Florida Department of
TRANSPORTATION

Pond Siting Report

Clearlake Road (SR 501)

From Michigan Ave. to Industry Rd.

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ETDM: 13120

December 2016

POND SITING REPORT

Clearlake Road (SR 501) Project Development and Environment (PD&E) Study

From Michigan Avenue to Industry Road

MP 2.235 to MP 3.358

Brevard County, Florida

Financial Project ID No. 433605-1-22-01

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December 2016

Prepared for:

Florida Department of Transportation, District 5

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Florida.

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EXECUTIVE SUMMARY

This report documents the analyses and procedures conducted for evaluating proposed stormwater management facilities and identifying potential pond sites associated with the reconstruction of Clearlake Road (SR 501) in Brevard County. The Clearlake Road Project Development and Environment (PD&E) Study limits extend from Michigan Avenue (MP 2.235) to Industry Road (MP 3.358). The proposed improvements consist of reconstructing Clearlake Road to establish a four-lane, divided, urban highway that includes dedicated bike lanes and sidewalks. The pond siting study is consistent with the PD&E Study process utilized by the Florida Department of Transportation (FDOT) to document compliance with the National Environmental Policy Act (NEPA) of 1969, St. Johns River Water Management District (SJRWMD), and Federal Clean Water and Safe Drinking Water Acts.

The objective of this report is to provide ideal locations for the construction of stormwater facilities to manage the runoff from the proposed roadway improvements. Alternative pond sites for stormwater treatment and attenuation were evaluated based on environmental permitting requirements, the existing infrastructure and potential outfalls, as well as available right-of-way (R/W). Pond sites were also analyzed for various potential impacts to the environment, including wetlands and protected uplands, threatened and endangered species, archeological and historical resources, flood zones, noise, contamination, and hazardous materials.

Pond site alternatives were compared based on the aforementioned evaluation parameters. Preferred pond sites were identified for each of the four existing drainage basins. The preferred stormwater treatment systems, for the Preferred (BP Gas) Roadway Alternative, are detailed in the following report. All pond site alternatives provide the required treatment needs for that particular basin, based either on anticipated roadway widening (south of Michigan Avenue or west of Industry Road) or complete reconstruction (Clearlake Road between Michigan Avenue to Industry Road). The stormwater treatment ponds were sized based on delineated basins using Microstation for the worst-case scenario (highest alternative impervious area) and a 10% safety factor was built into the conceptual pond sizing calculations to address any unknowns (i.e., total impervious area, seasonal high water tables, future permitting criteria changes, etc.).

This study corridor is not located within a verified impaired basin and, therefore, not associated with a Water Body Identification Number (WBID) basin. There are positive outfalls for this project, as all basins ultimately discharge to wetlands or ponds that ultimately convey stormwater to either the St. Johns River, to the west, or Indian River, to the east. Pond sizing includes both treatment and attenuation volumes as calculated by the pre-vs.-post volumes created from the proposed roadway improvements.

Stormwater management is regionally managed by the SJRWMD. The project is located between the St. Johns River and the Indian River. There are no local drainage districts within the project limits. FDOT currently maintains and operates the drainage systems within the Clearlake Road R/W.

The proposed stormwater facility design complies with the Department's drainage standards, along with SJRWMD and the Florida Department of Environmental Protection's (FDEP) permitting criteria.

The project's horizontal datum is the Florida State Plane West Zone (NAD 1983). The primary vertical datum used in this report and the calculations is the North American Vertical Datum (NAVD), 1988, and is expressed in feet. The vertical datum shift used to convert NAVD 88 to National Geodetic Vertical Datum (NGVD), 1929, along the project corridor is +1.35 feet (i.e., NAVD + 1.35′ = NGVD).

I. INTRODUCTION

1.1 BACKGROUND

The FDOT (District 5) is conducting a Project Development and Environment (PD&E) Study that proposes to widen and reconstruct Clearlake Road (SR 501) from Michigan Avenue (MP 2.235) to Industry Road (MP 3.358). The purpose of the PD&E Study is to evaluate engineering and environmental data, and document information that will aid in determining the type, preliminary design, and location of the proposed roadway improvements. The study meets the requirements of the National Environmental Policy Act (NEPA) and other related state and federal laws, rules, and regulations. The goal of the study is to develop a proposed roadway improvement alternative that is technically sound, environmentally sensitive and publicly acceptable with minimal community impacts.

This *Pond Siting Report*, prepared in accordance with FDOT procedures, is part of a collection of reports generated for the PD&E Study process of developing various roadway improvement alternatives. This report evaluates the preliminary stormwater management concepts for the proposed project. The intent of the report is to document and justify the selection of a specific site or system of constructed stormwater management facilities. This justification is needed for any necessary R/W acquisition anticipated to meet stormwater management requirements.

In addition to assessing the feasibility and effectiveness of the proposed drainage facility, the drainage analysis takes into consideration the impacts on the environment. This includes limiting wetland impacts associated with the proposed roadway alignments and future R/W acquisition needed to accommodate the drainage system. The report also describes the proposed stormwater management facility's design requirements to meet the current criteria set forth by local, state, and federal agencies. The preliminary drainage design focuses on the existing drainage conditions, basin characteristics, and future storm sewer design and stormwater management facilities. The body of this report serves as the basis for a more conclusive analysis which will identify and quantify the methods of treatment and conveyance for the preferred roadway alternative.

1.2 PROJECT LOCATION

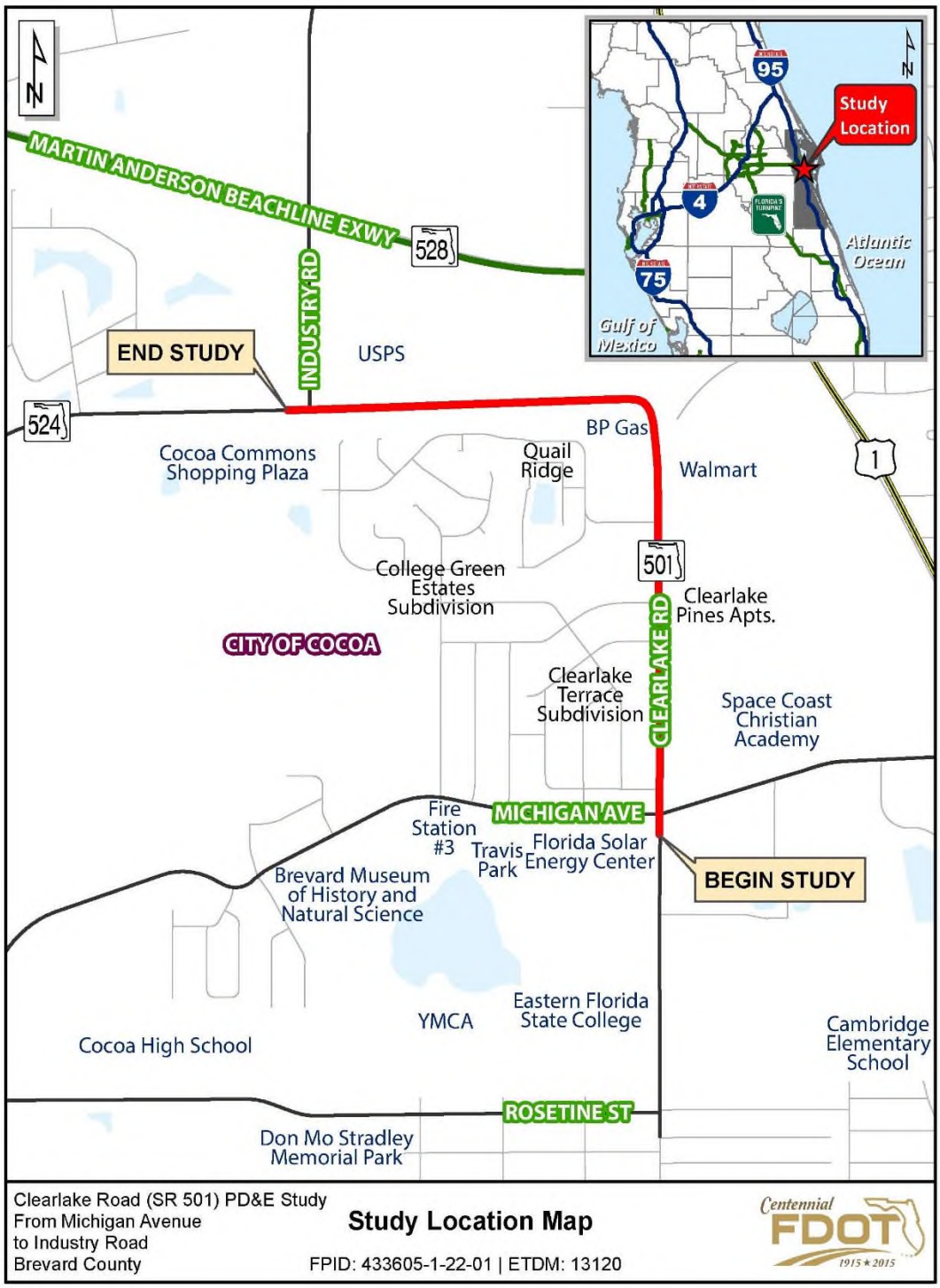


Figure 1-1: Project Location Map

II. PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

Clearlake Road, from Michigan Avenue to Industry Road, is classified as an Urban Principle Arterial. For a short distance (0.137 miles) north of Michigan Avenue, the road has four lanes with a 12 foot paved median. For the next 0.457 miles northward, the roadway has one, 12 foot lane southbound with grass shoulders and two, 12 foot lanes with curb and gutter in the northbound direction. For the last 0.529 miles (east/west segment), the roadway has two, 12 foot lanes, one in each direction, with four foot paved shoulders. The posted speed limit along this section of Clearlake Road varies and is posted at 40 mph and 45 mph. The various typical sections found along this corridor is due in part to roadway improvements required of adjacent developers. There are signalized intersections at Michigan Avenue, Otterbein Avenue, and Industry Road. It is anticipated that the improved roadway will be a four-lane, divided, urban typical section. Clearlake Road is not a Strategic Intermodal System (SIS) facility, but Industry Road has an interchange with SR 528 (Beachline Expressway) located just to the north which is a designated SIS facility connecting the City of Orlando and the Orlando International Airport to the west with the Port of Port Canaveral to the east.

2.2 ROADWAY IMPROVEMENT ALTERNATIVES

2.2.1 NO-BUILD ALTERNATIVE

Under the 'No-Build' alternative, Clearlake Road would remain the way it is today from Michigan Avenue to Industry Road. From Michigan Avenue to north approximately 0.137 miles, Clearlake Road has four lanes with a 12 foot paved median. For the next 0.457 miles northward, the roadway has one, 12 foot lane southbound with grass shoulders and two, 12 foot lanes with curb and gutter in the northbound direction. For the last 0.529 miles (east/west segment), the roadway has two, 12 foot lanes, one in each direction, with four foot paved shoulders. The existing right-of-way width would remain as is varying between 73 feet and approximately 239 feet. The existing undivided facility would continue to accommodate future year traffic volumes, as is, with degraded level of service (LOS). Currently (analysis year: 2014), the Clearlake Road study corridor operates at a minimum of LOS 'D' (both analysis segments). Under the 'No-Build' alternative, LOS would degrade to LOS 'F' for both segments by the opening analysis year 2023. The disadvantages, as well as advantages, of the 'No-Build' alternative are discussed below. The corridor does not have continuous sidewalks and a designated bicycle lane system throughout the entire limits of the study. This deficiency in multi-modal accommodations would remain as is under the 'No-Build' condition and does not conform to the Space Coast TPO's Bicycle & Pedestrian Mobility Plan (2013) which has identified the entire study segment as a proposed on-road bicycle facility for including designated bicycle lanes. In addition, the 'No-Build' alternative would retain the existing horizontal geometry and vertical profile.

The 'No-Build' alternative may be carried forward, but could be eliminated since it does not meet the study's purpose and need.

The primary advantages of the 'No-Build' alternative is that it does not directly require any capital, or expenditure of state/federal transportation trust funds, and it produces no physical or social impacts. Also, no purchase of additional land or mitigation is needed under the 'No-Build' alternative.

The disadvantages of the 'No-Build' alternative are numerous when compared to the 'Build' alternative.

- It produces poorer LOS and more traffic congestion due to less available capacity.
- It increases air pollution.
- It may increase motor vehicle crashes, property damages, and injuries/fatalities.
- It is non-conforming to the Space Coast TPO's *Long Range Transportation Plan* (*LRTP)*.
- No multimodal improvements are provided.
- Emergency vehicle response time is degraded.

- Hurricane evacuation clearance time is not improved.
- Increased user costs occur due to congestion.

In summary, there are more disadvantages than advantages.

2.2.2 BUILD ALTERNATIVES (URBAN FOUR LANE DIVIDED)

This typical section alternative, from Michigan Avenue to Industry Road, incorporates the FDOT's criteria for a four-lane, divided, urban facility. It is comprised of two, 11-foot travel lanes in each direction with a 22-foot median with type-F curb and gutter. In each direction, seven foot bicycle lanes are proposed adjacent to type-F curb and gutter and six foot sidewalks on both sides. This typical section will require a minimum of 104 feet in order to accommodate the proposed roadway improvements. Therefore, right-of-way for the mainline is required under this alternative at the south end of the project where only 73 feet of existing right-of-way is available. Offsite ponds requiring additional right-of-way are also included in order to help accommodate drainage. **Figures 2-2(a) – Figures 2-2(c)** depict the Urban Four Lane Divided typical section for the west, center, and east alignments (Alternative Nos. 1, 2, and 3, respectively) from Michigan Avenue to Industry Road.

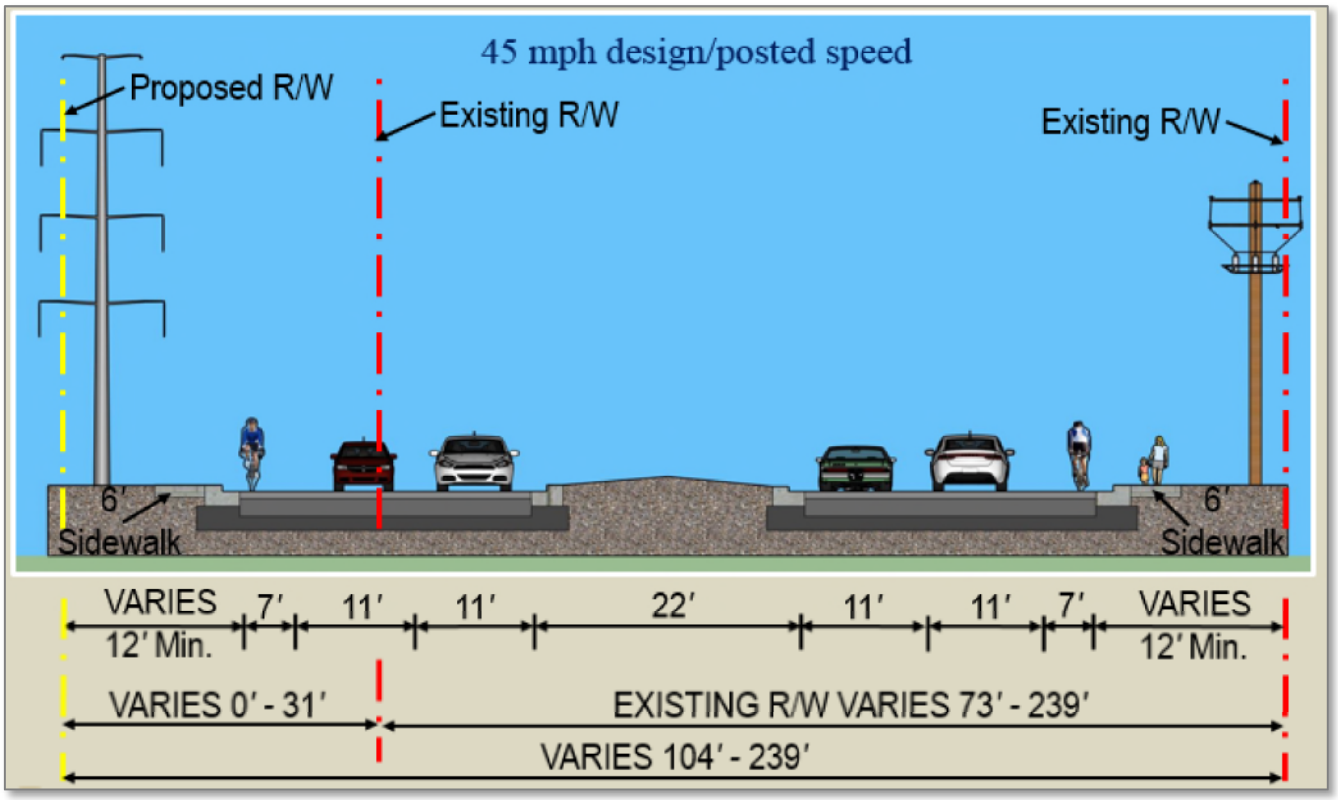


Figure 2-1(a): Alternative 1 (West Alignment): Urban Four Lane Divided Typical Section

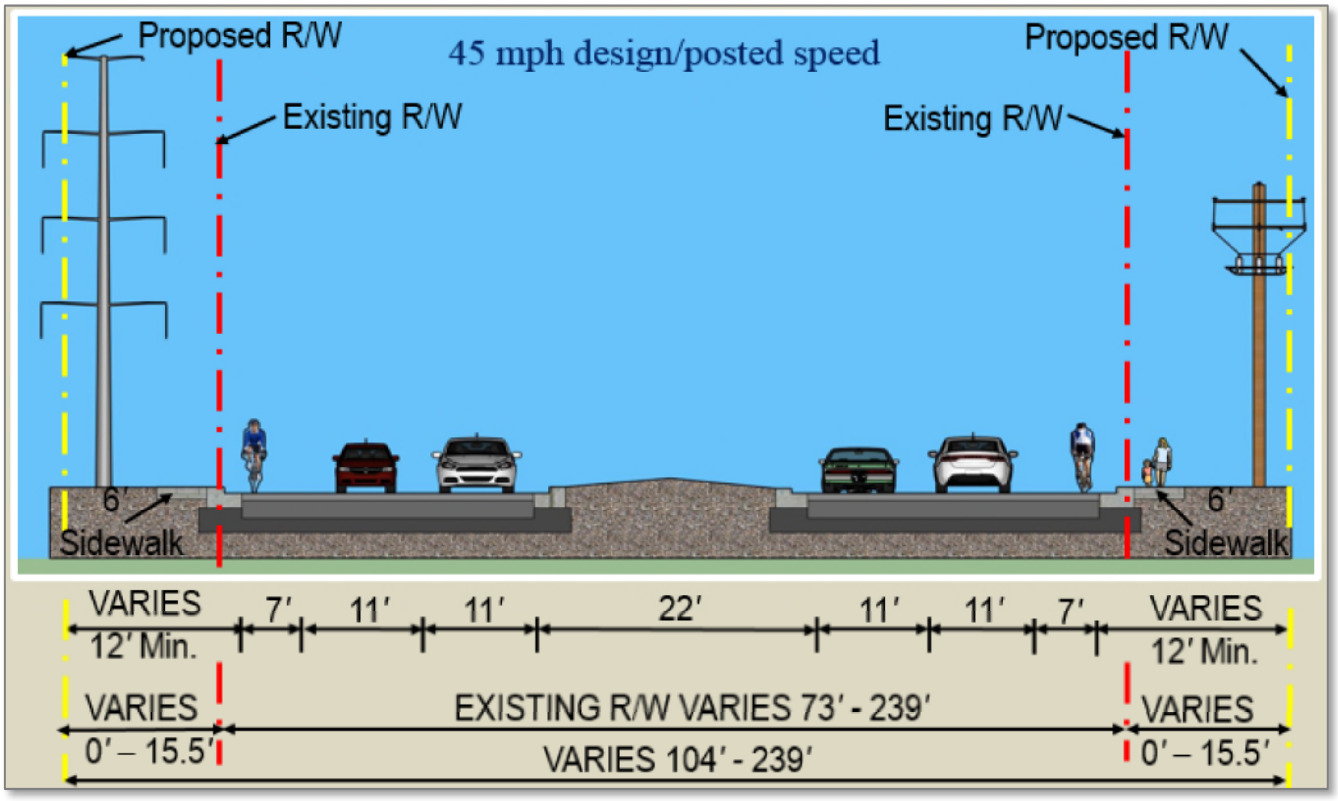


Figure 2-2(a): Alternative 2 (Center Alignment): Urban Four Lane Divided Typical Section

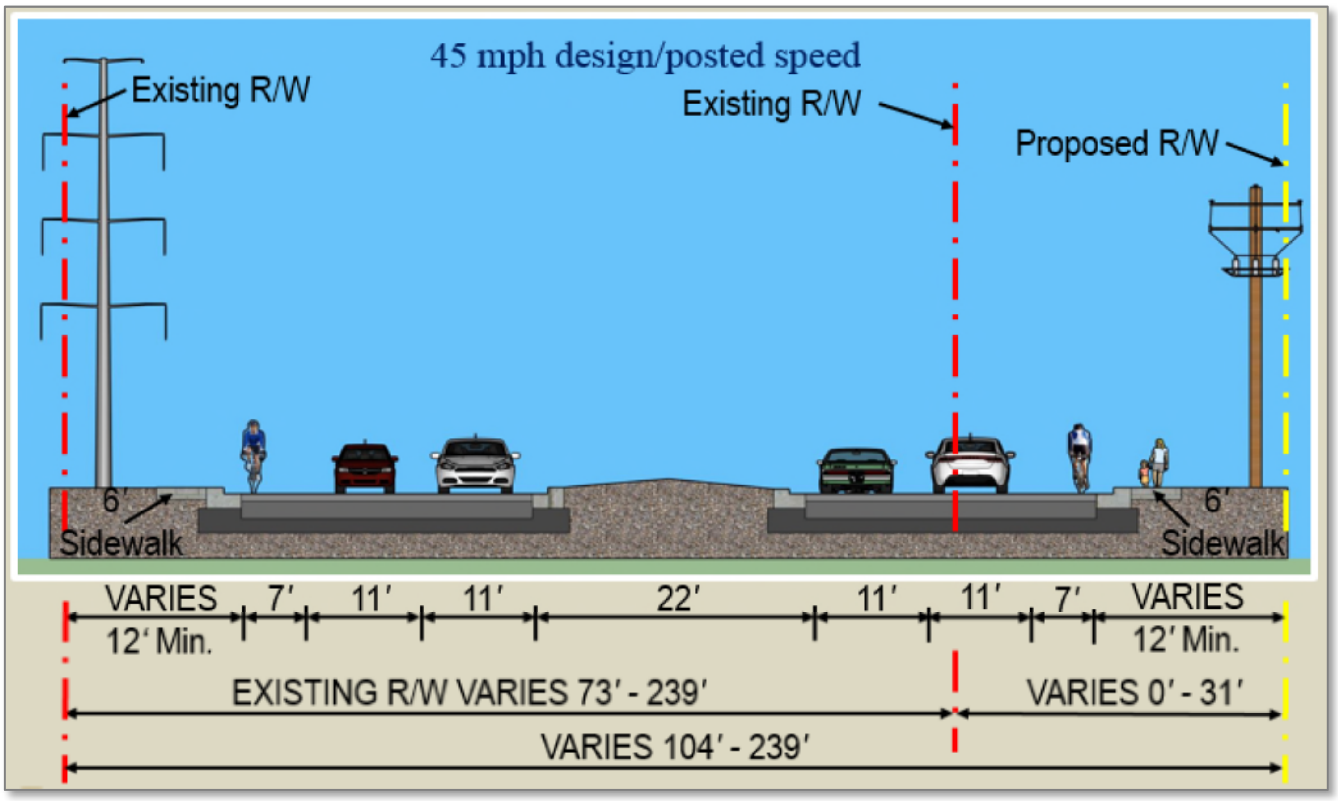


Figure 2-3(a): Alternative 3 (East Alignment): Urban Four Lane Divided Typical Section

2.2.3 SUB-ALTERNATIVES

From just north of Otterbein Avenue to Industry Road, the right-of-way is a minimum of 120 feet which can accommodate the proposed four lane, divided, urban typical section. Within these limits, four sub-alternatives for the existing 90-degree bend at the north end of Wal-Mart have been developed which can be combined with any of the previously mentioned four-lane, divided, urban typical section alignments (Alternative Nos. 1-3). These sub-alternatives are described below.

- **Sub-alternative A: 45 mph curve** – This sub-alternative consists of realigning the existing curve posted at 25 mph just north of Wal-Mart and introducing a curve which meets FDOT criteria for a 45-mph design speed. This curve will require additional right-of-way with some impact to the Paradise Shoppes of Cocoa, and will require relocation of the existing BP gas station. This sub-alternative is detailed and depicted in the *State Environmental Impact Report*, included as part of the project file.

- **Sub-alternative B: 35 mph curve** – This sub-alternative consists of realigning the existing curve posted at 25 mph just north of Wal-Mart and introducing a curve which meets FDOT criteria for a 35-mph design speed. This curve will require additional right-of-way from the Wal-Mart property and the BP gas station property, but will not impact the structural aspects of the gas station or its functionality. This sub-alternative is detailed and depicted in the *State Environmental Impact Report*, included as part of the project file.

- **Sub-alternative C: Roundabout** – This sub-alternative consists of replacing the existing curve posted at 25 mph just north of Wal-Mart and introducing a roundabout which meets FDOT criteria for a 20-mph design speed. The roundabout will require additional right-of-way from the Wal-Mart property and from vacant land just north of Wal-Mart. This sub-alternative is detailed and depicted in the *State Environmental Impact Report*, included as part of the project file.

- **Sub-alternative D: 'Bulb-Out'** – This sub-alternative consists of realigning the existing curve posted at 25 mph just north of Wal-Mart and introducing a 'bulb-out' or 'jug handle' type curve which meets FDOT criteria for a 35-mph design speed. The 'bulb-out' will require a substantial amount of additional right-of-way from vacant land located northwest of Wal-Mart. This sub-alternative is detailed and depicted in the *State Environmental Impact Report*, included as part of the project file.

III. SITE INFORMATION

3.1 TOPOGRAPHY

The existing topography is, predominantly, relatively flat with elevations ranging from 32.0′ (NAVD 88) (near Michigan Avenue and Industry Road) to 46.0′ (near Calvados Drive). The surface water historically flows from west to east, ultimately outfalling into either the St. Johns River, to the west, or Indian River Lagoon, to the east. Two (2) existing 18″ cross drains, located under Clearlake Road (SR 501) near the 90° roadway bend, help maintain the historical flow patterns by providing direct connectivity along the corridor. Detailed topographic maps can be found in the *Natural Resource Evaluation* document, submitted under a separate cover and included as part of the project file.

The project study site is located in Range 36 East, Township 24 South, Sections 17, 18, and 19.

3.2 HYDROLOGIC DATA

Historical rainfall data was obtained from SJRWMD for Brevard County (See **Exhibit D**). According to this information, average annual rainfall throughout Brevard County varies from 50.5 inches along the western border to 53 inches along the eastern border.

Below in **Table 3-1** are monthly average rainfall totals for Cocoa, Florida, retrieved from the *Broward County Weather (USA.com)*. Cocoa is a census-designated place that encompasses the entire study corridor.

Table 3-1: Average Monthly Rainfall (Cocoa, FL)

JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
2.27″	2.53″	3.28″	2.13″	3.29″	6.71″	5.96″	7.68″	7.64″	5.06″	2.88″	2.57″

3.3 LAND USE DESCRIPTION

Existing land use of the entire project corridor was determined utilizing a variety of resources, including the National Wetlands Inventory (NWI), the Natural Resources Conservation Service (NRCS) maps, Soil Surveys for Brevard County, U.S. Geological Survey (USGS) topographical maps, aerial photographs (2012), and field verification during wetland and habitat field reviews. Field reviews generally agreed with the recorded land use data. **Figure 3-1** provides a broad overview of the existing land use present within the study corridor.

The majority of the study area is dominated by residential, commercial, and institutional land uses, with high-density residential being the most prevalent. Small areas of native habitat, including forested wetlands, mixed scrub-shrub wetlands, and one remnant area of forested upland, are located immediately adjacent to the existing road corridor. All of the wetlands are located in the northern portion of the study area. Surface water features are primarily associated with the existing local stormwater management systems (i.e., Wal-Mart Pond). Upland habitats that remain in the study area are also extremely limited and exhibit moderate to high levels of disturbance due to exotic species, fire suppression, human activity, and fragmentation. More detailed descriptions of upland communities are provided in the *Natural Resource Evaluation Report*, performed by Quest Ecology and included as part of the project file. **Figure 3-1** provides additional details associated with the land use cover types and prevalence within and immediately adjacent to the study corridor.

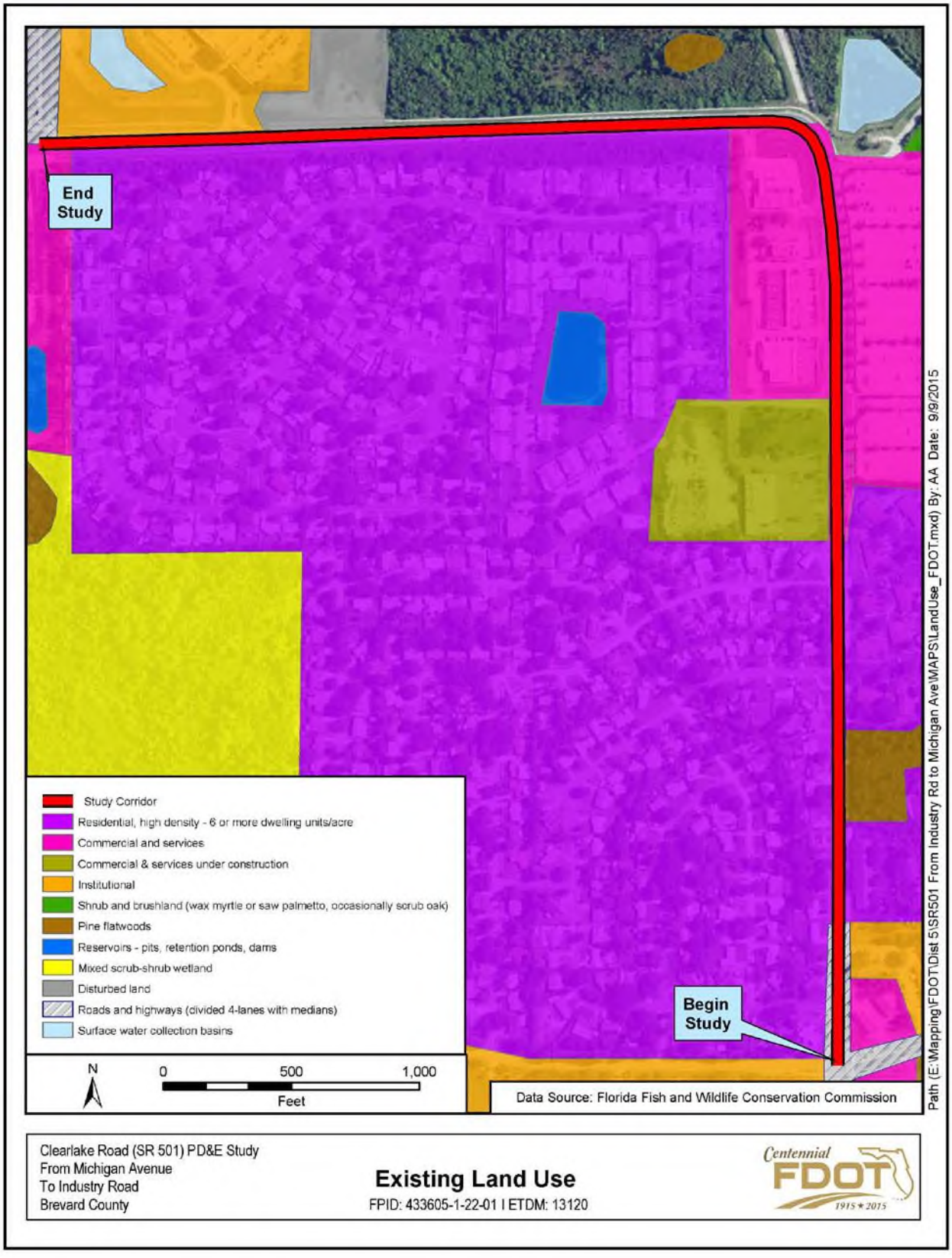


Figure 3-1: Existing Land Use Map

3.4 NATURAL AND BIOLOGICAL FEATURES

The project corridor was evaluated for the presence of potentially-occurring species. The proposed project has the potential to involve several State and/or Federally-listed wildlife species. Please refer to the *Natural Resource Evaluation Report*, performed by Quest Ecology and included as part of the project file.

Wetlands, regulated by the state and federal governments, have been investigated and identified adjacent to the corridor between Industry Road and the 90° roadway bend. Wetland impacts are expected as part of the proposed roadway improvements within the aforementioned limits, depending on the alternative selected. Please refer to the *Natural Resource Evaluation Report*, performed by Quest Ecology and included as part of the project file.

Stormwater treatment alternatives will be based on avoidance of wetlands, wherever possible.

3.5 100-YEAR FLOODPLAINS

The Federal Emergency Management Agency (FEMA) has developed Flood Insurance Rate Maps (FIRM) for Brevard County. FIRM Community Panel Number 12009C0320G, dated March 17, 2014, was reviewed in detail. The map indicates the entire existing right-of-way is located above the 100-year floodplain. See **Appendix D (Floodplain Data)** for additional details.

Floodplain impacts are also discussed in further detail in the *Location Hydraulics Report* which is included as part of the project file.

3.6 EXISTING CROSS DRAINS

A review of the existing cross drains within the project corridor was performed. For the purposes of this review, culverts crossing the roadway were considered as cross drains if the culverts were conveying offsite runoff beneath or into the project corridor. Other culverts which crossed the roadway, but conveyed onsite runoff, were considered as equalizers or part of the internal stormwater management system(s). Within the study corridor, two cross drains were identified and are detailed in **Table 3-2**. They were numbered from west to east. Under the 'Build' alternative (four-lane, divided, urban typical section), all cross drains will need to be replaced.

Table 3-2: Summary of Existing Cross Drains

ID	Basin No.	Station (BL of Survey)	Culvert Description	Replacement Required (Y/N)
CD-1	3	73+75	1 – 18" Reinforced Concrete Pipe	Y
CD-2	3	75+00	1 – 18" Reinforced Concrete Pipe	Y

3.7 WELLFIELDS

A desktop review of Brevard County was conducted to identify wellfields within the study corridor. The *Brevard County Comprehensive Future Land Use Plan (2009 EAR Amendments)* was reviewed and indicates the study corridor is not within a Brevard County identified wellfield. However, wellfields are planned (2025) within and near the project corridor and will need to be coordinated with Brevard County, as restrictions on the types of stormwater management systems may need to be adhered to. See **Appendix G (Project Correspondence)** for the described Brevard County wellfield map.

3.8 GEOLOGY AND HYDROGEOLOGY

3.8.1 SOIL SURVEY

An inventory of the existing soils in the vicinity of Clearlake Road from Michigan Avenue to Industry Road was obtained from the United States Department of Agriculture (USDA) and Soil Conservation Services (SCS) Brevard County Soil Survey and Natural Resources Conservation Service (NRCS) website. According to the database, both upland and hydric soil types are present along the project corridor (see **Figure 3-2 – NRCS Soil Survey Map**). The most common types of upland soils found within the corridor include: Immokalee sand, Paola-Urban land complex (0 to 8 percent slopes), Pomello sand, Satellite sand (0 to 2 percent slopes), St. Johns sand, St. Johns sand (depressional), St. Lucie fine sand (0 to 5 percent slopes, and 5 to 12 percent slopes). According to a listing provided by the Florida Department of Environmental Regulation to the Florida Soil Characterization Data Retrieval System Florida maintained by the University of Florida, Tomoka muck (undrained) is a hydric soil type that exists within the project corridor, as well. Considering the developed nature of the corridor, it is important to note that artificial berms and other artificially elevated areas are not always represented accurately in soils data.

A general description of the dominant soil units located along the project corridor, as described by the USDA, are presented below:

Immokalee sand: This is a nearly level, poorly-drained, sandy soil in broad areas in the flatwoods, on low ridges between sloughs, and in low, narrow areas between sand ridges, lakes, and ponds. It has a dark-colored, weakly cemented layer below a depth of 30 inches. This layer is dark colored because the sand grains are coated with organic matter. In most years, the water table is within a depth of ten inches for one to two months. It is between ten and 40 inches more than half the time, and during short, dry periods it is below 40 inches. The soil is flooded for two to seven days, once in two to five years.

Paola-Urban land complex, 0 to 8 percent slopes: This mapping unit is about 55 to 70 percent Paola fine sand, ten percent Paola fine sand that has been altered by earthmoving machines, and, generally, 20 to 45 percent Urban land, or areas covered with pavement and buildings. Urban land makes up as much as 60 percent of a few mapped areas and as little as 15 percent of a few others. Open areas of Paola fine sand are mostly lawns, vacant lots, and playgrounds. They are so small and so intermixed with Urban land that it is impractical to map the two separately.

Included with this complex in mapping are small areas of Cocoa, St. Lucie, Tavares, and Pomello soils and of Quartzipsamments, smoothed. One (1) or more of those soils make up as much as 25 percent of some areas. Also included are small areas where the soils are sloping to moderately steep. Areas are nearly level to gently sloping. Many have been modified by grading and shaping, and many have thin layers of dark topsoil spread over the surface.

Streets excavated below the original land surface and the excavated material spread over adjacent land areas are common. This excavated material is sometimes used to fill low places in other areas. Reworking of the soil has not been so great in the older communities as in the newer, more densely populated ones. Paola-Urban land complex is poorly suited to lawn grasses and most ornamental plants. The water table is below a depth of ten feet. Not assigned to a capability unit, range site, or woodland group.

Pomello sand: This is a nearly level, moderately well-drained sandy soil on broad low ridges and low knolls. The water table is 30 to 40 inches below the surface for two to four months in most years and between 40 and 60 inches for more than six months. During dry periods, it is below 60 inches for short periods.

Satellite sand, 0 to 2 percent slopes: This is a nearly level, somewhat poorly-drained sandy soil on broad low ridges in the flatwoods. The water table is ten to 40 inches below the surface for two to six months in most years. Most of the time it is within a depth of 60 inches. During prolonged dry periods it is below 60 inches.

St. Johns sand: This is a nearly level, poorly-drained sandy soil on broad low ridges in the flatwoods. This soil has the profile described as representative of the series. The water table is within a depth of ten inches for two to six months in most years, and typically between ten and 40 inches the rest of the time. During extended dry periods it is below 40 inches. This soil is occasionally flooded for two to seven days following heavy rains.

St. Johns sand, depressional: These soils are in sloughs, poorly-defined drainageways, and shallow intermittent ponds in the flatwoods. Individual areas are generally long and narrow, but some cover 40 acres or more. They consist of St. Johns soils and soils that are similar, but have a weakly cemented layer at a depth of 40 to 45 inches. The water table is within a depth of ten inches for six to 12 months in most years. Most areas are continuously flooded for six months or more in most years.

St. Lucie fine sand, 0 to 5 percent slopes: This is an excessively-drained, sandy soil on high dune-like ridges and isolated knolls. It has the profile described as representative of the series. The water table is below a depth of ten feet.

St. Lucie fine sand, 5 to 12 percent slopes: This is an excessively-drained, sandy soil on the sides of high dune-like ridges. It is similar to St. Lucie fine sand, 0 to 5 percent slopes, but has stronger slopes. The water table is below a depth of ten feet.

Tomoka muck, undrained: This is a nearly level, very poorly-drained muck soil in broad flat marshes, small depressions, and swamps. Sandy and loamy layers are at a depth of 16 to 40 inches. The water table is within a depth of ten inches for nine to 12 months in most years, and water is frequently above the surface. In dry periods it is between ten and 30 inches.

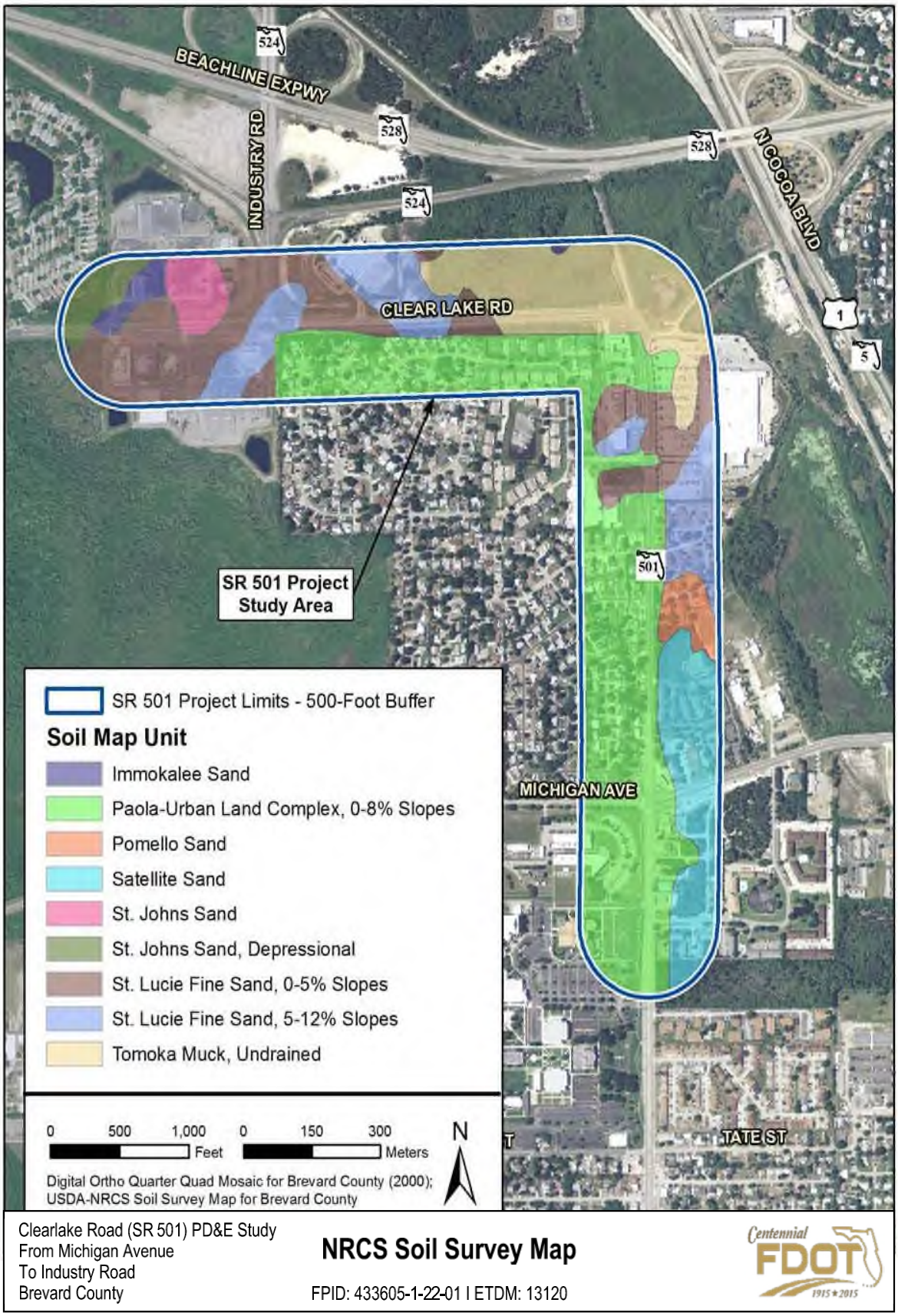


Figure 3-2: NRCS Soil Survey Map

Table 3-3: Existing Soil Survey Details

Map Unit Name	Permeability (in/hr)	Soil Type*	AASHTO Soil Classification	Risk of Corrosion	
				Uncoated Steel	Concrete
Pomello sand	2.0 – >20.0	Select	A-3 and A-2	Low	High
Satellite sand, 0 to 2 percent slopes	> 20.0	Select	A-3	Moderate	High
St. Johns sand	0.6 – >20.0	Select	A-3 and A-2	High	High
St. Johns sand, depressional	0.6 – >20.0	Select	A-3 and A-2	High	High
St. Lucie fine sand, 0 to 5 percent slopes	> 20.0	Select	A-3	Low	Moderate
St. Lucie fine sand, 5 to 12 percent slopes	> 20.0	Select	A-3	Low	Moderate
Tomoka muck, undrained	0.6 – 20.0		A-8, A-3 and A-2	High	Low
Immokalee sand	0.6 – 20.0	Select	A-3 and A-2	High	High
Paola-Urban land complex, 0 to 8 percent slopes	> 20.0	Select	A-3	Low	High

3.8.2 HYDROGEOLOGY

The hydrologic soil groups were determined from the NRCS water feature database for each of the primary soil types. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. The four hydrologic soil groups are:

Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well-drained to excessively-drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately-drained or well-drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C: Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a hardpan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Table 3-4 summarizes some of the hydrologic characteristics associated with the soils identified on the project corridor. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), then the first letter is for drained areas and the second is for undrained areas. *Surface Runoff*, as listed in **Table 3-4**, refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high. The *Months* in the table below indicate the portion of

the year in which a water table, ponding, and/or flooding is most likely to be a concern. *Water Table* refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*Upper Limit*) and base (*Lower Limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than one month is not considered a water table.

Table 3-4: Water Features – Brevard County, FL

Soil Name	Hydrological Group	Surface Runoff	Water Table	
			Upper Limit (feet)	Lower Limit (feet)
Pomello sand	A	Negligible	2	3.5
Satellite sand, 0 to 2 percent slopes	A/D	Low	1	2.0
St. Johns sand	B/D	High	0.5	1.5
St. Johns sand, depressional	B/D	Negligible	0	0
St. Lucie fine sand, 0 to 5 percent slopes	A	Negligible	> 6.7	> 6.7
St. Lucie fine sand, 5 to 12 percent slopes	A	Negligible	> 6.7	> 6.7
Tomoka muck, undrained	A/D	Negligible	0	0
Immokalee sand	A/D	High	0.5	1.5
Paola-Urban land complex, 0 to 8 percent slopes	A	Negligible	> 6.7	> 6.7

3.9 HAZARDOUS MATERIAL ASSESSMENT

The *Contamination Screening Evaluation Report* has been prepared pursuant to the FHWA Technical Advisory T 6640.8A, dated October 30, 1987, and in accordance with the FDOT PD&E Manual, Part 2, Chapter 22, dated January 17, 2008. A review of local, state and federal databases identified six sites, detailed in **Table 3-5**, as having potential for contamination adjacent to the project corridor. After file and site reviews of these areas were completed, no sites with potential contamination are located within the limits of alternative pond sites. The current potential for contamination issues within or directly adjacent to the all potential pond sites is minimal. More detailed information is provided in the *Contamination Screening Evaluation Report*, submitted under a separate cover and included as part of the project file.

Table 3-5: Parcels with Potential Contamination Risk

Map ID	Property Description	Location	Rating
1	Cocoa Mobil (7-11)	SW corner of Industry Rd. & Clearlake Rd.	Low
2	Sunshine Food Mart #121 (BP)	SW corner of 90° roadway bend	Low
3	Wal-Mart Supercenter #174	SE corner of 90° roadway bend	Low
4	Sunrise Food Mart #88 (Chevron)	NE corner of Michigan Ave. & Clearlake Rd.	Low
5	Huntley Jiffy Food Stores #526	NE corner of Michigan Ave. & Clearlake Rd.	Low
6	Speedway #6591	560′ south of intersection of Michigan Ave. & Clearlake Road	Low

3.10 HISTORICAL AND ARCHEOLOGICAL ASSESSMENT

A *Cultural Resource Assessment Survey* (CRAS) for the study was conducted to locate and evaluate potential archaeological and historic resources within the Area of Potential Effect (APE) and to assess eligibility for inclusion in the National Register of Historic Places (National Register). The archaeological survey resulted in the identification and evaluation of 31 newly recorded historic resources (8BR03301 to 8BR03331). All 31 resources identified within the Clearlake Road APE lack the architectural distinction and the significant historical associations necessary to be considered for listing in the NRHP and are recommended ineligible. No existing or potential historic districts were identified. No further architectural history survey was recommended in the CRAS. Detailed information as it relates to archaeological and historical resources can be found in the CRAS, submitted under a separate cover and included as part of the project file.

3.11 UTILITIES

One (1) of the important elements that directly impacts potential pond site locations is existing underground utilities. Utility information, including ownership, type, and location of existing utilities located within the study area, was obtained from all Utility Agency Owners. This was completed in accordance with Part 2, Chapter 10 of the FDOT PD&E Manual. Below is a summary of the utilities within the project corridor:

Table 3-6: Summary of Utilities within the Project Corridor

Type	Company/Owner	Contact Person
Telephone	AT&T - Distribution	Mark Gutierrez (772) 460-4443
Water & Sewer Mains	Brevard County Public Works Engineering	Brandon Collins (321) 455-1440
Cable / Internet	Bright House Networks, LLC	Mike Isom (321) 757-6451
Water, Sewer & Reclaimed Water	City of Cocoa	Peggy Turner (321) 433-8799
Gas Main(s)	City Gas Company of Florida	Ron Muller (321) 638-3424
Gas Main(s)	Florida Gas Transmission - Melbourne	Joseph Sanchez (407) 838-7171
Overhead Electric	Florida Power & Light	Tracy Stern (800) 868-9554
Telephone & Fiber Optic	MCI	John Bachelder (972) 729-6322
TBD	Transcore	Tushar Patel (386) 943-5315

3.12 EXISTING DRAINAGE BASINS

Stormwater runoff from Clearlake Road right-of-way is collected predominantly within closed conveyance systems along the north/south roadway segment and completely within open conveyance systems (i.e., roadside ditches) along the east/west segment. The north/south roadway segment, which consists of two local drainage basins (no. 1 and 2), ultimately outfalls to the east into the existing preserve situated between Clearlake Road and Florida East Coast (FEC) railway right-of-way. The east/west segment, which consists of two local drainage basins (no. 3 and 4), ultimately outfalls into either the aforementioned preserve, a wetland located southwest of Industry Road, or an existing private wet detention pond located west of the CVS Pharmacy.

Clearlake Road, from south of Michigan Avenue to west of Industry Road, is divided into four local drainage basins for stormwater management. Between south of Michigan Avenue and north of La Marche Drive (Basin

No. 1), roadway runoff is conveyed to Michigan Avenue, via roadside swales and interconnected curb inlets, and then east along Michigan Avenue to an existing wet detention pond located west of the FEC railway R/W. Between La Marche Drive and the northern Wal-Mart entrance (Basin No. 2), roadway runoff is predominantly conveyed to the north (Sub-Basin No. 2-East) via connected curb inlets and discharged into a wet detention pond ("Wal-Mart" Pond) located northeast of the described basin limits. A small portion of this basin's (Sub-Basin No. 2-West) stormwater runoff is conveyed to the western, interconnected onsite ditches, and discharged to the north into a wet conveyance canal located northwest of the BP Gas station. Roadway runoff within Basin No. 3, which extends from the 90° roadway bend near the Wal-Mart shopping center, west to Industry Road, is collected in shallow, adjacent roadside ditches and ultimately conveyed east around the Wal-Mart pond and into the preserve located behind the Wal-Mart parcel. West of Industry Road (Basin No. 4), a similar open stormwater management system exists that conveys runoff to the west, into either an existing wet detention pond located within the Coventry of Cocoa residential community to the north or existing wetlands located to the south. Refer to **Exhibit F** for the project's conceptual drainage maps, which include the basin boundaries.

Table 3-7: Summary of Existing Drainage Basins

Basin #	From (BL of Survey)	To (BL of Survey)	Ultimate Outfall Location
1	Sta. 154+10	Sta. 179+75	Indian River Lagoon
2	Sta. 179+75	Sta. 199+25	Indian River Lagoon
3	Sta. 50+00	Sta. 74+00	Indian River Lagoon
4	Sta. 31+00	Sta. 50+00	St. Johns River

The historical flow pattern through this area is from west to east, mainly through overland sheet flow. Offsite runoff that contributes to the mainline runoff is predominantly from adjacent residential parcels scattered along the north/south roadway segment, along with undeveloped uplands and wetlands located adjacent to the east/west segment.

Stormwater management is regionally managed by the SJRWMD (Basin: Northern Indian River Lagoon). The project is located between the St. Johns River and the Indian River Lagoon, both of which are classified as Class III waterbodies, per Florida Department of Environmental Protection (FDEP). Additional treatment volume will not be required for this project since it ultimately outfalls into a section of the Indian River Lagoon that is not classified as an Outstanding Florida Waters (OFW). A conservation easement, owned and maintained by SJRWMD, exists north of the east/west roadway segment. There are no local drainage districts within the project limits. FDOT currently maintains and operates the drainage systems within the Clearlake Road right-of-way.

Two (2) cross drains (18″ diameter) were identified within the project limits, and are anticipated to be replaced to accommodate the future roadway widening. Preliminary inspection indicates both culverts are in good working condition.

3.13 REGULATORY ISSUES AND DESIGN CRITERIA

3.13.1 DATA COLLECTION

The PD&E Team collected and reviewed data from the following sources:

- FDOT Drainage Manual (January 2016)
- FDOT Stormwater Management Facility Handbook (May 2004)
- FDOT Culvert Handbook (2004)
- SJRWMD Environmental Resource Permit Applicant's Handbook Volume I (General and Environmental) (October 2013)
- SJRWMD Permit Information Manual (October 2013)

- FDEP Environmental Resource Permit Manual Draft (March 2010)
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Brevard County and incorporated areas (Community Panel Number 12009C0320G, dated: March 17, 2014)
- Natural Resources Conservation Service (NRCS) Soil Survey of Brevard County, Florida
- United States Geological Survey (USGS) Maps for Cocoa
- Existing SJRWMD Permits, including:
    - Wal-Mart Store No. 174-03, Cocoa, Clearlake Road Phase II Offsite Roadway Improvements (Permit No. 40-009-95213-1)
    - Tenzel Commercial Site (Permit No. 40-009-16872-1)
- Existing Plans, including:
    - Clearlake Road Improvements – Wal-Mart Phase 2 (City of Cocoa) (2004)
- Field Review (August 2015)
- Geotechnical Subsurface Exploration (RADISE International)
- Cultural Resource Assessment Survey
- Contamination Screening Evaluation Report
- Natural Resource Evaluation Report

3.13.2 EXISTING PERMITS

The study corridor is located within the SJRWMD jurisdiction. SJRWMD Environmental Resource Permit (ERP) No. 40-009-95213-1, associated with the Wal-Mart shopping center, was issued on December 1, 2004. A permit modification of this ERP permit is anticipated to complete the proposed Clearlake Road widening and reconstruction, per detailed coordination with SJRWMD. The section of roadway immediately south and north of Michigan Avenue, improved as part of FDOT FPID No. 237567-1-52-01 (SR 501 from SR 520 to north of Michigan Avenue), has an existing ERP (Permit No. 400-009-102167-1), as well.

Many existing permits associated with commercial developments along the corridor have been identified. These existing and proposed commercial developments include, but are not limited to, Wal-Mart / Clearlake Road Phase II Improvements, Clearlake Commons (south of Otterbein Avenue), Clearlake Road Commercial Complex (north of Otterbein Avenue), Tenzel Commercial Site (east of Industry Road), and Home Depot (west of Industry Road). A review of these permits provided a better understanding of the drainage patterns in the immediate area.

SJRWMD is the principal permitting authority and institutes the controlling permit criteria. **Table 3-8** contains contact information for the water management districts and environmental agencies. Excerpts from the SJRWMD permits are located in **Appendix F**.

Table 3-8: Water Control Districts and Environmental Agencies

Agency	Address	Contact	Telephone / Email
St. Johns River Water Management District	525 Community College Parkway, Palm Bay, FL 32909	Mr. Nathan Ottoson (Division of Regulatory Services)	(321) 409-2119 / nottoson@sjrwmd.com
Florida Department of Environmental Protection	2600 Blair Stone Road, Tallahassee, FL 32399	Ms. Katie Hallas (Indian River Lagoon BMAP Coordinator)	(850) 245-8432 / Katie.hallas@dep.state.fl.us

Table 3-9: Summary of Existing SJRWMD Permits

Permit Name and ID No.	Date Issued	County	Project
Standard General Environmental Resource Permit; No. 40-009-95213-1	December 1, 2004	Brevard	Wal-Mart, Cocoa, Clearlake Road Phase II Offsite Roadway Improvements
Individual Environmental Resource Permit; No. 4-009-86250-2	December 6, 2007	Brevard	Wal Mart-Cocoa, FL Store No. 174-03, RSC, BP Development Site – Offsite Roadway
Noticed General Environmental Resource Permit; No. 400-009-102167-1	November 29, 2005	Brevard	SR 501 Milling & Resurfacing (from SR 520 to North of Michigan Avenue)
Standard General Environmental Resource Permit; No. 42-009-90705-1	December 16, 2003	Brevard	Clearlake Road Commercial Complex (north of Otterbein Avenue)
Standard General Environmental Resource Permit; No. 42-009-110756-1	June 19, 2007	Brevard	Clearlake Commons (south of Otterbein Avenue)
Standard General Environmental Resource Permit; No. 40-009-16872-1	January 14, 2000	Brevard	Tenzel Commercial Site (east of the Cocoa Post Office)

3.13.3 SEASONAL HIGH GROUND WATER TABLE (SHGWT)

The SHGWT is the highest average depth of soil saturation during the wet season in a normal year. The SHGWT is used to design wet and dry detention and retention areas, predict soil storage and set project control elevations. Therefore, any assumptions made regarding the SHGWT are critical to the stormwater management design.

Borings were performed along the Clearlake Road study corridor that detail water elevations ranging between 23.40′ (24.75′ NGVD) and 28.50′ NAVD (29.85′ NGVD). Calculations prepared for this study predominantly use a SHGWT elevation between 25.65′ NAVD (27.00′ NGVD) and 27.00′ NAVD (28.35′ NGVD). These elevations are recommended by the Geotechnical Report prepared for the study corridor by RADISE International, LC. A complete Geotechnical Report is available under a separate cover.

The NRCS Soil Survey Map was also reviewed to gather SHGWT information for this section of Clearlake Road from Michigan Avenue to Industry Road. See **Section 3.8.1: Soil Survey** for additional details.

3.13.4 DESIGN STORM AND ATTENUATION VOLUMES

The proposed stormwater management system provides for attenuation of SJRWMD's 25-year/1-day design storm event.

Attenuation volumes for this study were established based on the calculated pre-development and post-development runoff volumes for the 25-year/1-day design storm event. Attenuation volume calculations, as detailed in **Appendix E**, indicate that the total runoff in the post-development condition is anticipated to be slightly higher than the pre-development attenuation volumes and were accounted for in the pond's stage/storage conceptual calculations. A preliminary hydraulic model of the study corridor was not prepared using Interconnected Channel and Pond Routing (ICPR) software. During final design, additional coordination with SJRWMD should be conducted and a more detailed analysis, including a hydraulic model, should be prepared to verify that the appropriate discharge attenuation will be provided by the proposed stormwater management systems. See **Appendix E** for the conceptual pond sizing calculations output.

3.13.5 WATER QUALITY

The proposed stormwater management systems will provide water quality that meets SJRWMD criteria (Chapter 62-302 of the Florida Administrative Code) via dry retention on-site ponds or wet detention offsite ponds. Retention areas (i.e., dry treatment roadside ditches) located within Clearlake Road R/W were taken into treatment consideration for Basin Nos. 3 and 4, due to available FDOT R/W. All drainage systems indirectly discharge into either the Indian River Lagoon (Basin Nos. 1 to 3) or St. Johns River (Basin No. 4). Neither is classified as an Outstanding Florida Waters at the outfall locations; therefore, additional 50 percent treatment volume and permanent pool volume is not required or provided for this project. Below is a bullet-listing of the SJRWMD water quality criteria, as detailed in the 2013 *Permit Information Manual*. Also, see **Appendix A: Drainage Design Criteria Matrix** for additional SJRWMD and FDOT water quality requirements.

- The greater of the following design treatment volumes for wet detention systems:
  - 1″ of runoff over the drainage area (i.e., roadway R/W)
  - 2.5″ times the impervious area (excluding water bodies)
- Dry detention volume = 0.75 times the calculated wet detention volumes
- Dry retention volume = 0.50 times the calculated wet detention volume
- Additional treatment volume is required for systems which discharge directly to Class I, Class II, Outstanding Florida Waters, or Class III waters (which are approved, conditionally approved, restricted, or conditionally restricted for shellfish harvesting).

Since water quality treatment is only required for onsite runoff, the required water quality volume calculations were generated based on the pervious, impervious, and total widths and lengths of the existing and proposed roadway typical sections. The resulting existing and proposed land use and water quality volume calculations are provided below (**Table 3-10**), and in further details in **Appendix E**.

Table 3-10: Required Water Quality (Post-Development) – 'Build' Alternative 1VE

Basin / System No.	Exist. Treatment Provided (ac-ft)	Treatment Volume (2.5″ x Total Impervious Area (ac-ft)	Direct Discharge Into Impaired Waterway (150%)	Attenuation Treatment	Total Req'd. Treatment Volume (ac-ft)	Total Provided Treatment Vol. (ac-ft)
1	0.00	0.60	N/A	0.05	0.65	0.96
2 (East)*	1.78	1.78	N/A	0.27	2.05	2.28
2 (West)	0.00	0.20	N/A	0.55	0.75	0.76
3	0.00	0.66	N/A	0.30	0.96	1.36
4	0.00	0.05	N/A	0.07	0.12	0.85

* Treatment provided in existing Wal-Mart Wet Detention Pond (SJRWMD ERP Permit No. 40-009-86250-2)

In consideration of the ongoing discussions occurring at the state level (FDEP) for maximizing water quality and treatment, the proposed stormwater systems were developed to provide additional performance efficiencies for reducing pollutant loading.

3.13.6 POND SITE CONFIGURATION

The pond site configurations are based on SJRWMD's criteria (*Permit Information Manual*), along with FDOT's Pond Siting Procedures and Pond Siting Report Review Checklist. The following criteria were met as part of the pond site configuration:

- Pond Configuration – 2:1 (avg. length to width ratio) with the outfall on the side opposite of the inflow
- Pond Location – 20′ horizontal clearance between normal pool elevation and the R/W line
- Minimum Berm Corner Radius – 30′ (35′ preferred)
- Minimum Berm Width – 15′
- Maximum Berm Slope – 1:8

- Pond Slopes (above water line) – not steeper than 1:4
- Maximum Pond Depth – 12′
- Mean Pond Depth (pond volume / pond area at the control elevation) – between 2′ and 8′
- Littoral Zone Alternative – provide an additional 50% of the appropriate permanent pool volume
- One (1) Foot of Freeboard (design storm peak stage and low edge of maintenance berm) – allow for grading irregularities
- The use of fencing is not permitted around stormwater ponds AND, if proposed, requires a Design Variation approved by the State Roadway Design Engineer, per the FDOT Drainage Manual (2015).
- Design ponds consistent with the Department's Highway Beautification Policy (no Big Ugly Rectangular Ponds – BURPs).

For additional details on the proposed pond design, see **Exhibit E: Typical Section for Stormwater Treatment Ponds**.

IV. DRAINAGE SYSTEM DESCRIPTION

This section describes the Recommended Roadway and Pond Alternatives ('Build' Alternative 1VE) presented at the Public Hearing held on February 25, 2016. The following section (Section 5.0: Preferred Roadway Alternatives and Ponds) describes the Preferred Roadway Alternative (BP Gas Alternative) based on public and local government input received as part of the public hearing record. The preferred pond locations are detailed in **Appendix J (Preferred Pond Site Location Maps)**.

4.1 PRE-DEVELOPMENT AND POST-DEVELOPMENT CONDITIONS

From a stormwater treatment design perspective, the project was divided into four separate stormwater management drainage basins as depicted in **Exhibit F**. Post-development conceptual analyses, detailed below, was completed based on the four-lane, divided, urban typical section, the preferred alternative, as detailed in **Exhibit C**. Analyses was, also, based on the 35-mph design curve. The standard impervious width for the urban typical section footprint is 78′ for the entire proposed corridor (from Michigan Avenue to Industry Road). Below are the details on the individual drainage basin's pre-development and post-development conditions as delineated and determined using Microstation (and not the typical lengths and widths detailed in the Pond Sizing Calculations), along with the pond siting selection criteria and an overview of the alternatives analysis.

Table 4-1: Pre-Development Site, Peak Flow & Peak Stage Data

Basin / System No.	Impervious Area (ac)	Pervious Area (ac)	Pervious Pond Area (ac)	Water Surface Area (ac)	Total Area (ac)	Peak Flow * (cfs)
1	2.99	2.74	0.65	0.00	6.38	4.41
2 (East)	8.56	1.36	0.85	1.44	12.21	9.25
2 (West)	1.60	1.13	0.00	0.00	2.73	1.95
3	4.90	11.88	0.00	0.00	16.78	12.14
4	2.98	4.63	0.00	0.00	7.61	5.15

* Based on 25-year / 24-hour design storm event

Table 4-2: Post-Development Site, Peak Flow & Peak Stage Data

Basin / System No.	Impervious Area (ac)	Pervious Area (ac)	Pervious Pond Area (ac)	Water Surface Area (ac)	Total Area (ac)	Peak Flow * (cfs)	Freeboard Clearance (ft.)
1	2.87	2.91	0.25	0.35	6.38	4.46	1.00+
2 (East)	9.10	0.72	0.95	1.65	12.42	9.52	1.00+
2 (West)	1.93	1.62	0.00	0.00	3.55	2.50	1.00+
3	5.48	10.41	0.00	0.00	15.89	10.61	1.00+
4	3.34	4.28	0.00	0.00	7.62	5.22	1.00+

* Based on 25-year / 24-hour design storm event

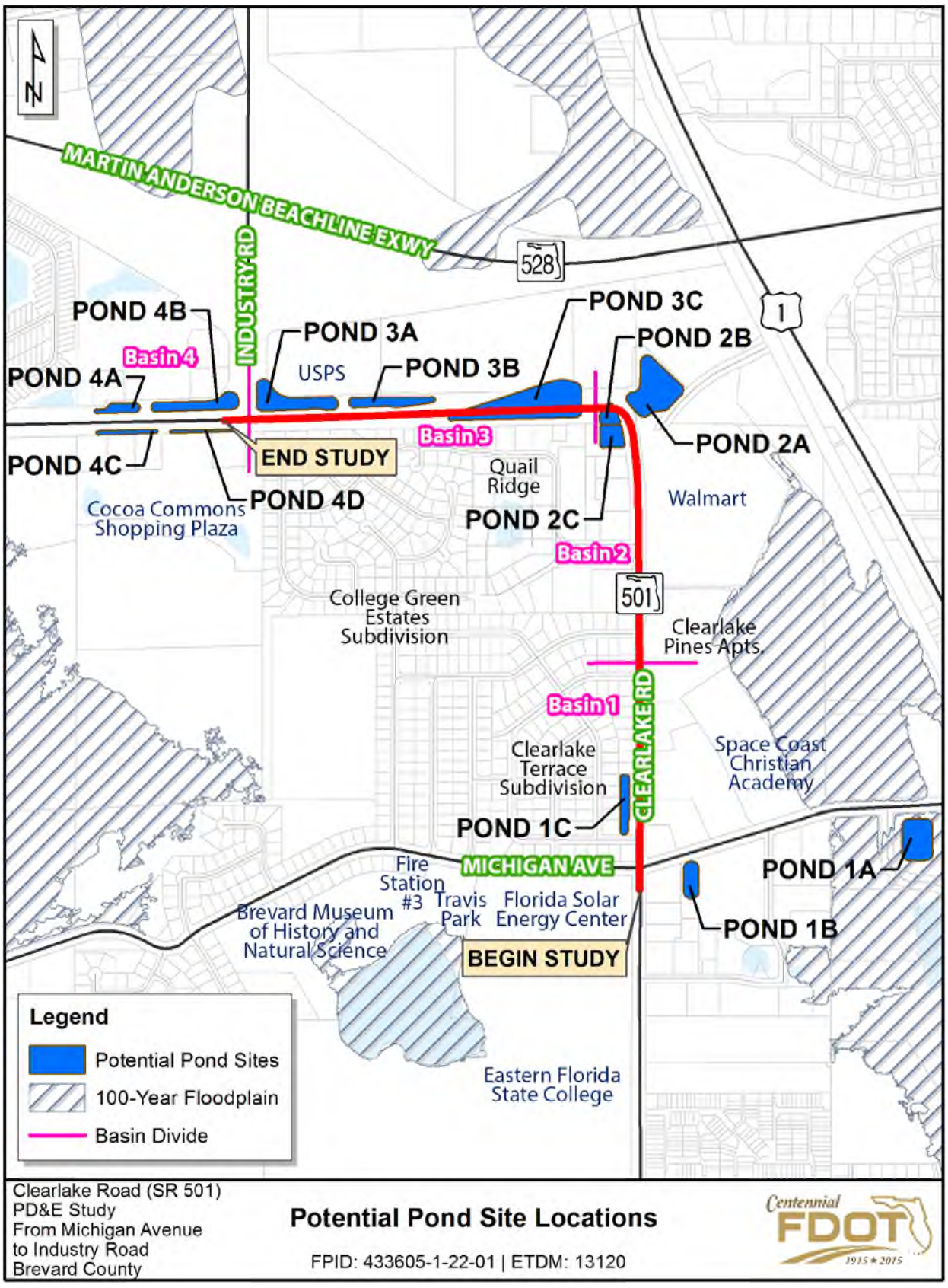


Figure 4-1: Pond Alternatives Location Map

4.1.1 SYSTEM 1

Existing Conditions: System No. 1 extends from Station 154+10 (south of Michigan Avenue) to Station 179+75 (north of La Marche Drive) and is located within the Northern Indian River Lagoon Basin. This system currently conveys runoff to Michigan Avenue, then east along Michigan Avenue where stormwater ultimately outfalls into an existing wet detention pond located on the south side of Michigan Avenue (0.4 miles east of Clearlake Road). See **Exhibit F (Drainage System 1 Map)** for additional drainage system details, including flow patterns.

Recommended Roadway Build Alternative No. 1VE: Within the limits of System No. 1 (south of Michigan Avenue), minor widening (< 3′) is anticipated to accommodate the southbound taper condition created by the expanded typical section at the north approach. North of Michigan Avenue, widening is proposed to accommodate four 11′ travel lanes (two in each direction), a 22′ median, 7′ dedicated bike lanes, and 6′ sidewalks located on either side of the roadway. Intersection improvements, including an exclusive southbound right turn lane, are proposed at Michigan Avenue, as well. Preliminary drainage calculations indicate that an offsite pond will be needed for this system for all 'Build' alternatives. Three (3) potential pond sites were identified for this system, all of which will satisfy the treatment and attenuation requirements. A pond alternatives location map is included in the report (see **Exhibit F**). These pond locations were presented at the Public Hearing as the recommended pond locations. The proposed stormwater management (SWM) treatment system for Basin No. 1 consists of a treatment "train" where a small amount of dry, retention, pre-treatment will be accomplished onsite within shallow median swales; this amount was considered negligible and was not accounted for in the preliminary drainage calculations. Final treatment will be provided within a wet detention pond located within the anticipated future roadway R/W. See **Appendix E** for the preliminary drainage calculations for Basin No. 1.

4.1.2 SYSTEM 2

Existing Conditions: System No. 2 extends from Station 179+75 (north of La Marche Drive) to Station 199+25 (90° roadway bend) and is located within the Northern Indian River Lagoon Basin. This system consists of two sub-basins (2-East and 2-West). Sub-Basin No. 2-East (northbound Clearlake Road, plus southern half of southbound Clearlake Road), a closed conveyance system, discharges into the existing wet detention pond located directly north of the Wal-Mart shopping center. Based on SJRWMD Permit No. 4-009-86250-2, the Wal-Mart Pond is permitted to accept 3.20 acres of Clearlake Road R/W (including 2.82 acres of impervious area). Sub-Basin No. 2-West (northern half of southbound Clearlake Road), an open-conveyance system, discharges into an existing, interconnected dry roadside swale system located adjacent to and west of Clearlake Road. This system ultimately discharges untreated stormwater into a wet conveyance channel located northwest of the BP gas station. See **Exhibit F (Drainage System 2 Map)** for additional drainage system details, including flow patterns.

Recommended Roadway Build Alternative No. 1VE: Within the limits of System No. 2, widening is anticipated to accommodate four 11′ travel lanes (two in each direction), a 22′ median, 7′ dedicated bike lanes, and 6′ sidewalks located on either side of the roadway. Preliminary drainage calculations indicate that the existing Wal-Mart pond will require minor expansion (< 0.15 acres) to accommodate the additional roadway improvements for all 'Build' alternatives. The remaining basin area (Sub-basin No. 2-West) will be routed to a dry ditch on the north side of BP where dry treatment will be provided, prior to discharging into the aforementioned wet conveyance channel to the west. The proposed stormwater management (SWM) systems for the two sub-basins will consist of treatment "trains" where a small amount of dry, retention, pre-treatment will be accomplished onsite within shallow median swales and roadside ditches; this amount was considered negligible and was not accounted for in the preliminary drainage calculations. See **Appendix E** for the preliminary drainage calculations for Basin No. 2.

4.1.3 SYSTEM 3

Existing Conditions: System No. 3 extends from Station 50+00 (Industry Road) to Station 74+50 (90° roadway bend) and is located within the Northern Indian River Lagoon Basin. This system, which consists of three dry roadside ditches (two on the north side, which are interconnected, and one on the south side), currently discharges to the east into an existing conveyance canal located near Station 73+75 (west of the BP gas station driveway).

The conveyance canal routes stormwater east around the Wal-Mart pond and into the preserve located behind Wal-Mart. See **Exhibit F (Drainage System 3 Map)** for additional drainage system details, including flow patterns.

Recommended Roadway Build Alternative No. 1VE: Within the limits of System No. 3, roadway reconstruction is anticipated to accommodate four 11′ travel lanes (two in each direction), a 22′ median, 7′ dedicated bike lanes, and 6′ sidewalks located on either side of the roadway. Preliminary drainage calculations indicate that onsite, interconnected roadside ditches (i.e., dry retention ponds) will provide the necessary treatment and attenuation for all 'Build' alternatives. The required treatment for the proposed SWM treatment system for Basin No. 3 takes into account the pervious median area. However, the pervious median is not included in the areas where treatment volume is conceptually provided. This amount of median storage was considered negligible. All treatment will be provided within a collection of interconnected, dry, roadside, retention areas. See **Appendix E** for the preliminary drainage calculations for Basin No. 3.

4.1.4 SYSTEM 4

Existing Conditions: System No. 4 extends from Station 31+00 (Coventry of Cocoa residential entrance) to Station 50+00 (Industry Road) and is within the Upper St Johns River Basin. This system currently discharges to the west, either into the Coventry of Cocoa residential frontage pond (Sub-Basin No. 4-North), located on the north side of SR 524, or existing wetlands/preserve (Sub-Basin No. 4-South), located on the south side of SR 524. The systems consist of an open basin condition where stormwater runoff is conveyed overland to the aforementioned outfall locations. See **Exhibit F (Drainage System 4 Map)** for an aerial view and limits of the system.

Recommended Roadway Build Alternative No. 1VE: Within the limits of System No. 4, minor widening is proposed to accommodate the extension of the four 11′ travel lanes, west, through the Industry Road intersection. Additional improvements include 7′ dedicated bike lanes that extend west to the CVS Pharmacy's east entrance (700′ west of Industry Road). Preliminary drainage calculations indicate that the adjacent, interconnected roadside ditches will require slight modifications (i.e., re-grading) to accommodate the added impervious area and provide the required treatment and attenuation volume. All treatment will be provided within the dry, roadside, retention areas. See **Appendix E** for the preliminary drainage calculations for Basin No. 4.

4.2 POND SITING SELECTION CRITERIA

Pond siting evaluation criteria were developed to screen the various potential pond sites. The criteria includes items such as R/W and land use costs, wetland impacts, wildlife impacts, cultural resource impacts, contamination and hazardous materials impacts, noise, drainage considerations, construction concerns, maintenance concerns, utility concerns, and public wellfield impacts. Refer to **Exhibit G** which includes a Pond Alternatives Evaluation Matrix that provides detailed descriptions and issues to consider for the multiple pond siting factors.

4.3 POND SITING ALTERNATIVE ANALYSIS

Each of the four drainage basins were evaluated to determine drainage needs, as well as potential pond site locations. Typical sections detailing the proposed roadway improvements, within Clearlake Road R/W, are included in the report (see **Exhibit C**). Preliminary drainage calculations utilized for evaluating pond sizes are provided in **Appendix E**. The drainage systems attenuation rates for all drainage basins were reduced in the post-development condition, meeting SJRWMD's attenuation requirements (post-development discharge rates < pre-development discharge rates). Conceptual drainage basin maps were prepared to highlight the proposed roadway and drainage facilities for the four basins (see **Exhibit F** for additional details).

Potential pond sites were evaluated and documented in general conformance with FDOT's Pond Siting Procedures. Recommendations were provided in a pond evaluation matrix. See **Exhibit G: Pond Alternatives Evaluation Matrix** which contains the final results of the Pond Siting process. To summarize, Ponds 1C, 2A, 3C and the combination of 4A to 4D (modification of existing roadside ditches) are the proposed alternatives based

on multiple evaluation criteria that includes residential and commercial parcels, wetlands, floodplains, and utility impacts.

4.4 PRE-DEVELOPMENT MODEL

In the pre-development condition, runoff for the semi-urban roadway section of Clearlake Road, from south of Michigan Avenue to the 90° roadway bend, is currently drained by either open swale drainage systems or closed conveyance systems. Runoff is collected and conveyed to wet detention ponds, located offsite, or a lateral conveyance canal, located west of the 90° roadway bend.

Runoff for the existing rural roadway section of Clearlake Road, from west of Industry Road to the 90° roadway bend, is currently drained by dry roadside ditches. The stormwater runoff is collected in the adjacent ditches, and conveyed to nearby wet ponds or conveyance canals. Considering the roadway predominantly sheet flows to shallow roadside ditches that convey runoff offsite, time of concentrations were computed for Basin Nos. 3 and 4 to accurately reflect the flow times.

Basin widths extend predominantly from the proposed R/W line to proposed R/W line for the divided, urban typical section. The existing R/W width varies along the corridor, with R/W in excess of 200′ west of the 90° roadway bend. All basins are made up entirely of asphalt roadway and grassed areas along the median and outside shoulder areas. The standard existing impervious width for each basin was approximately 70′ (urban and rural typical sections). Considering the roadway predominantly sheet flows to shallow roadside swales that convey runoff to lateral canals, time of concentrations were computed for those applicable basins to reflect more accurate flow times.

The basin's pre-development (and post-development) curve numbers (CN) were calculated according to the SJRWMD's *Permit Information Manual* and the 2012 FDOT Hydrology Handbook. The CN value is calculated based on the hydrologic soil group (A to D) and land use type (i.e., Streets and Roads). The hydrological soil group 'D' was used, resulting in a more conservative CN value for this conceptual drainage design. Once the CN value was calculated, a soil capacity was appropriately calculated (S = 1,000/CN - 10). SJRWMD bases the soil capacity on the depth from the average site elevation to the SHGWT elevation and then adjusting the soil storage to account only for the pervious areas in which water can be stored. The existing curve number (CN), on average, is 90.0 along the Clearlake Road corridor. The average existing soil capacity is 1.00.

4.5 POST-DEVELOPMENT MODEL

Runoff for the proposed roadway section of Clearlake Road, from south of Michigan Avenue to Industry Road, will be drained predominantly by closed drainage systems. Runoff will be collected by curb inlets and pipes, or a series of closed flumes, that will convey the stormwater directly to dry, retention or wet, detention ponds. The wet ponds will have control structures that allow for overflow into existing closed conveyance systems. Since all roadway runoff for the north/south portion of Clearlake Road will be collected and conveyed by a piping network, the FDOT minimum time of concentration of ten (10) minutes was used for Basin Nos. 1 and 2 (and corresponding sub-basins).

In the post-development condition, runoff for the proposed urban roadway section of Clearlake Road, from the 90° roadway bend to west of Industry Road, will be drained by a series of closed flumes to open drainage ditches, interconnected by a collection of side or cross drains. Dry retention treatment (and attenuation) will be provided roadside, prior to discharging via the historical outfalls.

The post-development results for the different pond sizes were evaluated based on the following criteria: (1) post-developed discharge being less than the pre-developed discharge for the 25-year/1-day design storm event and (2) peak pond stages during the 25-year/1-day design storm event more than one foot below the estimated pond berm elevation. A tolerance of +/- one inch of freeboard was given during the pond sizing analysis.

Table 4-3 shows the final areas (in acres) necessary to contain the required pond size with 15′ maintenance berms and 4′ tie-down widths.

Table 4-3: Final Required Pond Areas – 'Build' Alternative 1VE

Basin / System No.	Control Elevation / Normal Water Level (NWL; NAVD)	Wet Surface Area at NWL (ac.)	Pond R/W without 10% Safety Factor (ac.)	Pond R/W with 10% Safety Factor (ac.)
1	28.00	0.35	0.59	0.65
2 (East)	25.65	1.65	1.93	2.12
2 (West)	26.50	0.00 *	0.37	0.41
3	27.00	0.00 *	1.41	1.55
4	27.00	0.00 *	1.21	1.33

* Dry, retention systems (dry, interconnected ditches)

4.6 TOTAL MAXIMUM DAILY LOADS (TMDL)

The project is located within the SJRWMD's Indian River Lagoon Basin. This section of the Indian River Lagoon, the predominant ultimate outfall for this segment of Clearlake Road, is not considered an OFW (Outstanding Florida Waters) or aquatic preserve, per detailed coordination with SJRWMD. Additional treatment volume (50%) is not required for the drainage basins that outfall to the lagoon. However, a TMDL has been established for this section of the river. As such, pollutant loading analysis is required to demonstrate nutrient load reductions to the receiving waters for both nitrogen and phosphorus.

Preliminary pre-development and post-development annual mass loading(s) for both nitrogen and phosphorus have been calculated for the three drainage basins that ultimately discharge into the Indian River Lagoon (see **Table 4-4**). The annual mass loading(s) shown below were calculated based on FDEP's *Environmental Resource Permit Stormwater Quality Applicant's Handbook* (March 2010) – Section 25.0. Preliminary pollutant loading calculations are provided in **Appendix E**.

Table 4-4: Pre-Development and Post-Development TMDL

Basin / System No.	Pre-Annual Mass Loading (Nitrogen) (kg/yr)	Pre-Annual Mass Loading (Phosphorus) (kg/yr)	Post-Annual Mass Loading (Nitrogen) (kg/yr)	Post-Annual Mass Loading (Phosphorus) (kg/yr)
1	16.38	2.23	10.11	0.53
2 (East)	25.42	3.51	16.51	1.01
3	38.21	4.74	23.80	1.35

* TMDL & pre/post loading analysis is not required for Basin No. 4.

V. PREFERRED ROADWAY AND POND ALTERNATIVES

The Recommended Alternative ('Build' Alternative 1VE) was presented at the Public Hearing held on February 25, 2016. This chapter discusses the selected Preferred Alternative based on public and local government input received as part of the public hearing record.

5.1 CONSIDERATIONS FOLLOWING THE PUBLIC HEARING

Based on comments received at the Public Hearing, two considerations were presented resulting in further post-hearing analysis and, ultimately, slight modifications to the Recommended Alternative presented at the Public Hearing. These two considerations include the following:

- Consideration for alternative design to the 35 mph 'Bulb-Out' – This consisted of evaluation for a 35 mph curve impacting the BP Gas station property as opposed to the 35 mph 'Bulb-Out' alternative that was presented at the hearing.

- Consideration for meandering sidewalks/enhancement area – This consisted of additional drainage evaluation for moving the proposed sidewalk on the west side of Clearlake Road away from the proposed curb and gutter in order to meander behind proposed retention ponds from Michigan Avenue to Otterbein Avenue with additional landscaping in order to create an enhanced and more visually appealing setting.

5.2 BP GAS STATION ALTERNATIVE (PREFERRED)

Following the Public Hearing, a meeting was held with the Department, the BP Gas owners, and their attorney on March 29, 2016, to discuss the possible realignment of the Recommended Alternative. The realignment consists of modifying the Recommended Alternative of a 35 mph 'Bulb-Out' to a 35 mph curve that traverses through the BP Gas Station property. This would involve a complete take of the BP Gas property in order to accommodate the new alignment. A treatment pond is proposed to be located on the remainder of the parcel, thus eliminating the need to expand the existing "Walmart" Pond located north of Walmart that is included as part of the Recommended Alternative.

The BP Gas Alternative, which assumes a complete take of the BP Gas station parcel (1.43 acres), proposes a pond adjacent to the proposed curve in the remaining part of the parcel. This pond is proposed within Basin No. 2 and is a single, wet detention pond. The proposed pond was conceptually evaluated and analyzed to meet the treatment volume requirements and, more importantly, eliminate any impacts (i.e., widening) to the existing "Walmart" Pond. The "Walmart" Pond is the main outfall for Basin No. 2, which extends from nearby La Marche Drive to the 90-degree roadway bend. Incorporating a pond into the BP Gas station parcel has been found to be a viable pond site alternative. Details and drainage calculations related to the preferred pond location for the BP Gas Alternative are included in **Appendix I: Conceptual Pond Analysis Memorandum**. The preferred pond locations are detailed in **Appendix J (Preferred Pond Site Location Maps)**.

5.3 MEANDERING SIDEWALK/ENHANCEMENT AREA

As a result of comments received from the County at the Public Hearing, additional drainage evaluation was conducted on the meandering of the proposed sidewalk on the west side of Clearlake Road, from Michigan Avenue to Otterbein Avenue. In order to create an enhanced and more visually appealing setting, additional landscaping is being considered as part of this effort. For Basin No. 1, two, dry, interconnected ditches, located along the west side of Clearlake Road from Michigan Avenue to La Marche Drive, were evaluated and analyzed (versus the originally-proposed single wet detention pond). This alternative was deemed viable based on drainage calculations. A future 20-foot utility easement was assumed to be located adjacent to the proposed right-of-way line for overhead transmission line relocations and was taken into consideration for the interconnected ditch footprints; a meandering sidewalk was considered, as well. The two, dry, interconnected ditches were

conceptually analyzed; details and drainage calculations related to the preferred pond locations south of La Marche Drive are included in **Appendix I: Conceptual Pond Analysis Memorandum**. The preferred pond locations are detailed in **Appendix J (Preferred Pond Site Location Maps)**.

5.4 CONCEPTUAL POND ANALYSIS MEMORANDUM

Per the request of FDOT, additional drainage analysis was completed after the Public Hearing to confirm the requested roadway alternative modifications (that included a meandering sidewalk) can be applied to this project and still meet water quality and quantity requirements, as set forth by SJRWMD and FDOT. As part of this effort, a formal memorandum was assembled describing and detailing the additional drainage analysis completed on the two recommended modifications that impacted two of the four drainage basins. Refer to **Appendix I: Conceptual Pond Analysis Memorandum** for the complete memorandum provided to FDOT in July 2016. The preferred pond locations are detailed in **Appendix J (Preferred Pond Site Location Maps)**.

VI. RIGHT-OF-WAY ACQUISITION

Right-of-Way (R/W) will need to be acquired along the corridor to accommodate the stormwater treatment needs for the proposed roadway improvements. Currently, R/W acquisition is needed for seventeen (17) residential parcels and one (1) commercial parcel, along the north/south segment of Clearlake Road, to properly construct the preferred 'Build' Alternative (BP Gas Alternative).

VII. SUMMARY AND RECOMMENDATIONS

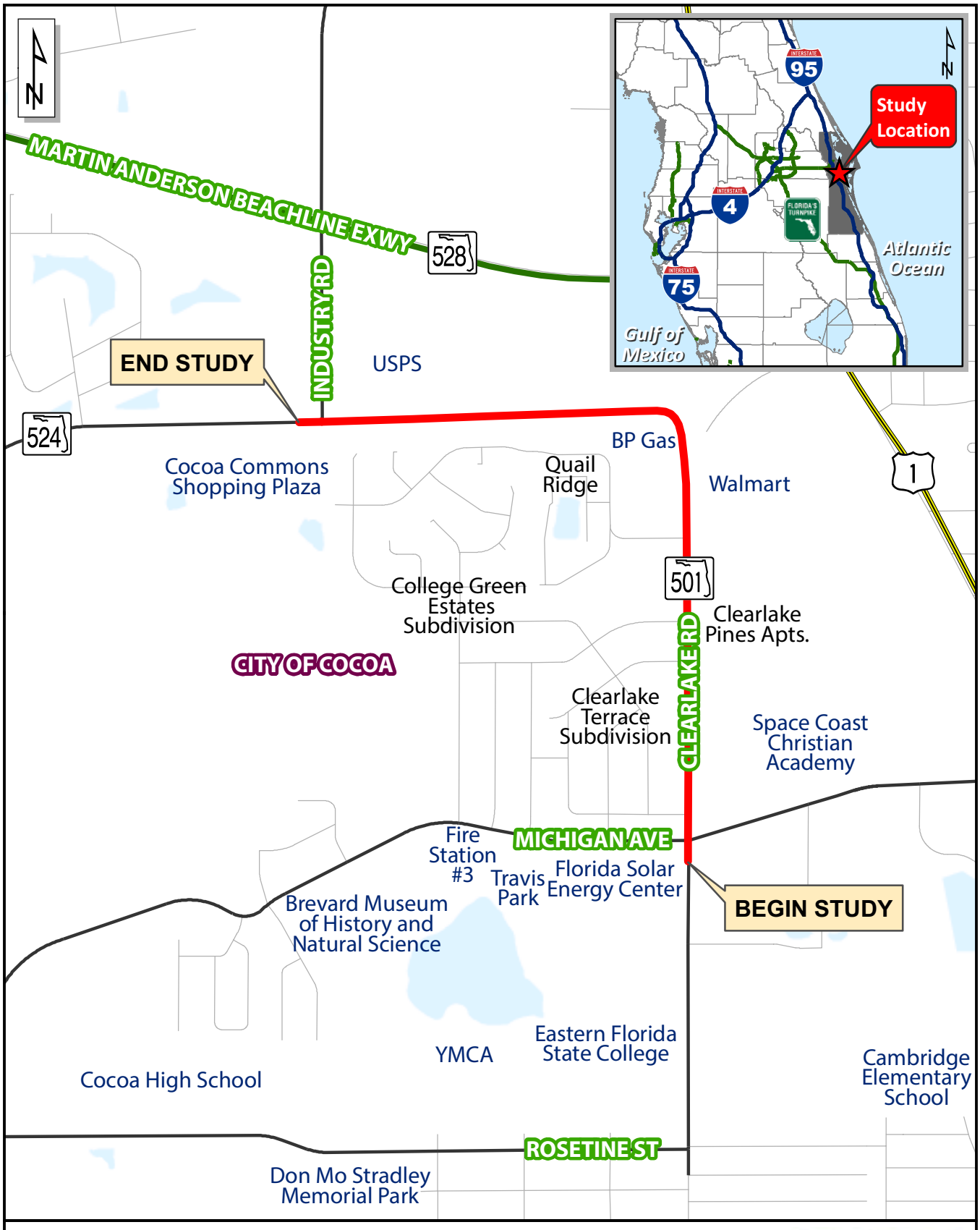
The purpose of the pond siting analysis is to identify the current permitting and drainage criteria, pond size requirements, and sites along the corridor that should be considered during the design phase. It is recommended that these preliminarily selected pond sites be further evaluated during the design phase, which is ongoing concurrently with the PD&E Study (Statewide Acceleration and Transformation Team (SWAT) project), in the event additional properties located along the corridor become for sale in the future. The selection of a preferred pond site for each drainage system shall occur during the design phase.

The preferred stormwater treatment systems along the north/south segment of Clearlake Road should consist of a collection of dry, retention systems located within the proposed Clearlake Road R/W (i.e., south of La Marche Drive), along with wet detention systems that are located offsite, immediately adjacent to the roadway corridor. The preferred stormwater systems along the north/south segment of Clearlake Road should consist of two dry, interconnected retention areas (Pond 1C) and one wet, detention area (Pond 2D). No expansion of Pond 2A (existing "Walmart" Pond) is required to meet the future treatment and attenuation requirements. This approach will result in the need for additional R/W along the north/south segment of Clearlake Road, as fully detailed in the Conceptual Pond Analysis Memorandum (**Appendix I**), beyond what has already been identified for the roadway improvements. The preferred stormwater treatment systems along the east/west segment of Clearlake Road should consist of a collection of interconnected, dry retention roadside ditches, situated within current FDOT R/W, that treat and convey runoff to the historical outfalls. For Basin No. 3 (Industry Road to the 90° roadway bend), interconnecting Ponds 3A, 3D, and 3E (each dry, retention ditches) is the preferred treatment alternative due to the available green space outside the proposed roadway footprint. For Basin No. 4 (western basin), where approximately 0.35 acres of impervious is anticipated to be added, the collection of the four existing roadside ditches are proposed to be re-graded such that the required treatment volume will be provided in the re-configured ditches.

Based on coordination with FDOT and other major stakeholders (including the City of Cocoa), along with feedback received from the general public, 'Build' BP Gas Alternative is the preferred roadway build alternative (western alignment that includes a horizontal curve at the 90° bend that traverses through a portion of the existing BP Gas Station).

EXHIBIT A

PROJECT LOCATION MAP



Clearlake Road (SR 501) PD&E Study
From Michigan Avenue
to Industry Road
Brevard County

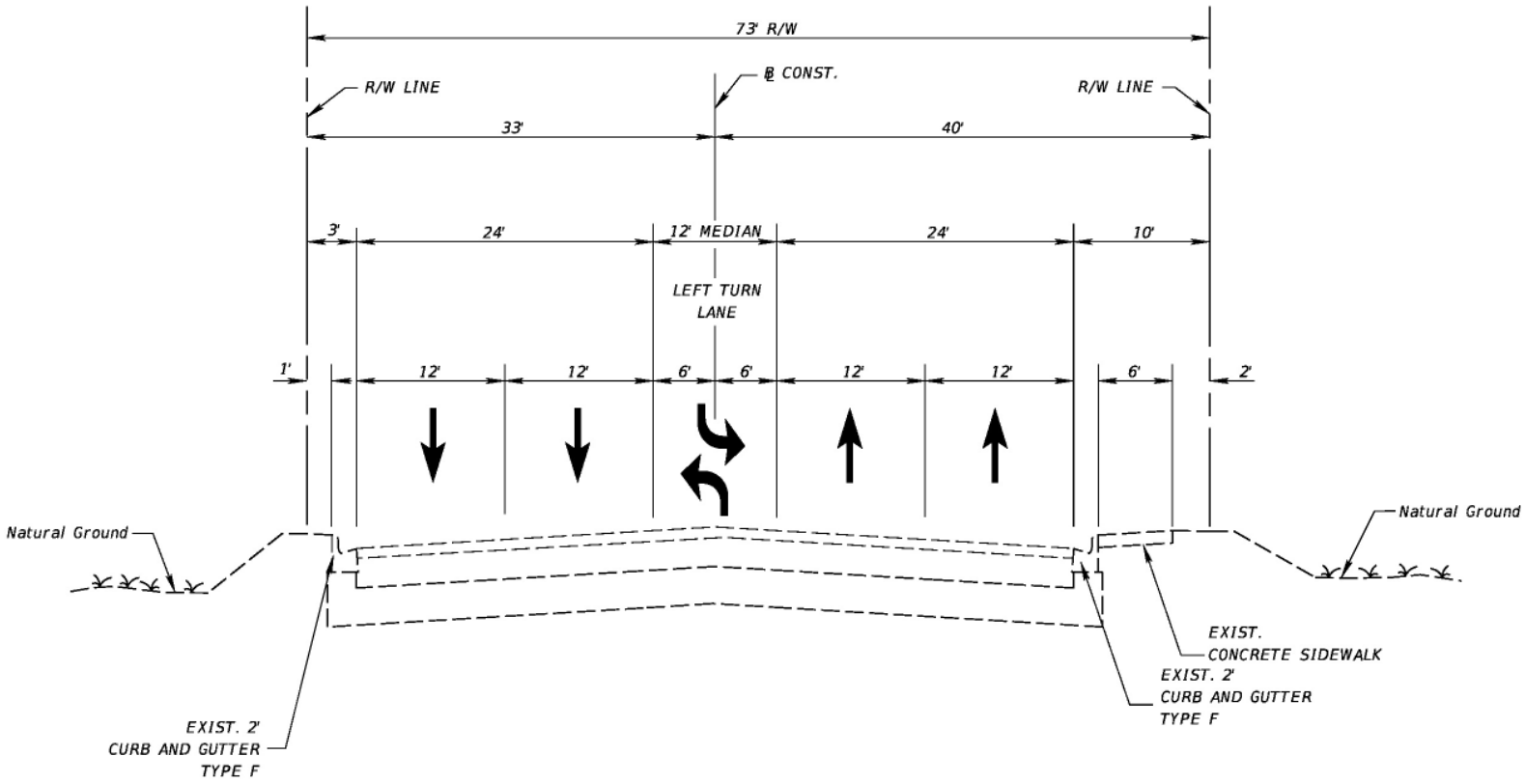
Study Location Map

FPID: 433605-1-22-01 | ETDM: 13120

Centennial FDOT 1915 ★ 2015

EXHIBIT B

EXISTING ROADWAY TYPICAL SECTIONS



EXISTING TYPICAL SECTION NO. 1

CLEARLAKE ROAD (SR 501)

FROM MICHIGAN AVENUE TO APPROX. 720' NORTH

REVISIONS					STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			EXISTING TYPICAL SECTION	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					501	BREVARD	433605-1-22-01		

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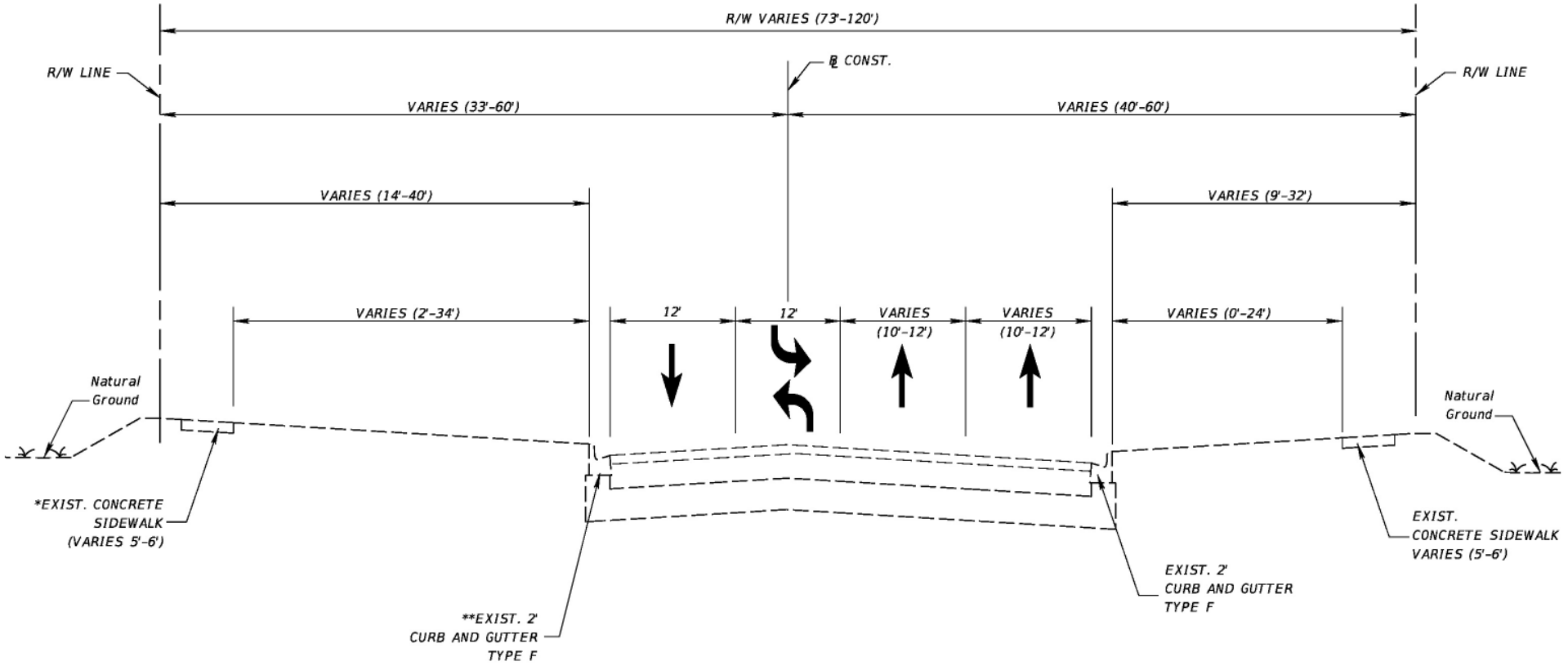

EXISTING TYPICAL SECTION NO. 2

CLEARLAKE ROAD (SR 501)

FROM APPROX. 720' NORTH OF MICHIGAN AVENUE

TO NORTH OF WAL-MART

*SIDEWALK IS ONLY PRESENT FROM NORTH OF OTTERBEIN AVENUE TO JUST SOUTH OF WAL-MART OF TYPICAL SECTION

**FROM APPROX. 720' NORTH OF MICHIGAN AVENUE TO NORTH OF CALVADOS DRIVE REPLACES C&G WITH 2' GRASS SHOULDER

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
501	BREVARD	433605-1-22-01

EXISTING TYPICAL SECTION

SHEET NO.

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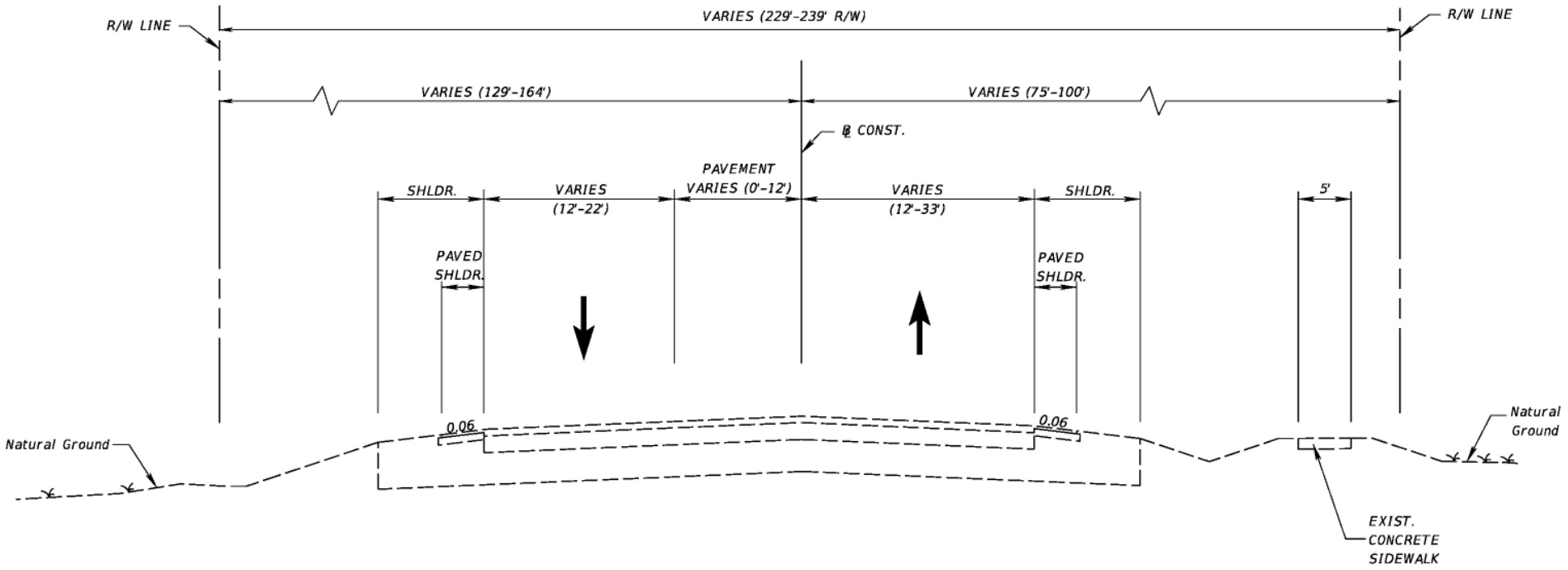


EXISTING TYPICAL SECTION NO. 3

CLEARLAKE ROAD (SR 501)

FROM NORTH OF WAL-MART TO INDUSTRY ROAD

REVISIONS				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			EXISTING TYPICAL SECTION	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
				501	BREVARD	433605-1-22-01		

$USER$ $DATE$ $TIME$ $FILE$

EXHIBIT C

PROPOSED ROADWAY TYPICAL SECTIONS

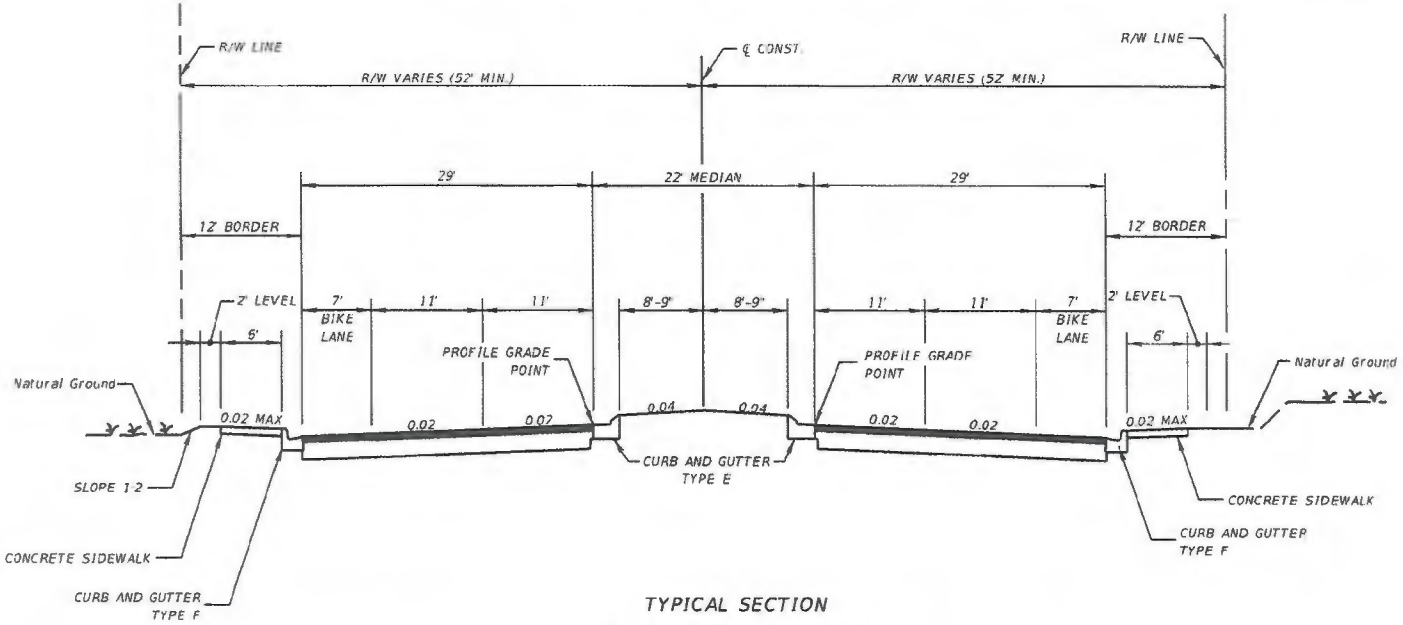
PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 433605-1-52-01 FEDERAL AID PROJECT NO. N/A COUNTY NAME BREVARD

SECTION NO. 70011 ROAD DESIGNATION SR 501 LIMITS/MILEPOST SOUTH OF MICHIGAN AVE. (MP 2.235) TO WEST OF INDUSTRY ROAD (MP 3.358)

PROJECT DESCRIPTION SR 501 (CLEARLAKE ROAD) WIDENING FROM SOUTH OF MICHIGAN AVENUE TO WEST OF INDUSTRY ROAD

PROPOSED ROADWAY TYPICAL SECTION



TYPICAL SECTION
SR 501 (CLEARLAKE ROAD)
STA. 159+00 TO STA. 188+50

DESIGN SPEED = 45 MPH

APPROVED BY: ANIRUDDHA GOTMARE, P.E.	FDOT CONCURRENCE	RECOMMENDED BY
Engineer of Record Scalar Consulting Group, Inc 4152 W. Blue Heron Boulevard, Suite Riviera Beach, FL 33404	Annette K. Brennan, P.E. FDOT District Design Engineer	Amy Sirmans, P.E. D-5 Project Development Engineer
1/25/2016 Date	2/9/2016 Date	N/A Date

ANIRUDDHA S. GOTMARE LICENSE NO. 54801 STATE OF FLORIDA PROFESSIONAL ENGINEER

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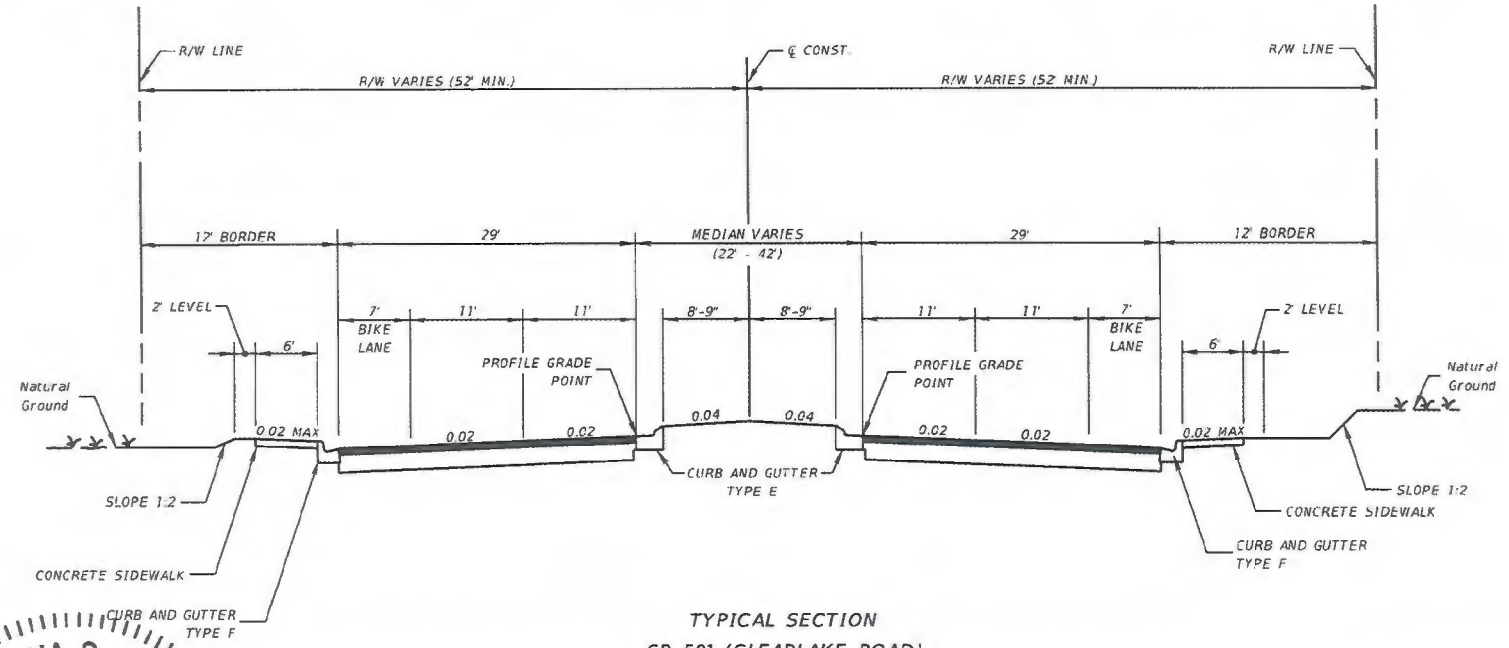
PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 433605-1-52-01 FEDERAL AID PROJECT NO. N/A COUNTY NAME BREVARD

SECTION NO. 70011 ROAD DESIGNATION SR 501 LIMITS/MILEPOST SOUTH OF MICHIGAN AVE. (MP 2.235) TO WEST OF INDUSTRY ROAD (MP 3.358)

PROJECT DESCRIPTION SR 501 (CLEARLAKE ROAD) WIDENING FROM SOUTH OF MICHIGAN AVENUE TO WEST OF INDUSTRY ROAD.

PROPOSED ROADWAY TYPICAL SECTION



TYPICAL SECTION
SR 501 (CLEARLAKE ROAD)
STA. 188+50 TO STA. 236+00

DESIGN SPEED = 35 MPH / 45 MPH

APPROVED BY: ANIRUDDHA GOTMARE, P.E.	FDOT CONCURRENCE	RECOMMENDED BY
STATE OF FLORIDA PROFESSIONAL ENGINEER ANIRUDDHA S. GOTMARE LICENSE No. 54801 Engineer of Record Scalar Consulting Group, Inc. 4152 W. Blue Heron Boulevard, Suite 1 Riviera Beach, FL 33404 1/25/2016 Date	Annette K. Brennan, P.E. FDOT District Design Engineer 2/9/2016 Date	N/A Amy Sirmans, P.E. D-5 Project Development Engineer N/A Date

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EXHIBIT D

SJRWMD RAINFALL DATA

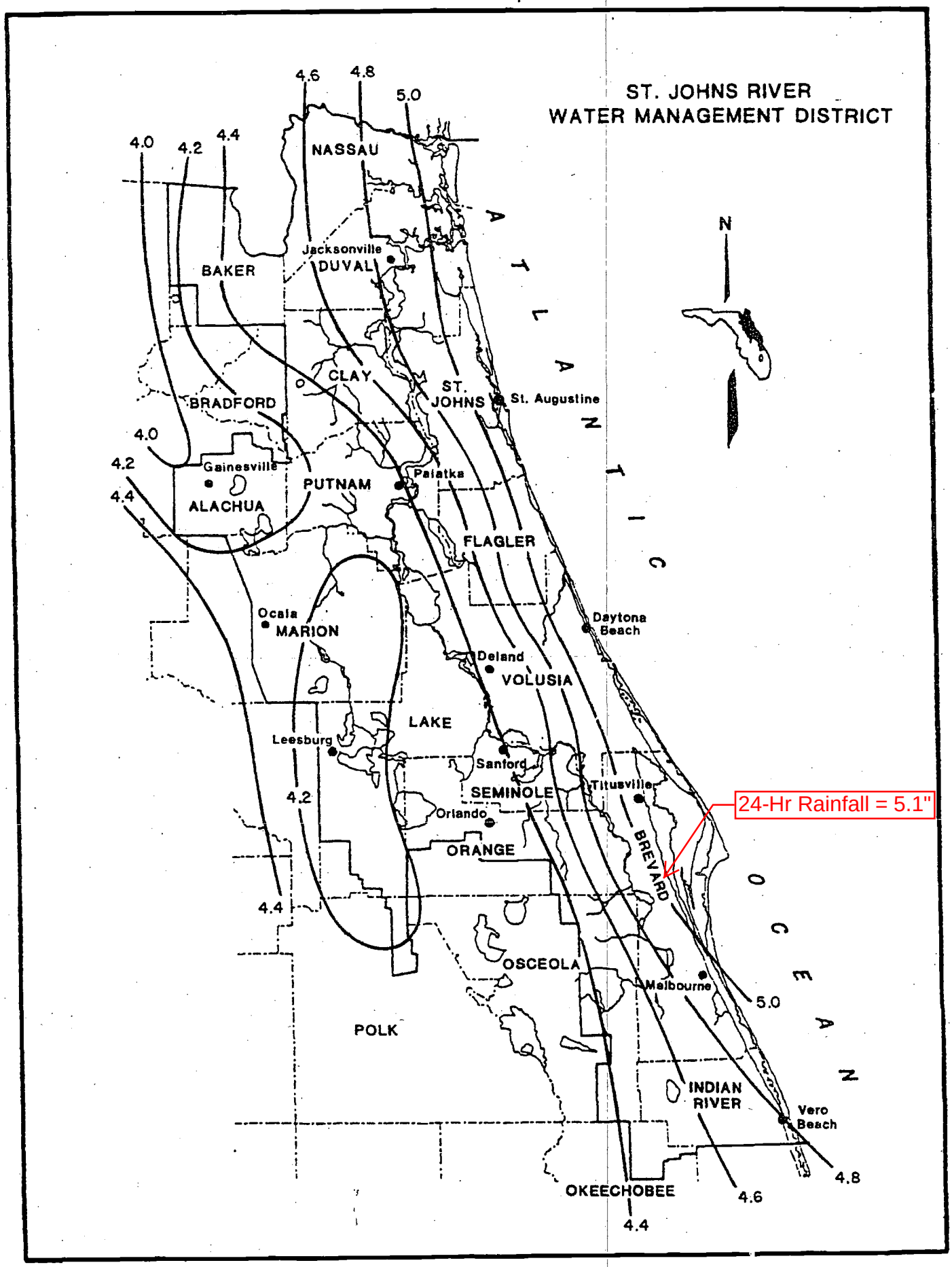


Figure 3. Mean Annual 24-Hour Maximum Rainfall for Northeast Florida, Inches.

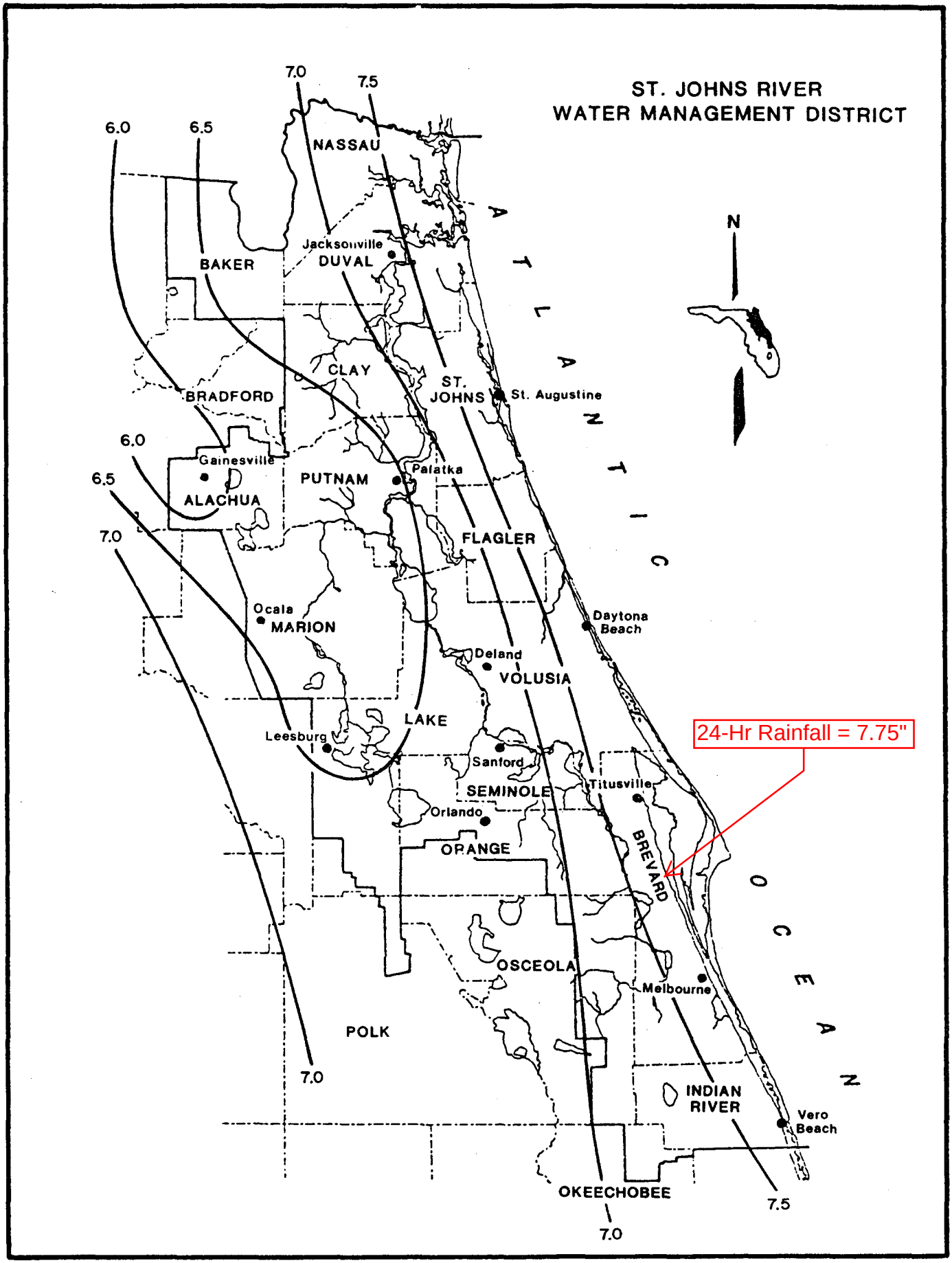


Figure 6. 10-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

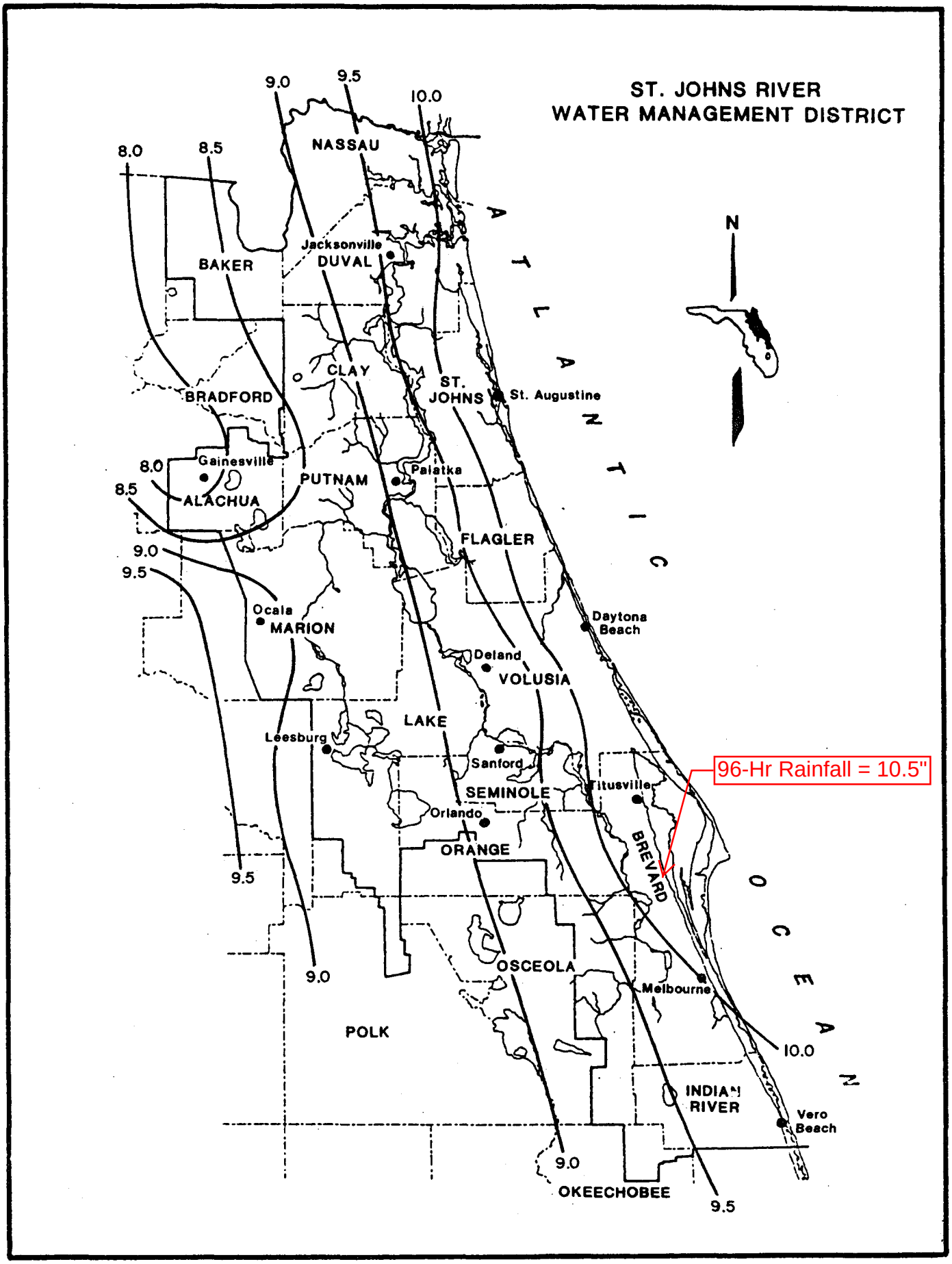


Figure 12. 10-Year 96-Hour Maximum Rainfall for Northeast Florida, Inches.

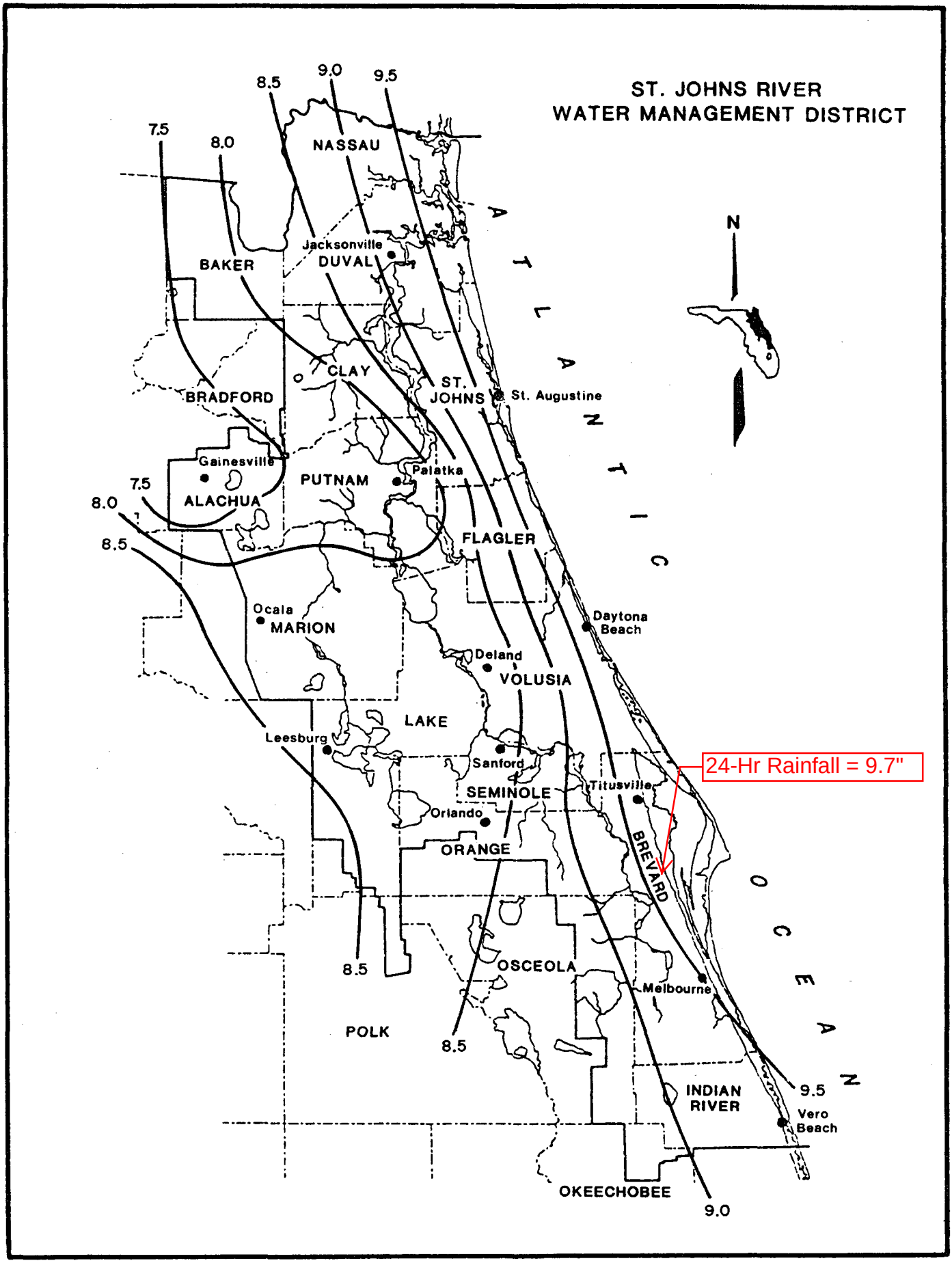


Figure 7. 25-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

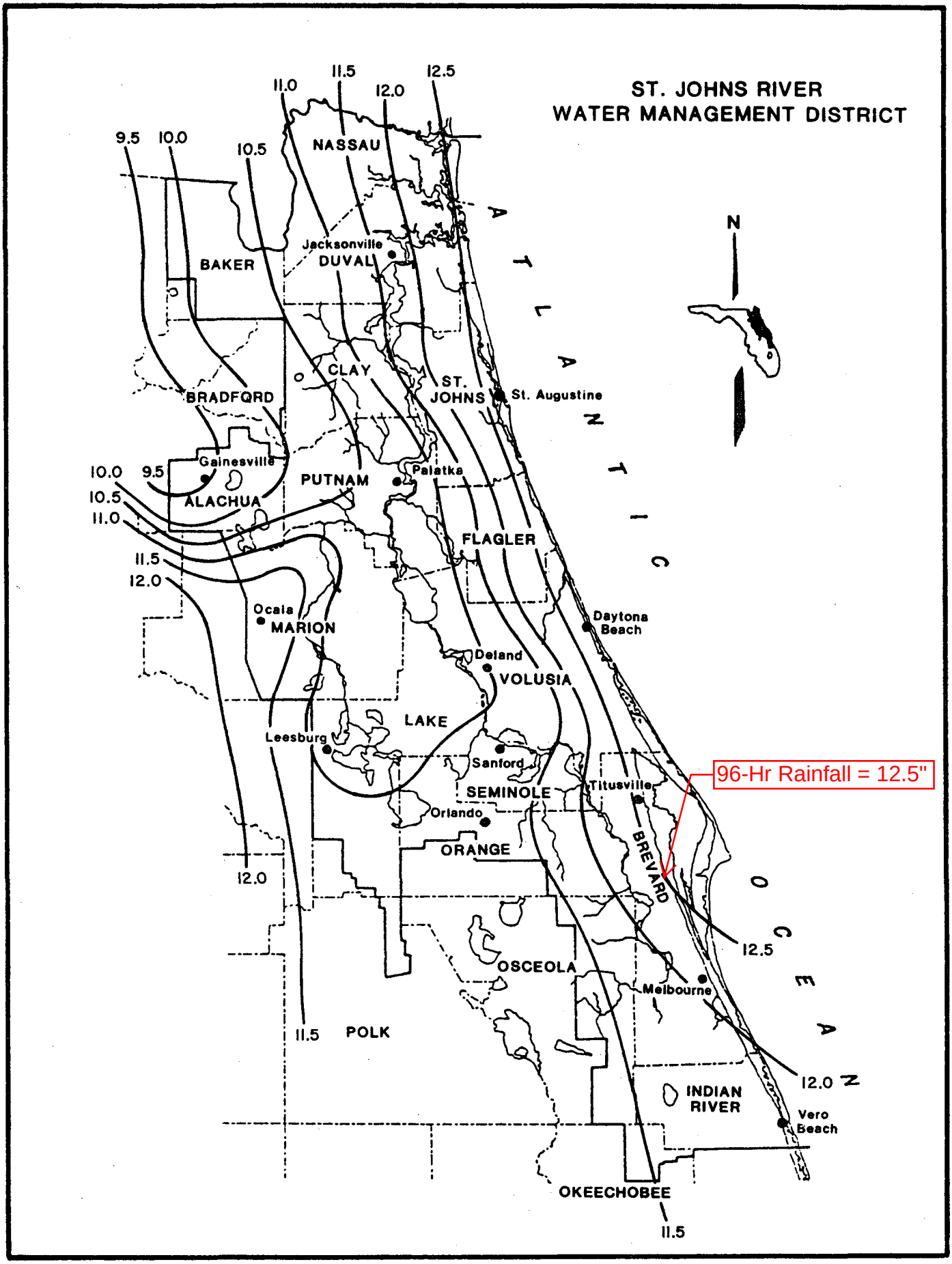


Figure 13. 25-Year 96-Hour Maximum Rainfall for Northeast Florida, Inches.

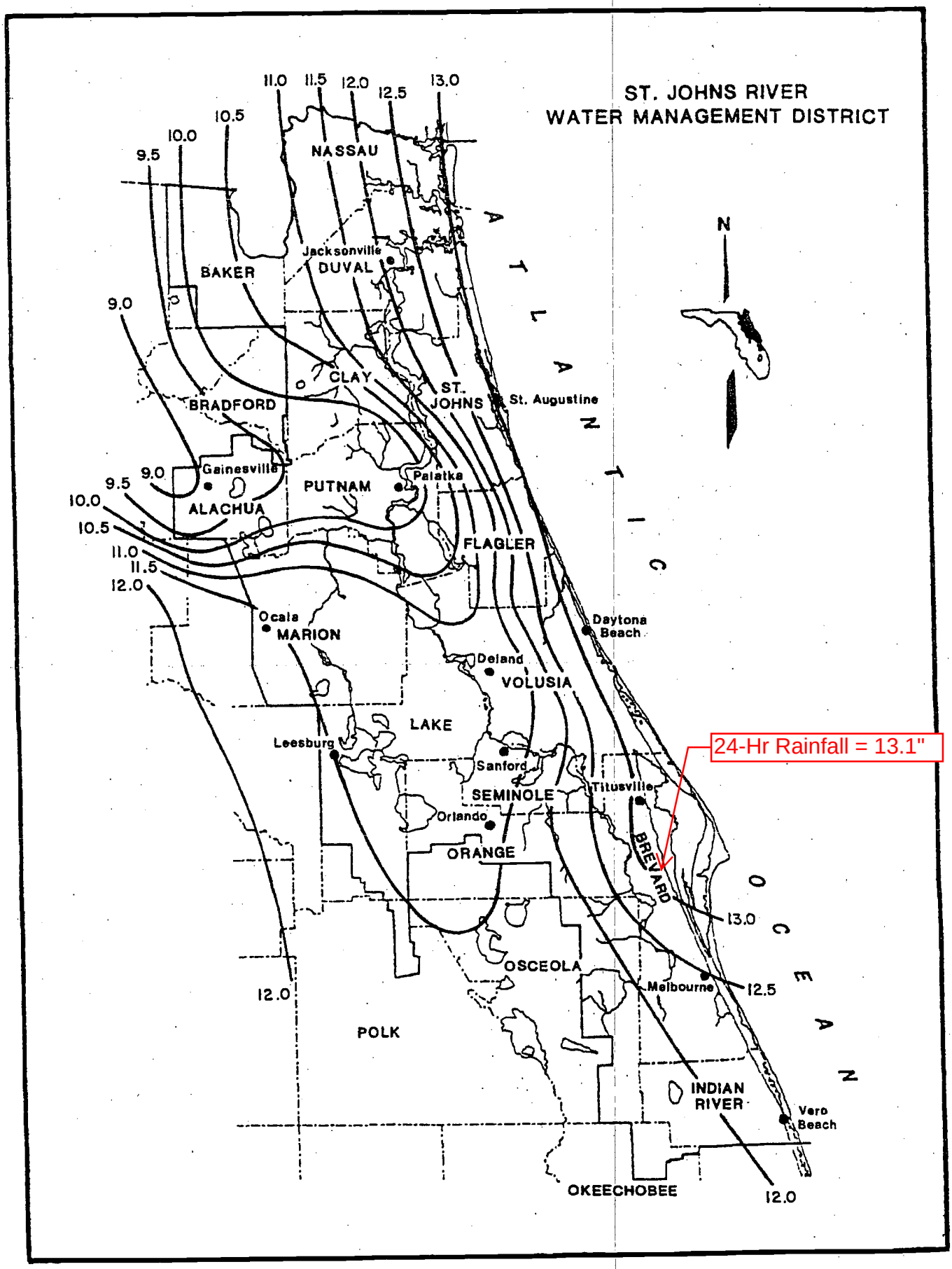
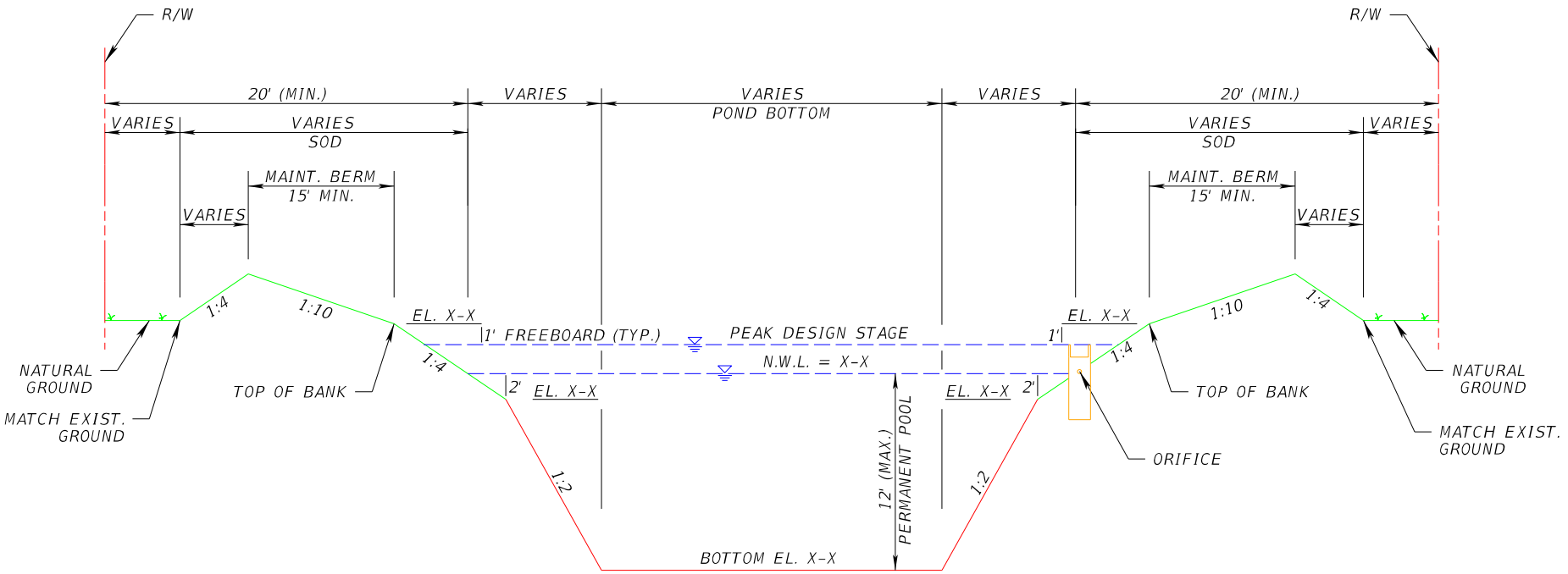


Figure 8. 100-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

EXHIBIT E

TYPICAL SECTION FOR STORMWATER TREATMENT PONDS



CLEARLAKE ROAD STORMWATER TREATMENT PONDS (TYPICAL)

NOTES

- ELEVATION TOLERANCES, FOR POND STRUCTURE, HAVE BEEN ACCOUNTED FOR IN THE DESIGN OF THIS STORMWATER MANAGEMENT FACILITY.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

NOT FOR CONSTRUCTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
501	BREVARD	433605-1-22-01

TYPICAL SECTION
WET DETENTION PONDS

SHEET NO.
-

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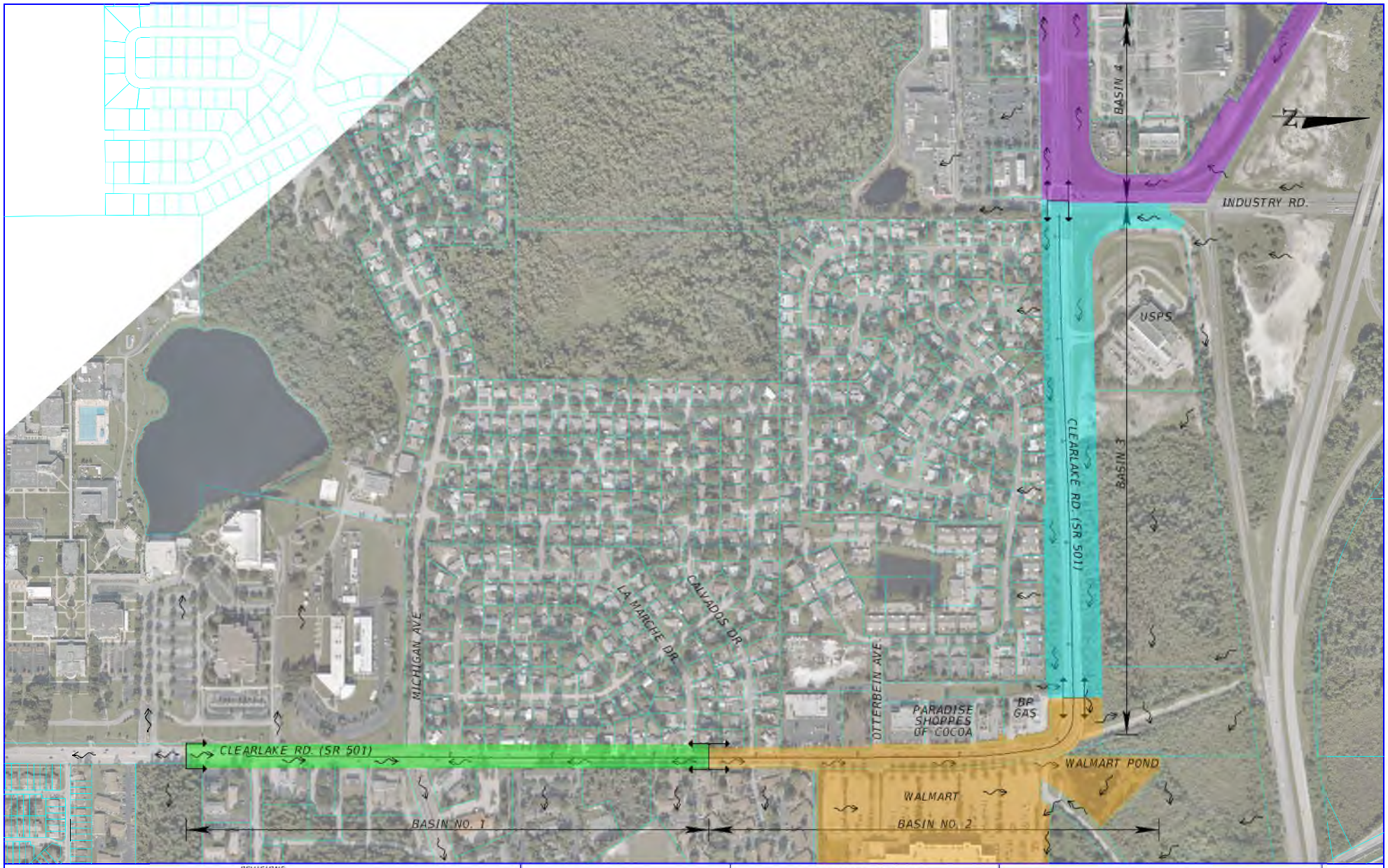
EXHIBIT F

CONCEPTUAL DRAINAGE MAPS



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

NOT FOR CONSTRUCTION

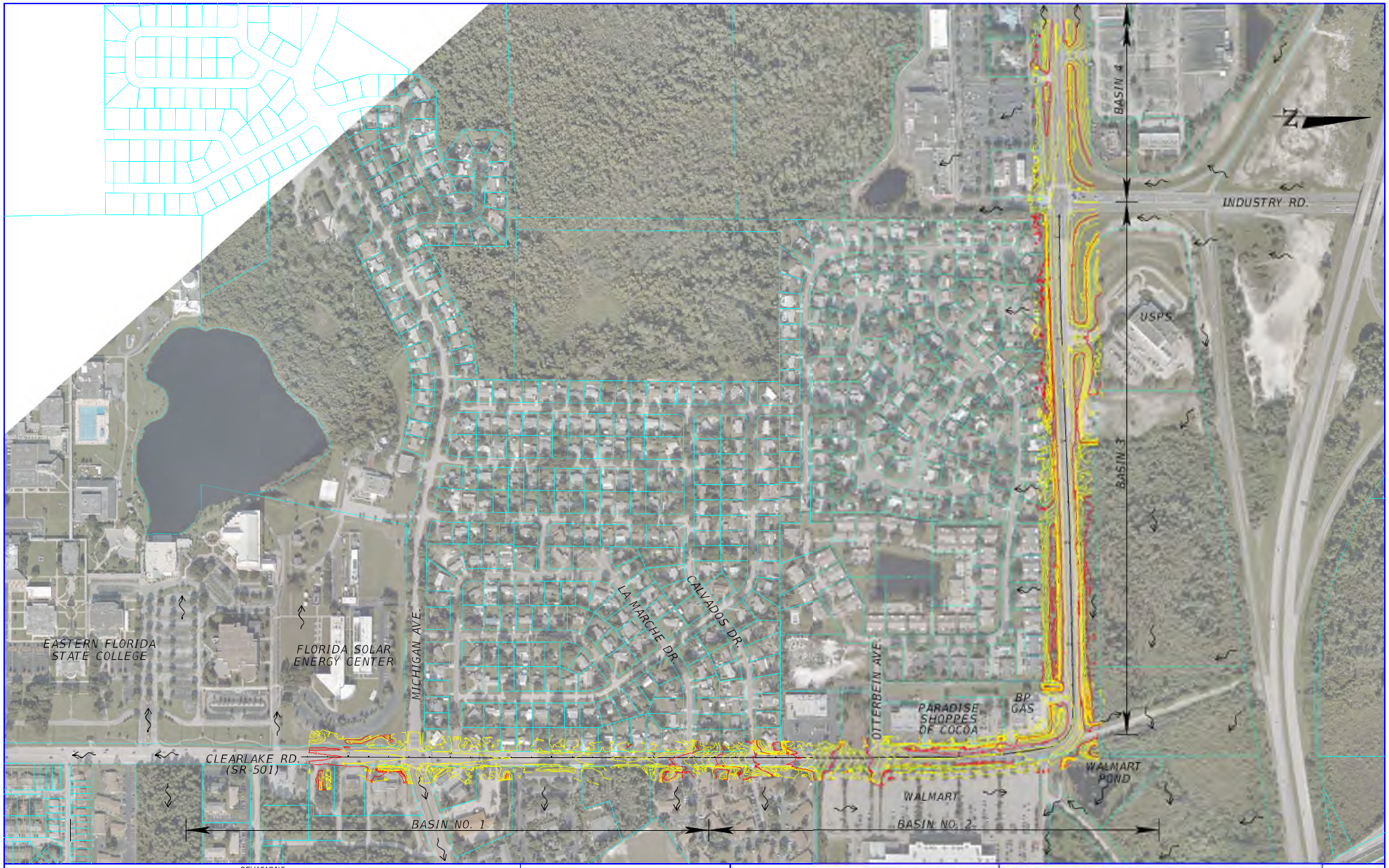
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
501	BREVARD	433605-1-22-01

$USER$ $DATE$ $TIME$ $FILE$

CONCEPTUAL DRAINAGE MAP

SHEET NO. 1



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

NOT FOR CONSTRUCTION

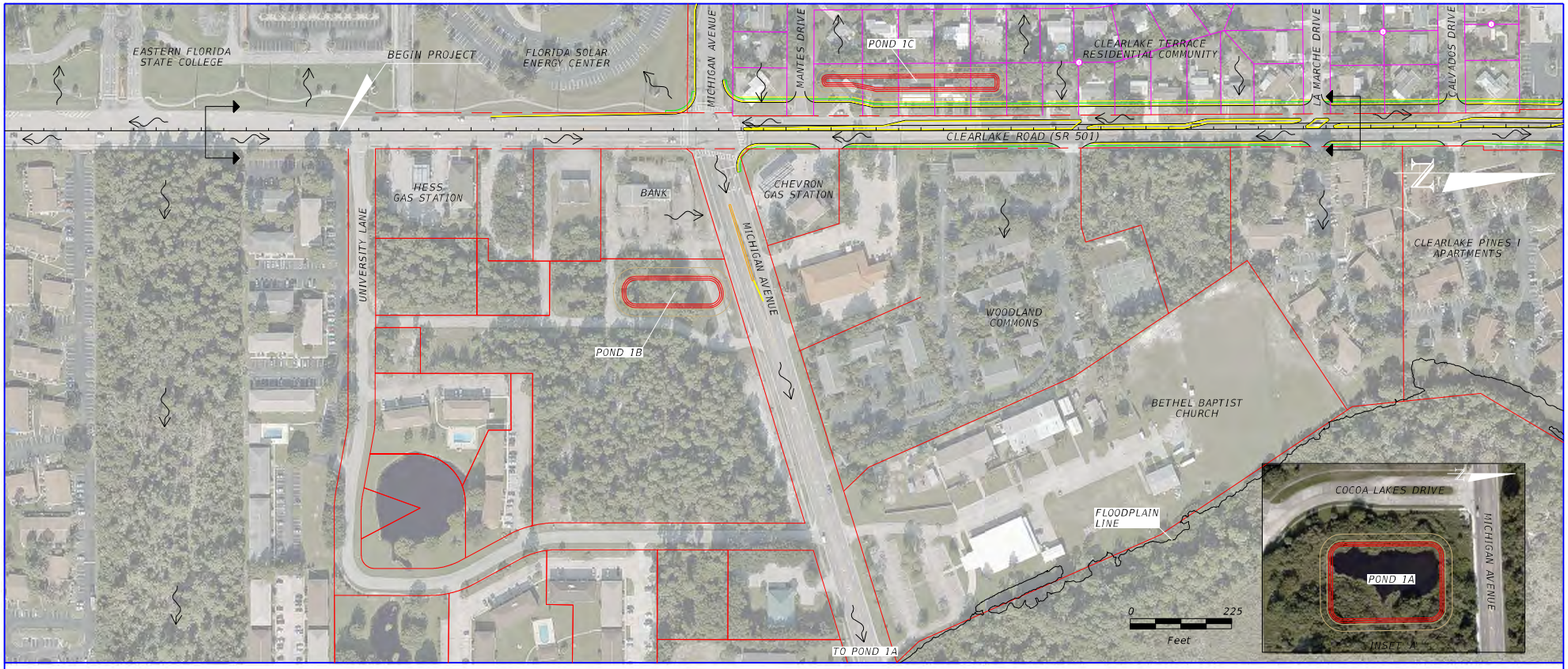
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
501	BREVARD	433605-1-22-01

$USER$ $DATE$ $TIME$ $FILE$

EXISTING DRAINAGE / CONTOUR MAP

SHEET NO.
-



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
1A	1	0.60 ACRES	-	EXPAND EXIST. WET DETENTION POND
1B	1	0.60 ACRES	-	
1C	1	0.60 ACRES	-	5 PARCELS IMPACTED

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY FROM MICHIGAN AVENUE TO INDUSTRY ROAD

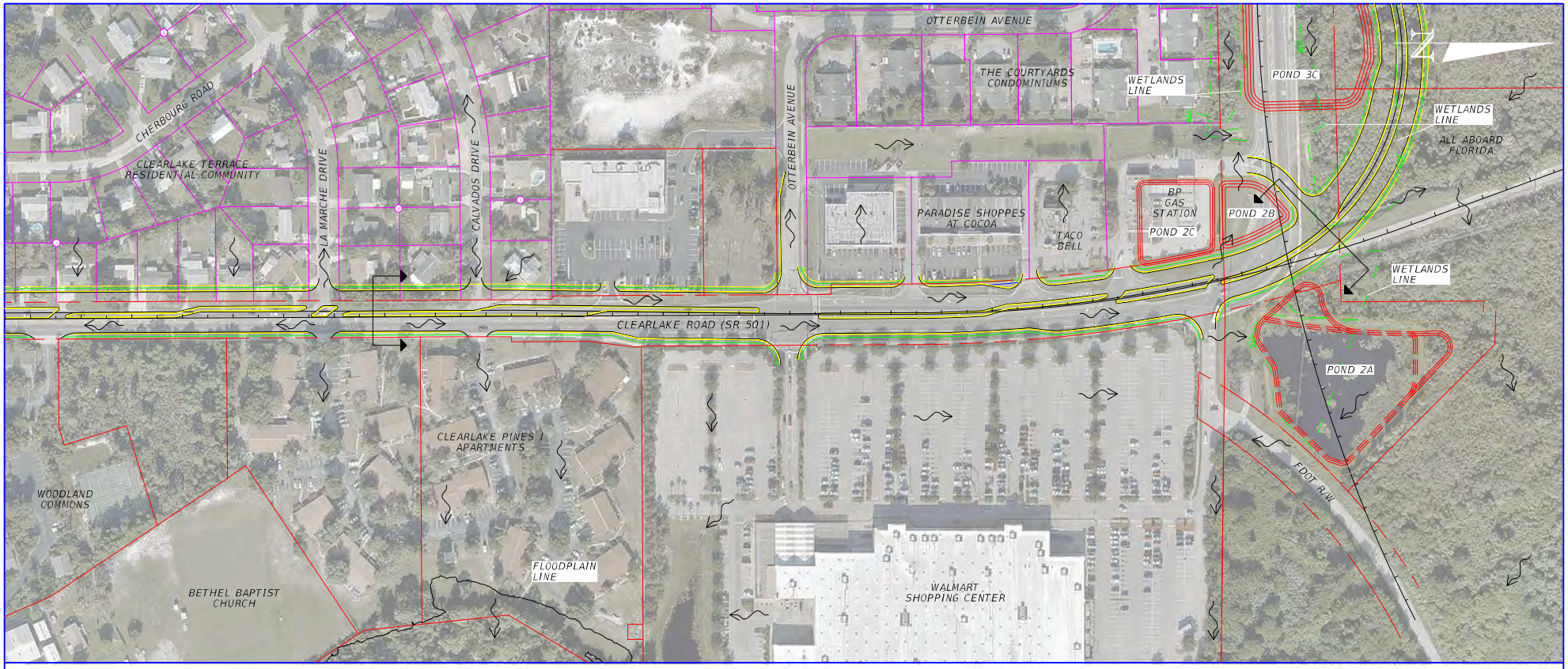
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 1
BUILD ALTERNATIVE NO. 1VE

BASIN NO. 1



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
2A	2	2.10 ACRES	24-36-17-00-256	EXPANDED 'WALMART' POND - PREFERRED ALTERNATIVE
2B	2	0.37 ACRES	24-36-17-00-256	DRY, RETENTION DITCH (PROP.)
2C	2	0.60 ACRES	24-36-18-00-766	POND "FOOTPRINT" LOCATED ON GAS STATION

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SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

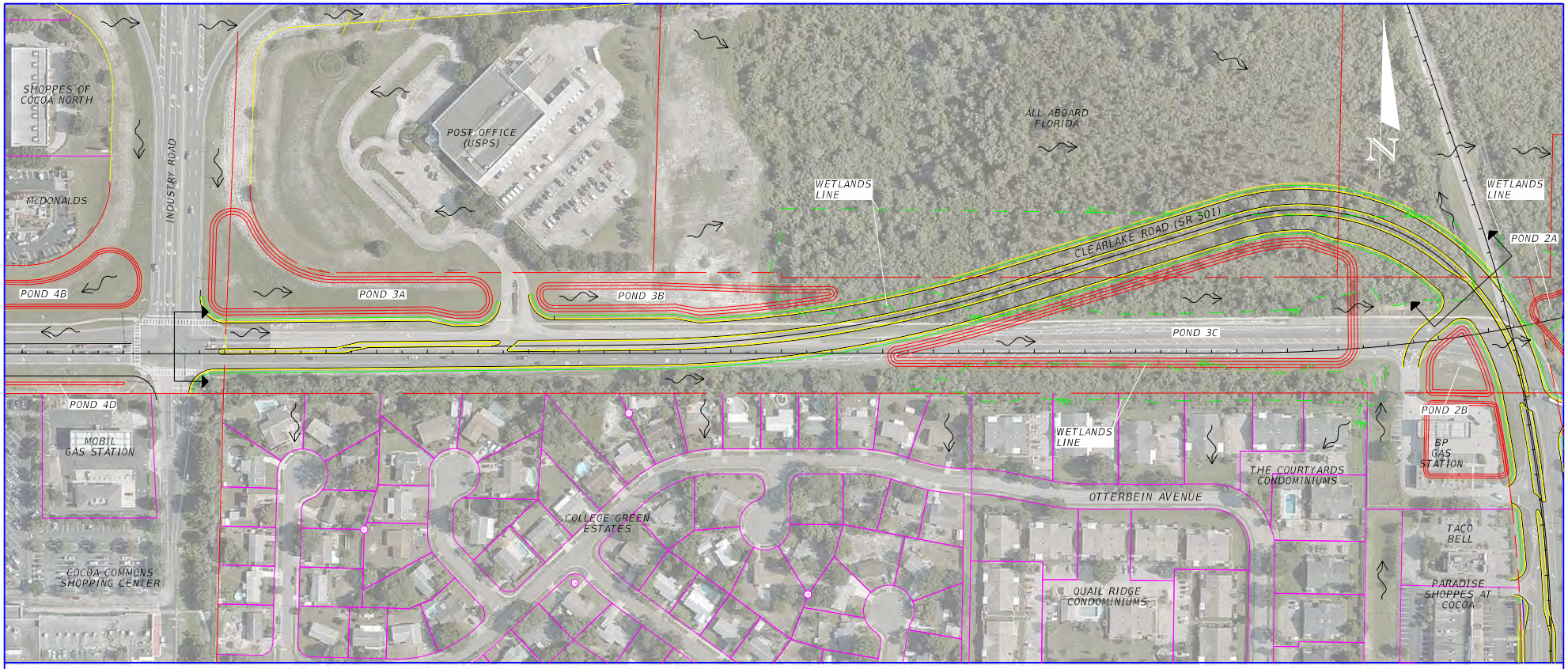
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 2
BUILD ALTERNATIVE NO. 1VE

BASIN NO. 2



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
3A	3	1.50 ACRES	-	FDOT R/W
3B	3	0.90 ACRES	-	FDOT R/W
3C	3	2.75 ACRES	-	FDOT R/W

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

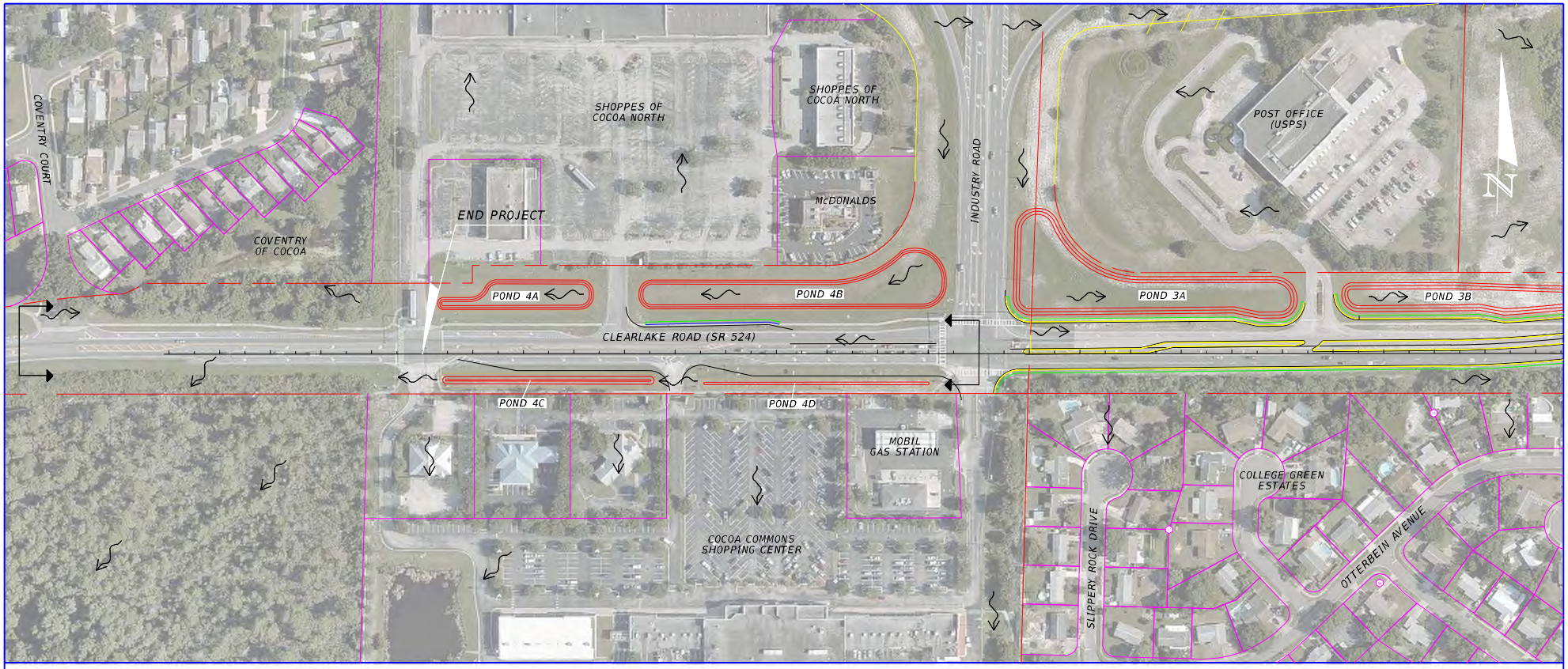
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 3
BUILD ALTERNATIVE NO. 1VE

BASIN NO. 3



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

SYSTEM LIMITS

POTENTIAL POND SITES

INDIVIDUAL PARCELS

EXISTING R/W LINE

PROPOSED R/W LINE

DRAINAGE FLOW ARROW

0 50 200

Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
4A	4	0.40 ACRES	-	FDOT R/W
4B	4	1.05 ACRES	-	FDOT R/W
4C	4	0.25 ACRES	-	FDOT R/W
4D	4	0.20 ACRES	-	FDOT R/W

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY FROM MICHIGAN AVENUE TO INDUSTRY ROAD

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

DRAINAGE SYSTEM 4
BUILD ALTERNATIVE NO. 1VE

BASIN NO. 4

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EXHIBIT G

POND ALTERNATIVES EVALUATION MATRIX

Clearlake Road (SR 501) PD&E Study

POND ALTERNATIVES EVALUATION MATRIX - RECOMMENDED

POND SITE EVALUATION CRITERIA	POND ALTERNATIVES (RECOMMENDED)											
	'No-Build' Alternative	'Build' Pond Site Alternatives (By Basin)										
		Basin No. 1			Basin No. 2			Basin No. 3			Basin No. 4	
		Pond 1A	Pond 1B	Pond 1C	Pond 2A	Pond 2B	Pond 2C	Pond 3A	Pond 3B	Pond 3C	Pond 4A/4B	Pond 4C/4D
Residential Relocations												
Number of Parcels Impacted	None	0	0	5	0	0	0	N/A	N/A	N/A	N/A	N/A
Number of Residences Relocated	None	0	0	5	0	0	0	N/A	N/A	N/A	N/A	N/A
Business Relocations												
Number of Parcels Impacted	None	0	0	0	0	1	0	N/A	N/A	N/A	N/A	N/A
Number of Businesses Relocated	None	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A
Unimproved Properties Impacted	None	0	1	0	2	0	1	N/A	N/A	N/A	N/A	N/A
Community Facilities												
Number of Parcels Impacted	None	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A
Number of Facilities Relocated	None	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A
Section 4(f) / Public Lands												
Number of Sites Potentially Impacted	None	0	0	0	0	0	0	0	0	0	0	0
Historic/Archeological												
Number of Sites Potentially Impacted	None	0	0	0	0	0	0	0	0	0	0	0
Wetland Area (acres impacted)	None	1.36	0.00	0.00	0.32	0.00	0.00	0.00	0.12	1.44	0.00	0.00
Upland Areas (acres impacted)	None	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aquatic Preserves / Outstanding Florida Waters Impacted	None	None	None	None	None	None	None	None	None	None	None	None
Wild and Scenic Rivers (Impacted)	None	None	None	None	None	None	None	None	None	None	None	None
Floodplains (Impacted)	None	None	None	None	None	None	None	None	None	None	None	None
Threatened and Endangered Species (Impacted)	None	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal
Farmlands (acres impacted)	None	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Noise (sites impacted)	None	None	None	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Potential Contamination Sites (Impacted by Road Construction and Potential Pond Sites)												
Number of High Risk Contamination Sites Impacted	None	0	0	0	0	0	0	0	0	0	0	0
Number of Medium Risk Contamination Sites Impacted	None	0	0	0	0	0	0	0	0	0	0	0
Utilities												
Utilities Impacted	None	None Anticipated	3 +/-	4 +/-	None	2 +/-	2 +/-	2 +/-	0	4 +/-	3 +/-	3 +/-
Utilities Relocated / Adjusted	None	None Anticipated	3 (approx.)	3 (approx.)	None	2 (approx.)	2 (approx.)	2 (approx.)	0	0	0	1
Constructabilty (high, moderate, low)	N/A	moderate	moderate	low	low	low	low	low	low	low	low	low
Advantages	-	Existing Treatment Pond for Basin No. 1	Available, undeveloped parcel	Future green space w/n future FDOT R/W to address treatment needs	Existing Treatment Pond for most of Basin No. 2	New alignment allows for additional green space for req'd. treatment	Parcel size would provide for more than necessary treatment needs	No R/W needed; No utility impacts anticipated; Overflow ditch area to NW of post office	No R/W needed; No utility impacts	Located "downstream"; additional treatment volume provided	No R/W needed; Unlimited space to meet water quality needs	No R/W needed; Available space to meet water quality needs
Disadvantages	-	Pond is located offsite by approx. 0.40 miles	Creation of a 2nd wet detention pond 0.25 miles west of ultimate outfall; not logical	Potential utility (i.e., OH Transmission Line) impacts	Results in minor R/W impacts & acquisition	Results in slight R/W impacts to maximize dry treatment pond	Eminent Domain of an existing gas station (costly)	Located "upstream"; Additional costs with piping to outfall	Located "midstream"; Additional costs with piping to outfall	Potential WM and wetland impacts, pending footprint limits	None	None
Recommendations	-	Not Recommended; Pond "footprint" to remain as is	Not Recommended	Recommended	Not Recommended	Recommended in conjunction w/ Pond 2A to minimize impacts to Pond 2A	Not Recommended	Recommended in conjunction with Pond 3B/C to maximize treatment area	Recommended in conjunction with Pond 3A/C to maximize treatment area	Recommended in conjunction with Pond 3A/B to maximize treatment area	Recommended, in conjunction with Ponds 4C/4D	Recommended, in conjunction with Ponds 4A/4B
Total Pond Costs (see note below)	-	$ 92,792.06	$ 763,467.30	$ 92,792.06	$ 605,792.06	$ 288,792.06	$ 4,954,722.75	$ 72,233.41	$ 54,175.06	$ 90,291.76	$ 84,351.76	$ 36,116.71

Note No. 1: The cost evaluation for the stormwater management facility alternatives in this report includes stormwater management facility construction costs, costs associated with wetland impacts, and parcel acquisition costs. The stormwater management facility construction costs includes cost of drainage pipes associated with the outfall, clearing and grubbing, earthwork excavation and grading, berm construction, fencing, access accomodations and sodding. The associated parcel acquisition costs for each alternative evaluated includes the estimated cost of land and any impacted improvements, administrative costs, and legal fees.

Note No. 2: Right-of-way acquisition costs for Ponds 1C and 3C are assumed to be $0 because it is accounted for as part of right-of-way acquisition costs under roadway mainline improvements.

APPENDIX A

DRAINAGE DESIGN CRITERIA MATRIX

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Design Frequency and Analysis for Pipe Hydraulics	N/A	Rational Method required. General design= 3-year/ 24-hour (P=5.5 in) Composite C-value- Impervious= 0.95, Pervious= 0.20	FDOT
	Spread	N/A	Analyze with 4 in./hr. rainfall intensity. Based on the design speed, 1/2 of lane shall remain clear (45 mph or less). Keep 8' lane clear (between 45 mph to 55 mph). With shoulder gutter, 10-year freq. storm shall not exceed 1'-3" outside gutter toward front slope. Refer to the 2014 FDOT Drainage Manual Section 3.9.1.	FDOT
	Inlet Types	N/A	FDOT Inlets (Design Standards 2014)	FDOT
	Maximum Inlet Interception Rates	N/A	FDOT Storm Drain Handbook (2012) Appendix A (Inlet Efficiencies)	FDOT
	Inlet Placement	N/A	Inlets shall be placed at all low points in the gutter grade. For curb inlets on a continuous grade, a maximum spacing of 300 feet shall be used unless spread calculations indicate a greater spacing is acceptable. Curb inlets shall be placed ten to twenty feet prior to the level section in superelevated transitions. Refer to the 2014 FDOT Drainage Manual Section 3.7.1.1	FDOT
	System Velocity	N/A	Min. velocity = 2.5 fps when flowing full	FDOT
	Pipe Lengths	N/A	18" Pipe - max. 300 ft. 24" to 36" - max. 400 ft. 42" and larger - max. 500 ft. Refer to the 2014 FDOT Drainage Manual Section 3.10.1.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Hydraulic Grade Line	N/A	Friction and energy losses due to pollution control and utility conflict structures shall be considered for the storm sewer design event (3-year / 24-hour). If minor losses are not considered in addition to the above losses, the HGL for the design storm shall be at least 1 ft. below the theoretical gutter elevation. If all minor losses are considered, the HGL elevation can reach the gutter elevation. This criteria does not apply to DBI's or structures where temporary ponding is not objectionable.	FDOT (minor losses will be considered in the storm sewer design)
	Design Tailwater	N/A	When discharging to stormwater ponds, the tailwater shall be the elevation of the pond at the peak inflow into the pond for the storm sewer design event (3-year / 24-hour). The tailwater shall be computed assuming the pond control orifice plugged and starting initial pond elevation at the weir. For free flowing ditches - normal depth in the ditch at the storm drain outlet for the storm drain design event (may differ from ditch design event). For ditches with downstream control - the higher of either the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the location of the connection for the storm drain design storm event.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Pipe Clearance	N/A	The minimum distance between the bottom of the roadway base material and the top of the pipe (outside edge) is 12" for all pipe materials as detailed in FDOT Design Standard Index 205. Utilities- If utility has been accurately located, clearance between the outside of the storm drain pipe and the utility shall not be less than 6 in. If the location of the utility has been estimated, the clearance should not be less than 1 ft.	FDOT
	Pipe Material	N/A	Optional Material Analysis to be performed for this project; Culvert Service Life Estimator (CSLE) program will be used for selection of appropriate materials.	FDOT
	Pipe Size	N/A	Truck line and lateral, min. = 18". 18" minimum pipe size does not apply to connections from external, private Stormwater Management Facilities. Refer to the 2014 FDOT Drainage Manual Section 3.10.1.	FDOT
Culvert Design	Minimum Size and Length	N/A	Cross drain = 18"; Median Drain = 15"/ 18"; Side Drain = 15"/18"; Box Culvert = 3' x 3' (Precast) 4' x 4' (Cast in Place). Pipe lengths shall follow the criteria for storm sewers. Max. Length for box culverts = 500 ft.	FDOT
	Design Procedure	N/A	Refer to the 2014 FDOT Drainage Manual Chapter 4 and the 2004 FDOT Drainage Handbook Culvert Design.	FDOT
Hydrologic and Hydraulic Calculations for all other Drainage Features	Peak Discharge and Runoff Volume	Use one of the following methods: 1) NRCS Curve Number and Unit Hydrograph Method, 2) Santa Barbara Urban Hydrograph Method, or 3) USACOE HEC-1 Programs 4) Other hydrographs methods approved by the District	For Open Channels and Crossdrains- Use gauge data when available. If not available, use regional or local regression equations (USGS) or use the rational equation for drainage areas up to 600 acres. For Stormwater Management Facilities, one of the following is acceptable: (1) for basins with a tc 15 minutes or less, the modified rational method shall be used OR (2) the SCS Unit Hydrograph method shall be used.	SJRWMD- SCS unit-hydrograph method Uh256

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Hydrologic and Hydraulic Calculations for all other Drainage Features	Design Frequency	Stormwater Management Facilities- 10 year- 24 hour storm event.	Roadside Ditches- 10 yr.; Outfall Ditches and Canals- 25-yr.; Off-site crossdrain- 50-yr; Stormwater Management Facilities-Critical Duration Analysis (Chapter 14-86)	SJRWMD and FDOT Critical Duration (if applicable)
	Time of Concentration (Tc)	TR-55 (Overland flow, storm sewer flow, channel flow). Minimum Tc= 10 minutes.	Velocity Method (Overland flow using Kinematic Wave equation, Shallow Channel Flow using V=kS^0.5, main channel flow using Manning's equation). Minimum Tc = 10 minutes. TR-55 methodology acceptable.	TR-55 methodology (SJRWMD and FDOT accepted)
	Design Storm Duration	24-hour storm duration for stormwater mgmt. facilities	24-hour storm duration for closed drainage systems and roadside ditches. Chapter 14-86 - Critical Duration Analysis (1-hour through 10-day duration)	SJRWMD and FDOT Critical Duration (if applicable)
	Rainfall Distributions	SJRWMD's Technical Publication and Technical Memorandum; SJRWMD Environmental Resource Permit Applicant's Handbook (Volume 1).	FDOT Rainfall Distributions	SJRWMD and FDOT Critical Duration (if applicable)
	Water Quality/ Treatment (Wet Detention/ Dry Retention)	Required treatment volume = 1" over the drainage area or 2.5" times the impervious area (excluding water bodies), whichever is greater (Wet Detention Systems). Pre-Post Pollutant Loading Calculations for the Impaired Water Body will be required.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quantity/ Attenuation	**Open Basins:** Post-development peak discharges shall be at or below pre-development peak discharges for the 25-year /24- hour storm events.	Post-development peak discharge cannot exceed pre-development peak discharge for all frequencies and duration from the 2-year/ 1-hour storm event to the 100-year / 10-day storm event (closed basins) and up to the 3-day duration (open basins) and those between (Critical Duration Analysis)	SJRWMD and FDOT Critical Duration (if applicable)
	Off-site Flows	N/A	When possible, offsite flows/discharges should be separated from the FDOT facilities.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Retention and Detention Facilities	Pond Configuration- Wet Ponds (for additional info, see Open Drainage Facilities	SJRWMD Permit Information Manual - Shallow littoral zones are desirable, but not required, for water quality enhancement (Please see Section 8.6 - Littoral Zone for more information). SJRWMD Permit Information Manual (Section 8.9) - The average length-to-width dimensional ratio of the pond must be at least 2:1. Ponds shall be designed to provide a minimum 20 feet of horizontal clearance between the control elevation and Right-of-Way.	Pond Depth specified by the Regulatory Agency (SJRWMD).	SJRWMD
Retention and Detention Facilities	Littoral Zone (Wet Detention)	SJRWMD Permit Information Manual (Section 8.6) - Shall be slopped 1:6 or flatter . The littoral area shall be shallower than 3 feet as measured from below the normal water level or control elevation. At least 30% of the wet detention pond surface area shall consist of a littoral zone. Planting of a littoral is recommended to meet the 80% coverage requirement.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quality/Quantity Volume Recovery Rate (Wet Detention/Dry Retention	The outfall structure shall be designed to drawdown one-half the required treatment volume within 24 and 30 hours following a storm event.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Orifice/Bleeder Devices (Wet Detention)	Drawdown devices shall incorporate dimensions no smaller than 6 square inches of cross-section area that is 2 inches wide or less than 20° for "V" notches shall include a device to eliminate clogging.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Skimmer	Systems which receive stormwater from areas with a greater than 50% impervious area (excluding water bodies) or which are a potential source of oil and grease must include a baffle, skimmer, grease trap or other mechanism suitable for preventing oil and grease from leaving the stormwater system in concentrations that would cause a violation of water quality standards.	Oil skimmer is required and should be designed to function from an elevation of 6 in. below the elevation of inflow to the outfall control structure to an elevation of 6 in. above the DHW of the pond. It should also cover all directions of inflow to the outfall control structure.	FDOT and SJRWMD
	Erosion Control Measures	N/A	Sod from the Pond Berm up to 2' below the Control Elevation (NWL)	FDOT
Floodplain	Compensation	"Cup to cup" methods; design storm is 100 yr-72 hr. for floodplain compensation and flood protection of finished floors.	Specified by the Regulatory Agency (SJRWMD)	FDOT and SJRWMD

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Requirements for Maintenance Berms around Perimeter of Ponds	N/A	Ponds - 20 ft. horizontal clearance between top edge of the normal pool elevation and R/W line. At least 15 ft. of berm adjacent to the pond shall be at a 1:8 slope or flatter. For wet ponds, keep the lowest point of the maintenance berm at least 1 ft. above the top of the treatment volume to minimize saturation of the maintenance berm. 1 ft. of freeboard is required above the maximum DHW. Inside edge of the berm shall have a minimum 30 ft. radius to accommodate the largest maintenance equipment (preference is 35 ft.). Refer to the D4 Drainage Checklist (8/2007).	FDOT
	Maximum Side Slopes for Ditches/ Canals	For permanently wet ponds or ditches, side slopes can be no steeper than 1:4 (average pond side slope) out to a depth of 2-feet below the control elevation.	Base on FDOT Clear Zone Criteria	FDOT
	Maximum Side Slopes for Ponds		Use 1:4 side slope for ease with maintenance. Side slope steeper than 1:3 require special equipment for mowing.	SJRWMD
	Minimum Longitudinal Slope	N/A	0.005 ft./ft.; Refer to the 2009 FDOT Open Channel Drainage Handbook.	FDOT
	Minimum Bottom Width	N/A	V-bottom allowed on swales/ditches; 3 ft. minimum bottom is desirable. Refer to the 2009 FDOT Open Channel Drainage Handbook.	FDOT
Open Drainage Facilities (Ponds, Ditches, Canals)	Tailwater Conditions for Ponds	For regulated systems the design and maintained stage elevations are available either from the respective local jurisdiction or the District. For non-regulated systems, water stages are computed from the best available data and must be submitted to the District for review and concurrence.	Free flowing ditches - normal depth flow in the ditch at the storm drain outlet for storm drain design storm event (may differ from ditch design storm event). For ditches with downstream control - the higher of the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design storm event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the connection for the design storm event.	SJRWMD and FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
	Erosion Control Measures (by max. velocity)	N/A	Grass with Mulch, Bare soil, Sod - 4 fps max vel.; Riprap (rubble) (ditch lining) - 6 fps max vel. (refer to FDOT Drainage Manual, Table 2.4)	FDOT
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Freeboard	N/A	1 ft. above DHW elevation. Less freeboard is acceptable when a permanent contaminant, such as concrete, is provided.	FDOT
	Treatment Swales (Manmade Trench)	Top width to depth ratio of the cross-section equal to or greater than 6:1, or side slopes equal to or greater than 3:1 (horizontal to vertical). Refer to SJRWMD's Permit Information Manual - Section 2.1 (u).	Swale drainage only permitted in Type A Soil Conditions. Refer to the 2009 FDOT Open Channel Drainage Handbook (Section 3.1).	SJRWMD and FDOT

APPENDIX B

GEOTECHNICAL DATA

SR501 PD&E Study
Michigan Ave to Industry Road
Financial Project ID: 433605-1-22-01
Table A2 Summary of SHWT at Pond Sites

Basin	Data provided by RADISE International											Average Depth of SHWT per Basin	Average Existing Ground EL. of All Proposed Pond Sites (within Basin) (NAVD 88)	Average SHWT at Pond Site (NAVD 88)
	Boring Number	Approximate Station	Approximate Offset from EOP	Approximate Ground Surface Elevation (NAVD88)	Approximate Ground Surface Elevation (NGVD29)	Approximate Groundwater Elevation Encountered in Borings (NAVD88)	Approximate Groundwater Elevation Encountered in Borings (NGVD29)	Approximate Groundwater Depth Encountered in Borings (feet)	Approximate Depth of SHWT (feet)	Approximate SHWT (NAVD88)	Approximate SHWT (NGVD29)			
Basin 1	B-1	18+50	750' RT	32.50	33.86	26.50	27.86	6.0	5.0	27.5	28.9	5.0	33.1	27.9
	B-2	19+00	70' LT	33.15	34.5	27.15	28.5	6.0	5.0	28.1	29.5			
	B-3	28+50	40' RT	33.53	34.88	27.53	28.88	6.0	5.0	28.5	29.9			
	B-11	29+25	50' LT	33.00	34.35	24.00	25.35	9.0	5.0	28.0	29.4			
	B-12	24+75	50' LT	32.50	33.85	23.20	24.55	9.3	5.0	27.5	28.9			
Basin 2	B-4	49+50	10' LT	29.85	31.21	23.85	25.21	6.0	5.0	24.9	26.2	5.0	29.9	24.9
Basin 3	B-5	57+00	50' RT	29.11	30.46	23.11	24.46	6.0	3.0	26.1	27.5	4.5	29.9	25.4
	B-6	66+00	40' LT	30.34	31.7	24.34	25.7	6.0	5.0	25.3	26.7			
	B-7	72+75	35' RT	30.23	31.58	24.23	25.58	6.0	5.0	25.2	26.6			
	B-10	55+25	50' LT	30.00	31.35	23.70	25.05	6.3	5.0	25.0	26.4			
Basin 4	B-8	82+75	50' RT	30.35	31.71	24.35	25.71	6.0	3.0	27.4	28.7	4.0	29.4	25.4
	B-9	83+25	40' LT	28.45	29.8	22.45	23.8	6.0	5.0	23.4	24.8			

Notes: 1) NAVD88 Elevations were obtained from Google Earth.
2) Datum shift NAVD88 minus NGVD29 = -1.35 was obtained from VERTCON.
3) Approximate Depth of SHWT was estimated using the USDA SCS Soil Survey.

RADISE
Infrastructure Engineers + Software Developers

LEGEND

B-1 20' SPT BORING

0 75' 150'

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	JC	12/28/15
						Checked by	AB	12/29/15
						Designed by		
						Checked by		
						Approved by		

ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 228
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

FLORIDA DEPARTMENT OF TRANSPORTATION

COUNTY	CLIENT
BREVARD	SCALAR

SCALE: VERTICAL N.T.S.
SCALE: HORIZONTAL N.T.S.

SHEET TITLE: BORING LOCATION PLAN

PROJECT NAME: PD&E FOR SR 501 FROM MICHIGAN AVE TO E TO INDUSTRY RD

SHEET NO. 4A

RADISE PROJECT NO: 150706

LEGEND

B-4 20' SPT BORING

EX-1 10' EXFILTRATION TEST

0 75' 150'

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	JC	12/28/15
						Checked by	AB	12/29/15
						Designed by		
						Checked by		
						Approved by		

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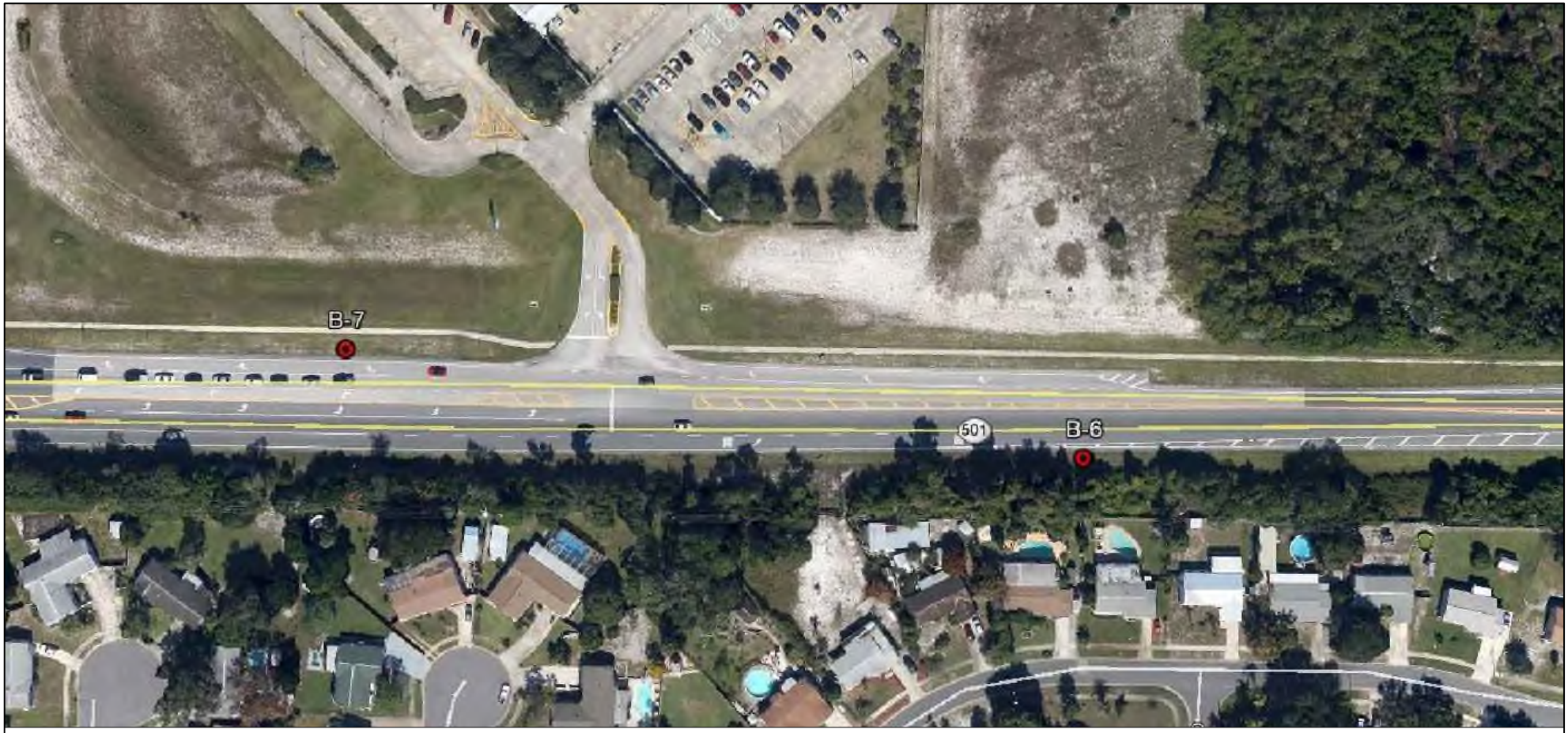
URL : http:// www.radise.net

FLORIDA DEPARTMENT OF TRANSPORTATION		SCALE: VERTICAL N.T.S.	SHEET TITLE: BORING LOCATION PLAN	SHEET NO. 4C
COUNTY	CLIENT	SCALE: HORIZONTAL N.T.S.	PROJECT NAME: PD&E FOR SR 501 FROM MICHIGAN AVE TO E INDUSTRY RD	RADISE PROJECT NO: 150706
BREVARD	SCALAR			



LEGEND

B-6 20' SPT BORING

0 75' 150'

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	JC	12/28/15
						Checked by	AB	12/29/15
						Designed by		
						Checked by		
						Approved by		

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FLORIDA DEPARTMENT OF TRANSPORTATION

COUNTY	CLIENT
BREVARD	SCALAR

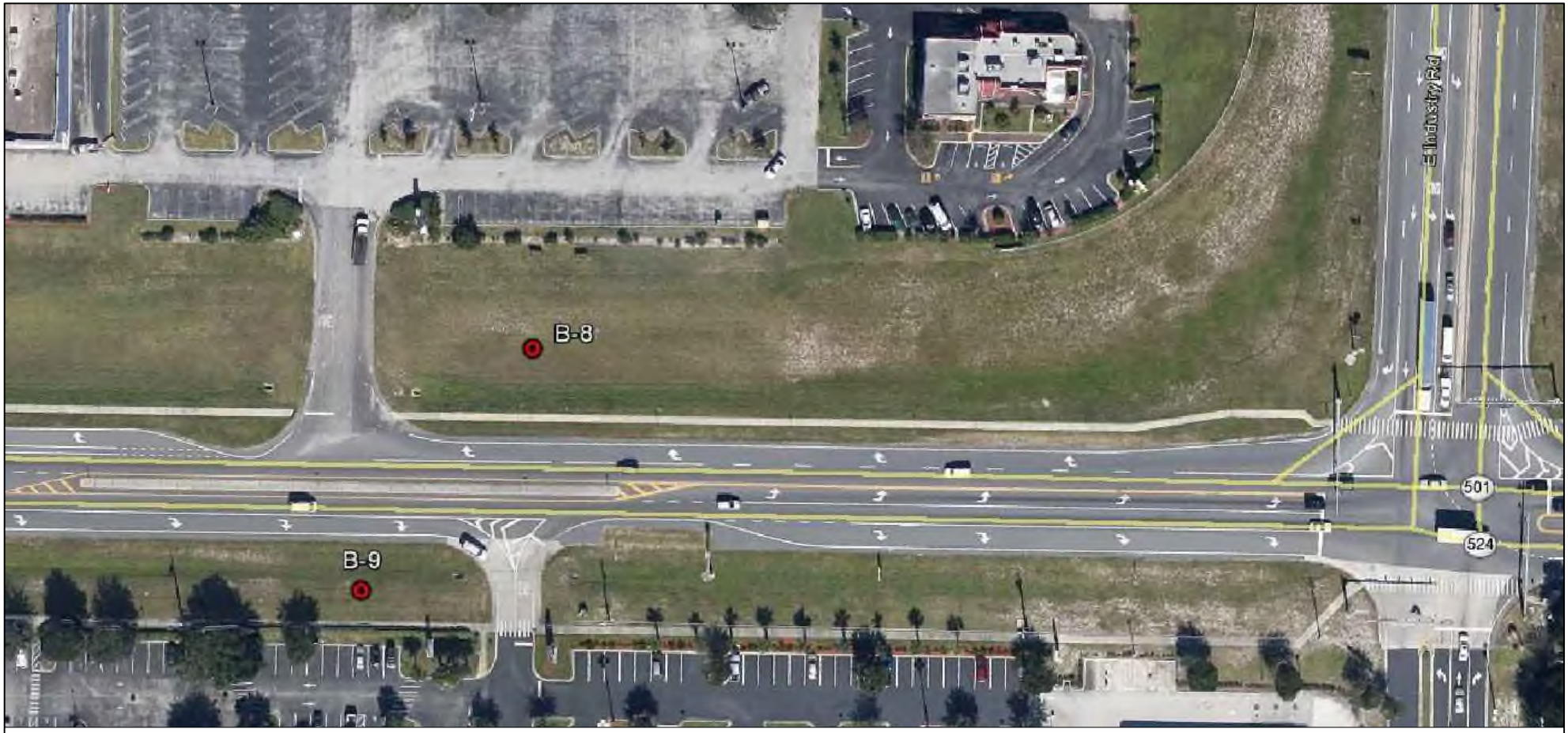
SCALE: VERTICAL N.T.S.
SCALE: HORIZONTAL N.T.S.

SHEET TITLE: BORING LOCATION PLAN

PROJECT NAME: PD&E FOR SR 501 FROM MICHIGAN AVE TO E INDUSTRY RD

SHEET NO. 4D

RADISE PROJECT NO: 150706



LEGEND

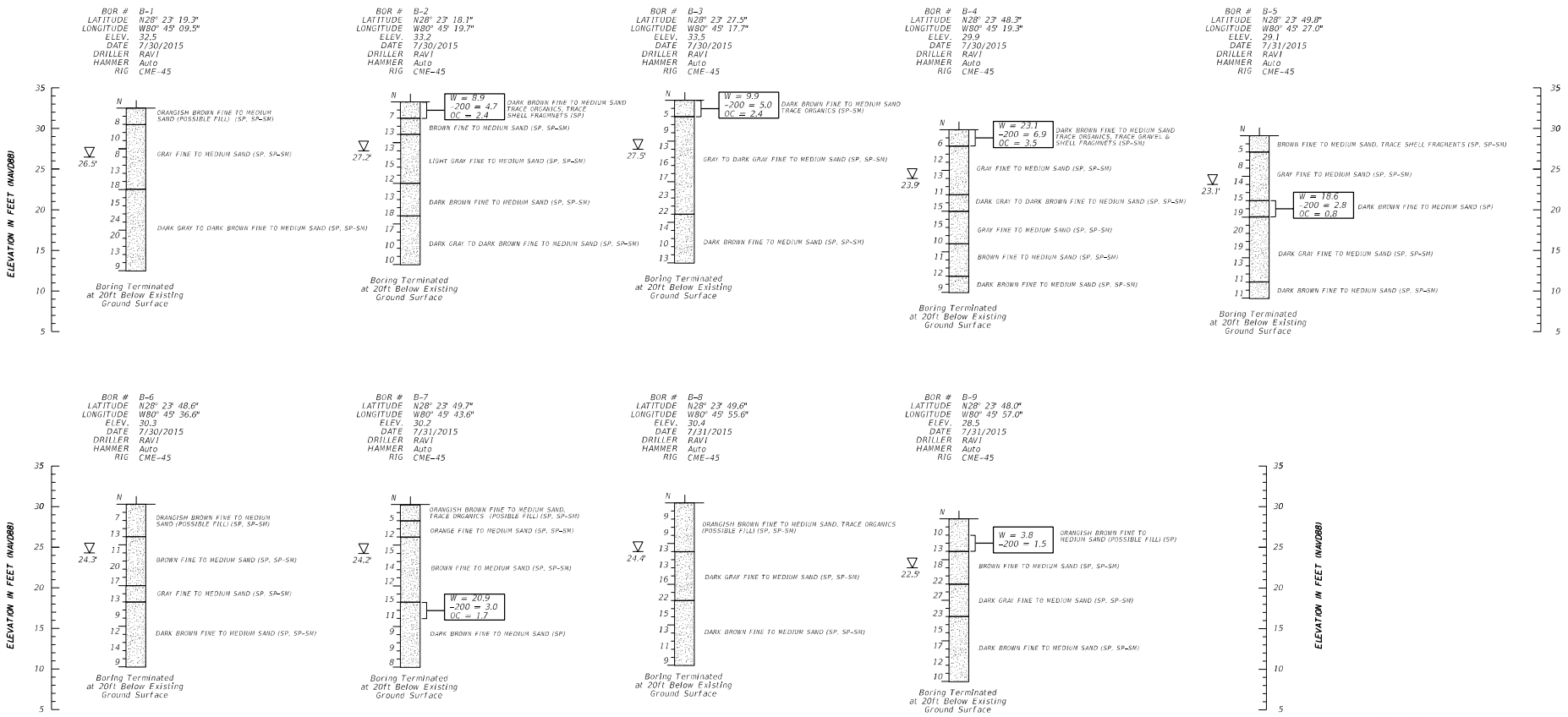
B-8 20' SPT BORING

0 75' 150'

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	JC	12/28/15
						Checked by	AB	12/29/15
						Designed by		
						Checked by		
						Approved by		

ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 228
Riviera Beach, Florida. 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

FLORIDA DEPARTMENT OF TRANSPORTATION		SCALE: VERTICAL N.T.S.	SHEET TITLE: BORING LOCATION PLAN	SHEET NO. 4E
COUNTY	CLIENT	SCALE: HORIZONTAL N.T.S.	PROJECT NAME: PD&E FOR SR 501 FROM MICHIGAN AVE TO E INDUSTRY RD	RADISE PROJECT NO: 150706
BREVARD	SCALAR			



LEGEND

SAND

24.3 ▽ WATER TABLE ELEVATION IN FEET (NAVD88)

(SP) ASTM-D 2487 & ASTM-D 2488 SOIL CLASSIFICATION GROUP SYMBOL

OC ORGANIC CONTENT (%)

W NATURAL MOISTURE CONTENT (%)

-200 FINES PASSING No. 200 SIEVE (%)

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT UNLESS OTHERWISE NOTED

NOTES:

1) LAYER BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL LAYERS AT EACH TEST HOLE LOCATION ONLY. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED.
2) LATITUDE AND LONGITUDE FOR BORINGS WERE MEASURED IN THE FIELD BY RADISE USING A GARMIN GPS 72H HANDHELD GPS UNIT.
3) ELEVATIONS WERE ESTIMATED USING GOOGLE EARTH AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

RIG TYPE: CME 45

DRILLED BY: RADISE

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1 3/8 In.
SPOON OUTSIDE DIA.	2 In.
ASTM STANDARD DROP	AUTOMATIC HAMMER
AVG. HAMMER DROP	30 In.
HAMMER WEIGHT	140 lbs.

GRANULAR MATERIALS

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

AKASH BISSOON, P.E.
P.E. LICENSE NUMBER 74582
RADISE INTERNATIONAL
4152 WEST BLUE HERON BOULEVARD, SUITE 228
RIVIERA BEACH, FLORIDA 33404
CERTIFICATE OF AUTHORIZATION 6174

DRAWN BY: BVV 8-17-15
CHECKED BY: AB 8-19-15
DESIGNED BY:
CHECKED BY:

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 501	BREVARD	433605-1-22-01

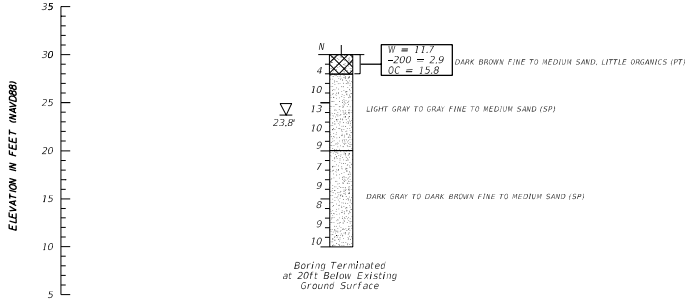
SHEET TITLE: REPORT OF CORE BORINGS FOR PONDS

PROJECT NAME: PD&E SERVICES FOR SR501 FROM MICHIGAN AVE TO INDUSTRY ROAD

REF. DWG. NO.

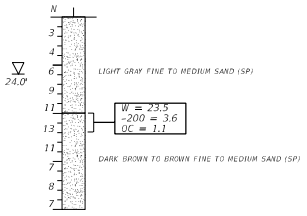
SHEET NO. 5A

BOR # B-10
LATITUDE N28° 23' 49.3"
LONGITUDE W80° 45' 24.5"
ELEV. 30.0
DATE 12/17/2015
DRILLER Tim F.
HAMMER Auto
RIG CME-45



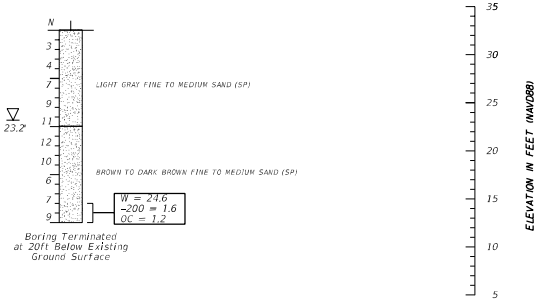
Boring Terminated at 20ft Below Existing Ground Surface

BOR # B-11
LATITUDE N28° 23' 27.9"
LONGITUDE W80° 45' 18.3"
ELEV. 33.0
DATE 12/17/2015
DRILLER Tim F.
HAMMER Auto
RIG CME-45



Boring Terminated at 20ft Below Existing Ground Surface

BOR # B-12
LATITUDE N28° 23' 22.9"
LONGITUDE W80° 45' 18.6"
ELEV. 32.5
DATE 12/17/2015
DRILLER Tim F.
HAMMER Auto
RIG CME-45



Boring Terminated at 20ft Below Existing Ground Surface

LEGEND

ORGANIC MATERIAL

SAND

23.8 WATER TABLE ELEVATION IN FEET (NAVD88)

(SP) ASTM-D 2487 & ASTM-D 2488 SOIL CLASSIFICATION GROUP SYMBOL

OC ORGANIC CONTENT (%)

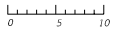
W NATURAL MOISTURE CONTENT (%)

-200 FINES PASSING No. 200 SIEVE (%)

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT UNLESS OTHERWISE NOTED

NOTES:

1) LAYER BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL LAYERS AT EACH TEST HOLE LOCATION ONLY. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED.
2) LATITUDE AND LONGITUDE FOR BORINGS WERE MEASURED IN THE FIELD BY RADISE USING A GARMIN GPS 72H HANDHELD GPS UNIT.
3) ELEVATIONS WERE ESTIMATED USING GOOGLE EARTH AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)



VERTICAL SCALE (FEET)

RIG TYPE: CME 45

DRILLED BY: RADISE

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1 3/8 In.
SPOON OUTSIDE DIA.	2 In.
ASTM STANDARD DROP	AUTOMATIC HAMMER
AVG. HAMMER DROP	30 In.
HAMMER WEIGHT	140 lbs.

GRANULAR MATERIALS

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

AKASH BISSOON, P.E.
P.E. LICENSE NUMBER 74582
RADISE INTERNATIONAL
4152 WEST BLUE HERON BOULEVARD, SUITE 228
RIVIERA BEACH, FLORIDA 33404
CERTIFICATE OF AUTHORIZATION 6174

DRAWN BY: JC 12-28-15
CHECKED BY: AB 12-29-15
DESIGNED BY:
CHECKED BY:

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

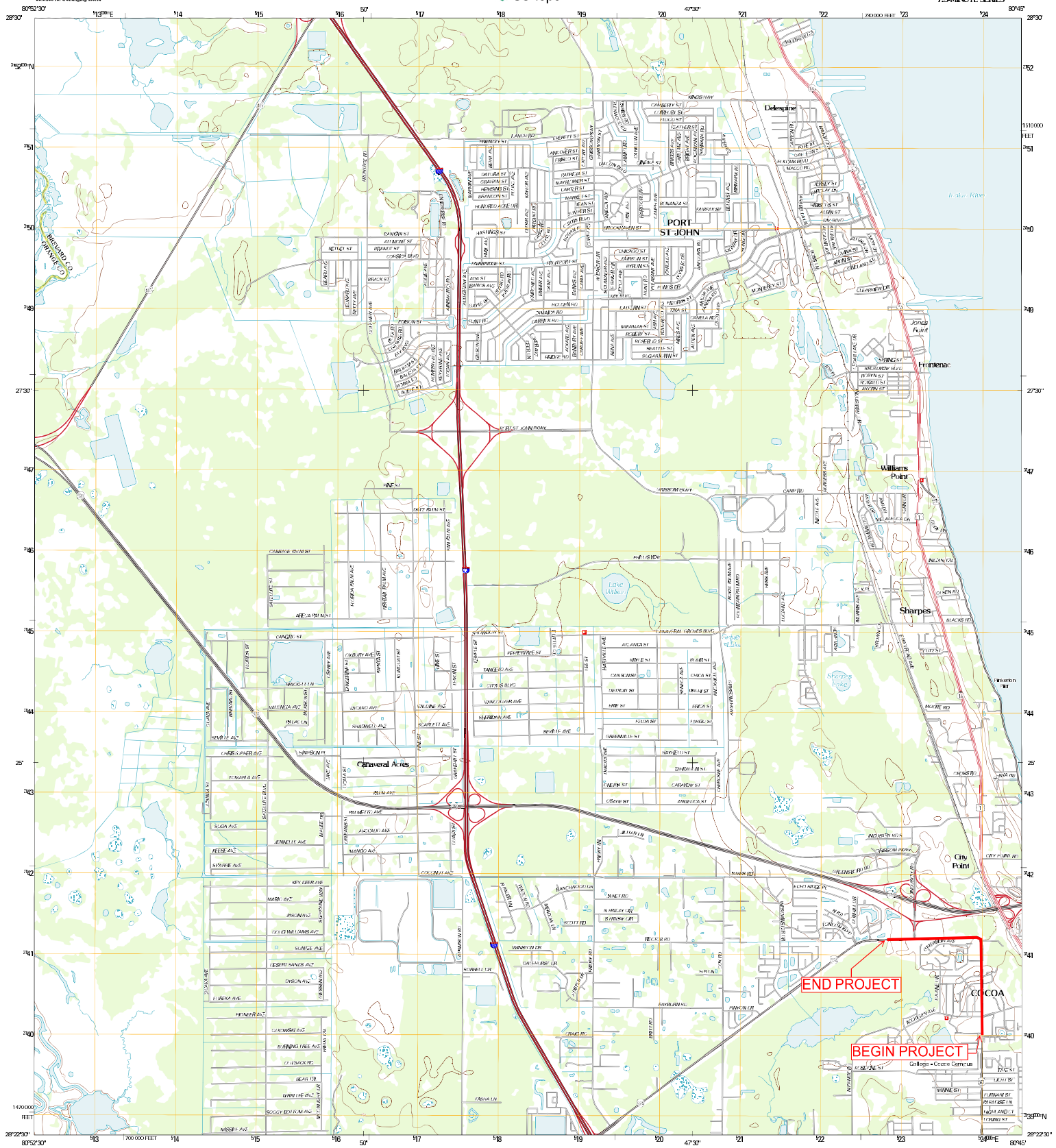
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 501	BREVARD	433605-1-22-01

SHEET TITLE: REPORT OF CORE BORINGS FOR PONDS

PROJECT NAME: PD&E SERVICES FOR SR501 FROM MICHIGAN AVE TO INDUSTRY ROAD

REF. DWG. NO.

SHEET NO. 5B



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 17R
10 000-foot ticks: Florida Coordinate System of 1983 (east zone)

Imagery.....NAIP, May 2010 - June 2010
Roads.....©2005-2011 TomTom
Names.....GNIS, 2011
Hydrography.....National Hydrography Dataset, 2010
Contours.....National Elevation Dataset, 2012
Boundaries.....Census, BWC, BC, USGS, 1972 - 2010

UTM GRID AND 2012 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-Meter Square ID
NM
Grid Zone Designation
17R

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011. A metadata file associated with this product is draft version 0.6.3

ADJOINING 7.5' QUADRANGLES

Titusville SW	Titusville	Cocoa
Lake Poinsett NW	Sharpes	Courtenay
Lake Poinsett SW	Lake Poinsett	Cocoa

Soil Map—Brevard County, Florida
(SR 501 (Clearlake Road) from Michigan Ave to Industry Rd)

Map Scale: 1:9,920 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 450 900 1800 2700

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Brevard County, Florida
Survey Area Data: Version 12, Sep 10, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 12, 2011—Mar 13, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Brevard County, Florida (FL009)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
28	Immokalee sand	0.7	1.3%
45	Paola-Urban land complex, 0 to 8 percent slopes	25.6	47.8%
49	Pomello sand	0.3	0.6%
53	Satellite sand, 0 to 2 percent slopes	0.7	1.4%
54	St. Johns sand	1.0	1.9%
55	St. Johns sand, depressional	0.3	0.5%
56	St. Lucie fine sand, 0 to 5 percent slopes	13.2	24.6%
57	St. Lucie fine sand, 5 to 12 percent slopes	5.1	9.6%
67	Tomoka muck, undrained	6.6	12.3%
Totals for Area of Interest		**53.6**	**100.0%**

APPENDIX C

RAINFALL

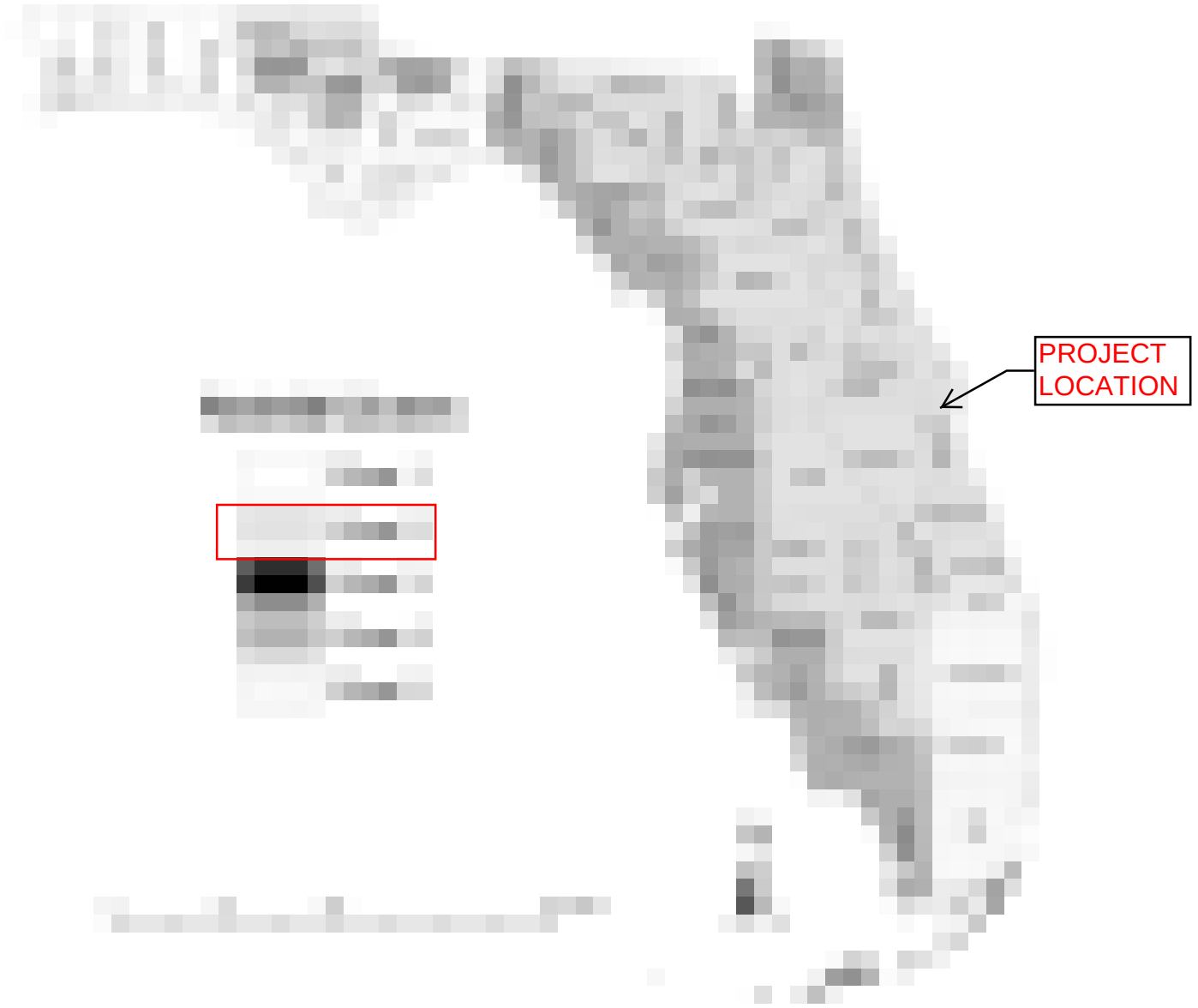


Figure 3.1 Designated Meteorological Regions (Zones) in Florida

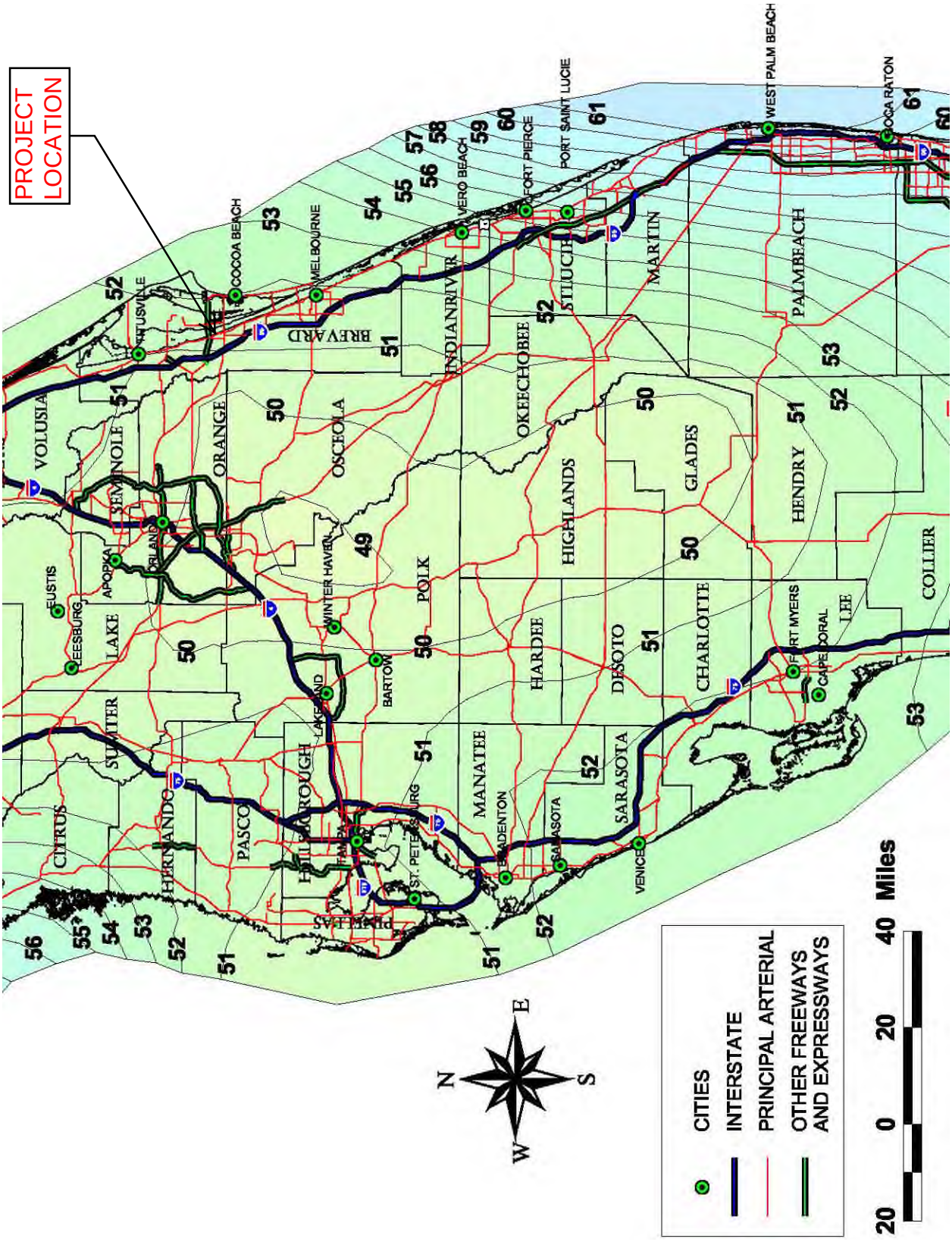
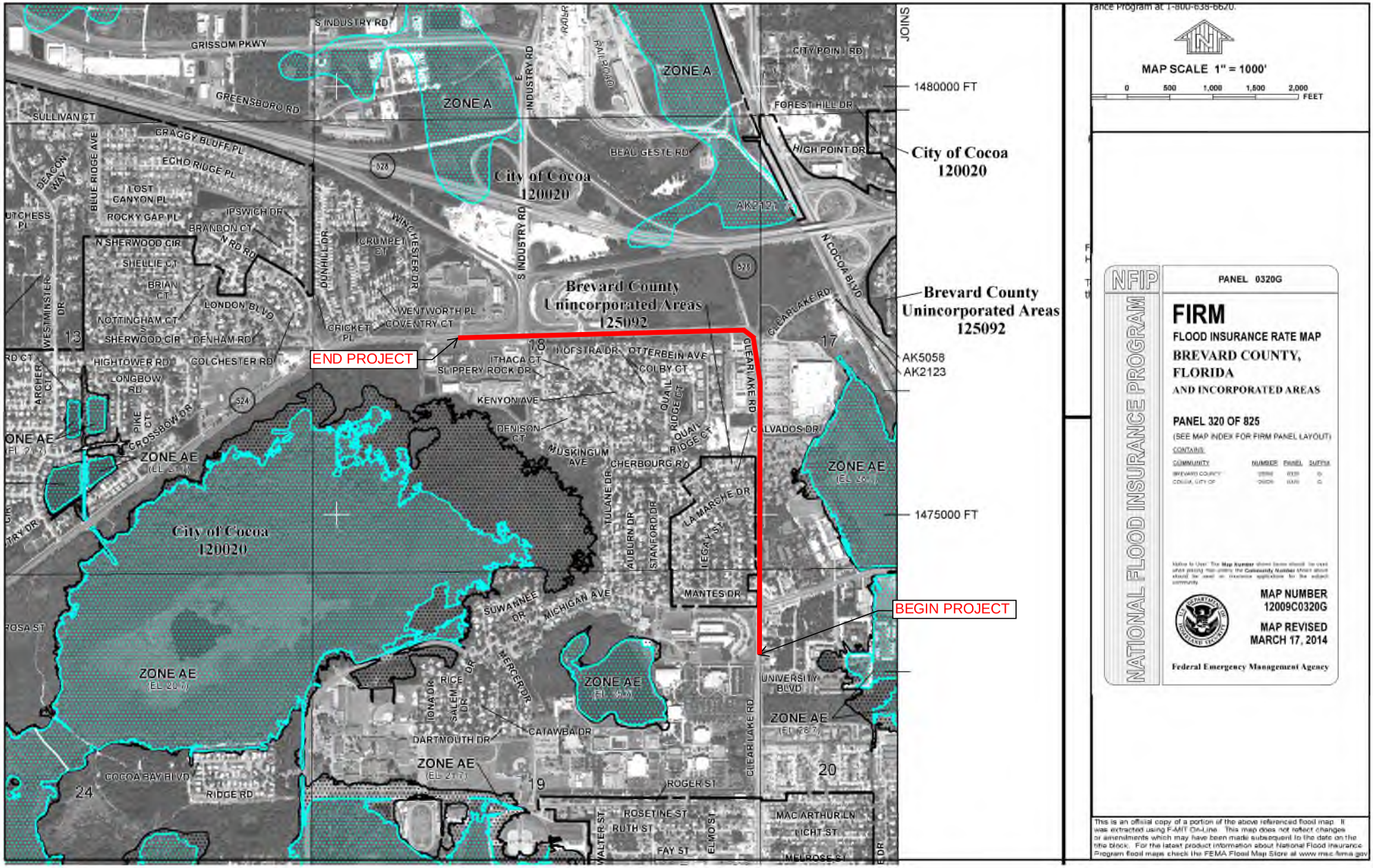


Figure 3.5 Rainfall Isopleth Map for Central Florida

APPENDIX D

FLOODPLAIN DATA


END PROJECT
BEGIN PROJECT
City of Cocoa
120020
Brevard County
Unincorporated Areas
125092
ZONE A
ZONE AE
1480000 FT
1475000 FT
MAP SCALE 1" = 1000'
0 500 1,000 1,500 2,000 FEET
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0320G
FIRM
FLOOD INSURANCE RATE MAP
BREVARD COUNTY, FLORIDA
AND INCORPORATED AREAS
PANEL 320 OF 825
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
MAP NUMBER
12009C0320G
MAP REVISED
MARCH 17, 2014
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX E

POND DESIGN CALCULATIONS

TIME OF CONCENTRATION

BASIN: 1 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	40
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.21**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**12.54**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,250
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.68**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**40.83**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
53.38

TIME OF CONCENTRATION

BASIN: 2 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	40
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.21**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**12.54**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,350
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.73**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**44.10**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
56.64

TIME OF CONCENTRATION

BASIN: 3 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	50
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.25**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**15.00**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	2,275
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**1.24**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**74.31**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
89.31

TIME OF CONCENTRATION

BASIN: 4 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	50
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.25**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**15.00**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,050
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.57**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**34.30**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
49.29

TIME OF CONCENTRATION

BASIN: 1 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	300
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.16**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**9.80**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
29.65

TIME OF CONCENTRATION

BASIN: 2 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	300
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.16**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**9.80**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
29.65

TIME OF CONCENTRATION

BASIN: 3 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	2,375
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**1.29**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**77.58**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
97.43

TIME OF CONCENTRATION

BASIN: 4 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,050
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.57**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**34.30**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
54.15

PRE-DEVELOPMENT - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 154+10 Roadway Length = 2565 ft

To: 179+75 R/W Width = 73 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	9.0 ft	1	9 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	6.0 ft	1	6 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		67 ft

Impervious Roadway Area: 1.99 ac

Pervious Roadway Area: 0.29 ac

Total Roadway Area: 2.28 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 2.99 ac (Rdwy. Imperv. Area = 1.99 ac)

Pervious Area: 3.39 ac

Total Area: 6.38 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.99	293.02
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	3.39	271.20
		Total:	6.38	564.22

CN = Total CN * Area / Total Area = 88.4

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.31			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.29	12.79	6.38
		Total Runoff (ac-ft) =	4.41	6.80	3.39
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	8.0 ft	1	8 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	5.0 ft	2	10 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		70 ft

Impervious Roadway Area: 2.90 ac

Pervious Roadway Area: 0.30 ac

Total Roadway Area: 3.20 ac

Pond Area: Pervious Pond Area = 0.85 ac (Exist. Wet Pond)

Water Surface Area = 1.44 ac (Exist. Wet Pond)

Total Area: Impervious Area: 8.56 ac

Pervious Area: 1.36 ac

Total Area: 12.21 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	8.56	838.88
Existing Ponds (Water Surface)	D	100	1.44	144.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	2.21	176.80
		Total:	12.21	1159.68

CN = Total CN * Area / Total Area = 95.0

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	$\frac{1000}{CN} - 10$ =	0.53			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$\frac{(P - 0.2S)^2}{(P + 0.8S)}$	Direct Runoff (Q) =	9.09	13.63	7.15
		Total Runoff (ac-ft) =	9.25	13.87	7.27
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 188+10 Roadway Length = 1115 ft

To: 199+25 R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	8.0 ft	1	8 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	5.0 ft	2	10 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		70 ft

Impervious Roadway Area: 1.60 ac

Pervious Roadway Area: 0.22 ac

Total Roadway Area: 1.82 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 1.60 ac

Pervious Area: 1.13 ac

Total Area: 2.73 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	1.60	156.80
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	1.13	90.40
		Total:	2.73	247.20

CN = Total CN * Area / Total Area = 90.5

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.04			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.55	13.07	6.62
		Total Runoff (ac-ft) =	1.95	2.97	1.51
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 3

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 50+00 Roadway Length = 2450 ft

To: 74+50 R/W Width = 230 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	2	24 ft
Imp. Pav't. (Avg.)	30.0 ft	1	30 ft
Bike Lane	3.0 ft	2	6 ft
Sidewalk (Avg.)	5.0 ft	1	5 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	-	-	-
Misc. Asphalt	-	-	-
	Total Impervious Width:		65 ft

Impervious Roadway Area: 4.90 ac

Pervious Roadway Area: 0.86 ac

Total Roadway Area: 5.76 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 4.90 ac

Pervious Area: 11.88 ac

Total Area: 16.78 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	4.90	480.20
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Poor Condition (grass cover < 50%)	D	89	11.88	1057.32
		Total:	16.78	1537.52

CN = Total CN * Area / Total Area = 91.6

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 - 10 =	0.91			
	CN	Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2$	Direct Runoff (Q) =	8.68	13.21	6.75
	(P + 0.8S)	Total Runoff (ac-ft) =	12.14	18.47	9.44
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 4

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 31+00 Roadway Length = 1900 ft

To: 50+00 R/W Width = 250 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Pav't. (Avg.)	16.0 ft	1	16 ft
Bike Lane	3.0 ft	2	6 ft
Sidewalk (Avg.)	5.0 ft	1	5 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	-	-	-
Misc. Asphalt	-	-	-
	Total Impervious Width:		75 ft

Impervious Roadway Area: 2.98 ac

Pervious Roadway Area: 0.22 ac

Total Roadway Area: 3.20 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 2.98 ac

Pervious Area: 4.63 ac

Total Area: 7.61 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.98	292.04
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	4.63	370.40
		Total:	7.61	662.44

CN = Total CN * Area / Total Area = 87.0

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 - 10 =	1.49			
	CN	Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2$	Direct Runoff (Q) =	8.12	12.61	6.21
	(P + 0.8S)	Total Runoff (ac-ft) =	5.15	8.00	3.94
Total Runoff (R_t) =	A*Q/12				

POST-DEVELOPMENT - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 154+10 Roadway Length = 2565 ft

To: 179+75 R/W Width = 73 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Pav't. (Avg.)	9.0 ft	1	9 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (F)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		87 ft

Impervious Roadway Area: 2.87 ac

Pervious Roadway Area: 0.28 ac

Total Roadway Area: 3.15 ac

Pond Area: Pervious Pond Area = 0.25 ac

Water Surface Area = 0.35 ac (Wet Pond)

Total Area: Impervious Area: 2.87 ac (Rdwy. Imperv. Area = 2.87 ac)

Pervious Area: 2.91 ac

Total Area: 6.38 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.87	281.26
Proposed Ponds (Water Surface)	D	100	0.35	35.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	3.16	252.80
		Total:	6.38	569.06

CN = Total CN * Area / Total Area = 89.2

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.21			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.38	12.89	6.46
		Total Runoff (ac-ft) =	4.46	6.85	3.44
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	0.05		

POST-DEVELOPMENT - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Median (Avg.)	10.0 ft	1	10 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (E)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		88 ft

Impervious Roadway Area: 3.45 ac

Pervious Roadway Area: 0.20 ac

Total Roadway Area: 3.65 ac

Pond Area: Pervious Pond Area = 0.95 ac

Water Surface Area = 1.65 ac (Exist. Wet Pond - Expanded)

Total Area: Impervious Area: 9.10 ac (Prop. Rdwy. Imperv. Area = 3.45 ac)

Pervious Area: 0.72 ac

Total Area: 12.42 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	9.10	891.80
Proposed Ponds (Water Surface)	D	100	1.65	165.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	1.67	133.60
		Total:	12.42	1190.40

CN = Total CN * Area / Total Area = 95.8

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	0.43			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	9.20	13.74	7.25
		Total Runoff (ac-ft) =	9.52	14.22	7.51
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	0.27		

POST-DEVELOPMENT - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Median (Avg.)	10.0 ft	1	10 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (E)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		88 ft

Impervious Roadway Area: 1.93 ac

Pervious Roadway Area: 0.30 ac

Total Roadway Area: 2.23 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 1.93 ac

Pervious Area: 1.62 ac

Total Area: 3.55 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	1.93	189.14
Proposed Ponds (Water Surface)	D	100	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	1.62	129.60
		Total:	3.55	318.74

CN = Total CN * Area / Total Area = 89.8

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.14			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.46	12.97	6.53
		Total Runoff (ac-ft) =	2.50	3.84	1.93
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	0.55		

POST-DEVELOPMENT - Basin No. 3

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 50+00 Roadway Length = 2450 ft

To: 74+50 R/W Width = 230 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Pav't. (Avg.)	5.0 ft	1	5 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (F)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		83 ft

Impervious Roadway Area: 5.48 ac

Pervious Roadway Area: 0.71 ac

Total Roadway Area: 6.19 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 5.48 ac

Pervious Area: 10.41 ac

Total Area: 15.89 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	5.48	537.04
Proposed Ponds (Water Surface)	D	100	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	10.41	832.80
		Total:	15.89	1369.84

CN = Total CN * Area / Total Area = 86.2

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.60			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.01	12.49	6.11
		Total Runoff (ac-ft) =	10.61	16.55	8.10
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	-1.53		

POST-DEVELOPMENT - Basin No. 4

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 31+00 Roadway Length = 1900 ft

To: 50+00 R/W Width = 250 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Pav't. (Avg.)	10.0 ft	1	10 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	1	6 ft
Curb & Gutter (F)	2.0 ft	1	2 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		76 ft

Impervious Roadway Area: 3.34 ac

Pervious Roadway Area: 0.14 ac

Total Roadway Area: 3.48 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 3.34 ac

Pervious Area: 4.28 ac

Total Area: 7.62 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	3.34	327.32
Proposed Ponds (Water Surface)	D	100	0	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	4.28	342.40
		Total:	7.62	669.72

CN = Total CN * Area / Total Area = 87.9

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.38			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.22	12.72	6.31
		Total Runoff (ac-ft) =	5.22	8.08	4.01
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	0.07		

POND SIZING CALCULATIONS - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Wet Detention**
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in.**	x Impervious Areas =	0.598 ac-ft
	1.00 in.	x Total Basin Area =	0.531 ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.60 ac-ft

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	4.41	6.80	3.39
Qpost =	4.46	6.85	3.44
Δ Q =	0.05		

Maintenance Area Width = 15.00 @ 1:10

Pond Tie-In Width = 4.0 ft @ 1:4

Maximum Storage Depth (**SD**) = 2.50 with 1.0 ft freeboard

Avg. Exist. Ground Elev. (ft) = 32.50

Normal Water Elevation (ft) = 28.00

Minimum EOP Elevation (ft) = 31.50 (At Furthest EOP from Pond)

Hydraulic Grade Line (HGL) check:

HGL Slope = 0.050% Use 0.05% for very flat terrain to 0.1% for flat terrain

Distance to Furthest EOP from Pond = 1250

Estimated Energy Losses = 0.7 ft

HGL Clearance = 1.0 ft Use 1.0 foot as a standard HGL clearance (no junction losses)

Maximum Allow. Storm Sewer Tailwater El. = 29.80

POND SIZING CALCULATIONS - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
32.00	Pond R/W	0.59	238.0	108.0	
33.00	Back of Maintenance Berm	0.56	234.0	104.0	2.15
32.25		0.50	226.5	96.5	1.75
31.50	Front of Maintenance Berm	0.45	219.0	89.0	1.40
30.50	Provided Treatment + Atten. Volume	0.42	215.0	85.0	**0.96**
29.73	Req'd Treatment + Attenuation Volume	0.40	211.9	81.9	**0.65**
29.65	Estimated Storm Sewer TW	0.40	211.6	81.6	0.62
29.60	Top of Treatment Vol.	0.40	211.4	81.4	**0.60**
28.50		0.37	207.0	77.0	0.18
28.00	Normal Water Level	0.35	205.0	75.0	0.00
26.00		0.30	197.0	67.0	
19.00	Pond Bottom	0.22	183.0	53.0	

Req'd Treat. + Atten. Vol. (ac-ft) = **0.65** Prov'd. Treat. + Atten. Vol. (ac-ft) = **0.96**

Req'd Treat. + Atten. Stage (ft) = **29.73** Prov'd. Treat. + Atten. Stage (ft) = **30.50**

Estimated Treat. Vol. + Storm Sewer Att. = **0.62** ac-ft

Estimated Storm Sewer TW El. = **29.65** ft HGL requirements met

Mean Depth = **7.07** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF):

Required Pond R/W = **0.65** **ac**

POND SIZING CALCULATIONS - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Wet Detention**
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in.**	x Impervious Areas =	1.78	ac-ft
	1.00 in.	x Total Basin Area =	0.653	ac-ft

Treatment V_{req} = Largest of Trt. Volume = 1.78 ac-ft

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	9.25	13.87	7.27
Qpost =	9.52	14.22	7.51
Δ Q =	0.27		

Maintenance Area Width = 15.00 @ 1:10

Pond Tie-In Width = 4.0 ft @ 1:4

Maximum Storage Depth (**SD**) = 3.00 with 1.0 ft freeboard

Avg. Exist. Ground Elev. (ft) = 30.65

Normal Water Elevation (ft) = 25.65

Minimum EOP Elevation (ft) = 29.65 (At Furthest EOP from Pond)

Hydraulic Grade Line (HGL) check:

HGL Slope = 0.050% Use 0.05% for very flat terrain to 0.1% for flat terrain

Distance to Furthest EOP from Pond = 1800 ft

Estimated Energy Losses = 1.0 ft

HGL Clearance = 1.0 ft Use 1.0 foot as a standard HGL clearance (no junction losses)

Maximum Allow. Storm Sewer Tailwater El. = 27.65

POND SIZING CALCULATIONS - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
28.65	Pond R/W	1.93	420.0	200.0	
29.65	Back of Maintenance Berm	1.87	416.0	196.0	7.05
29.15		1.84	414.0	194.0	6.12
28.65	Front of Maintenance Berm	1.82	412.0	192.0	5.20
27.00	Provided Treatment + Atten. Volume	1.73	405.4	185.4	**2.28**
26.87	Req'd Treatment + Attenuation Volume	1.72	404.9	184.9	**2.05**
26.80	Estimated Storm Sewer TW	1.71	404.6	184.6	1.94
26.71	Top of Treatment Vol.	1.71	404.2	184.2	**1.78**
26.25		1.68	402.4	182.4	1.00
25.65	Normal Water Level	1.65	400.0	180.0	0.00
23.65		1.55	392.0	172.0	
21.65	Pond Bottom	1.45	384.0	164.0	

Req'd Treat. + Atten. Vol. (ac-ft) = **2.05** Prov'd. Treat. + Atten. Vol. (ac-ft) = **2.28**

Req'd Treat. + Atten. Stage (ft) = **26.87** Prov'd. Treat. + Atten. Stage (ft) = **27.00**

Estimated Treat. Vol. + Storm Sewer Att. = **1.94** ac-ft

Estimated Storm Sewer TW El. = **26.80** ft HGL requirements met

Mean Depth = **3.75** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF):

Required Pond R/W =	**2.12**	**ac**

POND SIZING CALCULATIONS - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Dry Retention ***
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Dry Retention *	**2.50 in.**	x Impervious Areas =	0.402	ac-ft
	1.00 in.	x Total Basin Area =	0.296	ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.20 ac-ft * * 50% retention reduction

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	1.95	2.97	1.51
Qpost =	2.50	3.84	1.93
Δ Q =	0.55		

Maintenance Area Width =	6.00	@ 1:6	Avg. Exist. Ground Elev. (ft) =	29.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation (ft) =	25.50
Maximum Storage Depth (**SD**) =	3.50	with 1.0 ft freeboard	Minimum EOP Elevation (ft) =	30.00
			(At Furthest EOP from Pond)	

Hydraulic Grade Line (HGL) check:

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance to Furthest EOP from Pond =	75 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Maximum Allow. Storm Sewer Tailwater El. =	28.90	

POND SIZING CALCULATIONS - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
31.50	Ditch Perimeter	0.37	378.0	43.0	
32.50	Back of Maintenance Berm	0.33	374.0	39.0	1.35
32.00		0.32	372.0	37.0	1.19
31.50	Front of Maintenance Berm	0.30	370.0	35.0	1.04
30.50	Provided Treatment + Atten. Volume	0.26	366.0	31.0	**0.76**
30.45	Req'd Treatment + Attenuation Volume	0.26	365.8	30.8	**0.75**
28.80	Estimated Storm Sewer TW	0.20	359.2	24.2	0.37
27.90	Top of Treatment Vol.	0.17	355.6	20.6	**0.20**
27.50		0.15	354.0	19.0	0.14
26.50	Ditch Bottom	0.12	350.0	15.0	0.00
25.50	Normal Water Level	-	-	-	

Req'd Treat. + Atten. Vol. (ac-ft) = **0.75** Prov'd. Treat. + Atten. Vol. (ac-ft) = **0.76**

Req'd Treat. + Atten. Stage (ft) = **30.45** Prov'd. Treat. + Atten. Stage (ft) = **30.50**

Estimated Treat. Vol. + Storm Sewer Att. = **0.37** ac-ft

Estimated Storm Sewer TW El. = **28.80** ft HGL requirements met

Mean Depth = **N/A** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF)*:

Required Pond R/W = **0.41** **ac**

POND SIZING CALCULATIONS - Basin No. 3

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Dry Retention ***
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Dry Retention *	**2.50 in.**	x Impervious Areas =	1.142 ac-ft
	1.00 in.	x Total Basin Area =	1.324 ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.66 ac-ft* * 50% retention reduction

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	12.14	18.47	9.44
Qpost =	10.61	16.55	8.10
Δ Q =	-1.53	** 0.3 ac-ft applied to pond stage/storage calcs	

Maintenance Area Width =	6.00	@ 1:6	Avg. Exist. Ground Elev. (ft) =	29.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation (ft) =	26.00
Maximum Storage Depth (**SD**) =	3.00	with 1.0 ft freeboard	Minimum EOP Elevation (ft) =	30.00
			(At Furthest EOP from Pond)	

Hydraulic Grade Line (HGL) check:

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance to Furthest EOP from Pond =	75 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Maximum Allow. Storm Sewer Tailwater El. =	28.90	

POND SIZING CALCULATIONS - Basin No. 3

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
30.00	Ditch Perimeter	1.41	1428.0	43.0	
31.00	Back of Maintenance Berm	1.27	1424.0	39.0	3.51
30.50		1.17	1421.0	36.0	2.89
30.00	Front of Maintenance Berm	1.07	1418.0	33.0	2.33
29.00	Provided Treatment + Atten. Volume	0.88	1412.0	27.0	**1.36**
28.52	Req'd Treatment + Attenuation Volume	0.78	1409.1	24.1	**0.96** **
28.00	Estimated Storm Sewer TW	0.68	1406.0	21.0	0.58
28.11	Top of Treatment Vol.	0.70	1406.7	21.7	**0.66**
28.00		0.68	1406.0	21.0	0.58
27.00	Ditch Bottom	0.48	1400.0	15.0	0.00
26.00	Normal Water Level	-	-	-	

Req'd Treat. + Atten. Vol. (ac-ft) = **0.96** Prov'd. Treat. + Atten. Vol. (ac-ft) = **1.36**

Req'd Treat. + Atten. Stage (ft) = **28.52** Prov'd. Treat. + Atten. Stage (ft) = **29.00**

Estimated Treat. Vol. + Storm Sewer Att. = **0.58** ac-ft

Estimated Storm Sewer TW El. = **28.00** ft HGL requirements met

Mean Depth = **N/A** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF)*:

Required Pond R/W =	**1.55**	**ac**

POND SIZING CALCULATIONS - Basin No. 4

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Dry Retention ***
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Dry Retention *	**2.50 in.**	x Impervious Areas =	0.104 ac-ft
	1.00 in.	x Total Basin Area =	0.025 ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.052 ac-ft*

OFW Requirement (50% additional TV) = N/A ac-ft

* 50% retention reduction

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	5.15	8.00	3.94
Qpost =	5.22	8.08	4.01
Δ Q =	0.07		

Maintenance Area Width =	6.00	@ 1:6	Avg. Exist. Ground Elev. (ft) =	30.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation (ft) =	26.00
Maximum Storage Depth (**SD**) =	2.50	with 1.0 ft freeboard	Minimum EOP Elevation (ft) =	29.50
			(At Furthest EOP from Pond)	

Hydraulic Grade Line (HGL) check:

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance to Furthest EOP from Pond =	75 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Maximum Allow. Storm Sewer Tailwater El. =	28.40	

POND SIZING CALCULATIONS - Basin No. 4

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
30.00	Ditch Perimeter	1.21	993.0	53.0	
30.00	Back of Maintenance Berm	1.21	993.0	53.0	2.98
29.50		1.14	990.0	50.0	2.40
29.00	Front of Maintenance Berm	1.06	987.0	47.0	1.85
28.00	Provided Treatment + Atten. Volume	0.92	981.0	41.0	**0.85**
27.15	Req'd Treatment + Attenuation Volume	0.80	975.9	35.9	**0.12**
27.10	Estimated Storm Sewer TW	0.80	975.6	35.6	0.08
27.06	Top of Treatment Vol.	0.79	975.4	35.4	**0.05**
27.05		0.79	975.3	35.3	0.04
27.00	Ditch Bottom	0.78	975.0	35.0	0.00
26.00	Normal Water Level	-	-	-	

Req'd Treat. + Atten. Vol. (ac-ft) = **0.12** Prov'd. Treat. + Atten. Vol. (ac-ft) = **0.85**

Req'd Treat. + Atten. Stage (ft) = **27.15** Prov'd. Treat. + Atten. Stage (ft) = **28.00**

Estimated Treat. Vol. + Storm Sewer Att. = **0.08** ac-ft

Estimated Storm Sewer TW El. = **27.10** ft HGL requirements met

Mean Depth = **N/A** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF)*:

Required Pond R/W = **1.33** **ac**

PERMANENT POOL VOLUME CALCULATIONS - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Basin Characteristics

Land Use	Area (ac)	Runoff Coeff.	Product
Roadway Paved Area	2.87	0.95	2.73
Roadway Pervious Area	2.91	0.20	0.58
Pond Pervious Area	0.25	0.20	0.05
Pond Area at NWL	0.35	1.00	0.35
Totals	6.38		3.71

Composite C = 0.58

Annual Rainfall (P) = 51.5 in. FDEP Rainfall Isopleth Map for Florida

Stage Storage Calc. for Permanent Pool

ELEV. (ft; NAVD)	AREA (ac)	AVG. AREA (ac)	Delta (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
28.00	0.35				2.48
		0.33	2.00	0.65	
26.00	0.30				1.83
		0.27	5.00	1.36	
21.00	0.25				0.47
		0.23	2.00	0.47	
19.00	0.22				0.00

Permanent Pool Volume Provided (ac-ft) = **2.48**

Resident Time Provided (Days) = Perm. Pool Vol. Provided *150*12/ Area / C / P = **23.35**

Mean Depth = Permanent Pool Volume / Area at NWL = **7.08** ft

Anoxic Depth = Permanent Pool Volume - Anoxic Depth from WQ worksheet = **17.76** ft

Anoxic Depth = Maximum depth of PPV that can be counted for water quality

PERMANENT POOL VOLUME CALCULATIONS - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Basin Characteristics

Land Use	Area (ac)	Runoff Coeff.	Product
Paved Area (incl: Rdwy)	9.10	0.95	8.65
Pervious Area	0.72	0.20	0.14
Pond Pervious Area	0.95	0.20	0.19
Pond Area at NWL	1.65	1.00	1.65
Totals	12.42		10.63

Composite C = 0.86

Annual Rainfall (P) = 51.5 in. FDEP Rainfall Isopleth Map for Florida

Stage Storage Calc. for Permanent Pool

ELEV. (ft; NAVD)	AREA (ac)	AVG. AREA (ac)	Delta (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
25.65	1.65				6.20
		1.60	2.00	3.20	
23.65	1.55				3.00
		1.53	1.00	1.53	
22.65	1.50				1.48
		1.48	1.00	1.48	
21.65	1.45				0.00

Permanent Pool Volume Provided (ac-ft) = **6.20**

Resident Time Provided (Days) = Perm. Pool Vol. Provided *150*12/ Area / C / P = **20.39**

Mean Depth = Permanent Pool Volume / Area at NWL = **3.76** ft

Anoxic Depth = Permanent Pool Volume - Anoxic Depth from WQ worksheet = **14.69** ft

Anoxic Depth = Maximum depth of PPV that can be counted for water quality

POLLUTANT LOADING CALCULATIONS - Basin No. 1 (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.** Designer: JDW

Financial Project No.: **433605-1-22-01** 9/9/2015

County: **Brevard**

Annual Rainfall: **51.5 in/yr** **Rainfall Zone:** **2** The Pollutant Loading equations are from the March 2010 (Draft) Stormwater Quality Applicant's Handbook (FDEP)

SITE CONDITIONS

Description	Area (ac)	
	Pre-Dev	Post-Dev
DCIA (Within R/W)	1.99	2.87
Impervious Area (Non-DCIA)	1.00	0.00
Proposed Pervious Pond Area	0.65	0.27
Proposed Pond Water Area	0.00	0.38
Pervious Roadway Area	0.29	0.28
Offsite Pervious Area	2.45	2.58
Total Roadway Area (Within R/W):	2.28	3.15
%DCIA (Within R/W):	87.28	91.11
Total Basin Area:	**6.38**	**6.38**

1 Annual Runoff (AR) = A x P x Runoff Coefficient (C) x 1/12 (ft/in)

2 Pollutant Loading (TP) = AR x 43560 (ft^2/ac) x 7.48 (gal/ft^3) x 3.785 (L/gal) x EMC(TP) (mg/L) x 1 (kg/10^6 mg); EMC (Table 3.4 - SQA Handbook)

3 Permanent Pool: Proposed permanent pool volumes were determined using the permanent pool calculations spreadsheets
See Permanent Pool Volume Calculations for proposed pond PPV details

4 Resident Time = PPV / AR x 365 (days/yr)

5 Mean Pond Conc (aka Total P) = Pollutant Loading x 1 yr/(Pond Volume + AR) x 1 ac/43560 ft^2 x 1 ft^3/7.48 gal x 1 gal/3.875L x 10^6 mg/kg x 1000 ug/mg

6 Mean Chlorophyll Conc: ln(chyl-a) = 1.058 ln(MPC) - 0.934

7 Mean Secchi Disk Depth (SD) = (24.2386+(0.3041 x chyl-a))/(6.0632 + chyl-a)

8 Anoxic Depth (AD): Depth of DO < 1 (m) = 3.035(SD) + 0.02164(chyl-a) - 0.004979(MPC). AD is the max. depth of PPV that can be counted for WQ.

9 Required Reduction = (1-(PreDev Loading [kg/yr]/PostDev Loading [kg/yr])) x 100

10 Removal Efficiency: TP (% Removal) = 44.53 + 6.145 x $ln(t_d)$ + 0.145 x $(ln(t_d))^2$
TN (% Removal) = (43.75 x t_d) / (4.38 + t_d)

PRE-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area ('Highway')	2.28	87.28	80	0.721	7.05	1.37	11.92	0.17	1.48
Proposed Pond ('Single Family')	0.65	0.00	80	0.111	0.31	1.85	0.71	0.31	0.12
Offsite Area ('Single Family')	3.45	0.00	80	0.111	1.64	1.85	3.75	0.31	0.63
Total:	**6.38**				**9.01**		**16.38**		**2.23**

POST-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area ('Highway')	3.15	91.11	80	0.748	10.11	1.37	17.08	0.17	2.12
Prop. Pervious Pond Area ('S.F.')	0.27	0.00	80	0.111	0.13	1.85	0.29	0.31	0.05
Pond Water Surface	0.38	0.00	100	1.000	1.63	0.00	0.00	0.00	0.00
Offsite Area ('Single Family')	2.58	0.00	80	0.111	1.23	1.85	2.80	0.31	0.47
Total:	**6.38**				**11.87**		**17.38**		**2.17**

* Determined from the Mean Annual Runoff Coefficients (C Values) as a Function of DCIA Percentage and Non-DCIA Curve Number (CN) Table

TREATMENT REQUIRED

POLLUTANT LOADING CALCULATIONS - Basin No. 1 (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.** Designer: JDW

Financial Project No.: **433605-1-22-01** 9/9/2015

County: **Brevard**

Land Use	Annual Runoff[1] (ac-ft/yr)	Pollutant Loading[2] (kg/yr)		Required % Reduction (Removal Efficiency)	
		TN	TP	TN	TP
Pre-Development	9.01	16.38	2.23	5.77	-2.61
Post-Development	11.87	17.38	2.17		

TREATMENT PROVIDED

Pond ID	Perm. Pool Volume[3] PPV (ac-ft)	Residence Time[4] t_d (days)	Mean Pond Concentration[5] (u g/L)	Mean Chlorophyll Concentration[6] (mg/m^3)	Mean Secchi Disk Depth[7] (SD) (m)	Anoxic Depth[8] (ft)	Removal Efficiency[10] (%)		Pollutant Loading (kg/yr)	
							TN	TP	TN	TP
Pond 1	**9.49**	**94.93**	**20.16**	**9.43**	**1.75**	**17.76**	**41.82**	**75.52**	**10.11**	**0.53**

FINAL LOADINGS		
Condition	Pollutant	
	TN (kg/yr)	TP (kg/yr)
Pre-Development	**16.38**	**2.23**
Post-Development	**10.11**	**0.53**

POLLUTANT LOADING CALCULATIONS - Basin No. 2 East (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.** Designer: JDW

Financial Project No.: **433605-1-22-01** 9/9/2015

County: **Brevard**

Annual Rainfall: **51.5 in/yr** **Rainfall Zone:** **2** The Pollutant Loading equations are from the March 2010 (Draft) Stormwater Quality Applicant's Handbook (FDEP)

SITE CONDITIONS

Description	Area (ac)	
	Pre-Dev	Post-Dev
DCIA (Within R/W)	2.90	3.45
Impervious Area (Non-DCIA)	5.66	5.65
Pervious Pond Area	0.85	0.95
Pond Water Area	1.44	1.65
Pervious Roadway Area	0.30	0.20
Offsite Pervious Area	1.06	0.52
Total Roadway Area (Within R/W):	3.20	3.65
%DCIA (Within R/W):	90.63	94.52
Total Basin Area:	**12.21**	**12.42**

1 Annual Runoff (AR) = A x P x Runoff Coefficient (C) x 1/12 (ft/in)

2 Pollutant Loading (TP) = AR x 43560 (ft^2/ac) x 7.48 (gal/ft^3) x 3.785 (L/gal) x EMC(TP) (mg/L) x 1 (kg/10^6 mg); EMC (Table 3.4 - SQA Handbook)

3 Permanent Pool: Proposed permanent pool volumes were determined using the permanent pool calculations spreadsheets
See Permanent Pool Volume Calculations for proposed pond PPV details

4 Resident Time = PPV / AR x 365 (days/yr)

5 Mean Pond Conc (aka Total P) = Pollutant Loading x 1 yr/(Pond Volume + AR) x 1 ac/43560 ft^2 x 1 ft^3/7.48 gal x 1 gal/3.875L x 10^6 mg/kg x 1000 ug/mg

6 Mean Chlorophyll Conc: ln(chyl-a) = 1.058 ln(MPC) - 0.934

7 Mean Secchi Disk Depth (SD) = (24.2386+(0.3041 x chyl-a))/(6.0632 + chyl-a)

8 Anoxic Depth (AD): Depth of DO < 1 (m) = 3.035(SD) + 0.02164(chyl-a) - 0.004979(MPC). AD is the max. depth of PPV that can be counted for WQ.

9 Required Reduction = (1-(PreDev Loading [kg/yr]/PostDev Loading [kg/yr])) x 100

10 Removal Efficiency: TP (% Removal) = 44.53 + 6.145 x $ln(t_d)$ + 0.145 x $(ln(t_d))^2$
TN (% Removal) = (43.75 x t_d) / (4.38 + t_d)

PRE-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area ('Highway')	3.20	90.63	80	0.741	10.18	1.37	17.19	0.17	2.13
Pervious Pond Area	0.85	0.00	80	0.111	0.40	1.85	0.92	0.31	0.15
Pond Water Surface	1.44	0.00	100	1.000	6.18	0.00	0.00	0.00	0.00
Offsite Area ('Single Family')	6.72	0.00	80	0.111	3.20	1.85	7.30	0.31	1.22
Total:	**12.21**				**19.96**		**25.42**		**3.51**

POST-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area ('Highway')	3.65	94.52	80	0.770	12.06	1.37	20.38	0.17	2.53
Prop. Pervious Pond Area ('S.F.')	0.95	0.00	80	0.111	0.45	1.85	1.03	0.31	0.17
Pond Water Surface	1.65	0.00	100	1.000	7.08	0.00	0.00	0.00	0.00
Offsite Area ('Single Family')	6.17	0.00	80	0.111	2.94	1.85	6.71	0.31	1.12
Total:	**12.42**				**22.53**		**28.12**		**3.83**

* Determined from the Mean Annual Runoff Coefficients (C Values) as a Function of DCIA Percentage and Non-DCIA Curve Number (CN) Table

TREATMENT REQUIRED

POLLUTANT LOADING CALCULATIONS - Basin No. 2 East (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.**

Designer: JDW

Financial Project No.: **433605-1-22-01**

9/9/2015

County: **Brevard**

Land Use	Annual Runoff[1] (ac-ft/yr)	Pollutant Loading[2] (kg/yr)		Required % Reduction (Removal Efficiency)	
		TN	TP	TN	TP
Pre-Development	19.96	25.42	3.51	9.59	8.19
Post-Development	22.53	28.12	3.83		

TREATMENT PROVIDED

Pond ID	Perm. Pool Volume[3] PPV (ac-ft)	Residence Time[4] t_d (days)	Mean Pond Concentration[5] (u g/L)	Mean Chlorophyll Concentration[6] (mg/m^3)	Mean Secchi Disk Depth[7] (SD) (m)	Anoxic Depth[8] (ft)	Removal Efficiency[10] (%)		Pollutant Loading (kg/yr)	
							TN	TP	TN	TP
Pond 1	**5.59**	**72.82**	**29.18**	**13.94**	**1.42**	**14.69**	**41.27**	**73.55**	**16.51**	**1.01**

FINAL LOADINGS		
Condition	Pollutant	
	TN (kg/yr)	TP (kg/yr)
Pre-Development	**25.42**	**3.51**
Post-Development	**16.51**	**1.01**

POLLUTANT LOADING CALCULATIONS - Basin No. 3 (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.** Designer: JDW

Financial Project No.: **433605-1-22-01** 9/9/2015

County: **Brevard**

Annual Rainfall: **51.5 in/yr** **Rainfall Zone:** **2** The Pollutant Loading equations are from the March 2010 (Draft) Stormwater Quality Applicant's Handbook (FDEP)

SITE CONDITIONS

Description	Area (ac)	
	Pre-Dev	Post-Dev
DCIA (Within R/W)	4.90	5.48
Impervious Area (Non-DCIA)	0.00	0.00
Proposed Pervious Pond Area	0.00	0.00
Proposed Pond Water Area	0.00	0.00
Pervious Roadway Area	11.88	10.41
Offsite Pervious Area	0.00	0.00
Total Roadway Area (Within R/W):	16.78	15.89
%DCIA (Within R/W):	29.20	34.49
Total Basin Area:	**16.78**	**15.89**

1 Annual Runoff (AR) = A x P x Runoff Coefficient (C) x 1/12 (ft/in)

2 Pollutant Loading (TP) = AR x 43560 (ft^2/ac) x 7.48 (gal/ft^3) x 3.785 (L/gal) x EMC(TP) (mg/L) x 1 (kg/10^6 mg); EMC (Table 3.4 - SQA Handbook)

3 Permanent Pool: Proposed permanent pool volumes were determined using the permanent pool calculations spreadsheets
See Permanent Pool Volume Calculations for proposed pond PPV details

4 Resident Time = PPV / AR x 365 (days/yr)

5 Mean Pond Conc (aka Total P) = Pollutant Loading x 1 yr/(Pond Volume + AR) x 1 ac/43560 ft^2 x 1 ft^3/7.48 gal x 1 gal/3.875L x 10^6 mg/kg x 1000 ug/mg

6 Mean Chlorophyll Conc: ln(chyl-a) = 1.058 ln(MPC) - 0.934

7 Mean Secchi Disk Depth (SD) = (24.2386+(0.3041 x chyl-a))/(6.0632 + chyl-a)

8 Anoxic Depth (AD): Depth of DO < 1 (m) = 3.035(SD) + 0.02164(chyl-a) - 0.004979(MPC). AD is the max. depth of PPV that can be counted for WQ.

9 Required Reduction = (1-(PreDev Loading [kg/yr]/PostDev Loading [kg/yr])) x 100

10 Removal Efficiency: TP (% Removal) = 44.53 + 6.145 x $ln(t_d)$ + 0.145 x $(ln(t_d))^2$
TN (% Removal) = (43.75 x t_d) / (4.38 + t_d)

PRE-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area ('Highway')	16.78	29.20	80	0.314	22.61	1.37	38.21	0.17	4.74
Proposed Pond ('Single Family')	0.00	0.00	80	0.111	0.00	1.85	0.00	0.31	0.00
Offsite Area ('Single Family')	0.00	0.00	80	0.111	0.00	1.85	0.00	0.31	0.00
Total:	**16.78**				**22.61**		**38.21**		**4.74**

POST-DEVELOPMENT LOADINGS (Estimate)

Land Use	Area (ac)	% DCIA	Non-DCIA CN	Runoff C*	Annual Runoff (ac-ft/yr)	Conc. N (mg/L)	N Load[2] (kg/yr)	Conc. P (mg/L)	P Load (kg/yr)
Roadway Area Within R/W	15.89	34.49	80	0.351	23.94	1.37	40.44	0.17	5.02
Proposed Pervious Pond Area	0.00	0.00	80	0.111	0.00	1.85	0.00	0.31	0.00
Pond Water Surface	0.00	0.00	100	1.000	0.00	0.00	0.00	0.00	0.00
Offsite Area ('Single Family')	0.00	0.00	80	0.111	0.00	1.85	0.00	0.31	0.00
Total:	**15.89**				**23.94**		**40.44**		**5.02**

* Determined from the Mean Annual Runoff Coefficients (C Values) as a Function of DCIA Percentage and Non-DCIA Curve Number (CN) Table

TREATMENT REQUIRED

POLLUTANT LOADING CALCULATIONS - Basin No. 3 (Existing & Proposed Conditions)

Project: **Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.** Designer: JDW

Financial Project No.: **433605-1-22-01** 9/9/2015

County: **Brevard**

Land Use	Annual Runoff[1] (ac-ft/yr)	Pollutant Loading[2] (kg/yr)		Required % Reduction (Removal Efficiency)	
		TN	TP	TN	TP
Pre-Development	22.61	38.21	4.74	5.53	5.53
Post-Development	23.94	40.44	5.02		

TREATMENT PROVIDED

Pond ID	Perm. Pool Volume[3] PPV (ac-ft)	Residence Time[4] t_d (days)	Mean Pond Concentration[5] (u g/L)	Mean Chlorophyll Concentration[6] (mg/m^3)	Mean Secchi Disk Depth[7] (SD) (m)	Anoxic Depth[8] (ft)	Removal Efficiency[10] (%)		Pollutant Loading (kg/yr)	
							TN	TP	TN	TP
Pond 1	7.57	69.18	34.66	16.73	1.29	13.43	41.14	73.17	23.80	1.35

FINAL LOADINGS		
Condition	Pollutant	
	TN (kg/yr)	TP (kg/yr)
Pre-Development	38.21	4.74
Post-Development	23.80	1.35

APPENDIX F

EXISTING SJRWMD PERMIT INFORMATION

Permit Number 40-009-95213-1
Wal-Mart, Cocoa, Clearlake Road Phase II Offsite Roadway Improvements

Thank you for your cooperation, and if this office can be of any further assistance to you, please do not hesitate to contact us.

Sincerely,

Quenteria Johnson
Data Management Specialist II
Division of Permit Data Services

Enclosures: Permit with As-built Certification Form
Notice of Rights
List of Newspapers for Publication

cc: District Permit File

Agent: Kimley-Horn & Associates, Inc.
601 21st Street Suite 400
Vero Beach, FL 32960

STANDARD GENERAL ENVIRONMENTAL RESOURCE PERMIT
TECHNICAL STAFF REPORT
November 29, 2004
APPLICATION #: 40-009-95213-1

DATE RECEIVED:	DATE COMPLETED:	21ST DAY:	28TH DAY:
August 12, 2004	November 05, 2004	November 26, 2004	December 03, 2004

Applicant: Florida Dept of Transportation
719 S Woodland Blvd
Deland, FL 32720
(904) 943-5000

Agent: Kimley-Horn & Associates, Inc.
C/O David T. Corrie, P.E.
601 21st Street Suite 400
Vero Beach, FL 32960
(772) 562-7981

Project Name: Wal-Mart, Cocoa, Clearlake Road Phase II Offsite Roadway Improvements
Project Acreage: 2.480
Planning Unit: North Indian River Lagoon Unit 10C
Drainage Basin 21, Northern Indian River Lagoon
Special Basin Criteria: NA
Receiving Water Body: Existing Ditch **Class:** Other/Unknown.
County: Brevard
Correct Fee Submitted: Yes **Amount Received:** $1,000.00

Authority: 40C-4.041(2)(b) 8

Type of Treatment: Retention, Wet Detention
Type of Development: Roadway
Type of System: New Surface Water Management System
Final O&M Entity: City of Cocoa
Pre/Post Peak Rate Attenuation Provided: Yes
Pre/Post Volume Attenuation Provided: N/A
Mean Annual Storm Attenuation Provided: Yes
Recovery of Water Quality Vol. Within Req. Time: Yes
Recovery of Peak Attenuation Vol. Within Req. Time: Yes
Interested Parties: No
Objectors: No

Authorization Statement

A Permit Authorizing:

Construction of a Surface Water Management System with stormwater treatment by retention and wet detention for Wal-Mart, Cocoa, Clearlake Road Phase II Offsite Roadway Improvements, a 2.48-acre project to be constructed as per plans received by

the District on August 12, 2004 and per revised Sheets R4, R5, and R6 received on November 5, 2004.

Staff Comments:

In April 2004, permit #4-009-86250-2 was issued for the development of the Wal-Mart Super Center located near the intersection of SR 524 and Clearlake Road in the City of Cocoa. The permit also authorized off-site roadway improvements including the widening of SR 524 and Clearlake Road. Water quality and water quantity treatment for approximately 3.2 acres of off-site area along Clearlake Road is provided within the Wal-Mart wet-detention pond identified as Pond #3. The roadway widening was proposed to occur in two phases, and the permitted plans for #4-009-56250-2 reflected the Phase I improvements to be constructed by Wal-Mart in conjunction with the Wal-Mart development. The Phase II roadway improvements are the responsibility of the City of Cocoa and are now being considered under this application.

This application is for Phase II of the roadway widening and drainage improvements proposed along about 1.2-miles of SR 524 and Clearlake Road near the Wal-Mart facility. Approximately 3.2 acres of Clearlake Road, 2.82 acres of which are impervious, will drain to the Wal-Mart Pond #3 as previously approved. The City also proposes to construct a dry retention pond at the turn in Clearlake Road to provide additional water quality treatment for a 1.07-acre watershed inclusive of 0.76 acres of pavement along Clearlake Road.

Site Description:

The project area is all uplands consisting of existing roadway and adjacent grassed road right of way. The project area is surrounded by roadways, commercial and residential development. A District conservation easement is located on property adjacent to the road improvements north of Clearlake Road approximately between stations 22+00 and 32+00. The roadways and surrounding development limit wildlife utilization to birds, small mammals, amphibians and reptiles. The improvements to Clearlake Road were required by the City of Cocoa to address the additional traffic generated by the Wal-Mart facility.

Impacts:

12.2.2 states that an applicant "must provide reasonable assurances that a regulated activity will not impact the values of wetland and other surface water functions so as to cause adverse impacts to: (a) the abundance and diversity of fish, wildlife and listed species; and (b) the habitat of fish, wildlife and listed species.

There are no wetland or surface water impacts proposed. The wetland impacts associated with the roadway improvements were authorized and mitigated in the permit for Wal-Mart, number 4-009-86250-1.

Secondary impacts:

Section 12.2.7 A.H. contains a four part criterion which addresses additional impacts that may be caused by a project: (a) impacts to wetland functions that may result from the intended use of a project; (b) impacts to the upland nesting habitat of listed species that

are aquatic or wetland dependent; (c) impacts to significant historical and archaeological resources that are closely linked and causally related to any proposed dredging or filing of wetlands or other surface waters; and (d) wetland impacts that may be caused by future phases of the project or activities that are closely linked and causally related to the project.

Section 12.2.7 (a) provides that secondary impacts to the habitat functions of wetlands associated with adjacent upland activities will not be considered adverse if buffers, with a minimum width of 15 ft. and an average width of 25 ft. are provided abutting those wetlands that will remain under the permitted design, unless additional measures are needed for protection of wetlands used by listed species for nesting, denning, or critically important feeding habitat.

a) There are no wetland or surface water impacts proposed. The wetland and surface water impacts associated with the roadway improvements were authorized and mitigated in the permit for Wal-Mart, number 4-009-86250-1. The permittee will maintain adequate erosion controls to protect the adjacent wetland and conservation easement.

b) The project was assessed pursuant to the criterion of Section 12.2.7, A.H. Impacts to the ecological value of uplands to aquatic or wetland dependent listed species for enabling existing denning or nesting by these species are not anticipated due to a lack of suitable habitat.

c) There are no wetland impacts proposed under this application so impacts to significant historical and archaeological resources may not be considered.

d) There are no wetland or surface water impacts proposed under this application. The proposed work is within the existing road right of way and no future phases or wetland impacts are expected.

Elimination/Reduction of Impacts:

Pursuant to Section 12.2.1 A.H. the applicant must consider practicable design modifications, which would reduce or eliminate adverse impacts to wetlands and other surface waters. A proposed modification which is not technically capable of being done, is not economically viable, or which adversely affects public safety through endangerment of lives or property is not considered "practicable". Section 12.2.1

There are no wetland or surface water impacts proposed in this application.

Mitigation:

There are no wetland or surface water impacts proposed in this application. The wetland impacts associated with the roadway improvements were authorized and mitigated in the permit for Wal-Mart, number 4-009-86250-1.

Cumulative Impacts:

Section 12.2.8 A.H. requires applicants to provide reasonable assurances that their projects will not cause unacceptable cumulative impacts upon wetlands and other surface

waters within the same drainage basin as the project for which a permit is sought. This analysis considers past, present, and likely future similar impacts and assumes that reasonably expected future applications with like impacts will be sought, thus necessitating equitable distribution of acceptable impacts among future applications. Mitigation, which offsets a projects adverse impacts within the same basin as the project for which a permit is sought is presumed to not cause unacceptable cumulative impacts.

There are no wetland or surface water impacts proposed in this application. The wetland and surface water impacts associated with the roadway improvements were authorized, cumulative impacts were addressed and the impacts were mitigated in the Wal-Mart permit, number 4-009-86250-1.

Conditions for Application Number 40-009-95213-1:

ERP General Conditions by Rule (October 03, 1995):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

ERP/MSSW/Stormwater Special Conditions (November 09, 1995):
1, 4, 10, 13

Other Conditions:

1. The surface water management system must be constructed and operated in accordance with the plans received by the District on August 12, 2004 and per revised Sheets R4, R5, and R6 received on November 5, 2004.

2. Prior to initiating construction, an erosion control barrier (silt fence) must be properly installed surrounding the entire limits of construction. The barrier must be inspected weekly and after rain events and maintained in good working condition.

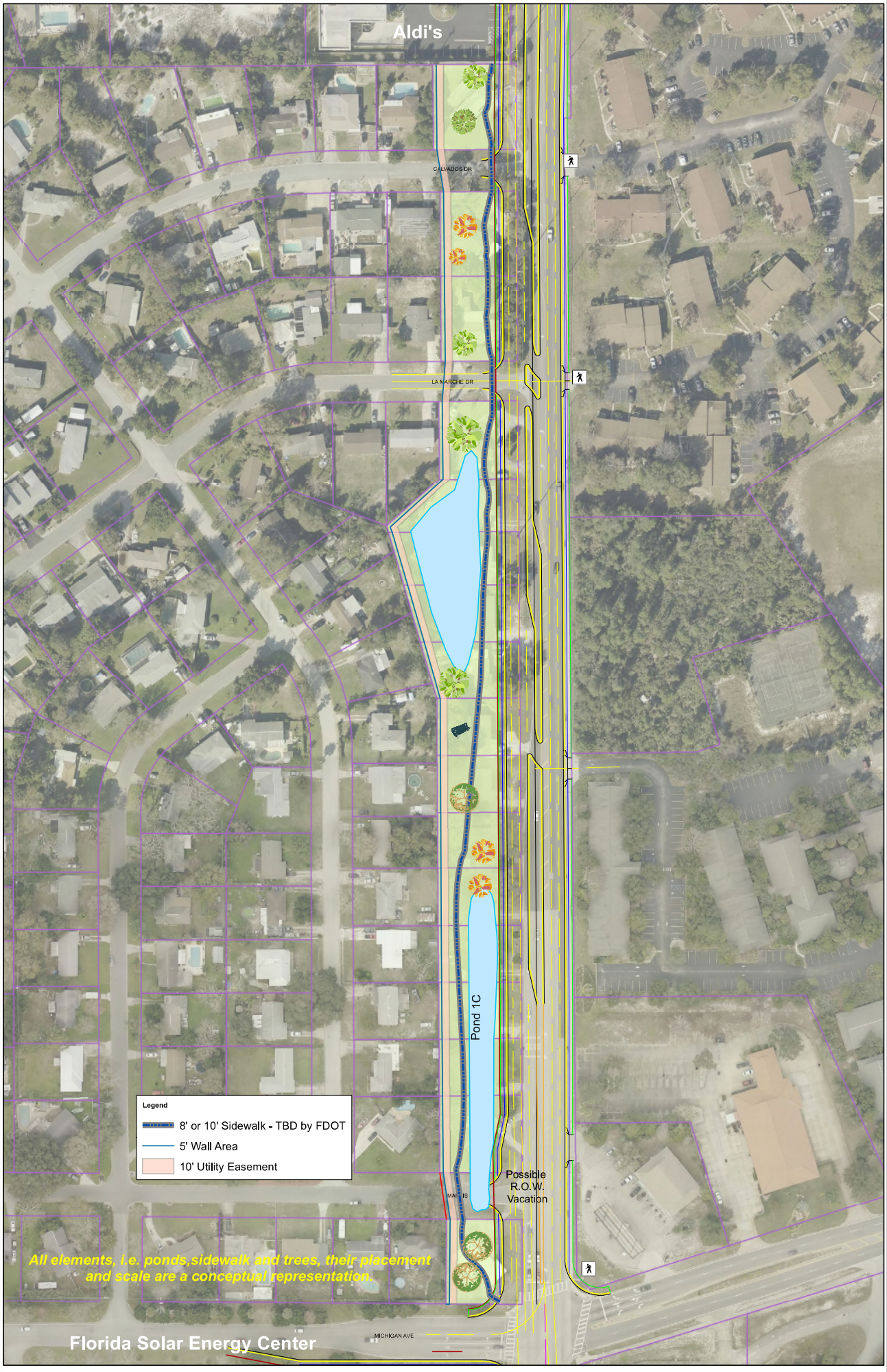
3. This permit does not authorize any impacts to the adjacent District conservation easement. Any inadvertent damage must be restored by regrading (if necessary) and replanting with native vegetation approved by the District. The restoration must occur within 30 days of request by the District.

Reviewers: Gretchen Reinertson
Susan Moor

APPENDIX G

PROJECT CORRESPONDENCE

Clearlake PD&E West Side Concept



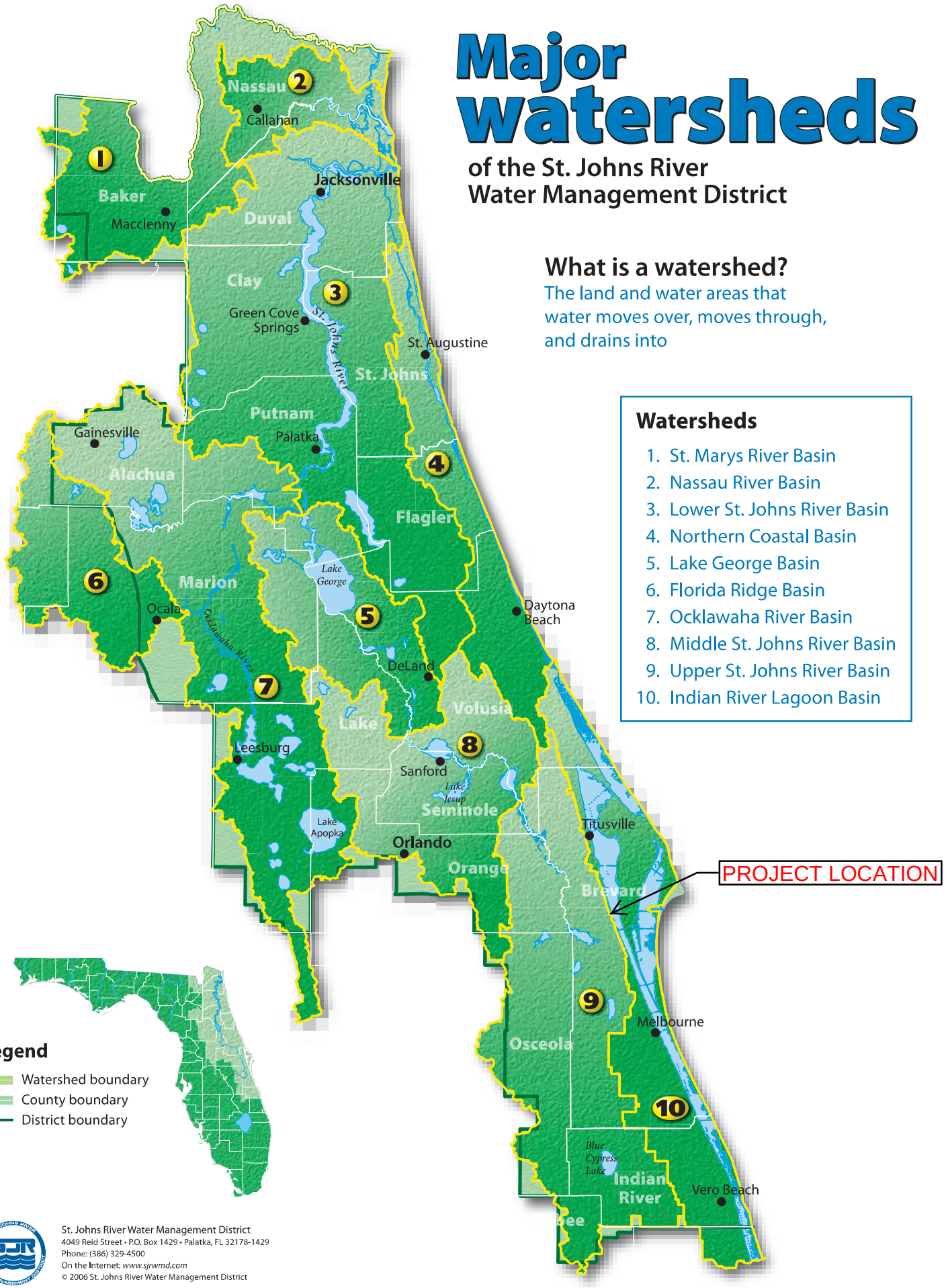
2015 Imagery

Prepared by Brevard Planning & Development GIS, Graphics

Clearlake_BrevPW_Concept2 3/11/2016

Major watersheds

of the St. Johns River Water Management District



What is a watershed?

The land and water areas that water moves over, moves through, and drains into

Watersheds

1. St. Marys River Basin
2. Nassau River Basin
3. Lower St. Johns River Basin
4. Northern Coastal Basin
5. Lake George Basin
6. Florida Ridge Basin
7. Ocklawaha River Basin
8. Middle St. Johns River Basin
9. Upper St. Johns River Basin
10. Indian River Lagoon Basin

Legend

- Watershed boundary
- County boundary
- District boundary

St. Johns River Water Management District
4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429
Phone: (386) 329-4500
On the Internet: *www.sjrwmd.com*

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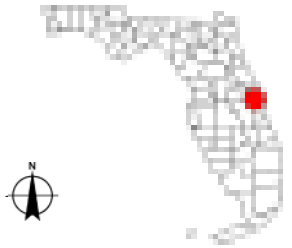
Map Direct: Verified Impaired WBIDs and TMDLs

28°24'20.8266", -80°46'16.4156" Scale 1:17,378 28°24'18.0760", -80°44'17.7433"

28°23'0.3702", -80°46'18.8082" 28°22'57.6202", -80°44'20.1602"

1 inch = 1448 feet



Aerial Imagery 2011-2013

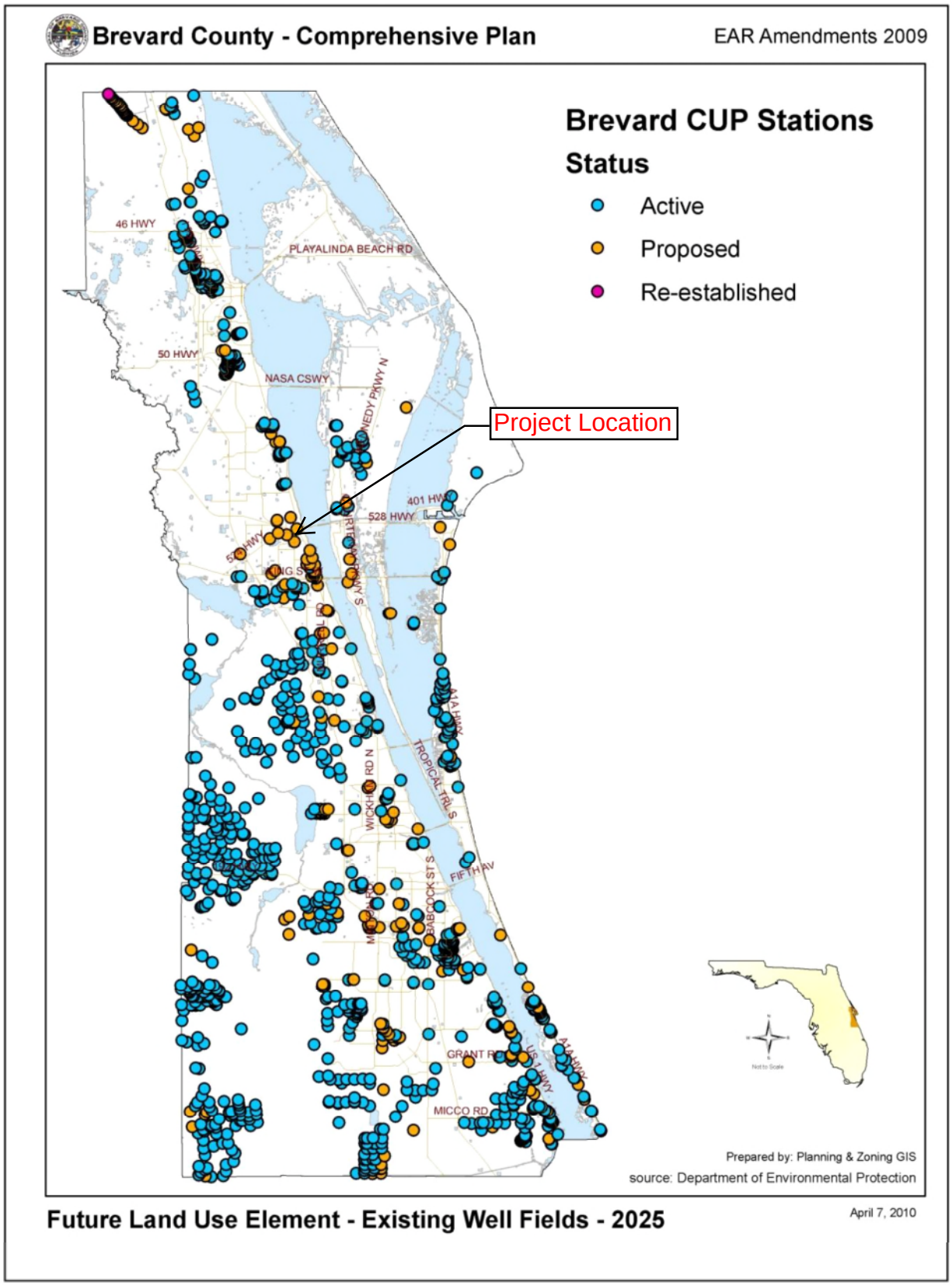
Florida Adopted TMDLs

- Dissolved Oxygen
- Fecal Coliform
- Iron
- Lead
- Nutrients
- Verified Impaired WBIDs
- Waterbody Ids (WBIDs)
- Counties

Aerial Imagery Flight Dates 2011-2013

Florida Department of Environmental Protection Disclaimer: This map created in Map Direct on Sun, 6 Jul 2014 17:09:14 UTC is intended for display purposes only. It was created using data from different sources collected at different scales, with different levels of accuracy, and/or covering different periods of time. NAVTEQ road data is provided "AS IS" and without warranties of any kind, either express or implied, including, but not limited to, the implied warranties of merchantability, fitness for a particular purpose, satisfactory quality and non-infringement.YOU SHOULD THEREFORE VERIFY ANY INFORMATION OBTAINED FROM THE SITE BEFORE ACTING ON IT.

EXISTING WELLFIELDS - 2025



JD Whitaker

From: JD Whitaker
Sent: Monday, August 17, 2015 2:18 PM
To: JD Whitaker
Subject: FW: SR 501 / Clearlake Road (south of Michigan Avenue to west of Industry Road) - SJRWMD Coordination (Treatment Requirements - OFW)

FYI…

From: JD Whitaker
Sent: Thursday, July 09, 2015 4:01 PM
To: 'Nathan Ottoson' <NOttoson@sjrwmd.com>
Cc: John Scarlatos <jscarlatos@scalarinc.net>
Subject: RE: SR 501 / Clearlake Road (south of Michigan Avenue to west of Industry Road) - SJRWMD Coordination (Treatment Requirements - OFW)

Nathan,

Thanks for the immediate feedback and clarification on the OFW/Preserve and TMDL. We will not include additional treatment volume in our drainage calcs. We will be sure to include pre/post pollutant loading analysis as part of this project. Thanks again.

Regards,

John (J.D.) Whitaker, P.E.
Project Manager
SCALAR Consulting Group Inc.
4152 W. Blue Heron Boulevard, Suite 119
Riviera Beach, FL 33404
Ph: (561) 429-5065
Cell: (561) 284-2376
jdwhitaker@scalarinc.net

From: Nathan Ottoson [mailto:NOttoson@sjrwmd.com]
Sent: Thursday, July 09, 2015 3:52 PM
To: JD Whitaker
Cc: John Scarlatos
Subject: RE: SR 501 / Clearlake Road (south of Michigan Avenue to west of Industry Road) - SJRWMD Coordination (Treatment Requirements - OFW)

JD,

This section of the IRL is not considered an OFW or aquatic preserve, which means you will not be required to provide the additional 50% extra TV.

However, a TMDL has been established for this section of the river and WBID, so you would have to provide a Pre-Post pollutant loading analysis. And you would need to demonstrate that Post-development pollutant (TP) Loads to the receiving Waters do not exceed pre-development loads. *This issue may affect the type of treatment system needed—especially if you are required to provide more than 64.5% removal efficiency for TP in post-development.*

Thanks.
Nathan

From: JD Whitaker [mailto:jdwhitaker@scalarinc.net]
Sent: Thursday, July 09, 2015 3:22 PM
To: Nathan Ottoson
Cc: John Scarlatos
Subject: SR 501 / Clearlake Road (south of Michigan Avenue to west of Industry Road) - SJRWMD Coordination (Treatment Requirements - OFW)

SR 501 (Clearlake Road) PD&E Study
FPID No. 433605-1-22-01
Scalar Project No. SP14D5001
Brevard County

Nathan,

Good afternoon. I'm currently working on a PD&E Study in Brevard County for FDOT – District 5 (see subject line for location and limits). This project is located fairly close to (< 1 mile) and ultimately outfalls into the Indian River (and Indian River Lagoon?). Will this project require an additional 50% treatment since it outfalls into the Lagoon, an OFW and Aquatic Preserve (similar to the US-1 PD&E Study from 53rd Street to CR 510 that we corresponded about in the past – see below). Please advise at your earliest convenience. If you need additional information beyond what is attached, feel free to give me a call at 561-429-5065. Thanks again for your help on this project, and previous projects.

Regards,

John (J.D.) Whitaker, P.E.
Project Manager
SCALAR Consulting Group Inc.
4152 W. Blue Heron Boulevard, Suite 119
Riviera Beach, FL 33404
Ph: (561) 429-5065
Cell: (561) 284-2376
jdwhitaker@scalarinc.net

Progress Meeting
AGENDA

Clearlake Road (SR 501) PD&E Study
Brevard County

FPID No. 433605-1-22-01
Wednesday, August 5, 2015

LOCATION:
Florida Department of Transportation – District Five
719 South Woodland Boulevard
DeLand, FL 32720

I. Survey Update (Lochrane and IF Rooks)

II. Drainage Kick-Off Meeting
   a. Pond Alternatives and Selection
   b. Pond Siting Matrix

III. General Discussions
   a. R/W Estimates (July 31, 2015)
   b. Revised Traffic (Aug. 17, 2015)
   c. Noise Methodology Call
   d. Alternatives Analysis
   e. Access Management Plan Format
   f. MPO Presentations (Sept. 8-14, 2015)
   g. Draft Document Submittal (Sept. 10, 2015)
   h. Value Engineering (Sept. 21-25, 2015)
   i. Alternatives Workshop (Oct. 20, 2015)

IV. Schedule
   a. Key Project Milestones:
      i. 1st Draft SEIR/PER Submittal (September 10, 2015)
      ii. Value Engineering (September 21, 2015)
      iii. Alternatives Public Meeting (October 20, 2015)
      iv. 2nd Draft SEIR/PER submittal (November 20, 2015)
      v. Public Hearing (February 25, 2016)
      vi. Final SEIR/Approval (April 29, 2016)

MEETING MINUTES

Drainage Kick-Off and Progress Meeting

Clearlake Road (SR 501) PD&E Study
Brevard County

FPID No. 433605-1-22-01
Wednesday, August 5, 2015

LOCATION:
D5 - Orange County Room

ATTENDEES: See attached Sign-In Sheet
AGENDA: See attached Attenda

The project team held a meeting with FDOT to discuss the status of the study and conduct initial discussion regarding drainage and pond site locations. Below are the topics that were discussed.

1. Survey and RW – Lochrane has completed the vertical PNC and also established aerial targets which have been provided to IF Rooks. The alignment was approved by the Department after the meeting on the same day. Lochrane will be using the approved alignment to finalize the RW. Lochrane is in the process of providing IF Rooks with obscured area topo and may need some additional areas. Drainage and utility survey field work is complete. PNC is not scoped at this time but will be needed for the design phase. Lochrane will send all draft survey files to Scalar for review. IF Rooks needs approximately another 1-2 weeks to complete the DTM and plannemtrics.

2. Drainage – The City of Cocoa will need to be coordinated with regarding the selection of preferred Pond Sites. At the meeting, four drainage basins were identified with each having several options for pond site locations. For Basin 2, expansion of the existing pond just north of Wal-Mart was presented for consideration which would require coordination with Wal-Mart. The draft LHR is complete and there are no expected impacts to floodplains. The Pond Siting Report is still in the process of being drafted. The Department agreed to provide Scalar with a sample approved Pond Siting Report to follow for format and content. Freddy Andrade, Sr. requested for Scalar to provide progress drafts of the LHR and PSR for early review. Amy Sirmans discussed that the drainage design needs to take into account Central Office's BURPs policy. Therefore, fencing for ponds is not permitted and that aesthetics for ponds needs to be considered. Freddy, will provide comments on the Pond Siting Evaluation matrix once the progress drafts of the LHR and PSR are submitted.

3. Traffic – Adam Burghdoff explained the TPO does recommend changing the land use information within the travel demand model that was utilized for the study. Adam will get a confirmation email from Laura Carter (TPO). The DTTM accounted for median closures in the analysis. The volumes currently in the DTTM will not be changing. Taleb Shams indicated that ESALs for the study will be needed.

4. Noise – It was discussed that a noise methodology call will be needed and should be setup with Dora or Bill. Traffic volumes from Kittleson will be provided to Carol Fowler for conducing noise analysis.

5. Miscellaneous – A preliminary review of the Evaluation Matrix was conducted. Taleb requested for the design costs presented to reflect the negotiated amount for the design phase. Amy stated that there

is a dashboard for SWAT projects which is reviewed as part of a monthly SWAT project meeting. The dashboard provides milestone dates which will be tracked by the SWAT team monthly. Jazlyn will provide Scalar a sample Access Management Plan template.

Action Items:

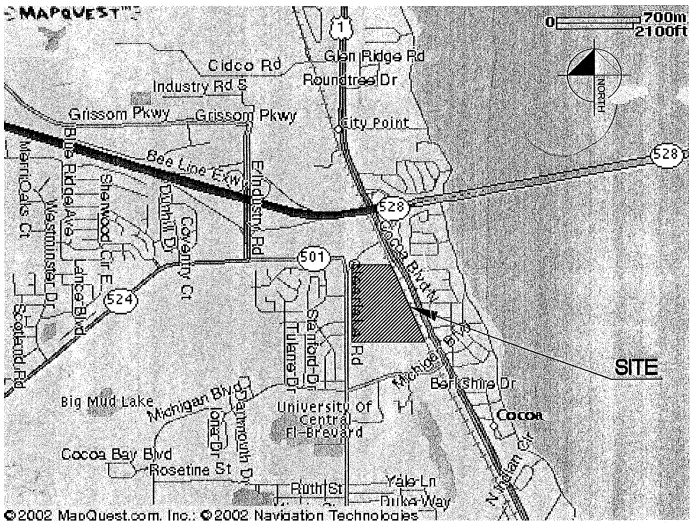
- Lochrane will send all draft survey files to Scalar for review.
- The Department will provide a sample approved Pond Siting Report to Scalar.
- Scalar to provide Freddy progress drafts of LHR and PSR for early review.
- Setup noise methodology call.
- Jazlyn to provide Scalar with Access Management Template
- Scalar to setup meeting with the City of Cocoa to discuss pond alternatives.

Post Meeting Note:

- FDOT Drainage provided Scalar with a drainage checklist and sections in the FDOT Stormwater Facilities Handbook to refer to during the Pond Siting Report (PSR) assembly. The Department does not have access to historical files; therefore, no example PSRs could be provided at this time.

Key Project Milestones:

i. Draft Environmental Documents (August 15, 2015)
ii. 1st Draft SEIR/PER Submittal (September 10, 2015)
iii. Value Engineering (September 21, 2015)
iv. Alternatives Public Meeting (October 20, 2015)
v. 2nd Draft SEIR/PER submittal (November 20, 2015)
vi. Public Hearing (February 25, 2016)
vii. Final SEIR/Approval (April 29, 2016)



VICINITY MAP

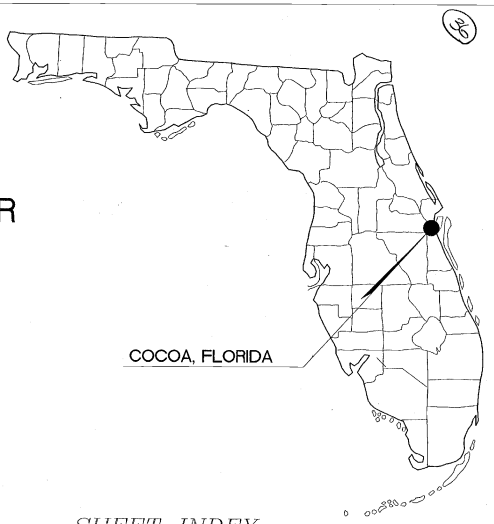
SITE DEVELOPMENT PLANS

WAL★MART

STORE No. 174-03, RSC, C-192-SEGR-0R
COCOA
BREVARD COUNTY, FLORIDA
BP DEVELOPMENT SITE
2800 CLEARLAKE ROAD (SR 501)
COCOA, FLORIDA

DEVELOPER

WAL★MART STORES EAST, INC.
2001 SE 10th STREET
BENTONVILLE, AR. 72716-0550



UTILITY AND GOVERNING AGENCIES CONTACT LIST

WATER
CITY OF COCOA PUBLIC WORKS AND UTILITIES
600 SCHOOL STREET
COCOA, FL 32922
PEGGY TURNER
PHONE (321) 639-7626
FAX (321) 639-7663

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
3319 MAGUIRE BLVD. SUITE 232
ORLANDO, FL 32803
OSAMA MAHMOOD
PHONE (407) 893-3300
FAX (407) 897-2966

SANITARY SEWER
CITY OF COCOA PUBLIC WORKS AND UTILITIES
600 SCHOOL STREET
COCOA, FL 32922
PEGGY TURNER
PHONE (321) 639-7626
FAX (321) 639-7663

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ORLANDO, FL 32803
CARY PADELL
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FAX (407) 897-3124

ELECTRIC
FLORIDA POWER AND LIGHT
7901 ELLIS ROAD
MELBOURNE, FL 32960
KELLY ROGERS
PHONE (321) 726-4865
FAX (321) 726-4813

CITY OF COCOA PLANNING AND ZONING
NELSON LAU
PLANNING-ZONING
603 BREVARD AVENUE
COCOA, FL 32922
PHONE (321) 639-7549
FAX (321) 639-7619

BUILDING DIVISION
PHIL CARUANA
603 BREVARD AVENUE
COCOA, FL 32904
PHONE (321) 639-7571
FAX (321) 639-7619

FIRE DEPARTMENT
VICTOR HIGGS
603 BREVARD AVENUE
COCOA, FL 32922
PHONE (321) 639-7608
FAX (321) 639-7619

NATURAL GAS
CITY GAS CO. OF FLORIDA
4180 S. HWY. US 1
ROCKLEDGE, FL 32955
JEROLD PIERCE
PHONE (321) 636-4644
FAX (321) 633-6733

STORM WATER
ST. JOHNS WATER RIVER MANAGEMENT DISTRICT
525 COMMUNITY COLLEGE PKWY.
PALM BAY, FL 32909
FARIBORZ ZANGANEH
PHONE (321) 676-6630
FAX (321) 722-5357

CITY OF COCOA PUBLIC WORKS AND UTILITIES
600 SCHOOL STREET
COCOA, FL 32922
PEGGY TURNER
PHONE (321) 639-7626
FAX (321) 639-7663

FLORIDA DEPARTMENT OF TRANSPORTATION
TRAFFIC OPERATIONS
DISTRICT FIVE
719 SOUTH WOODLAND BLVD.
DELAND, FL 3720-6800
MIKE CORNEJO
PHONE (386) 943-5315

FDOT PERMITTING DIVISION
555 CAMP ROAD
COCOA, FL 32922
JACK WEST
PHONE (321) 690-3241
FAX (321) 690-3229

LANDSCAPING AND TREE PRESERVATION
MARK DICK, LANDSCAPE ARCHITECT
603 BREVARD AVENUE
COCOA, FL 32922
PHONE (321) 639-7578

TELEPHONE
BELLSOUTH
517 HUGHLETT AVE.
COCOA, FL 32922
TOM SHEPPARD
PHONE (321) 633-3179
FAX (321) 639-0179

WORK WITHIN ROW
CITY OF COCOA ENGINEERING DEPT.
600 SCHOOL STREET
COCOA, FL 32922
PEGGY TURNER
PHONE (321) 639-7678
FAX (321) 639-7663

ENGINEER AND SURVEYOR
© 2002 Kimley-Horn and Associates, Inc.

Kimley-Horn
and Associates, Inc.
SUITE 400
601 21st STREET
VERO BEACH, FL 32960
PHONE 772-562-7981
E.B. NO. 696

NOTES:

1. THE SITEWORK FOR THE WAL-MART PORTION OF THIS PROJECT SHALL MEET OR EXCEED THE "WAL-MART STANDARD SITEWORK SPECIFICATIONS."
2. ALL NECESSARY INSPECTIONS AND/OR CERTIFICATIONS REQUIRED BY CODES AND/OR UTILITY SERVICE COMPANIES SHALL BE PERFORMED PRIOR TO ANNOUNCED BUILDING POSSESSION AND THE FINAL CONNECTION OF SERVICES.
3. ATTENTION IS DRAWN TO THE FACT THAT THE SCALE OF OF THESE DRAWINGS MAY HAVE BEEN DISTORTED DURING THE REPRODUCTION PROCESS.

SHEET INDEX

C1 GENERAL NOTES
C2 OVERALL SITE LAYOUT PLAN
C3 SITE PLAN A
C4 SITE PLAN B
C5 PAVING, GRADING AND DRAINAGE PLAN A
C6 PAVING, GRADING AND DRAINAGE PLAN B
C7 UTILITY PLAN A
C8 UTILITY PLAN B
C9 PAVING, GRADING AND DRAINAGE DETAILS
C10 PAVING GRADING AND DRAINAGE DETAILS
C11 PAVING GRADING AND DRAINAGE DETAILS
~~C12 SANITARY SEWER PROFILES~~
~~C13 LIFT STATION DETAILS~~
~~C14 WATER DISTRIBUTION DETAILS~~
~~C15 CITY OF COCOA TECHNICAL PROVISIONS - WATER~~
~~C16 SANITARY SEWER DETAILS~~
~~C17 CITY OF COCOA TECHNICAL PROVISIONS - SEWER~~
~~C18 MISCELLANEOUS DETAILS~~
~~C19 MISCELLANEOUS DETAILS~~
~~C20 LIGHTING DETAILS~~
C21 STORMWATER POLLUTION PREVENTION PLAN
C22 STORMWATER POLLUTION PREVENTION DETAILS
L-1A LANDSCAPE PLAN
L-1B LANDSCAPE PLAN
~~L-2A REVEGETATION PLAN~~
~~L-2B REVEGETATION PLAN~~
~~IR-1 OVERALL IRRIGATION PLAN~~
W1 WETLAND IMPACT PLAN A
W2 WETLAND IMPACT PLAN B
W3 SR 524 ROADWAY IMPROVEMENTS OFF-SITE WETLAND IMPACT PLAN
W4 CLEARLAKE ROAD IMPROVEMENTS OFF-SITE WETLAND IMPACT PLAN
R1 CLEARLAKE ROAD IMPROVEMENTS KEY SHEET
R2 GENERAL NOTES
R3-R4 INDUSTRY ROAD IMPROVEMENT PLANS
R5-R6 CLEARLAKE ROAD TYPICAL SECTIONS
R7-R12 CLEARLAKE ROAD PLAN
R13-R16 CLEARLAKE ROAD PAVING PLAN
R17-R23 CLEARLAKE ROAD CROSS SECTIONS
R24-R27 CLEARLAKE ROAD PAVEMENT MARKING AND SIGNING

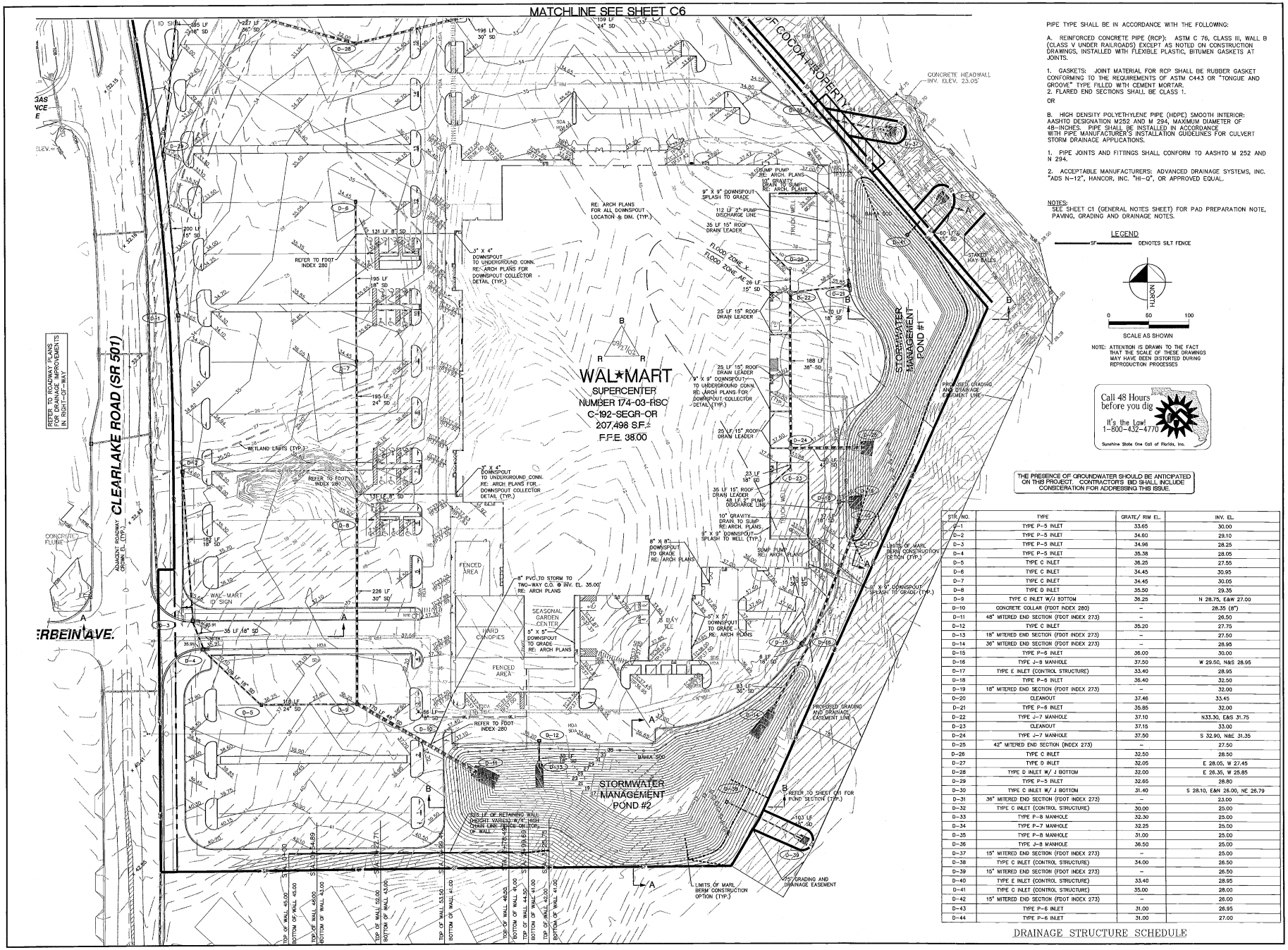
86250-2

RECEIVED
FEB 13 2004
Palm Bay Service Center

FINAL
APPROVED PLANS

SEAL

JOB No. 047253197



PIPE TYPE SHALL BE IN ACCORDANCE WITH THE FOLLOWING:

A. REINFORCED CONCRETE PIPE (RCP): ASTM C 76, CLASS III, WALL B (CLASS V UNDER RAILROADS) EXCEPT AS NOTED ON CONSTRUCTION DRAWINGS, INSTALLED WITH FLEXIBLE PLASTIC, BITUMEN GASKETS AT JOINTS.

1. GASKETS: JOINT MATERIAL FOR RCP SHALL BE RUBBER GASKET CONFORMING TO THE REQUIREMENTS OF ASTM C443 OR "TONGUE AND GROOVE" TYPE FILLED WITH CEMENT MORTAR.
2. FLARED END SECTIONS SHALL BE CLASS 1.

OR

B. HIGH DENSITY POLYETHYLENE PIPE (HDPE) SMOOTH INTERIOR: AASHTO DESIGNATION M252 AND M 294, MAXIMUM DIAMETER OF 48-INCHES. PIPE SHALL BE INSTALLED IN ACCORDANCE WITH PIPE MANUFACTURER'S INSTALLATION GUIDELINES FOR CULVERT STORM DRAINAGE APPLICATIONS.

1. PIPE JOINTS AND FITTINGS SHALL CONFORM TO AASHTO M 252 AND N 294.

2. ACCEPTABLE MANUFACTURERS: ADVANCED DRAINAGE SYSTEMS, INC. "ADS N-12", HANCOR, INC. "HI-Q", OR APPROVED EQUAL.

NOTES:
SEE SHEET C1 (GENERAL NOTES SHEET) FOR PAD PREPARATION NOTE, PAVING, GRADING AND DRAINAGE NOTES.

LEGEND
SF DENOTES SILT FENCE

NOTE: ATTENTION IS DRAWN TO THE FACT THAT THE SCALE OF THESE DRAWINGS MAY HAVE BEEN DISTORTED DURING REPRODUCTION PROCESSES

Call 48 Hours before you dig
It's the Law!
1-800-432-4770
Sunshine State One Call of Florida, Inc.

THE PRESENCE OF GROUNDWATER SHOULD BE ANTICIPATED ON THIS PROJECT. CONTRACTOR'S BID SHALL INCLUDE CONSIDERATION FOR ADDRESSING THIS ISSUE.

STR. NO.	TYPE	GRATE/ RIM EL.	INV. EL.
D-1	TYPE P-5 INLET	33.65	30.00
D-2	TYPE P-5 INLET	34.60	29.10
D-3	TYPE P-5 INLET	34.96	28.25
D-4	TYPE P-5 INLET	35.38	28.05
D-5	TYPE C INLET	36.25	27.55
D-6	TYPE C INLET	34.45	30.95
D-7	TYPE C INLET	34.45	30.05
D-8	TYPE D INLET	35.50	29.35
D-9	TYPE C INLET W/J BOTTOM	36.25	N 28.75, E&W 27.00
D-10	CONCRETE COLLAR (FDOT INDEX 280)	–	28.35 (8")
D-11	48" MITERED END SECTION (FDOT INDEX 273)	–	26.50
D-12	TYPE C INLET	35.20	27.75
D-13	18" MITERED END SECTION (FDOT INDEX 273)	–	27.50
D-14	36" MITERED END SECTION (FDOT INDEX 273)	–	28.95
D-15	TYPE P-6 INLET	36.00	30.00
D-16	TYPE J-8 MANHOLE	37.50	W 29.50, N&S 28.95
D-17	TYPE E INLET (CONTROL STRUCTURE)	33.40	28.95
D-18	TYPE P-9 INLET	36.40	32.50
D-19	18" MITERED END SECTION (FDOT INDEX 273)	–	32.00
D-20	CLEANOUT	37.46	33.45
D-21	TYPE P-6 INLET	35.85	32.00
D-22	TYPE J-7 MANHOLE	37.10	N33.30, E&S 31.75
D-23	CLEANOUT	37.15	33.00
D-24	TYPE J-7 MANHOLE	37.50	S 32.90, N&E 31.35
D-25	42" MITERED END SECTION (INDEX 273)	–	27.50
D-26	TYPE C INLET	32.50	28.50
D-27	TYPE D INLET	32.05	E 28.05, W 27.45
D-28	TYPE D INLET W/ J BOTTOM	32.00	E 26.35, W 25.85
D-29	TYPE P-5 INLET	32.65	28.80
D-30	TYPE C INLET W/ J BOTTOM	31.40	S 28.10, E&N 26.00, NE 26.79
D-31	36" MITERED END SECTION (FDOT INDEX 273)	–	23.00
D-32	TYPE C INLET (CONTROL STRUCTURE)	30.00	25.00
D-33	TYPE P-8 MANHOLE	32.30	25.00
D-34	TYPE P-7 MANHOLE	32.25	25.00
D-35	TYPE P-8 MANHOLE	31.00	25.00
D-36	TYPE J-8 MANHOLE	36.50	25.00
D-37	15" MITERED END SECTION (FDOT INDEX 273)	–	25.00
D-38	TYPE C INLET (CONTROL STRUCTURE)	34.00	26.50
D-39	15" MITERED END SECTION (FDOT INDEX 273)	–	26.50
D-40	TYPE E INLET (CONTROL STRUCTURE)	33.40	28.95
D-41	TYPE C INLET (CONTROL STRUCTURE)	35.00	28.00
D-42	15" MITERED END SECTION (FDOT INDEX 273)	–	26.00
D-43	TYPE P-6 INLET	31.00	26.95
D-44	TYPE P-6 INLET	31.00	27.00

DRAINAGE STRUCTURE SCHEDULE

Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants
E.B. No. 696
Suite 400
601 21st Street
Vero Beach, Fl 32960
Phone: 772-562-7981
Fax: 772-562-9689

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DAVID T. CORBIN, P.E. No. 56805, STATE OF FLORIDA, REGISTERED ENGINEER, DATE: 2/5/04

NO.	REVISION	BY	DATE

JOB NO. 042253197
DRAWN BY SHR
CHECKED BY DTC
APPROVED BY DTC
DATE 9/22/03
DRAWING NAME

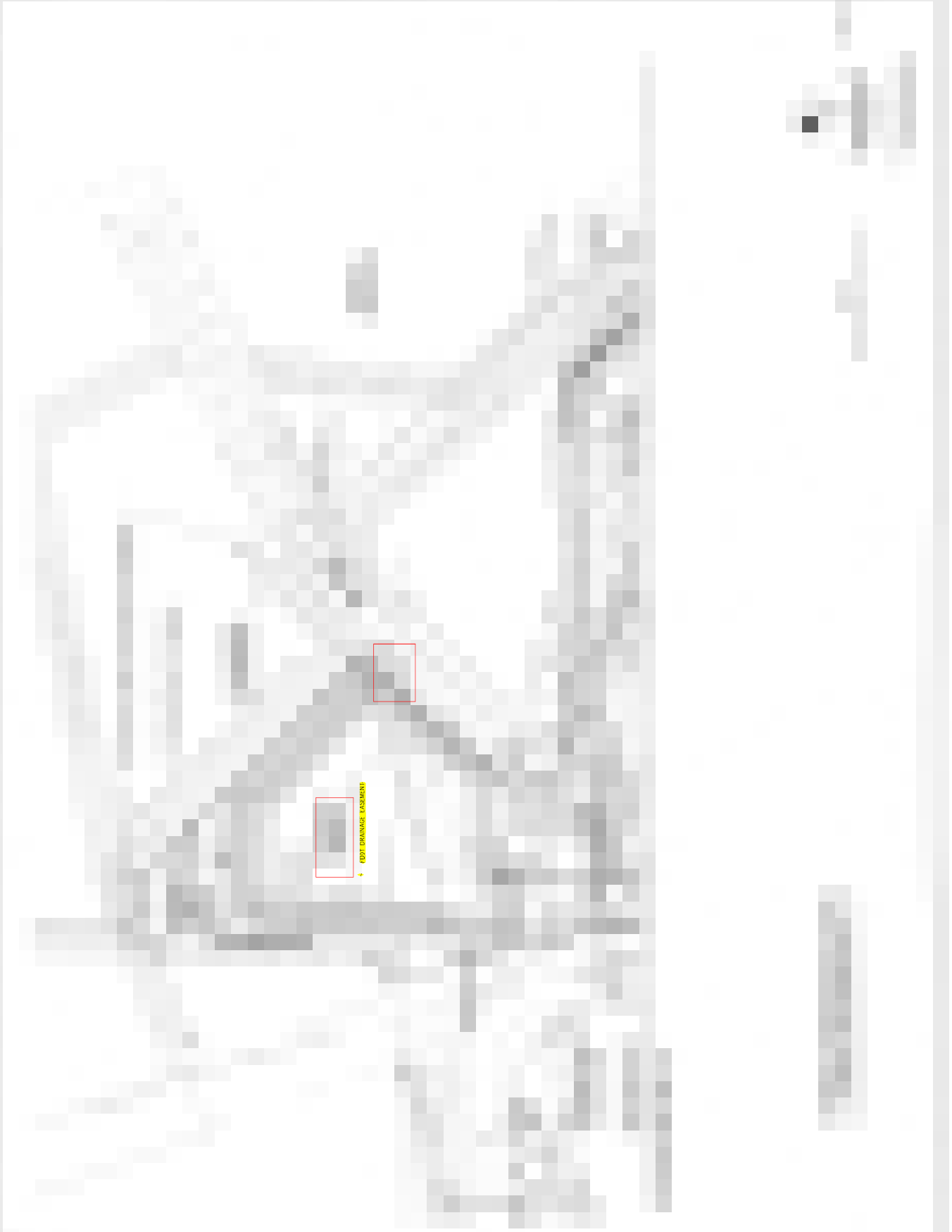
PAVING, GRADING AND DRAINAGE PLAN A

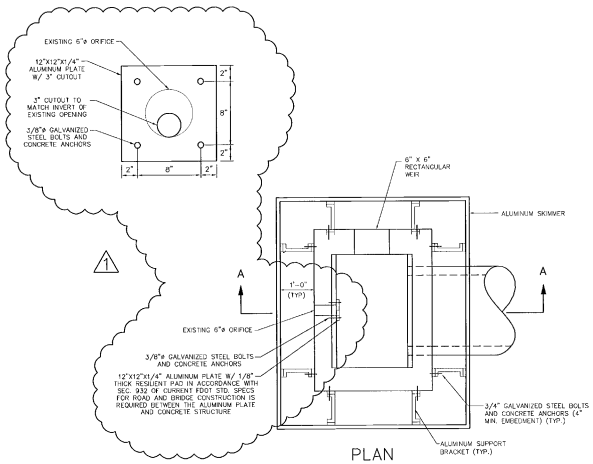
WAL★MART COCOA, FLORIDA
STORE #174-03, RSC, C-192-SEGR-OR
CITY OF COCOA, FLORIDA
BP DEVELOPMENT SITE

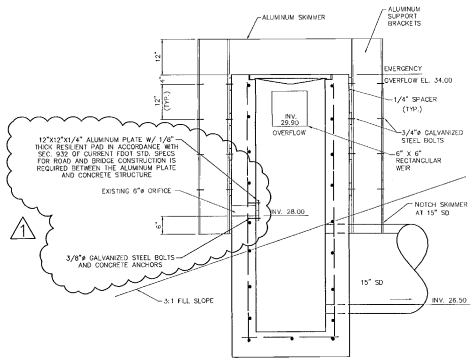
RECEIVED
FEB 13 2004
Palm Bay Service Center

SCALE 1" = 50'

SHEET NO. C5

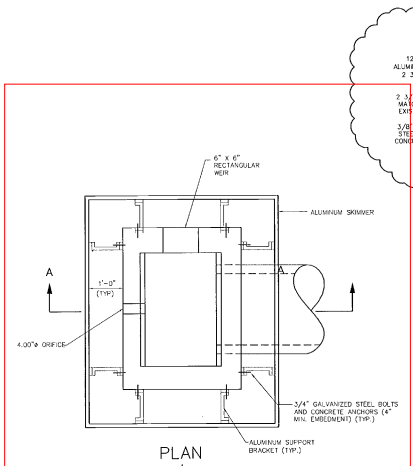

FDOT DRAINAGE EASEMENT

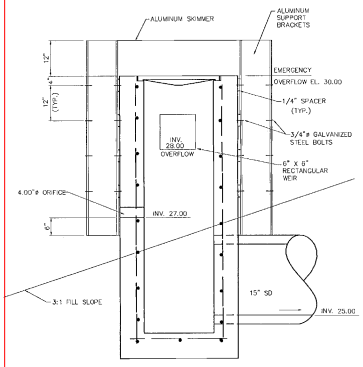




D-38

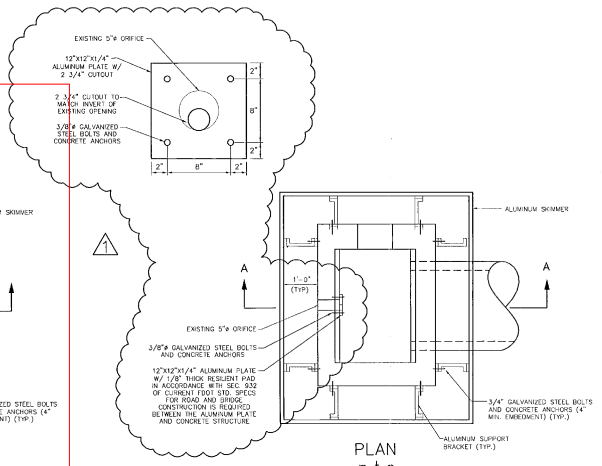
TYPE C INLET

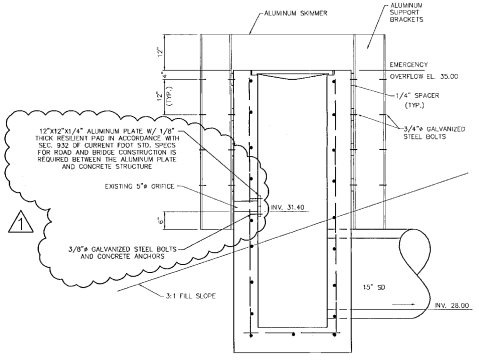




D-32

TYPE C INLET





D-41

TYPE C INLET

CONTROL STRUCTURES

NOTE

FOR STRUCTURAL DETAILS, DIMENSIONS AND GENERAL NOTES WHICH ARE NOT SHOWN ON THIS DETAIL, REFER TO FDOT, INDEX No. 232, "DITCH BOTTOM INLETS TYPES C,D,E & H".

1/8" THICK RESILIENT PADS (IN ACCORDANCE WITH SEC. 932 OF THE CURRENT FDOT STD. SPECS. FOR ROAD AND BRIDGE CONSTRUCTION) ARE REQUIRED AT ALL CONNECTIONS OF ALUMINUM SKIMMER TO CONCRETE TYPE C INLET.

RECEIVED
DEC 28 2006
Palm Bay Service Center

(2)

Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants
E.B. No. 696
Suite 400
601 21st Street
Vero Beach, Fl 32960
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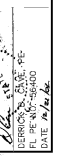


NO.	REVISION	BY	DATE
A	ALUMINUM PLATE OVER ORIFICE	SWW	9/18/06

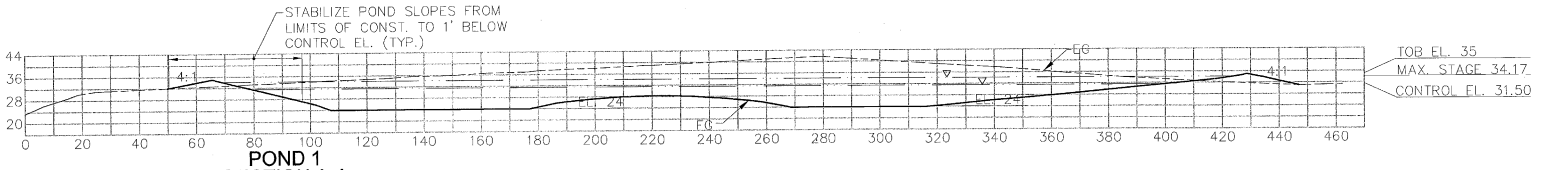
JOB NO. 027253197
DRAWN BY SHR
CHECKED BY DTC
APPROVED BY DTC
DATE 9/22/03
DRAWING NAME

PAVING, GRADING AND DRAINAGE DETAILS

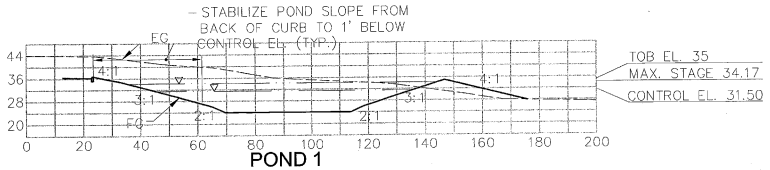
WAL*MART,COCOA, FLORIDA
STORE #174-03, RSC, C-192-SEGR-OR
CITY OF COCOA, FLORIDA
BP DEVELOPMENT SITE

SCALE NTS

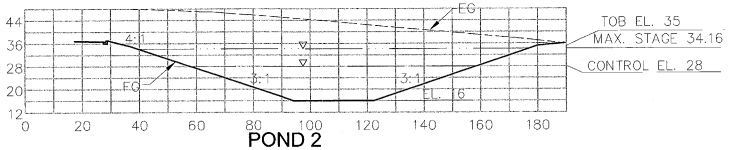
SHEET NO.
C10



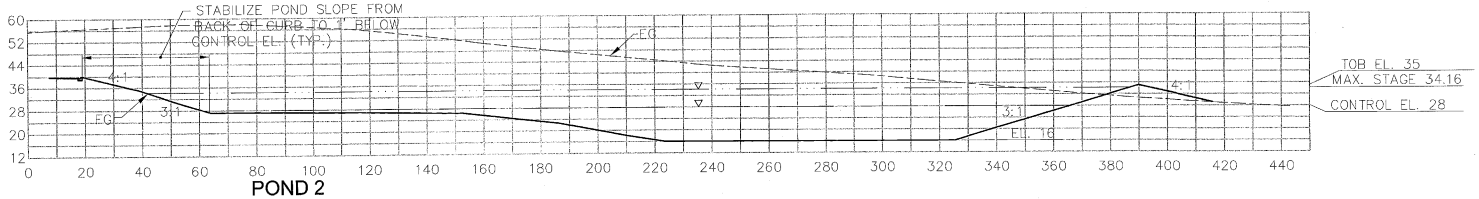
POND 1
SECTION A-A



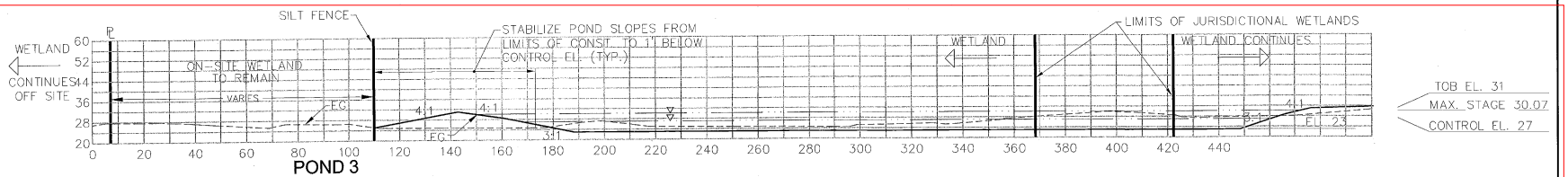
POND 1
SECTION B-B



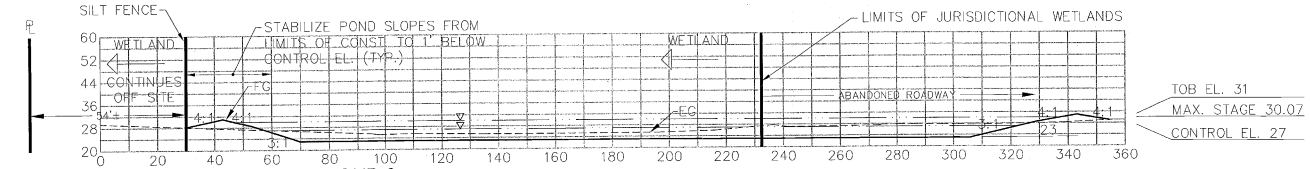
POND 2
SECTION A-A



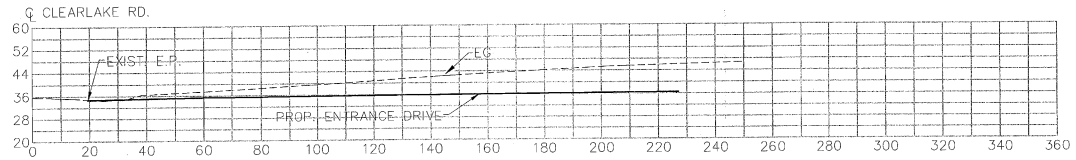
POND 2
SECTION B-B



POND 3
SECTION A-A



POND 3
SECTION B-B



CLEARLAKE RD.
SECTION A-A

NOTE:
ALL DETENTION AREA SIDE BANKS SHALL BE STABILIZED BY BAHIA SOD.

86250-2

Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants
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NO.	REVISION	BY	DATE

JOB NO. 042253197
DRAWN BY SHR
CHECKED BY SHR
APPROVED BY DTC
DATE 9/22/03
DRAWING NAME

PAVING, GRADING AND DRAINAGE DETAILS

WAL*MART, COCOA, FLORIDA
STORE #174-03, RSC, C-192-SEGR-OR
CITY OF COCOA, FLORIDA
BP DEVELOPMENT SITE

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SCALE 1" = 20'

SHEET NO.
C11

Revised September 2003

Environmental Resource Permit Application-Revised Pond #3 Calcuations

WAL★MART
COCOA, FLORIDA
STORE NO. 174-03, RSC
BP DEVELOPMENT SITE

Section 17, Township 24 South, Range 36 East
Brevard County

Prepared for:
St. Johns River Water Management District
525 Community College Pkwy.
Palm Bay, FL 32909
(321) 676-6630

Prepared by:
Kimley-Horn and Associates, Inc.
601 21st Street, Suite 400
Vero Beach, FL 32960

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Revised September 2003

Environmental Resource Permit Application-Revised Pond #3 Calculations

WAL★MART
COCOA, FLORIDA
STORE NO. 174-03, RSC
BP DEVELOPMENT SITE

Section 17, Township 24 South, Range 36 East
Brevard County

Prepared for:
St. Johns River Water Management District
525 Community College Pkwy.
Palm Bay, FL 32909
(321) 676-6630

Prepared by:
Kimley-Horn and Associates, Inc.
601 21st Street, Suite 400
Vero Beach, FL 32960

David T. Corrie, P.E.
FL Reg. No 49208
Date: 12/01/03

POND 3

Control Elevation	Top of Bank	Surface Area at TOB
ft	ft	acres
27.00	31.40	1.82

Treatment Volume	Treatment Volume	Permanent Pool	Permanent Pool
stage (ft)	volume (acre-ft)	stage (ft)	volume (acre-ft)
28.18	1.78	25.19	3.89

Pond #3 provides treatment and attenuation for a total drainage basin area of approximately 12.21 acres, 3.20 acres of which consists of those portions of Clearlake Road adjacent to the project site.

CN

Curve numbers have been calculated for each basin based on the impervious and pervious areas. The SCS method was used to determine composite CN values for each basin. Please see below for all CN values:

BASIN NAME	BASIN AREA (ACRES)	IMPERVIOUS AREA (ACRES)	IMPERVIOUS CURVE NUMBER	PERVIOUS AREA (ACRES)	PERVIOUS CURVE NUMBER	WEIGHTED CURVE NUMBER
POND 3	2.29	1.44	98	0.85	45	**78**
D29	1.46	1.21	98	0.25	45	**89**
D30	2.65	1.99	98	0.66	45	**85**
OFFSITE	3.20	3.20	98	0	45	**98**
D26	2.61	2.16	98	0.45	45	**89**
D6	1.78	1.72	98	0.06	45	**96**
D24	5.74	5.74	98	0	45	**98**
POND 1	1.11	0.53	98	0.58	45	**70**
D9	3.75	2.99	98	0.76	45	**87**
POND 2	1.87	0.62	98	1.25	45	**63**
D12	1.58	1.51	98	0.07	45	**96**

Time of Concentration

Time of concentrations for the individual basins are given in the adICPR models and assumed to be 10 minutes for conservative purposes.

POND 3

BasinD26, D30, OFFSITE, and Pond 3, shown on the Post adICPR basin/nodal/reach map, consists of the following

Basin	Impervious	Pervious	Total
D30	1.99	0.66	2.65
D26	2.16	0.45	2.61
D29	1.21	0.25	1.46
POND 3	1.44	.85	2.29
OFFSITE	3.20	0	3.20
Total area	**10.00**	2.21	
		Total basin area =	**12.21**

Pervious Area:

Total Pervious Area = **2.21 AC** ±

Impervious Area:

Detention Pond @ Control El. (27 NGVD) = **1.44AC ±**
Paved area includes (Clearlake Rd and S.R 503A)= **8.56AC ±**

Total Impervious Area = **10.00 AC ±**

☐ % Impervious (10.00/12.21) = 82%

TREATMENT VOLUME (ON-LINE)

The required treatment volume is the greater of the following two calculations:

1. 1" of runoff over the total basin area
   1"/12 x 12.21 acres = 1.0 ac-ft

OR

2. 2.5" of runoff over the impervious within the basin area (excluding the pond area)
   2.5"/12 x 8.56 acres = **1.78 ac-ft**

PERMANENT POOL VOLUME (PPV)

PPV = DA x C x R x RT / WS x CF

Where,

DA = Drainage Area (acres) = **12.21 acres**
C = Runoff coefficient for entire drainage area = see below
R = Rainfall Depth (inches) = **34 inches**
RT = Residence Time (days) = **21 days (NO LITTORAL ZONE)**
WS =Days during wet season (June 1 through October 31) = **153 days**
CF = Conversion factor

Runoff coefficient (C) = $\frac{(\text{impervious area} \times C_1) + (\text{pond area} \times C2) + (\text{pervious area} \times C_3)}{\text{Total drainage area}}$
(for entire drainage area)

$C_1 = 0.95$, $C_2 = 1.00$, and $C_3 = 0.20$

$$C = \frac{(8.56 \text{ acres} \times 0.95) + (1.44 \text{ acres} \times 1.00) + (2.21 \times 0.20)}{12.21 \text{ acres}} = \mathbf{0.82}$$

Rainfall Depth (R) = **34 inches** (see Appendix for Figure 4 of SJRWMD Attachment 5: Design Criteria and Guidelines for Wet Detention Treatment Systems, dated August 1991)

So,

Required Permanent Pool Volume:

PPV = DA x C x R x RT / WS x CF
= (12.21 x 0.82 x 34 x 21) / (153 x 12) = **3.89 ac-ft**

MEAN DEPTH OF POND

Pond 3 Volume @ Control Elevation of 27.00' is used in determining the mean depth.

Mean Depth = PPV@ Control EL. / Area @ Control EL. = 6.32 acre-feet / 1.44 acres = **4.39 feet (OK)***

Check: The mean depth of the pond must be between 2 feet and 8 feet.

Please note that PPV was provided at the control elevation 27.00' (WSWT)

OUTFALL/CONTROL STRUCTURE

The control structure (type "C") for pond #3 consists of three stages. Stage one is the 4" orifice located at elevation 27.00'. Stage two is a 6" X 6" vertical rectangular overflow weir at elevation 28.18'. Stage three is an emergency horizontal weir at elevation 30.30'. Pond #3 discharges to outfall #3, which is the drainage ditch located just east of the Wal-Mart site. Please refer to the Paving, Grading, and Drainage Details for the control structure detail.

STORMWATER DISCHARGE ANALYSIS

2 year-24 hour storm event

Pond 1 Q (cfs)	Pond 2 Q (cfs)	Pond 3 Q (cfs)
.29	1.62	1.46

25 year-24 hour storm event

Pond 1 Q (cfs)	Pond 2 Q (cfs)	Pond 3 Q (cfs)
.32	4.77	2.75

100 year-24 hour storm event

Pond 1 Q (cfs)	Pond 2 Q (cfs)	Pond 3 Q (cfs)
.35	15.16	3.83

Pre and Post Comparison 25year-24 hour storm event

Pre-Development Q (cfs)	Post-Development Q (cfs)
8.21	**7.84**

25 year-24 hour peak stage elevations

Pond 1 ft	Pond 2 ft	Pond 3 ft
34.16	34.15	30.40

RECOVERY RESULTS:

Recovery for Pond 3:
Discharge of ½ of treatment volume (@ stage 27.60 ft) at time = **28.35 hours**

ADICPR INPUT

86250-2

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Node----------
Name: D26 Base Flow(cfs): 0 Init Stage(ft): 27.45
Group: BASE Warn Stage(ft): 32.05
Comment:

Stage(ft)	Area(ac)
27.45	0
32.05	0.001
33	0.12

--------Class: Node----------
Name: D29 Base Flow(cfs): 0 Init Stage(ft): 28.8
Group: BASE Warn Stage(ft): 32.65
Comment:

Stage(ft)	Area(ac)
28.8	0
32.65	0.001
34	0.25

--------Class: Node----------
Name: D30 Base Flow(cfs): 0 Init Stage(ft): 27
Group: BASE Warn Stage(ft): 31.4
Comment: initial stage is based on wswt level on pond

Stage(ft)	Area(ac)
27	0
31.4	0.001
32	0.51

--------Class: Node----------
Name: OFFSITE Base Flow(cfs): 0 Init Stage(ft): 27
Group: BASE Warn Stage(ft): 30
Comment: 31 is arb grade in that basin

Stage(ft)	Area(ac)
27	0
30	0.001
31	1.08

--------Class: Node----------
Name: OUTFALL3 Base Flow(cfs): 0 Init Stage(ft): 27
Group: BASE Warn Stage(ft): 27.5
Comment:

Time(hrs)	Stage(ft)
0	27
12	27.5
72	27

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Node----------
Name: POND3 Base Flow(cfs): 0 Init Stage(ft): 27
Group: BASE Warn Stage(ft): 30
Comment:

Stage(ft)	Area(ac)
27	1.453
28	1.524
29	1.621
30	1.722
31	1.822

--------Class: Basin----------
Basin: D26 Node: D26 Status: On Site Type: SCS Unit Hydr
Group: BASE
Unit Hydrograph: UH484 Peak Factor: 484
Rainfall File: FLMOD Storm Duration(hrs): 24
Rainfall Amount(in): 9.5
Area(ac): 2.61 Concentration Time(min): 10
Curve #: 89 Time Shift(hrs): 0
DCIA(%): 0

--------Class: Basin----------
Basin: D29 Node: D29 Status: On Site Type: SCS Unit Hydr
Group: BASE
Unit Hydrograph: UH484 Peak Factor: 484
Rainfall File: FLMOD Storm Duration(hrs): 24
Rainfall Amount(in): 9.5
Area(ac): 1.46 Concentration Time(min): 10
Curve #: 89 Time Shift(hrs): 0
DCIA(%): 0

--------Class: Basin----------
Basin: D30 Node: D30 Status: On Site Type: SCS Unit Hydr
Group: BASE
Unit Hydrograph: UH484 Peak Factor: 484
Rainfall File: FLMOD Storm Duration(hrs): 24
Rainfall Amount(in): 9.5
Area(ac): 2.65 Concentration Time(min): 10
Curve #: 85 Time Shift(hrs): 0
DCIA(%): 0

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **

--------Class: Basin----------

Basin: OFFSITE Node: OFFSITE Status: On Site Type: SCS Unit Hydr
Group: BASE

Unit Hydrograph:	UH484	Peak Factor:	484
Rainfall File:	FLMOD	Storm Duration(hrs):	24
Rainfall Amount(in):	9.5		
Area(ac):	3.2	Concentration Time(min):	10
Curve #:	98	Time Shift(hrs):	0
DCIA(%):	0		

--------Class: Basin----------

Basin: POND3 Node: POND3 Status: On Site Type: SCS Unit Hydr
Group: BASE

Unit Hydrograph:	UH484	Peak Factor:	484
Rainfall File:	FLMOD	Storm Duration(hrs):	24
Rainfall Amount(in):	9.5		
Area(ac):	2.29	Concentration Time(min):	10
Curve #:	78	Time Shift(hrs):	0
DCIA(%):	0		

--------Class: Pipe----------

Name:	D26-D30	From Node:	D26	Length(ft):	582
Group:	BASE	To Node:	D30	Count:	1

	UPSTREAM	DOWNSTREAM		
			Equation:	Average K
Geometry:	Circular	Circular	Flow:	Both
Span(in):	30	30	Entrance Loss Coef:	0.5
Rise(in):	30	30	Exit Loss Coef:	1
Invert(ft):	28.5	26.3	Bend Loss Coef:	0
Manning's N:	0.012	0.012	Outlet Cntrl Spec:	Use dc or tw
Top Clip(in):	0	0	Inlet Cntrl Spec:	Use dn
Bottom Clip(in):	0	0	Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Pipe----------

Name:	D29-D30	From Node: D29	Length(ft):	200
Group:	BASE	To Node: D30	Count:	1

	UPSTREAM	DOWNSTREAM	Equation:	Average K
Geometry:	Circular	Circular	Flow:	Both
Span(in):	18	18	Entrance Loss Coef:	0.5
Rise(in):	18	18	Exit Loss Coef:	1
Invert(ft):	28.8	28.1	Bend Loss Coef:	0
Manning's N:	0.012	0.012	Outlet Cntrl Spec:	Use dc or tw
Top Clip(in):	0	0	Inlet Cntrl Spec:	Use dn
Bottom Clip(in):	0	0	Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

--------Class: Pipe----------

Name:	D30-P3	From Node: D30	Length(ft):	294
Group:	BASE	To Node: POND3	Count:	1

	UPSTREAM	DOWNSTREAM	Equation:	Average K
Geometry:	Circular	Circular	Flow:	Both
Span(in):	36	36	Entrance Loss Coef:	0.5
Rise(in):	36	36	Exit Loss Coef:	1
Invert(ft):	26.3	25	Bend Loss Coef:	0
Manning's N:	0.012	0.012	Outlet Cntrl Spec:	Use dc or tw
Top Clip(in):	0	0	Inlet Cntrl Spec:	Use dn
Bottom Clip(in):	0	0	Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **

--------Class: Pipe----------

Name:	OFF-P3	From Node:	OFFSITE	Length(ft): 560
Group:	BASE	To Node:	POND3	Count: 1

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Equation:	Average K
Span(in):	36	36	Flow:	Both
Rise(in):	36	36	Entrance Loss Coef:	0.5
Invert(ft):	26.3	25	Exit Loss Coef:	1
Manning's N:	0.012	0.012	Bend Loss Coef:	0
Top Clip(in):	0	0	Outlet Cntrl Spec:	Use dc or tw
Bottom Clip(in):	0	0	Inlet Cntrl Spec:	Use dn
			Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

--------Class: Drop Structure----------

Name:	DROP3	From Node: POND3	Length(ft): 1087
Group:	BASE	To Node: OUTFALL3	Count: 1

Outlet Cntrl Spec: Use dc or tw Inlet Cntrl Spec: Use dn
Upstream Geometry: Circular Downstream Geometry: Circular

	UPSTREAM	DOWNSTREAM
Span(in):	15	15
Rise(in):	15	15
Invert(ft):	25	25
Manning's N:	0.012	0.012
Top Clip(in):	0	0
Bottom Clip(in):	0	0

Entrance Loss Coef: 0.5 Flow: Both
Exit Loss Coef: 1 Equation: Aver Conveyance

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1
Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall 1 1

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **

*** Weir 1 of 3 for Drop Structure DROP3 *** [TABLE]

Count:	1	Bottom Clip(in):	0
Type:	Mavis	Top Clip(in):	0
Flow:	Both	Weir Discharge Coef:	3
Geometry:	Circular	Orifice Discharge Coef:	0.6
Span(in):	4	Invert(ft):	27
Rise(in):	4	Control Elev(ft):	27

*** Weir 2 of 3 for Drop Structure DROP3 *** [TABLE]

Count:	1	Bottom Clip(in):	0
Type:	Horiz	Top Clip(in):	0
Flow:	Both	Weir Discharge Coef:	3
Geometry:	Rectangular	Orifice Discharge Coef:	0.6
Span(in):	24	Invert(ft):	30.3
Rise(in):	36	Control Elev(ft):	30.3

*** Weir 3 of 3 for Drop Structure DROP3 *** [TABLE]

Count:	1	Bottom Clip(in):	0
Type:	Horiz	Top Clip(in):	0
Flow:	Both	Weir Discharge Coef:	3
Geometry:	Rectangular	Orifice Discharge Coef:	0.6
Span(in):	6	Invert(ft):	28.18
Rise(in):	6	Control Elev(ft):	28.18

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\25
Execution: None
Header: POND 3 POST 25YR-24HR ANALYSIS

---------HYDRAULICS----------HYDROLOGY----------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	24
Drop Structure Optimizer:	10	Rain Amount(in):	9
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	30		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
10	15	10	15
20	5	20	5
30	15	30	15

---------GROUP SELECTIONS----------
+ BASE [09/17/03]
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\OR
Execution: None
Header: POND 3 DRAWDOWN (RECOVERY CALCS) 24-30 HOURS

---------HYDRAULICS----------HYDROLOGY----------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	24
Drop Structure Optimizer:	10	Rain Amount(in):	9
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	100		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
10	60	10	15
20	15	20	5
30	60	30	15

---------GROUP SELECTIONS----------
+ BASE [10/16/02]

```
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    STORM ANALYSIS FOR POND3 - SOLO


    ********** Input Report ************************************************************
    --------Class: Simulation-----------------------------------------------------------
 G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\10
 Execution: None
    Header: POND 3 - POST 100YR-24HR STORM ANALYSIS


---------HYDRAULICS-----------------------------HYDROLOGY--------------------
        Max Delta Z (ft): 0.1
          Delta Z Factor: 0.005          Override Defaults: Yes
     Time Step Optimizer: 10                Storm Dur(hrs): 24
Drop Structure Optimizer: 10               Rain Amount(in): 11
     Sim Start Time(hrs): 0                  Rainfall File: FLMOD
       Sim End Time(hrs): 30
      Min Calc Time(sec): 0.5
      Max Calc Time(sec): 60
        To Hour:   PInc(min):                 To Hour:   PInc(min):
        10         15                         30         30
        20         5
        30         15
---------GROUP SELECTIONS-----------------------------------------------------------
+ BASE     [09/17/03]
    --------Class: Simulation-----------------------------------------------------------
 G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\5Y
 Execution: None
    Header: 5YR-1HR POST STORM ANALYSIS FOR COCOA, FL


---------HYDRAULICS-----------------------------HYDROLOGY--------------------
        Max Delta Z (ft): 1
          Delta Z Factor: 0.005          Override Defaults: Yes
     Time Step Optimizer: 10                Storm Dur(hrs): 1
Drop Structure Optimizer: 10               Rain Amount(in): 2.9
     Sim Start Time(hrs): 0                  Rainfall File: FLMOD
       Sim End Time(hrs): 5
      Min Calc Time(sec): 0.5
      Max Calc Time(sec): 60
        To Hour:   PInc(min):                 To Hour:   PInc(min):
        2          60                         5          15
        3          15
        5          60
---------GROUP SELECTIONS-----------------------------------------------------------
+ BASE     [10/28/02]
```

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    Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.20) [9]
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    STORM ANALYSIS FOR POND3 - SOLO


    ********** Input Report ************************************************************
    --------Class: Simulation-----------------------------------------------------------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\5Y
 Execution: None
    Header: 5YR-4HR POST STORM ANALYSIS FOR COCOA, FL


---------HYDRAULICS-----------------------------HYDROLOGY--------------------
        Max Delta Z (ft): 1
          Delta Z Factor: 0.005          Override Defaults: Yes
     Time Step Optimizer: 10                Storm Dur(hrs): 4
Drop Structure Optimizer: 10               Rain Amount(in): 4
     Sim Start Time(hrs): 0                  Rainfall File: FLMOD
       Sim End Time(hrs): 6
      Min Calc Time(sec): 0.5
      Max Calc Time(sec): 60
        To Hour:   PInc(min):                  To Hour:   PInc(min):
        2          60                          6          15
        3          15
        6          60
---------GROUP SELECTIONS-----------------------------------------------------------
+ BASE     [10/28/02]
    --------Class: Simulation-----------------------------------------------------------
 G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\5Y
 Execution: None
    Header: 5YR-240HR (10DAY) STORM ANALYSIS FOR COCOA, FL


---------HYDRAULICS-----------------------------HYDROLOGY--------------------
        Max Delta Z (ft): 1
          Delta Z Factor: 0.005          Override Defaults: Yes
     Time Step Optimizer: 10                Storm Dur(hrs): 240
Drop Structure Optimizer: 10               Rain Amount(in): 12
     Sim Start Time(hrs): 0                  Rainfall File: FLMOD
       Sim End Time(hrs): 246
      Min Calc Time(sec): 0.5
      Max Calc Time(sec): 60
        To Hour:   PInc(min):                  To Hour:   PInc(min):
        120        120                         246        120
        200        30
        246        120
---------GROUP SELECTIONS-----------------------------------------------------------
+ BASE     [10/28/02]
```

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.20) [10]
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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **********

--------Class: Simulation--------

G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\5Y
Execution: None
Header: 5YR-24HRPOST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	24
Drop Structure Optimizer:	10	Rain Amount(in):	6.5
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	30		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
10	60	30	15
12	15		
30	60		

---------GROUP SELECTIONS----------

+ BASE [10/28/02]

--------Class: Simulation--------

G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\25
Execution: None
Header: 25YR-1HR POST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	1
Drop Structure Optimizer:	10	Rain Amount(in):	3.9
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	5		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
2	60	5	15
3	15		
5	60		

---------GROUP SELECTIONS----------

+ BASE [10/28/02]

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.20) [11]
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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\24
Execution: None
Header: 25YR-4HR POST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 4
Drop Structure Optimizer: 10 Rain Amount(in): 5.28
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 6
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
2	60	6	15
4	15		
6	60		

---------GROUP SELECTIONS----------
+ BASE [10/28/02]
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\25
Execution: None
Header: 25YR-240HR (10DAY) STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 240
Drop Structure Optimizer: 10 Rain Amount(in): 16
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 246
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
120	120	246	120
200	30		
246	120		

---------GROUP SELECTIONS----------
+ BASE [10/28/02]

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\10
Execution: None
Header: 100YR-1HR POST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS-----------------------------HYDROLOGY--------------------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 1
Drop Structure Optimizer: 10 Rain Amount(in): 4.8
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 5
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
2	60	5	15
3	15		
5	60		

---------GROUP SELECTIONS---
+ BASE [10/28/02]
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\10
Execution: None
Header: 100YR-4HR POST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS-----------------------------HYDROLOGY--------------------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 4
Drop Structure Optimizer: 10 Rain Amount(in): 6.6
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 6
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
2	60	6	15
4	15		
6	60		

---------GROUP SELECTIONS---
+ BASE [10/28/02]

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **********

--------Class: Simulation--------

G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\10
Execution: None
Header: 100YR-240HR (10DAY) POST STORM ANALYSIS COCOA, FL

--------HYDRAULICS--------HYDROLOGY--------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	240
Drop Structure Optimizer:	10	Rain Amount(in):	20
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	246		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
120	120	246	120
200	30		
246	120		

--------GROUP SELECTIONS--------

+ BASE [10/28/02]

--------Class: Simulation--------

G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\25
Execution: None
Header: 25YR-72HR (3DAY) STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY---------

Max Delta Z (ft):	1		
Delta Z Factor:	0.005	Override Defaults:	Yes
Time Step Optimizer:	10	Storm Dur(hrs):	72
Drop Structure Optimizer:	10	Rain Amount(in):	11
Sim Start Time(hrs):	0	Rainfall File:	FLMOD
Sim End Time(hrs):	80		
Min Calc Time(sec):	0.5		
Max Calc Time(sec):	60		

To Hour:	PInc(min):	To Hour:	PInc(min):
10	40	80	40
40	10		
80	40		

--------GROUP SELECTIONS--------

BASE [10/29/02]

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STORM ANALYSIS FOR POND3 - SOLO

********** Input Report **
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\25
Execution: None
Header: 25YR-168HR (7DAY) STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 168
Drop Structure Optimizer: 10 Rain Amount(in): 14
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 168
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
20	84	172	84
84	20		
172	84		

---------GROUP SELECTIONS----------
+ BASE [12/09/02]
--------Class: Simulation----------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\POND-13\2Y
Execution: Both
Header: 2YR-24HR POST STORM ANALYSIS FOR COCOA, FL

---------HYDRAULICS----------HYDROLOGY----------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: Yes
Time Step Optimizer: 10 Storm Dur(hrs): 1
Drop Structure Optimizer: 10 Rain Amount(in): 5
Sim Start Time(hrs): 0 Rainfall File: FLMOD
Sim End Time(hrs): 24
Min Calc Time(sec): 0.5
Max Calc Time(sec): 5

To Hour:	PInc(min):	To Hour:	PInc(min):
10	60	24	15
12	15		
24	60		

---------GROUP SELECTIONS----------
+ BASE [09/17/03]

NODE MAXIMUM CONDITIONS

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2YR-24HR POST STORM ANALYSIS FOR COCOA, FL

********** Node Maximum Conditions - 2YR-24HR **********

(Time units - hours)

Node Name	Group Name	Max Time Conditions	Max Stage (ft)	Warning Stage (ft)	Max Delta Stage (ft)	Max Surface Area (sf)	Max Time Inflow	Max Inflow (cfs)	Max Time Outflow	Max Outflow (cfs)
D26	BASE	0.73	30.12	32.05	0.0050	643.38	0.75	14.37	0.63	18.97
D29	BASE	0.76	31.16	32.65	-0.0049	152.05	0.75	8.04	0.76	7.99
D30	BASE	0.78	29.24	31.40	0.0049	512.94	0.69	37.44	0.76	34.50
OFFS1TE	BASE	1.25	28.71	30.00	0.0025	625.45	0.75	19.47	0.74	18.66
OUTFALL3	BASE	12.00	27.50	27.50	0.0001	0.00	1.28	1.34	0.00	0.00
POND3	BASE	1.29	28.71	30.00	0.0021	69674.74	0.76	62.99	1.28	1.34

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POND 3 POST 25YR-24HR ANALYSIS

********** Node Maximum Conditions - 25Y24H **********

(Time units - hours)

Node Name	Group Name	Max Time Conditions	Max Stage (ft)	Warning Stage (ft)	Max Delta Stage (ft)	Max Surface Area (sf)	Max Time Inflow	Max Inflow (cfs)	Max Time Outflow	Max Outflow (cfs)
D26	BASE	12.01	31.79	32.05	0.0053	149.38	12.00	16.34	12.01	16.01
D29	BASE	12.02	32.60	32.65	0.0050	120.50	12.00	9.14	12.02	8.86
D30	BASE	12.02	30.80	31.40	0.0060	178.93	12.00	40.66	12.01	40.42
OFFSITE	BASE	16.06	30.41	30.00	0.0050	19156.13	12.00	21.04	12.00	20.84
OUTFALL3	BASE	12.00	27.50	27.50	0.0005	0.00	16.08	2.75	0.00	0.00
POND3	BASE	16.06	30.40	30.00	0.0029	76838.10	12.00	73.68	16.08	2.75

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POND 3 - POST 100YR-24HR STORM ANALYSIS

********** Node Maximum Conditions - 100YR24 **********

(Time units - hours)

Node Name	Group Name	Max Time Conditions	Max Stage (ft)	Warning Stage (ft)	Max Delta Stage (ft)	Max Surface Area (sf)	Max Time Inflow	Max Inflow (cfs)	Max Time Outflow	Max Outflow (cfs)
D26	BASE	12.10	32.74	32.05	0.0055	3867.83	12.00	20.27	12.06	17.11
D29	BASE	12.16	33.27	32.65	-0.0153	5038.90	12.00	11.34	11.90	8.77
D30	BASE	12.23	31.67	31.40	-0.0074	10084.57	12.00	44.99	11.97	43.27
OFFSITE	BASE	15.64	31.04	30.00	0.0017	49165.83	12.00	25.73	11.92	21.92
OUTFALL3	BASE	12.00	27.50	27.50	0.0004	0.00	15.88	3.83	0.00	0.00
POND3	BASE	15.62	31.04	30.00	0.0005	79616.03	11.97	79.22	15.88	3.83

ORIFICE DRAWDOWN (RECOVERY) ANALYSIS

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BLEEDER (DRAW DOWN) 24-36 HOUR FOR POND 3

********** Node Time Series by Node - BLEEDER3 **********

Time (hrs)	Stage (ft)	Surface Ar.(ac)	Inflow Base Q (cfs)	Inflow Onsite (cfs)	Inflow Offsite (cfs)	Inflow Bndry Q (cfs)	Inflow Link Q (cfs)	Link Outflow (cfs)	Cumulative Volume In (ac.ft)	Cumulative Volume Out (ac.ft)
35.600	27.30	0.00	0.00	0.00	0.00	0.00	0.39	0.00	1.1225	0.0000
35.850	27.30	0.00	0.00	0.00	0.00	0.00	0.39	0.00	1.1306	0.0000
*** Group: BASE		Node: POND3								
24.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7592
24.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7669
24.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7745
24.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7822
25.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7899
25.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.7977
25.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.8054
25.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.37	0.0000	0.8131
26.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8209
26.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8286
26.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8364
26.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8441
27.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8519
27.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8597
27.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8675
27.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8753
28.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8832
28.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8910
28.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.8988
28.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9067
29.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9146
29.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9224
29.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9303
29.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9382
30.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9461
30.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9540
30.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9619
30.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9699
31.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.38	0.0000	0.9778
31.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	0.9858
31.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	0.9937
31.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0017
32.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0097
32.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0177
32.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0257
32.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0337
33.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0417
33.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0497
33.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0578
33.850	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0658
34.100	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0739
34.350	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0820
34.600	28.18	1.54	0.00	0.00	0.00	0.00	0.00	0.39	0.0000	1.0901

1/2 TV

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.20) [1]
Copyright 1995, Streamline Technologies, Inc.

DRAWDOWN (24-30 HOURS) FOR POND 3

********** Input Report **
--------Class: Node----------
Name: OUTFALL3 Base Flow(cfs): 0 Init Stage(ft): 27
Group: BASE Warn Stage(ft): 27.5
Comment:

Time(hrs)	Stage(ft)
0	27
12	27.5
72	27

--------Class: Node----------
Name: POND3 Base Flow(cfs): 0 Init Stage(ft): 28.18
Group: BASE Warn Stage(ft): 31
Comment:

Stage(ft)	Area(ac)
28.18	1.54
29	1.621
30	1.22
31	1.822

--------Class: Weir----------
Name: ORIFICE From Node: POND3
Group: BASE To Node: OUTFALL3
Count: 1

Type: Horiz Flow: Both Geometry: Circular

Span(in): 4
Rise(in): 4
Invert(ft): 27
Control Elev(ft): 27
TABLE
Bottom Clip(in): 0
Top Clip(in): 0
Weir Discharge Coef: 3
Orifice Discharge Coef: 0.6

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.20) [2]
Copyright 1995, Streamline Technologies, Inc.

DRAWDOWN (24-30 HOURS) FOR POND 3

********** Input Report **********
--------Class: Simulation--------
G:\COCOA\BP_DEV~1\ENG\DRAINAGE\BLEEDE~1\B
Execution: Hydraulics
Header: BLEEDER (DRAW DOWN) 24-36 HOUR FOR POND 3

---------HYDRAULICS---------HYDROLOGY---------
Max Delta Z (ft): 1
Delta Z Factor: 0.005 Override Defaults: No
Time Step Optimizer: 10
Drop Structure Optimizer: 10
Sim Start Time(hrs): 0
Sim End Time(hrs): 72
Min Calc Time(sec): 0.5
Max Calc Time(sec): 60

To Hour:	PInc(min):	To Hour:	PInc(min):
10	15		
20	5		
30	15		

---------GROUP SELECTIONS---------
+ BASE [09/17/03]

STAGE STORAGE INFORMATION FOR POND # 3

WAL-MART, COCOA, FL - STORE # 174-03
STAGE-STORAGE
POND 3

	POND 3	VOLUME (AC*FT)	
STAGE	AREA (AC)	INCREMENTAL.	TOTAL
22	1.097	0.00	0.00
23	1.182	1.14	1.14
24	1.246	1.21	2.35
25	1.315	1.28	3.63
26	1.382	1.35	4.98
27	**1.453**	**1.42**	**6.40**
28	1.524	1.49	7.89
29	1.621	1.57	9.46
30	1.722	1.67	11.13
31	1.822	1.77	12.90

APPENDIX H

ENVIRONMENTAL LOOK-AROUND MEMORANDUM

Date: November 25, 2015

To: Mrs. Jazlyn Heywood, PE, FDOT Project Manager

From: Mr. John D. Whitaker, PE, Scalar Drainage Engineer

Reference: **Environmental Look-Around Memorandum**
Clearlake Road (SR 501) Widening
PD&E Study from Michigan Avenue to Industry Road
Brevard County, FL
FPID No.: 433605-1-22-01
Scalar Project No. SP14D5001

Exhibits: Project Location Map (attached)

CC: Mr. Aniruddha S. Gotmare, PE
Freddy B. Andrade, Sr., PE
Project File

PURPOSE / OVERVIEW

The *Environmental Look-Around Memorandum* is one of many documents that are assembled as part of the Project Development and Environment (PD&E) Study process of developing various alternatives for the proposed roadway improvements. The purpose of this *Environmental Look-Around Memorandum* is to document evaluated regional projects and/or regional stormwater ponds as an alternative approach to the design and construction of typical stormwater treatment ponds. Regional options may exists, other than a regional pond alternative. The sole intent is to allow for out-of-the-box stormwater treatment planning and solutions. This effort involves coordination with all the stakeholders noted in the Drainage Manual (Section 5.3: Environmental Look Arounds), including agencies such as the City, County, and TPO, on potential regional pond opportunities (i.e., joint-use ponds). This effort is in accordance with the PD&E Scope of Services and the 2015 FDOT Drainage Manual (Section 5.3: Environmental Look Arounds) where the study team is to coordinate regional stormwater needs with department staff, regulatory agencies, local governments and other local stakeholders, along with design and permitting approaches, that benefit the watershed as a whole. For the project limits of this PD&E Study, see attached **Exhibit A (Project Location Map)**.

The project team has participated in meetings with most of the stakeholders who have knowledge of alternative regional projects and nearby land developments currently in the planning phase. The effort completed is limited to the search and identification of potential regional projects and/or regional stormwater ponds. Details regarding these regional projects was not considered part of this effort. The following agencies were coordinated with during the Environmental Look-Around process:

- City of Cocoa – Planning & Zoning Department
- Brevard County Public Works Department
- St. Johns River Water Management District (SJRWMD)

Planned Developments (City of Cocoa)

Based on coordination with the City of Cocoa Planning Department, there are three developments that are in the site development stage and are all located either south of Michigan Avenue or near the western terminus point of the project.

- Clearlake Isles Apartments (south of PD&E Study)
    - Located across from Eastern Florida State College
    - Property owner is the US 1 Corridor CRA (City of Cocoa)
    - 84 senior apartments
    - Currently, going through the subdivision process

- 1234 Clearlake Road (south of PD&E Study)
    - Located in northeast quadrant of Loring Street and Clearlake Road (south of PD&E Study)
    - Comprised of commercial and office buildings

- Park N Go / SR 524 (western terminus of PD&E Study)
    - Former Home Depot Site (west of Industry Road)
    - Commercial park and ride lot that would serve cruise ship passengers to/from Port Canaveral
    - Plans are preliminary; review is on hold while discussions continue about approvals needed and site specifics required by the City

The drainage study team also coordinated with City of Cocoa regarding existing stormwater pond facilities and were not informed of any planned regional stormwater improvements in the immediate area.

Planned Developments (St. Johns River Water Management District)

The project corridor lies within the St. Johns River Water Management District's (SJRWMD) jurisdiction. Stormwater treatment of the project runoff will be provided as required by the SJRWMD criteria. The stormwater management systems proposed by this study have been coordinated with SJRWMD (Mr. Nathan Ottoson), where design criteria such as treatment requirements was established. Based on coordination with SJRWMD, no regional projects are planned at this time, nor are they aware of any new planned regional facilities.

Planned Developments (Brevard County)

The drainage study team coordinated with Brevard County regarding existing stormwater pond facilities (i.e., maintenance) and were not informed of any planned regional stormwater improvements in the immediate area.

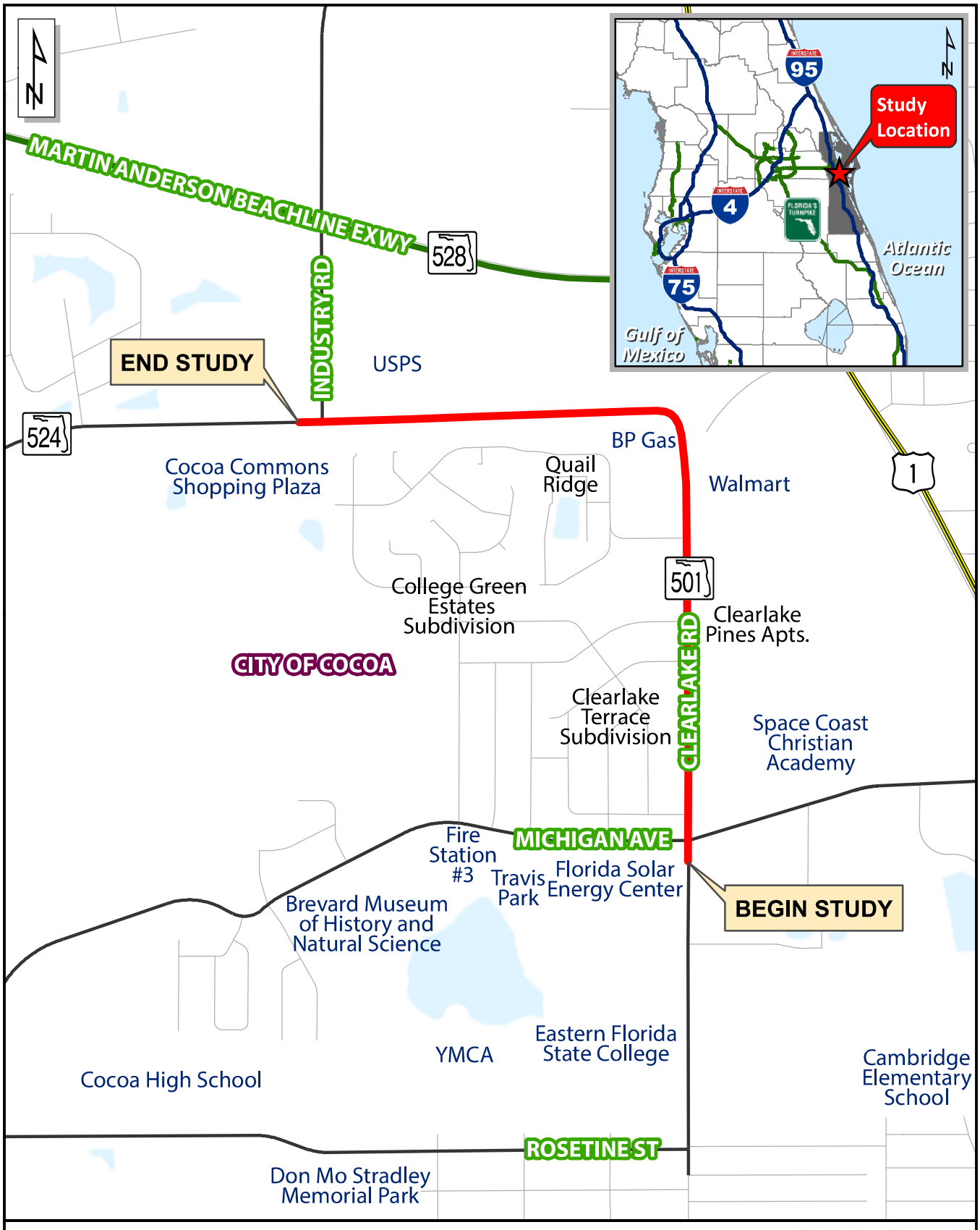
Summary

Based on detailed coordination to identify and document planned regional projects, only three active projects were identified near or within the project limits. Due to the limited stormwater treatment expansion needs for this 1.3-mile roadway improvement project, extensive available right-of-way along the east/west segment (> 225') to be used for treatment purposes, and the utilization and expansion of existing facilities (Walmart Pond), there are no regional stormwater pond opportunities as part of this project. The environmental look-around effort is considered complete.

APPENDIX H - Environmental Look-Around Memorandum

EXHIBIT A

PROJECT LOCATION MAP



Clearlake Road (SR 501) PD&E Study
From Michigan Avenue
to Industry Road
Brevard County

Study Location Map

FPID: 433605-1-22-01 | ETDM: 13120

Centennial FDOT 1915 ★ 2015

APPENDIX I

CONCEPTUAL POND ANALYSIS MEMORANDUM

Scalar Consulting Group Inc.
4152 W. Blue Heron Blvd., Suite 119
Riviera Beach, FL 33404
Ph: (561) 429-5065

Conceptual Pond Analysis Memorandum

Date:	July 1, 2016
To:	Jazlyn Heywood, PE, Florida Department of Transportation (FDOT) District 5
From:	John D. Whitaker, PE, Scalar Consulting Group Inc. (Drainage EOR)
Subject:	Pond Siting Analysis for the N/S segment of Clearlake Road (SR 501) from Michigan Avenue to Industry Road FPID No. 433605-1-22-01 / ETDM No. 13120

Project Description

The FDOT (District 5) is conducting a Project Development and Environment (PD&E) Study that proposes to widen and reconstruct Clearlake Road (SR 501) from Michigan Avenue (MP 2.235) to Industry Road (MP 3.358). See **Appendix A (Project Location Map)** for the project's location. The purpose of the PD&E Study is to evaluate engineering and environmental data, and document information that will aid in determining the type, preliminary design, and location of the proposed roadway improvements. The study meets the requirements of the National Environmental Policy Act (NEPA) and other related state and federal laws, rules, and regulations. The goal of the study is to develop a proposed roadway improvement alternative that is technically sound, environmentally sensitive and publicly acceptable with minimal community impacts.

Clearlake Road, from Michigan Avenue to Industry Road, is classified as an Urban Principal Arterial. For a short distance (0.137 miles) north of Michigan Avenue, the road has four lanes with a 12-foot paved median. For the next 0.457 miles northward, the roadway has one, 12-foot southbound lane and grass shoulders, and two, 12-foot northbound lanes with curb and gutter. For the last 0.529 miles (east/west segment), the roadway has two, 12-foot lanes, one in each direction, and 4-foot paved shoulders. The posted speed limit along this section of Clearlake Road varies (40 mph and 45 mph). The various typical sections found along this corridor are due in part to roadway improvements required of the adjacent developments. There are signalized intersections at Michigan Avenue, Otterbein Avenue, and Industry Road. It is anticipated that the improved roadway will be a 4-lane, divided, urban typical section. Refer to **Appendix B (Typical Section Package (Approved))** for additional details.

Purpose

The purpose of this memorandum is to document additional conceptual drainage analysis completed on two of the four existing drainage basins (Basin 1 and 2) located within the project limits. For Basin 1, two, dry, interconnected ditches, located along the west side of Clearlake Road from Michigan Avenue to La Marche Drive, were evaluated and analyzed (versus the originally-proposed wet, detention pond). For Basin 2, a single, wet, detention pond, located within the existing BP gas station (1.43-acre) parcel, was evaluated and analyzed to meet the treatment volume requirements and, more importantly, eliminate any impacts (i.e., widening) to the existing Walmart pond, located northeast of the 90-degree, Clearlake Road bend. The Walmart pond is the main outfall for Basin 2, which extends from nearby La Marche Drive to the 90-degree roadway bend. The proposed stormwater treatment facilities are required to provide the necessary treatment and attenuation, as set forth by St. Johns River Water Management District's (SJRWMD) permitting criteria. These treatment alternatives are being considered to be incorporated into the current roadway widening project, ultimately providing cost savings to the Department and a more aesthetically-pleasing corridor for pedestrians and bicyclists. Included

in the memorandum are drainage system maps and conceptual drainage analysis output confirming the treatment facilities will meet the required criteria, will fit within the proposed, future FDOT right-of-way (R/W) footprint, and will enhance the overall appeal of the roadway corridor.

Existing Conditions

The existing topography is, predominantly, relatively flat with elevations ranging from 32.0′ (NAVD 88) (near Michigan Avenue and Industry Road) to 46.0′ (near Calvados Drive). The surface water predominantly flows from west to east, ultimately discharging into the Indian River Lagoon, located to the east. A small portion of the project (west of Industry Road) flows west and ultimately discharges into the St. Johns River.

The majority of the study area is dominated by residential, commercial, and institutional land uses, with high-density residential being the most prevalent. Small areas of native habitat, including forested wetlands, mixed scrub-shrub wetlands, and one remnant area of forested upland, are located immediately adjacent to the existing roadway corridor. All of the described wetlands are located in the northern portion of the study area (i.e., east-west segment of Clearlake Road). Surface water features are primarily associated with the existing local stormwater management systems (i.e., Walmart Pond).

Floodplains

Based on a review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Brevard County, the entire study limits, including the anticipated offsite impact areas, are located above the 100-year floodplain. Therefore, the preferred treatment alternatives within Basin 1 and 2, being evaluated as part of this memorandum, will not result in any floodplain impacts.

Soil Survey

An inventory of the existing soils in the vicinity of Clearlake Road from Michigan Avenue to Industry Road was obtained from the United States Department of Agriculture (USDA) and Soil Conservation Services (SCS) Brevard County Soil Survey and Natural Resources Conservation Service (NRCS) website. According to the database, both upland and hydric soil types are present along the study corridor. One (1) of the most common types of upland soils found within the corridor was **Paola-Urban land complex (0 to 8 percent slopes)**. The proposed treatment facilities, detailed in this memorandum, fall within this soil region, with a hydrological group classification of ‘A’. Open areas of Paola fine sand are mostly lawns, vacant lots, and playgrounds. They are so small and so intermixed with Urban land that it is impractical to map the two separately. Paola-Urban land complex is poorly suited to lawn grasses and most ornamental plants. The water table is typically below a depth of 6.7 feet.

Contamination Assessment

A *Contamination Screening Evaluation Report* was prepared during the PD&E Study phase, based on site reviews of the area and a review of local, state and federal databases. Six (6) sites were identified as having potential for contamination adjacent to the study corridor. A wet, detention pond (Basin 2) is recommended on one of the sites (Sunshine Food Mart #121 (BP)). This particular site’s evaluation resulted in a rating of ‘low’. However, the Study Team recommends additional contamination screening be completed at this BP gas station site (i.e., Level II Contamination Testing), as highly contaminated soils may exist. If highly contaminated

soils are encountered, the Study Team recommends to remove the contaminated soils located within the proposed pond footprint, which will result in additional project costs.

Utilities

One (1) of the important elements that directly impacts potential pond site locations is existing utilities. Impacts from new pipe culverts to existing telephone, water and sanitary sewer lines that run along the west side of Clearlake Road are anticipated as part of this project. Also, existing overhead transmission lines extend along the west side of Clearlake Road and will be directly impacted by the proposed roadway widening and new stormwater treatment facilities. Within Basin 1, the Study Team recommends two, dry, retention ditches between Michigan Avenue and La Marche Drive that are interconnected with one equalizer pipe to maximize the ditch capacities and ensure predominantly dry conditions for Florida Power & Light's access to their future relocated transmission facilities.

Seasonal High Ground Water Table (SHGWT) – Basins 1 & 2

The SHGWT is the highest average depth of soil saturation during the wet season in a normal year. The SHGWT is used to design wet and dry detention and retention areas, predict soil storage and set project control elevations. Therefore, any assumptions made regarding the SHGWT are critical to the stormwater management design.

Borings were performed along the Clearlake Road study corridor that detail water elevations ranging between 24.9′ NAVD (Basin No. 2) and 28.1′ NAVD (Basin No. 1). For the purposes of the conceptual analysis, calculations use the aforementioned SHGWT elevations. These elevations are recommended by the *Geotechnical Report* prepared for the study corridor by RADISE International, LC. A complete *Geotechnical Report* is available under a separate cover.

Existing Drainage Conditions – Basins 1 & 2

Clearlake Road, from south of Michigan Avenue to west of Industry Road, is divided into four local drainage basins for stormwater management. The historical flow pattern through this area is predominantly from west to east, mainly through overland sheet flow. Offsite runoff that contributes to the mainline right-of-way is from adjacent residential parcels scattered along the corridor, along with undeveloped uplands and wetlands located north of the east/west roadway segment.

Basin 1 extends from Station 154+10 (south of Michigan Avenue) to Station 179+75 (north of La Marche Drive) and is located within the Northern Indian River Lagoon Basin. This system currently conveys runoff to Michigan Avenue, then east along Michigan Avenue where stormwater ultimately outfalls into an existing wet detention pond located on the south side of Michigan Avenue (0.4 miles east of Clearlake Road). See **Appendix D (Conceptual Drainage Maps (Basin 1 & 2)** for additional drainage system details, including flow patterns.

Basin 2 extends from Station 179+75 (north of La Marche Drive) to Station 199+25 (90° roadway bend) and is located within the Northern Indian River Lagoon Basin. This system consists of two sub-basins (2-East and 2-West). Sub-Basin No. 2-East (northbound Clearlake Road, plus southern half of southbound Clearlake Road), a closed conveyance system, discharges into an existing wet detention pond located directly north of the Walmart shopping center. Based on SJRWMD Permit No. 4-009-86250-2, the Walmart Pond is permitted to accept stormwater from 3.20 acres of Clearlake Road R/W (including 2.82 acres of impervious area). Sub-Basin No. 2-West (northern half of southbound Clearlake Road), an open-conveyance system, discharges into an existing, interconnected dry roadside swale system located adjacent

to and west of Clearlake Road. This system conveys untreated stormwater to a wet conveyance channel located northwest of the BP gas station. See **Appendix D (Conceptual Drainage Maps (Basin 1 & 2)** for additional drainage system details, including flow patterns.

Proposed Roadway & Drainage Conditions – Basins 1 & 2

Basin 1:

Within the limits of Basin 1 (south of Michigan Avenue), minor widening (< 3′) is anticipated to accommodate the southbound taper condition created by the expanded typical section at the north approach. North of Michigan Avenue, widening is proposed to accommodate four 11′ travel lanes (two in each direction), a 22′ median, 7′ dedicated bike lanes, and 6′ sidewalks located on both sides of the roadway. Intersection improvements, including an exclusive southbound right turn lane, are proposed at Michigan Avenue, as well. Conceptual drainage calculations indicate that an offsite treatment facility will be needed for this drainage basin for the preferred 'Build' alternative. An expansion of the conceptually proposed Pond 1C into two similar-sized shallow ditches, along with a change of the treatment facility type to dry retention, was evaluated based on the corridor enhancement exhibit provided by Brevard County (see **Appendix G (Brevard County Conceptual Corridor Exhibit)**). Based on preliminary calculations, this expanded stormwater facility will satisfy the treatment and attenuation requirements. A pond alternatives location map is included in the memorandum (see **Appendix D (Conceptual Drainage Maps (Basin 1 &2))**). Also, see **Appendix F (Drainage Calculations)** for the conceptual drainage calculations for Basin 1.

Basin 2:

Within the limits of Basin 2, widening is anticipated to accommodate four 11′ travel lanes (two in each direction), a 22′ median, 7′ dedicated bike lanes, and 6′ sidewalks located on both sides of the roadway. Preliminary drainage calculations indicate that the existing Walmart pond would require minor expansion (+/- 0.15 acres) to accommodate the additional roadway improvements for the preferred 'Build' alternative. However, with the introduction of a new wet, detention pond (+/- 0.8 acres) located within the BP gas station parcel, the Walmart pond could remain in its current existing condition and the new pond would provide additional treatment for Basin 2. This would be accomplished by expanding the Sub-basin No. 2-West limits by approximately 0.50 acres and accepting additional soutbound roadway runoff. The remaining outstanding treatment would be provided within the Sub-basin No. 2-West. A pond alternatives location map is included in the memorandum (see **Appendix D (Conceptual Drainage Maps (Basin 1 &2))**). Also, see **Appendix F (Drainage Calculations)** for the conceptual drainage calculations for Basin 2.

Criteria – SJRWMD

Drainage improvements are required in conjunction with the roadway improvements. Refer to **Appendix E (Drainage Design Criteria Matrix)** for additional details on the criteria applicable to the design of the proposed stormwater management facilities.

Table 1 – Pre-Development Site, Peak Flow & Peak Stage Data

Basin / System No.	Impervious Area (ac)	Pervious Area (ac)	Pervious Pond Area (ac)	Water Surface Area (ac)	Total Area (ac)	Peak Flow * (cfs)
1	2.99	1.94	1.45	0.00	6.38	4.41
2 (East)	8.56	1.83	0.38	1.44	12.21	9.25
2 (West)	1.60	1.13	0.00	0.00	2.73	1.95

* Based on 25-year / 24-hour design storm event

Table 2 – Post-Development Site, Peak Flow & Peak Stage Data

Basin / System No.	Impervious Area (ac)	Pervious Area (ac)	Pervious Pond Area (ac)	Water Surface Area (ac)	Total Area (ac)	Peak Flow * (cfs)	Freeboard Clearance (ft.)
1	2.87	2.06	1.45	0.00	6.38	4.39	1.00+
2 (East)	8.56	1.83	0.38	1.44	12.21	9.25	1.00+
2 (West)	2.53	1.78	0.28	0.50	5.09	3.65	1.00+

* Based on 25-year / 24-hour design storm event

Table 3 – Required Water Quality (Post-Development) – 'Build' Alternative 1VE

Basin / System No.	Exist. Treatment Provided (ac-ft)	Treatment Volume (2.5" x Total Impervious Area (ac-ft)	Direct Discharge Into Impaired Waterway (150%)	Attenuation Treatment	Total Req'd. Treatment Volume (ac-ft)	Total Provided Treatment Vol. (ac-ft)
1	0.00	0.30	N/A	-0.02	0.28	0.50
2 (East)*	1.78	1.78	N/A	0.00	1.78	1.78
2 (West)	0.00	0.53	N/A	0.64	1.17	1.18

* Treatment provided in existing Walmart Wet Detention Pond (SJRWMD ERP Permit No. 40-009-86250-2)

Table 4 – Final Required Pond Areas – 'Build' Alternative 1VE

Basin / System No.	Control Elevation / Normal Water Level (NWL; NAVD)	Wet Surface Area at NWL (ac.)	Pond R/W without 10% Safety Factor (ac.)	Pond R/W with 10% Safety Factor (ac.)
1	28.10	0.00 (Dry)	0.73	0.80
2 (East)*	25.65*	1.44*	N/A*	N/A*
2 (West)	24.90	0.55	0.71	0.78

* Existing Walmart Wet Detention Pond proposed to remain as permitted (SJRWMD ERP Permit No. 40-009-86250-2). As such, no Walmart pond sizing calculations provided as part of this memorandum.

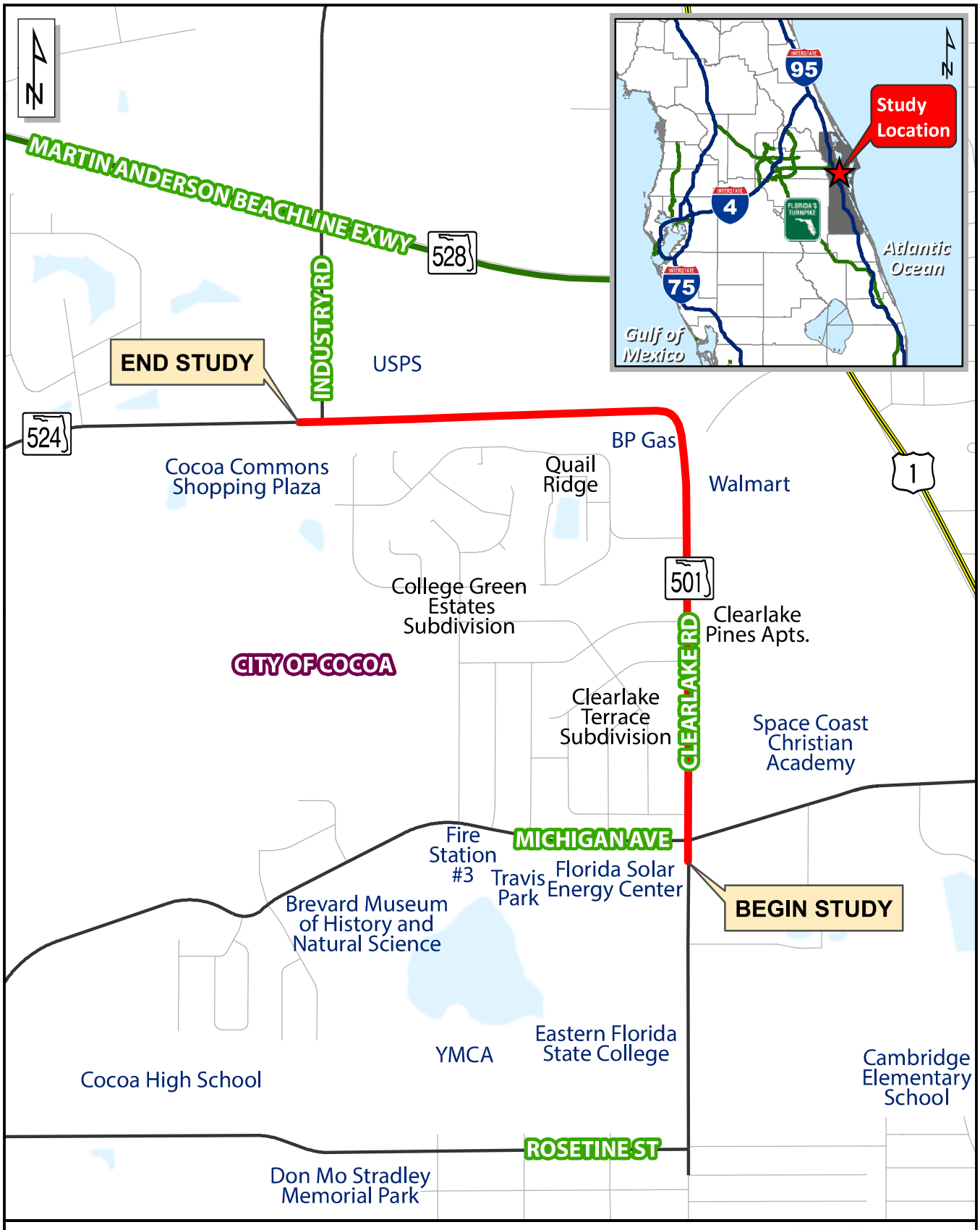
Conclusion / Recommendations

After a detailed review of the conceptual drainage analysis of the newly recommended treatment alternatives for Basin 1 and 2, a determination has been made that the proposed treatment facilities (Basin 1: two, interconnected, dry, retention ditches; Basin 2: single wet, detention pond) will adequately accommodate the proposed roadway improvements.

APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX A

PROJECT LOCATION MAP



Clearlake Road (SR 501) PD&E Study
From Michigan Avenue
to Industry Road
Brevard County

Study Location Map

FPID: 433605-1-22-01 | ETDM: 13120

Centennial FDOT 1915 ★ 2015

APPENDIX I - Conceptual Pond Analysis Memorandum

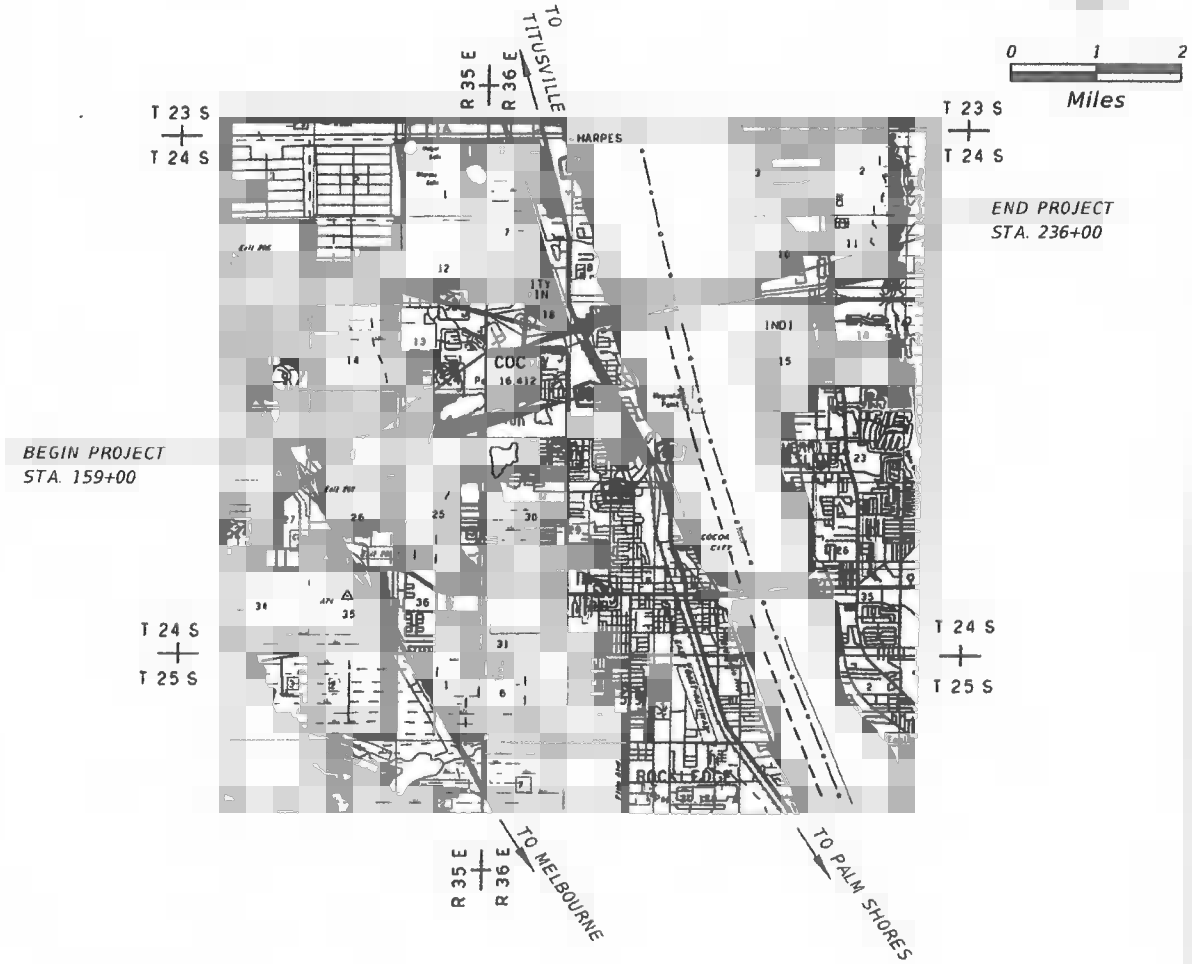
APPENDIX B

TYPICAL SECTION PACKAGE (APPROVED)

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTION PACKAGE

FINANICAL PROJECT ID: 433605-1-52-01
BREVARD COUNTY (70011)
SR 501 (CLEARLAKE ROAD)



LENGTH OF PROJECT SR 501	(FEET)	(MILES)
ROADWAY	7,700.00	1.458
BRIDGES	0.00	0.000
NET LENGTH	7,700.00	1.458
EXCEPTIONS	0.00	0.000
GROSS LENGTH	7,700.00	1.458

SCALAR CONSULTING GROUP INC.
4152 W. BLUE HERON BOULEVARD, SUITE 119
RIVIERA BEACH, FL 33404
TEL. NO. (561) 429-5065
CERTIFICATE OF AUTHORIZATION NO. 29560
CONTRACT NO. C-9H54
VENDOR NO. 451909667002
ENGINEER OF RECORD: ANIRUDDHA GOTMARE, P.E.
FL P.E. NO. 54801

PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 433605-1-52-01 COUNTY (SECTION) BREVARD (70011)

PROJECT DESCRIPTION SR 501 (CLEARLAKE ROAD) WIDENING FROM SOUTH OF MICHIGAN AVE. TO WEST OF INDUSTRY ROAD.

PROJECT CONTROLS

FUNCTIONAL CLASSIFICATION

( ) RURAL

(X) URBAN

( )	FREEWAY/EXPWY.	( )	MAJOR COLL.
(X)	PRINCIPAL ART.	( )	MINOR COLL.
( )	MINOR ART.	( )	LOCAL

HIGHWAY SYSTEM

Yes	No	
(X)	( )	NATIONAL HIGHWAY SYSTEM
( )	(X)	STRATEGIC INTERMODAL SYSTEM
(X)	( )	STATE HIGHWAY SYSTEM
( )	(X)	OFF STATE HIGHWAY SYSTEM

ACCESS CLASSIFICATION

( ) 1 - FREEWAY

( ) 2 - RESTRICTIVE w/Service Roads

( ) 3 - RESTRICTIVE w/660 ft. Connection Spacing

( ) 4 - NON-RESTRICTIVE w/2640 ft. Signal Spacing

(X) 5 - RESTRICTIVE w/440 ft. Connection Spacing

( ) 6 - NON-RESTRICTIVE w/1320 ft. Signal Spacing

( ) 7 - BOTH MEDIAN TYPES

CRITERIA

(X) NEW CONSTRUCTION / RECONSTRUCTION

( ) RRR INTERSTATE / FREEWAY

( ) RRR NON-INTERSTATE / FREEWAY

( ) TDLC / NEW CONSTRUCTION / RECONSTRUCTION

( ) TDLC / RRR

( ) MANUAL OF UNIFORM MINIMUM STANDARDS (FLORIDA GREENBOOK) (OFF-STATE HIGHWAY SYSTEM ONLY)

TRAFFIC

	YEAR	AADT
CURRENT	2016	20,000
OPENING	2023	22,000
DESIGN	2043	26,000

DESIGN SPEED

STA. 159+00 TO STA. 188+50	45
STA. 188+50 TO STA. 208+00	35
STA. 208+00 TO STA. 236+00	45

POSTED SPEED

STA. 159+00 TO STA. 188+50	45
STA. 188+50 TO STA. 208+00	35
STA. 208+00 TO STA. 236+00	45

DISTRIBUTION

K	9%
D	55.3%
T_{24}	7.1%

DESIGN SPEED APPROVALS

AK Brennan — 2/9/2016

DISTRICT DESIGN ENGINEER — DATE

Robert B. Moore — 3/8/16

DISTRICT TRAFFIC OPERATIONS ENGINEER — DATE

LIST ANY POTENTIAL EXCEPTIONS AND VARIATIONS RELATED TO TYPICAL SECTION ELEMENTS:

N/A

LIST MAJOR STRUCTURES LOCATION/DESCRIPTION - REQUIRING INDEPENDENT STRUCTURE DESIGN:

N/A

LIST MAJOR UTILITIES WITHIN PROJECT CORRIDOR:

BREVARD COUNTY PUBLIC WORKS ENGINEERING
CITY OF COCOA
FLORIDA CITY GAS
FLORIDA GAS TRANSMISSION - MELBOURNE
FLORIDA POWER & LIGHT
MCI
AT&T DISTRIBUTION
TRANSCORE
BRIGHT HOUSE NETWORKS, LLC

LIST OTHER INFORMATION PERTINENT TO DESIGN OF PROJECT:

DESIGN SPEED CHANGES FROM 45 MPH TO 35 MPH TO ACCOMODATE THE CURVE AND R/W IMPACTS.

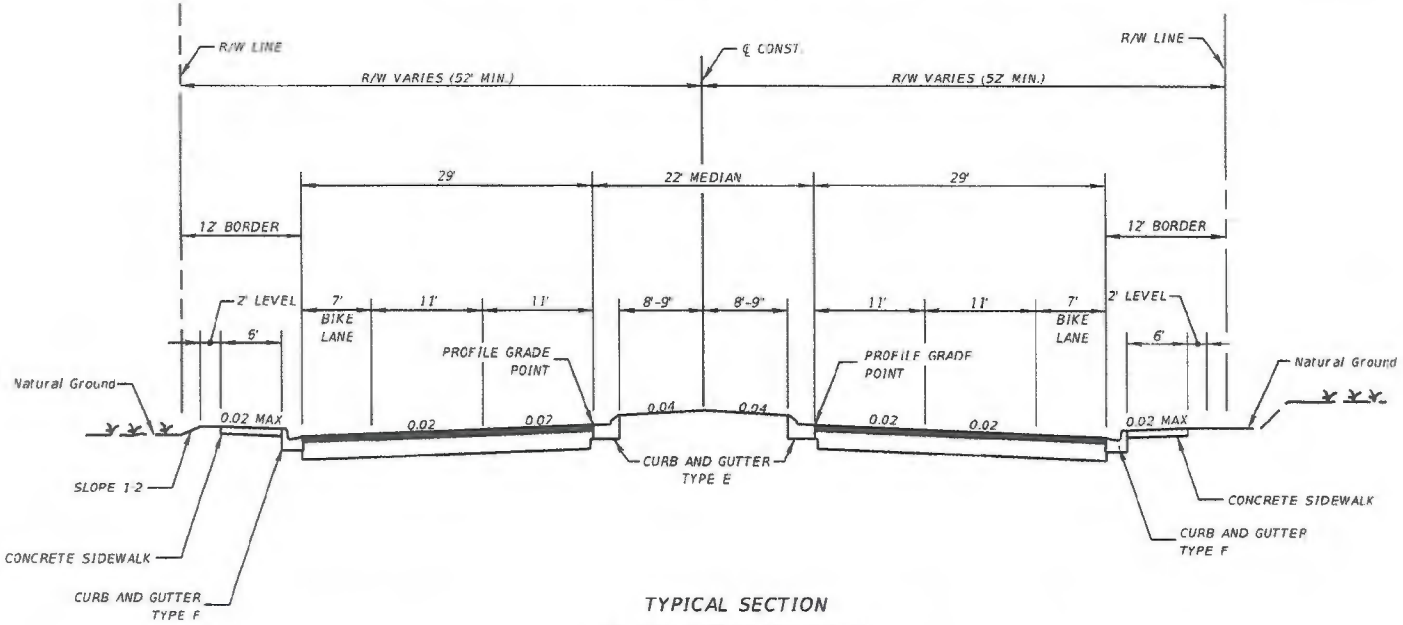
PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 433605-1-52-01 FEDERAL AID PROJECT NO. N/A COUNTY NAME BREVARD

SECTION NO. 70011 ROAD DESIGNATION SR 501 LIMITS/MILEPOST SOUTH OF MICHIGAN AVE. (MP 2.235) TO WEST OF INDUSTRY ROAD (MP 3.358)

PROJECT DESCRIPTION SR 501 (CLEARLAKE ROAD) WIDENING FROM SOUTH OF MICHIGAN AVENUE TO WEST OF INDUSTRY ROAD

PROPOSED ROADWAY TYPICAL SECTION



TYPICAL SECTION
SR 501 (CLEARLAKE ROAD)
STA. 159+00 TO STA. 188+50

DESIGN SPEED = 45 MPH

APPROVED BY: ANIRUDDHA GOTMARE, P.E.	FDOT CONCURRENCE	RECOMMENDED BY
Engineer of Record Scalar Consulting Group, Inc 4152 W. Blue Heron Boulevard, Suite Riviera Beach, FL 33404	Annette K. Brennan, P.E. FDOT District Design Engineer	Amy Sirmans, P.E. D-5 Project Development Engineer
1/25/2016 Date	2/9/2016 Date	N/A Date

ANIRUDDHA S. GOTMARE LICENSE NO. 54801 STATE OF FLORIDA PROFESSIONAL ENGINEER

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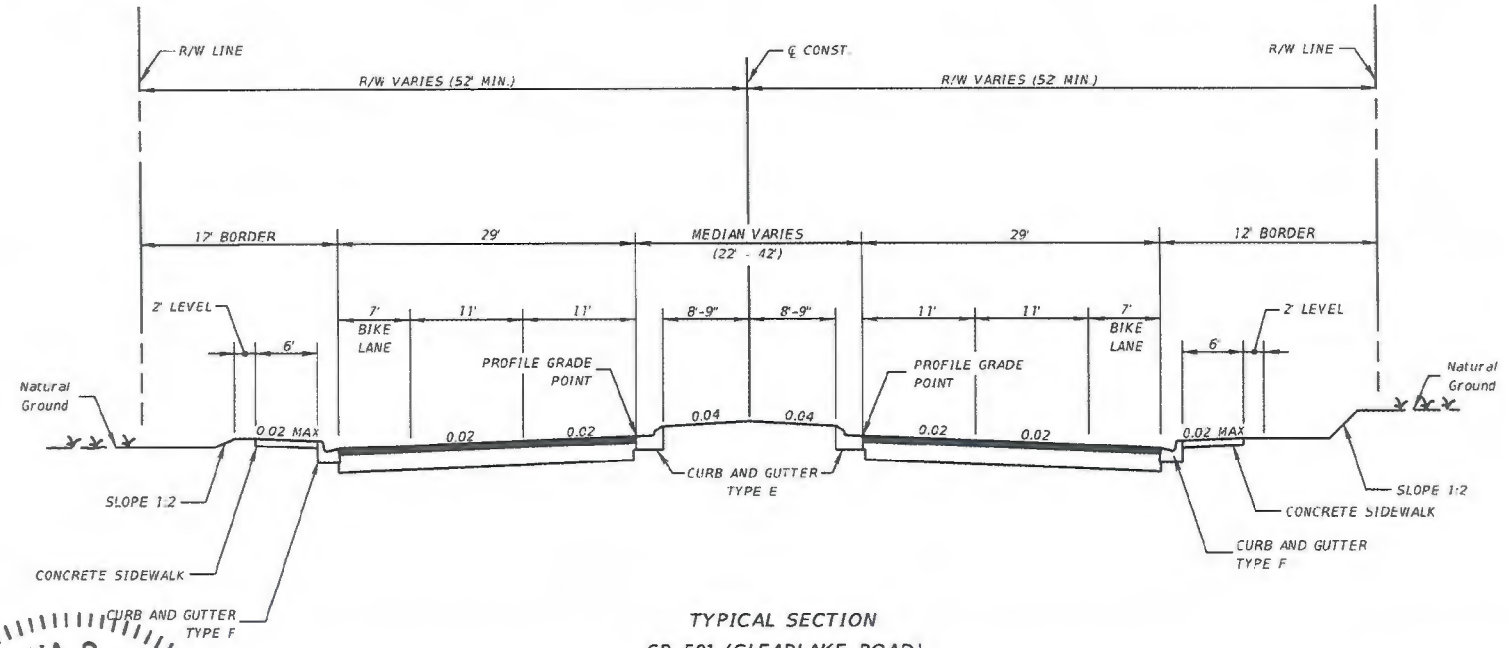
PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 433605-1-52-01 FEDERAL AID PROJECT NO. N/A COUNTY NAME BREVARD

SECTION NO. 70011 ROAD DESIGNATION SR 501 LIMITS/MILEPOST SOUTH OF MICHIGAN AVE. (MP 2.235) TO WEST OF INDUSTRY ROAD (MP 3.358)

PROJECT DESCRIPTION SR 501 (CLEARLAKE ROAD) WIDENING FROM SOUTH OF MICHIGAN AVENUE TO WEST OF INDUSTRY ROAD.

PROPOSED ROADWAY TYPICAL SECTION



TYPICAL SECTION
SR 501 (CLEARLAKE ROAD)
STA. 188+50 TO STA. 236+00

DESIGN SPEED = 35 MPH / 45 MPH

APPROVED BY: ANIRUDDHA GOTMARE, P.E.	FDOT CONCURRENCE	RECOMMENDED BY
STATE OF FLORIDA PROFESSIONAL ENGINEER ANIRUDDHA S. GOTMARE LICENSE No. 54801 Engineer of Record Scalar Consulting Group, Inc. 4152 W. Blue Heron Boulevard, Suite 1 Riviera Beach, FL 33404 1/25/2016 Date	Annette K. Brennan, P.E. FDOT District Design Engineer 2/9/2016 Date	Amy Sirmans, P.E. D-5 Project Development Engineer N/A Date

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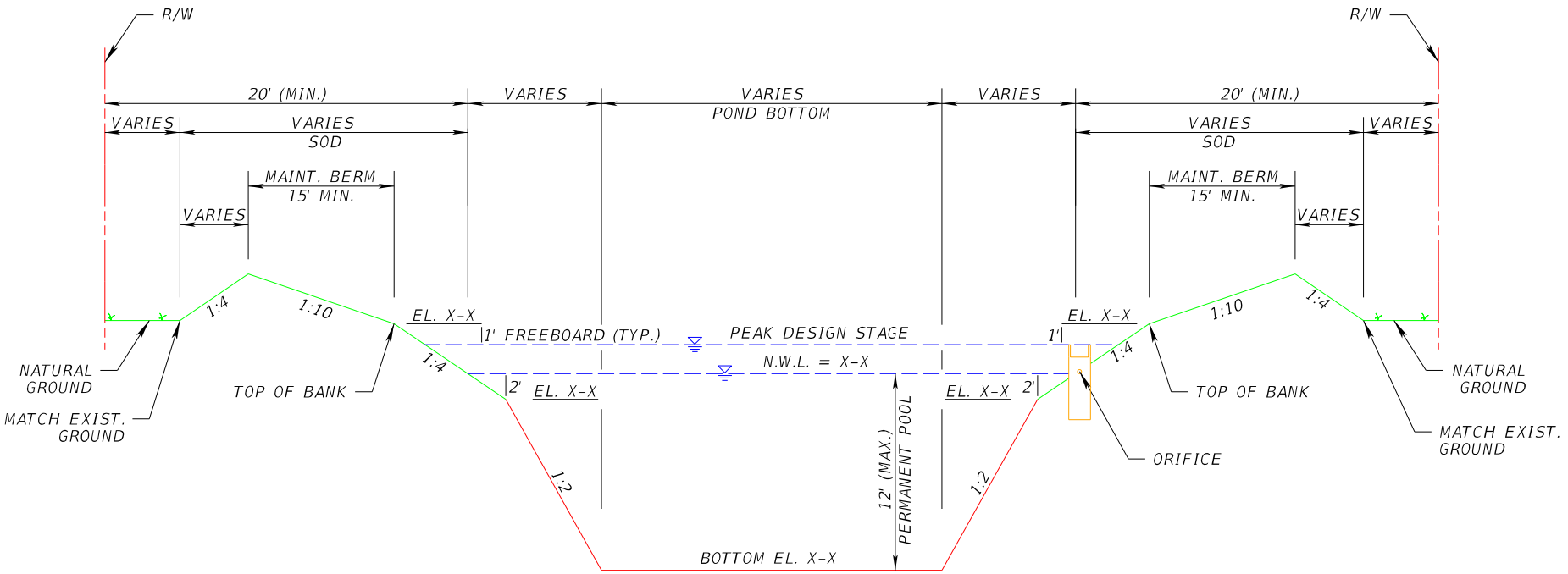
APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX C

TYPICAL SECTION FOR STORMWATER TREATMENT POND (BASIN 2)



CLEARLAKE ROAD STORMWATER TREATMENT PONDS (TYPICAL)

NOTES

- ELEVATION TOLERANCES, FOR POND STRUCTURE, HAVE BEEN ACCOUNTED FOR IN THE DESIGN OF THIS STORMWATER MANAGEMENT FACILITY.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

NOT FOR CONSTRUCTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
501	BREVARD	433605-1-22-01

TYPICAL SECTION
WET DETENTION PONDS

SHEET NO.
-

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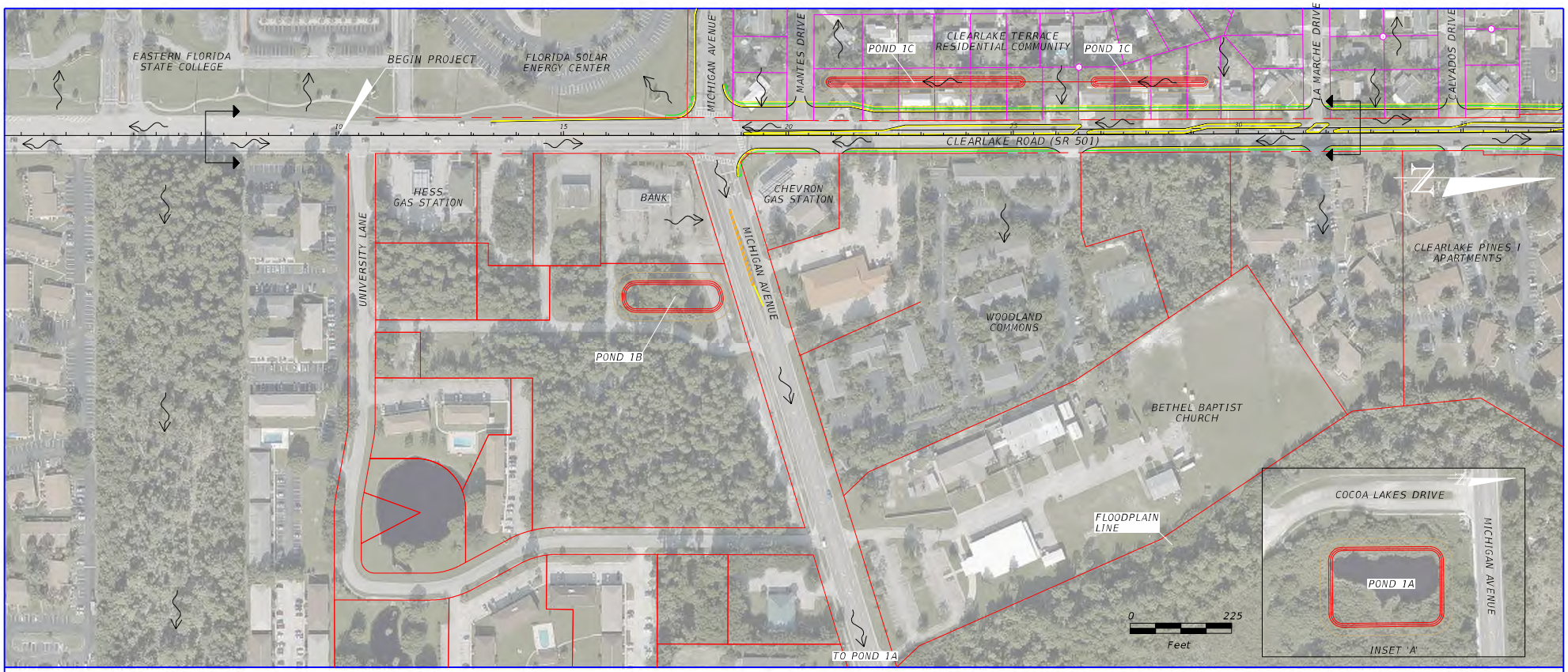
APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX D

CONCEPTUAL DRAINAGE MAPS (BASIN 1 & 2)



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
1A	1	1.40 ACRES	-	EXPAND EXIST. WET DETENTION POND
1B	1	0.60 ACRES	-	PROP. WET DETENTION POND
1C	1	0.83 ACRES	-	10 PARCELS IMPACTED; 2 PROP. DRY RETENTION DITCHES

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY FROM MICHIGAN AVENUE TO INDUSTRY ROAD

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

DRAINAGE SYSTEM 1
BUILD ALTERNATIVE NO. 1VE

BASIN NO. 1A

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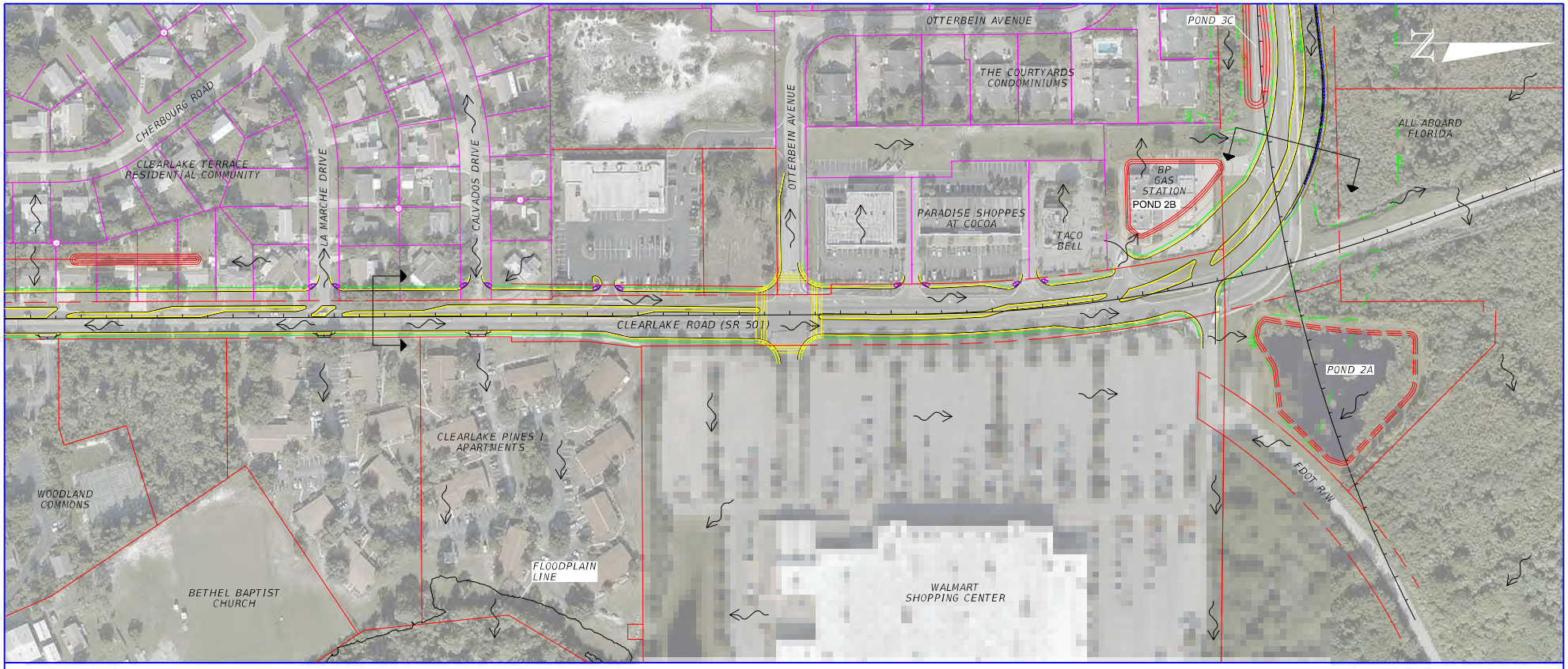

REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
2A	2	1.82 ACRES	24-36-17-00-256	EXISTING 'WALMART' POND - TO REMAIN
2B	2	0.78 ACRES	24-36-18-00-766	POND "FOOTPRINT" LOCATED ON GAS STATION

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
8/5/15	501	BREVARD	433605-1-22-01

DRAINAGE SYSTEM 2
BUILD ALTERNATIVE NO. 1VE

BASIN NO.
2A

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APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX E

DRAINAGE DESIGN CRITERIA MATRIX

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Design Frequency and Analysis for Pipe Hydraulics	N/A	Rational Method required. General design= 3-year/ 24-hour (P=5.5 in) Composite C-value- Impervious= 0.95, Pervious= 0.20	FDOT
	Spread	N/A	Analyze with 4 in./hr. rainfall intensity. Based on the design speed, 1/2 of lane shall remain clear (45 mph or less). Keep 8' lane clear (between 45 mph to 55 mph). With shoulder gutter, 10-year freq. storm shall not exceed 1'-3" outside gutter toward front slope. Refer to the 2014 FDOT Drainage Manual Section 3.9.1.	FDOT
	Inlet Types	N/A	FDOT Inlets (Design Standards 2014)	FDOT
	Maximum Inlet Interception Rates	N/A	FDOT Storm Drain Handbook (2012) Appendix A (Inlet Efficiencies)	FDOT
	Inlet Placement	N/A	Inlets shall be placed at all low points in the gutter grade. For curb inlets on a continuous grade, a maximum spacing of 300 feet shall be used unless spread calculations indicate a greater spacing is acceptable. Curb inlets shall be placed ten to twenty feet prior to the level section in superelevated transitions. Refer to the 2014 FDOT Drainage Manual Section 3.7.1.1	FDOT
	System Velocity	N/A	Min. velocity = 2.5 fps when flowing full	FDOT
	Pipe Lengths	N/A	18" Pipe - max. 300 ft. 24" to 36" - max. 400 ft. 42" and larger - max. 500 ft. Refer to the 2014 FDOT Drainage Manual Section 3.10.1.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Hydraulic Grade Line	N/A	Friction and energy losses due to pollution control and utility conflict structures shall be considered for the storm sewer design event (3-year / 24-hour). If minor losses are not considered in addition to the above losses, the hydraulic grade line (HGL) for the design storm shall be at least 1 ft. below the theoretical gutter elevation. If all minor losses are considered, the HGL elevation can reach the gutter elevation. This criteria does not apply to ditch bottom inlets (DBIs) or structures where temporary ponding is not objectionable.	FDOT (minor losses will be considered in the storm sewer design)
	Design Tailwater	N/A	When discharging to stormwater ponds, the tailwater shall be the elevation of the pond at the peak inflow into the pond for the storm sewer design event (3-year / 24-hour). The tailwater shall be computed assuming the pond control orifice plugged and starting initial pond elevation at the weir. For free flowing ditches - normal depth in the ditch at the storm drain outlet for the storm drain design event (may differ from ditch design event). For ditches with downstream control - the higher of either the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the location of the connection for the storm drain design storm event.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Pipe Clearance	N/A	The minimum distance between the bottom of the roadway base material and the top of the pipe (outside edge) is 12" for all pipe materials as detailed in FDOT Design Standard Index 205. Utilities- If utility has been accurately located, clearance between the outside of the storm drain pipe and the utility shall not be less than 6 in. If the location of the utility has been estimated, the clearance should not be less than 1 ft.	FDOT
	Pipe Material	N/A	Optional Material Analysis to be performed for this project; Culvert Service Life Estimator (CSLE) program will be used for selection of appropriate materials.	FDOT
	Pipe Size	N/A	Truck line and lateral, min. = 18". 18" minimum pipe size does not apply to connections from external, private Stormwater Management Facilities. Refer to the 2014 FDOT Drainage Manual Section 3.10.1.	FDOT
Culvert Design	Minimum Size and Length	N/A	Cross drain = 18"; Median Drain = 15"/ 18"; Side Drain = 15"/18"; Box Culvert = 3' x 3' (Precast) 4' x 4' (Cast in Place). Pipe lengths shall follow the criteria for storm sewers. Max. Length for box culverts = 500 ft.	FDOT
	Design Procedure	N/A	Refer to the 2014 FDOT Drainage Manual Chapter 4 and the 2004 FDOT Drainage Handbook Culvert Design.	FDOT
Hydrologic and Hydraulic Calculations for all other Drainage Features	Peak Discharge and Runoff Volume	Use one of the following methods: 1) NRCS Curve Number and Unit Hydrograph Method, 2) Santa Barbara Urban Hydrograph Method, or 3) USACOE HEC-1 Programs 4) Other hydrographs methods approved by the District	For Open Channels and Crossdrains- Use gauge data when available. If not available, use regional or local regression equations (USGS) or use the rational equation for drainage areas up to 600 acres. For Stormwater Management Facilities, one of the following is acceptable: (1) for basins with a time of concentration (tc) of 15 minutes or less, the modified rational method shall be used OR (2) the SCS Unit Hydrograph method shall be used.	SJRWMD- SCS unit-hydrograph method Uh256

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Hydrologic and Hydraulic Calculations for all other Drainage Features	Design Frequency	Stormwater Management Facilities- 10 year- 24 hour storm event.	Roadside Ditches- 10 yr.; Outfall Ditches and Canals- 25-yr.; Off-site crossdrain- 50-yr; Stormwater Management Facilities-Critical Duration Analysis (Chapter 14-86)	SJRWMD and FDOT Critical Duration (if applicable)
	Time of Concentration (Tc)	TR-55 (Overland flow, storm sewer flow, channel flow). Minimum Tc= 10 minutes.	Velocity Method (Overland flow using Kinematic Wave equation, Shallow Channel Flow using V=kS^0.5, main channel flow using Manning's equation). Minimum Tc = 10 minutes. TR-55 methodology acceptable.	TR-55 methodology (SJRWMD and FDOT accepted)
	Design Storm Duration	24-hour storm duration for stormwater mgmt. facilities	24-hour storm duration for closed drainage systems and roadside ditches. Chapter 14-86 - Critical Duration Analysis (1-hour through 10-day duration)	SJRWMD and FDOT Critical Duration (if applicable)
	Rainfall Distributions	SJRWMD's Technical Publication and Technical Memorandum; SJRWMD Environmental Resource Permit Applicant's Handbook (Volume 1).	FDOT Rainfall Distributions	SJRWMD and FDOT Critical Duration (if applicable)
	Water Quality/ Treatment (Wet Detention/ Dry Retention)	Required treatment volume = 1" over the drainage area or 2.5" times the impervious area (excluding water bodies), whichever is greater (Wet Detention Systems). Pre-Post Pollutant Loading Calculations for the Impaired Water Body will be required.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quantity/ Attenuation	**Open Basins:** Post-development peak discharges shall be at or below pre-development peak discharges for the 25-year /24- hour storm events.	Post-development peak discharge cannot exceed pre-development peak discharge for all frequencies and duration from the 2-year/ 1-hour storm event to the 100-year / 10-day storm event (closed basins) and up to the 3-day duration (open basins) and those between (Critical Duration Analysis)	SJRWMD and FDOT Critical Duration (if applicable)
	Off-site Flows	N/A	When possible, offsite flows/discharges should be separated from the FDOT facilities.	FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Retention and Detention Facilities	Pond Configuration- Wet Ponds (for additional info, see Open Drainage Facilities	SJRWMD Permit Information Manual - Shallow littoral zones are desirable, but not required, for water quality enhancement (Please see Section 8.6 - Littoral Zone for more information). SJRWMD Permit Information Manual (Section 8.9) - The average length-to-width dimensional ratio of the pond must be at least 2:1. Ponds shall be designed to provide a minimum 20 feet of horizontal clearance between the control elevation and Right-of-Way.	Pond Depth specified by the Regulatory Agency (SJRWMD).	SJRWMD
Retention and Detention Facilities	Littoral Zone (Wet Detention)	SJRWMD Permit Information Manual (Section 8.6) - Shall be sloped 1:6 or flatter . The littoral area shall be shallower than 3 feet as measured from below the normal water level or control elevation. At least 30% of the wet detention pond surface area shall consist of a littoral zone. Planting of a littoral is recommended to meet the 80% coverage requirement.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quality/Quantity Volume Recovery Rate (Wet Detention/Dry Retention	The outfall structure shall be designed to drawdown one-half the required treatment volume within 24 and 30 hours following a storm event.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Orifice/Bleeder Devices (Wet Detention)	Drawdown devices shall incorporate dimensions no smaller than 6 square inches of cross-section area that is 2 inches wide or less than 20° for "V" notches shall include a device to eliminate clogging.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Skimmer	Systems which receive stormwater from areas with a greater than 50% impervious area (excluding water bodies) or which are a potential source of oil and grease must include a baffle, skimmer, grease trap or other mechanism suitable for preventing oil and grease from leaving the stormwater system in concentrations that would cause a violation of water quality standards.	Oil skimmer is required and should be designed to function from an elevation of 6 in. below the elevation of inflow to the outfall control structure to an elevation of 6 in. above the DHW of the pond. It should also cover all directions of inflow to the outfall control structure.	FDOT and SJRWMD
	Erosion Control Measures	N/A	Sod from the Pond Berm up to 2' below the Control Elevation (NWL)	FDOT
Floodplain	Compensation	"Cup to cup" methods; design storm is 100 yr-72 hr. for floodplain compensation and flood protection of finished floors.	Specified by the Regulatory Agency (SJRWMD)	FDOT and SJRWMD

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Requirements for Maintenance Berms around Perimeter of Ponds	N/A	Ponds - 20 ft. horizontal clearance between top edge of the normal pool elevation and right-of-way (R/W) line. At least 15 ft. of berm adjacent to the pond shall be at a 1:8 slope or flatter. For wet ponds, keep the lowest point of the maintenance berm at least 1 ft. above the top of the treatment volume to minimize saturation of the maintenance berm. 1 ft. of freeboard is required above the maximum DHW. Inside edge of the berm shall have a minimum 30 ft. radius to accommodate the largest maintenance equipment (preference is 35 ft.). Refer to the D4 Drainage Checklist (8/2007).	FDOT
	Maximum Side Slopes for Ditches/ Canals	For permanently wet ponds or ditches, side slopes can be no steeper than 1:4 (average pond side slope) out to a depth of 2-feet below the control elevation.	Base on FDOT Clear Zone Criteria	FDOT
	Maximum Side Slopes for Ponds		Use 1:4 side slope for ease with maintenance. Side slope steeper than 1:3 require special equipment for mowing.	SJRWMD
	Minimum Longitudinal Slope	N/A	0.005 ft./ft.; Refer to the 2009 FDOT Open Channel Drainage Handbook.	FDOT
	Minimum Bottom Width	N/A	V-bottom allowed on swales/ditches; 3 ft. minimum bottom is desirable. Refer to the 2009 FDOT Open Channel Drainage Handbook.	FDOT
Open Drainage Facilities (Ponds, Ditches, Canals)	Tailwater Conditions for Ponds	For regulated systems the design and maintained stage elevations are available either from the respective local jurisdiction or the District. For non-regulated systems, water stages are computed from the best available data and must be submitted to the District for review and concurrence.	Free flowing ditches - normal depth flow in the ditch at the storm drain outlet for storm drain design storm event (may differ from ditch design storm event). For ditches with downstream control - the higher of the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design storm event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the connection for the design storm event.	SJRWMD and FDOT

DRAINAGE DESIGN CRITERIA MATRIX

Project: Clearlake Road (SR 501) PD&E Study
Financial Project No.: 433605-1-22-01
County: Brevard

Design Parameter		SJRWMD Criteria	FDOT Criteria	Drainage Criteria to be Used
	Erosion Control Measures (by max. velocity)	N/A	Grass with Mulch, Bare soil, Sod - 4 fps max vel.; Riprap (rubble) (ditch lining) - 6 fps max vel. (refer to FDOT Drainage Manual, Table 2.4)	FDOT
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Freeboard	N/A	1 ft. above DHW elevation. Less freeboard is acceptable when a permanent contaminant, such as concrete, is provided.	FDOT
	Treatment Swales (Manmade Trench)	Top width to depth ratio of the cross-section equal to or greater than 6:1, or side slopes equal to or greater than 3:1 (horizontal to vertical). Refer to SJRWMD's Permit Information Manual - Section 2.1 (u).	Swale drainage only permitted in Type A Soil Conditions. Refer to the 2009 FDOT Open Channel Drainage Handbook (Section 3.1).	SJRWMD and FDOT

APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX F

DRAINAGE CALCULATIONS

TIME OF CONCENTRATION

BASIN: 1 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	40
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.21**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**12.54**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,250
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.68**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**40.83**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
53.38

TIME OF CONCENTRATION

BASIN: 2 (Pre-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	40
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.005
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.21**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**12.54**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	1,350
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.73**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**44.10**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
56.64

TIME OF CONCENTRATION

BASIN: 1 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	300
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.16**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**9.80**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
29.65

TIME OF CONCENTRATION

BASIN: 2 (Post-Development)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd.
Financial 433605-1-22-01 Designer: JDW
County: Brevard Date: 9/7/2015

1. KINEMATIC WAVE EQUATION : TIME OF CONCENTRATION, OVERLAND FLOW

METHOD: FDOT DRAINAGE MANUAL, 1987

OVERLAND FLOW LENGTH, L (ft)	55
MANNING'S ROUGHNESS COEFFICIENT, n	0.35
AVERAGE SLOPE OF OVERLAND PATH, S (ft / ft)	0.003
RAINFALL (2-YR/24-HR), P (in)	5.3

METHOD: SCS TECHNICAL RELEASE 55, JUNE 1986

Th2 = ((0.007) x (n x L)^0.8) / ((P^0.5) x (S^0.4))

OVERLAND FLOW TRAVEL TIME, Th_1 (Hours)	**0.33**
OVERLAND FLOW TRAVEL TIME, Tm_1 (Minutes)	**19.85**

2. TIME OF CONCENTRATION, SHALLOW CONCENTRATED FLOW

Velocity, V (fps) = 16.1345 x (S^0.5)
Th = L / V x 3600)

FLOW LENGTH, L (ft)	300
AVERAGE SLOPE OF PATH, S (ft / ft)	0.001
VELOCITY, V (fps)	**0.51**
OVERLAND FLOW TRAVEL TIME, Th_2 (Hours)	**0.16**
OVERLAND FLOW TRAVEL TIME, Tm_2 (Minutes)	**9.80**

3. TOTAL TIME OF CONCENTRATION

$Tc = Tm_1 + Tm_2$

Tc (SCS)
29.65

PRE-DEVELOPMENT - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 154+10 Roadway Length = 2565 ft

To: 179+75 R/W Width = 73 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	9.0 ft	1	9 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	6.0 ft	1	6 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		67 ft

Impervious Roadway Area: 1.99 ac

Pervious Roadway Area: 0.29 ac

Total Roadway Area: 2.28 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 2.99 ac (Rdwy. Imperv. Area = 1.99 ac)

Pervious Area: 3.39 ac

Total Area: 6.38 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.99	293.02
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	3.39	271.20
		Total:	6.38	564.22

CN = Total CN * Area / Total Area = 88.4

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.31			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.29	12.79	6.38
		Total Runoff (ac-ft) =	4.41	6.80	3.39
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	8.0 ft	1	8 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	5.0 ft	2	10 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		70 ft

Impervious Roadway Area: 3.20 ac

Pervious Roadway Area: 0.20 ac

Total Roadway Area: 3.40 ac

Pond Area: Pervious Pond Area = 0.38 ac (Exist. Wet Pond)

Water Surface Area = 1.44 ac (Exist. Wet Pond)

Total Area: Impervious Area: 8.56 ac

Pervious Area: 1.83 ac

Total Area: 12.21 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	8.56	838.88
Existing Ponds (Water Surface)	D	100	1.44	144.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	2.21	176.80
		Total:	12.21	1159.68

CN = Total CN * Area / Total Area = 95.0

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 - 10 =	0.53			
	CN	Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2$	Direct Runoff (Q) =	9.09	13.63	7.15
	(P + 0.8S)	Total Runoff (ac-ft) =	9.25	13.87	7.27
Total Runoff (R_t) =	A*Q/12				

PRE-DEVELOPMENT - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 9/9/2015

County: Brevard

Station Limits: From: 188+10 Roadway Length = 1115 ft

To: 199+25 R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	12.0 ft	4	48 ft
Imp. Median (Avg.)	8.0 ft	1	8 ft
Bike Lane	-	-	-
Sidewalk (Avg.)	5.0 ft	2	10 ft
Curb & Gutter (E)	-	-	-
Curb & Gutter (F)	2.0 ft	2	4 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		70 ft

Impervious Roadway Area: 1.60 ac

Pervious Roadway Area: 0.22 ac

Total Roadway Area: 1.82 ac

Pond Area: Pervious Pond Area = 0.00 ac

Water Surface Area = 0.00 ac

Total Area: Impervious Area: 1.60 ac

Pervious Area: 1.13 ac

Total Area: 2.73 ac

Curve Number (FDOT Hydrology Handbook):

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	1.60	156.80
Brush-Weed-Grass Mixture; Good Condition (> 75% ground cover)	D	73	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	1.13	90.40
		Total:	2.73	247.20

CN = Total CN * Area / Total Area = 90.5

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.04			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.55	13.07	6.62
		Total Runoff (ac-ft) =	1.95	2.97	1.51
Total Runoff (R_t) =	A*Q/12				

POST-DEVELOPMENT - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Station Limits: From: 154+10 Roadway Length = 2565 ft

To: 179+75 R/W Width = 73 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Pav't. (Avg.)	9.0 ft	1	9 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (F)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		87 ft

Impervious Roadway Area: 2.87 ac

Pervious Roadway Area: 0.28 ac

Total Roadway Area: 3.15 ac

Pond Area: Pervious Pond Area = 1.45 ac

Water Surface Area = 0.00 ac (Dry Pond)

Total Area: Impervious Area: 2.87 ac (Rdwy. Imperv. Area = 2.87 ac)

Pervious Area: 2.06 ac

Total Area: 6.38 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.87	281.26
Proposed Ponds (Water Surface)	D	100	0.00	0.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	3.51	280.80
		Total:	6.38	562.06

CN = Total CN * Area / Total Area = 88.1

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.35			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.25	12.75	6.34
		Total Runoff (ac-ft) =	4.39	6.78	3.37
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	-0.02		

POST-DEVELOPMENT - Basin No. 2 (East)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Median (Avg.)	10.0 ft	1	10 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (E)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		88 ft

Impervious Roadway Area: 3.20 ac

Pervious Roadway Area: 0.20 ac

Total Roadway Area: 3.40 ac

Pond Area: Pervious Pond Area = 0.38 ac

Water Surface Area = 1.44 ac (Exist. Wet Pond - Un-modified)

Total Area: Impervious Area: 8.56 ac (Prop. Rdwy. Imperv. Area = 3.20 ac)

Pervious Area: 1.83 ac

Total Area: 12.21 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	8.56	838.88
Proposed Ponds (Water Surface)	D	100	1.44	144.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	2.21	176.80
		Total:	12.21	1159.68

CN = Total CN * Area / Total Area = 95.0

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	0.53			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	9.09	13.63	7.15
		Total Runoff (ac-ft) =	9.25	13.87	7.27
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	0.00		

POST-DEVELOPMENT - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Station Limits: From: 179+75 Roadway Length = 1950 ft

To: 199+25 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Description	Width	Quantity	Total Width
Travel Lane	11.0 ft	4	44 ft
Imp. Median (Avg.)	10.0 ft	1	10 ft
Shoulder (Inside)	-	-	-
Shoulder (Outside)	7.0 ft	2	14 ft
Sidewalk	6.0 ft	2	12 ft
Curb & Gutter (E)	2.0 ft	4	8 ft
Misc. Asphalt	-	-	-
	Total Impervious Width:		88 ft

Impervious Roadway Area: 2.53 ac

Pervious Roadway Area: 0.25 ac

Total Roadway Area: 2.78 ac

Pond Area: Pervious Pond Area = 0.28 ac

Water Surface Area = 0.50 ac (Wet Pond)

Total Area: Impervious Area: 2.53 ac (Rdwy. Imperv. Area = 2.53 ac)

Pervious Area: 1.78 ac

Total Area: 5.09 ac

Curve Number:

Land Use Description	Hydrologic Soil Group	CN	Area (A)	CN * Area
Impervious areas; Streets/Roads	-	98	2.53	247.94
Proposed Ponds (Water Surface)	D	100	0.50	50.00
Open Space (lawns, parks, golf courses, cemeteries, etc.); Good Conditions (grass cover > 75%)	D	80	2.06	164.80
		Total:	5.09	462.74

CN = Total CN * Area / Total Area = 90.9

Runoff:

			SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Soil Capacity (S) =	1000 / CN - 10 =	1.00			
		Precipitation (P) =	9.70	14.25	7.75
Direct Runoff (Q) =	$(P - 0.2S)^2 / (P + 0.8S)$	Direct Runoff (Q) =	8.60	13.12	6.67
		Total Runoff (ac-ft) =	3.65	5.56	2.83
Total Runoff (R_t) =	A*Q/12	ΔR_t (Post - Pre; PPDR) =	1.70		

POND SIZING CALCULATIONS - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Dry Retention ***
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Dry Retention *	**2.50 in.**	x Impervious Areas =	0.598	ac-ft
	1.00 in.	x Total Basin Area =	0.532	ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.30 ac-ft* * 50% retention reduction

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	4.41	6.80	3.39
Qpost =	4.39	6.78	3.37
Δ Q =	-0.02		

Maintenance Area Width = 15.00 @ 1:6

Pond Tie-In Width = 4.0 ft @ 1:4

Maximum Storage Depth (**SD**) = 0.90 with 1.0 ft freeboard

Avg. Exist. Ground Elev. (ft) = 29.00

Normal Water Elevation (ft) = 28.10

Minimum EOP Elevation (ft) = 30.00 (At Furthest EOP from Pond)

Hydraulic Grade Line (HGL) check:

HGL Slope = 0.050% Use 0.05% for very flat terrain to 0.1% for flat terrain

Distance to Furthest EOP from Pond = 75 ft

Estimated Energy Losses = 0.1 ft

HGL Clearance = 1.0 ft Use 1.0 foot as a standard HGL clearance (no junction losses)

Maximum Allow. Storm Sewer Tailwater El. = 28.90

POND SIZING CALCULATIONS - Basin No. 1

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
32.30	Ditch Perimeter	0.73	818.8	38.8	
33.30	Back of Maintenance Berm	0.65	814.8	34.8	1.58
32.80		0.59	811.8	31.8	1.27
32.30	Front of Maintenance Berm	0.53	808.8	28.8	0.99
31.30	Provided Treatment + Atten. Volume	0.46	804.8	24.8	**0.50**
31.20	Req'd Treatment + Attenuation Volume	0.45	804.4	24.4	**0.45**
31.10	Estimated Storm Sewer TW	0.44	804.0	24.0	0.41
31.00	Top of Treatment Vol.	0.44	803.6	23.6	**0.36**
30.60		0.41	802.0	22.0	0.19
30.10	Ditch Bottom	0.37	800.0	20.0	0.00
28.10	SHWT El.	-	-	-	

Req'd Treat. + Atten. Vol. (ac-ft) = **0.45** Prov'd. Treat. + Atten. Vol. (ac-ft) = **0.50**

Req'd Treat. + Atten. Stage (ft) = **31.20** Prov'd. Treat. + Atten. Stage (ft) = **31.30**

Estimated Treat. Vol. + Storm Sewer Att. = **0.41** ac-ft

Estimated Storm Sewer TW El. = **31.10** ft HGL requirements met

Mean Depth = **N/A** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF)*:

Required Pond R/W =	**0.80**	**ac**

POND SIZING CALCULATIONS - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Pond Sizing:

Required Treatment Volume (TV)

Selection Criteria:

Permitting Agency	**SJRWMD**
Stormwater Mgmt.	**Wet Detention**
Online / Offline	**Online**
OFW	**No**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in.**	x Impervious Areas =	0.527 ac-ft
	1.00 in.	x Total Basin Area =	0.424 ac-ft

Treatment V_{req} = Largest of Trt. Volume = 0.527 ac-ft

OFW Requirement (50% additional TV) = N/A ac-ft

Attenuation (Treatment):

Total Runoff (ac-ft)

	SJRWMD (25yr/24hr)	FDOT Critical Duration (100yr/72hr)	Storm Sewer Design (10yr/24hr)
Qpre =	1.95	2.97	1.51
Qpost =	3.65	5.56	2.83
Δ Q =	1.70		

Maintenance Area Width = 15.00 @ 1:10

Pond Tie-In Width = 4.0 ft @ 1:4

Maximum Storage Depth (**SD**) = 3.60 with 1.0 ft freeboard

Avg. Exist. Ground Elev. (ft) = 30.25

Normal Water Elevation (ft) = 24.90

Minimum EOP Elevation (ft) = 29.50 (At Furthest EOP from Pond)

Hydraulic Grade Line (HGL) check:

HGL Slope = 0.050% Use 0.05% for very flat terrain to 0.1% for flat terrain

Distance to Furthest EOP from Pond = 1000 ft

Estimated Energy Losses = 0.5 ft

HGL Clearance = 1.0 ft Use 1.0 foot as a standard HGL clearance (no junction losses)

Maximum Allow. Storm Sewer Tailwater El. = 28.00

POND SIZING CALCULATIONS - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Pond Stage / Storage Calculations:

ELEVATION (ft, NAVD)	DESCRIPTION	AREA (ac)	DIMENSIONS		STORAGE (ac-ft)
			Length (ft)	Width (ft)	
27.90	Pond R/W	0.71	240.0	128.0	
28.90	Back of Maintenance Berm	0.67	236.0	124.0	2.43
28.40		0.66	234.0	122.0	2.10
27.90	Front of Maintenance Berm	0.64	232.0	120.0	1.78
26.95	Provided Treatment + Atten. Volume	0.61	228.2	116.2	**1.18**
26.93	Req'd Treatment + Attenuation Volume	0.61	228.1	116.1	**1.17**
26.40	Estimated Storm Sewer TW	0.59	226.0	114.0	0.85
25.96	Top of Treatment Vol.	0.58	224.2	112.2	**0.60**
25.50		0.56	222.4	110.4	0.33
24.90	Normal Water Level	0.55	220.0	108.0	0.00
22.90		0.49	212.0	100.0	
20.90	Pond Bottom	0.46	208.0	96.0	

Req'd Treat. + Atten. Vol. (ac-ft) = **1.17** Prov'd. Treat. + Atten. Vol. (ac-ft) = **1.18**

Req'd Treat. + Atten. Stage (ft) = **26.93** Prov'd. Treat. + Atten. Stage (ft) = **26.95**

Estimated Treat. Vol. + Storm Sewer Att. = **0.85** ac-ft

Estimated Storm Sewer TW El. = **26.40** ft HGL requirements met

Mean Depth = **3.62** ft 2 ft < MD < 8 ft

Use a 10% Safety Factor (SF):

Required Pond R/W = **0.78** **ac**

PERMANENT POOL VOLUME CALCULATIONS - Basin No. 2 (West)

Project: Clearlake Road (SR 501) from Michigan Ave. to Industry Rd. Designer: JDW

Financial Project No.: 433605-1-22-01 5/2/2016

County: Brevard

Basin Characteristics

Land Use	Area (ac)	Runoff Coeff.	Product
Paved Area (incl: Rdwy)	2.53	0.95	2.40
Pervious Area	1.78	0.20	0.36
Pond Pervious Area	0.28	0.20	0.06
Pond Area at NWL	0.50	1.00	0.50
Totals	5.09		3.32

Composite C = 0.65

Annual Rainfall (P) = 51.5 in. FDEP Rainfall Isopleth Map for Florida

Stage Storage Calc. for Permanent Pool

ELEV. (ft; NAVD)	AREA (ac)	AVG. AREA (ac)	Delta (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
24.90	0.50				1.76
		0.47	2.00	0.94	
22.90	0.44				0.82
		0.43	1.00	0.43	
21.90	0.41				0.40
		0.40	1.00	0.40	
20.90	0.38				0.00

Permanent Pool Volume Provided (ac-ft) = **1.76**

Resident Time Provided (Days) = Perm. Pool Vol. Provided *150*12/ Area / C / P = **18.55**

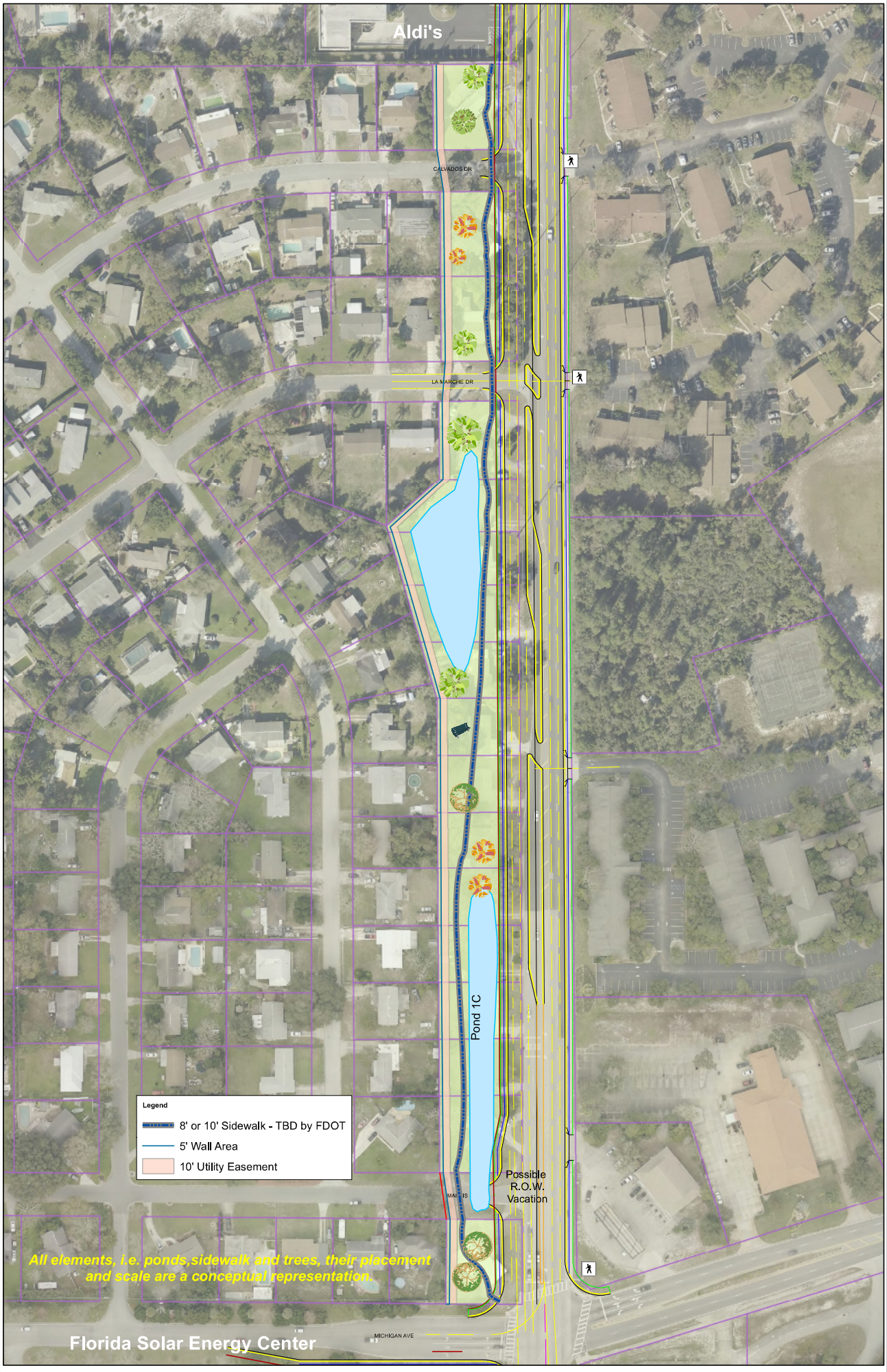
Mean Depth = Permanent Pool Volume / Area at NWL = **3.52** ft

APPENDIX I - Conceptual Pond Analysis Memorandum

APPENDIX G

BREVARD COUNTY CONCEPTUAL CORRIDOR EXHIBIT

Clearlake PD&E West Side Concept



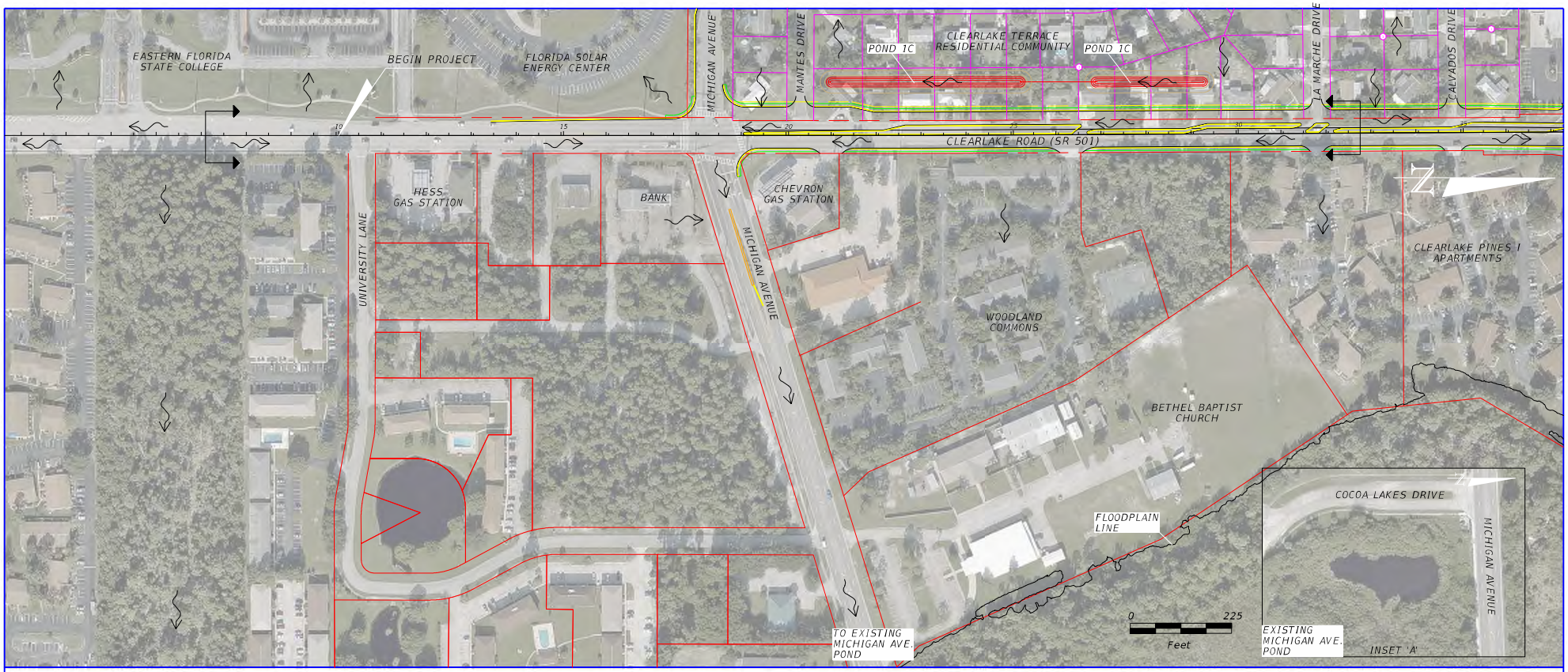
2015 Imagery

Prepared by Brevard Planning & Development GIS, Graphics

Clearlake_BrevPW_Concept2 3/11/2016

APPENDIX J

PREFERRED POND SITE LOCATION MAPS



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
1C	1	0.83 ACRES	-	10 PARCELS IMPACTED; 2 PROP. DRY RETENTION DITCHES

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

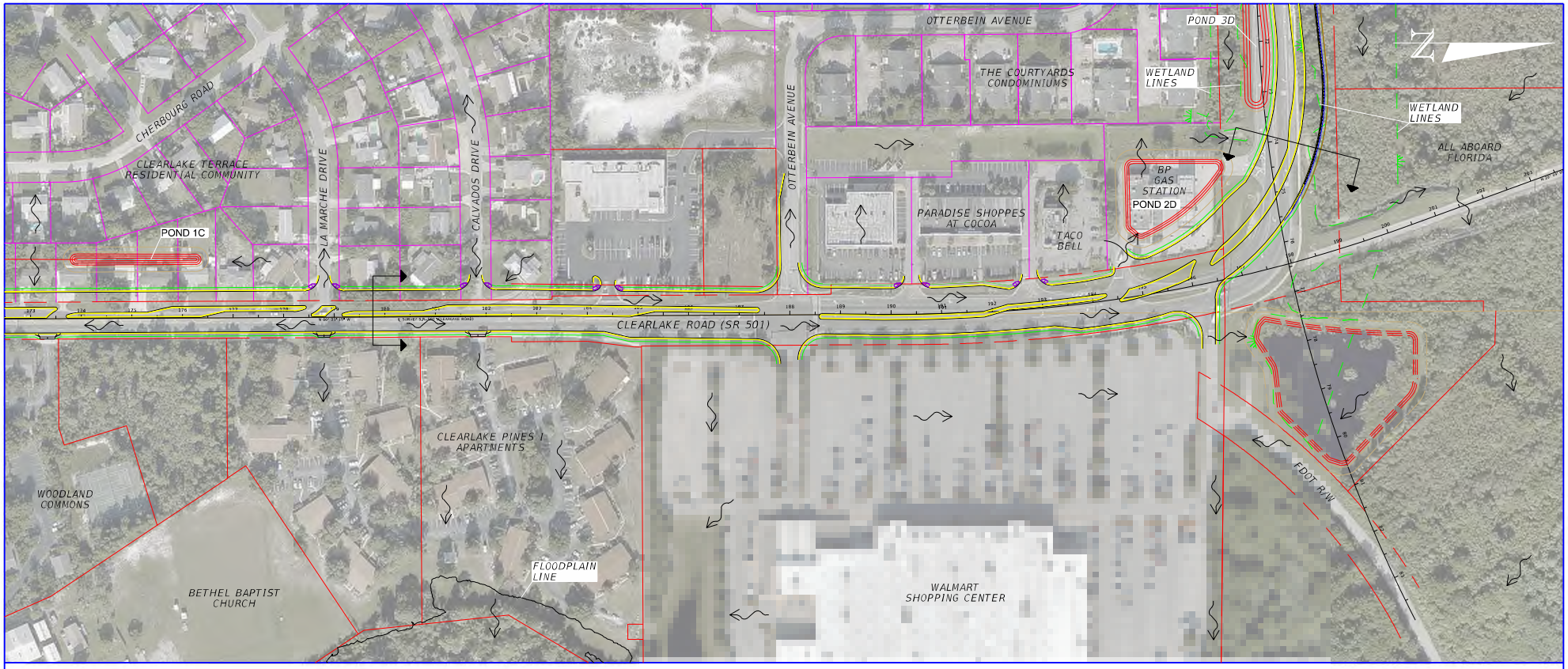
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
10/18/16	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 1
BP GAS ALTERNATIVE

BASIN NO. 1



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
2D	2	0.78 ACRES	24-36-18-00-766	POND "FOOTPRINT" LOCATED ON GAS STATION

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
10/18/16	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 2
BP GAS ALTERNATIVE

BASIN NO. 2

REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
3A	3	1.50 ACRES	-	FDOT R/W
3D	3	0.52 ACRES	-	FDOT R/W
3E	3	1.74 ACRES	-	FDOT R/W

NOT FOR CONSTRUCTION

SR 501 PD&E STUDY
FROM MICHIGAN AVENUE
TO INDUSTRY ROAD

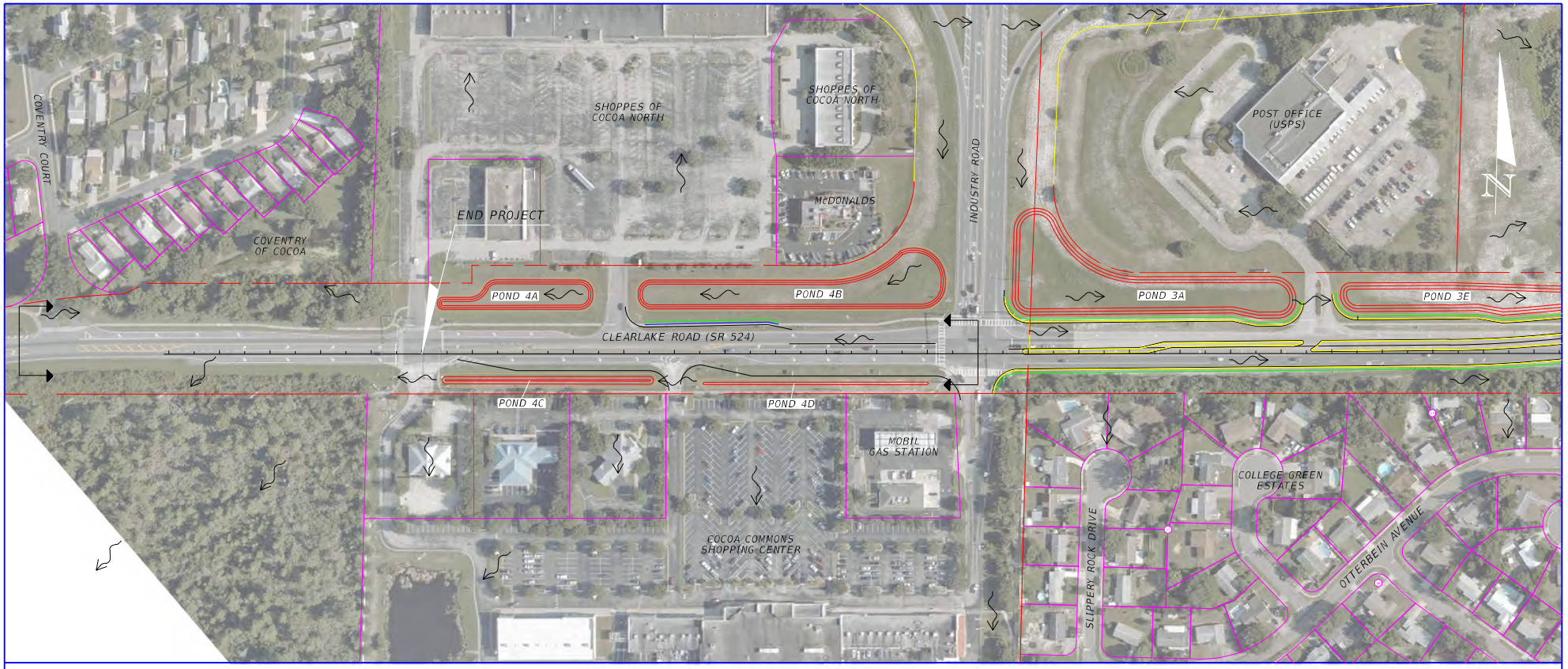
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

DATE	ROAD NO.	COUNTY	FINANCIAL PROJECT ID
10/18/16	501	BREVARD	433605-1-22-01

$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 3
BP GAS ALTERNATIVE

BASIN NO. 3



REVIEWER NOTES

DATE	REVIEWER	DISCIPLINE	POND ID	COMMENT

LEGEND

- SYSTEM LIMITS
- POTENTIAL POND SITES
- INDIVIDUAL PARCELS
- EXISTING R/W LINE
- PROPOSED R/W LINE
- DRAINAGE FLOW ARROW

0 50 200
Feet

POND ID	BASIN	POND SIZE	PARCEL ID	COMMENT
4A	4	0.40 ACRES	-	FDOT R/W
4B	4	1.05 ACRES	-	FDOT R/W
4C	4	0.25 ACRES	-	FDOT R/W
4D	4	0.20 ACRES	-	FDOT R/W

NOT FOR CONSTRUCTION

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$USERS $DATES $TIMES $FILES

DRAINAGE SYSTEM 4
BP GAS ALTERNATIVE

BASIN NO. 4