow-up with Evin Jones regarding the survey request.

4. Follow-up with Carolyn Schultz regarding the water quality investigation.

5. Locate and obtain construction plans and drainage calculations for Park Avenue (S.R. 435).

6. Complete the hydrologic/hydraulic analysis in preparation of the upcoming status meeting with Orange County, SJRWMD, and the City of Apopka (scheduled tentatively for February 14, 1996).

7. Submit Minority/Women Business Enterprise Quarterly Report No. 2 by April 8, 1996.

END OF MEMO

F:\cler\ld\oc-70\009.P.MEM

cc: Danny Quick, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Leila Jammal Nodarse, L.J. Nodarse & Associates, Inc.
Evin Jones, Jones, Hoechst, & Associates, Inc.
Carolyn Schultz, Lotspeich and Associates, Inc.
Walt Phillips, PEC
Troy Tarbox, PEC

Boyle Engineering Corporation

engineers/planners/surveyors

320 East South Street
Orlando, FL 32801

407 / 425-1100
FAX 407 / 422-3866

Mr. Danny J. Quick, PE, City Engineer
CITY OF APOPKA
P.O. Drawer 1229
Apopka, FL 32703

October 12, 1994

Stormwater Management Issues Associated With
Lakes McCoy, Coroni and Prevatt

Dan, in accordance with your request we have prepared this letter to address certain stormwater management issues associated with Lake McCoy, Lake Coroni and Lake Prevatt. Our purpose for this letter is to put these issues into perspective and to present our recommendations concerning this regional lake system.

This letter was requested following discussions related to the preliminary development plan for Sandpiper Estates during the City Council Meeting of September 21, 1994. We have also been requested to review the stormwater management plan for this project. Our review comments regarding Sandpiper Estates will be the subject of a separate letter.

The discussion herein will focus on the following general issues.

- Stormwater concerns associated with the King property.
- Miscellaneous Issues Related to Lake McCoy.
- The Lake McCoy, Lake Coroni, Lake Prevatt System of Interconnected Lakes.

The King Property

The King property is generally located west of Ustler Road between Sandpiper Road on the north and Tanglewilde Street on the south. The owners of this property have historically been concerned about stormwater runoff from adjacent or nearby properties which is discharged to the conveyance systems that cross their property.

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Historical Drainage Patterns

We did not conduct an extensive search of the historical record. However, U.S. Geological Survey (USGS) quadrangle (quad) maps provide over 40 years of historical information. The USGS Map attached as Exhibit 1 was compiled based on aerial photos taken in 1952. This map shows the following.

- Sandpiper Road was not extended all the way to Ustler Road
- Flow from the Grossenbacher ditch including the outfall from Buchan Pond traveled west to east, under Rock Springs Road, to the King property.
- Stormwater flow from areas located north of the Sandpiper Road corridor moved from north to south.

The USGS Map was revised in 1980. A copy of this map for the subject area is shown in Exhibit 2. There are no discernible differences in the drainage patterns shown between these two maps. The revised map shows Sandpiper Road connecting to Ustler Road.

Based on the USGS mapping, it is evident that the drainage courses or stormwater conveyances that are present on the King property have been there for at least 40 years or more. Additionally, these conveyances have had to handle stormwater flows from areas that are upstream of the King property including areas west of Rock Springs Road and north of Sandpiper Road.

This condition was acknowledged by the FDOT when Rock Springs Road was expanded in the 1970's. As part of the road construction, a 36 inch diameter culvert was placed under the road to transmit the stormwater flow from the Grossenbacher ditch from the west side of the road to the east side of the road. This culvert is still in service today and is a controlling factor in the stormwater flows which originate from the east.

When Sandpiper Road was constructed, a 48 inch diameter culvert was installed to convey stormwater that had historically flowed from areas north of the Sandpiper Road corridor. There appears to be no basis for redirecting this historical path of stormwater conveyance.

Development Impacts

The St. Johns River Water Management District (SJRWMD) was created on December 31, 1976. Since, that time land development projects have had to meet rigorous stormwater management requirements. These requirements were designed by the SJRWMD so that upstream development would not adversely impact downstream development.

Under District Rules (40C-4.301), an applicant must give reasonable assurance that their development activity will not:

- Endanger life, health or property.
- Cause adverse impacts on the quality of receiving waters.
- Increase the potential for damages to off-site property or the public caused by:
  a) floodplain development, encroachment or other alteration,
  b) retardance, acceleration, displacement or diversion of surface water
  c) reduction of natural water storage areas, and
  d) facility failure.
- Increase the potential for flood damages to residences, public building or proposed and existing streets and roadways.

These objectives are met by employing stormwater detention and retention systems that restrict the post development peak rate of discharge to a value which is less than or equal to the pre-development peak rate of discharge. It is doubtful that development projects that have been designed, constructed and maintained in accordance with the District's stormwater management criteria are contributing to the concerns or problems which have been identified by the King property owners.

Activity on the King property may also be contributing to conditions observed by the owners. At some point in time, ponds were constructed on the King property. These ponds do not appear on the most recent USGS Quad Map dated 1980 (refer to Exhibit 2). We are not certain of how the presence of these ponds has affected the movement of surface waters and groundwater conditions.

In our opinion, there does not appear to be sufficient evidence to recommend immediate improvements to the stormwater conveyances on the King property. We have taken this position because the historical drainage patterns have been maintained and developments that have been constructed over the last 15 years have employed stormwater management techniques.

Miscellaneous Issues related to Lake McCoy

The two issues that will be discussed under this topic are the Tanglewilde Street Drainage System and the Lake McCoy Master Drainage Pond.

Tanglewilde Street Drainage System

During Boyle's review of the Magnolia Oaks subdivision, we concluded that this system was not capable of conveying the stormwater runoff from the 25 year, 24 hour storm. Further, Boyle recommended that the system be upgraded using a closed or piped system. Boyle's recommendations were included in a letter dated January 19, 1994 to Mr. Danny Quick, PE (copy attached). We recommend that the City work together with other contributors to

Tanglewilde Street drainage system such as Orange County and the Post Office to assess the feasibility of improving the system.

Further, it is recommend that this closed system be extended northward from Tanglewilde Street to intercept the flow under Ustler Road from the King property.

Lake McCoy Master Drainage Pond

It is our understanding, that development projects in the vicinity of Lake McCoy have been contributing to the eventual design and construction of a master drainage pond. We recommend that the City assess the need for and the feasibility of constructing this pond. Due to the nature of actual development activities, land areas which were formerly going to contribute to this pond will not be contributing. An example of this is the Magnolia Oaks project. This project is constructing retention ponds which are designed to retain the runoff from the 100-year storm.

Lake McCoy, Lake Coroni and Lake Prevatt System of Interconnected Lakes

Background

Recent heavy rainfalls have recharged this chain of lakes. This system of lakes is interconnected by culverts and ditches and flows northward from Lake McCoy to Lake Prevatt and then eventually into the Wekiva River system. In recent years, the interconnections between these lakes have not been obvious due to low water levels. In fact, the USGS map, which is attached as Exhibit 2, does not show a blue area in the location of Lake Coroni. Evidently, the lake bed was dry when the aerial photography for this map was flown.

Since January of this year, Lake McCoy has risen from an elevation of 59.44 feet to an elevation in September of 61.47 feet. In September, the elevation of Lake Coroni was measured as 60.83 feet on the south side of Sandpiper Road and 60.89 feet on the north side of Sandpiper Road. Since January of this year Lake Prevatt has risen 2.5 feet from elevation 53.47 feet to elevation 56.09 feet in September.

It is interesting to note that until the early 1970's, the City of Apopka's Wastewater Treatment Plant discharged to Lake McCoy. This flow continued on downstream through Lake Coroni and through Lake Prevatt on its way to the Wekiva River system. The City's old wastewater treatment facility was formerly located near the intersection of Forest Avenue and Oak Street.

Attached to this letter as Exhibit 3, is a copy of the FIRM Flood Insurance Rate Map which was compiled by the Federal Emergency Management Agency (FEMA). The effective date of these particular maps was December 1, 1981. As can be seen in Exhibit 3, Lake McCoy, Lake Coroni and Lake Prevatt are all identified as Zone A. These areas represent the boundary of the 100 year flood. A 100 year flood elevation of 65 feet has been determined for Lake McCoy. Based on a comparison with the USGS Quad Maps, it appears that the 100 year flood elevation of 65 feet has been extended northward to Lake Coroni. Similarly, the 100 year flood elevation for Lake Prevatt appears to be 60 feet. Clearly, FEMA anticipates that the water elevations in these three lakes will increase to elevation 65 during a 100 year storm event. The water elevations currently measured at these lakes are substantially lower than the 100 year flood elevation.

At the present time, we do not see the need to institute immediate measures to address potential flood control issues for this lake system. However, it appears that the 100 year flood elevation was calculated only for Lake McCoy. The FIRM Map shows the limit of detailed study as the outlet of Lake McCoy. It appears that FEMA estimated the flood elevations for Lake Coroni and Lake Prevatt as 65 feet and 60 ft, respectively. It would be desirable to look at the 100 year flood condition for the entire lake system. More research would be needed to determine exactly what was done to establish the current flood elevations. Based on this information, then a strategy could be developed to identify the flood elevations for Lakes Coroni and Prevatt.

Since this lake system is regional in nature, it was suggested by City staff that a study, jointly ventured by the City, the County and the St. Johns River Water Management District, could be done to evaluate this system. We contacted Mr. Charles Tai with the SJRWMD concerning this issue. Mr. Tai emphasized that in order for the District to participate in a project it has to be regional in nature. He indicated that it would not be possible for the District to get started on such a project until a year or more from now due to budgeting constraints. He suggested that a proposal be developed and submitted to the District by March of next year. He also indicated that a joint project involving the City, the County and the District would be viewed favorably by the District's Board. We recommend that City staff work with the County to develop a proposal for consideration by the District.

It is our view, the recent heavy rainfalls have hastened the recovery of lake levels throughout the area. What is being experienced in the Lake McCoy, Coroni and Prevatt system is representative of what lake systems are experiencing in other areas of the County and State. The heavy rainfalls are replenishing lake basins. Water levels are coming up and are reaching or exceeding normal high water elevations. Since these lakes are recharged by stormwater runoff, we would anticipate that lake levels will recede as we enter into the drier winter and spring seasons. Our discussion in this letter assumes that property owners along the shores of these lakes are familiar with the 100 year flood elevations that have been established by FEMA. Finished floor elevations for homes and other buildings are typically constructed to at least one foot above the 100 year flood elevation. If there are homes and/or buildings that have finished floor elevations at or below elevation 65, then these property owners will need to be advised that they could be potentially impacted by the 100 year flood elevation.

Danny, we hope that this letter will be of assistance to you and the rest of staff in evaluating the regional concerns associated with Lakes McCoy, Coroni and Prevatt. Please call if you have any questions or need additional information.

Boyle Engineering Corporation

Victor J. Godlewski, Jr., PE
Senior Engineer

Enclosures: Exhibits 1, 2, 3

OR-A02-001-94/bem

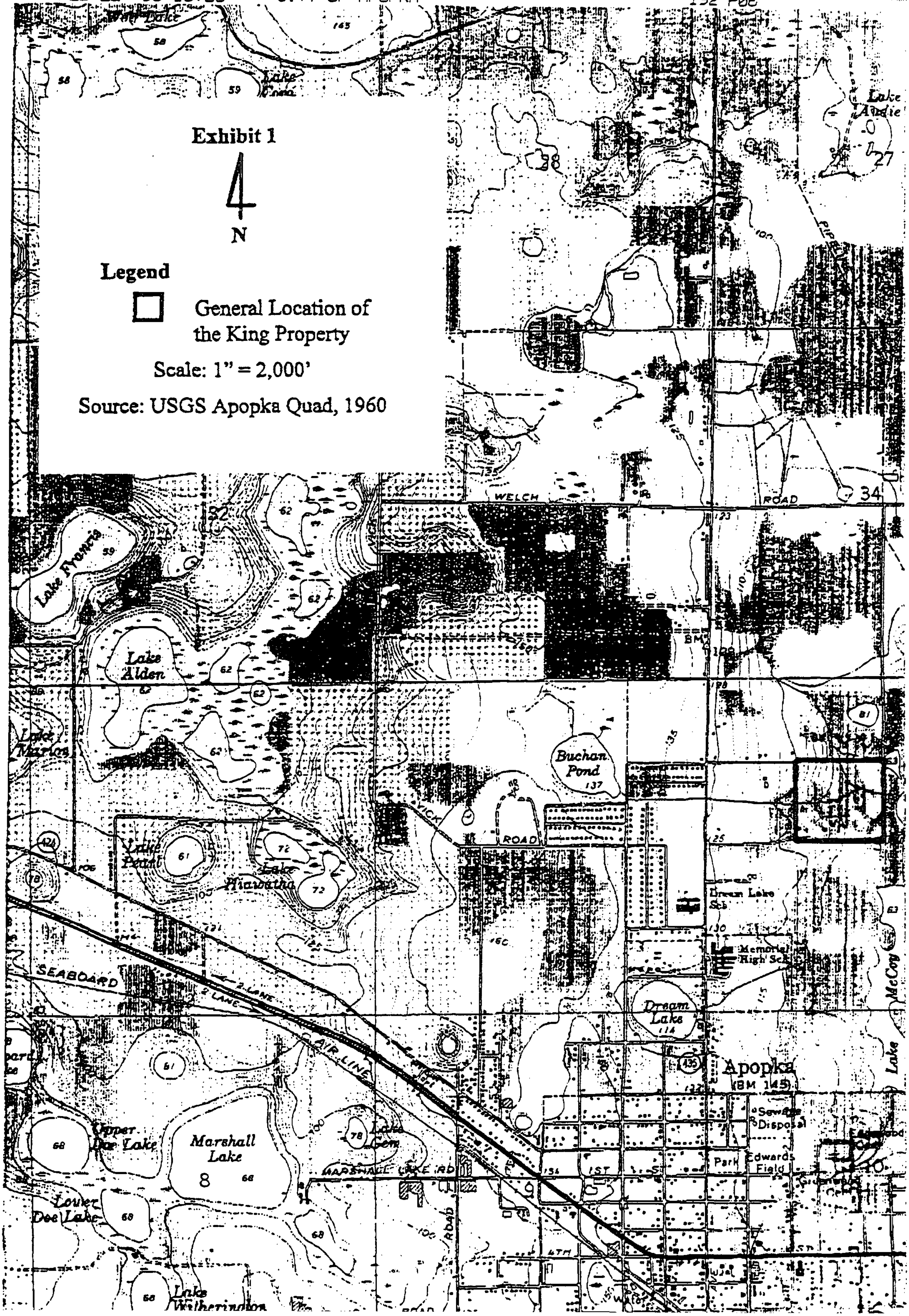


Exhibit 1

N

Legend

☐ General Location of the King Property

Scale: 1" = 2,000'

Source: USGS Apopka Quad, 1960

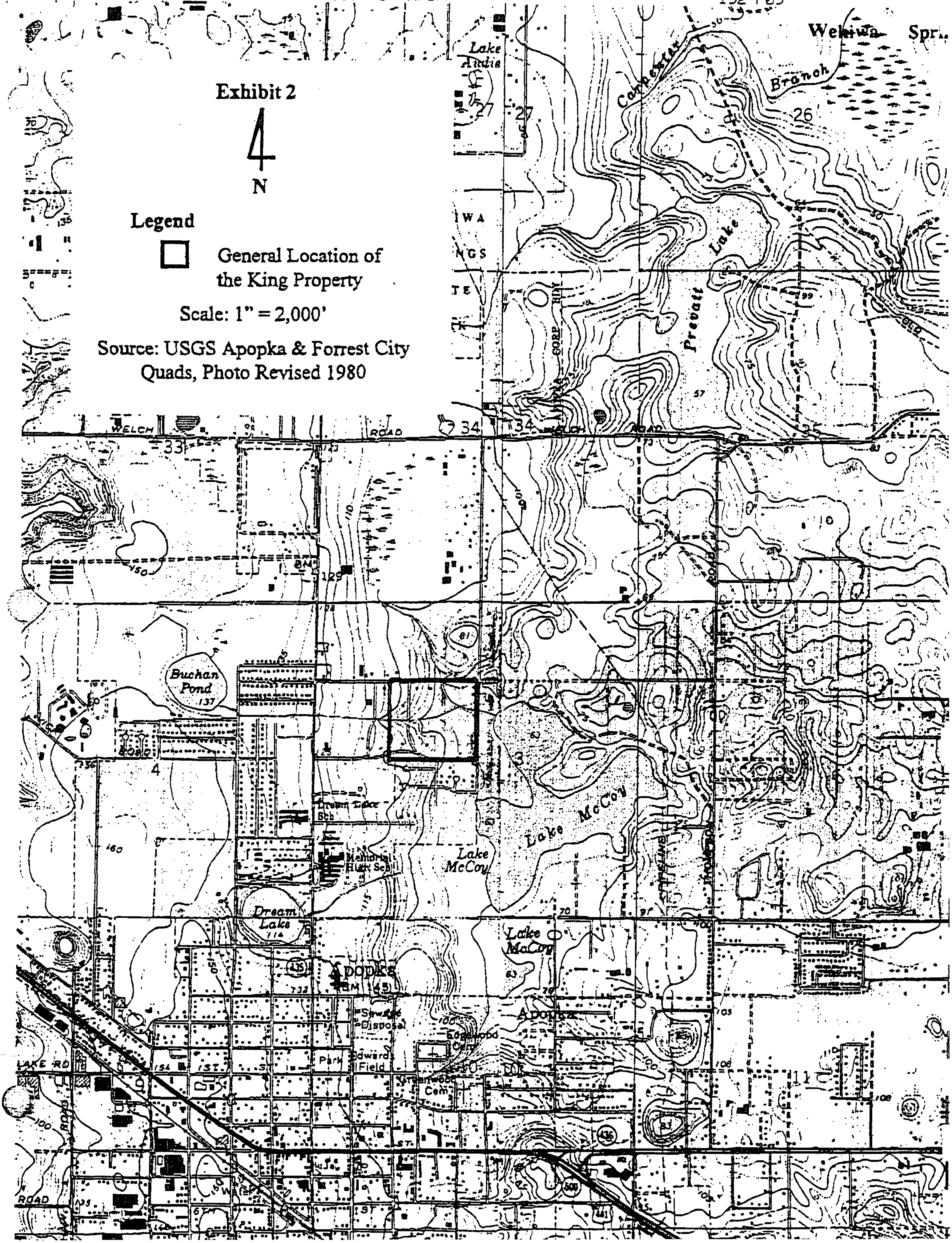


Exhibit 2

Legend

☐ General Location of the King Property

Scale: 1" = 2,000'

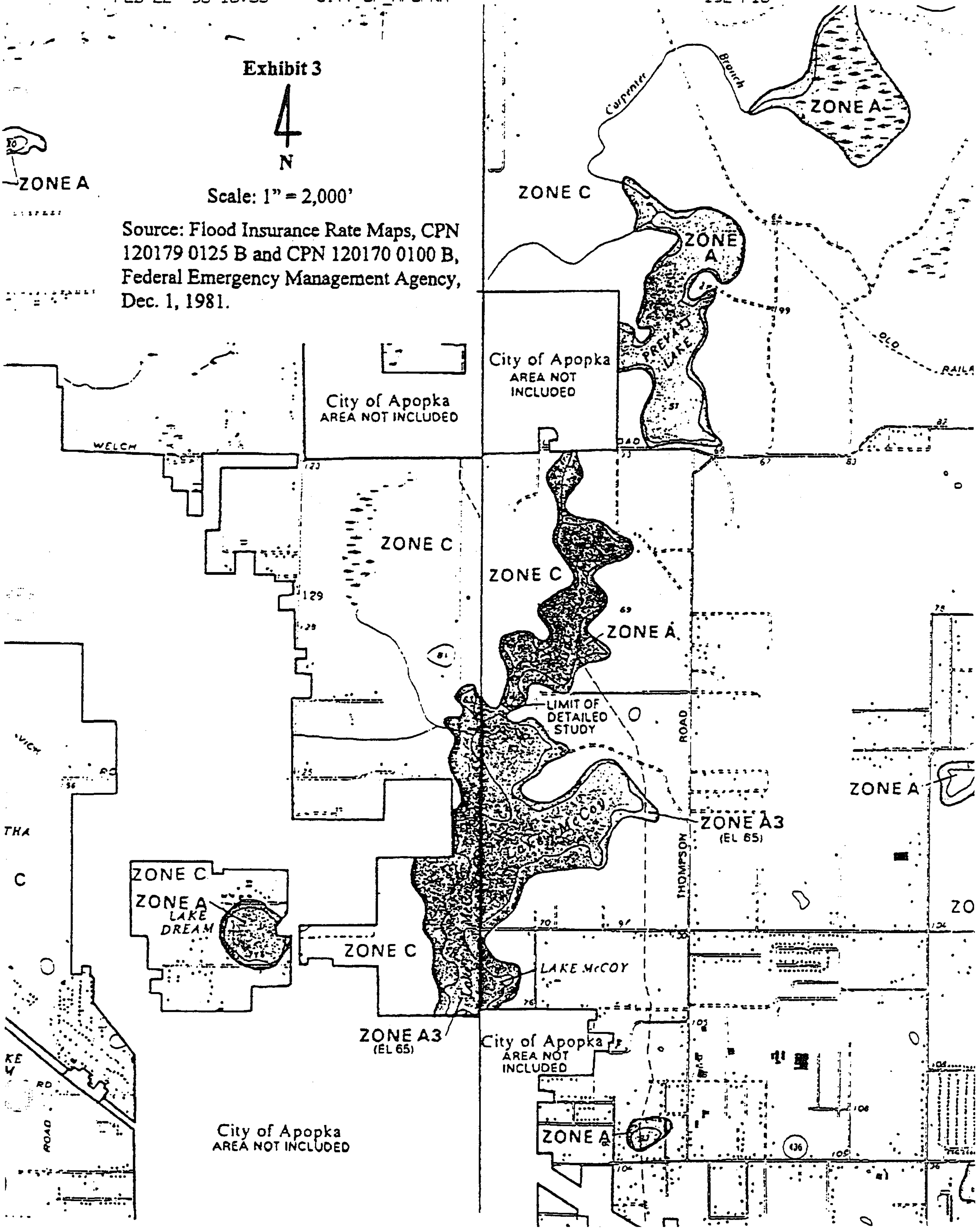
Source: USGS Apopka & Forrest City Quads, Photo Revised 1980

Exhibit 3

N

Scale: 1" = 2,000'

Source: Flood Insurance Rate Maps, CPN 120179 0125 B and CPN 120170 0100 B, Federal Emergency Management Agency, Dec. 1, 1981.



Boyle Engineering Corporation

engineers planners surveyors

320 East South Street
Orlando, Florida 32801

305 425-1100

C.W. Temby, PE
City Engineer
CITY OF APOPKA
P.O. Drawer 1229
Apopka, FL 32703

August 26, 1987

RE: Conceptual Plan for Stormwater Management in the Area Around the Old Ustler Nursery

Bill, we have completed the conceptual planning for a stormwater management system for the area around the old Ustler Nursery, which is generally bounded by New Hampshire, Orange, Washington and Sharpe Streets (See Exhibit 1). The purpose of this letter report is to summarize our findings and present our recommendations.

Background. In recent years, the depressional area around the old Ustler Nursery has come under development pressure. Based on data provided to the City by one developer, the low spot which receives stormwater runoff from the depressional area is underlain with poorly drained soils. It has been reported by the City that a drainage well is located in the vicinity of the low spot. This well has provided a point of discharge for the low spot, which explains why serious flooding has not been a problem in the past. However, there have been instances of flooding problems observed by residents who live near the vacant depressional area.

Because the City is concerned that future development in the depressional area could create serious stormwater problems, the City authorized Boyle to develop a conceptual plan for a positive stormwater outfall. The City undertook the study because there are four separate properties within the depressional area, and it wanted an unbiased analysis covering the entire area, not a piecemeal analysis of each individual property.

Positive Outfall Options. We identified the following four positive outfall options for the depressional area.

1. Continue to rely on the existing drainage well. This was not felt to be an acceptable option because of environmental concerns, and the City's desire to eliminate existing drainage wells, if possible.

2. Discharge to the unnamed lake near the southwest corner of the depressional area. This lake receives stormwater runoff from a system of inlets and pipes in US 441, which were constructed by FDOT. It was reported that water levels in the lake are monitored by means of a drainage well. This option was not acceptable for the same reasons outlined in 1. above.

3. Construct a retention area in the low spot. Penetrate the poorly drained soils by installing sand packed "chimneys", or similar devices. This procedure was proposed by one developer. This was not felt to be an acceptable option because of the unreliability of such a facility. Over a period of time, the "chimneys" could become clogged with the poorly drained natural soils, thereby reducing their effectiveness and resulting in flooding.

4. Install a discharge pipe from the depressional area to Dream Lake. It appears from the contours on the west side of Dream Lake (refer to Exhibit 2, which is an enlargement of a USGS quadrangle map) that water in the depressional area spilled over to Dream Lake at one point in time. This may have occurred before the drainage well was installed. Under this option, a positive discharge that may have existed at one time would be established. This was felt to be the most reliable and environmentally sound option. <u>Under this option, the existing drainage well would be eliminated</u>.

<u>Procedure</u>. We met with a representative of St. Johns River Water Management District (SJRWMD), which has stormwater permitting jurisdiction over developments planned within the depressional area. At that meeting, we agreed upon a procedure for analyzing a direct discharge from the depressional area to Dream Lake. SJRWMD stated that it was concerned about the impact that discharge from the depressional area would have on water levels in Dream Lake. Dream Lake discharges to Lake McCoy via a single 24-inch diameter pipe under Park Avenue and an open ditch. SJRWMD did not feel that it would be concerned with the impact on Lake McCoy because the lake receives runoff from a much larger drainage area than Dream Lake.

As a result of our meeting with SJRWMD, we followed the following procedure in our analysis:

1. Estimate the water level in Dream Lake resulting from the flow it receives from the area that is presently tributary to it under design storm conditions (the Dream Lake Basin on Exhibit 2).

2. Estimate the facilities that will have to be installed to allow the depressional area to discharge to Dream Lake without a significant increase in the water levels calculated in Step 1 above.

The new facilities will consist of detention facilities within the depressional area, a discharge pipe connecting the detention facilities with Dream Lake, and additional discharge pipes out of Dream Lake.

We used the Route IV flood routing computer program to perform our analysis.

Description of Depressional Area. The boundary of the depressional area drainage basin was estimated from an old drainage master plan, field observations, and discussions with City staff. (See Exhibit 2). Soil types were estimated from the Orange County SCS Soil Survey Interim Report (1985). Existing land use was obtained from aerial photos taken in 1986 and information provided by City staff. Under existing development conditions (See Exhibit 2), we estimated the composite curve number (CN) to be 63. To estimate the CN under future developed conditions, we reviewed plans for the Xebec Apartments and Rhapsody Oaks, two developments planned within the depressional area. We also looked at two existing nearby developments (Main Avenue Apartments and Main Avenue Villas West). Assuming that future development within the depressional area would be similar to these four developments, we estimated a composite CN of 79 under post-development conditions.

Dream Lake Basin. The Dream Lake Basin (see Exhibit 2) is almost fully developed at this time. The Dream Lake Basin actually consists of three subbasins, or reaches. The first reach is comprised of those areas which drain to the lake via overland flow. These are located south and north of the lake. The second and third reaches are located in the Dream Lake subdivision, located northwest of the lake. Reach 2 is a retention pond which receives flow from approximately five acres of the subdivision. This pond overflows into a second pond designated as Reach 3, which receives runoff from the remainder of the subdivision. This second pond (Reach 3) discharges to Dream Lake via an 18-inch pipe. Since our modeling conditions consider a storm event more severe than the storm event used to size the ponds and pipe, Reach 3 actually spills over its banks into Dream Lake.

Design Criteria. The following design criteria were used:

* 25 year, 24 hour storm event

- Initial level of Dream Lake before the storm event is 114.0 feet above MSL (based on data shown on USGS quadrangle maps and confirmed from data shown on FDOT construction plans for Park Avenue).

- SCS rainfall distribution curve.

- Antecedent moisture content factor of 2.

- The minimum detention pond volume within the depressional area is equal to the sum of (a) the volume necessary to keep post-development discharge equal to pre-development discharge, and (b) the first 1/2-inch of rainfall over the basin. This equates to 12 acre-feet (Ac-ft).

Results of Analysis. As a basis for comparison, we estimated the area that would be flooded within the depressional area under fully developed conditions without a positive outfall. We estimate that approximately 33 Ac-ft of water would accumulate in the low spot. Without a positive outfall, this volume of water would not recede within a reasonable time period.

In our next computer analysis, we estimated the water level rise in Dream Lake as a result of flow received from only the Dream Lake Basin. The computer modeling results for this analysis are attached as Exhibit 3. The water level rose from 114.0 ft MSL to 115.5 ft MSL. The peak flow through the 24-inch discharge pipe under Park Avenue is 8 cubic feet per second (CFS).

In our next analysis, we estimated the lake level rise with both the Dream Lake Basin and the depressional area basin routed through Dream Lake. In this run, we assumed that (a) there was a minimum detention volume of 12 Ac-ft in the depressional area basin (b) a 36-inch pipe connected the detention facilities in the depressional area with Dream Lake, and (c) the existing 24-inch pipe was the only discharge out of Dream Lake. The results of this analysis showed that the water level in Dream Lake would rise above the target level of 115.5 ft MSL.

In our next computer analysis, we enlarged the detention volume within the depressional area basin to 19.8 Ac-ft. This volume detention facility would occupy approximately 10% of the total area within the depressional area basin, which was felt to be a reasonable upper limit for detention facility area. Other conditions were unchanged from the previous run. This decreased the level to which Dream Lake would rise over the previous run, but it still caused the lake level to rise approximately 0.5 ft above the 115.5 ft MSL target level.

Being concerned about making the detention volume within the depressional area too large, we decided to incorporate into the analysis additional discharge pipes out of Dream Lake. An analysis, which is attached as Exhibit 4, includes two additional 24-inch pipes under Park Avenue. The detention pond volume within the depressional area remained the same (19.8 Ac-ft), and the discharge pipe from the depressional area to Dream Lake was kept the same (36-inch diameter). The results of this analysis showed that the level of Dream Lake would not rise significantly above 115.5 MSL. Peak discharge from the depressional area to Dream Lake would be 36 CFS, while peak discharge out of Dream Lake would be approximately 25 CFS (as compared with 8 CFS <u>without</u> the depressional areas routed through the lake).

In our final computer analysis, we reduced the number of new 24-inch discharge pipes out of Dream Lake from two to one. The results of this analysis (See Exhibit 5) showed that the water level in Dream Lake would only rise approximately 0.2 feet above the 115.5 ft MSL target level (to 115.7 ft MSL). Peak discharge from the depressional area to Dream Lake would be 36 CFS, while peak discharge out of Dream Lake would be approximately 19 CFS (as compared with 8 CFS <u>without</u> the depressional area routed through the lake).

We feel that it would be prudent to install additional discharge capacity out of Dream Lake equivalent to two new 24-inch diameter pipes to keep the level of Dream Lake from rising above the 115.5 ft MSL target level. Any additional storage that the lake might provide should be reserved for more severe storm events.

<u>Recommendations</u>. As a result of our analysis, we offer the following recommendations:

1. In conjunction with new development in the depressional area, provide the following storm drainage facilities:

    a) Detention volume facilities within the depressional area totaling 19.8 Ac-ft. This could be provided in a single facility or multiple facilities located at the individual properties. Underdrains will probably be required in order to provide the necessary storage volume within 72 hours following a storm event.

    b) A 36-inch pipe connecting the detention facilities with the depressional area to Dream Lake. The minimum slope should be 1.5% toward Dream Lake. We performed our analysis under the assumption that the pipe would be installed in Myrtle Street and Lake Avenue. Shorter routes may be used. The 36-inch pipe is conservatively sized to provide a safety factor to handle larger design storms.

   c) Additional discharge pipe capacity out of Dream Lake equivalent to two 24-inch pipes. These pipes will have to be installed under Park Avenue to connect Dream Lake with the existing ditch to Lake McCoy.

2. Submit this report to SJRWMD for conceptual approval.

3. If conceptual approval is received from SJRWMD, consult with Orange County to see if the recommended discharge pipes can be constructed under Park Avenue by means of an open-cut. This is probably the only feasible method that can be used to install the pipes.

4. If Orange County will allow an open-cut, obtain approval from the Orange County drainage engineer to discharge the increased flows to the ditch and Lake McCoy. The ditch and outlet structure at Dream Lake may have to be modified to comply with the County's requirements.

5. After approvals have been obtained, preliminary design plans for developments within the depressional area should be reviewed for conformance with the recommendations set forth in this letter.

Estimated Costs. Approximate costs for the major facilities recommended above are as follows:

1. 36-inch pipe connecting depressional area to Dream Lake; approximate length is 1,500 ft. Estimated cost is $140,000.

2. Two 24-inch pipes or equivalent under Park Avenue connecting Dream Lake with existing ditch. Estimated cost is $30,000. This estimate assumes that an open-cut will be allowed by Orange County.

Costs associated with the detention facilities within the depressional area, as well as any costs that may be associated with improvements to the ditch have not been estimated.

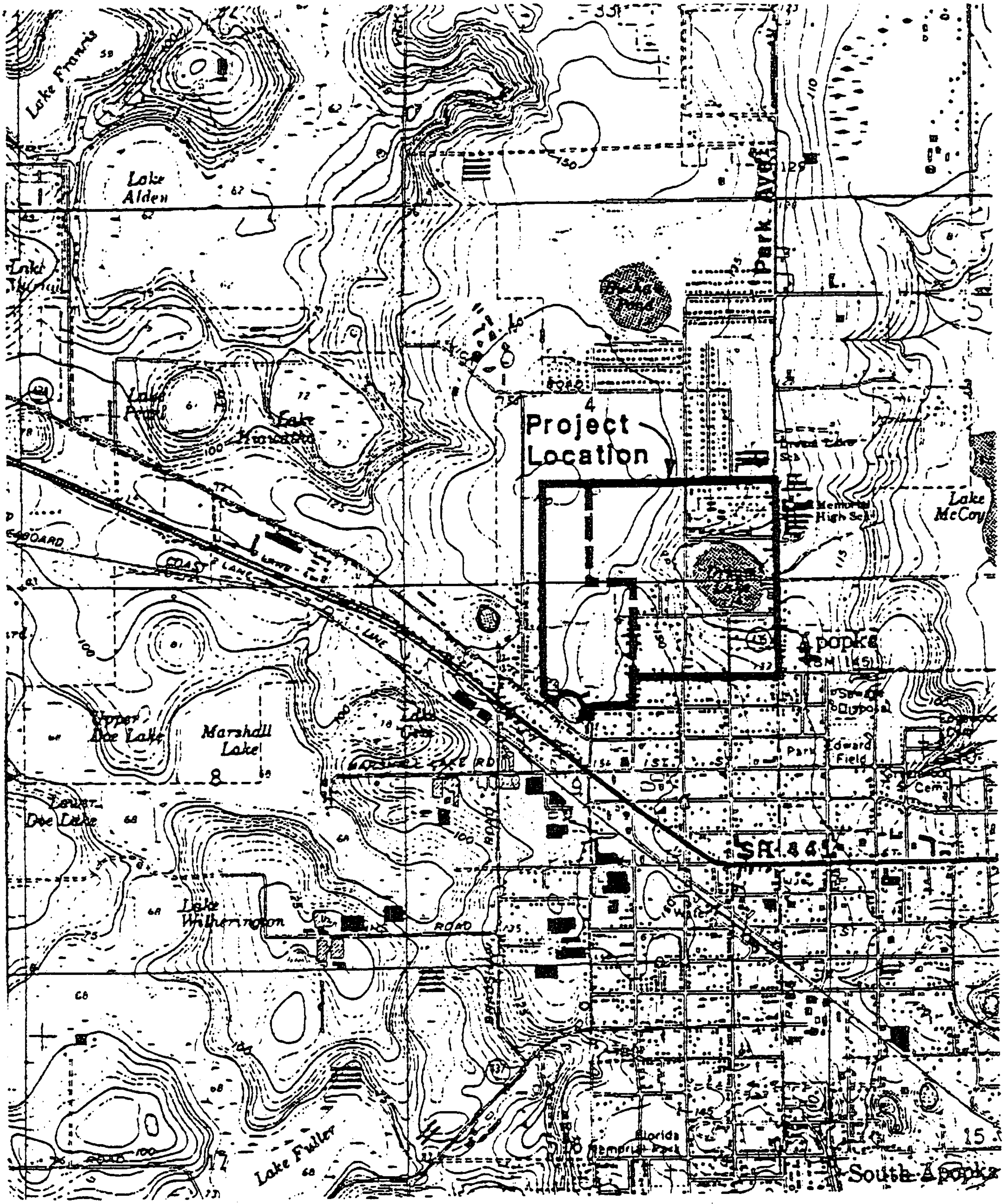
We hope this report provides you with the information you need. If you have any questions, please don't hesitate to call.

BOYLE ENGINEERING CORPORATION

Richard J. Coleman, PE
Senior Civil Engineer

Robert E. Penoyer, EI
Assistant Environmental Engineer

OR-A02-204-00



LOCATION MAP

Scale : 1"=2000'

Exhibit 1

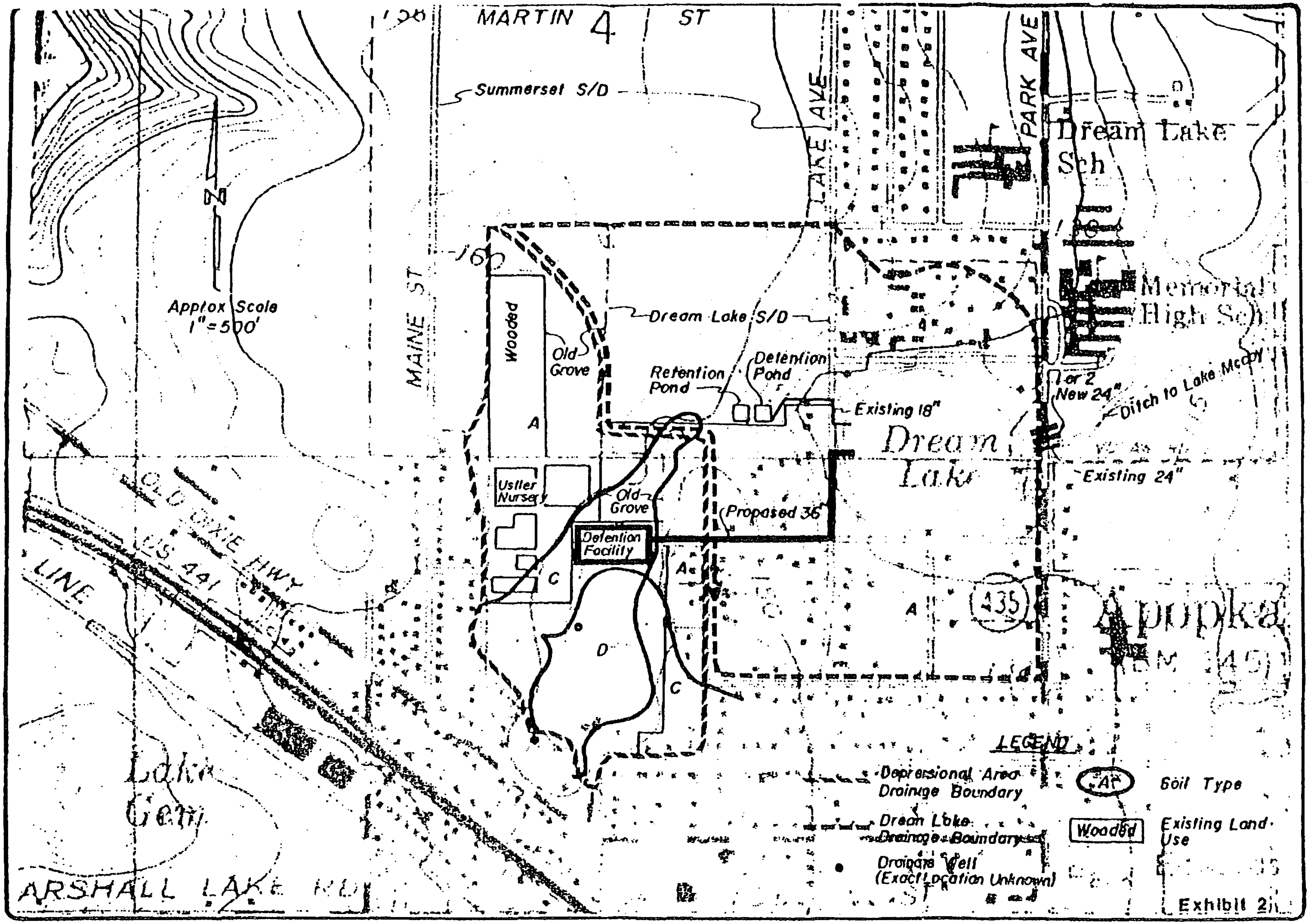
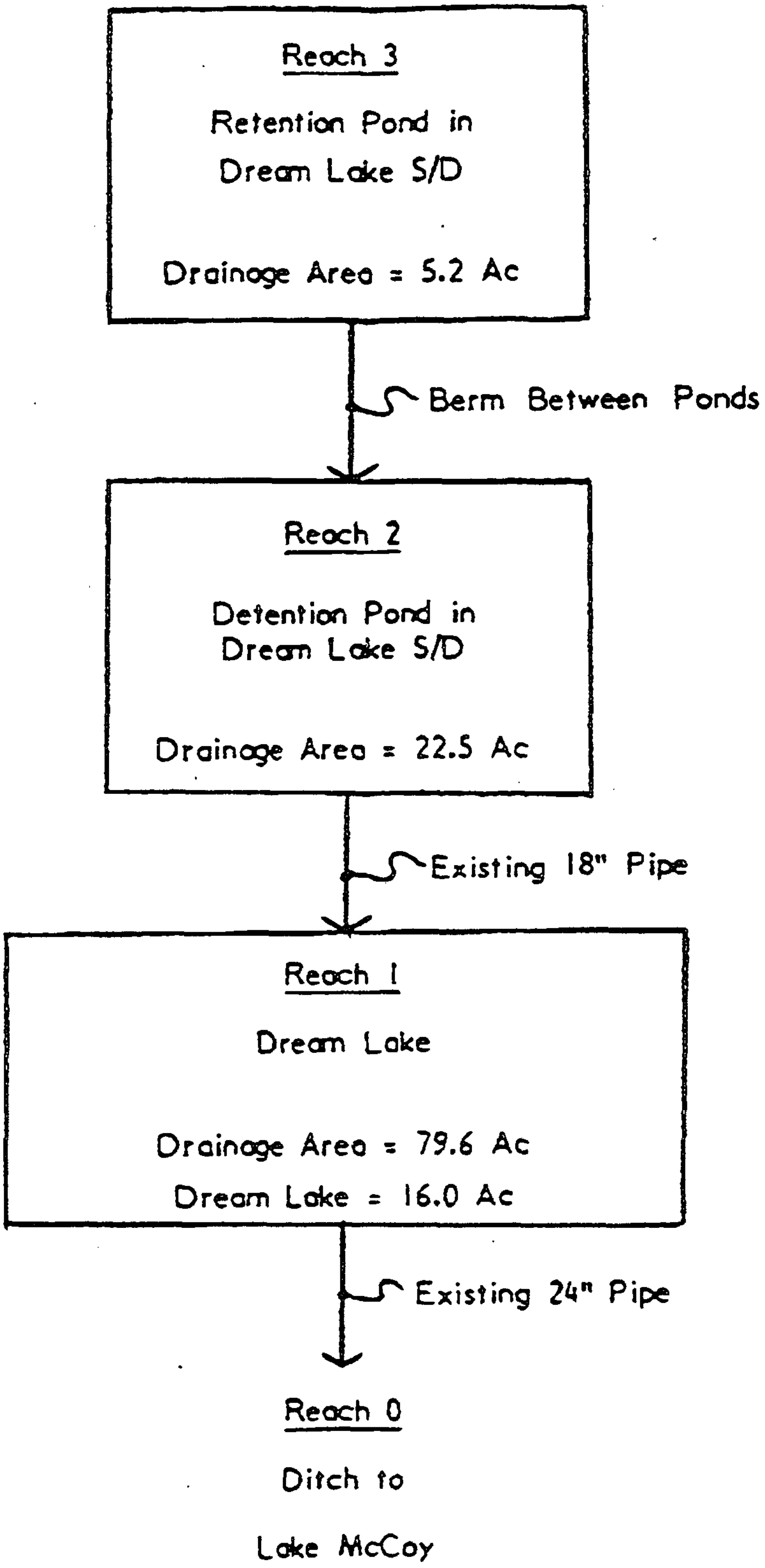

MARTIN ST
4
Summerset S/D
LAKE AVE
PARK AVE
Dream Lake Sch
Memorial High Sch
N
Approx Scale 1"=500'
160
MAINE ST
Wooded
Old Grove
Dream Lake S/D
Retention Pond
Detention Pond
Existing 18"
1 or 2 New 24"
Ditch to Lake Mccoy
Dream Lake
Existing 24"
A
Ustler Nursery
Old Grove
Proposed 36"
Detention Facility
C
A
A
435
Apopka
D
C
OLD DIXIE HWY
US 441
LINE
Lake Gem
MARSHALL LAKE RD
LEGEND
Depressional Area Drainage Boundary
Dream Lake Drainage Boundary
Drainage Well (Exact Location Unknown)
A
Soil Type
Wooded
Existing Land Use

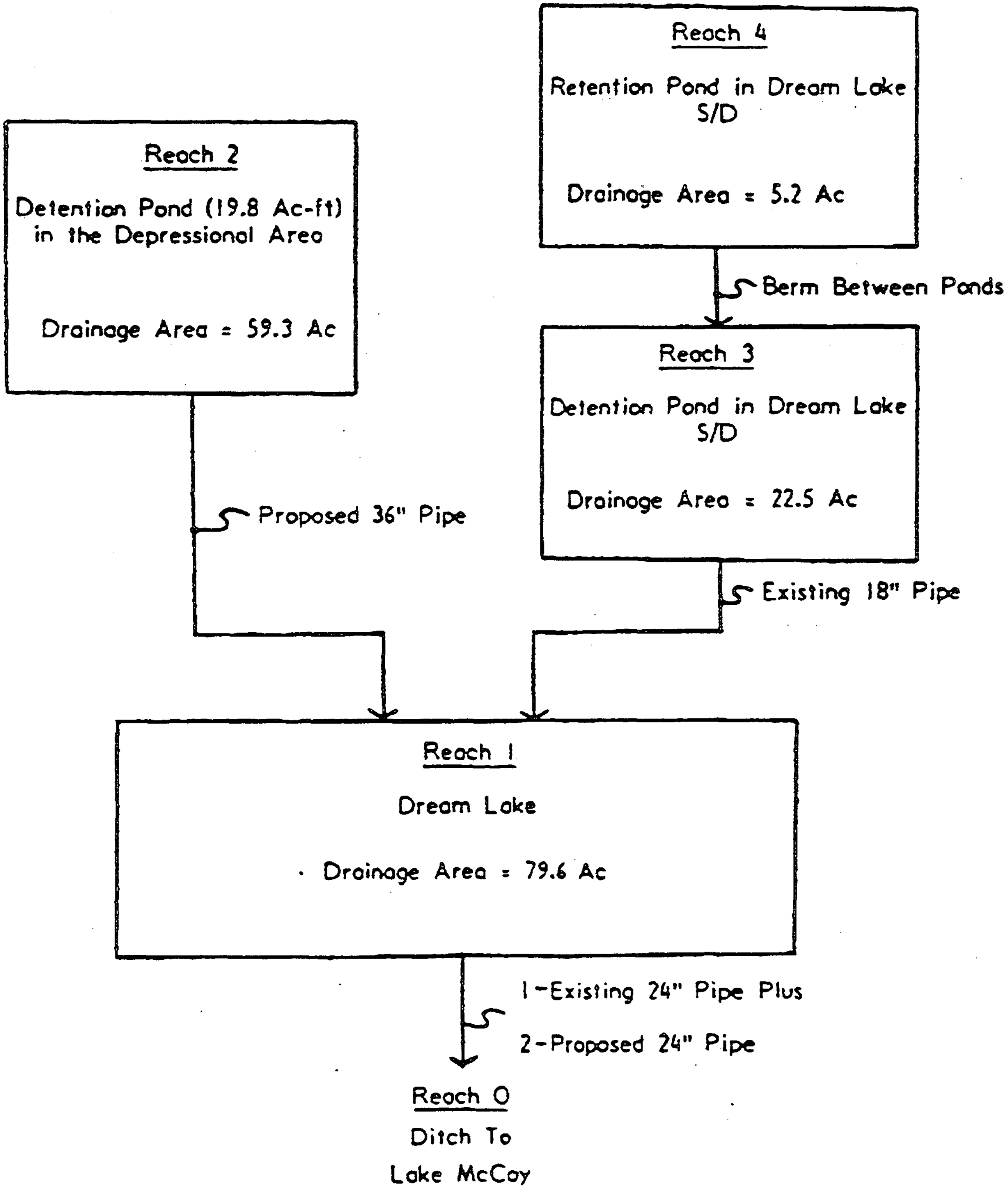
Exhibit 2

EXHIBIT 3



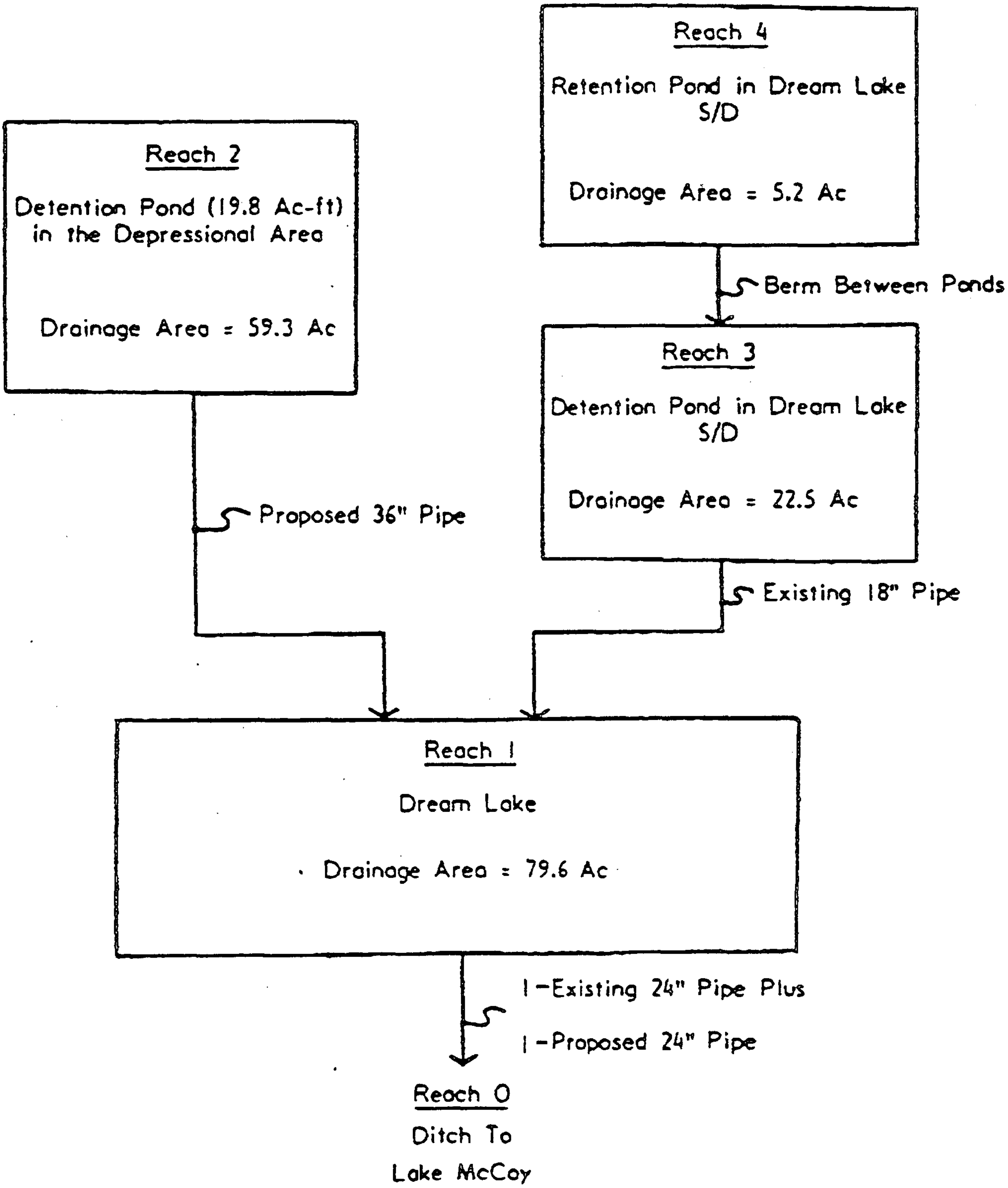
Route IV Model: Dream Lake Drainage Basin Under Existing Conditions;
8/17/87 DREAMEX2 1-24 inch outfall

EXHIBIT 4



Route IV Model: Dream Lake Drainage Basin with Depressional Area added and 3-24 inch outfall pipes; 8/14/87 DREAMP07 3-24 inch outfall

EXHIBIT 5



Route IV Model: Dream Lake Drainage Basin with Depressional Area added and 3-24 inch outfall pipes; 8/14/87 DREAMP07 2-24 inch outfall

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 2

TO: Mr. Deodat Budhu, P.E., P.H.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: April 5, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 01/28/96 TO 04/06/96

1. On Monday, January 29, 1996, PEC (David Hamstra) prepared "Project Status Report No. 1" which discussed the tasks completed for weeks 08/20/95 to 01/27/96.

2. On Monday, January 29, 1996, PEC (Walt Phillips) received a letter from the SJRWMD (Tim Minter), dated January 26, 1996, and one (1) 8 mm tape containing the requested arc/info data (land use, soils, 5-foot contours, etc.).

3. On Friday, February 9, 1996, PEC (David Hamstra) received one (1) copy of the Water Quality Data Analysis Report from Lotspeich and Associates, Inc. (Carolyn Schultz), dated February 6, 1996.

4. On Friday, February 9, 1996, PEC (David Hamstra) received copies of the reduced survey field notes from Jones, Hoechst & Associates, Inc. (Evin Jones).

5. On Thursday, February 15, 1996, PEC (David Hamstra) received pages 15, 16, and 17 of the reduced survey field notes from Jones, Hoechst & Associates, Inc. (Evin Jones).

6. On Friday, February 16, 1996, PEC (David Hamstra) received pages 33 and 34 of the reduced survey field notes from Jones, Hoechst & Associates, Inc. (Evin Jones).

7. On Monday, February 19, 1996, PEC (David Hamstra and Walt Phillips) conducted Status Meeting No. 1 with Dr. M. Krishnamurthy (Orange County), Deodat Budhu

engineers
planners
surveyors

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(Orange County), Danny Quick (City of Apopka), and Tom Ziegler (SJRWMD). The purpose of the meeting was to discuss the "preliminary" flood routing results.

8. On Wednesday, February 21, 1996, PEC (David Hamstra) received a fax from Danny Quick transmitting a copy of a letter prepared by Boyle Engineering Corporation, dated October 12, 1994, regarding the King property and miscellaneous issues associated with Lakes McCoy, Coroni, and Prevatt.

9. On Wednesday, February 21, 1996, PEC (David Hamstra) received one (1) set of FDOT construction plans for Park Avenue from the City of Apopka (Danny Quick).

10. On Friday, February 23, 1996, PEC received construction plans from the City of Apopka (Danny Quick) for Wekiva Glen Subdivision and Summerset Subdivision and the Wekiva Park revised calculations.

11. On Thursday, February 29, 1996, PEC (Walt Phillips) transmitted a marked-up topographic map to Orange County (Deodat Budhu) regarding a recently constructed berm within Lake Coroni.

12. On Thursday, March 7, 1996, PEC (David Hamstra and Walt Phillips) conducted Status Meeting No. 2 with Dr. M. Krishnamurthy, Deodat Budhu, Danny Quick and Tom Ziegler. The purpose of the meeting was to discuss the existing conditions and recommended improvements.

13. On Wednesday March 13, 1996, PEC (Walt Phillips) prepared and mailed a letter to Deodat Budhu requesting additional survey work to be performed by the Orange County Survey Department in order to refine the computer model and supplement three (3) critical areas.

14. On Wednesday, March 13, 1996, PEC (David Hamstra) spoke with Mr. Ronald H. Wilson, P.E. (R.H. Wilson & Associate) regarding Rhapsody Oaks and The Oaks at Sumit Lake Subdivisions. Mr. Wilson expressed his dismay with PEC's findings and discounted the possibility of the FDOT pond overflowing towards the north. David informed Mr. Wilson that PEC would transmit a copy of the "Draft" Engineering Report, with the County's permission, in order to review our model, results, assumptions, etc.

15. On Thursday, March 14, 1996, PEC (Walt Phillips) received a fax from Danny Quick transmitting a copy of a report prepared by Boyle Engineering Corporation, dated August 26, 1987, regarding development in the vicinity of Dream Lake and the Old Ustler Nursery.

16. On Tuesday, March 19, 1996, PEC (Walt Phillips) received copies of the Sandpiper Road plan and profile and cross-section sheets from Deodat Budhu.

17. On Tuesday, March 26, 1996, PEC (David Hamstra and Walt Phillips) conducted a 9:00 a.m. meeting with Carolyn Schultz (Lotspeich and Associates, Inc.). The purpose of the meeting was to discuss the scope of the required field work necessary for the wetland evaluation associated with the Votaw Road pond retrofit.

18. On Monday, April 1, 1996, PEC (David Hamstra and Walt Phillips) conducted a 2:00 p.m. meeting with Gabi Stephan (L. J. Nodarse & Associates, Inc.). The purpose of the meeting was to discuss the scope of the required field work necessary for the borings associated with the Votaw Road pond retrofit.

19. On Tuesday, April 2, 1996, PEC (Walt Phillips) attended an 11:00 a.m. meeting at the Wekiwa Springs State Park to discuss the concerns of the park regarding the water levels and discharge rate associated with Lake Prevatt. On Saturday, March 30, 1996, Central Florida received approximately 4-inches of rainfall and the park staff expressed concerns that the upstream runoff, specifically from Wekiva Park Subdivision, was causing excessive flood stages and flow rates.

20. On Wednesday, April 3, 1996, PEC (Walt Phillips) received copies of the reduced survey notes from Deodat Budhu for the Lake McCoy outfall ditch and the mobile home park outfall pipe. On that same day, Walt spoke with Deodat and informed him that the survey notes were incomplete and would require additional measurements/distances.

21. On Thursday, April 4, 1996, PEC (David Hamstra) submitted Minority/Women Business Enterprise Quarterly Report No. 2 to Juan Belgodere.

22. During the months of February and March, PEC (Walt Phillips, Troy Tarbox, and List Steele) completed the following tasks:

    - The basin and sub-basin parameters (drainage areas, weighted runoff curve numbers, times of concentration, and peak rate factors);
    - Developed input data for the adICPR computer model (nodes and reaches);
    - Flood routed three (3) storm events and plotted the limits of the 100-year flood plain associated with the five (5) main water bodies;
    - Began Section 1 (introduction) of the Engineering Report;
    - Approximately 80% complete with Exhibits No. 1 to 4 (land use, soils, nodal diagram, and flood plain limits, respectively); and
    - Developed the recommended improvements to address flood protection, water quality and localized flooding.

TASKS TO BE COMPLETED

1. Follow-up with Carolyn Schultz regarding the Wetland Evaluation Report (expect Monday, April 8, 1996).

2. Follow-up with Gabi Stephan regarding the Geotechnical Report (expect the week of April 8, 1996).

3. Follow-up with Deodat Budhu regarding the additional survey data, specifically the drainage ditch for the wetland system located east of Park Avenue and south of Welch Road.

4. Coordinate with Deodat Budhu and WBQ regarding the roadway improvements associated with Sandpiper Road.

5. Coordinate with Danny Quick and Ron Wilson regarding the proposed Rhapsody Oaks Development.

6. Complete and distribute the "Draft" Engineering Report by Friday, April 19, 1996.

7. Conduct a public workshop/presentation to discuss the existing conditions and recommended improvements.

8. Submit Minority/Women Business Enterprise Quarterly Report No. 3 by July 10, 1996.

END OF MEMO

F:\cler\ld\wpwin\oc-70\011p.rpt

cc: Danny Quick, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Leila Jammal Nodarse, L.J. Nodarse & Associates, Inc.
Evin Jones, Jones, Hoechst, & Associates, Inc.
Carolyn Schultz, Lotspeich and Associates, Inc.
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 3

TO: Mr. Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: May 10, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 04/07/96 TO 04/27/96

1. On Friday, April 5, 1996, PEC (David Hamstra) prepared "Project Status Report No. 2" which discussed the tasks completed for weeks 01/28/96 to 04/06/96.

2. The week of April 8, 1996, PEC (Walt Phillips) received the remainder of the Orange County survey notes associated with the existing wetland system located east of Rock Springs Road and south of Welch Road.

3. On Tuesday, April 9, 1996, PEC (David Hamstra) received one (1) copy of the Environmental Report from Lotspeich and Associates, Inc. (Carolyn Schultz).

4. On Thursday, April 11, 1996, PEC (Lisa Steele) transmitted an AutoCAD base map to L.J. Nodarse & Associates, Inc. (Gabi Stephan).

5. The week of April 15, 1996, PEC (Walt Phillips) finalized the ICPR routings based on Orange County survey notes and Mike Galura's HEC-RAS analysis of various channel/ditch sections.

6. On Tuesday, April 16, 1996, PEC (David Hamstra) spoke with Ron Wilson (682-1990) regarding Rhapsody Oaks and The Oaks at Summit Lake Subdivisions. Ron called to dispute the predicted peak stage associated with the FDOT pond that receives stormwater runoff from U.S. 441.

   Ron claimed that the FDOT pond would not stage as high as predicted by PEC but instead would sheet flow at lower elevations. David informed Ron that based on the SJRWMD aerial topographic map, the FDOT pond and existing wetland system within the proposed developments is contained below elevation 148.0. David requested that Ron drop off the topographic survey associated with the subdivisions in order to compare to the SJRWMD aerial topographic maps utilized by PEC. As of the date of this memorandum, PEC has received no additional information from Ron Wilson.

7. On Thursday, April 25, 1996, PEC (David Hamstra) prepared and faxed a letter to Deodat Budhu requesting a 21-day extension.

engineers
planners
surveyors

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8. On Friday, April 26, 1996, PEC (David Hamstra) received three (3) draft copies of the Geotechnical Report from L.J. Nodarse & Associates, Inc. (Gabi Stephan).

9. During the month of April, PEC (Walt Phillips, Mike Galura, and Lisa Steele) completed the following tasks:

   - Section 1 (Introduction) and Section 2 (Existing Conditions) of the Engineering Report;
   - Exhibits No. 1 to 4; and
   - ICPR routings associated with the Existing Conditions.

TASKS TO BE COMPLETED

1. Complete Section 3 (recommended improvement) of the Engineering Report and the recommended improvements Flood Routing Analysis.

2. Finalize and transmit the "Draft" Engineering Report (Volume I) and Calculations (Volume II) by Friday, May 10, 1996.

3. Coordinate with Deodat Budhu and WBQ regarding the roadway improvements associated with Sandpiper Road.

4. Coordinate with Danny Quick and Ron Wilson regarding the proposed Rhapsody Oaks Development.

5. Conduct a public workshop/presentation to discuss the existing conditions and recommended improvements after receiving review comments of the "draft" submittal.

6. Submit Minority/Women Business Enterprise Quarterly Report No. 3 by July 10, 1996.

END OF MEMO

F:\cler\ld\oc-70\013.P.MEM

cc: Danny Quick, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Leila Jammal Nodarse, L.J. Nodarse & Associates, Inc.
Evin Jones, Jones, Hoechst, & Associates, Inc.
Carolyn Schultz, Lotspeich and Associates, Inc.
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 4

TO: Mr. Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: June 3, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 04/28/96 TO 06/01/96

1. The weeks of April 29, 1996, and May 6, 1996, PEC (David Hamstra, Walt Phillips, Mike Galura, and Lisa Steele) finalized the Draft Engineering Report (Volume I) and Calculations (Volume II).

2. On Thursday, May 9, 1996, PEC (David Hamstra) received a letter from Orange County (Deodat Budhu), dated May 7, 1996, granting a 21-day extension.

3. On Friday, May 10, 1996, PEC (David Hamstra) prepared "Project Status Report No. 3" which discussed the tasks completed for weeks 04/07/96 to 04/27/96.

4. On Friday, May 10, 1996, PEC submitted "Draft" copies of Volumes I and II to Orange County (Deodat Budhu), City of Apopka (Danny Quick), and SJRWMD (Tom Ziegler) for review and comment.

5. On Tuesday, May 28, 1996, Deodat contacted David Hamstra to request that PEC conduct a presentation to the Wekiva River Basin Ecosystem Working Group. On the same day, PEC (David Hamstra) received a fax from Orange County (Deodat) transmitting a copy of the May 29, 1996 Wekiva River Basin Ecosystem Working Group Meeting Agenda.

6. On Tuesday, May 28, 1996, PEC (David Hamstra and Lisa Steele) prepared a hand-out and exhibit for the Wekiva River Basin Group presentation.

7. On Wednesday, May 29, 1996, PEC (David Hamstra) presented a Project Overview to the Wekiva River Basin Ecosystem Working Group.

8. On Thursday, May 30, 1996, PEC (David Hamstra) transmitted one (1) copy of the Draft Engineering Report and Calculations to Dr. M. Krishnamurthy for review and comment.

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TASKS TO BE COMPLETED

1. Coordinate with Deodat Budhu and WBQ regarding the roadway improvements associated with Sandpiper Road. Also, coordinate with Deodat Budhu and DRMP regarding roadway improvements associated with Rock Springs Road.

2. Coordinate with the City of Apopka and Ron Wilson regarding the proposed Rhapsody Oaks Development.

3. Conduct a second public workshop/presentation to discuss the existing conditions and recommended improvements after receiving review comments of the "draft" submittal.

4. Have PEC finalize and distribute copies of the Engineering Report and Calculations upon receipt of review comments from Orange County, Apopka, and the SJRWMD.

5. Submit Minority/Women Business Enterprise Quarterly Report No. 3 by July 10, 1996.

END OF MEMO

F:\cler\ld\oc-70\015.P.MEM

cc: Steve Lockington, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Leila Jammal Nodarse, L.J. Nodarse & Associates, Inc.
Evin Jones, Jones, Hoechst, & Associates, Inc.
D. J. Silverberg, Lotspeich and Associates, Inc.
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 5

TO: Mr. Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: July 15, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 06/02/96 TO 07/13/96

1. On Monday, June 3, 1996, PEC (David Hamstra) prepared "Project Status Report No. 4" which discussed the tasks completed for weeks 04/28/96 to 06/01/96.

2. On Tuesday, June 18, 1996, PEC (Walt Phillips) received a fax from the City of Apopka (Steve Lockington) transmitting a 4-page letter prepared by Mr. Ron Wilson regarding the Rhapsody Oaks Subdivision. Walt reviewed the comments in order to inform the City of Apopka of their validity.

3. The weeks of June 24, 1996, and July 1, 1996, PEC (Tom Kelley, Craig Batterson, David Hamstra and Walt Phillips) spoke with Mr. Jeff Garner (Developer of Rhapsody Oaks); Mr. Ron Wilson (Engineer of Record for Rhapsody Oaks); Ms. Nicole Guillet (City of Apopka - Director of Planning); Mr. Tom Ross (Attorney for Mr. Jeff Garner); and Orange County staff (Dr. M. Krishnamurthy and Deodat Budhu) regarding the proposed Rhapsody Oaks Subdivision.

4. The week of June 24, 1996, PEC (Walt Phillips and Mike Galura) developed a rating curve associated with the FDOT/Ustler pond and reran the adICPR model with and without the drainwell to demonstrate that its inclusion in the model does not substantially change the results or negate the recommendations contained in the Draft Report.

5. On Thursday, June 27, 1996, PEC (David Hamstra) received a fax from Ron Wilson transmitting his 4-page letter to Mr. Jeff Garner.

6. On Wednesday, July 3, 1996, PEC (David Hamstra) received a letter from Deodat Budhu, dated July 1, 1996, transmitting the review comments from Orange County, City of Apopka, and the St. Johns River Water Management District regarding the Draft Engineering Report and Calculations.

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7. On Wednesday, July 10, 1996, PEC (David Hamstra) prepared and submitted Quarterly Report No. 3 to Mr. Juan Belgodere (Orange County Minority/Women's Business Enterprise Department).

8. On Thursday, July 11, 1996, PEC (Craig Batterson, David Hamstra, and Walt Phillips) attended a 10:30 a.m. meeting at Apopka City Hall with Nicole Guillet, Steve Lockington, Ron Wilson, and Jeff Garner. The purpose of the meeting was for PEC to explain the modeling and the technical issues supporting PEC's recommendations (i.e., redesign the proposed stormwater pond to accept the off-site discharge from the Ustler Pond and to accommodate the loss of floodplain storage).

TASKS TO BE COMPLETED

1. Schedule a meeting with Deodat Budhu to discuss the review comments with Orange County, Apopka, and the St. Johns River Water Management District (SJRWMD). During the meeting, PEC will also discuss the possibility of additional compensation based on out of scope services (e.g., "Geo-referencing" the County's Base Maps, Rhapsody Oaks).

2. Conduct a second public workshop/presentation to discuss the existing conditions and recommended improvements after meeting with Orange County, Apopka, and the St. Johns River Water Management District (SJRWMD) regarding their review comments.

3. Have PEC finalize and distribute copies of the Engineering Report and Calculations after addressing the review comments and feedback from the public workshop.

4. Follow-up with the City of Apopka (Steve Lockington and Nicole Guillet) and Ron Wilson regarding the proposed Rhapsody Oaks development.

5. Coordinate with Deodat Budhu and WBQ regarding the roadway improvements associated with Sandpiper Road. Also, coordinate with Deodat Budhu and DRMP regarding roadway improvements associated with Rock Springs Road.

6. Submit Minority/Women Business Enterprise Quarterly Report No. 4 by October 3, 1996.

END OF MEMO

g:\cler\ld\oc-70\019.P.MEM

cc: Steve Lockington, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 6

TO: Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: October 28, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 07/14/96 TO 10/26/96

1. On Monday, July 15, 1996, PEC (David Hamstra) prepared and mailed "Project Status Report No. 5" which discussed the tasks completed for weeks 06/02/96 to 07/13/96.

2. On Monday, July 15, 1996, PEC (David Hamstra) received a letter from Steve Lockington (interim City Engineer), dated July 12, 1996, thanking PEC for their assistance in the Rhapsody Oaks Subdivision issue.

3. On Monday, July 15, 1996, PEC (Walt Phillips) transmitted a 3.5-inch diskette containing adICPR input/output files to Ron Wilson.

4. On Tuesday, August 6, 1996, PEC (David Hamstra and Walt Phillips) attended a 9:30 a.m. meeting with Deodat Budhu, Tom Ziegler, and Steve Lockington to discuss the review comments associated with the Draft Engineering Report and Drainage Calculations.

5. On Wednesday, August 7, 1996, PEC (David Hamstra) received a fax from Deodat Budhu transmitting preliminary calculations associated with the Sandpiper Road drainage and roadway improvements.

6. The week of August 12, 1996, PEC (David Hamstra and Walt Phillips) reviewed the Sandpiper Road calculations and coordinated with Deodat Budhu regarding PEC's review comments/recommendations.

7. On Wednesday, August 14, 1996, PEC (David Hamstra) prepared and submitted Addendum No. 1 to Deodat Budhu regarding a proposal for additional compensation in the amount of $26,000.

8. On Monday, August 19, 1996, PEC (Walt Phillips) transmitted a 3.5-inch diskette containing adICPR input/output files to Deodat Budhu.

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9. On Wednesday, August 28, 1996, PEC (David Hamstra) received the following documents from Penny Post (Orange County) for review and comment:

   - Tabulation of the 10-year and 100-year storm events;
   - adICPR input/output; and
   - Excerpts of the Sandpiper Road construction plans.

10. On Wednesday, August 28, 1996, David Hamstra spoke with Deodat Budhu at 4:50 p.m. regarding Commissioner Stanley's comments associated with the Draft Engineering Report.

11. On Friday, August 30, 1996, PEC (David Hamstra) received a letter from Deodat Budhu, dated August 29, 1996, responding/denying PEC's request for additional compensation.

12. The week of September 9, 1996, PEC (David Hamstra) reviewed the Sandpiper Road results and adICPR analysis and informed Deodat Budhu of PEC's comments.

13. On Monday, September 9, 1996, PEC (David Hamstra) received a fax from Deodat Budhu transmitting examples of public information documents for the upcoming public involvement meeting.

14. On Tuesday, September 10, 1996, PC (David Hamstra) received a fax from Deodat Budhu transmitting additional examples of public information documents.

15. On Friday, September 13, 1996, PEC (David Hamstra) received a letter from Deodat Budhu, dated September 12, 1996, confirming that the public meeting has been scheduled for September 25, 1996.

16. On Friday, September 13, 1996, PEC (David Hamstra) received a fax from Deodat Budhu transmitting a Draft Public Information Pamphlet prepared by Ken Thomas (Orange County Planning Department).

17. On Wednesday, September 18, 1996, PEC (David Hamstra) finalized and transmitted the public information package to Deodat Budhu.

18. On Wednesday, September 18, 1996, PEC (David Hamstra) received a fax from Deodat Budhu regarding rescheduling of the public meeting from September 25, 1996 to October 3, 1996.

19. On Thursday, September 19, 1996, PEC (David Hamstra) received a letter from Steve Lockington, dated September 18, 1996, informing PEC to invoice Jeff Garner (Developer of Rhapsody Oaks Subdivision) directly for the fees ($1,412.50) associated with meetings and coordination with Ron Wilson.

20. On Tuesday, September 24, 1996, PEC (David Hamstra) received a fax from Deodat Budhu confirming the October 3, 1996 public involvement meeting.

21. The week of September 30, 1996, PEC (David Hamstra, Lisa Steele, and Heather Stephens) began preparing the overheads and exhibits for the upcoming public meeting.

22. On Wednesday, October 2, 1996, PEC (David Hamstra and Walt Phillips) attended an 11:00 a.m. meeting with M. Krishnamurthy and Deodat Budhu to discuss the format and content of PEC's public meeting presentation.

23. On Tuesday, October 3, 1996, PEC (David Hamstra and Walt Phillips) conducted the public involvement meeting from 6:00 to 9:30 p.m. at Dream Lake Elementary School.

24. On Friday, October 4, 1996, PEC (David Hamstra) received a fax from Deodat Budhu transmitting a copy of the sign-in sheets.

25. On Monday, October 7, 1996, PEC (David Hamstra) received a fax from Deodat Budhu transmitting Deodat's notes from the October 3, 1996 public meeting.

26. On Tuesday, October 8, 1996, PEC (David Hamstra) prepared and submitted Quarterly Report No. 4 to Mr. Ronnie Escano (Senior Contract Administrator, Orange County Business Development Department).

27. On Tuesday, October 8, 1996, PEC (David Hamstra) spoke with Mr. Bill Morris at 2:40 p.m. regarding the recommendations associated with the unnamed Ustler Road pond.

28. On Wednesday, October 9, 1996, PEC (Walt Phillips) transmitted the Draft Report to Jim Bradner (FDEP) for review and comment.

29. On Thursday, October 10, 1996, PEC (David Hamstra) spoke with Mr. Murray King at 10:30 a.m. regarding the chronic flooding problems associated with the King property.

30. On Friday, October 18, 1996, PEC (Walt Phillips) spoke with Mr. Jim Bradner at 11:45 a.m. regarding FDEP's review. Jim informed Walt that FDEP had no comments associated with PEC's Draft Report.

31. On Friday, October 18, 1996, PEC (David Hamstra) spoke with Mr. Joe Foley at 12:00 p.m. regarding the proposed Lake McCoy control structure. On that same day, PEC faxed Mr. Foley a copy of the Orange County normal high water ordinance.

32. On Friday, October 18, 1996, PEC (David Hamstra) received a letter from Mr. Ronald Edenfield, dated October 8, 1996, regarding the Lake Coroni discharge elevation and downstream conveyance systems.

33. On Friday, October 18, 1996, PEC (David Hamstra) received a letter from Mr. William Morris, dated October 14, 1996, regarding the unnamed Ustler Road pond.

34. The week of October 21, 1996, PEC (Lisa Steele) plotted the water surface elevations for Lakes McCoy, Coroni, Prevatt and Dream Lake based on Orange County records.

35. On Wednesday, October 23, 1996, PEC (Walt Phillips) spoke with Steve Lockington (Boyle Engineering/City of Apopka) regarding revised calculations submitted by Ron Wilson for the proposed Rhapsody Oaks Development.

TASKS TO BE COMPLETED

1. Prepare for and attend the October 31, 1996 meeting at 9:30 a.m. with Orange County, the St. Johns River Water Management District (SJRWMD), and the City of Apopka to discuss the comments and concerns brought up during and after the October 3, 1996 public involvement meeting.

2. Have PEC finalize and distribute copies of the Engineering Report and Calculations after addressing the review comments and feedback from the public workshop. Follow-up with Deodat regarding the Orange County Commission adopting the recommendations.

3. Follow-up with the City of Apopka (Steve Lockington and Nicole Guillet) and Ron Wilson regarding the proposed Rhapsody Oaks development (City received revised construction plans and Drainage Calculations the week of October 21, 1996).

4. Submit Minority/Women Business Enterprise Quarterly Report No. 5 by January 2, 1997.

END OF MEMO

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cc: Steve Lockington, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT MEMORANDUM

TO: Deodat Budhu, P.E.
Senior Engineer

FROM: David Hamstra, P.E. DWH
Project Manager

DATE: October 30, 1996

SUBJECT: **Lakes McCoy, Coroni, and Prevatt**
Drainage Basin Study
Contract No. Y5-811

On Thursday, October 3, 1996, PEC (David Hamstra and Walt Phillips) attended and participated in the public involvement meeting at Dream Lake Elementary School for the above referenced project. Approximately 70 people were in attendance, approximately 60 residents and 10 representing the public sector (refer to Attachment "A"). The purpose of the public involvement meeting was to present the results of the Draft Engineering Report and discuss in detail the recommendations associated with flood control, water quality, and localized flooding. The following is a list of pertinent topics, questions, and/or issues discussed during the meeting.

1. The King family (Mr. Murray King) complained about chronic flooding on their property and even structural flooding on a few occasions. The following are some reasons brought up during and after the meeting that the King family believe to be the cause of their problems:

    - Continual development within the watershed, specifically the Pines of Wekiva Subdivision;
    - Alternations to the Buchan Pond control structure; and
    - The City of Apopka drains their water supply system tanks into the Buchan Pond outfall system.

    The King family strongly opposed the recommendations associated with the Dream Lake outfall system and the Lake McCoy control structure. They would like to see the proposed weir elevation associated with Lake McCoy lower than proposed (elevation 61.0) which is in direct opposition of the majority of the Lake McCoy residents.

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2. Mr. Peter Scalco (1800 Wekiwa Circle) was concerned that the recommendations (e.g., Dream Lake outfall system) would impact Lake Prevatt and the Wekiva State Park. Peter also suggested that the St. Johns River Water Management District (SJRWMD) and/or Orange County revise their regulations in order to "regulate" the post-development annual volume of runoff to pre-development conditions.

3. Mr. Ronald Edenfield (607 East Sandpiper Road) was extremely upset that nothing was suggested to improve the outfall conditions (ditch north of Welch Road) and/or discharge elevations (culverts under Paradise Isle Drive and Welch Road) associated with Lake Coroni. Both Mr. Edenfield and another resident on Lake Coroni believe that lowering the existing culverts under the power easement and Paradise Isle Drive would improve water levels.

4. Mr. Chris Smith (426 Tanglewilde Street) recommended that the stormwater runoff from the school bus parking facility be incorporated as a water quality improvement.

5. Several complaints about the secondary conveyance systems, and supposedly structural flooding, in the vicinity of Tanglewilde Street and Ustler Road. Orange County Maintenance staff were present and stated that they have continued to work directly with the residents.

6. A resident on South Lake McCoy supplied a picture prior to the meeting which demonstrates standing water in his rear yard (refer to Attachment "B"). The City of Apopka, as a minimum, may want to survey the water level and rear yard elevations in order to inform the resident to relocate his fence closer to his house. There is a possibility that the fence is built in the Lake's normal water level limits (elevation 65.0, plus or minus 6-inches).

7. There was a general concern that adopting a "new" base flood (100-year) elevation would cause additional flooding and less maintenance. The residents were reminded repeatedly that the "new" base flood elevations were based on existing conditions, not increases due to development and/or structural improvements.

Also, plenty of comments were centered around localized flooding issues. PEC stated repeatedly that the basin study involved the "Big Picture" and flood protection and <u>not</u> addressing flooding associated with an inadequate conveyance system.

8. Since the meeting, several residents called and/or mailed letters to PEC regarding the same and/or additional comments. Refer to Attachment "C" for copies of letters and telephone conversations.

END OF MEMO

bk/024p

cc: Jay Davoll, City of Apopka
Steve Lockington, City of Apopka
Thomas Ziegler, SJRWMD
Walt Phillips, PEC
File OC-70 (1-1.0)

ATTACHMENT "A"
(Sign-in Sheets)

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DISTRICT 2 TOWN MEETING

LAKES MCCOY, CORONI & PREVATT DRAINAGE BASIN PLAN

OCTOBER 3, 1996

SIGN IN SHEET

	NAME	ADDRESS & PHONE NUMBER
1.	Alicia Sandoval	596 Lake McCoy Dr. 886-2243
2.	Lorraine Anaya	//
3.	Nancy Rexach	585 Sir Arthur Ct. 889-432
4.	LIZ JORDAN	740 N. Sugar Plum Lane 886-4
5.	Tim Jordan	740 N. Sugar Plum Lane 886-43
6.	Thomas Shaw	354 MORNING CREEK CIRCLE
7.	Wayne [illegible]	520 Sir Arthur Ct 886-4557
8.	John & Patricia Cloran	593 N. Ustler Rd 886 0577
9.	[illegible] Shaw	354 Morning Creek Cr., Apopka 884-

LAKEMcCOY, CORONI & PREVATT DRAINAGE BASIN STUDY COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

Name	Address/Zip Code	Phone #
10. Barbara Martin	720 N Sugarplum LN Apopka 32712	889-275
Carol Foley	522 Wekiva Landing	884-657
12. Landry Burns	516 Wekiva Landing	884-857
13. FRANK CYNTHIA A. JOWERS	1516 BETHESDA ST	886-5035
14. GARY & Marsha Pike	1065 Grizzly Ct. Apopka. FL.	
15. JACK Weinstein	McIntosh Assoc 2200 PARK AVE N. WINTER PARK, 327	644-4000

③

LAKEMcCOY, CORONI & PREVATT DRAINAGE BASIN STUDY COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

	Name	*Address/Zip Code*	*Phone #*
16.	Peter J. Scalco	1800 Wekiwa Circle	884-2006
	Stephen T Robinson	4200 S John Young Pkwy	836-7870
18.	Sharon Craig	570 Wekiva Landing Dr	886-3471
19.	Curt Lundborg	1175 Academy	741-8845
20.	Joseph Foley	552 Wekiva Landing Dr.	884-6574
.	Tom & Joan Murray	1508 Silver Fox Cir	889-9209
22.		Imperial Palms	880-9357
23.	Les Hess	578 Wekiva Landing Dr.	889-3038 Apopka F.
24.	Kerry Luellen	1213 Lavanham Ct.	886-2288

LAKEMcCOY, CORONI & PREVATT
DRAINAGE BASIN STUDY
COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

Name	Address/Zip Code	Phone #
25. Mark Meifert	1384 Deer Lake Cir	880 672
Alfred Firda	1360 Deer Lake Circle	880-328
27. Willis L. Warran	2665 Valerie Ave	889-315
28. Greg Orleman	222 Cervidae Dr	889 3643
29. Sharon Bray	215 No. Lake Ave	889-261
30. Robert Vittler	215 Tanglewilde St	589-23
31. Murray King	455 E Tanglewilde St	8893
3 Joyce Etty	211 N. Thompson	889-3.
33. Ron Edenfield	607 E Sandpiper Road 32282	880-1006

⑤

LAKEMcCOY, CORONI & PREVATT
DRAINAGE BASIN STUDY
COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

Name	Address/Zip Code	Phone #
4. [illegible] Smith ORANGE COUNTY ROADS AND DRAINAGE	426 Tanglewilde St.	880-3381
5. CALVIN DYAL	25834 Aberdovey AVE	383-6564
6. DONALD Rhoades	572 E. Church AVE.	260-0620
7. DENNIS WILCOX	1080 OAKPOINT CI	880-3461
8. Bill & Eileen Jasper	1121 N. Ustler Rd 32712	889-3613
9. DOUG MAISE	238 N. WESTMONTE, SUITE 290	682-7747
10. Ned Reilly	1438 Deer Lake Cr. Apopka	889-9979
11. Michael Freeny	1050 Oakpoint Cir	884-0065
12.	SW THRUSH	886-6420

LAKEMcCOY, CORONI & PREVATT DRAINAGE BASIN STUDY COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

Name	Address/Zip Code	Phone #
43. John JREIJ	P.O. DRAWER 1729 Apopka FLA, 32704	889-1717
44. Mr. & Mrs. Wm. M. Morris	909 Ustler Rd P.O. Box 930 Apopka FL 504 E. Sir arthur ct 32712	889-4435 889-2442
45. J. C. Goolsby		
46. Mr & Mrs Dennis Long	461 Via Florence Dr Apopka, 32712	880-6978
47. JOHN & HELEN NADON	536 SIR ARTHUR COURT APOPKA 32712	884-7701
48. Nancy Edenfeld	607 E. Sandpiper Apopka Fl 32712	880-1006
v 49. Mr. & MRS ROBIN McBride	21 N. HIGHLAND APOPKA	889-3818
Wilson M. Hemrick	3423 Rock Springs Rd	886-8836
51. CLYDE RICKETSON	710 RUTAGE·ARBOL	889-72

⑦

LAKEMcCOY, CORONI & PREVATT
DRAINAGE BASIN STUDY
COMMUNITY MEETING

Thursday, October 3, 1996
6:00 P.M.

PLEASE PRINT

Name	Address/Zip Code	Phone #
52. Ken Thomas	P.O.Box2010 Orl.32802 O.C. Planning Dept	836-5600
STEVE LOCKINGTON	320 EAST SOUTH STREET ORLANDO, FL 32801 BOYLE ENGINEER	425-1100
4. Deodat Budhu	ORANGE COUNTY PUBLIC WORKS 4200 JOHN YOUNG PKY	836-7990
5. M. KRISHNAMURTHY	″	″
Tom Ziegler	SJRWMD P.O. Box 1429 Palatka, Fl 32178	904/329-4359
7. JIM KRAUSE	1396 DEER LK. CIR. APOPKA 32712	884-5440
8. David Hamstra	PEC, INC. 200 E. ROBINSON ST. SUITE 1560 ORLANDO, FL 32801	422-8062
WALT PHILLIPS		422-8062
0. JOE MINISZAK	1372 Deer Lake Cir Apopka 32712	886 8875

ATTACHMENT "B"
(Photograph)

ATTACHMENT "C"
(Correspondence)

①

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WHP
FILE ORIG. TO OC-70
1-1.0

RONALD H. EDENFIELD
607 E. Sandpiper Road
Apopka, Florida 32712
(407) 880-1006 home
(407) 294-6324 office
(407) 294-0952

October 8, 1996

Mr. David Hamstra
Professional Engineering Consultants, Inc.
200 E. Robinson St., Suite 1560
Orlando, FL 32801-1955

Re: Lake McCoy, Coroni & Prevatt
Drainage Basin Study

Dear Mr. Hamstra:

I attended the October 3, 1996 meeting regarding the above captioned study.

It was presented that your "study" was substantially complete. Your study is far from complete. It did nothing to insure that run off and flood waters would pass from Lake Coroni to Lake Prevatt continuing to the Wekiva River Basin.

I am not a professional engineer, but even the layman can see that before you improve upstream drainage it is imperative to insure provisions are made for proper downstream drainage all the way to the final outfall.

The study, if implemented, will reduce the current water storage capacity of Dream Lake by 9 inches, routing that water down stream to eventually end up in Lake Coroni. Unless a definite down stream flow from Lake Coroni to Lake Prevatt is included in your study and ultimate final master plan, reducing the level of Dream Lake should not take place.

I agree with the study in as much as it controls the spill over levels at each lake. Each successive upstream lake should have a spill over elevation high enough that it is subjected to the same potential for flooding as will occur in Lake Coroni. At the meeting it was stated that Lake Coroni has a very high percolation and evaporation rate and that any flooding would quickly subside. That statement needs to be modified to state that previous flooding has taken a minimum of 6 to 8 weeks to subside to within the boundaries of the normal lake level.

My profession is driven by theory, formulas and calculation, but experience has taught me that a conversation with people knowing the history has always provided a better compilation of decision making facts. I would recommend that you discuss rising water type flooding directly with the effected landowners before completing your study. With such a long history of flooding complaints and a pending lawsuit, it would appear that Orange County may have hired you looking for an escape goat.

Thank you for your attention to the above.

Very truly yours,

RONALD H. EDENFIELD

cc: Mr. Tom Staley, Orange County Commissioner
Mr. Deodat Budhu, Orange County Stormwater Mgmt. Dept.
Mr. Tom Ziegler, St. Johns River Water Mgmt. District
Mr. Steve Lockington, City of Apopka
Mr. Kenneth Thomas, Orange County Neighborhood Planning Dept.

Lake1008

③

William M. Morris

909 Ustler Road, P. O. Box 930
Apopka, Florida 32704

RECEIVED
OCT 16 1996
P.E.C. INC. ORLANDO
WORK COPY [✓ Y] N
ORIGINATOR
ONE COPY & ROUTE TO: WHD
FILE ORIG. OC-70

October 14, 1996

Mr. David Hamstra, P. E.
Professional Engineering Consultants, Inc.
200 East Robinson Street, Suite 1560
Orlando, Florida 32801

RE: *Lake McCoy, Coroni, and Prevatt Drainage Basin Study.*
Localized Flooding: 1) Improve the outfall system for an unnamed pond west of Ustler Road ($7,000).

Dear Mr. Hamstra:

This is a follow-up of our phone conversation on the above study in which you recommend improvements to the outfall from the "unnamed pond". Per your recommendation, overflow is to cross under Ustler Road and run down the property line between our property and property owned by Don Myers. The path referred to as the "ditch" in your work is not a normal and regular conveyance for water, and there is no well defined flow path as the water washes across our property, overland flow takes place where the stream path varies from 10 to 30 feet wide and generally is less than an inch deep. The "ditch" is not wetlands property; it does not now and never has had flora or fauna incident to wetlands.

As there is no drainage easement across our property, and we are not interested in granting one, we feel your recommendation needs to be changed to: "improve the outfall system directing overflow from unnamed pond into existing storm-drain going south on Ustler Road, then east on Sandpiper to the Lake McCoy/Lake Coroni flow-way". I am sure that you would agree the use of the existing stormwater management infrastructure to handle any possible overflow would have less detrimental impact than the unwanted encroachment and subsequent devaluation of homeowner properties.

History of the unnamed pond: This pond was originally built by the late Mr. Beerman, and constructed by building an artificial bank higher than the road with no outlet. There is a stream running through the property west of unnamed pond. Mr. Beerman built a dam across it where a small spring was located, and during dry weather he could maintain the pond's water level by diverting water through underground pipes. The pond level was controlled by manually opening or closing off the pipe in the stream.

History of "the ditch": The "ditch" referred to in your report was accidentally created approximately 20 years ago when the eastern end of this man-made pond collapsed. It caused a washout of unpaved Ustler Road and the property line between us and Don Myers as water rushed southeast toward the Lake McCoy and Coroni flow-way. Repair was made by building a dam on the pond's eastern shoreline with an overflow under Ustler Road.

Current status: Water has overflowed only twice during the 13 years we have lived here, and that was because the intake in the spring was left open during heavy rains. When we complained to the Beermans about the overflow, they closed the intake, and overflow stopped within 24 hours. Heavy flooding during the past two years has eroded the stream's bank, washed away the dam and displaced the underground pipe which carried water from the spring to the pond. In the absence of that pipe artificially raising the water level, there has been no overflow onto our property. That is natural and as it should be.

Impact of Future Development: Possible development of the Beerman property into 60-65 home sites will cause an unnatural amount of water collection in the unnamed pond because of the impervious area that will be added by homes, driveways, sidewalks, and paved roads. We are not interested in this water running through our yard and home.

Summary: Your recommendation in this completed study will be very important as property surrounding unnamed pond is developed in the future. In the absence of an existing drainage easement across our property, water must be directed in public flow-ways. We appreciate the opportunity to provide input to you on your report. Please feel free to contact us if we can provide additional information at home 407 889-4435 or office 407 889-5732.

Sincerely,

William M. Morris Kathy Morris

William M. Morris Kathryn L. Morris

cc: Steve Lockington, P.E., Acting City Engineer
City of Apopka
Tom Ziegler, P.E.,, Senior Professional Engineer
St. Johns River Water Management District
M. Krishnamurthy, Ph.D., P.E., Manager
Orange County Utilities Stormwater Management Department
Tom Staley, Board of County Commissioner, District 2
Mr. and Mrs. Don Myers, adjoining property owner

BILL MORRIS, CLU, ChFC
CHARTERED FINANCIAL CONSULTANT

Farm Bureau Insurance Company
Located in the Hamrick Building
242 South Central Avenue/Apopka, FL 32703-4244

Telephone - Area Code 407
Office 889-5732
Fax 889-9705

Auto 256-4021
Home 889-4435

RECEIVED
OCT 08' 1996
P.E.C. INC. ORLANDO

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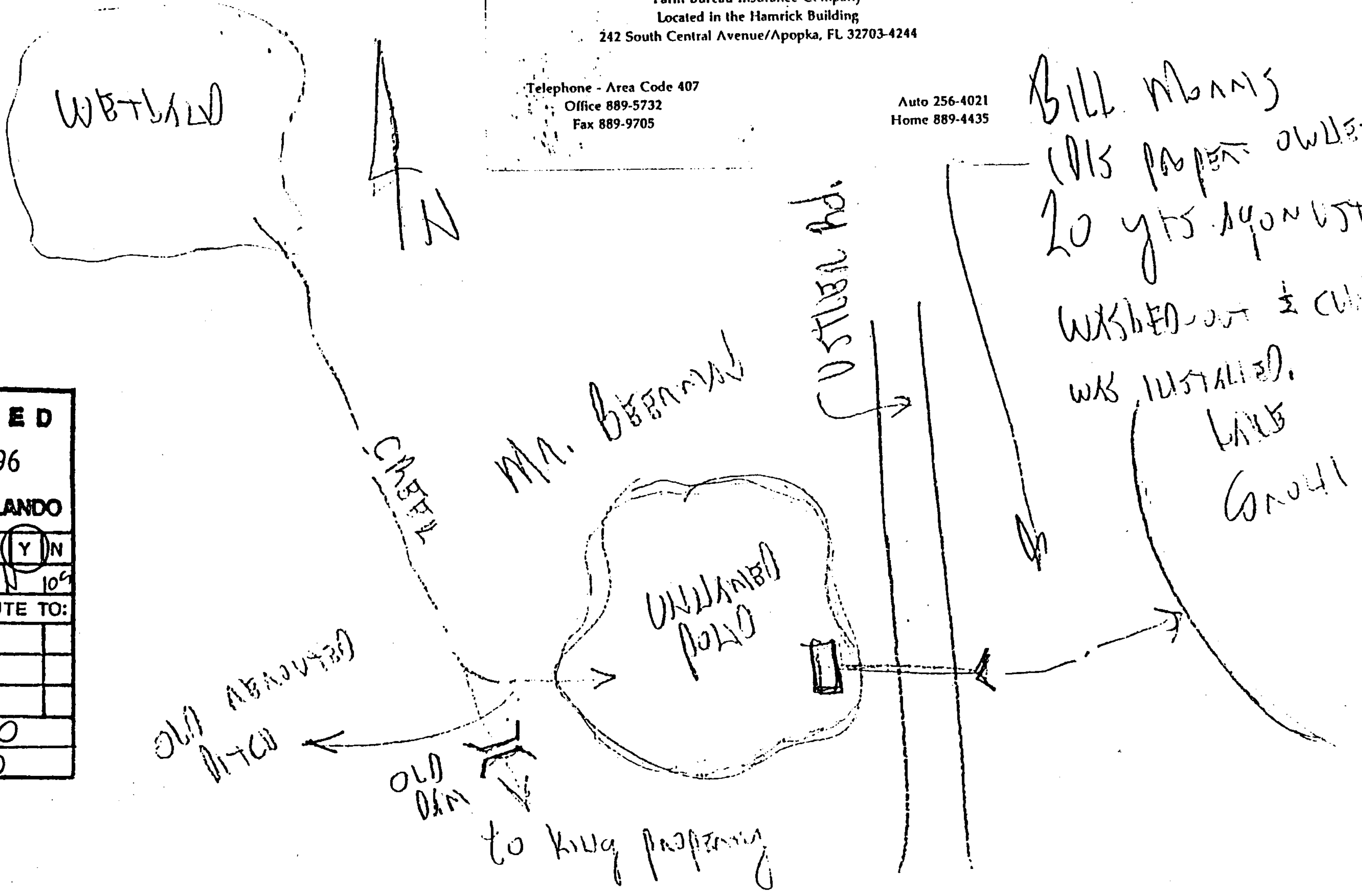


BILL MEANS
(HIS PROPERTY OWNER)
20 YRS AGO ON CUSTER
WASHED-OUT ½ CULV.
WAS INSTALLED.
LAKE
GNOHL

WNER WOULD PREFER
OUTFALL INTO CUSTER
/ SANDPIPER ST.

*WILL NOT SELL LAND FOR AN EASEMENT!!

TELEPHONE CALL
10-8-96
2:40 PM

⑤

PHONE CALL

FOR A. Hanosha DATE 09 TIME 3:14 AM [✓ P.M.]

M Murray King

OF

PHONE 889 3316
AREA CODE NUMBER EXTENSION

FAX#

MESSAGE re: Lake McCoy Drainage Basin Study (He asked if you returned calls)

SIGNED BK

☐ TELEPHONED
☐ RETURNED YOUR CALL
☑ PLEASE CALL
☐ WILL CALL AGAIN
☐ CAME TO SEE YOU
☐ WANTS TO SEE YOU

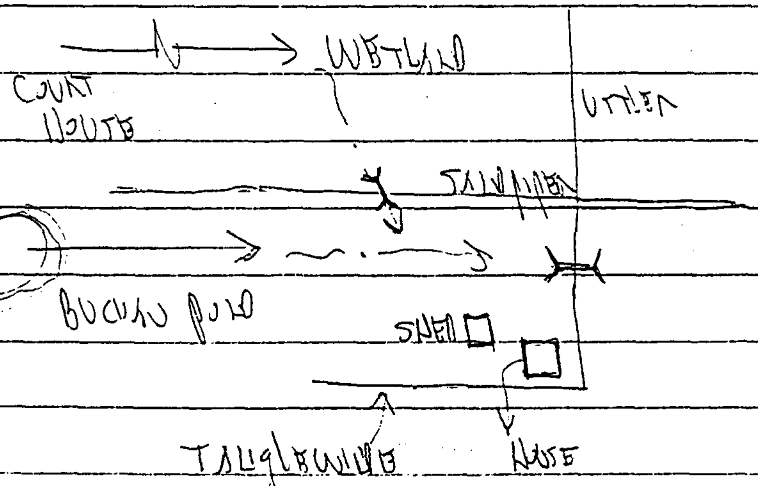
Adams SC 1154-2D

10-10-96
9:30am
LEFT MESSAGE

SHED FLOODS N TWICE THIS PAST YEAR. CONVINCED NEW DEV. IS CAUSING THE PROBLEM.

RECEIVED
OCT 10 1996
P.E.C. INC. ORLANDO
WORK COPY [✓ Y] N
ORIGINATOR WWD 10-11
ONE COPY & ROUTE TO:
WWD TOY
FILE ~~ORIG.~~ TO OC-70 1-1.0

10:30 am
USTLER RD & TANGLEWOOD



BOTTOM LINE:
WILL NOT ALLOW PONDS TO BE CONSTRUCTED ON THEIR PROPERTY!!

WOULD LIKE TO
WATER FROM WETLAN
AWAY FROM KING PR
AND PIPE ALONG
SANDPIPER TOWARD
CORNER.

⑦

OC-70

10-18-96 @ Noon

Joe Foley (629-6060)
Resident on Lake McCoy

Kept at a higher elev.
(Above elev. 61.0)

Fax 629-1919

Option ~ Variable weir (bds.)

Residents would prefer
higher lake level

PEC faxed a copy of the O/C
Normal High Water Ordinance

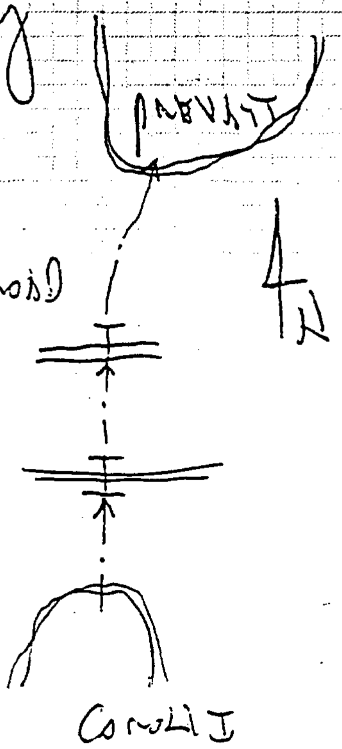
Project Call

PEC PROFESSIONAL ENGINEERING CONSULTANTS, INC.
engineers planners surveyors

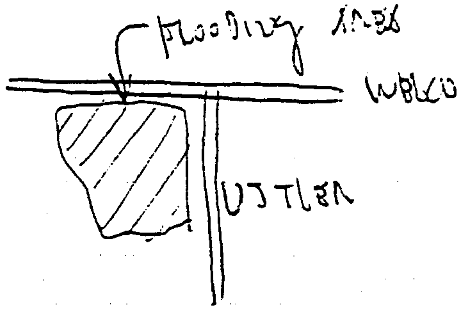
8-28-96 Comm. 0670
4:50 pm Stanley

Concerns:

1) North of Welko Road
Under Ditch
(Did not Rec. Regarding)



2) Welco Road
& Ustler Road



Over

3) Positive; OLC actually
doing something!!

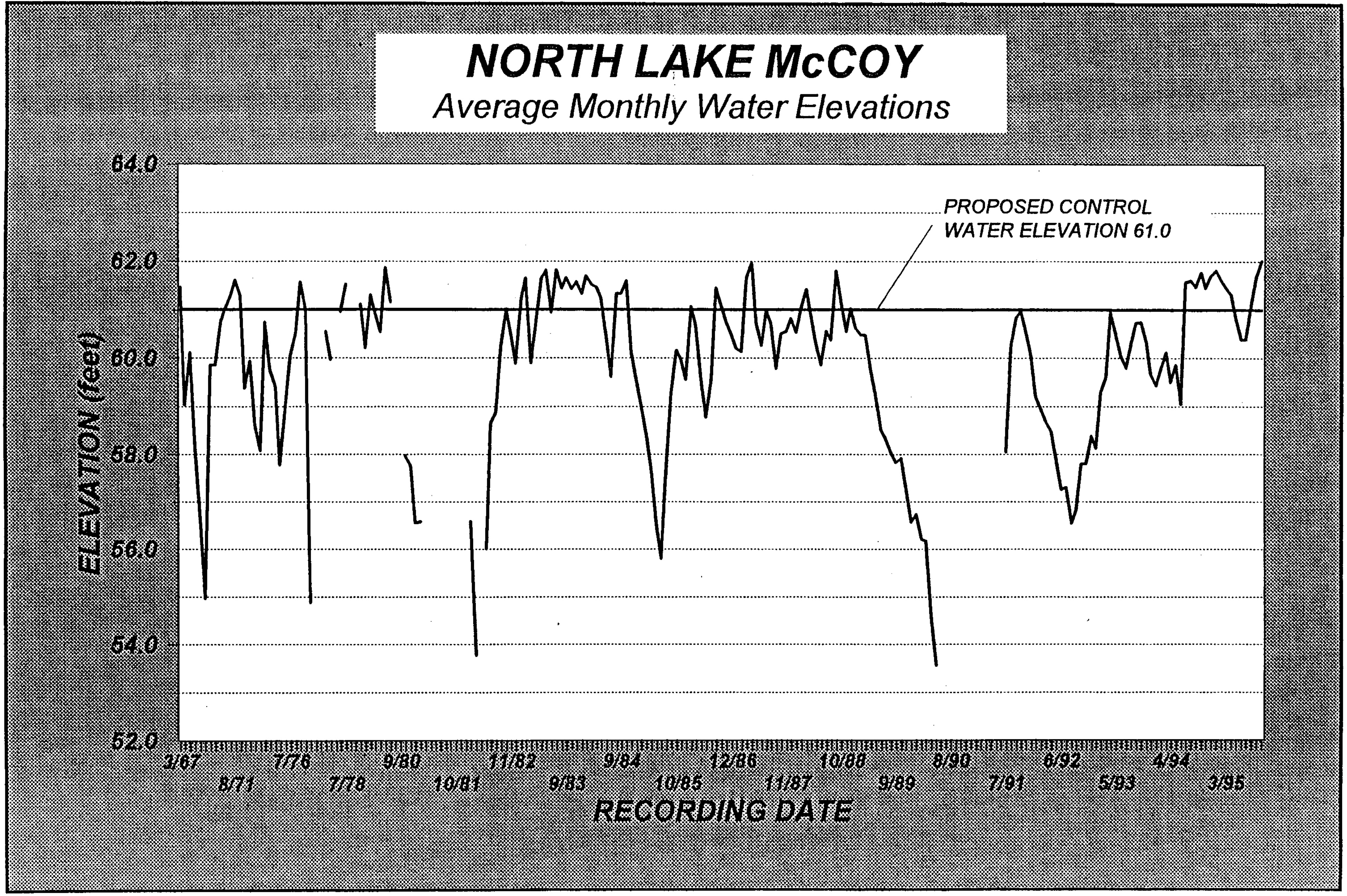
4) Orange Lake outfall: Flood Impact

orlando
407/422-8062

tampa
813/281-4692

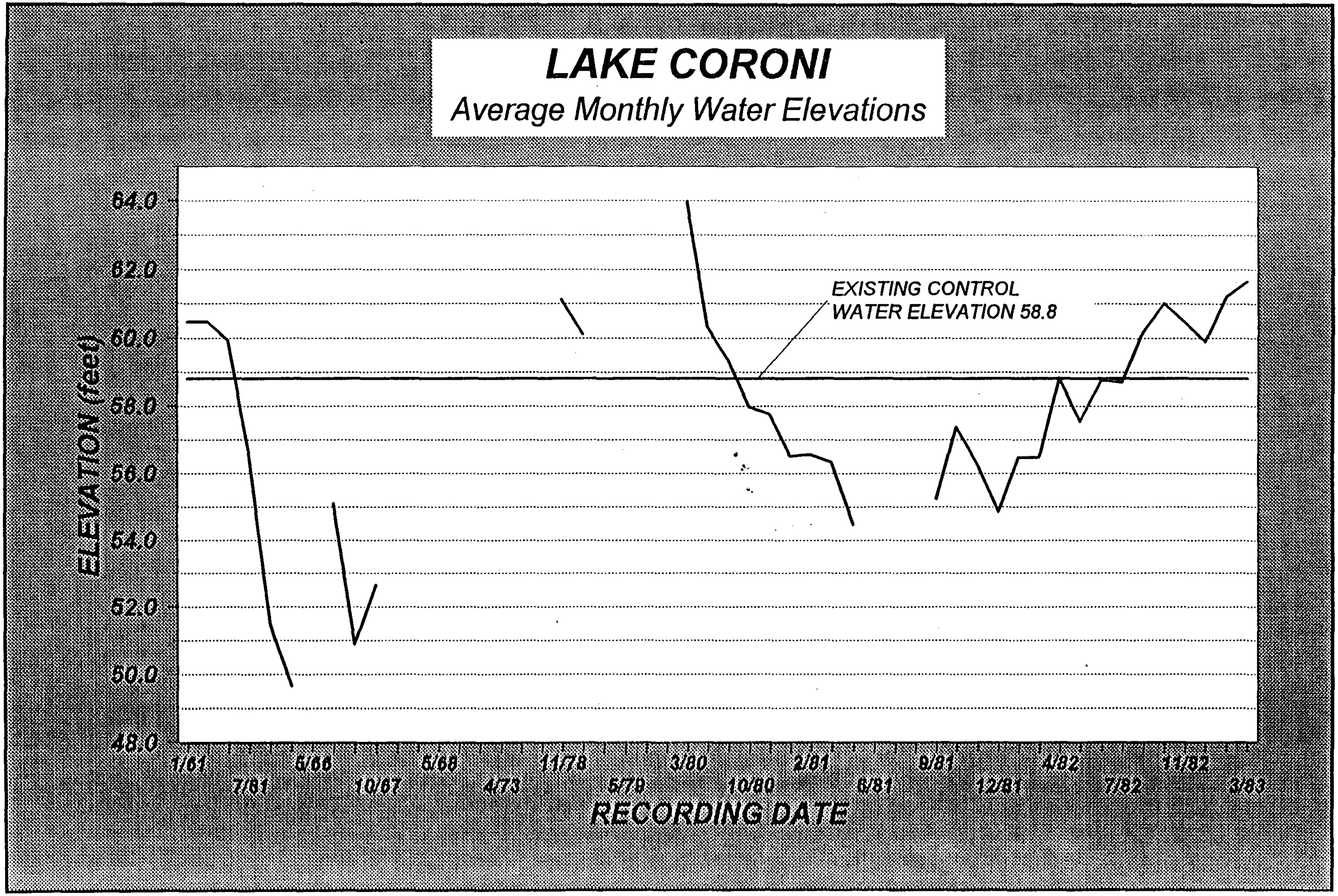
lake city
904/752-6400

ATTACHMENT "D"
(Water Surface Elevations)



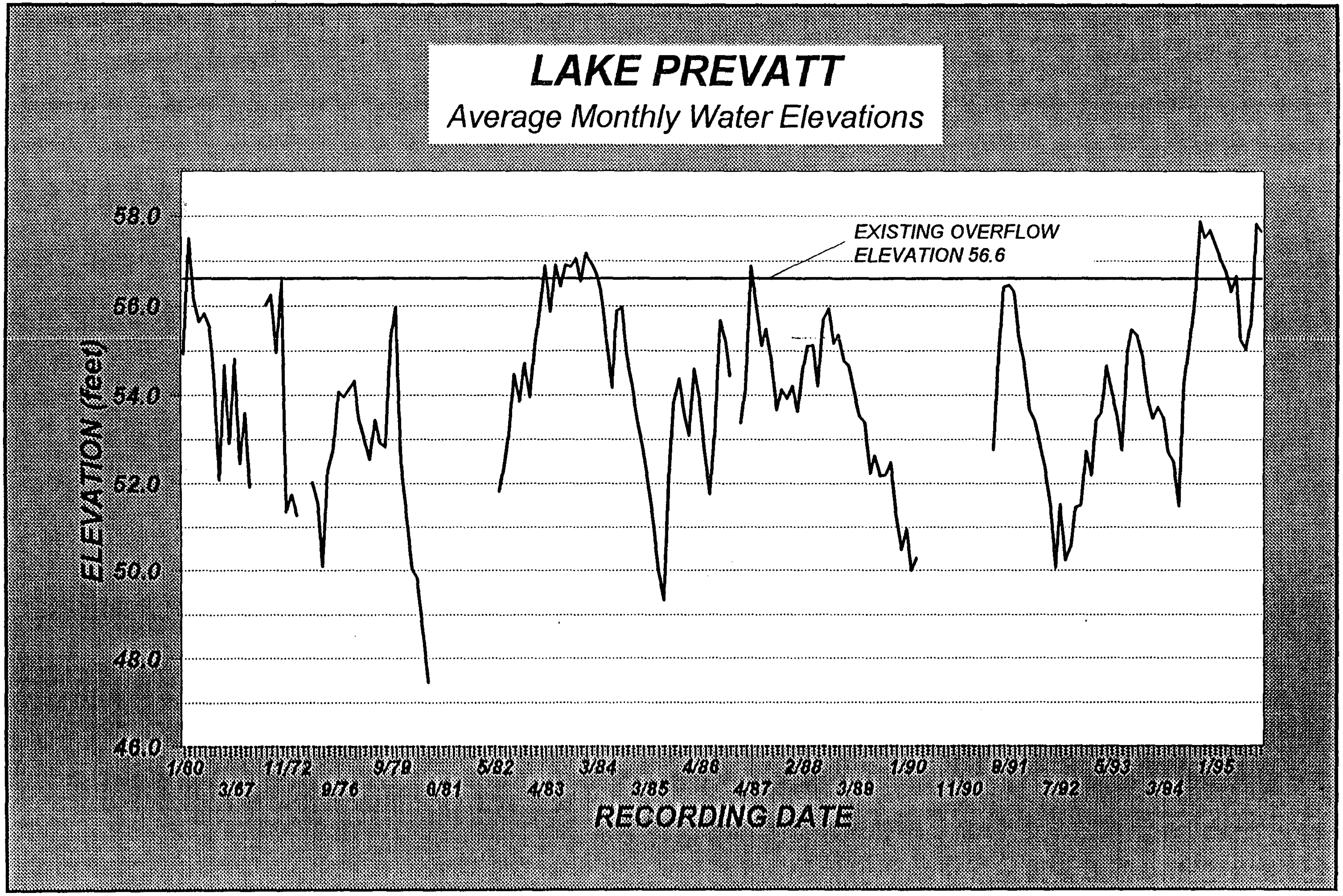
NORTH LAKE McCOY

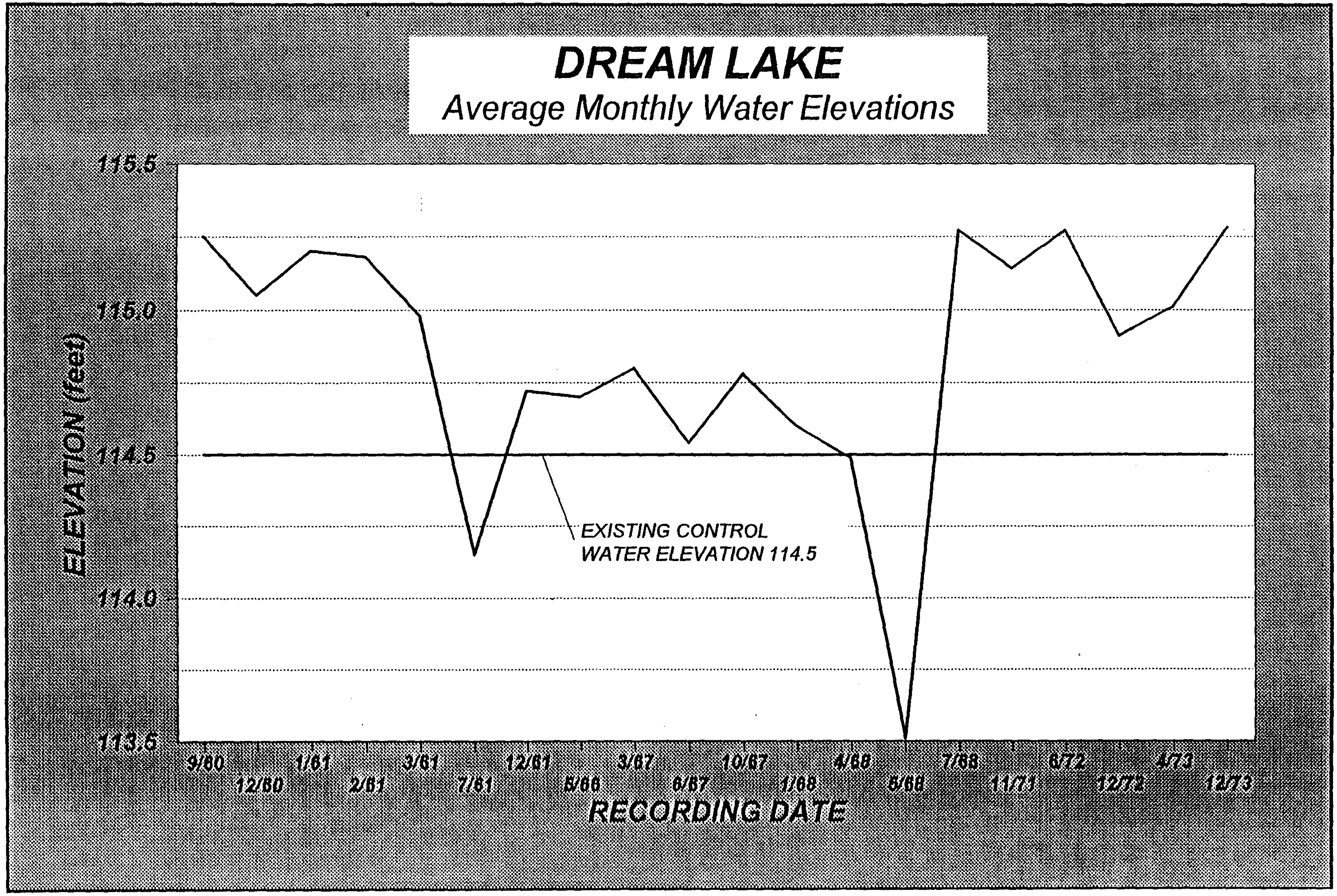
Average Monthly Water Elevations



LAKE CORONI

Average Monthly Water Elevations


LAKE PREVATT
Average Monthly Water Elevations
EXISTING OVERFLOW ELEVATION 56.6
ELEVATION (feet)
58.0
56.0
54.0
52.0
50.0
48.0
46.0
1/60
3/67
11/72
9/76
9/79
6/81
5/82
4/83
3/84
3/85
4/86
4/87
2/88
3/89
1/90
11/90
9/91
7/92
5/93
3/94
1/95
RECORDING DATE


DREAM LAKE
Average Monthly Water Elevations
ELEVATION (feet)
115.5
115.0
114.5
114.0
113.5
EXISTING CONTROL
WATER ELEVATION 114.5
9/60
12/60
1/61
2/61
3/61
7/61
12/61
5/66
3/67
6/67
10/67
1/68
4/68
5/68
7/68
11/71
6/72
12/72
4/73
12/73
RECORDING DATE

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 7

TO: Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E. DWH
Project Manager

DATE: December 30, 1996

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 10/27/96 TO 11/23/96

1. On Monday, October 28, 1996, PEC (David Hamstra) prepared and mailed "Project Status Report No. 6" which discussed the tasks completed for weeks 07/14/96 to 10/26/96.

2. On Wednesday, October 30, 1996, PEC (David Hamstra) prepared and mailed a 3-page project memorandum, with attachments, to Deodat Budhu (Orange County Stormwater Management Department), Jay Davoll (City of Apopka), Steve Lockington (City of Apopka), and Tom Ziegler (SJRWMD). The project memorandum documented comments and concerns raised during the October 3, 1996 public involvement meeting.

3. On Thursday, October 31, 1996, PEC (David Hamstra and Walt Phillips) attended a 9:30 a.m. status meeting with M. Krishnamurthy, Deodat Budhu, Jay Davoll, Steve Lockington, and Tom Ziegler. The purpose of the meeting was to discuss the comments and concerns brought up during the October 3, 1996 public involvement meeting.

4. On Tuesday, November 5, 1996, PEC (Walt Phillips) prepared and mailed a one-page letter to Deodat Budhu respectfully requesting Orange County staff to survey Mr. Edenfield's property.

5. On Monday, November 25, 1996, PEC (Walt Phillips) received a copy of the Edenfield survey notes, dated November 21, 1996, from Deodat Budhu.

engineers
planners
surveyors

200 East Robinson Street • Suite 1560 • Orlando, Florida

TASKS TO BE COMPLETED

1. Have PEC finalize and distribute one (1) copy of the final draft of the Engineering Report addressing the review comments and feedback from the public workshop by Monday, January 6, 1997. Deodat will distribute the final draft copy of the report to Jay Davoll and Tom Ziegler for review and approval. PEC will transmit final copies of Volumes I and II for distribution upon receipt of final comments and/or approval. Follow-up with Deodat regarding the Orange County Commission adopting the recommendations.

2. Follow-up with the City of Apopka (Jay Davoll and Steve Lockington) and Ron Wilson regarding the proposed Rhapsody Oaks development (City staff and PEC met with Ron Wilson and Jeff Garner on Tuesday, October 29, 1996 to discuss the proposed design).

3. Submit Minority/Women Business Enterprise Quarterly Report No. 5 by January 2, 1997.

END OF MEMO

g:\cler\ld\oc-70\026a.rpt

cc: Jay Davoll, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Walt Phillips, PEC
File OC-70 (1-1.0)

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

PROJECT STATUS REPORT NO. 8

TO: Deodat Budhu, P.E.
Senior Engineer

FROM: David W. Hamstra, P.E.
Project Manager

DATE: January 22, 1997

SUBJECT: Stormwater Management Master Plan
for the Lake McCoy, Lake Coroni,
and Lake Prevatt Drainage Basins
Orange County Project No. Y5-811

The following is a list of tasks completed to date and tasks remaining to complete the above referenced project.

TASKS COMPLETED FOR THE WEEKS OF 11/24/96 TO 01/18/97

1. On Monday, December 30, 1996, PEC (David Hamstra) prepared and mailed "Project Status Report No. 7" which discussed the tasks completed for weeks 10/27/96 to 11/23/96.

2. During the month of December 1996 and January 1997, PEC (Walt Phillips) revised the adICPR routings under existing conditions to incorporate the existing drainage well; revised the adICPR routings under proposed conditions to incorporate the existing drainage well and the proposed roadway and drainage improvements to Sandpiper Street; and revised the Engineering Report and exhibits to incorporate the review comments from Orange County, the City of Apopka, and the St. Johns River Water Management District (SJRWMD) as well as comments raised during the October 3, 1996 public involvement meeting.

3. On Monday, January 13, 1997, PEC (Walt Phillips) submitted one (1) copy of the Final Draft Engineering Report to Deodat Budhu for review, comment, and/or approval.

4. On Thursday, January 16, 1997, PEC (David Hamstra and Walt Phillips) attended the Wekiva River Basin Ecosystem Working Group meeting to address any technical questions raised during Dr. Krishnamurthy's stormwater management presentation.

TASKS TO BE COMPLETED

1. Follow-up with Orange County (Deodat Budhu), the City of Apopka (Jay Davoll) and the St. Johns River Water Management District (SJRWMD) (Tom Ziegler) regarding the Final Draft Engineering Report. Deodat will distribute the final draft copy of the report to Jay Davoll and Tom Ziegler for review and approval. PEC will transmit final copies of Volumes I and II for distribution upon receipt of final comments and/or approval. Follow-up with Deodat regarding the Orange County Commission adopting the recommendations.

2. Follow-up with the City of Apopka (Jay Davoll and Steve Lockington) and Ron Wilson regarding the proposed Rhapsody Oaks development (City staff and PEC met with Ron Wilson and Jeff Garner on Tuesday, October 29, 1996 to discuss the proposed design).

END OF MEMO

g:\cler\ld\oc-70\027p.rpt

cc: Jay Davoll, City of Apopka
Thomas Ziegler, St. Johns River Water Management District
Walt Phillips, PEC
File OC-70 (1-1.0)

Lakes McCoy, Coroni and Prevatt Drainage Basin Study Orange County, Florida

EXHIBITS

Prepared By:
PEC/Professional Engineering Consultants, Inc.
200 East Robinson Street, Suite 1560
Orlando, Florida 32801