

FINAL
POND SITING REPORT

The City of Palm Bay
Malabar Road Project Development and Environment (PD&E) Study
Limits of Project: St. Johns Heritage Parkway to Minton Road
Brevard County, Florida
Financial Management Number: 437210-1-28-01
ETDM Number: 14396
Date: October 2023

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022, and executed by the Federal Highway Administration and FDOT.

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PROFESSIONAL ENGINEER CERTIFICATION

POND SITING REPORT

Project: Malabar Road PD&E Study

ETDM Number: N/A

Financial Project ID: 437210-1-28-01

Federal Aid Project Number: N/A

This Pond Siting Report contains engineering information that fulfills the purpose and need for the Malabar Road Project Development & Environment Study from St. Johns Heritage Parkway to Minton Road in Brevard County, Florida. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of transportation engineering as applied through professional judgment and experience.

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Inwood Consulting Engineers, and that I have prepared or approved the evaluation, findings, opinions, conclusions or technical advice for this project.



This item has been digitally signed and sealed by Renato Chuw, PE on the date adjacent to the seal.

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Executive Summary

The Malabar Road Project Development and Environment (PD&E) Study evaluated capacity, safety, and multi-modal improvements on Malabar Road from St. Johns Heritage Parkway to Minton Road, a distance of approximately four miles. This project involves the widening of Malabar Road from two lanes to four lanes to meet future travel demands, improve safety and provide for bicycle and pedestrian features, such as sidewalks and a shared use path.

The purpose of this Pond Siting Report is to discuss, analyze, and identify the stormwater management plan for the proposed roadway improvements based on environmental, hydrological, hydraulic, and economic factors. Stormwater management for water quality treatment and runoff attenuation will be provided using wet detention ponds, dry retention ponds, and dry linear swales. The design of the drainage and stormwater facilities will comply with the standards set forth by the St. Johns River Water Management District (SJRWMD) ERP manual, City of Palm Bay stormwater criteria, and Melbourne Tillman Water Control District (MTWCD) discharge criteria.

Alternative pond sites have been identified along the project limits. The analysis estimates right-of-way needs using both a volumetric analysis and hydraulic/hydrologic modeling which account for water quality treatment and water quantity for runoff attenuation. The total pond cost estimate found in this report is a budget tool used to estimate total acquisition costs associated with each pond site and to budget the appropriate funds for acquisition.

Please note that the volumetric and modeling analyses of the pond sites were performed with preliminary data, reasonable engineering judgment, and assumptions. Pond sites and configurations may change during final design as more detailed information on seasonal high water table (SHWT), wetland hydrologic information (as applicable), and a final roadway design profile become available. Please refer to **Table 1-1** for a **Summary of Preferred Stormwater & Floodplain Compensation Pond Sites**.

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1.0 Project Summary

Initiated in November 2019, this Project Development and Environment (PD&E) Study has been conducted to assess various widening alternatives for Malabar Road. This Preliminary Engineering Report (PER) documents the project's purpose and need, the alternatives developed, the process of selecting the preferred alternative, and presents the preliminary design analysis for the preferred alternative.

1.1 Project Description

The Malabar Road Project Development and Environment (PD&E) Study evaluated capacity, safety, and multi-modal improvements on Malabar Road from St. Johns Heritage Parkway to Minton Road, a distance of approximately four miles, in the City of Palm Bay and Brevard County, Florida. Malabar Road is an east-west regional roadway connecting western Brevard County/City of Palm Bay to US 1 in Malabar. The roadway's maintaining jurisdiction is Brevard County at its western edge, before transitioning to the City of Palm Bay for several miles, and then becoming a state road (S.R. 514) between I-95 and US 1. Malabar Road has an existing diamond interchange with I-95. Within the study area, Malabar Road is an urban minor arterial. The study area is shown in **Figure 1-1**.

Malabar Road within the project limits is a two-lane roadway. The section from St. Johns Heritage Parkway to Garvey Road is undivided, whereas the section from Garvey Road to Minton Road has median turn lanes. An 8' sidewalk is present on Malabar Road's north side for the entirety of the project limits. Minimal sidewalk is present on the south side. No on road bicycle facilities are present along the study limit's length.

There are currently four signalized intersections and numerous unsignalized intersections along the study corridor. The four signalized intersections are located at Krassner Drive/Bending Branch Lane, Jupiter Boulevard, the Plaza Shopping Center, and Minton Road.

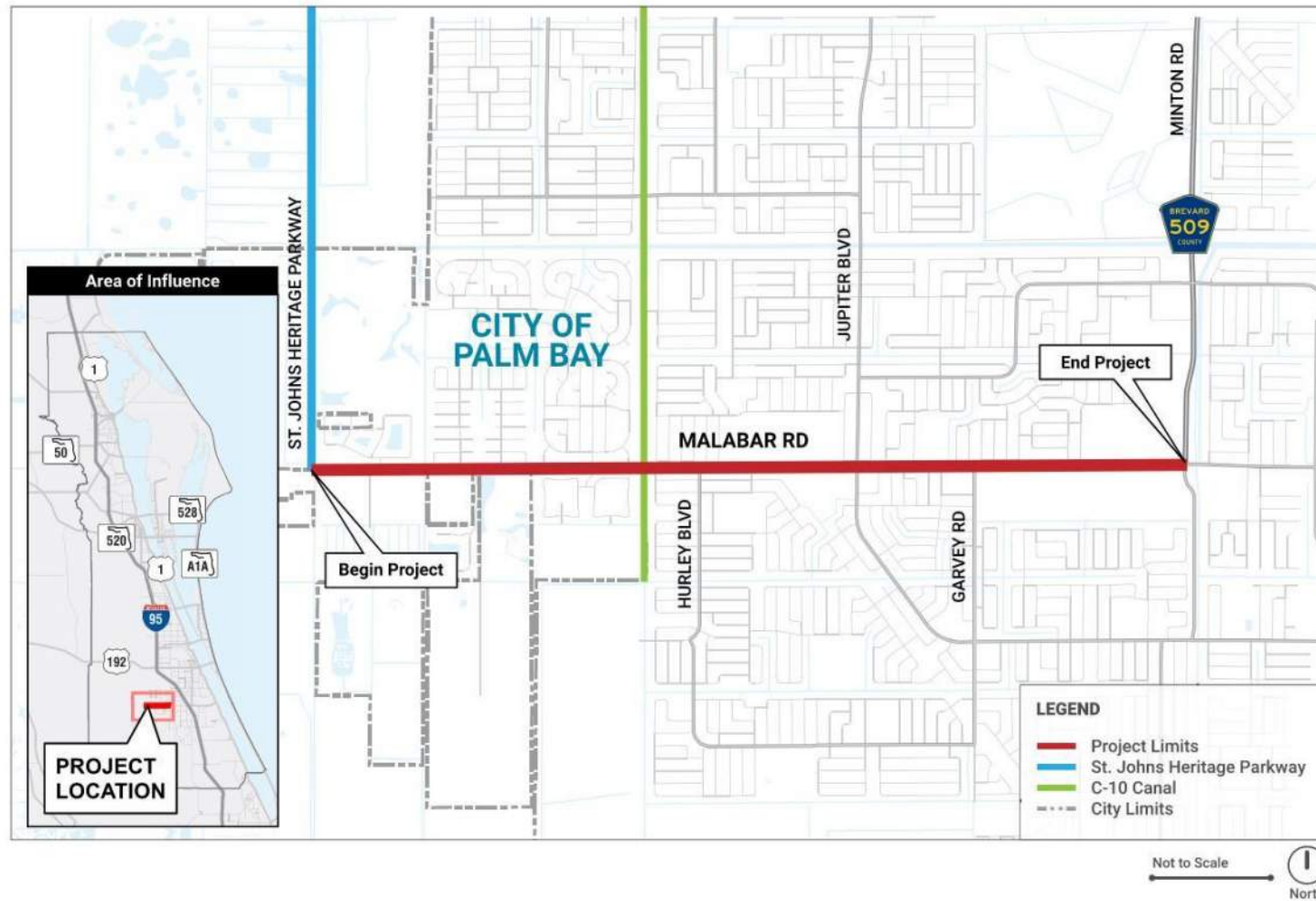
This roadway is unique due to the surrounding canal system that is operated/maintained by the Melbourne-Tillman Water Control District (MTWCD). Malabar Road within the project limits crosses over four canals (C-7, C-8, C-9, and C-10). Canal C-20 runs parallel to Malabar Road on the north side from Canal C-10 (250' west of Bavarian Avenue) to approximately 0.30 miles west of Minton Road. One bridge, crossing over Canal C-10, is located within the project limits.

The proposed improvements will widen Malabar Road from two to four lanes from the St. Johns Heritage Parkway to Minton Road. The preferred alternative's typical section along the study corridor will include two 11' lanes in each direction, a 22' wide median, a 10' shared-use path on the north side, and an 8' sidewalk on the south side. The intersections at St. Johns Heritage Parkway, Krassner Drive/Bending Branch Lane, Hurley Boulevard, and Maywood Avenue/Daffodil Drive are proposed as roundabouts while Jupiter Boulevard, the Plaza Shopping Center, and Minton Road are proposed to remain signalized.

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Figure 1-1: Study Roadway



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STUDY ROADWAY

FIGURE 1

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1.2 Purpose and Need

The purpose of this project is to evaluate the need for capacity improvements (roadway widening) to relieve existing congestion and accommodate projected future traffic demand. The project's secondary goals are to 1) Enhance safety conditions; 2) Improve multi-modal facilities; and 3) Enhance regional and local mobility. The need for these improvements is described in this section.

1.2.1 Transportation Demand/Capacity

The existing (2020) traffic analysis shows the four signalized intersections and 13 unsignalized intersections operated with an overall Level of Service (LOS) of E or better and no overcapacity movements. Even though the intersections were operating acceptably, the existing traffic analysis for the segments shows multiple segments of the Malabar Road corridor operated worse than the City standard of LOS C, with traffic volumes ranging from 7,200 to 16,000 Annual Average Daily Traffic (AADT). As population and employment growth are expected to continue in western Palm Bay, the east-west traffic volumes along Malabar Road are anticipated to increase. This will ultimately lead to unacceptable segment and intersection operations.

1.2.2 Safety

Crash records were obtained for Malabar Road from 900' west of the St. Johns Heritage Parkway to ¼ mile east of Minton Road for the most recent five-year period on record (2016 through 2020). There was a total of 642 reported crashes during this period, 202 (32 percent) resulted in at least one injury. There were no reported fatal crashes along the study corridor during the five-year period. As displayed in **Figure 1-2**, the crashes per year along the corridor generally increased between 2016 (123 crashes) and 2019 (137 crashes). The 2020 crash data saw a decrease to 113 crashes, likely due to decreases in traffic volumes related to the COVID-19 pandemic. While the overall total crashes decreased in 2020, the total number of injury crashes was the second highest behind 2017. This could be attributed to higher travel speeds along the corridor due to the lower volume, which leads to more severe crashes. It is important to note the traffic counts for this project were performed in January 2020, prior to the beginning of the pandemic restrictions in March 2020.

The highest crash type observed was rear end, comprising 54 percent of the total crashes. Left turn (14 percent) and sideswipe crashes (12 percent) were the second and third highest crash types.

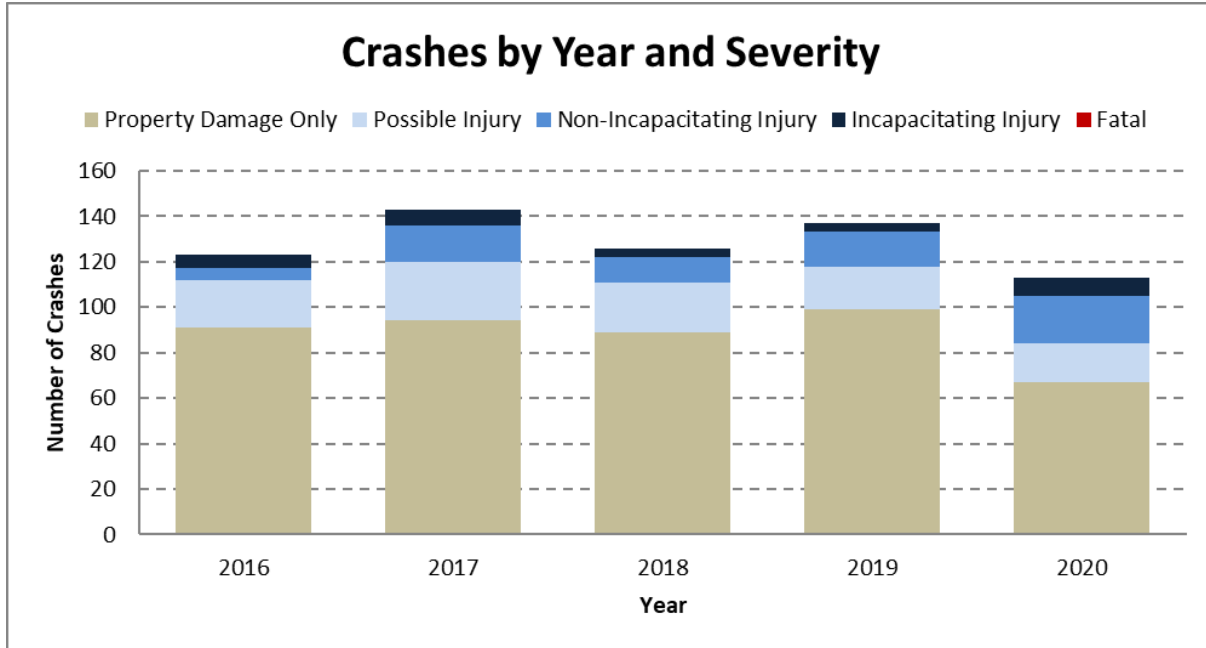
Three existing signalized intersections at Jupiter Boulevard, the Plaza Shopping Center, and Minton Road were the highest crash locations along the study corridor, accounting for 330 of the 642 total reported crashes (51 percent). The four highest crash unsignalized intersections are St. Johns Heritage Parkway, Hurley Boulevard, Hillock Avenue, and Maywood Avenue/Daffodil Drive accounting for 90 total crashes (14 percent). Two high crash segments from 0.05 miles east of Jupiter Boulevard to 0.05 west of Santa Rosa Avenue (1,400 feet in length) and from 0.05 miles east of Maywood Avenue/Daffodil Drive to 0.05 west of the Plaza Shopping Center (1,175 feet in length) accounted for 61 total crashes (10 percent). A crash rate analysis was performed on the 2016 to 2018 crash data because average crash rates were not available for 2019 and 2020. Only one segment of Malabar Road, between Jupiter Boulevard and the Plaza Shopping Center, had a higher than average crash rate for one year of analysis. While the segments had low safety ratios, the three signalized intersections at Jupiter

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Boulevard, the Plaza Shopping Center, and Minton Road each had higher crash rates than statewide or districtwide averages for similar roadways in at least two of the three analysis years.

Figure 1-2: Crashes per Year (Corridor Wide)



1.2.3 Modal Interrelationships

An 8' sidewalk is present on the north side of Malabar Road for the entirety of the project limits. Where Canal C-20 exists, this facility is on the north side of the canal. Sidewalk is present for approximately 40 percent of the project limits on the south side. No on-road bicycle facilities are present along the length of the project limits.

The Office of Greenways and Trails (OGT) and the Space Coast Transportation Planning Organization (SCTPO) identified trail opportunities in the vicinity of Malabar Road. The St. Johns River Eco-Heritage Trail will align with the St. Johns Heritage Parkway and connect the Brevard Zoo Linear Trail to Malabar Road. The St. Johns River Eco-Heritage Trail will extend south where it will connect to existing trail facilities. In addition to OGT and SCTPO identified trails, two local trails are in the study vicinity. One local trail runs east-west along Malabar Road from St. John Heritage Parkway to west of Minton Road as previously discussed. The second local trail called the Cross City Trail ends just south of Malabar Road near the City of Palm Bay Public Works Department. The trail is located adjacent to the power lines and starts at Walpole Road and ends just south of Malabar Road. There is no connection between Cross City Trail and the trail paralleling Malabar Road's north side due to the presence of Canal C-20. The existing trails and trail opportunities are displayed in **Figure 15** of the *Malabar Road Preliminary Engineering Report*.

Two transit routes with 16 total transit stops (six eastbound and 10 westbound) operate along Malabar Road within the study corridor. Space Coast Area Transit Route 20 connects Heritage and West Melbourne and Route 23 provides service to the West Palm Bay area. Route 20 operates along the entire corridor and Route 23

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operates between Jupiter Boulevard and Minton Road. Both routes operate from approximately 6:30 AM to 8:30 PM on weekdays and 7:30 AM to 5:30 PM on Saturdays with hour long headways. The eastbound bus stop in front of the Madalyn Landing Apartments is the only stop with a bus shelter. The existing transit routes and shelters are displayed in **Figure 15** of the *Malabar Road Preliminary Engineering Report*.

1.2.4 System Linkage

The western Palm Bay area is anticipated to experience population and traffic growth in the next 30 years, leading to increased travel on facilities west of I-95 and south of US 192. The St. Johns Heritage Parkway is providing a “beltway” facility to accommodate the forecasted increase in traffic in western Palm Bay. The St. Johns Heritage Parkway is already constructed from Malabar Road to US 192, and a study is being performed for the extension of the Parkway from Babcock Street north to Malabar Road.

Malabar Road is one of three primary east-west roadways connecting to the Parkway and is the only one of those roadways that has an interchange with I-95. Malabar Road from Minton Road to Corporate Circle is four lanes and the section from Corporate Circle to I-95 is six lanes. The Malabar Road four-lane alternative proposed from the St. Johns Heritage Parkway to Minton Road would tie into the existing four-lane section starting at Minton Road.

A PD&E study was completed in 2021 for Malabar Road from Babcock Street to US 1 with a preferred alternative to widen from two to four lanes. Design and right-of-way for the Babcock Street to US 1 project is planned in the SCPTO’s 2045 Long Range Transportation Plan (LRTP) Cost Feasible Plan for the 2026 to 2030 time period and construction is planned for the 2031 to 2035 time period.

1.3 Alternatives Analysis Summary

1.3.1 Roadway Typical Sections

Two initial typical section alternatives were developed to support the Malabar Road purpose and need for capacity and safety improvements:

- Alternative A – Minimum right-of-way alternative
 - 89.5’ right-of-way alternative from the St. Johns Heritage Parkway to Canal C-10 (**Figure 1-3**)
 - 92.5’ right-of-way alternative from Canal C-10 to Sta. 256+80 (**Figure 1-4**)
- Alternative B – Desired right-of-way alternative
 - 100’ right-of-way alternative from the St. Johns Heritage Parkway to Canal C-10 (**Figure 1-5**)
 - 103’ right-of-way alternative from Canal C-10 to Sta. 256+80 (**Figure 1-6**)

Each of the initial typical sections were applied from the St. Johns Heritage Parkway to Sta. 256+80, which is just west of the Plaza Shopping Center where Malabar Road begins to transition to a four-lane roadway. The posted speed for each typical section alternative is 35 mph from St. Johns Heritage Parkway to Championship Circle, 45 mph from Championship Circle to east of Maywood Avenue/Daffodil Drive, and 35 mph from east of Maywood Avenue/Daffodil Drive to Minton Road. This maintains the existing posted speed limits.

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The initial Malabar Road typical section alternatives were developed using design provisions from the Florida Greenbook and the FDOT Design Manual (FDM). Alternative A was developed to minimize the right-of-way impacts to residential properties on the south side of Malabar Road and minimize Canal C-20 impacts on the north side of Malabar Road east of Canal C-10. The following features are common between the 89.5' and the 92.5' typical sections:

- Two 11' travel lanes in each direction;
- 15.5' wide median, including Type E curb and gutter;
- Type F curb and gutter outside of the travel lanes; and
- 10' shared-use path on the north side and 6' sidewalk on the south side.
 - The inside edge of the 6' sidewalk is at the back of curb.

The primary difference between the 89.5' and 92.5' typical sections is the presence of Canal C-20 on the north side of Malabar Road east of Canal C-10. In the 92.5' typical, an extra 3' is added on the north side for guardrail protection between the roadway and Canal C-20.

Alternative A utilized a smaller median width of 15.5' and a 6' south side sidewalk at the back of curb to reduce the overall right-of-way needed for the study corridor. A 15.5' median does not meet the minimum 22' Florida Greenbook or FDM median widths for a 45 mph facility, thus a design variation would be needed if this alternative was to move forward. Alternative B increases the median width to a standard 22' median (including Type E curb and gutter) per FDM criteria. Alternative B also provides a 4' grass buffer between the south side curb and the sidewalk, which was not provided in Alternative A. The additional 6.5' in the median and 4' grass buffer on the south side equates to the 10.5' difference between the 89.5'/92.5' Alternative A typical sections and the 100'/103' Alternative B typical sections. The following features are common between the 100' and the 103' typical section alternatives:

- Two 11' travel lanes in each direction;
- 22' wide median, including Type E curb and gutter;
- Type F curb and gutter outside of the travel lanes;
- 10' shared-use path on the north side and 6' sidewalk on the south side; and
- 4' grass buffer between the back of the curb and the 6' south side sidewalk.

Similar to Alternative A, the 3' difference between the 100' and 103' typical sections is north side guardrail protection between the roadway and Canal C-20.

The Alternative A and Alternative B typical sections were presented at the Alternatives Public Meeting conducted on Thursday, September 24, 2020 and subsequent local jurisdiction meetings in October 2020. During these meetings, discussion was held regarding the lack of on-road bicycle facilities being provided in the typical section alternatives. While adding on-road bicycle facilities was deemed not feasible by the study team due to the right-of-way and Canal C-20 impacts, widening the south side sidewalk to 8' was explored. A 10' shared-use path is already being proposed on the north side, so widening the south side sidewalk to 8' would provide a wider facility accommodating both pedestrians and bicycles. The 8' south side sidewalk was incorporated into the preferred alternative.

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1.3.2 Bridge Typical Sections

One bridge structure is present over Canal C-10 at approximately Sta. 142+00. Four bridge typical sections were developed in support of the initial typical section alternatives discussed in the previous section:

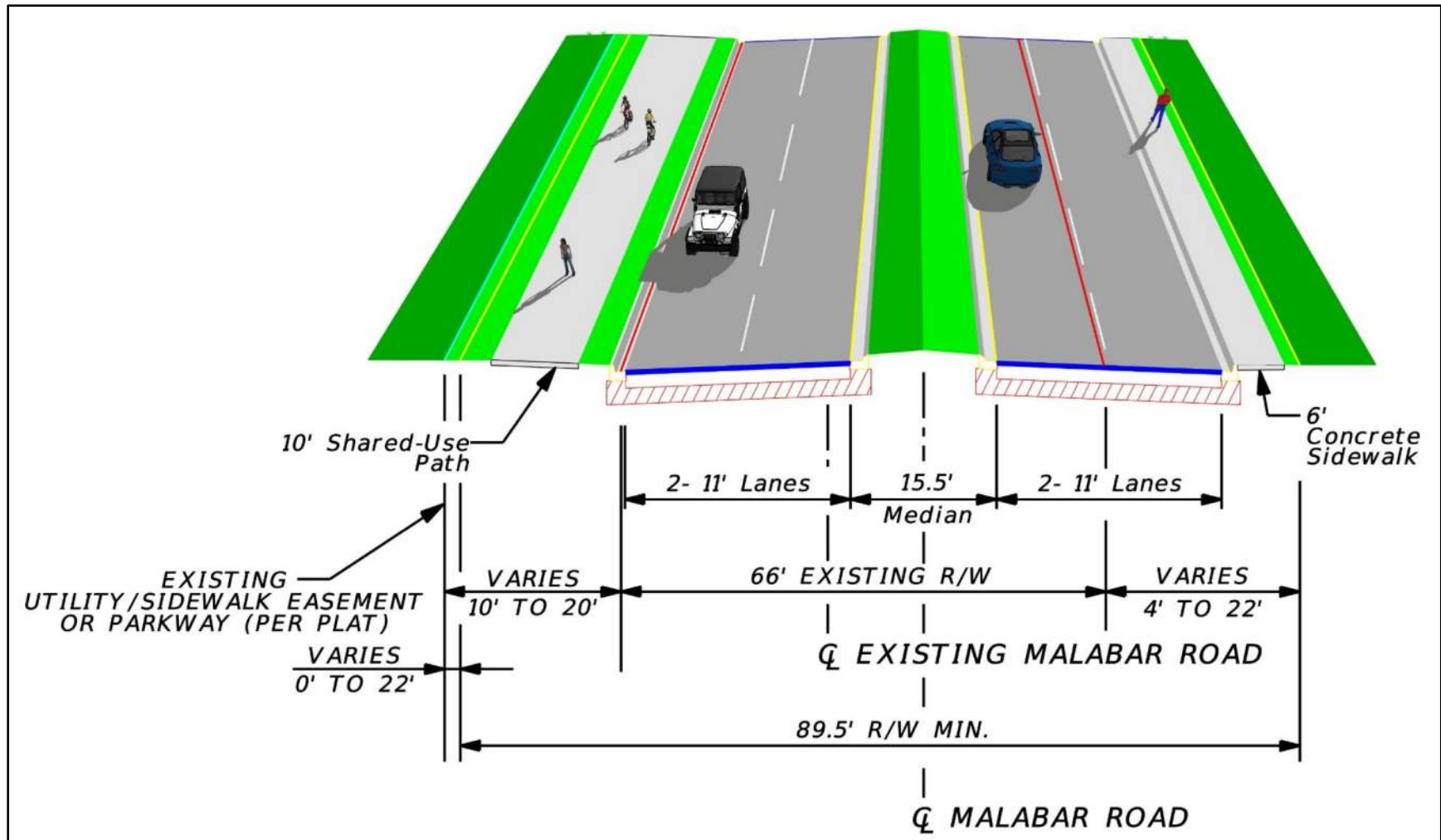
- Alternative A – Minimum right-of-way bridge typical sections
 - Raised sidewalk alternative
 - Flush sidewalk with traffic separator alternative
- Alternative B – Desired right-of-way bridge typical sections
 - Raised sidewalk alternative
 - Flush sidewalk with traffic separator alternative

The Alternative A bridge typical sections have a 15.5' median consistent with the Alternative A roadway typical section. The Alternative B bridge typical sections have a 22' median consistent with Alternative B roadway typical section. The raised sidewalk bridge typical section (both Alternatives A and B) incorporates a 10' shared-use path on the north side and 6' sidewalk on the south side that is raised above the travel lanes and separated by a 1.5' paved shoulder. A traffic railing with a pedestrian/bicycle railing on top is present to the outside of the bridge structure. The flush sidewalk bridge typical section (both Alternatives A and B) provides the same 10' shared-use path and 6' sidewalk, but the facilities are flush with the bridge deck and separated from the travel lanes by a 2.5' paved shoulder and 1'4" traffic railing. A pedestrian/bicycle railing is present to the outside of the bridge structure.

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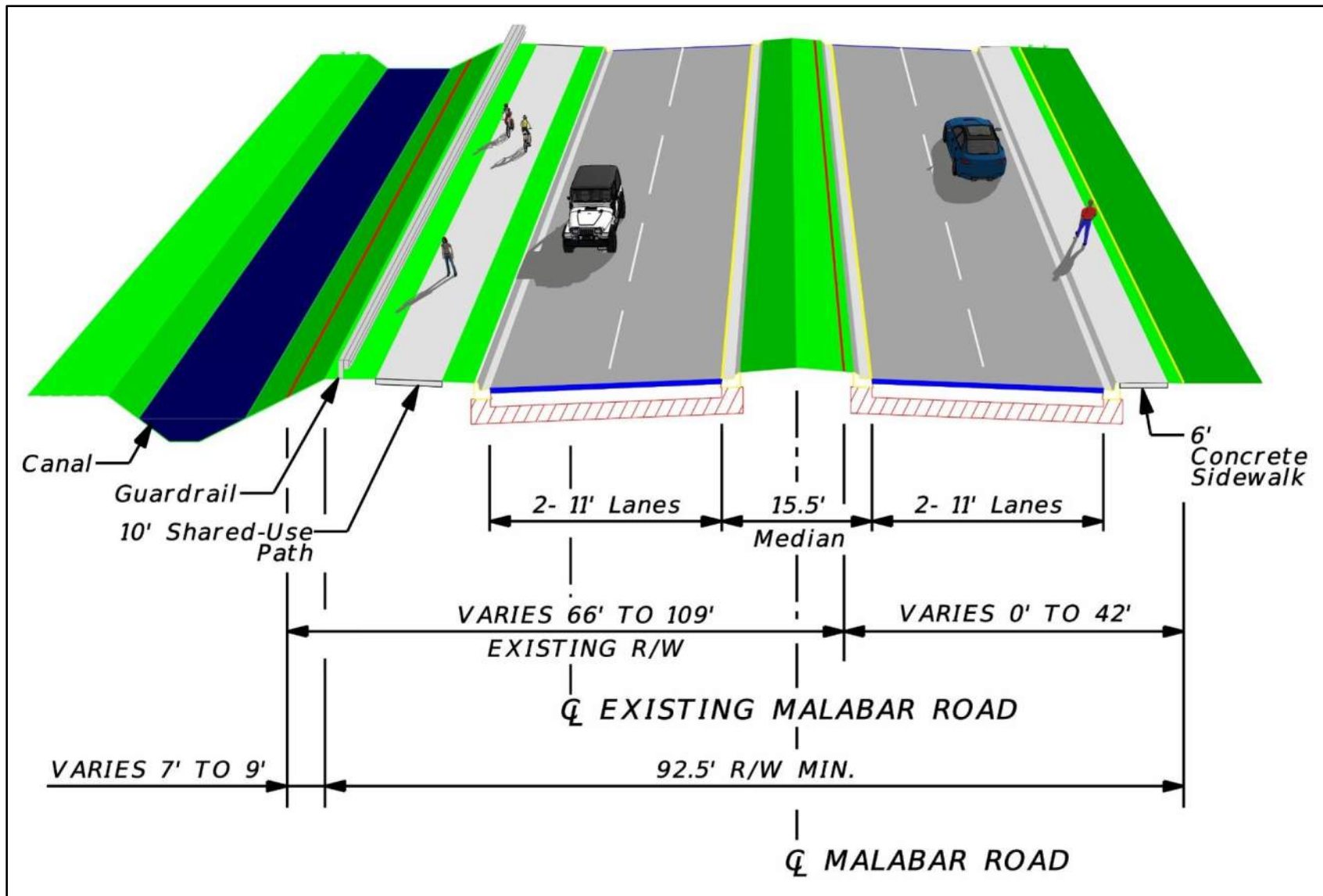
Figure 1-3: 89.5' Alternative A – St. Johns Heritage Parkway to Canal C-10



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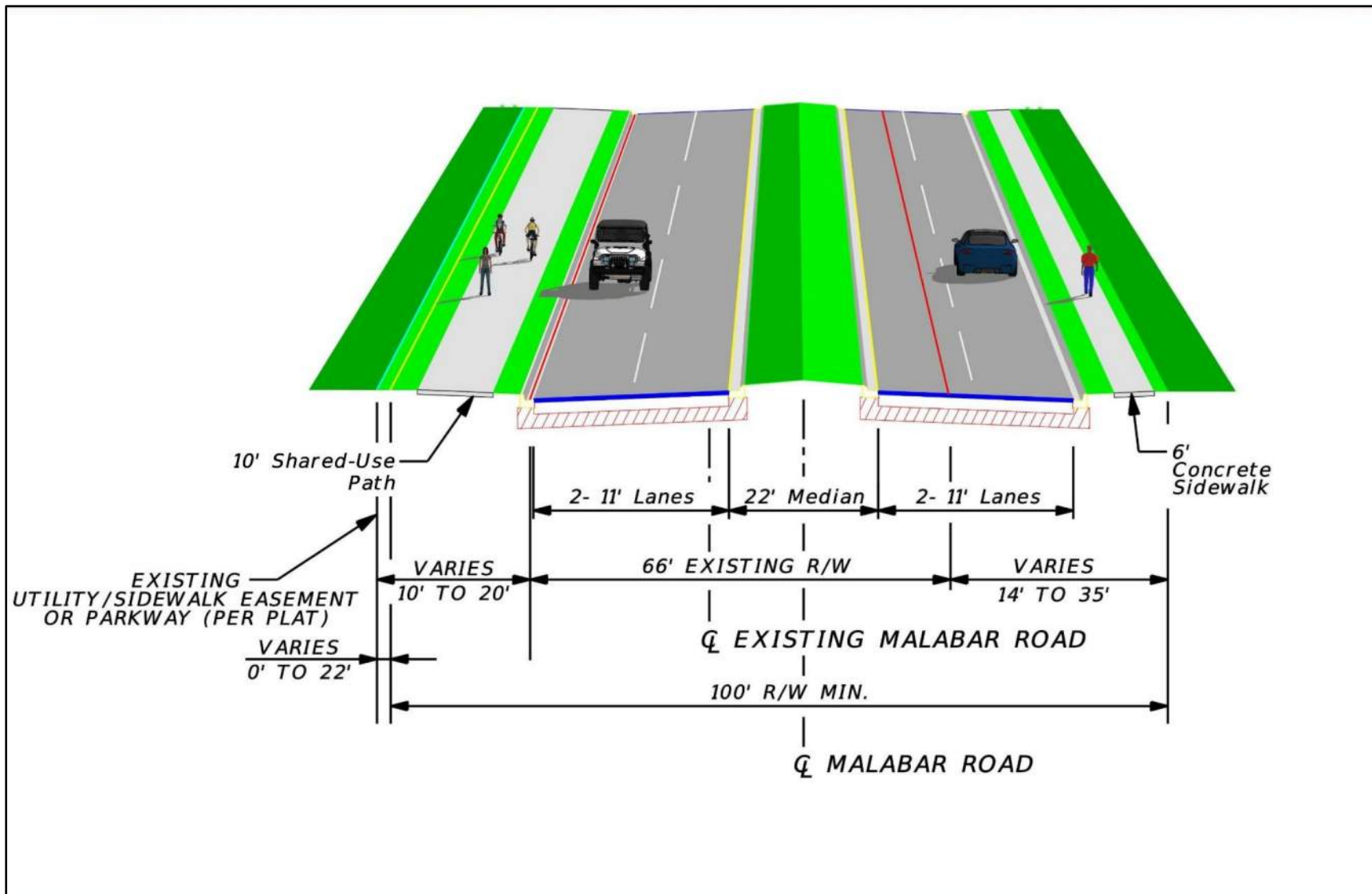
Figure 1-4: 92.5' Alternative A – Canal C-10 to Sta. 256+80



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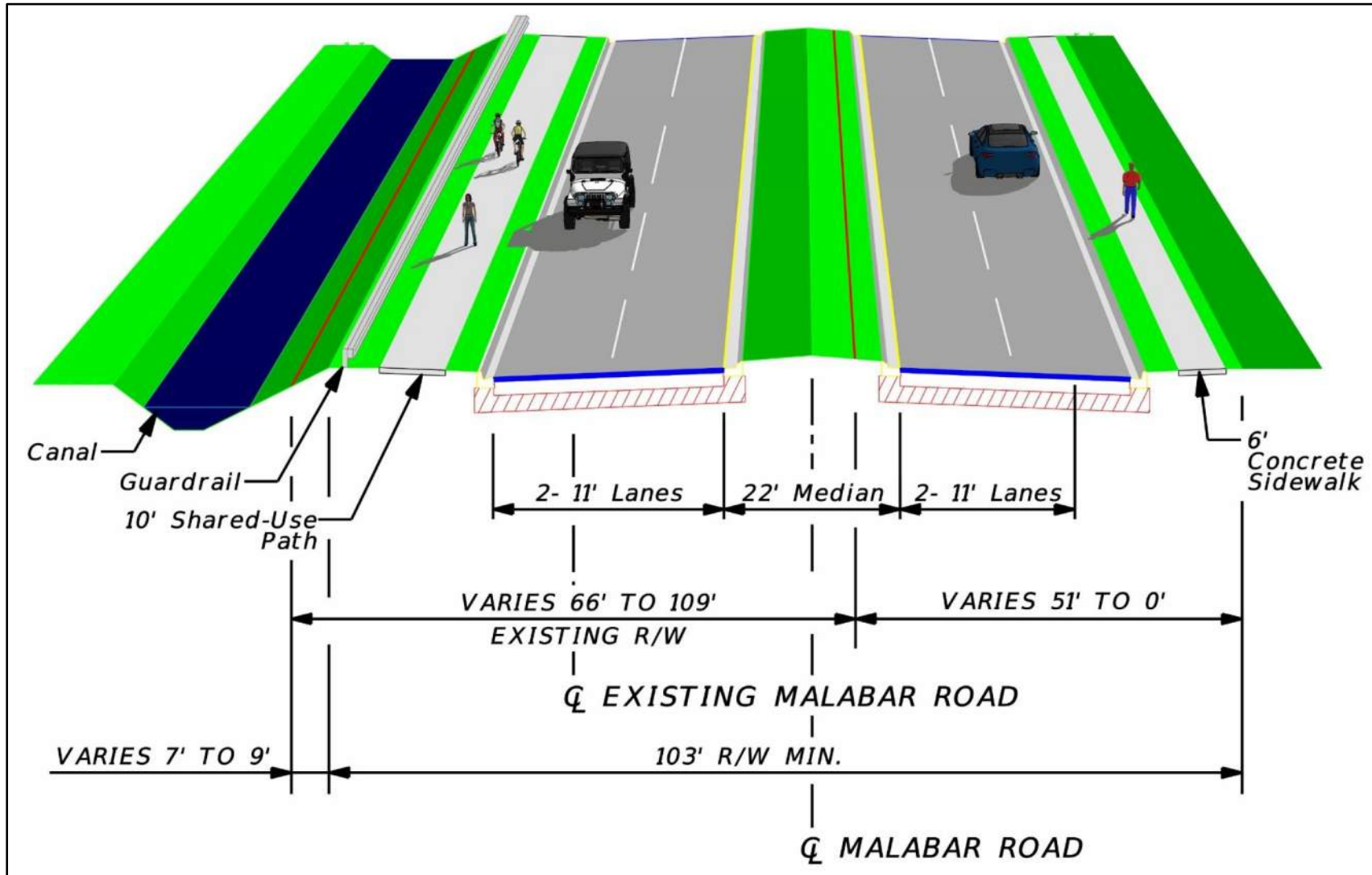
Figure 1-5: 100' Alternative B – St. Johns Heritage Parkway to Canal C-10



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Figure 1-6: 103' Alternative B – Canal C-10 to Sta. 256+80



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1.3.3 Intersection Alternatives

The following intersections were reviewed for either a traffic signal/unsignalized intersection or a roundabout:

- Traffic Signal vs Roundabout Evaluation –
 - Malabar Road & St. Johns Heritage Parkway;
 - Malabar Road & Wisteria Avenue/Abilene Drive;
 - Malabar Road & Krassner Drive/Bending Branch Lane;
 - Malabar Road & Jupiter Boulevard; and
 - Malabar Road & Garvey Road.
- Unsignalized Intersection vs Roundabout Evaluation –
 - Malabar Road & Hurley Boulevard; and
 - Malabar Road & Maywood Avenue/Daffodil Drive.

In order to analyze and compare the signalized/unsignalized alternatives to the roundabouts at each location, an intersection operational analysis and safety analysis were performed. Based on this analysis, roundabouts are anticipated to operate better or the same as the signalized/unsignalized intersection at every location except Garvey Road. Roundabouts have been shown to reduce fatal/injury crash types versus signalized/unsignalized intersections, and the results show the roundabout has lower predicted fatal/injury crashes at every intersection.

During the intersection alternatives analysis, it was determined that the following intersections would remain signalized in the preferred alternative due to operational limitations and right-of-way impacts of a roundabout configuration:

- Malabar Road & Plaza Shopping Center; and
- Malabar Road & Minton Road.

1.4 Description of Preferred Alternative

1.4.1 Selection of Preferred Alternative

The purpose of this project is to evaluate the need for capacity improvements (roadway widening) to relieve existing congestion and accommodate projected future traffic demand. The project's secondary goals are to 1) Enhance safety conditions; 2) Improve multi-modal facilities; and 3) Enhance regional and local mobility.

Alternative B with 8' south side sidewalks was selected as the preferred alternative by the City of Palm Bay and Brevard County. Alternative B was selected because it provides the wider median plus the 4' grass buffer, both meeting 2023 FDM standards, while having a negligible impact on right-of-way and only a slighter higher project cost when compared to Alternative A. A wider median would facilitate U-turn movements at directional median openings not having a bulb-out. The 4-ft grass buffer between the back of curb and the sidewalk enhances pedestrian safety from an errant vehicle and provides more comfort to the pedestrian in the sidewalk. The following bullets summarize how the preferred alternative meets the primary and secondary purpose and need goals noted above:

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- Transportation Demand/Capacity
 - In the 2050 build condition, each roadway segment is anticipated to operate at LOS C or better, except the segment from the Plaza Shopping Center to Minton Road.
 - This segment is anticipated to operate at LOS F due to the short distance (approximately 750') between the signalized intersections at the Plaza Shopping Center and Minton Road, and the effect of the overlapping delays of these two adjacent signals.
 - The signals at the Plaza Shopping Center and Minton Road will be optimized as one system in the future build condition to enhance operations between the two signals.
 - Each of the signalized intersections are anticipated to perform at LOS E or better and no intersections operated with a V/C ratio greater than 1.0 in either the 2050 AM or PM peak hour.
- Safety
 - Using the predictive safety analysis methods provided in the Highway Safety Manual (HSM), as traffic volumes increase in the no-build condition, crashes are predicted to increase by over 120 percent between 2020 and 2050.
 - By providing a four-lane facility, the 2050 crashes are predicted to be up to 40 percent less than a two-lane facility with the same traffic volumes.
- Modal Interrelationships
 - A 10' shared-use path will be provided on the north side of Malabar Road.
 - An 8' sidewalk will be provided on the south side of Malabar Road.
 - Existing transit stop access will be enhanced as part of the four-lane widening and sidewalk improvements.
- System Linkage
 - Providing a four-lane Malabar Road from the St. Johns Heritage Parkway to Minton Road would provide at least four travel lanes from the St. Johns Heritage Parkway to US 1 once the planned projects are constructed.
 - The project will also enhance the access to St. Johns Heritage Parkway, a critical north/south arterial in western Brevard County.

1.4.2 Typical Sections

The preferred alternative typical sections were designed using 2023 FDM criteria as discussed in **Section 4.2** of the *Malabar Road Preliminary Engineering Report*. The following describes the typical section elements:

- Two 11' travel lanes in each direction;
- 22' wide median, including Type E curb and gutter;
- Type F curb and gutter outside of the travel lanes;
- 10' shared-use path on the north side and 8' sidewalk on the south side; and
- 4' grass buffer between the back of the curb and the 8' south side sidewalk.

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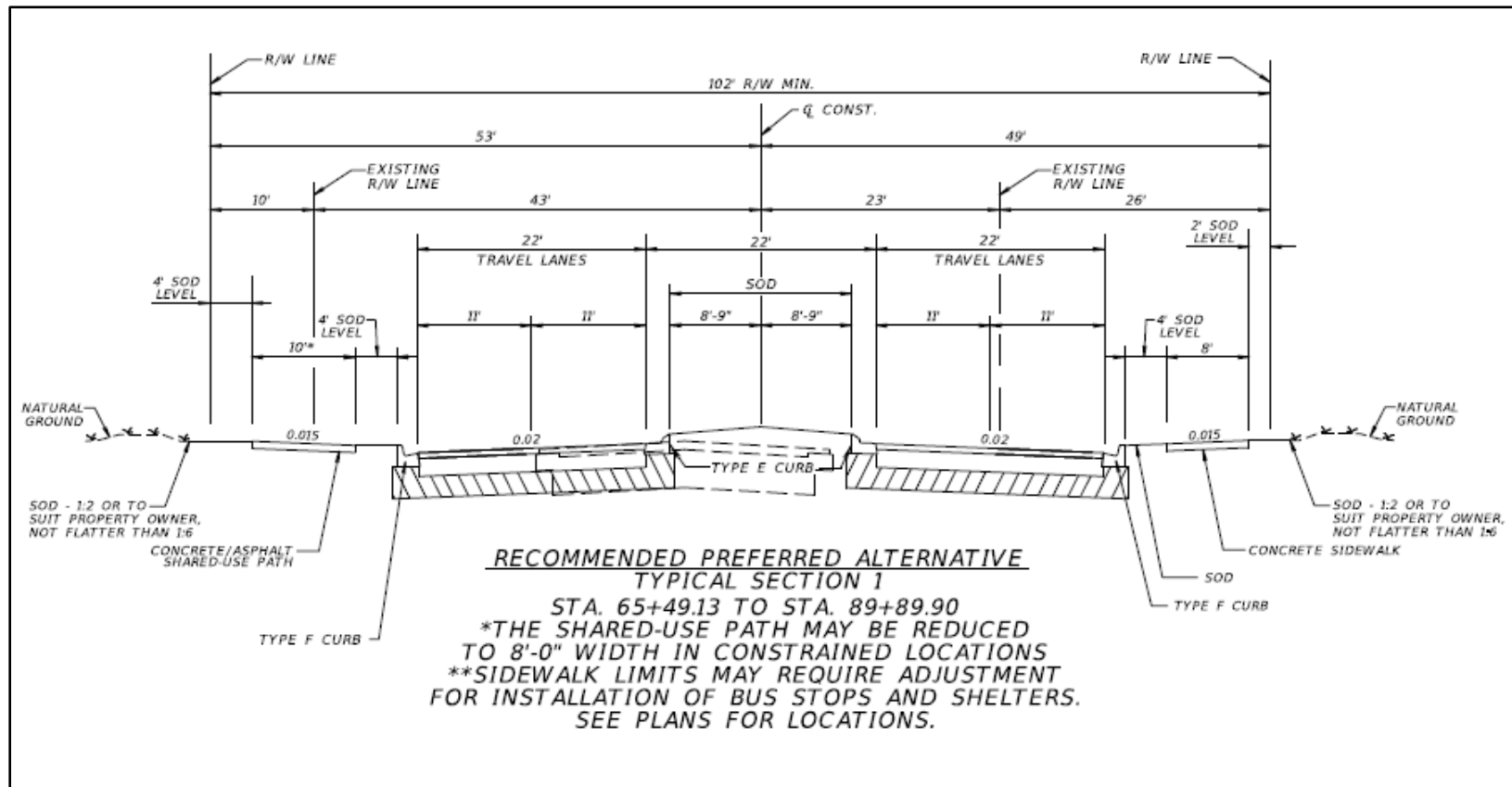
The following highlights key differences in typical section elements along the Malabar Road study corridor:

- St. Johns Heritage Parkway to Canal C-10 (**Figure 1-7**) –
 - Primarily contained within 102' to 106' of right-of-way.
 - Between Bending Branch Lane/Krassner Drive and the bridge over Canal C-10, the proposed roadway alignment is generally in the same location as the existing roadway. This was done to maintain the alignment of the westbound travel lanes coming from the bridge. The roadway in this section is positioned further south than the section from St. Johns Heritage Parkway to and Bending Branch Lane/Krassner Drive, resulting in the 106' right-of-way.
 - In front of the Tillman Lakes development (Abilene Drive), the right-of-way expands to 136'.
 - No roadside drainage swales are present within this section.
- Malabar Road over Canal C-10 (**Figure 1-8**) –
 - Two 11' travel lanes in each direction, a 10' barrier separated shared-use path on the north side and an 8' barrier separated sidewalk on the south side.
 - 19' mountable raised median on the bridge with two 1.5' inside shoulders.
 - The overall bridge width is 93.25' with the roadway crowned at 2 percent at the centerline of construction.
- Canal C-10 to West of Jupiter Boulevard (**Figure 1-9**) –
 - Proposed right-of-way width varies between 100' west of Jupiter Boulevard to 194' in the areas where dry retention linear swales are present.
 - Canal C-20 runs parallel to Malabar Road on the north side for this entire section.
- West of Jupiter Boulevard to East of Jupiter Boulevard (**Figure 1-10**) –
 - Widening is primarily contained within a 101.5' proposed right-of-way footprint.
 - In front of the USPS, the proposed right-of-way reduces to 94.5', and the south side sidewalk is reduced to 6' and brought adjacent to the back of curb.
 - Canal C-20 is being relocated to the north and retaining walls are proposed for the north and south sides of the canal.
- East of Jupiter Boulevard to Maywood Avenue/Daffodil Drive (**Figure 1-11**) –
 - Proposed right-of-way width is typically 101.5' in this section but does widen to 191' in the area where dry retention linear swales are present.
 - Canal C-20 runs parallel to Malabar Road on this section's north side.
- Note the preferred typical section varies through the Maywood Avenue/Daffodil Drive roundabout.
- West of Plaza Shopping Center (**Figure 1-12**) –
 - Widening is primarily contained within a 107' proposed right-of-way.
 - A third lane is added in the eastbound direction to accommodate turn lane improvements on the Minton Road intersection's western leg.
- The section between the Plaza Shopping Center and Minton Road intersections varies due to the turn lane configurations.

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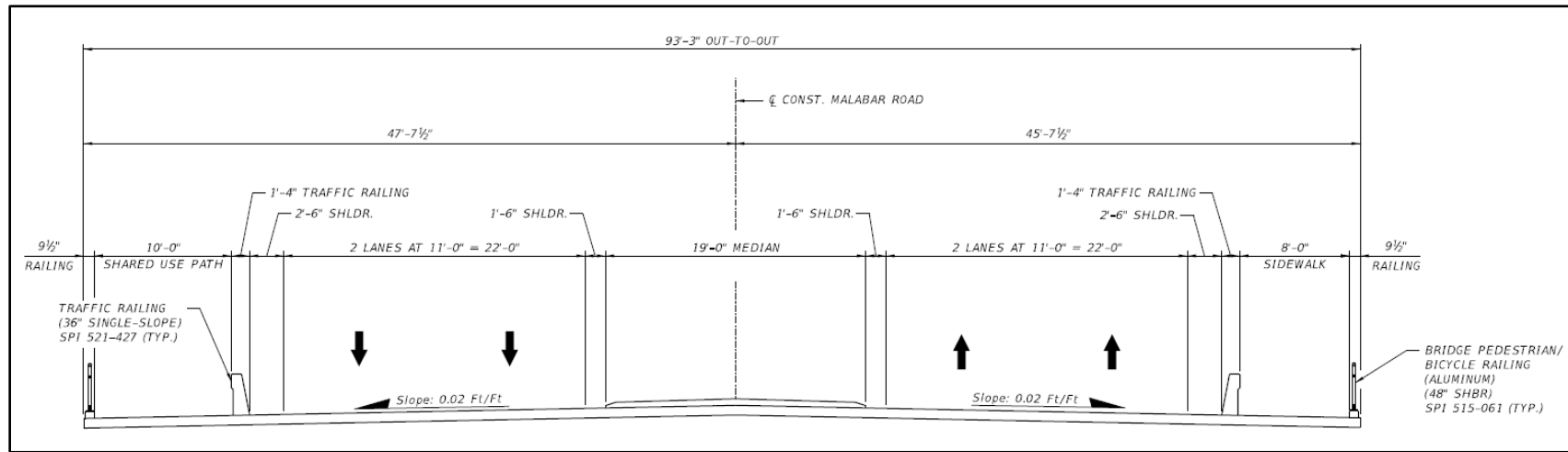
Figure 1-7: Representative Preferred Alternative Typical Section – St. Johns Heritage Parkway to Canal C-10



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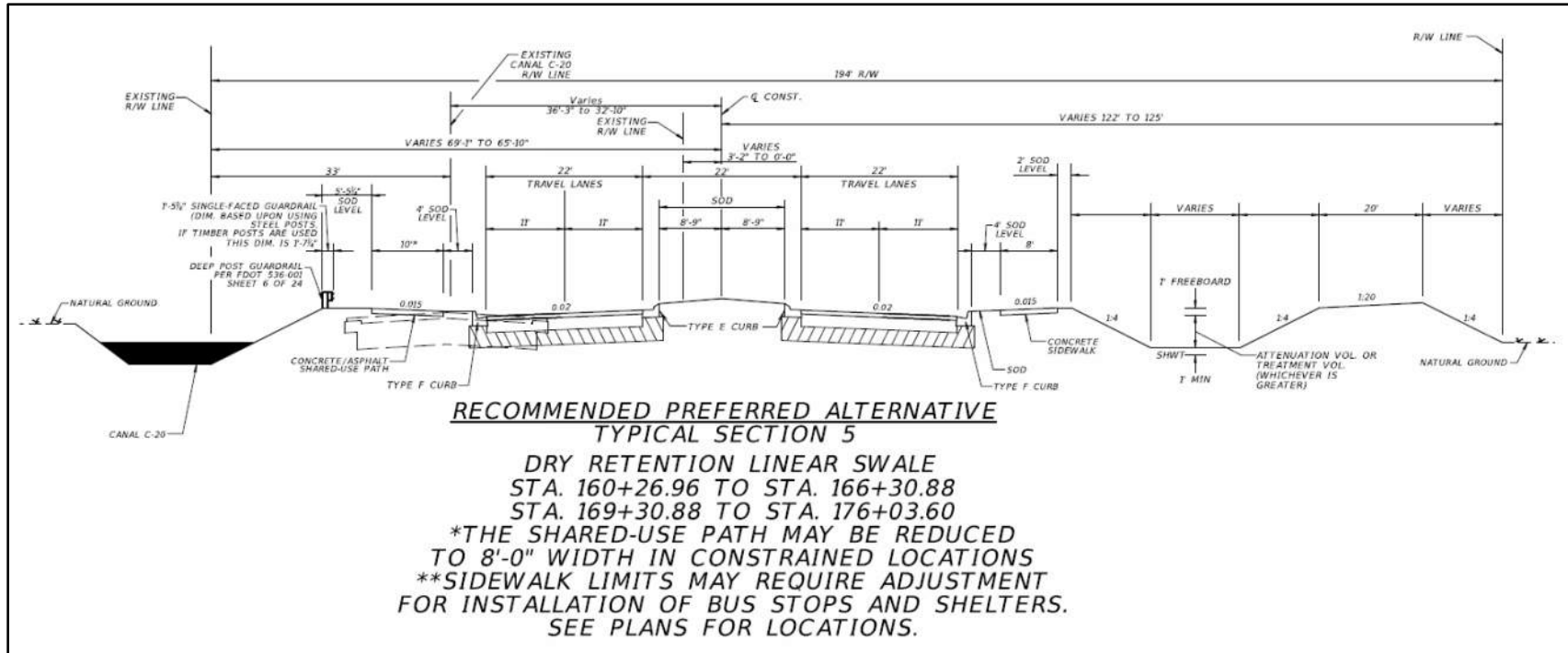
Figure 1-8: Preferred Alternative Typical Section – Bridge over Canal C-10



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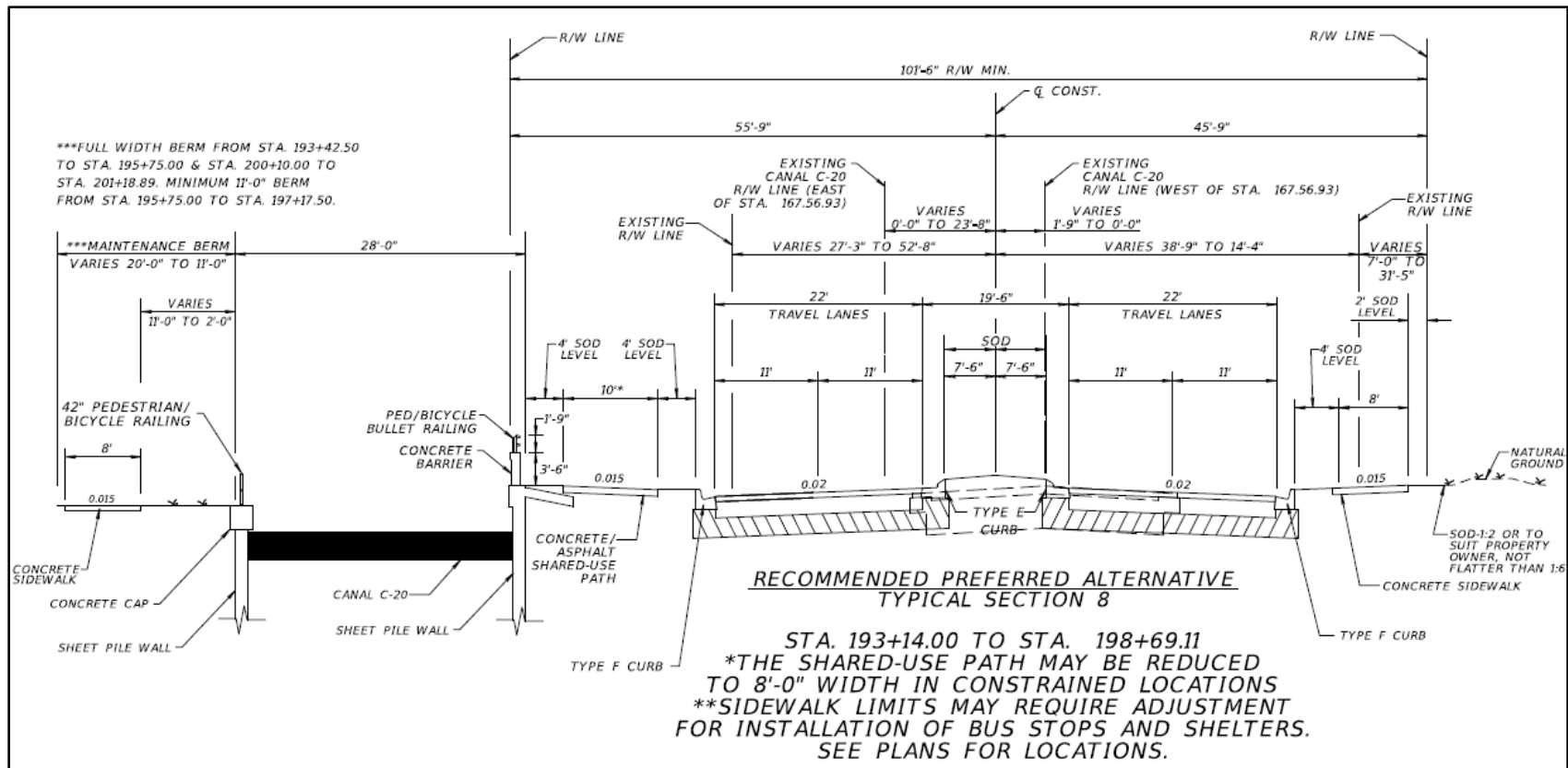
Figure 1-9: Representative Preferred Alternative Typical Section – Canal C-10 to West of Jupiter Boulevard



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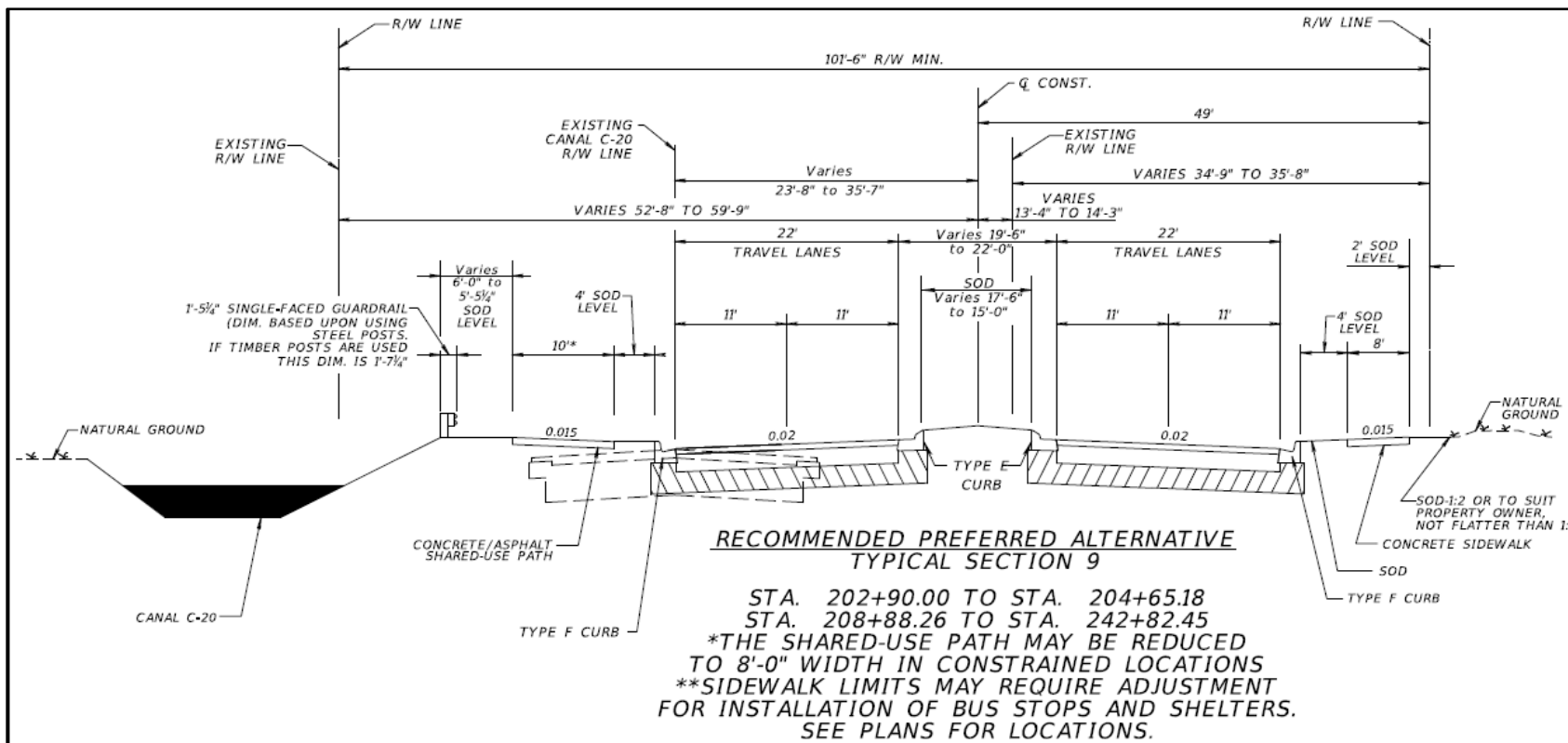
Figure 1-10: Representative Preferred Alternative Typical Section – West of Jupiter Boulevard to East of Jupiter Boulevard



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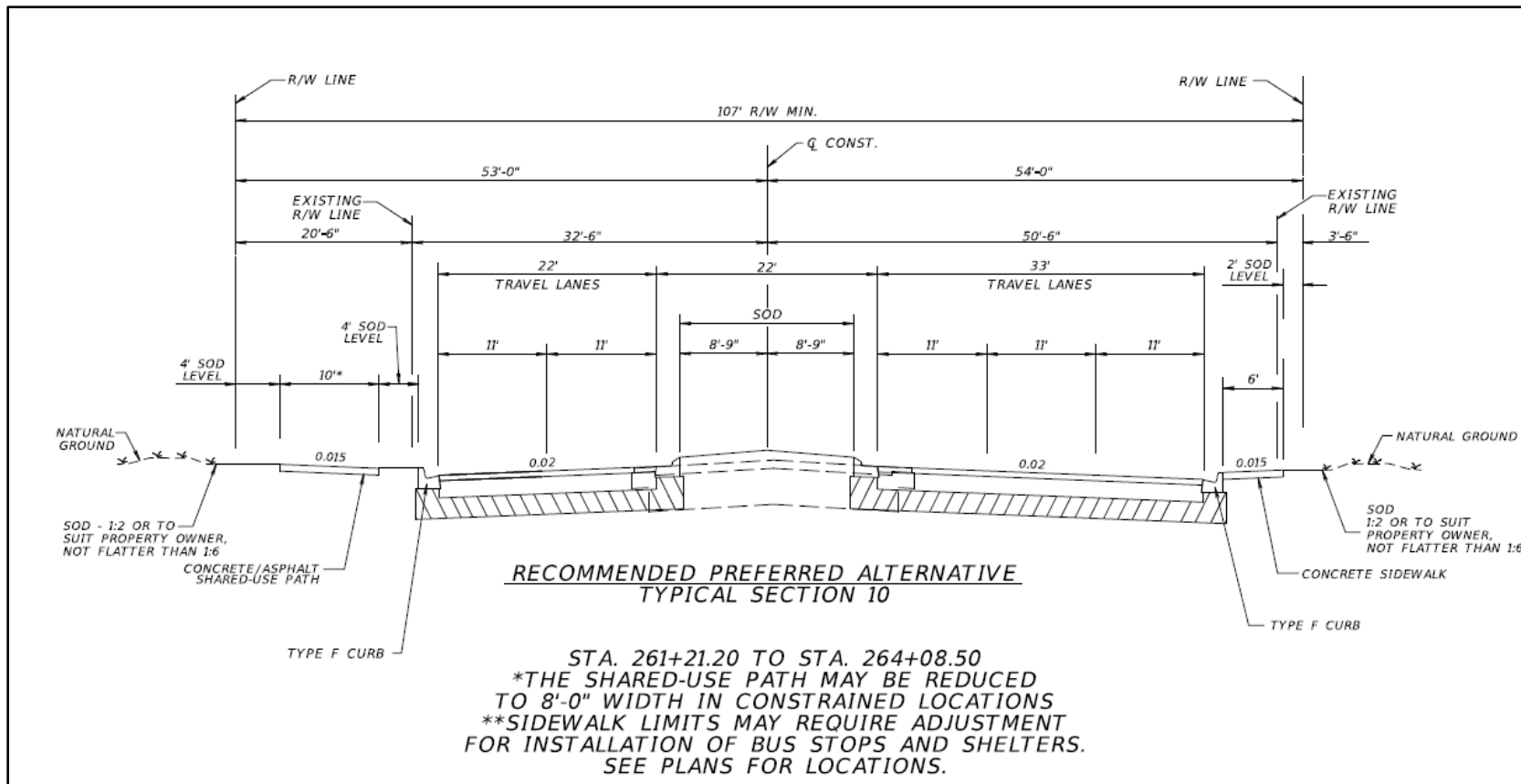
Figure 1-11: Representative Preferred Alternative Typical Section – East of Jupiter Boulevard to Maywood Avenue/Daffodil Drive



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Figure 1-12: Representative Preferred Alternative Typical Section – West of Plaza Shopping Center



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1.4.3 Intersections

Based on the intersection alternatives analysis, the following intersection control types are recommended for the preferred alternative:

- Traffic Signals –
 - Malabar Road & Jupiter Boulevard*;
 - Malabar Road & Garvey Road;
 - Malabar Road & Plaza Shopping Center; and
 - Malabar Road & Minton Road.
- Roundabouts –
 - Malabar Road & St. Johns Heritage Parkway;
 - Malabar Road & Krassner Drive/Bending Branch Lane;
 - Malabar Road & Hurley Boulevard; and
 - Malabar Road & Maywood Avenue/Daffodil Drive.
- Two-Way Stop Control –
 - Malabar Road & Snapdragon Drive;
 - Malabar Road & Championship Circle;
 - Malabar Road & Wisteria Avenue/Abilene Drive;
 - Malabar Road & Bavarian Avenue;
 - Malabar Road & Watoga Avenue/Avery Springs;
 - Malabar Road & Palm Bay Public Works Driveways;
 - Malabar Road & Post Office;
 - Malabar Road & Santa Rosa Avenue;
 - Malabar Road & Madalyn Landing; and
 - Malabar Road & Sutherland Drive.

* While the intersection of Malabar Road and Jupiter Boulevard would have improved operations and safety as a roundabout, the signal alternative was selected due to constrained right-of-way. The US Post Office in the intersection's southwest corner is federal property and cannot be impacted, shifting the alignment to the north requiring the Canal C-20 to be relocated even as a signalized intersection. The roundabout's larger footprint would require additional Canal C-20 relocation impacting nearby residences.

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2.0 Design Criteria

The design of the stormwater management facilities for the project is governed by the rules set forth by the SJRWMD, FDOT, City of Palm Bay, and Melbourne-Tillman Water Control District (MTWCD) discharge criteria, where applicable. Water treatment and attenuation requirements will comply with the guidelines as defined in Chapter 62-330 of the Florida Administrative Code (F.A.C) and the SJRWMD Permit Information Manual.

Wet detention ponds, dry retention ponds, and swale systems will provide for water quality improvements as well as water quantity attenuation for the project runoff. Please refer to the sections below for the water quality, water quantity, and pond facilities configuration criterion used for the project.

2.1 Melbourne-Tillman Water Control District Criteria

- Refer to **Section 5.2.2** for information regarding the MTWCD discharge limitations.

2.2 SJRWMD Criteria

- **Water Quality:**
 - Wet Detention Ponds: Treatment will be provided for the greater of one inch (1”) of runoff over the drainage area or two and a half inches (2.5”) of runoff from the impervious area (excluding water bodies). The drainage area for this project is considered to be all areas within the project right of way.
 - An orifice should be set at the Average Wet Seasonal Water Elevation (AWSWE) and sized to drawdown one-half of the required treatment volume within 24 to 30 hours but no more than one half of this volume will be discharged within the first 24 hours.
 - Retention Ponds and Linear Swales:
 - Off-line Systems: retention will be provided for the greater of one-half inch (0.5”) of runoff over the drainage area or one and a quarter inches (1.25”) of runoff from the impervious area (excluding waterbodies).
 - On-line Systems: retention of an additional one-half inch (0.5”) of runoff from the drainage area over the volume specified for off-line systems.
 - The entire treatment volume is to be infiltrated within 72 hours after a storm event.

The project traverses Waterbody ID (WBID) 3090 – Melbourne-Tillman (C-1) Canal, which is not impaired for nutrients according to the current FDEP 303(d) list of impaired water bodies. However, Canal C-1 eventually outfalls to the Indian River Lagoon, which is impaired for both Total Phosphorus and Total Nitrogen and is subject to a Total Maximum Daily Load (TMDL). As a conservative measure, nutrient loading analysis has been performed on all basins to show that no adverse effects are anticipated to the downstream waters. Canal C-1 is located north of Malabar Road and its location is shown in **Figure 1 of Appendix A**. There are no Outstanding Florida Waters (OFW) within this District.

- **Water Quantity:** For open basins, SJRWMD requires that the post-development peak discharge shall be at or below pre-development peak discharge for the 25-year/24-hour and mean annual storms.

Offsite discharges and peak stages for the existing and proposed conditions shall be computed using the SJRWMD 25-year/24-hour rainfall depth and the Natural Resources Conservation Service (NRCS) Type II Florida Modified 24-hour rainfall distribution with an AMC II.

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- **Pond Configuration:**
 - Wet Detention Ponds: The average length to width ratio of the wet detention pond must be at least 2:1. If short flow paths are unavoidable, the effective flow path can be increased by adding diversion barriers within the pond. Another alternative is to demonstrate that the effective permanent pool volume is provided between each inflow point in the pond to the outflow of the pond.
 - Permanent Pool – The permanent pool shall be sized to provide at least a 14-day residence time during the wet season (June – October).
 - Littoral Zone – The littoral zone shall be gently sloped (1V:6H or flatter). At least 30 percent of the wet detention pond surface area shall consist of a littoral zone.
 - Littoral Zone Alternatives:
 - An additional 50% of the appropriate permanent pool volume.
 - Pre-treatment of stormwater prior to the stormwater entering the wet detention pond. The level of pretreatment must be at least that required for retention, underdrain, exfiltration or swale systems.
 - Pond Depth – Maximum pond depth of 12 feet and a mean depth (pond volume divided by the pond area at the control elevation) between 2 and 8 feet.
 - Side Slopes – The pond must be designed so that the average pond side slope measured between the control elevation and two feet below the control elevation is no steeper than 1V:3H.
 - Retention Ponds and Linear Swales: The effectiveness of retention facilities is controlled by two key factors: the construction procedures for the facility and the overall sequence of the site construction.
 - Initially construct the retention basin to rough grade by under-excavating the basin bottom and sides by approximately 12 inches.
 - After the drainage area contributing to the retention basin has been fully stabilized, the interior side slopes and basin bottom should be excavated to final design specifications.
 - Once the retention basin has been excavated to final grade, the entire basin bottom should be deep raked and loosened for optimal infiltration.
 - The retention basin should be stabilized with pervious material or permanent vegetative cover.

2.3 City of Palm Bay Criteria

- **Water Quality:** That which is specified in Section 2.1 above.
 - Wet Detention Ponds: That which is specified in Section 2.1 above.
 - Retention Ponds:
 - Retention will be provided for the greater of one-half inch (0.5”) of runoff over the drainage area or one and one-half inches (1.50”) of runoff from the impervious area (excluding waterbodies).
- **Water Quantity:** That which is specified in Section 2.1 above.
- **Pond Configuration:** That which is specified in Section 2.1 above.

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3.0 Data Collection

The design team collected and reviewed data from the following sources:

- Palm Bay Code of Ordinances Title XVII, Chapter 174.068 – Stormwater Management and Conservation – Design Standards (August 2020)
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel Nos. 12009C0590G, 12009C0595G, 12009C0655G, and 12009C0660G, Effective Date 3/17/2014, in Brevard County, Florida.
- United States Geological Survey (USGS) Quadrangle Maps
- United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Soils Survey of Brevard County, Florida, 2016
- Field Reconnaissance (June 2020)
- Melbourne-Tillman Water Control District (MTWCD) Permitting Policy, February 2021
- City of Palm Bay Basin Maps
- Existing Permit Databases (SJRWMD)
- 1-ft LIDAR Data Source: Florida Division of Emergency Management (FDEM), Brevard County, 2007
- Total Maximum Daily Load (TMDL) for the Indian River Lagoon (March 2009)

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4.0 Existing Drainage Conditions

4.1 Topography & Hydrologic Features

Topography throughout the project is relatively flat with a very gradual uphill slope from the western end of the corridor to the east. Roadway elevations begin at 19.0 feet and increase to 26.0 feet. All elevations mentioned in this report are in reference to the North American Vertical Datum of 1988 (NAVD) unless otherwise stated. Where information was available only in the National Geodetic Vertical Datum of 1929 (NGVD), it was converted to NAVD using the conversion NAVD = NGVD – 1.38 feet. Please refer to the **USGS Quadrangle Map, Figure 2 in Appendix A**. Malabar Road does not traverse any OFWs. It is within one (1) Waterbody ID (WBID) – 3090 Melbourne-Tillman (C-1) Canal, which is not impaired for nutrients, but is within the established TMDL for nutrients for the Indian River Lagoon. There are ten (10) existing cross drains underneath Malabar Road and one (1) bridge within the project limits. The cross drains and bridge allow for conveyance of offsite and onsite runoff beneath the road toward its historical path, including the conveyance of several canals. The size and geometry of all cross drains and bridges have been estimated from 1-foot LiDAR contours, existing plans, and during field reconnaissance but should be verified during design. Please refer to **Table 4-1 for a Summary of Existing Cross Drains and Bridges**.

Table 4-1: Summary of Existing Cross Drains and Bridges

Structure No.	Station	Description	Remarks
CD-1	62+80	Double 96" RCP	C-7
CD-2	89+18	8' x 6' CBC	C-8
CD-3	114+67	18" CMP	
CD-4	115+71	Single 54" RCP	C-9
Bridge	142+00	#704004	C-10
CD-5	155+75	Single 13" x 21" RCP	
CD-6	176+84	Single 14" x 23" RCP	
CD-7	188+40	Single 21" x 28" RCP	
CD-8	224+58	Single 18" x 30" RCP	
CD-9	238+72	Single 19" x 30" RCP	
CD-10	248+33	Single 19" x 30" RCP	

4.2 Soils Data and Geotechnical Investigations

The soil survey of Brevard County, Florida (dated 2016) published by the USDA NRCS has been reviewed within the project vicinity. USDA Soil Survey Geographic database (SSURGO) data was also obtained from NRCS to create a soils map for the project limits using GIS ArcMap. The soil survey map for the project vicinity is illustrated in **Figure 3 of Appendix A**.

Table 4-2: USDA NRCS Soil Survey Information for Brevard County

Soil No.	USDA Soil Name	Seasonal High Ground Water	HSG	Soil Classification
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		Depth* (feet)	Duration (months)		Depth (inches)	Unified	AASHTO
2	Anclote Sand, Depressional, 0 to 1 percent slopes	0-1.0	---	A/D	0-19	SP, SP-SM	A-3
					19-72	SP, SP-SM	A-3
11	Canova Mucky Peat	0-1.0	---	B/D	0-13	SP, SP-SM	A-3
					13-57	SC, SM-SC	A-2, A-6
17	EauGallie Sand	0-1.0	---	A/D	0-22	SP, SP-SM	A-3
					22-35	SP-SM, SM	A-2-4, A-3
					35-55	SP, SP-SM	A-3
					55-61	SM, SM-SC, SC	A-2-4
					61-84	SM, SM-SC	A-2-4
18	EauGallie, Winder, and Riviera Soils, Depressional	0-1.0	---	A/D	N/A	N/A	N/A
19	Riviera Sand	0.25-1.5	---	C/D	N/A	N/A	N/A
22	Floridana Sand, Frequently Poned, 0 to 1 percent slopes	0-0.5	---	C/D	0-12	SP-SM	A-3
					12-29	SP-SM, SP	A-3
					29-62	SM-SC, SC	A-2
24	Floridana, Chobee, and Felda Soils, Frequently Flooded	0-1.0	---	B/D	N/A	N/A	N/A
30	Malabar Sand	0-1.0	---	A/D	0-45	SP	A-3
					45-61	SM-SC, SC	A-2-4, A-2-6
					61-65	SP-SM	A-3, A-2-4
31	Malabar, Holopaw, and Pineda Soils	0-1.0	---	A/D	N/A	N/A	N/A
33	Micco Mucky Peat, Frequently Flooded	0-1.0	---	A/D	0-30	PT	Organic
					30-38	SP, SP-SM	A-3
					38-55	SC, SM-SC	A-2, A-6
47	Pineda Sand, 0 to 2 percent slopes	0-1.0	---	C/D	0-19	SP, SP-SM	A-3
					19-35	SP, SP-SM	A-3
					35-38	SP-SM, SM	A-2-4
					38-60	SM, SM-SC, SC	A-2-4
					60-64	SM, SP-SM	A-2-4, A-3
71	Wabasso Sand	0-1.0	---	C/D	0-23	SP, SP-SM	A-3
					23-28	SP-SM	A-2-4, A-3
					28-34	SM, SP-SM	A-2-4, A-3
					34-62	SC, SM-SC	A-2
73	Winder Loamy Sand	0-1.0	---	B/D	0-12	SM	A-2
					12-17	SM	A-2
					17-31	SC, SM-SC	A-2, A-6
					31-47	SC, SM-SC, SM	A-2
					47-65	SC, SM-SC, SM	A-2

*Seasonal High Ground Water Table: Depth is referenced below existing grade, except where indicated as "+".

The soils encountered along the project limits are mostly Hydrologic Soil Group (HSG) A/D and C/D. Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission. Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. Group D soils have high runoff potential. They

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have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission. If a soil is assigned to a dual HSG, the first letter is for drained areas and the second is for un-drained areas. Soils are only assigned a dual class if they are group D in their natural condition. According to the Soil Survey, there are 13 different soil types located along the project limits within Brevard County. **Table 4-2: USDA NRCS Soil Survey Information for Brevard County** summarizes and lists the soil types and relevant information. The ground water depth varies from 0' to 5' along the project per the NRCS Soil Survey information.

A preliminary geotechnical investigation was performed by Geotechnical and Environmental Consultants, Inc. (GEC) for the pond site alternatives. A copy of the report is provided in **Appendix K – Geotechnical Investigation** of the Pond Siting Report. The geotechnical investigation estimated the seasonal high water depths at each pond site. However, SJRWMD allows controlling stormwater ponds at the average wet seasonal water elevations (AWSWE). Reasonable assumptions are made to set the control elevations of the pond site alternatives that are based on the results of the preliminary geotechnical investigation, existing permitted control elevations of nearby ponds, and NRCS information. A more detailed geotechnical investigation should be supplemented during the design phase for the selected stormwater ponds.

4.2.1 Contamination Screening

Contamination screening was conducted by Geotechnical & Environmental Consultants, Inc (GEC). As a result of the contamination screening evaluation, 21 sites have been assigned Contamination Risk Potential Ratings (CRPR). The CRPR rating system was developed by FDOT and incorporates four levels of risk: No, Low, Medium, and High. Of the 21 sites, 12 were identified as Low Risk and 9 as Medium Risk. Of the Medium Risk sites, 3 are located within or near pond site alternatives. These three sites are described below.

Site 2 is located southwest of the Malabar Road and Allison Drive Intersection and has been assigned a Medium Risk due to prior agricultural use and potential for Petroleum and Hazardous Materials. This site is located in the area of Pond C-7 Alt. 2 and FPCA Alt. 1.

Site 7 is located south of Malabar Road and east of Sutherland Drive and has been assigned a Medium Risk due to prior agriculture use resulting in an arsenic groundwater contamination plume that was documented in October 2019. A letter from FDEP dated April 3, 2020 indicated that cleanup was not required. This site is located in the area of Pond C-20 Alt. 2.

Site 21 consists of several areas of historical citrus groves throughout the project area that have been assigned Medium Risk due to potential for Hazardous Materials. None of these citrus grove locations are currently visible and many have been developed for residential or commercial use. There is potential for contamination in the following pond sites: Pond C-7 Alt. 1, FPCA C-7 Alt. 1, Pond C-7 Alt. 2, Pond C-10 East Alt. 2/C-10 West Alt. 2 Opt. 2, Pond C-20 Alt. 1 (recommended preferred).

A Level II Impact to Construction Assessment Report was conducted by GEC and completed in December 2021 for Site 21 in the vicinity of Pond C-20 Alt. 1. Since C-20 Alt. 2 has a known arsenic plume and it is difficult to determine the potential cost of remediation without significant additional investigation, it was discussed with the City of Palm Bay that a better approach would be to conduct a Level II Assessment on the site of C-20 Alt. 1

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and recommend that pond as the preferred alternative if the contamination risk was determined to be lower. GEC concluded that soils on the site do not appear to have significant impacts from arsenic, pesticides, or herbicides and should not require special handling during construction.

The sites, business operations and/or facilities identified, to date, and the risk rankings given to them are preliminary. It should be understood that these risk rankings may change pending receipt of information which indicates a discharge occurred on-site or in nearby surrounding areas. Variables that may change the risk ranking include a facility's non-compliance to environmental regulations, new discharges to the soil or groundwater, and modifications to current permits. Should any of these variables change, additional assessment of the facilities should be conducted.

For any sites with a risk ranking of "Medium", Level II field screening should be conducted if it is determined during the project's design that construction activities could be within their vicinity. Please refer to **Appendix J - Contamination Screening Evaluation Report** for further information. A contamination assessment of the pond site alternatives and the Level II Assessment are also included in **Appendix J**.

4.3 Environmental Characteristics

4.3.1 Land Use Data

The project corridor is predominantly forest and residential for the majority of the project length, with some commercial properties clustered around Jupiter Boulevard and Garvey Road. At Daffodil Drive, the land use transitions to commercial for the remainder of the project limits. Please see **Figure 5** for the **Land Use Map** in **Appendix A**. The widening of Malabar Road does not alter the existing or future land uses in the area.

4.3.2 Cultural Features

A desktop cultural resource analysis has been conducted by SEARCH Inc. The Area of Potential Effects (APE) for the ponds was defined as the pond footprints in addition to a 100-foot (30.5-meter) buffer. Based on the desktop analysis, it was determined that all sites have a Low or Low-Moderate probability of prehistoric archaeological resources and a Low probability of historic archaeological resources.

Additionally, a Phase I Cultural Resource Assessment Survey was conducted on the recommended preferred pond sites, swales, and FPCA site. The archaeological survey consisted of systematic shovel testing and pedestrian survey of the project corridor and pond footprints (i.e., the archaeological APE). A total of 23 shovel tests were excavated within the Malabar Road archaeological APE. All shovel tests were negative for cultural material. One historical resource, previously recorded archaeological site 8BR00025, was identified within the project vicinity. Due to their proximity to this resource, Pond C-7 Alt. 2 and FPCA Alt. 1 were assessed at a moderate probability for archaeological deposits. No archaeological sites or archaeological occurrences were recorded within the APE, and no further archaeological work is recommended.

The architectural survey resulted in the identification and evaluation of one newly recorded historic resource within the Malabar Road Ponds APE. The newly recorded historic resource is a linear resource (8BR04375). Based on the results of the current survey, it is the opinion of SEARCH that the Melbourne-Tillman Canal No. 8

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(8BR04375) is ineligible for the NRHP due to a lack of significant historic associations and architectural distinction. No further architectural work is recommended.

The full Cultural Resource Desktop Analysis Memo and CRAS Ponds Addendum for the proposed ponds are included in **Appendix H**.

4.3.3 Natural and Biological Features

The proposed project has potential to involve several State and/or Federally listed protected wildlife species. These species and their anticipated involvement are identified in the **Natural Resources Evaluation Report** located in **Appendix I**.

The project corridor was evaluated for the presence of potentially occurring protected species. The western most portion of the proposed project corridor occurs within the secondary protection zone (1,500 meters) of two Audubon's crested caracara nests, the preferred alternative "may affect, but is not likely to adversely affect" the continued existence of the caracara. Due to the lack of suitable habitat or defined conservation measures for the species, the preferred alternative "may affect, but is not likely to adversely affect" the continued existence of the Florida scrub-jay, wood stork, American alligator, eastern indigo snake, gopher tortoise, and federally protected plant species. The project is considered to have "no effect" on the Everglades snail kite, Florida grasshopper sparrow, red-cockaded woodpecker, and bald eagle. Similarly, "no adverse effect is anticipated" for the Florida burrowing owl, Florida pine snake, Florida sandhill crane, southeastern American kestrel, wading birds, state listed plant species, Florida black bear, and southern fox squirrel.

Wetlands and other surface waters with potential to be affected by the proposed project were identified within the study area. A wetland assessment was performed for these wetlands and other surface waters in accordance with the Uniform Mitigation Assessment Method (UMAM) as described in Chapter 62-345, FAC to determine the functional value provided by the wetlands and other surface waters. Other surface waters classified as upland cut ditches and permitted reservoirs were included in the assessment; however, mitigation will not be required for impacts to these other surface waters. Based on the wetland assessment, no direct wetland impacts are associated with the preferred alternative; however, approximately 2.20 acres of direct impacts to other surface waters are associated with the preferred alternative. Direct impacts of 0.61 acres to wetlands and 0.04 acres to other surface waters are associated with the preferred floodplain compensation site. Direct impacts to wetlands of 0.28 acres are associated with the preferred pond alternatives.

4.4 Floodplains/Floodways

According to the Federal Emergency Management Agency (FEMA), the relevant Flood Insurance Rate Map (FIRM) panel numbers are 12009C0590G, 12009C0595G, 12009C0655G, and 12009C0660G, dated 3/17/2014.

According to the FEMA FIRMs, portions of the project intersect Zone AE of the 100-year floodplain at the western end of the project limits. These areas are associated with the Three Forks Conservation Area and C-8 Canal and have a 1% probability of flooding every year. The established flood water elevation is 20.0 feet NAVD. There are no federally regulated floodways within the project limits. Please refer to **Appendix A – Figure 5** for the **FEMA Floodplains Map**.

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The MTWCD has a watershed model that includes the canals along the project. Additionally, a Stormwater Management Model (SWMM) was developed for Canal C-1 by SJRWMD and the MTWCD. This model includes data for Canals C-7 and C-8 which outfall directly to Canal C-1. Results of this model were also utilized for data collection. Please refer to the Location Hydraulics Report prepared for this study for additional information regarding floodplains.

4.4.1 Flooding History and Maintenance Concern

Discussions were held with the City of Palm Bay, MTWCD, and SJRWMD regarding drainage issues along the project corridor. Mike McCabe from MTWCD indicated that flooding occurs around Belvedere Road during large storm events, where the C-20 Canal overtops into nearby streets and yards. A review of the MTWCD data indicates that two of the downstream culverts (located at the entrances to the Hoyle property and Davis property) are undersized relative to the upstream culverts, which is likely contributing to the overtopping. We recommend replacement of the undersized culverts to alleviate some of the flooding concern. The culvert sizes in this vicinity can be seen in **Figure 4-1** below. More information can be found in the *Location Hydraulics Report* prepared for this study.

Figure 4-1: Flooding History



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4.5 Existing Drainage Permits

There are currently thirty-two (32) SJRWMD permits within the project limits that are adjacent to or along Malabar Road and may be impacted by the proposed improvements. The sections below briefly describe the permitted condition and the impacts to the permit associated with the proposed improvements. Generally, permits are listed in order from the beginning of the project to the end (west to east). Documents from select permits that will be significantly impacted by the widening of Malabar Road or were used for the collection of drainage structure data can be found in **Appendix G – Existing Permits**.

4.5.1 Permit No. 113120-2

Permit No. 113120-2 was issued on November 11, 2008. This permit is to construct approximately 4,090 feet of 28' wide asphalt paved roadway extension of Malabar Road NW to replace existing dirt road. It is anticipated that the roundabout and widening of Malabar Road will impact the existing drainage swales, cross drains, drainage structures, and sidewalk. This permit was used for collection of drainage information for the purpose of this PD&E Study, and relevant documents can be found in Appendix G.

4.5.2 Permit No. 113120-4

Permit No. 113120-4 was issued on November 19, 2013. This permit is a modification to the previously permitted stormwater management system for the extension of Malabar Road NW and the addition of turn lanes. It is anticipated that the roundabout and widening of Malabar Road will impact the existing drainage swales, cross drains, drainage structures, and sidewalk. This permit was used for collection of drainage information for the purpose of this PD&E Study, and relevant documents can be found in Appendix G.

4.5.3 Permit No. 62976-1

Permit No. 62976-1 was issued on November 29, 1999. This permit is for the construction of a concrete sidewalk along the north side of Malabar Road from the Palm Bay Regional Park Entrance Road to Minton Road and associated drainage improvements. The sidewalk spans almost the entire limits of this PD&E Study. It is anticipated that this sidewalk will be reconstructed from the beginning of the project to Canal C-10 and from Daffodil Drive to the end of the project. This permit was used for collection of drainage information for the purpose of this PD&E Study, and relevant documents can be found in Appendix G.

4.5.4 Permit No. 125243-1

Permit No. 125243-1 was issued on March 29, 2011. This permit is for the construction of approximately 3 miles of the Palm Bay Parkway, from Malabar Road to the north limits of the City of Palm Bay; the western extension of Pace Drive from Gillmar Avenue NW to the Parkway which is approximately 0.5 miles; and the western extension of Emerson Drive from Amadar Avenue NW to the Parkway which is approximately 0.5 miles; and the associated stormwater management areas. It is anticipated that the roundabout and widening of Malabar Road will impact the existing drainage swales, cross drains, drainage structures, and sidewalk. This permit was used for collection of drainage information for the purpose of this PD&E Study, and relevant documents can be found in Appendix G.

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4.5.5 Permit No. 126000-3 and 126000-4

Permits No. 126000-3 (December 10, 2018) and 126000-4 (September 18, 2020) are for the construction of a new single-family residential subdivision, St. Johns Preserve, with an associated surface water management system. This development is located northwest of the intersection of St. Johns Heritage Parkway and Malabar Road. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.6 Permit No. 95293-1

Permit No. 95293-1 was issued on December 1, 2004. This permit is for the construction of a single-family residential subdivision, Parkside West, with an associated surface water management system, located northeast of the intersection of St. Johns Heritage Parkway and Malabar Road. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.7 Permit No. 158876-1

Permit No. 158876-1 was issued on September 6, 2019. This permit is to replace an existing failing arch pipe (103-inch x 71-inch) under Malabar Road with a new box culvert (8' x 6' CBC) to allow for adequate conveyance of flood waters to protect the roadway and not adversely impact surrounding properties. Construction of this project was recently completed and for the purpose of this study, 8' x 6' is considered to be the existing culvert size for CD-2. It is anticipated that the widening of Malabar Road will require extension of this box culvert. Relevant documents for this permit can be found in Appendix G.

4.5.8 Permit No. 62395-1

Permit No. 62395-1 was issued on October 28, 1999. This permit is the construction of three pedestrian bridges to provide a continuous connection for a proposed sidewalk on the north side of Malabar Road. The pedestrian bridges cross over Canals C-8, C-9 and C-10. It is anticipated that all three pedestrian bridges will be removed as part of the widening of Malabar Road. Relevant documents for this permit can be found in Appendix G.

4.5.9 Permit No. 136835-1

Permit No. 136835-1 was issued on June 3, 2014. This permit is for the construction of a residential subdivision and associated stormwater system located on the south side of Malabar Road adjacent to Canal C-8. The permit expired in 2019 before construction was initiated. This parcel is a 32.72 acre parcel owned by Vacation Finance LLC and is the location of Pond C-8 & C-9 Alternative 2, which is not the recommended preferred pond site for this basin. It is not anticipated that the widening of Malabar Road will impact this permit, unless the recommended preferred pond alternative is changed during design and/or the permit is extended and construction is initiated. This permit also included a 46' right-of-way dedication for the widening of Malabar Road.

4.5.10 Permit No. 101710-7

Permit No. 101710-7 was issued on December 6, 2018. This permit is for a stormwater management system to serve the Chapparral subdivision located on the south side of Malabar Road adjacent to Allison Drive. The mass grading and stormwater management facilities for this project were previously constructed, and construction has now resumed on the remaining features. It is not anticipated that the widening of Malabar Road will impact

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the stormwater management system since the project included a 50' right-of-way dedication for the widening of Malabar Road.

4.5.11 Permit No. 95299-1, 95299-4, and 95299-5

Permits No. 95299-1 (January 11, 2005), 95299-4 (July 19, 2016), and 95299-5 (May 20, 2019) are for the construction and subsequent modifications of the Brentwood Lakes single family subdivision and associated stormwater management facilities, located on the south side of Malabar Road at Bending Branch Lane. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.12 Permit No. 156684-1

Permit No. 156684-1 was issued on February 26, 2019. This permit is for the Palm Bay Safe Routes to School Project and includes construction of sidewalk along various roadway segments, including along the south side of Malabar Road from Hurley Boulevard to the United States Post Office. This sidewalk is under construction as of the publication of this report. It is anticipated that the widening of Malabar Road will impact the sidewalk and this permit. Relevant documents for this permit can be found in Appendix G.

4.5.13 Permit No. 149645-1 and 149645-2

Permits No. 149645-1 (August 8, 2017) and 149645-3 (September 14, 2020) are for the construction and subsequent modification of a single-family residential subdivision named Avery Springs, including stormwater management facilities. This permit also includes the enclosure of City of Palm Bay Canal 26-06. This project is under construction as of the publication of this report. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.14 Permit No. 134029-1

Permit No. 134029-1 was issued on February 21, 2014. This permit is for the construction of an 8' wide asphalt trail (Cross City Trail) in the FPL easement, beginning at Malabar Road and extending to the south. It is anticipated that the sidewalk proposed as part of this PD&E study will tie-in to the existing trail at this location, and no impacts to the permit are anticipated.

4.5.15 Permit No. 34558-1

Permit No. 34558-1 was issued on November 6, 1995. This permit is for the construction of the Fellowship United Methodist Church and associated stormwater management facility. The project is located on the north side of Malabar Road, west of Jupiter Boulevard. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.16 Permit No. 32204-1

Permit No. 32204-1 was issued on February 22, 1998. This permit is for the construction of the City of Palm Bay Public Works Complex and associated stormwater management facilities. The project is located on the south side of Malabar Road, west of Jupiter Boulevard. It is not anticipated that the widening of Malabar Road will impact this permit.

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4.5.17 Permit No. 34712-1

Permit No. 34712-1 was issued on November 21, 1996. This permit is for the construction of the Palm Bay West Post Office and associated stormwater management facilities. This property is located at the southwest corner of the intersection of Malabar Road and Jupiter Boulevard. It is not anticipated that the widening of Malabar Road will impact this permit, and as a federal property, steps have been taken to avoid any impacts to the Post Office.

4.5.18 Permit No. 153108-1

Permit No. 153108-1 was issued on December 17, 2018. This permit is for the construction of a dry retention stormwater management system to serve a new Circle K gas station and convenience store that will replace an existing gas station and convenience store currently located at the southeast corner of Malabar Road and Jupiter Boulevard. The widening of Malabar Road will impact the permitted Swale C-1, however this swale was designed to provide nutrient treatment to Malabar Road only and will therefore not affect the overall stormwater management system of this property.

4.5.19 Permit No. 131143-1

Permit No. 131143-1 was issued on August 27, 2012. This permit is for the replacement of the Canal C-20 side drain underneath Greenbriar Avenue, which was previously a 40" x 65" corrugated metal pipe and was permitted to be replaced with a double 38" x 60" RCP with MES end treatments. However, the final condition of this side drain is a single round 66" RCP with no end treatments. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.20 Permit No. 157293-1

Permit No. 157293-1 was issued on May 17, 2019. This permit is for the construction of a grocery store and retail building with associated parking lot and 2 dry retention areas. The project is located at the southwest corner of the intersection of Malabar Road and Garvey Road. It is anticipated that the widening of Malabar Road will impact the parking area and associated drainage structures, but not the retention areas.

4.5.21 Permit No. 24472-1

Permit No. 24472-1 was issued on October 14, 1998. This permit is for construction of 19 apartment buildings for the Madalyn Landings Apartment Complex, located on the south side of Malabar Road east of Garvey Road. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.22 Permit No. 96870-1 and 96870-3

Permits No. 96870-1 (October 23, 2007) and 96870-3 (March 2, 2016) are for the construction of a multi-family townhome development and subsequent modification to a single-family residential subdivision called The Falls. The project includes construction of two wet detention stormwater ponds. It is not anticipated that the widening of Malabar Road will impact this permit since the project included a 46' right-of-way dedication for Malabar Road.

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4.5.23 Permit No. 113800-1

Permit No. 11300-1 was issued on February 12, 2008. This permit is for the construction of a multi-family development called Malabar Cove, with associated stormwater management facilities. The project is located approximately 600' south of Malabar Road, at Daffodil Drive. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.24 Permit No. 136920-2

Permit No. 136920-2 was issued on May 21, 2014. This permit is for the construction of a nursing home facility known as Palm Bay Memory Care and infrastructure for future out parcels, located on the south side of Malabar Road. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.25 Permit No. 123594-1

Permit No. 123594-1 was issued on August 16, 2010. This permit is for the construction of a Dollar General and associated parking and stormwater management facilities located on the north side of Malabar Road. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.26 Permit No. 132978-1

Permit 132978-1 was issued on March 26, 2013. This permit is for the construction of O'Reilly Auto Parts and associated parking and stormwater management facilities, including a dry retention pond. It is not anticipated that the widening of Malabar Road will impact the building or retention pond, but minor impacts to the parking area and associated drainage infrastructure may occur.

4.5.27 Permit No. 63650-1

Permit No. 63650-1 was issued on April 11, 2000. This permit is for the construction of the Palm Bay City Center, a retail development located at the northwest corner of the intersection of Malabar Road and Minton Road, as well as future outparcel space. The master stormwater pond was constructed, but not the remaining development features. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.28 Permit No. 63650-2

Permit No. 63650-2 was issued on November 21, 2002. This permit is for the construction of Walgreens on Outparcel 5 of the Palm Bay City Center. This development utilizes the existing Palm Bay City Center master stormwater pond. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.29 Permit No. 63650-3

Permit No. 63650-3 was issued on April 8, 2005. This permit is for the construction of Outparcel 6 of the Palm Bay City Center, named Coral Bay Center. This development utilizes the existing Palm Bay City Center master stormwater pond. It is not anticipated that the widening of Malabar Road will impact this permit.

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4.5.30 Permit No. 23750-1

Permit No. 23750-1 was issued on November 15, 1988. This permit is for the construction of the Palm Bay West shopping center with associated stormwater management, parking, and outparcels. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.31 Permit No. 34427-1

Permit No. 34427-1 was issued on February 20, 1995. This permit is for the construction of Autozone and associated parking and stormwater management facilities. The control structure for the dry retention area is located near the front of the property and may be impacted by the widening of Malabar Road.

4.5.32 Permit No. 16558-5

Permit No. 16558-5 was issued on July 8, 1998. This permit is for the widening of Malabar Road from just west of Minton Road to Emerson Drive and the construction of several stormwater management ponds including “Pond A” that is utilized for the purpose of this Study. This is a modification to several previous versions of this permit, however under the previous versions of the permit, Pond A was proposed to be in a different location. This version of the permit was determined to most accurately reflect the constructed location and dimensions of Pond A, and was used for data collection about the basin and pond. Pond A is officially located on the property of the adjacent 7-11 Convenience Store, although they have their own stormwater management facilities (Permit No. 76300-1). It is recommended that Pond A be used for the minor improvements that are proposed within Basin A and it is anticipated that the pond will be used as-is and no modifications will be proposed. Pond A is a linear dry retention pond that outfalls to the adjacent Canal C-37. Relevant documents for this permit can be found in Appendix G.

4.5.33 Permit No. 76300-1

Permit No. 76300-1 was issued on July 14, 1999. This permit is for the construction of the 7-11 Convenience Store and a retail building at the southeast corner of the intersection of Malabar Road and Minton Road with associated stormwater management facilities consisting of two dry retention ponds. It is not anticipated that the widening of Malabar Road will impact this permit.

4.5.34 Permit No. 150560-1

Permit No. 150560-1 was issued on June 26, 2017. This permit is for the redevelopment of the Jiffy Lube at the northeast corner of the intersection of Malabar Road and Minton Road to a new Cumberland Farms Convenience Store. This permit includes the plugging of an old control structure that previously directed overflow runoff from the site to “Pond A.” The stormwater is now directed to an underground detention system that overflows directly into Canal C-37. As a result, a small amount of additional capacity is created in Pond A that can be utilized for minor improvements to Malabar Road. Relevant documents for this permit can be found in Appendix G.

4.6 Existing Drainage Basins

There are currently seven (7) existing drainage basins within the project limits. Existing basin limits were determined by reviewing permitted plans and MTWCD Interconnected Channel and Pond Routing (ICPR) model

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information to identify the most probable drainage patterns and outfall locations. Refer to **Appendix B – Basin Maps** for basin locations. The sections below describe the basin limits and characteristics.

4.6.1 Basin C-7

Basin C-7 begins at the project start, approximately 600 feet west of St. Johns Heritage Parkway, at station 55+48 and continues east to Championship Circle NW at station 88+10. Runoff from Malabar Road is collected in roadside swales that convey runoff to Canal C-7. From west of the project limit to Snapdragon Drive (station 78+50) the swales are permitted under Permit No. 113120-2 to provide treatment for the 2-lane configuration of Malabar Road. From Snapdragon Drive to Championship Circle NW, the swales are not permitted for treatment. CD-1 is located at station 62+80 and connects Canal C-7 underneath Malabar Road. Canal C-7 flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via Canal C-1.

4.6.2 Basin C-8

Basin C-8 begins at Championship Circle NW at station 88+10 and continues east to Wisteria Avenue NW at station 107+68. Stormwater runoff from Malabar Road is collected in roadside ditches and conveyed west to Canal C-8. CD-2 is located at station 89+18 and connects Canal C-8 underneath Malabar Road. Canal C-8 flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via the Canal C-1.

4.6.3 Basin C-9

Basin C-9 begins at Wisteria Avenue NW at station 107+68 and continues east to Krassner Drive at station 129+48. Stormwater runoff from Malabar Road is collected in roadside ditches and conveyed to Canal C-9. CD-3 is located at station 114+67 and conveys stormwater from the ditch on the south side of Malabar Road to the ditch on the north side. CD-4 is located at station 115+71 and connects Canal C-9 underneath Malabar Road. The Canal C-9 flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via the Canal C-1.

4.6.4 Basin C-10 West

Basin C-10 West begins at Krassner Drive at station 129+48 and continues east to the bridge over the C-10 Canal at station 142+00. Stormwater runoff from Malabar Road is collected in roadside ditches and conveyed to the C-10 Canal, which flows north. There are no existing cross drains within this basin. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via Canal C-1.

4.6.5 Basin C-10 East

Basin C-10 East begins at the bridge over the C-10 Canal at station 142+00 and continues east to a high point at station 184+00. The C-20 Canal runs parallel to Malabar Road along the north side and stormwater runoff sheet flows directly into the canal. Ditches along the south side of Malabar Road also collect stormwater runoff and discharge to the C-20 Canal via CD-5 and CD-6 located at stations 155+75 and 176+84, respectively. The C-20 Canal flows west and discharges into the C-10 Canal, which flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via Canal C-1.

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4.6.6 Basin C-20

Basin C-20 begins at a high point at station 184+00 and continues east to station 264+15, which is the entrance to the Coral Bay shopping center. The C-20 Canal runs parallel to Malabar Road along the north side and stormwater runoff sheet flows directly into the canal. Ditches along the south side of Malabar Road also collect stormwater runoff and discharge to the C-20 Canal via CD-7, C-8, CD-9 and CD-10 located at stations 188+40, 224+58, 238+72, and 248+33, respectively. The C-20 Canal flows west and discharges into the C-10 Canal, which flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via Canal C-1.

4.6.7 Basin A

Basin A begins at station 264+15 and continues east to station 274+00, approximately 300 feet past the end of the project limits. This basin consists of an existing curb and gutter roadway with stormwater collected in a storm sewer system. The storm sewer flows east to City of Palm Bay "Pond A", which is a dry pond permitted under Permit No. 16558-4 and modified under Permit No. 16558-5. The pond outfalls to the adjacent C-37 Canal which flows north. This basin is considered an open basin and the ultimate outfall is the Indian River Lagoon via Canal C-1.

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5.0 Proposed Drainage Conditions

The stormwater runoff from the project limits will be collected and conveyed via curb and gutter to the recommended preferred pond alternative for each basin. The various pond alternatives consist of dry retention ponds, wet detention ponds, and dry linear swales. The ponds will discharge at or near the same cross drains that carry the roadway runoff in the existing condition, or directly into canals where appropriate. The proposed ponds have been sized to achieve the required water quality treatment and water quantity attenuation and serve as a budget tool for right-of-way estimation for the project to the City of Palm Bay.

5.1 Proposed Basins

There are currently six (6) proposed drainage basins within the project limits. Two (2) pond alternatives for each basin have been analyzed, with the exception of Basin A for which the existing Pond A will be utilized and Basin C-7 where three pond alternatives have been investigated.

The onsite roadway basin areas draining to the ponds were determined to be the areas within the proposed right-of-way limits. The limits of the proposed basins typically begin and end at the same locations as the existing condition, except at two locations. The C-8 and C-9 Basins are combined in the proposed condition due to limited pond site availability. At the east end of the project, the divide between Basin C-20 and Basin A is moved approximately 335 feet east in order to maintain the same amount of impervious area directed to Pond A. Please see the basin descriptions below for more information. The location of the outfall in the proposed condition is the same as the existing condition. Attenuation in the proposed ponds is provided in all basins. Please refer to the Basin Maps in **Appendix B** for the pond locations. **Table 5-1: Summary of Proposed Drainage Basins** provides a summary of the proposed basin limits.

Table 5-1: Summary of Proposed Drainage Basins

Basin Name	From Station	To Station
C-7	55+48	88+10
C-8 & C-9	88+10	129+48
C-10 West	129+48	142+00
C-10 East	142+00	184+00
C-20	184+00	267+50*
A	267+50*	274+00

*In the proposed condition, the basin divide between Basin C-20 and Basin A is moved 335 feet to the east.

5.2 Methodology of Pond Determination

5.2.1 General Process

The pond sizing analysis assumes that all ponds will be designed using the appropriate criteria for wet detention or dry retention based on the best available water table data and other conditions at the proposed site. Water table data was collected from the geotechnical report completed by GEC (**Appendix K – Geotechnical Report**). SJRWMD allows controlling stormwater ponds at the average wet seasonal water elevations (AWSWE), which is the criteria used for wet detention ponds. Dry retention ponds were designed with bottom elevations set a

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minimum of 2 feet above the estimated seasonal high water table elevation (SHWT) and dry retention swales were designed with bottom elevations set a minimum of 1 foot above the estimated SHWT elevation. Reasonable assumptions are made to set the control elevations of the pond site alternatives that are based on the results of the preliminary geotechnical investigation, existing permitted control elevations of nearby ponds, and NRCS information, as described in the sections below. The ponds were sized on the assumption that offsite runoff would bypass the pond site alternative toward its historical path. Our preliminary investigation indicates that the proposed pond site alternatives will have minimal impacts to offsite runoff except for Pond C-8 & C-9 Combined Alt. A which will require the replacement of a network of drainage ditches that serve the Port Malabar residential areas north of Malabar Road. The report focuses on the preliminary estimate of required pond volumes necessary for each roadway drainage basin. A 20% upsize in the required pond right-of-way area has been applied for all the ponds to account for preliminary parameters such as the estimated average wet seasonal water elevations, ground elevations and potential natural contouring of the ponds. Additionally, the recommended preferred pond alternative for each basin was modeled in ICPR, and the model was used to determine an additional contingency factor needed to better represent the pond size that would meet local limiting discharge criteria (see **Section 5.2.2** and **Section 5.2.3** below).

The ponds were sized to accommodate four (4) 11-foot travel lanes, curb and gutter, a 8-foot sidewalk on the south side of the roadway, and a 10-foot shared use path on the north side of the roadway. From the beginning of the project to the C-10 Canal, the proposed R/W width is 102 feet. For the remainder of the project, the proposed R/W width is 105 feet.

The locations of potential pond sites were selected by first considering proximity to the outfall location, then by considering site features such as estimated average wet seasonal water elevations, soil types, land use, and aesthetic features. There are several vacant parcels near Malabar Road that are currently owned by the City of Palm Bay and have been identified as potential pond sites wherever possible. Additionally, the City has begun purchasing individual residential parcels along the south side of Malabar Road from station 145+00 to 175+00 for the future widening of Malabar Road. These and other adjacent parcels will be left with remnant portions not needed for the roadway, and as such have been identified as potential swale locations. The other pond alternative sites are vacant parcels including vacant or unused agricultural lands, vacant residential properties, and vacant commercial properties. It is not anticipated that any of the pond site alternatives will alter existing or future land uses of surrounding properties or significantly impact existing landscapes. During the final design, additional consideration should be given to aesthetic features to comply with the Highway Beautification Act including softening of the pond contours, landscaping, and other aesthetics features.

The following parameters were considered in determining the size and location of the potential pond sites:

- Hydrologic and hydraulic factors such as existing ground elevations, soil types, estimated average wet seasonal water elevations (AWSWE) stormwater conveyance feasibility, allowable hydraulics grade line (HGL), and local discharge criteria (see below);
- Environmental resource impacts including wetlands and threatened or endangered species;
- Floodplain Impacts;
- Major utility conflict potential;

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- Parcel descriptions and land usage;
- Impacts to cultural resources;
- Impacts to contamination sites;

5.2.2 Local Discharge Criteria

The canals in the area of this PD&E are maintained by the MTWCD and are subject to limiting discharge criteria established by the agency. This criteria was used to establish maximum allowable discharges for each basin along Malabar Road that was considered during the ICPR modeling process. For Basin C-20, the supplemental swale was not included in the model, and discharge calculations were performed only for the recommended preferred pond alternative because a separate basin area was not identified for the supplemental swale. It is anticipated that the discharge from the supplemental swale will be minimal. Basin A was excluded from the modeling process because it utilizes an existing pond and it is not anticipated that any modifications will be made to the pond or its control structure.

The maximum discharge allowed is 0.08 cfs/acre for the 25-year/24-hour storm and 0.05 cfs/acre for the mean annual storm. This criteria only applies to new impervious area; therefore, the maximum allowable discharge was calculated by adding the pre-development discharge over the existing R/W and the MTWCD maximum discharge over the new impervious area.

For the calculated allowable discharge for each basin, please refer to **Table 5-2: Summary of Allowable Discharge Criteria** and the ICPR calculations provided in **Appendix D – Pond Modeling**.

Table 5-2: Summary of Allowable Discharge Criteria

Basin Name	Design Storm	Allowable Maximum Discharge (cfs)	Provided Maximum Discharge (cfs)
C-7	25yr/24hr	13.17	5.93
	Mean Annual	7.15	1.52
C-8 & C-9	25yr/24hr	14.43	13.87
	Mean Annual	7.79	1.39
C-10 West & East	25yr/24hr	34.79	33.85
	Mean Annual	19.83	18.73
C-20	25yr/24hr	71.71	63.30
	Mean Annual	40.19	22.84

5.2.3 ICPR Modeling Process

In order to show that local discharge criteria will be met, it was necessary to perform an ICPR model that allowed for the analysis of basin characteristics, pond volumes, pond stages, outfall structures, and tailwater conditions. Tailwater conditions were determined from the MTWCD ICPR watershed C-20 model or the SWMM model, as appropriate. All models were performed in ICPR 3. The complete input and node results reports are available in **Appendix D**.

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Each pond alternative was initially sized to meet treatment and attenuation requirements using a volumetric analysis as set forth by Brevard County, the City of Palm Bay, and SJRWMD. Once an initial pond size was determined for each pond alternative and a recommended preferred pond site selected, an ICPR model was performed on the recommended preferred pond alternative for each basin, except Basins C-10 West and C-10 East, in which all possible alternatives and combinations were modeled due to the different modeling needs for a dry detention pond, swale, and wet detention pond. Each model began using the pond size determined by the volumetric analysis and then the size was increased, and other characteristics altered (including berm and weir elevations), until the pond met limiting discharge criteria. The size of the modeled pond was compared to the initial pond size, and this comparison was used to determine a contingency factor, which was applied to all pond alternatives within that basin (except in Basins C-10 West and C-10 East in which each pond alternative has its own contingency factor). Each basin has a different contingency factor, depending on the results of the basin’s model. Models were not performed for Basin A because the only pond alternative is to use an existing pond.

Table 5-3: Summary of Adjusted Stormwater Pond Sizes provides a summary of each pond’s initial size required to meet treatment and attenuation requirements, the pond size increase factor determined from the ICPR model for that basin, and the final pond size that is recommended for each pond.

Table 5-3: Summary of Adjusted Stormwater Pond Sizes

Basin Name	Pond Alternative	Initial Pond Size Required (ac)	Pond Size Increase (Contingency) Factor	Final Pond Size (ac) ₁
C-7	1	2.01	58%	3.17
	2	2.17		3.42
	3*	2.34	39%	3.25
C-8 & C-9	1*	3.45	0%	3.45
	2	3.13		3.13
C-10 West	1	0.73	79%	1.31
	2, Option 1*	4.55	0%	4.55
	2, Option 2	0.94	0%	0.94
C-10 East	1*	4.55	0%	4.55
	2	3.89	0%	3.89
C-20	1*	7.04	0%	7.04
	2	5.04		5.04

*This is the recommended preferred pond site for this basin.

1. These areas do not include access easement areas.

5.2.4 Nutrient Loading Analysis

The project traverses Waterbody ID (WBID) 3090 – Melbourne-Tillman (C-1) Canal, which is not impaired for nutrients according to the current FDEP 303(d) list of impaired water bodies. However, Canal C-1 eventually outfalls to the Indian River Lagoon, which is impaired for both Total Phosphorus and Total Nitrogen and is subject to a Total Maximum Daily Load (TMDL). As a conservative measure, nutrient loading analysis has been performed on all basins to show there will be no adverse effects to the downstream waters. All analysis was performed using BMPTRAINS 2020 software, developed by the University of Central Florida Stormwater Management Academy. Results of the analysis are included in **Appendix E – Nutrient Loading Analysis** and

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summarized below in **Table 5-4**. All of the recommended preferred pond sites showed a reduction in Phosphorus loading when compared with pre-development conditions. The three proposed wet detention ponds did not meet Nitrogen removal; however, the dry swale for Basin C-10 West & East provides enough Nitrogen removal so that when considered as a whole, the project has a net reduction in Nitrogen loading. Therefore, this project meets requirements for both Phosphorus and Nitrogen removal.

More information on the nutrient loading criteria for the Central Indian River Lagoon can be found at the links below:

Basin Management Action Plan: <https://floridadep.gov/sites/default/files/central-irl-bmap.pdf>

TMDL: <https://floridadep.gov/sites/default/files/indian-banana-nutrient-do-tmdl.pdf>

Table 5-4: Summary of Nutrient Removal

Basin	Recommended Preferred Alternative	Pre-Development Nitrogen Loading (kg/yr)	Post-Development Nitrogen Loading (kg/yr)	Pre-Development Phosphorus Loading (kg/yr)	Post-Development Phosphorus Loading (kg/yr)	Nitrogen Removal Met?
Basin C-7	Alt. 3	19.39	23.31	2.55	1.06	NO
Basin C-8 & C-9	Alt. 1	24.27	29.89	3.19	1.93	NO
Basin C-10 West & East	Alt. 1	32.30	2.26	4.25	0.30	YES
Basin C-20	Alt. 1	73.31	89.45	9.65	5.92	NO
Total		149.27	144.91	19.64	9.21	YES

5.3 Stormwater Pond Evaluation

The following sections detail each proposed basin and the relevant pond site alternatives. The full Pond Site Evaluation Matrix is available in **Appendix F**. Please note that the recommended preferred pond site alternative for each basin was selected based on the lowest estimated total cost including the cost of right-of-way acquisition, construction, potential remediation of contaminated soil, and wetland mitigation unless otherwise noted in the Pond Site Evaluation Matrix.

5.3.1 Basin C-7

Basin C-7 begins at the project start, approximately 600 feet west of St. Johns Heritage Parkway, at station 55+48 and continues east to Championship Circle NW at station 88+10. This basin is considered an open basin and discharges to Canal C-7. This basin is located within WBID 3090 which is not impaired for nutrients; however, the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, so nutrient loading analysis has been performed. Initially, there were two (2) alternatives for this basin. However, recent coordination with the City of Palm Bay has indicated that the sites selected for Alts. 1 and 2 are planned for new development. It was requested that a third alternative be investigated west of the C-7 Canal

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utilizing a property already owned by the City. All three alternatives are offsite wet detention ponds. The alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in **Appendix C – Pond Design Calculations**. The recommended preferred alternative for this basin is Alt. 3.

5.3.1.1 Pond C-7 Alternative 1

Pond C-7 Alt. 1 will serve as the treatment and attenuation pond for C-7. Alt. 1 is located south of Malabar Road at approximately station 63+58 (RT.). This pond site sits within one (1) parcel (29-36-04-25-*9). The pond site has no impacts to wetlands or Zone AE floodplains. According to the Brevard County Soil Survey, Pond C-7 Alt. 1 consists of Pineda Sand (#47, HSG C/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 20.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 17.00 feet NAVD (3.0 feet below grade). With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 1 will be a wet pond with the normal water/control elevation set at elevation 17.00 feet. Preliminary pond sizing calculations indicate that this pond requires 3.17 acres of area. This pond will outfall to Canal C-7. This pond has a high risk for environmental impact due to the presence of Caracara nests.

5.3.1.2 Pond C-7 Alternative 2

Pond C-7 Alt. 2 will serve as the treatment and attenuation pond for C-7. Alt. 2 is located south of Malabar Road at approximately station 85+64 (RT.). This pond site sits within two (2) parcels (29-36-04-25-*1; 29-36-04-25-*2). The pond site has no impacts to wetlands or Zone AE floodplains. According to the Brevard County Soil Survey, Pond C-7 Alt. 2 consists of Pineda Sand (#47, HSG C/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 20.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 16.67 feet NAVD (3.33 feet below grade). With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2 will be a wet pond with the normal water/control elevation set at elevation 17.00 feet. Preliminary pond sizing calculations indicate that this pond requires 3.42 acres of area. Although this pond serves Basin C-7, the pond outfall will be to Canal C-8. MTWCD has confirmed that as long as limiting discharge criteria is still met, this approach is acceptable due to this pond's proximity to Canal C-8. Documentation of this discussion can be found in **Appendix L – Correspondence**.

5.3.1.3 Pond C-7 Alternative 3

Pond C-7 Alt. 3 will serve as the treatment and attenuation pond for C-7. Alt. 3 is located south of Malabar Road at approximately station 53+00 (RT.). This pond site sits within one (1) parcel (29-36-05-00-3), which is currently owned by the City of Palm Bay. The pond site has 0.28 acres of direct impacts to wetlands and 0.50 acres of impacts to Zone AE floodplains. According to the Brevard County Soil Survey, Pond C-7 Alt. 3 consists of Pineda Sand (#47, HSG C/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 18.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 16.05 feet NAVD (1.95 feet below grade). With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 3 will be a wet pond with the normal water/control elevation set at elevation 16.20 feet. Preliminary pond sizing calculations indicate that this pond requires 3.25 acres of area with an additional 0.51 acres for the inflow easement. This pond will require a jack and bore pipe to cross

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underneath the C-7 Canal in order to convey water from the eastern portion of the basin. This is the recommended preferred alternative for this basin.

5.3.2 Basin C-8 & C-9

Basin C-8 & C-9 begins at station 88+10 and continues east to Krassner Drive at station 129+40. The existing Basins C-8 and C-9 were combined into a single basin due to a lack of viable pond sites within the original Basin C-9 limits. Since Canal C-9 merges with Canal C-8 just north of the project area, the MTWCD confirmed that this approach is acceptable, and the canals can be treated as a single outfall. This basin is considered an open basin. This basin is located within WBID 3090 which is not impaired for nutrients; however, the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, so nutrient loading analysis has been performed. There are two (2) alternatives for this basin. Both alternatives are offsite wet detention ponds. The alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in **Appendix C – Pond Design Calculations**. The recommended preferred alternative for this basin is Alt. 1.

5.3.2.1 Pond C-8 & C-9 Alternative 1

Pond C-8 & C-9 Alt. 1 will serve as the treatment and attenuation pond for C-8 and C-9. Alt. 1 is located north of Malabar Road at approximately station 101+65 (LT.). This pond site sits within one (1) parcel (28-36-33-01-B), which is currently owned by the City of Palm Bay. The pond site has approximately 0.39 acres of impacts to other surface waters (OSW) but no direct impacts to wetlands. There are no impacts to floodplains. According to the Brevard County Soil Survey, Pond C-8 & C-9 Alt. 1 consists of Malabar, Holopaw, and Pineda Sand (#31, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 20.00 feet NAVD. The geotechnical borings did not encounter groundwater at this site, indicating that the AWSWE is at least 5.0 feet below grade; however, all three borings were taken in upland portions of the site and surface waters are present on the site within the existing ditch system, so the AWSWE was conservatively estimated to be at elevation 17.00 feet NAVD (3.00 feet below grade) based on the water lines present in the ditches. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 1 will be a wet pond with the normal water/control elevation set at elevation 17.00 feet. This parcel contains several existing ditches that collect stormwater runoff from surrounding residential parcels and convey it to Canal C-9. The ditches will need to be replaced in order to maintain existing drainage patterns. A 40' buffer has been placed around the sides of the proposed pond to accommodate a new drainage ditch, which can be seen in **Appendix B – Basin Maps**. Preliminary pond sizing calculations indicate that this pond requires 3.45 acres of area with an additional 0.36 acres for the inflow easement and 1.94 acres to relocate the existing drainage ditch, for a total of 5.75 acres. This pond will outfall to Canal C-9 via an existing easement located north of the parcel. The existing easement is owned by the City of Palm Bay. This is the recommended preferred alternative for this basin.

5.3.2.2 Pond C-8 & C-9 Alternative 2

Pond C-8 & C-9 Alt. 2 will serve as the treatment and attenuation pond for C-8 and C-9. Alt. 2 is located south of Malabar Road at approximately station 89+98 (RT.). This pond site sits within one (1) parcel (29-36-04-00-4). The pond site has no impacts to wetlands and 0.03 acres of impacts to Zone AE floodplains. According to the Brevard

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County Soil Survey, Pond C-8 & C-9 Alt. 2 consists of Pineda Sand (#47, HSG C/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 20.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 16.35 feet NAVD (3.65 feet below grade). Two adjacent permits provided additional water table information. Permit No. 136835-1 for Palm Island (expired), on the same parcel as the pond site, has a permitted control elevation at 17.62 feet NAVD and Permit No. 101710-7 for Chaparral, on the adjacent parcel to the east, has a permitted control elevation at 17.62 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2 will be a wet pond with the normal water/control elevation set at elevation 17.60 feet. Preliminary pond sizing calculations indicate that this pond requires 3.13 acres of area. This pond will outfall to Canal C-8.

5.3.3 Basin C-10 West

Basin C-10 West begins at station 129+40 and continues east to the bridge high point at station 142+00. This basin is considered an open basin and discharges to Canal C-10. This basin is located within WBID 3090 which is not impaired for nutrients; however, the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, so nutrient loading analysis has been performed. There are three (3) alternatives for this basin – a standalone pond alternative (Alt. 1) and two options for Alt. 2 which are each contingent on the alternative selected for Basin C-10 East. The alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in **Appendix C – Pond Design Calculations**. The recommended preferred alternative for this basin is Alt. 2, Option 1.

5.3.3.1 Pond C-10 West Alternative 1

Pond C-10 West Alt. 1 will serve as the treatment and attenuation pond for C-10 West. Alt. 1 is located north of Malabar Road at approximately station 135+09 (LT.). This pond site sits within one (1) parcel (28-36-34-25-D), which is currently owned by the City of Palm Bay. The pond site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, Pond C-10 West Alt. 1 consists of Malabar, Holopaw, and Pineda Sand (#31, HSG A/D) and EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 22.00 feet NAVD. The geotechnical borings did not encounter groundwater at this site, indicating that the SHWT is at least 5.0 feet below grade. One nearby permit provided additional water table information. Permit No. 95299-4 for Brentwood Lakes, located approximately 1000 feet south of C-10 West Alt. 1, has similar site conditions (elevation and soils) and a permitted control elevation at 15.10 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 1 will be a dry pond with the bottom elevation set at 17.00 feet, which is 2.00 feet above the estimated SHWT of 15.00 feet. Preliminary pond sizing calculations indicate that this pond requires 1.31 acres of area and an additional 0.73 acres for the inflow and outflow easement, for a total of 2.04 acres. There is an existing ditch that runs along the west side of the Florida Power and Light property (parallel to Canal C-10) and is located within the pipe inflow easement for this pond alternative. The existing ditch should be maintained and restored during and after construction. This pond will outfall to this ditch, which continues to flow north and ultimately outfalls to Canal C-10 at an existing outfall approximately 0.5 miles to the north.

5.3.3.2 Swale C-10 West Alternative 2, Option 1

Swale C-10 West Alt. 2, Opt. 1 is a swale option that will provide treatment and attenuation for C-10 West. This option utilizes additional capacity in the C-10 East Alt. 1 Swale, and will therefore only be selected if C-10 East

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Alt. 1 is also selected. Alt. 2, Opt. 1 is located south of Malabar Road at approximately station 144+97 (RT.). This alternative consists of three swales; however, sizing calculations were only performed for the first two swales and the third serves as additional room for contingency. The swales sit within twenty-eight (28) parcels (please see **Appendix F – Pond Alternatives Evaluation Matrix** for a list of parcel numbers). Fourteen (14) of the parcels are owned by the City of Palm Bay. The rest of the parcels will be purchased for the Malabar Road widening and the swale will fit within the remnant parcels created by the widening. The site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, Swale C-10 West Alt. 2, Opt. 1 consists of Malabar, Holopaw, and Pineda Sand (#31, HSG A/D) and EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this site, the existing ground is at approximately 23.00 feet NAVD. The geotechnical borings did not encounter groundwater within the area of the first swale, indicating that the SHWT is at least 5.0 feet below grade. Within the second swale, the geotechnical borings indicate the SHWT is at approximately elevation 20.43 feet NAVD (2.57 feet below grade) and within the third swale, they indicate a SHWT of approximately 19.65 feet NAVD (3.35 feet below grade). Two nearby permits provided additional water table information. Permit No. 32204-1 for Palm Bay Public Works, located approximately 150 feet east of the third swale, has similar site conditions (elevation and soils) and a perimeter dry swale with bottom elevation 20.62 feet NAVD (no water table information is available). Permit No. 149645-2 for the Avery Springs Subdivision, located approximately 220 feet north of the second and third swales, has similar site conditions (elevation and soils) and a permitted control elevation at 19.10 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2, Opt. 1 will be a dry swale system with the bottom elevations ranging from 20.00-21.00 feet, which is 1.00 feet above the estimated SHWT of 19.00-20.00 feet (varies throughout the length of the swale). Preliminary swale sizing calculations indicate that this swale requires 4.55 acres of area. Due to the desire of the City of Palm Bay to utilize all remnant parcel space, a total of 4.86 acres has been provided. This pond will outfall to Canal C-10. Due to the physical challenge of conveying water across Canal C-10, it is recommended that a compensating treatment approach be used, where Basin C-10 West is discharged untreated to Canal C-10 and the swale provides enough additional treatment volume to compensate for the untreated runoff. This is the recommended preferred alternative for this basin.

5.3.3.3 Pond C-10 West Alternative 2, Option 2

Pond C-10 West Alt. 2, Opt. 2 will serve as the treatment and attenuation pond for C-10 West. This option is an expansion of C-10 East Alt. 2, and will therefore only be selected if C-10 East Alt. 2 is also selected. Alt. 2, Opt. 2 is located north of Malabar Road at approximately station 175+65 (LT.). This pond site sits within one (1) parcel (28-36-35-00-503). The pond site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, Pond C-10 West Alt. 2, Opt. 2 consists of Malabar, Holopaw, and Pineda Sand (#31, HSG A/D) and EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 23.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 20.00 feet NAVD (3.00 feet below grade). One adjacent permit provided additional water table information. Permit No. 149645-2 for the Avery Springs Subdivision, located on the adjacent parcel to the west, has a permitted control elevation at 19.10 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2, Opt. 2 will be a wet detention pond expansion with the normal water/control elevation set at elevation 19.70 feet. Preliminary pond sizing calculations indicate that the additional pond area required for this expansion is 0.94 acres, and that the total pond area required for the combination of C-10 East Alt. B with this alternative is 4.83 acres. This pond will also require 0.57 acres for the

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inflow and outflow easement. This pond will outfall to the C-20 Canal, which flows west to Canal C-10. Due to the physical challenge of conveying water across Canal C-10, it is recommended that a compensating treatment approach be used, where Basin C-10 West is discharged untreated to Canal C-10 and this pond provides enough additional treatment volume to compensate for the untreated runoff.

5.3.4 Basin C-10 East

Basin C-10 East begins at station 142+00 and continues east to a high point at station 184+00. This basin is considered an open basin and discharges to Canal C-10. This basin is located within WBID 3090 which is not impaired for nutrients; however, the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, so nutrient loading analysis has been performed. There are two (2) alternatives for this basin. For each alternative, there is also an associated C-10 West alternative that is contingent on the alternative selected for this basin. The alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in **Appendix C – Pond Design Calculations**. The recommended preferred alternative for this basin is Alt. 1.

5.3.4.1 Swale C-10 East Alternative 1

Swale C-10 East Alt. 1 is a swale option that will provide treatment and attenuation for C-10 East. Alt. 1 is located south of Malabar Road at approximately station 144+97 (RT.). This alternative consists of three swales; however, sizing calculations were only performed for the first two swales and the third serves as additional room for contingency. The swales sit within twenty-eight (28) parcels (please see **Appendix F – Pond Alternatives Evaluation Matrix** for list of parcel numbers). Fourteen (14) of the parcels are owned by the City of Palm Bay. The rest of the parcels will be purchased for the Malabar Road widening and the swale will fit within the remnant parcels created by the widening. The swale will be divided into three parts that will be connected by equalizer pipes underneath Hurley Boulevard and Watoga Avenue which cross the swale. The site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, Swale C-10 East Alt. 1 consists of Malabar, Holopaw, and Pineda soils (#31, HSG A/D) and EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this site, the existing ground is at approximately 23.00 feet NAVD. The geotechnical borings did not encounter groundwater within the area of the first swale, indicating that the SHWT is at least 5.0 feet below grade. Within the second swale, the geotechnical borings indicate the SHWT is at approximately elevation 20.43 feet NAVD (2.57 feet below grade) and within the third swale, they indicate a SHWT of approximately 19.65 feet NAVD (3.35 feet below grade). Two nearby permits provided additional water table information. Permit No. 32204-1 for Palm Bay Public Works, located approximately 150 feet east of the third swale, has similar site conditions (elevation and soils) and a perimeter dry swale with bottom elevation 20.62 feet NAVD (no water table information is available). Permit No. 149645-2 for the Avery Springs Subdivision, located approximately 220 feet north of the second and third swales, has similar site conditions (elevation and soils) and a permitted control elevation at 19.10 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 1 will be a dry swale with the bottom elevation set at 20.00-21.00 feet, which is 1.00 feet above the estimated SHWT of 19.00-20.00 feet (varies throughout the length of the swale). Preliminary swale sizing calculations indicate that this swale requires 4.55 acres of area. Due to the desire of the City of Palm Bay to utilize all remnant parcel space, a total of 4.86 acres has been provided. According to the sizing calculations and ICPR models performed, the swale has enough additional

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capacity to provide treatment and attenuation for Basin C-10 West; therefore this site has also been identified as Basin C-10 West Alt. 2, Option 1. Please see section 5.3.3.2 for more information. This pond will outfall to Canal C-10. This is the recommended preferred alternative for this basin.

5.3.4.2 Pond C-10 East Alternative 2

Pond C-10 East Alt. 2 will serve as the treatment and attenuation pond for C-10 East. Alt. 2 is located north of Malabar Road at approximately station 175+65 (LT.). This pond site sits within one (1) parcel (28-36-35-00-503). The pond site has approximately 0.07 acres of impacts to wetlands and no impacts to floodplains. According to the Brevard County Soil Survey, Pond C-10 East Alt. 2 consists of EauGallie Sand (#17, HSG A/D) and Anclote Sand (#2, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 23.00 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 20.00 feet NAVD (3.00 feet below grade). One adjacent permit provided additional water table information. Permit No. 149645-2 for the Avery Springs Subdivision, located on the adjacent parcel to the west, has a permitted control elevation at 19.10 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2 will be a wet pond with the normal water/control elevation set at elevation 19.70 feet. Preliminary pond sizing calculations indicate that this pond requires 3.89 acres of area and an additional 0.57 acres for the inflow and outflow easement, for a total of 4.46 acres. Additionally, the parcel on which this site is located has enough additional room available to expand this pond and provide treatment and attenuation for Basin C-10 West; therefore, this site has also been identified as Basin C-10 West Alt. 2, Option 2, which would require a 0.94 acre expansion. Please see section 5.3.3.3 for more information This pond will outfall to the C-20 Canal, which flows west to Canal C-10.

5.3.5 Basin C-20

Basin C-20 begins at station 184+00 and continues east to the Coral Bay shopping center entrance at station 267+50. The proposed basin end limit is shifted approximately 335 feet to the east in order to reduce the length of Basin A. This basin is considered an open basin and discharges to the C-20 Canal. This basin is located within WBID 3090 which is not impaired for nutrients; however, the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, so nutrient loading analysis has been performed. There are two (2) alternatives for this basin. Additionally, the City of Palm Bay has requested that remnant parcels created by the Malabar Road widening be used for stormwater purposes. Since these parcels alone do not provide enough area for the necessary treatment and attenuation for this basin, they have been identified as a supplemental treatment swale that will be utilized in conjunction with one of the two pond alternatives. The alternatives and the supplemental swale are discussed in the following sections. All calculations and parameters for each alternative are located in **Appendix C – Pond Design Calculations**. The recommended preferred alternative for this basin is Alt. 1 used in conjunction with the Supplemental Swale.

5.3.5.1 Pond C-20 Alternative 1

Pond C-20 Alt. 1 will serve as the treatment and attenuation pond for C-20. Alt. 1 is located south of Malabar Road at approximately station 229+06 (RT.). This pond site sits within one (1) parcel (29-36-01-00-253). The pond site has approximately 0.46 acres of impacts to wetlands and no impacts to floodplains. According to the Brevard County Soil Survey, Pond C-20 Alt. 1 consists of EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 23.50 feet NAVD. The geotechnical borings

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indicate the AWSWE is at approximately elevation 21.82 feet NAVD (1.68 feet below grade). Two adjacent permits provided additional water table information. Permit No. 24472-1 for Madalyn Landing, on the adjacent parcel to the west, has a permitted control elevation at 19.62 feet NAVD and Permit No. 96870-4 for Falls of Palm Bay, on the adjacent parcel to the east, has a permitted control elevation at 20.12 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 1 will be a wet pond with the normal water/control elevation set at elevation 20.80 feet. Preliminary pond sizing calculations indicate that this pond requires 7.04 acres of area and an additional 0.32 acres for the inflow and outflow easement, for a total of 7.36 acres. The parcel on which this pond site is located outfalls to a City of Palm Bay canal and therefore, the pond area is not counted toward the pre-development basin area because it does not share the same outfall as the roadway basin. This pond will outfall to the C-20 Canal. This pond was identified as medium risk for groundwater contamination due to the presence of historic citrus groves. A Level II Impact Assessment was conducted by GEC on this site to determine whether additional remediation should be anticipated. GEC concluded that soils on the site do not appear to have significant impacts from arsenic, pesticides, or herbicides and should not require special handling during construction. This is the recommended preferred alternative for this basin and is recommended for use with the Supplemental Swale.

5.3.5.2 Pond C-20 Alternative 2

Pond C-20 Alt. 2 will serve as the treatment and attenuation pond for C-20. Alt. 2 is located south of Malabar Road at approximately station 240+39 (RT.). This pond site sits within one (1) parcel (29-36-01-00-250). The pond site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, Pond C-10 East Alt. 2 consists of Malabar, Holopaw, and Pineda soils (#31, HSG A/D) and EauGallie Sand (#17, HSG A/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 23.50 feet NAVD. The geotechnical borings indicate the AWSWE is at approximately elevation 20.72 feet NAVD (2.78 feet below grade). Two adjacent permits provided additional water table information. Permit No. 96870-4 for Falls of Palm Bay, on the adjacent parcel to the west, has a permitted control elevation at 20.12 feet NAVD and Permit No. 113800-1 for Malabar Cove, on the adjacent parcel to the south, also has a permitted control elevation at 20.12 feet NAVD. With the data compiled from roadway soil borings, available permits, and soil information, it was determined that Alt. 2 will be a wet pond with the normal water/control elevation set at elevation 20.25 feet. Preliminary pond sizing calculations indicate that this pond requires 5.04 acres of area. This pond will outfall to the C-20 Canal. This pond was identified as medium risk for groundwater contamination due to the presence of an arsenic plume, which may require remediation. The total cost of this alternative includes an estimated remediation cost for the potential impact to the arsenic plume, but this cost may vary greatly depending on the actual remediation requirements and potential need to haul soil offsite which cannot be determined at this stage of the Study. Consequently, this pond site alternative was determined not to be the recommended preferred alternative for this basin despite its lower estimated cost.

5.3.5.3 C-20 Supplemental Swale

The C-20 Supplemental Swale will provide supplemental treatment and attenuation for C-20. At the request of the City of Palm Bay, this swale will utilize remnant parcels created by the widening of Malabar Road. The swale will be divided into two parts that will be connected by an equalizer pipe underneath Wellsley Avenue and Tile Avenue. Depending on the final design, it is possible that additional swale capacity may be available in other remnant parcels; however, based on the current recommended preferred alternative, the other remnant parcels

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are either too narrow or too fragmented to provide enough usable area. Calculations were performed to determine the treatment volume available in the swale, which was subtracted from the total treatment volume required for the basin, and the reduced volume was used in sizing Alternatives 1 and 2. The supplemental swale is located south of Malabar Road at approximately station 198+44 (RT.). This site sits within eight (8) parcels (please see **Appendix F – Pond Alternatives Evaluation Matrix** for list of parcel numbers). The site has no impacts to wetlands or floodplains. According to the Brevard County Soil Survey, the C-20 Supplemental Swale consists of Pineda sand (#47, HSG C/D) and Wabasso sand (#71, HSG C/D). According to LIDAR data obtained for this pond site, the existing ground is at approximately 24.00 feet NAVD. The geotechnical borings did not encounter groundwater within the area of the first swale, indicating that the SHWT is at least 5.0 feet below grade. Within the second swale, the geotechnical borings indicate the SHWT is at approximately elevation 21.20 feet NAVD (2.80 feet below grade). One nearby permit provided additional water table information. Permit No. 153108-1 for Circle K, located approximately 300 feet west of the first swale, has similar site conditions (elevation and soils) and a dry pond with bottom elevation 21.75 feet NAVD (SHWT at 19.70 feet NAVD). With the data compiled from roadway soil borings, available permits, and soil information, it was determined that the supplemental swale will have the bottom elevation set at 21.10 feet, which is 1.00 foot above the estimated SHWT of 20.10 feet. The available area for this supplemental swale is 1.41 acres.

5.3.6 Basin A

Basin A begins at station 267+50 and continues east to station 274+00, approximately 300 feet past the end of the project limits. The proposed begin basin limit is shifted approximately 335 feet to the east in order to reduce the length of Basin A, thereby keeping the total impervious area within the basin the same as the existing condition once the widening is completed. This basin is considered an open basin and discharges to the C-37 Canal. This basin is located within WBID 3090 which is not impaired for nutrients. Although the ultimate outfall is the Indian River Lagoon which is impaired for nutrients and subject to a TMDL, nutrient loading analysis has not been performed for this basin because it involves the use of an existing permitted pond. There is only one alternative for this basin, which utilizes the existing City of Palm Bay “Pond A” that was permitted under Permit No. 16558-4 and modified under Permit No. 16558-5. Calculations were performed to verify that the proposed improvements within this basin will not increase the treatment volume for which the pond was permitted. If the final design of Malabar Road requires additional treatment volume, we recommend that the additional runoff be directed to Basin C-20, rather than modifying or expanding Pond A. This can be achieved by shifting the basin divide and altering the existing storm sewer system to connect to the new system that will be constructed with the Malabar Road improvements. All calculations and parameters for Pond A are located in **Appendix C – Pond Design Calculations**.

Pond A is located south of Malabar Road at approximately station 273+49 (RT.). This pond site sits within two (2) parcels (29-36-01-00-15 and 29-36-01-00-16) which are privately owned parcels that house a 7-11 convenience store. The pond is located on these parcels under an agreement between the City of Palm Bay and the property owner(s). According to permitted information, the front of the main berm is at elevation 23.62 feet NAVD (converted from NGVD) and the bottom of the dry pond is at elevation 18.62 feet NAVD (converted from NGVD). SHWT data was not available in the permit documents. Originally, this pond was also permitted to receive overflow runoff from the Jiffy Mart dry pond located at the northeast corner of Malabar Road and Minton Road. The Jiffy Mart site has since been redeveloped to a new Cumberland Farms convenience store under Permit No.

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150560-1, which has a new underground detention pond that discharges directly into the C-37 Canal instead of Pond A. As such, the area contributing to Pond A was reduced by this permit, which increased the capacity available in the pond.

5.3.7 Floodplain Compensation

One Floodplain Impact Area (FIA) has been identified within the project limits, located at the western end of the corridor. The FIA includes floodplains associated with low-lying lands throughout the Three Forks Conservation Area, as well as the C-7 and C-8 Canals. Initially, one (1) Floodplain Compensation Area (FPCA) site was identified. However, recent coordination with the City of Palm Bay has indicated that the site selected for Alt. 1 is planned for new development. It was requested that a second alternative be investigated west of the C-7 Canal utilizing a property already owned by the City (FPCA Alt. 2). Both FPCA sites are offsite scraped down areas that are adjacent to or within the 100-year floodplain. Compensation is provided between the estimated seasonal high water table (SHWT) of the pond and the 100-year floodplain elevation or the site's existing ground elevation (if located within the floodplain). More information about the floodplain compensation sites is provided in the following sections.

These FPCA sites have been sized as a conservative measure for right of way estimation; however, it is recommended that alternative approaches are considered during the design phase. One option is to develop a floodplain model or modify the existing C-1 Rediversion Phase 1 SWMM model with the proposed improvements to demonstrate no increase in the 100-year floodplain elevations associated with the improvements along Malabar Road. Another option is to provide floodplain compensation within the stormwater management pond that is selected for Basin C-7. All calculations and parameters for the FPCA sites are located in the Location Hydraulics Report.

5.3.7.1 FPCA C-7 Alt. 1

FPCA C-7 Alt. 1 is a scraped down area on the south side of Malabar Road located at station 84+17 (RT.). This site is located within two (2) parcels (29-36-04-25-*-1; 29-36-04-25-*-2) and is adjacent to Pond C-7 Alt. 2. This site compensates for roadway impacts to the 100-year floodplain associated with the Three Forks Conservation Area, C-7 Canal, and C-8 Canal. This floodplain is Zone AE with an established Base Flood Elevation (BFE) at 20.00 feet. The impacts total approximately 1.41 ac-ft of floodplain volume and were calculated by using approximate length of encroachment and depth of excavation and fill to estimate cut and fill volumes associated with the Malabar Road improvements. It is anticipated that there will be no wetland impacts associated with this site. According to the Brevard County Soil Survey, the site consists of Pineda sand (#47, HSG C/D). The estimated SHWT elevation for this site is 17.00 feet. According to LIDAR data obtained for this floodplain compensation site, the existing ground varies from 19.00 to 20.00 feet across the site. In lower areas, it is recommended that a berm be added to provide compensation storage up to 20.00 feet. With the data compiled it was determined that FPCA C-7 Alt. 1 will be a 1.64 acre site which will provide approximately 1.41 acre-feet of compensating volume.

5.3.7.2 FPCA C-7 Alt. 2

FPCA C-7 Alt. 2 is a scraped down area on the south side of Malabar Road located at station 50+00 (RT.). This pond site sits within one (1) parcel (29-36-05-00-3) and is adjacent to Pond C-7 Alt. 3. This site compensates for

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roadway impacts to the 100-year floodplain associated with the Three Forks Conservation Area, C-7 Canal, and C-8 Canal. This floodplain is Zone AE with an established Base Flood Elevation (BFE) at 20.00 feet. The impacts total approximately 1.41 ac-ft of floodplain volume and were calculated by using approximate length of encroachment and depth of excavation and fill to estimate cut and fill volumes associated with the Malabar Road improvements. Additionally, it was estimated that the berm for Pond C-7 Alt. 3 will create 0.50 ac-ft of floodplain impacts, for a total impact of 1.91 ac-ft. It is anticipated that there will be 0.61 acres of direct wetland impacts and 0.04 acres of direct impacts to other surface waters associated with this site. According to the Brevard County Soil Survey, the site consists of Pineda sand (#47, HSG C/D). The estimated SHWT elevation for this site is 16.20 feet. According to LIDAR data obtained for this floodplain compensation site, the existing ground is at 18.00 feet. With the data compiled it was determined that FPCA C-7 Alt. 2 will be a 1.85 acre site which will provide approximately 1.91 acre-feet of compensating volume.

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6.0 Environmental Look Arounds (ELAs)

Environmental Look Arounds (ELAs) provide a unique opportunity to team up with regional stakeholders to explore watershed wide stormwater needs and alternative permitting approaches for the project. Areas of potential cooperation are documented in this report for future follow up as the design moves forward. Through discussions with stakeholders, it was possible to reduce the number of overall drainage basins within the study limits and utilize existing City owned parcels and remnant parcels created by the proposed roadway widening. Additional research and coordination were done to evaluate other potential opportunities such as joint-use or regional ponds or stormwater projects. These discussions are summarized below.

Stakeholder Participation and Combining Drainage Basins

Discussion of ELA opportunities occurred several times throughout the course of this study, including two stakeholder meetings held on August 5, 2020 and March 31, 2021 for the purpose of discussing the location and intent of various stormwater pond alternatives, coordinating with the MTWCD, and seeking pond site approval from the City of Palm Bay. During the first of these meetings, eight drainage basins were presented, with two pond site alternatives per basin. Ideas were presented that would allow for the combination of Basins C-8 & C-9 and C-20 West & C-20 East, to reduce the overall number of basins to six. Additionally, the City of Palm Bay expressed their desire to maximize use of properties already owned by the City of Palm Bay and any remnant parcels that would be created by the widening of Malabar Road. These changes were incorporated into the eventual pond site alternatives. Furthermore, several options were developed to combine Basins C-10 West and C-10 East by utilizing a compensating treatment approach for C-10 West within the C-10 East Alternatives. While these basins are still considered to be separate basins throughout this report, the recommended preferred alternative utilizes one pond alternative for both basins. All pond alternatives were presented again at the March 31st meeting, during which all stakeholders concurred that they were acceptable.

Summaries of both of these meetings can be found in **Appendix L – Correspondence**.

Adjacent Roadway Projects

There are several ongoing FDOT, Brevard County, and City of Palm Bay roadway projects in the area near Malabar Road that should be further evaluated during the Malabar Road design phase for joint-use opportunities. Adjacent projects include the St. Johns Heritage Parkway widening north of Malabar Road and St. Johns Heritage Parkway Alternatives Corridor Evaluation (initiated January 2020) south of Malabar Road. At the time of writing this document, there are no plans available for these projects and therefore no proposed pond sites to consider for joint-use.

Save Our Indian River Lagoon (SOIRL) Project

This project was updated in 2021 by Brevard County with the purpose of meeting water quality targets and improving the health of the Indian River Lagoon after years of development have caused critically high nutrient levels and led to algal blooms and brown tides. The project includes various nutrient removal sites and methods located throughout Brevard County, broken down into categories of pollutant reduction, pollutant removal, and lagoon restoration. A review of the project documents identified stormwater management Basin 1604 as the closest basin to the Malabar Road study limits, located in the area surrounding Emerson Drive and the SJHP,

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approximately 2 miles to the north of Malabar Road. However, the stormwater projects identified in the SOIRL project are intended to reduce nutrient loads that already exist, and do not create credits or mitigation for new projects. As a result of the project intent and distance to this basin, it was determined that it would not be feasible to consider this as a regional alternative to stormwater management for Malabar Road.

SJRWMD C-10 Reservoir Project

On December 9, 2022, an ELA meeting was held with the SJRWMD, primarily to discuss their upcoming C-10 Reservoir project and evaluate whether there were any potential opportunities for joint-use with this project. SJRWMD indicated that the C-10 project was currently being evaluated for state funding and at the time of the meeting, the construction timeline was unknown. The reservoir was not specifically designed for regional use and the reservoir sits above-ground, so any runoff taken from the adjacent road would need to be pumped. Additionally, while the reservoir could possibly provide treatment for Malabar Road, it would not meet the attenuation needs set forth by MTWCD. As a result of these various potential issues, it was determined that the C-10 Reservoir project would not be a feasible alternative to replace stormwater ponds for this Study.

A summary of this meeting can be found in **Appendix L – Correspondence**.

Brevard County Coordination

Coordination with Rachel Gerena (Brevard County Public Works Engineering Manager) occurred on January 9, 2023 to investigate if the county had any future regional studies or plans in the vicinity of the Malabar Road Project. The county indicated that they were not aware of any future regional projects other than the St. Johns Heritage Parkway Project.

This correspondence can be found in **Appendix L – Correspondence**.

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7.0 Total Pond Cost Estimate

The total pond cost estimate for each alternative site includes construction costs of the stormwater facility, any costs associated with mitigation of wetland impacts, cost of potential remediation of contaminated soil (where applicable), and preliminary right of way cost estimates which include any administrative costs and legal fees. The total pond cost estimate for each alternative is available in **Appendix F – Pond Alternatives Evaluation Matrix**. The preliminary right-of-way cost estimates are a budget tool for use by the City to estimate total acquisition costs associated with each pond site and to budget the appropriate funds for acquisition. Right-of-way cost estimates are not real estate appraisals and do not reflect market value.

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8.0 Conclusions and Recommendations

Potential ponds have been sized and located along the project limits for this PD&E study. The analysis estimates right-of-way needs using a volumetric analysis, which accounts for water quality treatment and water quantity for runoff attenuation. Please note that the estimated right-of-way areas for the ponds were based on pond sizes determined from preliminary data calculations, reasonable engineering judgment, and assumptions. Pond sizes and configurations may change during final design as more detailed information on SHWT, wetland normal pool elevation, final roadway profile design, etc. become available. Please refer to **Table 8-1 for Recommended Preferred Stormwater Pond Requirements** and **Table 8-2 for Recommended Preferred FPCA Site Requirements**.

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Table 8-1: Recommended Preferred Stormwater Pond Requirements

Basin	From Station	To Station	Preferred Alternative	Required Treatment + Attenuation (ac-ft)	Provided Treatment + Attenuation (ac-ft)	Allowable Discharge – 25yr/24hr (cfs)	Provided Max Discharge – 25yr/24hr (cfs)	Pond R/W Area (incl. easements) (ac)
C-7	55+48	88+10	Alt. 3	2.03	4.10	13.17	5.93	3.76
C-8 & C-9	88+10	129+48	Alt. 1	2.54	4.70	14.43	13.87	5.75
C-10 West	129+48	142+00	Alt. 2, Opt. 1	1.65	4.04	34.79	33.85	4.86
C-10 East	142+00	184+00	Alt. 1					
C-20	184+00	267+50	Alt. 1 with Supplemental Swale	6.21	11.27	71.71 ₁	63.30 ₁	7.36
A	267+50	274+00	Exist. A	0.50	0.50	N/A	N/A	0.71

1. Discharge calculations for Basin C-20 were performed only for Pond Alt. 1 and do not include discharge from the supplemental swale. However, discharge from the supplemental swale is anticipated to be minimal.

Table 8-2: Recommended Preferred FPCA Site Requirements

FIA	From Station	To Station	Preferred Alternative	Required Floodplain Compensation (ac-ft)	Provided Floodplain Compensation (ac-ft)	FPCA R/W Area (ac)
C-7	55+48	89+44	Alt. 2	1.91	1.91	1.85

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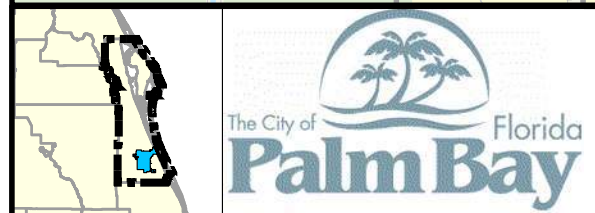
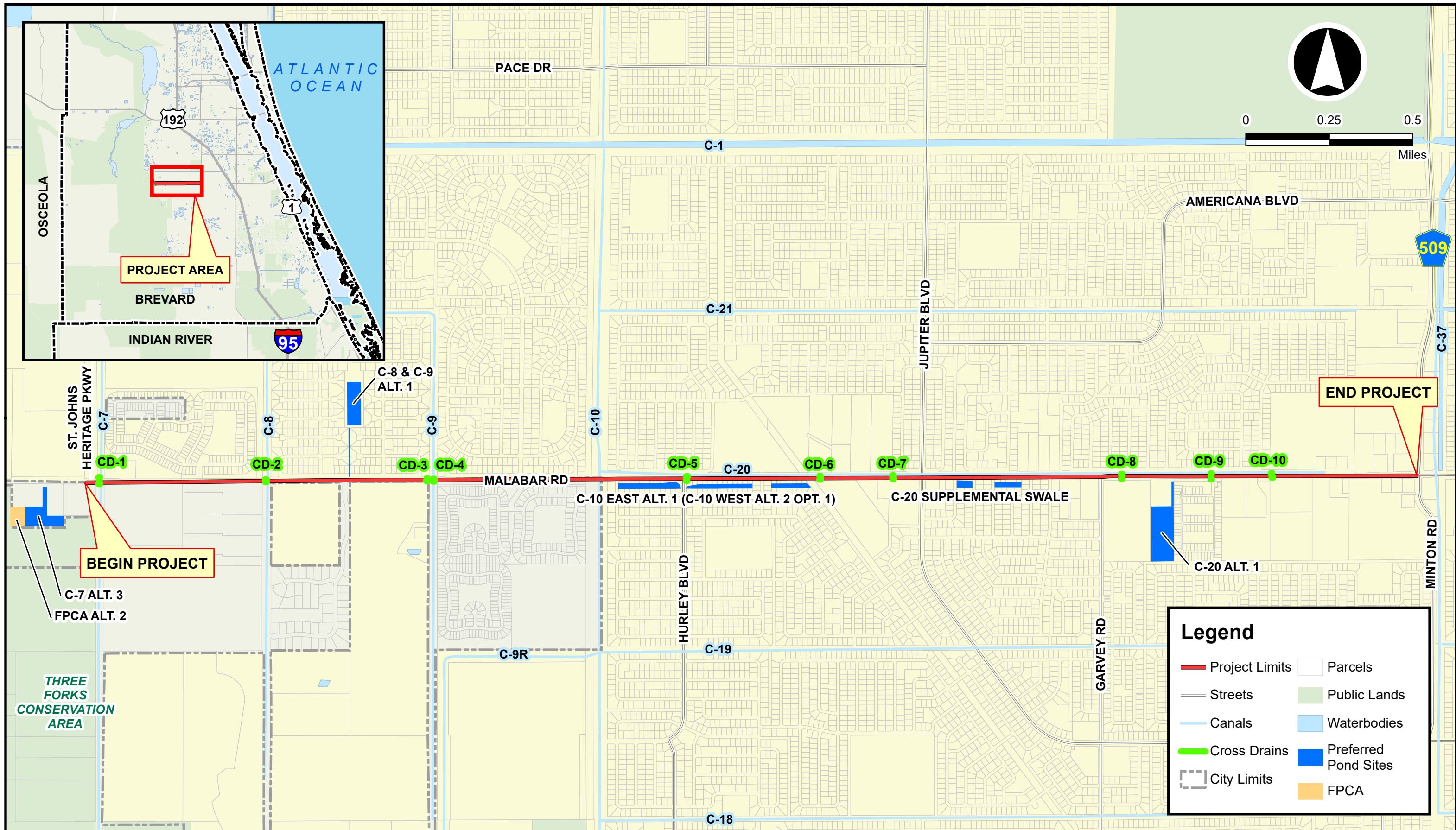
APPENDIX A

Exhibits

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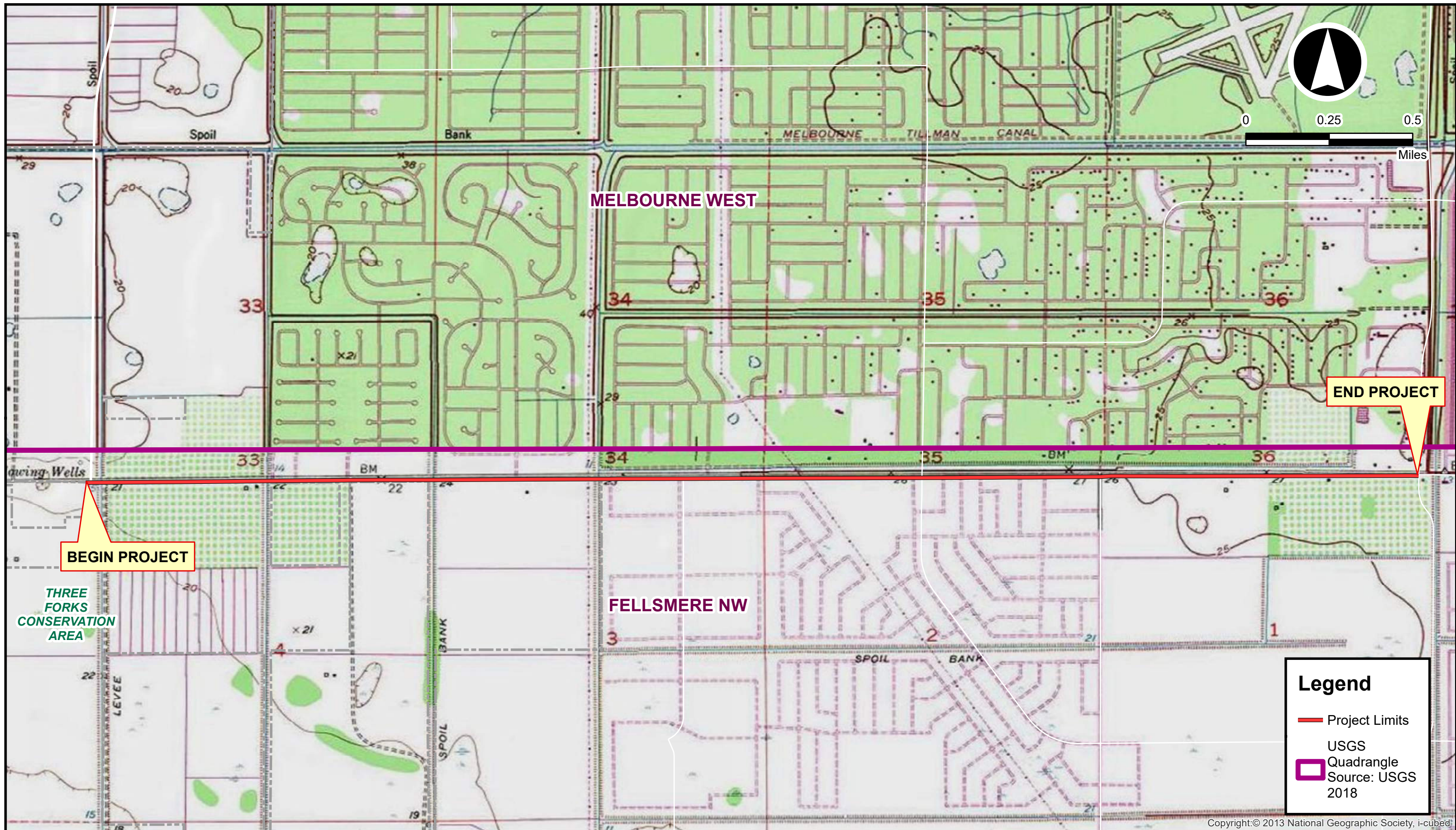
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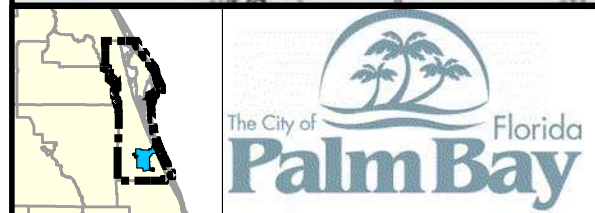
Malabar Road PD&E Study
 From St. Johns Heritage Parkway to Minton Road
 Brevard County, Florida
 Financial Project ID: 437210-1-28-01

PROJECT LOCATION MAP

Figure 1



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Malabar Road PD&E Study
 From St. Johns Heritage Parkway to Minton Road
 Brevard County, Florida
 Financial Project ID: 437210-1

USGS QUADRANGLE MAP

Figure 2

Brevard County Soil Descriptions

2: Anclote sand, depressional, 0 to 1 percent slopes

11: Canova mucky peat, undrained

17: EauGallie sand

18: EauGallie, Winder, and Riviera soils, depressional

19: Riviera sand, 0 to 2 percent slopes

22: Floridana sand, frequently ponded, 0 to 1 percent slopes

24: Floridana, Chobee, and Felda soils, frequently flooded

30: Malabar sand

31: Malabar, Holopaw, and Pineda soils

33: Micco mucky peat, frequently flooded

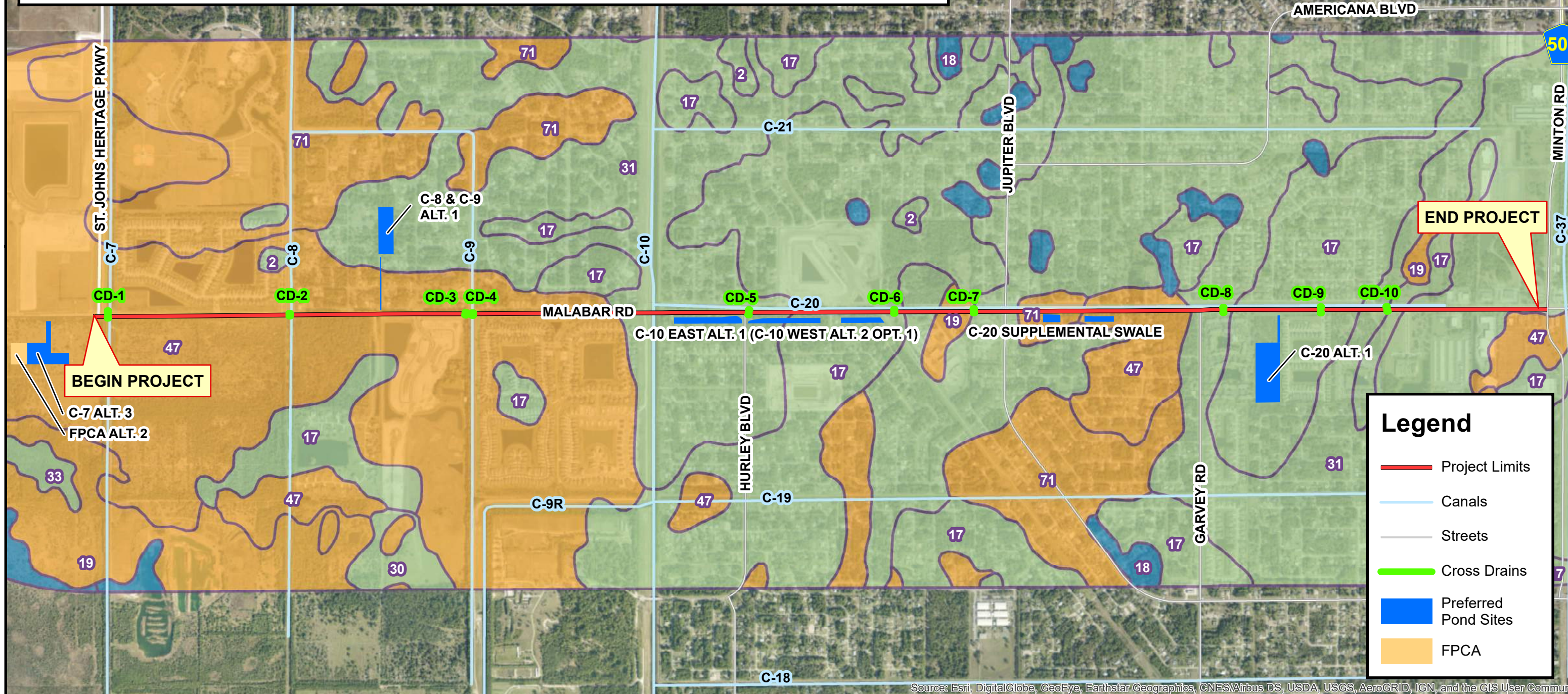
47: Pineda sand, 0 to 2 percent slopes

71: Wabasso sand

73: Winder loamy sand

Soil Group

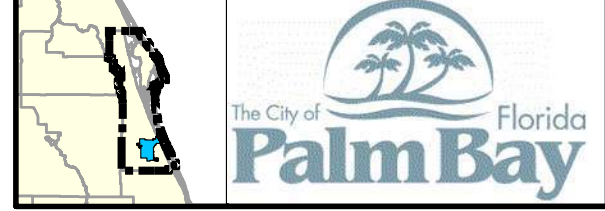
- A/D
- B/D
- C/D



Legend

- Project Limits
- Canals
- Streets
- Cross Drains
- Preferred Pond Sites
- FPCA

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Malabar Road PD&E Study
 From St. Johns Heritage Parkway to Minton Road
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NRCS SOILS MAP

Figure 3

Brevard County Land Use

URBAN AND BUILT UP

- 1100: Residential, low density - less than 2 dwelling units/acre
- 1200: Medium density residential - 2-5 units/acre
- 1300: Residential, high density - 6 units/acre
- 1400: Commercial and services
- 1700: Institutional

AGRICULTURE

- 1890: Other recreation
- 1900: Open land
- 1920: Inactive land with street patterns, no structures
- 2110: Improved pastures
- 2120: Unimproved pastures
- 2130: Woodland pastures

UPLAND NONFORESTED

- 2150: Field crops
- 2430: Ornamentals
- 2600: Other open lands - rural
- 3100: Herbaceous upland (non-forested)
- 3200: Shrub and brushland
- 3300: Mixed upland (non-forested)

UPLAND FORESTS

- 4110: Pine flatwoods
- 4200: Upland hardwood
- 4340: Upland mixed coniferous/hardwood

WATER

- 5100: Streams and waterways
- 5300: Reservoirs - pits, ponds, dammed systems

WETLANDS

- 6182: Cabbage palm savannah
- 6410: Freshwater marsh
- 6430: Wet prairies
- 6460: Mixed scrub-shrub wetland

BARREN LAND

- 7430: Spoil areas

TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

- 8140: Roads
- 8200: Communications
- 8320: Electrical power transmission lines
- 8370: Surface water collection basins



0 0.25 0.5 Miles

AMERICANA BLVD

509

END PROJECT

BEGIN PROJECT

Legend

- Project Limits
- Cross Drains
- Canals
- Preferred Pond Sites
- Streets
- FPCA

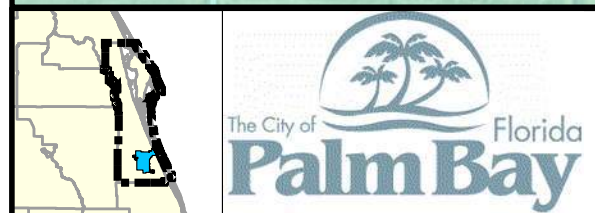
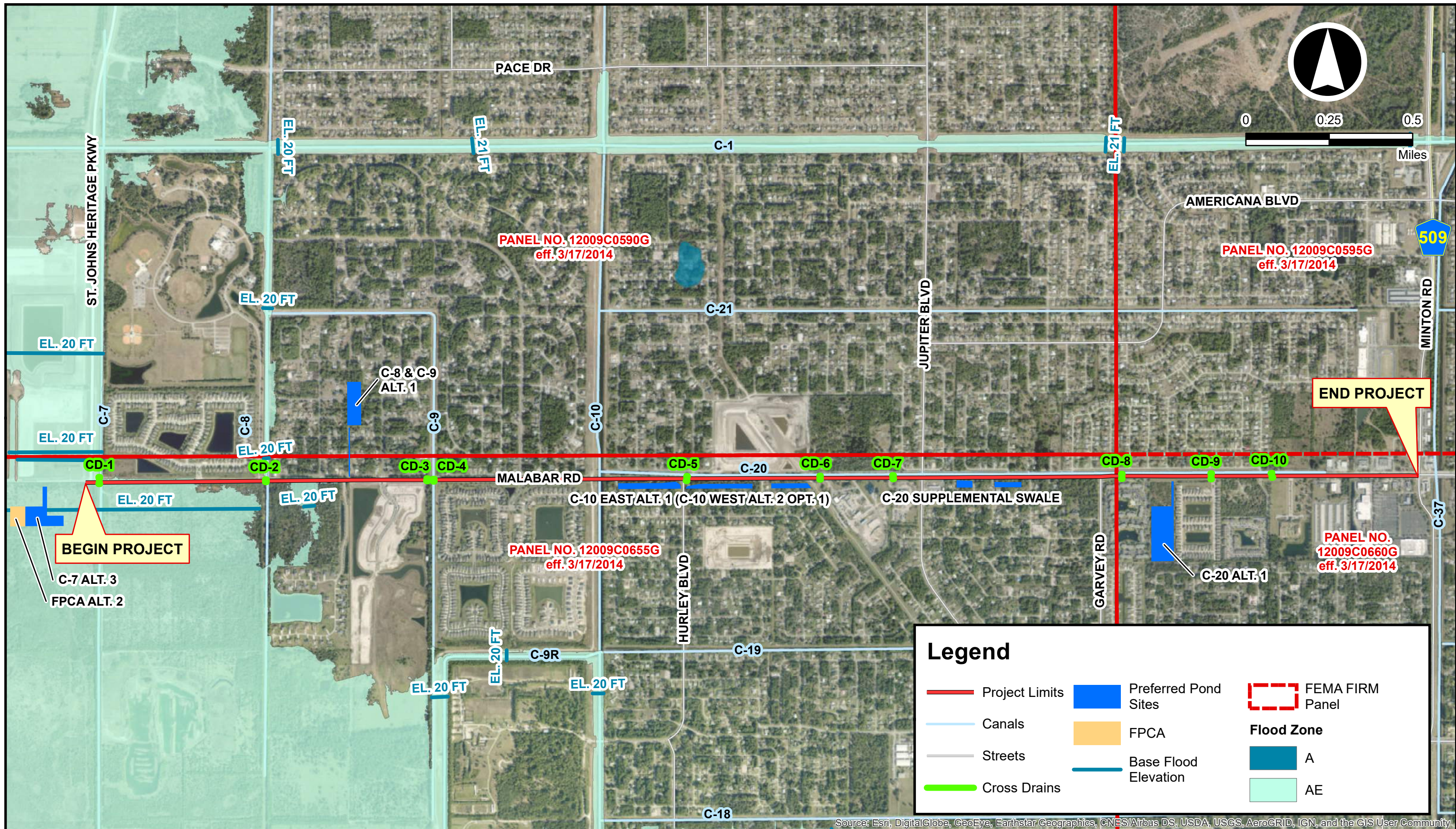
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Malabar Road PD&E Study
 From St. Johns Heritage Parkway to Minton Road
 Brevard County, Florida
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LAND USE MAP

Figure
4



Malabar Road PD&E Study
 From St. Johns Heritage Parkway to Minton Road
 Brevard County, Florida
 Financial Project ID: 437210-1-28-01

FEMA FLOODPLAINS MAP

Figure
5

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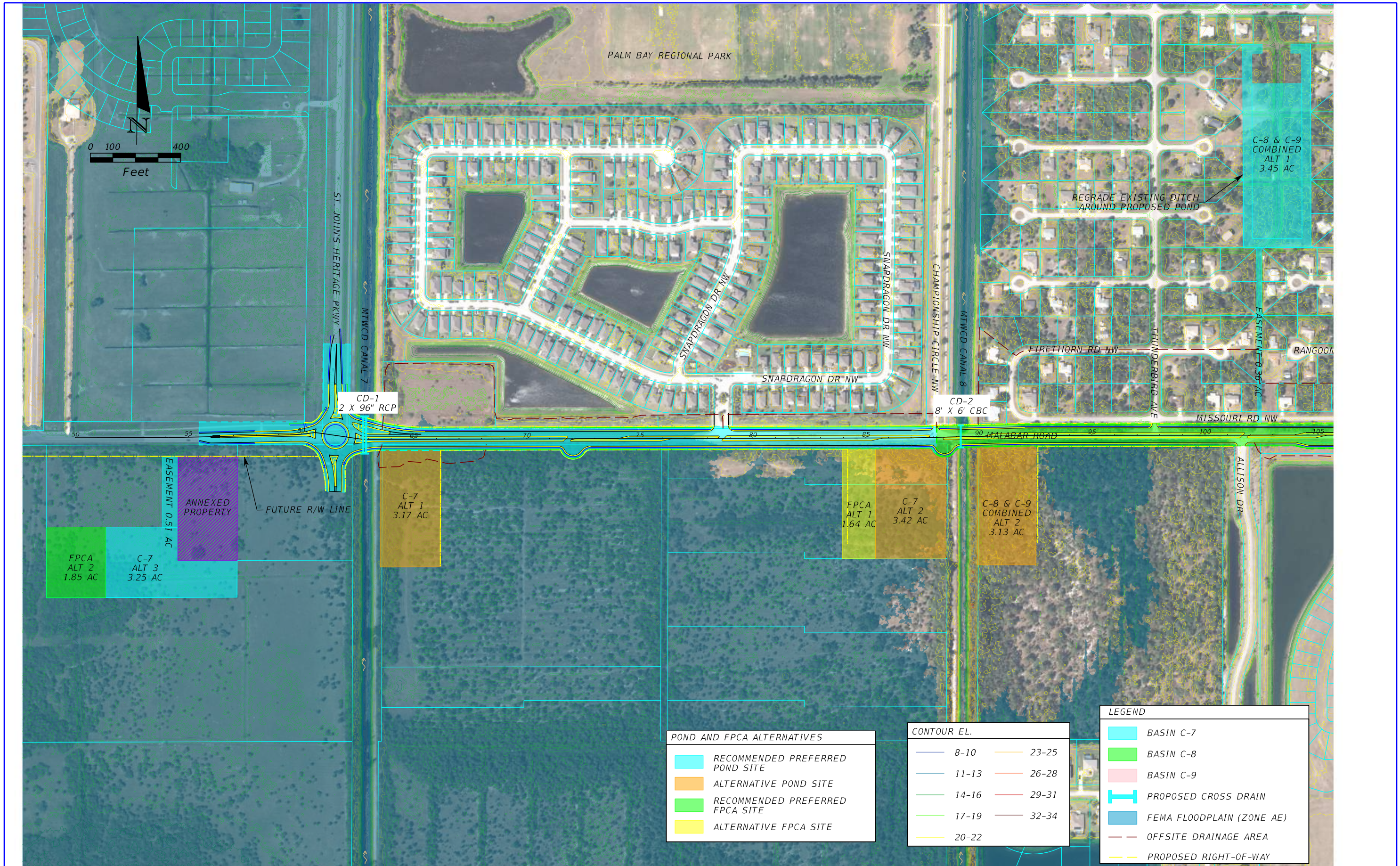
APPENDIX B

Basin Maps

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POND AND FPCA ALTERNATIVES

■	RECOMMENDED PREFERRED POND SITE
■	ALTERNATIVE POND SITE
■	RECOMMENDED PREFERRED FPCA SITE
■	ALTERNATIVE FPCA SITE

CONTOUR EL.

8-10	23-25
11-13	26-28
14-16	29-31
17-19	32-34
20-22	

LEGEND

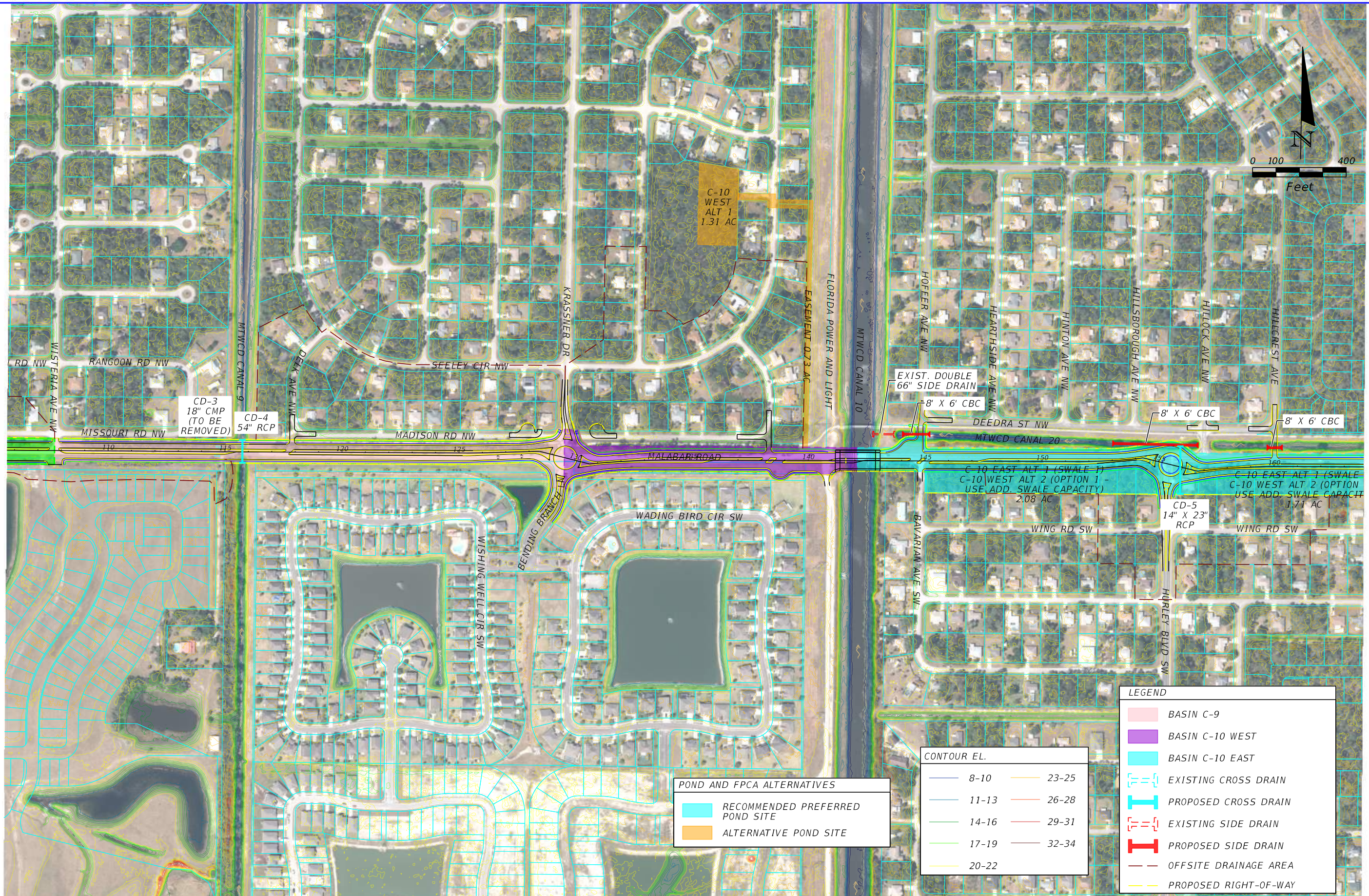
■	BASIN C-7
■	BASIN C-8
■	BASIN C-9
—	PROPOSED CROSS DRAIN
■	FEMA FLOODPLAIN (ZONE AE)
—	OFFSITE DRAINAGE AREA
—	PROPOSED RIGHT-OF-WAY

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID

BASIN MAPS

SHEET NO.
1



POND AND FPCA ALTERNATIVES

 RECOMMENDED PREFERRED POND SITE	 ALTERNATIVE POND SITE
--	---

CONTOUR EL.

8-10	23-25
11-13	26-28
14-16	29-31
17-19	32-34
20-22	

LEGEND

 BASIN C-9
 BASIN C-10 WEST
 BASIN C-10 EAST
 EXISTING CROSS DRAIN
 PROPOSED CROSS DRAIN
 EXISTING SIDE DRAIN
 PROPOSED SIDE DRAIN
 OFFSITE DRAINAGE AREA
 PROPOSED RIGHT-OF-WAY

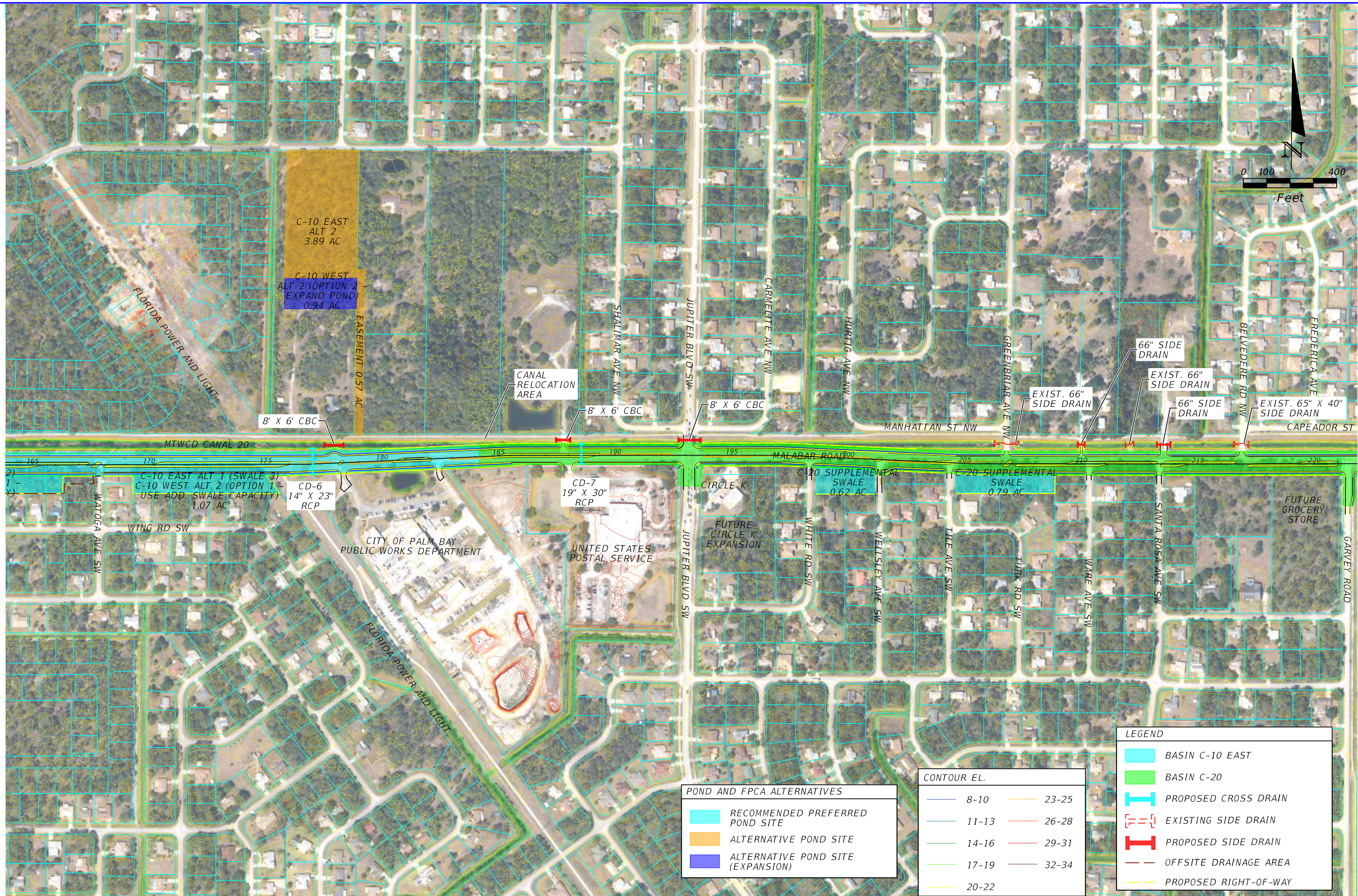
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID

BASIN MAPS

SHEET NO.
2



POND AND FPCA ALTERNATIVES

■	RECOMMENDED PREFERRED POND SITE
■	ALTERNATIVE POND SITE
■	ALTERNATIVE POND SITE (EXPANSION)

CONTOUR EL.

8-10	23-25
11-13	26-28
14-16	29-31
17-19	32-34
20-22	

LEGEND

■	BASIN C-10 EAST
■	BASIN C-20
┌─┐	PROPOSED CROSS DRAIN
- - -	EXISTING SIDE DRAIN
┌─┐	PROPOSED SIDE DRAIN
---	OFFSITE DRAINAGE AREA
---	PROPOSED RIGHT-OF-WAY

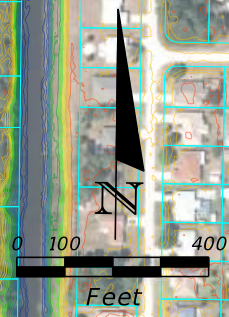
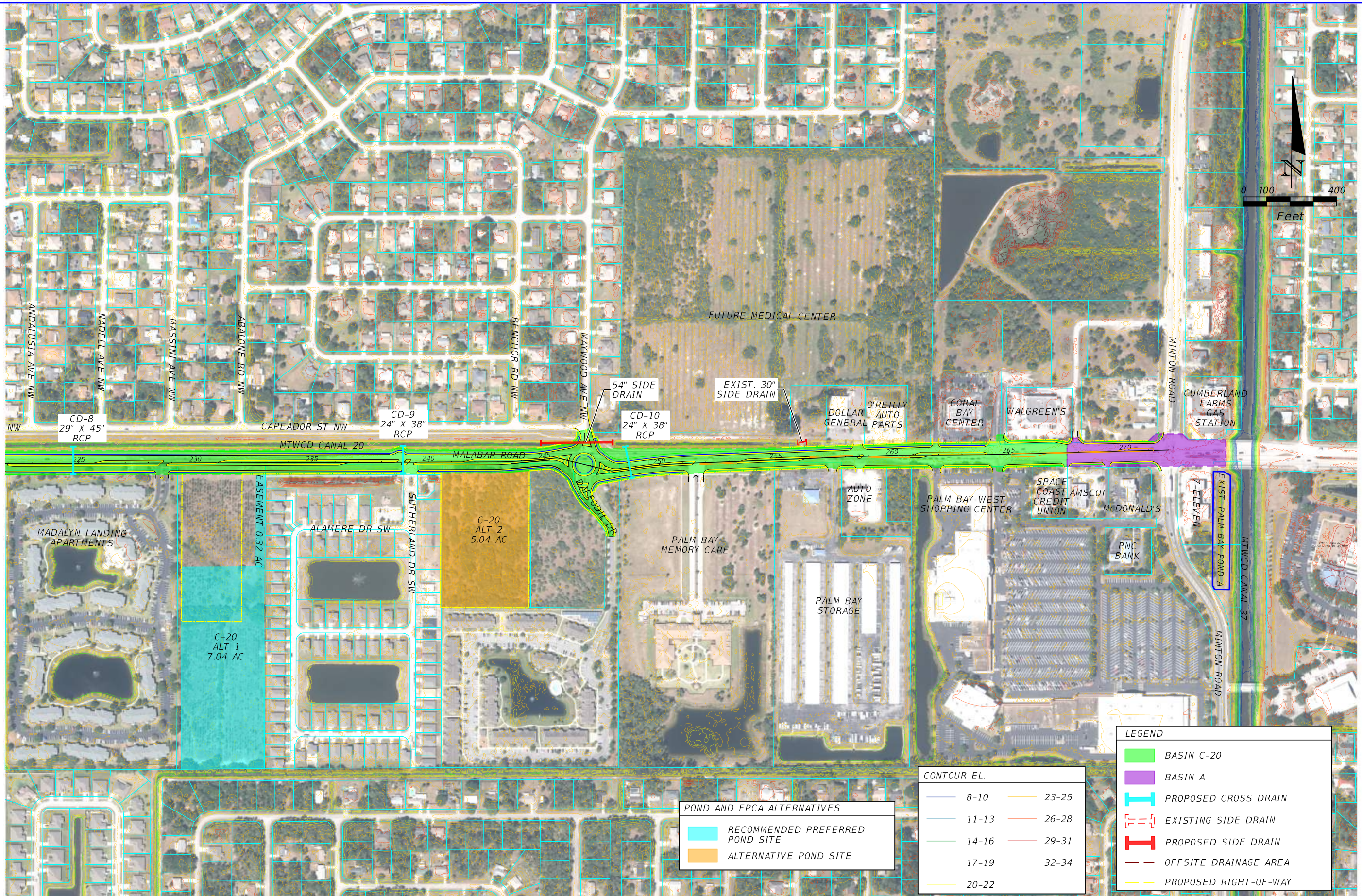
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID

BASIN MAPS

SHEET NO.
3



POND AND FPCA ALTERNATIVES

■	RECOMMENDED PREFERRED POND SITE
■	ALTERNATIVE POND SITE

CONTOUR EL.

8-10	23-25
11-13	26-28
14-16	29-31
17-19	32-34
20-22	

LEGEND

■	BASIN C-20
■	BASIN A
┌─┐	PROPOSED CROSS DRAIN
- - -	EXISTING SIDE DRAIN
┌─┐	PROPOSED SIDE DRAIN
---	OFFSITE DRAINAGE AREA
---	PROPOSED RIGHT-OF-WAY

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID

BASIN MAPS

SHEET NO.
4

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX C

Pond Design Calculations

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Basin C-7

Alternative 1

Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 1**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 1.80 ac
 Pervious Area: 5.84 ac
 Total Roadway Areas: 7.64 ac

Pond Area: Pervious Pond Area = 1.67 ac

Total Area: Impervious Area: 1.80 ac
 Pervious Area: 5.84 ac
 Pond Area: 1.67 ac
 Total Area: 9.31 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	1.80 ac	176.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.15 ac	251.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.70 ac	213.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	1.67 ac	134.0
Total:			9.31 ac	774.7

CN = Total CN*Area / Total Area = **83.2**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = **2.02 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.96 in** | **5.90 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 1**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 5.28 ac
 Pervious Roadway Area: 2.36 ac
 Total Roadway Area: 7.64 ac

Pond Area:

Pervious Pond Area : 0.97 ac
 Water Surface Area: 0.70 ac Wet Pond
 Total Pond Area: 1.67 ac

Total Area:

Impervious Area: **5.28 ac**
 Pervious Area: **3.33 ac**
 Water Surface Area: **0.70 ac**
 Total Area: **9.31 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	5.28 ac	517.4
Proposed Roadway Pervious	D	80	2.36 ac	188.7
Proposed Pond Pervious	D	80	0.97 ac	77.7
Proposed Ponds (Water Surface)	D	100	0.70 ac	70.4
			Total:	854.2

CN = Total CN*Area / Total Area = **91.7**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.90 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.00 in** | **6.91 in** |

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 1**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area= 0.78 ac-ft
	2.50 in	x Imperv. Area= 1.10 ac.-ft.

Treatment V_{req} = **1.10 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	5.40 ac-ft	4.58 ac-ft	
Q_{post} =	6.21 ac-ft	5.36 ac-ft	
ΔQ =	0.81 ac-ft	0.78 ac-ft	

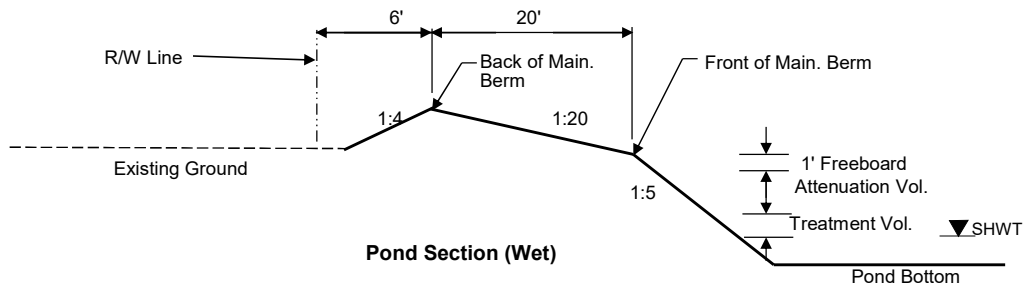
Attenuation V_{req} = **0.81 ac-ft**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 1**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>20.00</u>
Pond Tie-In Width =	<u>6.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>17.00</u>
Maximum Storage Depth (SD) =	<u>2.50 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>20.50</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>400 ft</u>	
Estimated Energy Losses =	<u>0.2 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>19.30 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
20.00	Pond R/W	1.67 ac	382.0 ft	191.0 ft	
21.50	Back of Main. Berm	1.52 ac	370.0 ft	179.0 ft	4.36 ac-ft
21.00		1.28 ac	350.0 ft	159.0 ft	3.66 ac-ft
20.50	Front of Main. Berm	1.05 ac	330.0 ft	139.0 ft	3.08 ac-ft
19.50	Provided Treat. Vol.+Att. Vol	0.95 ac	320.0 ft	129.0 ft	2.06 ac-ft
19.32	Req'd Treat. Vol+Att. Vol	0.93 ac	318.2 ft	127.2 ft	1.89 ac-ft
19.30	Estimated Storm Sewer TW	0.93 ac	318.0 ft	127.0 ft	1.88 ac-ft
18.42	Top of Treatment Vol.	0.84 ac	309.2 ft	118.2 ft	1.10 ac-ft
17.00	Normal Water Level	0.70 ac	295.0 ft	104.0 ft	0.00 ac-ft
14.00	Begin 1:2 Slope	0.45 ac	265.0 ft	74.0 ft	
12.00	Pond Bottom	0.39 ac	257.0 ft	66.0 ft	

Required Treatment+Attenuation Vol.= **1.91 ac-ft**
 Required Treatment+Attenuation Stage= 19.32 ft

Provided Treatment+Attenuation Vol.= 2.06 ac-ft
 Provided Treatment+Attenuation Stage= 19.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= **1.88 ac-ft**
 Estimated Storm Sewer TW EL.= **19.30 ft**

HGL requirements met
 Required Treatment Vol.= **1.10 ac-ft**

PROPOSED POND R/W (Safety Factor of 20%) =	2.01 ac
PROPOSED POND R/W ADJUSTED FOR MODEL	3.17 ac

Basin C-7

**Alternative 2
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 66 ft

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 1.80 ac
 Pervious Area: 3.15 ac
 Total Roadway Areas: 4.94 ac

Total Area: Impervious Area: **1.80 ac**
 Pervious Area: **3.15 ac**
 Total Area: **4.94 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	1.80 ac	176.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.15 ac	251.6
Total:			4.94 ac	427.7

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in** Precipitation (P) = **9.00 in** **7.90 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$ Runoff (Q) = **7.37 in** **6.30 in**

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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 2**

Station From: **055+48** Roadway Length = 3262 ft
 Limits: To: **088+10** R/W Width = 102 ft

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	24	0.015	0.021	0.32			--	3
Overland	22	0.24	0.021	0.32			--	13
Ditch Flow	2236	0.24	0.0004	0.32			2.50	15
Pipe Flow	242	0.012	0.001	0.32			2.50	2
Total:								32

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	34.5	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	2100	0.012	0.001	0.32			2.50	14
Total:								18

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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 1.80 ac
 Pervious Area: 5.84 ac
 Total Roadway Areas: 7.64 ac

Pond Area: Pervious Pond Area = 2.85 ac

Total Area: Impervious Area: 1.80 ac
 Pervious Area: 5.84 ac
 Pond Area: 2.85 ac
 Total Area: 10.49 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	1.80 ac	176.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.15 ac	251.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.70 ac	213.0
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.85 ac	225.5
Total:			10.49 ac	866.2

CN = Total CN*Area / Total Area = **82.6**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **2.11 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.88 in** | **5.83 in** |

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Made by: DLD
 Checked by: REC

DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 5.28 ac
 Pervious Roadway Area: 2.36 ac
 Total Roadway Area : 7.64 ac

Pond Area:

Pervious Pond Area : 1.30 ac
 Water Surface Area: 1.55 ac Wet Pond
 Total Pond Area: 2.85 ac

Total Area:

Impervious Area: 5.28 ac
 Pervious Area: 3.66 ac
 Water Surface Area: 1.55 ac
 Total Area: 10.49 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	5.28 ac	517.4
Proposed Roadway Pervious	D	80	2.36 ac	188.7
Proposed Pond Pervious	D	80	1.30 ac	104.2
Proposed Ponds (Water Surface)	D	100	1.55 ac	155.2
			Total:	965.4
			Total:	10.49 ac

CN = Total CN*Area / Total Area = **92.0**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.87 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.04 in** | **6.95 in** |

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Made by: DLD
 Checked by: REC

DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area=	0.87 ac-ft
	2.50 in	x Imperv. Area=	1.10 ac.-ft.

Treatment $V_{req} =$ **1.10 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	6.02 ac-ft	5.10 ac-ft	
$Q_{post} =$	7.03 ac-ft	6.07 ac-ft	
$\Delta Q =$	1.01 ac-ft	0.98 ac-ft	

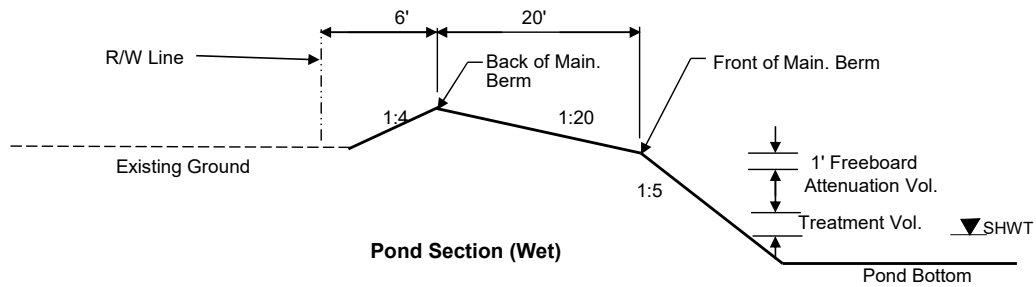
Attenuation $V_{req} = 1.01 ac-ft$

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	20.00
Pond Tie-In Width =	6.0 ft	@ 1:4	Normal Water Elevation =	17.00
Maximum Storage Depth (SD) =	2.50 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	20.50

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	400 ft	
Estimated Energy Losses =	0.2 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	19.30 ft	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
20.00	Pond R/W	2.85 ac	480.0 ft	259.0 ft	
21.50	Back of Main. Berm	2.65 ac	468.0 ft	247.0 ft	8.61 ac-ft
21.00		2.33 ac	448.0 ft	227.0 ft	7.37 ac-ft
20.50	Front of Main. Berm	2.03 ac	428.0 ft	207.0 ft	6.27 ac-ft
19.50	Provided Treat.Vol.+Att.Vol	1.89 ac	418.0 ft	197.0 ft	4.30 ac-ft
18.27	Estimated Storm Sewer TW	1.72 ac	405.7 ft	184.7 ft	2.08 ac-ft
17.69	Top of Treatment Vol.	1.64 ac	399.9 ft	178.9 ft	1.10 ac-ft
17.00	Normal Water Level	1.55 ac	393.0 ft	172.0 ft	0.00 ac-ft
14.00	Begin 1:2 Slope	1.18 ac	363.0 ft	142.0 ft	
12.00	Pond Bottom	1.09 ac	355.0 ft	134.0 ft	

Required Treatment+Attenuation Vol.= 2.11 ac-ft

Provided Treatment+Attenuation Vol.= 4.30 ac-ft
 Provided Treatment+Attenuation Stage= 19.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= 2.08 ac-ft
 Estimated Storm Sewer TW EL.= 18.27 ft

HGL requirements met
 Required Treatment Vol.= 1.10 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) =	3.42 ac
ADJUSTED POND MODEL SAFETY FACTOR =	58%

Basin C-7

**Alternative 3
(Preferred)
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 66 ft

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 1.80 ac
 Pervious Area: 3.15 ac
 Total Roadway Areas: 4.94 ac

Total Area: Impervious Area: **1.80 ac**
 Pervious Area: **3.15 ac**
 Total Area: **4.94 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	1.80 ac	176.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.15 ac	251.6
Total:			4.94 ac	427.7

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in** Precipitation (P) = **9.00 in** **7.90 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$ Runoff (Q) = **7.37 in** **6.30 in**

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Made by: DLD
 Checked by: REC

DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3**

Station From: **055+48** Roadway Length = 3262 ft
Limits: To: **088+10** R/W Width = 102 ft

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	24	0.015	0.021	0.32			--	3
Overland	22	0.24	0.021	0.32			--	13
Ditch Flow	2236	0.24	0.0004	0.32			2.50	15
Pipe Flow	242	0.012	0.001	0.32			2.50	2
Total:								32

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	34.5	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	3900	0.012	0.001	0.32			2.50	26
Total:								30

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 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: June 30, 2023
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 1.80 ac
 Pervious Area: 5.84 ac
 Total Roadway Areas: 7.64 ac

Pond Area: Pervious Pond Area = 2.71 ac

Total Area: Impervious Area: 1.80 ac
 Pervious Area: 5.84 ac
 Pond Area: 2.71 ac
 Total Area: 10.35 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	1.80 ac	176.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.15 ac	251.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.70 ac	213.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	2.71 ac	216.7
Total:			10.35 ac	857.4

CN = Total CN*Area / Total Area = 82.9

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 = 2.07 \text{ in}$

Precipitation (P) = 9.00 in 7.90 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 6.92 in 5.87 in

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Made by: DLD
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DATE: June 30, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **055+48** Roadway Length = 3262 ft
 To: **088+10** R/W Width = 102 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 5.28 ac
 Pervious Roadway Area: 2.36 ac
 Total Roadway Area : 7.64 ac

Pond Area:

Pervious Pond Area : 1.42 ac
 Water Surface Area: 1.29 ac Wet Pond
 Total Pond Area: 2.71 ac

Total Area:

Impervious Area: **5.28 ac**
 Pervious Area: **3.78 ac**
 Water Surface Area: **1.29 ac**
 Total Area: **10.35 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	5.28 ac	517.4
Proposed Roadway Pervious	D	80	2.36 ac	188.7
Proposed Pond Pervious	D	80	1.42 ac	113.3
Proposed Ponds (Water Surface)	D	100	1.29 ac	129.2
			Total:	948.6
			Total:	10.35 ac

CN = Total CN*Area / Total Area = **91.7**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.91 in**

Precipitation (P) = **9.00 in** **7.90 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.00 in** **6.91 in**

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Made by: DLD
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DATE: June 30, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3 (Modeled in ICPR to meet limiting discharge criteria)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area=	0.86 ac-ft
	2.50 in	x Imperv. Area=	1.10 ac.-ft.

Treatment V_{req} = **1.10 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	5.97 ac-ft	5.06 ac-ft	
Q_{post} =	6.89 ac-ft	5.96 ac-ft	
ΔQ =	0.93 ac-ft	0.90 ac-ft	

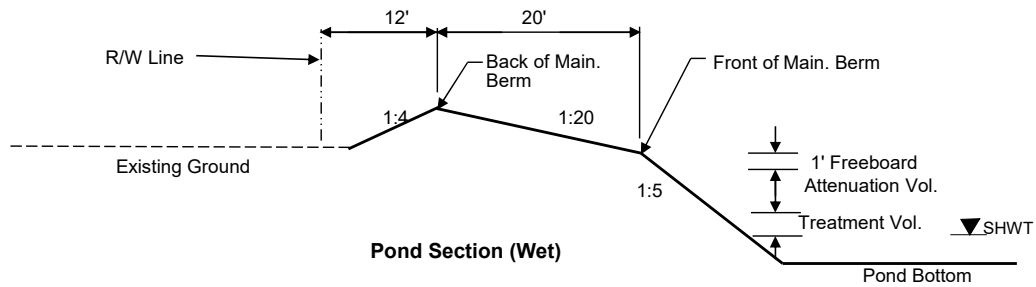
Attenuation V_{req} = **0.93 ac-ft**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3 (Modeled in ICPR to meet limiting discharge criteria)**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>18.00</u>
Pond Tie-In Width =	<u>12.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>16.20</u>
Maximum Storage Depth (SD) =	<u>2.80 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>19.50</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>400 ft</u>	
Estimated Energy Losses =	<u>0.2 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>18.30 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
18.00	Pond R/W	2.71 ac	437.0 ft	270.0 ft	
21.00	Back of Main. Berm	2.33 ac	413.0 ft	246.0 ft	7.85 ac-ft
20.50		2.04 ac	393.0 ft	226.0 ft	6.76 ac-ft
20.00	Front of Main. Berm	1.76 ac	373.0 ft	206.0 ft	5.81 ac-ft
19.00	Provided Treat.Vol.+Att.Vol	1.63 ac	363.0 ft	196.0 ft	4.10 ac-ft
17.85	Estimated Storm Sewer TW	1.49 ac	351.5 ft	184.5 ft	2.29 ac-ft
17.25	Top of Treatment Vol.	1.42 ac	345.5 ft	178.5 ft	1.42 ac-ft
16.20	Normal Water Level	1.29 ac	335.0 ft	168.0 ft	0.00 ac-ft
13.20	Begin 1:2 Slope	0.97 ac	305.0 ft	138.0 ft	
1.00	Pond Bottom	0.52 ac	256.2 ft	89.2 ft	

Required Treatment+Attenuation Vol.= **2.03 ac-ft**

Provided Treatment+Attenuation Vol.= 4.10 ac-ft
 Provided Treatment+Attenuation Stage= 19.00 ft

Estimated Treat. Vol.+Storm Sewer Att.= **2.00 ac-ft**
 Estimated Storm Sewer TW EL.= **17.85 ft**

HGL requirements met
 Required Treatment Vol.= **1.10 ac-ft**

PROPOSED POND R/W (Safety Factor of 20%) =	3.25 ac
ADJUSTED POND MODEL SAFETY FACTOR =	39%

Basin C-8 & C-9

**Alternative 1
(Preferred)
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9 Combined**

Station Limits: From: **088+10** Roadway Length = 4138 ft
 To: **129+48** R/W Width = **66 ft**

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 2.28 ac
 Pervious Area: 3.99 ac
 Total Roadway Areas: 6.27 ac

Total Area: Impervious Area: **2.28 ac**
 Pervious Area: **3.99 ac**
 Total Area: **6.27 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.28 ac	223.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.99 ac	319.2
Total:			6.27 ac	542.6

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.37 in** | **6.30 in** |

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9**
 POND NAME : **C-8 & C-9 Alt. 1**

Station From: **088+10** Roadway Length = 4138 ft
 Limits: To: **129+48** R/W Width = **102 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	54	0.015	0.009	0.32			--	5
Overland	54	0.24	0.009	0.32			--	28
Ditch Flow	1180	0.24	0.0013	0.32			2.50	8
Pipe Flow	95	0.012	0.001	0.32			2.50	1
Total:								42

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	3370	0.012	0.001	0.32			2.50	22
Total:								26

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Made by: DLD
 Checked by: REC

DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9 Combined**
 POND NAME : **C-8 & C-9 Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **088+10** Roadway Length = 4138 ft
 To: **129+48** R/W Width = 102 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 2.28 ac
 Pervious Area: 7.41 ac
 Total Roadway Areas: 9.69 ac

Pond Area: Pervious Pond Area = 2.88 ac

Total Area: Impervious Area: 2.28 ac
 Pervious Area: 7.41 ac
 Pond Area: 2.88 ac
 Total Area: 12.57 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.28 ac	223.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.99 ac	319.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.42 ac	270.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.88 ac	227.4
Total:			12.57 ac	1040.2

CN = Total CN*Area / Total Area = **82.8**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **2.08 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.91 in** | **5.85 in** |

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Made by: DLD
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DATE: June 22, 2023
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9 Combined**
 POND NAME : **C-8 & C-9 Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: 088+10 Roadway Length = 4138 ft
 To: 129+48 R/W Width = 102 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 6.70 ac
 Pervious Roadway Area: 2.99 ac
 Total Roadway Area : 9.69 ac

Pond Area:

Pervious Pond Area : 1.53 ac
 Water Surface Area: 1.35 ac Wet Pond
 Total Pond Area: 2.88 ac

Total Area:

Impervious Area: **6.70 ac**
 Pervious Area: **4.52 ac**
 Water Surface Area: **1.35 ac**
 Total Area: **12.57 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.70 ac	656.3
Proposed Roadway Pervious	D	80	2.99 ac	239.4
Proposed Pond Pervious	D	80	1.53 ac	122.4
Proposed Ponds (Water Surface)	D	100	1.35 ac	134.9
			Total:	12.57 ac
				1153.0

CN = Total CN*Area / Total Area = 91.7

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 0.90 in

Precipitation (P) = 9.00 in 7.90 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 8.00 in 6.91 in

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Made by: DLD
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DATE: June 22, 2023
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9 Combined**
 POND NAME : **C-8 & C-9 Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area=	1.05 ac-ft
	2.50 in	x Imperv. Area=	1.40 ac.-ft.

Treatment $V_{req} =$ 1.40 ac-ft

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	7.23 ac-ft	6.13 ac-ft	
$Q_{post} =$	8.38 ac-ft	7.24 ac-ft	
$\Delta Q =$	1.15 ac-ft	1.11 ac-ft	

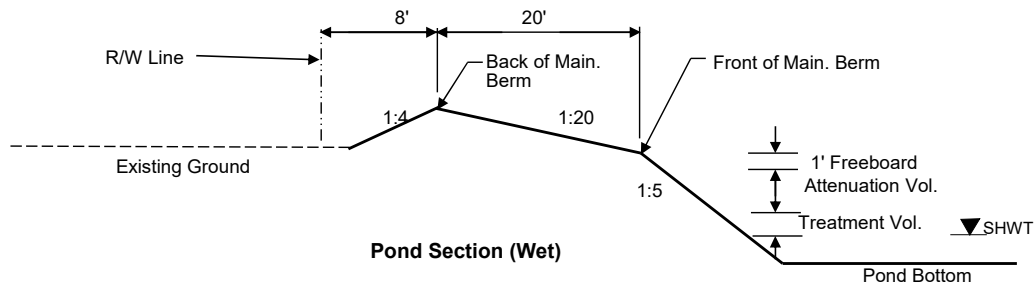
Attenuation $V_{req} = 1.15$ ac-ft

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9 Combined**
 POND NAME : **C-8 & C-9 Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>20.00</u>
Pond Tie-In Width =	<u>8.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>17.00</u>
Maximum Storage Depth (SD) =	<u>3.00 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>20.50</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>1600 ft</u>	
Estimated Energy Losses =	<u>0.8 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>18.70 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
20.00	Pond R/W	2.88 ac	570.0 ft	220.0 ft	
22.00	Back of Main. Berm	2.59 ac	554.0 ft	204.0 ft	8.83 ac-ft
21.50		2.26 ac	534.0 ft	184.0 ft	7.62 ac-ft
21.00	Front of Main. Berm	1.94 ac	514.0 ft	164.0 ft	6.57 ac-ft
20.00	Provided Treat.Vol.+Att.Vol	1.78 ac	504.0 ft	154.0 ft	4.70 ac-ft
18.70	Estimated Storm Sewer TW	1.59 ac	491.0 ft	141.0 ft	2.50 ac-ft
17.99	Top of Treatment Vol.	1.49 ac	483.9 ft	133.9 ft	1.40 ac-ft
17.00	Normal Water Level	1.35 ac	474.0 ft	124.0 ft	0.00 ac-ft
14.00	Begin 1:2 Slope	0.96 ac	444.0 ft	94.0 ft	
12.00	Pond Bottom	0.86 ac	436.0 ft	86.0 ft	

Required Treatment+Attenuation Vol.= 2.54 ac-ft

Provided Treatment+Attenuation Vol.= 4.70 ac-ft
 Provided Treatment+Attenuation Stage= 20.00 ft

Estimated Treat. Vol.+Storm Sewer Att.= 2.50 ac-ft
 Estimated Storm Sewer TW EL.= 18.70 ft

HGL requirements met
 Required Treatment Vol.= 1.40 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) =	3.45 ac
ADJUSTED POND MODEL SAFETY FACTOR =	0%

Basin C-8 & C-9

Alternative 2

Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9**
 POND NAME : **C-8 & C-9 Alt. 2**

Station Limits: From: **088+10** Roadway Length = 4138 ft
 To: **129+48** R/W Width = **102 ft**

EXISTING CONDITION

Roadway Area:

Impervious Area : 2.28 ac
 Pervious Area: 7.41 ac
 Total Roadway Areas: 9.69 ac

Pond Area: Pervious Pond Area = 2.61 ac

Total Area: Impervious Area: 2.28 ac
 Pervious Area: 7.41 ac
 Pond Area: 2.61 ac
 Total Area: 12.30 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.28 ac	223.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	3.99 ac	319.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.42 ac	270.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	2.61 ac	206.3
Total:			12.30 ac	1019.1

$$CN = \frac{\text{Total CN*Area}}{\text{Total Area}} = \frac{1019.1}{12.30} = \mathbf{82.8}$$

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = **2.07 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.92 in** | **5.86 in** |

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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9**
 POND NAME : **C-8 & C-9 Alt. 2**

Station Limits: From: **088+10** Roadway Length = 4138 ft
 To: **129+48** R/W Width = **102 ft**

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 6.70 ac
 Pervious Roadway Area: 2.99 ac
 Total Roadway Area : 9.69 ac

Pond Area:

Pervious Pond Area : 1.29 ac
 Water Surface Area: 1.32 ac Wet Pond
 Total Pond Area: 2.61 ac

Total Area:

Impervious Area: 6.70 ac
 Pervious Area: 4.28 ac
 Water Surface Area: 1.32 ac
 Total Area: 12.30 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.70 ac	656.3
Proposed Roadway Pervious	D	80	2.99 ac	239.4
Proposed Pond Pervious	D	80	1.29 ac	103.4
Proposed Ponds (Water Surface)	D	100	1.32 ac	131.9
			Total:	12.30 ac
				1131.0

CN = Total CN*Area / Total Area = **91.9**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.88 in**

Precipitation (P) = **9.00 in** **7.90 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.03 in** **6.94 in**

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9**
 POND NAME : **C-8 & C-9 Alt. 2**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area= 1.03 ac-ft
	2.50 in	x Imperv. Area= 1.40 ac.-ft.

Treatment $V_{req} = 1.40 \text{ ac-ft}$

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	7.09 ac-ft	6.01 ac-ft	
$Q_{post} =$	8.23 ac-ft	7.11 ac-ft	
$\Delta Q =$	1.14 ac-ft	1.10 ac-ft	

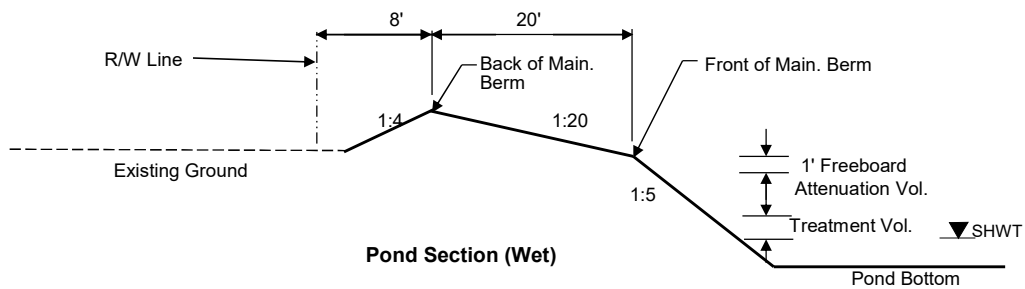
Attenuation $V_{req} = 1.14 \text{ ac-ft}$

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 & C-9**
 POND NAME : **C-8 & C-9 Alt. 2**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>20.00</u>
Pond Tie-In Width =	<u>8.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>17.60</u>
Maximum Storage Depth (SD) =	<u>2.40 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>21.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>1300 ft</u>	
Estimated Energy Losses =	<u>0.7 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>19.35 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
20.00	Pond R/W	2.61 ac	477.0 ft	238.5 ft	
22.00	Back of Main. Berm	2.35 ac	461.0 ft	222.5 ft	7.30 ac-ft
21.50		2.05 ac	441.0 ft	202.5 ft	6.19 ac-ft
21.00	Front of Main. Berm	1.76 ac	421.0 ft	182.5 ft	5.24 ac-ft
20.00	Provided Treat. Vol.+Att. Vol	1.63 ac	411.0 ft	172.5 ft	3.54 ac-ft
19.37	Req'd Treat. Vol+Att. Vol	1.54 ac	404.7 ft	166.2 ft	2.53 ac-ft
19.35	Estimated Storm Sewer TW	1.54 ac	404.5 ft	166.0 ft	2.50 ac-ft
18.62	Top of Treatment Vol.	1.45 ac	397.2 ft	158.7 ft	1.41 ac-ft
17.60	Normal Water Level	1.32 ac	387.0 ft	148.5 ft	0.00 ac-ft
14.60	Begin 1:2 Slope	0.97 ac	357.0 ft	118.5 ft	
12.60	Pond Bottom	0.89 ac	349.0 ft	110.5 ft	

Required Treatment+Attenuation Vol.= **2.53 ac-ft**
 Required Treatment+Attenuation Stage= 19.37 ft

Provided Treatment+Attenuation Vol.= 3.54 ac-ft
 Provided Treatment+Attenuation Stage= 20.00 ft

Estimated Treat. Vol.+Storm Sewer Att.= **2.50 ac-ft**
 Estimated Storm Sewer TW EL.= **19.35 ft**

HGL requirements met
 Required Treatment Vol.= **1.40 ac-ft**

PROPOSED POND R/W (Safety Factor of 20%) =	3.13 ac
PROPOSED POND R/W ADJUSTED FOR MODEL	3.13 ac

Basin C-10 West

**Alternative 1
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 West**

Station Limits: From: **129+48** Roadway Length = 1252 ft
 To: **142+00** R/W Width = **66 ft**

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 0.69 ac
 Pervious Area: 1.21 ac
 Total Roadway Areas: 1.90 ac

Total Area: Impervious Area: **0.69 ac**
 Pervious Area: **1.21 ac**
 Total Area: **1.90 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	0.69 ac	67.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	1.21 ac	96.6
Total:			1.90 ac	164.2

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.37 in** | **6.30 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 West**
 POND NAME : **C-10 West Alt. 1**

Station From: **129+48** Roadway Length = 1252 ft
Limits: To: **142+00** R/W Width = 102 ft

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	58	0.015	0.017	0.32			--	5
Overland	82	0.24	0.012	0.32			--	33
Ditch Flow	2200	0.24	0.0009	0.32			2.50	15
Pipe Flow	190	0.012	0.001	0.32			2.50	1
Total:								54

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	1970	0.012	0.001	0.32			2.50	13
Total:								17

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 West**
 POND NAME : **C-10 West Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: 129+48 Roadway Length = 1252 ft
 To: 142+00 R/W Width = 102 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 0.69 ac
 Pervious Area: 2.24 ac
 Total Roadway Areas: 2.93 ac

Pond Area: Pervious Pond Area = 1.09 ac

Total Area: Impervious Area: **0.69 ac**
 Pervious Area: **1.90 ac**
 Pond Area: **1.09 ac**
 Total Area: **3.68 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	0.69 ac	67.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	1.21 ac	96.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	1.03 ac	86.9
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	1.09 ac	86.0
			Total:	337.1

CN = Total CN*Area / Total Area = **83.8**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.93 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.04 in** | **5.98 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

Station Limits: From: 129+48 Roadway Length = 1252 ft
 To: 142+00 R/W Width = 102 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 2.03 ac
 Pervious Roadway Area: 0.91 ac
 Total Roadway Area : 2.93 ac

Pond Area:

Pervious Pond Area : 1.09 ac Dry Pond
 Water Surface Area: 0.00 ac
 Total Pond Area: 1.09 ac

Total Area:

Impervious Area: **2.03 ac**
 Pervious Area: **1.99 ac**
 Water Surface Area: **0.00 ac**
 Total Area: **4.02 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.03 ac	198.6
Proposed Roadway Pervious	D	80	0.91 ac	72.4
Proposed Pond Pervious	D	80	1.09 ac	87.1
Proposed Ponds (Water Surface)	D	100	0.00 ac	0.0
			Total:	358.1
			4.02 ac	

CN = Total CN*Area / Total Area = **89.1**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = **1.23 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.04 in** | **5.98 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Dry Retention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Dry Retention	1.50 in	x Impervious Areas =	0.25 ac-ft	*1.50 in per City of Palm Bay
	0.50 in	x Total Basin Area =	0.12 ac-ft	

Treatment V_{req} = **0.25 ac-ft**

Treatment V_{req} = 0.5 x Total Basin Area + Greater Volume of the Above = **0.38 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	2.16 ac-ft	1.83 ac-ft	
Q_{post} =	2.36 ac-ft	2.00 ac-ft	
ΔQ =	0.20 ac-ft	0.17 ac-ft	

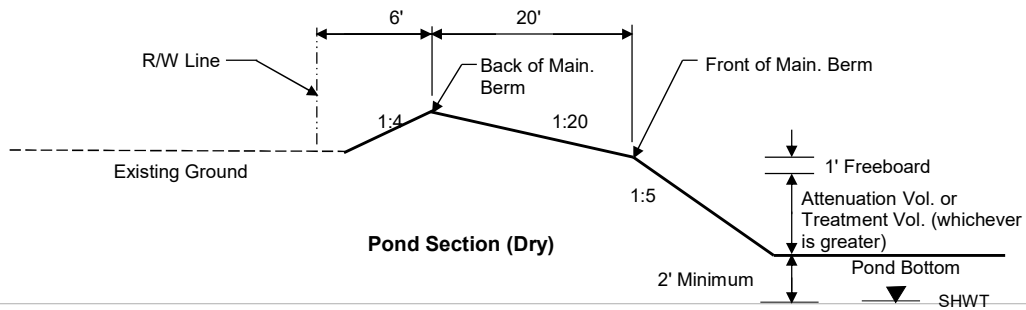
Attenuation V_{req} = **0.20 ac-ft**

PROJECT : **Malabar Road PD&E**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>22.00</u>
Pond Tie-In Width =	<u>6.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>15.00</u>
Maximum Storage Depth (SD) =	<u>4.50 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>22.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>1400 ft</u>	
Estimated Energy Losses =	<u>0.7 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>20.30 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
22.00	Pond R/W	1.09 ac	308.0 ft	154.0 ft	
23.50	Back of Main. Berm	0.96 ac	296.0 ft	142.0 ft	3.02 ac-ft
23.00		0.77 ac	276.0 ft	122.0 ft	2.59 ac-ft
22.50	Front of Main. Berm	0.60 ac	256.0 ft	102.0 ft	2.24 ac-ft
21.50	Provided Treat. Vol. OR Att. Vol.	0.52 ac	246.0 ft	92.0 ft	1.66 ac-ft
17.70	Estimated Storm Sewer TW	0.26 ac	208.0 ft	54.0 ft	0.17 ac-ft
17.00	Pond Bottom	0.22 ac	201.0 ft	47.0 ft	0.00 ac-ft

Required Treatment OR Attenuation Vol.= 0.38 ac-ft

Provided Treatment OR Attenuation Vol.= 1.66 ac-ft
 Provided Treatment OR Attenuation Stage= 21.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= 0.17 ac-ft
 Estimated Storm Sewer TW EL.= 17.70 ft

HGL requirements met

Required Treatment Vol.= 0.38 ac-ft
 Required Attenuation Vol.= 0.20 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) =	1.31 ac
ADJUSTED POND MODEL SAFETY FACTOR =	79%

Basin C-10 West

**Alternative 2, Option 1
Utilize Additional Swale Capacity in C-10 East Alternative 1
(Preferred)
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East with C-10 West**

Station Limits: From: 129+48 Roadway Length = 5452 ft
 To: 184+00 R/W Width = 66 ft

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 3.00 ac
 Pervious Area: 5.26 ac
 Total Roadway Areas: 8.26 ac

Total Area: Impervious Area: **3.00 ac**
 Pervious Area: **5.26 ac**
 Total Area: **8.26 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	3.00 ac	294.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	5.26 ac	420.5
Total:			8.26 ac	714.9

CN = Total CN*Area / Total Area = 86.5

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 1.55 in

Precipitation (P) = 9.00 in | 7.90 in |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 7.37 in | 6.30 in |

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 1**

Station From: **142+00** Roadway Length = 4200 ft
 Limits: To: **184+00** R/W Width = **105 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	40	0.015	0.017	0.32			--	4
Overland		0.24	0.012	0.32			--	0
Ditch Flow	1000	0.24	0.0010	0.32			2.50	7
Pipe Flow	77	0.012	0.001	0.32			2.50	1
Total:								11

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	1460	0.012	0.001	0.32			2.50	10
Total:								14

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**
With Compensation for Basin C-10 West

Station Limits: From: **129+48** Roadway Length = 5452 ft
 To: **184+00** R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 3.00 ac
 Pervious Area: 10.14 ac
 Total Roadway Areas: 13.14 ac

Pond Area: Pervious Pond Area = 3.79 ac

Total Area: Impervious Area: 3.00 ac
 Pervious Area: 10.14 ac
 Pond Area: 3.79 ac
 Total Area: 16.93 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	3.00 ac	294.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	5.26 ac	420.5
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	4.88 ac	385.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.79 ac	299.5
			Total:	1400.0
			16.93 ac	

CN = Total CN*Area / Total Area = **82.7**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **2.09 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.90 in** | **5.84 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

Station Limits: From: 129+48 Roadway Length = 5452 ft
 To: 184+00 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 8.82 ac
 Pervious Roadway Area: 4.32 ac
 Total Roadway Area : 13.14 ac

Pond Area:

Pervious Pond Area : 3.79 ac Dry Pond
 Water Surface Area: 0.00 ac
 Total Pond Area: 3.79 ac

Total Area:

Impervious Area: **8.82 ac**
 Pervious Area: **8.11 ac**
 Water Surface Area: **0.00 ac**
 Total Area: **16.93 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	8.82 ac	864.7
Proposed Roadway Pervious	D	80	4.32 ac	345.4
Proposed Pond Pervious	D	80	3.79 ac	303.3
Proposed Ponds (Water Surface)	D	100	0.00 ac	0.0
			Total:	16.93 ac 1513.5

CN = Total CN*Area / Total Area = 89.4

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = 1.19 in

Precipitation (P) = 9.00 in 7.90 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 6.90 in 5.84 in

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Dry Retention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Dry Retention	1.50 in	x Impervious Areas =	1.10 ac-ft	*1.50 in per City of Palm Bay
	0.50 in	x Total Basin Area =	0.55 ac-ft	

Treatment V_{req} = **1.10 ac-ft**

Treatment V_{req} = 0.5 x Total Basin Area + Greater Volume of the Above = **1.65 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	9.73 ac-ft	8.25 ac-ft	
Q_{post} =	9.73 ac-ft	8.25 ac-ft	
ΔQ =	0.00 ac-ft	0.00 ac-ft	

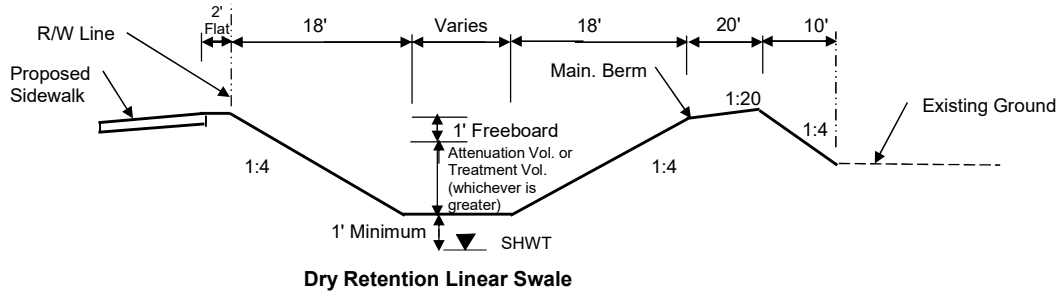
Attenuation V_{req} = **0.00 ac-ft**

PROJECT : **Malabar Road PD&E**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>23.00</u>
Pond Tie-In Width =	<u>10.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>18.00</u>
Maximum Storage Depth (SD) =	<u>3.50 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>23.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>50 ft</u>	
Estimated Energy Losses =	<u>0.0 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>21.98 ft</u>	



Pond Stage / Storage Calculations - SWALE 1

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	2.08 ac	1020.0 ft	89.0 ft	
25.50	Back of Main. Berm	1.81 ac	1000.0 ft	79.0 ft	5.58 ac-ft
25.00		1.55 ac	980.0 ft	69.0 ft	4.74 ac-ft
24.50	Front of Main. Berm	1.30 ac	960.0 ft	59.0 ft	4.02 ac-ft
23.50	Provided Treat. Vol. OR Att. Vol.	1.11 ac	952.0 ft	51.0 ft	2.80 ac-ft
21.59	Req'd Treat. Vol. OR Att. Vol.	0.77 ac	936.7 ft	35.7 ft	1.00 ac-ft
20.97	Estimated Storm Sewer TW	0.66 ac	931.8 ft	30.8 ft	0.56 ac-ft
20.00	Pond Bottom	0.49 ac	924.0 ft	23.0 ft	0.00 ac-ft

Pond Stage / Storage Calculations - SWALE 2

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	1.71 ac	985.0 ft	75.5 ft	
25.50	Back of Main. Berm	1.45 ac	965.0 ft	65.5 ft	3.24 ac-ft
25.00		1.20 ac	945.0 ft	55.5 ft	2.58 ac-ft
24.50	Front of Main. Berm	0.97 ac	925.0 ft	45.5 ft	2.03 ac-ft
23.50	Provided Treat. Vol. OR Att. Vol.	0.79 ac	917.0 ft	37.5 ft	1.23 ac-ft
22.59	Req'd Treat. Vol. OR Att. Vol.	0.63 ac	909.7 ft	30.2 ft	0.66 ac-ft
21.97	Estimated Storm Sewer TW	0.52 ac	904.8 ft	25.3 ft	0.35 ac-ft
21.00	Pond Bottom	0.20 ac	897.0 ft	9.5 ft	0.00 ac-ft

Required Treatment OR Attenuation Vol.= 1.65 ac-ft
 Required Treatment OR Attenuation Stage= 21.59 ft

Provided Treatment OR Attenuation Vol.= 4.04 ac-ft
 Provided Treatment OR Attenuation Stage= 23.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= 0.00 ac-ft
 Estimated Storm Sewer TW EL.= 20.97 ft

HGL requirements met

Required Treatment Vol.= 1.65 ac-ft
 Required Attenuation Vol.= 0.00 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) =	4.55 ac
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Basin C-10 West

**Alternative 2, Option 2
Expand C-10 East Alternative 2
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East with C-10 West**

Station Limits: From: 129+48 Roadway Length = 5452 ft
 To: 184+00 R/W Width = 66 ft

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 3.00 ac
 Pervious Area: 5.26 ac
 Total Roadway Areas: 8.26 ac

Total Area: Impervious Area: **3.00 ac**
 Pervious Area: **5.26 ac**
 Total Area: **8.26 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	3.00 ac	294.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	5.26 ac	420.5
Total:			8.26 ac	714.9

CN = Total CN*Area / Total Area = 86.5

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
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Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 1.55 in

Precipitation (P) = 9.00 in | 7.90 in |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 7.37 in | 6.30 in |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2**

Station From: **142+00** Roadway Length = 4200 ft
 Limits: To: **184+00** R/W Width = **105 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	40	0.015	0.017	0.32			--	4
Overland		0.24	0.012	0.32			--	0
Ditch Flow	1000	0.24	0.0010	0.32			2.50	7
Pipe Flow	77	0.012	0.001	0.32			2.50	1
Total:								11

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	1600	0.012	0.001	0.32			2.50	11
Total:								14

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**
With Compensation for Basin C-10 West

Station Limits: From: **129+48** Roadway Length = 5452 ft
 To: **184+00** R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 3.00 ac
 Pervious Area: 10.14 ac
 Total Roadway Areas: 13.14 ac

Pond Area: Pervious Pond Area = 4.03 ac

Total Area: Impervious Area: 3.00 ac
 Pervious Area: 10.14 ac
 Pond Area: 4.03 ac
 Total Area: 17.17 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	3.00 ac	294.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	5.26 ac	420.5
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	4.88 ac	385.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	4.03 ac	318.2
Total:			17.17 ac	1418.8

$CN = \text{Total } CN \cdot \text{Area} / \text{Total Area} = 82.6$

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 = 2.10 \text{ in}$

Precipitation (P) = 9.00 in 7.90 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 6.89 in 5.84 in

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: 129+48 Roadway Length = 5452 ft
 To: 184+00 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 8.82 ac
 Pervious Roadway Area: 4.32 ac
 Total Roadway Area : 13.14 ac

Pond Area:

Pervious Pond Area : 1.48 ac
 Water Surface Area: 2.55 ac Wet Pond
 Total Pond Area: 4.03 ac

Total Area:

Impervious Area: 8.82 ac
 Pervious Area: 5.80 ac
 Water Surface Area: 2.55 ac
 Total Area: 17.17 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	8.82 ac	864.7
Proposed Roadway Pervious	D	80	4.32 ac	345.4
Proposed Pond Pervious	D	80	1.48 ac	118.3
Proposed Ponds (Water Surface)	D	100	2.55 ac	255.0
			Total:	17.17 ac
				1583.4

CN = Total CN*Area / Total Area = **92.2**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.84 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.06 in** | **6.97 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area= 1.43 ac-ft
	2.50 in	x Imperv. Area= 1.84 ac.-ft.

Treatment $V_{req} = 1.84 \text{ ac-ft}$

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	9.86 ac-ft	8.35 ac-ft	
$Q_{post} =$	11.53 ac-ft	9.97 ac-ft	
$\Delta Q =$	1.67 ac-ft	1.62 ac-ft	

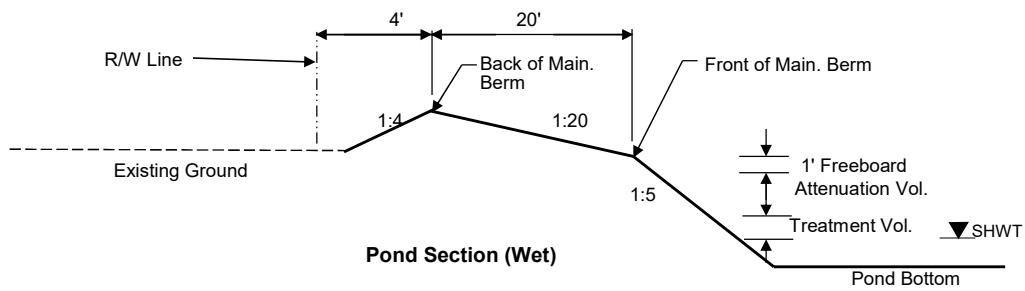
Attenuation $V_{req} = 1.67 \text{ ac-ft}$

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	23.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation =	19.70
Maximum Storage Depth (SD) =	2.30 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	23.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	2000 ft	
Estimated Energy Losses =	1.0 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	21.00 ft	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	4.03 ac	566.0 ft	310.0 ft	
24.00	Back of Main. Berm	3.87 ac	558.0 ft	302.0 ft	12.84 ac-ft
23.50		3.48 ac	538.0 ft	282.0 ft	11.00 ac-ft
23.00	Front of Main. Berm	3.12 ac	518.0 ft	262.0 ft	9.35 ac-ft
22.00	Provided Treat. Vol+Att. Vol	2.94 ac	508.0 ft	252.0 ft	6.31 ac-ft
21.00	Estimated Storm Sewer TW	2.77 ac	498.0 ft	242.0 ft	3.46 ac-ft
20.40	Top of Treatment Vol.	2.67 ac	492.0 ft	236.0 ft	1.84 ac-ft
19.70	Normal Water Level	2.55 ac	485.0 ft	229.0 ft	0.00 ac-ft
16.70	Begin 1:2 Slope	2.08 ac	455.0 ft	199.0 ft	
14.70	Pond Bottom	1.96 ac	447.0 ft	191.0 ft	

Required Treatment+Attenuation Vol.= 3.51 ac-ft

Provided Treatment+Attenuation Vol.= 6.31 ac-ft
 Provided Treatment+Attenuation Stage= 22.00 ft

Estimated Treat. Vol.+Storm Sewer Att.= 3.46 ac-ft
 Estimated Storm Sewer TW EL.= 21.00 ft

HGL requirements met
 Required Treatment Vol.= 1.84 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) = 4.83 ac

Basin C-10 East

**Alternative 1
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**

Station Limits: From: **142+00** Roadway Length = 4200 ft
 To: **184+00** R/W Width = **66 ft**

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 2.31 ac
 Pervious Area: 4.05 ac
 Total Roadway Areas: 6.36 ac

Total Area: Impervious Area: **2.31 ac**
 Pervious Area: **4.05 ac**
 Total Area: **6.36 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.31 ac	226.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	4.05 ac	324.0
Total:			6.36 ac	550.7

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.37 in** | **6.30 in** |

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 1**

Station From: **142+00** Roadway Length = 4200 ft
 Limits: To: **184+00** R/W Width = **105 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	40	0.015	0.017	0.32			--	4
Overland		0.24	0.012	0.32			--	0
Ditch Flow	1000	0.24	0.0010	0.32			2.50	7
Pipe Flow	77	0.012	0.001	0.32			2.50	1
Total:								11

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	1460	0.012	0.001	0.32			2.50	10
Total:								14

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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 1 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **142+00** Roadway Length = 4200 ft
 To: **184+00** R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 2.31 ac
 Pervious Area: 7.81 ac
 Total Roadway Areas: 10.12 ac

Pond Area: Pervious Pond Area = 3.79 ac

Total Area: Impervious Area: 2.31 ac
 Pervious Area: 6.36 ac
 Pond Area: 3.79 ac
 Total Area: 12.47 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.31 ac	226.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	4.05 ac	324.0
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.76 ac	297.1
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.79 ac	299.5
Total:			13.92 ac	1147.3

$CN = \frac{\text{Total CN*Area}}{\text{Total Area}} = 82.5$

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 = 2.13 \text{ in}$

Precipitation (P) = 9.00 in 7.90 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 6.87 in 5.82 in

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

Station Limits: From: 142+00 Roadway Length = 4200 ft
 To: 184+00 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 6.80 ac
 Pervious Roadway Area: 3.33 ac
 Total Roadway Area : 10.12 ac

Pond Area:

Pervious Pond Area : 3.79 ac Dry Pond
 Water Surface Area: 0.00 ac
 Total Pond Area: 3.79 ac

Total Area:

Impervious Area: **6.80 ac**
 Pervious Area: **7.12 ac**
 Water Surface Area: **0.00 ac**
 Total Area: **13.92 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.80 ac	666.2
Proposed Roadway Pervious	D	80	3.33 ac	266.1
Proposed Pond Pervious	D	80	3.79 ac	303.3
Proposed Ponds (Water Surface)	D	100	0.00 ac	0.0
			Total:	1235.6
				13.92 ac

CN = Total CN*Area / Total Area = **88.8**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = **1.26 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.87 in** | **5.82 in** |

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Dry Retention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Dry Retention	1.50 in	x Impervious Areas =	0.85 ac-ft	*1.50 in per City of Palm Bay
	0.50 in	x Total Basin Area =	0.42 ac-ft	

Treatment V_{req} = **0.85 ac-ft**

Treatment V_{req} = 0.5 x Total Basin Area + Greater Volume of the Above = **1.27 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	7.14 ac-ft	6.04 ac-ft	
Q_{post} =	7.97 ac-ft	6.75 ac-ft	
ΔQ =	0.83 ac-ft	0.70 ac-ft	

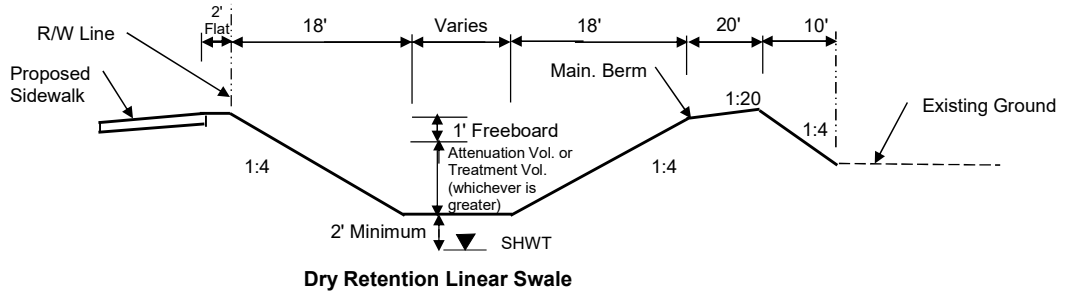
Attenuation V_{req} = **0.83 ac-ft**

PROJECT : **Malabar Road PD&E**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>23.00</u>
Pond Tie-In Width =	<u>10.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>18.00</u>
Maximum Storage Depth (SD) =	<u>3.50 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>23.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>50 ft</u>	
Estimated Energy Losses =	<u>0.0 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>21.98 ft</u>	



Pond Stage / Storage Calculations - SWALE 1

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	2.08 ac	1020.0 ft	89.0 ft	
25.50	Back of Main. Berm	1.81 ac	1000.0 ft	79.0 ft	5.58 ac-ft
25.00		1.55 ac	980.0 ft	69.0 ft	4.74 ac-ft
24.50	Front of Main. Berm	1.30 ac	960.0 ft	59.0 ft	4.02 ac-ft
23.50	Provided Treat. Vol. OR Att. Vol.	1.11 ac	952.0 ft	51.0 ft	2.80 ac-ft
20.74	Req'd Treat. Vol. OR Att. Vol.	0.62 ac	929.9 ft	28.9 ft	0.41 ac-ft
20.62	Estimated Storm Sewer TW	0.60 ac	929.0 ft	28.0 ft	0.34 ac-ft
20.00	Pond Bottom	0.49 ac	924.0 ft	23.0 ft	0.00 ac-ft

Pond Stage / Storage Calculations - SWALE 2

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	1.71 ac	985.0 ft	75.5 ft	
25.50	Back of Main. Berm	1.45 ac	965.0 ft	65.5 ft	3.24 ac-ft
25.00		1.20 ac	945.0 ft	55.5 ft	2.58 ac-ft
24.50	Front of Main. Berm	0.97 ac	925.0 ft	45.5 ft	2.03 ac-ft
23.50	Provided Treat. Vol. OR Att. Vol.	0.79 ac	917.0 ft	37.5 ft	1.23 ac-ft
21.74	Req'd Treat. Vol. OR Att. Vol.	0.49 ac	902.9 ft	23.4 ft	0.25 ac-ft
21.62	Estimated Storm Sewer TW	0.47 ac	902.0 ft	22.5 ft	0.20 ac-ft
21.00	Pond Bottom	0.20 ac	897.0 ft	9.5 ft	0.00 ac-ft

Required Treatment OR Attenuation Vol.= **0.85 ac-ft**
 Required Treatment OR Attenuation Stage= 20.74 ft

Provided Treatment OR Attenuation Vol.= 4.04 ac-ft
 Provided Treatment OR Attenuation Stage= 23.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= **0.70 ac-ft**
 Estimated Storm Sewer TW EL.= **20.62 ft**

HGL requirements met

Required Treatment Vol.= **0.85 ac-ft**
 Required Attenuation Vol.= 0.83 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) = 4.55 ac

Basin C-10 East

**Alternative 2
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**

Station Limits: From: **142+00** Roadway Length = 4200 ft
 To: **184+00** R/W Width = **66 ft**

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 2.31 ac
 Pervious Area: 4.05 ac
 Total Roadway Areas: 6.36 ac

Total Area: Impervious Area: **2.31 ac**
 Pervious Area: **4.05 ac**
 Total Area: **6.36 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.31 ac	226.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	4.05 ac	324.0
Total:			6.36 ac	550.7

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.37 in** | **6.30 in** |

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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2**

Station From: **142+00** Roadway Length = 4200 ft
 Limits: To: **184+00** R/W Width = **105 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	40	0.015	0.017	0.32			--	4
Overland		0.24	0.012	0.32			--	0
Ditch Flow	1000	0.24	0.0010	0.32			2.50	7
Pipe Flow	77	0.012	0.001	0.32			2.50	1
Total:								11

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	33	0.015	0.020	0.32			--	3
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	1600	0.012	0.001	0.32			2.50	11
Total:								14

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: **142+00** Roadway Length = 4200 ft
 To: **184+00** R/W Width = 105 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 2.31 ac
 Pervious Area: 7.81 ac
 Total Roadway Areas: 10.12 ac

Pond Area: Pervious Pond Area = 3.24 ac

Total Area: Impervious Area: 2.31 ac
 Pervious Area: 7.81 ac
 Pond Area: 3.24 ac
 Total Area: 13.36 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.31 ac	226.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	4.05 ac	324.0
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.76 ac	297.1
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	3.24 ac	255.8
Total:			13.36 ac	1103.6

CN = Total CN*Area / Total Area = **82.6**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
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Soil Capacity (S) = $\frac{1000 - 10}{CN}$ = **2.11 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **6.89 in** | **5.83 in** |

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Made by: DLD
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DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Station Limits: From: 142+00 Roadway Length = 4200 ft
 To: 184+00 R/W Width = 105 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 6.80 ac
 Pervious Roadway Area: 3.33 ac
 Total Roadway Area: 10.12 ac

Pond Area:

Pervious Pond Area : 1.27 ac
 Water Surface Area: 1.97 ac Wet Pond
 Total Pond Area: 3.24 ac

Total Area:

Impervious Area: **6.80 ac**
 Pervious Area: **4.60 ac**
 Water Surface Area: **1.97 ac**
 Total Area: **13.36 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.80 ac	666.2
Proposed Roadway Pervious	D	80	3.33 ac	266.1
Proposed Pond Pervious	D	80	1.27 ac	101.8
Proposed Ponds (Water Surface)	D	100	1.97 ac	196.6
			Total:	1230.6

CN = Total CN*Area / Total Area = **92.1**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
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Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.86 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.05 in** | **6.96 in** |

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Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area= 1.11 ac-ft
	2.50 in	x Imperv. Area= 1.42 ac.-ft.

Treatment $V_{req} =$ **1.42 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	7.67 ac-ft	6.50 ac-ft	
$Q_{post} =$	8.96 ac-ft	7.75 ac-ft	
$\Delta Q =$	1.29 ac-ft	1.25 ac-ft	

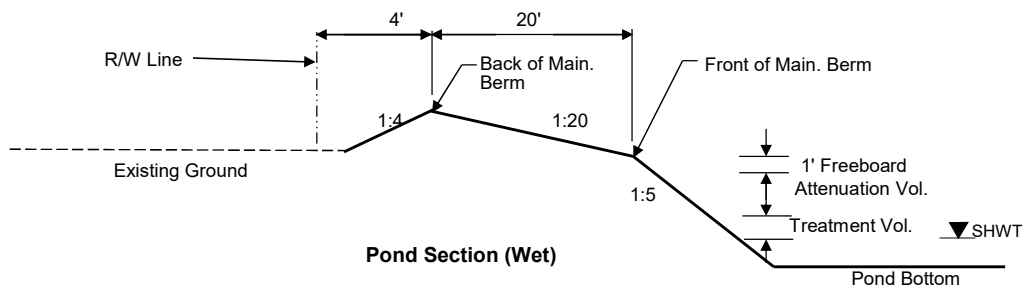
Attenuation $V_{req} =$ **1.29 ac-ft**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-10 East**
 POND NAME : **C-10 East Alt. 2 (Modeled in ICPR to meet limiting discharge criteria)**

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	23.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation =	19.70
Maximum Storage Depth (SD) =	2.30 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	23.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	2000 ft	
Estimated Energy Losses =	1.0 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	21.00 ft	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.00	Pond R/W	3.24 ac	455.0 ft	310.0 ft	
24.00	Back of Main. Berm	3.10 ac	447.0 ft	302.0 ft	10.05 ac-ft
23.50		2.76 ac	427.0 ft	282.0 ft	8.59 ac-ft
23.00	Front of Main. Berm	2.45 ac	407.0 ft	262.0 ft	7.28 ac-ft
22.00	Provided Treat. Vol.+Att. Vol	2.30 ac	397.0 ft	252.0 ft	4.90 ac-ft
21.00	Estimated Storm Sewer TW	2.15 ac	387.0 ft	242.0 ft	2.68 ac-ft
20.41	Top of Treatment Vol.	2.07 ac	381.1 ft	236.1 ft	1.43 ac-ft
19.70	Normal Water Level	1.97 ac	374.0 ft	229.0 ft	0.00 ac-ft
16.70	Begin 1:2 Slope	1.57 ac	344.0 ft	199.0 ft	
10.00	Pond Bottom	1.25 ac	317.2 ft	172.2 ft	

Required Treatment+Attenuation Vol.= 2.71 ac-ft

Provided Treatment+Attenuation Vol.= 4.90 ac-ft
 Provided Treatment+Attenuation Stage= 22.00 ft

Estimated Treat. Vol.+Storm Sewer Att.= 2.67 ac-ft
 Estimated Storm Sewer TW EL.= 21.00 ft

HGL requirements met
 Required Treatment Vol.= 1.42 ac-ft

PROPOSED POND R/W (Safety Factor of 20%) = 3.89 ac

Basin C-20

Supplemental Swale

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Supplemental Swale**

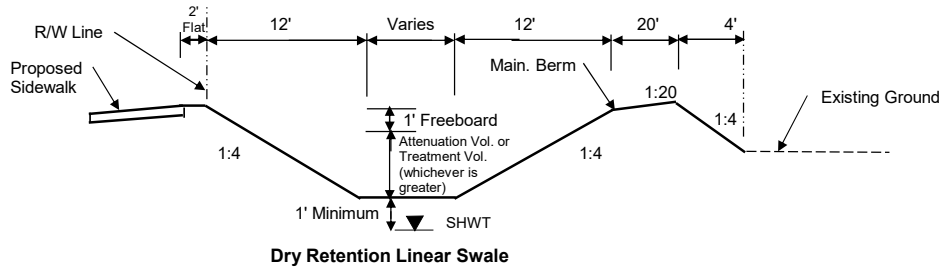
Station Limits: From: 142+00 Roadway Length = 12550 ft
 To: 267+50 R/W Width = 105 ft

Note: This swale is intended to utilize remnant parcels created by the expanded R/W and provide additional treatment in conjunction with either C-20 Alt. 1 or C-20 Alt. 2. It is not a pond site alternative. Calculations have been performed only to show available volume, which will be subtracted from the required treatment volume for C-20 Alt. 1 and C-20 Alt. 2.

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	24.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation =	20.10
Maximum Storage Depth (SD) =	1.90 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	23.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	50 ft	
Estimated Energy Losses =	0.0 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	21.98 ft	



Pond Stage / Storage Calculations - SWALE 1

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
24.00	Pond R/W	0.63 ac	246.0 ft	111.0 ft	
25.00	Back of Main. Berm	0.58 ac	238.0 ft	107.0 ft	1.43 ac-ft
24.50		0.49 ac	218.0 ft	97.0 ft	1.16 ac-ft
24.00	Front of Main. Berm	0.40 ac	198.0 ft	87.0 ft	0.94 ac-ft
23.00	Provided Treat. Vol. OR Att. Vol.	0.34 ac	190.0 ft	79.0 ft	0.57 ac-ft
21.10	Pond Bottom	0.26 ac	174.8 ft	63.8 ft	0.00 ac-ft

Pond Stage / Storage Calculations - SWALE 2

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
24.00	Pond R/W	0.79 ac	425.0 ft	80.5 ft	
25.00	Back of Main. Berm	0.73 ac	417.0 ft	76.5 ft	1.71 ac-ft
24.50		0.61 ac	397.0 ft	66.5 ft	1.37 ac-ft
24.00	Front of Main. Berm	0.49 ac	377.0 ft	56.5 ft	1.10 ac-ft
23.00	Provided Treat. Vol. OR Att. Vol.	0.41 ac	369.0 ft	48.5 ft	0.65 ac-ft
21.10	Pond Bottom	0.27 ac	353.8 ft	33.3 ft	0.00 ac-ft

Provided Treatment OR Attenuation Vol. = 1.22 ac-ft
 Provided Treatment OR Attenuation Stage = 23.00 ft

PROPOSED POND R/W =	1.41 ac
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Basin C-20

**Alternative 1
(Preferred)
Pre-Development Basin Calculations
TC Calculations
Modeled Pond Calculations**

Inwood Consulting Engineers, Inc.
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 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**

Station Limits: From: **142+00** Roadway Length = 12550 ft
 To: **267+50** R/W Width = **66 ft**

EXISTING CONDITION - FOR ICPR MODEL

Roadway Area:

Impervious Area : 6.91 ac
 Pervious Area: 12.10 ac
 Total Roadway Areas: 19.02 ac

Total Area: Impervious Area: **6.91 ac**
 Pervious Area: **12.10 ac**
 Total Area: **19.02 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.91 ac	677.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	12.10 ac	968.0
Total:			19.02 ac	1645.7

CN = Total CN*Area / Total Area = **86.5**

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.55 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.37 in** | **6.30 in** |

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Made by: DLD
 Checked by: REC

DATE: February 15, 2022
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 1**

Station From: **142+00** Roadway Length = 12550 ft
 Limits: To: **267+50** R/W Width = **105 ft**

TIME OF CONCENTRATION - EXISTING CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	58	0.015	0.017	0.32			--	5
Shallow Concentrated (curb)		0.012	0.030	0.32			3.52	0
Ditch Flow	1586	0.24	0.0009	0.32			2.50	11
Pipe Flow	50	0.012	0.001	0.32			2.50	0
Total:								15

TIME OF CONCENTRATION - PROPOSED CONDITION

Overland Flow (Sheet Flow): $T_o = \frac{0.93 * L^{0.6} * n^{0.6}}{i^{0.4} * S^{0.3}}$

Shallow Concentrated Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = Vunpaved, Vpaved, Vpipe and/or Vditch
 - Vunpaved = 16.1345 x (S)^{0.5}
 - Vpaved = 20.3282 x (S)^{0.5}
 - Vpipe = 2.5 fps (Minimum Flowing Full)
 - Vditch = 0.5 fps

Channel Flow: $T_s = \frac{\text{Length}}{60 * \text{Velocity}}$ Velocity = $\frac{1.49 r^{2/3} S^{1/2}}{n}$ (r = hydraulic radius)

Flow Type	Length (ft)	n	Slope (ft/ft)	Rainfall (iterative) (in/hr)			Velocity (ft/sec)	Time (min)
Overland	59	0.015	0.020	0.32			--	4
Shallow Concentrated (curb)	150	0.012	0.030	0.32			3.52	1
Pipe Flow	3400	0.012	0.001	0.32			2.50	23
Total:								28

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Made by: DLD
 Checked by: REC

DATE: February 16, 2022
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 1 (Modeled in ICPR to achieve 0.08 cfs/ac discharge)**

Station Limits: From: **142+00** Roadway Length = 12550 ft
 To: **267+50** R/W Width = **105 ft**

EXISTING CONDITION

Roadway Area:

Impervious Area : 6.91 ac
 Pervious Area: 23.34 ac
 Total Roadway Areas: 30.25 ac

Pond Area: Pervious Pond Area = 0.00 ac *Pond area outfalls to a different canal in existing condition

Total Area: Impervious Area: **6.91 ac**
 Pervious Area: **23.34 ac**
 Pond Area: **0.00 ac**
 Total Area: **30.25 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.91 ac	677.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	12.10 ac	968.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	11.24 ac	898.9
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	0.00 ac	0.0
			Total: 30.25 ac	2544.6

CN = Total CN*Area / Total Area = **84.1**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.89 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.07 in** | **6.01 in** |

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Made by: DLD
 Checked by: REC

DATE: February 16, 2022
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 1 (Modeled in ICPR to achieve 0.08 cfs/ac discharge)**

Station Limits: From: **142+00** Roadway Length = 12550 ft
 To: **267+50** R/W Width = 105 ft

*Typically, it is more conservative to include the pond area in all calculations as an additional contingency. However, a comment received from MTWCD on the Draft PSR indicated that in the existing condition, the parcel on which C-20 Alt. 1 is located outfalls to a City of Palm Bay canal rather than the C-20 Canal as originally assumed. Altering the pre-development basin area would necessarily increase the required attenuation volume and it was discovered that the storm sewer attenuation volume in particular would drive up the size of the pond. As a result, it was decided that for this pond only, the area of the pond would not be counted toward the storm sewer attenuation volume. All other contingencies remain in place.

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 20.31 ac
 Pervious Roadway Area: 9.94 ac
 Total Roadway Area : 30.25 ac

Pond Area:

Pervious Pond Area : 2.49 ac
 Water Surface Area: 3.38 ac Wet Pond
 Total Pond Area: 5.87 ac

Total Area:

Impervious Area: 20.31 ac
 Pervious Area: 12.42 ac
 Water Surface Area: 3.38 ac
 Total Area: 36.12 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	20.31 ac	1990.5
Proposed Roadway Pervious	D	80	9.94 ac	795.2
Proposed Pond Pervious	D	80	2.49 ac	198.8
Proposed Ponds (Water Surface)	D	100	3.38 ac	338.1
			Total:	36.12 ac 3322.6

CN = Total CN*Area / Total Area = **92.0**

Denotes Pond Area

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 = \mathbf{0.87 \text{ in}}$ Precipitation (P) = **9.00 in**

SJRWMD		
25yr/24hr		

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$ Runoff (Q) = **8.03 in**

--	--	--

Curve Number (Excluding Pond Area for Storm Sewer Calculation)*:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	20.31 ac	1990.5
Proposed Roadway Pervious	D	80	9.94 ac	795.2
Proposed Pond Pervious	D	80	0.00 ac	0.0
Proposed Ponds (Water Surface)	D	100	0.00 ac	0.0
			Total:	30.25 ac 2785.7

CN = Total CN*Area / Total Area = **92.1**

Denotes Pond Area

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 = \mathbf{0.86 \text{ in}}$ Precipitation (P) = **7.90 in**

Storm		
Sewer		
10yr/24hr		
Brevard Co.		

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$ Runoff (Q) = **6.95 in**

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Inwood Consulting Engineers, Inc.
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 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: February 16, 2022
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 1 (Modeled in ICPR to achieve 0.08 cfs/ac discharge)**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area=	3.01 ac-ft
	2.50 in	x Imperv. Area=	4.23 ac.-ft.

Treatment $V_{req} = 4.23$ ac-ft

Subtract Treatment Volume Available in Swale 3.01 ac-ft

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
$Q_{pre} =$	17.83 ac-ft	15.16 ac-ft	
$Q_{post} =$	24.18 ac-ft	17.53 ac-ft	
$\Delta Q =$	6.35 ac-ft	2.37 ac-ft	

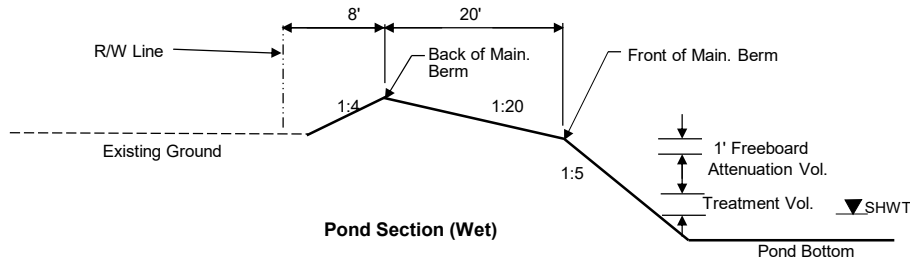
Attenuation $V_{req} = 6.35$ ac-ft

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 1 (Modeled in ICPR to achieve 0.08 cfs/ac discharge)**

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	23.50
Pond Tie-In Width =	8.0 ft	@ 1:4	Normal Water Elevation =	20.80
Maximum Storage Depth (SD) =	2.70 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	24.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	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)
Allowable Storm Sewer Tailwater EL =	22.50 ft	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.50	Pond R/W	5.87 ac	1002.0 ft	255.0 ft	
25.50	Back of Main. Berm	5.41 ac	986.0 ft	239.0 ft	19.11 ac-ft
25.00		4.86 ac	966.0 ft	219.0 ft	16.54 ac-ft
24.50	Front of Main. Berm	4.32 ac	946.0 ft	199.0 ft	14.25 ac-ft
23.50	Provided Treat. Vol.+Att. Vol	4.06 ac	936.0 ft	189.0 ft	10.05 ac-ft
22.31	Estimated Storm Sewer TW	3.76 ac	924.1 ft	177.1 ft	5.39 ac-ft
21.70	Top of Treatment Vol.	3.60 ac	918.0 ft	171.0 ft	3.14 ac-ft
20.80	Normal Water Level	3.38 ac	909.0 ft	162.0 ft	0.00 ac-ft
17.80	Begin 1:2 Slope	2.66 ac	879.0 ft	132.0 ft	
15.80	Pond Bottom	2.48 ac	871.0 ft	124.0 ft	

Required Treatment+Attenuation Vol. = 9.36 ac-ft

Provided Treatment+Attenuation Vol. = 10.05 ac-ft
 Provided Treatment+Attenuation Stage = 23.50 ft

Estimated Treat. Vol.+Storm Sewer Att. = 5.39 ac-ft
 Estimated Storm Sewer TW EL. = 22.31 ft

Required Treatment Vol. = 3.01 ac-ft
 HGL requirements met

PROPOSED POND R/W (Safety Factor of 20%) =	7.04 ac
ADJUSTED POND MODEL SAFETY FACTOR =	0%

Basin C-20

Alternative 2

Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: February 15, 2022
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 2**

Station Limits: From: **142+00** Roadway Length = 12550 ft
 To: **267+50** R/W Width = **105 ft**

EXISTING CONDITION

Roadway Area:

Impervious Area : 6.91 ac
 Pervious Area: 23.34 ac
 Total Roadway Areas: 30.25 ac

Pond Area: Pervious Pond Area = **4.20 ac**

Total Area: Impervious Area: **6.91 ac**
 Pervious Area: **23.34 ac**
 Pond Area: **4.20 ac**
 Total Area: **34.45 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	6.91 ac	677.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	12.10 ac	968.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	D	80	11.24 ac	898.9
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	4.20 ac	331.7
Total:			34.45 ac	2876.2

CN = Total CN*Area / Total Area = **83.5**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **1.98 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **7.00 in** | **5.94 in** |

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 (407) 971-8850 (phone)
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Made by: DLD
 Checked by: REC

DATE: February 15, 2022
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 2**

Station Limits: From: **142+00** Roadway Length = 12550 ft
 To: **267+50** R/W Width = **105 ft**

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 20.31 ac
 Pervious Roadway Area: 9.94 ac
 Total Roadway Area : 30.25 ac

Pond Area:

Pervious Pond Area : 1.74 ac
 Water Surface Area: 2.46 ac Wet Pond
 Total Pond Area: 4.20 ac

Total Area:

Impervious Area: **20.31 ac**
 Pervious Area: **11.68 ac**
 Water Surface Area: **2.46 ac**
 Total Area: **34.45 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	20.31 ac	1990.5
Proposed Roadway Pervious	D	80	9.94 ac	795.2
Proposed Pond Pervious	D	80	1.74 ac	139.2
Proposed Ponds (Water Surface)	D	100	2.46 ac	245.8
			Total:	34.45 ac
				3170.8

CN = Total CN*Area / Total Area = **92.0**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.86 in**

Precipitation (P) = **9.00 in** **7.90 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.04 in** **6.95 in**

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Made by: DLD
 Checked by: REC

DATE: February 15, 2022
 Job Number: **KIT-009-01**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 2**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Wet Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Wet Detention	1.00 in	x Total Area=	2.87 ac-ft
	2.50 in	x Imperv. Area=	4.23 ac.-ft.

Treatment $V_{req} =$ 4.23 ac-ft

Subtract Treatment Volume Available in Swale **3.01 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.		
$Q_{pre} =$	20.09 ac-ft	17.05 ac-ft		
$Q_{post} =$	23.08 ac-ft	19.95 ac-ft		
$\Delta Q =$	2.99 ac-ft	2.90 ac-ft		

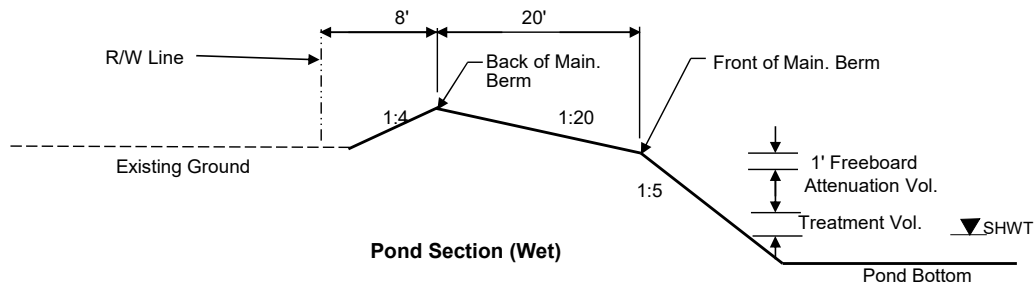
Attenuation $V_{req} =$ **2.99 ac-ft**

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-20**
 POND NAME : **C-20 Alt. 2**

Maintenance Area Width =	<u>20.0 ft</u>	@ 1:20	Existing Ground Elevation =	<u>23.50</u>
Pond Tie-In Width =	<u>8.0 ft</u>	@ 1:4	Normal Water Elevation =	<u>20.25</u>
Maximum Storage Depth (SD) =	<u>3.25 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>24.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>1000 ft</u>	
Estimated Energy Losses =	<u>0.5 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>22.50 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
23.50	Pond R/W	4.20 ac	508.0 ft	360.0 ft	
25.50	Back of Main. Berm	3.89 ac	492.0 ft	344.0 ft	15.44 ac-ft
25.00		3.51 ac	472.0 ft	324.0 ft	13.59 ac-ft
24.50	Front of Main. Berm	3.15 ac	452.0 ft	304.0 ft	11.93 ac-ft
23.50	Provided Treat.Vol.+Att.Vol	2.98 ac	442.0 ft	294.0 ft	8.84 ac-ft
22.53	Req'd Treat.Vol+Att. Vol	2.82 ac	432.3 ft	284.3 ft	6.02 ac-ft
22.50	Estimated Storm Sewer TW	2.82 ac	432.0 ft	284.0 ft	5.93 ac-ft
21.70	Top of Treatment Vol.	2.69 ac	424.0 ft	276.0 ft	3.73 ac-ft
20.25	Normal Water Level	2.46 ac	409.5 ft	261.5 ft	0.00 ac-ft
17.25	Begin 1:2 Slope	2.02 ac	379.5 ft	231.5 ft	
15.25	Pond Bottom	1.91 ac	371.5 ft	223.5 ft	

Required Treatment+Attenuation Vol.= **6.01 ac-ft**
 Required Treatment+Attenuation Stage= 22.53 ft

Provided Treatment+Attenuation Vol.= 8.84 ac-ft
 Provided Treatment+Attenuation Stage= 23.50 ft

Estimated Treat. Vol.+Storm Sewer Att.= **5.91 ac-ft**
 Estimated Storm Sewer TW EL.= **22.50 ft**

HGL requirements met

Required Treatment Vol.= **3.01 ac-ft**

PROPOSED POND R/W (Safety Factor of 20%) =	5.04 ac
PROPOSED POND R/W ADJUSTED FOR MODEL	5.04 ac

Basin A

Existing Pond A

Inwood Consulting Engineers, Inc.
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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **Existing Pond A**
 POND NAME : **Existing Pond A**

Station Limits: From: **267+50** Roadway Length = 650 ft
 To: **274+00** R/W Width = 115 ft

EXISTING CONDITION

Roadway Area:

Impervious Area : 2.30 ac
 Pervious Area: 1.27 ac
 Total Roadway Areas: 3.57 ac

Pond Area: Pervious Pond Area = 0.33 ac

Total Area:

Impervious Area: **2.30 ac**
 Pervious Area: **1.88 ac**
 Pond Area: **0.33 ac**
 Old Jiffy Area: **0.59 ac**
 Total Area: **5.10 ac**

There is a control structure located on the north side of Malabar Rd. that used to serve the pond for the old Jiffy Lube at the northeast corner of Malabar & Minton. The site has been redeveloped into a Cumberland Farms gas station/convenience store with a new pond. The control structure orifice was plugged but the weir remains, and the structure collects runoff from a small landscaped area.

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.30 ac	225.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	1.27 ac	106.7
7-11 Commercial Area	D	92	0.59 ac	54.3
Proposed Pond Pervious	D	80	0.61 ac	48.8
Proposed Ponds (Water Surface)	D	100	0.33 ac	33.0
Total:			5.10 ac	468.2

CN = Total CN*Area / Total Area = **91.8**

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **0.89 in**

Precipitation (P) = **9.00 in** | **7.90 in** |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = **8.01 in** | **6.92 in** |

Inwood Consulting Engineers, Inc.
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 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

Station Limits: From: 267+50 Roadway Length = 650 ft
 To: 274+00 R/W Width = 115 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 2.42 ac
 Pervious Roadway Area: 1.15 ac
 Total Roadway Area : 3.57 ac

Pond Area:

Pervious Pond Area : 0.61 ac Dry Pond
 Water Surface Area: 0.33 ac Area Below Weir (Per permit 16558-5)
 Total Pond Area: 0.94 ac

Total Area:

Impervious Area: 2.42 ac
 Pervious Area: 1.76 ac
 Pond Area: 0.33 ac
 Old Jiffy Area: 0.00 ac
 Total Area: 4.51 ac

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	D	98	2.42 ac	237.2
Proposed Roadway Pervious	D	84	1.15 ac	96.6
Proposed Pond Pervious	D	80	0.61 ac	48.8
Proposed Ponds (Water Surface)	D	100	0.33 ac	33.0
			Total:	415.6

CN = Total CN*Area / Total Area = 92.1

Denotes Pond Area

Runoff:

SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
---------------------	--	--

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 0.85 in

Precipitation (P) = 9.00 in | 7.90 in |

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

Runoff (Q) = 8.01 in | 6.92 in |

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 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: DLD
 Checked by: REC

DATE: May 6, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	SJRWMD
StormW.Mgmt.	Dry Detention
Online/Offline	Online
Impaired/OFW	Yes/No
Open/Closed Basin	Open

Treatment Volume for Existing Basin

Dry Detention	2.50 in
	1.00 in

0.49 ac-ft *This treatment volume was established in Permit 16558-5 for Malabar Road.

x Impervious Areas = 0.50 ac-ft
 x Total Basin Area = 0.38 ac-ft

Treatment V_{req} = **0.50 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD 25yr/24hr	Storm Sewer 10yr/24hr Brevard Co.	
Q_{pre} =	3.01 ac-ft	2.60 ac-ft	
Q_{post} =	3.01 ac-ft	2.60 ac-ft	
ΔQ =	0.00 ac-ft	0.00 ac-ft	

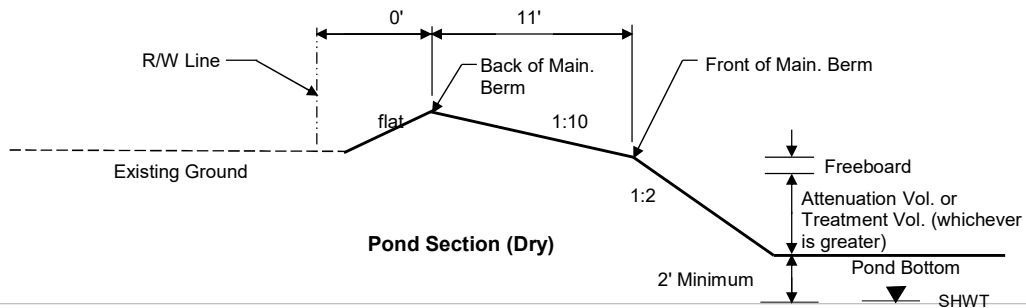
Attenuation V_{req} = **0.00 ac-ft**

PROJECT : **Malabar Road PD&E**

Maintenance Area Width =	<u>11.0 ft</u>	@ 1:10	Existing Ground Elevation =	<u>23.00</u>
Pond Tie-In Width =	<u>0.0 ft</u>	flat	Normal Water Elevation =	<u>N/A</u>
Maximum Storage Depth (SD) =	<u>4.00 ft</u>	with 1.0 ft freeboard	Lowest EOP Elevation =	<u>24.00</u>

Hydraulic Grade Line (HGL) check

HGL Slope =	<u>0.050%</u>	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	<u>900 ft</u>	
Estimated Energy Losses =	<u>0.5 ft</u>	
HGL Clearance =	<u>1.0 ft</u>	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	<u>22.55 ft</u>	



Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
24.72	Pond R/W	0.71 ac	470.0 ft	66.0 ft	
24.72	Back of Main. Berm	0.58 ac	470.0 ft	54.0 ft	1.00 ac-ft
24.17		0.45 ac	459.0 ft	43.0 ft	0.71 ac-ft
23.62	Front of Main. Berm	0.33 ac	448.0 ft	32.0 ft	0.50 ac-ft
22.92	Overflow Weir Elevation	0.33 ac	445.2 ft	29.2 ft	0.96 ac-ft
21.44	Req'd Treat. Vol. OR Att. Vol.	0.23 ac	439.3 ft	23.3 ft	0.50 ac-ft
21.42	Provided Treat. Vol. OR Att. Vol.	0.23 ac	439.2 ft	23.2 ft	0.49 ac-ft
18.62	Pond Bottom	0.12 ac	428.0 ft	12.0 ft	0.00 ac-ft

Required Treatment OR Attenuation Vol.= 0.50 ac-ft
 Required Treatment OR Attenuation Stage= 21.42 ft

Provided Treatment OR Attenuation Vol.= 0.50 ac-ft
 Provided Treatment OR Attenuation Stage= 21.44 ft

Estimated Treat. Vol.+Storm Sewer Att.= 0.50 ac-ft
 Estimated Storm Sewer TW EL.= 21.44 ft

HGL requirements met

Required Treatment Vol.= 0.50 ac-ft
 Required Attenuation Vol.= 0.00 ac-ft

ACTUAL POND R/W	0.71 ac
------------------------	----------------

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX D

Pond Modeling (ICPR 3)

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Basin C-7

**Alternative 2
ICPR Models**

Nodes

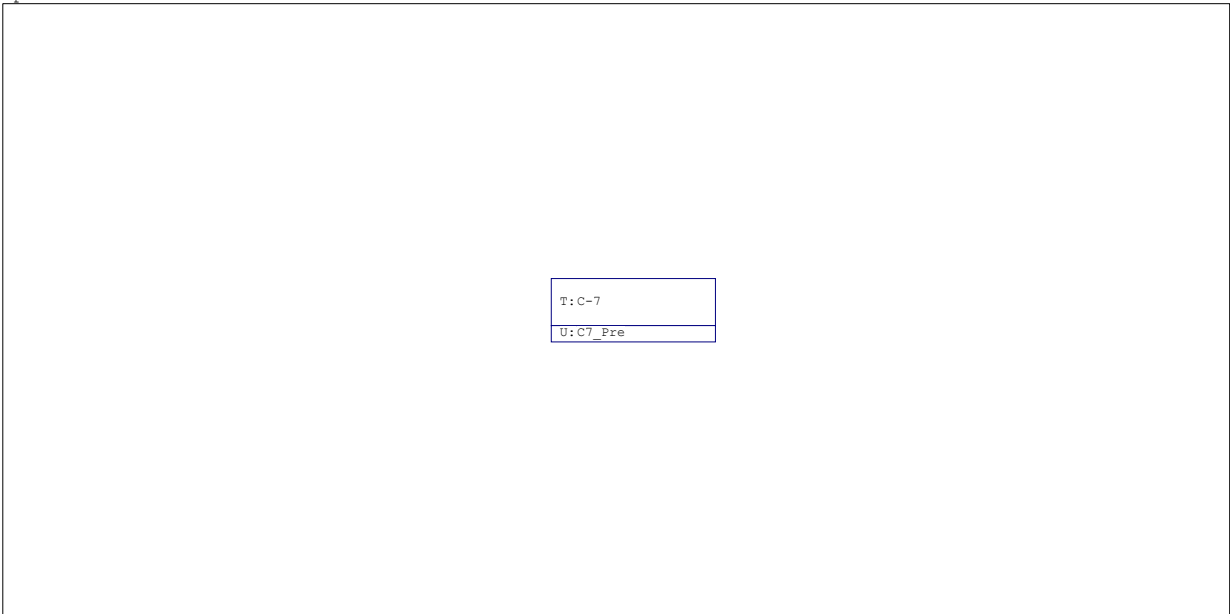
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C7_Pre	C7_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-7	C-7
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	4.27	4.27
Comp Time Inc(min):	4.27	4.27
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	32.00	32.00
Time Shift(hrs):	0.00	0.00
Area(ac):	4.940	4.940
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.22	12.30
Flow Max(cfs):	12.89	6.98
Runoff Volume(in):	7.358	3.514
Runoff Volume(ft3):	131945	63016

25yr/24hr Allowable discharge = 12.89 cfs + 0.08 cfs/acre x 3.48 acres (new impervious) = 13.17 cfs

Mean annual allowable discharge = 6.98 cfs + 0.05 cfs/acre x 3.48 acres (new impervious) = 7.15 cfs

Nodes

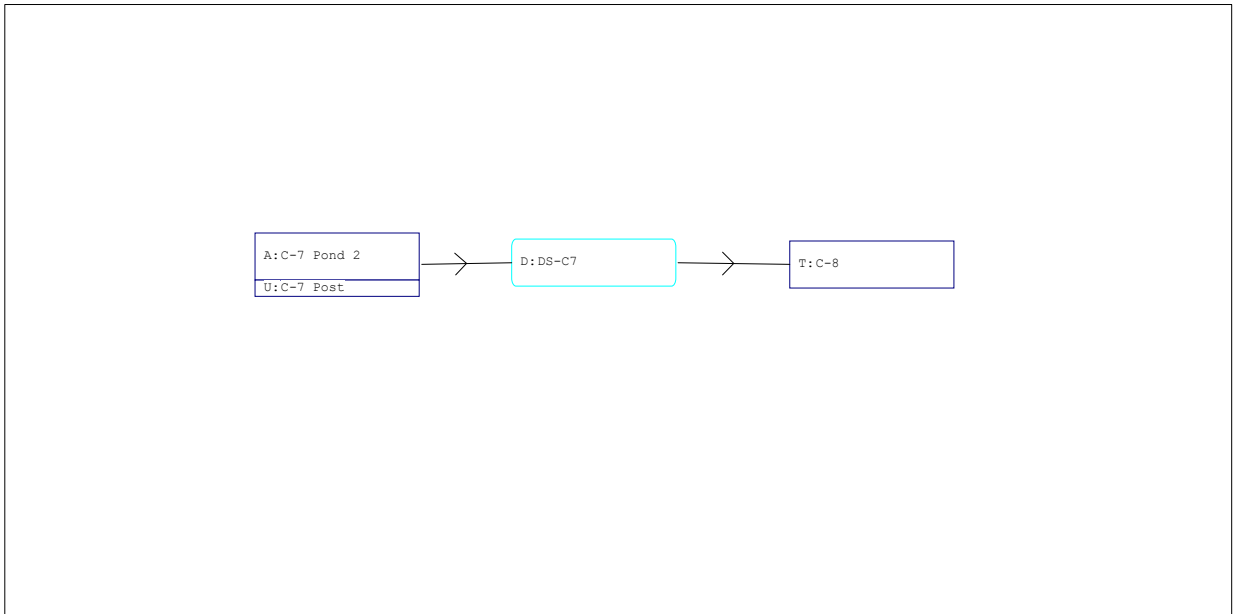
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



=====
 Basins =====
 =====

```

Name: C-7 Post           Node: C-7 Pond 2           Status: Onsite
Group: BASE              Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256           Peaking Factor: 256.0
Rainfall File:                   Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000       Time of Conc(min): 18.00
Area(ac): 10.490                 Time Shift(hrs): 0.00
Curve Number: 92.00              Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00
  
```

=====
 Nodes =====
 =====

```

Name: C-7 Pond 2         Base Flow(cfs): 0.000       Init Stage(ft): 17.000
Group: BASE              Type: Stage/Area           Warn Stage(ft): 19.500
  
```

Stage(ft)	Area(ac)
17.000	1.5500
19.500	1.8900
20.500	2.0300

```

Name: C-8                 Base Flow(cfs): 0.000       Init Stage(ft): 8.370
Group: BASE              Type: Time/Stage           Warn Stage(ft): 14.490
  
```

Tailwater data based on C-1 Rediversion Phase 1 SWMM Model - Node C108

Time(hrs)	Stage(ft)
0.00	8.370
24.00	14.490
48.00	14.420
72.00	13.480
96.00	12.600
120.00	11.780
144.00	10.910

=====
 Drop Structures =====
 =====

```

Name: DS-C7               From Node: C-7 Pond 2       Length(ft): 25.00
Group: BASE               To Node: C-8                Count: 1

UPSTREAM                   DOWNSTREAM                   Friction Equation: Automatic
Geometry: Circular         Circular                       Solution Algorithm: Most Restrictive
Span(in): 24.00            24.00                         Flow: Both
Rise(in): 24.00           24.00                         Entrance Loss Coef: 0.000
Invert(ft): 14.000        13.500                        Exit Loss Coef: 1.000
Manning's N: 0.012000     0.012000                     Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000       0.000                         Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000       0.000                         Solution Incs: 10
  
```

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

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

*** Weir 1 of 3 for Drop Structure DS-C7 ***

Count: 1	Bottom Clip(in): 0.000	TABLE
Type: Vertical: Mavis	Top Clip(in): 0.000	
Flow: Both	Weir Disc Coef: 3.200	
Geometry: Circular	Orifice Disc Coef: 0.600	
Span(in): 3.00	Invert(ft): 17.000	
Rise(in): 3.00	Control Elev(ft): 17.000	

*** Weir 2 of 3 for Drop Structure DS-C7 ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Horizontal Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Rectangular Orifice Disc Coef: 0.600
Span(in): 24.00 Invert(ft): 19.100
Rise(in): 37.00 Control Elev(ft): 19.100

*** Weir 3 of 3 for Drop Structure DS-C7 ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Vertical: Mavis Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Rectangular Orifice Disc Coef: 0.600
Span(in): 8.00 Invert(ft): 18.100
Rise(in): 12.00 Control Elev(ft): 18.100

==== Weirs =====
=====

Name: From Node:
Group: BASE To Node:
Flow: Both Count: 1
Type: Horizontal Geometry: Circular

Span(in): 0.00
Rise(in): 0.00
Invert(ft): 0.000
Control Elevation(ft): 0.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

==== Hydrology Simulations =====
=====

Name: 25yr_24hr
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\25yr_24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 30.00
Rainfall File: Flmod
Rainfall Amount(in): 9.00

Time(hrs) Print Inc(min)

30.000 5.00

Name: Meanann
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\Meanann.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 5.00

Time(hrs) Print Inc(min)

30.000 5.00

==== Routing Simulations =====
=====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\25yr_24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
999.000	15.000
Group	Run
-----	-----
BASE	Yes

Name: Meanann Hydrology Sim: Meanann
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\Meanann.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z (ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time (hrs): 0.000 End Time (hrs): 30.00
Min Calc Time (sec): 0.5000 Max Calc Time (sec): 60.0000
Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
30.000	15.000
Group	Run
-----	-----
BASE	Yes

Malabar Road PD&E
 C-7 Basin Post-Development
 Alternative 2

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-7 Pond 2	25yr_24hr	19.45	19.50	0.0050	82022	38.08	10.00
C-7 Pond 2	Meanann	18.63	19.50	0.0050	77176	22.45	1.11
C-8	25yr_24hr	14.49	14.49	0.0043	0	10.00	0.00
C-8	Meanann	14.49	14.49	0.0043	0	1.11	0.00

Basin C-7

**Alternative 3
(Preferred)
ICPR Models**

Nodes

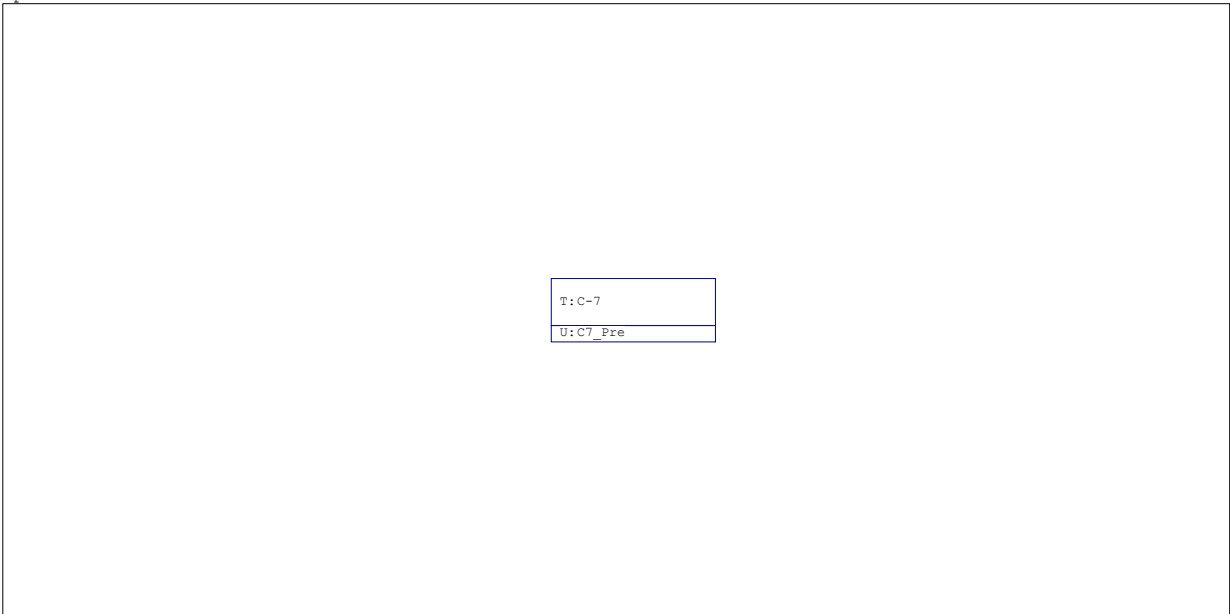
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C7_Pre	C7_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-7	C-7
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	4.27	4.27
Comp Time Inc(min):	4.27	4.27
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	32.00	32.00
Time Shift(hrs):	0.00	0.00
Area(ac):	4.940	4.940
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.22	12.30
Flow Max(cfs):	12.89	6.98
Runoff Volume(in):	7.358	3.514
Runoff Volume(ft3):	131945	63016

25yr/24hr Allowable discharge = 12.89 cfs + 0.08 cfs/acre x 3.48 acres (new impervious) = 13.17 cfs

Mean annual allowable discharge = 6.98 cfs + 0.05 cfs/acre x 3.48 acres (new impervious) = 7.15 cfs

Nodes

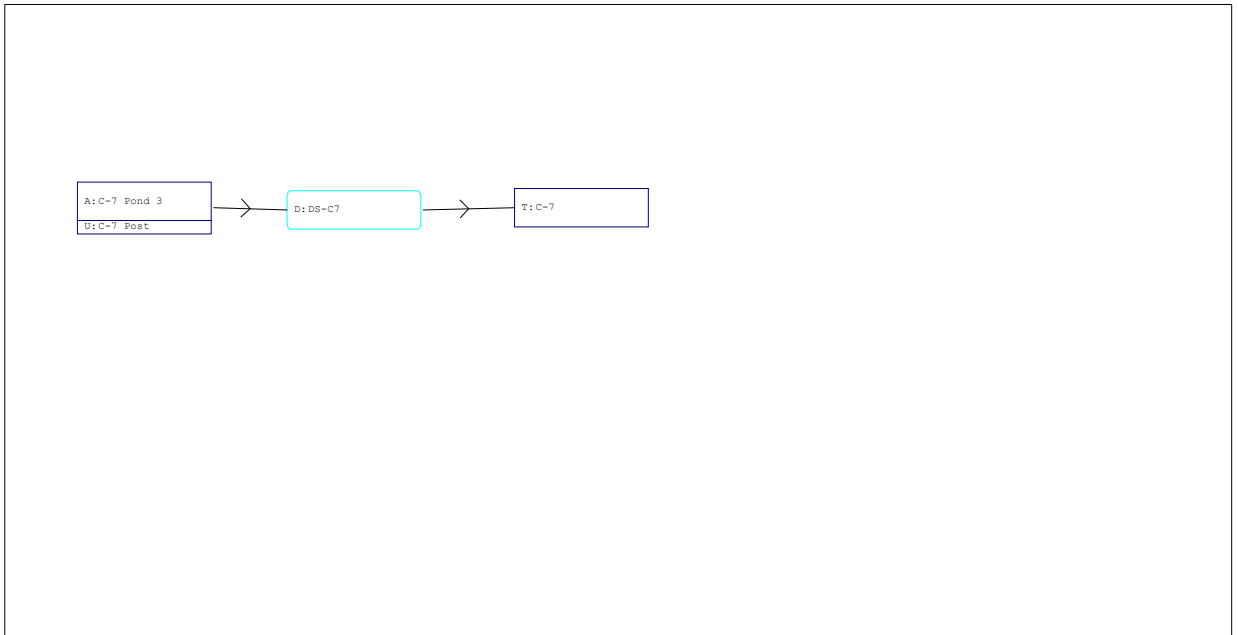
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



TABLE

Count: 1 Bottom Clip(in): 0.000
 Type: Horizontal Top Clip(in): 0.000
 Flow: Both Weir Disc Coef: 3.200
 Geometry: Rectangular Orifice Disc Coef: 0.600
 Span(in): 24.00 Invert(ft): 18.300
 Rise(in): 37.00 Control Elev(ft): 18.300

*** Weir 3 of 3 for Drop Structure DS-C7 ***

TABLE

Count: 1 Bottom Clip(in): 0.000
 Type: Vertical: Mavis Top Clip(in): 0.000
 Flow: Both Weir Disc Coef: 3.200
 Geometry: Rectangular Orifice Disc Coef: 0.600
 Span(in): 8.00 Invert(ft): 17.300
 Rise(in): 12.00 Control Elev(ft): 17.300

=====
 Weirs =====
 =====

Name: From Node:
 Group: BASE To Node:
 Flow: Both Count: 1
 Type: Horizontal Geometry: Circular

Span(in): 0.00
 Rise(in): 0.00
 Invert(ft): 0.000
 Control Elevation(ft): 0.000

TABLE

Bottom Clip(in): 0.000
 Top Clip(in): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

=====
 Hydrology Simulations =====
 =====

Name: 25yr_24hr
 Filename: \\Icenvs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\25yr_24hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 30.00
 Rainfall File: Flmod
 Rainfall Amount(in): 9.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Meanann
 Filename: \\Icenvs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\Meanann.R32
 Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Flmod
 Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
30.000	5.00

=====
 Routing Simulations =====
 =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
 Filename: \\Icenvs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\25yr_24hr.I32
 Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 30.00
 Min Calc Time(sec): 0.50000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
999.000	15.000

Group	Run
BASE	Yes

Name: Meanann Hydrology Sim: Meanann
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-7\Post\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z (ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time (hrs): 0.000 End Time (hrs): 30.00
Min Calc Time (sec): 0.5000 Max Calc Time (sec): 60.0000
Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
30.000	15.000

Group	Run
BASE	Yes

Malabar Road PD&E
 C-7 Basin Post-Development
 Alternative 3

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-7	25yr_24hr	14.29	14.34	0.0041	0	5.93	0.00
C-7	Meanann	14.29	14.34	0.0041	0	1.52	0.00
C-7 Pond 3	25yr_24hr	19.00	19.00	0.0050	71019	29.39	5.93
C-7 Pond 3	Meanann	17.99	19.00	0.0050	65646	17.11	1.52

Basin C-8 & C-9

**Alternative 1
(Preferred)
ICPR Models**

Nodes

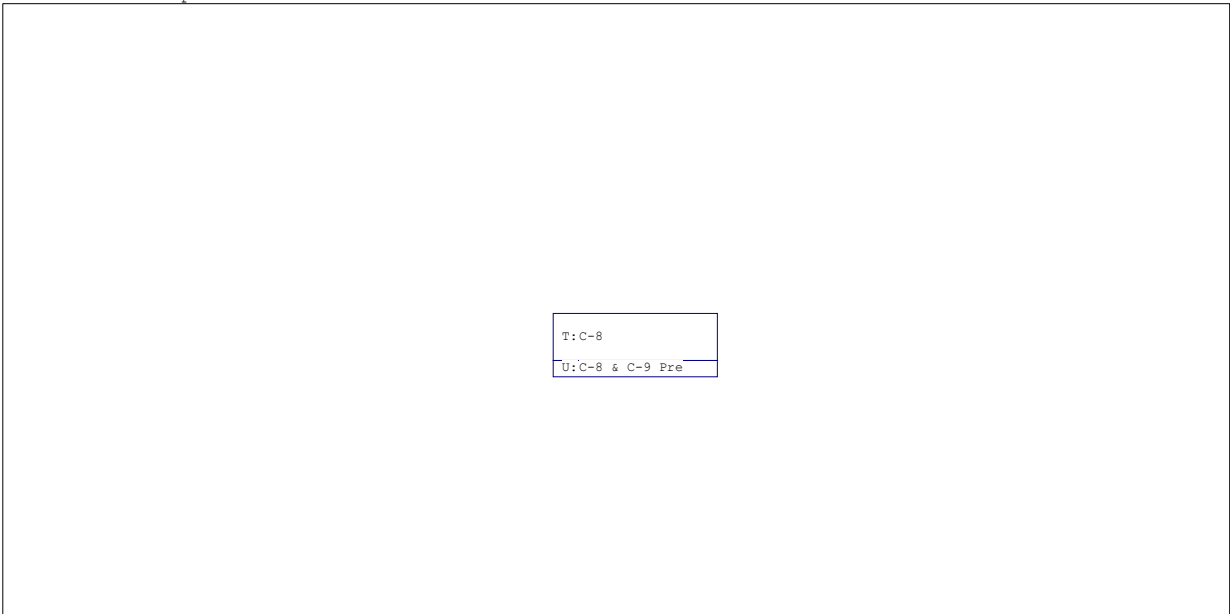
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C-8 & C-9 Pre	C-8 & C-9 Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-8	C-8
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	5.60	5.60
Comp Time Inc(min):	5.00	5.00
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	42.00	42.00
Time Shift(hrs):	0.00	0.00
Area(ac):	6.270	6.270
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.33	12.42
Flow Max(cfs):	14.08	7.57
Runoff Volume(in):	7.351	3.510
Runoff Volume(ft3):	167310	79897

25yr/24hr Allowable discharge = 14.08 cfs + 0.08 cfs/acre x 4.42 acres (new impervious) = 14.43 cfs

Mean annual allowable discharge = 7.57 cfs + 0.05 cfs/acre x 4.42 acres (new impervious) = 7.79 cfs

Malabar Road PD&E
C-8 & C-9 Combined Basin Post-Development
Alternative 1

Nodes

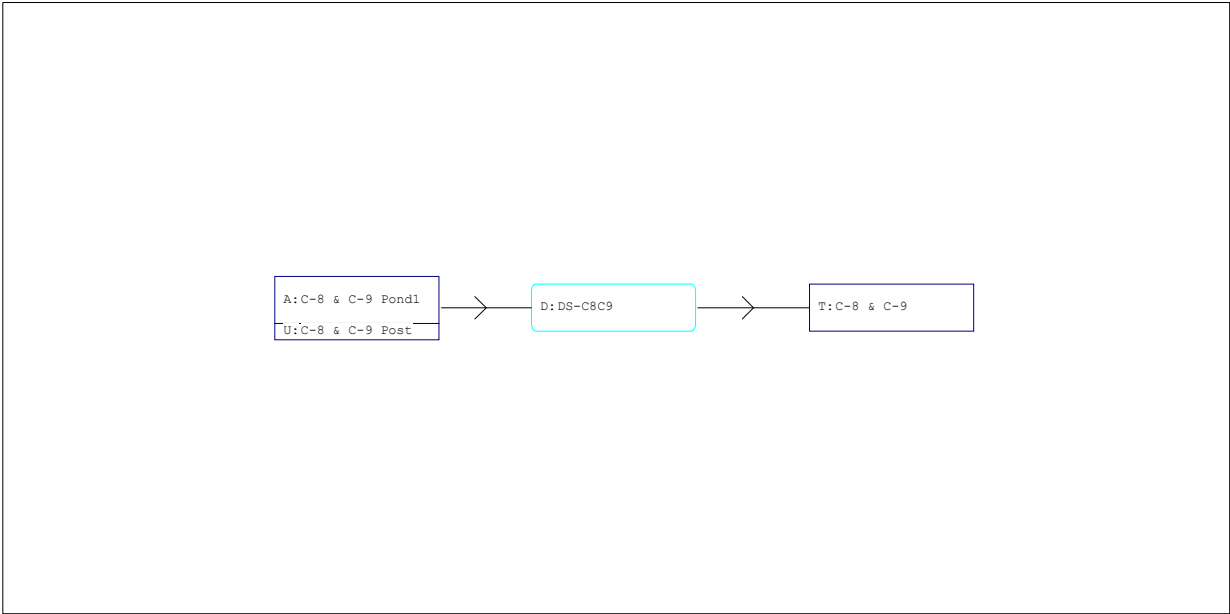
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Count: 1 Bottom Clip(in): 0.000
 Type: Horizontal Top Clip(in): 0.000
 Flow: Both Weir Disc Coef: 3.200
 Geometry: Rectangular Orifice Disc Coef: 0.600
 Span(in): 24.00 Invert(ft): 19.500
 Rise(in): 37.00 Control Elev(ft): 19.500

*** Weir 3 of 3 for Drop Structure DS-C8C9 ***

TABLE

Count: 1 Bottom Clip(in): 0.000
 Type: Vertical: Mavis Top Clip(in): 0.000
 Flow: Both Weir Disc Coef: 3.200
 Geometry: Rectangular Orifice Disc Coef: 0.600
 Span(in): 8.00 Invert(ft): 18.500
 Rise(in): 12.00 Control Elev(ft): 18.500

==== Weirs =====
 =====

Name: From Node:
 Group: BASE To Node:
 Flow: Both Count: 1
 Type: Horizontal Geometry: Circular

Span(in): 0.00
 Rise(in): 0.00
 Invert(ft): 0.000
 Control Elevation(ft): 0.000

TABLE

Bottom Clip(in): 0.000
 Top Clip(in): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

==== Hydrology Simulations =====
 =====

Name: 25yr_24hr
 Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-8 and C-9 Combined\Post\25yr_24hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 30.00
 Rainfall File: Flmod
 Rainfall Amount(in): 9.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Meanann
 Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-8 and C-9 Combined\Post\Meanann.R32
 Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Flmod
 Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
30.000	5.00

==== Routing Simulations =====
 =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
 Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-8 and C-9 Combined\Post\25yr_24hr.I32
 Execute: Yes Restart: No Patch: No
 Alternative: No
 Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 30.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
999.000	15.000
Group	Run
-----	-----
BASE	Yes

Name: Meanann Hydrology Sim: Meanann
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-8 and C-9 Combined\Post\Meanann.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z (ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time (hrs): 0.000 End Time (hrs): 30.00
Min Calc Time (sec): 0.5000 Max Calc Time (sec): 60.0000
Boundary Stages: Boundary Flows:

Time (hrs)	Print Inc (min)
30.000	15.000
Group	Run
-----	-----
BASE	Yes

Malabar Road PD&E
 C-8 & C-9 Combined Basin Post-Development
 Alternative 1

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-8 & C-9	25yr_24hr	14.49	14.49	0.0043	0	13.87	0.00
C-8 & C-9	Meanann	14.49	14.49	0.0043	0	1.39	0.00
C-8 & C-9 Pond1	25yr_24hr	19.97	20.00	0.0050	77343	38.31	13.87
C-8 & C-9 Pond1	Meanann	19.13	20.00	0.0050	72089	22.33	1.39

Basin C-10 West

**Alternative 1
ICPR Models**

Nodes

A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C10W_Pre	C10W_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-10	C-10
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	7.20	7.20
Comp Time Inc(min):	5.00	5.00
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	54.00	54.00
Time Shift(hrs):	0.00	0.00
Area(ac):	1.900	1.900
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.50	12.58
Flow Max(cfs):	3.70	1.97
Runoff Volume(in):	7.359	3.514
Runoff Volume(ft3):	50752	24236

25yr/24hr Allowable discharge = 3.70 cfs + 0.08 cfs/acre x 1.34 acres (new impervious) = 3.81 cfs

Mean annual allowable discharge = 1.97 cfs + 0.05 cfs/acre x 1.34 acres (new impervious) = 2.04 cfs

Nodes

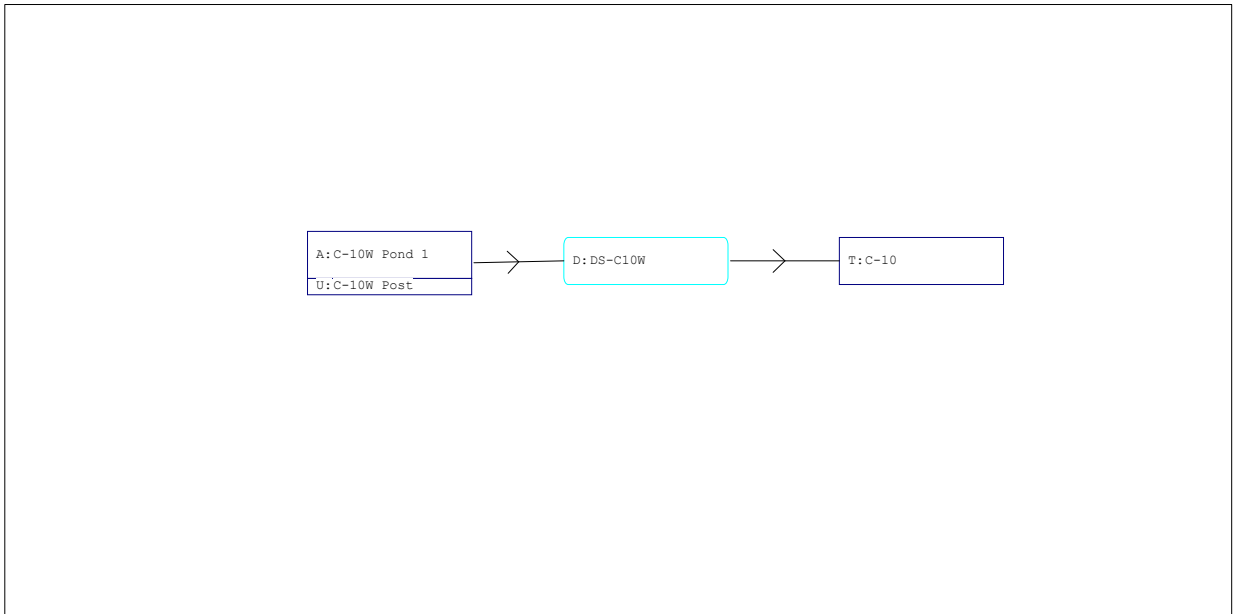
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Group: BASE To Node:
 Flow: Both Count: 1
 Type: Horizontal Geometry: Circular

Span(in): 0.00
 Rise(in): 0.00
 Invert(ft): 0.000
 Control Elevation(ft): 0.000

TABLE

Bottom Clip(in): 0.000
 Top Clip(in): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

==== Percolation Links =====

Name: From Node: Flow: Both
 Group: BASE To Node: Count: 1

Surface Area Option: Use 1st Point in Stage/Area Table
 Vertical Flow Termination: Horizontal Flow Algorithm
 Aquifer Base Elev(ft): 0.000 Perimeter 1(ft): 0.000
 Water Table Elev(ft): 0.000 Perimeter 2(ft): 0.000
 Ann Recharge Rate(in/year): 0.000 Perimeter 3(ft): 0.000
 Horiz Conductivity(ft/day): 0.000 Distance 1 to 2(ft): 0.000
 Vert Conductivity(ft/day): 0.000 Distance 2 to 3(ft): 0.000
 Effective Porosity(dec): 0.000 Num Cells 1 to 2: 0
 Suction Head(in): 0.000 Num Cells 2 to 3: 0
 Layer Thickness(ft): 0.000

==== Hydrology Simulations =====

Name: 25yr_24hr
 Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 West\Post\25yr_24hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 30.00
 Rainfall File: Flmod
 Rainfall Amount(in): 9.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Meanann
 Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 West\Post\Meanann.R32
 Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Flmod
 Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
30.000	5.00

==== Routing Simulations =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
 Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 West\Post\25yr_24hr.I32
 Execute: Yes Restart: No Patch: No
 Alternative: No
 Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 30.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----

999.000 15.000

Group Run

BASE Yes

Name: Meanann Hydrology Sim: Meanann
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 West\Post\Meanann.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z (ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time (hrs): 0.000 End Time (hrs): 30.00
Min Calc Time (sec): 0.5000 Max Calc Time (sec): 60.0000
Boundary Stages: Boundary Flows:

Time (hrs) Print Inc (min)

30.000 15.000
Group Run

BASE Yes

Malabar Road PD&E
 C-10 West Basin Post-Development
 Alternative 1

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-10	25yr_24hr	15.44	15.44	0.0061	0	3.52	0.00
C-10	Meanann	15.44	15.44	0.0061	0	0.00	0.00
C-10W Pond 1	25yr_24hr	21.48	21.50	0.0050	22585	14.56	3.52
C-10W Pond 1	Meanann	20.69	21.50	0.0050	20305	8.32	0.00

Basin C-10 West

**Alternative 2, Option 1
Utilize Additional Swale Capacity in C-10 East Alternative 1
(Preferred)
ICPR Models**

Nodes

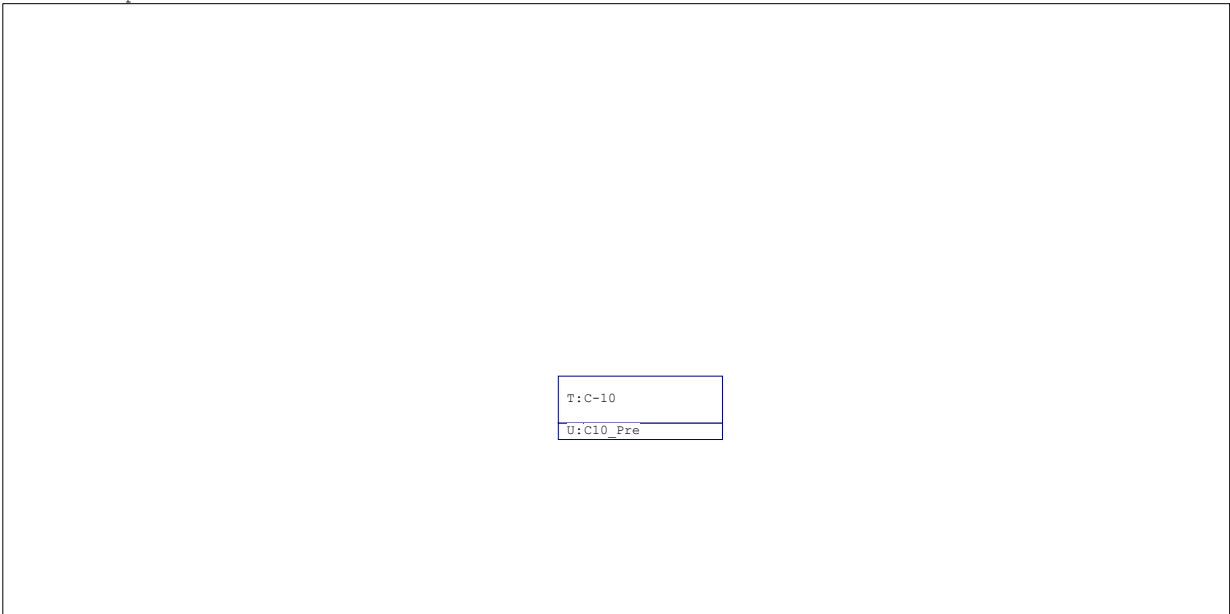
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C10_Pre	C10_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-10	C-10
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	1.47	1.47
Comp Time Inc(min):	1.47	1.47
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	11.00	11.00
Time Shift(hrs):	0.00	0.00
Area(ac):	8.260	8.260
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.03	12.05
Flow Max(cfs):	34.32	19.54
Runoff Volume(in):	7.362	3.515
Runoff Volume(ft3):	220737	105389

25yr/24hr Allowable discharge = 34.32 cfs + 0.08 cfs/acre x 5.82 acres (new impervious) = 34.79 cfs

Mean annual allowable discharge = 19.54 cfs + 0.05 cfs/acre x 5.82 acres (new impervious) = 19.83 cfs

Malabar Road PD&E
C-10 East (with C-10 West) Basin Post-Development
Alternative 1 (Swale)

Nodes

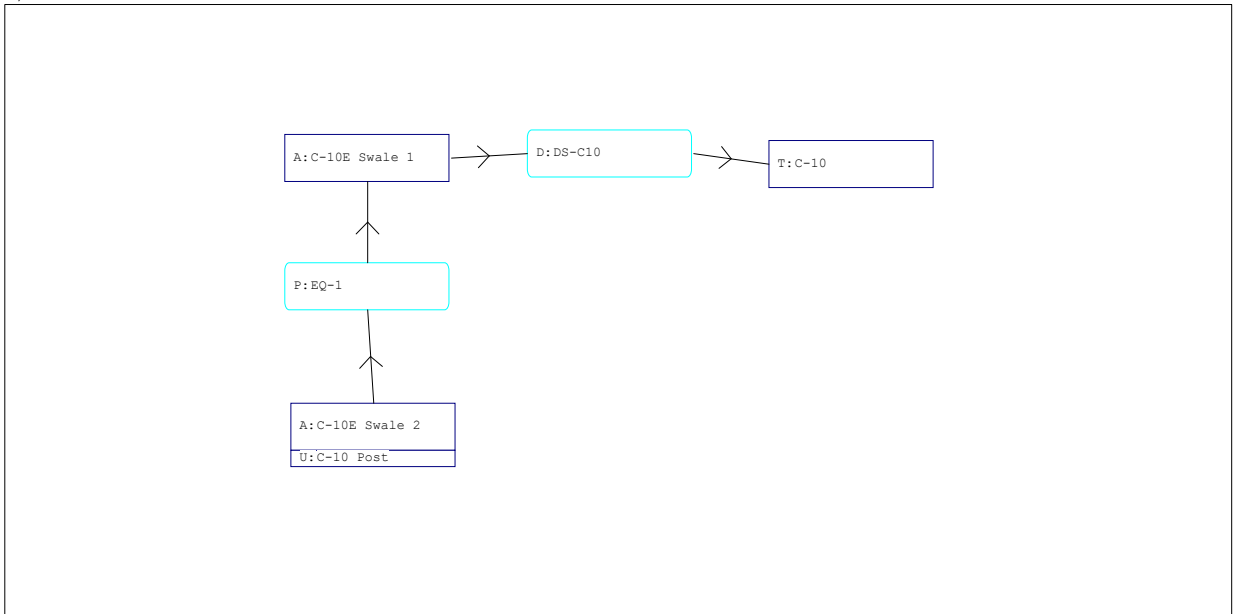
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
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Z SBUH GA

Links

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X Exfil Trench



==== Drop Structures =====
 =====

Name: DS-C10	From Node: C-10E Swale 1	Length(ft): 300.00
Group: BASE	To Node: C-10	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 24.00	24.00	Flow: Both
Rise(in): 24.00	24.00	Entrance Loss Coef: 0.000
Invert(ft): 14.500	14.000	Exit Loss Coef: 1.000
Manning's N: 0.012000	0.012000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

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

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

*** Weir 1 of 1 for Drop Structure DS-C10 ***

Count: 1	Bottom Clip(in): 0.000	TABLE
Type: Horizontal	Top Clip(in): 0.000	
Flow: Both	Weir Disc Coef: 3.200	
Geometry: Rectangular	Orifice Disc Coef: 0.600	
Span(in): 36.00	Invert(ft): 22.100	
Rise(in): 54.00	Control Elev(ft): 22.100	

==== Weirs =====
 =====

Name:	From Node:
Group: BASE	To Node:
Flow: Both	Count: 1
Type: Horizontal	Geometry: Circular
Span(in): 0.00	
Rise(in): 0.00	
Invert(ft): 0.000	
Control Elevation(ft): 0.000	
	TABLE
Bottom Clip(in): 0.000	
Top Clip(in): 0.000	
Weir Discharge Coef: 3.200	
Orifice Discharge Coef: 0.600	

==== Percolation Links =====
 =====

Name:	From Node:	Flow: Both
Group: BASE	To Node:	Count: 1
Surface Area Option: Use 1st Point in Stage/Area Table		
Vertical Flow Termination: Horizontal Flow Algorithm		
Aquifer Base Elev(ft): 0.000	Perimeter 1(ft): 0.000	
Water Table Elev(ft): 0.000	Perimeter 2(ft): 0.000	
Ann Recharge Rate(in/year): 0.000	Perimeter 3(ft): 0.000	
Horiz Conductivity(ft/day): 0.000	Distance 1 to 2(ft): 0.000	
Vert Conductivity(ft/day): 0.000	Distance 2 to 3(ft): 0.000	
Effective Porosity(dec): 0.000	Num Cells 1 to 2: 0	
Suction Head(in): 0.000	Num Cells 2 to 3: 0	
Layer Thickness(ft): 0.000		

==== Hydrology Simulations =====
 =====

Name: 25yr_24hr
 Filename: \\Icevns01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\25yr_24hr.R
 Override Defaults: Yes
 Storm Duration(hrs): 30.00
 Rainfall File: Flmod

Rainfall Amount(in): 9.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Meanann

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\Meanann.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
30.000	5.00

==== Routing Simulations =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\25yr_24hr.I

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: Meanann Hydrology Sim: Meanann

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
30.000	15.000

Group	Run
BASE	Yes

Malabar Road PD&E
 C-10 East (with C-10 West) Basin Post-Development
 Alternative 1 (Swale)

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-10	25yr_24hr	15.74	15.74	0.0063	0	33.85	0.00
C-10	Meanann	15.74	15.74	0.0063	0	18.73	0.00
C-10E Swale 1	25yr_24hr	23.43	23.50	0.0050	47925	51.26	33.85
C-10E Swale 1	Meanann	22.63	23.50	0.0050	42106	42.65	18.73
C-10E Swale 2	25yr_24hr	23.50	23.50	-0.0050	34733	66.21	51.26
C-10E Swale 2	Meanann	22.65	23.50	0.0050	26319	38.66	42.65

Basin C-10 West

**Alternative 2, Option 2
Expand C-10 East Alternative 2
ICPR Models**

Nodes

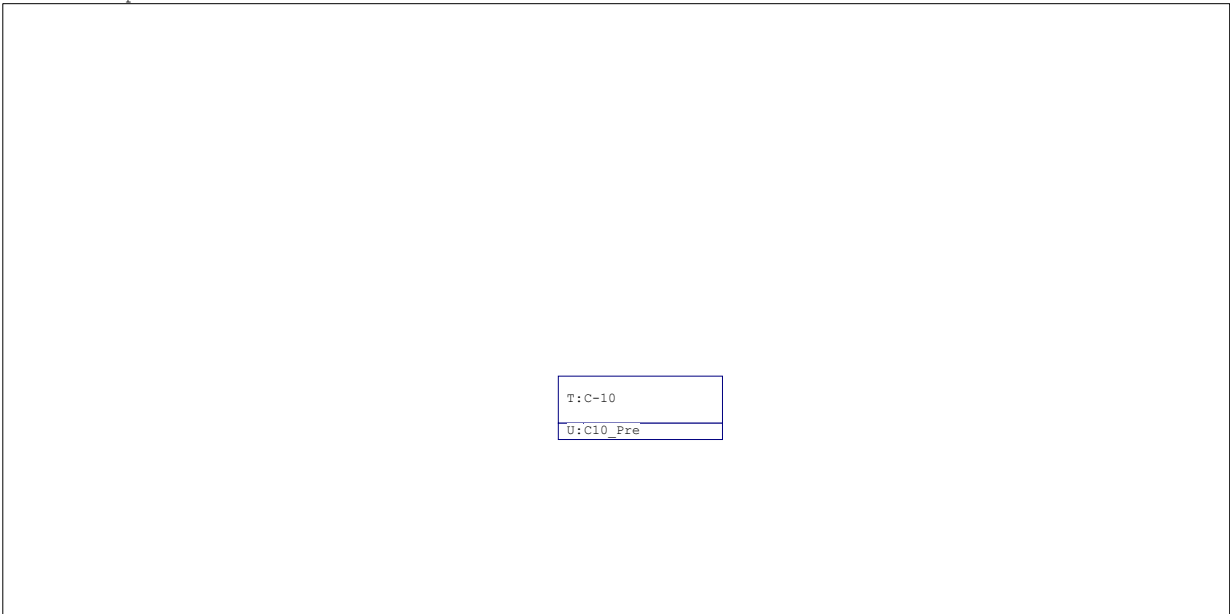
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C10_Pre	C10_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-10	C-10
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	1.47	1.47
Comp Time Inc(min):	1.47	1.47
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	11.00	11.00
Time Shift(hrs):	0.00	0.00
Area(ac):	8.260	8.260
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.03	12.05
Flow Max(cfs):	34.32	19.54
Runoff Volume(in):	7.362	3.515
Runoff Volume(ft3):	220737	105389

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Malabar Road PD&E
C-10 East (with C-10 West) Basin Post-Development
Alternative 2

Nodes

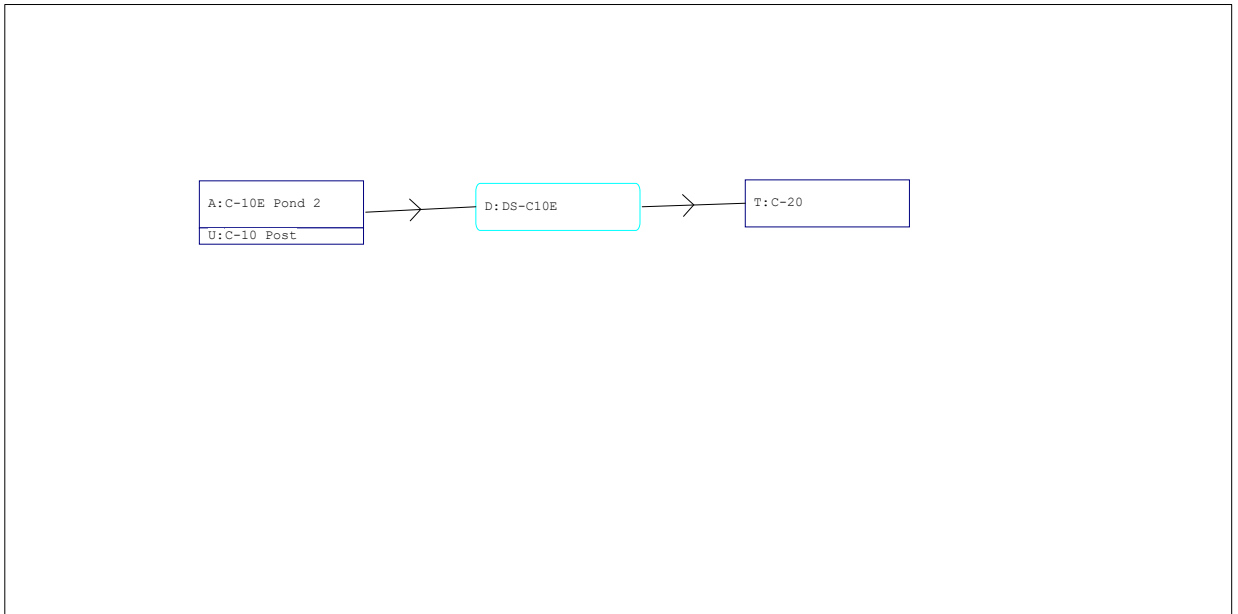
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

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X Exfil Trench



=====
 Basins
 =====

```

Name: C-10 Post           Node: C-10E Pond 2       Status: Onsite
Group: BASE              Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256           Peaking Factor: 256.0
Rainfall File:                  Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000      Time of Conc(min): 14.00
Area(ac): 17.170               Time Shift(hrs): 0.00
Curve Number: 92.20           Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00
  
```

=====
 Nodes
 =====

```

Name: C-10E Pond 2       Base Flow(cfs): 0.000      Init Stage(ft): 19.700
Group: BASE              Warn Stage(ft): 22.000
Type: Stage/Area
  
```

Stage(ft)	Area(ac)
19.700	2.5500
22.000	2.9400
23.000	3.1200

```

Name: C-20               Base Flow(cfs): 0.000      Init Stage(ft): 12.800
Group: BASE              Warn Stage(ft): 17.870
Type: Time/Stage
  
```

Tailwater Data based on MTWCD C-10 ICPR Model - Node 20-04N

Time(hrs)	Stage(ft)
0.00	12.800
24.00	17.870
144.00	12.800

=====
 Drop Structures
 =====

```

Name: DS-C10E           From Node: C-10E Pond 2   Length(ft): 600.00
Group: BASE             To Node: C-20             Count: 1

UPSTREAM                DOWNSTREAM                Friction Equation: Automatic
Geometry: Circular      Circular                  Solution Algorithm: Most Restrictive
Span(in): 36.00         36.00                    Flow: Both
Rise(in): 36.00        36.00                    Entrance Loss Coef: 0.000
Invert(ft): 15.000     14.000                   Exit Loss Coef: 1.000
Manning's N: 0.012000  0.012000                 Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000    0.000                    Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000    0.000                    Solution Incs: 10
  
```

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

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

*** Weir 1 of 3 for Drop Structure DS-C10E ***

```

Count: 1                                     TABLE
Type: Vertical: Mavis                       Bottom Clip(in): 0.000
Flow: Both                                   Top Clip(in): 0.000
Geometry: Circular                           Weir Disc Coef: 3.200
Orifice Disc Coef: 0.600

Span(in): 4.00                               Invert(ft): 19.700
Rise(in): 4.00                               Control Elev(ft): 19.700
  
```

*** Weir 2 of 3 for Drop Structure DS-C10E ***

```

Count: 1                                     TABLE
Type: Horizontal                             Bottom Clip(in): 0.000
Flow: Both                                   Top Clip(in): 0.000
Geometry: Rectangular                       Weir Disc Coef: 3.200
Orifice Disc Coef: 0.600
  
```


==== Routing Simulations =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\25yr_24hr.I

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

999.000 15.000

Group Run

BASE Yes

Name: Meanann Hydrology Sim: Meanann
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 Combined\POST\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

30.000 15.000

Group Run

BASE Yes

Malabar Road PD&E
 C-10 East (with C-10 West) Basin Post-Development
 Alternative 2

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-10E Pond 2	25yr_24hr	21.90	22.00	0.0050	127315	68.70	30.09
C-10E Pond 2	Meanann	21.36	22.00	0.0050	123364	41.50	2.15
C-20	25yr_24hr	17.87	17.87	0.0035	0	30.09	0.00
C-20	Meanann	17.87	17.87	0.0035	0	2.15	0.00

Basin C-10 East

**Alternative 1
ICPR Models**

Nodes

A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C10E_Pre	C10E_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-10	C-10
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	1.47	1.47
Comp Time Inc(min):	1.47	1.47
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	11.00	11.00
Time Shift(hrs):	0.00	0.00
Area(ac):	6.360	6.360
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.03	12.05
Flow Max(cfs):	26.42	15.05
Runoff Volume(in):	7.362	3.515
Runoff Volume(ft3):	169962	81147

25yr/24hr Allowable discharge = 26.42 cfs + 0.08 cfs/acre x 4.48 acres (new impervious) = 26.78 cfs

Mean annual allowable discharge = 15.05 cfs + 0.05 cfs/acre x 4.48 acres (new impervious) = 15.27 cfs

Nodes

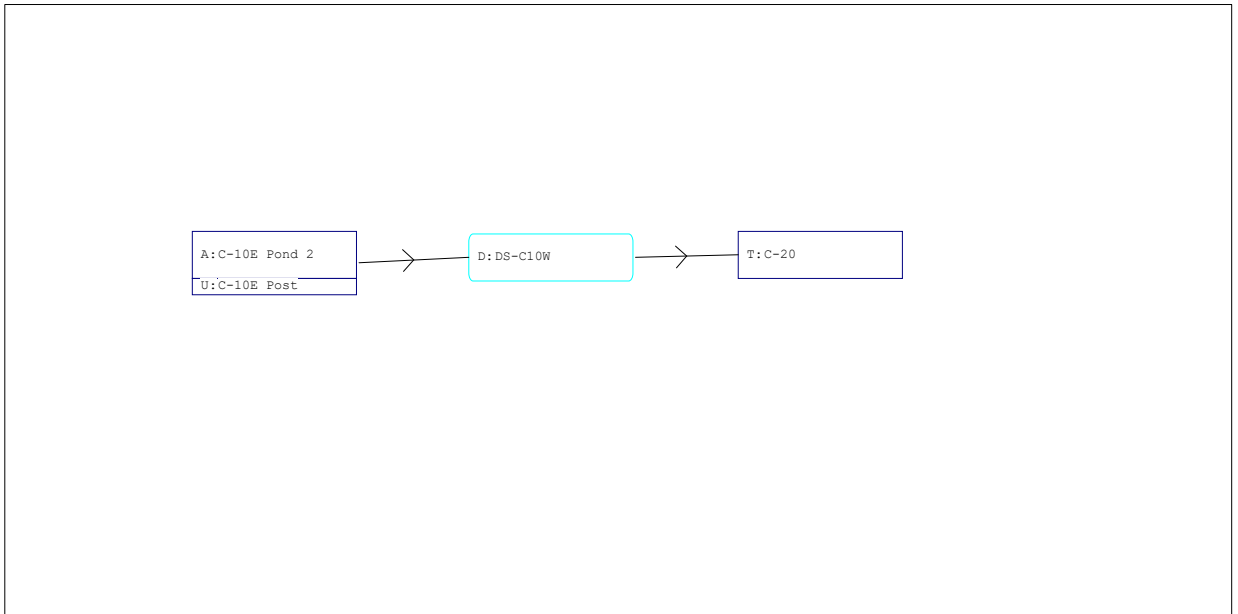
A Stage/Area
V Stage/Volume
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Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

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C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



==== Drop Structures =====
 =====

Name: DS-C10W	From Node: C-10E Swale 1	Length(ft): 300.00
Group: BASE	To Node: C-10	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 18.00	18.00	Flow: Both
Rise(in): 18.00	18.00	Entrance Loss Coef: 0.000
Invert(ft): 14.500	14.000	Exit Loss Coef: 1.000
Manning's N: 0.012000	0.012000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

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

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

*** Weir 1 of 1 for Drop Structure DS-C10W ***

Count: 1	Bottom Clip(in): 0.000	TABLE
Type: Horizontal	Top Clip(in): 0.000	
Flow: Both	Weir Disc Coef: 3.200	
Geometry: Rectangular	Orifice Disc Coef: 0.600	
Span(in): 36.00	Invert(ft): 21.800	
Rise(in): 54.00	Control Elev(ft): 21.800	

==== Weirs =====
 =====

Name:	From Node:
Group: BASE	To Node:
Flow: Both	Count: 1
Type: Horizontal	Geometry: Circular
Span(in): 0.00	
Rise(in): 0.00	
Invert(ft): 0.000	
Control Elevation(ft): 0.000	
	TABLE
Bottom Clip(in): 0.000	
Top Clip(in): 0.000	
Weir Discharge Coef: 3.200	
Orifice Discharge Coef: 0.600	

==== Percolation Links =====
 =====

Name:	From Node:	Flow: Both
Group: BASE	To Node:	Count: 1
Surface Area Option: Use 1st Point in Stage/Area Table		
Vertical Flow Termination: Horizontal Flow Algorithm		
Aquifer Base Elev(ft): 0.000	Perimeter 1(ft): 0.000	
Water Table Elev(ft): 0.000	Perimeter 2(ft): 0.000	
Ann Recharge Rate(in/year): 0.000	Perimeter 3(ft): 0.000	
Horiz Conductivity(ft/day): 0.000	Distance 1 to 2(ft): 0.000	
Vert Conductivity(ft/day): 0.000	Distance 2 to 3(ft): 0.000	
Effective Porosity(dec): 0.000	Num Cells 1 to 2: 0	
Suction Head(in): 0.000	Num Cells 2 to 3: 0	
Layer Thickness(ft): 0.000		

==== Hydrology Simulations =====
 =====

Name: 25yr_24hr
 Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\25yr_24hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 30.00
 Rainfall File: Flmod

Rainfall Amount(in): 9.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Meanann

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\Meanann.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
30.000	5.00

==== Routing Simulations =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\25yr_24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: Meanann Hydrology Sim: Meanann

Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
30.000	15.000

Group	Run
BASE	Yes

Malabar Road PD&E
 C-10 East Basin Post-Development
 Alternative 1 (Swale)

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-10	25yr_24hr	15.74	15.74	0.0063	0	17.15	0.00
C-10	Meanann	15.74	15.74	0.0063	0	15.24	0.00
C-10E Swale 1	25yr_24hr	23.44	23.50	0.0050	48035	49.26	17.15
C-10E Swale 1	Meanann	22.27	23.50	0.0050	39411	23.90	15.24
C-10E Swale 2	25yr_24hr	23.46	23.50	0.0050	34345	54.12	49.26
C-10E Swale 2	Meanann	22.41	23.50	0.0050	23877	31.36	23.90

Basin C-10 East

**Alternative 2
ICPR Models**

Nodes

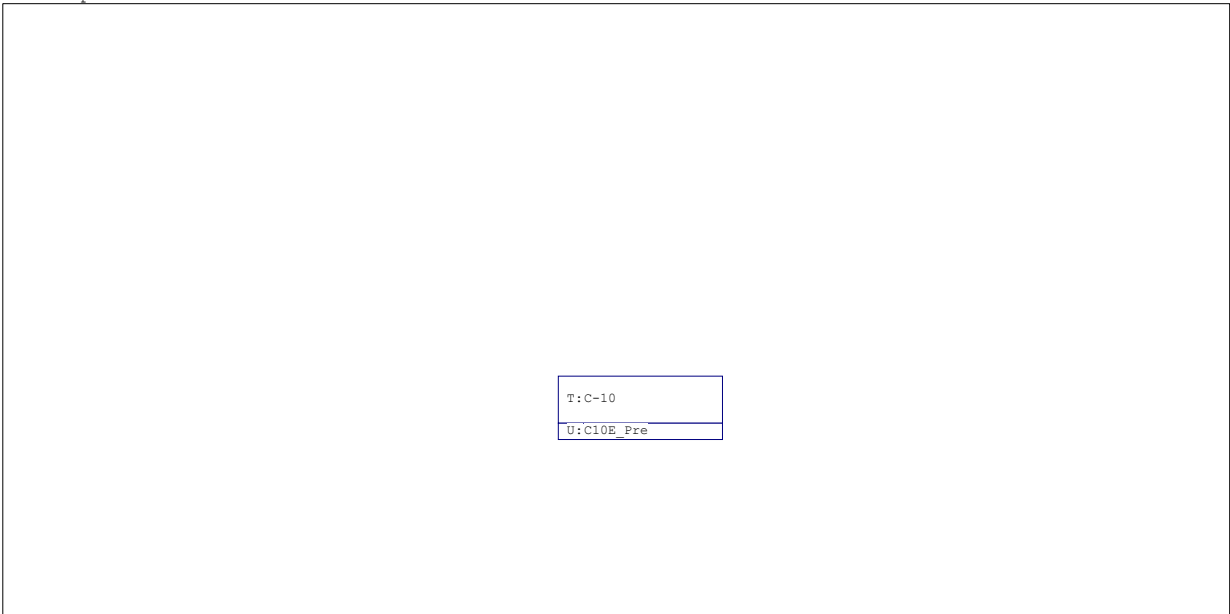
A Stage/Area
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T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C10E_Pre	C10E_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-10	C-10
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	1.47	1.47
Comp Time Inc(min):	1.47	1.47
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	11.00	11.00
Time Shift(hrs):	0.00	0.00
Area(ac):	6.360	6.360
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.03	12.05
Flow Max(cfs):	26.42	15.05
Runoff Volume(in):	7.362	3.515
Runoff Volume(ft3):	169962	81147

25yr/24hr Allowable discharge = 26.42 cfs + 0.08 cfs/acre x 4.48 acres (new impervious) = 26.78 cfs

Mean annual allowable discharge = 15.05 cfs + 0.05 cfs/acre x 4.48 acres (new impervious) = 15.27 cfs

Nodes

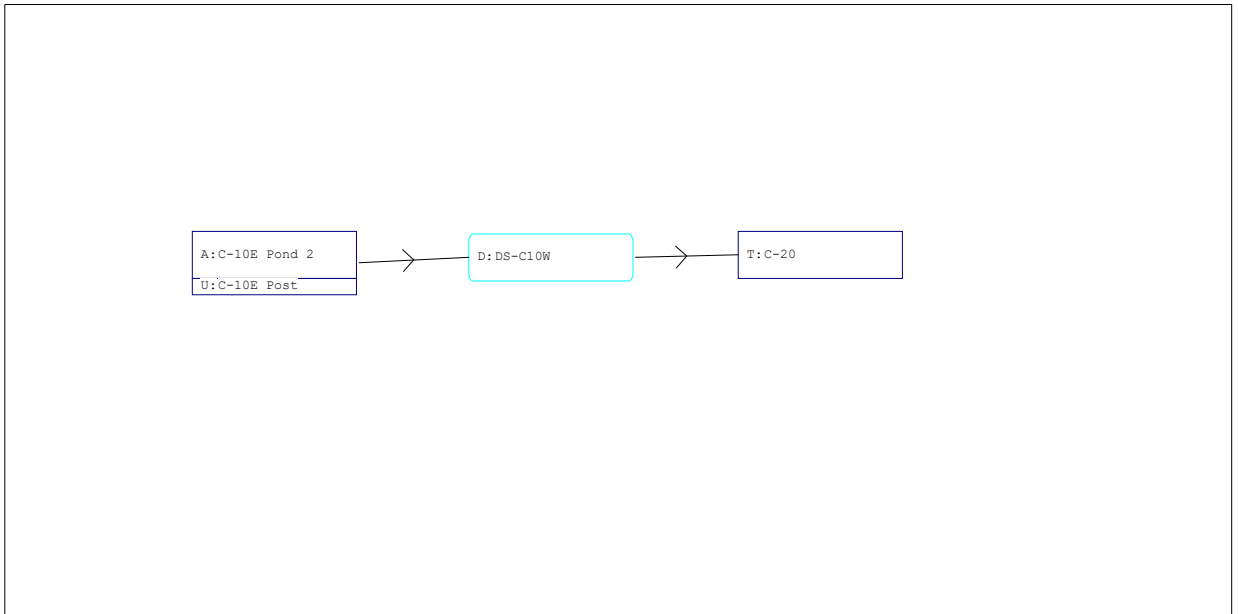
A Stage/Area
V Stage/Volume
T Time/Stage
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Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



=====
==== Routing Simulations =====
=====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\25yr_24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

999.000 15.000

Group Run

BASE Yes

Name: Meanann Hydrology Sim: Meanann
Filename: \\Icevfs01\production\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-10 East\Post\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

30.000 15.000

Group Run

BASE Yes

Malabar Road PD&E
 C-10 East Basin Post-Development
 Alternative 2

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-10E Pond 2	25yr_24hr	21.78	22.00	0.0050	98797	53.43	25.21
C-10E Pond 2	Meanann	21.18	22.00	0.0050	95072	32.24	2.56
C-20	25yr_24hr	17.87	17.87	0.0035	0	25.21	0.00
C-20	Meanann	17.87	17.87	0.0035	0	2.56	0.00

Basin C-20

**Alternative 1
(Preferred)
ICPR Models**

Nodes

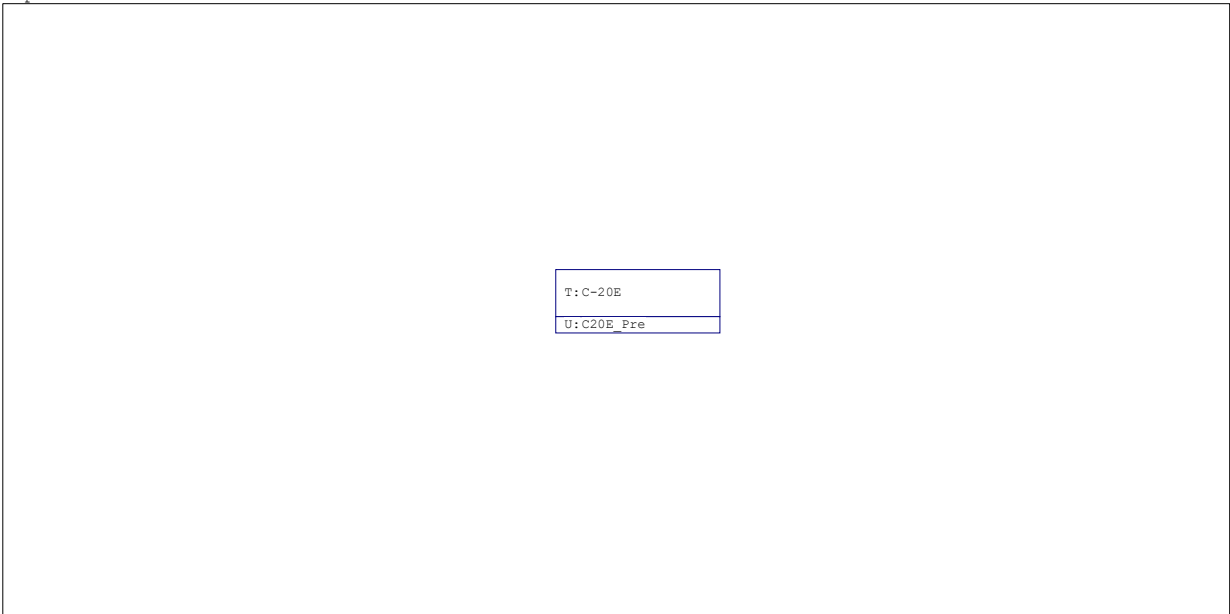
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name:	C20E_Pre	C20E_Pre
Group:	BASE	BASE
Simulation:	25yr_24hr	Meanann
Node:	C-20E	C-20E
Type:	SCS	SCS
Unit Hydrograph:	Uh256	Uh256
Peaking Factor:	256.0	256.0
Spec Time Inc(min):	2.00	2.00
Comp Time Inc(min):	2.00	2.00
Rain File:	Flmod	Flmod
Rain Amount(in):	9.000	5.000
Duration(hrs):	30.00	24.00
Status:	Onsite	Onsite
TC(min):	15.00	15.00
Time Shift(hrs):	0.00	0.00
Area(ac):	19.020	19.020
Vol of Unit Hyd(in):	1.000	1.000
Curve Num:	86.500	86.500
DCIA(%):	0.000	0.000
Time Max(hrs):	15.07	12.10
Flow Max(cfs):	70.64	39.52
Runoff Volume(in):	7.362	3.516
Runoff Volume(ft3):	508316	242739

25yr/24hr Allowable discharge = 70.64 cfs + 0.08 cfs/acre x 13.40 acres (new impervious) = 71.71 cfs

Mean annual allowable discharge = 39.52 cfs + 0.05 cfs/acre x 13.40 acres (new impervious) = 40.19 cfs

Nodes

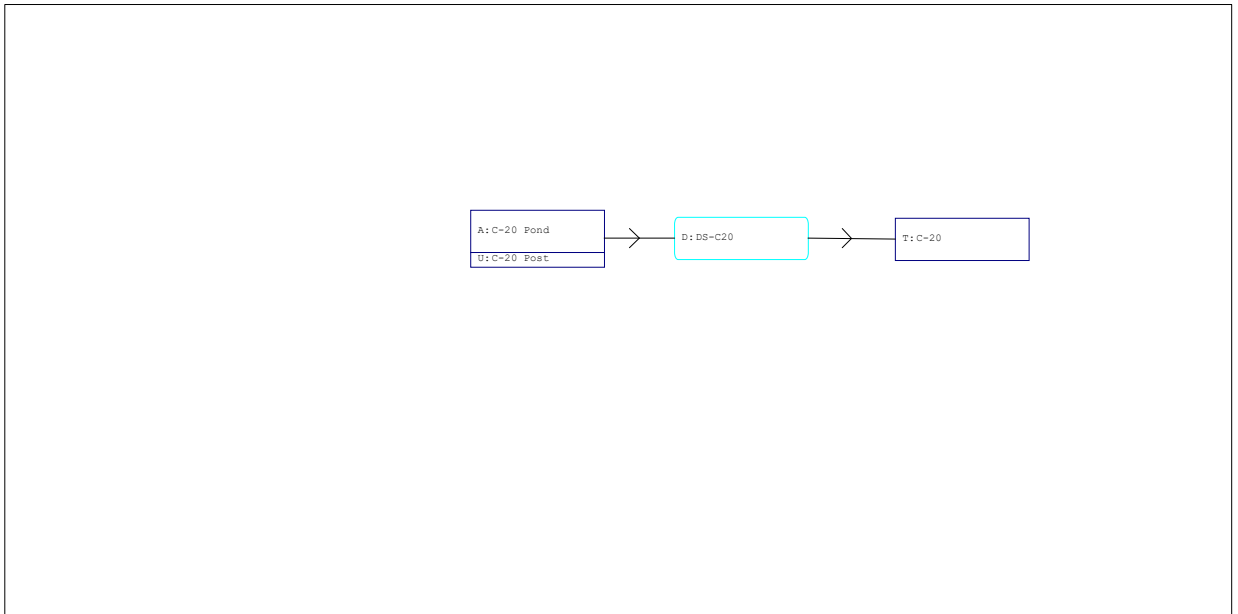
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



==== Routing Simulations =====

Name: 25yr_24hr Hydrology Sim: 25yr_24hr
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-20\Post\25yr_24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

999.000 15.000

Group Run

BASE Yes

Name: Meanann Hydrology Sim: Meanann
Filename: F:\Projects\KIT-009-01\admin\Drainage\Pond Sizing Analysis\ICPR\C-20\Post\Meanann.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

30.000 15.000

Group Run

BASE Yes

Malabar Road PD&E
 C-20 Basin Post-Development
 Alternative 1

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
C-20	25yr_24hr	23.50	23.50	0.0046	0	63.30	0.00
C-20	Meanann	23.50	23.50	0.0046	0	22.84	0.00
C-20 Pond	25yr_24hr	23.47	23.50	-0.0050	176563	106.33	63.30
C-20 Pond	Meanann	23.45	23.50	0.0050	176340	62.37	22.84

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX E

Nutrient Loading Analysis (BMPTRAINS)

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Inwood Consulting Engineers, Inc.
 3000 Dovera Drive, Suite 200, Oviedo, FL 32765
 (407) 971-8850 (phone)
 (407) 971-8955 (fax)

Made by: ZKE
 Checked by: REC

DATE: June 30, 2023
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-7**
 POND NAME : **C-7 Alt. 3**

PERMANENT POOL VOLUME CALCULATIONS

Basin Characteristics

Meteorological Zone: **2**

Land Use	Area (ac)	CN	Product
Roadway Paved Area	5.28	98.00	517.44
Roadway Pervious Area	2.36	80.00	188.80
Pond Pervious Area	1.42	80.00	113.60
Pond Area at NWL	1.29	100.00	129.00
Total	10.35		948.84

%DCIA = 63.48 %
 Non-DCIA CN = 80.00
 Composite C = **0.66**
 Annual Rainfall (P) = **52.00 in**

Min. Permanent Pool Vol. = Area x Composite C x P x 14 / (365 x 12) = **1.14 ac-ft**

Stage Storage Calc. for Permanent Pool

ELEV. (ft)		AREA (ac)	AVG AREA (ac)	Delta D (ft)	Delta storage (ac-ft)	Sum Storage (ac-ft)
16.20	Normal Water Level	1.29				12.54
			1.13	3.00	3.39	
13.20		0.97				9.15
			0.75	12.20	9.15	
1.00	Pond Bottom	0.52				0.00

Permanent Pool Volume Provided = 12.54 ac-ft

Mean Depth = Permanent Pool Volume / Area at NWL = 9.72 ft

Inwood Consulting Engineers, Inc.

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Made by: ZKE
 Checked by: REC

DATE: May 3, 2021
 Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
 BASIN NAME : **C-8 and C-9**
 POND NAME : **C-8 and C-9 Alt. 1**

PERMANENT POOL VOLUME CALCULATIONS

Basin Characteristics

Meteorological Zone: **2**

Land Use	Area (ac)	CN	Product
Roadway Paved Area	6.70	98.00	656.60
Roadway Pervious Area	2.99	80.00	239.20
Pond Pervious Area	1.53	80.00	122.40
Pond Area at NWL	1.35	100.00	135.00
Total	12.57		1153.20

%DCIA = 64.04 %
 Non-DCIA CN = 80.00
 Composite C = **0.66**
 Annual Rainfall (P) = **52.00 in**

Min. Permanent Pool Vol. = Area x Composite C x P x 14 / (365 x 12) = **1.38 ac-ft**

Stage Storage Calc. for Permanent Pool

ELEV. (ft)		AREA (ac)	AVG AREA (ac)	Delta D (ft)	Delta storage (ac-ft)	Sum Storage (ac-ft)
17.00	Normal Water Level	1.35				5.30
			1.16	3.00	3.48	
14.00		0.96				1.82
			0.91	2.00	1.82	
12.00	Pond Bottom	0.86				0.00

Permanent Pool Volume Provided = 5.30 ac-ft

Mean Depth = Permanent Pool Volume / Area at NWL = **3.93 ft**

Inwood Consulting Engineers, Inc.

3000 Dovera Drive, Suite 200, Oviedo, FL 32765

(407) 971-8850 (phone)

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Made by: ZKE
Checked by: REC

DATE: January 7, 2022
Job Number: KIT-009-01

PROJECT : **Malabar Road PD&E**
BASIN NAME : **C-20**
POND NAME : **C-20 Alt. 1**

PERMANENT POOL VOLUME CALCULATIONS

Basin Characteristics

Meteorological Zone: **2**

Land Use	Area (ac)	CN	Product
Roadway Paved Area	20.31	98.00	1990.38
Roadway Pervious Area	9.94	80.00	795.20
Pond Pervious Area	2.49	80.00	199.20
Pond Area at NWL	3.38	100.00	338.00
Total	36.12		3322.78

%DCIA = 65.59 %
Non-DCIA CN = 80.00
Composite C = **0.66**
Annual Rainfall (P) = **52.00 in**

Min. Permanent Pool Vol. = Area x Composite C x P x 14 / (365 x 12) = **3.96 ac-ft**

Stage Storage Calc. for Permanent Pool

ELEV. (ft)		AREA (ac)	AVG AREA (ac)	Delta D (ft)	Delta storage (ac-ft)	Sum Storage (ac-ft)
20.80	Normal Water Level	3.38				14.20
			3.02	3.00	9.06	
17.80		2.66				5.14
			2.57	2.00	5.14	
15.80	Pond Bottom	2.48				0.00

Permanent Pool Volume Provided = 14.20 ac-ft

Mean Depth = Permanent Pool Volume / Area at NWL = 4.20 ft

Complete Report (not including cost) Ver 4.3.5

Project: Malabar Road C-7

Date: 6/30/2023 11:05:06 AM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Basin C-7
Rainfall Zone	Florida Zone 2
Annual Mean Rainfall	52.00

Pre-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	10.35
Rational Coefficient (0-1)	0.23
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	17.10
Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	10.347
Groundwater N (kg/yr)	0.000
Groundwater P (kg/yr)	0.000
Nitrogen Loading (kg/yr)	19.392
Phosphorus Loading (kg/yr)	2.552

Post-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	10.35
Rational Coefficient (0-1)	0.55
Non DCIA Curve Number	80.00

DCIA Percent (0-100)	63.48
Wet Pond Area (ac)	1.29
Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	21.764
Groundwater N (kg/yr)	0.000
Groundwater P (kg/yr)	0.000
Nitrogen Loading (kg/yr)	40.790
Phosphorus Loading (kg/yr)	5.367

Catchment Number: 1 Name: Basin C-7
Project: Malabar Road C-7
Date: 6/30/2023

Wet Detention Design

Permanent Pool Volume (ac-ft)	12.540
Permanent Pool Volume (ac-ft) for 31 days residence	1.848
Annual Residence Time (days)	210
Littoral Zone Efficiency Credit	
Wetland Efficiency Credit	

Watershed Characteristics

Catchment Area (acres)	10.35
Contributing Area (acres)	9.060
Non-DCIA Curve Number	80.00
DCIA Percent	63.48
Rainfall Zone	Florida Zone 2
Rainfall (in)	52.00

Surface Water Discharge

Required TN Treatment Efficiency (%) 52

Provided TN Treatment Efficiency (%) 43

Required TP Treatment Efficiency (%) 52

Provided TP Treatment Efficiency (%) 80

Media Mix Information

Type of Media Mix Not Specified

Media N Reduction (%)

Media P Reduction (%)

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr) 0.000

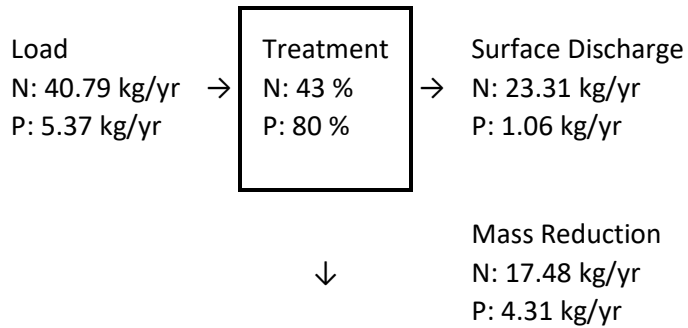
TN Mass Load (kg/yr) 0.000

TN Concentration (mg/L) 0.000

TP Mass Load (kg/yr) 0.000

TP Concentration (mg/L) 0.000

Load Diagram for Wet Detention (stand-alone)



Summary Treatment Report Version: 4.3.5

Project: Malabar Road C-7

Analysis Type: Net Improvement

Date:6/30/2023

BMP Types:

Catchment 1 - (Basin C-7) Wet Detention

Routing Summary

Catchment 1 Routed to Outlet

Based on % removal values to the nearest percent

Total nitrogen target removal met? **No**

Total phosphorus target removal met? **Yes**

Summary Report

Nitrogen

Surface Water Discharge

Total N pre load	19.39 kg/yr	
Total N post load	40.79 kg/yr	
Target N load reduction	52 %	
Target N discharge load	19.39 kg/yr	
Percent N load reduction	43 %	
Provided N discharge load	23.31 kg/yr	51.39 lb/yr
Provided N load removed	17.48 kg/yr	38.55 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load	2.552 kg/yr	
Total P post load	5.367 kg/yr	
Target P load reduction	52 %	
Target P discharge load	2.552 kg/yr	
Percent P load reduction	80 %	
Provided P discharge load	1.057 kg/yr	2.33 lb/yr
Provided P load removed	4.31 kg/yr	9.503 lb/yr

Complete Report (C-8/C-9)

Project: Malabar Road C-8/C-9

Date: 5/4/2021 11:53:57 AM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Basin C-8/C-9
Rainfall Zone	Florida Zone 2
Annual Mean Rainfall	52.00

Pre-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	12.57
Rational Coefficient (0-1)	0.24
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	18.10
Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	12.948
Nitrogen Loading (kg/yr)	24.266
Phosphorus Loading (kg/yr)	3.193

Post-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	12.57
Rational Coefficient (0-1)	0.56
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	64.00
Wet Pond Area (ac)	1.35

Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	27.130
Nitrogen Loading (kg/yr)	50.846
Phosphorus Loading (kg/yr)	6.690

Catchment Number: 1 Name: Basin C-8/C-9

Project: Malabar Road C-8/C-9

Date: 5/4/2021

Wet Detention Design

Permanent Pool Volume (ac-ft)	5.300
Permanent Pool Volume (ac-ft) for 31 days residence	2.304
Annual Residence Time (days)	71
Littoral Zone Efficiency Credit	
Wetland Efficiency Credit	

Watershed Characteristics

Catchment Area (acres)	12.57
Contributing Area (acres)	11.220
Non-DCIA Curve Number	80.00
DCIA Percent	64.00
Rainfall Zone	Florida Zone 2
Rainfall (in)	52.00

Surface Water Discharge

Required TN Treatment Efficiency (%) 52

Provided TN Treatment Efficiency (%) 41

Required TP Treatment Efficiency (%) 52

Provided TP Treatment Efficiency (%) 71

Media Mix Information

Type of Media Mix Not Specified

Media N Reduction (%)

Media P Reduction (%)

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr) 0.000

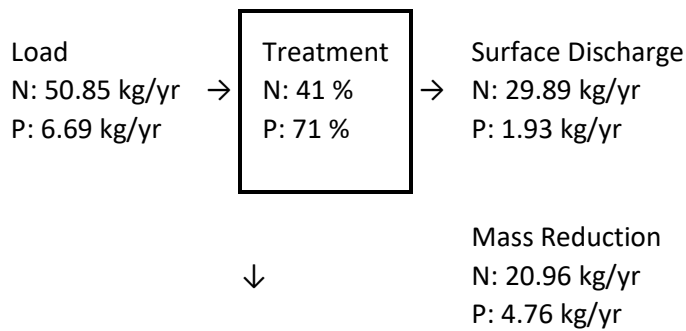
TN Mass Load (kg/yr) 0.000

TN Concentration (mg/L) 0.000

TP Mass Load (kg/yr) 0.000

TP Concentration (mg/L) 0.000

Load Diagram for Wet Detention (stand-alone)



Summary Treatment Report Version: 4.2.3

Project: Malabar Road C-8/C-9

Date:5/4/2021

Analysis Type: Net Improvement

BMP Types:

Catchment 1 - (Basin C-8/C-9) Wet Detention
Based on % removal values to the nearest percent

Routing Summary

Catchment 1 Routed to Outlet

Total nitrogen target removal met? **No**

Total phosphorus target removal met? **Yes**

Summary Report

Nitrogen

Surface Water Discharge

Total N pre load	24.27 kg/yr	
Total N post load	50.85 kg/yr	
Target N load reduction	52 %	
Target N discharge load	24.27 kg/yr	
Percent N load reduction	41 %	
Provided N discharge load	29.89 kg/yr	65.9 lb/yr
Provided N load removed	20.96 kg/yr	46.21 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load	3.193 kg/yr	
Total P post load	6.69 kg/yr	
Target P load reduction	52 %	
Target P discharge load	3.193 kg/yr	
Percent P load reduction	71 %	
Provided P discharge load	1.927 kg/yr	4.25 lb/yr
Provided P load removed	4.763 kg/yr	10.503 lb/yr

Complete Report Basin C-10

Project: Malabar Road C-10

Date: 5/5/2021 2:26:29 PM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Basin C-10
Rainfall Zone	Florida Zone 2
Annual Mean Rainfall	52.00

Pre-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	16.93
Rational Coefficient (0-1)	0.23
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	17.70
Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	17.233
Nitrogen Loading (kg/yr)	32.297
Phosphorus Loading (kg/yr)	4.250

Post-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200
Area (acres)	16.93
Rational Coefficient (0-1)	0.47
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	52.10
Wet Pond Area (ac)	0.00

Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200
Runoff Volume (ac-ft/yr)	34.826
Nitrogen Loading (kg/yr)	65.269
Phosphorus Loading (kg/yr)	8.588

Catchment Number: 1 Name: Basin C-10

Project: Malabar Road C-10

Date: 5/5/2021

Retention Design

Retention Depth (in) 2.860

Retention Volume (ac-ft) 4.035

Watershed Characteristics

Catchment Area (acres) 16.93

Contributing Area (acres) 16.930

Non-DCIA Curve Number 80.00

DCIA Percent 52.10

Rainfall Zone Florida Zone 2

Rainfall (in) 52.00

Surface Water Discharge

Required TN Treatment Efficiency (%) 51

Provided TN Treatment Efficiency (%) 97

Required TP Treatment Efficiency (%) 51

Provided TP Treatment Efficiency (%) 97

Media Mix Information

Type of Media Mix Not Specified

Media N Reduction (%)

Media P Reduction (%)

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr) 0.000

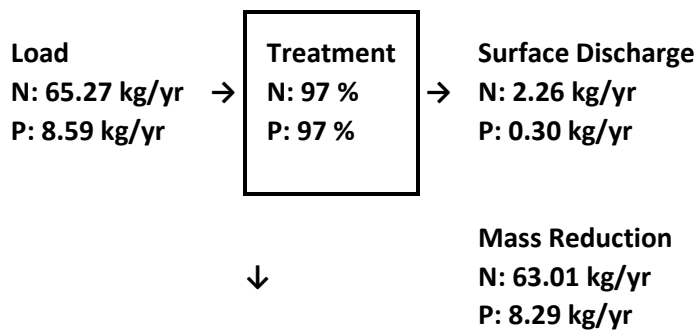
TN Mass Load (kg/yr) 63.011

TN Concentration (mg/L) 0.000

TP Mass Load (kg/yr) 8.291

TP Concentration (mg/L) 0.000

Load Diagram for Retention (stand-alone)



Summary Treatment Report Version: 4.2.3

Project: Malabar Road C-10

Date:5/5/2021

Analysis Type: Net Improvement

BMP Types:

Catchment 1 - (Basin C-10) Retention Routing Summary

Based on % removal values to the nearest percent Catchment 1 Routed to Outlet

Total nitrogen target removal met? Yes

Total phosphorus target removal met? Yes

Summary Report

Nitrogen

Surface Water Discharge

Total N pre load	32.3 kg/yr	
Total N post load	65.27 kg/yr	
Target N load reduction	51 %	
Target N discharge load	32.3 kg/yr	
Percent N load reduction	97 %	
Provided N discharge load	2.26 kg/yr	4.98 lb/yr
Provided N load removed	63.01 kg/yr	138.94 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load	4.25 kg/yr	
Total P post load	8.588 kg/yr	
Target P load reduction	51 %	
Target P discharge load	4.25 kg/yr	
Percent P load reduction	97 %	
Provided P discharge load	.297 kg/yr	.66 lb/yr
Provided P load removed	8.291 kg/yr	18.281 lb/yr

Complete Report

Project: Malabar Road C-20

Date: 1/7/2022 11:00:02 AM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Basin C-20	Basin C-20 Supplement
Rainfall Zone	Florida Zone 2	Florida Zone 2
Annual Mean Rainfall	52.00	52.00

Pre-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200	Highway: TN=1.520 TP=0.200
Area (acres)	36.12	1.62
Rational Coefficient (0-1)	0.24	0.24
Non DCIA Curve Number	80.00	80.00
DCIA Percent (0-100)	18.31	18.31
Nitrogen EMC (mg/l)	1.520	1.520
Phosphorus EMC (mg/l)	0.200	0.200
Runoff Volume (ac-ft/yr)	37.435	1.679
Groundwater N (kg/yr)	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000
Nitrogen Loading (kg/yr)	70.159	3.147
Phosphorus Loading (kg/yr)	9.231	0.414

Post-Condition Landuse Information

Landuse	Highway: TN=1.520 TP=0.200	Highway: TN=1.520 TP=0.200
Area (acres)	36.12	1.62
Rational Coefficient (0-1)	0.57	0.48
Non DCIA Curve Number	80.00	80.00

DCIA Percent (0-100)	65.59	53.33
Wet Pond Area (ac)	3.38	0.00
Nitrogen EMC (mg/l)	1.520	1.520
Phosphorus EMC (mg/l)	0.200	0.200
Runoff Volume (ac-ft/yr)	80.744	3.393
Groundwater N (kg/yr)	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000
Nitrogen Loading (kg/yr)	151.328	6.359
Phosphorus Loading (kg/yr)	19.912	0.837

Catchment Number: 1 Name: Basin C-20

Project: Malabar Road C-20

Date: 1/7/2022

Wet Detention Design

Permanent Pool Volume (ac-ft) 14.200

Permanent Pool Volume (ac-ft) for 31 days residence 6.858

Annual Residence Time (days) 64

Littoral Zone Efficiency Credit

Wetland Efficiency Credit

Watershed Characteristics

Catchment Area (acres) 36.12

Contributing Area (acres) 32.740

Non-DCIA Curve Number 80.00

DCIA Percent 65.59

Rainfall Zone Florida Zone 2

Rainfall (in) 52.00

Surface Water Discharge

Required TN Treatment Efficiency (%) 54

Provided TN Treatment Efficiency (%) 41

Required TP Treatment Efficiency (%) 54

Provided TP Treatment Efficiency (%) 70

Media Mix Information

Type of Media Mix Not Specified

Media N Reduction (%)

Media P Reduction (%)

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr) 0.000

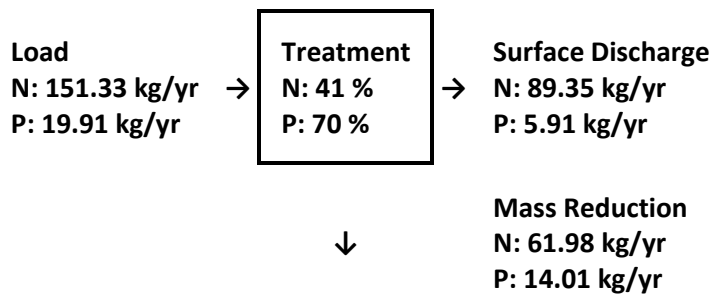
TN Mass Load (kg/yr) 0.000

TN Concentration (mg/L) 0.000

TP Mass Load (kg/yr) 0.000

TP Concentration (mg/L) 0.000

Load Diagram for Wet Detention (stand-alone)



Catchment Number: 2 Name: Basin C-20 Supplement

Project: Malabar Road C-20

Date: 1/7/2022

Retention Design

Retention Depth (in) 9.000

Retention Volume (ac-ft) 1.215

Watershed Characteristics

Catchment Area (acres) 1.62

Contributing Area (acres) 1.620

Non-DCIA Curve Number 80.00

DCIA Percent 53.33

Rainfall Zone Florida Zone 2

Rainfall (in) 52.00

Surface Water Discharge

Required TN Treatment Efficiency (%) 51

Provided TN Treatment Efficiency (%) 98

Required TP Treatment Efficiency (%) 51

Provided TP Treatment Efficiency (%) 98

Media Mix Information

Type of Media Mix Not Specified

Media N Reduction (%)

Media P Reduction (%)

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr) 0.000

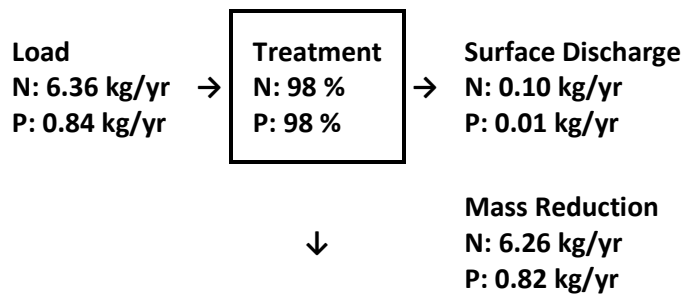
TN Mass Load (kg/yr) 6.257

TN Concentration (mg/L) 0.000

TP Mass Load (kg/yr) 0.823

TP Concentration (mg/L) 0.000

Load Diagram for Retention (stand-alone)



Summary Treatment Report Version: 4.3.3

Project: Malabar Road C-20

Analysis Type: Net Improvement

Date:1/7/2022

BMP Types:

**Catchment 1 - (Basin C-20) Wet
Detention**

Routing Summary

**Catchment 2 - (Basin C-20
Supplement) Retention**

Catchment 1 Routed to Outlet

Catchment 2 Routed to Outlet

**Based on % removal values to the
nearest percent**

Total nitrogen target removal met? No

Total phosphorus target removal met? Yes

Summary Report

Nitrogen

Surface Water Discharge

Total N pre load 73.31 kg/yr

Total N post load 157.69 kg/yr

Target N load reduction 54 %

Target N discharge load 73.31 kg/yr

Percent N load reduction 43 %

Provided N discharge load 89.45 kg/yr 197.24 lb/yr

Provided N load removed 68.23 kg/yr 150.46 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load 9.645 kg/yr

Total P post load 20.748 kg/yr

Target P load reduction 54 %

Target P discharge load 9.645 kg/yr

Percent P load reduction 71 %

Provided P discharge load 5.919 kg/yr 13.05 lb/yr

Provided P load removed 14.829 kg/yr 32.698 lb/yr

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX F

Pond Alternatives Evaluation Matrix

Malabar Road PD&E Study

FM No. 437210-1-28-01

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MALABAR ROAD PD&E STUDY



BASIN C-7 ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Pond Type	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable DHW _{25yr/24hr} (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area Excluding Pond (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
C-7 Alt. 1	Sta. 63+58 (Rt.) Parcel No. 29-36-04-25-*9	20.00	Wet Detention	Pineda sand, 0 to 2 percent slopes (C/D)	17.00	20.50	400	19.50	2.50	C-7 Canal	7.64	1.91	0.00	3.17	3.17
C-7 Alt. 2	Sta. 85+64 (Rt.) Parcel No. 29-36-04-25-*1; 29-36-04-25-*2	20.00	Wet Detention	Pineda sand, 0 to 2 percent slopes (C/D)	17.00	20.50	400	19.50	2.50	C-7 Canal	7.64	2.11	0.00	3.42	3.42
C-7 Alt. 3	Sta. 53+00 (Rt.) Parcel No. 29-36-05-00-3	18.00	Wet Detention	Pineda sand, 0 to 2 percent slopes (C/D)	16.20	19.50	400	19.50	2.80	C-7 Canal	7.64	2.03	0.51	3.25	3.76

IMPACT & COST ANALYSIS

Alternatives	Pond Floodplain Impacts (ac-ft)	FEMA Floodzone	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
C-7 Alt. 1	0.00	AE	Low	0.00	High	Caracara (within nest buffer), gopher tortoise, eastern indigo snake, Florida pine snake, southeastern American Kestrel, southern fox squirrel	Medium	N	Cabbage Palm Forest (FLUCFCS 428)	Residential 1 Unit Per Acre	27.90	\$536,891	3
C-7 Alt. 2	0.00	AE	Moderate	0.00	Medium	Caracara, gopher tortoise, eastern indigo snake, Florida pine snake, southeastern American Kestrel, southern fox squirrel	Medium	N	Cabbage Palm Forest (FLUCFCS 428)	Residential 1 Unit Per Acre	14.01	\$546,803	2
C-7 Alt. 3	0.50	AE	Low	0.28	High	Caracara (within nest buffer), gopher tortoise, eastern indigo snake, Florida pine snake, wood stork, wading birds	Low	N	Unimproved Pasture (FLUCFCS 212), Upland Hardwood Forest (FLUCFCS 420), Mixed Wetland Hardwoods (FLUCFCS 617), Emergent Aquatic Vegetation (FLUCFCS 646)	Residential 1 Unit Per Acre	13.05	\$1,186,713	1*

Note:

The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews. A determination of low was given for areas that are developed and exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.

*While this pond site alternative has the highest total cost, it was selected as the preferred alternative due to new development planned for Alt. 1 and Alt. 2. Discussions held with the City of Palm Bay indicated their desire to use their existing parcel on the west side of the C-7 Canal.



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MALABAR ROAD PD&E STUDY



BASIN C-8 & C-9 ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Pond Type	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable DHW _{25yr/24hr} (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
C-8 & C-9 Combined Alt. 1	Sta. 101+65 (Lt.) Parcel No. 28-36-33-01-B	20.00	Wet Detention	Malabar, Holopaw, and Pineda soils (A/D)	17.00	20.50	1600	20.00	3.00	C-9 Canal	9.69	2.54	2.30 (including ditch relocation)	3.45	5.75
C-8 & C-9 Combined Alt. 2	Sta. 89+98 (Rt.) Parcel No. 29-36-04-00-4	20.00	Wet Detention	Pineda sand, 0 to 2 percent slopes (C/D)	17.60	21.00	1300	20.00	2.40	C-8 Canal	9.69	2.53	0.00	3.13	3.13

IMPACT & COST ANALYSIS

Alternatives	Pond Floodplain Impacts (ac-ft)	FEMA Floodzone	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
C-8 & C-9 Combined Alt. 1	0.00	X	Low	0.39	Medium	Gopher tortoise, eastern indigo snake, southern fox squirrel, wood stork, wading birds	Low	N	Low density residential (FLUCFCS 110)	Residential Open Space	6.79	\$852,160	1*
C-8 & C-9 Combined Alt. 2	0.03	AE	Low	0.00	Medium	Gopher tortoise, eastern indigo snake, Florida pine snake, southern fox squirrel	Low	N	Hardwood-Conifer Mixed Upland Forest (FLUCFCS 434)	Commercial	32.80	\$526,823	2

Note:

The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews and species-specific surveys. A determination of low was given for areas that exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.

*While this pond site alternative has a higher total cost than Alt. 2, it was selected as the preferred alternative due to its ability to utilize an existing City of Palm Bay parcel.



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MALABAR ROAD PD&E STUDY



BASIN C-10 WEST ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Pond Type	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable DHW _{25yr/24hr} (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
C-10 West Alt. 1	Sta. 135+09 (Lt.) Parcel No. 28-36-34-25-D	22.00	Dry Retention	Malabar, Holopaw, and Pineda soils (A/D); EauGallie sand (A/D)	15.00	22.00	1400	21.50	4.50	C-10 Canal	2.93	0.38	0.73	1.31	2.04
C-10 West Alt. 2 Option 1	Sta. 144+97 (Rt.) *See Swale Parcel Numbers Sheet	23.00	Swale (Using C-10 East Alt. 1)	Malabar, Holopaw, and Pineda soils (A/D); EauGallie sand (A/D)	19.00	23.00	50	23.50	5.50	C-10 Canal	3.01	0.38	0.00	4.55 (C-10 East Alt. 1)	4.55 (4.86 provided)
C-10 West Alt. 2 Option 2	Sta. 175+65 (Lt.) Parcel No. 28-36-35-00-503	23.00	Wet Detention (Expanding C-10 East Alt. 2)	EauGallie sand (A/D), Anclote sand, depressionnal, 0 to 1 percent slopes (A/D)	19.70	23.00	2000	22.00	2.30	C-10 Canal	3.02	0.80	0.00	0.94 (in addition to C-10 East Alt. 2 required area)	0.94

IMPACT & COST ANALYSIS

Alternatives	Pond Floodplain Impacts (ac-ft)	FEMA Floodzone	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
C-10 West Alt. 1	0.00	X	Low	0.00	Medium	Gopher tortoise, eastern indigo snake, Florida pine snake, Southern fox squirrel	Low	N	Medium Density Residential (FLUCFCS 120)	Residential Open Space	5.51	\$484,608	3
C-10 West Alt. 2 Option 1	0.00	X	Low	0.00	Low	Gopher tortoise, eastern indigo snake	Low	N	Medium Density Residential (FLUCFCS 120)	Single Family Residential	7.59	\$0	1
C-10 West Alt. 2 Option 2	0.00	X	Low	0.00	Medium	Gopher tortoise, eastern indigo snake, Florida pine snake, Southern fox squirrel	Medium	N	Pine Flatwoods (FLUCFCS 411)	Single Family Residential	9.28	\$85,325	2

Note:

The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews and species-specific surveys. A determination of low was given for areas that exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.



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MALABAR ROAD PD&E STUDY



BASIN C-10 EAST ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Pond Type	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable DHW _{25yr/24hr} (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
C-10 East Alt. 1	Sta. 144+97 (Rt.) Parcel No. 29-36-03-KL-1702-1	23.00	Swale	Malabar, Holopaw, and Pineda soils (A/D); EauGallie sand (A/D)	19.00	23.00	50	24.50	3.50	C-10 Canal	10.13	0.90	0.00	4.55	4.55 (4.86 provided)
C-10 East Alt. 2	Sta. 175+65 (Lt.) Parcel No. 28-36-35-00-503	23.00	Wet Detention	EauGallie sand (A/D); Anclote sand, depressionnal, 0 to 1 percent slopes (A/D)	19.70	23.00	2000	23.00	2.67	C-10 Canal	10.12	2.71	0.57	3.89	4.46

IMPACT & COST ANALYSIS

Alternatives	Pond Floodplain Impacts (ac-ft)	FEMA Floodzone	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
C-10 East Alt. 1	0.00	X	Low	0.00	Low	Gopher tortoise, eastern indigo snake	Low	N	Medium Density Residential (FLUCFCS 120)	Single Family Residential	5.51	\$773,567	1
C-10 East Alt. 2	0.00	X	Low	0.07	Medium	Gopher tortoise, eastern indigo snake, Florida pine snake, Southern fox squirrel	Medium	N	Pine flatwoods (FLUCFCS 411), Wetland forested mixed (FLUCFCS 630)	Single Family Residential	9.28	\$1,153,540	2

Note:

The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews and species-specific surveys. A determination of low was given for areas that exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.



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MALABAR ROAD PD&E STUDY



BASIN C-20 ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Pond Type	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable DHW _{25yr/24hr} (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
C-20 Supplemental Swale	Sta. 198+44 (Rt.) *See Swale Parcel Numbers Sheet	24.00	Swale	Pineda sand, 0 to 2 percent slopes (C/D); Wabasso sand (C/D)	20.10	20.10	50	23.00	1.90	C-20 Canal	N/A	N/A	0.00	1.41	1.41
C-20 Alt. 1	Sta. 229+06 (Rt.) Parcel No. 29-36-01-00-253	23.50	Wet Detention	EauGallie sand (A/D)	20.80	24.00	1000	24.50	2.70	C-20 Canal	30.25	6.21	0.32	7.04	7.36
C-20 Alt. 2	Sta. 240+39 (Rt.) Parcel No. 29-36-01-00-250	23.50	Wet Detention	EauGallie sand (A/D); Malabar, Holowpaw, and Pineda soils (A/D)	20.25	24.00	1000	23.50	3.325	C-20 Canal	30.25	6.01	0.00	5.04	5.04

IMPACT & COST ANALYSIS

Alternatives	Pond Floodplain Impacts (ac-ft)	FEMA Floodzone	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
C-20 Supplemental Swale	0.00	X	Low	0.00	Low	Gopher tortoise, eastern indigo snake	Low	N	Medium Density Residential (FLUCFCS 120)	Single Family Residential	1.96	\$183,478	N/A
C-20 Alt. 1	0.00	X	Low	0.46	Medium	Florida scrub-jay, gopher tortoise, eastern indigo snake, southern fox squirrel, southeastern American kestrel, wood stork, wading birds.	Medium	N	Tree plantations (FLUCFCS 440), Freshwater marsh (FLUCFCS 641)	Multi-Family Residential	11.33	\$2,464,973	1*
C-20 Alt. 2	0.00	X	Low	0.00	Medium	Florida scrub-jay, gopher tortoise, eastern indigo snake, southeastern American kestrel, southern fox squirrel	Medium	N	Cabbage palm forest (FLUCFCS 428), Medium density residential (FLUCFCS 428)	Multi-Family Residential	5.31	\$1,945,009	2

Note: The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews and species-specific surveys. A determination of low was given for areas that exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.

*While this pond site alternative has a higher total cost than Alt. 2, it was selected as the preferred alternative due to the arsenic groundwater plume identified on the site for Alt. 2. The estimated cost of remediation is included for Alt. 2, but is highly variable and therefore may be significantly higher than estimated.



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MALABAR ROAD PD&E STUDY



FLOODPLAIN COMPENSATION ALTERNATIVE SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Estimated 100-Year Floodplain Elevation	Roadway Floodplain Impacts (ac-ft)	Pond Floodplain Compensation (ac-ft)	FEMA Floodzone	Outfall Location	Required Pond Access Area (ac)	Required Pond Area (ac)	Required Pond Area Including Access (ac)
FPC C-7 Alt. 1	Sta. 84+17 (Rt.) Parcel No. 29-36-04-25*-1; 29-36-04-25*-2	20.00	Pineda sand, 0 to 2 percent slopes (C/D)	17.00	20.00	1.41	2.15	AE	C-8 Canal	0.00	1.64	1.64
FPC C-7 Alt. 2	Sta. 50+00 (Rt.) Parcel No. 29-36-05-00-3	20.00	Pineda sand, 0 to 2 percent slopes (C/D)	16.20	20.00	1.91	1.91	AE	C-7 Canal	0.00	1.85	1.85

IMPACT & COST ANALYSIS

Alternatives	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Environmental Impact Risk	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Future Land Use	Total Area of Parcels (Including Non-Impacted Area) (ac)	Total Pond Costs	Rankings
FPC C-7 Alt. 1	Moderate	0.00	Medium	Caracara, gopher tortoise, eastern indigo snake, Florida pine snake, southeastern American Kestrel, southern fox squirrel	Medium	N	Cabbage Palm Forest (FLUCFCS 428)	Residential 1 Unit Per Acre	14.01	\$228,362	2
FPC C-7 Alt. 2	Low	0.65	High	Caracara (within nest buffer), gopher tortoise, eastern indigo snake, Florida pine snake, wood stork, wading birds	Low	N	Unimproved Pasture (FLUCFCS 212), Upland Hardwood Forest (FLUCFCS 420), Streams and Waterways (FLUCFCS 510), Mixed Wetland Hardwoods (FLUCFCS 617), Emergent Aquatic Vegetation (FLUCFCS 646)	Residential 1 Unit Per Acre	13.05	\$257,487	1*

Note:

The cost evaluation for the stormwater management facility alternatives in this report include stormwater management facility construction costs, costs associated with wetland impacts, potential remediation of contaminated sites, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations, sodding and any potential impermeable liners. The associated parcel acquisition cost for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

The potential occurrence of any listed species within each proposed pond site was valued as low, medium, or high based on FLUCFCS type, FNAI reports, and data gathered during field reviews and species-specific surveys. A determination of low was given for areas that exhibited minimal to no available habitat for listed species. A determination of medium was given for areas where suitable habitat was identified within one quarter mile of the pond site, or suboptimal habitat was observed within the pond site. A determination of high was given for direct observations of listed species, or areas with greater than one mile of contiguous suitable habitat.

*While this FPC site alternative has the highest total cost, it was selected as the preferred alternative due to new development planned for Alt. 1. Discussions held with the City of Palm Bay indicated their desire to use their existing parcel on the west side of the C-7 Canal.



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MALABAR ROAD PD&E STUDY



Pond Combination Cost Summary

This table is intended to summarize and clarify the costs of various possible combinations of pond alternatives.

	Alternative Name(s)	Estimated Total Cost of Combination	Combination Overall Rank
Choose One	C-7 Alt. 1	\$536,891	3
	C-7 Alt. 2	\$546,803	2
	C-7 Alt. 3	\$1,186,713	1
Choose One	C-8 & C-9 Alt. 1	\$852,160	1
	C-8 & C-8 Alt. 2	\$526,823	2
Choose One	C-10 West Alt. 1 + C-10 East Alt. 1 Standalone Dry Pond + Dry Swale	\$1,258,175	3
	C-10 West Alt. 1 + C-10 East Alt. 2 Standalone Dry Pond + Standalone Wet Pond	\$1,638,148	4
	C-10 West Alt. 2 Option 1 + C-10 East Alt. 1 Dry Swale Only	\$773,567	1
	C-10 West Alt. 2 Option 2 + C-10 East Alt. 2 Wet Pond + Expansion	\$1,238,866	2
Choose One	C-20 Supplemental Swale + C-20 Alt. 1	\$2,648,451	1
	C-20 Supplemental Swale + C-20 Alt. 2	\$2,128,487	2

Preferred Alternative or Combination



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 (407) 971-8850 phone (407) 971-8955 fax

MALABAR ROAD PD&E STUDY



SWALE PARCEL NUMBERS

Swale	Parcel Numbers
C-10 East Alt. 1 (C-10 West Alt. 2 Option 1)	29-36-03-KL-1702-1, 29-36-03-KL-1702-5, 29-36-03-KL-1702-7, 29-36-03-KL-1702-8, 29-36-03-KL-1702-9, 29-36-03-KL-1702-10, 29-36-03-KL-1702-11, 29-36-03-KL-1702-12, 29-36-03-KL-1695-1, 29-36-03-KL-1695-2, 29-36-03-KL-1695-3, 29-36-03-KL-1695-4, 29-36-03-KL-1695-5, 29-36-03-KL-1695-6, 29-36-03-KL-1695-7, 29-36-03-KL-1695-8, 29-36-03-KL-1695-9, 29-36-03-KL-1695-10, 29-36-03-KL-1695-11, 29-36-03-KL-1695-12, 29-36-03-KL-1695-13, 29-36-02-GI-982-29, 29-36-02-GI-982-30, 29-36-02-GI-982-31, 29-36-02-GI-982-32, 29-36- 02-GI-982-33, 29-36-02-GI-982-34, 29-36-02-GI-982-35
C-20 Supplemental Swale	29-36-02-GI-1000-1, 29-36-02-GI-1000-2, 29-36-02-GI-1000-3, 29-36-02-GI-1011-1, 29-36- 02-GI-1011-2, 29-36-02-GI-1011-3, 29-36-02-GI-1011-4, 29-36-02-GI-1011-5

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX G

Existing Permits

Malabar Road PD&E Study

FM No. 437210-1-28-01

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G.1

Permit No. 113120-2



St. Johns River Water Management District

Kirby B. Green III, Executive Director • David W. Fisk, Assistant Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • (386) 329-4500
On the Internet at www.sjrwmd.com.

November 11, 2008

Brevard County Road and Bridge
2725 Judge Fran Jamieson Way, Building A, Room 201
Viera, FL 32940

SUBJECT: Permit Number 4-009-113120-2
Malabar Road Extension

Dear Sir/Madam:

Enclosed is your permit as authorized by the Governing Board of the St. Johns River Water Management District on November 11, 2008.

This permit is a legal document and should be kept with your other important documents. The attached MSSW/Stormwater As-Built Certification Form should be filled in and returned to the Palatka office within thirty days after the work is completed. By so doing, you will enable us to schedule a prompt inspection of the permitted activity.

In addition to the MSSW/Stormwater As-Built Certification Form, your permit also contains conditions which require submittal of additional information. All information submitted as compliance to permit conditions must be submitted to the Palatka office address.

Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state and/or local agencies asserting concurrent jurisdiction for this work.

In the event you sell your property, the permit can be transferred to the new owner, if we are notified by you within thirty days of the sale. Please assist us in this matter so as to maintain a valid permit for the new property owner.

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,

Gloria Lewis, Director
Division of Regulatory Information Management

Enclosures: Permit with EN Form(s), if applicable

cc: District Permit File

Agent: Allen Engineering, Inc.
P.O. Box 321321
Cocoa Beach, FL 32932-1321

GOVERNING BOARD

David G. Graham, CHAIRMAN
JACKSONVILLE

Susan N. Hughes, VICE CHAIRMAN
PONTE VEDRA

Ann T. Moore, SECRETARY
BUNNELL

W. Leonard Wood, TREASURER
FERNANDINA BEACH

Douglas C. Bourrique
VERO BEACH

Michael Ertel
OMIEDO

Hersey "Herky" Huffman
ENTERPRISE

Arlen N. Jumper
FORT McCOY

Hans G. Tanzler III
JACKSONVILLE

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO. 4-009-113120-2

DATE ISSUED: November 11, 2008

PROJECT NAME: Malabar Road Extension

A PERMIT AUTHORIZING:

Construction of a Surface Water Management System with stormwater treatment by swales for Malabar Road Extension, a 6.62-acre project to be constructed as per plans received by the District on May 22, 2008.

LOCATION:

Section(s): 32, 33 Township(s): 28S Range(s): 36E

Brevard County

ISSUED TO:

Brevard County Road and Bridge
2725 Judge Fran Jamieson Way, Building A, Room 201
Viera, FL 32940

Permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to permittee any property rights nor any rights of privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes:


PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated November 11, 2008


AUTHORIZED BY: St. Johns River Water Management District

Department of Water Resources

Governing Board

By: 

Jeff Elledge
(Director)

By: 

Kirby B. Greer III
(Assistant Secretary)

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 4-009-113120-2
BREVARD COUNTY ROAD AND BRIDGE
DATED NOVEMBER 11, 2008

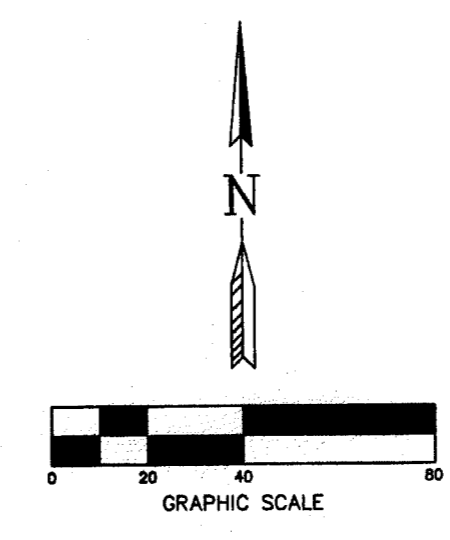
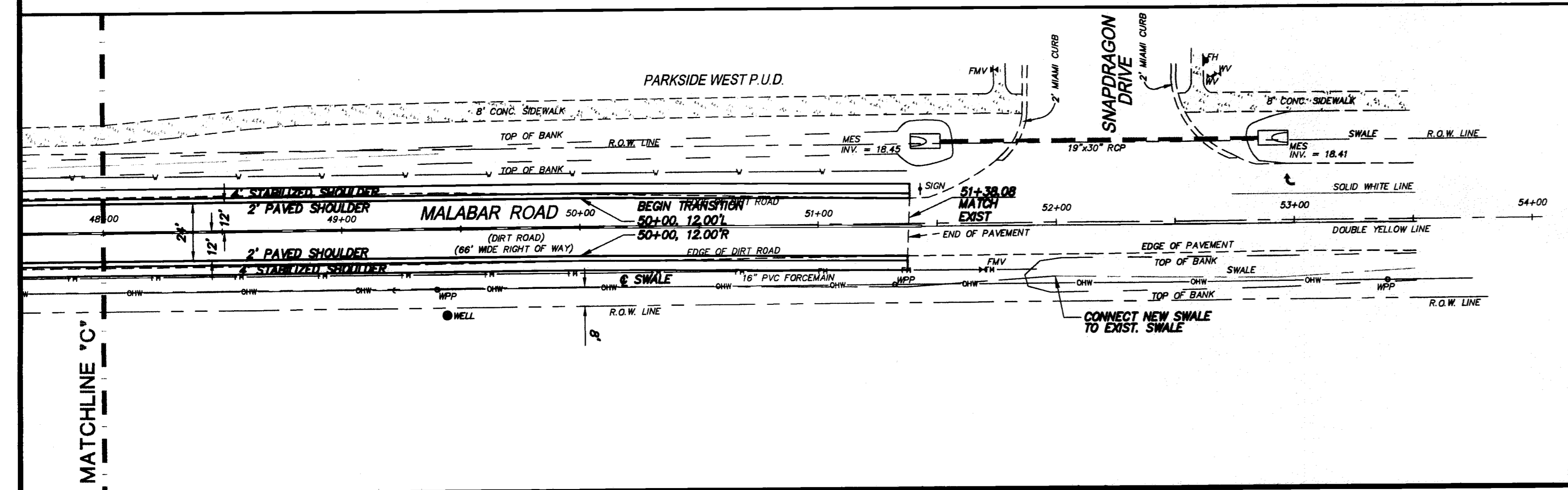
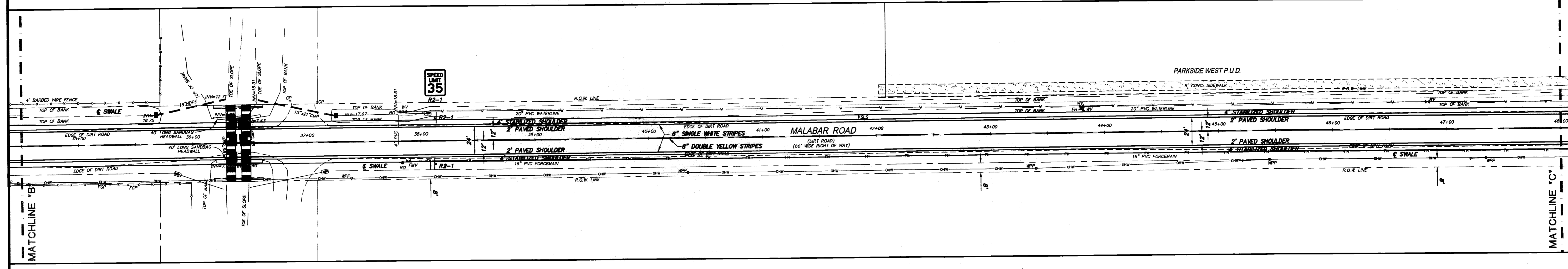
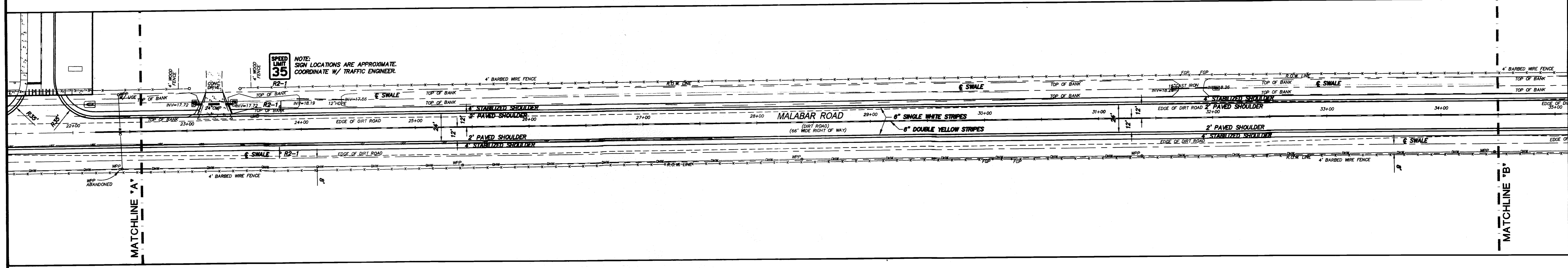
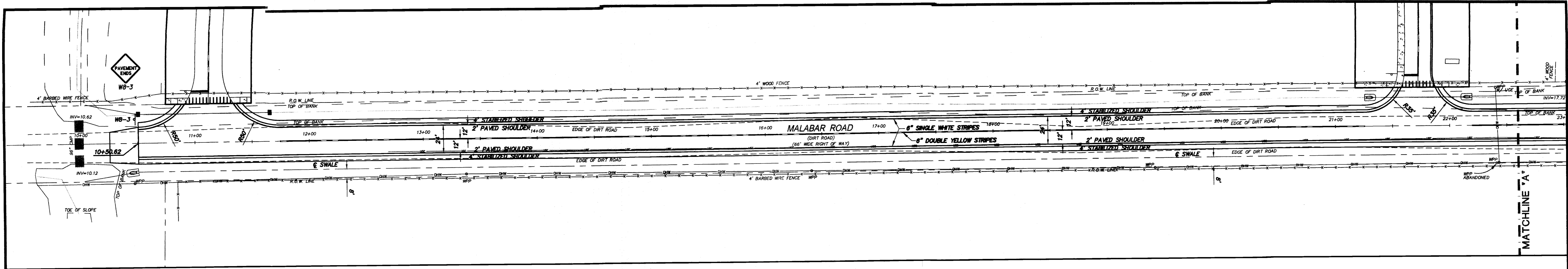
1. This permit for construction will expire five years from the date of issuance unless otherwise specified by a special condition of the permit.
2. Permittee must obtain a permit from the District prior to beginning construction of subsequent phases or any other work associated with this project not specifically authorized by this permit.
3. Before any offsite discharge from the stormwater management system occurs, the retention and detention storage must be excavated to rough grade prior to building construction or placement of impervious surface within the area served by those systems. Adequate measures must be taken to prevent siltation of these treatment systems and control structures during construction or siltation must be removed prior to final grading and stabilization.
4. The permittee must maintain a copy of this permit complete with all conditions, attachments, exhibits, and permit modification in good condition at the construction site. The complete permit must be available for review upon request by District representatives. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.
5. All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall be considered a violation of this permit.
6. District authorized staff, upon proper identification, must be granted permission to enter, inspect and observe the system to insure conformity with the plans and specifications approved by the permit.
7. Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are hereby incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which case the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specification in chapter 6 of the Florida Land Development Manual: A guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.
8. If the permitted system was designed by a registered professional, within 30 days after completion of the stormwater system, the permittee must submit to the District the following: District Form No. 40C-1.181(13) (As built Certification By a Registered Professional), signed and sealed by an appropriated professional registered in the State of Florida, and two (2) sets of "As Built" drawings when a) required by a special condition of this permit, b) the professional uses "As Built" drawings to support the As Built Certification, or c) when the completed system substantially differs from permitted plans. This submittal will serve to

notify the District staff that the system is ready for inspection and approval.

9. If the permitted system was not designed by a registered professional, within 30 days after completion of the stormwater system, the permittee must submit to the District the following: District Form No. 40C-1.181(14) (As built Certification), signed by the permittee and two (2) sets of "As Built" drawings when required by a special condition of this permit, or when the completed system substantially differs from permitted plans. This submittal will serve to notify the District staff that the system is ready for inspection and approval.
10. Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than seven (7) days before the construction activity in that portion of the site has temporarily or permanently ceased.
11. Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the District of the Changes prior to implementation so that a determination can be made whether a permit modification is required.
12. Within thirty (30) days after sale or conveyance of the permitted stormwater management system or the real property on which the system is located, the owner in whose name the permit was granted shall notify the District of such change of ownership. Transfer of the permit shall be in accordance with the provisions of section 40C-612, F.A.C. All terms and conditions of this permit shall be binding upon the transferee. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.
13. The stormwater management system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure. The system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of the stormwater management system to a local government or other responsible entity.
14. The operation phase of the permit shall not become effective until the requirements of Condition No. 8 or 9 have been met, the district determines that the system complies with the permitted plans, and the entity approved by the District in accordance with section 40C-42.027, F.A.C., accepts responsibility for operation and maintenance of the system. The permit cannot be transferred to such an approved, responsible operation and maintenance entity until the requirements of section 40C-42.028, F.A.C., are met, and the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the District in accordance with section 40C-42.028, F.A.C., the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to subsection 40C-42.028 (4) F.A.C., the permittee shall be liable for compliance with the terms of the permit.
15. Prior to lot or unit sales, or upon completion of construction of the system, whichever occurs first, the District must receive the final operation and maintenance document(s) approved by the District and recorded, if the latter is appropriate. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the District when maintenance and operation of the system is accepted by the local government entity, Failure to submit the appropriate final document will result in the permittee remaining personally liable for carrying out maintenance and operation of the permitted system.
16. This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any

interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and Chapter 40C-42.028, F.A.C.

17. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.
18. The permittee shall immediately notify the District in writing of any previously submitted information that is later discovered to be inaccurate.
19. Activities approved by this permit shall be conducted in a manner which do not cause violations of state water quality standards.
20. This permit for construction will expire five years from the date of issuance.
21. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to building construction or placement of impervious surface within the area to be served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.
22. All wetland areas or water bodies that are outside the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring or excess turbidity, and dewatering.
23. Prior to construction, the permittee must clearly designate the limits of construction on-site. The permittee must advise the contractor that any work outside the limits of construction, including clearing, may be a violation of this permit.
24. The stormwater management system must be inspected by the operation and maintenance entity once within two years after the completion of construction and every two years thereafter to insure that the system is functioning as designed and permitted. If a required inspection reveals that the system is not functioning as designed and permitted, then within 14 days of that inspection the entity shall submit an Exceptions Report on form number 40C-42.900(6), Exceptions Report for Stormwater Management System Out of Compliance. The operation and maintenance entity must maintain a record of each required inspection, including the date of inspection, the name, address, and telephone number of the inspector, and whether the system was functioning as designed and permitted, and make such record available for inspection upon request by the District during normal business hours.
25. The surface water management system must be constructed and operated in accordance with the plans received by the District on May 22, 2008.
26. Prior to initiation of construction of the surface water management system, the permittee shall provide an executed, original Cost Participation Agreement in the form approved by the District and deposit one thousand seven hundred fifty-four dollars and thirty cents (\$1,754.30) in the Escrow Account in accordance with paragraph 1 of the Agreement. The Escrow Amount shall be held in escrow for use by the District in designing, constructing, operating, and maintaining the C-1 Rediversion Project. Disbursement of the Escrow Amount shall be in accordance with the provisions of the approved Cost Participation Agreement.



Received
MAY 22 2008
13:20
Palm Bay SC

SCHOOL BOARD OF BREVARD COUNTY	DATE
HIGH SCHOOL CCC - MALABAR ROAD PALM BAY, FLORIDA OFF-SITE SITE AND STRIPING PLAN	3-14-08
ALLEN ENGINEERING, INC. FLORIDA CERTIFICATE OF AUTHORIZATION No. LB 266 P.O. BOX 321321 COCOA BEACH, FLORIDA 32932-1321 TELEPHONE: (321)783-7443 FAX: (321)783-5902 E-MAIL: info@alleneng.net	SCALE 1"=40'
<i>Don Allen</i>	JOB NO. 070007.2
JOHN M. ALLEN, P.E. 9423 DONALD F. ROBERTS, P.E. 9131 MICHAEL S. ALLEN, P.E. 45798 DAVIS A. LAVENDER, P.E. 65400	DRAWN DSL
	SHT. NO. 1

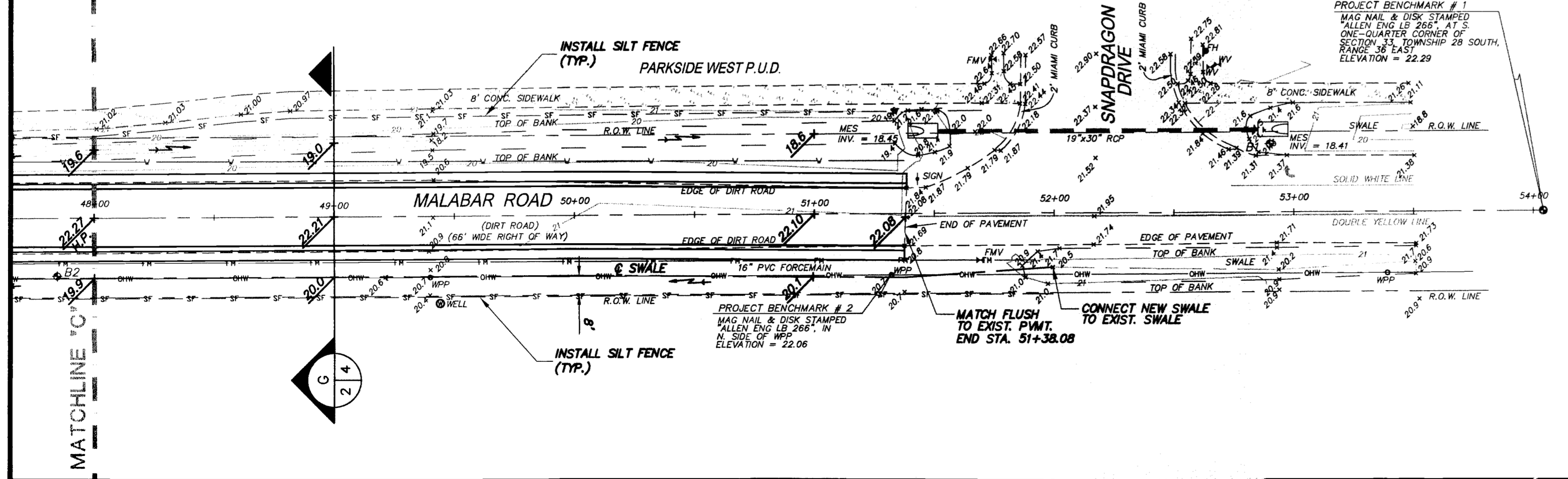
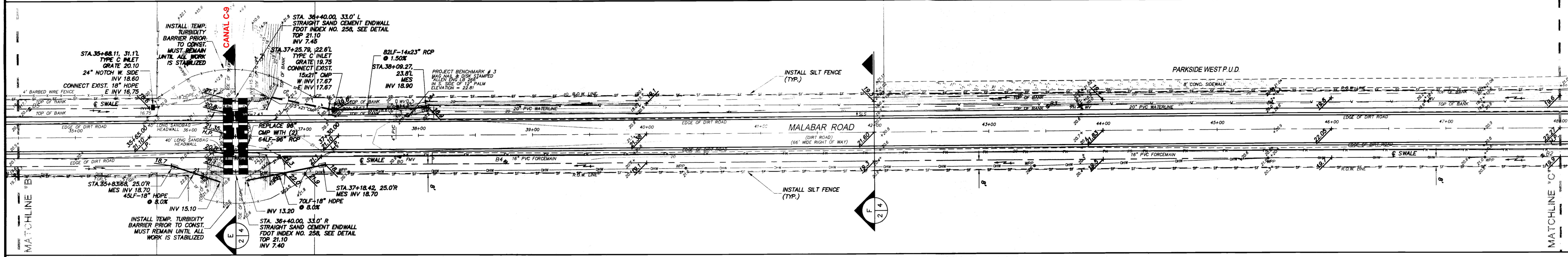
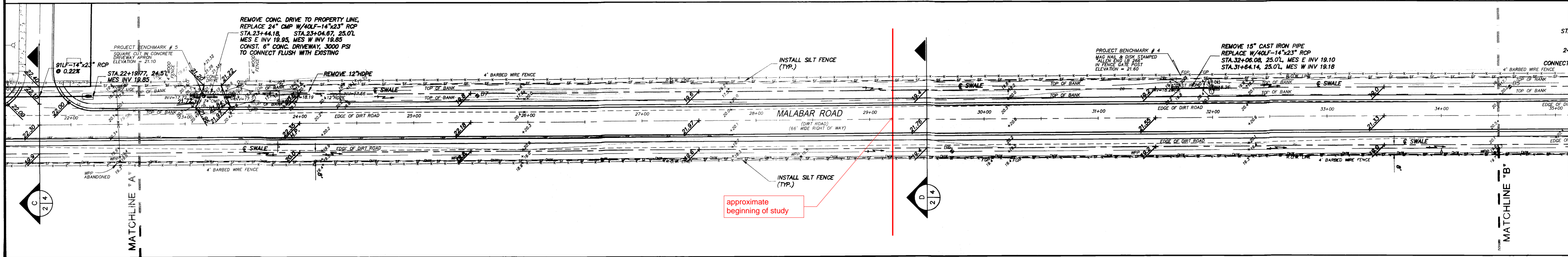
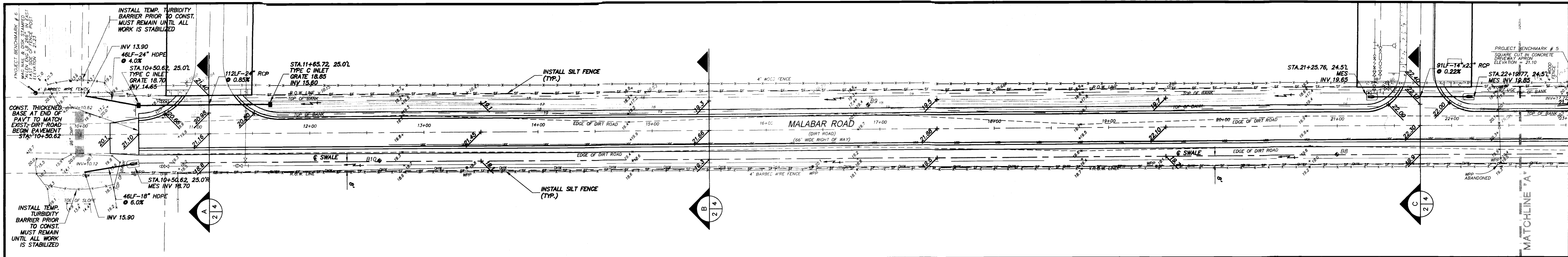
NO.	DATE	REVISIONS	BY

REPRODUCTION IN PART
OR WHOLE IS PROHIBITED
WITHOUT THE EXPLICIT
WRITTEN PERMISSION FROM
ALLEN ENGINEERING, INC.

MAY 20 2008

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LEGEND

- EXISTING GRADE
- EXISTING CONTOUR
- EXISTING UTILITIES
- EXISTING STORMDRAIN PIPE
- SS EXISTING SANITARY SEWER MAIN
- FM EXISTING FORCE MAIN
- G EXISTING GAS MAIN
- RW EXISTING RECLAIM WATER MAIN
- W EXISTING WATER MAIN
- PROPOSED SWALE FLOW LINE
- PROPOSED STORMDRAIN PIPE
- SF PROPOSED SILT FENCE
- PROPOSED GRADE
- DRAINAGE FLOW ARROW
- CROSS SECTION SYMBOL LABEL
- CUT ON SHEET / SHOWN ON SHEET

NOTES

- ANY DAMAGE TO THE EXISTING INFRASTRUCTURE, INCLUDING CULVERTS AND HEADWALLS, SWALES OR DITCHES, BY THE CONTRACTOR MUST BE REPLACED PRIOR TO FINAL INSPECTION.
- A VISUAL OR MECHANICAL INSPECTION OF THE EXISTING CULVERTS WILL BE REQUIRED PRIOR TO THE FINAL INSPECTION.
- ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE SODED SOLID ACCORDING TO FDOT STANDARD INDEX 105.

MAY 22 2008
113/2008

SCHOOL BOARD OF BREVARD COUNTY
DATE 3-14-08

**HIGH SCHOOL CCC - MALABAR ROAD
PALM BAY, FLORIDA
OFF-SITE PAVING AND DRAINAGE PLAN**
SCALE 1"=40'
JOB NO. 070007.2
DRAWN DSL

ALLEN ENGINEERING, INC.
FLORIDA CERTIFICATE OF AUTHORIZATION No. LB 266
P.O. BOX 321321 COCOA BEACH, FLORIDA 32932-1321
TELEPHONE: (321)783-7443 FAX: (321)783-5002 E-MAIL: info@alleneng.net

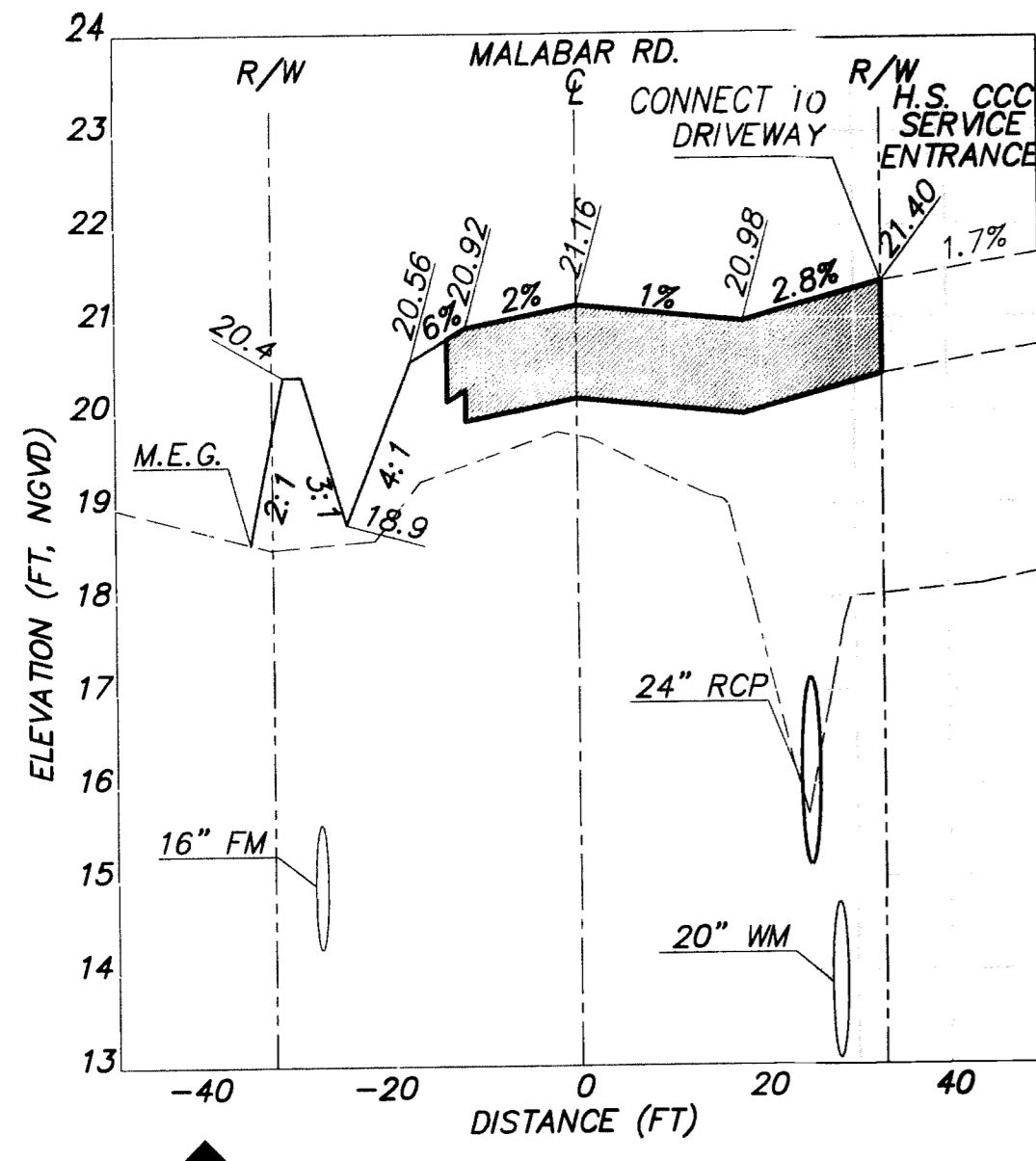
REPRODUCTION IN PART OR WHOLE IS PROHIBITED WITHOUT THE EXPLICIT WRITTEN PERMISSION FROM ALLEN ENGINEERING, INC.

NO.	DATE	REVISIONS	BY
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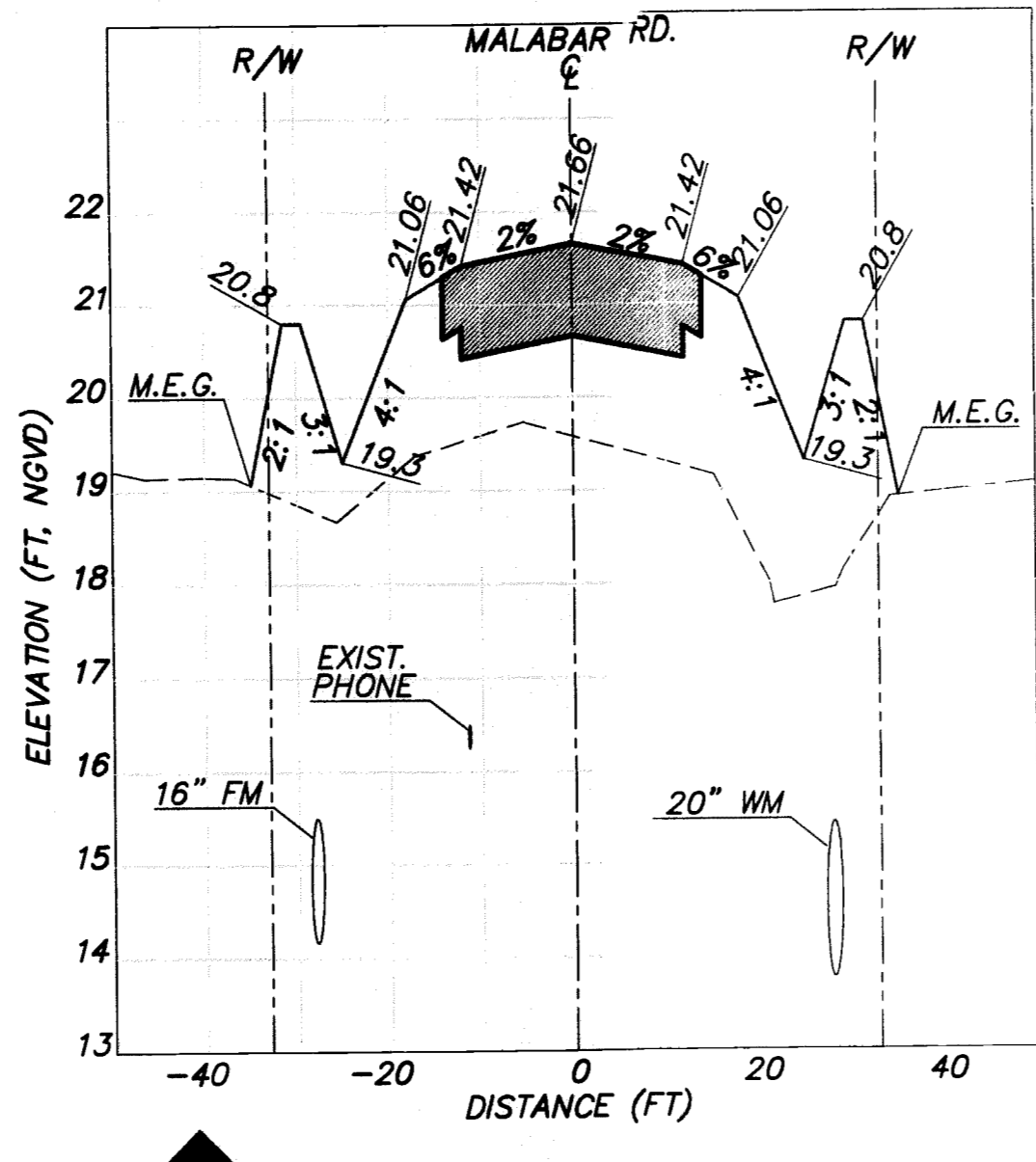
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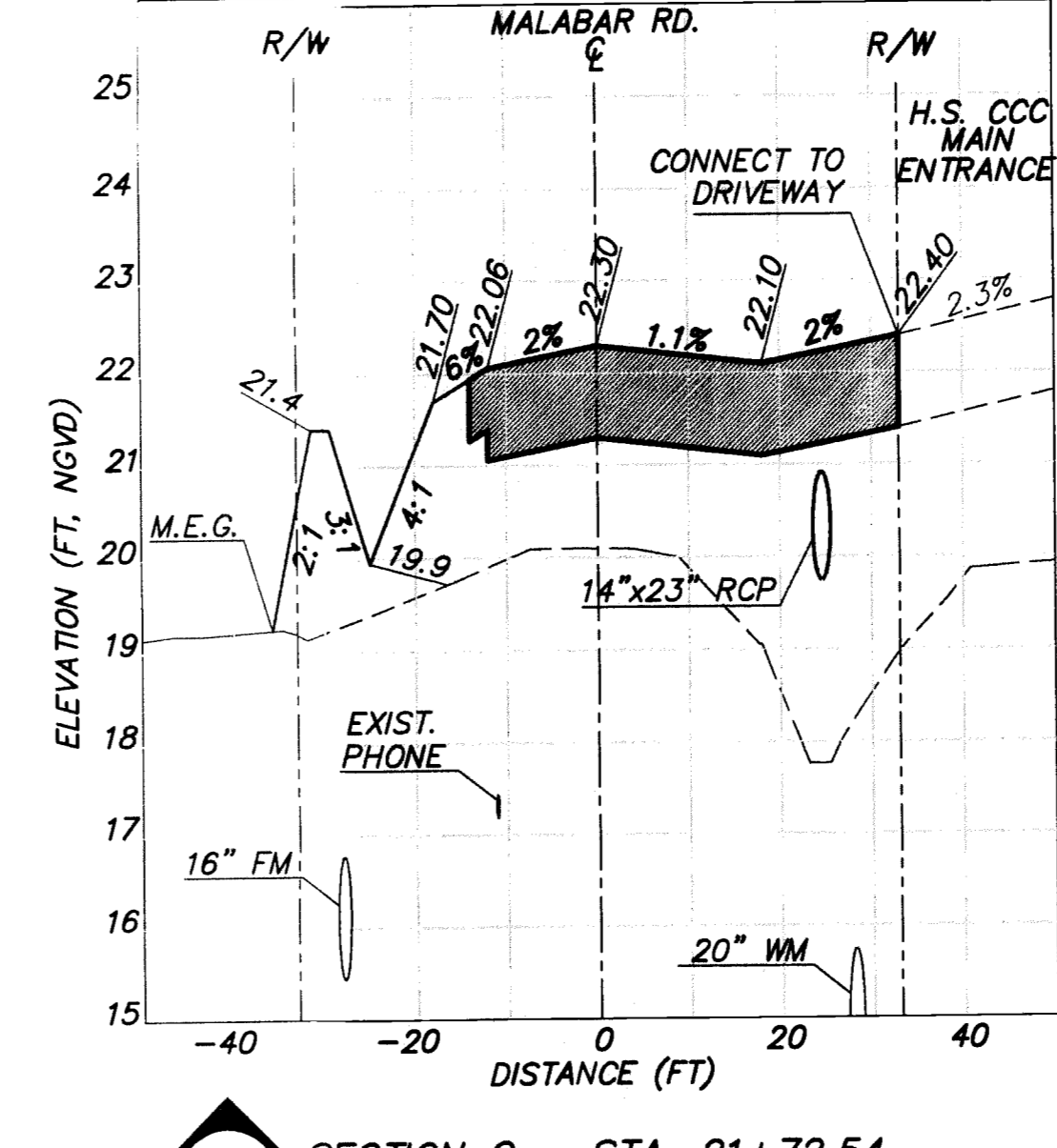
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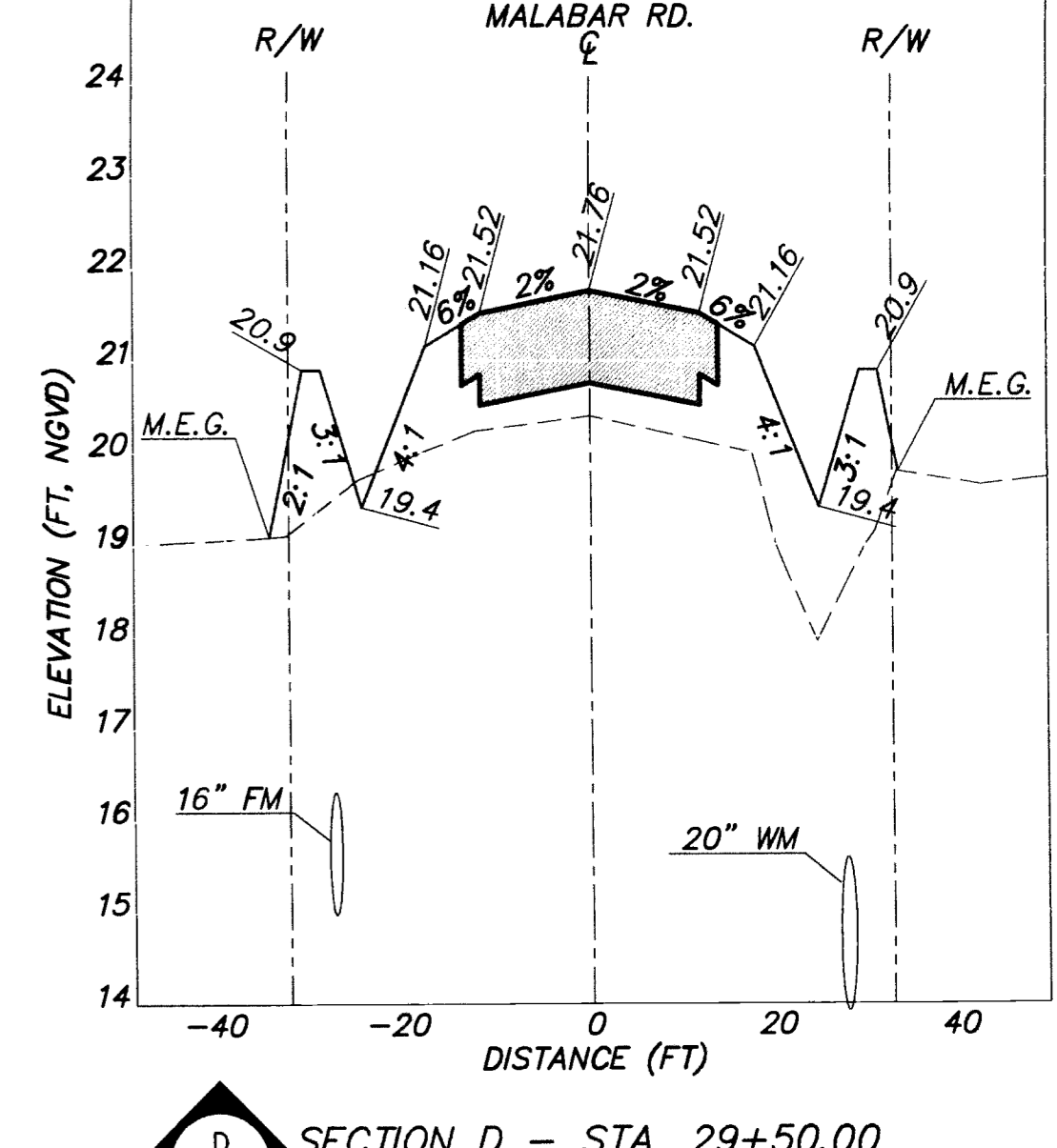
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VERT: 1"=2'



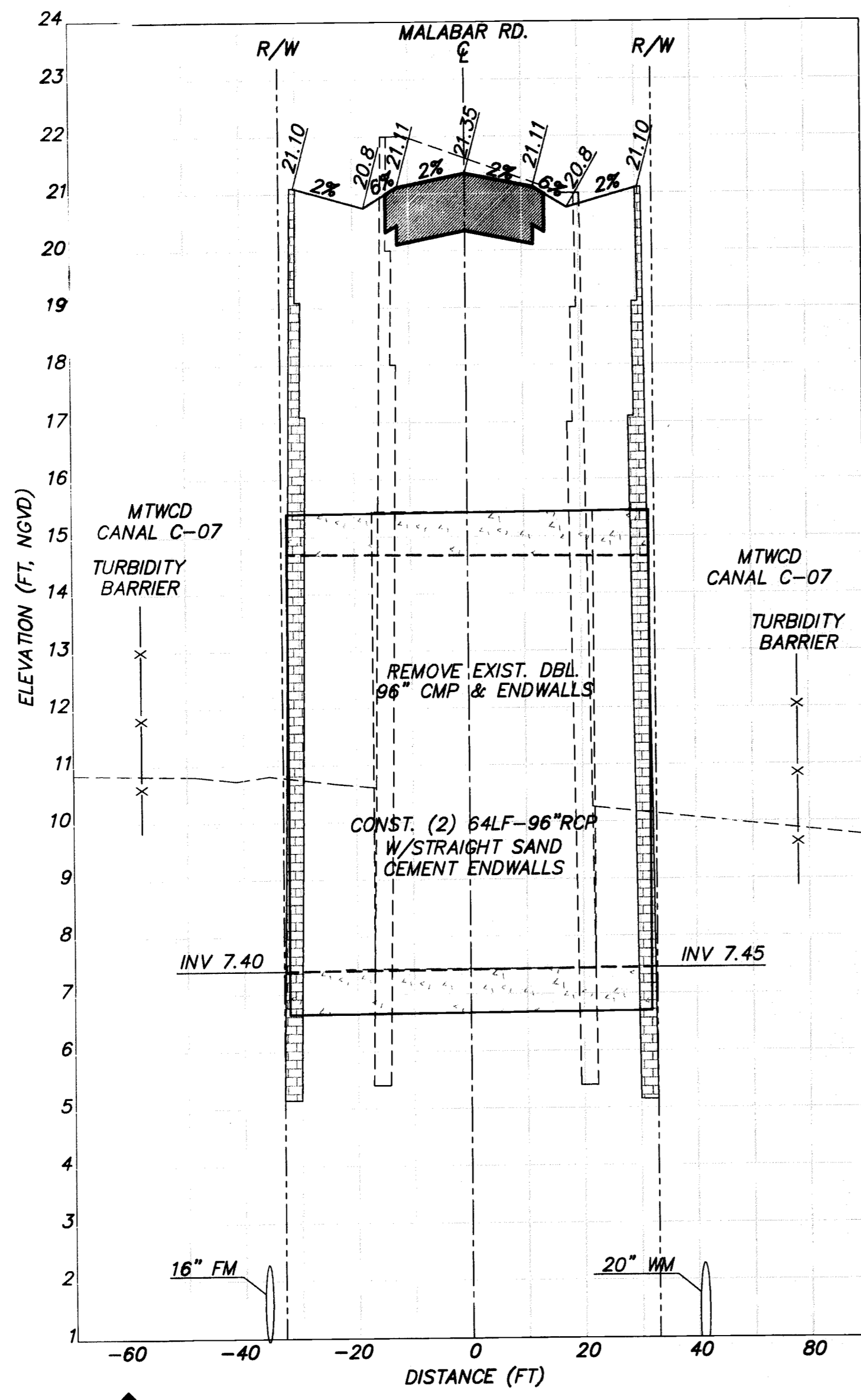
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VERT: 1"=2'



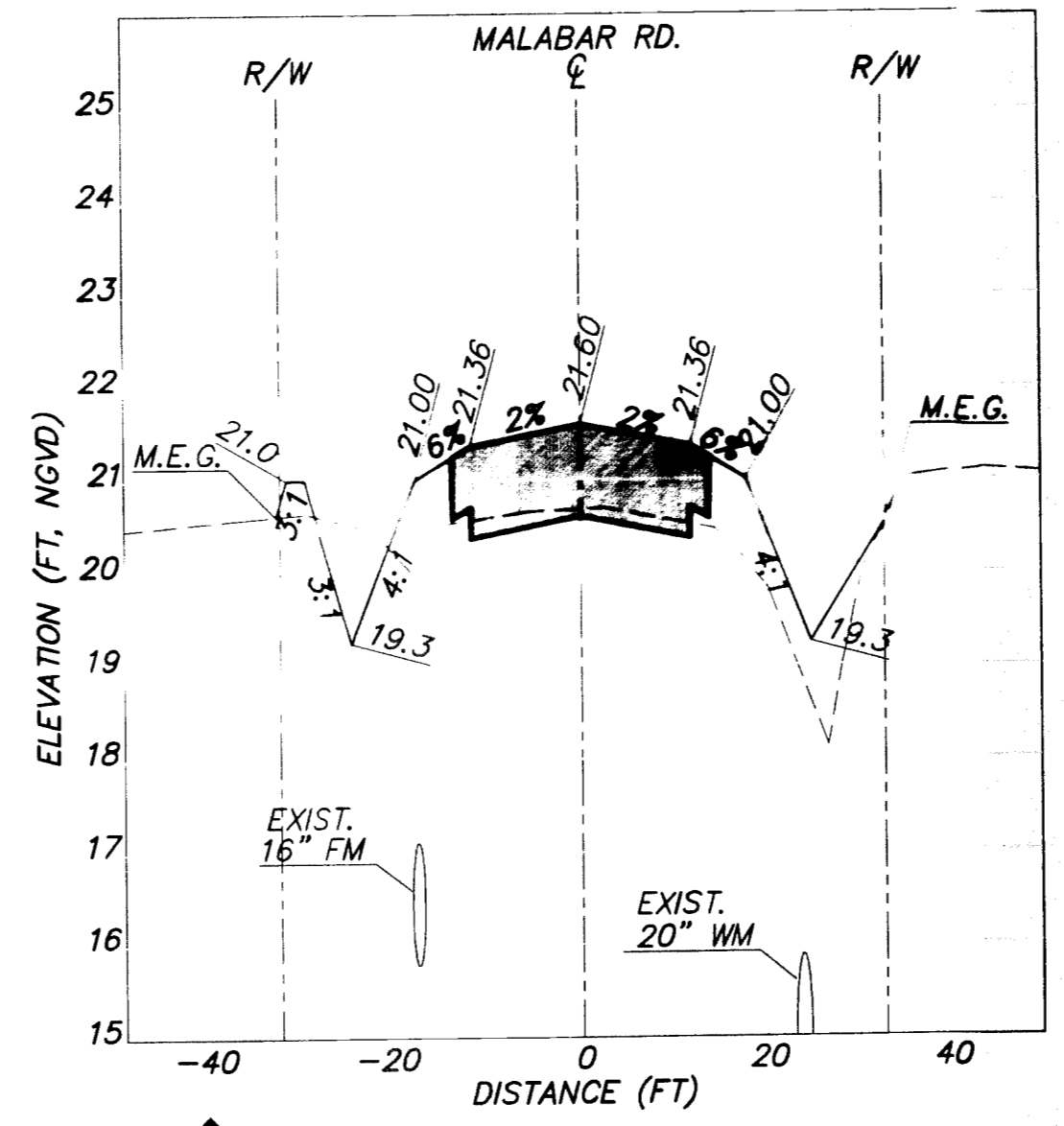
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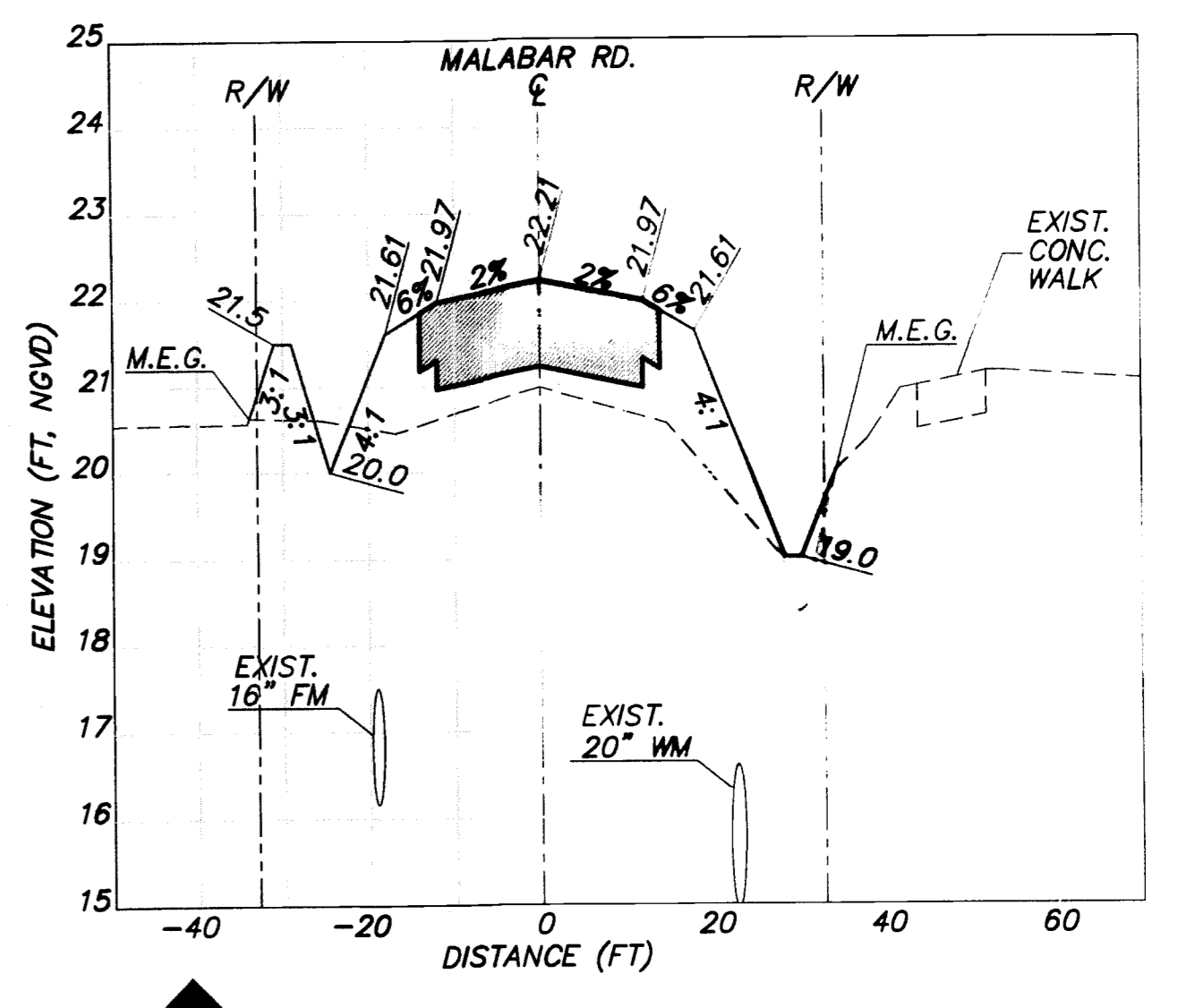
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VERT: 1"=2'



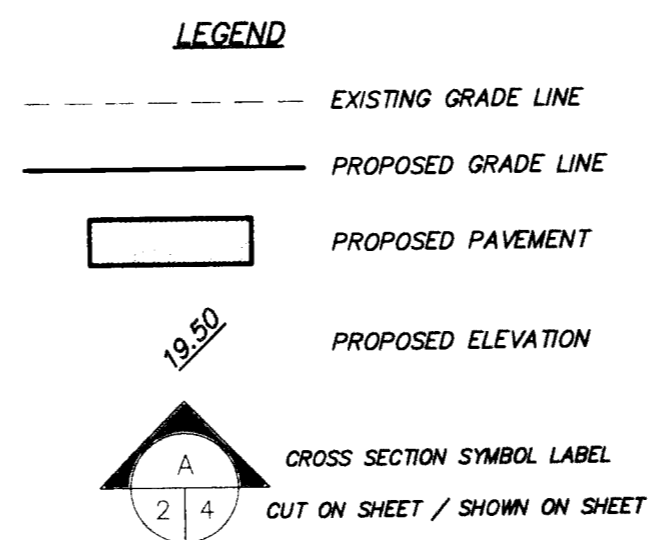
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F SECTION F - STA. 42+00.00
SCALE: HORIZ: 1"=20'
VERT: 1"=2'



G SECTION G - STA. 49+00.00
SCALE: HORIZ: 1"=20'
VERT: 1"=2'



- NOTES:
1. ANY DAMAGE TO THE EXISTING INFRASTRUCTURE, INCLUDING CULVERTS AND HEADWALLS, SWALES OR DITCHES, BY THE CONTRACTOR MUST BE REPLACED PRIOR TO FINAL INSPECTION.
 2. A VISUAL OR MECHANICAL INSPECTION OF THE EXISTING CULVERTS WILL BE REQUIRED PRIOR TO THE FINAL INSPECTION.
 3. ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE SODED SOLID ACCORDING TO FDOT STANDARD INDEX 105.
 4. NOT ALL EXISTING UNDERGROUND UTILITIES HAVE BEEN LOCATED, CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO DIGGING.

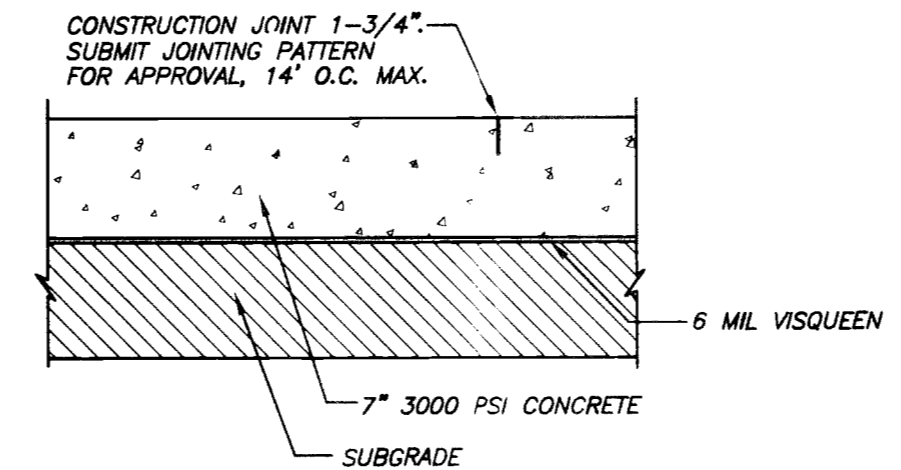
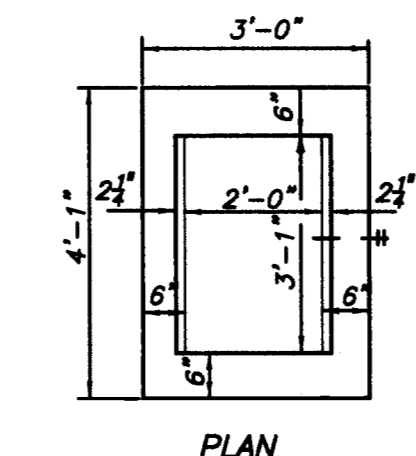
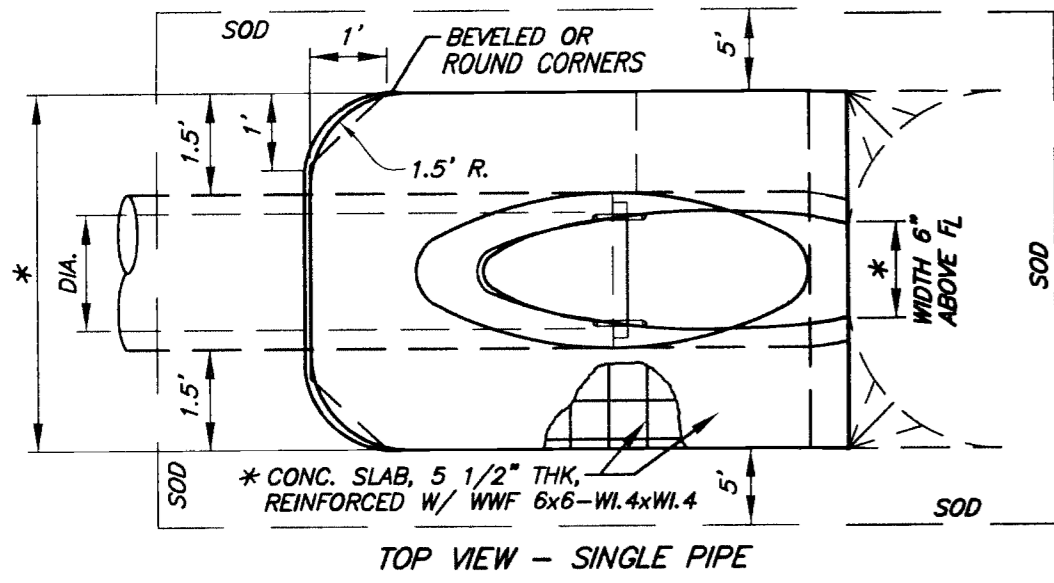
MAY 22 2008
113202

REPRODUCTION IN PART OR WHOLE IS PROHIBITED WITHOUT THE EXPLICIT WRITTEN PERMISSION FROM ALLEN ENGINEERING, INC.		NO.	DATE	REVISIONS	BY
1	4-17-08	REVISED ROAD ELEVATION ABOVE FLOOR	DAL		

SCHOOL BOARD OF BREVARD COUNTY		DATE
HIGH SCHOOL CCC - MALABAR ROAD PALM BAY, FLORIDA		3-14-08
OFF-SITE CROSS SECTIONS		SCALE AS SHOWN
ALLEN ENGINEERING, INC.		JOB NO. 070007.2
FLORIDA CERTIFICATE OF AUTHORIZATION No. LB 266		DRAWN DSL
P.O. BOX 321321 COCOA BEACH, FLORIDA 32932-1321		SHT. NO. 4
TELEPHONE: (321)783-7443 FAX: (321)783-5902 E-MAIL: info@alleneng.net		
JOHN M. ALLEN, P.E. 9423 *** DONALD F. ROBERTS, P.E. 9131		
MICHAEL S. ALLEN, P.E. 45798 *** DAVID A. LAVENDER, P.E. 66400		

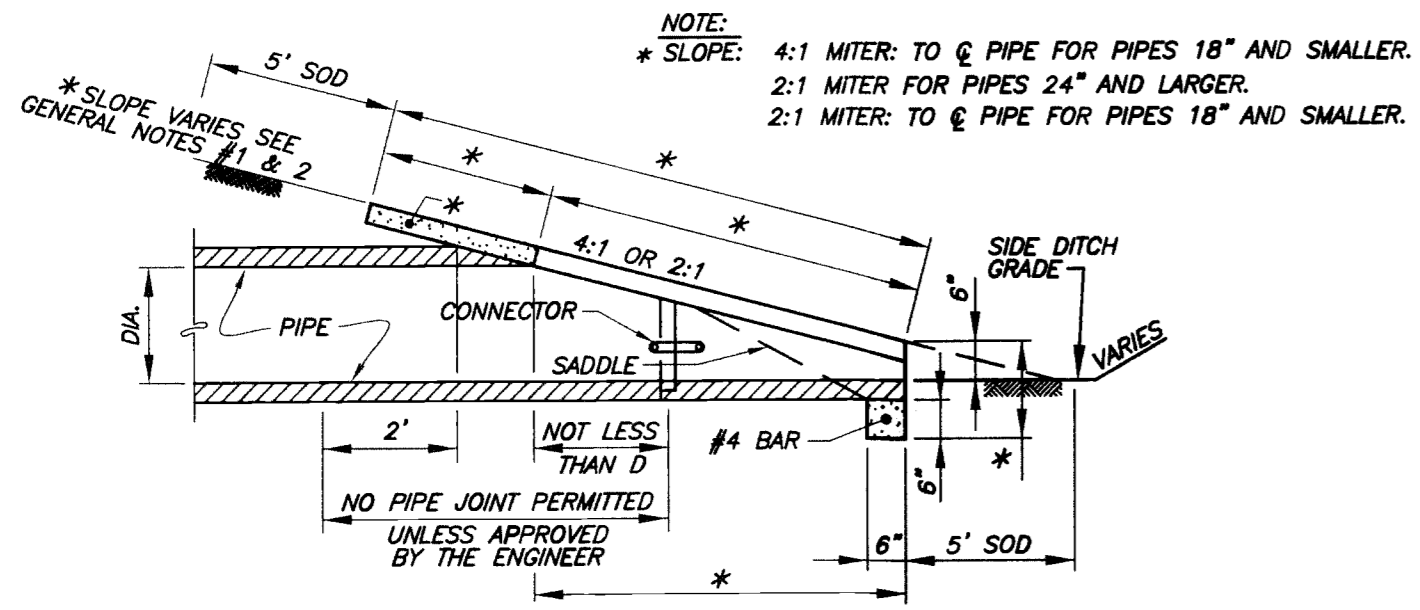
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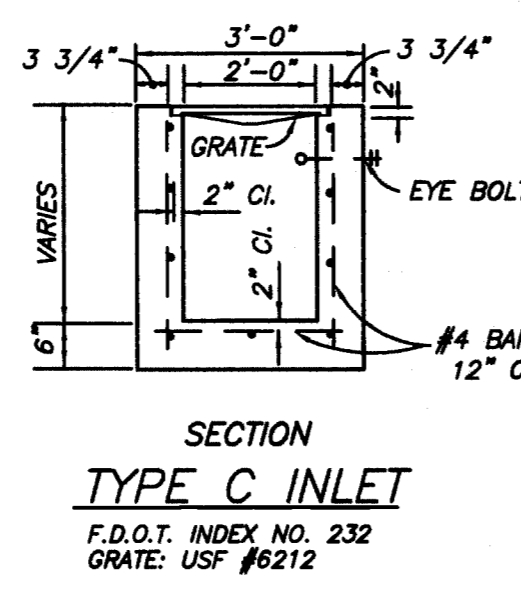


CONCRETE PAVEMENT SECTION
N.T.S.

- Notes:
1. For subgrade, use the existing surface grade or recommend clean fine sand fill (SP), without additional stabilization.
 2. Subgrade soils must be densified to at least 95 percent of Modified Proctor test maximum dry density (ASTM D 1557) for a depth of at least 2 feet, or the full depth of fill, whichever is greater, prior to placement of concrete.
 3. The surface of the subgrade soils must be smooth, and any disturbances or wheel rutting corrected prior to placement of concrete.
 4. The subgrade soils must be moistened prior to placement of concrete.
 5. Concrete pavement thickness should be uniform throughout, with exception to the thickened edges (curb or footing).



SECTION *SEE FDOT INDEX NO. 272
MITERED END SECTION
N.T.S.



SECTION
TYPE C INLET
F.D.O.T. INDEX NO. 232
GRADE: USE #6212

GENERAL NOTES:

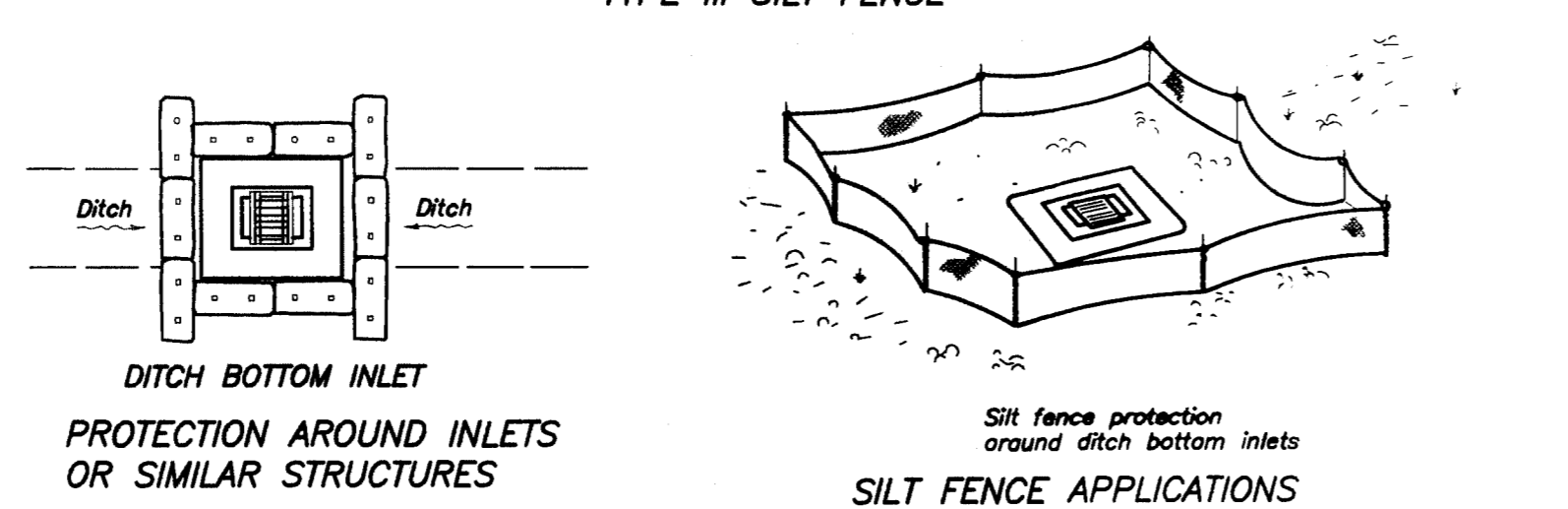
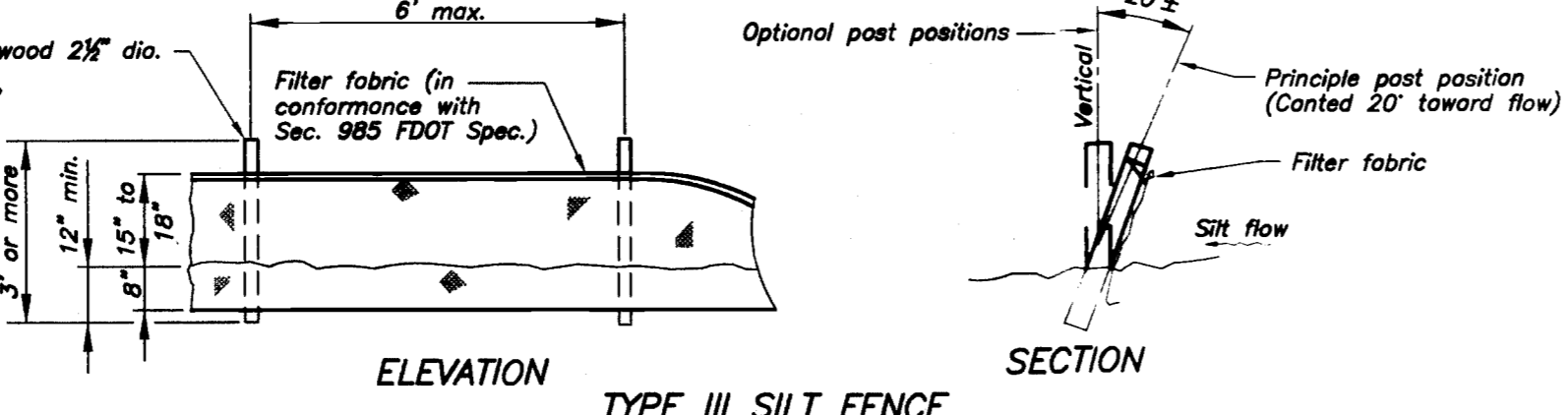
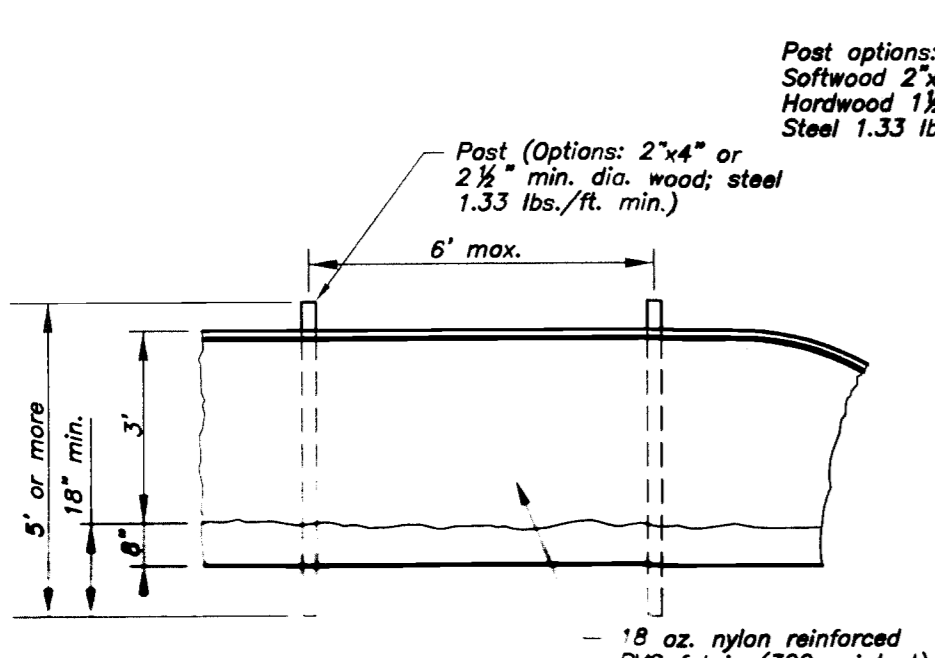
1. The Contractor shall notify all existing utility companies with facilities in the area of at least 48 hours prior to construction. Sunshine One - (800) 432-4770; City Gas - (800) 432-4770; City of Palm Bay (Water) - (800) 432-4770; Southern Bell - (800) 432-4770; Florida Power & Light - (800) 432-4770; City of Palm Bay (Sewer) - (800) 432-4770; St. John's River Water Management District - (321) 984-4940.
2. Locations of existing utilities as shown on plans are approximate but are based on best available information. Contractor shall determine the locations and critical elevations of utilities prior to construction.
3. Any discrepancies on the drawings shall be brought to the attention of the Engineer before commencing work.
4. The elevations shown herein are based on a published elevation of 21.77 feet (1929 National Geodetic Vertical Datum) on St. John's River Water Management District Monument "01-19-615-0".
5. According to F.I.R.M. (Flood Insurance Rate Map) Number 120404 0580 E, 125092 0580 E and 125092 0515 E. Map Index date: November 19, 1997, this property lies within F.I.R.M. Zone "AE", Base Flood Elevation = 21.
6. All pipe lengths are approximate and are measured from center of fittings and/or structures.
7. Conflicts between water, storm sewer, and sanitary sewer are to be resolved by adjusting water lines as necessary upon approval by Owner's Engineer.
8. Testing reports shall be copied to the Engineer's office & the City of Palm Bay.
9. A SJRWMD Consumptive Use Permit shall be obtained and maintained by the Contractor for any site dewatering.
10. The Contractor shall be responsible for any fines levied by the Regulatory Agencies due to use of improper techniques during dewatering.
11. Restore all disturbed areas to original conditions (including swales, driveways, and vegetation) at no increase in cost to the Owner. Seed and mulch all disturbed areas which do not have existing landscaping. Excess dirt will be hauled from the site.
12. Construction shall comply with the conditions of Permits from city of Palm Bay, FDEP, FDOT & SJRWMD.
13. Contractor is responsible for restoration of any existing pavement, sidewalks, curbing, utilities and drainage systems damaged during construction. All damaged areas to be restored to original condition or better. Any damage as a direct result of new construction to roadway, right of way, sidewalks, or utilities shall be repaired by contractor prior to C.O.
14. See soils report for fill and compaction requirements.
15. See soils report for sewer & utility line recommendations for soft or deleterious soils encountered during construction of utilities.
16. Provide notification to Engineering Inspection Service the City of Palm Bay Public Works Division at (321)952-3436, 48 hours prior to construction start.
17. Provide as-built information five (5) working days prior to request for Certificate of Occupancy.
18. Boundary and Topographic information provided by B.S.E. Consultants, Inc. Drawing No. 10554101, Dated 04/02/07.
19. The following shall be required where trench excavation exceeds 5 feet depth, see Laws of Florida, Chapter 90-96:
 - a. Include OSHA Standard 29 CFR, Section 1926.650 subpart P.
 - b. The Contractor shall provide written assurance of compliance with this Law.
 - c. A separate cost item identifying the cost of compliance.
 - d. A trench safety system shall be designed by the Contractor.

PAVING AND DRAINAGE NOTES:

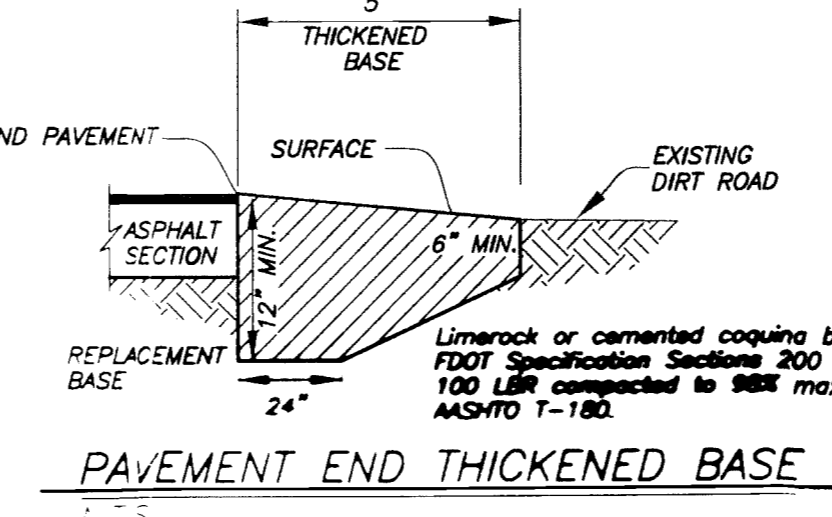
1. Install Reinforced Concrete Pipe (RCP) storm sewers. Circular pipes shall have 0-ring gaskets. Pipe joints shall be wrapped with filter fabric. PVC pipe shall meet ASTM D3034, SDR35 specifications. Polyethylene pipe shall be smooth wall meeting AASHTO M252 type S or M294 type S, depending on pipe size.
2. Existing off-site drainage patterns shall be maintained during construction. The Contractor shall provide the Engineer with As-Built Plans from a Registered Surveyor, as follows:
 - a. Storm Drains - Types, Size, Location, Invert Elevations, and Pipe Sizes
 - b. Site Elevations as shown on Engineering Plans
 - c. Swales - Top of bank and bottom
3. All underground utilities must be installed before roadway base and surface courses are constructed.
4. The Contractor shall adjust valve box covers, manhole rims and covers, grates, etc., necessary to match final grades as shown on plans.
5. The following shall be required where trench excavation exceeds 5 feet depth, see Laws of Florida, Chapter 90-96:
 - a. Include OSHA Standard 29 CFR, section 1926.650 subpart P.
 - b. The Contractor shall provide written assurance of compliance with this Law.
 - c. A separate cost item identifying the cost of compliance.
 - d. A trench safety system shall be designed by the contractor.
6. Concrete pavement/sidewalk construction and jointing shall be in accordance with ACI-330R.
7. All concrete used on project site shall have a minimum compressive strength of 3,000 PSI at 28 days, unless otherwise noted.
8. Where concrete paving is specified, provide full-depth expansion joints containing premolded joint filler at all manholes, storm sewer structures, buildings, sidewalks, power poles, or other permanent structures.
9. All storm structures, storm drain piping, asphalt paving and concrete paving shall meet the requirements of F.D.O.T. Standard Specifications for Road and Bridge Construction, 2006 Edition.
10. Contractor shall remove all organic material from the existing swales and ditches prior to backfilling with clean fill.
11. Final grade of edge of sidewalks shall not fall away from more than a 3% gradient slope for a minimum distance of 5 feet from the edge.
12. All swales/retention areas/depressed areas shall be sodded with bahia sod.
13. Side slopes with a grade greater than 3:1 shall be sod & pegged. Sod retention area side slopes. Pond banks steeper than 5:1 must be sodded.
14. The contractor shall be responsible to water the newly placed sod until a healthy stand of grass is established - approx. 80% establishment.
15. All swales shall be sodded with bahia sod to a distance of 5 feet outside of the top of bank.
16. A two foot strip of bahia sod shall be placed along edges of pavement and backs of curb immediately following paving.
17. Pipe for roof drain leaders shall be PVC (ASTM D3034, SDR35) unless otherwise noted.
18. Cleanouts for roof drain leaders shall have polished bronze plugs when located within a sidewalk or cast iron plugs with an 18" square concrete collar when located within a grass/landscaped area.
19. All structures shall meet FDOT requirements.
20. Centerline slopes not otherwise noted are 0.5%.
21. Sidewalks terminating a vehicular drives shall be ramped a 12H:1V to be flush with drive.

EROSION AND SEDIMENT CONTROL NOTES:

1. Sediment basins and traps, perimeter dikes, sediment barriers and other measures intended to trap sediment shall be constructed as a first step in any land disturbing activity and shall be made functional before upslope land disturbance takes place.
2. Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within seven days to denuded areas that may not be of final grade but remain undisturbed for longer than 30 days. Permanent stabilization shall be applied to areas that are to be left undisturbed for more than one year.
3. After any significant rainfall, sediment control structures will be inspected for integrity. Any damaged devices shall be corrected immediately.
4. Sediment will be prevented from entering any storm drain system, ditch, or channel. All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.
5. Before temporary or newly constructed stormwater conveyance channels are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.
6. Periodic inspection and maintenance of all sediment control structures must be provided to ensure intended purpose is accomplished. The Developer, owner and/or contractor shall be continually responsible for all sediment leaving the property. Sediment control measures shall be in working condition at end of each working day.
7. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property.
8. Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria:
 - (a) No more than 500 linear feet of trench may be opened at one time.
 - (b) Excavated material shall be placed on the uphill side of trenches.
 - (c) Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property.
 - (d) Restoration shall be accomplished in accordance with these regulations.
9. Where construction vehicle access routes intersect paved public roads, provisions shall be made to minimize the transport of sediment by tracking onto the paved surface. Where sediment is transported onto a public road surface with curbs and gutters, the road shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area. Street washing shall be allowed only after sediment is removed in this manner. This provision shall apply to individual subdivision lots as well as to larger land-disturbing activities.
10. Silt fences shall be installed along the limits of the fill areas prior to the start of construction. Silt fences shall remain in place and be maintained for duration of construction.
11. The Contractor shall use appropriate measures to prevent erosion and transport of sediment to surface drains. The Contractor shall use hay bales, silt barriers or other appropriate measures to mitigate adverse impacts to existing surface water quality. Turbidity barriers must remain in place until construction is completed, soils are stabilized, and vegetation has been established.



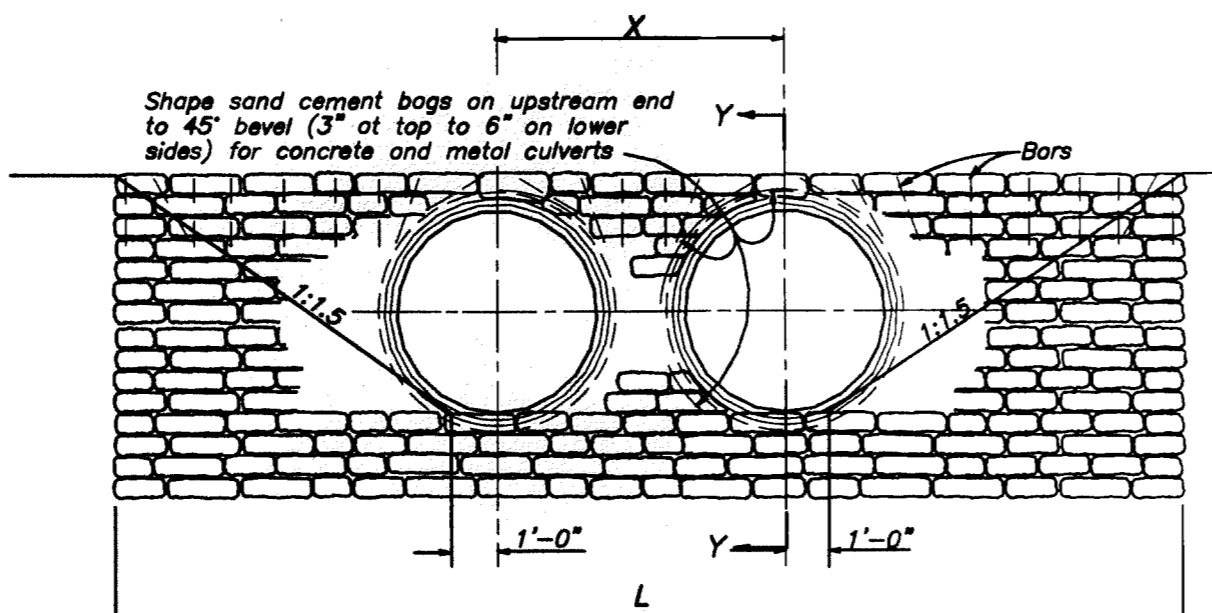
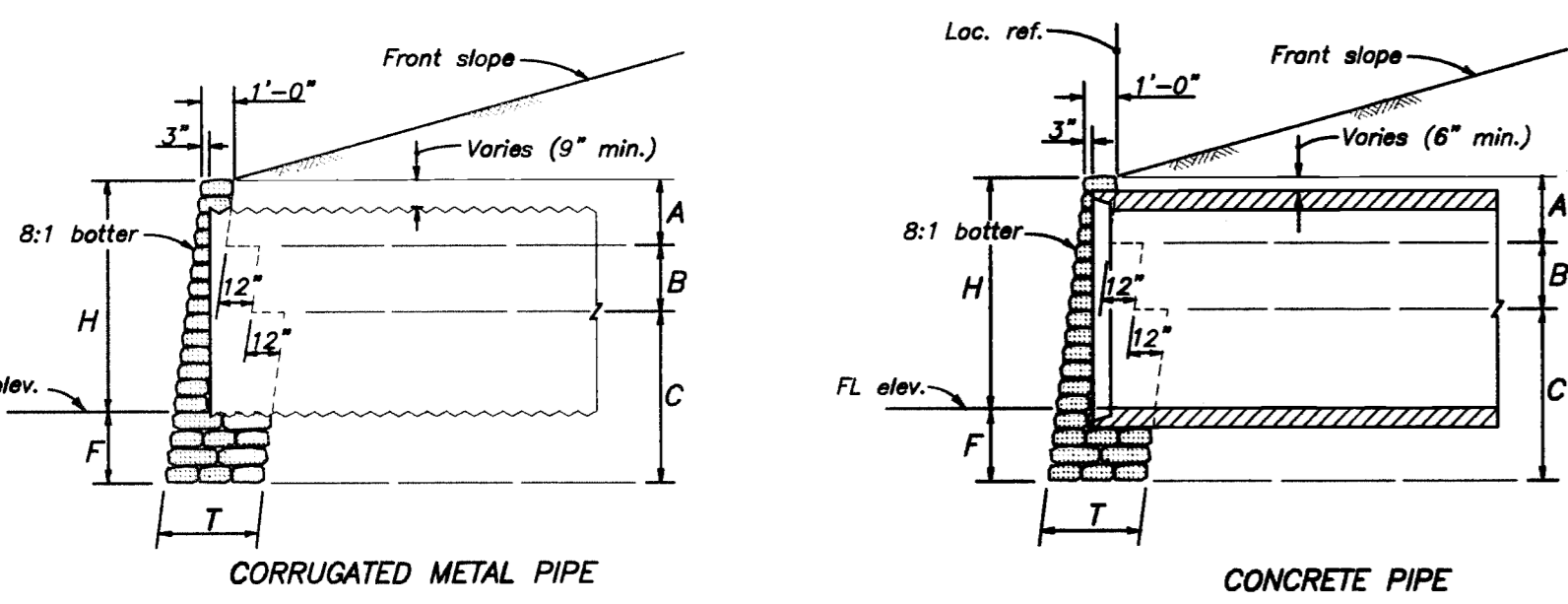
DITCH BOTTOM INLET PROTECTION AROUND INLETS OR SIMILAR STRUCTURES
SILT FENCE APPLICATIONS



PAVEMENT END THICKENED BASE

STAKED TURBIDITY BARRIER

Note:
Turbidity barriers for flowing streams and tidal creeks may be either floating, or staked types or any combinations of types that will suit site conditions and meet erosion control and water quality requirements. The barrier type(s) will be at the Contractor's option unless otherwise specified in the plans, however payment will be under the pay item(s) established in the plans for floating turbidity barrier and/or staked turbidity barrier. Posts in staked turbidity barriers to be installed in vertical position unless otherwise directed by the Engineer.



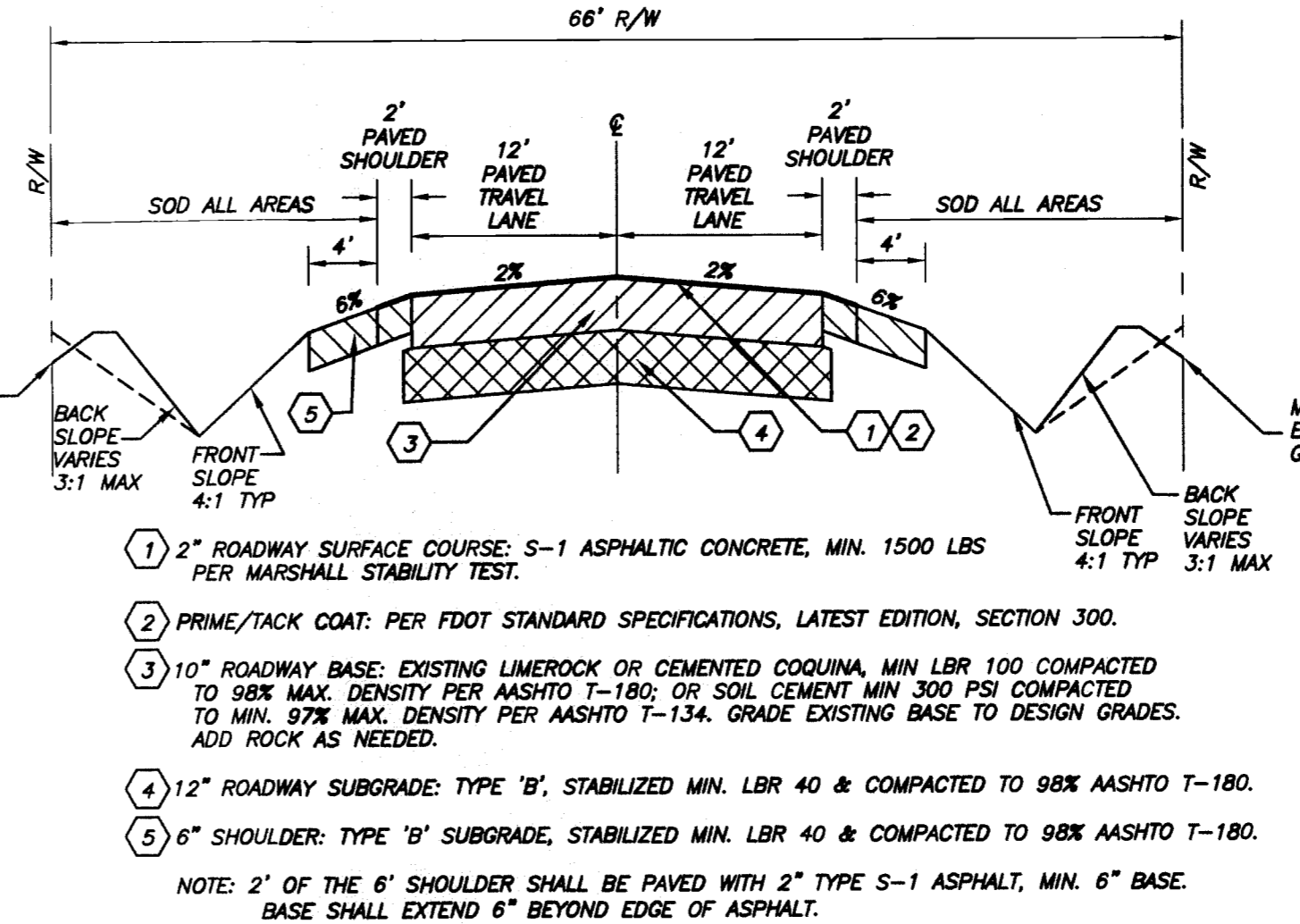
Note: (1) For concrete and corrugated metal pipes. Concrete pipe shown.
(2) The top row of riprap bags shall be secured by pinning, using #4 reinforcing bars 18 inches in length, as follows:
(a) The end bags shall be secured using two bars per bag, one vertical and one diagonal as shown.
(b) The next to last bag on each end shall be secured with two bars vertically.
(c) Bags located over the pipe shall be secured by a bar which is driven diagonally except that for concrete pipe two bars shall be used for single bags above the pipe.
(d) Intermediate bags shall be secured with a single bar.
Bars shall be driven to one inch below the surface of the bag.
The cost of furnishing and installing the bars shall be included in the cost of the riprap.

GENERAL NOTES

1. Straight sand-cement endwalls are intended for use outside the clear zone.
2. Height 'H' and 'C' may be increased to the necessary dimensions to obtain the overall height of wall as shown on the plans.

SIZE OF PIPE	H	T	A	B	C	F	X	TWO PIPE CULVERTS	
								L	RIPRAP CY
18"	2'-3"	1'-0"	4'-0"	0'-0"	0'-0"	1'-9"	2'-10"	11'-7"	1.5 1.6
24"	2'-9"	2'-0"	2'-0"	2'-6"	0'-0"	1'-9"	3'-5"	13'-8"	3.0 3.2
30"	3'-4"	2'-0"	2'-0"	3'-2"	0'-0"	1'-10"	4'-3"	16'-3"	4.2 4.5
36"	3'-10"	2'-0"	2'-0"	3'-8"	0'-0"	1'-10"	5'-1"	18'-7"	5.2 5.7
42"	4'-5"	3'-0"	2'-0"	2'-0"	2'-4"	1'-11"	6'-0"	21'-3"	8.3 8.9
48"	4'-11"	3'-0"	2'-0"	2'-0"	2'-10"	1'-11"	6'-9"	23'-6"	10.0 10.8
54"	5'-6"	3'-0"	2'-0"	2'-0"	3'-6"	2'-0"	7'-8"	26'-2"	12.4 13.5
60"	6'-0"	3'-0"	2'-0"	2'-0"	4'-0"	2'-0"	8'-6"	28'-6"	14.4 15.8
66"	6'-7"	3'-0"	2'-0"	2'-0"	4'-8"	2'-1"	9'-3"	31'-0"	17.2 18.9
72"	7'-1"	3'-0"	2'-0"	2'-0"	5'-2"	2'-1"	10'-0"	33'-3"	19.4 21.4
78"	7'-8"	3'-0"	2'-0"	2'-0"	5'-10"	2'-2"	10'-9"	35'-9"	22.6 25.0
84"	8'-2"	3'-0"	2'-0"	2'-0"	6'-4"	2'-2"	11'-8"	38'-2"	25.3 28.1
96"	9'-4"	3'-0"	2'-0"	2'-0"	7'-7"	2'-3"	13'-4"	43'-3"	

MODIFIED STRAIGHT SAND-CEMENT ENDWALLS
FDOT Index No. 258



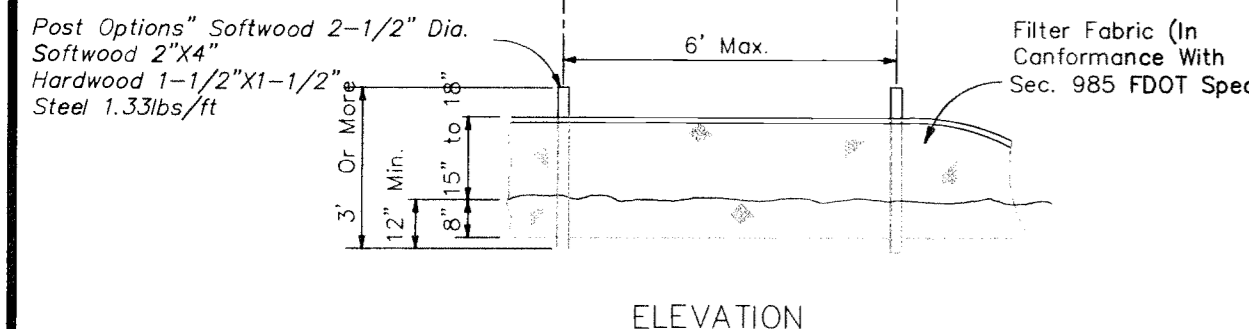
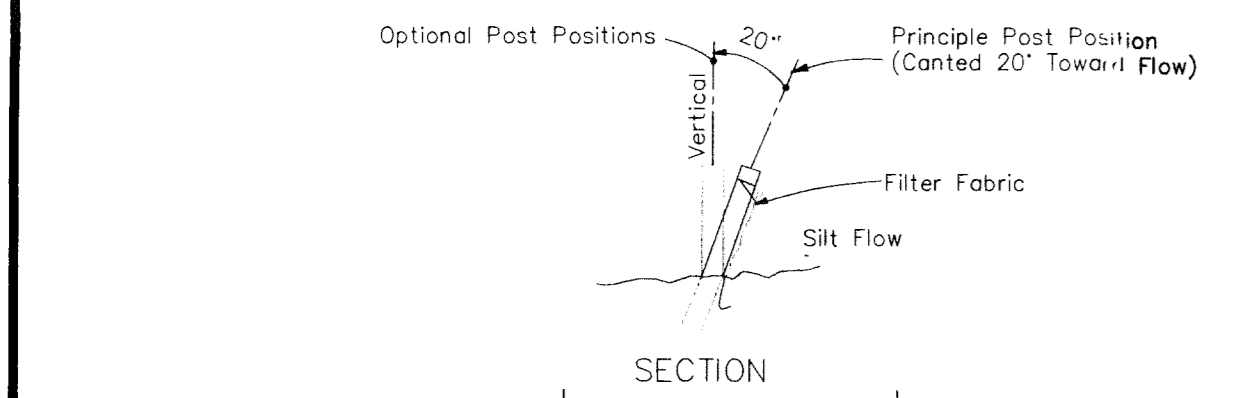
MALABAR ROAD SECTION
N.T.S.

REPRODUCTION IN PART OR WHOLE IS PROHIBITED WITHOUT THE EXPLICIT WRITTEN PERMISSION FROM ALLEN ENGINEERING, INC.

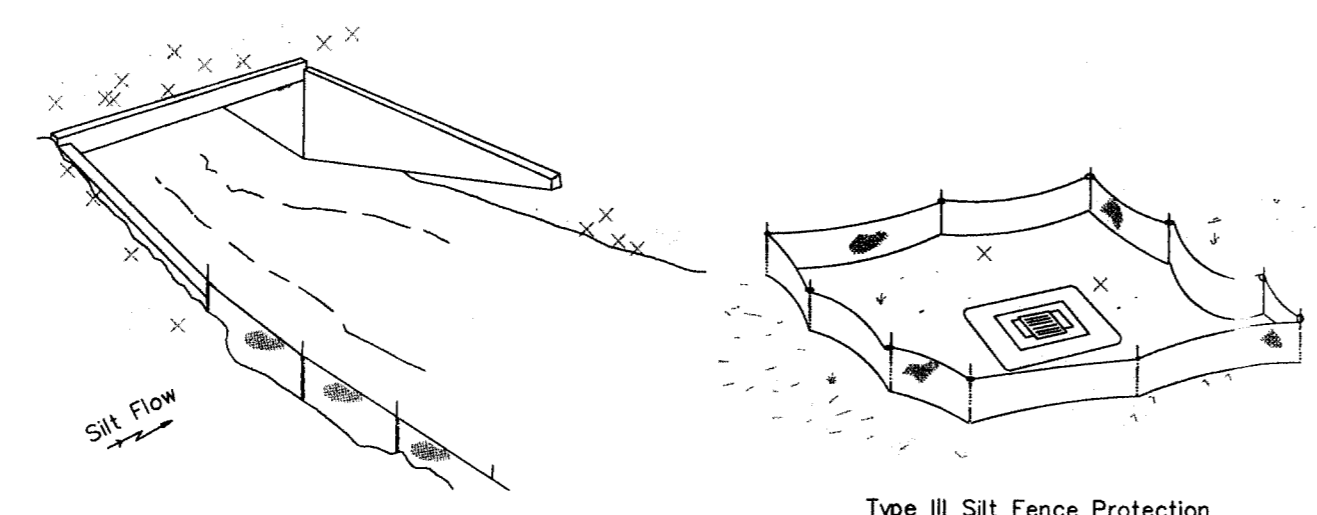
NO.	DATE	REVISIONS

SCHOOL BOARD OF BREVARD COUNTY		DATE
HIGH SCHOOL CCC - MALABAR ROAD PALM BAY, FLORIDA		3-14-08
PAVING AND DRAINAGE DETAILS		SCALE
ALLEN ENGINEERING, INC.		NTS
FLORIDA CERTIFICATE OF AUTHORIZATION No. LB 266		JOB NO.
P.O. BOX 321321 COCOA BEACH, FLORIDA 32932-1321		070007.2
TELEPHONE: (321)783-7443 FAX: (321)783-5902 E-MAIL: info@alleneng.com		DRAWN
		DSL
		SHT. NO.
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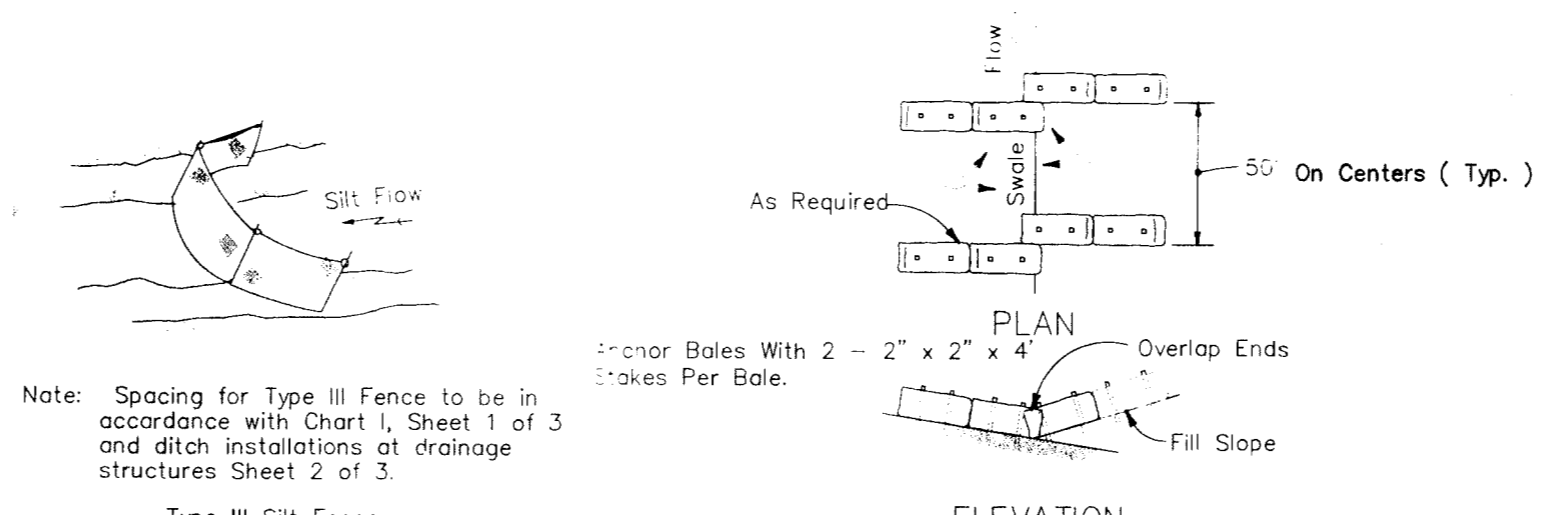


TYPE III SILT FENCE



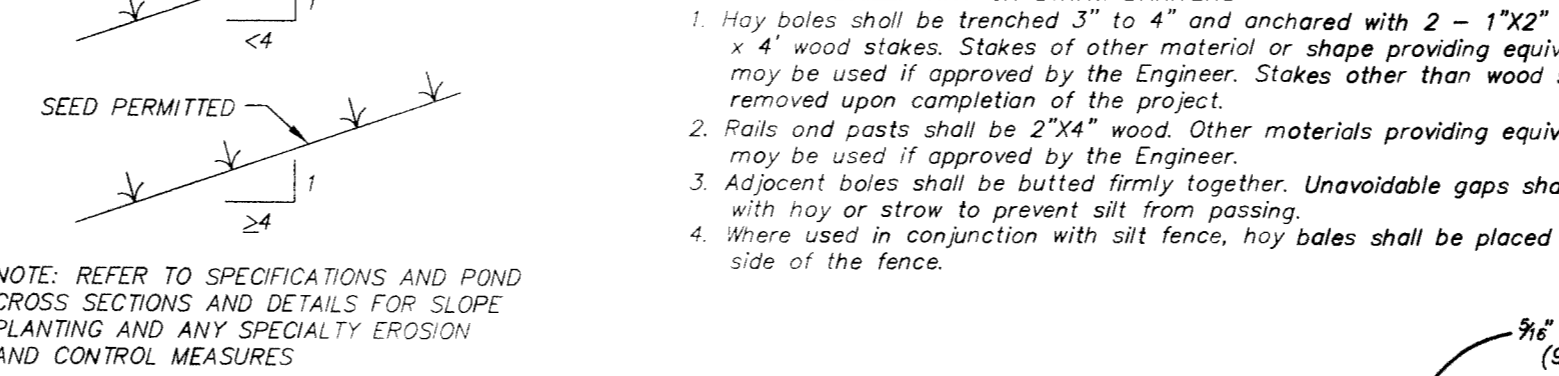
NOTES FOR SILT FENCES
 1. Do not construct silt fences across permanent flowing watercourses. Silt fences are to be upland locations and turbidity barriers used at permanent bodies of water.
 2. Where used as slope protection, Silt Fence is to be constructed on a 0% longitudinal grade to avoid channelizing runoff along the length of the fence.

SILT FENCE APPLICATIONS



NOTES FOR BAILED HAY OR STRAW BARRIERS
 1. Hay bales shall be trenched 3" to 4" and anchored with 2 - 1"x2" (or 1" dia.) x 4' wood stakes. Stakes of other material or shape providing equivalent strength may be used if approved by the Engineer. Stakes other than wood shall be removed upon completion of the project.
 2. Ribs and posts shall be 2"x4" wood. Other materials providing equivalent strength may be used if approved by the Engineer.
 3. Adjacent bales shall be butted firmly together. Unavoidable gaps shall be plugged with hay or straw to prevent silt from passing.
 4. Where used in conjunction with silt fence, hay bales shall be placed on the upstream side of the fence.

BARRIERS FOR FILL SLOPES

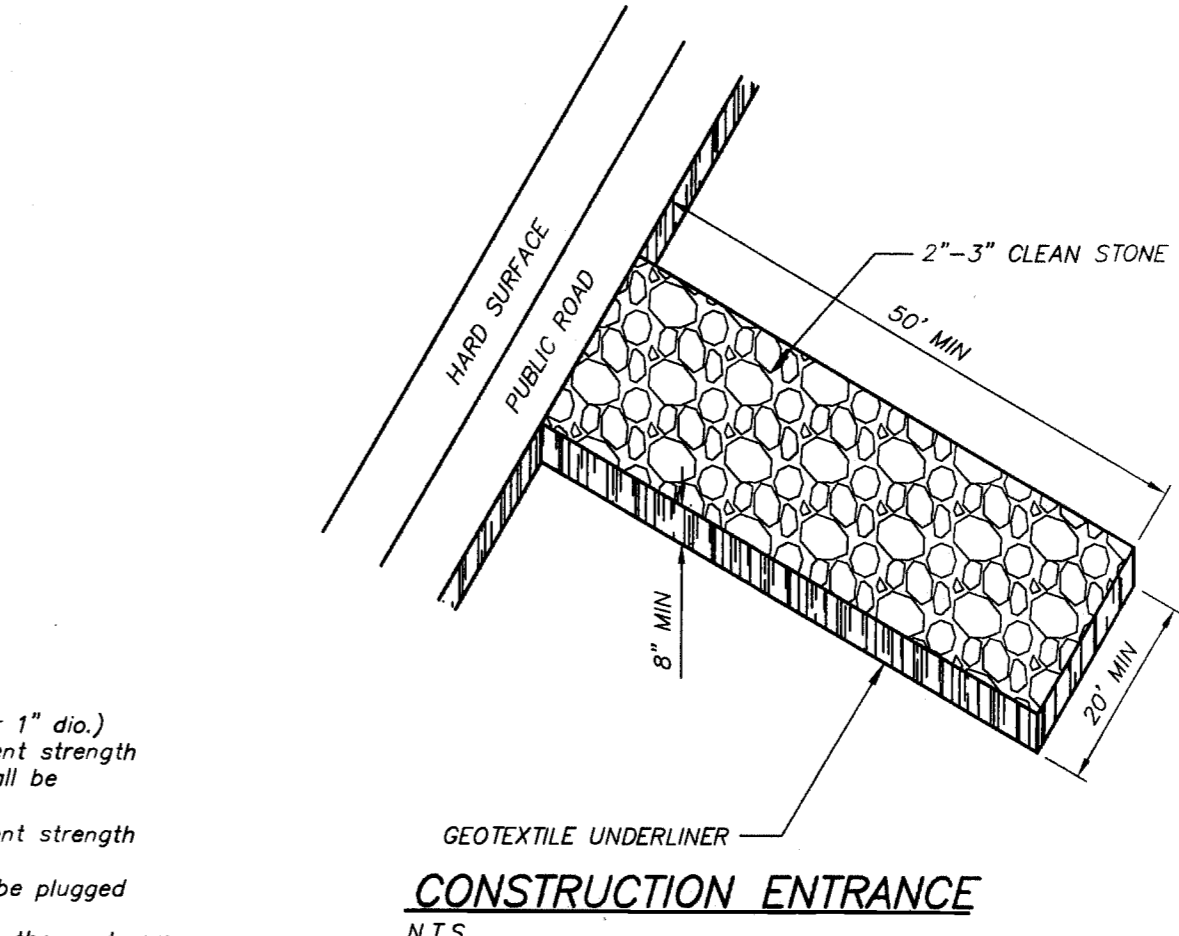


NOTE: REFER TO SPECIFICATIONS AND POND CROSS SECTIONS AND DETAILS FOR SLOPE PLANTING AND ANY SPECIALTY EROSION AND CONTROL MEASURES

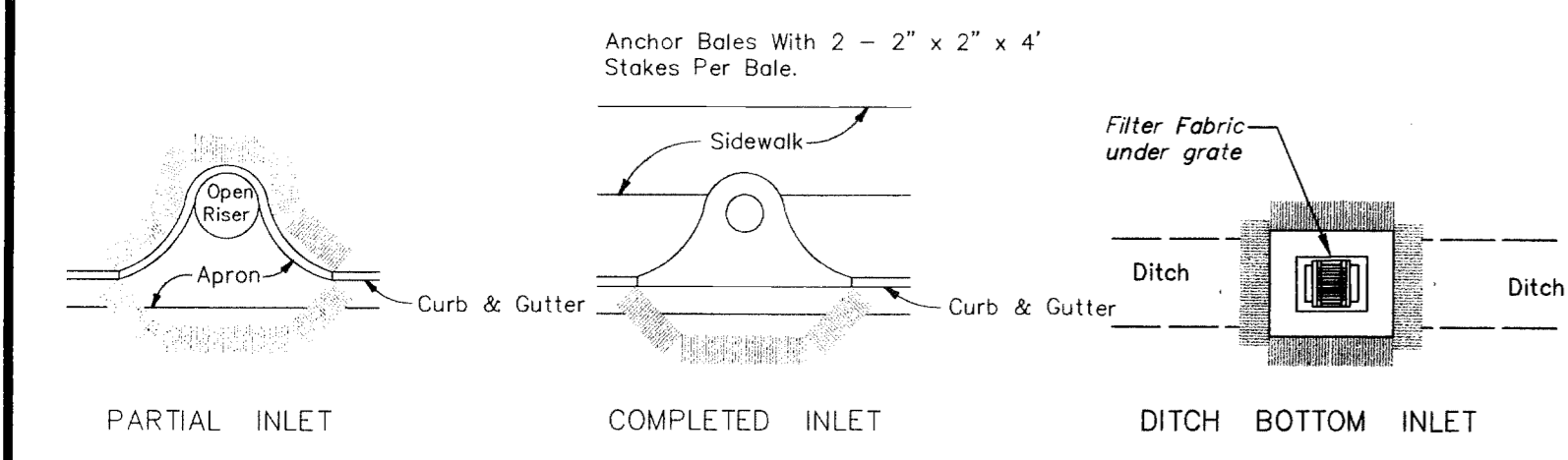
GRASS SLOPES



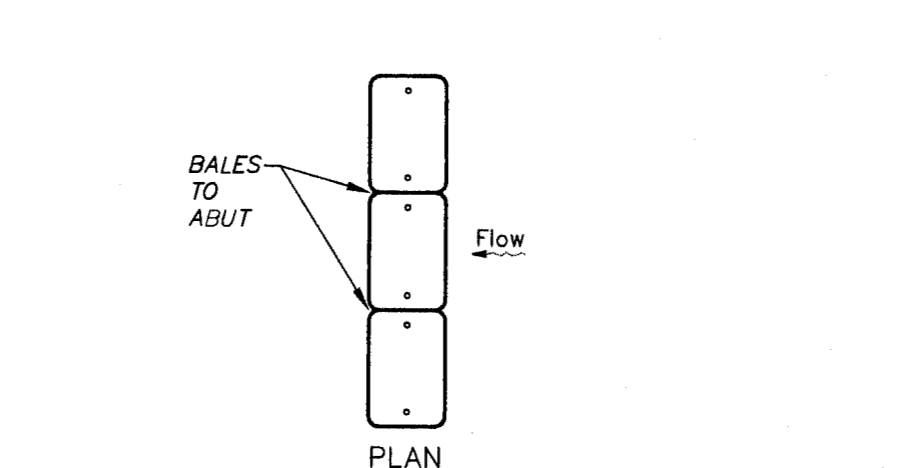
SOD ALONG CURB AND AROUND INLET



CONSTRUCTION ENTRANCE



PROTECTION AROUND INLETS OR SIMILAR STRUCTURES - HAY BALES

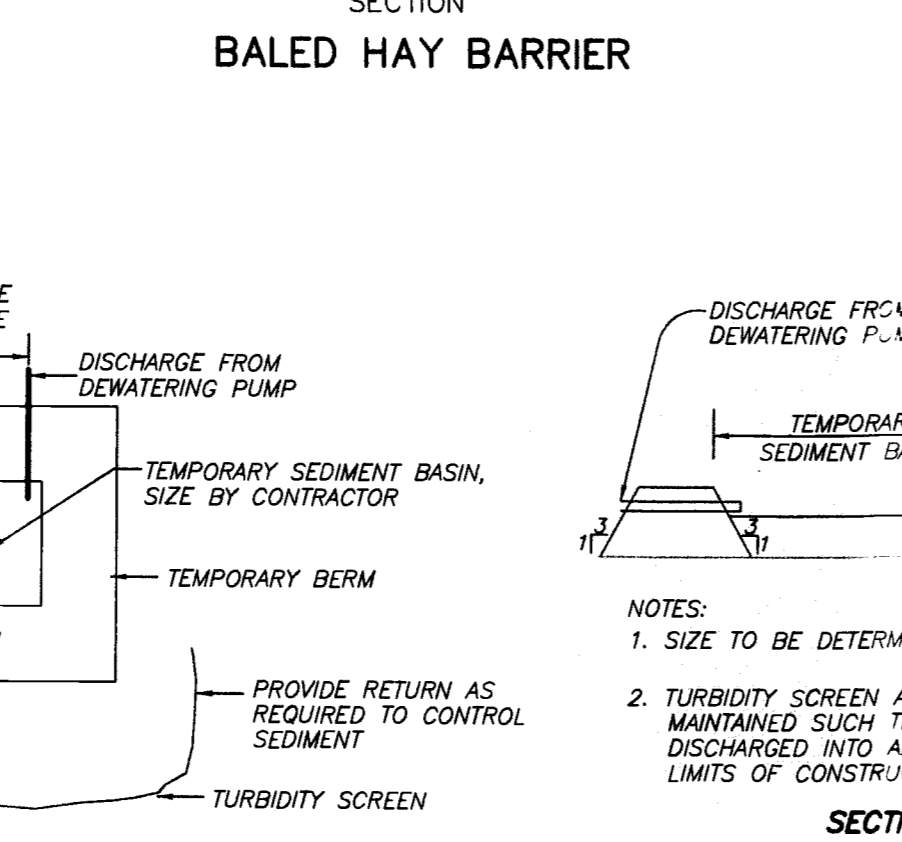


BAILED HAY BARRIER

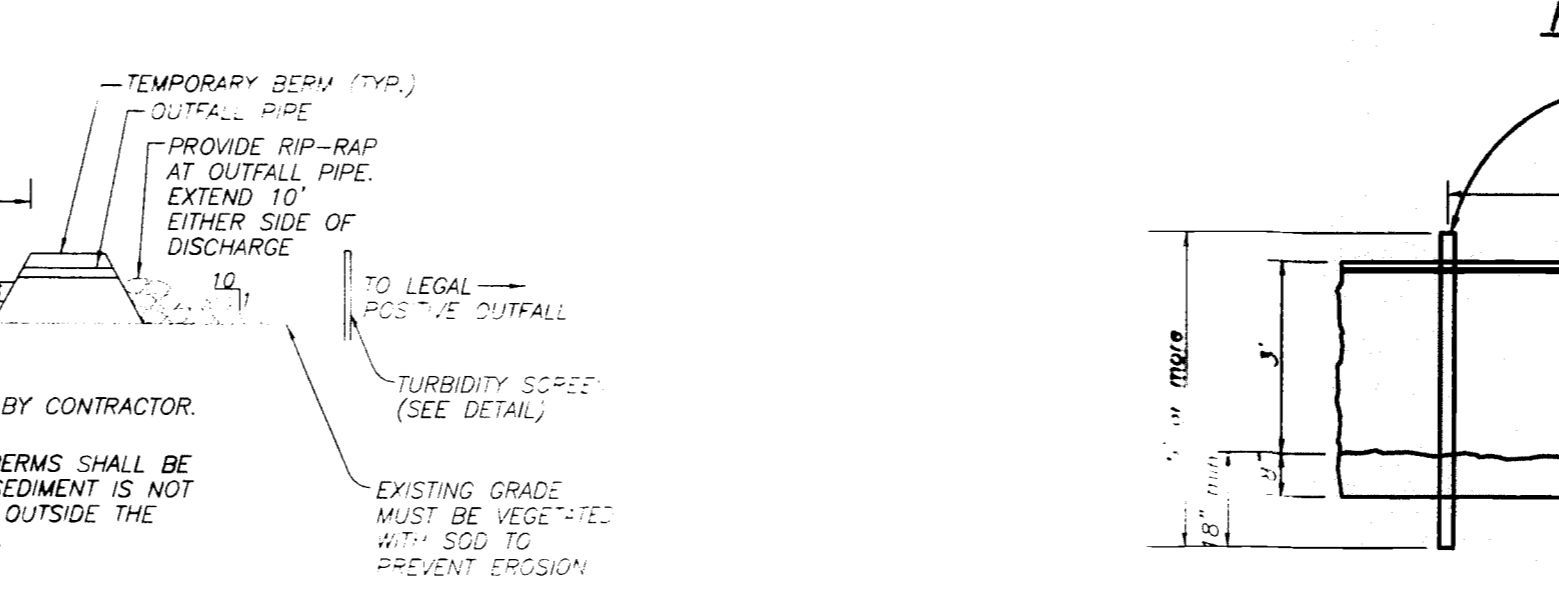
EROSION AND SEDIMENT CONTROL NOTES:

- Sediment basins and traps, perimeter dikes, sediment barriers and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity and shall be made functional before up-slope land disturbance takes place.
- Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within seven days to denuded areas that may not be at final grade but will remain undisturbed for longer than 30 days. Permanent stabilization shall be applied to areas that are to be left undisturbed for more than one year.
- After 1/2" or greater rainfall, sediment control structures will be inspected for integrity. Any damaged devices shall be corrected immediately.
- Sediment will be prevented from entering any storm drain system, ditch, or channel. All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.
- Before temporary or newly constructed stormwater conveyance channels are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.
- Weekly inspection and maintenance of all sediment control structures must be provided to ensure intended purpose is accomplished. The Operator shall be responsible for the maintenance of all sediment control structures. Sediment control structures shall be inspected and maintained at the end of each working day.
- Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property.
- Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria:
 - No more than 500 linear feet of trench may be opened at one time.
 - Excavated material shall be placed on the uphill side of trenches.
 - Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharges in a manner that does not adversely affect flowing streams or off-site property.
 - Restoration shall be accomplished in accordance with these regulations.
- Where construction vehicle access routes intersect paved public roads, provisions shall be made to minimize the transport of sediment onto public roads by use of a construction entrance as detailed on these plans. Where sediment is transported onto a public road surface with curbs and gutters, the road shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area. Street washing shall be allowed only after sediment is removed in this manner. This provision shall apply to individual subdivision lots as well as to larger land-disturbing activities.
- Prior to the start of construction, silt fences shall be installed around the perimeter of the project as shown. However, the silt fence may be phased along with the construction schedule.
- The Operator shall keep a copy on-site of the St. John's River Water Management District Permit, The Army Corps of Engineers Permit, and the NPDES Construction Permit, as well as the approved construction drawings and SWPPP drawings. The Contractor shall be responsible for following the conditions of all permits.
- Temporary sediment basin size to be determined by contractor.
- New or additional workers will be informed of the the SWPPP plan details for the operation and maintenance of plan features.
- It shall be the Coordinators responsibility to complete the project in conformance with the NPDES Standards and approved plans and permit.

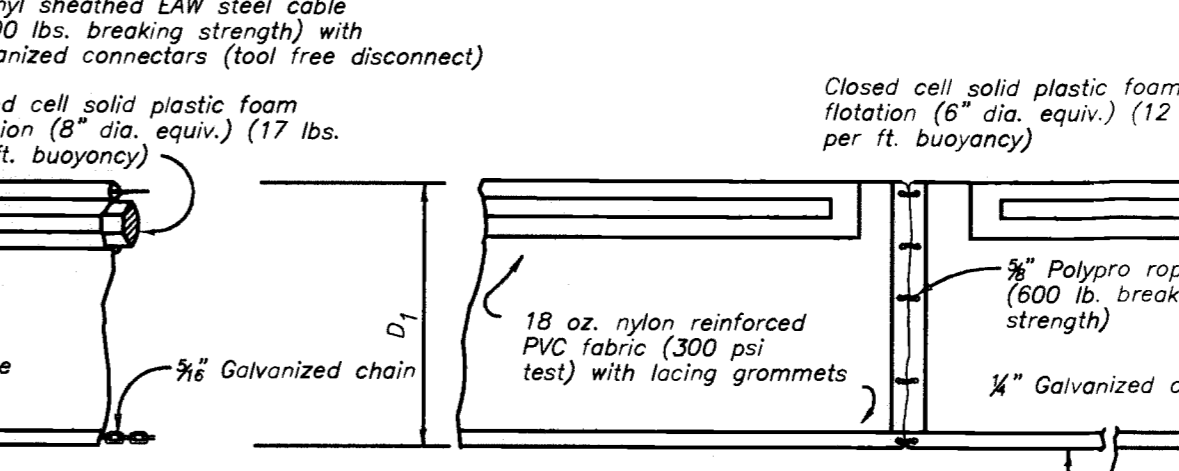
DEWATERING PLAN (TEMPORARY SEDIMENT BASIN)



DEWATERING PLAN (TEMPORARY SEDIMENT BASIN)



STAKED TURBIDITY BARRIER



FLOATING TURBIDITY BARRIER

GENERAL SITE INFORMATION

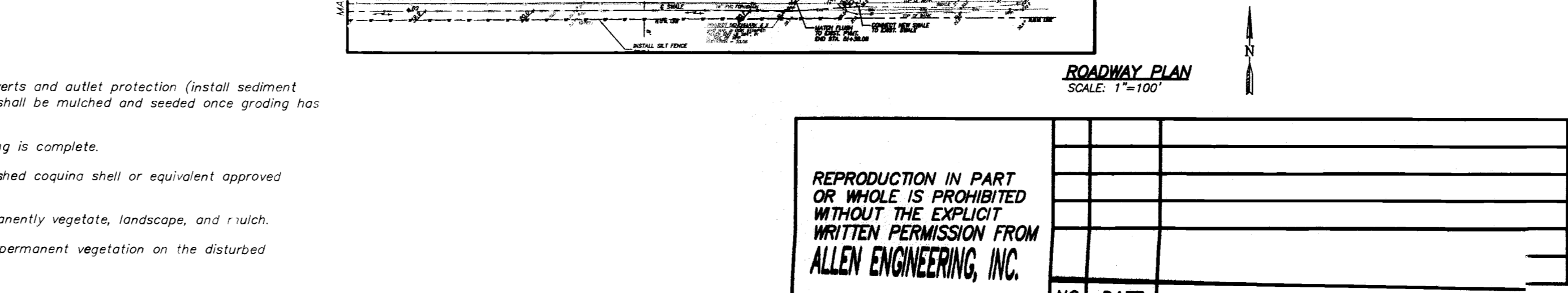
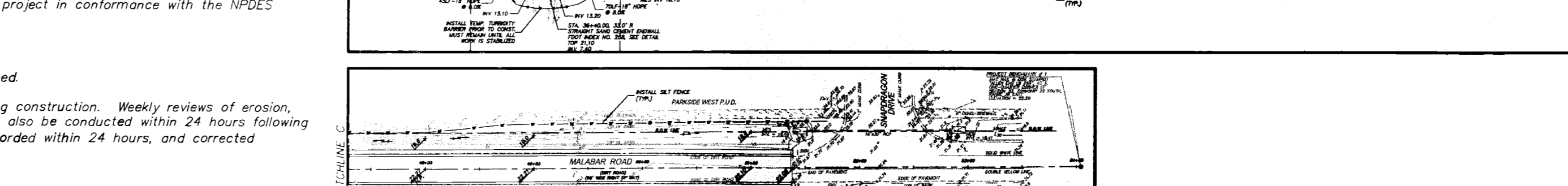
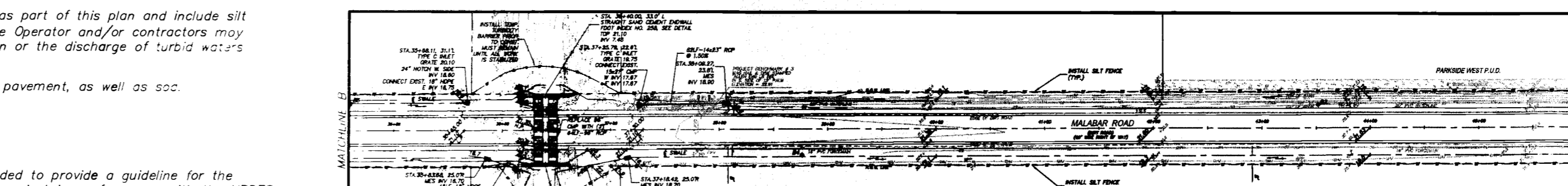
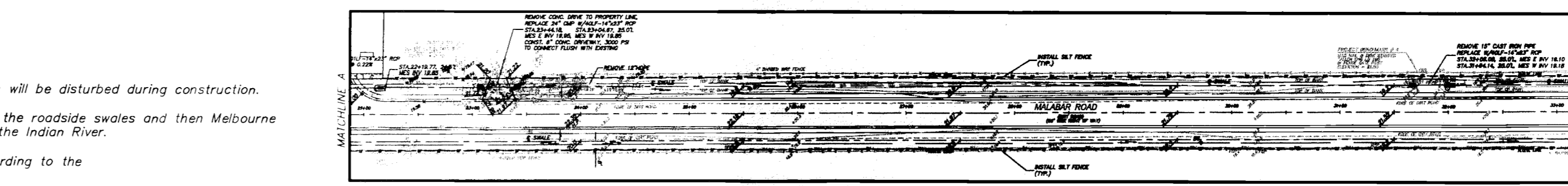
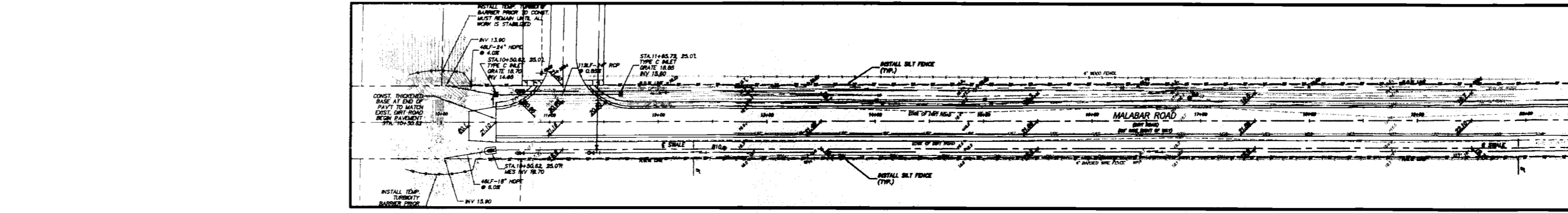
The total road right-of-way area is 6.62 acres, the majority of which will be disturbed during construction. The receiving water body for any and all stormwater discharge will be the roadside swales and then Melbourne Tallow Drainage District Canal No. 6 and Canal No. 7 and ultimately the Indian River. The majority of the site soils are mapped as Pineda sand (Pn), according to the Brevard County Soil Survey (BCSS), dated 1974. The minimum temporary and sediment control measures are describe as part of this plan and include silt fences, settling basins, haybales, and construction entrance/exits. The Operator and/or contractors may require additional measure as the project progresses to control erosion or the discharge of turbid water off-site. Final soil stabilization will be provided by impervious surfaces such as pavement, as well as sod.

GENERAL CONSTRUCTION SEQUENCING PLAN

- Obtain plan approval and other applicable permits.
- Flag the limits of construction and identify areas not to be disturbed.
- Hold pre construction conference at least one week prior to starting construction. Weekly reviews of erosion, sediment, and storm water controls will be conducted. Reviews will also be conducted within 24 hours following all rain events exceeding 1/2" intensity. Needed repairs will be recorded within 24 hours, and corrected immediately.
- Install sediment controls as the first construction activity.
- Install temporary stabilized construction Entrance/Exit.
- Complete necessary site clearing.
- Rough grade site, stockpile topsoil, construct waterways, install culverts and outlet protection (install sediment controls and silt fencing as needed). Bare areas of exposed land shall be mulched and seeded once grading has been completed.
- Finish the slopes around building dirt pads as soon as rough grading is complete.
- Complete final grading for roads and parking and stabilize with crushed coquina shell or equivalent approved material.
- Complete final grading of grounds, topsoil critical areas, and permanently vegetate, landscape, and mulch.
- After site is stabilized, remove all temporary measures and install permanent vegetation on the disturbed areas.

SWPPP COORDINATOR DUTIES

- The operator shall comply with the following and all other requirements of the EPA, FDEP, SJRWMD, and Brevard County regulations:
 - The Operator must execute NPDES certification form and insure that all subcontractors responsible for erosion control measures execute the NPDES certification form. Copies of this certification must be provided to the owner prior to the start of any new construction, and copies shall be maintained at the job site.
 - The Operator shall maintain a copy of DEP document No. 62-621.300 (4) (A) on site. This permit is the State of Florida Department of Environmental protection generic permit for stormwater discharge from large and small construction activities.
 - Prepare inspection reports summarizing:
 - Daily Rainfall Totals
 - Measures/Areas Inspected
 - Changes necessary to the SWPPP.
- Inspections shall be completed on a weekly basis; and after rainfall events exceeding 1/2" intensity. A sample inspection form shall be supplied to the contractor for his use. Contractor must utilize this inspection form or an approved equivalent.
- Maintain records of construction activities, including:
 - Dates when major grading activities occur.
 - Dates when construction activities temporarily cease on a portion of the site.
 - Dates when stabilization measures are initiated on site.
 - Records must be maintained at the job site.
- Report releases of reportable quantities of oil or hazardous materials (if they occur):
 - Notify State Warning Point @ 1-800-320-0519 or 1-850-413-9911
 - Notify DEP in writing within 14 days
 - Modify the pollution prevention plan to include improved management controls.
- Modify the storm water pollution prevention plan (SWPPP) as necessary to:
 - Comply with minimum permit requirements when notified by the DEP, address changes in design, construction operation or maintenance that have an effect on the potential for discharge of pollutants into state waters.
 - Prevent recurrence of reportable quantity releases hazardous material, oil and/or fuel.
- At the completion of the project and as a condition of final payment, operator shall provide the owner with two (2) copies of the above-described reports.



CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

I certify under penalty of law that I understand the terms and conditions of the generic storm water permit issued pursuant to section 403.0885, F.S., that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification.

Name: _____
 Title: _____
 Company Name: _____
 Company Address: _____
 Company Phone #: _____
 Project Site Description: High School CCC - Malabar Rd.
 Signature: _____
 Date of Certification: _____

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 Project Site Description: High School CCC - Malabar Rd.
 Signature: _____
 Date of Certification: _____

CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

I certify under penalty of law that I understand the terms and conditions of the generic storm water permit issued pursuant to section 403.0885, F.S., that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification.

Name: _____
 Title: _____
 Company Name: _____
 Company Address: _____
 Company Phone #: _____
 Project Site Description: High School CCC - Malabar Rd.
 Signature: _____
 Date of Certification: _____

ENGINEERS CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violators.

Name: David A. Lavender, P.E.
 Title: The Engineer
 Company Name: Allen Engineering, Inc.
 Company Address: 106 Dixie Lane
 Cocoa Beach, FL 32931
 Company Phone #: (321) 783-7443
 Project Site Description: High School CCC - Malabar Rd.
 Signature: _____
 Date of Certification: _____

OPERATORS CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violators.

Name: Ed Gardulski
 Title: Assistant Director of Road & Bridge
 Company Name: Brevard County
 Company Address: 2725 Judge Fran Jamieson Way, Suite A-201
 Viera, FL 32940
 Company Phone #: (321) 690-6877
 Project Site Description: High School CCC - Malabar Rd.
 Signature: _____
 Date of Certification: _____

SCHOOL BOARD OF BREVARD COUNTY		DATE
HIGH SCHOOL CCC - MALABAR ROAD		3-31-08
STORM WATER		SCALE
POLLUTION PREVENTION PLAN		NTS
		JOB NO.
		070007.2
		DRAWN
		DSL
		SHT. NO.
		9

REPRODUCTION IN PART OR WHOLE IS PROHIBITED WITHOUT PERMISSION FROM ALLEN ENGINEERING, INC.

ROADWAY PLAN
SCALE: 1"=100'

NO. DATE

REVISIONS

MAY 20 2008

an area that is generally depicted in Figure 41-1 of Chapter 40C-41.023, F.A.C. and legally described in Appendix K of the *Applicant's Handbook for Management and Storage of Surface Waters* (A.H.). The special basin criteria for this basin are set forth in Section 40C-41.063(1), F.A.C. and Sections 11.1 through 11.1.3, A.H. and include special criteria regarding storm frequency, runoff volume and discharge to coastal receiving waters (interbasin diversion). A significant amount of land located within this basin currently drains to coastal receiving waters because of the construction of canals; these lands include the area drained by the C-1 canal operated by the Melbourne-Tillman Water Control District (MTWCD).

(a) Storm frequency and run-off volume

The proposed construction is paving of approximately 4,090 linear feet of a 28-foot-wide existing dirt road portion of Malabar Road and the construction of a surface water management system to serve the improvements. The road extension will serve the new Brevard County High School CCC in Palm Bay. The roadway runoff will be collected, treated, and attenuated by swales at the both sides of the road. The over-flow runoff from the swales is to the MTWCD Canal C-6 and Canal C-7. This project also proposes a new double 96-inch RCP culvert to replace the existing culverts at the Canal C-7 roadway crossing. The applicant has demonstrated that the difference in the volume of runoff in pre-and post-development conditions cannot be achieved because of the lack of storage and limited area of the swales in the right-of-way, and the low permeability of the hydrologic soils group at the site.

(b) Increase in amount of discharge to coastal receiving waters

Rule 41.063(1)(c)1., F.A.C. and Section 11.1.3, A.H. state that “[a] system may not result in an increase in the amount of water being diverted from the Upper St. Johns River Hydrologic Basin into coastal receiving waters.” To meet this criterion, the applicant has opted to participate in a cost share agreement with the District that will partially fund the construction of a restoration project known as the C-1 Rediversion Project.

The amount that the applicant will pay to the District is proportional to the cost of the C-1 Rediversion project needed to offset the increase in runoff associated with the proposed modifications. For this project, participation in the C-1 Rediversion Project through a cost share agreement requires the payment of \$265.00 per acre or \$1,754.30 (\$265.00 X 6.62- acres).

The C-1 Rediversion Project is expected to be completed several years after the applicant wishes to commence construction. To address this “time lag,” the applicant has filed a petition for variance pursuant to Section 120.542, F.S. The variance petition is recommended for approval concurrently with this application.

The project meets all applicable criteria for permit issuance pursuant to sections 40C-4.301 and 40C-4.302, F.A.C.

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.

The applicant proposes to dredge and/or fill 0.026 acres of surface waters in order to construct the proposed roadway and stormwater system.

The surface waters are upland cut ditches that provide minimal wildlife habitat and impacts to such are addressed by rule. Therefore, the proposed project is not expected to cause adverse impacts to the abundance and diversity of fish, wildlife and listed species or their habitat.

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 filling 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.

The proposed project will not result in secondary impacts to wetlands or other surface waters. The proposed surface water impacts are to upland-cut ditches, and pursuant to Section 12.2.2.2, A.H., secondary impacts are not applied to upland-cut ditches.

This project will cause no adverse impacts to significant historical and archaeological resources that are closely linked and causally related to any proposed filling of surface waters.

There are no expected future phases. The high school served by this road extension was authorized under permit 40-009-111957-2.

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

Elimination and reduction of impacts to upland-cut ditches was not required since these surface waters provide minimal habitat for fish and wildlife.

Mitigation:

No mitigation is required for the surface water impacts pursuant to section 12.2.2.2, A.H. since, the ditch is upland-cut and does not provide significant habitat to listed species.

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.

Pursuant to 12.2.2.2 Applicant’s Handbook, cumulative impacts for impacts to the upland-cut ditch will not be considered.

Wetland Summary Table

Malabar Road Extension Roadway

	<u>Acres</u>
Total Wetlands On-site	0.000
Total Surface Waters On-site	0.070
Impacts that Require Mitigation	0.000
Impacts that Require No Mitigation	0.026
D or F	0.026
H	0.000
Mitigation	0.000

Recommendation: Approval

Conditions for Application Number 4-009-113120-2:

ERP Stormwater 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 stormwater management system must be inspected by the operation and maintenance entity once within two years after the completion of construction and

every two years thereafter to insure that the system is functioning as designed and permitted. If a required inspection reveals that the system is not functioning as designed and permitted, then within 14 days of that inspection the entity shall submit an Exceptions Report on form number 40C-42.900(6), Exceptions Report for Stormwater Management System Out of Compliance. The operation and maintenance entity must maintain a record of each required inspection, including the date of inspection, the name, address, and telephone number of the inspector, and whether the system was functioning as designed and permitted, and make such record available for inspection upon request by the District during normal business hours.

2. The surface water management system must be constructed and operated in accordance with the plans received by the District on May 22, 2008.
3. Prior to initiation of construction of the surface water management system, the permittee shall provide an executed, original Cost Participation Agreement in the form approved by the District and deposit one thousand seven hundred fifty-four dollars and thirty cents (\$1,754.30) in the Escrow Account in accordance with paragraph 1 of the Agreement. The Escrow Amount shall be held in escrow for use by the District in designing, constructing, operating, and maintaining the C-1 Rediversion Project. Disbursement of the Escrow Amount shall be in accordance with the provisions of the approved Cost Participation Agreement.

Reviewers: Kris Hebert
Mohammad Moayer

G.2

Permit No. 113120-4



St. Johns River Water Management District

Hans G. Tanzler III, Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • (386) 329-4500
On the Internet at floridaswater.com.

November 19, 2013

Brevard County Public Works
2725 Judge Fran Jamieson Way Ste 201-A
Melbourne, FL 32940

SUBJECT: Permit Number IND-009-113120-4
Malabar Road Turn Lanes

Dear Sir/Madam:

Enclosed is your permit issued by the St. Johns River Water Management District on November 19, 2013. This permit is a legal document and should be kept with your other important documents. Permit issuance does not relieve you from the responsibility of obtaining any necessary permits from any federal, state, or local agencies for your project.

Technical Staff Report:

If you wish to review a copy of the Technical Staff Report (TSR) that provides the District's staff analysis of your permit application, you may view the TSR by going to the Permitting section of the District's website at floridaswater.com/permitting. Using the "search applications and permits" feature, you can use your permit number or project name to find information about the permit. When you see the results of your search, click on the permit number.

Noticing Your Permit:

For noticing instructions, please refer to the noticing materials in this package regarding closing the point of entry for someone to challenge the issuance of your permit. Please note that if a timely petition for administrative hearing is filed, your permit will become nonfinal and any activities that you choose to undertake pursuant to your permit will be at your own risk.

Compliance with Permit Conditions:

To submit your required permit compliance information, go to the District's website at floridaswater.com/permitting. Under the "Apply for a permit or submit compliance data" section, click to sign-in to your existing account or to create a new account. Select the "Compliance Submittal" tab, enter your permit number, and select "No Specific Date" for the Compliance Due Date Range. You will then be able to view all the compliance submittal requirements for your project. Select the compliance item that you are ready to submit and then attach the appropriate information or form.

The forms to comply with your permit conditions are available at floridaswater.com/permitting under the section "Handbooks, forms, fees, final orders". Click on forms to view all permit compliance forms, then scroll to the ERP application forms section and select the applicable compliance forms. Alternatively, if you have difficulty finding forms or need copies of the appropriate forms, please contact the Bureau of Regulatory Support at (386) 329-4570.

Transferring Your Permit:

As required by a condition of your permit, you must notify the District in writing within 30 days of any sale, conveyance or other transfer of a permitted system or facility, or within 30 days of any transfer of ownership or control of the real property where the permitted system or facility is

GOVERNING BOARD

John A. Miklos, CHAIRMAN
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VERO BEACH

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ORLANDO BEACH
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Lad Daniels
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George W. Robbins, TREASURER
JACKSONVILLE
Chuck Drake
ORLANDO

W. Leonard Wood
FERNANDINA BEACH

located. You will need to provide the District with the information specified in District rule 40C-1.612, Florida Administrative Code (name and address of the transferee and a copy of the instrument effectuating the transfer). Please note that a permittee remains liable for any corrective actions that may be required as a result of any permit violations that occur before the sale, conveyance, or other transfer of the system or facility, so it is recommended that you request a permit transfer in advance.

Thank you and please let us know if you have additional questions. For general questions contact e-permit@sjrwmd.com or (386) 329-4570.
Sincerely,



Margaret Daniels, Bureau Chief
Bureau of Regulatory Support
St. Johns River Water Management District
4049 Reid Street
Palatka, FL 32177-2529
(386) 329-4570

Enclosures: Permit

cc: District Permit File

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO. IND-009-113120-4

DATE ISSUED: November 19, 2013

PROJECT NAME: Malabar Road Turn Lanes

A PERMIT AUTHORIZING:

Construction of a Stormwater Management System with stormwater treatment by Swales for Malabar Road Turn Lanes, a 3.12 - acre project to be constructed as per plans received by the District on November 4, 2013.

LOCATION:

SECTION(S): 32, 33

TOWNSHIP(S): 28S RANGE(S): 36E

Brevard County

ISSUED TO:

Brevard County Public Works
2725 Judge Fran Jamieson Way Ste 201-A
Melbourne, FL 32940

Permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to permittee any property rights nor any rights or privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes.

PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated November 19, 2013

AUTHORIZED BY: St. Johns River Water Management District
Division of Regulatory Engineering and Environmental Services

By:



John Julianna
Service Center Director

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER IND-009-113120-4
Brevard County Public Works
DATED November 19, 2013

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the Agency staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.
3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.
4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice," [October 1, 2013], incorporated by reference herein (<http://www.flrules.org/Gateway/reference.asp?No=Ref-02505>), indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C. If available, an Agency website that fulfills this notification requirement may be used in lieu of the form.
5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.
6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:
 - (a) For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex - "Construction Completion and Inspection Certification for Activities Associated With a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or
 - (b) For all other activities - "As-Built Certification and Request for Conversion to Operational Phase" [Form 62-330.310(1)].
 - (c) If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.
7. If the final operation and maintenance entity is a third party:
 - (a) Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see

sections 12.3 thru 12.3.3 of Volume I) as filed with the Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

(b) Within 30 days of submittal of the as-built certification, the permittee shall submit "Request for Transfer of Environmental Resource Permit to the Perpetual Operation Entity" [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

8. The permittee shall notify the Agency in writing of changes required by any other regulatory agency that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.
9. This permit does not:
 - (a) Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;
 - (b) Convey to the permittee or create in the permittee any interest in real property;
 - (c) Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or
 - (d) Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.
10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.
11. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.
12. The permittee shall notify the Agency in writing:
 - (a) Immediately if any previously submitted information is discovered to be inaccurate; and
 - (b) Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.
13. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.
14. If any prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, work involving subsurface disturbance in the immediate vicinity of such discoveries shall cease. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance and Review Section, at (850) 245-6333 or (800) 847-7278, as well as the appropriate permitting agency office. Such subsurface work shall not resume without verbal or written authorization from

the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and notification shall be provided in accordance with Section 872.05, F.S.

15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.
16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.
17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the Agency will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.
18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with subsection 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.
19. This permit for construction will expire five years from the date of issuance.
20. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to building construction or placement of impervious surface within the area to be served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.
21. All wetland areas or water bodies that are outside the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring or excess turbidity, and dewatering.
22. Prior to construction, the permittee must clearly designate the limits of construction on-site. The permittee must advise the contractor that any work outside the limits of construction, including clearing, may be a violation of this permit.
23. The proposed stormwater management system shall be constructed in accordance with plans received by the District on November 4, 2013.
24. The operation and maintenance entity shall inspect the stormwater management system once within two years after the completion of construction and every two years thereafter to determine if the system is functioning as designed and permitted. The operation and maintenance entity must maintain a record of each required inspection, including the date of the inspection, the name, address, and telephone number of the inspector, and whether the system was functioning as designed and permitted, and make such record available for inspection upon request by the District during normal business hours. If at any time the system is not functioning as designed and permitted, then within 14 days the entity shall submit a report to the District detailing the reasons for non-function and a proposal to remedy the non-functioning of the system.

Notice Of Rights

1. A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwm.com, within twenty-six (26) days of the District depositing the notice of District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing the notice of District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes, and Chapter 28-106, Florida Administrative Code. The District will not accept a petition sent by facsimile (fax), as explained in paragraph no. 4 below.
2. Please be advised that if you wish to dispute this District decision, mediation may be available and that choosing mediation does not affect your right to an administrative hearing. If you wish to request mediation, you must do so in a timely-filed petition. If all parties, including the District, agree to the details of the mediation procedure, in writing, within 10 days after the time period stated in the announcement for election of an administrative remedy under Sections 120.569 and 120.57, Florida Statutes, the time limitations imposed by Sections 120.569 and 120.57, Florida Statutes, shall be tolled to allow mediation of the disputed District decision. The mediation must be concluded within 60 days of the date of the parties' written agreement, or such other timeframe agreed to by the parties in writing. Any mediation agreement must include provisions for selecting a mediator, a statement that each party shall be responsible for paying its pro-rata share of the costs and fees associated with mediation, and the mediating parties' understanding regarding the confidentiality of discussions and documents introduced during mediation. If mediation results in settlement of the administrative dispute, the District will enter a final order consistent with the settlement agreement. If mediation terminates without settlement of the dispute, the District will notify all the parties in writing that the administrative hearing process under Sections 120.569 and 120.57, Florida Statutes, is resumed. Even if a party chooses not to engage in formal mediation, or if formal mediation does not result in a settlement agreement, the District will remain willing to engage in informal settlement discussions.
3. A person whose substantial interests are or may be affected has the right to an informal administrative hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must also comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

Notice Of Rights

4. A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8:00 a.m. – 5:00 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8:00 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at floridaswater.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile is prohibited and shall not constitute filing.
5. Failure to file a petition for an administrative hearing within the requisite timeframe shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, Florida Administrative Code).
6. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. A person whose substantial interests are or may be affected by the District's final action has the right to become a party to the proceeding, in accordance with the requirements set forth above.
7. Pursuant to Section 120.68, Florida Statutes, a party to the proceeding before the District who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.
8. A District action is considered rendered, as referred to in paragraph no. 7 above, after it is signed on behalf of the District and filed by the District Clerk.
9. Failure to observe the relevant timeframes for filing a petition for judicial review as described in paragraph no. 7 above will result in waiver of that right to review.


Notice Of Rights

Certificate of Service

I HEREBY CERTIFY that a copy of the foregoing Notice of Rights has been sent to the permittee:

Brevard County Public Works
2725 Judge Fran Jamieson Way Ste 201-A
Melbourne, FL 32940

This 19th day of November, 2013.



Margaret Daniels, Bureau Chief
Bureau of Regulatory Support
St. Johns River Water Management District
4049 Reid Street
Palatka, FL 32177-2529
(386) 329-4570

Permit Number: IND-009-113120-4

NOTICING INFORMATION

Dear Permittee:

Please be advised that the St. Johns River Water Management District has not published a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit to file a petition challenging the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice, the time to challenge the issuance of your permit will not expire.

A copy of the notice and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit as proof of publication. Please submit a scanned copy of the affidavit by emailing compliancesupport@sjrwmd.com (preferred method) or send the original affidavit of publication to:

Margaret Daniels, Bureau Chief
Bureau of Regulatory Support
4049 Reid Street
Palatka, FL 32177

If you have any questions, please contact the Bureau of Regulatory Support at (386) 329-4570.

Sincerely,



Margaret Daniels, Bureau Chief

Bureau of Regulatory Support

NOTICE OF AGENCY ACTION TAKEN BY THE
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Notice is given that the following permit was issued on _____:

(Name and address of applicant) _____
permit# _____. The project is located in _____ County, Section
_____, Township _____ South, Range _____ East. The permit authorizes a surface
water management system on _____ acres for _____ known as
_____. The receiving water body is _____.

A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code (F.A.C.), the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P.O. Box 1429, Palatka FL 32178-1429 (4049 Reid St, Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwm.d.com, within twenty six (26) days of the District depositing the notice of intended District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing notice of intended District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of intended District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes (F.S.), and Chapter 28-106, F.A.C. The District will not accept a petition sent by facsimile (fax). Mediation pursuant to Section 120.573, F.S., is not available.

A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8 a.m. – 5 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8 a.m. on the next regular District business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at floridaswater.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile (fax) is prohibited and shall not constitute filing.

The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. **Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, F.A.C.).**

If you wish to do so, please visit <http://floridaswater.com/noticeofrights/> to read the complete Notice of Rights to determine any legal rights you may have concerning the District's intended decision(s) on the permit application(s) described above. You can also request the Notice of Rights by contacting the Bureau Chief, Bureau of Regulatory Support (RS), 4049 Reid St., Palatka, FL 32177-2529, tele. no. (386)329-4570.

NEWSPAPER ADVERTISING

ALACHUA

The Alachua County Record, Legal Advertising
P. O. Box 806
Gainesville, FL 32602
352-377-2444/ fax 352-338-1986

BRAFORD

Bradford County Telegraph, Legal Advertising
P. O. Drawer A
Starke, FL 32901
904-964-6305/ fax 904-964-8628

CLAY

Clay Today, Legal Advertising
1560 Kinsley Ave., Suite 1
Orange Park, FL 32073
904-264-3200/ fax 904-264-3285

FLAGLER

Flagler Tribune, c/o News Journal
P. O. Box 2831
Daytona Beach, FL 32120-2831
386-681-2322

LAKE

Daily Commercial, Legal Advertising
P. O. Drawer 490007
Leesburg, FL 34749
352-365-8235/fax 352-365-1951

NASSAU

News-Leader, Legal Advertising
P. O. Box 766
Fernandina Beach, FL 32035
904-261-3696/fax 904-261-3698

ORANGE

Sentinel Communications, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

PUTNAM

Palatka Daily News, Legal Advertising
P. O. Box 777
Palatka, FL 32178
386-312-5200/ fax 386-312-5209

SEMINOLE

Seminole Herald, Legal Advertising
300 North French Avenue
Sanford, FL 32771
407-323-9408

BAKER

Baker County Press, Legal Advertising
P. O. Box 598
MacLenny, FL 32063
904-259-2400/ fax 904-259-6502

BREVARD

Florida Today, Legal Advertising
P. O. Box 419000
Melbourne, FL 32941-9000
321-242-3832/ fax 321-242-6618

DUVAL

Daily Record, Legal Advertising
P. O. Box 1769
Jacksonville, FL 32201
904-356-2466 / fax 904-353-2628

INDIAN RIVER

Vero Beach Press Journal, Legal Advertising
P. O. Box 1268
Vero Beach, FL 32961-1268
772-221-4282/ fax 772-978-2340

MARION

Ocala Star Banner, Legal Advertising
2121 SW 19th Avenue Road
Ocala, FL 34474
352-867-4010/fax 352-867-4126

OKEECHOBEE

Okeechobee News, Legal Advertising
P. O. Box 639
Okeechobee, FL 34973-0639
863-763-3134/fax 863-763-5901

OSCEOLA

Little Sentinel, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

ST. JOHNS

St. Augustine Record, Legal Advertising
P. O. Box 1630
St. Augustine, FL 32085
904-819-3436

VOLUSIA

News Journal Corporation, Legal Advertising
P. O. Box 2831
Daytona Beach, FL 32120-2831
(386) 681-2322

COMPONENTS OF CONTRACT PLANS SET

ROADWAY PLANS

A DETAILED INDEX APPEARS ON THE KEY SHEET OF EACH COMPONENT

INDEX OF ROADWAY PLANS

SHEET NO.	SHEET DESCRIPTION
1	KEY SHEET
2	TYPICAL SECTION
3	SUMMARY OF DRAINAGE STRUCTURES
4	GENERAL NOTES
5-6	PLAN AND PROFILE
7	INTERSECTION DETAIL
7A	DRAINAGE DETAIL
8-10	SPECIAL DETAILS
11-15	CROSS SECTIONS
16-17	STORMWATER POLLUTION PREVENTION PLAN
18	TRAFFIC CONTROL PLAN
19-27	UTILITY ADJUSTMENTS
S-1	SIGNING AND PAVEMENT MARKINGS

GOVERNING STANDARDS AND SPECIFICATIONS:

FLORIDA DEPARTMENT OF TRANSPORTATION, 2013 DESIGN STANDARDS AND REVISED INDEX DRAWINGS AS APPENDED HEREIN, AND 2013 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, AS AMENDED BY CONTRACT DOCUMENTS.

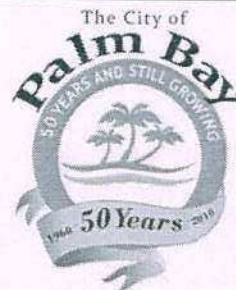
For Design Standards click on the "Design Standards" link at the following web site:
<http://www.dot.state.fl.us/rddesign/>

For the Standard Specifications for Road and Bridge Construction click on the "Specifications" link at the following web site:
<http://www.dot.state.fl.us/specificationsoffice/>

REVISIONS

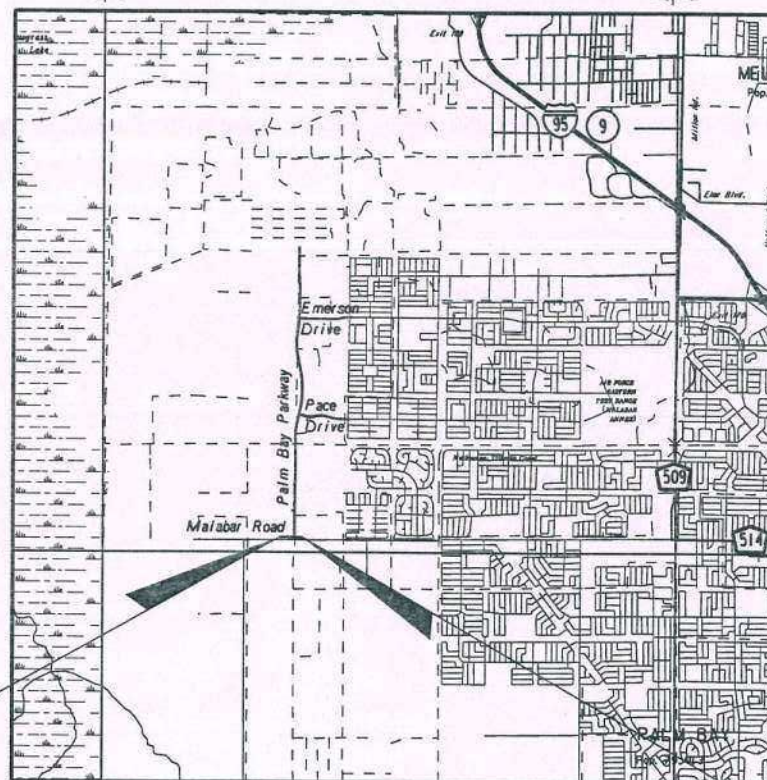
- △ ROADWAY SHEETS 1-3, 5, 6, 7, 7A, 13-15, and S-1 (10/03/13)
- △ ROADWAY SHEETS 5, 6, 7 and 13 (10/24/13)

THE CITY OF PALM BAY



CONTRACT PLANS

FINANCIAL PROJECT ID 428346-1-58-01
 FEDERAL AID No. 8887-971-A
 CONTRACT No. AQF85
 BREVARD COUNTY
MALABAR ROAD (CR 514)



BEGIN PROJECT
 STA. 53+02.57

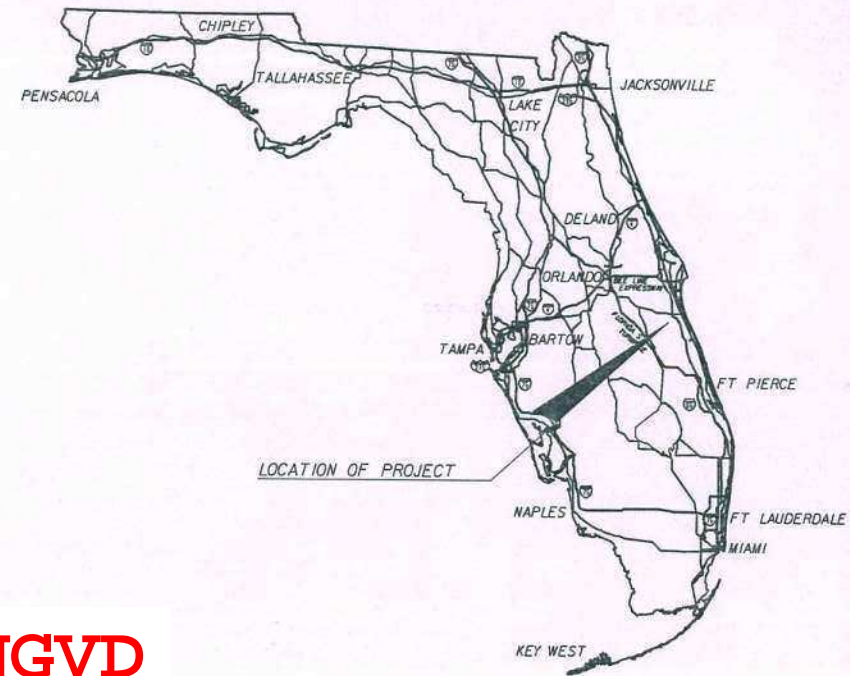
END PROJECT
 STA. 66+42.84

PROJECT LENGTH IS BASED ON \mathcal{C} OF CONSTRUCTION

LENGTH OF PROJECT		
	LINEAR FEET	MILES
ROADWAY	1340.27	0.253
BRIDGES	N/A	N/A
NET LENGTH OF PROJECT	1340.27	0.253
EXCEPTIONS	N/A	N/A
GROSS LENGTH OF PROJECT	1340.27	0.253

KEY SHEET REVISIONS	
DATE	DESCRIPTION
10/3/13	△ ADDED SHEET 7A TO INDEX

NGVD



ROADWAY SHOP DRAWINGS TO BE SUBMITTED TO:

S. MARK KLINE, P.E.
 KEITH & SCHNARS, P.A.
 6500 NORTH ANDREWS AVENUE
 FORT LAUDERDALE, FL. 33309-2132

PLANS PREPARED BY:



KEITH and SCHNARS, P.A.
 ENGINEERS • PLANNERS • SURVEYORS
 6500 NORTH ANDREWS AVENUE
 FORT LAUDERDALE, FL. 33309-2132
 CERTIFICATE OF AUTHORIZATION NO. 1337

NOTE: THE SCALE OF THESE PLANS MAY HAVE CHANGED DUE TO REPRODUCTION.

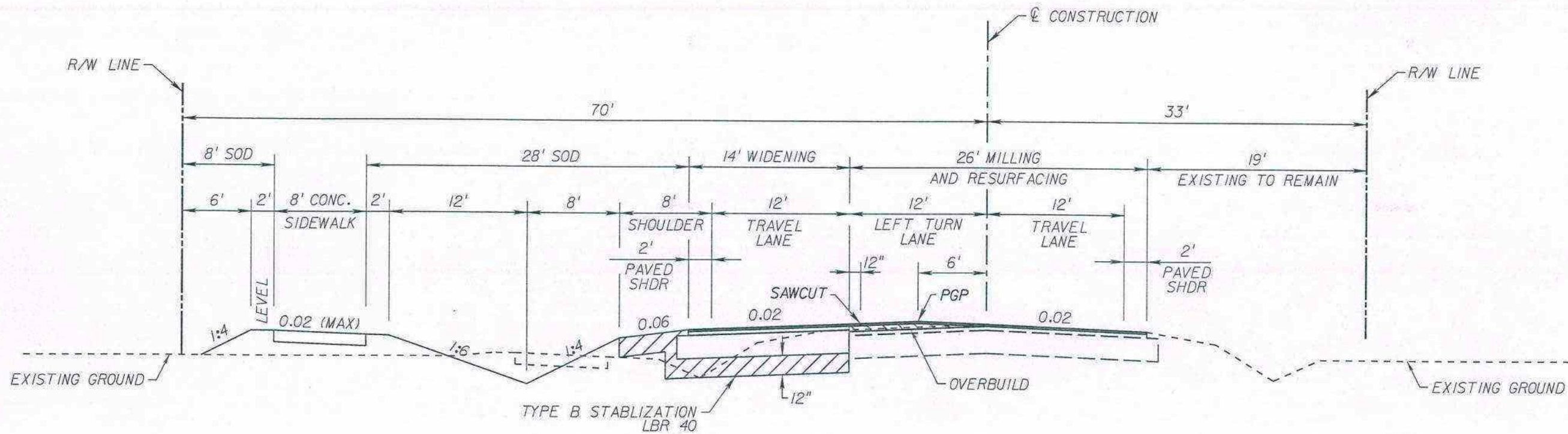
ROADWAY PLANS
 ENGINEER OF RECORD: S. MARK KLINE, P.E.

P.E. NO. 44016

FISCAL YEAR SHEET NO.

13

1



TYPICAL SECTION - MALABAR ROAD - CR 515

STA 53+02.57 TO STA 66+42.84

DESIGN SPEED = 40 MPH
POSTED SPEED = 35 MPH

WIDENING

OPTIONAL BASE GROUP 9 WITH
TYPE SP STRUCTURAL COURSE (TRAFFIC C)(2")
AND FRICTION COURSE FC-12.5 (TRAFFIC C)(1.5")(RUBBER)

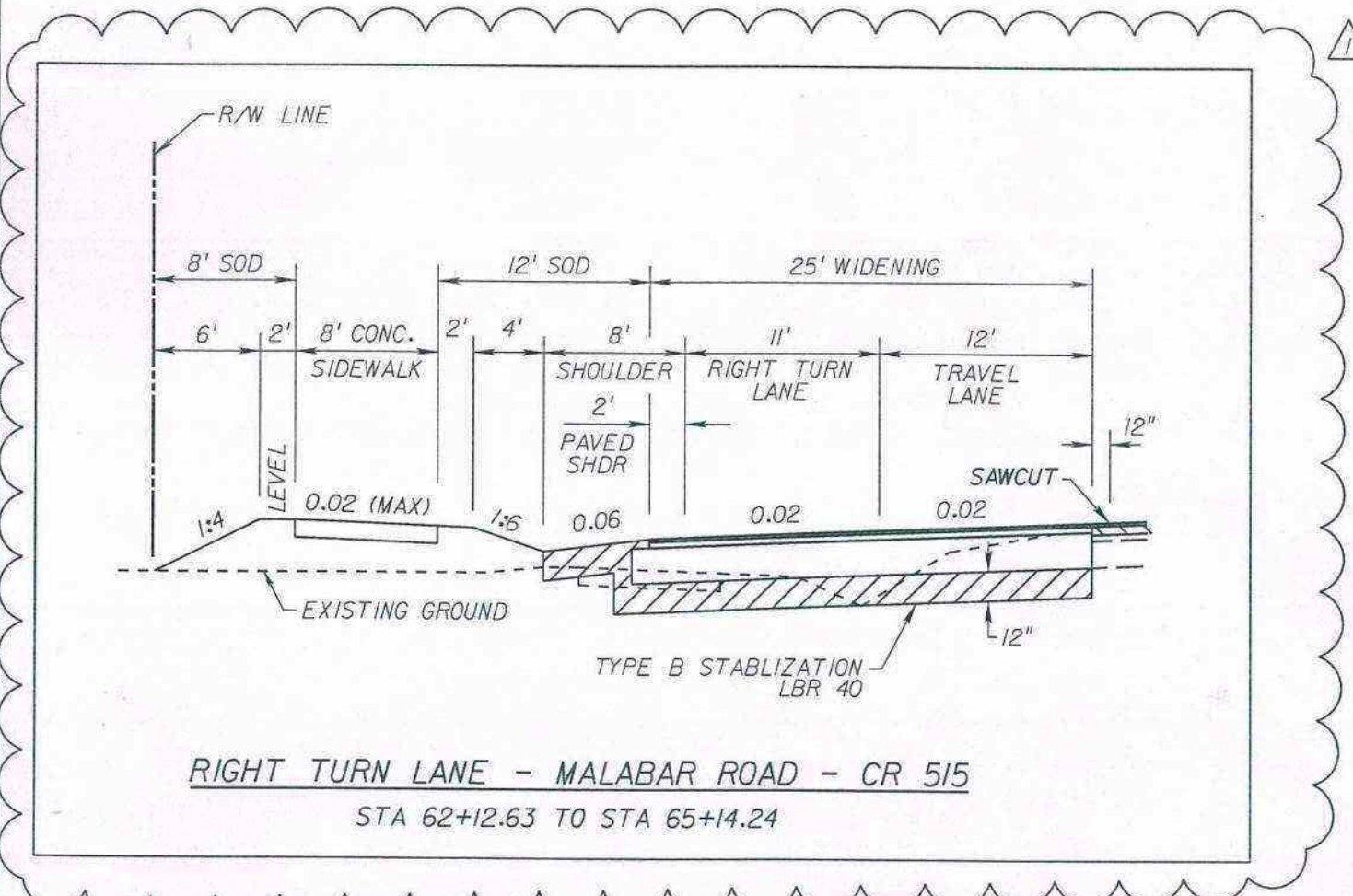
MILLING AND RESURFACING

MILL EXISTING ASPHALT PAVEMENT (1 1/2" AVG. DEPTH)
OVERBUILD WITH TYPE SP STRUCTURAL COURSE (TRAFFIC C)(AVERAGE DEPTH 1-1/2")
FRICTION COURSE FC-12.5 (TRAFFIC C)(1 1/2")(RUBBER)

NOTES:

1. BASE COURSE TO EXTEND 1' BEYOND EDGE OF WIDENING.
2. SUBGRADE STABILIZATION TO EXTEND 2' BEYOND WIDENING.
3. EXISTING ASPHALT PAVEMENT SHALL BE SAWCUT AND REMOVED 1 FOOT BEYOND THE JOINT BETWEEN THE OLD AND NEW OF THE BASE MATERIAL PRIOR TO PAVING. WIDENING PAVEMENT DESIGN SHALL EXTEND TO THE SAWCUT LINE.

Signature
10/25/13



RIGHT TURN LANE - MALABAR ROAD - CR 515

STA 62+12.63 TO STA 65+14.24

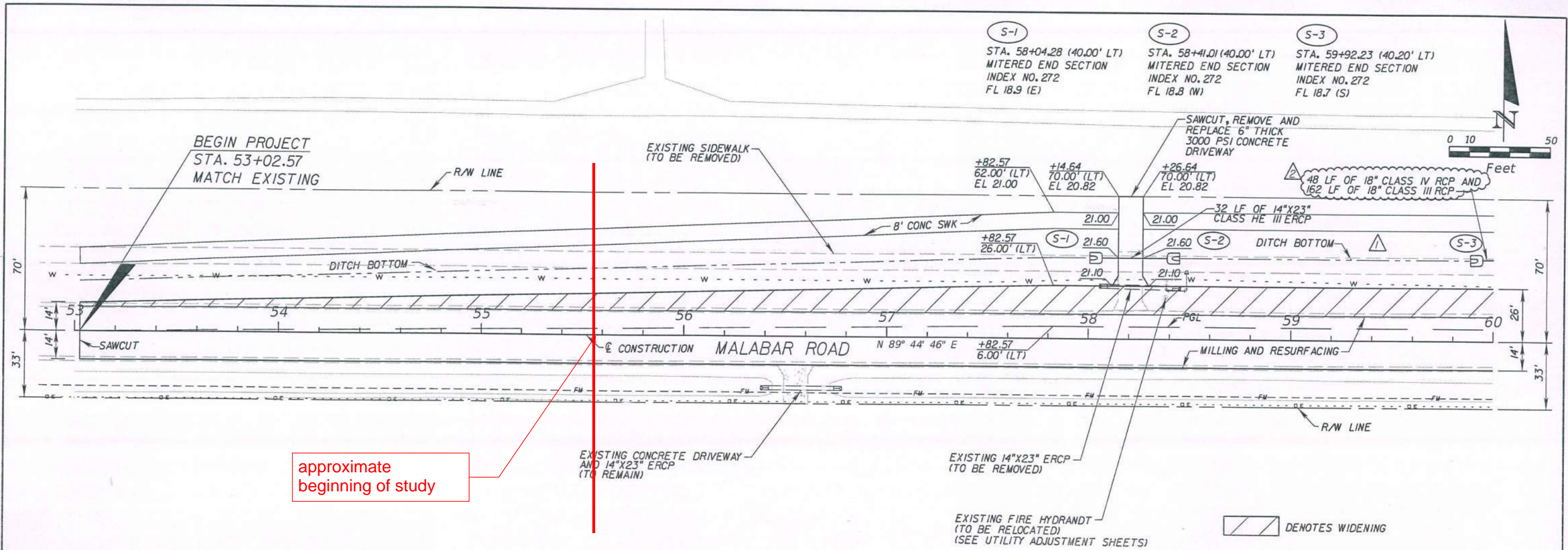
REVISIONS	
DATE	DESCRIPTION
10/03/13	1 ADDED RIGHT TURN LANE

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

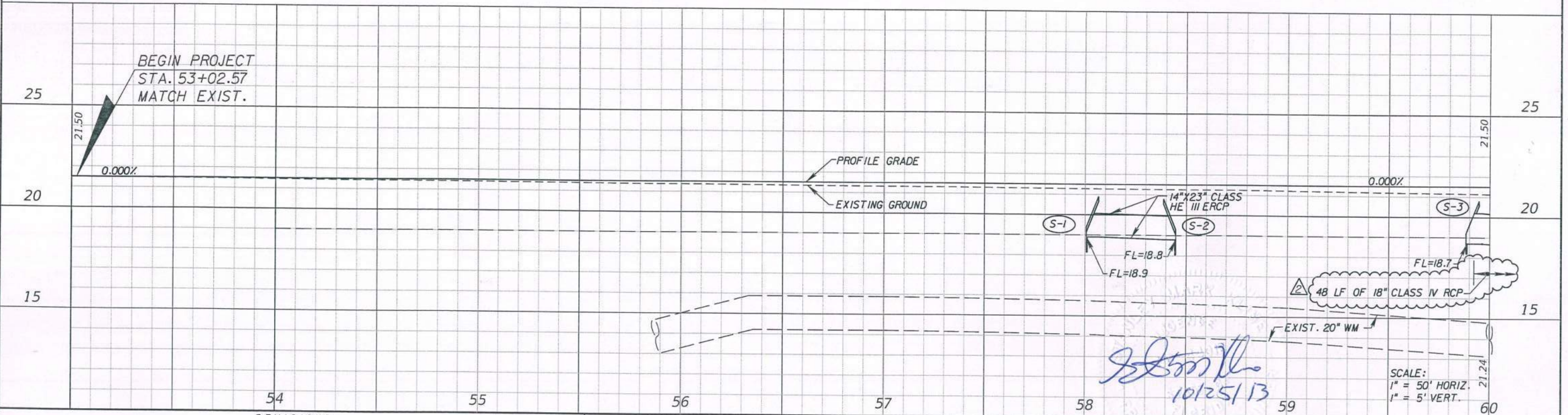
KEITH and SCHNARS, P.A.
 ENGINEERS, PLANNERS, SURVEYORS
 CERTIFICATE OF AUTHORIZATION NO. 1337
 6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/776-1616

THE CITY OF PALM BAY	
ROAD NO.	COUNTY
CR 514	BREVARD

TYPICAL SECTION
 SHEET NO. 2



approximate beginning of study



REVISIONS	
DATE	DESCRIPTION
10/03/13	△ UPDATED DRAINAGE QUANTITIES
10/24/13	△ PIPE CLASS

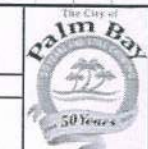
ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS
CERTIFICATE OF AUTHORIZATION NO. 1337

6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 (954) 776-1616

THE CITY OF PALM BAY

ROAD NO.	COUNTY
CR 514	BREVARD

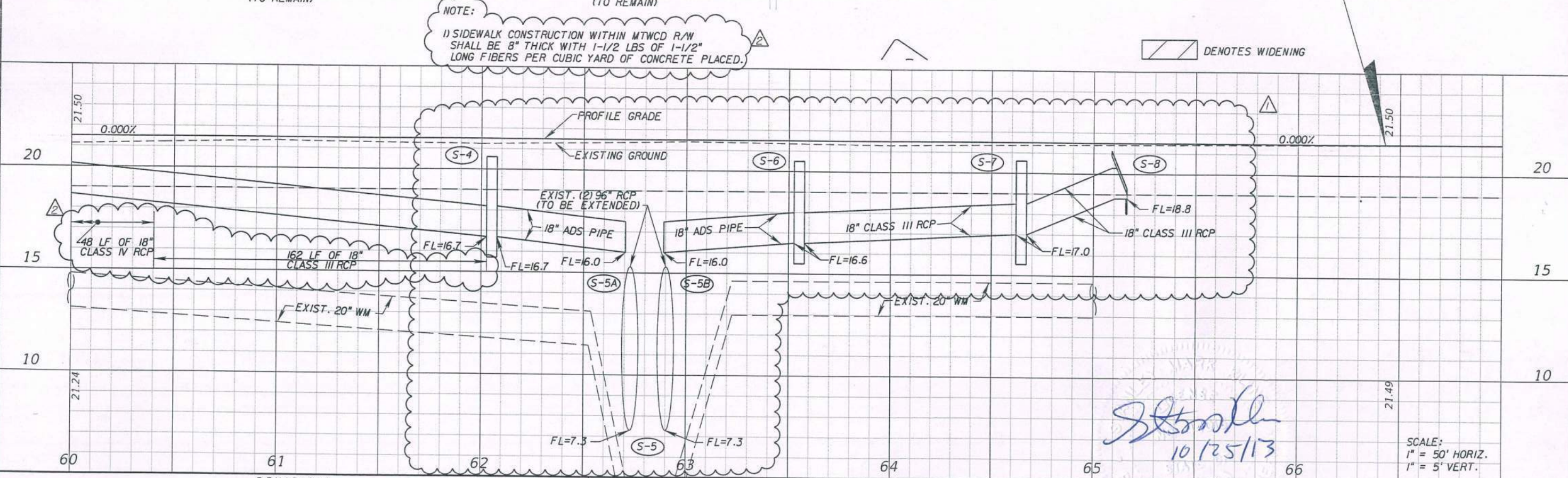
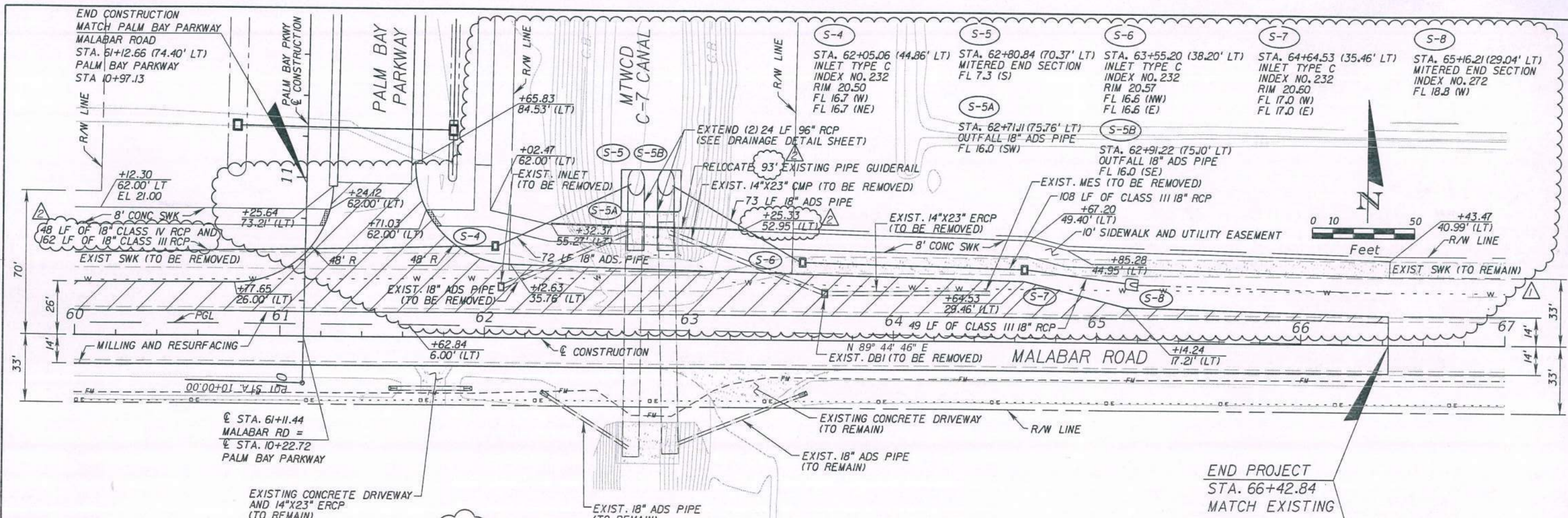


PLAN AND PROFILE

SHEET NO. 5

[Handwritten Signature]
10/25/13

SCALE:
1" = 50' HORIZ.
1" = 5' VERT.



DATE	DESCRIPTION	DATE	DESCRIPTION
10/03/13	△ ADDED RIGHT TURN LANE MODIFIED DRAINAGE STRUCTURES		
10/24/13	△ PIPE CLASS, FIBER REINF. NOTE, END HANDRAIL		

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

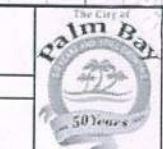
KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS
CERTIFICATE OF AUTHORIZATION NO. 1337

6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 (954) 776-1616

THE CITY OF PALM BAY

ROAD NO. COUNTY

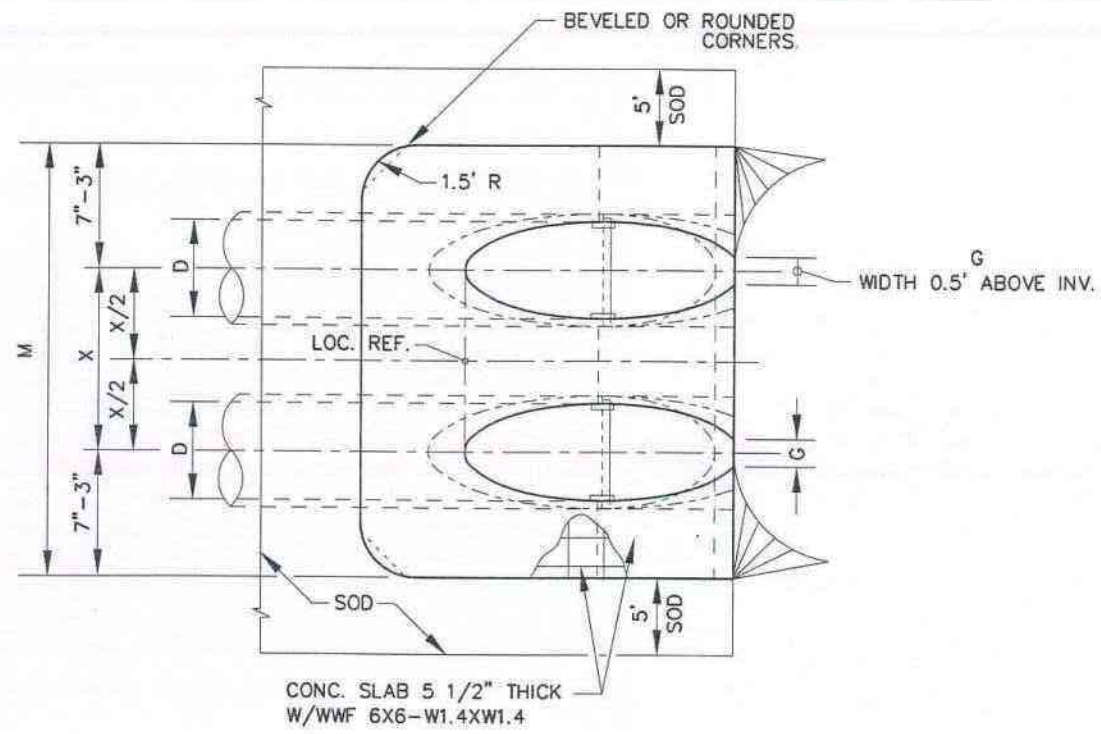
CR 514 BREVARD



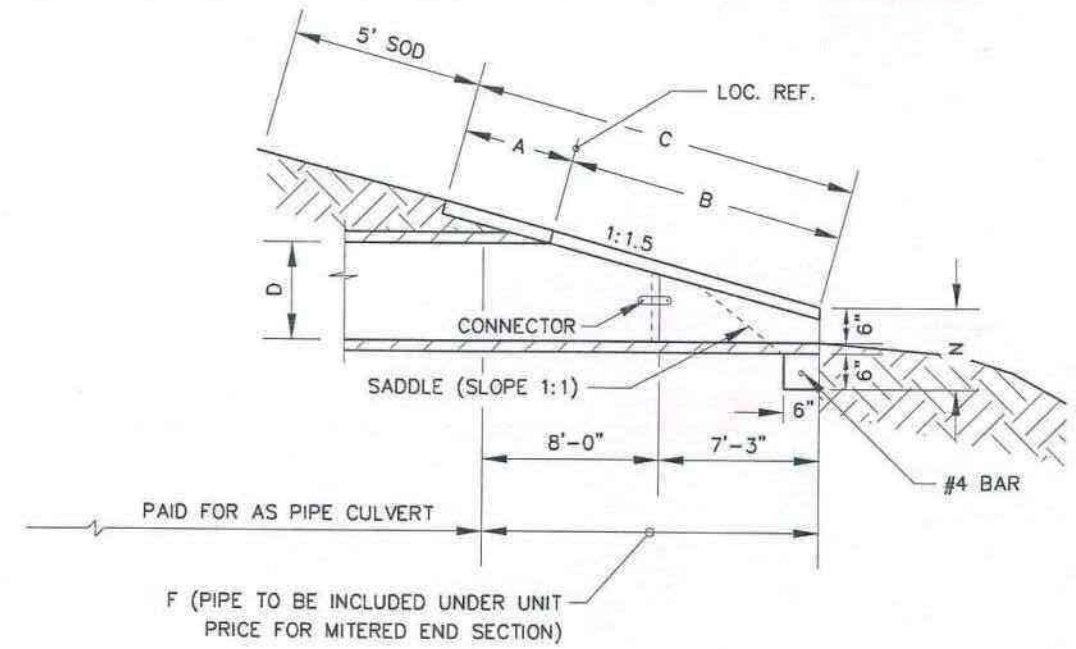
PLAN AND PROFILE

SHEET NO. 6

10/25/13



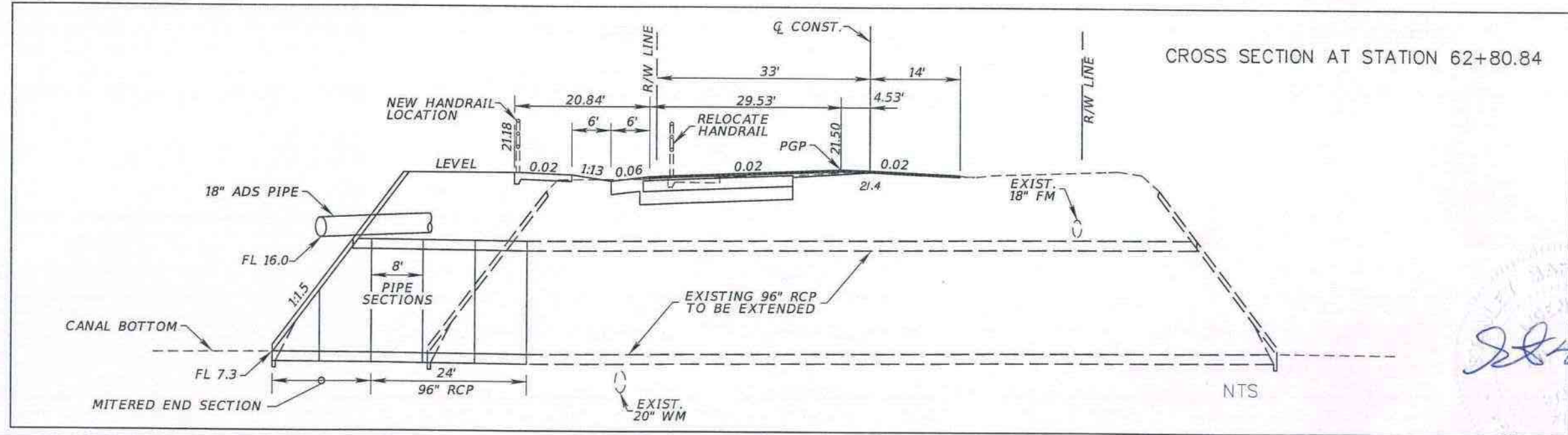
TOP VIEW DOUBLE ROUND CONCRETE PIPE (RCP)



ELEVATION

	D	X	A	B	C	F	G	M	N	CONCRETE (CY)	SODDING (SY)
1:1.5 SLOPE	96"	14'-6"	9.5'	14.88'	24.38'	15.25'	3.71'	29.0'	1.75'	11.3	49

NOTES:
 THIS SHEET SHALL BE USED AS A SUPPLEMENT TO FDOT DESIGN STANDARDS INDEX 272. DETAILS AND DIMENSIONS SHOWN ON THIS SHEET WHICH CONFLICT WITH INDEX 272 SHALL TAKE PRECEDENCE OVER THOSE SHOWN ON INDEX 272.



[Handwritten Signature]
 10/25/13

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION
10/03/13	ADDED SHEET		

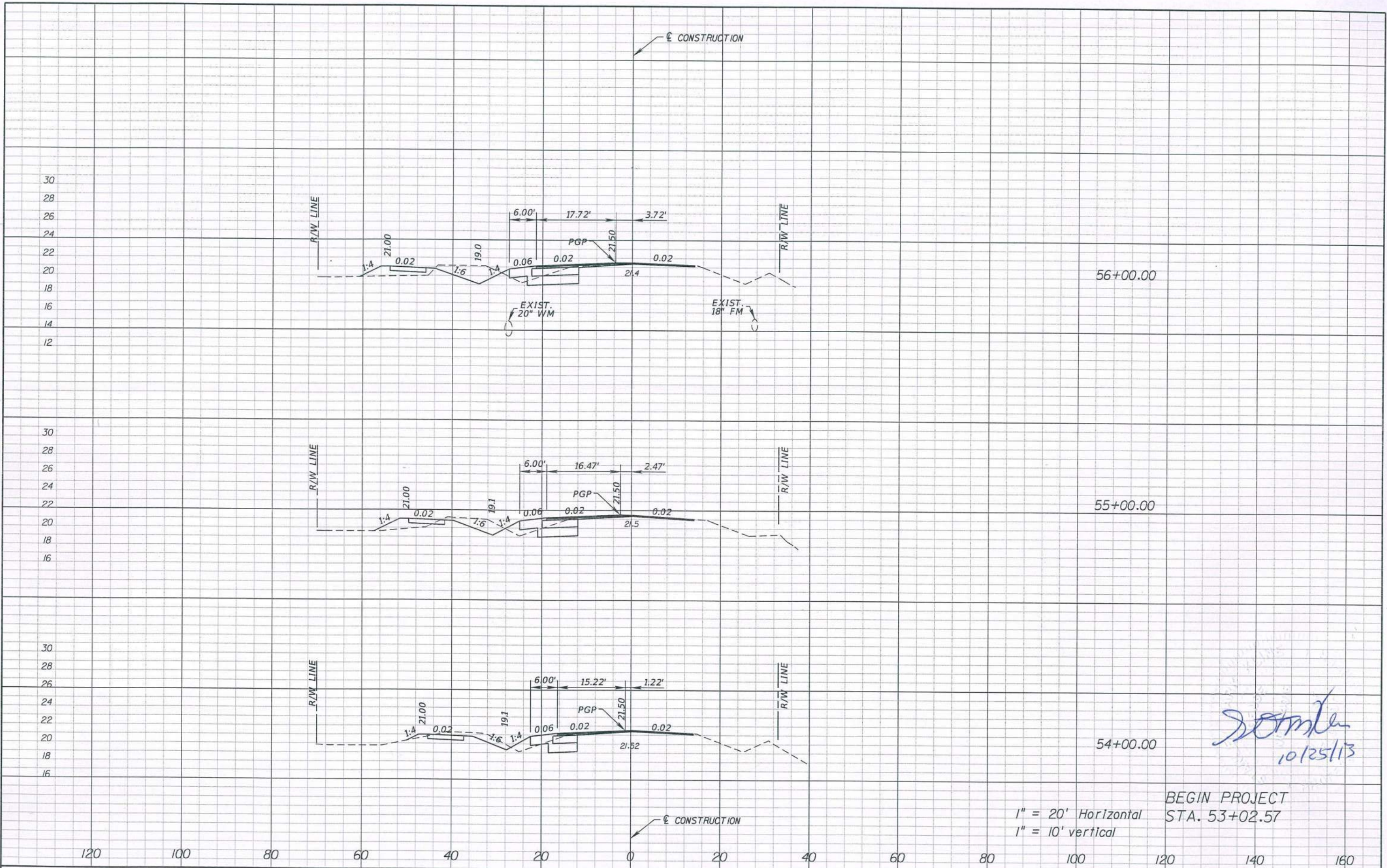
ENGINEER OF RECORD: S. MARK KLINE P.E. #44016
KEITH and SCHNARS, P.A.
 ENGINEERS, PLANNERS, SURVEYORS
 CERTIFICATE OF AUTHORIZATION NO. 1337
 6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/RT6-1616

THE CITY OF PALM BAY
 ROAD NO. CR 514
 COUNTY BREVARD



DRAINAGE DETAIL

SHEET NO. 7A



Storment
10/25/13

BEGIN PROJECT
STA. 53+02.57
1" = 20' Horizontal
1" = 10' Vertical

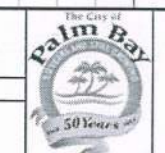
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS
CERTIFICATE OF AUTHORIZATION NO. 1337
6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/76-1616

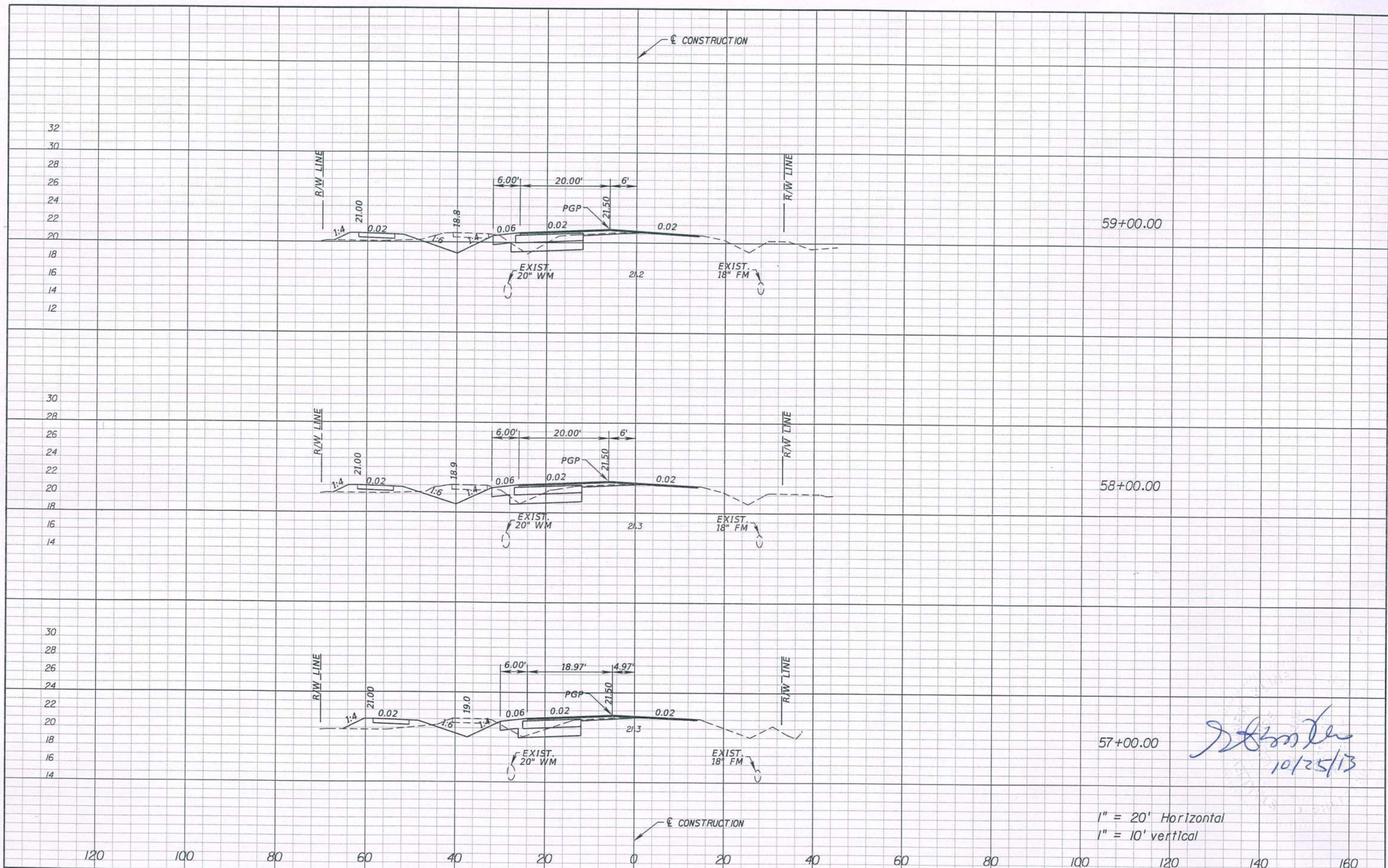
THE CITY OF PALM BAY

ROAD NO.	COUNTY
CR 514	BREVARD



CROSS SECTIONS

SHEET NO.
11



Handwritten signature
10/25/13

1" = 20' Horizontal
1" = 10' Vertical

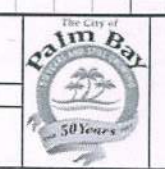
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS
CERTIFICATE OF AUTHORIZATION NO. 1337
6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/776-1616

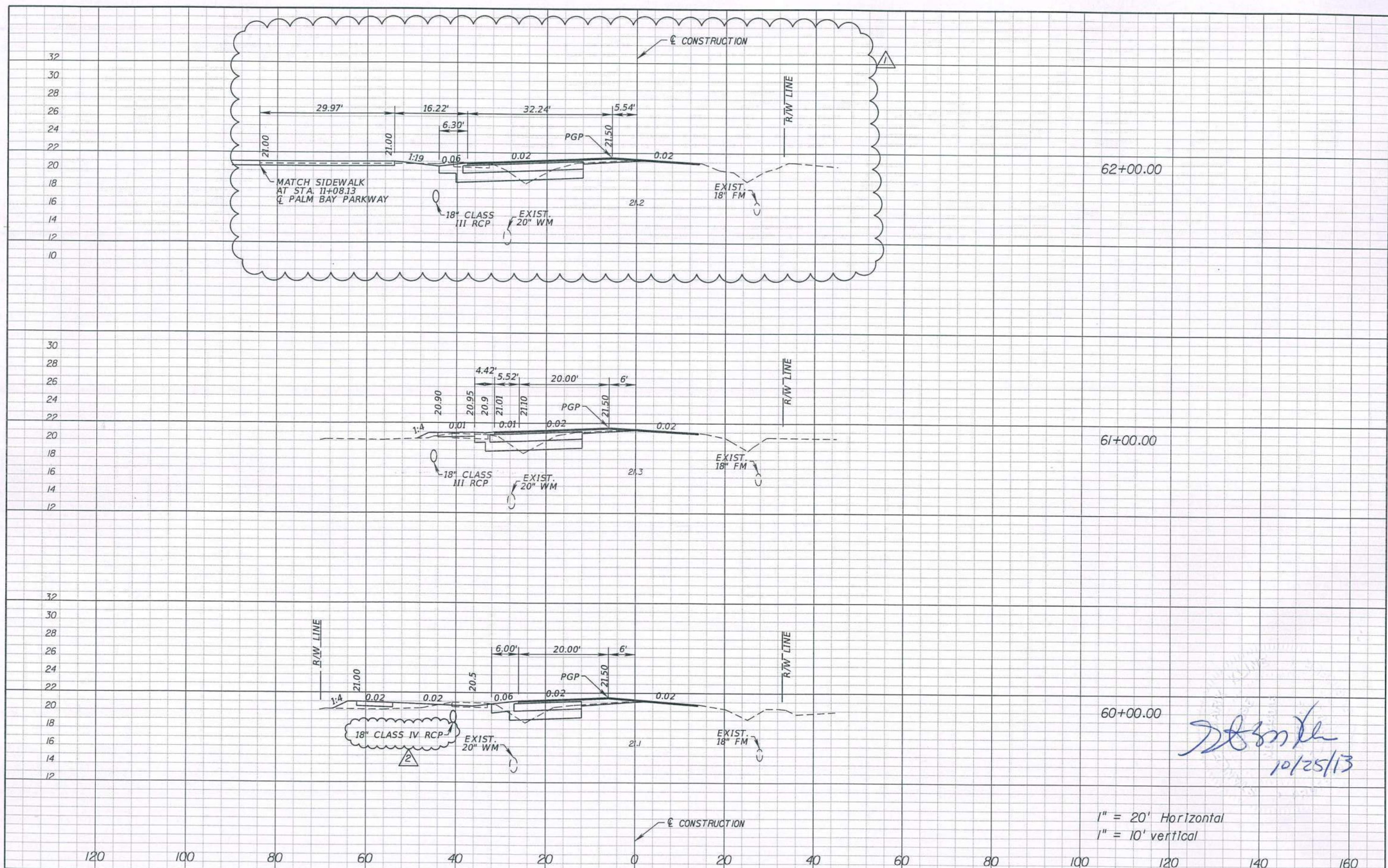
THE CITY OF PALM BAY

ROAD NO.	COUNTY
CR 514	BREVARD



CROSS SECTIONS

SHEET NO.
12



62+00.00

61+00.00

60+00.00

Handwritten signature and date:
 10/25/13

1" = 20' Horizontal
 1" = 10' Vertical

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION
10/03/13	1. ADDED RIGHT TURN LANE		
10/24/13	2. PIPE CLASS		

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

KEITH and SCHNARS, P.A.
 ENGINEERS, PLANNERS, SURVEYORS
 CERTIFICATE OF AUTHORIZATION NO. 1337
 6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/176-1616

THE CITY OF PALM BAY

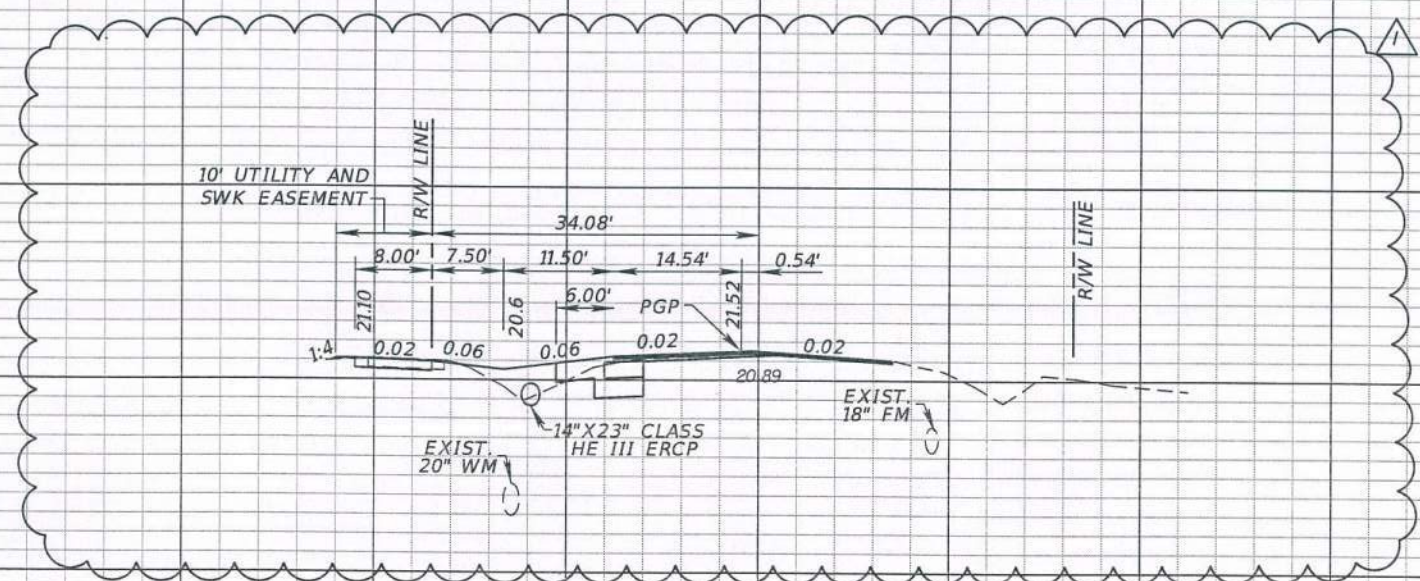
ROAD NO.	COUNTY
CR 514	BREVARD

CROSS SECTIONS

SHEET NO. 13

CONSTRUCTION

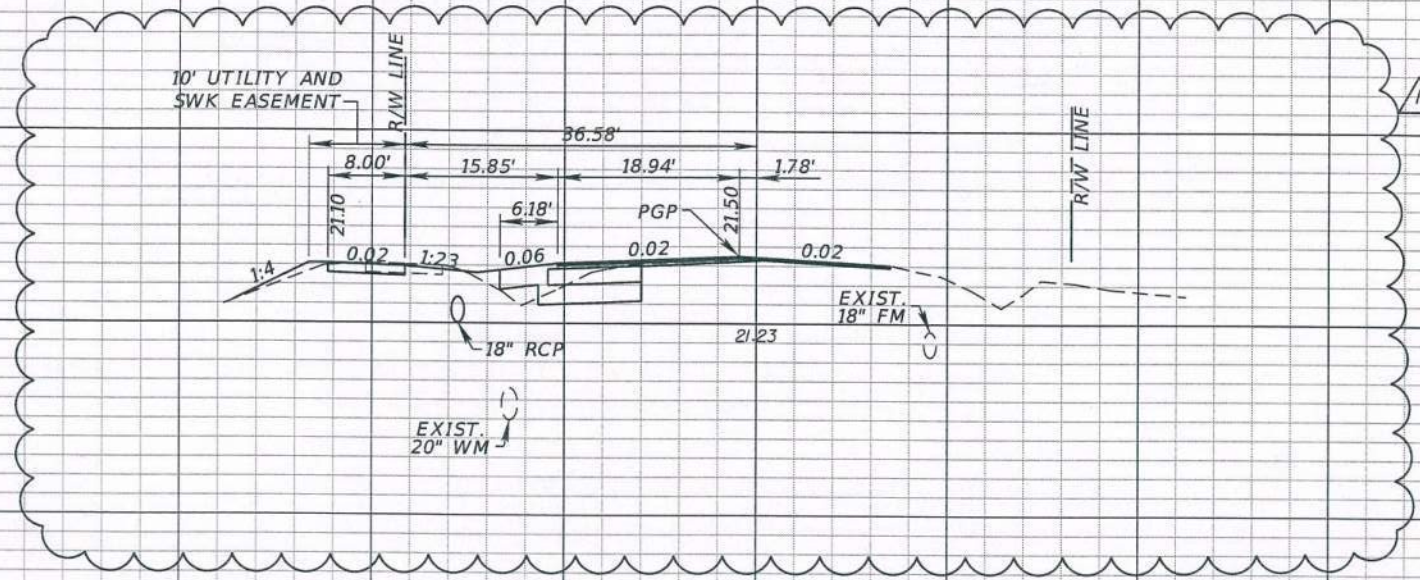
30
28
26
24
22
20
18
16
14
12



END PROJECT
STA. 66+42.84

66+00.00

30
28
26
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12
10
8



65+00.00

Handwritten signature
10/25/13

1" = 20' Horizontal
1" = 10' Vertical

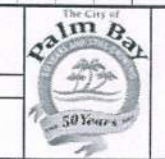
CONSTRUCTION

120 100 80 60 40 20 0 20 40 60 80 100 120 140 160

REVISIONS		DESCRIPTION		THE CITY OF PALM BAY		SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	
10/03/13	ADDED RIGHT TURN LANE			CR 514	BREVARD	15

ENGINEER OF RECORD: S. MARK KLINE P.E. #44016

KEITH and SCHNARS, P.A.
ENGINEERS, PLANNERS, SURVEYORS
CERTIFICATE OF AUTHORIZATION NO. 1337
6500 N. Andrews Ave., Ft. Lauderdale, FL 33309-2132 1954/76-1616



CROSS SECTIONS



**TECHNICAL MEMORANDUM (ANALYSES OF ROADSIDE SWALES FOR
SJRWMD ERP MODIFICATION)**

To: S. MARK KLINE, P.E.

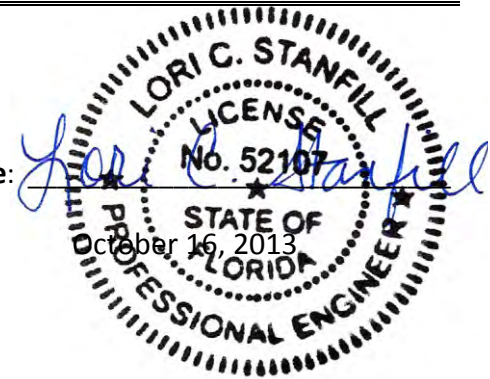
By: LORI STANFILL, P.E.

Registration #: FL #52107

Checked By: GREG SEIDEL, P.E.

Signature:

Date:



Subject: Analysis of Malabar Road Swales for SJRWMD ERP Modification

Malabar Road Turn Lane Project

Prepared for the City of Palm Bay

Financial Project No.(FPN): 428356-1-58-01

Federal Aid Project Number (FAN): 8887-971-A

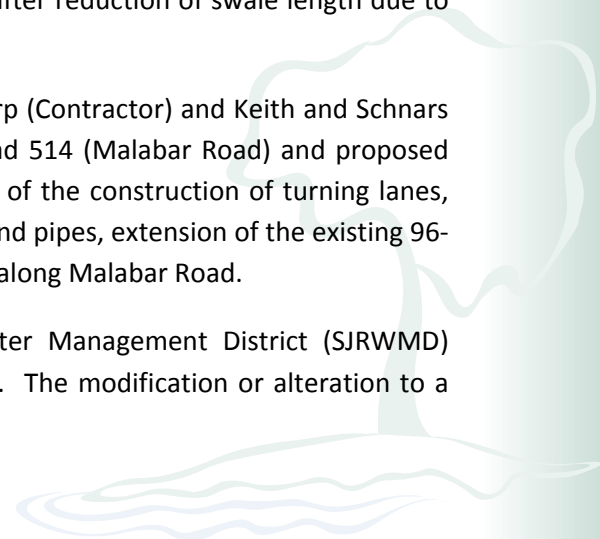
City of Palm Project Number: 10PW18

Brevard County, Florida

This memo forms the analysis of the proposed roadside swales for the Malabar Road Turn Lane Project. The memo demonstrates that the existing roadside swales, which currently infiltrate 80% of the runoff volume per SJRWMD criteria, will continue to meet this criterion after reduction of swale length due to the addition of turn lanes.

The Balmoral Group is a sub consultant to Community Asphalt Corp (Contractor) and Keith and Schnars Engineers (Designer) for the addition of turn lanes at County Road 514 (Malabar Road) and proposed Palm Bay Parkway for the City of Palm Bay. This project consists of the construction of turning lanes, removal of the existing pipes and inlets, installation of new inlets and pipes, extension of the existing 96-inch pipes in Canal C-7, and re-grading of the existing swales/ditch along Malabar Road.

After a permit determination request, the St. Johns River Water Management District (SJRWMD) determined that the project would require a permit modification. The modification or alteration to a



previously permitted project requires a permit modification per regulated activities described in 62-330.020(2) (j), F.A.C.. Due to a proposed surface water impact in Canal C-7 of MTWCD (extending the 2-96-inch RCPs), a major modification will be required for this project. In addition, the surface water impacts due to the extension will need to be quantified.

There are two existing ERP permits for Malabar Road in this vicinity. The Malabar Road Extension High School CCC (Permit No. 4-009-113120-2), May 2008, included paving of Malabar Road and the addition of swales which are permitted to infiltrate a treatment volume equal to 80% of the runoff from the drainage area for the 3-Yr/1-Hr. storm event. A second permit for the proposed Palm Bay Parkway was obtained in March of 2011. This ERP (Permit No. 40-009-125243-1) included a turn lane and modifications to the drainage along Malabar Road at the proposed intersection with Palm Bay Parkway, however, it did not include an extension of the double 96 inch pipes. A modification of the ERP for the Malabar Road Extension (High School) will be requested for this project.

The proposed project starts at Sta. 53+02.57 and ends at Sta. 66+42.84, a length of 1340.27 feet (or 0.25 mile). This includes both the right turn and left turn lanes from Malabar Road onto Palm Bay Parkway on the east and west side of the intersection, respectively. From the initial permit for this project, the addition of the turn lanes on Malabar Road has added 11,235 SF (0.257 ac.) of impervious area which was not included with the original Palm Bay Parkway permit. However, the Emerson Drive typical section has been reduced from 4-lanes to only 2 lanes. This revision decreased the amount of impervious area from the original permit by 104,108 SF (2.39 ac.).

Currently, the existing stormwater system consists of dry roadside swales which are permitted to infiltrate a treatment volume equal to 80% of the runoff from the drainage area for the 3-Year/1-Hour storm event. Since the addition of the extra pavement for the turn lanes reduced the length of the swales, the Stormwater Report from the Malabar Road Extension High School CCC, Revised May 2008, was used to determine if the modified swales would continue to meet the SJRWMD criteria. These impacted swales which are located on the north side of Malabar Road discharge to the Melbourne Tillman Water Control District Canal C-7 from the west and east sides of the canal.

Swales N-SWL-32 and N-SWL-50 discharge into the west and east sides of Canal C-7, respectively. Swale N-SWL-32 was reduced in length from 385 feet to 161 feet, and N-SWL-50 was reduced in length from 1000 feet to 925 feet. The time of concentration calculations were modified for the reduced swale lengths and input into the ICPR analysis. The hydrology for the two swale basins were recreated and then modeled with the revised times of concentration. As the current version of ICPR (3.10) is different from the ICPR version (3.02) used for the original calculations, the runoff volume for swale N-SWL-50 is slightly larger than shown in the previous version. The calculations for the infiltration of 80% of the runoff from a 3-yr/1-hr storm event were then updated with the revised runoff volumes for the modified swales. The Ponds Channel program (Version 3.30028) was then updated to determine the new efficiencies of each swale system. It was determined that the modified swales still meet the criteria, and infiltration of 82.6% of the runoff from the overall contributing basins is provided. In addition, the required treatment volume recovers in 36.1 hours following a storm event. See Attachment for adjusted computations which utilize the permitted calculations.

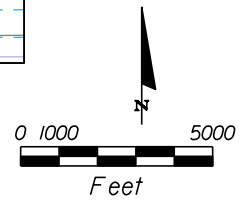
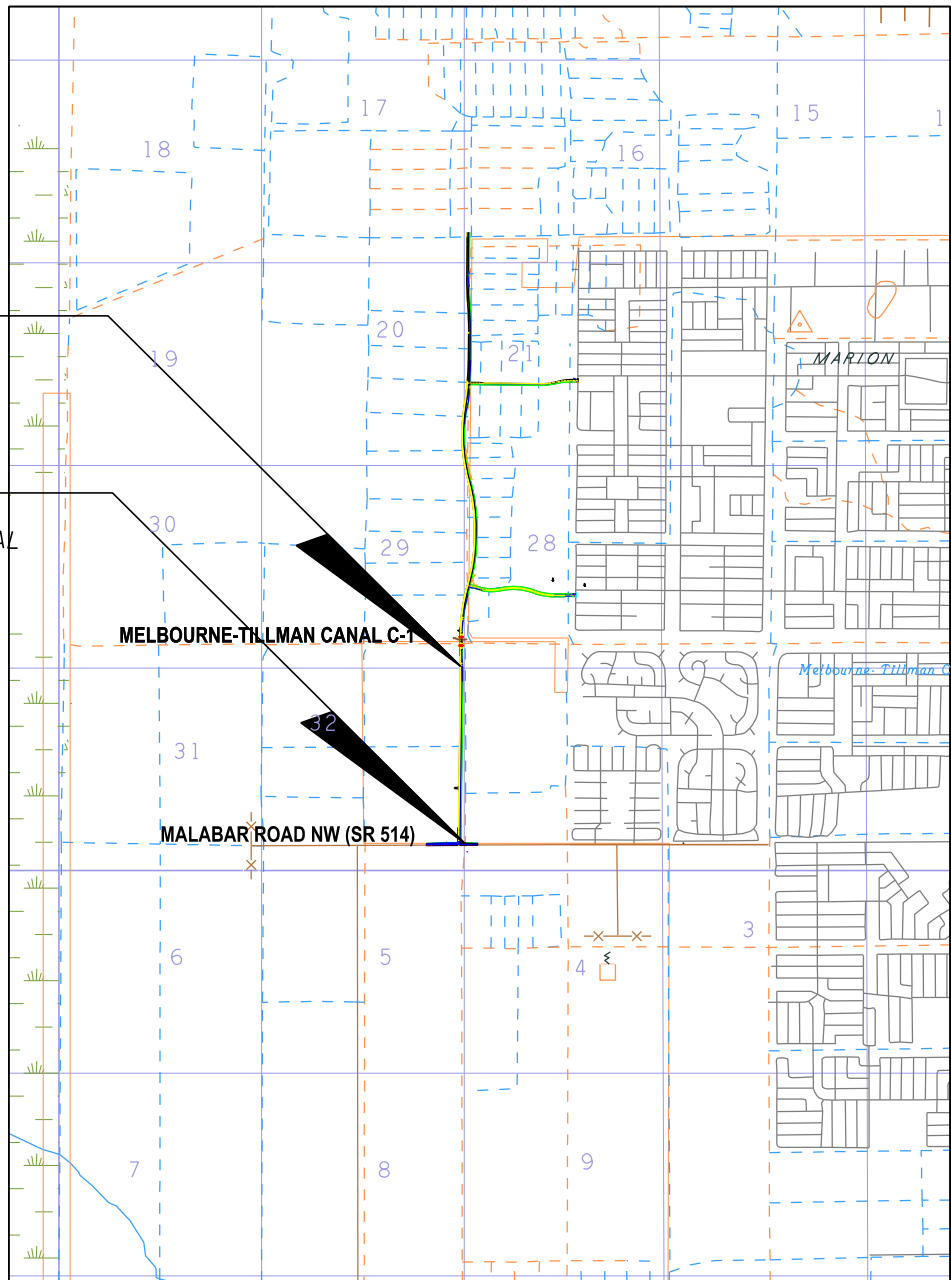
The extension of the double 96 inch culvert impacted the MTWCD C-7 Canal. As a result, the surface water impacts have been quantified per SFWMD criteria. The MTWCD has provided a normal water elevation of 8.0 feet NGVD for the C-7 Canal in this location. The contour information for the C-7 Canal does not show any contours lower than the 11.0 foot NGVD contour. As the 8.0 foot contour was not available, the 11.0 foot contour was used to determine the surface water impact of 0.019 acres. See the attached Surface Water Impact exhibit.



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PROPOSED
PALM BAY
PARKWAY

PROPOSED
DOUBLE 96"
EXTENSION
AT C-7 CANAL



The Balmoral Group
165 Lincoln Avenue
Winter Park, FL 32789
Phone: (407) 629-2185
www.balmoralgroup.us
Certificate of Authorization No. 26123
E.O.R.: Lori C. Stanfill, P.E. No. 52107

Figure #1
Location Map
City of Palm Bay - Double 96"
Culvert Extension over C-7 Canal
Financial Project ID 428356-1-58-01
Brevard County, Florida

Knapp

Calculations Revised for Malabar Road Turn Lane Project (Calculations From SJRWMD ERP No. 4-009-113120-2)

**STORMWATER MANAGEMENT CALCULATIONS
SWALE DESIGN - WATER QUALITY**

Allen Engineering, Inc.

Project Name: MALABAR RD. EXTENSION - H.S. CCC

Project No.: 070007.2

Calculated by: D. Lavender, P.E.

Date: 3/25/2008

Revised: 5/13/2008

Basin ID: ALL POST DEVELOPMENT BASINS

SJRWMD Swale Criteria:

- Infiltrate 80% of the runoff from the 3-Year/1-Hour Storm
 - infiltrate 100% if discharge is to OFW, Class I, II, or III.
- Recovery Time:
- Total recovery of the required treatment volume within 72 hours.

Swale System Basin Data:

Drainage Area, DA =	6.618	ac
Impervious Area =	2.912	ac
Percent Impervious =	44.0	%

Required Treatment Volume (Infiltration of 80% runoff from the 3-YR/1-HR Storm):

Basin	Runoff	
N-SWL-10-14	3496.8 CF	
N-SWL-30-32	2844.3 CF	Revised - 2856 CF
N-SWL-50	3284.9 CF	Revised - 3445 CF
N-SWL-70	1534.9 CF	
S-SWL-20	2956.5 CF	
S-SWL-40	2889.0 CF	
S-SWL-60	3468.6 CF	
Total Runoff	20,475 CF	Rev. - 20647 CF
80% of Runoff	16,380 CF	Rev. - 16517 CF

0.376 AC-FT **Rev.- 0.379**

See attached AdICPR 3.0 Basin Summary results

Provided Treatment Volume:

- Runoff from the contributing basins to a particular swale may not infiltrate the entire 80%, but on an overall total, 80% is infiltrated from the 3-Year/1-Hour Storm Event (I = 2.7 in/hr)

Amount of Runoff Infiltrated:

	CF	%
1160' N-SWL-10 to 14 =	3322.7 CF	95.0%
1145' N-SWL-30 to 32 =	2550.5 CF	89.7% 65.4% (Revised)
1000' N-SWL-50 =	2355.9 CF	71.7% 60.8% (Revised)
350' N-SWL-70 =	458.3 CF	29.9%
1360' S-SWL-20 =	2956.5 CF	100.0%
1190' S-SWL-40 =	2889.0 CF	100.0%
1425' S-SWL-60 =	3468.6 CF	100.0%
Total Provided Treatment Volume =	18,002 CF	87.9%
	Revised - 17058 CF	82.6% (Revised)

0.413 AC-FT **Rev.- 0.392 ac-ft**

See attached PONDS 3.2 Channel and Overland Flow analysis for each swale

Treatment Volume Recovery:

Rev.- 0.379 ac-ft
Rev. 36.1 hrs.

The required treatment volume of 0.376 ac-ft recovers within less than 35.8 hours following a storm event. This is estimated based on the minimum swale infiltration rate of 0.127 cfs (16,380 cf/0.127cfs = 128,976 sec = 35.8 hr). See attached PONDS 3.2 Channel and Overland Flow analysis.

Rev. 16517 CF/0.127 cfs = 130,055 sec = 36.1hrs.

Calculations From SJRWMD ERP No. 4-009-113120-2

POST-DEVELOPMENT DETERMINATION OF TIME OF CONCENTRATION

CONVEYANCE CALCULATIONS :

1.a. OVERLAND (<300 ft): TR55 METHOD

$$T_c = 0.007(NL)^{0.8} / P_2^{0.5} S^{0.4}$$

b. OVERLAND (>300 ft) : VELOCITY CURVES FOR VARIOUS LAND USE TYPES

2. OPEN CHANNEL : MANNINGS EQUATION

$$V = (1.49 / n) * R^{0.67} * S^{0.5}$$

3. CONTINUITY EQUATION : $Q = V * A$

PROJECT : MALABAR RD. EXTENSION - H.S. CCC

DATE: 3/12/2008

BASIN ID. : N-SWL-10

AREA (ac) = 0.057

ASSUMPTIONS : USE MINIMUM OF 10 MINUTES

TOTAL Tc (min.) = 10.0

BASIN ID. : N-SWL-12

AREA (ac) = 0.115

ASSUMPTIONS : USE MINIMUM OF 10 MINUTES

TOTAL Tc (min.) = 10.0

BASIN ID. : N-SWL-14

AREA (ac) = 0.881

1. OVERLAND FLOW

LENGTH	"N" VALUE	SLOPE	RAINFALL	STORM FREQUENCY	STORM DURATION		OVERLAND VELOCITY	TIME OF CONC. 1
(ft)		(ft/ft)	(in.)	(year)	(min)	(hour)	(ft/min.)	(min.)
55	0.015	0.020	5.0	2	--	24	---	0.8
SUB-TOTAL (min) =								0.8

2. OPEN CHANNEL FLOW

ASSUMPTIONS : RAINFALL INTENSITY (in/hr) = 3.3 (10 year freq., 1 hour duration)

"C" VALUE = 0.53

Q(cfs) = iCA = 1.51 (RATIONAL METHOD)

SWALE DEPTH % = 0.75

PIPE SIZE / CHANNEL	LENGTH	"N" VALUE	SLOPE	Rh	VELOCITY	TIME OF CONC. 2
(ft)	(ft)		(ft/ft)	(ft)	(ft/sec.)	(min.)
15	955	0.15	0.0008	0.65	0.22	73.6
SUB-TOTAL (min) =						73.6
TOTAL Tc (min.) =						74.4

BASIN ID. : N-SWL-30

AREA (ac) = 0.595

1. OVERLAND FLOW

LENGTH	"N" VALUE	SLOPE	RAINFALL	STORM FREQUENCY	STORM DURATION		OVERLAND VELOCITY	TIME OF CONC. 1
(ft)		(ft/ft)	(in.)	(year)	(min)	(hour)	(ft/min.)	(min.)
25	0.015	0.020	5.0	2	--	24	---	0.4
SUB-TOTAL (min) =								0.4

2. OPEN CHANNEL FLOW

ASSUMPTIONS : RAINFALL INTENSITY (in/hr) = 3.3 (10 year freq., 1 hour duration)

"C" VALUE = 0.53

Q(cfs) = iCA = 1.04 (RATIONAL METHOD)

SWALE DEPTH % = 0.75

PIPE SIZE / CHANNEL	LENGTH	"N" VALUE	SLOPE	Rh	VELOCITY	TIME OF CONC. 2
(ft)	(ft)		(ft/ft)	(ft)	(ft/sec.)	(min.)
15	750	0.15	0.0011	0.65	0.25	50.5
SUB-TOTAL (min) =						50.5
TOTAL Tc (min.) =						50.9

Calculations Revised for Malabar Road Turn Lane Project (Calculations From SJRWMD ERP No. 4-009-113120-2)

BASIN ID. : N-SWL-32
AREA (ac) = 0.345

Revised swale length = 161'

1. OVERLAND FLOW

LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	RAINFALL (in.)	STORM FREQUENCY (year)	STORM DURATION		OVERLAND VELOCITY (ft / min.)	TIME OF CONC. 1 (min.)
					(min)	(hour)		
25	0.015	0.020	5.0	2	--	24	---	0.4
SUB-TOTAL (min) =								0.4

**2. OPEN CHANNEL FLOW
ASSUMPTIONS :**

RAINFALL INTENSITY (in / hr) = 3.3 (10 year freq. , 1 hour duration)
 "C" VALUE = 0.53
 Q(cfs) = iCA = 0.60 (RATIONAL METHOD)
 SWALE DEPTH % = 0.75

PIPE SIZE / CHANNEL (ft)	LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	Rh (ft)	VELOCITY (ft / sec.)	TIME OF CONC. 2 (min.)
15	360	0.15	0.0014	0.65	0.28	21.5
SUB-TOTAL (min) =						21.5
TOTAL Tc (min.) =						21.9

136'

**Rev. 8.1 min.
Rev. 8.5 min.
- Use 10 min.**

BASIN ID. : N-SWL-50
AREA (ac) = 1.031

Revised swale length = 925'

1. OVERLAND FLOW

LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	RAINFALL (in.)	STORM FREQUENCY (year)	STORM DURATION		OVERLAND VELOCITY (ft / min.)	TIME OF CONC. 1 (min.)
					(min)	(hour)		
25	0.015	0.020	5.0	2	--	24	---	0.4
SUB-TOTAL (min) =								0.4

**2. OPEN CHANNEL FLOW
ASSUMPTIONS :**

RAINFALL INTENSITY (in / hr) = 3.3 (10 year freq. , 1 hour duration)
 "C" VALUE = 0.53
 Q(cfs) = iCA = 1.80 (RATIONAL METHOD)
 SWALE DEPTH % = 0.75

PIPE SIZE / CHANNEL (ft)	LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	Rh (ft)	VELOCITY (ft / sec.)	TIME OF CONC. 2 (min.)
15	975	0.15	0.0010	0.65	0.24	68.9
SUB-TOTAL (min) =						68.9
TOTAL Tc (min.) =						69.3

900'

**Rev. 62.4 min.
Rev. 62.8 min.**

BASIN ID. : N-SWL-70
AREA (ac) = 1.031

1. OVERLAND FLOW

LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	RAINFALL (in.)	STORM FREQUENCY (year)	STORM DURATION		OVERLAND VELOCITY (ft / min.)	TIME OF CONC. 1 (min.)
					(min)	(hour)		
25	0.015	0.020	5.0	2	--	24	---	0.4
SUB-TOTAL (min) =								0.4

**2. OPEN CHANNEL FLOW
ASSUMPTIONS :**

RAINFALL INTENSITY (in / hr) = 3.3 (10 year freq. , 1 hour duration)
 "C" VALUE = 0.53
 Q(cfs) = iCA = 1.80 (RATIONAL METHOD)
 SWALE DEPTH % = 0.75

PIPE SIZE / CHANNEL (ft)	LENGTH (ft)	"N" VALUE	SLOPE (ft / ft)	Rh (ft)	VELOCITY (ft / sec.)	TIME OF CONC. 2 (min.)
15	330	0.15	0.0026	0.65	0.38	14.5
SUB-TOTAL (min) =						14.5
TOTAL Tc (min.) =						14.9

Calculations From SJRWMD ERP No. 4-009-113120-2

MALABAR RD. EXTENSION - HIGH SCHOOL CCC
 PALM BAY, FLORIDA
 3-YEAR/1-HOUR STORM EVENT
 BASIN SUMMARY

Name:	N-SWL-10	N-SWL-12	N-SWL-14	N-SWL-30	N-SWL-32
Group:	BASE	BASE	BASE	BASE	BASE
Simulation:	3YR-1HR	3YR-1HR	3YR-1HR	3YR-1HR	3YR-1HR
Node:	N-SWL-10	N-SWL-12	N-SWL-14	N-SWL-30	N-SWL-32
Type:	SCS	SCS	SCS	SCS	SCS
Unit Hydrograph:	Uh484	Uh484	Uh484	Uh484	Uh484
Peaking Factor:	484.0	484.0	484.0	484.0	484.0
Spec Time Inc(min):	1.33	1.33	9.87	6.80	2.93
Comp Time Inc(min):	1.33	1.33	9.87	6.80	2.93
Rain File:	Flmod	Flmod	Flmod	Flmod	Flmod
Rain Amount(in):	2.700	2.700	2.700	2.700	2.700
Duration(hrs):	1.00	1.00	1.00	1.00	1.00
Status:	Onsite	Onsite	Onsite	Onsite	Onsite
TC(min):	10.00	10.00	74.00	51.00	22.00
Time Shift(hrs):	0.00	0.00	0.00	0.00	0.00
Area(ac):	0.057	0.115	0.861	0.595	0.345
Vol of Unit Hyd(in):	1.001	1.000	1.000	1.000	1.000
Curve Num:	80.000	80.000	78.000	77.000	77.000
DCIA(%):	0.000	0.000	0.000	0.000	0.000
Time Max(hrs):	0.62	0.62	1.32	1.13	0.78
Flow Max(cfs):	0.234	0.472	0.682	0.598	0.657
Runoff volume(in):	1.028	1.028	0.913	0.819	0.858
Runoff volume(ft3):	212.788	429.309	2854.680	1769.908	1074.413

Name:	N-SWL-50	N-SWL-70	S-SWL-20	S-SWL-40	S-SWL-60
Group:	BASE	BASE	BASE	BASE	BASE
Simulation:	3YR-1HR	3YR-1HR	3YR-1HR	3YR-1HR	3YR-1HR
Node:	N-SWL-50	N-SWL-70	S-SWL-20	S-SWL-40	S-SWL-60
Type:	SCS	SCS	SCS	SCS	SCS
Unit Hydrograph:	Uh484	Uh484	Uh484	Uh484	Uh484
Peaking Factor:	484.0	484.0	484.0	484.0	484.0
Spec Time Inc(min):	9.20	2.00	12.80	11.47	13.33
Comp Time Inc(min):	9.20	2.00	12.80	11.47	13.33
Rain File:	Flmod	Flmod	Flmod	Flmod	Flmod
Rain Amount(in):	2.700	2.700	2.700	2.700	2.700
Duration(hrs):	1.00	1.00	1.00	1.00	1.00
Status:	Onsite	Onsite	Onsite	Onsite	Onsite
TC(min):	69.00	15.00	96.00	86.00	100.00
Time Shift(hrs):	0.00	0.00	0.00	0.00	0.00
Area(ac):	1.031	0.460	1.033	0.940	1.181
Vol of Unit Hyd(in):	1.000	1.000	1.000	1.000	1.000
Curve Num:	78.000	78.000	77.000	77.000	77.000
DCIA(%):	0.000	0.000	0.000	0.000	0.000
Time Max(hrs):	1.23	0.67	1.49	1.53	1.56
Flow Max(cfs):	0.848	1.219	0.569	0.597	0.642
Runoff volume(in):	0.878	0.919	0.788	0.847	0.809
Runoff volume(ft3):	3284.946	1534.884	2956.492	2889.023	3468.571

2854
 429
 212.7

Revised ICPR Analysis

=====
Basins
=====

Name: N-SWL-32_Orig. Node: N-SWL-32_Orig. Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484 Peaking Factor: 484.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 22.00
Area(ac): 0.345 Time Shift(hrs): 0.00
Curve Number: 77.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Original ICPR - Recreated from SJRWMD Permit for Malabar Road Extension - High School CCC
Permit No. 4-009-113120-2

Name: N-SWL-32_Rev Node: N-SWL-32_Rev Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484 Peaking Factor: 484.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.345 Time Shift(hrs): 0.00
Curve Number: 77.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Revised ICPR - Adjusted Time of Concentration for shorter swale length

Name: N-SWL-50_Orig Node: N-SWL-50_Orig Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484 Peaking Factor: 484.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 69.00
Area(ac): 1.031 Time Shift(hrs): 0.00
Curve Number: 78.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Original ICPR - Recreated from SJRWMD Permit for Malabar Road Extension - High School CCC
Permit No. 4-009-113120-2

Name: N-SWL-50_Rev Node: N-SWL-50_Rev Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484 Peaking Factor: 484.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 63.00
Area(ac): 1.031 Time Shift(hrs): 0.00
Curve Number: 78.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Revised ICPR - Adjusted Time of Concentration for shorter swale length

=====
Hydrology Simulations
=====

Name: 3 YR - 1 HR
Filename: U:_Palm Bay ParkWay\zTBG\drainage\Supplemental for Pipe Extension\ICPR\3 YR - 1 HR.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Flmod
Rainfall Amount(in): 2.70

Time(hrs)	Print Inc(min)
1.000	5.00

Basin Name: N-SWL-32_Orig.
Group Name: BASE
Simulation: 3 YR - 1 HR
Node Name: N-SWL-32_Orig.
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 2.93
Comp Time Inc (min): 2.93
Rainfall File: Flmod
Rainfall Amount (in): 2.700
Storm Duration (hrs): 1.00
Status: Onsite
Time of Conc (min): 22.00
Time Shift (hrs): 0.00
Area (ac): 0.345
Vol of Unit Hyd (in): 1.001
Curve Number: 77.000
DCIA (%): 0.000

Time Max (hrs): 0.78
Flow Max (cfs): 0.66
Runoff Volume (in): 0.858
Runoff Volume (ft3): 1074

Basin Name: N-SWL-32_Rev
Group Name: BASE
Simulation: 3 YR - 1 HR
Node Name: N-SWL-32_Rev
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 1.33
Comp Time Inc (min): 1.33
Rainfall File: Flmod
Rainfall Amount (in): 2.700
Storm Duration (hrs): 1.00
Status: Onsite
Time of Conc (min): 10.00
Time Shift (hrs): 0.00
Area (ac): 0.345
Vol of Unit Hyd (in): 1.000
Curve Number: 77.000
DCIA (%): 0.000

Time Max (hrs): 0.62
Flow Max (cfs): 1.16
Runoff Volume (in): 0.867
Runoff Volume (ft3): 1086

Basin Name: N-SWL-50_Orig
Group Name: BASE
Simulation: 3 YR - 1 HR
Node Name: N-SWL-50_Orig
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 9.20
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 2.700
Storm Duration (hrs): 1.00
Status: Onsite
Time of Conc (min): 69.00
Time Shift (hrs): 0.00
Area (ac): 1.031
Vol of Unit Hyd (in): 1.000
Curve Number: 78.000
DCIA (%): 0.000

Time Max (hrs): 1.33
Flow Max (cfs): 0.87
Runoff Volume (in): 0.920
Runoff Volume (ft3): 3444

Basin Name: N-SWL-50_Rev
Group Name: BASE
Simulation: 3 YR - 1 HR

Node Name: N-SWL-50_Rev
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 8.40
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 2.700
Storm Duration (hrs): 1.00
Status: Onsite
Time of Conc (min): 63.00
Time Shift (hrs): 0.00
Area (ac): 1.031
Vol of Unit Hyd (in): 1.000
Curve Number: 78.000
DCIA (%): 0.000

Time Max (hrs): 1.25
Flow Max (cfs): 0.94
Runoff Volume (in): 0.920
Runoff Volume (ft3): 3445

Revised Ponds Analysis

PONDS Channel and Overland Flow Analysis

Version 3.3.0028

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Devo Seereeram, Ph.D., P.E.

I. INPUT DATA

Job Information

Job Name: HIGH SCHOOL CCC - MALABAR RD - N-SWL-30 AND N-SWL-32 (REVISED)
Engineer: LCS
Date: 10-09-2013

Solution Type

Calculate efficiency of specified channel length (with infiltration)

Channel Geometry

Swale length, [L]: 936 ft
Bottom width of channel, [B]: .01 ft
Left side slope of channel, [Z1]: 3 ?H : 1V
Right side slope of channel, [Z2]: 4 ?H : 1V
Slope of channel, [Sc]: .00122 ft/ft

Channel Flow Rate

Channel flow rate, [Qp]: .7804 cfs
Duration of flow: 61 min

Flow Velocity

Lining Type: GRASS
Permissible velocity, [Vp]: 5 feet per second
Manning's roughness coefficient, [n]: .15

Aquifer

Unsaturated vertical infiltration rate, [Kvu]: 12.7 feet per day
Factor of Safety (for soil infiltration), [FSi]: 2
Soil Porosity, [f]: 25 %
Depth to water table from bottom of channel, [hb]: 2.4 ft

PONDS Channel and Overland Flow Analysis
Version 3.3.0028
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Devo Seereeram, Ph.D., P.E.

II. RESULTS

Summary Of Results

Length of channel, [L]:	936 ft
Treatment efficiency, [e]:	65.34737 %
Factor of safety against erosion, [FSe]:	23.22106

Channel Inflow Calculations

Channel inflow rate, [Qp]:	0.7804 cfs
Inflow volume (treatment volume), [Vr]:	2856.264 ft ³

Channel Geometry Calculations

Normal depth of flow, [d]:	1.016181 ft
Top width of water surface, [Wt]:	7.123264 ft
Cross-sectional flow area, [Ax]:	3.624342 ft ²
Wetted perimeter, [P]:	7.413265 ft
Hydraulic radius, [Rh]:	0.4888996 ft

Protection Against Erosion

Mean velocity, [V]:	0.2153218 fps
Factor of safety against erosion, [FSe]:	23.22106

Infiltration Calculations

Design infiltration rate, [Id]:	6.35 ft/day
Effective channel bottom area, [Ab]:	6938.816 ft ²
Infiltration rate at normal depth, [Qip]:	0.5099708 cfs
Computed max infiltration volume, [Vm]:	1866.493 ft ³
Available soil storage volume below channel, [Vs]:	4000.425 ft ³

PONDS Channel and Overland Flow Analysis
Version 3.3.0028
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Devo Seereeram, Ph.D., P.E.

I. INPUT DATA

Job Information

Job Name: HIGH SCHOOL CCC - MALABAR RD - N-SWL-50 (REVISED)
Engineer: LCS
Date: 10-09-2013

Solution Type

Calculate efficiency of specified channel length (with infiltration)

Channel Geometry

Swale length, [L]: 925 ft
Bottom width of channel, [B]: .01 ft
Left side slope of channel, [Z1]: 4 ?H : 1V
Right side slope of channel, [Z2]: 3 ?H : 1V
Slope of channel, [Sc]: .001 ft/ft

Channel Flow Rate

Channel flow rate, [Qp]: .9114 cfs
Duration of flow: 63 min

Flow Velocity

Lining Type: GRASS
Permissible velocity, [Vp]: 5 feet per second
Manning's roughness coefficient, [n]: .15

Aquifer

Unsaturated vertical infiltration rate, [Kvu]: 12.7 feet per day
Factor of Safety (for soil infiltration), [FSi]: 2
Soil Porosity, [f]: 25 %
Depth to water table from bottom of channel, [hb]: 2.4 ft

PONDS Channel and Overland Flow Analysis
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II. RESULTS

Summary Of Results

Length of channel, [L]:	925 ft
Treatment efficiency, [e]:	60.8372 %
Factor of safety against erosion, [FSe]:	24.06689

Channel Inflow Calculations

Channel inflow rate, [Qp]:	0.9114 cfs
Inflow volume (treatment volume), [Vr]:	3445.092 ft ³

Channel Geometry Calculations

Normal depth of flow, [d]:	1.118127 ft
Top width of water surface, [Wt]:	7.836893 ft
Cross-sectional flow area, [Ax]:	4.386913 ft ²
Wetted perimeter, [P]:	8.155988 ft
Hydraulic radius, [Rh]:	0.5378764 ft

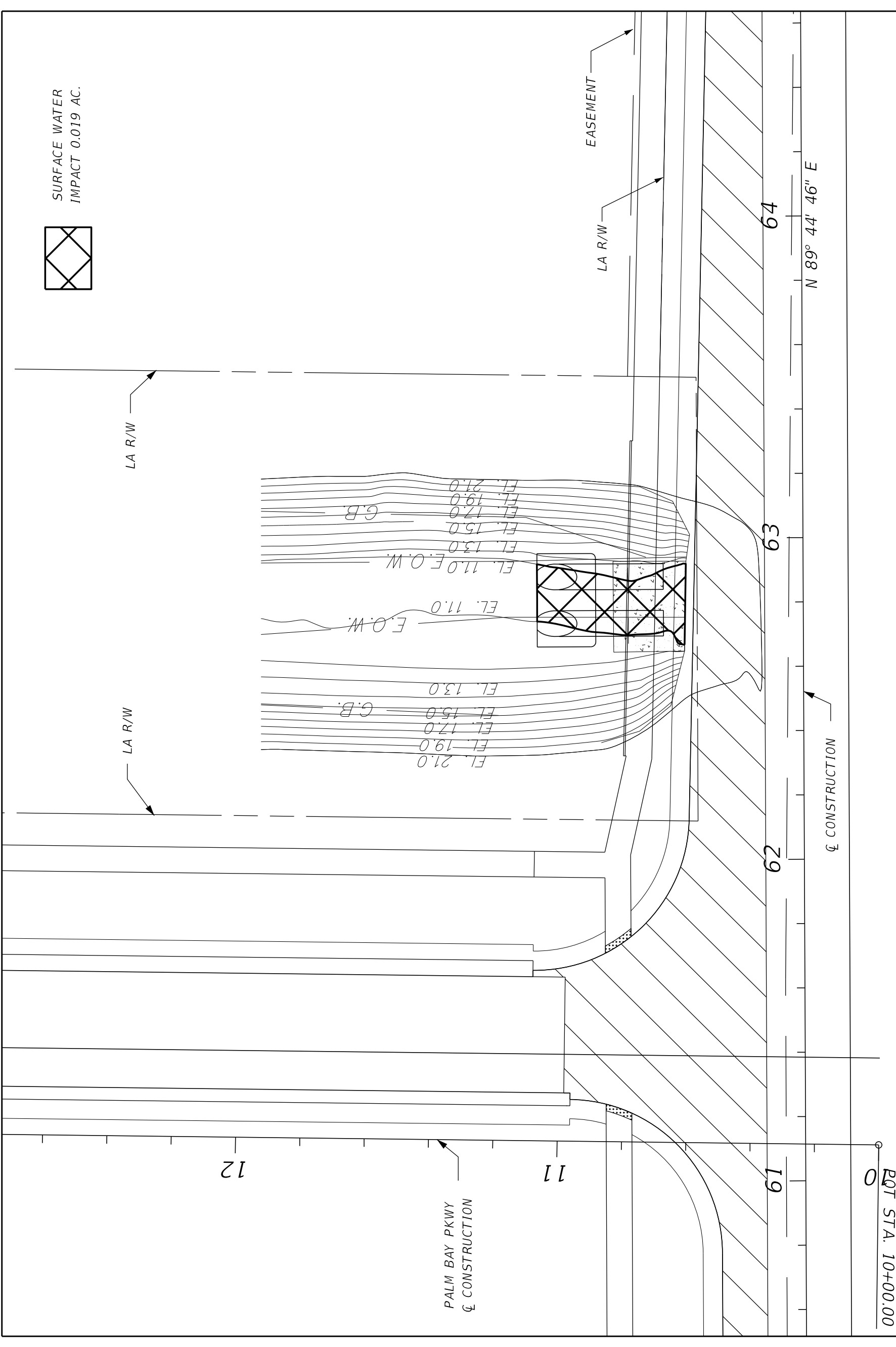
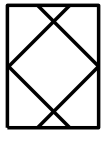
Protection Against Erosion

Mean velocity, [V]:	0.2077543 fps
Factor of safety against erosion, [FSe]:	24.06689

Infiltration Calculations

Design infiltration rate, [Id]:	6.35 ft/day
Effective channel bottom area, [Ab]:	7544.288 ft ²
Infiltration rate at normal depth, [Qip]:	0.5544702 cfs
Computed max infiltration volume, [Vm]:	2095.897 ft ³
Available soil storage volume below channel, [Vs]:	4349.475 ft ³

SURFACE WATER
IMPACT 0.019 AC.



STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		COUNTY BREVARD		FINANCIAL PROJECT ID 428346-1-58-01	
ROAD NO. CR 514		COUNTY BREVARD		FINANCIAL PROJECT ID 428346-1-58-01	
165 Lincoln Avenue Winter Park, FL 32789 Phone: (407) 629-2185 Fax: (407) 629-2183 Certificate of Authorization No. 26123		E.O.R.: Gregory S. Seidel, P.E., No. 47571			
REVISIONS		DATE		DESCRIPTION	
DATE	DESCRIPTION	DATE	DESCRIPTION	DATE	DESCRIPTION

INDIVIDUAL ENVIRONMENTAL RESOURCE PERMIT TECHNICAL STAFF REPORT

19-Nov-2013

APPLICATION #: IND-009-113120-4

Applicant: Brevard County Public Works
Richard B Szpyrka
2725 Judge Fran Jamieson Way Ste 201-A
Melbourne FL 32940
(321) 637-5437

Owner: Brevard County Public Works
Richard B Szpyrka
2725 Judge Fran Jamieson Way Ste 201-A
Melbourne FL 32940
(321) 637-5437

Agent: Keith and Schnars PA
S Mark Kline
6500 N Andrews Ave
Fort Lauderdale FL 33309
(954) 776-1616

Project Name: Malabar Road Turn Lanes

Acres Owned: 6.62

Project Acreage: 3.12

County: Brevard

STR:

Section(s):	Township(s):	Range(s):
32,33	28S	36E

Receiving Water Body:

Name	Class
MTWCD C-7 Canal	III Fresh

Authority: 62-330.020 (2)(j)
Existing Land Use: Roads and Highways(8140)
Mitigation Drainage Basin: Southern St. Johns River
Special Regulatory Basin:
Final O&M Entity: Brevard County

ERP Conservation Easements/Restrictions: No
Interested Parties: No
Objectors: No

Authorization Statement:

Construction of a Stormwater Management System with stormwater treatment by Swales for Malabar Road Turn Lanes, a 3.12 - acre project to be constructed as per plans received by the District on November 4, 2013.

Recommendation: Approval

Reviewers: Mark Crosby; Nanette Church

Staff Comments

Project Location and Brief Description:

The project is located at the west end of Malabar Road, in the City of Palm Bay. The applicant proposes to construct new turning lanes, remove existing pipes and inlets, install new pipes and inlets, extend the existing 96-inch diameter pipes in the Melbourne Tillman Water Control District (MTWCD) Canal C-7 under Malabar Road, and re-grade roadside swales at the Malabar Road and future Palm Bay Parkway intersection.

Permitting History:

The overall project was originally permitted on November 11, 2008, under District permit number 4-009-113120-2. This current application modifies portions of that permitted project.

Engineering

Description of Surface Water Management System:

The proposed stormwater management system remains as permitted under the previous sequence 2 permit, and includes roadside swales. These swales will be regraded to accommodate the new turning lanes at the future intersection of Malabar Road and Palm Bay Parkway.

Water Quality:

Water quality treatment is provided in the roadside swales pursuant to the presumptive design criterion under the *Environmental Resource Permit Applicant's Handbook, Volume II: for use within the geographic limits of the St. Johns River Water Management District*, Part 9.0, and the conditions for permit issuance under Chapter 62-330.301, F.A.C. The system also provides the required nutrient removal efficiency for discharge to an Impaired Water Body.

Flood Protection:

The stormwater management system attenuates the post-development peak rates to below the pre-development peak rates for the mean-annual, 24-hour and 10-year, 24-hour design storm events.

Environmental

Site Description:

This project is situated within the existing improved Malabar Road right of way in the City of Palm Bay and consists of paved roadway, sidewalks, a MTWCD Canal C-7, grassed swales as well as other associated stormwater features. The MTWCD canal is characterized by steep slopes and vegetated with various grasses and dog fennel.

Impacts: *Subsection 10.2.2, ERP A.H., 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.*

The project includes impacting 0.019 acres of the MTWCD C-7 Canal through filling and dredging for the extension of 2-96" diameter stormwater pipes. Although this ditch is considered suitable foraging habitat for the Wood Stork, a listed species, utilizing the Determination Key for the Wood Stork in Central and North Peninsular Florida, the impacts are not likely to adversely affect this species because the area of dredging/filling of the ditch totals less than 0.5 acres. The proposed project will not result in adverse impacts to fish, wildlife and listed species or their habitat.

Secondary impacts: *Subsection 10.2.7, ERP 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 filling 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.

a) Impacts to upland cut canals/ditches that do not provide significant habitat for threatened or endangered species do not require consideration for secondary impacts pursuant to Section 10.2.2.2 A.H.

b) No listed species were identified within or adjacent to the project area and therefore unacceptable impacts to the upland nesting habitat of wetland dependent listed species are not expected to occur.

c) A letter from the Department of Historical Resources indicates the project was reviewed and is not expected to affect any historical or archaeological resources.

d) There are no additional phases proposed that would result in impacts to wetlands or surface waters.

Elimination/Reduction of Impacts: *Pursuant to subsection 10.2.1, ERP 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".*

The upland cut canal to be impacted does not provide significant habitat for listed species. This surface water provides minimal functions to fish and wildlife species and the applicant was not required to minimize these impacts.

Mitigation:

In accordance with the criteria outlined under section 10.2.2.1, A.H., the proposed impact to upland cut canals/ditches that do not provide significant habitat to threatened or endangered species does not require mitigation to offset the potential loss of habitat functions.

Cumulative Impacts: *Subsection 10.2.8, ERP 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.

Staff has determined that there will be no cumulative impacts as a result of this project and that the project is consistent with the wetland review criteria in sections 10.2-10.3.8, A.H.

**Wetland Summary Table
Malabar Road Turn Lanes Roadway**

	<u>Acres</u>
Total Surface Water and Upland RHPZ in Project	
Wetlands	0.000
OSW	0.019
Upland RHPZ	0.000
Total	0.019
Impacts that Require Mitigation	
Total	0.000
Impacts that Require No Mitigation	
Dredged or Filled	0.019
Total	0.019
Mitigation	
On-Site	
Total	0.000
Off-Site	
Total	0.000

Other

0.000

Special Basin Criteria

Summary:

Staff has determined that the project is consistent with the wetland review criteria in sections 10.2-10.3.8, A.H. The proposed project meets all applicable conditions for permit issuance pursuant to Rule Sections 62-330.301 and 62-330.302, F.A.C.

Conditions

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the Agency staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.
3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida

Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.

4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), Construction Commencement Notice, [October 1, 2013], incorporated by reference herein (<http://www.flrules.org/Gateway/reference.asp?No=Ref-02505>), indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C. If available, an Agency website that fulfills this notification requirement may be used in lieu of the form.
5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.
6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:
 - (a) For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex - Construction Completion and Inspection Certification for Activities Associated With a Private Single-Family Dwelling Unit [Form 62-330.310(3)]; or
 - (b) For all other activities - As-Built Certification and Request for Conversion to Operational Phase [Form 62-330.310(1)].
 - (c) If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.
7. If the final operation and maintenance entity is a third party:
 - (a) Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.3 of Volume I) as filed with the Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

(b) Within 30 days of submittal of the as-built certification, the permittee shall submit Request for Transfer of Environmental Resource Permit to the Perpetual Operation Entity [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

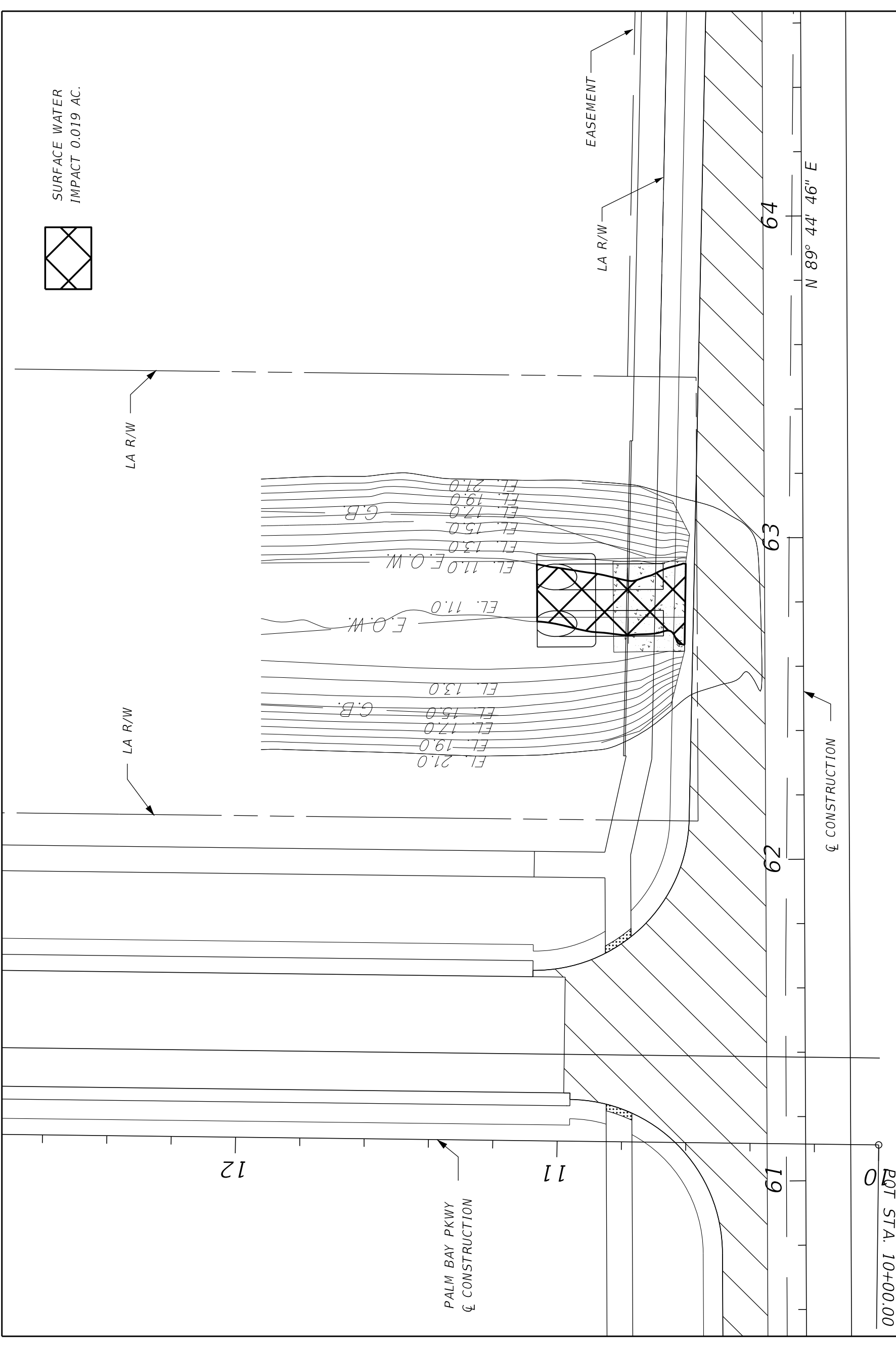
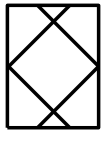
8. The permittee shall notify the Agency in writing of changes required by any other regulatory agency that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.
9. This permit does not:
 - (a) Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;
 - (b) Convey to the permittee or create in the permittee any interest in real property;
 - (c) Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or
 - (d) Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.
10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.
11. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.
12. The permittee shall notify the Agency in writing:
 - (a) Immediately if any previously submitted information is discovered to be inaccurate; and
 - (b) Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or

commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

13. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.
14. If any prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, work involving subsurface disturbance in the immediate vicinity of such discoveries shall cease. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance and Review Section, at (850) 245-6333 or (800) 847-7278, as well as the appropriate permitting agency office. Such subsurface work shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and notification shall be provided in accordance with Section 872.05, F.S.
15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.
16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.
17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the Agency will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.

18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with subsection 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.
19. This permit for construction will expire five years from the date of issuance.
20. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to building construction or placement of impervious surface within the area to be served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.
21. All wetland areas or water bodies that are outside the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring or excess turbidity, and dewatering.
22. Prior to construction, the permittee must clearly designate the limits of construction on-site. The permittee must advise the contractor that any work outside the limits of construction, including clearing, may be a violation of this permit.
23. The proposed stormwater management system shall be constructed in accordance with plans received by the District on November 4, 2013.
24. The operation and maintenance entity shall inspect the stormwater management system once within two years after the completion of construction and every two years thereafter to determine if the system is functioning as designed and permitted. The operation and maintenance entity must maintain a record of each required inspection, including the date of the inspection, the name, address, and telephone number of the inspector, and whether the system was functioning as designed and permitted, and make such record available for inspection upon request by the District during normal business hours. If at any time the system is not functioning as designed and permitted, then within 14 days the entity shall submit a report to the District detailing the reasons for non-function and a proposal to remedy the non-functioning of the system.

SURFACE WATER
IMPACT 0.019 AC.



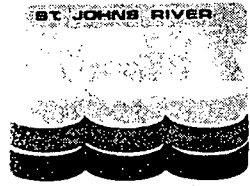
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REVISIONS		STATE OF FLORIDA		DEPARTMENT OF TRANSPORTATION		COUNTY		FINANCIAL PROJECT ID	
DATE	DESCRIPTION	ROAD NO.	COUNTY	ROAD NO.	COUNTY	FINANCIAL PROJECT ID			
		CR 514	BREVARD	CR 514	BREVARD	428346-1-58-01			
		165 Lincoln Avenue Winter Park, FL 32789 Phone: (407) 629-2185 Fax: (407) 629-2183 Certificate of Authorization No. 26123 E.O.R.: Gregory S. Seidel, P.E., No. 47571							
								SURFACE WATER IMPACT	
								SHEET NO.	

\$/USER\$ \$/DATE\$ \$/TIME\$ \$/FILE\$

G.3

Permit No. 62976-1



**WATER
MANAGEMENT
DISTRICT**

November 29, 1999

CITY OF PALM BAY
Attn: Zak Zakeri, P. E.
5240 Babcock Street, N. E.
Suite 300
Palm Bay, FL 32905

RE: Noticed General Permit 400-009-62976-1
Section 34, 35, & 36, Township 28 South, Range 36 East

Dear Sir/Madam:

The District has received your notice to use a noticed general permit for the City of Palm Bay constructing 3.8 miles of 6 to 8 feet wide concrete sidewalks within the City's rights-of-ways. The sidewalk is proposed along the north side of Malabar Road starting at Minton Road and ending at Palm Bay Regional Park. The proposed project includes the replacement of four (4) existing CMP (Corrugated Metal Pipe) culverts due to maintenance and structural failure. The replacements are proposed in artificial waterways and shall be adequate to pass normal high water stages. There will be no dredging or filling except that which is directly involved in the construction of the proposed culvert crossings. Best Management practices are included in the plans to protect water quality.

Based on the submitted information, the proposed activity qualifies for a Noticed General Environmental Resource Permit pursuant to section 40C-400.439, Florida Administrative Code, so long as it is constructed and operated in accordance with that general permit and the general conditions set forth in section 40C-400.215, Florida Administrative Code (attached).

Please be advised that the District has not published a notice in the newspaper advising the public of this proposed project. Publication, using the attached District form, notifies members of the public (third parties) of their rights to challenge the use of the noticed general permit. If proper notice is given by publication, third parties have a 21 day limit on the time they have to file a petition opposing the permit. If you do not publish, a party's rights to challenge the use of the noticed general permit are extended for an indefinite period of time. If you wish to have certainty that the period for filing such a challenge is closed, then you may publish, at your own expense, such a notice in a newspaper of general circulation. A list of newspapers of general circulation is attached for your use. If you do publish a notice, please submit a copy of the published notice to the District for our records.

POST OFFICE BOX 1429 **PALATKA, FLORIDA 32178-1429**
TELEPHONE 904-329-4500 1-800-451-7106 SUNCOM 904-860-4500
TDD 904-329-4450 TDD SUNCOM 860-4450
FAX (Executive) 329-4125 (Legal) 329-4485 (Permitting) 329-4315 (Administration/Finance) 329-4508

SERVICE CENTERS

618 E. South Street Orlando, Florida 32801 407-897-4300 1-877-228-1658 FAX 407-897-4354 TDD 407-897-5960	7775 Baymeadows Way Suite 102 Jacksonville, Florida 32256 904-730-6270 1-800-852-1563 FAX 904-730-6267 TDD 904-448-7900	PERMITTING: 305 East Drive Melbourne, Florida 32904 407-984-4940 1-800-295-3264 FAX 407-722-5357 TDD 407-722-5368	OPERATIONS: 2133 N. Wickham Road Melbourne, Florida 32935-8109 407-752-3100 TDD 407-752-3102
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William Kerr, CHAIRMAN
MELBOURNE BEACH

Ometrias D. Long, VICE CHAIRMAN
APOPKA

Jeff K. Jennings, SECRETARY
MAITLAND

Duane Ottenstroer, TREASURER
SWITZERLAND

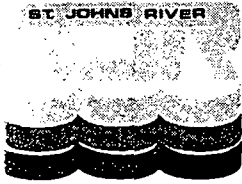
Dan Roach
FERNANDINA BEACH

William M. Segal
MAITLAND

Otis Mason
ST. AUGUSTINE

Clay Albright
EAST LAKE WEIR

Reid Hughes
DAYTONA BEACH



**WATER
MANAGEMENT
DISTRICT**

POST OFFICE BOX 1429

TELEPHONE 904-329-4500
TDD 904-329-4450
FAX (Executive) 329-4125 (Legal) 329-4485

PALATKA, FLORIDA 32178-1429

1-800-451-7106
TDD SUNCOM 860-4450
(Permitting) 329-4315
SUNCOM 904-860-4500
(Administration/Finance) 329-4508

SERVICE CENTERS

618 E. South Street
Orlando, Florida 32801
407-897-4300
1-877-228-1658
FAX 407-897-4354
TDD 407-897-5960

7775 Baymeadows Way
Suite 102
Jacksonville, Florida 32256
904-730-6270
1-800-852-1563
FAX 904-730-6267
TDD 904-448-7900

PERMITTING:
305 East Drive
Melbourne, Florida 32904
407-984-4940
1-800-295-3264
FAX 407-722-5357
TDD 407-722-5368

OPERATIONS:
2133 N. Wickham Road
Melbourne, Florida 32935-8109
407-752-3100
TDD 407-752-3102

RE: CITY OF PALM BAY
Attn: Zak Zakeri, P. E.
Permit 400-009-62976-1

A copy of your application was transmitted to the U.S. Army Corps of Engineers for review. This authorization to use a noticed general environmental resource permit does not obviate the need for obtaining all necessary permits or approval from other agencies.

Sincerely,

Marti DePalma, Permit Data Technician
Melbourne Service Center

Enclosures: Permit
Notice of Rights

William Kerr, CHAIRMAN
MELBOURNE BEACH

Ometrias D. Long, VICE CHAIRMAN
APOPKA

Jeff K. Jennings, SECRETARY
MAITLAND

Duane Ottenstroer, TREASURER
SWITZERLAND

Dan Roach
FERNANDINA BEACH

William M. Segal
MAITLAND

Otis Mason
ST. AUGUSTINE

Clay Albright
EAST LAKE WEIR

Reid Hughes
DAYTONA BEACH

**ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT**

Permit Number: 400-009-62976-1

Date Issued: 11/29/1999

Project Name: MALABAR ROAD WEST SIDEWALK

Authorization:

The City of Palm Bay will be constructing 3.8 miles of 6 to 8 feet wide concrete sidewalks within the City's rights-of-ways. The sidewalk is proposed along the north side of Malabar Road starting at Minton Road and ending at Palm Bay Regional Park. The proposed project includes the replacement of four (4) existing CMP (Corrugated Metal Pipe) culverts due to maintenance and structural failure. The replacements are proposed in artificial waterways and shall be adequate to pass normal high water stages. There will be no dredging or filling except that which is directly involved in the construction of the proposed culvert crossings. Best Management Practices are included in the plans to protect water quality.

Project Location:

Sections: 34, 35, & 36
County Name: Brevard

Township: 28S

Range: 36E

Issued To:

CITY OF PALM BAY
Attn: Zak Zakeri, P.E.
5240 Babcock Street, N. E.
Suite 300
Palm Bay, FL 32905

The District received your notice to use a Noticed General Environmental Resource Permit pursuant to Chapter 40C-400, F.A.C. on November 29, 1999.

Based on the forms, design plans, and other documents submitted with your notice, it appears that the project meets the requirements for a Noticed General Environmental Resource Permit. Any activities performed under a Noticed General Environmental Resource Permit are subject to the general conditions as specified in Section 40C-400.215, F.A.C. (attached). Any Deviations from these conditions may subject you to enforcement action and possible penalties.

Please be advised that the Noticed General Environmental Resource Permit expires five years from the date on which the notice of intent to use a Noticed General Environmental Resource Permit was received by the District. If you wish to continue this noticed general permit beyond the expiration date, you must notify the District at least 30 days prior to the permit expiration date.

A copy of your notice also has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action and possible penalties.

AUTHORIZED BY: St. Johns River Water Management District Department of Resource



(SERVICE CENTER DIRECTOR, MELBOURNE)
JOHN JULIANNA

400-009-62976-1

11/29/1999

1. The terms, conditions, requirements, limitations, and restrictions set forth in this section are general permit conditions and are binding upon the permittee for all noticed general permits in this chapter. These conditions are enforceable under part IV of Chapter 373, F.S.
2. The general permit is valid only for the specific activity indicated. Any deviation from the specified activity and the conditions for undertaking that activity shall constitute a violation of the permit. A violation of the permit is a violation of part IV of Chapter 373, F.S., and may result in suspension or revocation of the permittees right to conduct such activity under the general permit. The district may also begin legal proceedings seeking penalties or other remedies as provided by law for any violation of these conditions.
3. The general permit does not eliminate the necessity to obtain any required federal, state, local, and special district authorizations prior to the start of any construction, alteration, operation, maintenance, removal or abandonment authorized by this permit.
4. This general permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, nor convey any rights or privileges other than those specified in the general permit and this chapter.
5. This general permit does not relieve the permittee from liability and penalties when the permitted activity causes harm or injury to human health or welfare; animal, plant or aquatic life; or property. It does not allow the permittee to cause pollution in contravention of Florida Statutes and District rules.
6. The permittee is hereby advised that Section 253.77, F.S., states that a person may not commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.
7. The authorization to conduct activities pursuant to a general permit may be modified, suspended or revoked in accordance with Chapter 120, and Section 373.429, F.S.
8. This permit shall not be transferred to a third party except pursuant to Section 40C-4.351, F.A.C. The permittee transferring the general permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located.
9. Upon reasonable notice to the permittee, District staff with proper identification shall have permission to enter, inspect, sample and test the permitted system to insure conformity with the plans and specifications approved by the permit.

400-009-62976-1

11/29/1999

10. The permittee shall maintain any permitted system in accordance with the plans submitted to the District and authorized by this general permit.
11. The permittee's right to conduct a specific noticed activity under this noticed general permit is authorized for a duration of five years.
12. Construction, alteration, operation, maintenance, removal and abandonment approved by this general permit shall be conducted in a manner which does not cause violations of state water quality standards, including any antidegradation provisions of Sections 62-4.242 (1) (a) and (b), 62-4.242 (2), and (3), and 6-302.300, F.A.C., and any special standards for Outstanding Florida Waters and Outstanding National Resource Waters. The permittee shall implement best management practices for erosion, turbidity, and other pollution control to prevent violation of state water quality standards. Temporary erosion control measures such as sodding, mulching, and seeding shall be implemented and shall be maintained on all erodible ground areas prior to and during construction. Permanent erosion control measures such as sodding and planting of wetland species shall be complete within seven days of any construction activity. Turbidity barriers shall be installed and maintained at all locations where the possibility of transferring suspended solids into wetlands or other surface waters exists due to the permitted activity. Turbidity barriers shall remain in place and shall be maintained in a functional condition at all locations until construction is completed and soils are stabilized and vegetation has been established. Thereafter, the permittee shall be responsible for the removal of the barriers. The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.
13. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities which may arise by reason of the construction alteration, operation, maintenance, removal, abandonment or use of any system authorized by the general permit.
14. The permittee shall immediately notify the District in writing of any previously submitted information that is later discovered to be inaccurate.
15. The permittee shall stabilize fill areas and waterway banks disturbed by the activity by revegetation or riprap within 72 hours of completion of construction to prevent erosion, siltation or turbid runoff into wetlands and other surface waters.
16. If dewatering is performed, all temporary fill dikes and dewatering discharges shall be installed and constructed so that no upstream flooding or impoundment occurs and no siltation, erosion or turbid discharges into wetlands or other surface waters occur in violation of state water quality standards. Any temporary works shall be completely removed and all areas upstream and downstream from the crossing shall be restored to grades, elevations and conditions which existed before construction.

NOTICE OF RIGHTS

1. A person whose substantial interests are or may be determined has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District), or may choose to pursue mediation as an alternative remedy under Sections 120.569 and 120.573, Florida Statutes, before the deadline for filing a petition. Choosing mediation will not adversely affect the rights to a hearing if mediation does not result in a settlement. The procedures for pursuing mediation are set forth in Sections 120.569 and 120.57, Florida Statutes, and Rules 28-106.111 and 28-106.401-.405, Florida Administrative Code. Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed at the office of the District Clerk at District Headquarters, P. O. Box 1429 Palatka, Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) within twenty-six (26) days of the District depositing notice of District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail actual notice). A petition must comply with Chapter 28-106, Florida Administrative Code.
2. If the Governing Board takes action which substantially differs from the notice of District decision a person whose substantial interests are or may be determined has the right to request an administrative hearing or may choose to pursue mediation as an alternative remedy as described above. Pursuant to District Rule 40C-1.1007, Florida Administrative Code, the petition must be filed at the office of the District Clerk at the address described above, within twenty-six (26) days of the District depositing notice of final District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of its final agency action (for those persons to whom the District does not mail actual notice). Such a petition must comply with Rule Chapter 28-106, Florida Administrative Code.
3. A substantially interested person has the right to a formal administrative hearing pursuant to Sections 120.569 and 120.57(1), Florida Statutes, where there is a dispute between the District and the party regarding an issue of material fact. A petition for formal hearing must comply with the requirements set forth in Rule 28-106.201, Florida Administrative Code.
4. A substantially interested person has the right to an informal hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.
5. A petition for an administrative hearing is deemed filed upon delivery of the petition to the District Clerk at the District Headquarters in Palatka, Florida.
6. Failure to file a petition for an administrative hearing, within the requisite time frame shall constitute a waiver of the right to an administrative hearing (Section 28-106.111, Florida Administrative Code).
7. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, and Chapter 28-106, Florida Administrative Code, and Section 40C-1.1007, Florida Administrative Code.
8. An applicant with a legal or equitable interest in real property who believes that a District permitting action is unreasonable or will unfairly burden the use of his property, has the right to, within 30 days of receipt of notice of the District's written decision regarding a permit application, apply for a special master proceeding under Section 70.51, Florida Statutes, by filing a written request for relief at the office of the District Clerk located at District headquarters, P. O. Box 1429, Palatka, FL 32178-1429 (4049 Reid St., Palatka, FL 32177). A request for relief must contain the information listed in Subsection 70.51(6), Florida Statutes.
9. A timely filed request for relief under Section 70.51, Florida Statutes, tolls the time to request an administrative hearing under paragraph no. 1 or 2 above (Paragraph 70.51(10)(b), Florida Statutes). However, the filing of a request for an administrative hearing under paragraph no. 1 or 2 above waives the right to a special master proceeding (Subsection 70.51(10)(b), Florida Statutes).

10. Failure to file a request for relief within the requisite time frame shall constitute a waiver of the right to a special master proceeding (Subsection 70.51(3), Florida Statutes).
11. Any substantially affected person who claims that final action of the District constitutes an unconstitutional taking of property without just compensation may seek review of the action in circuit court pursuant to Section 373.617, Florida Statutes, and the Florida Rules of Civil Procedures, by filing an action in circuit court within 90 days of rendering of the final District action, (Section 373.617, Florida Statutes).
12. Pursuant to Section 120.68, Florida Statutes, a person who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to the Florida Rules of Appellate Procedure within 30 days of the rendering of the final District action.
13. A party to the proceeding before the District who claims that a District order is inconsistent with the provisions and purposes of Chapter 373, Florida Statutes, may seek review of the order pursuant to Section 373.114, Florida Statutes, by the Florida Land and Water Adjudicatory Commission, by filing a request for review with the Commission and serving a copy on the Department of Environmental Protection and any person named in the order within 20 days of adoption of a rule or the rendering of the District order.
14. For appeals to the District Courts of Appeal, a District action is considered rendered after it is signed on behalf of the District, and is filed by the District Clerk.
15. Failure to observe the relevant time frames for filing a petition for judicial review described in paragraphs #11 and #12, or for Commission review as described in paragraph #13, will result in waiver of that right to review.

CERTIFICATE OF SERVICE

I hereby certify that copy of the foregoing notice of rights has been sent by U.S. Mail to:

City of Palm Bay
Attn: Zak Zakeri, P. E.
5240 Babcock Street, NE
Palm Bay FL 32905

at 4:00 p.m. this 29th day of November, 1999



Gloria Jean Lewis, Director
Permit Data Services

St. Johns River Water Management District
Post Office Box 1429
Palatka, FL 32178-1429
(904) 329-4500

Permit No. 400-009-62976-1

DATE: November 23, 1999

**NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT
TECHNICAL STAFF REPORT**

APPLICANT: City of Palm Bay
Attn: Zak Zakeri, P.E.
5240 Babcock St., NE, Suite 300
Palm Bay, FL 32905

APPLICATION NO.: 400-009-62976-1

AGENT: Same as applicant

CONSULTANT: N/A

PROJECT NAME: Malabar Road West Sidewalk

COUNTY: BREVARD

SECTION(S): 34,35,&36

TOWNSHIP(S): 28S

RANGE(S): 36E

PROJECT ACREAGE: 3.22

EASEMENTS/RESTRICTIONS: NO

AUTHORITY: CHAPTERS 373 F.S.; CHAPTER 40C-400 F.A.C.;

APPLICATION TO USE NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT
PURSUANT TO SECTION 40C-400.439 F.A.C.

GENERAL PROJECT DESCRIPTION:

The City of Palm Bay will be constructing 3.8 miles of 6 to 8 feet wide concrete sidewalks within the City's rights-of ways. The sidewalk is proposed along the north side of Malabar Rd. starting at Minton Road and ending at Palm Bay Regional Park. The proposed project includes the replacement of four (4) existing CMP(Corrugated Metal Pipe) culverts due to maintenance and structural failure. The replacements are proposed in artificial waterways and shall be adequate to pass normal high water stages. There will be no dredging or filling except that which is directly involved in the construction of the proposed culvert crossings. Best Management Practices are included in the plans to protect water quality.

HYDROLOGIC BASIN(S): 6D

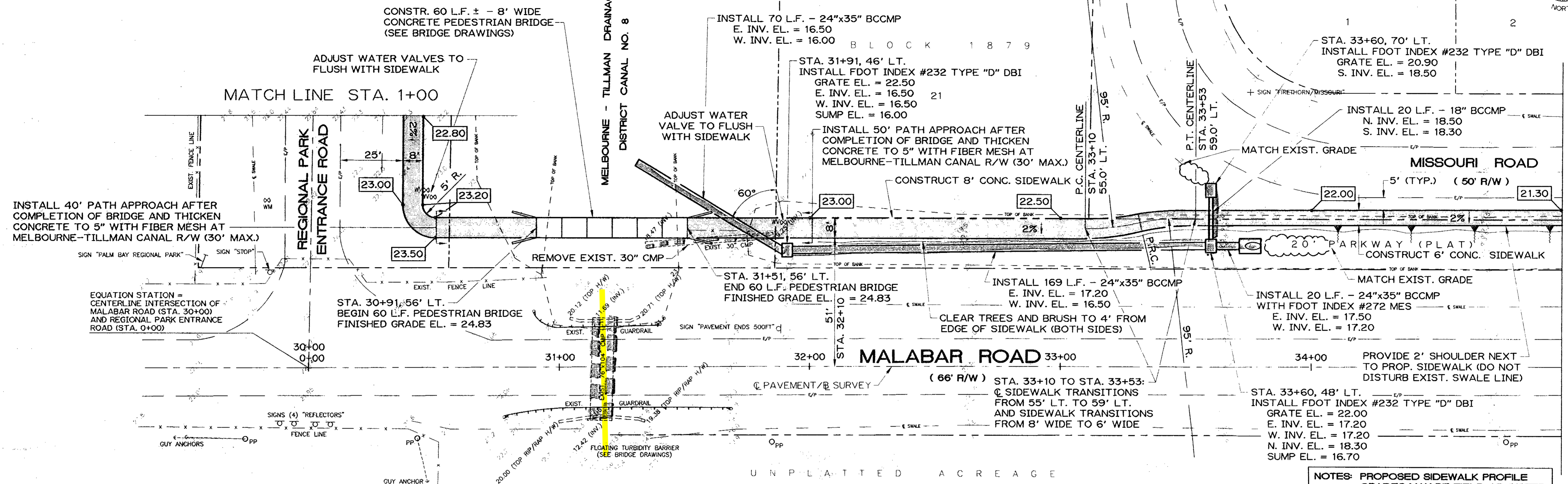
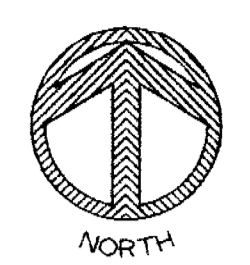
WATER BODY(IES): roadside ditches to Indian River Lagoon **CLASS:** III

RECOMMENDATION: APPROVAL WITH THE FOLLOWING CONDITIONS:

**NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT CONDITIONS
PURSUANT TO SECTION 40C-400.215, F.A.C. 1-14**

BENCHMARK:
41-26 FOUND PK NAIL & DISK "ALLEN
ENG LB 266" AT C/L MTDD
CANAL NO. 8 - WEST END U-41
ELEVATION = 22.417

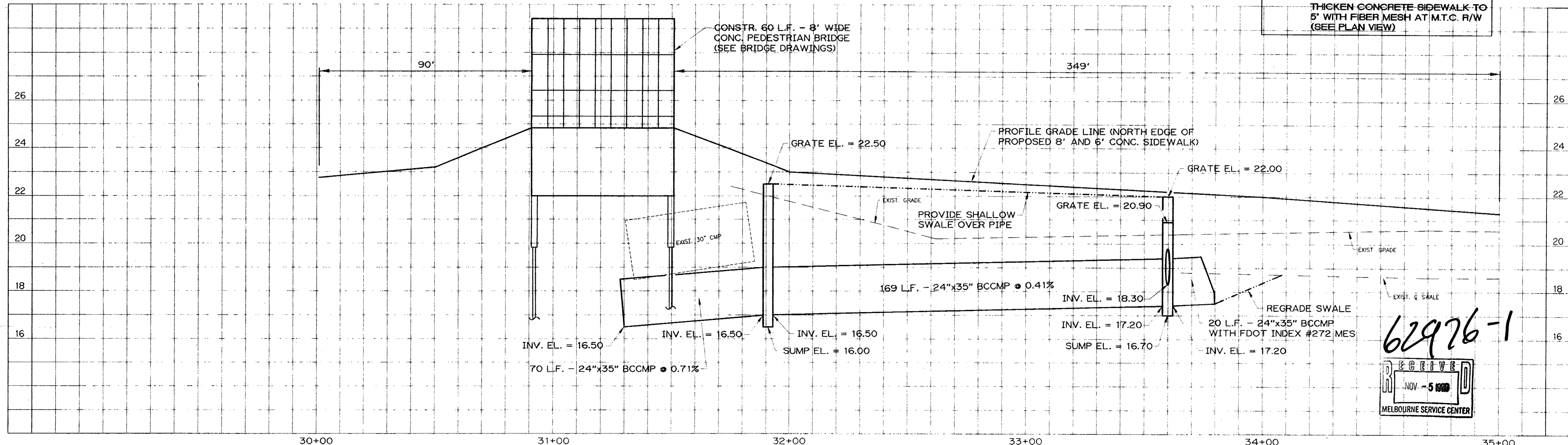
PORT MALABAR
UNIT 41
BLOCK 1879
BLOCK 1880



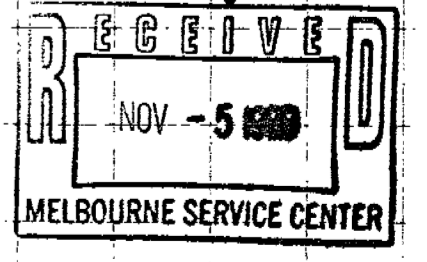
EQUATION STATION =
CENTERLINE INTERSECTION OF
MALABAR ROAD (STA. 30+00)
AND REGIONAL PARK ENTRANCE
ROAD (STA. 0+00)

NOTES: PROPOSED SIDEWALK PROFILE
GRADES MAY BE FIELD ADJUSTED
TO MATCH EXISTING GRADES.

**THICKEN CONCRETE SIDEWALK TO
5" WITH FIBER MESH AT M.T.C. R/W
(SEE PLAN VIEW)**



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



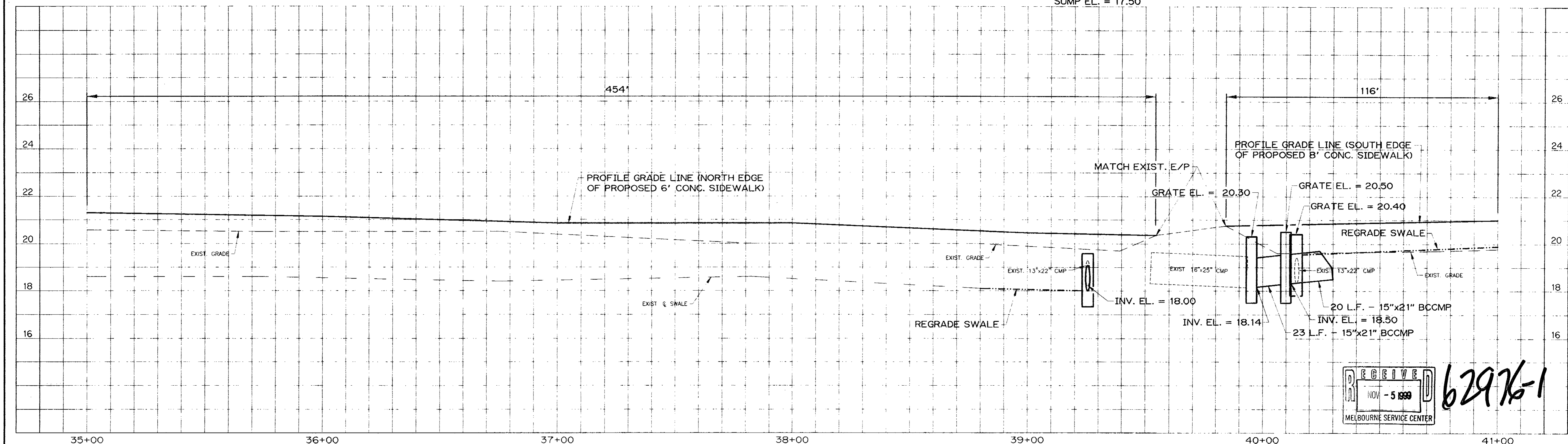
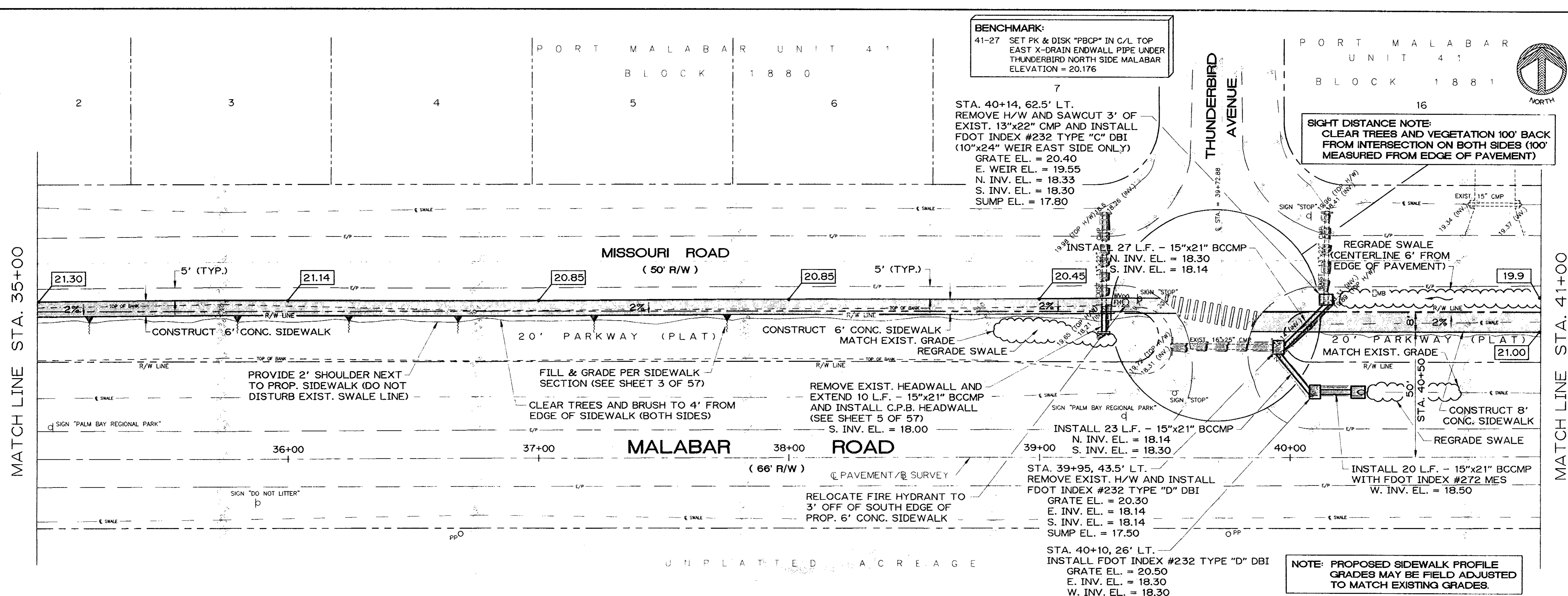
CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 30+00 THRU STA. 35+00

DATE: AUG 1999
SCALE: 1" = 20'
HORIZ.
1" = 2'
VERT.

PROJECT NO. 98-39
SHEET 9 OF 57



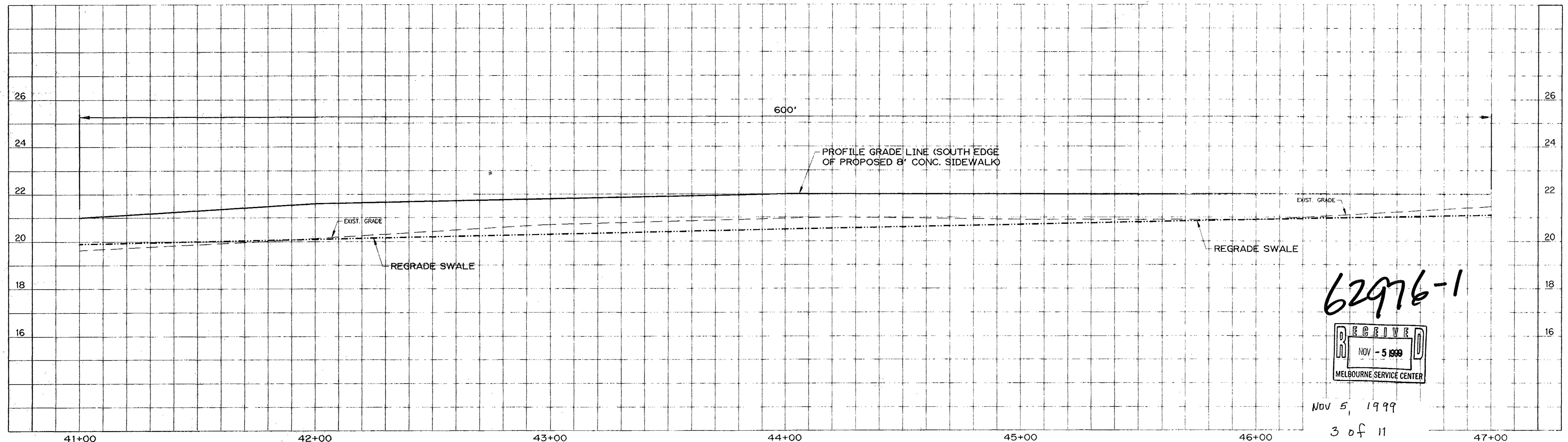
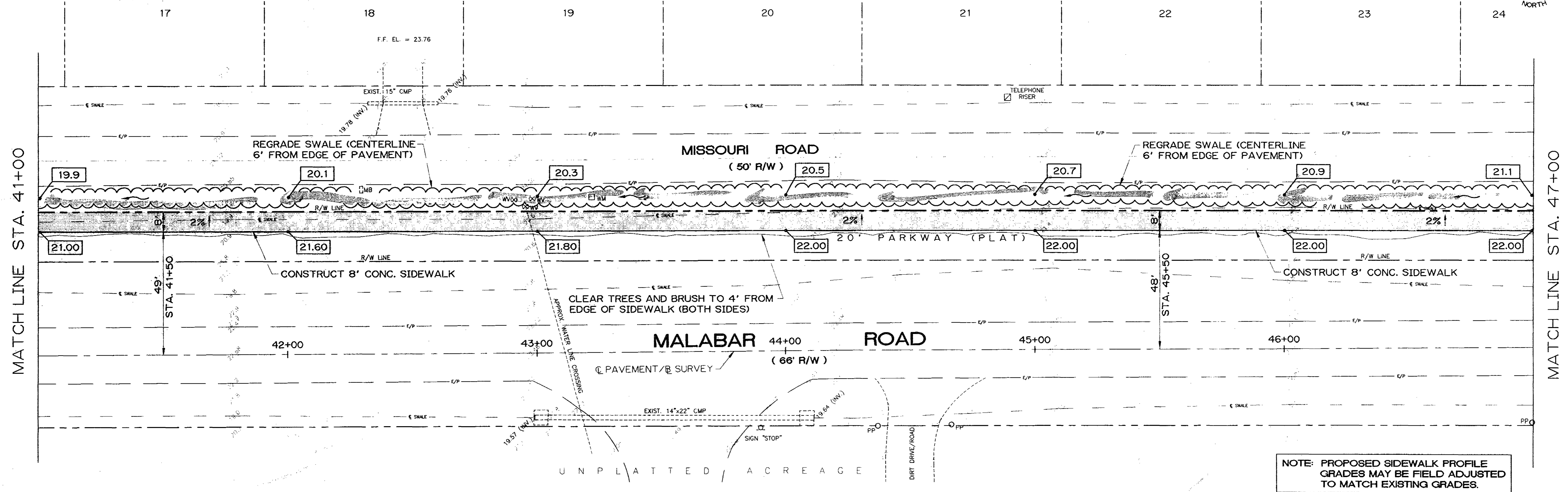
DESIGNED	ZZ	APPROVED:			CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION	MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS	DATE:	AUG 1999	PROJECT NO.	98-39
DRAWN	MH	CITY ENGINEER					SCALE:	HORIZ. 1" = 20'	VERT. 1" = 2'	SHEET
REVISION	DATE	REVISION	BY	CHECKED	MN	DATE:				

NOV - 5 1999
 MELBOURNE SERVICE CENTER
 62976-1

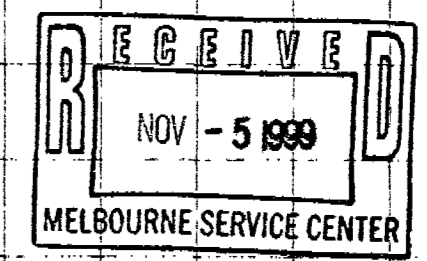
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17

PORT MALABAR UNIT 41
BLOCK 1881



62976-1



NOV 5, 1999

3 of 11

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 41+00 THRU STA. 47+00

DATE: AUG 1999
SCALE: HORIZ. 1" = 20'
VERT. 1" = 2'

PROJECT NO.	98-39
SHEET	11 OF 57

FILE NAME: C:\DATA\PROJ\9839\9839P11.DWG/10/15m/15 Oct 99 PLOT: 11-20

13

PORT MALABAR UNIT 41
BLOCK 1881

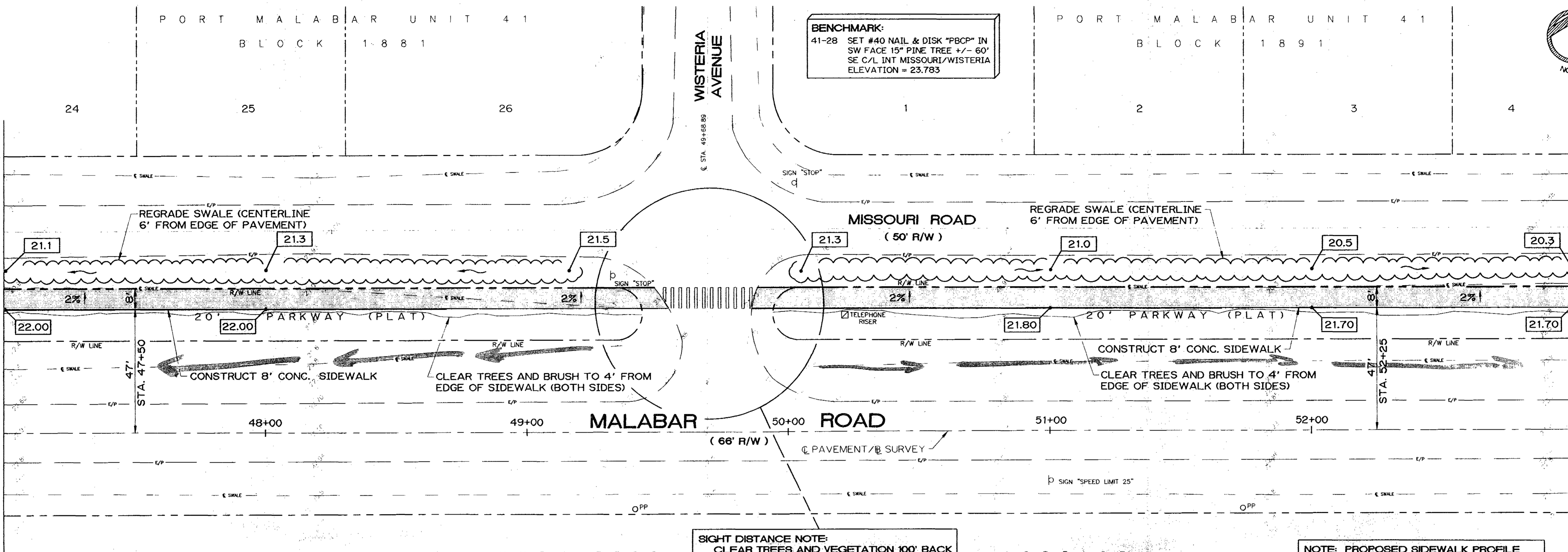
PORT MALABAR UNIT 41
BLOCK 1891



BENCHMARK:
41-28 SET #40 NAIL & DISK "PBCP" IN
SW FACE 15" PINE TREE +/- 60'
SE C/L INT MISSOURI/WISTERIA
ELEVATION = 23.783

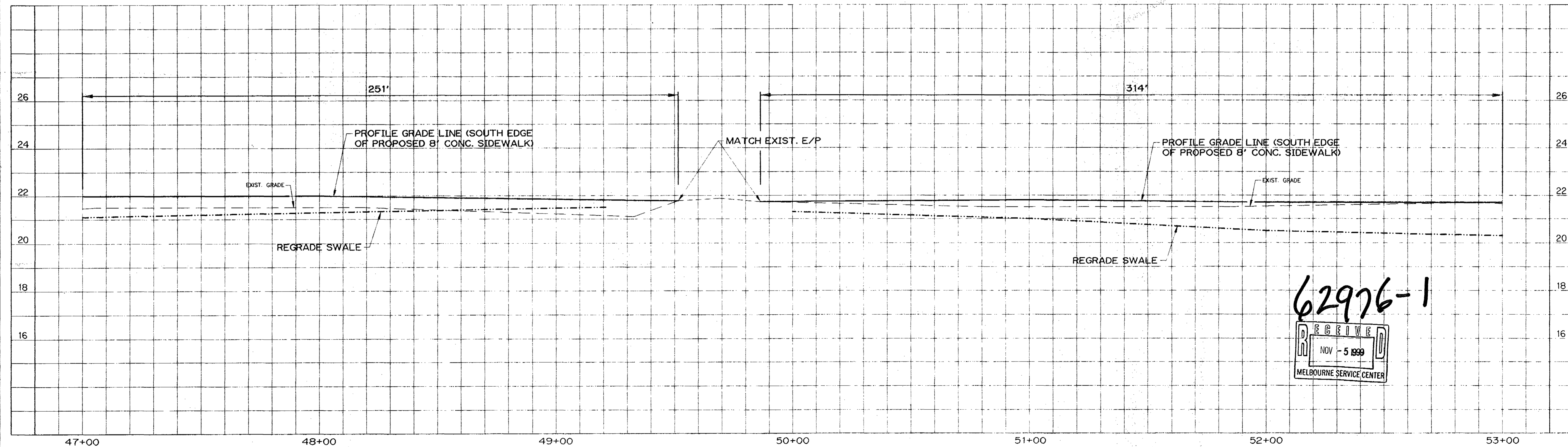
MATCH LINE STA. 47+00

MATCH LINE STA. 53+00



SIGHT DISTANCE NOTE:
CLEAR TREES AND VEGETATION 100' BACK
FROM INTERSECTION ON BOTH SIDES (100'
MEASURED FROM EDGE OF PAVEMENT)

NOTE: PROPOSED SIDEWALK PROFILE
GRADES MAY BE FIELD ADJUSTED
TO MATCH EXISTING GRADES.



62976-1

RECEIVED
NOV - 5 1999
MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	
REVISION			

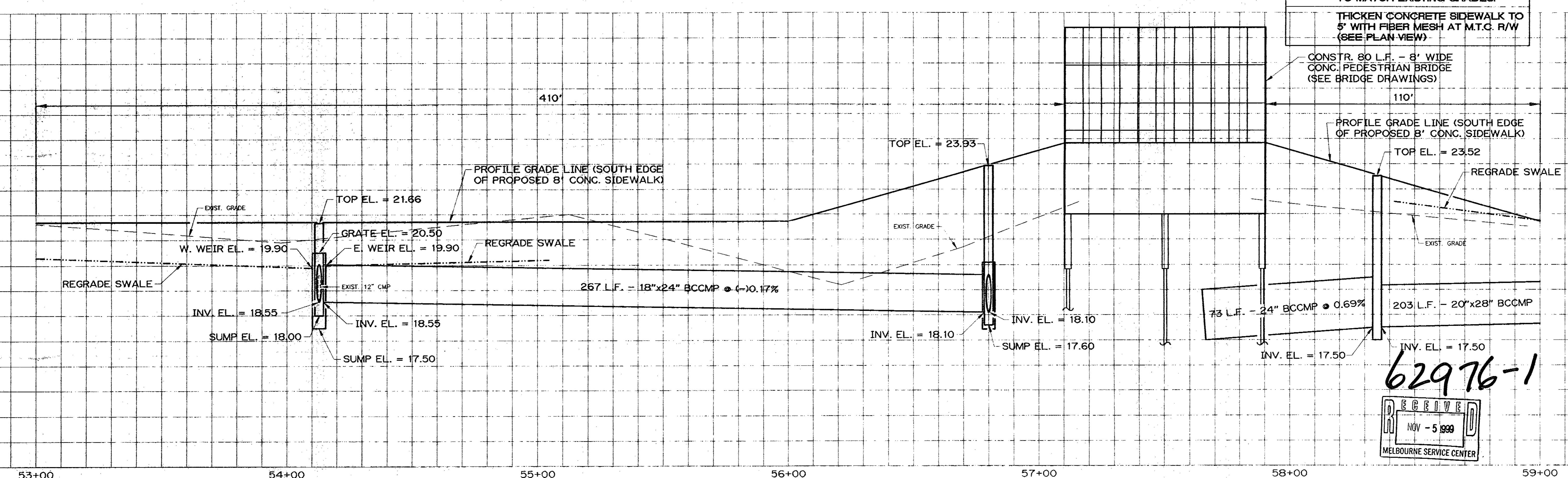
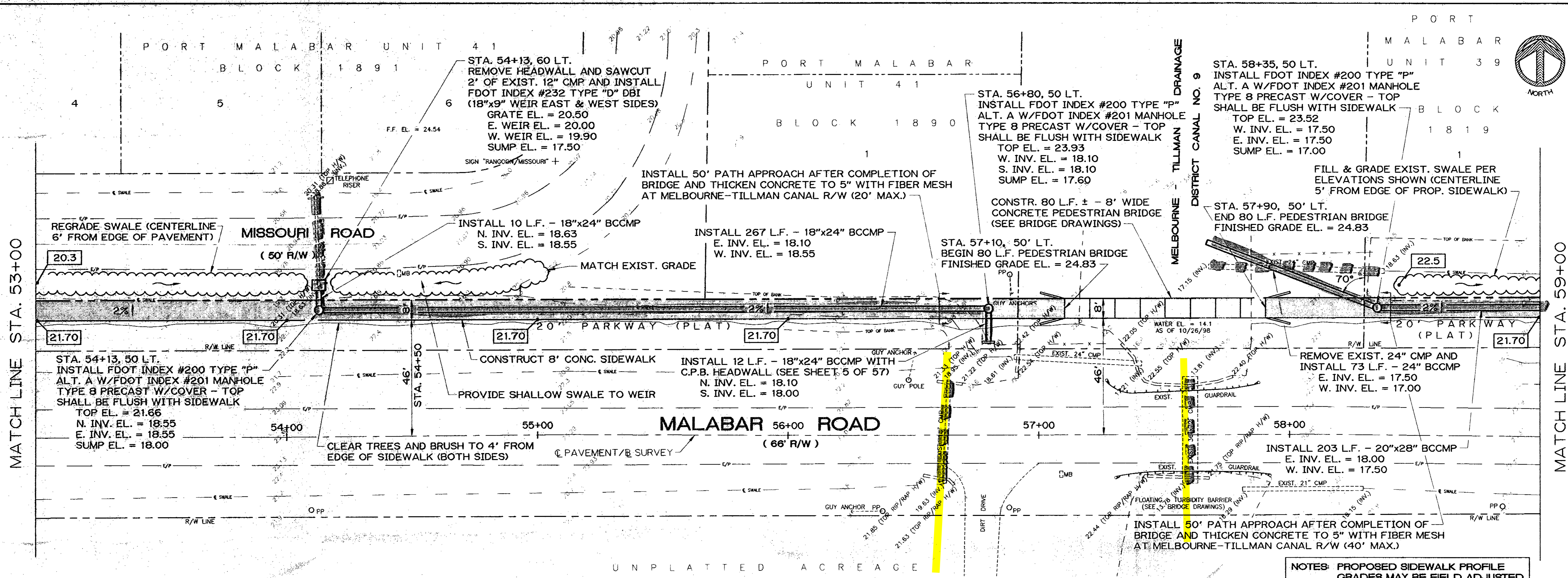


CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 47+00 THRU STA. 53+00

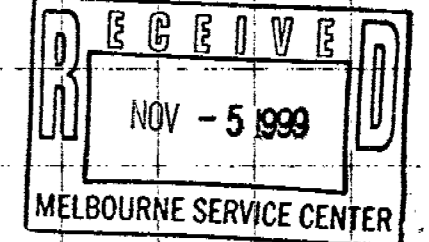
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SCALE	1" = 20'	SHEET	12
VERT.	1" = 2'	OF	57

FILE NAME: C:\DATA\PROJ\9839\9839P12.DWG 5:45pm 07 Oct 99



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)
 CONSTR. 80 L.F. - 8' WIDE CONC. PEDESTRIAN BRIDGE (SEE BRIDGE DRAWINGS)

62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	

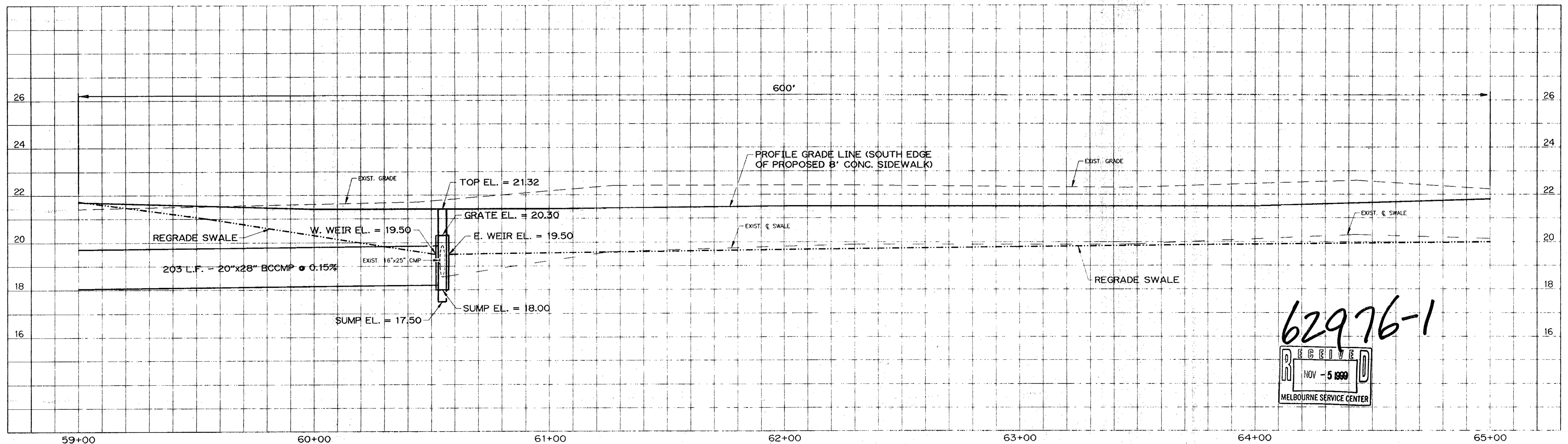
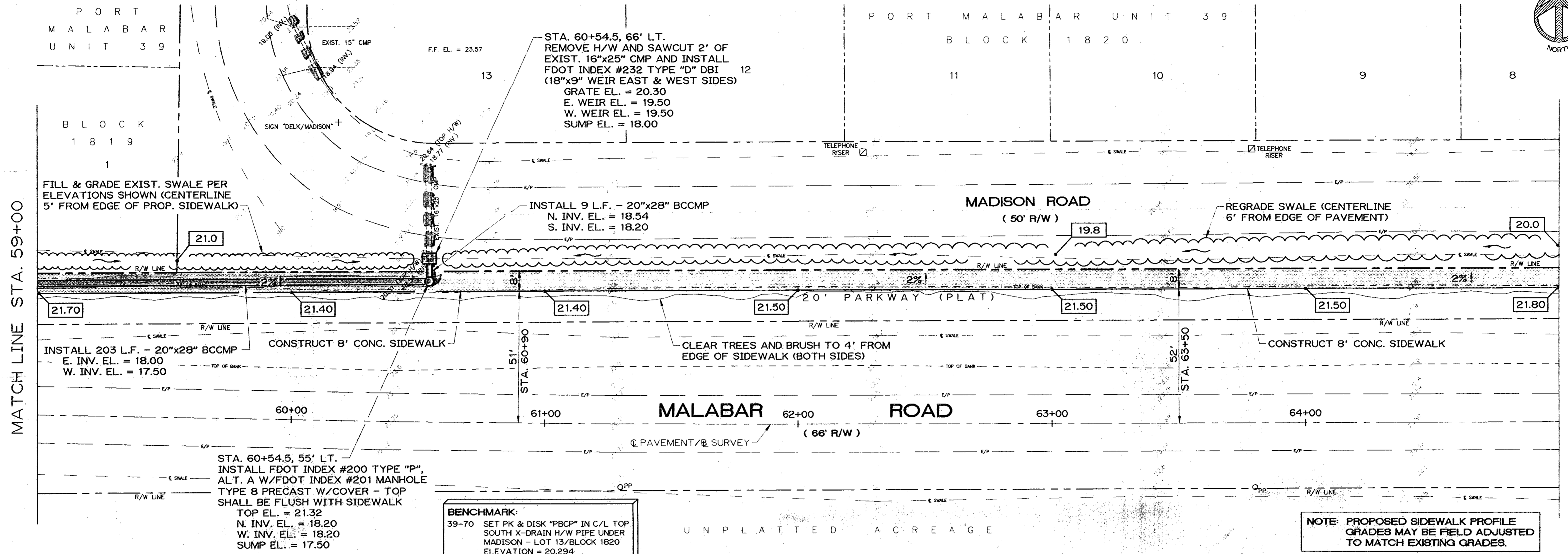
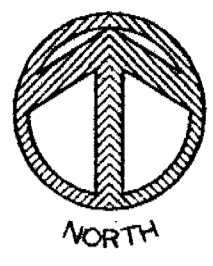


CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS
 PLAN & PROFILE - MALABAR ROAD STA. 53+00 THRU STA. 59+00

DATE	AUG 1999	PROJECT NO.	98-39
SCALE	1" = 20'	SHEET	13 OF 57
VERT.	1" = 2'		

FILE NAME: C:\DATA\PROJECTS\9839\9839P13.DWG / 13000/16 Oct 99



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NOV - 5 1999
MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED		<p>CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION</p>	<p>MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS</p> <p>PLAN & PROFILE - MALABAR ROAD STA. 59+00 THRU STA. 65+00</p>	DATE:	AUG 1999	PROJECT NO.	98-39		
DRAWN	MH	CITY ENGINEER				SCALE:	1" = 20'	SHEET	14	OF	57
CHECKED	MN					VERT.	1" = 2'				

16



PORT MALABAR UNIT 39

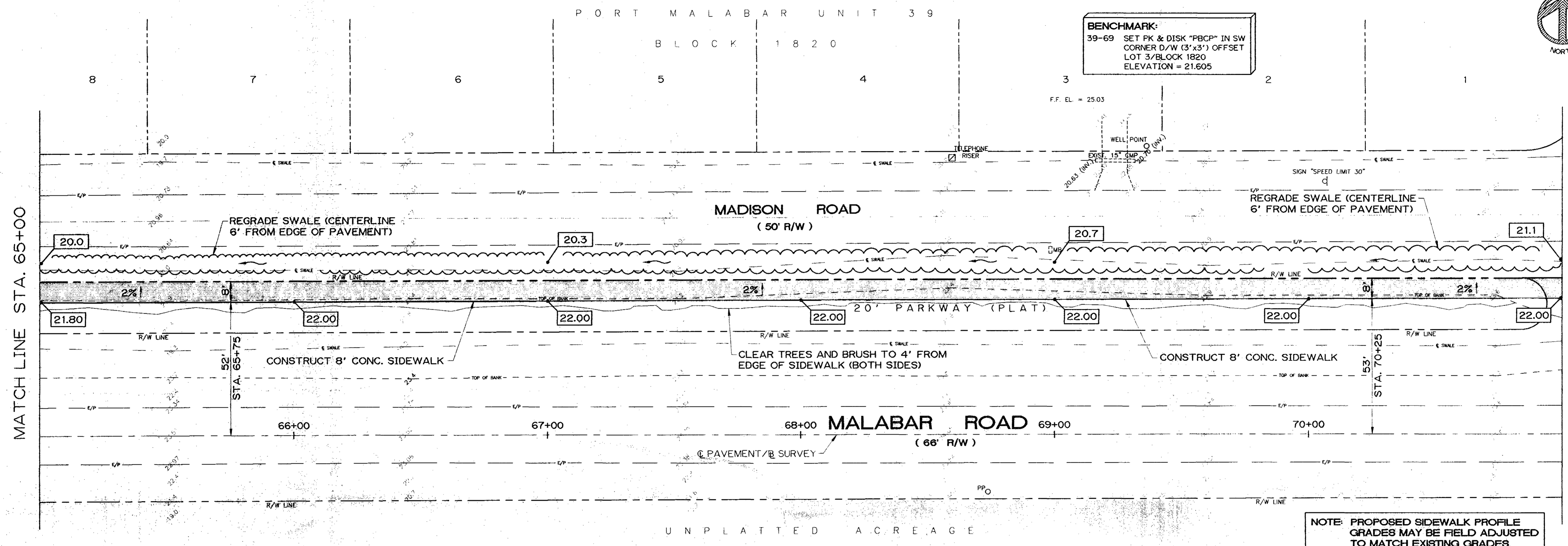
BLOCK 1820

BENCHMARK:
39-69 SET PK & DISK "FBCP" IN SW
CORNER D/W (3'x3') OFFSET
LOT 3/BLOCK 1820
ELEVATION = 21.605

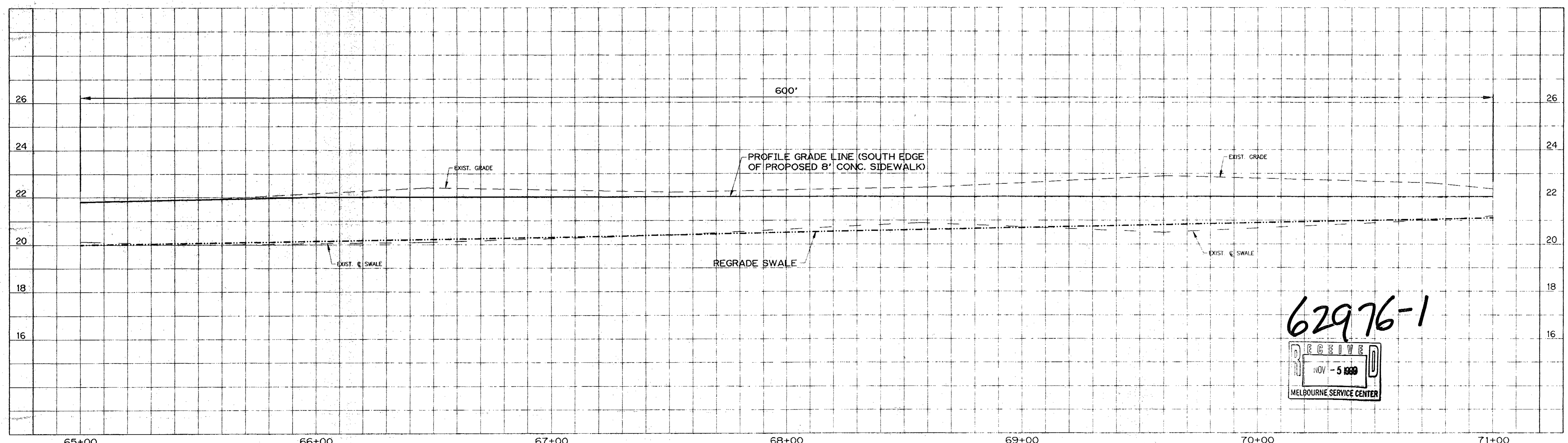
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MATCH LINE STA. 65+00

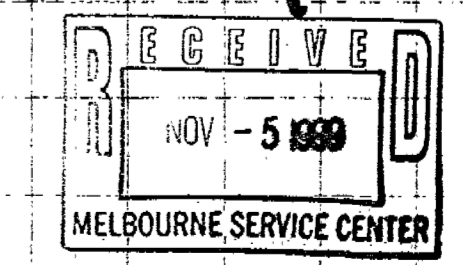
MATCH LINE STA. 71+00



NOTE: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

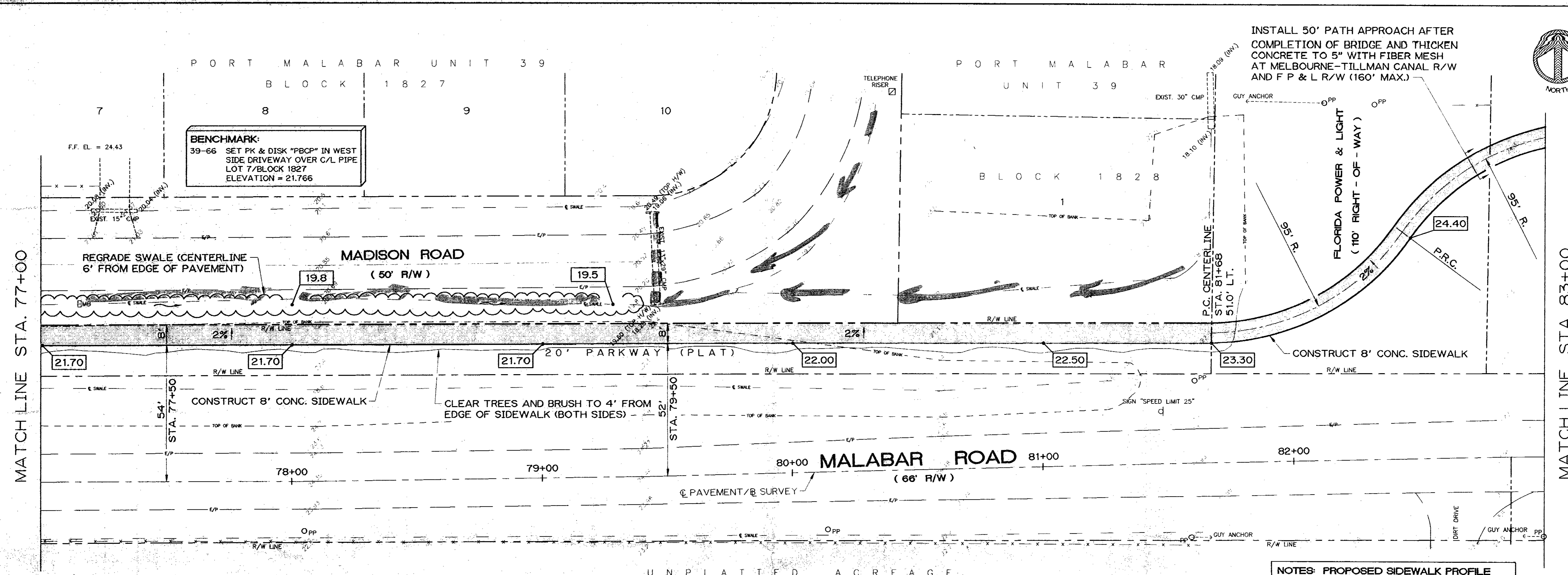
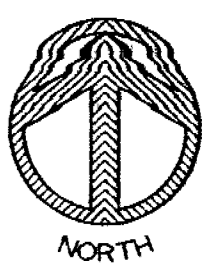
PLAN & PROFILE - MALABAR ROAD STA. 65+00 THRU STA. 71+00

DATE: AUG 1999
SCALE: HORIZ. 1" = 20'
VERT. 1" = 2'

PROJECT NO. 98-39
SHEET 15 of 57

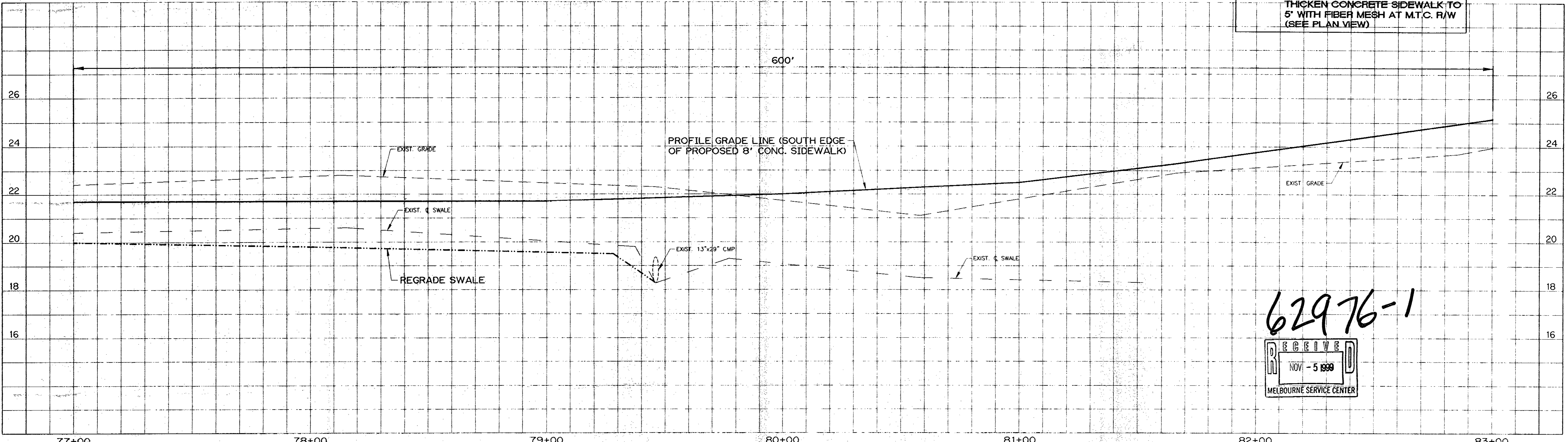
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18

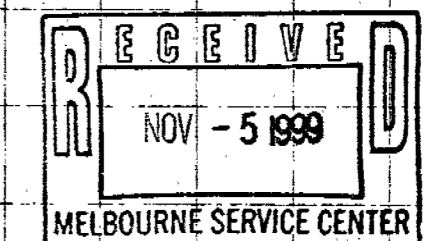


NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

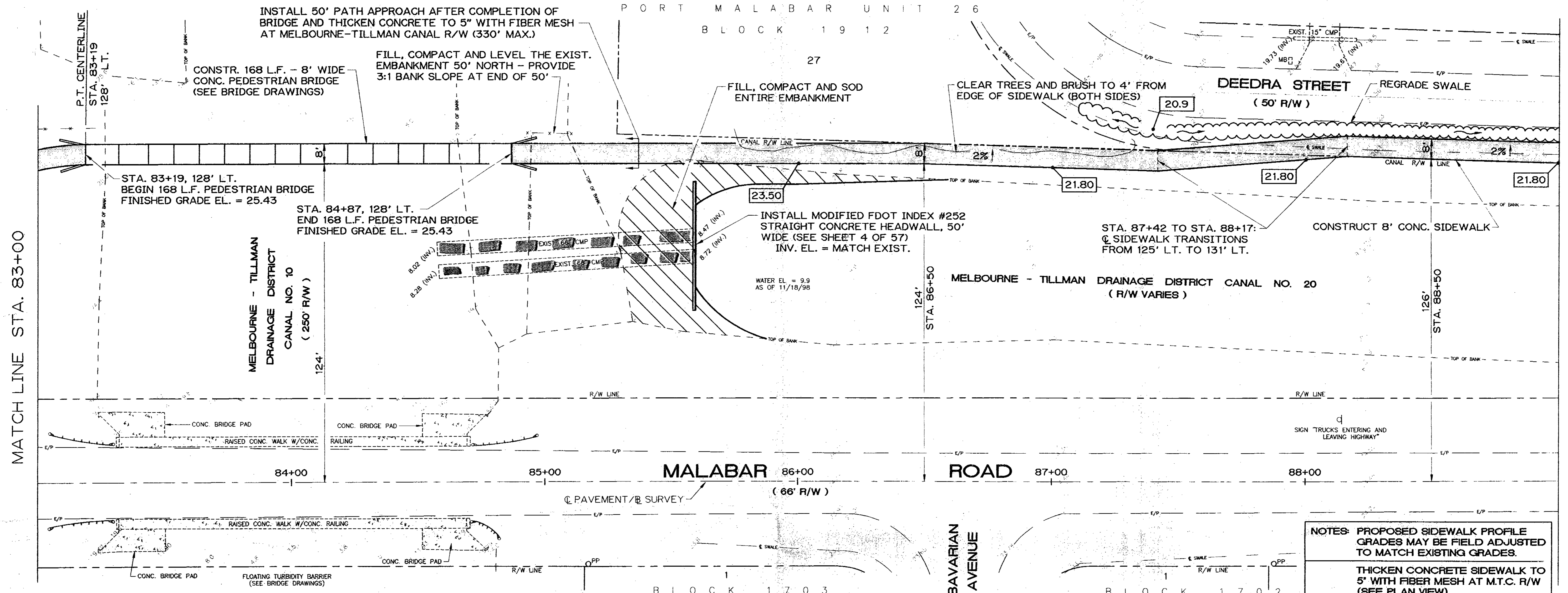
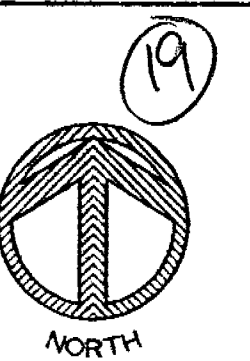
MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 77+00 THRU STA. 83+00

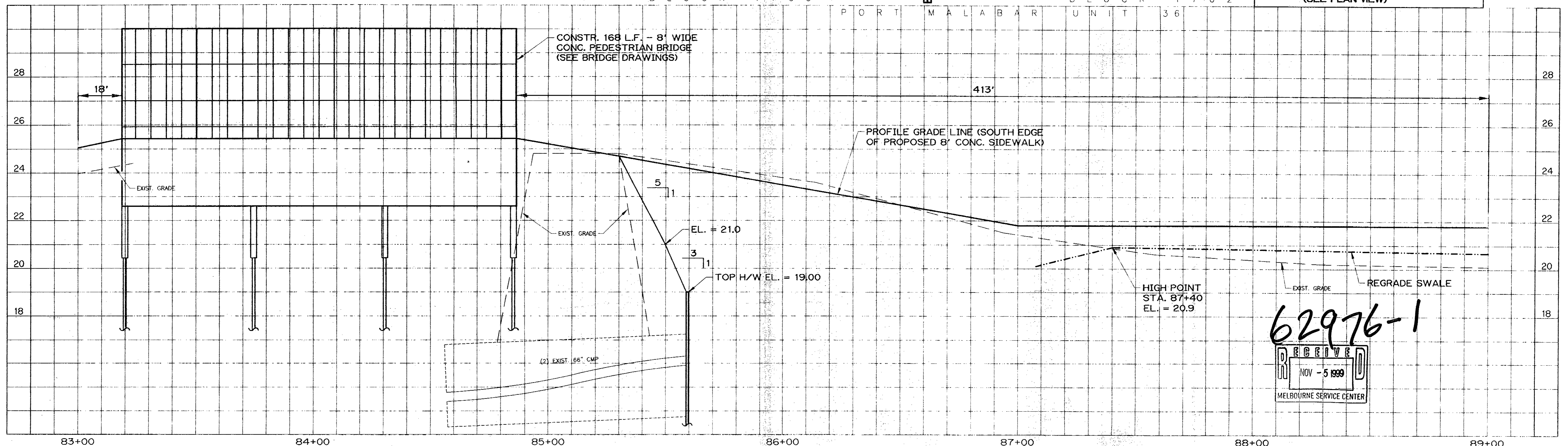
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VERT. 1" = 2'

PROJECT NO. 98-39
SHEET 17 of 57

FILE NAME: C:\DATA\PROJ\9839\9839P17.DWG 22/09/99 2:04:59



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



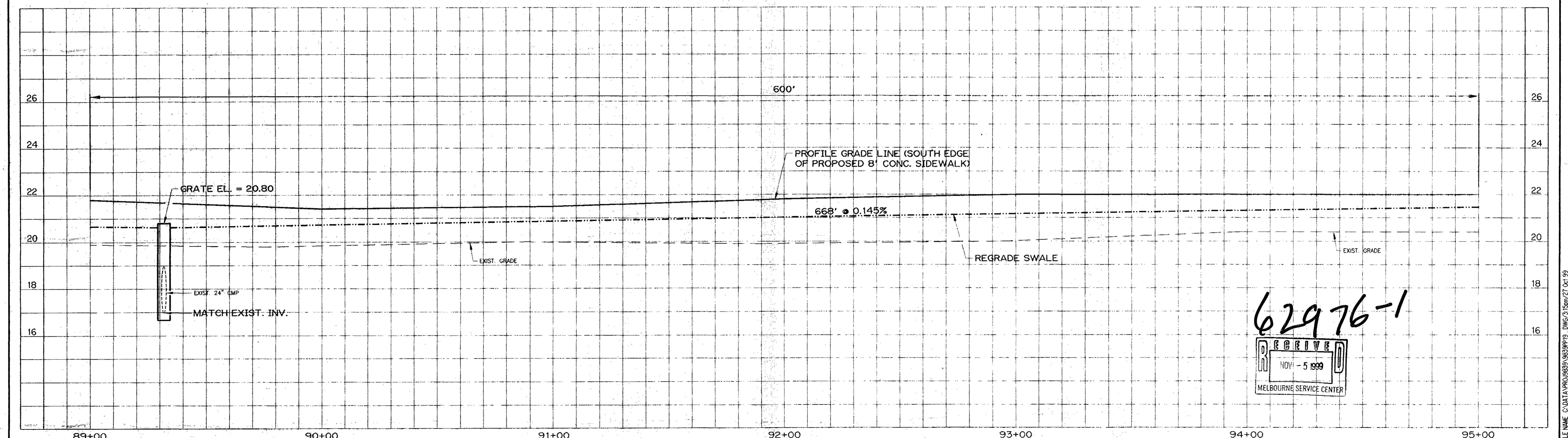
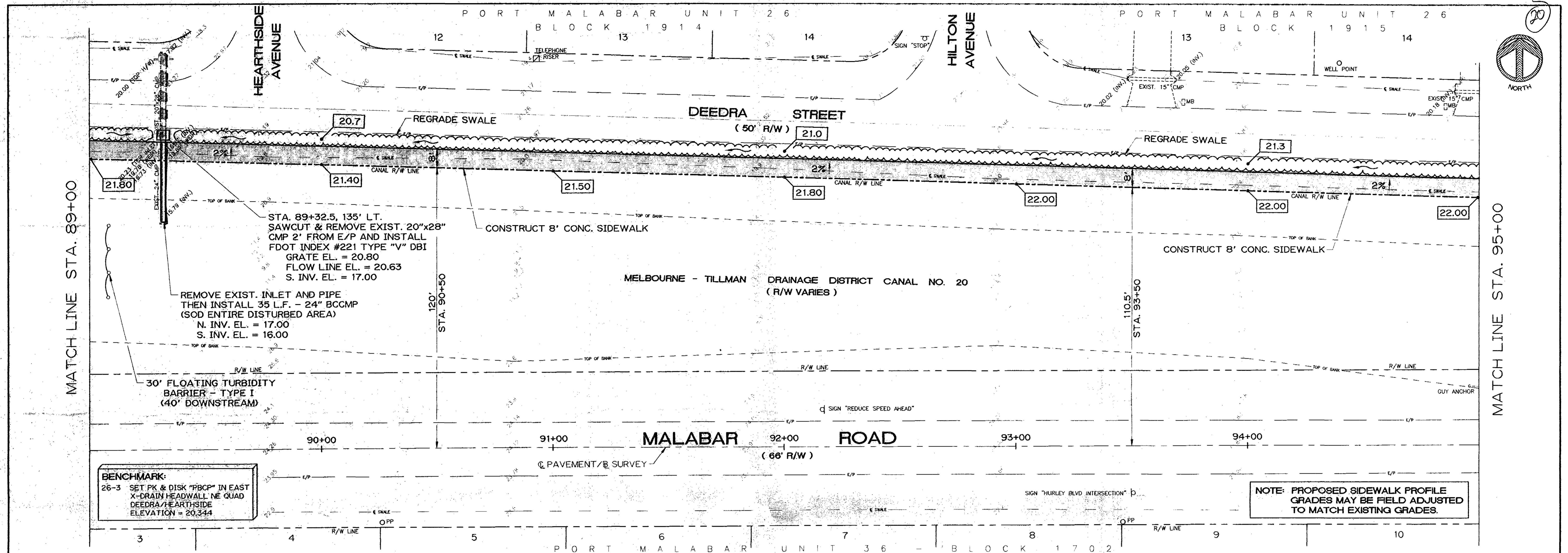
CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 83+00 THRU STA. 89+00

DATE	AUG 1999	PROJECT NO.	98-39
SCALE: HORIZ.	1" = 20'	SHEET	18
SCALE: VERT.	1" = 2'	OF	57

62976-1
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PLOT - 11-20 FILE NAME: C:\DATA\980303\980303\FB.DWG\11/30/99/29 Oct 99



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	

CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

DATE: AUG 1999
SCALE: HORIZ. 1" = 20'
VERT. 1" = 2'

PROJECT NO. 98-39
SHEET 19 of 57

PLAN & PROFILE - MALABAR ROAD STA. 89+00 THRU STA. 95+00

62976-1

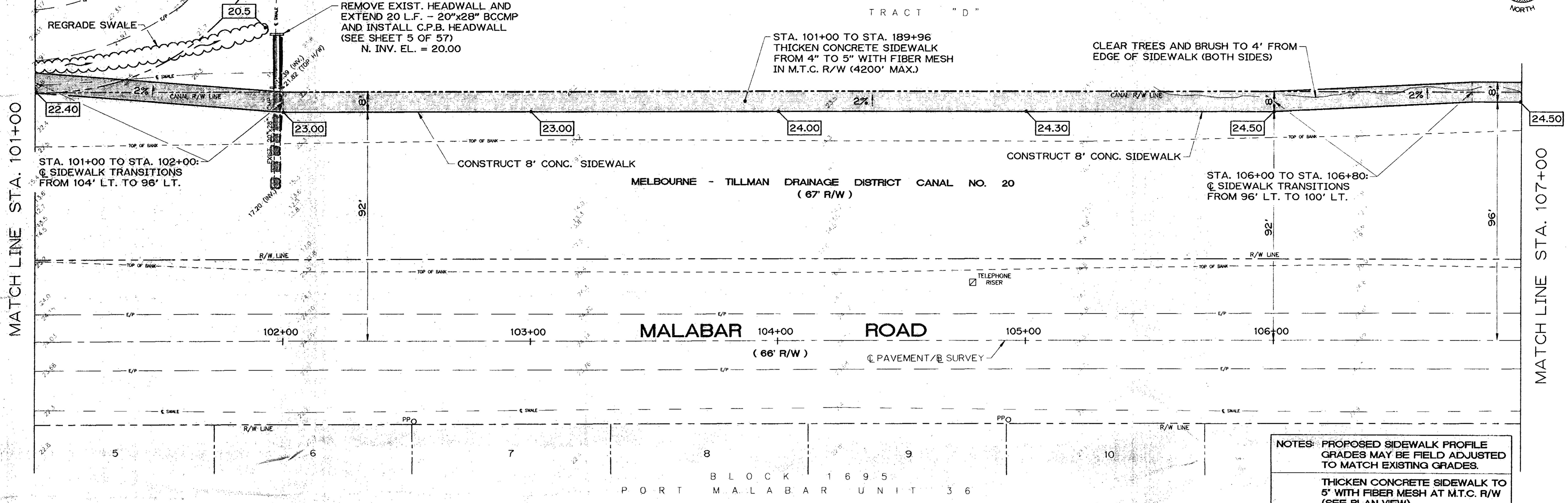
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NOV - 5 1999
MELBOURNE SERVICE CENTER

FILE NAME: C:\DATA\PROJ\8830\8830.P19.DWG/3/15/99/27 Oct 99

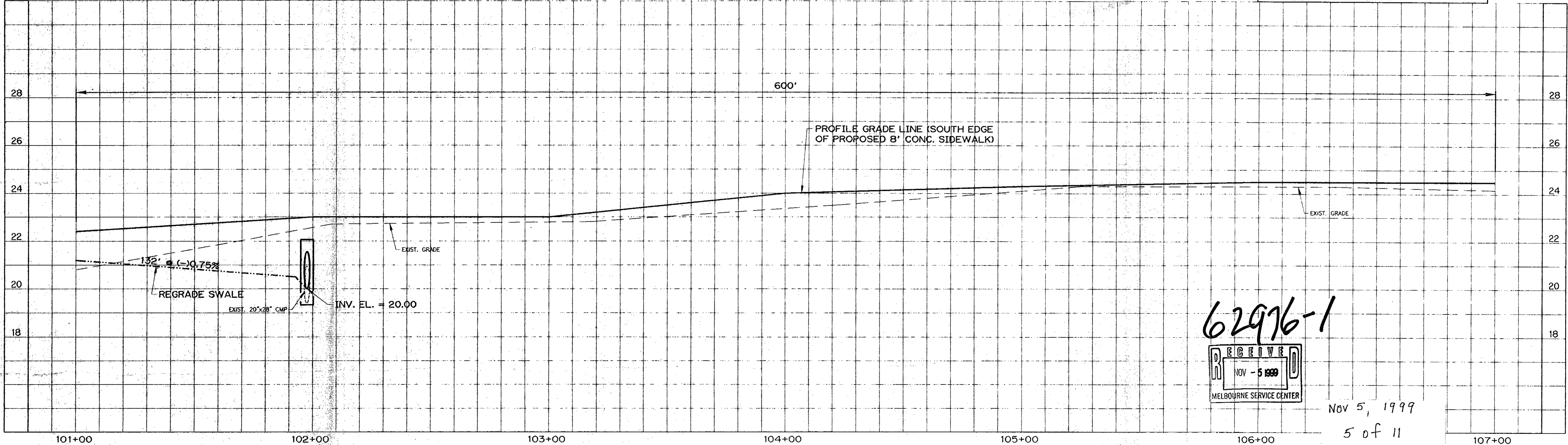
22



PORT MALABAR UNIT TWENTY SIX TRACT "D"



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



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MELBOURNE SERVICE CENTER

Nov 5, 1999
5 of 11

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	
REVISION			



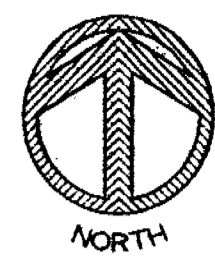
CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 101+00 THRU STA. 107+00

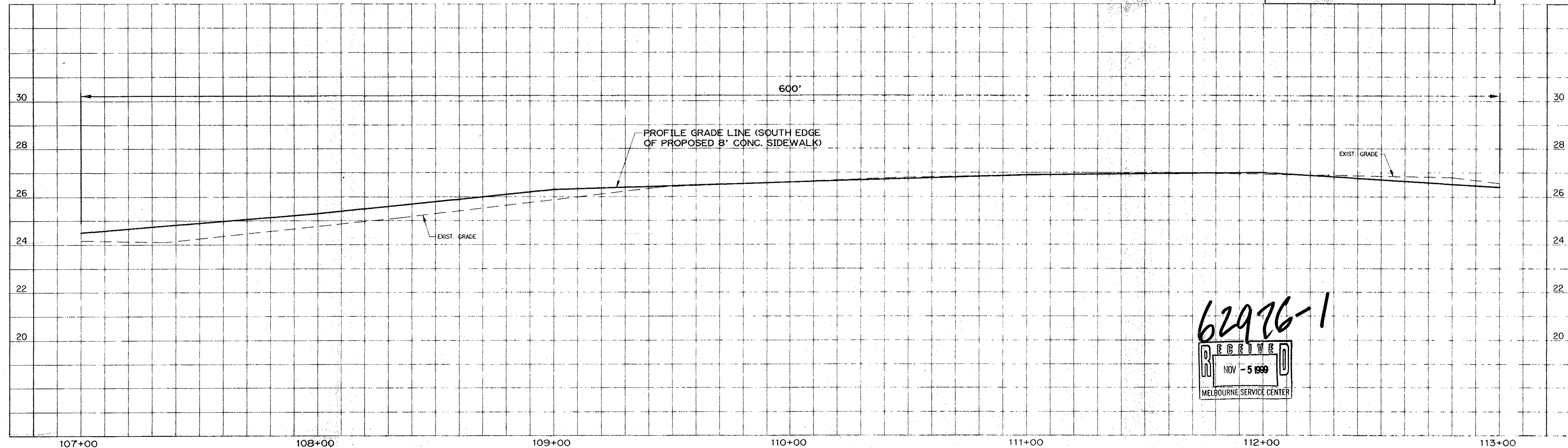
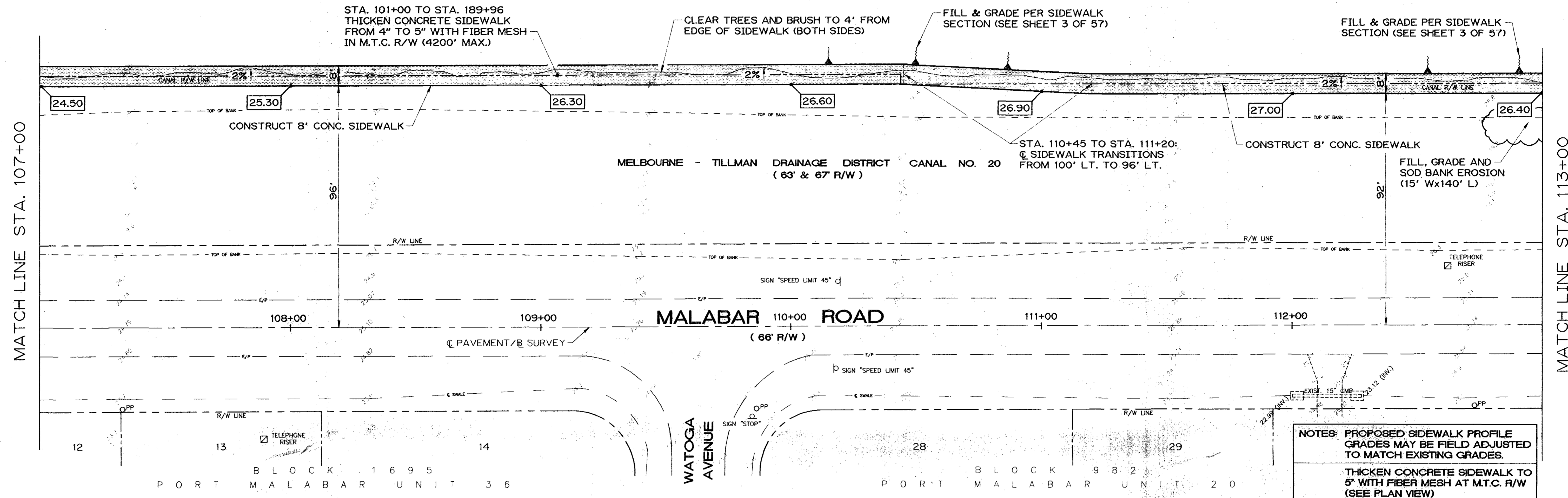
DATE	AUG 1999	PROJECT NO.	98-39
SCALE	HORIZ. 1" = 20'	SHEET	21
	VERT. 1" = 2'	of	57

FILE NAME: C:\DATA\980603\9839P21.DWG 01/15/99 19 Oct 99

33



PORT MALABAR UNIT TWENTY SIX
TRACT "D"



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NOV - 5 1999

MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE:	



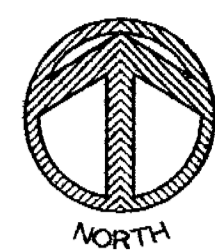
CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 107+00 THRU STA. 113+00

DATE:	AUG 1999	PROJECT NO.	98-39
SCALE:	HORIZ 1" = 20'	SHEET	22
VERT.	1" = 2'	OF	57

FILE NAME: C:\DATA\PROJ\9839\9839PP2.DWG/930m/19 Oct 99

2A

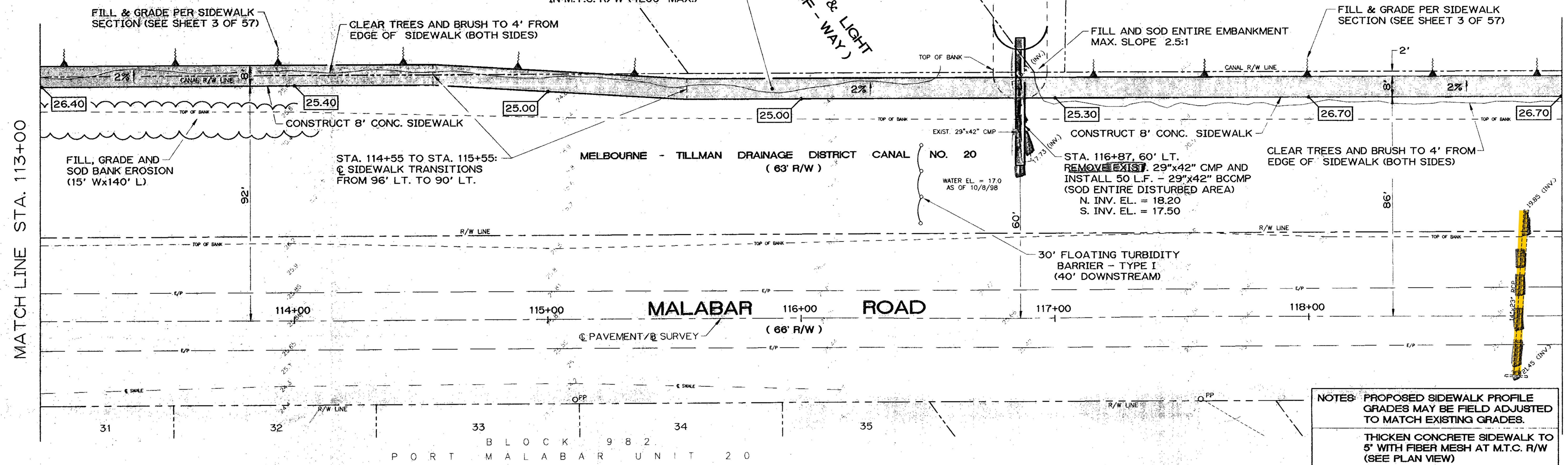


PORT MALABAR UNIT TWENTY SIX TRACT "D"

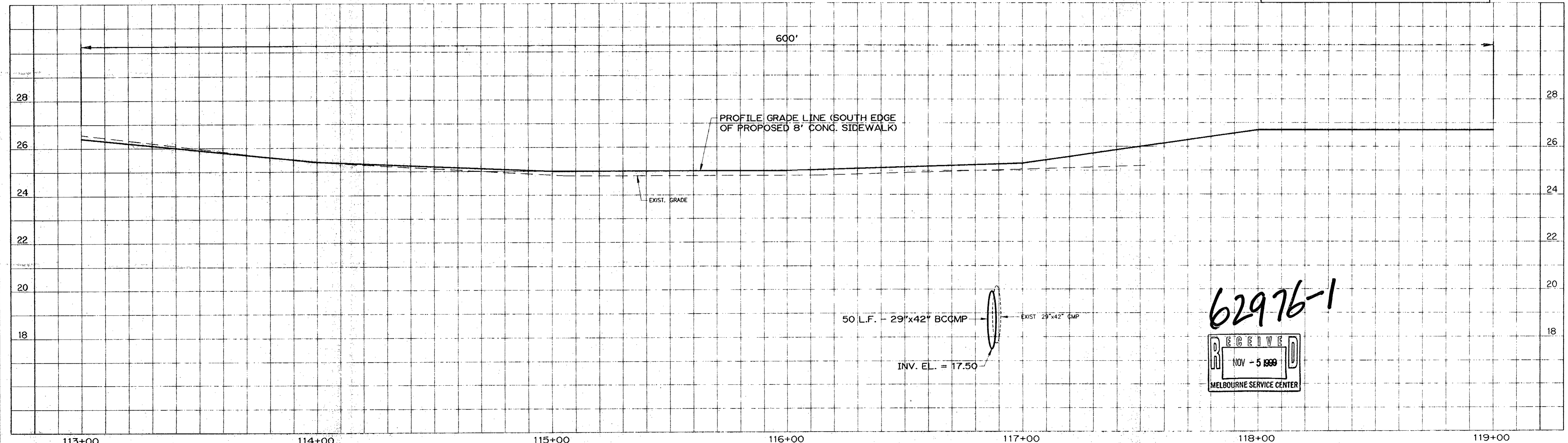
UNPLATTED ACREAGE

STA. 101+00 TO STA. 189+96 THICKEN CONCRETE SIDEWALK FROM 4" TO 5" WITH FIBER MESH IN M.T.C. R/W (4200' MAX.)

FLORIDA POWER & LIGHT (10' RIGHT-OF-WAY)



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



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 NOV - 5 1999
 MELBOURNE SERVICE CENTER

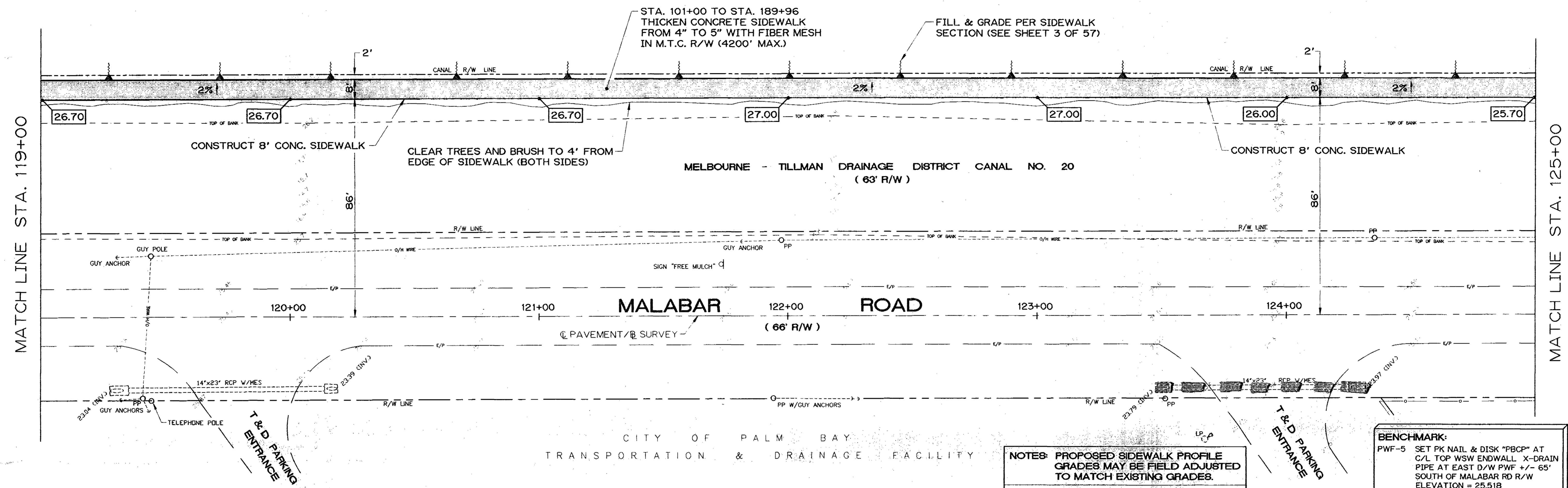
DESIGNED	ZZ	APPROVED		<p>CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION</p>	<p>MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS</p> <p>PLAN & PROFILE - MALABAR ROAD STA. 113+00 THRU STA. 119+00</p>	DATE:	AUG 1999	PROJECT NO.	98-39		
DRAWN	MH	CITY ENGINEER				SCALE:	1" = 20'	SHEET	23	OF	57
CHECKED	MN	DATE:				VERT.	1" = 2'				

FILE NAME: C:\DATA\PROJ\8839\8839PP23.DWG/10/15am/19 Oct 99

55



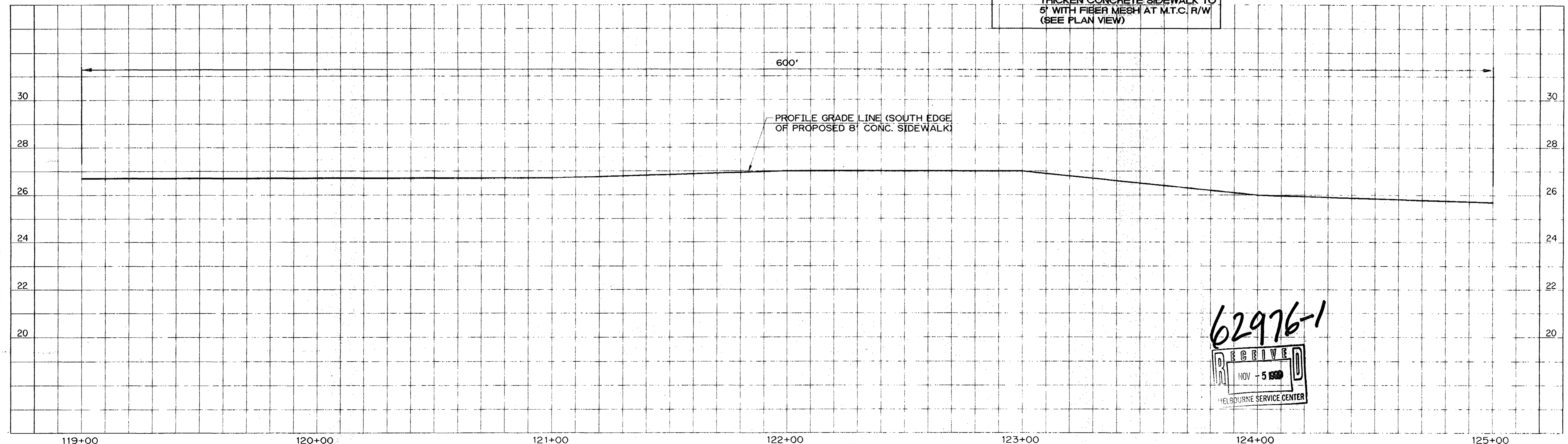
UNPLATTED ACREAGE



CITY OF PALM BAY
TRANSPORTATION & DRAINAGE FACILITY

NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)

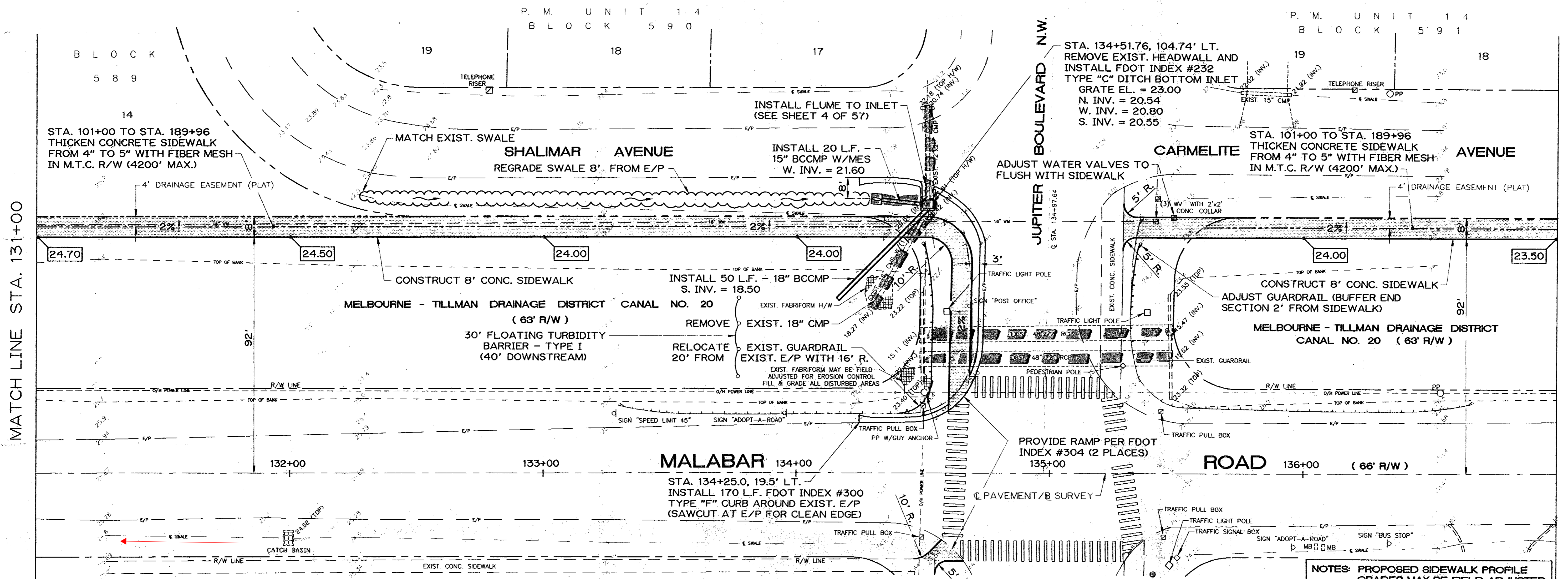
BENCHMARK:
PWF-5 SET PK NAIL & DISK "PBCP" AT C/L TOP WSW ENDWALL X-DRAIN PIPE AT EAST D/W PWF +/- 65' SOUTH OF MALABAR RD R/W ELEVATION = 25.518



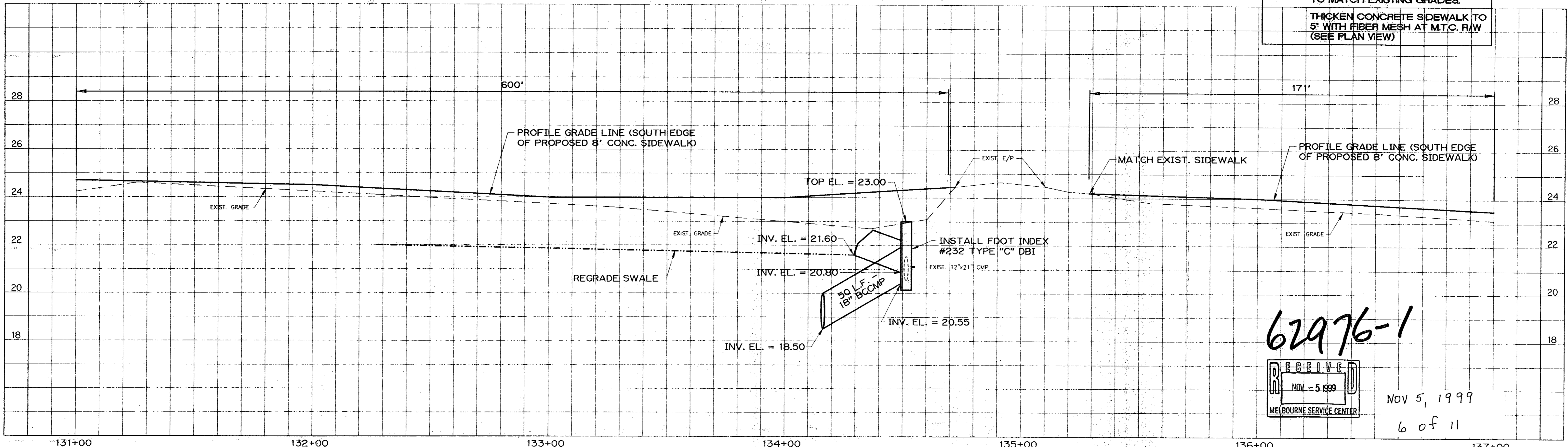
62976-1
RECEIVED
NOV - 5 1999
MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED		<p>CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION</p>	<p>MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS</p> <p>PLAN & PROFILE - MALABAR ROAD STA. 119+00 THRU STA. 125+00</p>	DATE:	AUG 1999	PROJECT NO:	98-39		
DRAWN	MH	CITY ENGINEER				SCALE:	HORIZ 1" = 20'	SHEET	24	OF	57
CHECKED	MN	DATE:				VERT.	1" = 2'				

FILE NAME: C:\DATA\PROJ\9839\9839PP24.DWG/1050am21.04.99



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



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 NOV - 5 1999
 MELBOURNE SERVICE CENTER
 NOV 5, 1999
 6 of 11

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	

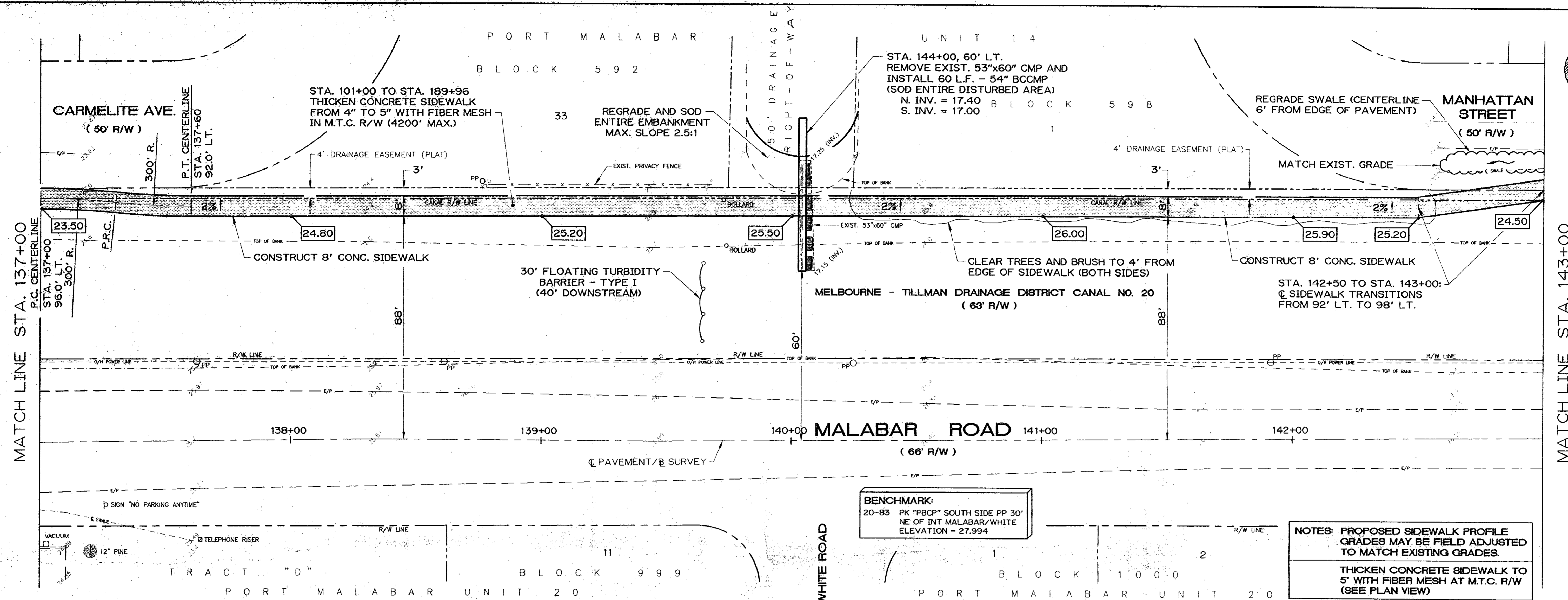
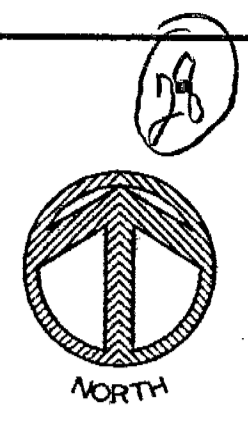


CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS
 PLAN & PROFILE - MALABAR ROAD STA. 131+00 THRU STA. 137+00

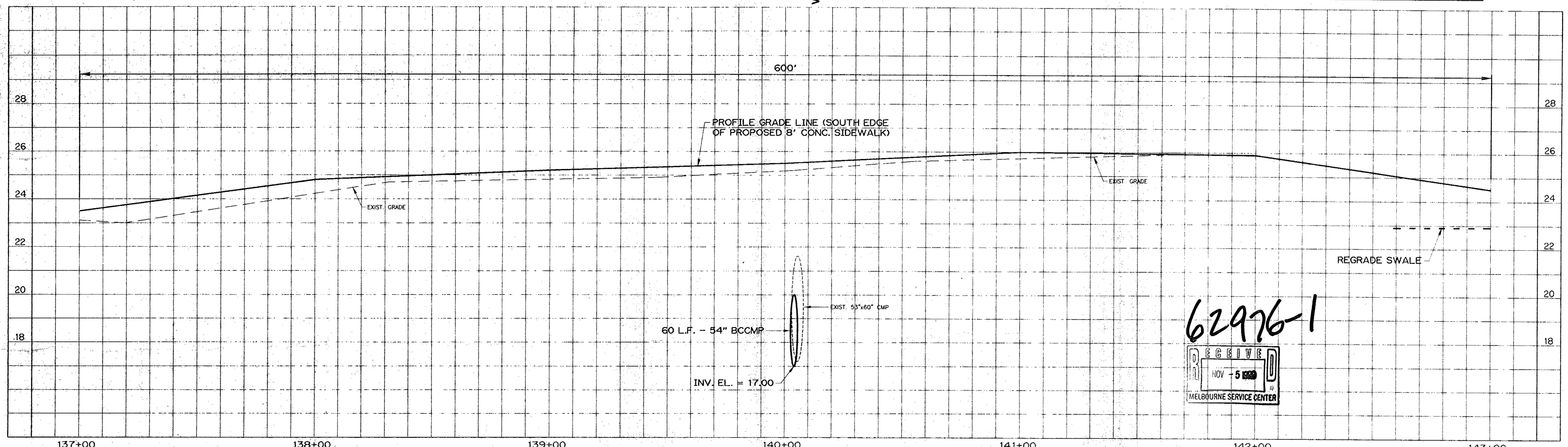
DATE	AUG 1999	PROJECT NO.	98-39
SCALE	HORIZ. 1" = 20'	SHEET	26
VERT.	1" = 2'	OF	57

FILE NAME C:\DATA\PROJ\8839\8839P26.DWG 2/23/99 10:19



BENCHMARK:
 20-83 PK "PBCP" SOUTH SIDE PP 30'
 NE OF INT MALABAR/WHITE
 ELEVATION = 27.994

NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO 5' WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



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 NOV - 5 1999
 MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS
 PLAN & PROFILE - MALABAR ROAD STA. 137+00 THRU STA. 143+00

DATE	AUG 1999	PROJECT NO.	98-39
SCALE:	HORIZ 1" = 20'	SHEET	27 OF 57
VERT.	1" = 2'		

FILE NAME: C:\DATA\PROJ98\9839\9839.P27.DWG/14507/06 OCT 99

PORT MALABAR UNIT 14
BLOCK 600

STA. 148+28, 76' LT.
REMOVE EXIST. H/W AND INSTALL
FDOT INDEX #232 TYPE "C" DBI
GRATE EL. = 23.20
N.W. INV. EL. = 20.50
S.W. INV. EL. = 20.49
SUMP EL. = 20.00

STA. 148+13, 105' LT.
SAWCUT EXIST. 12"x18" RCP 3' FROM
EDGE OF PAVEMENT AND INSTALL
FDOT INDEX #232 TYPE "C" DBI
GRATE EL. = 22.60
N. INV. EL. = 20.54
S. INV. EL. = 20.54
SUMP EL. = 20.00

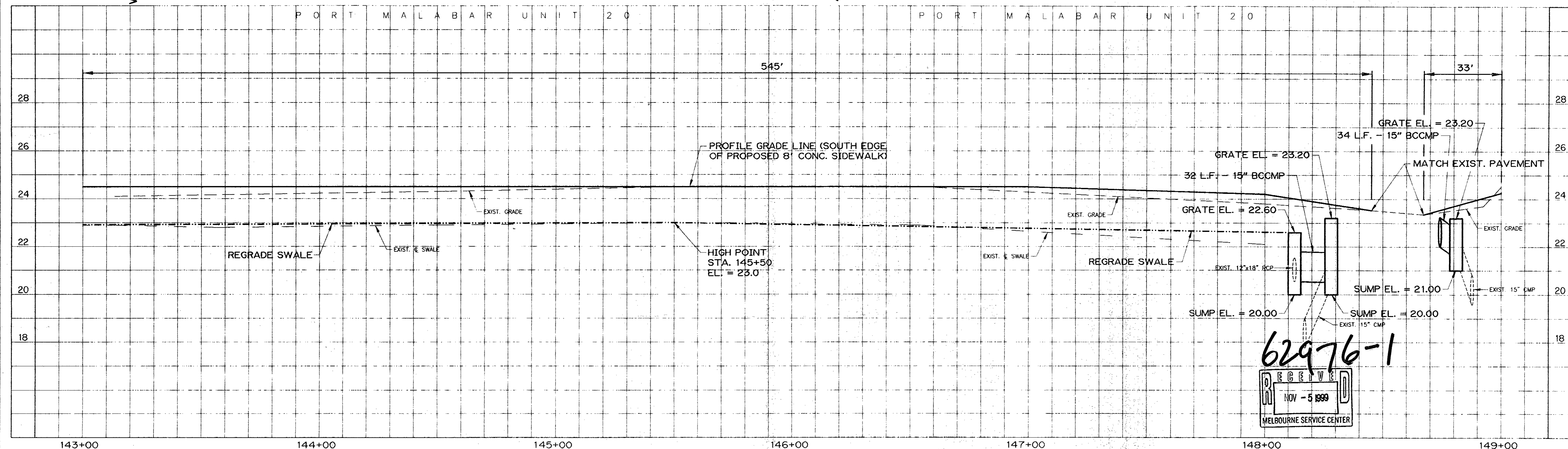
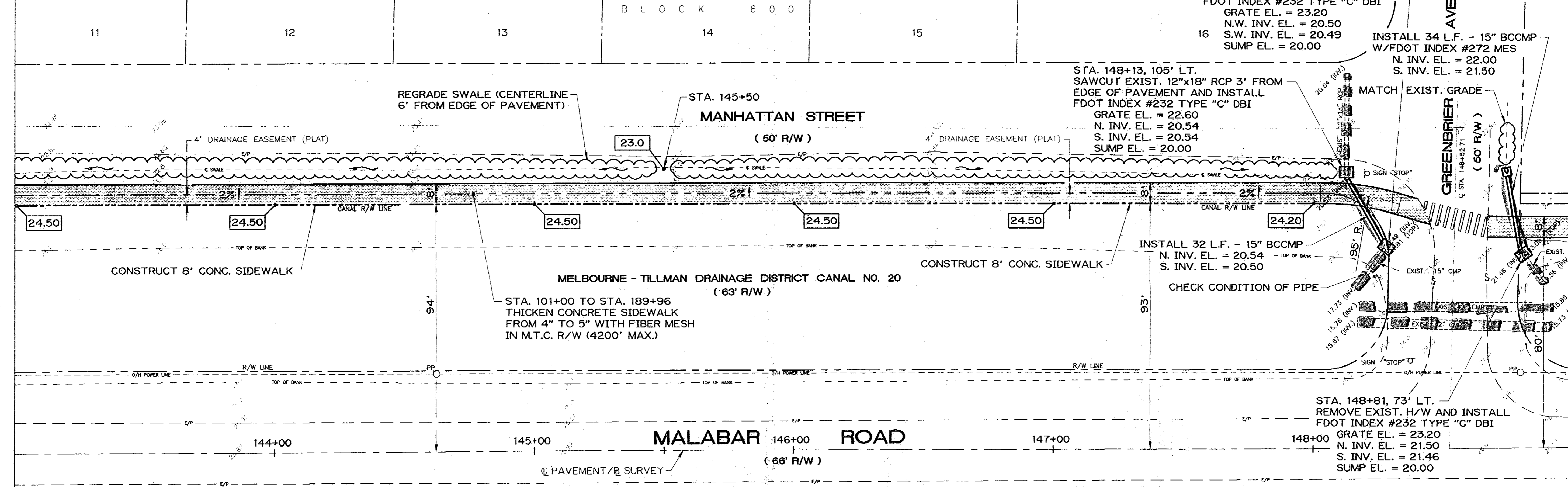
INSTALL 34 L.F. - 15" BCCMP
W/FDOT INDEX #272 MES
N. INV. EL. = 22.00
S. INV. EL. = 21.50

STA. 148+81, 73' LT.
REMOVE EXIST. H/W AND INSTALL
FDOT INDEX #232 TYPE "C" DBI
GRATE EL. = 23.20
N. INV. EL. = 21.50
S. INV. EL. = 21.46
SUMP EL. = 20.00

NOTES: PROPOSED SIDEWALK PROFILE
GRADES MAY BE FIELD ADJUSTED
TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO
5" WITH FIBER MESH AT M.T.C. R/W
(SEE PLAN VIEW)

MATCH LINE STA. 143+00

MATCH LINE STA. 149+00



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RECEIVED
NOV - 5 1999
MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 143+00 THRU STA. 149+00

DATE:	AUG 1999	PROJECT NO.	98-39
SCALE:	1" = 20'	SHEET	28
HORIZ.	1" = 2'	OF	57

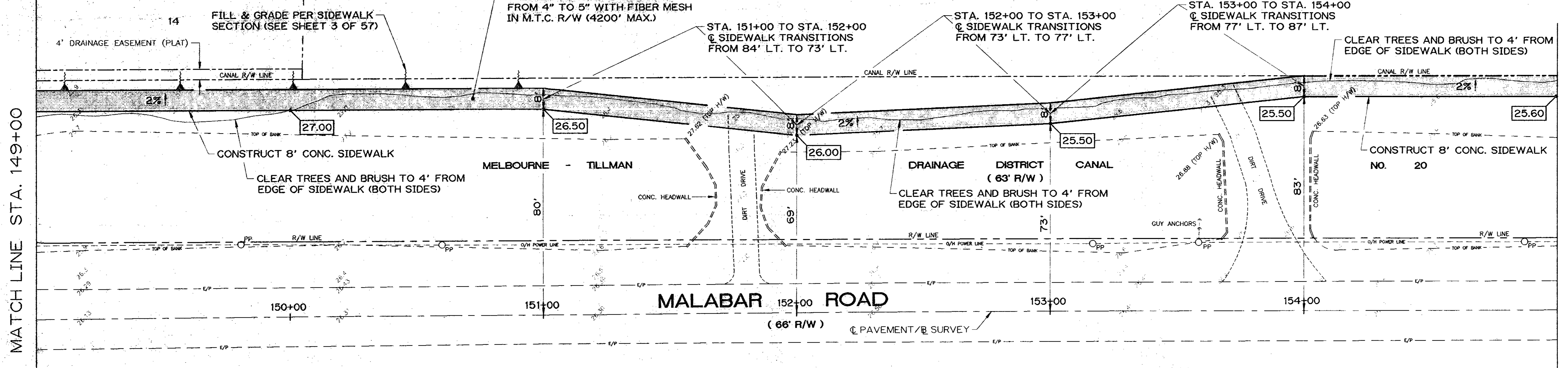
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30



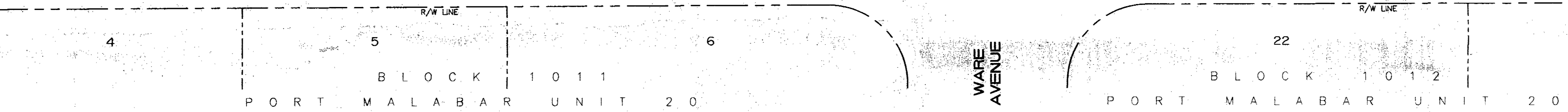
PORT MALABAR
UNIT 14
BLOCK 601

UNPLATTED ACREAGE



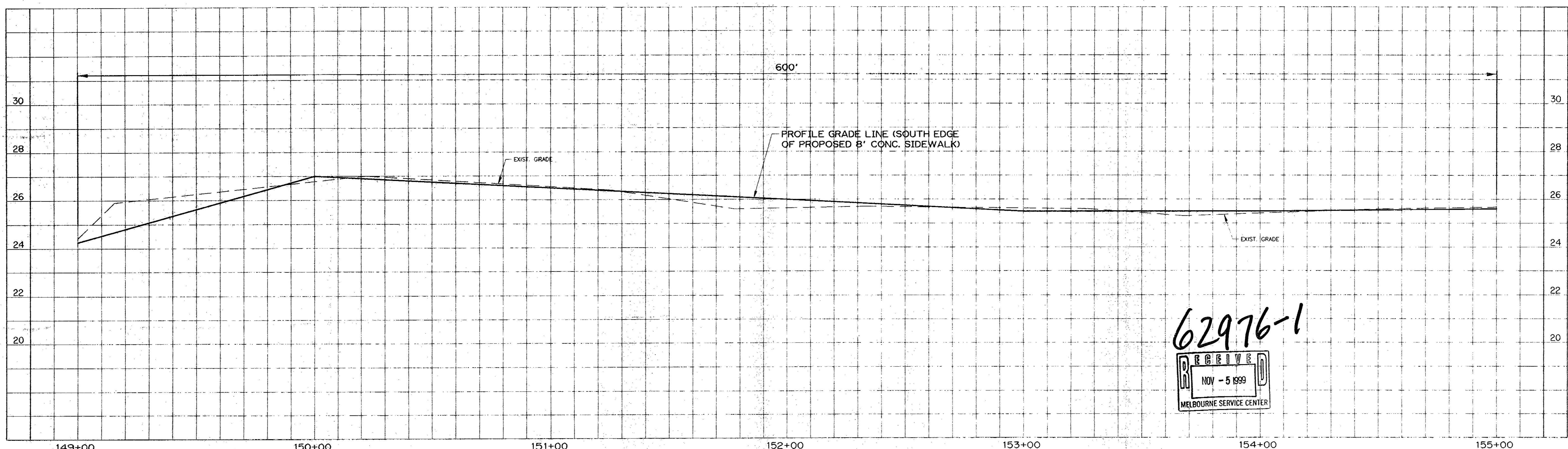
MATCH LINE STA. 149+00

MATCH LINE STA. 155+00

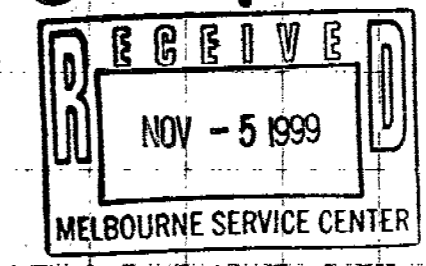


NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



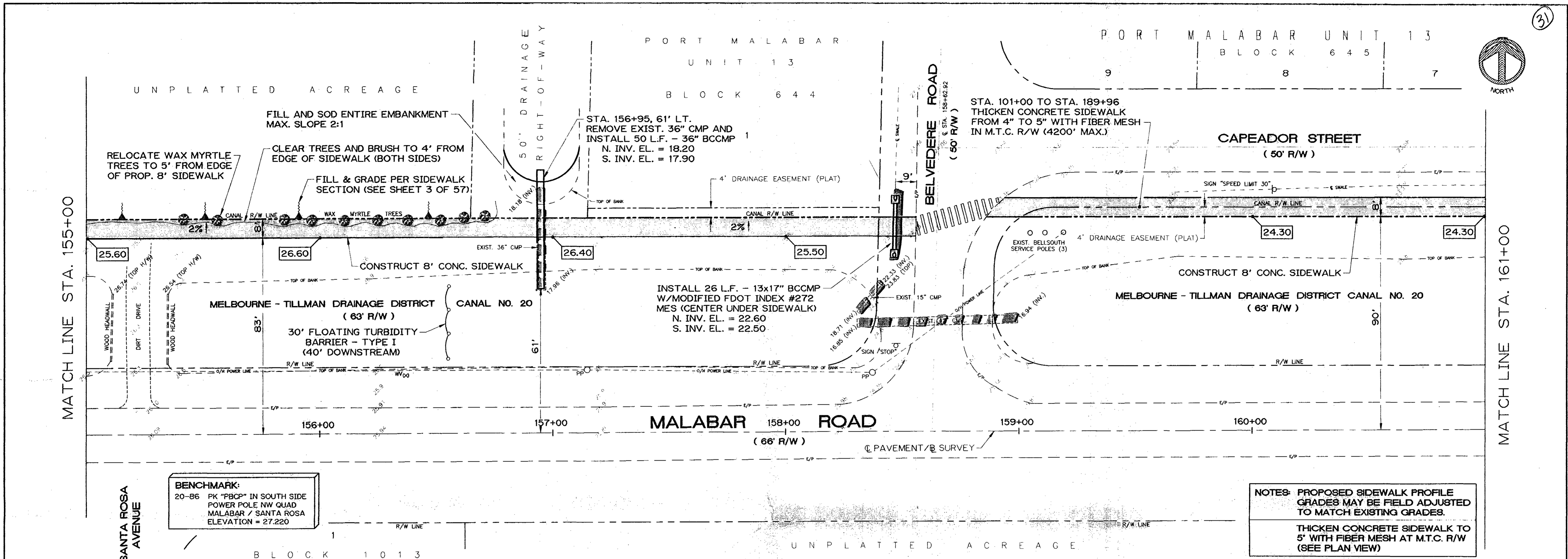
CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 149+00 THRU STA. 155+00

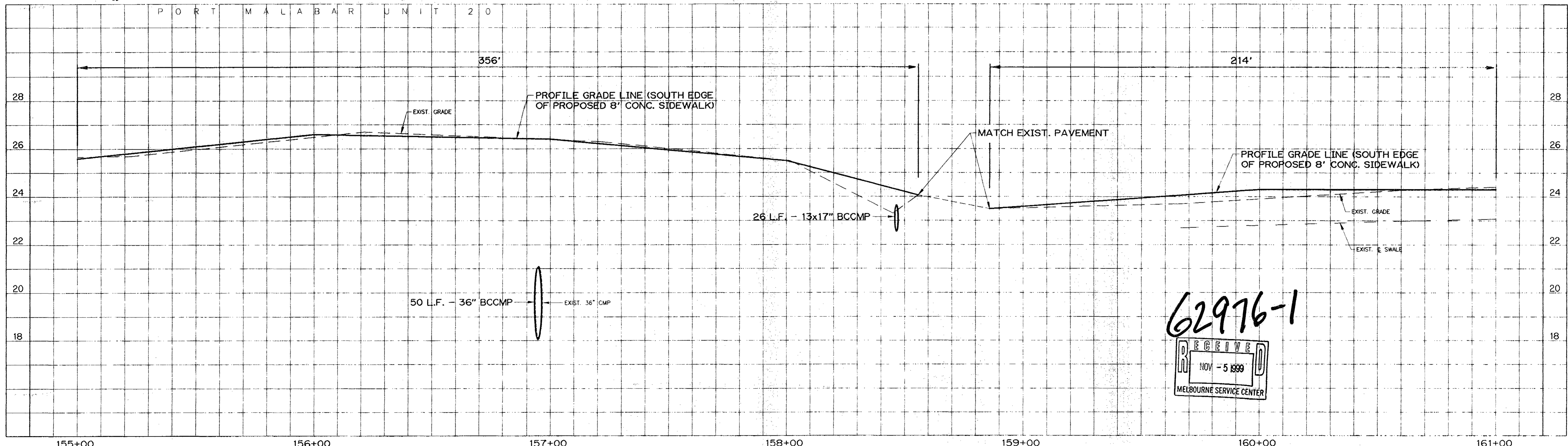
DATE	AUG 1999	PROJECT NO.	98-39
SCALE	HORIZ. 1" = 20'	SHEET	29
VERT.	1" = 2'	OF	57

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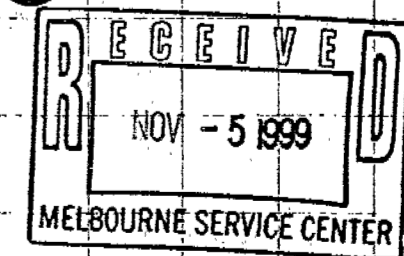


BENCHMARK:
 20-86 PK "PBCP" IN SOUTH SIDE
 POWER POLE NW QUAD
 MALABAR / SANTA ROSA
 ELEVATION = 27.220

NOTES: PROPOSED SIDEWALK PROFILE
 GRADES MAY BE FIELD ADJUSTED
 TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO
 5" WITH FIBER MESH AT M.T.C. R/W
 (SEE PLAN VIEW)



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
BY	MIN	DATE	

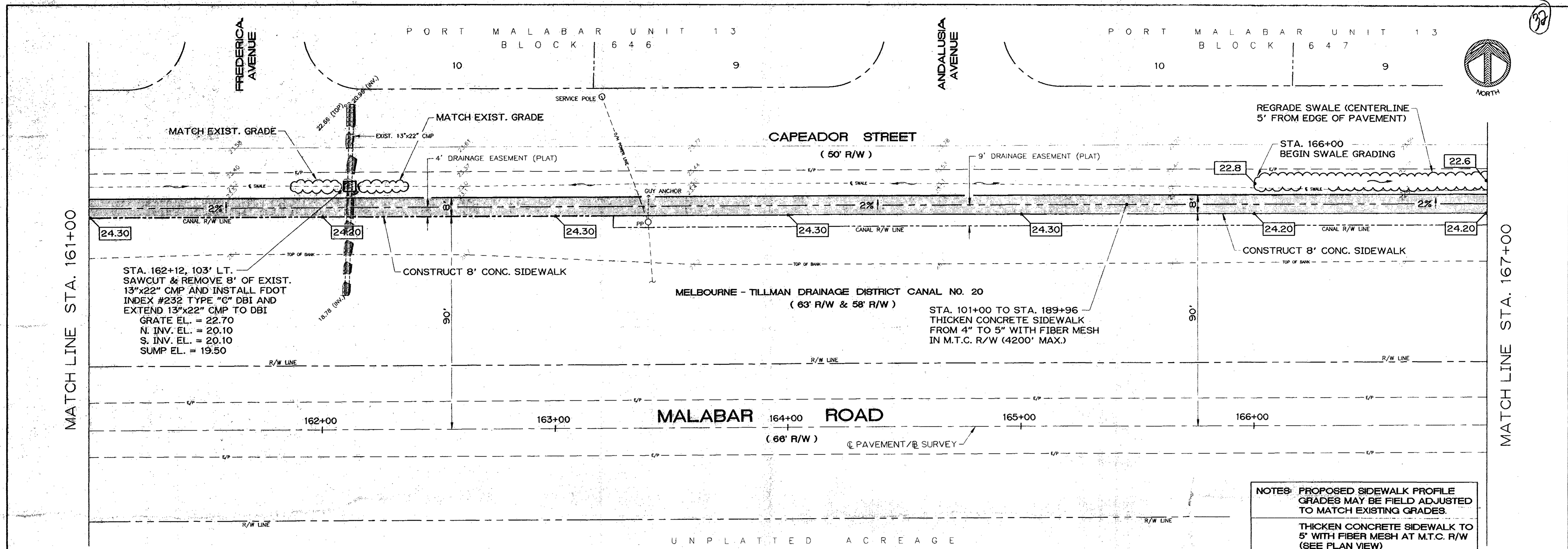


CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 155+00 THRU STA. 161+00

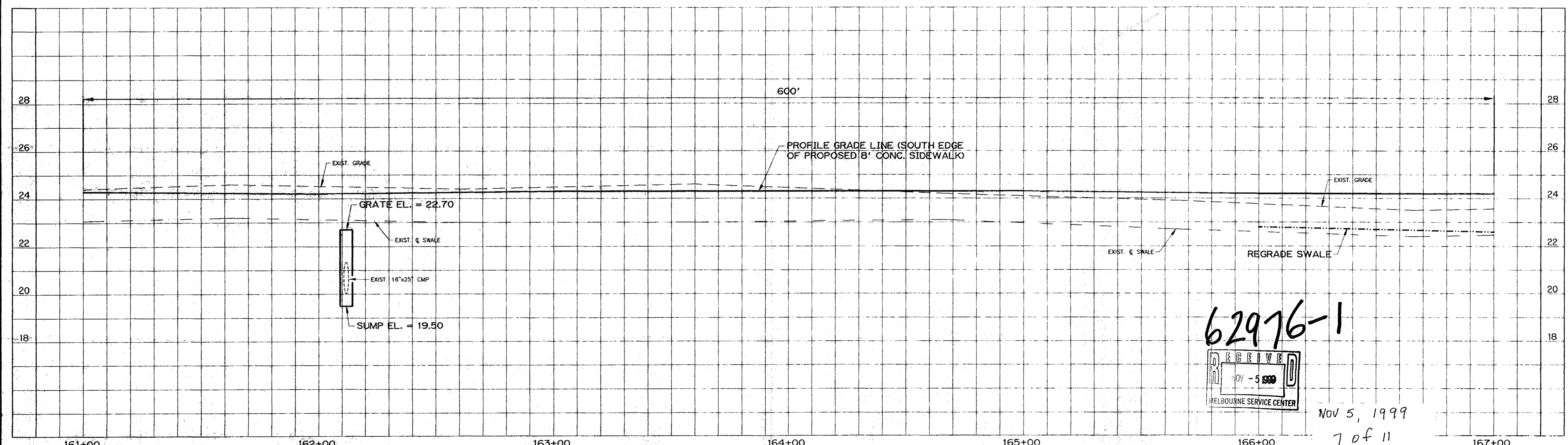
DATE:	AUG 1999	PROJECT NO.	98-39
SCALE:	HORIZ. 1" = 20'	SHEET	30
VERT.	1" = 2'	OF	57



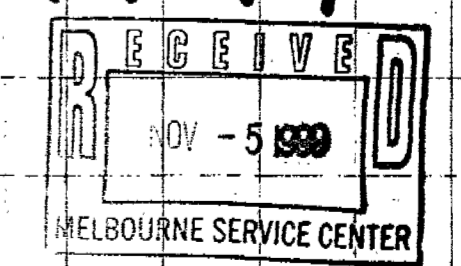
STA. 162+12, 103' LT. SAWCUT & REMOVE 8' OF EXIST. 13"x22" CMP AND INSTALL FDOT INDEX #232 TYPE "G" DBI AND EXTEND 13"x22" CMP TO DBI
 GRATE EL. = 22.70
 N. INV. EL. = 20.10
 S. INV. EL. = 20.10
 SUMP EL. = 19.50

STA. 101+00 TO STA. 189+96 THICKEN CONCRETE SIDEWALK FROM 4" TO 5" WITH FIBER MESH IN M.T.C. R/W (4200' MAX.)

NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



62976-1

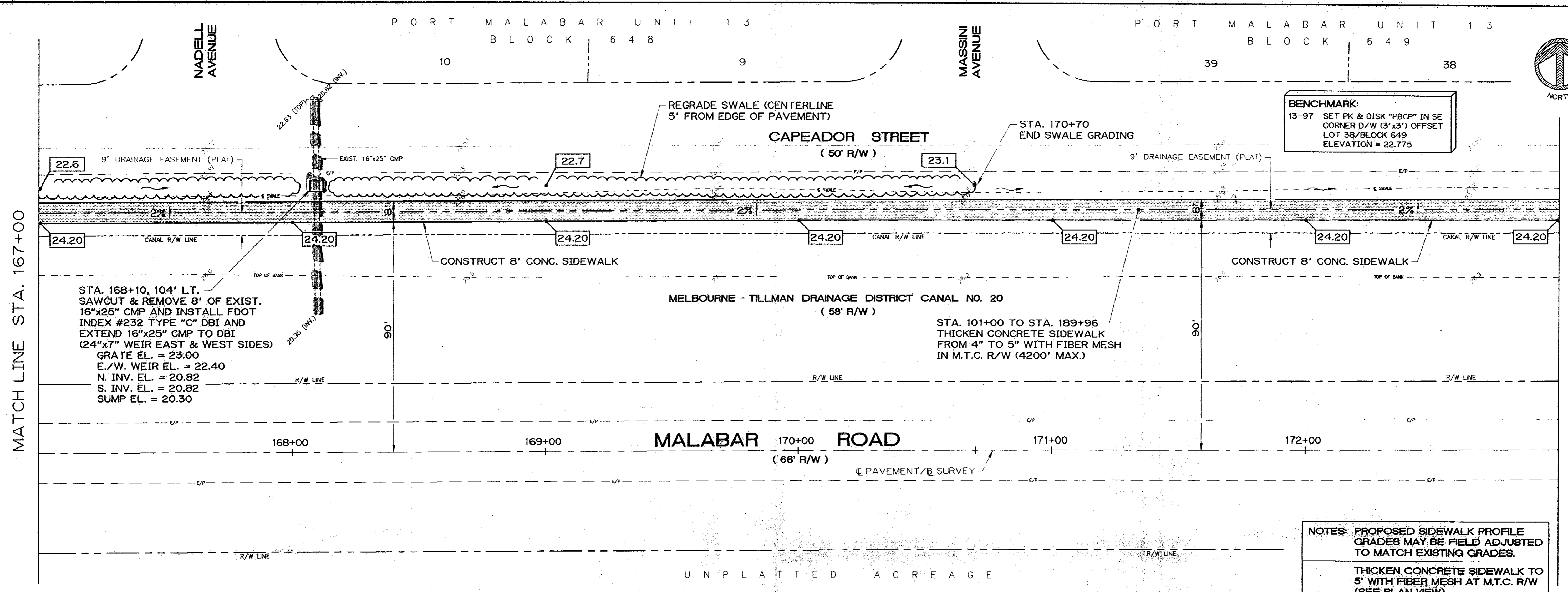


NOV 5, 1999
 7 of 11

DESIGNED: ZZ	APPROVED:	 CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION	MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS PLAN & PROFILE - MALABAR ROAD STA. 161+00 THRU STA. 167+00		DATE: AUG 1999 SCALE: HORIZ 1" = 20' VERT. 1" = 2'	PROJECT NO. 98-39 SHEET 31 of 57
DRAWN: MH	CITY ENGINEER:					
CHECKED: MN	DATE:					

FILE NAME: C:\DATA\PROJECTS\9806931.DWG 4/20/99 15:04:59

33

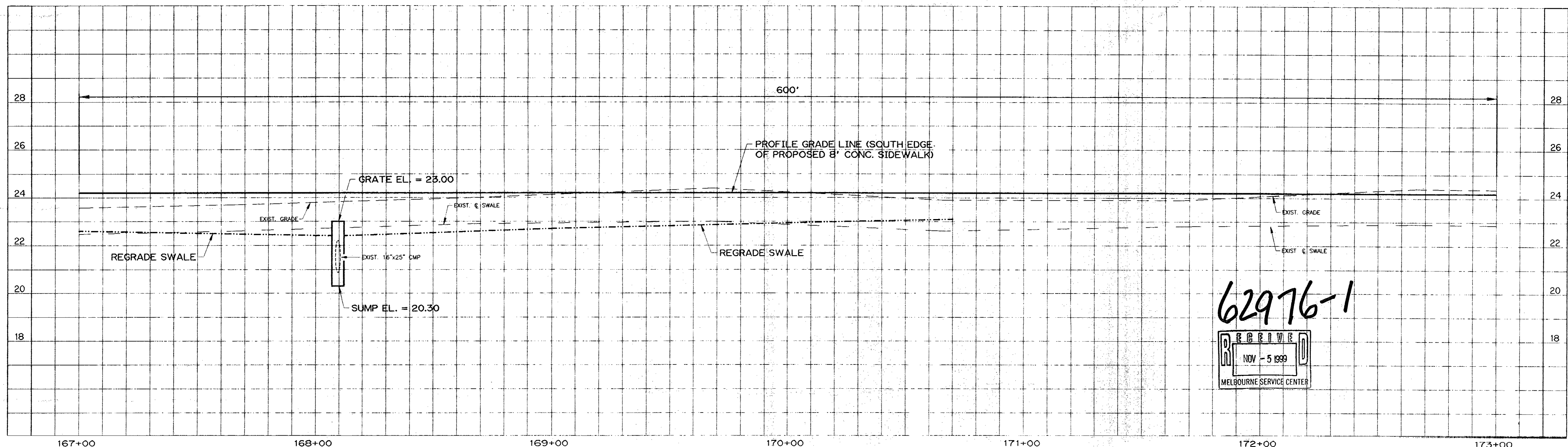


MATCH LINE STA. 167+00

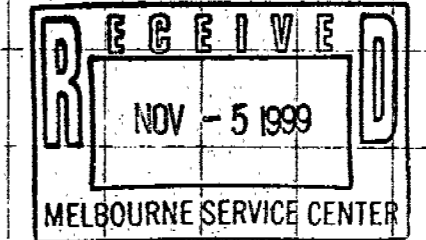
MATCH LINE STA. 173+00


BENCHMARK:
 13-97 SET PK & DISK "PBCP" IN SE CORNER D/W (3'x3') OFFSET LOT 38/BLOCK 649 ELEVATION = 22.775

NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
 THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



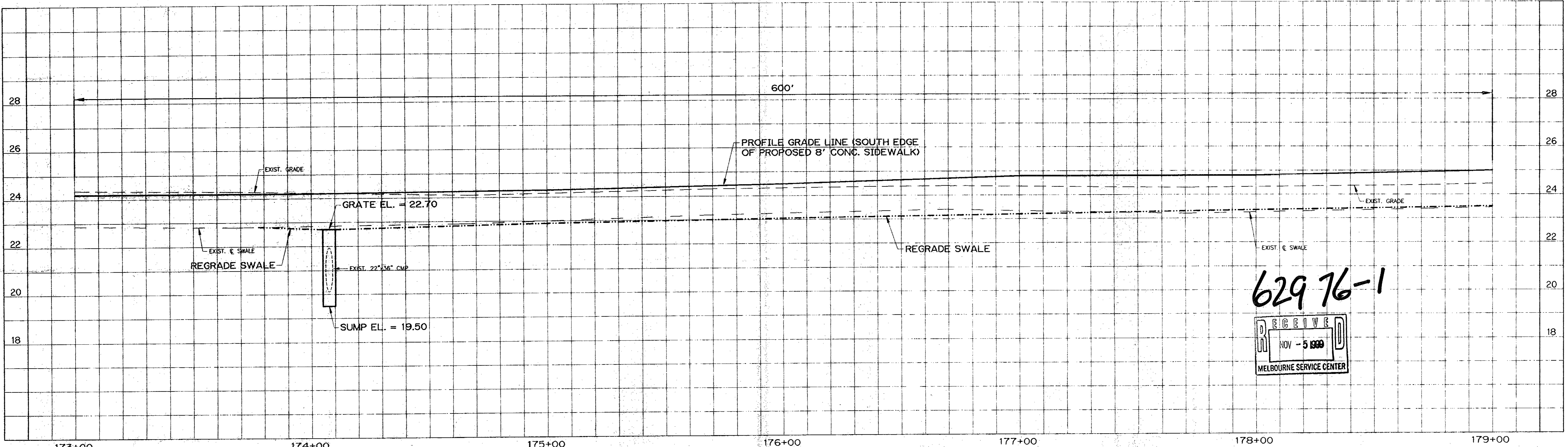
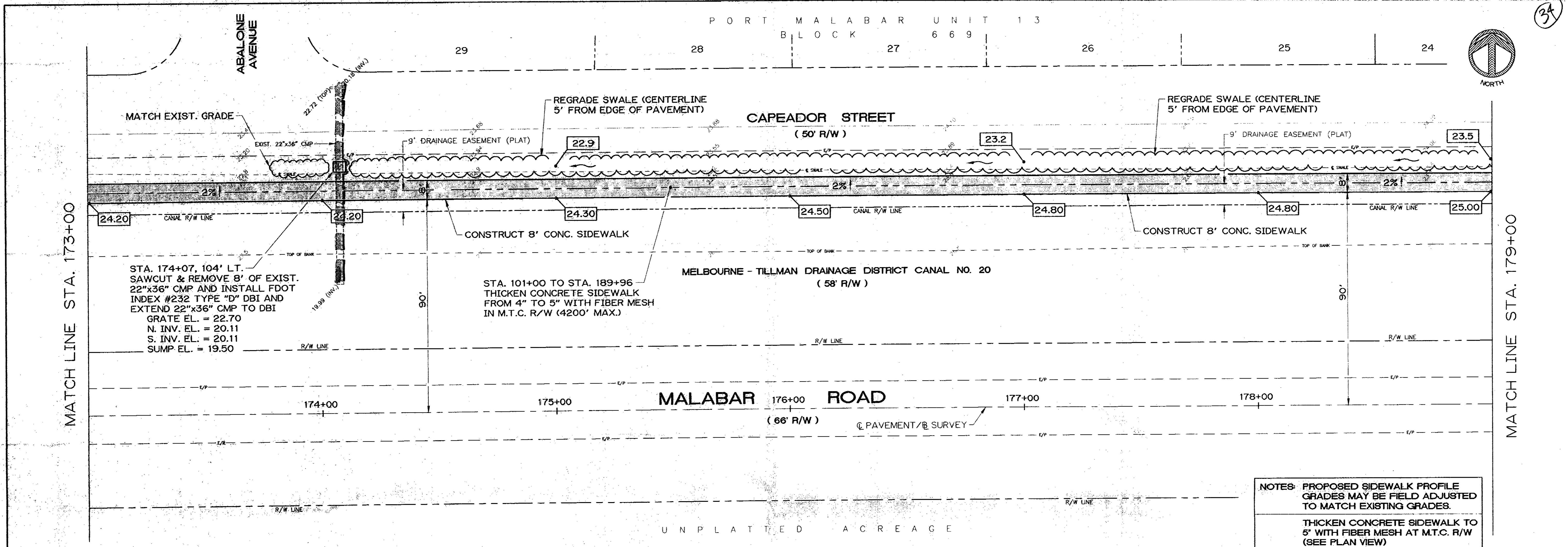
62976-1



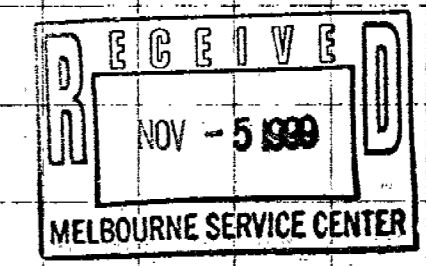
DESIGNED	ZZ	APPROVED:	 CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION	MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS		DATE: AUG 1999	PROJECT NO. 98-39
DRAWN	MH	CITY ENGINEER		PLAN & PROFILE - MALABAR ROAD STA. 167+00 THRU STA. 173+00		SCALE: 1" = 20'	SHEET 32 OF 57
CHECKED	MN	DATE:				VERT. 1" = 2'	

FILE NAME: C:\DATA\PROJ\893\893P23.DWG 4/20/99 15:04:59

34



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	

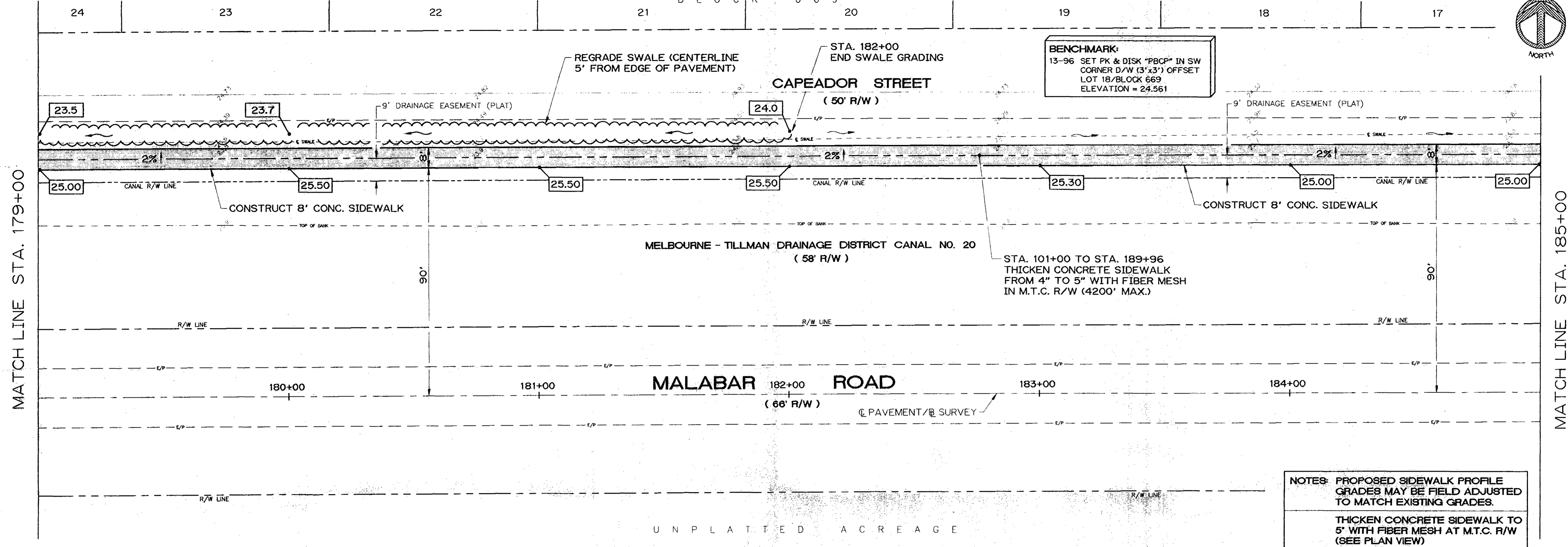


CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

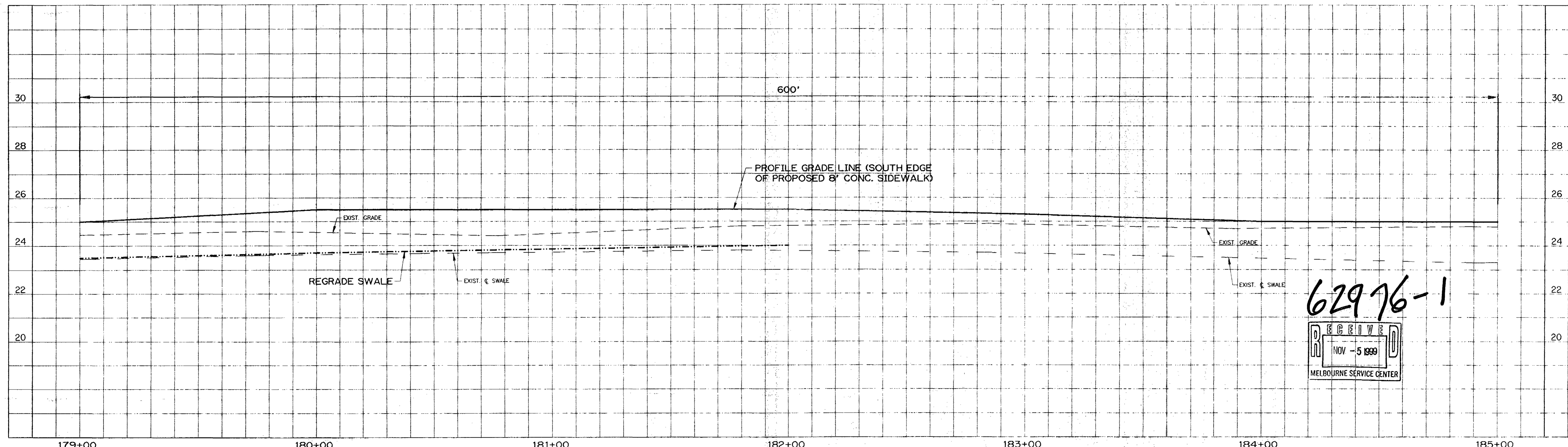
MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 173+00 THRU STA. 179+00

DATE	AUG 1999	PROJECT NO.	98-39
SCALE	1" = 20'	SHEET	33 of 57
VERT.	1" = 2'		

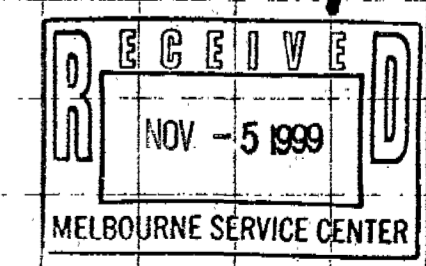
FILE NAME: C:\DATA\PROJ\8859\8859P33.DWG 4/29/99 19:04:59



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.
THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



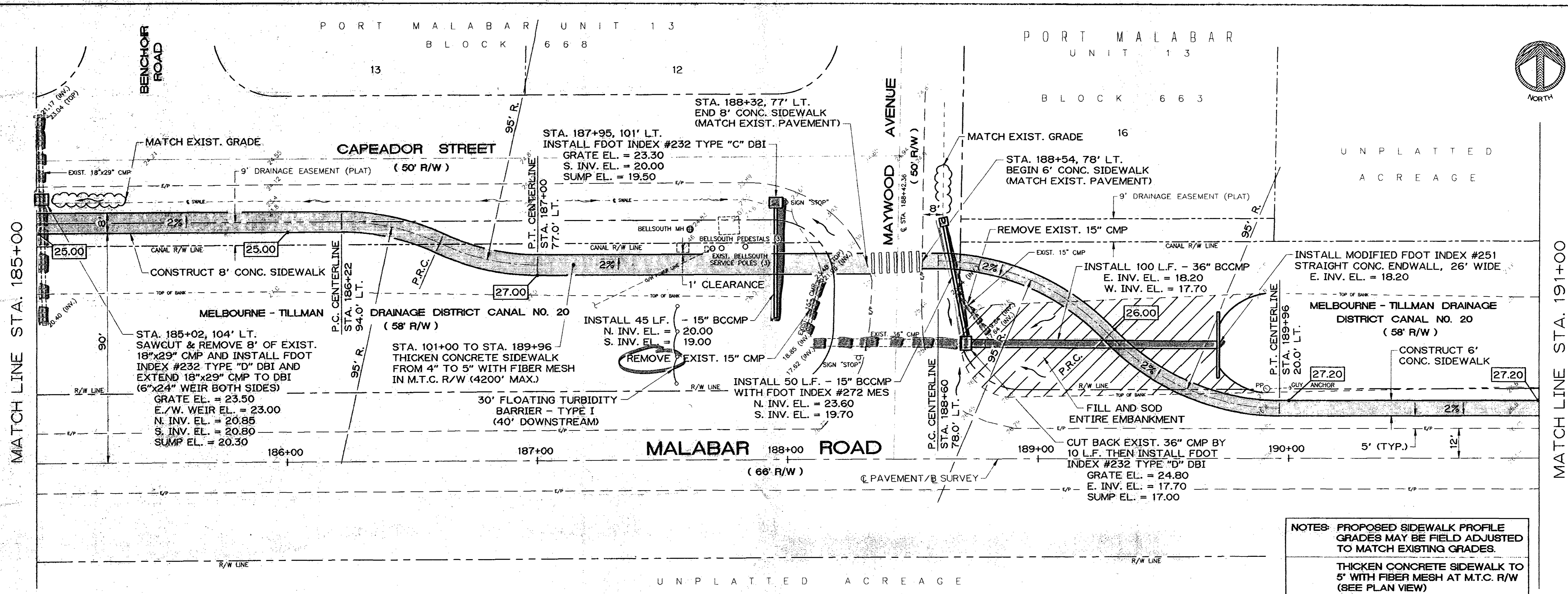
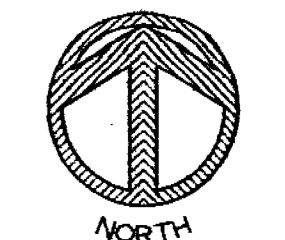
62976-1



DESIGNED	ZZ	APPROVED		<p>CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION</p>	<p>MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS</p> <p>PLAN & PROFILE - MALABAR ROAD STA. 179+00 THRU STA. 185+00</p>	DATE:	AUG 1999	PROJECT NO.	98-39		
DRAWN	MH	CITY ENGINEER				SCALE:	1" = 20'	SHEET	34	OF	57
CHECKED	MN	DATE:				VERT.	1" = 2'				

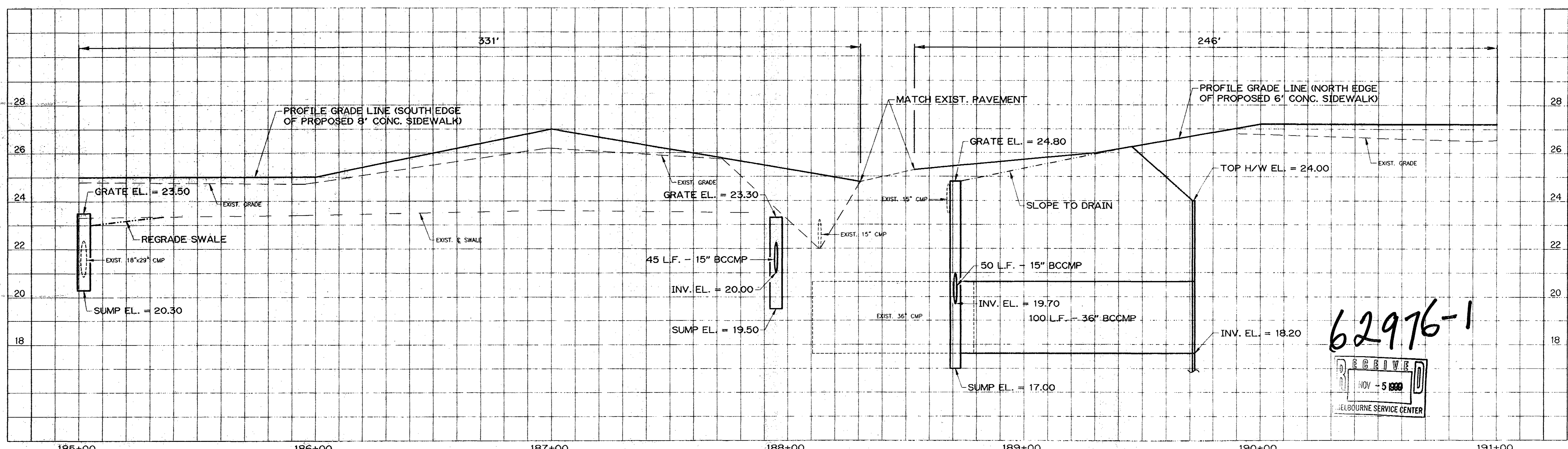
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34

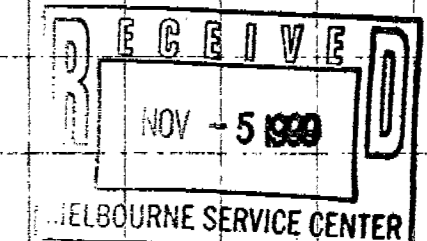



NOTES: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

THICKEN CONCRETE SIDEWALK TO 5" WITH FIBER MESH AT M.T.C. R/W (SEE PLAN VIEW)



62976-1



DESIGNED	ZZ	APPROVED		 CITY OF PALM BAY, FLORIDA ENGINEERING DIVISION	MALABAR ROAD WEST SIDEWALK CONSTRUCTION PLANS PLAN & PROFILE - MALABAR ROAD STA. 185+00 THRU STA. 191+00	DATE:	AUG 1999	PROJECT NO.	98-39
DRAWN	MH	CITY ENGINEER				SCALE:	1" = 20'	SHEET	35
CHECKED	MN	DATE				VERT.	1" = 2'	OF	57

FILE NAME: C:\DATA\PROJ\8839\8839P25.DWG(11/05/99) 25/04/99

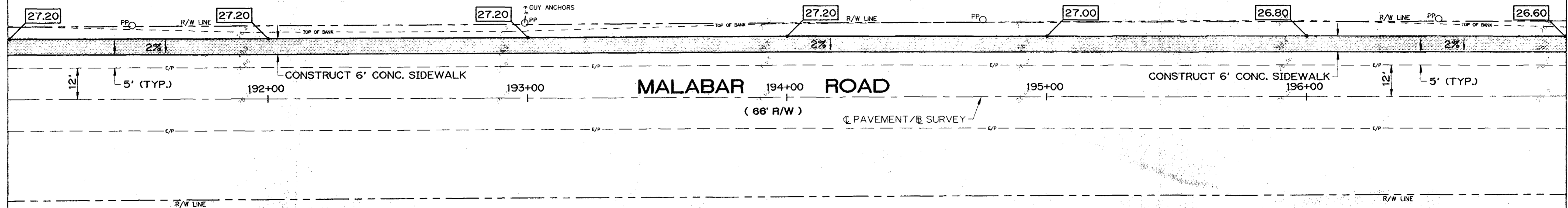


UNPLATTED ACREAGE

MATCH LINE STA. 191+00

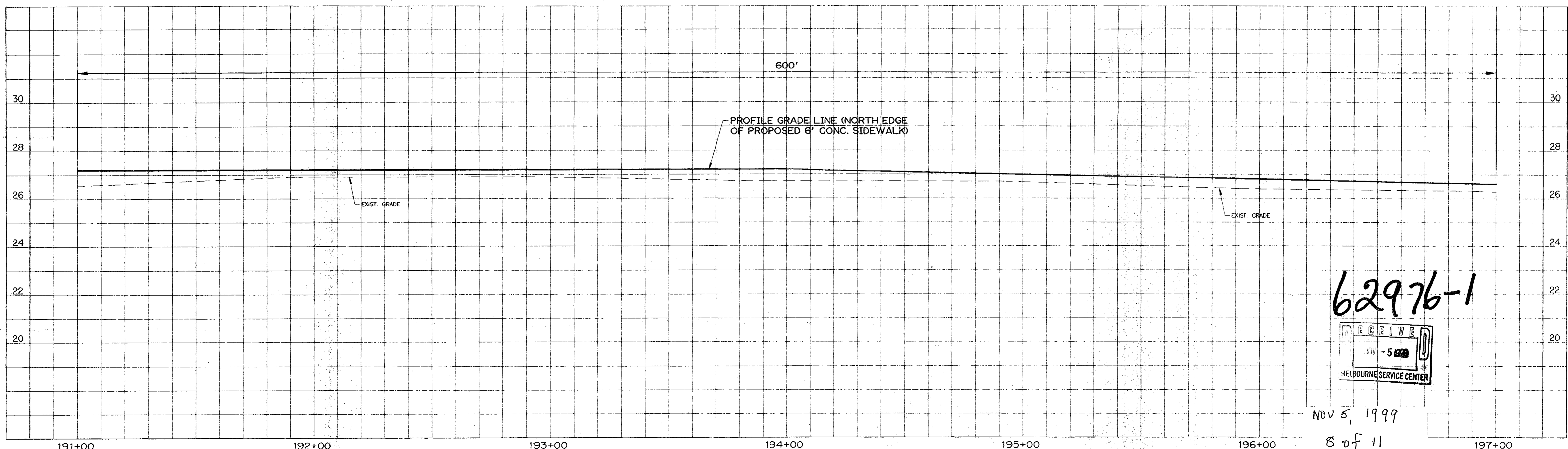
MATCH LINE STA. 197+00

MELBOURNE - TILLMAN DRAINAGE DISTRICT CANAL NO. 20
(58' R/W)

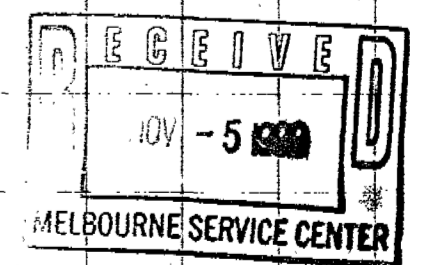


NOTE: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

UNPLATTED ACREAGE



62976-1



NOV 5, 1999

8 of 11

DESIGNED	ZZ	APPROVED:	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE:	
REVISION			



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

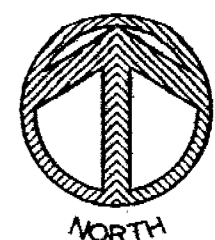
MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 191+00 THRU STA. 197+00

DATE: AUG 1999
SCALE: HORIZ. 1" = 20'
VERT. 1" = 2'

PROJECT NO. 98-39
SHEET 36 OF 57

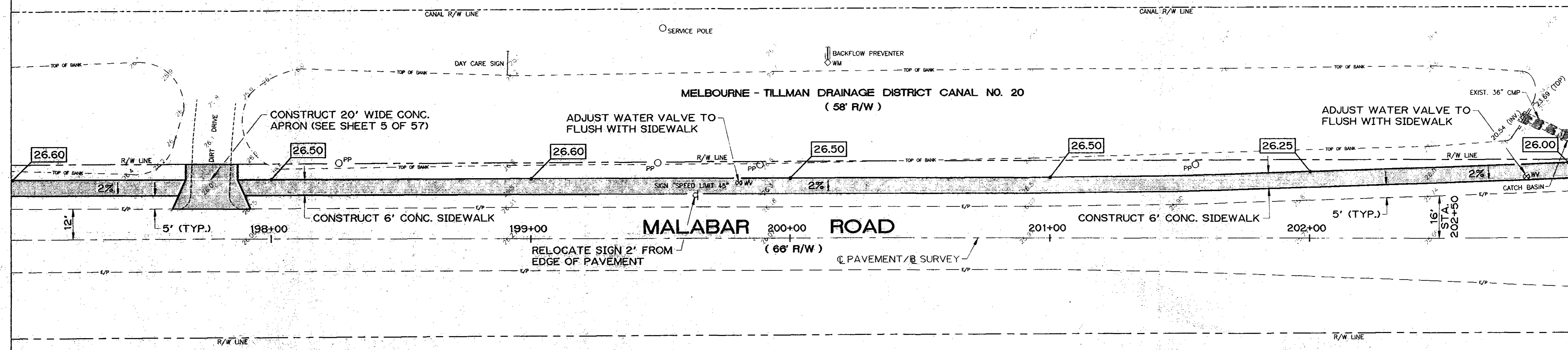
38



UNPLATTED ACREAGE

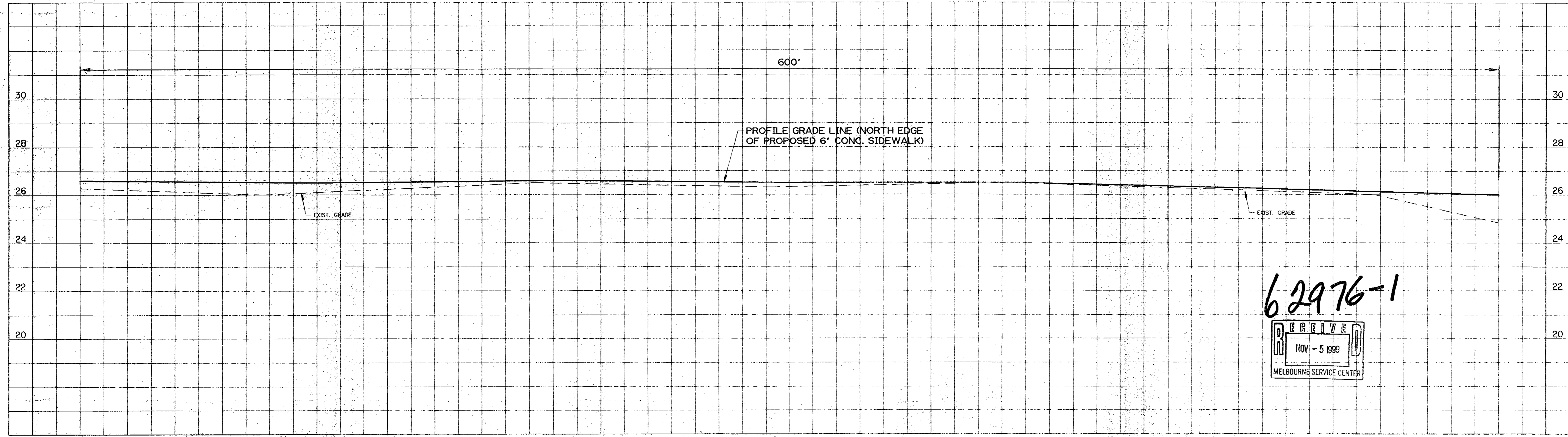
MATCH LINE STA. 197+00

MATCH LINE STA. 203+00

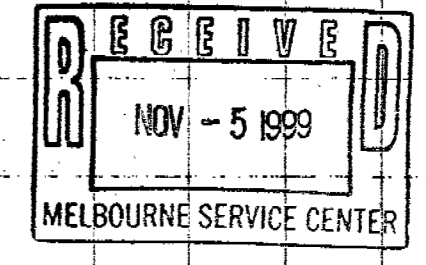


NOTE: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

UNPLATTED ACREAGE



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
ENGINEERING DIVISION

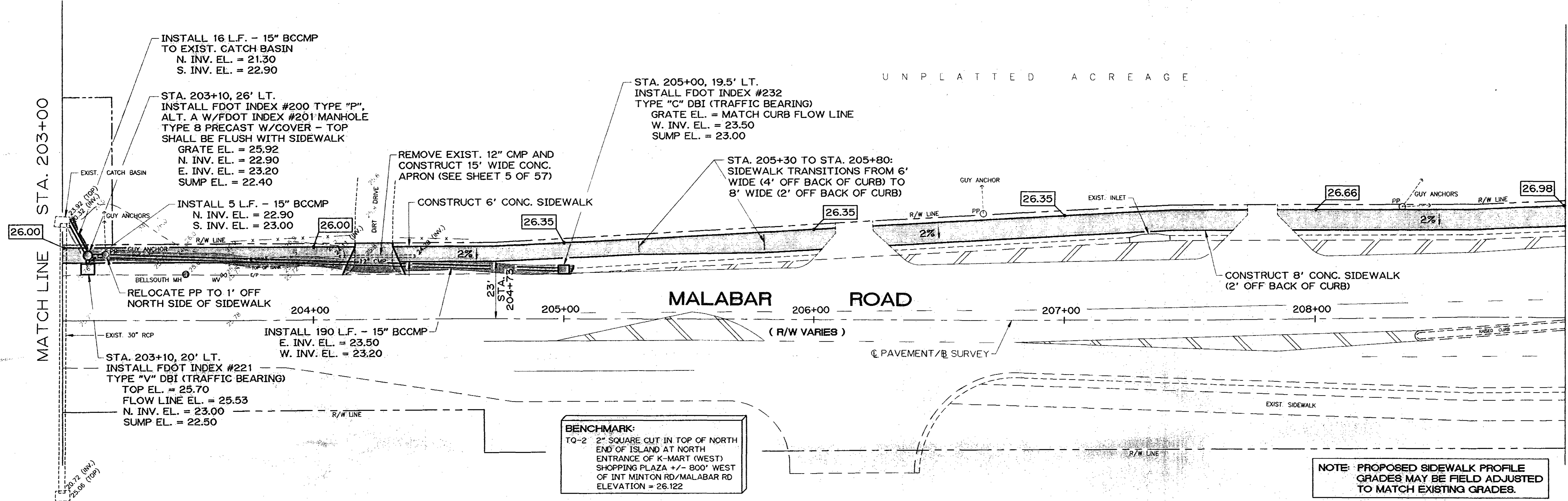
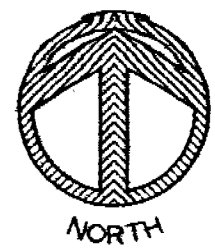
MALABAR ROAD WEST SIDEWALK
CONSTRUCTION PLANS
PLAN & PROFILE - MALABAR ROAD STA. 197+00 THRU STA. 203+00

DATE: AUG 1999
SCALE: HORIZ. 1" = 20'
VERT. 1" = 2'

PROJECT NO. 98-39
SHEET 37 OF 57

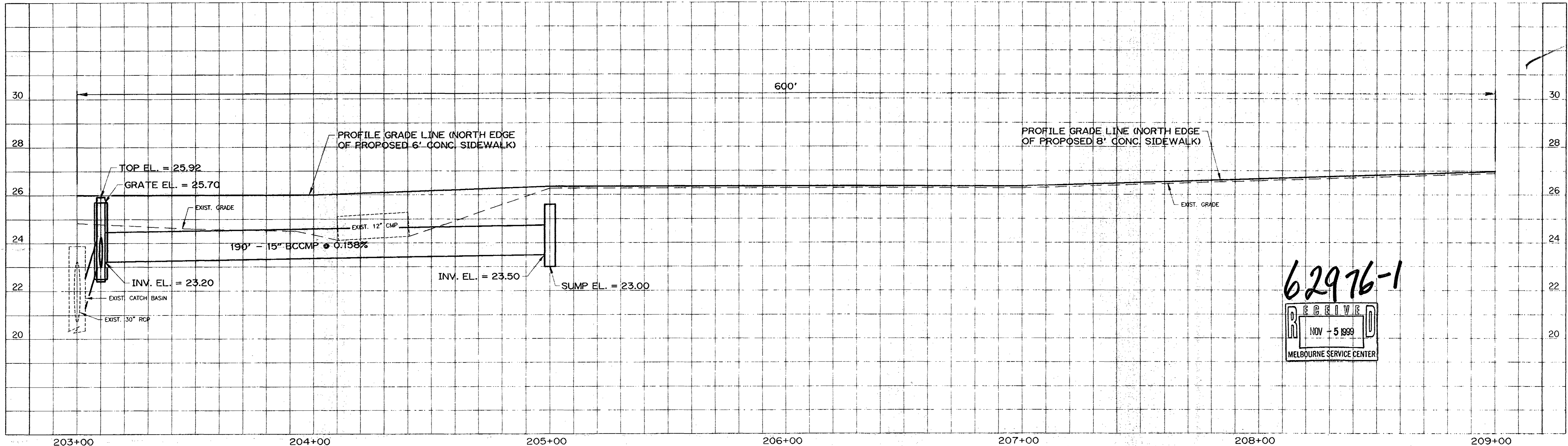
PLOT: 1-20 FILE NAME: C:\DATA\PROJ\9839\SP\9837.DWG: 10/20/99 20 Oct 99

39



BENCHMARK:
 TQ-2 2" SQUARE CUT IN TOP OF NORTH
 END OF ISLAND AT NORTH
 ENTRANCE OF K-MART (WEST)
 SHOPPING PLAZA +/- 800' WEST
 OF INT MINTON RD/MALABAR RD
 ELEVATION = 26.122

**NOTE: PROPOSED SIDEWALK PROFILE
 GRADES MAY BE FIELD ADJUSTED
 TO MATCH EXISTING GRADES.**



62976-1
 RECEIVED
 NOV - 5 1999
 MELBOURNE SERVICE CENTER

DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



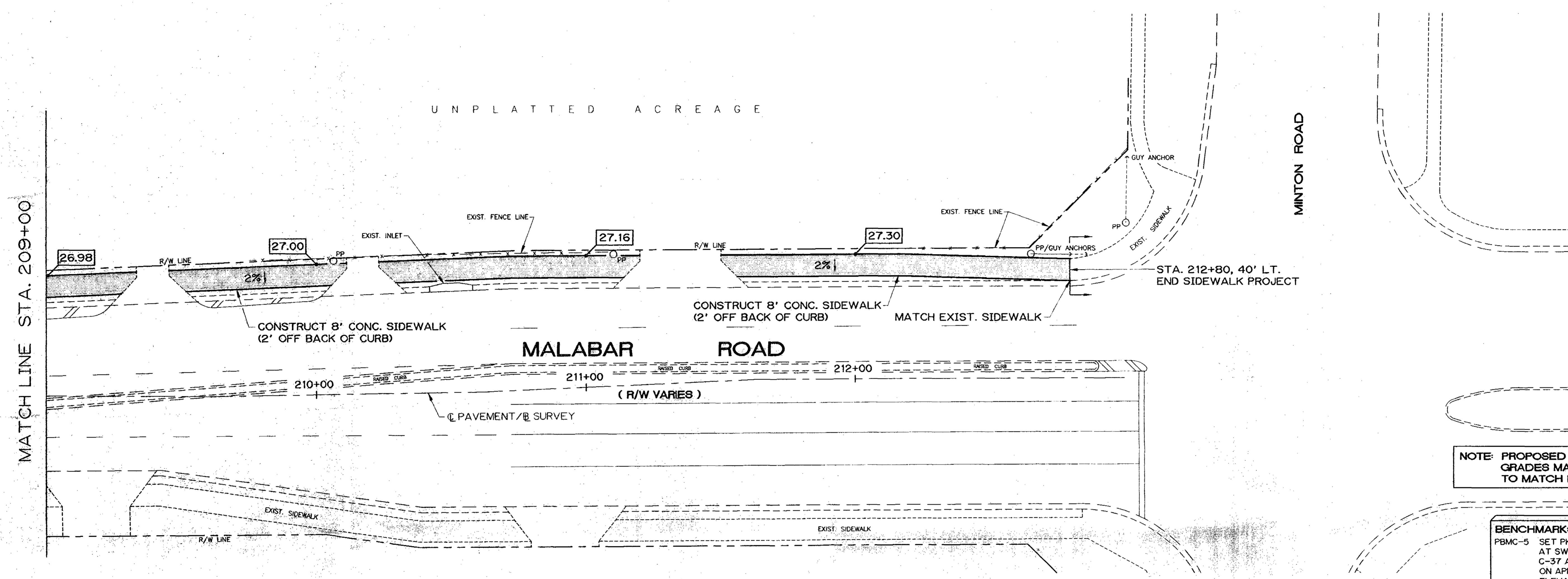
CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

**MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS**
 PLAN & PROFILE - MALABAR ROAD STA. 203+00 THRU STA. 209+00

DATE	AUG 1999	PROJECT NO.	98-39
SCALE	1" = 20'	SHEET	38
VERT.	1" = 2'	OF	57

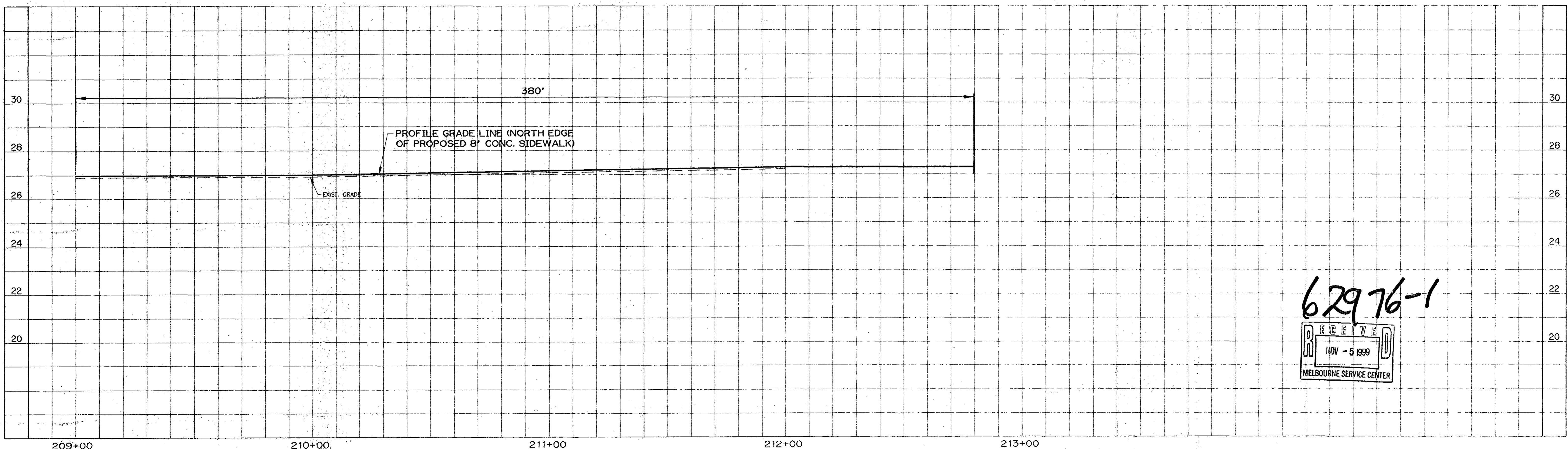
FILE NAME C:\DATA\PROJ9899\9839P38.DWG 10/15/99 12:08:59

40

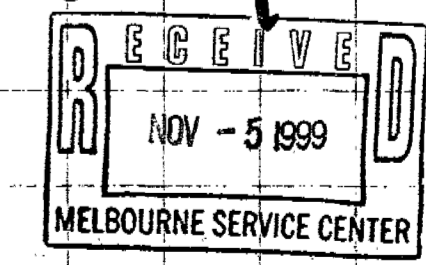


NOTE: PROPOSED SIDEWALK PROFILE GRADES MAY BE FIELD ADJUSTED TO MATCH EXISTING GRADES.

BENCHMARK:
 PBMC-5 SET PK NAIL & DISK "PBCP" AT SW END BRIDGE OVER C-37 AT DEGROODT LIBRARY ON APPROACH SLAB RAIL ELEVATION = 29.910



62976-1



DESIGNED	ZZ	APPROVED	
DRAWN	MH	CITY ENGINEER	
CHECKED	MN	DATE	



CITY OF PALM BAY, FLORIDA
 ENGINEERING DIVISION

MALABAR ROAD WEST SIDEWALK
 CONSTRUCTION PLANS

PLAN & PROFILE - MALABAR ROAD STA. 209+00 THRU STA. 213+00

DATE: AUG 1999
 SCALE: HORIZ. 1" = 20'
 VERT. 1" = 2'

PROJECT NO. 98-39
 SHEET 39 OF 57

FILE NAME C:\DATA\PROJ\9839\9839P39.DWG 11/05/99 21:00:59

DATE: November 23, 1999

**NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT
TECHNICAL STAFF REPORT**

APPLICANT: City of Palm Bay
Attn: Zak Zakeri, P.E.
5240 Babcock St., NE, Suite 300
Palm Bay, FL 32905

APPLICATION NO.: 400-009-62976-1

AGENT: Same as applicant

CONSULTANT: N/A

PROJECT NAME: Malabar Road West Sidewalk

COUNTY: BREVARD

SECTION(S): 34,35,&36

TOWNSHIP(S): 28S

RANGE(S): 36E

PROJECT ACREAGE: 3.22

EASEMENTS/RESTRICTIONS: NO

AUTHORITY: CHAPTERS 373 F.S.; CHAPTER 40C-400 F.A.C.;

APPLICATION TO USE NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT
PURSUANT TO SECTION 40C-400.439 F.A.C.

GENERAL PROJECT DESCRIPTION:

The City of Palm Bay will be constructing 3.8 miles of 6 to 8 feet wide concrete sidewalks within the City's rights-of ways. The sidewalk is proposed along the north side of Malabar Rd. starting at Minton Road and ending at Palm Bay Regional Park. The proposed project includes the replacement of four (4) existing CMP(Corrugated Metal Pipe) culverts due to maintenance and structural failure. The replacements are proposed in artificial waterways and shall be adequate to pass normal high water stages. There will be no dredging or filling except that which is directly involved in the construction of the proposed culvert crossings. Best Management Practices are included in the plans to protect water quality.

HYDROLOGIC BASIN(S): 6D

WATER BODY(IES): roadside ditches to Indian River Lagoon

CLASS: III

RECOMMENDATION: APPROVAL WITH THE FOLLOWING CONDITIONS:

**NOTICED GENERAL ENVIRONMENTAL RESOURCE PERMIT CONDITIONS
PURSUANT TO SECTION 40C-400.215, F.A.C. 1-14**

GIS/ADMINISTRATIVE APPLICATION TRACKING SHEET

Application Number: 400-009-62976-1 Reviewer (s): ZANGANEH/GARRETT-KRAUS

Date Received: 11-5-99

Applicant: CITY OF PALM BAY

Project Name: MALABAR ROAD WEST SIDEWALK PROJECT

Request for Additional Information must be mailed by : DECEMBER 3, 1999

Regulatory Meeting Date if determined technically/administratively complete: _____

Date 1st RAI sent: _____ Date 1st Resp. received: _____
Date 2nd RAI sent: _____ Date 2nd Resp. received: _____
Date 3rd RAI sent: _____ Date 3rd Resp. received: _____
Date 4th RAI sent: _____ Date 4th Resp. received: _____

Date Application Complete: _____

Schedule for _____ Regulatory Meeting (Approval/Denial)

MAPPING INFORMATION:

Acceptable as Recorded: YES _____ NO _____

Location Criteria: _____

<u>MAP NUMBER</u>	<u>QUAD</u>
_____	_____
_____	_____
_____	_____
_____	_____

Comments: _____

Date Application Entered: _____ Initials: _____

Date Application Mapped: _____ Initials: _____

****NOTE: PLEASE RETURN TO THE DATA MANAGEMENT SUPERVISOR
UPON SCHEDULING BOARD ACTION**

TSR FOLDER ITEMS

Project Name: Mabber Road West Sidewalk

Project Number: 400-009-62976-1

(Write N/A if not applicable.)

GIS Tracking Sheet
—must be included with all TSRs

Quad Map(s)
—must be included with all TSRs
—Label with name of quad, project name and app. number
and outline project boundary.

Biological Report

Wetland Inventory
—40's: tables completed in TSR template with project name and number
added to tables, 4's: tables attached to TSR

TSR

SSL Tracking Info Form

Mitigation Permit Form
(Bcb Epting Form)

Money for Mitigation Memo in TSR folder and permit file
and routed to Rich Turnbull and all cc's

Draft Conservation Easement with Legal Description
—If CE is required, provide two quad maps in
TSR folder and label one as Conservation
Easement Depiction.

Copy of Permitted Plans, Stamped
"Final Approved Plans"
(and a copy of the permitted plans placed
in the vault file and stamped "Final Approved Plans").

ES AND ENGINEER FILES COMBINED

G.4

Permit No. 125243-1

THE CITY OF PALM BAY

Palm Bay

50 Years

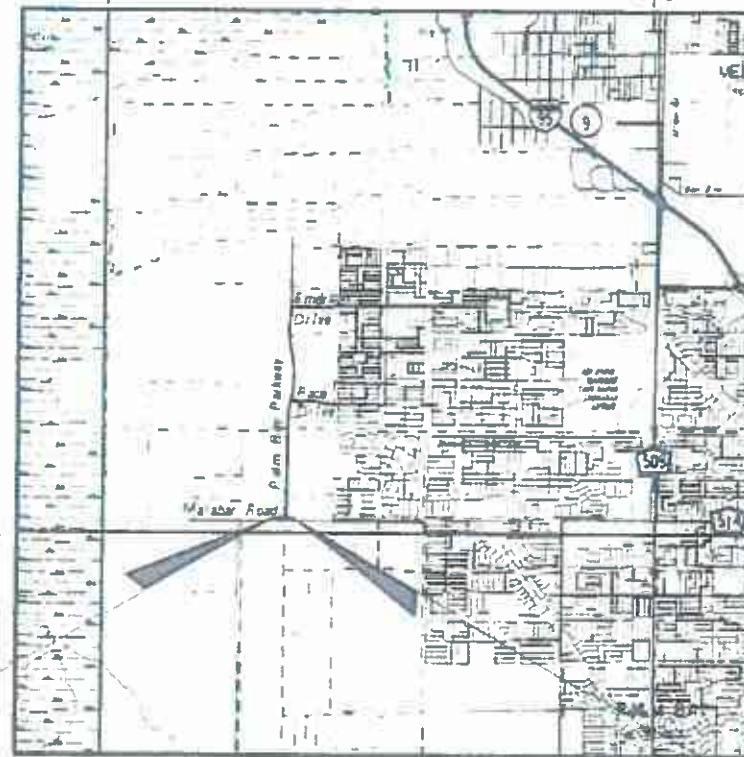
CONTRACT PLANS

FINANCIAL PROJECT ID 428346-1-58-01
 FEDERAL AID No. 8887-971-A
 CONTRACT No. AQF85
 BREVARD COUNTY
 MALABAR ROAD (CR 514)



INDEX OF ROADWAY PLANS

1	CONTRACT PLANS	(RECORD)
2	CONSTRUCTION PLANS	(RECORD)
3	AS-BUILT PLANS	(RECORD)
4	UTILITY PLANS	(RECORD)
5	ENVIRONMENTAL PLANS	(RECORD)
6	TRAILER	(RECORD)



FOR MORE INFORMATION
 CONTACT THE
 ENGINEER, P.E.
 KEITH & SCHNARS, P.A.
 8600 NORTH ANDREWS AVENUE
 FORT LAUDERDALE, FL 33309-2332



KEITH and SCHNARS, P.A.
 ENGINEERS • PLANNERS • SURVEYORS
 8600 NORTH ANDREWS AVENUE
 FORT LAUDERDALE, FL 33309-2332
 CERTIFICATE OF AUTHORIZATION NO. 387

ADMINISTRATIVE AND REGULATORY
 ALL RECORDS SHALL BE MAINTAINED IN ACCORDANCE WITH THE
 RECORDS MANAGEMENT ACT, CHAPTER 119, F.S., AND THE
 RECORDS MANAGEMENT ACT, CHAPTER 218, F.S., AS APPLIED TO
 THE RECORDS MANAGEMENT ACT, CHAPTER 119, F.S.

ALL RECORDS SHALL BE MAINTAINED IN ACCORDANCE WITH THE
 RECORDS MANAGEMENT ACT, CHAPTER 119, F.S., AND THE
 RECORDS MANAGEMENT ACT, CHAPTER 218, F.S., AS APPLIED TO
 THE RECORDS MANAGEMENT ACT, CHAPTER 119, F.S.

RECORD DRAWING BEGIN PROJECT
 (ROADWAY) STA. 53+02.57

APOGEE SERVICES, INC. L.B. 7644
 703 S.W. 24 AVE., BOYNTON BCH., FL 33435
 TEL: (561)441-6195 FAX: (561)441-6195

- SURVEYORS' NOTES:**
- THIS RECORD DRAWING WAS CREATED USING THE CONSTRUCTION PLANS BY KEITH & SCHNARS, P.A. PROVIDED BY CLIENT.
 - HORIZONTAL DATA CONTROL BASED PER CONSTRUCTION PLANS.
 - VERTICAL DATA CONTROL BASED PER CLIENT SURVEYOR, BENCHMARK USED DESIGNATION RM11 99-19-643-1 A ST. JOHNS RIVER WATER MANAGEMENT DISTRICT BENCHMARK, ELEVATION 19.644 NGVD 29
 - AS-BUILT INFORMATION WAS OBTAINED UNDER THE SUPERVISION OF A FLORIDA PROFESSIONAL LAND SURVEYOR.
 - THIS RECORD DRAWING SET IS NOT VALID UNLESS SIGN AND SEALED WITH THE EMBOSSED SEAL OF THE CERTIFYING SURVEYOR.

2-17-2013
 DATE

Hans Wikie
 HANS WIKIE, P.L.S.
 REG. LAND SURVEYOR LS #6316

PROJECT LENGTH IS BASED ON THE CONSTRUCTION BY

LENGTH OF PROJECT		
	LINEAR FEET	MILES
ROADWAY	1340.27	0.253
EASEMENTS	N/A	N/A
NET LENGTH OF PROJECT	1340.27	0.253
EXCEPTIONS	N/A	N/A
GROSS LENGTH OF PROJECT	1340.27	0.253

KEY SHEET REVISIONS	
DATE	DESCRIPTION

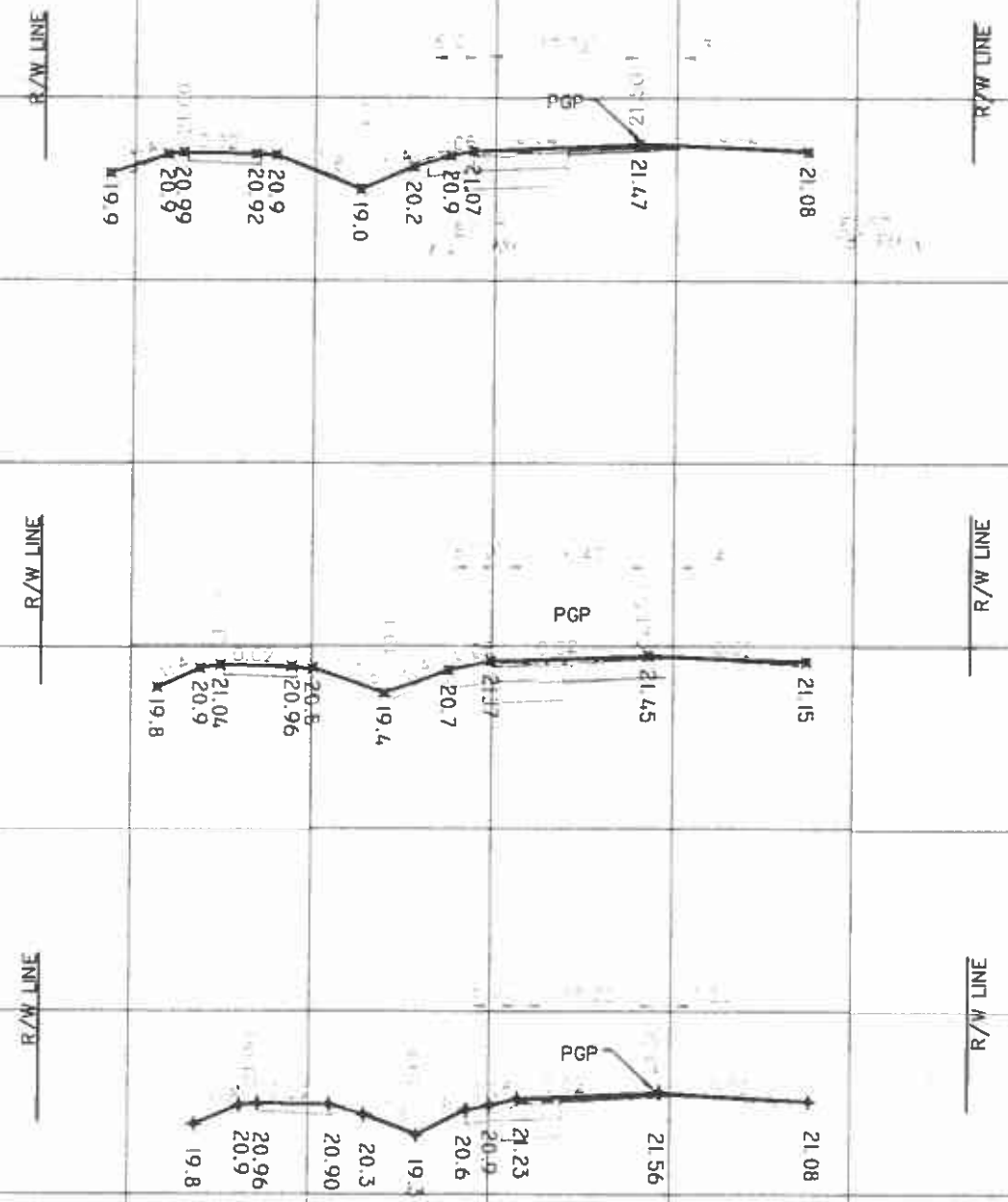
WITH THE SIGNATURE OF THE SURVEYOR, THIS DRAWING SHALL BE VALID FOR THE PROJECT.

FOR MORE INFORMATION
 CONTACT THE
 ENGINEER, P.E.
 KEITH & SCHNARS, P.A.

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56+00.00

55+00.00

54+00.00

120 100 80 60 40 20 0 20 40 60 80 100 120 140 160

1" = 20' Horizontal
1" = 10' Vertical



CR 514 BREVARD

CROSS SECTIONS

RECORD DRAWING
APOGEE SERVICES, INC.
 703 S.W. 24TH AVE., BOYNTON BCH., FL 33435
 TEL. (561)441-6136 FAX. (561)441-6195

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R/W LINE

R/W LINE

R/W LINE

R/W LINE

R/W LINE

R/W LINE

± CONSTRUCTION

± CONSTRUCTION

59+00.00

58+00.00

57+00.00

PGP

PGP

PGP

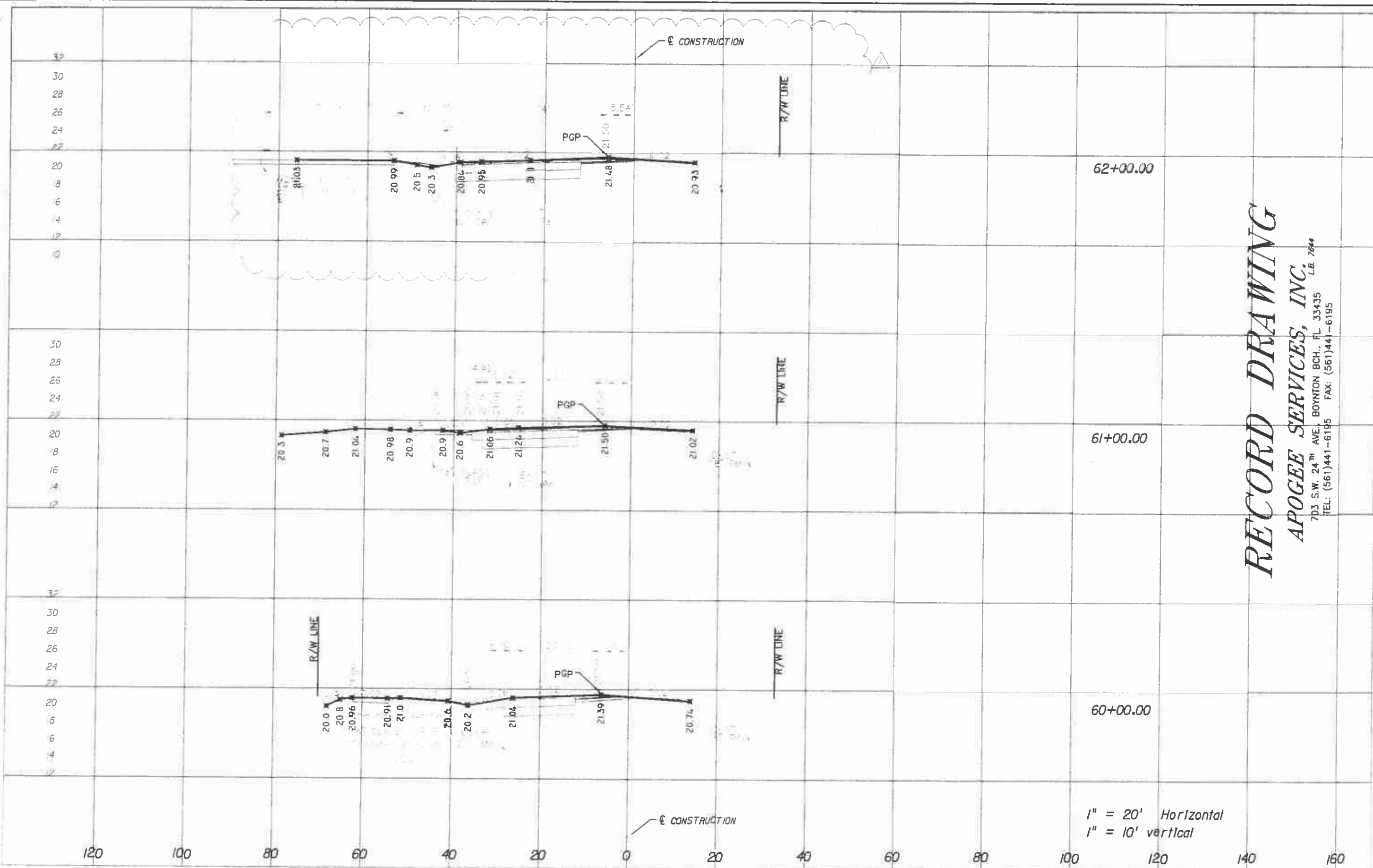
1" = 20' Horizontal
1" = 10' Vertical

RECORD DRAWING

APOGEE SERVICES, INC.

703 S.W. 24TH AVE., BOYNTON BCH., FL. 33435 L.B. 7644
TEL: (561)441-6195 FAX: (561)441-6195





ADDED RIGHT TURN LANE
PIPE CLASS



CR 514 BREVARD

CROSS SECTIONS

RECORD DRAWING

APOGEE SERVICES, INC.
 L.B. 7644
 703 S.W. 24TH AVE., BOYNTON BCH., FL 33435
 TEL: (561)441-6195 FAX: (561)441-6195

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120 100 80 60 40 20 0 20 40 60 80 100 120 140 160

CONSTRUCTION

CONSTRUCTION

R/W LINE

R/W LINE

PGP

PGP

R/W LINE

R/W LINE

66+00.00

65+00.00

1" = 20' Horizontal
1" = 10' vertical

ADDED RIGHT TURN LANE



CR 514 BREVARD

CROSS SECTIONS

12

RECORD DRAWING

APOGEE SERVICES, INC.

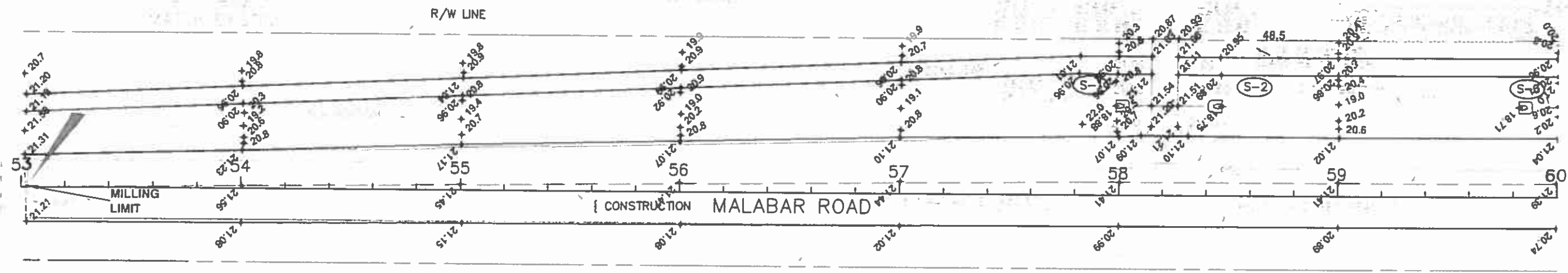
703 S.W. 24TH AVE. BOYNTON BCH., FL. 33435
TEL: (561)441-6195 FAX: (561)441-6195

ENC - APPROVED
DATE: 08/14/00

S-1 57+98.3 40.1' L
 STA ~~57+98.3~~ (45.55) T
 MITERED END SECTION
 INDEX NO. 272
 FL 18.88

S-2 58+46.8 40.2' L
 STA ~~58+46.8~~ (45.55) T
 MITERED END SECTION
 INDEX NO. 272
 FL 18.75

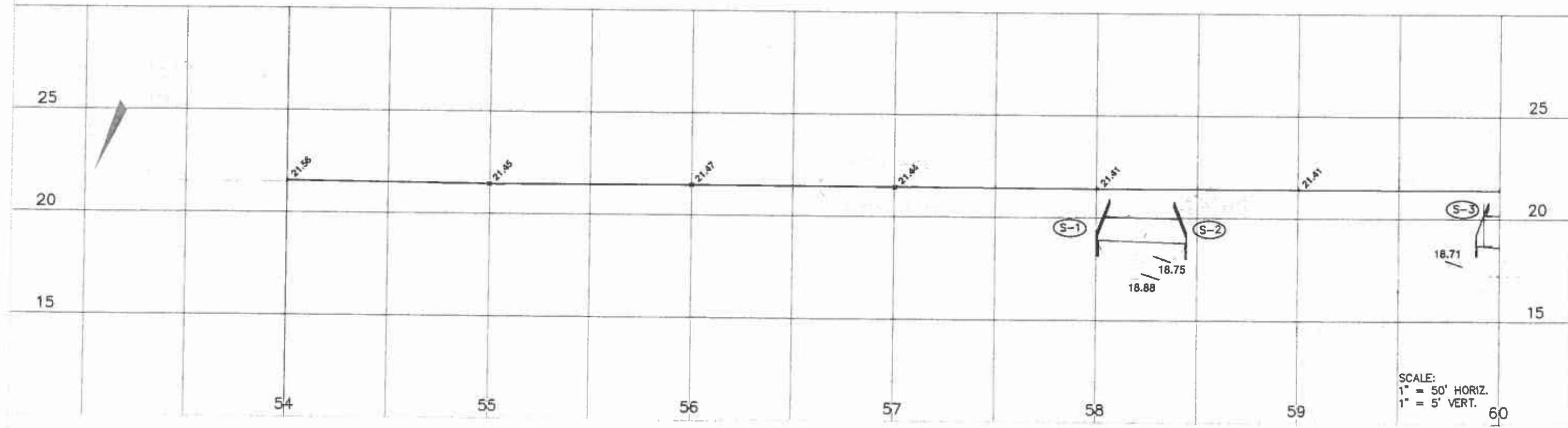
S-3 59+82.6 40.3' L
 STA ~~59+82.6~~ (45.55) T
 MITERED END SECTION
 INDEX NO. 272
 FL 18.71



RECORD DRAWING

APOGEE SERVICES, INC.

703 S.W. 24TH AVE., BOYNTON BCH., FL. 33435 L.B. 7644
 TEL: (561)441-6195 FAX: (561)441-6195



SCALE:
 1" = 50' HORIZ.
 1" = 5' VERT.



PLAN AND PROFILE

G.5

Permit No. 158876-1



St. Johns River

Water Management District

Ann B. Shortelle, Ph.D., Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • 386-329-4500
On the internet at www.sjrwmd.com.

September 06, 2019

Rachel Gerena
Brevard County, Public Works Department
2725 Judge Fran Jamieson Way Ste A-201
Viera, FL 32940-6605

SUBJECT: General Permit: 158876-1

Dear Ms. Gerena:

The District has received your notice to use a general permit. Based on the submitted information, the proposed activity qualifies for a General Environmental Resource Permit pursuant to section 62-330.447, Florida Administrative Code, provided it is constructed and operated in accordance with that general permit and the general and special conditions set forth in section 62-330.447, Florida Administrative Code (attached).

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has determined your project qualifies for this general permit. Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the use of the general permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the use of the permit. To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.11 of the *Florida Statutes*. If you do not publish a newspaper notice to close the point of entry, the time to challenge your use of the permit will not expire and someone could file a petition even after your project is constructed. Please refer to the attached Notice of Rights to determine any legal rights you may have concerning the District's agency action.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to compliancesupport@sjrwmd.com (preferred method) or send a copy of the original affidavit to:

Margaret Daniels, Office Director
Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

GOVERNING BOARD

Fred N. Roberts Jr., CHAIRMAN
OCALA

Douglas C. Bourmique
VERO BEACH

Chuck Drake, SECRETARY
ORLANDO

Douglas Burnett
ST. AUGUSTINE

Ron Howse, TREASURER
COCOA

Susan Dolan
SANFORD

A copy of your application was transmitted to the U.S. Army Corps of Engineers for review. This authorization to use a general environmental resource permit does not obviate the need for obtaining all necessary permits or approval from other agencies.

Sincerely,



Michelle Reiber, Bureau Chief
Division of Regulatory Services

Enclosures: Permit
Notice of Rights
List of Newspapers for Publication

cc: District Permit File
Consultants: John Minton
DRMP
941 Lake Baldwin Ln
Orlando, FL 32814-6438
Consultant: Maria Bazemore
DRMP
955 Croton Rd
Melbourne, FL 32935-3153

**ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
GENERAL ENVIRONMENTAL RESOURCE PERMIT**

PERMIT NO: 158876-1

DATE ISSUED: September 06, 2019

PROJECT NAME: Malabar Road Box Culvert Replacement

A PERMIT AUTHORIZING:

Use of the General Permit to the Florida Department of Transportation, Counties, and Municipalities for Minor Activities within Existing Rights-of-Way or Easements to replace an existing failing arch pipe (103-inch x 71-inch) under Malabar Road with a new box culvert (96-inch x 72-inch) to allow for adequate conveyance of flood waters to protect the roadway and not adversely impact surrounding properties to be constructed as per plans received by the District on August 23, 2019.

LOCATION:

Section(s): 33 Township(s): 28S Range(s): 36E
 4 29S 36E
Brevard County

Receiving Water Body:

Name	Class
Melbourne-Tillman (C-1) Canal	III Fresh, IW

ISSUED TO:

Brevard County, Public Works Department
2725 Judge Fran Jamieson Way Ste A-201
Viera, FL 32940-6605

The District received your notice to use a General Environmental Resource Permit pursuant to Chapter 62-330, Florida Administrative Code (F.A.C.) on October 7, 2014.

Based on the forms, design plans, and other documents submitted with your notice, it appears that the project meets the requirements for a General Environmental Resource Permit. Any activities performed under a General Environmental Resource Permit are subject to the general conditions and special conditions specified in rules 62-330.405 and 62-330.447, F.A.C. respectively (attached). Any deviations from these conditions may subject you to enforcement action and possible penalties.

Please be advised that the General Environmental Resource Permit expires 5 years from the date on which the notice of intent to use a General Environmental Resource Permit was received by the District.

A copy of your notice also has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action and possible penalties.

AUTHORIZED BY: St. Johns River Water Management District
Division of Regulatory Services



By:

Everett Frye
Supervising Professional Engineer

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 158876-1
Malabar Road Box Culvert Replacement
DATED: September 06, 2019

1. The general permit is valid only for the specific activity indicated. Any deviation from the specified activity and the conditions for undertaking that activity shall constitute a violation of the permit and may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. The general permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any construction, alteration, operation, maintenance, removal or abandonment authorized by this permit; and it does not authorize any violation of any other applicable federal, state, local, or special district laws (including, but not limited to, those governing the "take" of listed species).
3. The general permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the general permit.
4. The general permit does not relieve the permittee from liability and penalties when the permitted activity causes harm or injury to: human health or welfare; animal, plant or aquatic life; or property. It does not allow the permittee to cause pollution that violates state water quality standards.
5. Section 253.77, F.S., provides that a person may not commence any excavation, construction, or other activity involving the use of state-owned or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required consent, lease, easement, or other form of authorization authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on state-owned lands.
6. The authorization to conduct activities under a general permit may be modified, suspended or revoked in accordance with Chapter 120, F.S., and Section 373.429, F.S.
7. The general permit is not transferable to a third party. To be used by a different permittee, a new notice to use a general permit must be submitted in accordance with Rule 62-330.402, F.A.C. Activities constructed in accordance with the terms and conditions of a general permit are automatically authorized to be operated and maintained by the permittee and subsequent owners in accordance with subsection 62-330.340(1), F.A.C. Any person holding the general permit, persons working under the general permit, and owners of land while work is conducted under the general permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to sale, conveyance, or other transfer of ownership or control of the permitted project, activity, or the real property at which the permitted project or activity is located.
8. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the permitted system to ensure conformity with the plans and specifications approved by the general permit.
9. The permittee shall maintain any permitted project or activity in accordance with the plans submitted to the Agency and authorized in the general permit.

10. A permittee's right to conduct a specific activity under the general permit is authorized for a duration of five years.
11. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be implemented and maintained immediately prior to, during, and after construction as needed to stabilize all disturbed areas, including other measures specified in the permit to prevent adverse impacts to the water resources and adjacent lands. Erosion and sediment control measures shall be installed and maintained in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), available at <https://www.flrules.org/Gateway/reference.asp?No=Ref-04227>, and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), available at http://publicfiles.dep.state.fl.us/DEAR/Stormwater_Training_Docs/erosion-inspectors-manual.pdf.
12. Unless otherwise specified in the general permit, temporary vehicular access within wetlands during construction shall be performed using vehicles generating minimum ground pressure to minimize rutting and other environmental impacts. Within forested wetlands, the permittee shall choose alignments that minimize the destruction of mature wetland trees to the greatest extent practicable. When needed to prevent rutting or soil compaction, access vehicles shall be operated on wooden, composite, metal, or other non-earth construction mats. In all cases, access in wetlands shall comply with the following:
 - a. Access within forested wetlands shall not include the cutting or clearing of any native wetland tree having a diameter 4 inches or greater at breast height;
 - b. The maximum width of the construction access area shall be limited to 15 feet;
 - c. All mats shall be removed as soon as practicable after equipment has completed passage through, or work has been completed, at any location along the alignment of the project, but in no case longer than seven days after equipment has completed work or passage through that location; and
 - d. Areas disturbed for access shall be restored to natural grades immediately after the maintenance or repair is completed.
13. Barges or other work vessels used to conduct in-water activities shall be operated in a manner that prevents unauthorized dredging, water quality violations, and damage to submerged aquatic communities.
14. The construction, alteration, or use of the authorized project shall not adversely impede navigation or create a navigational hazard in the water body.
15. Except where specifically authorized in the general permit, activities must not:
 - a. Impound or obstruct existing water flow, cause adverse impacts to existing surface water storage and conveyance capabilities, or otherwise cause adverse water quantity or flooding impacts to receiving water and adjacent lands; or
 - b. Cause an adverse impact to the maintenance of surface or ground water levels or surface water flows established pursuant to Section 373.042, F.S., or a Works of the District established pursuant to Section 373.086, F.S.
16. If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all

activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850) 245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, F.S.

17. The activity must be capable, based on generally accepted engineering and scientific principles, of being performed and of functioning as proposed, and must comply with any applicable District special basin and geographic area criteria.
18. The permittee shall comply with the following when performing work within waters accessible to federally- or state-listed aquatic species, such as manatees, marine turtles, smalltooth sawfish, and Gulf sturgeon:
 - (a) All vessels associated with the project shall operate at "Idle Speed/No Wake" at all times while in the work area and where the draft of the vessels provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
 - (b) All deployed siltation or turbidity barriers shall be properly secured, monitored, and maintained to prevent entanglement or entrapment of listed species.
 - (c) All in-water activities, including vessel operation, must be shut down if a listed species comes within 50 feet of the work area. Activities shall not resume until the animal(s) has moved beyond a 50-foot radius of the in-water work, or until 30 minutes elapses since the last sighting within 50 feet. Animals must not be herded away or harassed into leaving. All on-site project personnel are responsible for observing water-related activities for the presence of listed species.
 - (d) Any listed species that is killed or injured by work associated with activities performed shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1(888)404-3922 and ImperiledSpecies@myFWC.com.
 - (e) Whenever there is a spill or frac-out of drilling fluid into waters accessible to the above species during a directional drilling operation, the FWC shall be notified at imperiledspecies@myfwc.com with details of the event within 24 hours following detection of the spill or frac-out.
19. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities which may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any activity authorized by the general permit.
20. The permittee shall immediately notify the Agency in writing of any submitted information that is discovered to be inaccurate.
21. The permittee shall limit stream channel relocation to streams which have an average discharge of 10 cubic feet per second or less. The length of relocated channels or those significantly altered shall be limited to 200 feet per stream. A stream channel shall be altered only when such a measure will reduce the long term adverse water quality impacts and will maintain or restore the stream's natural hydraulic capability; and
22. This general permit shall not apply to ditch construction in Class I or Class II surface waters, Outstanding National Resource Waters or waters designated as Outstanding Florida Waters.
23. Activities under this general permit must not diminish existing stormwater treatment, attenuation, or conveyance capacity.

24. This general permit does not authorize the construction of additional traffic lanes. Activities that require additional traffic lanes must first obtain an individual environmental resource permit under this chapter, as applicable, before the start of construction.

Notice of Rights

1. A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-six (26) days of the District depositing the notice of District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing the notice of District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes, and Chapter 28-106, Florida Administrative Code. The District will not accept a petition sent by facsimile (fax), as explained in paragraph no. 4 below.
2. Please be advised that if you wish to dispute this District decision, mediation may be available and that choosing mediation does not affect your right to an administrative hearing. If you wish to request mediation, you must do so in a timely-filed petition. If all parties, including the District, agree to the details of the mediation procedure, in writing, within 10 days after the time period stated in the announcement for election of an administrative remedy under Sections 120.569 and 120.57, Florida Statutes, the time limitations imposed by Sections 120.569 and 120.57, Florida Statutes, shall be tolled to allow mediation of the disputed District decision. The mediation must be concluded within 60 days of the date of the parties' written agreement, or such other timeframe agreed to by the parties in writing. Any mediation agreement must include provisions for selecting a mediator, a statement that each party shall be responsible for paying its pro-rata share of the costs and fees associated with mediation, and the mediating parties' understanding regarding the confidentiality of discussions and documents introduced during mediation. If mediation results in settlement of the administrative dispute, the District will enter a final order consistent with the settlement agreement. If mediation terminates without settlement of the dispute, the District will notify all the parties in writing that the administrative hearing process under Sections 120.569 and 120.57, Florida Statutes, is resumed. Even if a party chooses not to engage in formal mediation, or if formal mediation does not result in a settlement agreement, the District will remain willing to engage in informal settlement discussions.
3. A person whose substantial interests are or may be affected has the right to an informal administrative hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must also comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

Notice of Rights

4. A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8:00 a.m. – 5:00 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8:00 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at sjrwmd.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile is prohibited and shall not constitute filing.
5. Failure to file a petition for an administrative hearing within the requisite timeframe shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, Florida Administrative Code).
6. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. A person whose substantial interests are or may be affected by the District's final action has the right to become a party to the proceeding, in accordance with the requirements set forth above.
7. Pursuant to Section 120.68, Florida Statutes, a party to the proceeding before the District who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.
8. A District action is considered rendered, as referred to in paragraph no. 7 above, after it is signed on behalf of the District and filed by the District Clerk.
9. Failure to observe the relevant timeframes for filing a petition for judicial review as described in paragraph no. 7 above will result in waiver of that right to review.

NOTICING INFORMATION

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice to close the point of entry, the time to challenge the issuance of your permit will not expire and someone could file a petition even after your project is constructed.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to compliancesupport@sjrwmd.com (preferred method) or send a copy of the original affidavit to:

Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

If you have any questions, please contact the Office of Business and Administrative Services at (386) 329-4570.

NOTICE OF AGENCY ACTION TAKEN BY THE
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Notice is given that the following permit was issued on _____:

(Name and address of applicant) _____
permit# _____. The project is located in _____ County, Section
_____, Township _____ South, Range _____ East. The permit authorizes a surface
water management system on _____ acres for
_____ known as
_____. The receiving water body is _____.

A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code (F.A.C.), the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P.O. Box 1429, Palatka FL 32178-1429 (4049 Reid St, Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwm.com, within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes (F.S.), and Chapter 28-106, F.A.C. The District will not accept a petition sent by facsimile (fax). Mediation pursuant to Section 120.573, F.S., may be available and choosing mediation does not affect your right to an administrative hearing.

A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8 a.m. – 5 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at www.sjrwm.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile (fax) is prohibited and shall not constitute filing.

The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. **Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, F.A.C.).**

If you wish to do so, please visit http://www.sjrwm.com/nor_dec/ to read the complete Notice of Rights to determine any legal rights you may have concerning the District's decision(s) on the permit application(s) described above. You can also request the Notice of Rights by contacting the Director of Business and Administrative Services, 4049 Reid St., Palatka, FL 32177-2529, tele. no. (386)329-4570.

NEWSPAPER ADVERTISING

ALACHUA

The Alachua County Record, Legal Advertising
P. O. Box 806
Gainesville, FL 32602
352-377-2444/ fax 352-338-1986

BRADFORD

Bradford County Telegraph, Legal Advertising
P. O. Drawer A
Starke, FL 32901
904-964-6305/ fax 904-964-8628

CLAY

Clay Today, Legal Advertising
1560 Kinsley Ave., Suite 1
Orange Park, FL 32073
904-264-3200/ fax 904-264-3285

FLAGLER

Flagler Tribune, c/o News Journal
P. O. Box 2831
Daytona Beach, FL 32120-2831
386-681-2322

LAKE

Daily Commercial, Legal Advertising
P. O. Drawer 490007
Leesburg, FL 34749
352-365-8235/fax 352-365-1951

NASSAU

News-Leader, Legal Advertising
P. O. Box 766
Fernandina Beach, FL 32035
904-261-3696/fax 904-261-3698

ORANGE

Sentinel Communications, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

PUTNAM

Palatka Daily News, Legal Advertising
P. O. Box 777
Palatka, FL 32178
386-312-5200/ fax 386-312-5209

SEMINOLE

Seminole Herald, Legal Advertising
300 North French Avenue
Sanford, FL 32771
407-323-9408

BAKER

Baker County Press, Legal Advertising
P. O. Box 598
MacLenny, FL 32063
904-259-2400/ fax 904-259-6502

BREVARD

Florida Today, Legal Advertising
P. O. Box 419000
Melbourne, FL 32941-9000
321-242-3832/ fax 321-242-6618

DUVAL

Daily Record, Legal Advertising
P. O. Box 1769
Jacksonville, FL 32201
904-356-2466 / fax 904-353-2628

INDIAN RIVER

Vero Beach Press Journal, Legal Advertising
P. O. Box 1268
Vero Beach, FL 32961-1268
772-221-4282/ fax 772-978-2340

MARION

Ocala Star Banner, Legal Advertising
2121 SW 19th Avenue Road
Ocala, FL 34474
352-867-4010/fax 352-867-4126

OKEECHOBEE

Okeechobee News, Legal Advertising
P. O. Box 639
Okeechobee, FL 34973-0639
863-763-3134/fax 863-763-5901

OSCEOLA

Little Sentinel, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

ST. JOHNS

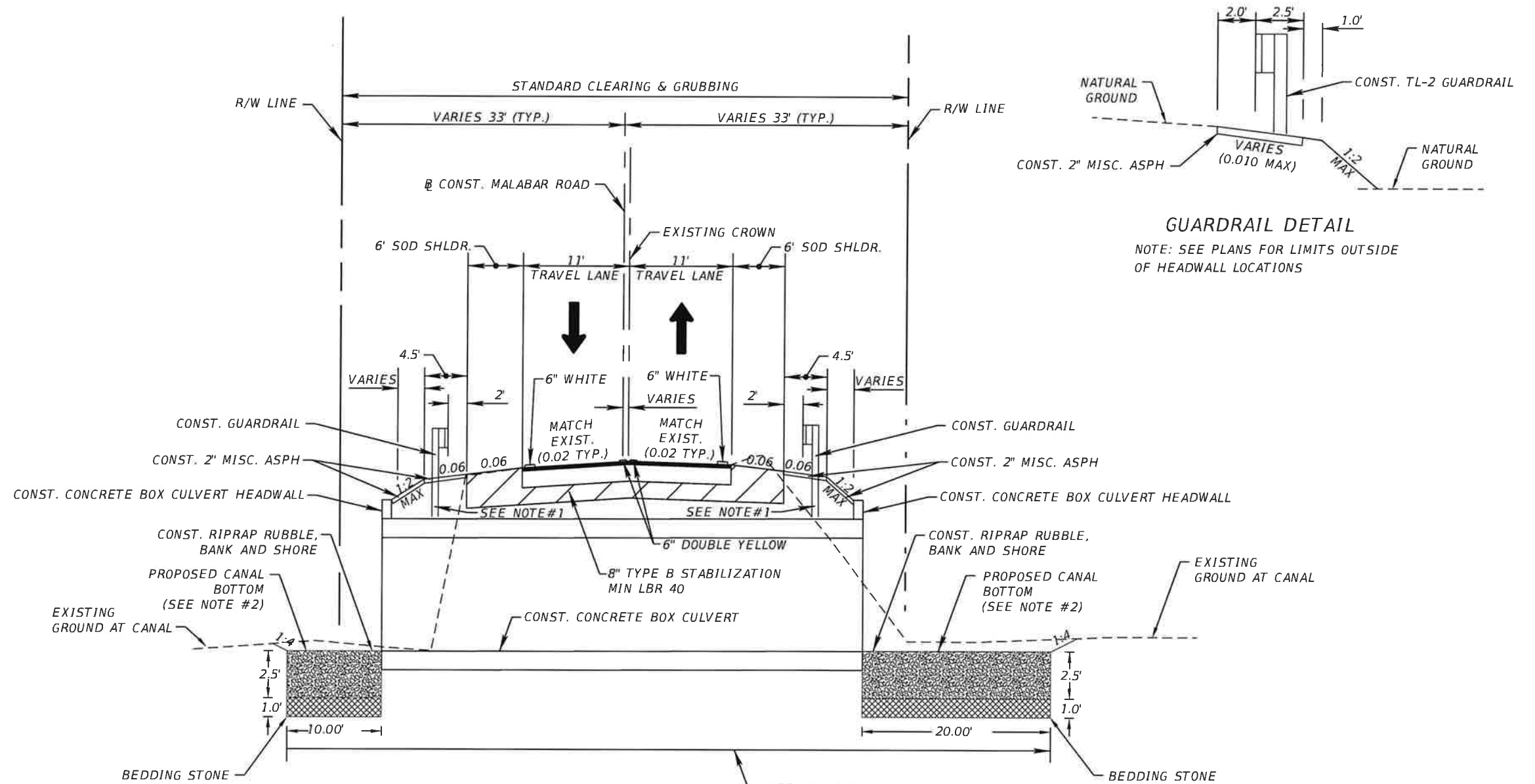
St. Augustine Record, Legal Advertising
P. O. Box 1630
St. Augustine, FL 32085
904-819-3439

VOLUSIA

News Journal Corporation, Legal Advertising
P. O. Box 2831
Daytona Beach, FL 32120-2831
(386) 681-2322

TYPICAL SECTION NOTES:

1. CONSTRUCT GUARDRAIL SPECIAL POST (OPTION 2, PG 21 OF 22 INDEX 536-001) FOR LIMITS OF BOX CULVERT
2. REMOVE EXISTING SURFICIAL MUCK WHEN REMOVING THE EXISTING PIPE FOR ALL DISTURBED LIMITS.



GUARDRAIL DETAIL
NOTE: SEE PLANS FOR LIMITS OUTSIDE OF HEADWALL LOCATIONS

TYPICAL SECTION
MALABAR RD.
STA. 26+07.97 TO STA. 26+67.97

TRAVEL LANES
OPTIONAL BASE GROUP 6 WITH
TYPE SP STRUCTURAL COURSE (1.5")



REVISIONS				DRMP, INC. 941 LAKE BALDWIN LANE, ORLANDO, FL 32814 PHONE: (407) 896-0594 FAX: (407) 896-4836 CERTIFICATE OF AUTHORIZATION No. 2648 JOHN L. MINTON, P.E. LICENSE NO. 54857	BREVARD COUNTY APPROVED BY:	TYPICAL SECTION	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION				2

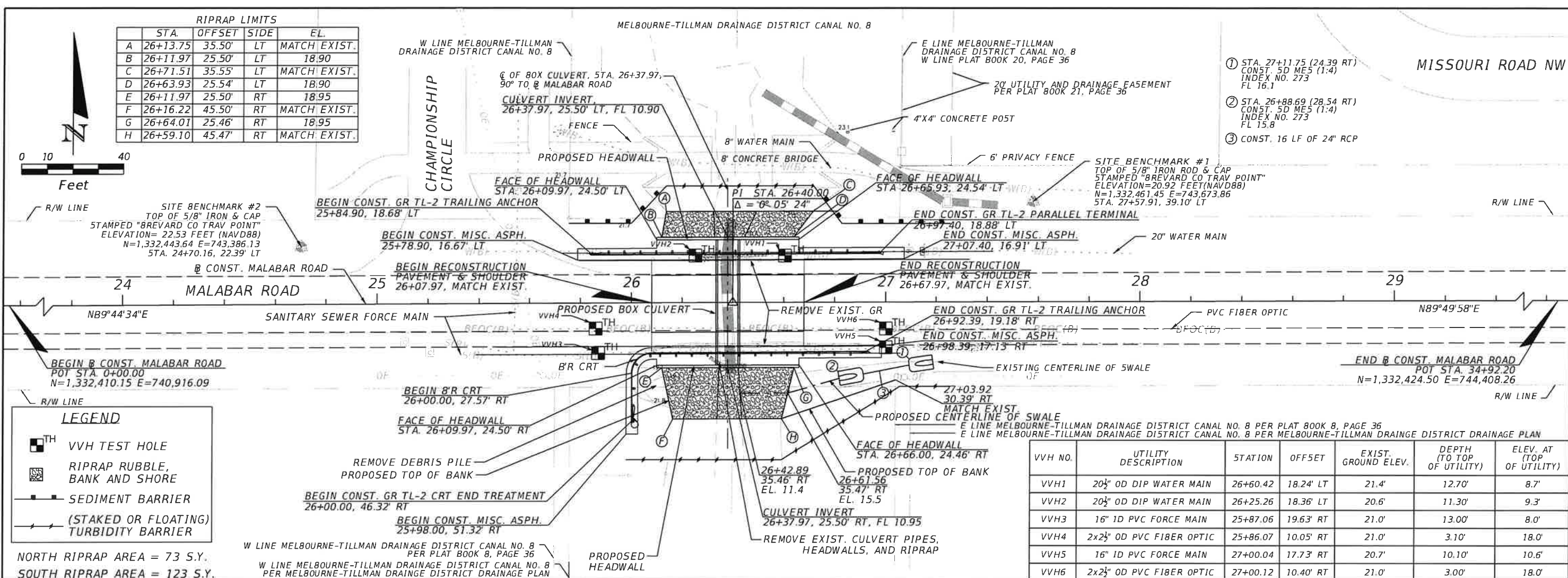
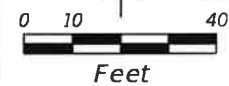
GENERAL NOTES

1. BENCHMARK ELEVATIONS SHOWN ON THE PLANS ARE NORTH AMERICA VERTICAL DATUM OF 1988 (NAVD 88).
 2. THE BEARINGS AND COORDINATES SHOWN HEREON ARE BASED ON GRID NORTH, FLORIDA STATE PLANE COORDINATE SYSTEM EAST ZONE 0901, NORTH AMERICAN DATUM OF 1983 AND READJUSTED IN 2011 (NAD83(2011)). SEE SPECIFIC PURPOSE SURVEY FOR MORE INFORMATION.
 3. ALL EXISTING PIPES AND DRAINAGE STRUCTURES WITHIN RIGHT OF WAY OR WITHIN EASEMENTS SHALL REMAIN UNLESS OTHERWISE NOTED.
 4. IF MOISTURE CONDITIONS PRECLUDE COMPACTION OF THE CLAYEY SOIL, OVER-EXCAVATE APPROXIMATELY 1 TO 2 FEET BELOW THE PROPOSED FOUNDATION BOTTOM AND BACKFILL THE EXCAVATION WITH COMPACTED GRAVEL.
 5. PROOF-COMPACT THE CLEARED SURFACE TO LOCATE ANY UNFORESEEN SOFT AREAS OR UNSUITABLE SURFACE OR NEAR-SURFACE SOILS. INCREASE THE DENSITY OF THE UPPER SOILS, AND TO PREPARE THE EXISTING SURFACE FOR THE ADDITION OF THE FILL SOILS (AS REQUIRED). PROOF-COMPACT THE CULVERT AND WINGWALL AREAS TO ACHIEVE THE DENSITY REQUIREMENTS. IF NECESSARY, IN AREAS THAT CONTINUE TO "YIELD", REMOVE ALL DELETERIOUS MATERIAL AND REPLACE WITH CLEAN, COMPACTED SAND BACKFILL.
 6. A DENSITY EQUIVALENT TO OR GREATER THAN 95 PERCENT OF THE MODIFIED PROCTOR (ASTM D-1557) MAXIMUM DRY DENSITY VALUE FOR A DEPTH OF 1 FOOT IN THE CULVERT AND WINGWALL AREAS MUST BE ACHIEVED BENEATH THE CLEARED GROUND SURFACE. OVEREXCAVATION AND RECOMPACTING MAY BE NEEDED BENEATH THE CLEARED GROUND SURFACE.
 7. MAINTAIN FLOWS IN THE CANAL THROUGHOUT DURATION OF CONSTRUCTION, AND BE PREPARED FOR RAPID RISES IN STAGE AND FLOW DUE TO STORM EVENTS OR WATER CONTROL OPERATIONS ON THE DOWNSTREAM C-1 CANAL. DEWATERING OPERATIONS SHOULD BE PLANNED IN CONJUNCTION WITH MAINTENANCE OF CANAL FLOW.
- B. THE LOCATIONS OF THE UTILITIES SHOWN IN THE PLANS (INCLUDING THOSE DESIGNATED Vv, Vh, AND Vvh) ARE BASED ON LIMITED INVESTIGATION TECHNIQUES AND SHOULD BE CONSIDERED APPROXIMATE ONLY. THE VERIFIED LOCATIONS/ELEVATIONS APPLY ONLY AT THE POINTS SHOWN. INTERPOLATIONS BETWEEN POINTS HAVE NOT BEEN VERIFIED.**
9. UTILITY/AGENCY OWNERS:
- | <u>COMPANY</u> | <u>CONTACT</u> | <u>TELEPHONE NUMBERS</u> |
|--------------------------------------|--------------------|--------------------------|
| AT&T DISTRIBUTION | BRYAN COUGHLIN | 321-258-9244 |
| SPECTRUM (FKA BRIGHT HOUSE NETWORKS) | PAUL RYMER | 321-757-6451 |
| CITY OF PALM BAY UTILITIES DEPT. | CHRISTOPHER LITTLE | 321-952-3410 |
| FLORIDA POWER & LIGHT | SUE WILLIAMS | 321-726-4847 |
10. EXISTING UTILITIES TO REMAIN IN PLACE UNLESS OTHERWISE NOTED.
 11. THE COUNTY SHALL NOTIFY UTILITY OWNERS OF ANY EXCAVATION OR DEMOLITION ACTIVITY THROUGH SUNSHINE ONE-CALL OF FLORIDA, INC. (1-800-432-4770) AND SHALL ALSO NOTIFY THOSE UTILITY OWNERS/AGENCIES LISTED WITHIN OR IMPACTED BY THESE PLANS, NOT LESS THAN TWO (2) FULL BUSINESS DAYS IN ADVANCE OF THE BEGINNING OF CONSTRUCTION ON THE JOB SITE.
 12. COORDINATE WITH UTILITY OWNERS AS NEEDED TO MAINTAIN EXISTING FACILITIES THROUGHOUT CONSTRUCTION DURATION.



REVISIONS				DRMP, INC. 941 LAKE BALDWIN LANE, ORLANDO, FL 32814 PHONE: (407) 896-0594 FAX: (407) 896-4836 CERTIFICATE OF AUTHORIZATION No. 2648 JOHN L. MINTON, P.E. LICENSE NO. 54857	BREVARD COUNTY APPROVED BY:	GENERAL NOTES	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION				3

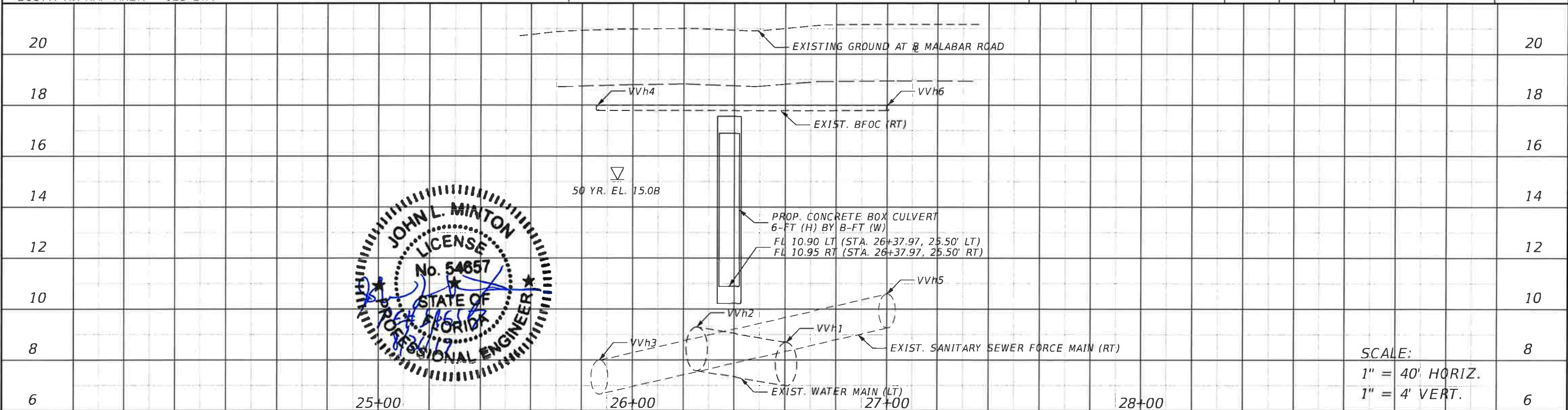
RIPRAP LIMITS				
	STA.	OFFSET	SIDE	EL.
A	26+13.75	35.50'	LT	MATCH EXIST.
B	26+11.97	25.50'	LT	18.90
C	26+71.51	35.55'	LT	MATCH EXIST.
D	26+63.93	25.54'	LT	18.90
E	26+11.97	25.50'	RT	18.95
F	26+16.22	45.50'	RT	MATCH EXIST.
G	26+64.01	25.46'	RT	18.95
H	26+59.10	45.47'	RT	MATCH EXIST.



- ① STA. 27+11.75 (24.39 RT)
CONST. 5D ME5 (1:4)
INDEX NO. 273
FL 16.1
- ② STA. 26+88.69 (28.54 RT)
CONST. 5D ME5 (1:4)
INDEX NO. 273
FL 15.8
- ③ CONST. 16 LF OF 24" RCP

LEGEND	
	VVH TEST HOLE
	RIPRAP RUBBLE, BANK AND SHORE
	SEDIMENT BARRIER (STAKED OR FLOATING) TURBIDITY BARRIER

VVH NO.	UTILITY DESCRIPTION	STATION	OFFSET	EXIST. GROUND ELEV.	DEPTH (TO TOP OF UTILITY)	ELEV. AT (TOP OF UTILITY)
VVH1	20 1/2" OD DIP WATER MAIN	26+60.42	18.24' LT	21.4'	12.70'	8.7'
VVH2	20 1/2" OD DIP WATER MAIN	26+25.26	18.36' LT	20.6'	11.30'	9.3'
VVH3	16" ID PVC FORCE MAIN	25+87.06	19.63' RT	21.0'	13.00'	8.0'
VVH4	2x2 1/2" OD PVC FIBER OPTIC	25+86.07	10.05' RT	21.0'	3.10'	18.0'
VVH5	16" ID PVC FORCE MAIN	27+00.04	17.73' RT	20.7'	10.10'	10.6'
VVH6	2x2 1/2" OD PVC FIBER OPTIC	27+00.12	10.40' RT	21.0'	3.00'	18.0'

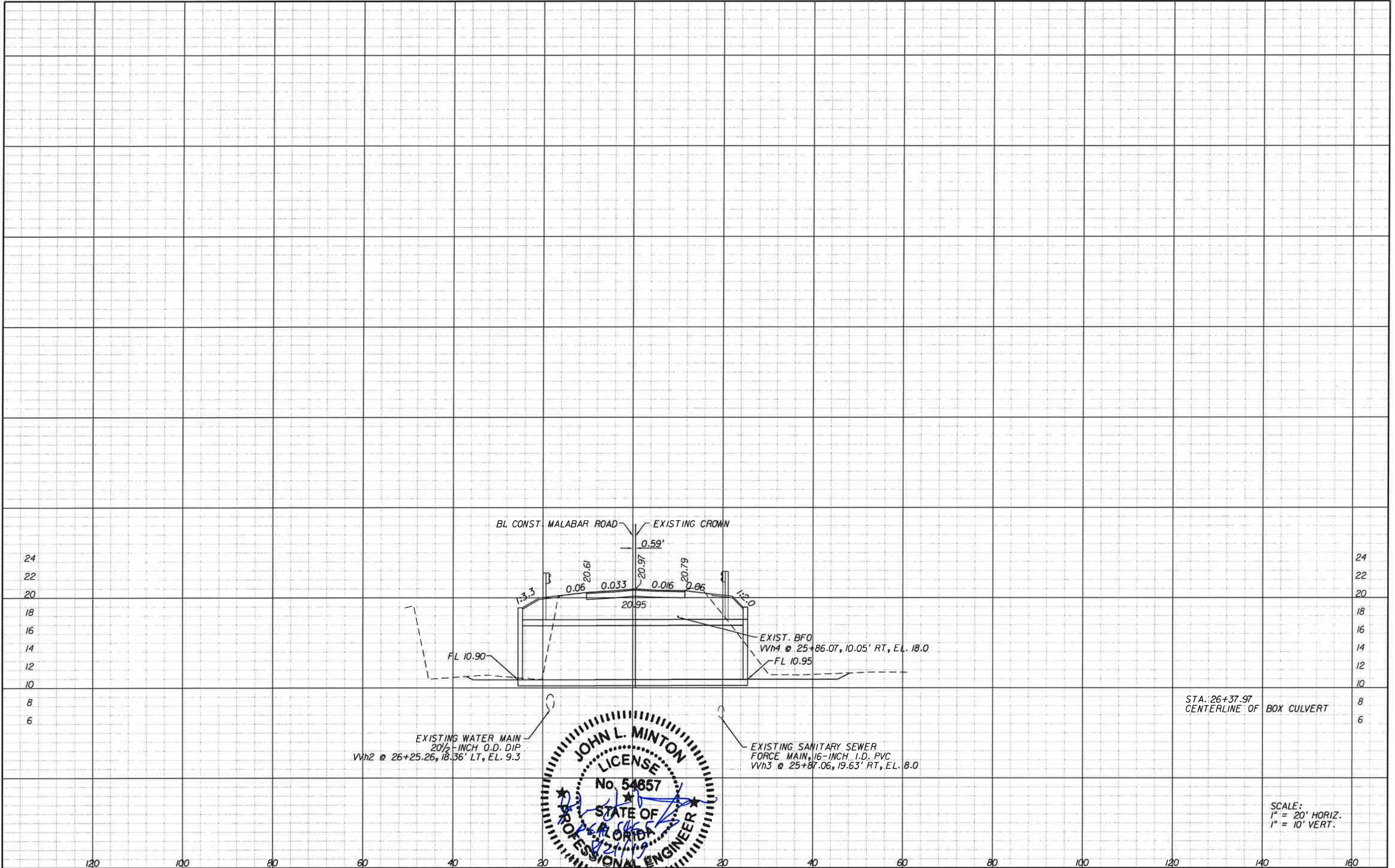


REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DRMP, INC.
 941 LAKE BALDWIN LANE, ORLANDO, FL 32814
 PHONE: (407) 896-0594 FAX: (407) 896-4836
 CERTIFICATE OF AUTHORIZATION NO. 2648
 JOHN L. MINTON, P.E.
 LICENSE NO. 54657

BREVARD COUNTY
 APPROVED BY: _____

**PLAN & PROFILE
 MALABAR ROAD**
 SHEET NO. 4



STA. 26+37.97
CENTERLINE OF BOX CULVERT

SCALE:
1" = 20' HORIZ.
1" = 10' VERT.

REVISIONS	
DATE	DESCRIPTION

941 LAKE BALDWIN LANE, ORLANDO, FL 32814
PHONE: (407) 896-0594 FAX: (407) 896-4836
CERTIFICATE OF AUTHORIZATION No. 26-48
JOHN L. MINTON, P.E.
LICENSE NO. 54657

BREVARD COUNTY
APPROVED BY:

CROSS SECTION

SHEET NO.
5



① PCMS DETOUR TEXT
(TWO WEEKS PRIOR TO DETOUR)

MESSAGE 1

M	A	L	A	B	A	R
T	O	B	E			
C	L	O	S	E	D	

MESSAGE 2

D	D	/	M	M		
T	O					
D	D	/	M	M		

① PCMS DETOUR TEXT






MESSAGE 1

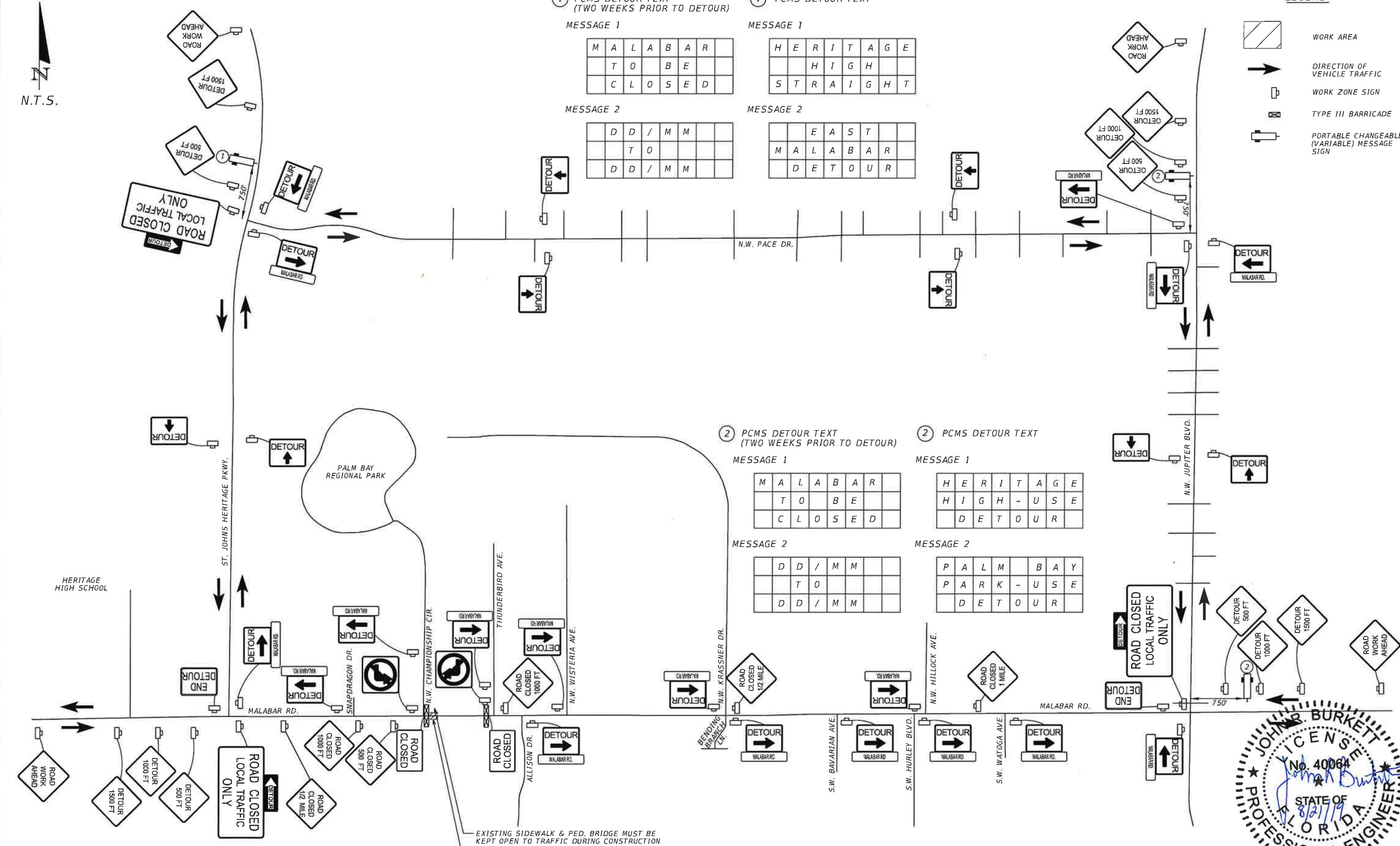
H	E	R	I	T	A	G	E
		H	I	G	H		
S	T	R	A	I	G	H	T

MESSAGE 2

		E	A	S	T		
M	A	L	A	B	A	R	
D	E	T	O	U	R		

LEGEND

-  WORK AREA
-  DIRECTION OF VEHICLE TRAFFIC
-  WORK ZONE SIGN
-  TYPE III BARRICADE
-  PORTABLE CHANGEABLE (VARIABLE) MESSAGE SIGN



② PCMS DETOUR TEXT
(TWO WEEKS PRIOR TO DETOUR)

MESSAGE 1

M	A	L	A	B	A	R
T	O	B	E			
C	L	O	S	E	D	

MESSAGE 2

D	D	/	M	M		
T	O					
D	D	/	M	M		

② PCMS DETOUR TEXT

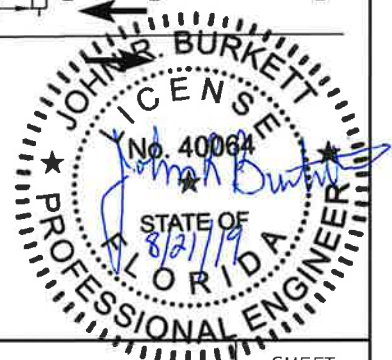
MESSAGE 1

H	E	R	I	T	A	G	E
H	I	G	H	-	U	S	E
D	E	T	O	U	R		

MESSAGE 2

P	A	L	M	B	A	Y	
P	A	R	K	-	U	S	E
D	E	T	O	U	R		

EXISTING SIDEWALK & PED. BRIDGE MUST BE KEPT OPEN TO TRAFFIC DURING CONSTRUCTION BOX CULVERT CONSTRUCTION AREA



REVISIONS	
DATE	DESCRIPTION

DRMP, INC.
941 LAKE BALDWIN LANE, ORLANDO, FL 32814
PHONE: (407) 896-0594 FAX: (407) 896-4836
CERTIFICATE OF AUTHORIZATION No. 2648
JOHN R. BURKETT, P.E.
LICENSE NO. 40064

BREVARD COUNTY
APPROVED BY: _____

TRAFFIC CONTROL PLAN

SHEET NO.
6

BOX CULVERT DATA TABLES

BOX, HEADWALL AND CUTOFF WALL DATA TABLE (inches unless shown otherwise)																			Table Date 7-01-09	
LOCATION	STRUCTURE / BRIDGE NUMBER	BOX									HEADWALL AND CUTOFF WALL									
		Wc(ft)	Hc(ft)	Tt	Tw	Tb	Ti	#cells	Lc(ft)	Cover	Blhw	Hlhw	Brhw	Hrhw	Blcw	Hlcw	Brcw	Hrcw	SL(deg)	SR(deg)
STA. 26+37.97	-	8	6	8	8	8	N/A	1	51.00	2	12	24	12	24	12	24	12	24	0	0

LEFT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise)																	Table Date 01-01-11	
STRUCTURE NUMBER	LEFT END WINGWALL									LEFT BEGIN WINGWALL								
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)
-	10	10	48	10	90	26.57	8	8	23.33	10	10	48	10	90	26.57	8	8	23.33

RIGHT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise)																	Table Date 01-01-11	
STRUCTURE NUMBER	RIGHT END WINGWALL									RIGHT BEGIN WINGWALL								
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)
-	10	10	48	10	90	26.57	8	8	23.33	10	10	48	10	90	26.57	8	8	23.33

ESTIMATED CONCRETE QUANTITIES (CY)																					Table Date 7-01-13	
STRUCTURE NUMBER	BOX								LEFT END WINGWALL			LEFT BEGIN WINGWALL			RIGHT END WINGWALL			RIGHT BEGIN WINGWALL				
	Left Cutoff Wall	Right Cutoff Wall	Bottom Slab	Walls	Top Slab	Left Head Wall	Right Head Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total		
-	0.46	0.46	12.44	15.11	11.75	0.46	0.46	41.3	5.09	5.76	10.9	5.09	5.76	10.9	5.09	5.76	10.9	5.09	5.76	10.9		

MAIN STEEL REINFORCEMENT SPACING (inches)																			Table Date 7-01-09	
STRUCTURE NUMBER	BOX															HEADWALLS		CUTOFF WALLS		
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115, 116...	803	806	809	812	
-	9	9	9	9	9	9	N/A	12	12	12	12	12	12	12	N/A	12	12	12	12	

WINGWALL STEEL REINFORCEMENT SPACING (inches)																											Table Date 7-01-09	
STRUCTURE NUMBER	LEFT END WINGWALL							LEFT BEGIN WINGWALL							RIGHT END WINGWALL							RIGHT BEGIN WINGWALL						
	401 (407(B))	402 (403)	404 (405)	406	409	410	411	501 (507(B))	502 (503)	504 (505)	506	509	510	511	601 (607(B))	602 (603)	604 (605)	606	609	610	611	701 (707(B))	702 (703)	704 (705)	706	709	710	711
-	6	12	12	12	6	12	12	6	12	12	12	6	12	12	6	12	12	6	12	12	6	12	12	12	6	12	12	12


WINGWALL NOTE: Bar designations in "()" are only required for variable height wingwalls.



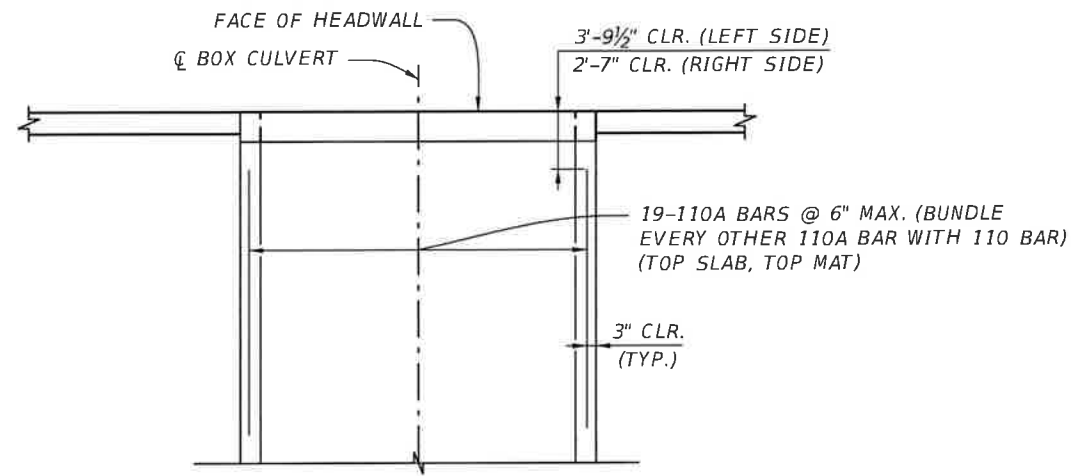
 Jocelyn M. Haisch-Linn
 8/21/2019

NOTES

- ENVIRONMENTAL CLASS: MODERATELY AGGRESSIVE
- REINFORCING STEEL, GRADE 60
- CONCRETE CLASS IV f'c = 5.5 ksi
- SOIL PROPERTIES:
 FRICTION ANGLE: 30 DEG
 MODULULUS OF SUBGRADE REACTION: 172800 LB/FT^3
 NOMINAL BEARING RESISTANCE: 6000 LB/FT^2
- WORK THIS DRAWING WITH STANDARD PLANS INDEX 400-289, ROADWAY PLAN SHEET, DRAINAGE STRUCTURES SHEET, "BOX CULVERT" REINFORCING BAR LIST.
- SETTLEMENT CRITERIA FOR PRECAST BOX CULVERT OPTION (INDEX 400-291):
 LONG TERM DIFFERENTIAL SETTLEMENT (ΔY) = 1 in.
 EFFECTIVE LENGTH FOR SETTLEMENT (L) = 10 ft.
- ORGANIC MUCK/PEAT HAS BEEN IDENTIFIED AT THIS LOCATION. ORGANIC MUCK/PEAT SHALL BE REMOVED TO ITS FULL DEPTH BENEATH THE BOX CULVERT AND WINGWALLS.
- THE CONTRACTOR IS TO VERIFY ALL UTILITIES AND NOTIFY ALL INVOLVED UTILITY COMPAINES PRIOR TO EXCAVATION OR CONSTRUCTION AND IS RESPONSIBLE FOR MAKING ITS OWN DETERMINATION TO AVOID DAMAGE. THE CONTRACTOR IS TO ENSURE THAT ACTIVE UTILITIES ARE PROPERLY MAINTAINED DURING CONSTRUCTION.
- FOR DETAILS REGARDING UTILITIES, SEE ROADWAY PLANS.
- FOR DETAILS REGARDING DRAINAGE, SEE ROADWAY PLANS.

REVISIONS DATE DESCRIPTION DATE DESCRIPTION		 <p>DRMP ENGINEERS - SURVEYORS - PLANNERS - SCIENTISTS DRMP, INC. 941 LAKE BALDWIN LANE, ORLANDO, FLORIDA 32814 PHONE: (407) 896-0594 FAX: (407) 896-4836 CERTIFICATE OF AUTHORIZATION NO. 2648 JOCELYN M. HAISCH-LINN, P.E. LICENSE NO. 60013</p>	BREVARD COUNTY APPROVED BY:	BOX CULVERT DATA TABLE	SHEET NO.
					7

MARK	LENGTH	NO	TYP	STY	B	C	D	E	F	H	J	K	N	Ø													
SIZE	DES	FT	IN	BARS	BAR	A	G	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	NO	ANG
LOCATION					MAIN BOX										NO. REQUIRED = 1												
6	101	9-0		69	1			9-0																			
6	102	9-0		69	1			9-0																			
6	103	9-0		73	1			9-0																			
6	104	9-0		73	1			9-0																			
6	105	7-5		138	10			2-7		4-10																	
6	106	7-5		138	10			2-7		4-10																	
4	108	7-0		104	1			7-0																			
4	109	53-8		10	1			53-8																			
4	110	50-8		10	1			50-8																			
5	110A	5-0		38	1			5-0																			
4	111	50-0		10	1			50-0																			
4	112	53-8		10	1			53-8																			
4	113	50-8		14	1			50-8																			
4	114	50-8		14	1			50-8																			
LOCATION					LEFT END WINGWALL										NO. REQUIRED = 1												
4	401	7-9		47	1			7-9																			
4	402	23-0		9	1			23-0																			
4	404	23-0		9	1			23-0																			
4	406	7-9		25	1			7-9																			
4	407	3-11		47	10			1-4		2-7																	
4	409	5-4		47	1			5-4																			
4	410	5-4		24	1			5-4																			
4	411	23-0		14	1			23-0																			
5	412	2-0		14	1			2-0																			
LOCATION					LEFT BEGIN WINGWALL										NO. REQUIRED = 1												
4	501	7-9		47	1			7-9																			
4	502	23-0		9	1			23-0																			
4	504	23-0		9	1			23-0																			
4	506	7-9		25	1			7-9																			
4	507	3-11		47	10			1-4		2-7																	
4	509	5-4		47	1			5-4																			
4	510	5-4		24	1			5-4																			
4	511	23-0		14	1			23-0																			
5	512	2-0		14	1			2-0																			
LOCATION					RIGHT END WINGWALL										NO. REQUIRED = 1												
4	601	7-9		47	1			7-9																			
4	602	23-0		9	1			23-0																			
4	604	23-0		9	1			23-0																			
4	606	7-9		25	1			7-9																			
4	607	3-11		47	10			1-4		2-7																	
4	609	5-4		47	1			5-4																			
4	610	5-4		24	1			5-4																			
4	611	23-0		14	1			23-0																			
5	612	2-0		14	1			2-0																			



PARTIAL CONCRETE BOX CULVERT PLAN
 (SHOWING 110A BARS)
 (LEFT SIDE OF CULVERT SHOWN; RIGHT SIDE OF CULVERT SIMILAR)

Jocelyn M. Haisch-Linn
 9/26/2019
 JOCELYN M. HAISCH-LINN
 LICENSE
 PROFESSIONAL ENGINEER
 FLORIDA

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DRMP
 ENGINEERS - SURVEYORS - PLANNERS - SCIENTISTS
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 JOCELYN M. HAISCH-LINN, P.E. LICENSE NO. 60103

BREVARD COUNTY
 APPROVED BY:

BOX CULVERT REINFORCING
BAR LIST (1 OF 2)

SHEET NO.
 8

MARK	LENGTH	NO	TYP	STY	B	C	D	E	F	H	J	K	N	Ø													
SIZE	DES	FT	IN	BARS	BAR	A	G	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	FT	IN	FR	NO	ANG
LOCATION					RIGHT BEGIN WINGWALL										NO. REQUIRED = 1												
4	701	7-9		47	1			7-9																			
4	702	23-0		9	1			23-0																			
4	704	23-0		9	1			23-0																			
4	706	7-9		25	1			7-9																			
4	707	3-11		47	10			1-4	2-7																		
4	709	5-4		47	1			5-4																			
4	710	5-4		24	1			5-4																			
4	711	23-0		14	1			23-0																			
5	712	2-0		14	1			2-0																			
LOCATION					LEFT HEADWALL										NO. REQUIRED = 1												
6	801	9-0		2	1			9-0																			
6	802	9-0		2	1			9-0																			
4	803	4-8		10	27			1-7 1/4	0-6	0-2	0-5	1-2 1/4	0-6	0-6													
LOCATION					RIGHT HEADWALL										NO. REQUIRED = 1												
6	804	9-0		2	1			9-0																			
6	805	9-0		2	1			9-0																			
4	806	4-8		10	27			1-7 1/4	0-6	0-2	0-5	1-2 1/4	0-6	0-6													
LOCATION					LEFT CUTOFF WALL										NO. REQUIRED = 1												
4	807	9-0		2	1			9-0																			
4	808	9-0		3	1			9-0																			
4	809	4-10		10	7			1-7	0-8	0-6	0-6																
LOCATION					RIGHT CUTOFF WALL										NO. REQUIRED = 1												
4	810	9-0		2	1			9-0																			
4	811	9-0		3	1			9-0																			
4	812	4-10		10	7			1-7	0-8	0-6	0-6																

END OF LIST



 Jocelyn M. Haisch-Linn

 8/21/2019

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION


DRMP
 ENGINEERS - SURVEYORS - PLANNERS - SCIENTISTS
 DRMP, INC.
 941 LAKE BALDWIN LANE, ORLANDO, FLORIDA 32814
 PHONE: (407) 896-0594 FAX: (407) 896-4836
 CERTIFICATE OF AUTHORIZATION NO. 2648
 JOCELYN M. HAISCH-LINN, P.E. LICENSE NO. 60103

BREVARD COUNTY
 APPROVED BY:

BOX CULVERT REINFORCING
BAR LIST (2 OF 2)

SHEET NO.
 9

**Malabar Road at MTWMD Canal C-8
Box Culvert Project**

Brevard County, Florida

**Hydraulic Analysis for Box Culvert
Installation**

Prepared For:



**Brevard County Public Works Department
2725 Judge Fran Jamieson Way
Building A, Room 201
Viera, FL 32940**

Prepared By:

**DRMP, Inc.
941 Lake Baldwin Lane
Orlando, Florida 32814
Certificate of Authorization No. 2648
John L. Minton, Jr., P.E.
State of Florida PE No. 54657**

April 2019

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing engineering with **DRMP, Inc.** and that I have supervised the preparation of and approve the analysis and design of the drainage system hereby reported for:

PROJECT: Malabar Road at MTWCD Canal C-8 Box Culvert Installation
Brevard County, Florida

The engineering work represented by this document was performed through the following duly authorized engineering business:

DRMP, Inc.
941 Lake Baldwin Lane
Orlando, Florida 32814
Certificate of Authorization No. 2648
Telephone: 407-896-0594

This report provides the hydraulic and hydrologic drainage analyses for the installation of a box culvert along Canal C-8 under Malabar Road. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of hydrologic analysis and hydraulic engineering as applied through professional judgment experience.

Any engineering analysis, documents, conclusions or recommendations relied upon from other professional sources or provided with responsibility by the client are referenced accordingly in the following report.

FLORIDA REGISTERED ENGINEER:

John L. Minton, P.E.
Name

REGISTRATION NUMBER: FL # 54657

SIGNATURE:



John L. Minton, P.E., State of Florida, Professional Engineer, License No. 54657. This item has been electronically signed and sealed by John L. Minton, P.E. on April 26, 2019 using a SHA-1 authentication code. Printed copies of this document are not considered signed and sealed and the SHQ-1 authentication code must be verified on all electronic copies.

HYDRAULICS REPORT

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3.1	FLOW DETERMINATIONS	4
3.2	CULVERT ANALYSIS	4
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APPENDICES

- Appendix A Data from MTWCD & SJRWMD
- Appendix B Topographic Survey from Brevard County
- Appendix C Culvert Hydraulic Analyses

HYDRAULICS REPORT

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Brevard County will be replacing an existing failing arch pipe with a new box culvert. DRMP has been tasked by the County with designing the culvert replacement to allow for adequate conveyance of flood waters to protect the roadway and not adversely impact surrounding properties. The project is in the St. Johns River Water Management District (SJRWMD), east of the St. Johns River and west of Interstate 95 (I-95). The culvert is located under Malabar Road, near the intersection with Championship Circle NW. Please see **Figure 1** for a depiction of the project location.

1.2 EXISTING CONDITIONS

The County provided a Specific Purpose Survey, dated March 30, 2018, of the project area. Please refer to the survey included in **Appendix B**. The survey provides the northern invert of the 103-inch x 71-inch (span x height) corrugated metal arch pipe and the southern invert of a 36-inch plastic pipe, which was added inside of the arch pipe during the span of the project to prevent the collapse of the road in the event of failure of the pipe arch. The picture to the right shows the pipes on March 29, 2018.

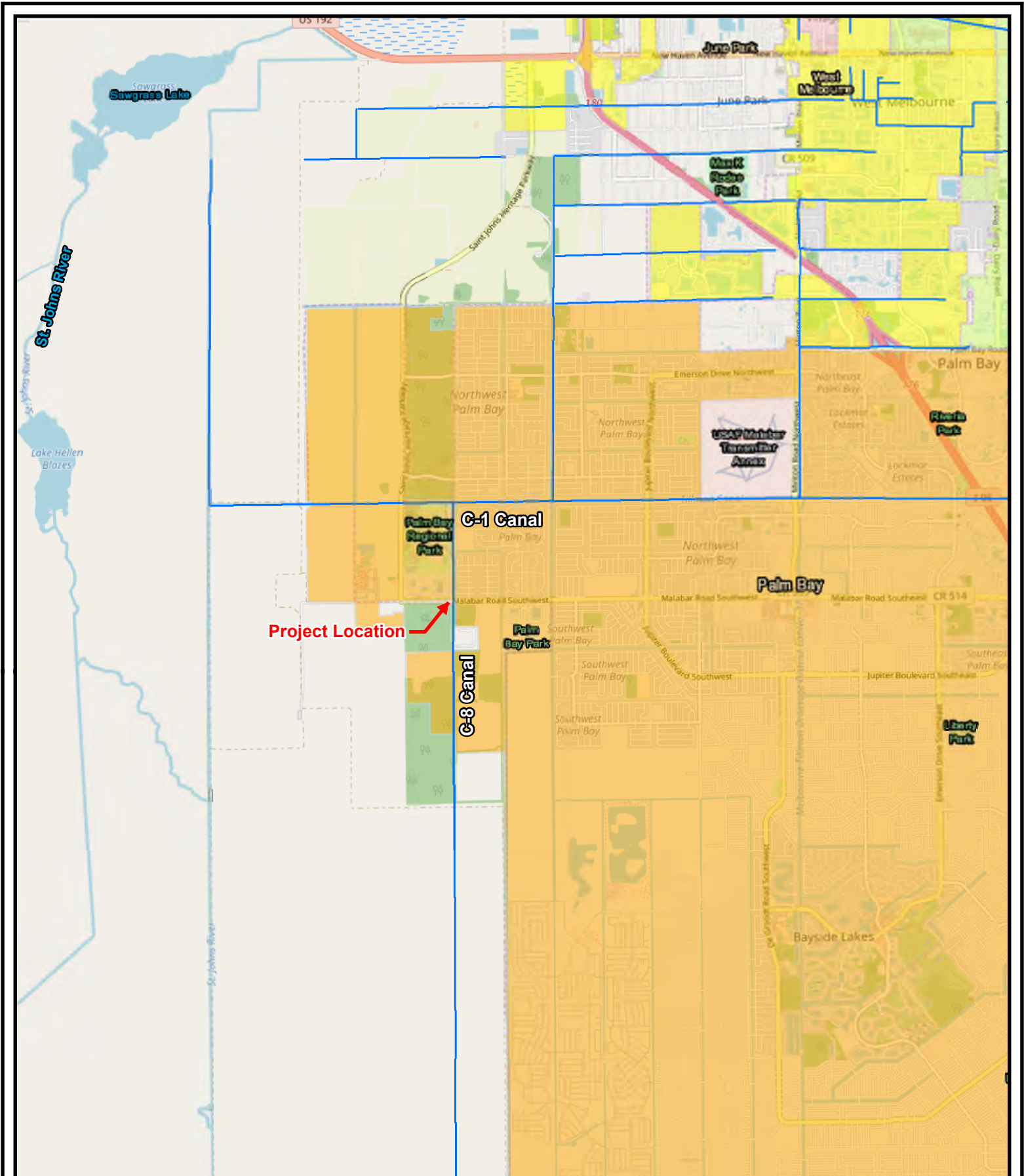


Picture 1: 36" CPEP in 103"x71" arch pipe

A more recent field investigation was conducted by DRMP on September 12, 2018, in which it appeared that the County had extended the northern side of the 36-inch CPEP with a 48-inch CPEP. It appears that fill had been added to cover the north end-wall. The inside of the pipe was inspected and was clear of debris. The southern side was overgrown and there had been some recent roadwork done. The picture on the right shows the north side of Malabar Road looking south.



Picture 2: 48" CPEP on northern side



Prepared by:



October 2018

Malabar Road Box Culvert Replacement

Location Map

Figure 1

Prepared for:



Brevard County, FL



1" = 6,750'

HYDRAULICS REPORT

1.3 DRAINAGE PATTERNS

The Malabar Road culvert is located within the jurisdiction of the SJRWMD, on the Melbourne-Tillman Water Control District (MTWCD) C-8 Canal. The historical function of the C-8 Canal has been to provide drainage of adjacent lands with flow northward into the C-1 Canal that, in-turn, flows eastward into the Indian River Lagoon. More recently the MTWCD canal network has been repurposed for a regional project by SJRWMD known as the C-1 Re-diversion Project, which diverts the stormwater into the St. Johns River basin. The re-diversion project has the effect of maintaining higher stages in the C-1 canal that promote flow from north to south along the C-8 Canal in early parts of a large storm event into a large expanse of floodplain area at the south end of the canal. The floodplain area is land owned by SJRWMD adjacent to the Three Forks Marsh Conservation Area. Consequently, the highest design peak flows through the box culvert are expected to travel from north to south, with secondary peak flows in the reverse direction from south to north as the floodwaters recede. MTWCD has provided DRMP with stage and flow graph data for the C-8 Canal at the culvert location for the 25-year and 100-year storms. The original source of the model results data is understood to be from the SJRWMD model for the C-1 Re-diversion Project. Please refer to **Appendix A** for data provided by MTWCD and SJRWMD.

1.4 PROPOSED BOX CULVERT INSTALLATION

The replacement culvert proposed for this site is an 8-foot wide by 6-foot high concrete box culvert. Straight end-walls will be constructed on both sides of the culvert to tie into the canal banks.

<u>Culvert Type and Dimensions</u>	<u>Cross-Sectional Area</u>
103-inch x 71-inch corrugated metal arch pipe	42.4 sf
8-foot x 6-foot concrete box culvert	48.0 sf

The proposed box culvert is the approximate height, width and inverts of the existing arch pipe, thereby minimizing the effects to Malabar Road during construction and matching existing drainage conditions to the extent possible. The proposed box culvert size and configuration has been approved by MTWCD District Engineer, Michael McCabe PE, by e-mail dated October 25, 2018.

2.0 FEMA FLOODPLAIN DESCRIPTION

The most recent Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the project area was published on March 17, 2014. The FIRM (Panel 12009C0655G) shows the C-8 Canal represented by a Zone AE floodplain with Base Flood Elevation (BFE) of 20 feet with a southern terminus at the Malabar Road crossing. A separate Zone AE floodplain at the same BFE of 20 encompasses a large area that spans

HYDRAULICS REPORT

across the southern part of Canal C-8. Please refer to the National Flood Hazard Layer (NFHL) FIRMette, included as **Figure 2**, for a depiction of the floodplain.

With the disconnect between delineated floodplains on the FEMA map, it is inferred that Canal C-8 does not contribute meaningful conveyance between the floodplains as depicted.

3.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

3.1 FLOW DETERMINATIONS

Peak flows and tailwater peak stage elevations were derived from flow and stage graphs received from MTWCD and SJRWMD for 25-year and 100-year storms. This modeling is understood to have been performed by SJRWMD staff in support of the C-1 Re-diversion project. Data from MTWCD and SJRWMD for the 25-yr storm event shows the north to south, or negative, flow peaking on the fourth day before the flow reverses and peaks a day and a half later. For the 100-yr storm event, the positive flow peaks two and a half days after the negative flow peaks. Data for the 50-yr and 500-yr storm events were calculated using semi-log linear regressions from the given 25-yr and 100-yr storm event data. Please refer to the **Linear Regression** sheets in **Appendix C** for reference.

3.2 CULVERT ANALYSIS

Culvert analysis was performed using spreadsheets to consider inlet and outlet control conditions. The existing and proposed culverts were analyzed and compared. Peak flows from both directions for the 50-year design storm were analyzed. The proposed headwater stages for proposed conditions are lower than existing conditions for the series of highest flows from north to south. Peak headwater stages appear to remain within the canal banks below the low edge of pavement for all storms within the vicinity of the Malabar Road crossing. The hydraulic function of the existing pipe arch appears to be adequately replaced with the proposed box culvert installation. Please refer to **Appendix C** for the culvert analysis.

3.3 CHANNEL PROTECTION

Since the peak flow velocity of 4.3 feet per second for the 50-year storm event is above the Florida Department of Transportation's *FDOT Drainage Manual* recommended velocity of 1.5 feet per second, a 10-foot wide border of rubble rip-rap is recommended on both ends of the culvert to reduce the likelihood of scouring and erosion of the channel. It should be noted that the current velocities were calculated to be higher than the proposed velocities, and no scouring or erosion has been found at the existing culvert.

National Flood Hazard Layer FIRMette



Figure 2

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- | | | |
|------------------------------------|--|---|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
Zone A, V, A99 |
| | | With BFE or Depth Zone AE, AO, AH, VE, AR |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
| | | Future Conditions 1% Annual Chance Flood Hazard Zone X |
| | | Area with Reduced Flood Risk due to Levee. See Notes. Zone X |
| | | Area with Flood Risk due to Levee Zone D |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard Zone X |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard Zone D |
| | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | 17.5 Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| MAP PANELS | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |



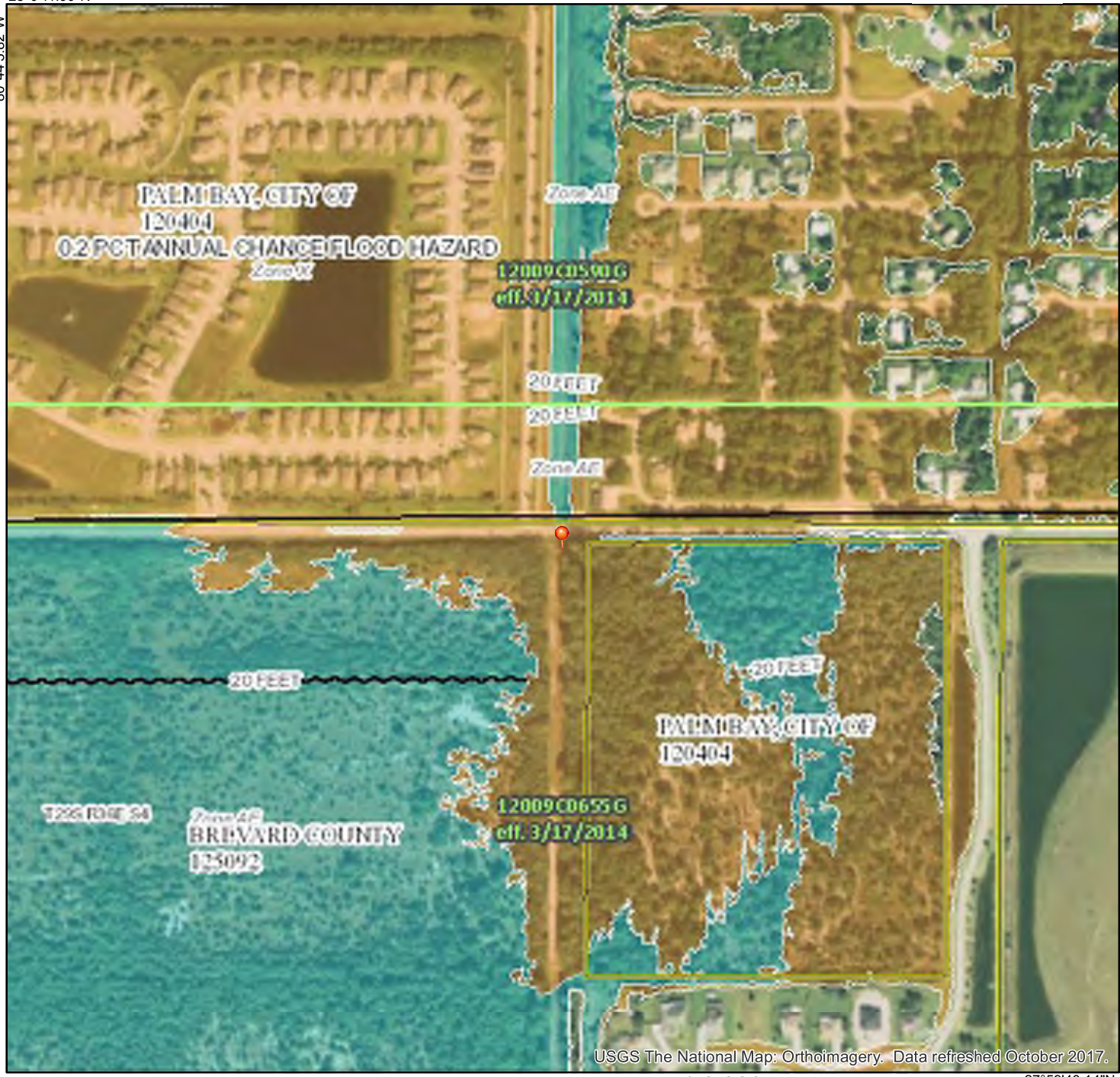
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

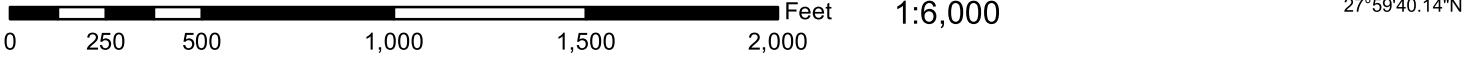
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/2/2018 at 11:02:02 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

28°0'11.90"N
80°44'3.82"W



USGS The National Map: Orthoimagery. Data refreshed October 2017.

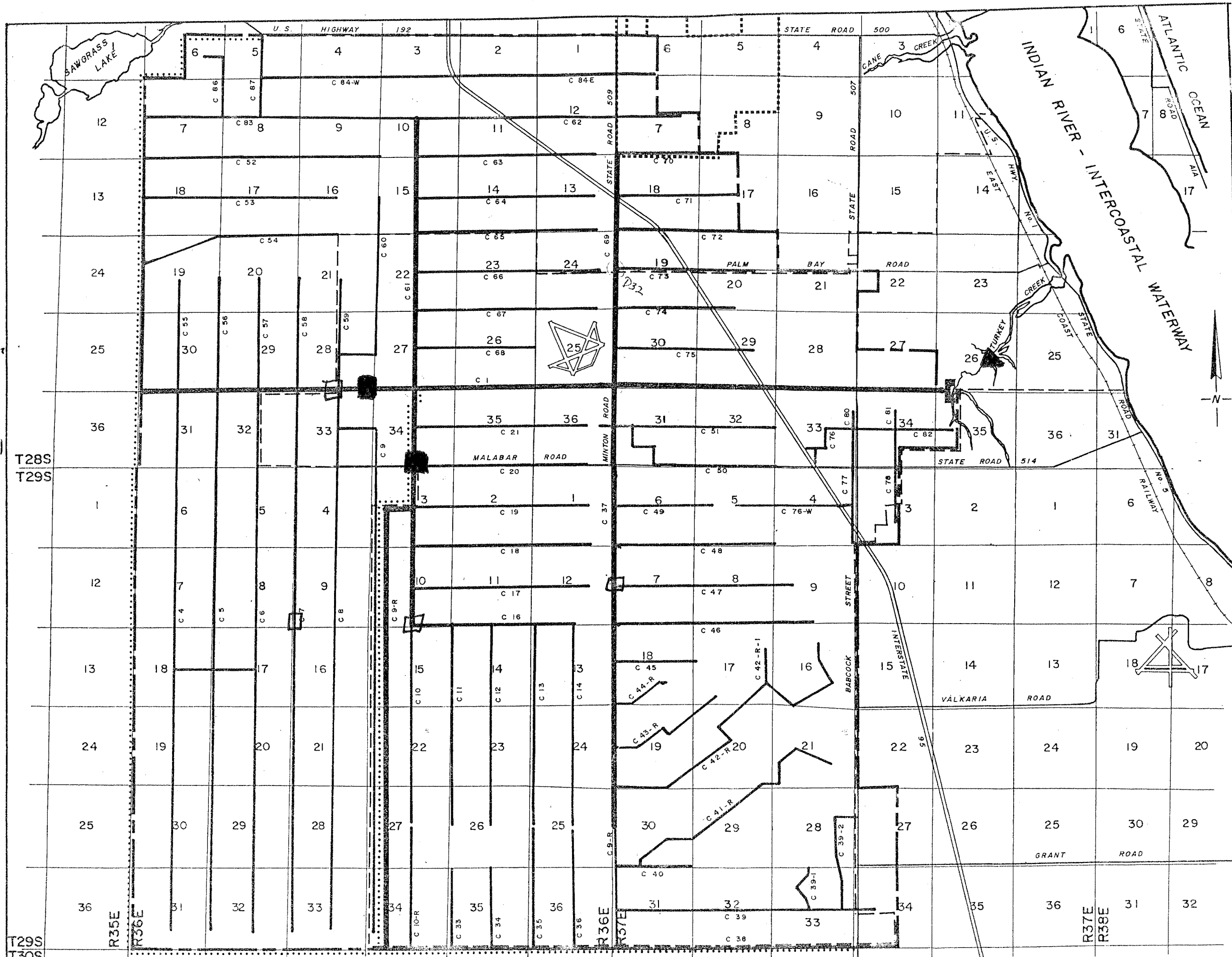


80°43'26.36"W

Appendix A

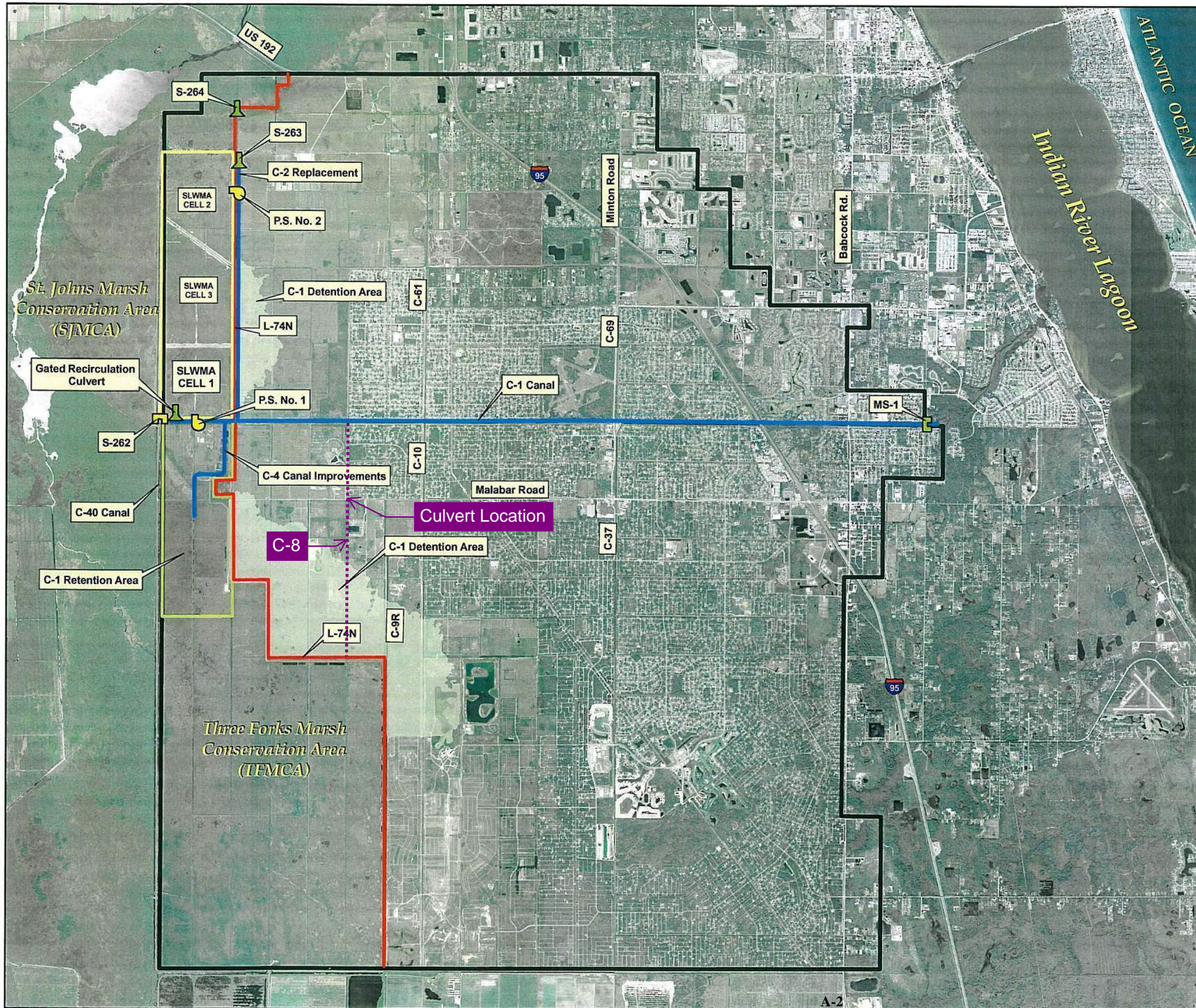
Data from MTWCD & SJRWMD

WATER CONTROL DISTRICT OF SOUTH BREVARD



- DISTRICT BOUNDARY
- - - CITY OF PALM BAY
- CITY OF WEST MELBOURNE
- CANAL
- LEVEE
- MS-1 STRUCTURE

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.
APRIL 1988



DRMP Additions,
October 2018

**Melbourne-Tillman
Water Control District with
C-1 Rediversion elements
INTERIM
FEBRUARY 4, 2008**

LEGEND

- MTWCD boundary
- SLWMA boundary
- C-1 Retention Area
- Main Flowway
- Existing L-74N
- Proposed pump station
- Proposed structure
- Existing structure
- Existing gated culvert

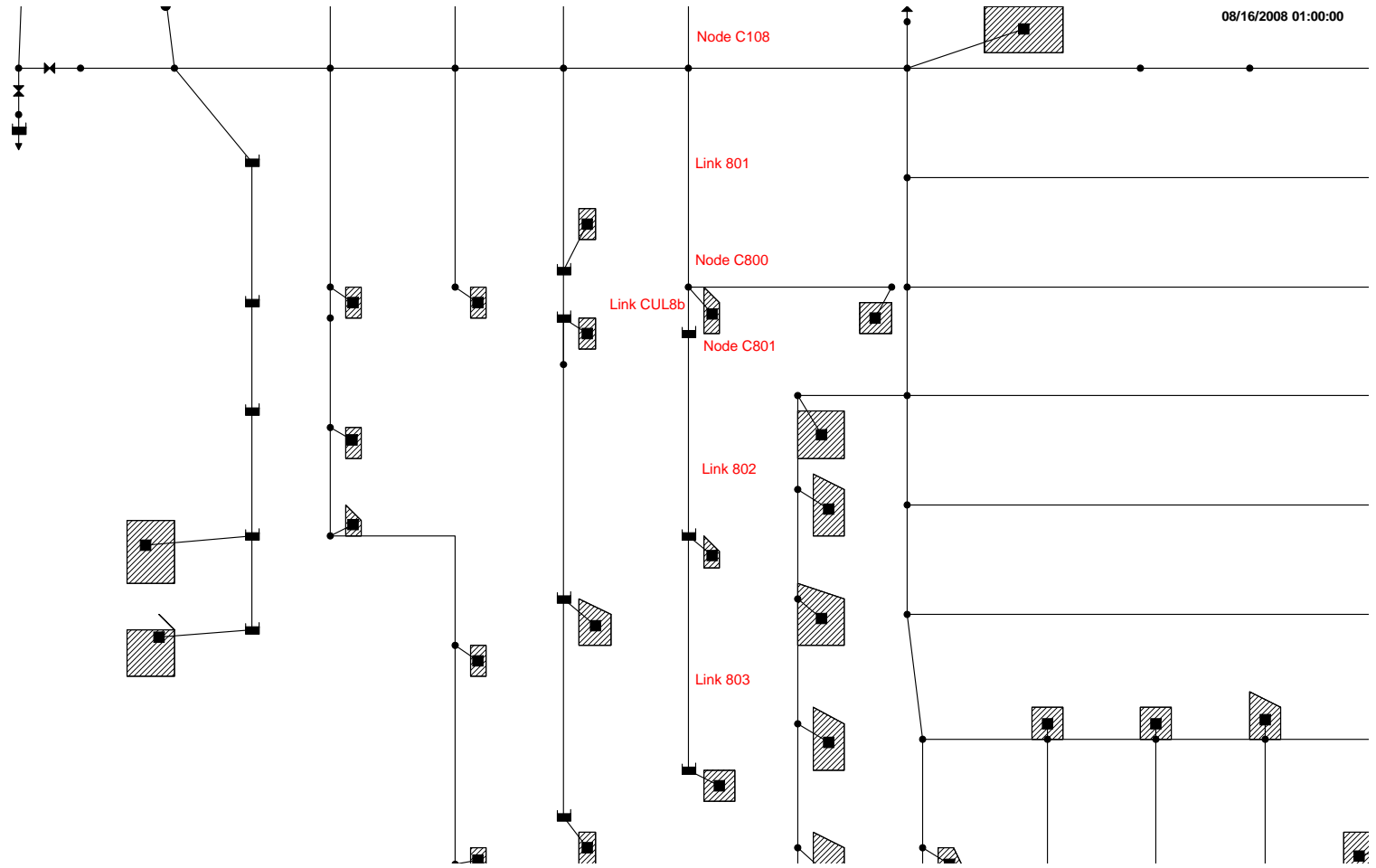


1:78545



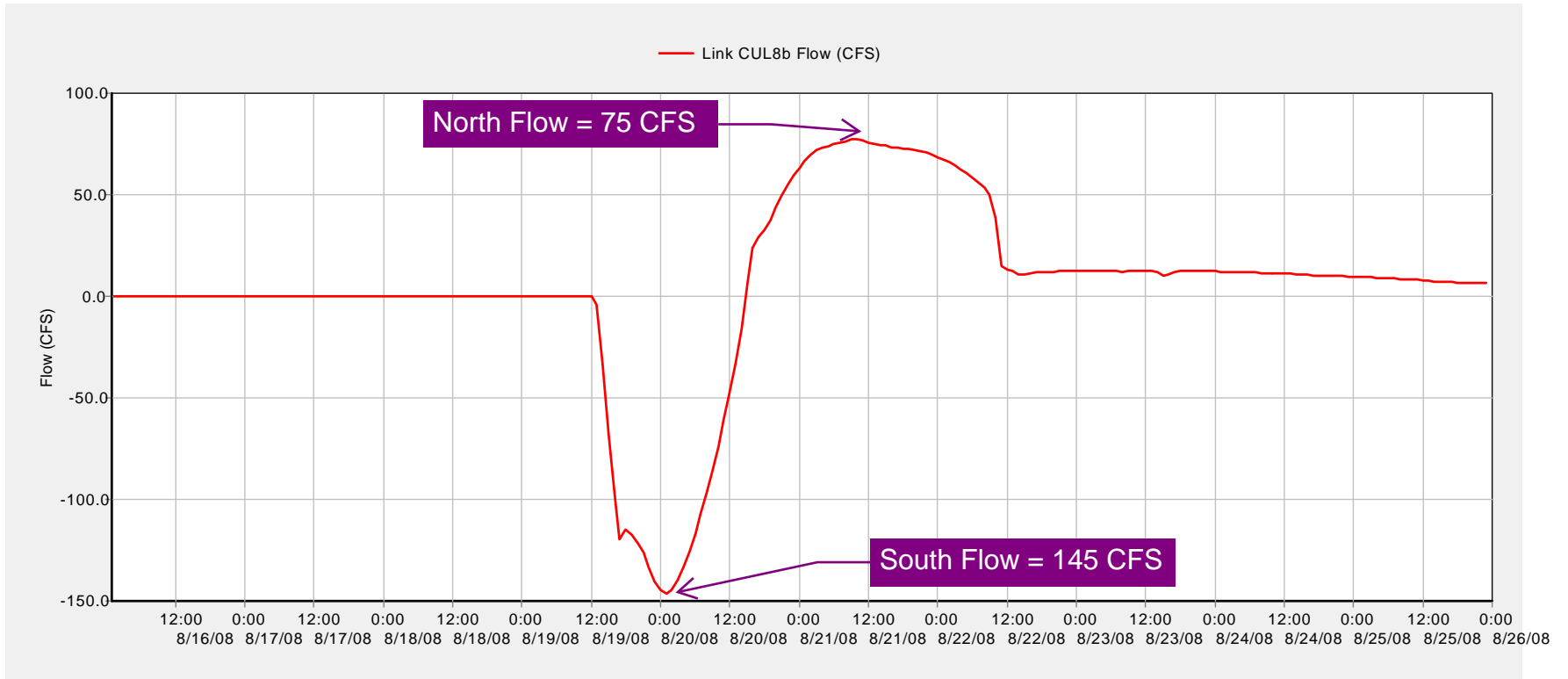
The St. Johns River Water Management District prepares and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided as is. Further documentation of this data can be obtained by contacting: St. Johns River Water Management District, Geographic Information Systems, Program Management, P.O. Box 1429, 4049 Reid Street, Palatka, Florida 32178-1429. Tel: (386) 329-4176.

MTWCD C-1 Rediversion Phase 1 - Interium Level of Service- January 2015



25-Yr Storm Event

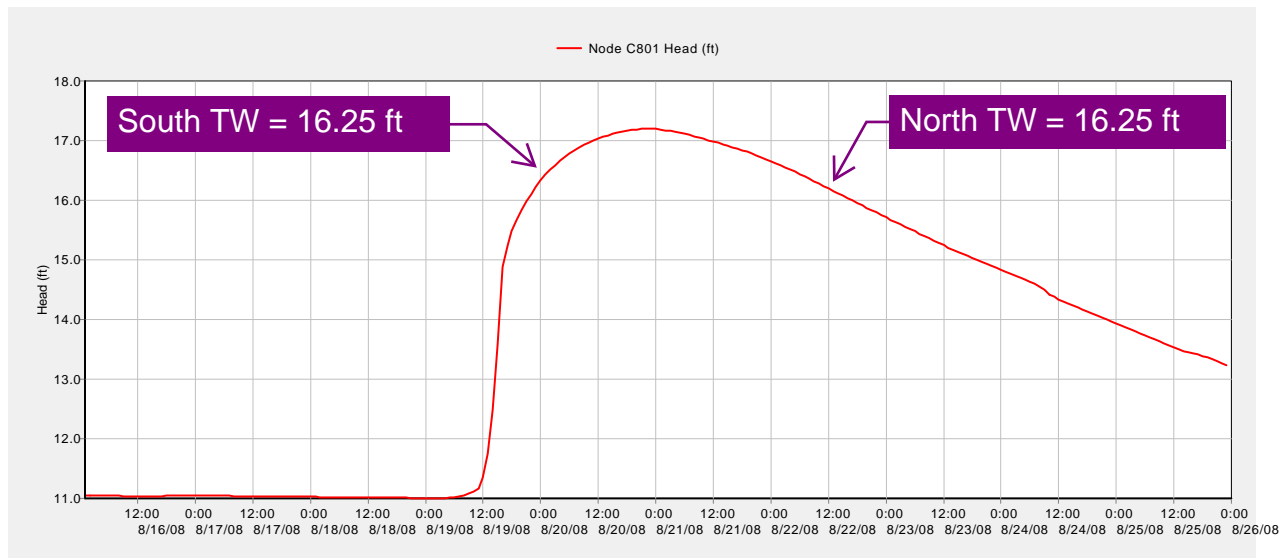
MTWCD C-1 Rediversion Phase 1 - Interium Level of Service- January 2015



-All notations in purple are DRMP additions.

100-Yr Storm Event

MTWCD C-1 Rediversion Phase 1 - Interim Level of Service- January 2015



-All notations in purple are DRMP additions.
-SWMM model data in NGVD 29.
-Data converted to NAVD 88 for hydraulic analysis using the following equation given on Survey, which is in NAVD 88:
$$\text{NAVD 88} = \text{NGVD 29} - 1.321$$

-North and South TW = 16.25 ft (NGVD 29) or 14.93 ft (NAVD 88)

Appendix B

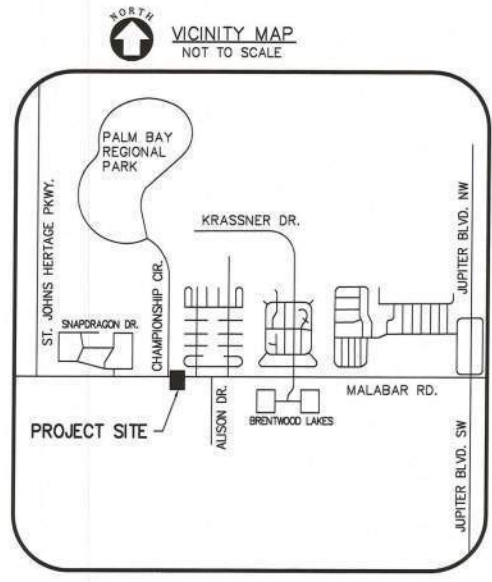
Topographic Survey from Brevard County

SPECIFIC PURPOSE SURVEY

MALABAR ROAD AT CHAMPIONSHIP CIRCLE CULVERT REPLACEMENT

BREVARD COUNTY, FLORIDA

SECTION 4, TOWNSHIP 29 SOUTH, RANGE 36 EAST



LEGEND	
	RIGHT OF WAY LINE
	SECTION LINE
	CENTERLINE
	PROPERTY LINE
	EASEMENT LINE
	TOE OF BANK
	TOP OF BANK
	CENTERLINE OF SWALE
	OVERHEAD WIRE
	WATER LINE
	SANITARY SEWER LINE
	RIP RAP HEADWALL
	CONCRETE
	ASPHALT PAVEMENT
	WATER VALVE
	SANITARY SEWER VALVE
	WOOD UTILITY POLE

ABBREVIATIONS	
BL	= BASELINE
B.O.B.	= BASIS OF COORDINATES
B.O.C.	= BASIS OF BEARING
CLS	= CENTERLINE SWALE
CPEP	= CORRUGATED POLYETHYLENE PIPE
ECMP	= ELLIPTICAL CORRUGATED METAL PIPE
EP	= EDGE OF PAVEMENT
ID	= IDENTIFICATION
LB	= LICENSED BUSINESS
N/F	= NOW OR FORMERLY
ORB	= OFFICIAL RECORDS BOOK
PLS	= PROFESSIONAL LAND SURVEYOR
PVC	= POLYVINYL CHLORIDE PIPE
RNG	= RANGE
TOB	= TOP OF BANK
TOE	= TOE OF BANK
TWP	= TOWNSHIP
WUP	= WOOD UTILITY POLE

SURVEY REPORT:

SPECIFIC PURPOSE SURVEY

THE SPECIFIC PURPOSE OF THIS SURVEY IS TO PROVIDE AND LOCATE A RIGHT OF WAY LINES AND RIGHT OF WAY CONTROL AND TO PROVIDE A TOPOGRAPHIC SURVEY TO PROVIDE SUFFICIENT INFORMATION FOR ENGINEERING DESIGN BY BREVARD COUNTY ENGINEERING AT THE EXISTING CULVERT CROSSING MALABAR ROAD JUST EAST OF CHAMPIONSHIP CIRCLE.

DATA SOURCES AND REFERENCES:

ALL DEED, MAP AND PLAT REFERENCES AS SHOWN HEREON.

- MELBOURNE-TILLMAN DRAINAGE DISTRICT DRAINAGE PLAN, SEPT. 11, 1961, REVISED 4/26/62, STATE OF FLORIDA, BREVARD COUNTY (ORIGINALLY DRAWN JAN. 1, 1929, REVISED DEC. 1937).
- MALABAR LAKES WEST SUBDIVISION, PHASE 1A AS RECORDED IN PLAT BOOK 43, PAGE 23.

EXCEPT AS NOTED, INSTRUMENTS OF RECORD PERTAINING TO ENCUMBRANCES SUCH AS EASEMENTS, RIGHTS OF WAY, COVENANTS, AGREEMENTS, AND RESTRICTIONS WERE NOT PROVIDED BY THE CLIENT. A SEARCH OF THE PUBLIC RECORDS WAS NOT PERFORMED BY THIS SURVEYOR AND NO TITLE REPORT WAS PROVIDED. NO OPINION OF TITLE, OWNERSHIP OR UNWRITTEN RIGHTS IS EXPRESSED OR IMPLIED. ALL PUBLIC RECORDS REFER TO THE PUBLIC RECORDS OF BREVARD COUNTY FLORIDA.

LIMITATIONS AND DISCREPANCIES:

A. PER THE ABOVE STATED MELBOURNE-TILLMAN DRAINAGE DISTRICT DRAINAGE PLAN, THE WIDTH OF CANAL NO. 8 SOUTH OF MALABAR ROAD IS 128 FEET. PER THE PLAT OF CISNA PARK ACCORDING TO PLAT BOOK 8, PAGE 30 AND PER THE PLAT OF MALABAR LAKES WEST SUBDIVISION, PHASE 1A ACCORDING TO PLAT BOOK 43, PAGE 23, THE WIDTH OF CANAL NO. 8 IS 140.00 FEET SOUTH OF MALABAR ROAD.

SURVEY NOTES:

- COORDINATES SHOWN HEREON ARE BASED ON GRID NORTH, FLORIDA STATE PLANE COORDINATE SYSTEM, EAST ZONE 0901, NORTH AMERICAN DATUM OF 1983 AND READJUSTED IN 2011(NAD83(2011)), REFERENCED TO THE FOLLOWING NATIONAL GEODETIC SURVEY CONTROL STATION:
 - "BREVARD GPS 1083 SOCCER", A FOUND ALUMINUM ALLOY ROD WITH LOGO CAP STAMPED "GPS 1083 SOCCER 2003". PID# = "D06889". LATITUDE = 27°59'57.52021"N, LONGITUDE = 080°43'45.74815"W, NORTHING = 1,332,550.37, EASTING = 743,495.53.
 - THE SCALE FACTOR AT THIS STATION IS 0.99994992. THE COMBINED FACTOR IS 0.99995332 AND THE CONVERGENCE IS +0°17'37.4".
 - UNLESS OTHERWISE NOTED, ALL DISTANCES SHOWN HEREON ARE GROUND DISTANCES.
- BEARINGS SHOWN HEREON ARE BASED ON GRID NORTH, FLORIDA STATE PLANE COORDINATE SYSTEM, EAST ZONE 0901, NORTH AMERICAN DATUM OF 1983 AND READJUSTED IN 2011(NAD83(2011)) AND SPECIFICALLY BASED ON THE MONUMENTED WEST LINE OF PORT MALABAR UNIT 41 ACCORDING TO PLAT BOOK 21, PAGE 36 AS BEING NORTH 00°39'16"E AS DETERMINED BY THEIR COORDINATE VALUES PER SAID FLORIDA STATE PLANE COORDINATE SYSTEM, EAST ZONE 0901.
- ELEVATIONS AND BENCHMARKS BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1983 (NAV83) AND IS BASED ON CLOSED VERTICAL CONTROL NETWORK WITH LINEAR CLOSURE THAT MEETS AND/OR EXCEEDS FLORIDA MINIMUM TECHNICAL STANDARDS CHAPTER 5J-17.
 - PRIMARY BENCHMARK: CITY OF PALM BAY BENCHMARK NO. 41-082 A FOUND PK NAIL IN THE NORTHWEST CORNER OF A DRAINAGE INLET AT THE SOUTHEAST CORNER OF MISSOURI ROAD NW AND FIRETHORN ROAD NW, ELEVATION = 19.509 FEET (NAV08B).
 - TO CALCULATE ELEVATIONS IN THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29) ADD 1.321 FEET TO THE NAV08B ELEVATIONS SHOWN HEREON (NGVD29 = NAV08B + 1.321).
- THE LOCATION OF UNDERGROUND UTILITIES HAVE BEEN DETERMINED BY HORIZONTAL FIELD LOCATIONS AS MARKED BY THE UTILITY OWNER OR THEIR REPRESENTATIVE. NOT ALL UTILITY COMPANIES PROVIDED FIELD MARKINGS. FIELD LOCATES WERE REQUESTED VIA SUNSHINE11 OF FLORIDA, INC. TICKET NUMBER 088002546. EXACT LOCATION OF THE UTILITY LINES HAVE NOT BEEN FIELD VERIFIED BY EXPOSURE OF THE UTILITY LINE AND THEREFORE THE ACCURACY OF UNDERGROUND UTILITIES AS SHOWN CANNOT BE DETERMINED. STORM SEWER PIPES SHOWN WITHOUT INVERTS ARE NOT ACCESSIBLE. CONTACT "SUNSHINE STATE ONE-CALL CENTER" PRIOR TO ANY EXCAVATION.
- FENCE LOCATIONS ARE TO THE CENTERLINE OF SUPPORT POST AT GROUND LEVEL, UNLESS OTHERWISE NOTED. OWNERSHIP OF FENCES IS NOT IMPLIED OR DETERMINED.

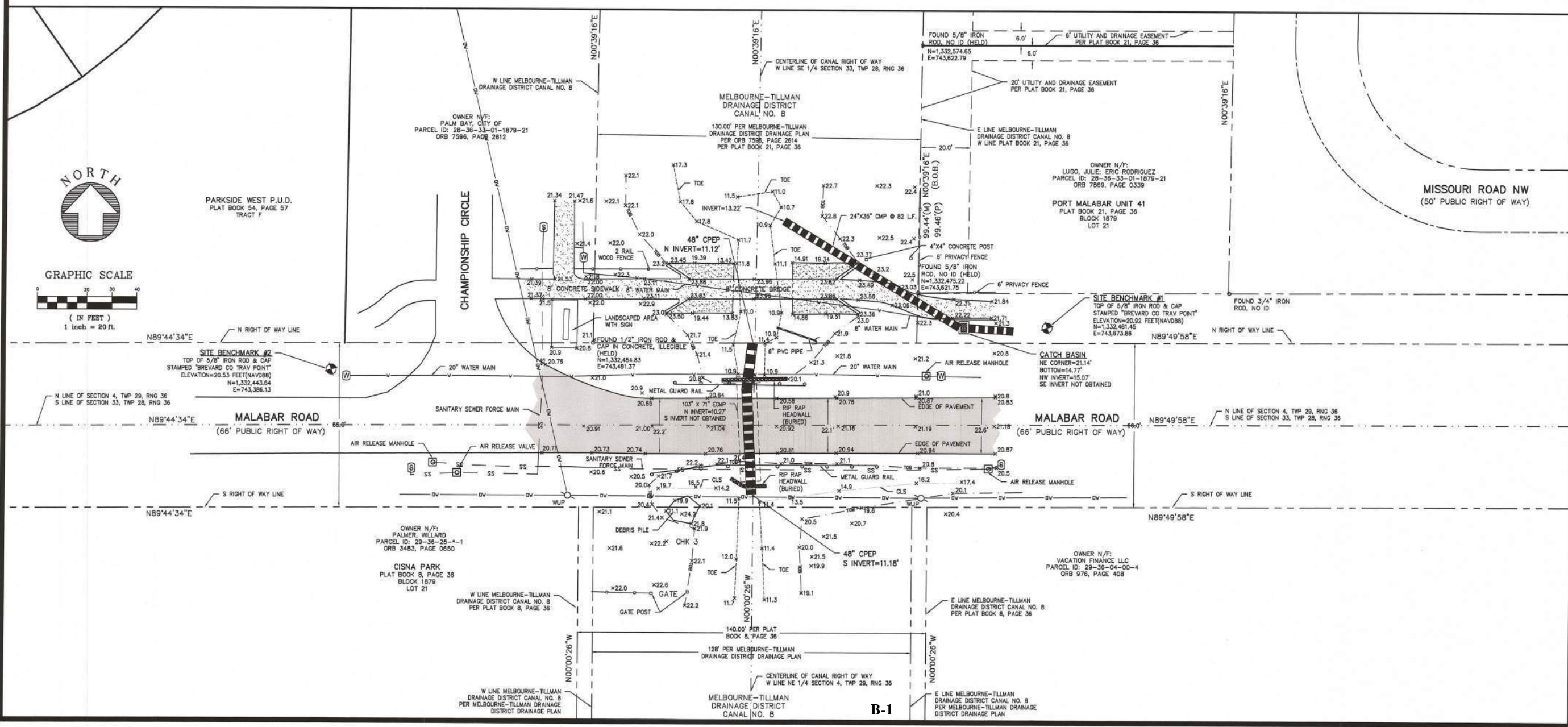
Brevard COUNTY
Public Works

SURVEYING & MAPPING DIVISION

2725 JUDGE FRAN JAMIESON WAY
BUILDING A, SUITE A220
VIERA, FL. 32940
PHONE (321)633-2080

SURVEY DATE: MARCH 30, 2018
SCALE: 1"=20'
PARTY CHIEF: G. GORDON
DRAWN BY: R. HENNING
CHECK BY: M. J. SWEENEY
FIELD BOOK: 617 PAGE: 44-54
PROJECT NUMBER: 17-04-052
DRAWING NAME: 293604_SP_1704052_MALABAR-CULVERT.dwg
SHEET: 1 OF 1

DATE	REVISION
09/21/18	ADJUSTED PIPE SIZES, ADDED 48" CPEP ON NORTH SIDE



I HEREBY CERTIFY THAT THIS SPECIFIC PURPOSE SURVEY WAS MADE UNDER MY RESPONSIBLE CHARGE AND MEETS THE MINIMUM TECHNICAL STANDARDS AS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN SUBPARAGRAPH 5J-17.051 + 5J-17.052(12), FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTION 472.027, FLORIDA STATUTES.

MICHAEL J. SWEENEY, PSM #4870
PROFESSIONAL SURVEYOR & MAPPER

REPRODUCTION OR ALTERATION OF THIS DRAWING WITHOUT PERMISSION BY THE SURVEYOR IS HEREBY FORBIDDEN.

THIS SURVEY IS PREPARED AND CONTROLLED BY THE SURVEYOR. THE EXCLUSIVE USE OF THE COUNTY AGENCY OR ANY OTHER AGENCY, STATE OR LOCAL, IN THE SERVICE OF BREVARD COUNTY, FLORIDA, IS NOT GUARANTEED. UNDER NO CIRCUMSTANCES SHALL THE SURVEYOR BE RESPONSIBLE FOR ANY DAMAGE TO PERSONS OR PROPERTY, INCLUDING BUT NOT LIMITED TO, DAMAGE TO THE SURVEYOR'S EQUIPMENT AND MATERIALS, CAUSED BY THE COUNTY AGENCY OR ANY OTHER AGENCY, STATE OR LOCAL, IN THE SERVICE OF BREVARD COUNTY, FLORIDA.

SPECIFIC PURPOSE SURVEY
MALABAR ROAD AT CHAMPIONSHIP CIRCLE
CULVERT REPLACEMENT

BREVARD COUNTY
ROAD AND BRIDGE DEPARTMENT

PREPARED FOR:
TWP: 29 SOUTH RANG: 36 EAST
SECTION: 04

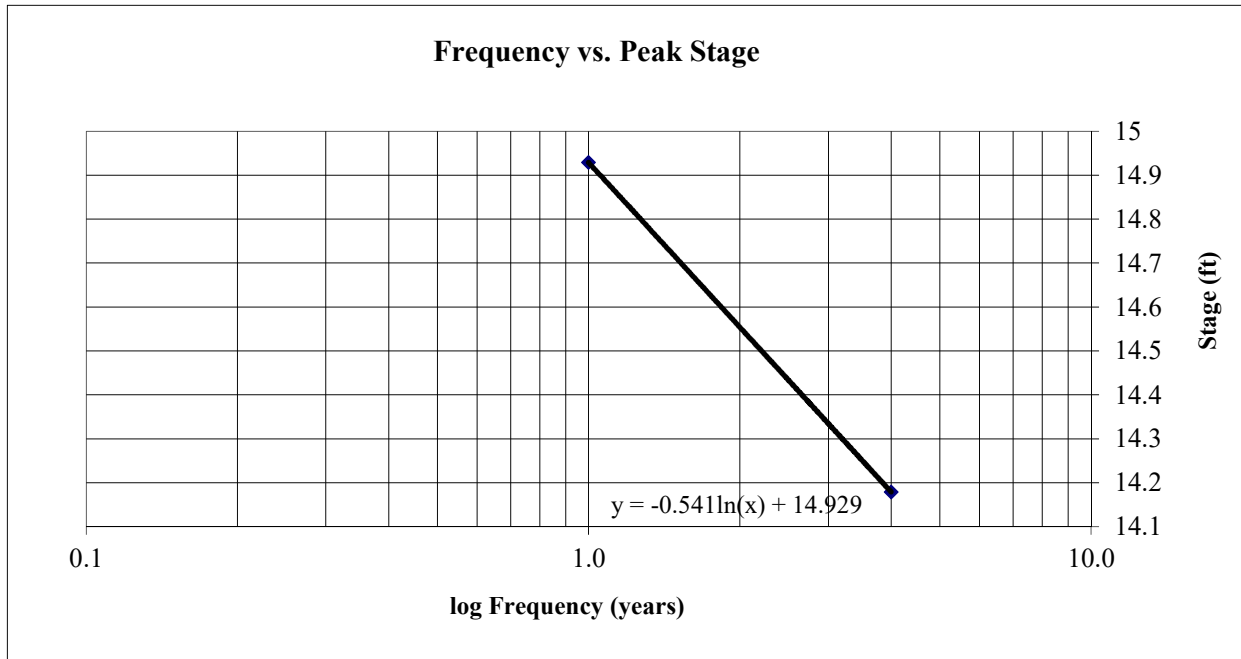
Appendix C

Culvert Hydraulic Analyses

Malabar Road Box Culvert Replacement Semi-log Linear Regression - Peak Stages

A logarithmic interpretation has been used to determine the peak stages for the 50-year and 500-year storm events.

Frequency (years)	Frequency %	Stage (ft)
25	4.0	14.18
100	1.0	14.93



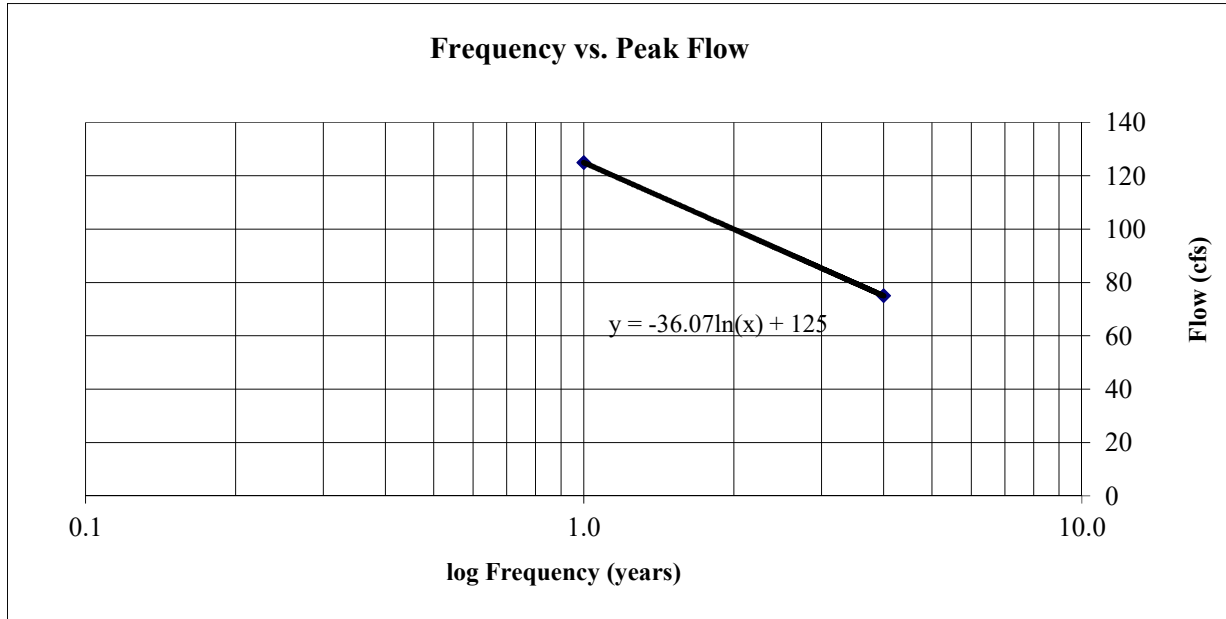
Estimate peak flow for 50-year and 500-year event substituting log(freq) for x in trendline equation.

Frequency (years)	Frequency %	Peak Stage (ft)
50	2.0	14.55
500	0.2	15.80

Malabar Road Box Culvert Replacement Semi-log Linear Regression - North Flows

A logarithmic interpretation has been used to determine the peak flows northward for the 50-year and 500-year storm events.

Frequency (years)	Frequency %	Flow (cfs)
25	4.0	75.00
100	1.0	125.00



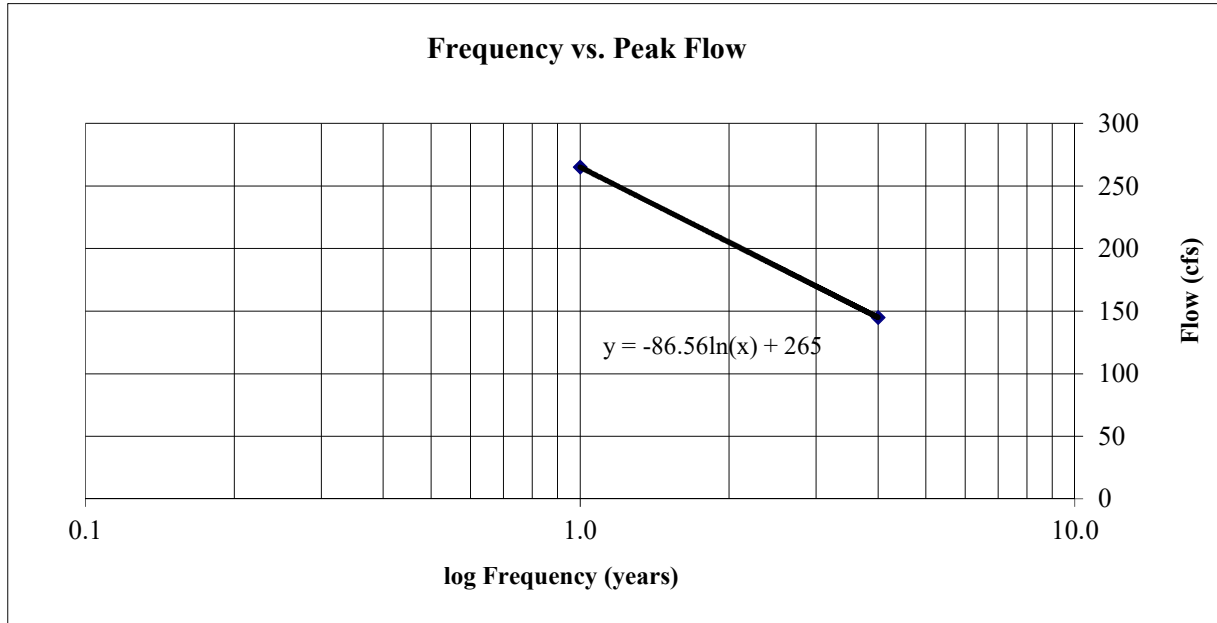
Estimate peak flow for 50-year and 500-year event substituting log(freq) for x in trendline equation.

Frequency (years)	Frequency %	Peak Flow (cfs)
50	2.0	100.00
500	0.2	183.05

Malabar Road Box Culvert Replacement Semi-log Linear Regression - South Flows

A logarithmic interpretation has been used to determine the peak flows southward for the 50-year and 500-year storm events.

Frequency (years)	Frequency %	Flow (cfs)
25	4.0	145.00
100	1.0	265.00



Estimate peak flow for 50-year and 500-year event substituting log(freq) for x in trendline equation.

Frequency (years)	Frequency %	Peak Flow (cfs)
50	2.0	205.00
500	0.2	404.32

Equivalency Table

DESIGN TABLE



CORRUGATED STEEL PIPE-ARCH

H-20 OR H-25 LOADING

EQUIV. DIAMETER (INCH)	SPAN X-RISE (INCH)	END AREA (Sq. Ft.)	MIN. GAGE ⁵	MIN. COVER ¹ (INCH)	MAX. COVER ⁴ (FEET)	WEIGHT (Lbs./Ft.)	PROFILE (INCH)
24	28x20	2.9	16	12	15	19	2-2/3x1/2
30	35x24	4.5	16	12	15	24	2-2/3x1/2
36	42x29	6.5	16	12	15	29	2-2/3x1/2
42	49x33	8.9	14	12	15	42	2-2/3x1/2
48	57x38	11.6	12	12	15	65	2-2/3x1/2
54	64x43	14.7	12	12	15	73	2-2/3x1/2
54	60x46	15.6	14	15	25	61	3x1 / 5x1
60	71x47	18.1	10	12	15	103	2-2/3x1/2
60	66x51	19.3	14	15	25	67	3x1 / 5x1
66	73x55	23.2	14	18	24	74	3x1 / 5x1
72	81x59	27.4	14	18	21	81	3x1 / 5x1
78	87x63	32.1	14	18	20	87	3x1 / 5x1
84	95x67	37.0	14	18	20	94	3x1 / 5x1
90	103x71	42.4	14	18	20	100	3x1 / 5x1
96	112x75	48.0	14	21	20	107	3x1 / 5x1
102	117x79	54.2	12	21	19	155	3x1 / 5x1
108	128x83	60.5	12	24	19	165	3x1 / 5x1
114	137x87	67.4	12	24	19	174	3x1 / 5x1
120	142x91	74.5	10	24	19	234	3x1 / 5x1
126	150x96 ⁶	82.3	10	30	19	247	3x1 / 5x1
132	157x101 ⁶	90.3	10	30	19	259	3x1 / 5x1
138	164x105 ⁶	98.7	10	30	19	270	3x1 / 5x1
144	171x110 ⁶	107.4	10	30	19	282	3x1 / 5x1

1. Minimum cover is measured from top of pipe to top of subgrade or top of rigid pavement. Minimum cover for heavy construction equipment or other excessive loading is 48 inches. H-20 or H-25 live loads are assumed in all cases.

4. Maximum height of cover is based on 2-ton/square foot corner soil bearing pressure. Heights of cover can be increased up to 100% with proportional increase in corner soil bearing pressure. Support under and around the haunch is critical for pipe-arch structures. Trench conditions to at least 12-inches above spring line with slurry cement or other flowable backfill material is recommended.

5. Minimum gage is based on conditions approaching maximum height of cover. With proper design and appropriate installation techniques, thinner gauges may be used when heights of cover are substantially reduced. (14-gage is minimum for 3"x1" and 5"x1" corrugation pipe-arch.)

6. Flexibility increases with span in pipe-arch structures. Backfill methods and materials must be carefully controlled to ensure proper installation of all pipe-arch structures, and special care must be taken with these larger sizes.

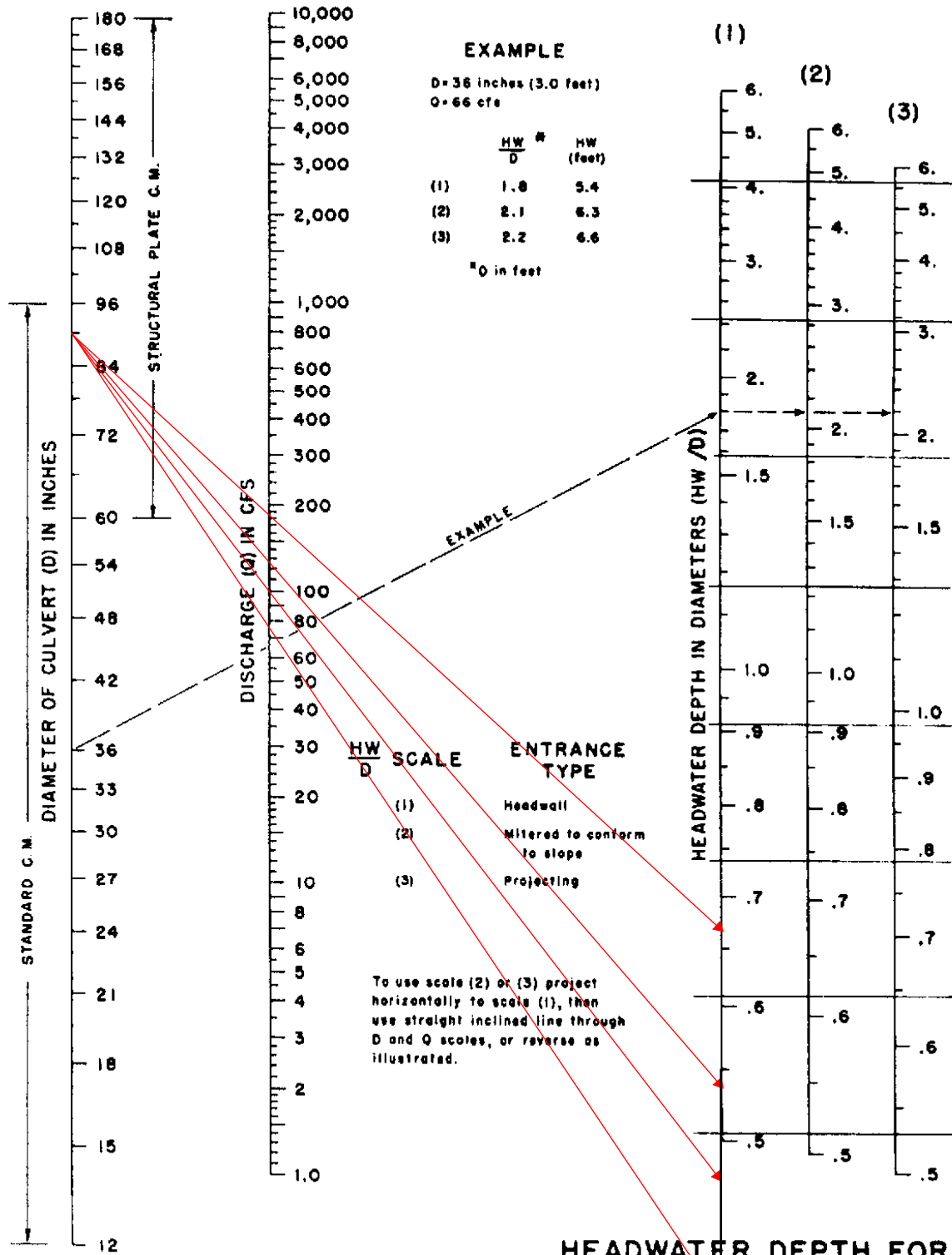
NOTE: Pipe-arch dimensions shown are nominal and should not be used to design headwall structures or for other uses where dimensions are critical. Actual dimensions will be "plus" in the rise dimension and "minus" in the span dimension. Contact your Pacific Corrugated sales engineer for manufacturing tolerances and layout details for pipe-arches, and for complete height of cover tables for all other corrugated pipe products.

The information in this brochure should be checked in detail by the professional engineer responsible for the project design to verify its accuracy; also, the assumptions and methods used to obtain the information should be reviewed to make certain they are applicable and suitable for the design.

Tables adapted from AISI Handbook of Steel Drainage and Construction Products

HW/D for 90" Round CMP - North Flows

CHART 2B



**HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL**

Malabar Road Box Culvert Replacement Culvert Hydraulic Analysis - North Flows (Pre)

PROJECT NO.: **0**
 PROJECT: **Malabar Road Crossing at C-8 Canal**
 SUBJECT: **Cross Drain Hydraulics - Pre**

PREPARED BY: Josh Miller
 CHECKED BY: John Minton
 Date: 10/26/2018

CROSS DRAIN: **CD-1** Station: **0**

HYDROLOGIC AND CHANNEL INFORMATION	SKETCH
Circular Pipe D = Diameter N = Number of Barrels	
Q ₂₅ = 75.0 TW EL. ₂₅ = 14.18 NAVD	
Q ₅₀ = 100.0 TW EL. ₅₀ = 14.55 NAVD	
Q ₁₀₀ = 125.0 TW EL. ₁₀₀ = 14.93 NAVD	
Q ₅₀₀ = 183.0 TW EL. ₅₀₀ = 15.80 NAVD	

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q (cfs)	N	SIZE D (ft)	HEADWATER COMPUTATION											CONTROLLING HW ELEV. (ft navd)	OUTLET VELOCITY (fps)	COMMENTS
				INLET CONTROL				OUTLET CONTROL									
				Q/N	HW/D	HW	K _e	H	d _c	(d _c +D)/2	TW	DTW	LS _o	HW			
90" CMP	75.0	1	7.5	75.0	0.50	3.75	0.5	0.07	2.13	4.82	3.91	4.82	0.08	4.80	15.16	1.70	25 year frequency
90" CMP	100.0	1	7.5	100.0	0.50	3.75	0.5	0.13	2.45	4.97	4.28	4.97	0.08	5.02	15.37	2.26	50 year frequency
90" CMP	125.0	1	7.5	125.0	0.54	4.05	0.5	0.20	2.74	5.12	4.66	5.12	0.08	5.24	15.59	2.83	100 year frequency
90" CMP	183.0	1	7.5	183.0	0.67	5.025	0.5	0.43	3.36	5.43	5.53	5.53	0.08	5.88	16.23	4.14	500 year frequency

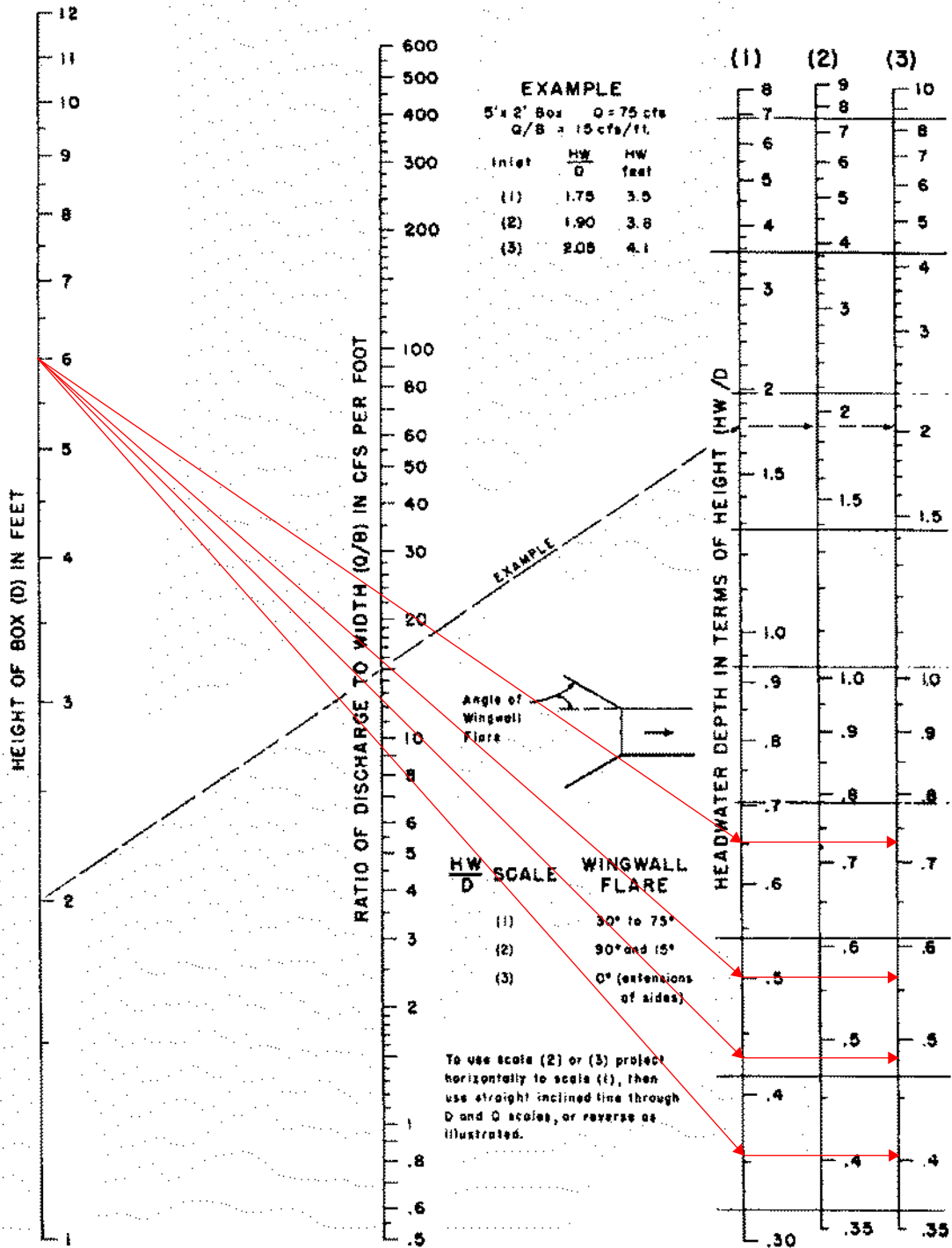
SUMMARY & RECOMMENDATION:
 In order to use this spreadsheet set up for round pipe cross-drains, a round pipe with a similar cross-sectional area to the current arch pipe was used.
 Based on equivalency table.

Note: This spreadsheet is set up for round pipe cross drains

NOTE (1): Use standard charts to determine HW/D, such as Figure 8-4 FDOT General Reference Volume 2A, 1987.

HW/D for 6x8 Box Culvert - North Flows

CHART 8B

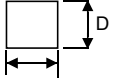
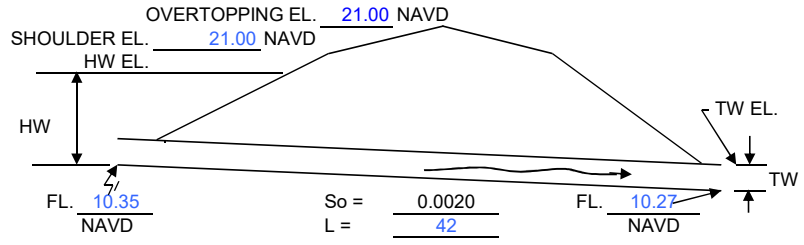


HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

Malabar Road Box Culvert Replacement Culvert Hydraulic Analysis - North Flows (Post)

PROJECT NO.: **0**
 PROJECT: **Malabar Road Crossing at C-8 Canal**
 SUBJECT: **Cross Drain Hydraulics - Post**
 CROSS DRAIN: **CD-1** Station: **0**

PREPARED BY: _____ Josh Miller
 CHECKED BY: _____ John Minton
 Date: 10/26/2018

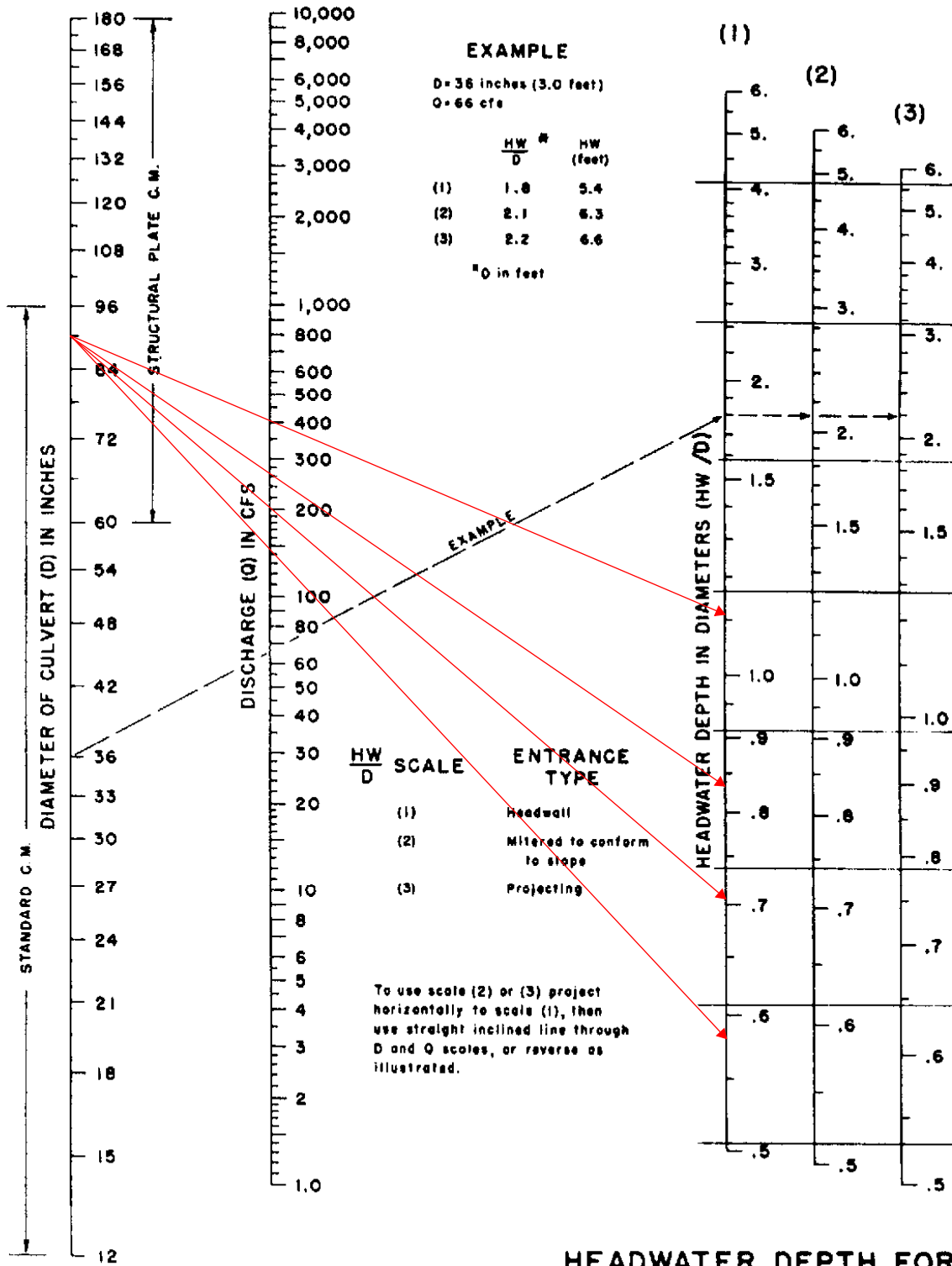
HYDROLOGIC AND CHANNEL INFORMATION				SKETCH																
 <p>D = Diameter or Height B = Span N = Number of Barrels</p> <p>Q₂₅ = 75.0 TW EL. ₂₅ = 14.18 NAVD Q₅₀ = 100.0 TW EL. ₅₀ = 14.55 NAVD Q₁₀₀ = 125.0 TW EL. ₁₀₀ = 14.93 NAVD Q₅₀₀ = 183.0 TW EL. ₅₀₀ = 15.80 NAVD</p>																				
CULVERT DESCRIPTION (ENTRANCE TYPE)	Q (cfs)	N	SIZE		HEADWATER COMPUTATION											CONTROLLING HW ELEV. (ft navd)	OUTLET VELOCITY (fps)	COST (\$)	COMMENTS	
			D (ft)	B (ft)	INLET CONTROL				OUTLET CONTROL											
					Q/B	HW/D	HW	K _e	H	d _c	(d _c +D)/2	TW	DTW	LS _o	HW					
6' x 8'	75	1	6.0	8.0	9.4	0.40	2.40	0.2	0.05	1.40	3.70	3.91	3.91	0.08	3.87	14.23	1.6		25 Year	
6' x 8'	100	1	6.0	8.0	12.5	0.48	2.88	0.2	0.09	1.69	3.85	4.28	4.28	0.08	4.28	14.64	2.1		50 Year	
6' x 8'	125	1	6.0	8.0	15.6	0.57	3.42	0.2	0.14	1.96	3.98	4.66	4.66	0.08	4.71	15.07	2.6		100 Year	
6' x 8'	183	1	6.0	8.0	22.9	0.73	4.38	0.2	0.29	2.53	4.27	5.53	5.53	0.08	5.74	16.09	3.8		500 Year	
SUMMARY & RECOMMENDATION: (HW/D from HDS-5 Culvert Charts)																				

Note: This spreadsheet is set up for box culvert cross drains

NOTE (1): Use standard charts to determine HW/D, such as Figure 8-4 FDOT General Reference Volume 2A, 1987.

HW/D for 90" Round CMP - South Flows

CHART 2B



**HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL**

Malabar Road Box Culvert Replacement Culvert Hydraulic Analysis - South Flows (Pre)

PROJECT NO.: **0**
 PROJECT: **Malabar Road Crossing at C-8 Canal**
 SUBJECT: **Cross Drain Hydraulics - Pre**
 CROSS DRAIN: **CD-1** Station: **0**

PREPARED BY: _____ Josh Miller
 CHECKED BY: _____ John Minton
 Date: 10/26/2018

HYDROLOGIC AND CHANNEL INFORMATION	SKETCH												
Circular Pipe D = Diameter N = Number of Barrels													
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Q₂₅ = 145.0</td> <td style="width: 33%;">TW EL. _{.25} = 14.18</td> <td style="width: 33%;">NAVD</td> </tr> <tr> <td>Q₅₀ = 205.0</td> <td>TW EL. _{.50} = 14.55</td> <td>NAVD</td> </tr> <tr> <td>Q₁₀₀ = 265.0</td> <td>TW EL. _{.100} = 14.93</td> <td>NAVD</td> </tr> <tr> <td>Q₅₀₀ = 404.0</td> <td>TW EL. _{.500} = 15.80</td> <td>NAVD</td> </tr> </table>	Q ₂₅ = 145.0	TW EL. _{.25} = 14.18	NAVD	Q ₅₀ = 205.0	TW EL. _{.50} = 14.55	NAVD	Q ₁₀₀ = 265.0	TW EL. _{.100} = 14.93	NAVD	Q ₅₀₀ = 404.0	TW EL. _{.500} = 15.80	NAVD	
Q ₂₅ = 145.0	TW EL. _{.25} = 14.18	NAVD											
Q ₅₀ = 205.0	TW EL. _{.50} = 14.55	NAVD											
Q ₁₀₀ = 265.0	TW EL. _{.100} = 14.93	NAVD											
Q ₅₀₀ = 404.0	TW EL. _{.500} = 15.80	NAVD											

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	N	SIZE	HEADWATER COMPUTATION											CONTROLLING HW ELEV.	OUTLET VELOCITY	COMMENTS
				INLET CONTROL					OUTLET CONTROL								
				D	Q/N	HW/D	HW	K _e	H	d _c	(d _c +D)/2	TW	DTW	LS _o			
(cfs)	(ft)	(1)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft navd)	(fps)			
90" CMP	145.0	1	7.5	145.0	0.58	4.35	0.5	0.27	2.96	5.23	3.83	5.23	-0.08	5.59	15.86	3.28	25 year frequency
90" CMP	205.0	1	7.5	205.0	0.71	5.325	0.5	0.54	3.57	5.54	4.20	5.54	-0.08	6.16	16.43	4.64	50 year frequency
90" CMP	265.0	1	7.5	265.0	0.84	6.3	0.5	0.91	4.12	5.81	4.58	5.81	-0.08	6.80	17.07	6.00	100 year frequency
90" CMP	404.0	1	7.5	404.0	1.11	8.325	0.5	2.10	5.26	6.38	5.45	6.38	-0.08	8.57	18.84	9.14	500 year frequency

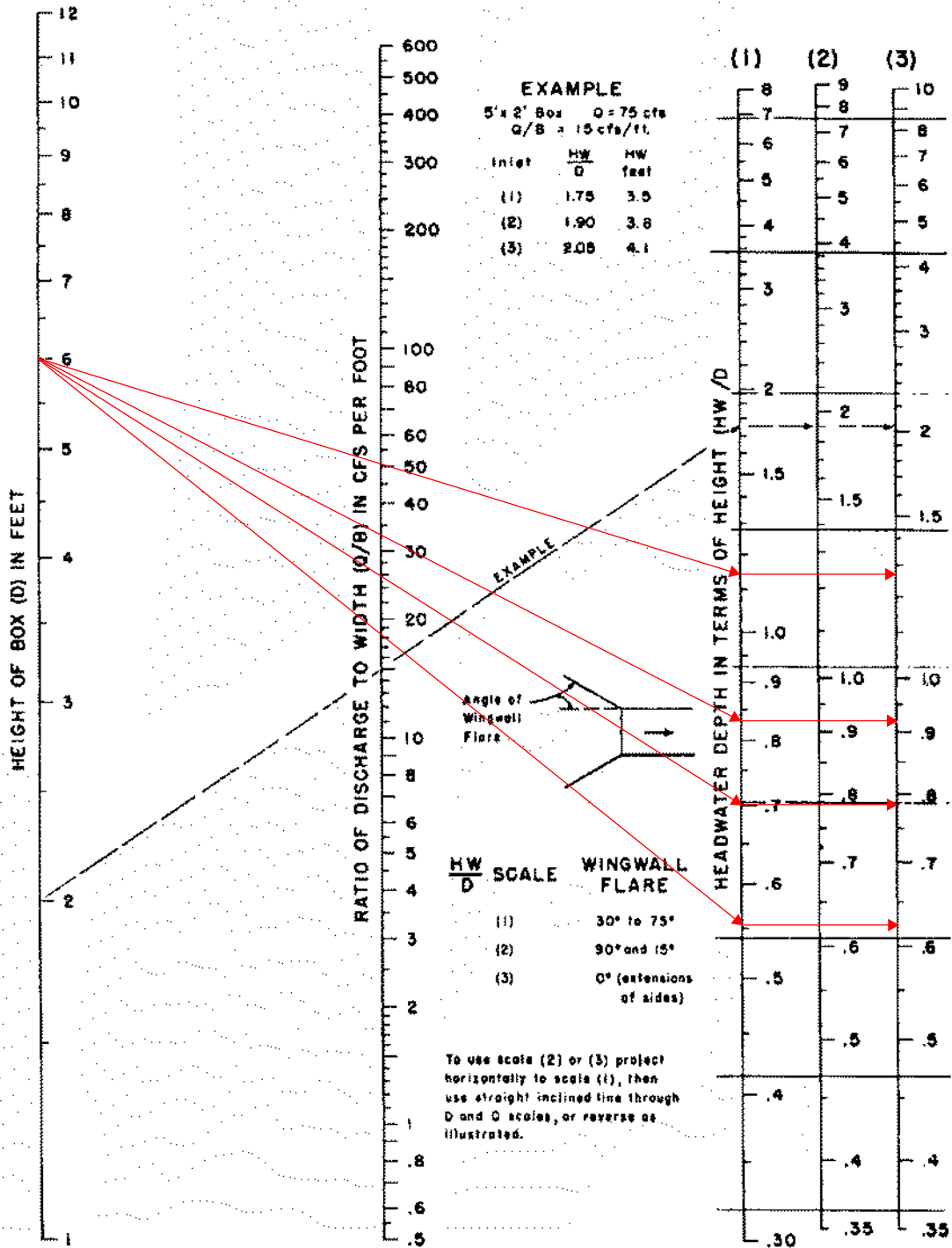
SUMMARY & RECOMMENDATION:
 In order to use this spreadsheet set up for round pipe cross-drains, a round pipe with a similar cross-sectional area to the current arch pipe was used.
 Based on equivalency table.

Note: This spreadsheet is set up for round pipe cross drains

NOTE (1): Use standard charts to determine HW/D, such as Figure 8-4 FDOT General Reference Volume 2A, 1987.

HW/D for 6x8 Box Culvert - South Flows

CHART 8B



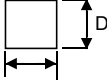
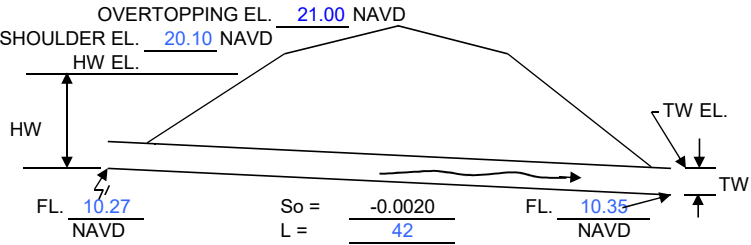
HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

Malabar Road Box Culvert Replacement Culvert Hydraulic Analysis - South Flows (Post)

PROJECT NO.: **0**
 PROJECT: **Malabar Road Crossing at C-8 Canal**
 SUBJECT: **Cross Drain Hydraulics - Post**

PREPARED BY: Josh Miller
 CHECKED BY: John Minton
 Date: 10/26/2018

CROSS DRAIN: **CD-1** Station: **0**

HYDROLOGIC AND CHANNEL INFORMATION										SKETCH															
					D = Diameter or Height B = Span N = Number of Barrels																				
Q ₂₅ = 145.0		TW EL. ₂₅ = 14.18 NAVD		Q ₅₀ = 205.0		TW EL. ₅₀ = 14.55 NAVD		Q ₁₀₀ = 265.0		TW EL. ₁₀₀ = 14.93 NAVD		Q ₅₀₀ = 404.0		TW EL. ₅₀₀ = 15.80 NAVD											
CULVERT DESCRIPTION (ENTRANCE TYPE)	Q (cfs)	N	SIZE		HEADWATER COMPUTATION											CONTROLLING HW ELEV. (ft navd)	OUTLET VELOCITY (fps)	COST (\$)	COMMENTS						
			D (ft)	B (ft)	INLET CONTROL					OUTLET CONTROL															
					Q/B	HW/D	HW	K _e	H	d _c	(d _c +D)/2	TW	DTW	LS _o	HW										
6' x 8'	145	1	6.0	8.0	18.1	0.63	3.78	0.2	0.18	2.17	4.08	3.83	4.08	-0.08	4.35	14.62	3.0		25 Year						
6' x 8'	205	1	6.0	8.0	25.6	0.78	4.68	0.2	0.36	2.73	4.37	4.20	4.37	-0.08	4.81	15.08	4.3		50 Year						
6' x 8'	265	1	6.0	8.0	33.1	0.92	5.52	0.2	0.61	3.24	4.62	4.58	4.62	-0.08	5.31	15.79	5.5		100 Year						
6' x 8'	404	1	6.0	8.0	50.5	1.27	7.62	0.2	1.41	4.29	5.15	5.45	5.45	-0.08	6.94	17.89	8.4		500 Year						
SUMMARY & RECOMMENDATION: (HW/D from HDS-5 Culvert Charts), 500 Year overtops so values not considered.																									

Note: This spreadsheet is set up for box culvert cross drains

NOTE (1): Use standard charts to determine HW/D, such as Figure 8-4 FDOT General Reference Volume 2A, 1987.

Malabar Road Box Culvert Replacement Culvert Hydraulic Analysis - South Flows (Pre vs Post)

PROJECT NO.: **0**
 PROJECT: **Malabar Road Crossing at C-8 Canal**
 SUBJECT: **Cross Drain Hydraulics - Pre vs Post**

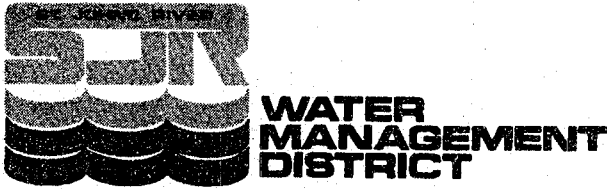
CROSS DRAIN: **CD-1** Station: **0**

PREPARED BY: Josh Miller
 CHECKED BY: John Minton
 Date: 10/26/2018

HYDROLOGIC AND CHANNEL INFORMATION										SKETCH									
Circular Pipe D = Diameter or Height N = Number of Barrels 																			
Q ₂₅ = 145 cfs					TW EL. ₂₅ = 14.18					NAVD									
Q ₅₀ = 205 cfs					TW EL. ₅₀ = 14.55					NAVD									
Q ₁₀₀ = 265 cfs					TW EL. ₁₀₀ = 14.93					NAVD									
Q ₅₀₀ = 404 cfs					TW EL. ₅₀₀ = 15.80					NAVD									
CULVERT DESCRIPTION (ENTRANCE TYPE)	Q (cfs)	N	HEADWATER COMPUTATION										COMMENTS						
			SIZE D (ft)	Twpre (ft navd)	Hwpre (ft navd)	Vel (fps)	Twpost (ft navd)	Hwpost (ft navd)	Vel (fps)	Inc. HW (ft)									
6' x 8'	145	1	6.0	14.18	15.86	3.28	14.18	14.62	3.0	-1.24					25 Year				
6' x 8'	205	1	6.0	14.55	16.43	4.64	14.55	15.08	4.3	-1.35					50 Year				
6' x 8'	265	1	6.0	14.93	17.07	6.00	14.93	15.79	5.5	-1.28					100 Year				
6' x 8'	404	1	6.0	15.80	18.84	9.14	15.80	17.89	8.4	-0.95					500 Year				
SUMMARY & RECOMMENDATION: 500 Year overtops so values not considered.																			

G.6

Permit No. 62395-1



Henry Dean, Executive Director
John R. Wehle, Assistant Executive Director

POST OFFICE BOX 1429

PALATKA, FLORIDA 32178-1429

TELEPHONE 904-329-4500 SUNCOM 904-880-4500
TDD 904-329-4450 TDD SUNCOM 880-4450
FAX (Executive) 329-4125 (Legal) 329-4485 (Permitting) 329-4315 (Administration/Finance) 329-4508

618 E. South Street
Orlando, Florida 32801
407-897-4300
TDD 407-897-5960

7775 Baymeadows Way
Suite 102
Jacksonville, Florida 32256
904-730-6270
TDD 904-448-7900

SERVICE CENTERS

PERMITTING:
305 East Drive
Melbourne, Florida 32904
407-984-4940
TDD 407-722-6368

OPERATIONS:
2133 N. Wickham Road
Melbourne, Florida 32935-8109
407-752-3100
TDD 407-752-3102

October 28, 1999

CITY OF PALM BAY
ATTN: SUSAN HANN, P.E.
120 MALABAR ROAD, SE
PALM BAY, FLORIDA 32907

Subject: Permit Number 40-009-62395-1

Dear Sir/Madam:

Enclosed is your general permit as authorized by the staff of the St. Johns River Water Management District on October 28, 1999.

This permit is a legal document and should be kept with your other important documents. The attached MSSW/Stormwater As-Built Certification Form should be filled in and returned to the Palatka office within thirty days after the work is completed. By so doing, you will enable us to schedule a prompt inspection of the permitted activity.

In addition to the MSSW/Stormwater AS-Built Certification Form, your permit also contains conditions, which require submittal of additional information. All information submitted as compliance to permit conditions must be submitted to the Palatka office address.

Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state and/or local agencies asserting concurrent jurisdiction for this work.

Please be advised that the District has not published a notice in the newspaper advising the public that it is issuing a permit for this proposed project. Publication, using the District form, notifies members of the public (third parties) of their rights to challenge the issuance of the general permit. If proper notice is give by publication, third parties have a 21 day time limit on the time they have to file a petition opposing the issuance of the permit. If you do not publish, a party's right to challenge the issuance of the general permit extends for an indefinite period of time. If you wish to have certainty that the period for filing such a challenge is closed, then you may publish, at your own expense, such a notice in a newspaper of general circulation. A copy of the form of the notice and a list of newspapers of general circulation is attached for your use.

Dan Roach, CHAIRMAN
FERNANDINA BEACH
Jeff K. Jennings
MAITLAND

Duane Ottenstroer, TREASURER
SWITZERLAND
William M. Segal
MAITLAND

Otis Mason, SECRETARY
ST. AUGUSTINE
Ometrias D. Long
APOPKA

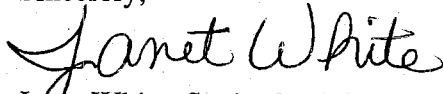
William Kerr
MELBOURNE BEACH
Clay Albright
EAST LAKE WEIR

Reid Hughes
DAYTONA BEACH

In the event you sell your property, the permit will be transferred to the new owner, if we are notified by you within thirty days of the sale. Please assist us in this matter so as to maintain a valid permit for the new property owner.

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,



Janet White, Senior Permit Data Technician
Permit Data Services Division – Melbourne

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

CC: District Files

FRAZIER ENGINEERING, INC.
ATTN: JOHN FRAZIER
1682 N. HARBOR CITY BOULEVARD
MELBOURNE, FLORIDA 32935

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO.: 40-009-62395-1

DATE ISSUED: OCTOBER 28, 1999

PROJECT NAME: MALABAR PEDESTRIAN BRIDGES C-8, C-9 AND C-10

A PERMIT AUTHORIZING:

CONSTRUCTION OF THREE 8-FEET WIDE PEDESTRAIN BRIDGES ADJACENT TO MALABAR ROAD. THE BRIDGES WILL CROSS MELBOURNE TILLMAN CANALS NUMBER 8, 9, AND 10.

LOCATION:

Section 33 and 34, Township 28 South, Range 36 East
Brevard County

ISSUED TO:

CITY OF PALM BAY
ATTN: SUSAN HANN, P.E.
120 MALABAR ROAD, SE
PALM BAY, FLORIDA 32907

Permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to permittee any property rights nor any rights or privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This Permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes:

PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated OCTOBER 28, 1999

AUTHORIZED BY: St. Johns River Water Management District

Department of Resource Management

By:


(SERVICE CENTER DIRECTOR - MELBOURNE)
JOHN JUILIANNA

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 40-009-62395-1
CITY OF PALM BAY

1. All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activities and the conditions for undertaking that activity shall constitute a violation of this permit.
2. This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by District staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.
3. Activities approved by this permit shall be conducted in a manner, which do not cause violations of state water quality standards.
4. Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in Chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which case the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specifications in Chapter 6 of the Florida Land Development Manual: A Guide To Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.
5. Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.
6. At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the District a Construction Commencement Notice Form No. 40C-4.900(3) indicating the actual start date and the expected completion date.
7. When the duration of construction will exceed one year, the permittee shall submit construction status reports to the District on an annual basis utilizing an annual Status Report Form No. 40C-4.900(4). These forms shall be submitted during June of each year.

8. For those systems which will be operated or maintained by an entity which will require an easement or deed restriction in order to provide that entity with the authority necessary to operate or maintain the system, such easement or deed restriction, together with any other final operation or maintenance documents as are required by Subsections 7.1.1. through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, must be submitted to the District for approval. Documents meeting the requirements set forth in these Subsections of the Applicants Handbook will be approved. Deed restrictions, easements and other operation and maintenance documents which require recordation either with the Secretary of State or the Clerk of the Circuit Court must be so recorded prior to lot or unit sales within the project served by the system, or upon completion of construction of the system, whichever occurs first. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the District when maintenance operation of the system is accepted by the local governmental entity. Failure to submit the appropriate final documents referenced in this paragraph will result in the permittee remaining liable for carrying out maintenance and operation of the permitted system.
9. Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government.
10. Within 30 days after completion of construction of the permitted system, or independent portion of the system, the certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing As-Built Certification Form 40C-1.81(13) or 40C-1.181(14) supplied with this permit. When the completed system differs substantially from the permitted plans, any substantial deviations shall be noted and explained and two copies of as-built drawings submitted to the District. Submittal of the completed form shall serve to notify the District that the system is ready for inspection. Statement of completion and certification shall be based on the on-site observation of construction (conducted by the registered professional engineer, or other appropriate individual as authorized by law, or under his her direct supervision) or review of as-built drawings for the purpose of determining if the work was completed in compliance with approved plans and specifications. As-built drawings shall be the permitted drawings revised to reflect any changes made during construction. Both the original and any revised specifications must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawing. All surveyed dimensions and elevations shall be certified by a registered surveyor. The following information, at a minimum, shall be certified on the as-built drawings:
 - A. Dimensions and elevations of all discharge structures including all weirs, slots, gates, pumps, pipes, and oil and grease skimmers;
 - B. Locations, dimensions, and elevations of all filter, exfiltration, or underdrain systems including cleanouts, pipes, connections to control structures, and points of discharge to the receiving waters;

- C. Dimensions, elevations, contours, or cross-sections of all treatment storage areas sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems, when appropriate;
 - D. Dimensions, elevations, contours, final grades, or cross-sections of the system to determine flow directors and conveyance of runoff to the treatment system;
 - E. Dimensions, elevations, contours, final grades, or cross-sections of all conveyance systems utilized to convey off-site runoff around the system;
 - F. Existing water elevations(s) and the date determined; and
 - G. Elevation and location of benchmark(s) for the survey.
11. The operation phase of this permit shall not become effective until the permittee has complied with the requirements of general condition no. 9 above, the District determines the system to be in compliance with the permitted plans, and the entity approved by the District in accordance with Subsections 7.1.1. through 7.1.4 of the Applicants Handbook: Management and Storage of Surface Waters, accepts responsibility for operation and maintenance of the system. The permit may not be transferred to such an approved operation and maintenance entity until the operation phase of the permit become effective. Following inspection and approval of the permitted system by the District, the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to Section 7.1 of the Applicants Handbook: Management and Storage of Surface Waters, the permittee shall be liable for compliance with the terms of the permit.
12. Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the District of the changes prior to implementation so that a determination can be made whether a permit modification is required.
13. This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and Chapter 40C-4 or Chapter 40C-40, F.A.C.
14. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered specifically approved unless a specific condition of this permit or a formal determination under Section 373.421(2), F.S., provides otherwise.
16. The permittee shall notify the District in writing within 30 days of any sale, conveyance, or other transfer or ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of Section 40C-1.612, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to the sale conveyance or other transfer.
17. Upon reasonable notice to the permittee, District authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.
18. If historical or archeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the District.
19. The permittee shall immediately notify the District in writing of any previously submitted information that is later discovered to be inaccurate.
20. This permit for construction will expire five years from the date of issuance.
21. The proposed surface water management system must be constructed and operated in accordance with the plans received by the District on October 13, 1999.

NOTICE OF RIGHTS

1. A person whose substantial interests are or may be determined has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District), or may choose to pursue mediation as an alternative remedy under Sections 120.569 and 120.573, Florida Statutes, before the deadline for filing a petition. Choosing mediation will not adversely affect the rights to a hearing if mediation does not result in a settlement. The procedures for pursuing mediation are set forth in Sections 120.569 and 120.57, Florida Statutes, and Rules 28-106.111 and 28-106.401-.405, Florida Administrative Code. Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed at the office of the District Clerk at District Headquarters, P. O. Box 1429 Palatka, Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) within twenty-six (26) days of the District depositing notice of District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail actual notice). A petition must comply with Chapter 28-106, Florida Administrative Code.
2. If the Governing Board takes action which substantially differs from the notice of District decision, a person whose substantial interests are or may be determined has the right to request an administrative hearing or may choose to pursue mediation as an alternative remedy as described above. Pursuant to District Rule 40C-1.1007, Florida Administrative Code, the petition must be filed at the office of the District Clerk at the address described above, within twenty-six (26) days of the District depositing notice of final District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of its final agency action (for those persons to whom the District does not mail actual notice). Such a petition must comply with Rule Chapter 28-106, Florida Administrative Code.
3. A substantially interested person has the right to a formal administrative hearing pursuant to Sections 120.569 and 120.57(1), Florida Statutes, where there is a dispute between the District and the party regarding an issue of material fact. A petition for formal hearing must comply with the requirements set forth in Rule 28-106.201, Florida Administrative Code.
4. A substantially interested person has the right to an informal hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.
5. A petition for an administrative hearing is deemed filed upon delivery of the petition to the District Clerk at the District Headquarters in Palatka, Florida.
6. Failure to file a petition for an administrative hearing, within the requisite time frame shall constitute a waiver of the right to an administrative hearing (Section 28-106.111, Florida Administrative Code).
7. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, and Chapter 28-106, Florida Administrative Code, and Section 40C-1.1007, Florida Administrative Code.
8. An applicant with a legal or equitable interest in real property who believes that a District permitting action is unreasonable or will unfairly burden the use of his property, has the right to, within 30 days of receipt of notice of the District's written decision regarding a permit application, apply for a special master proceeding under Section 70.51, Florida Statutes, by filing a written request for relief at the office of the District Clerk located at District headquarters, P. O. Box 1429, Palatka, FL 32178-1429 (4049 Reid St., Palatka, FL 32177). A request for relief must contain the information listed in Subsection 70.51(6), Florida Statutes.
9. A timely filed request for relief under Section 70.51, Florida Statutes, tolls the time to request an administrative hearing under paragraph no. 1 or 2 above (Paragraph 70.51(10)(b), Florida Statutes). However, the filing of a request for an administrative hearing under paragraph no. 1 or 2 above waives the right to a special master proceeding (Subsection 70.51(10)(b), Florida Statutes).

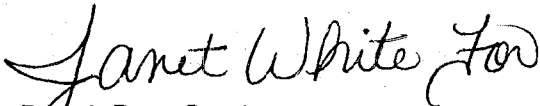
10. Failure to file a request for relief within the requisite time frame shall constitute a waiver of the right to a special master proceeding (Subsection 70.51(3), Florida Statutes).
11. Any substantially affected person who claims that final action of the District constitutes an unconstitutional taking of property without just compensation may seek review of the action in circuit court pursuant to Section 373.617, Florida Statutes, and the Florida Rules of Civil Procedures, by filing an action in circuit court within 90 days of rendering of the final District action, (Section 373.617, Florida Statutes).
12. Pursuant to Section 120.68, Florida Statutes, a person who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to the Florida Rules of Appellate Procedure within 30 days of the rendering of the final District action.
13. A party to the proceeding before the District who claims that a District order is inconsistent with the provisions and purposes of Chapter 373, Florida Statutes, may seek review of the order pursuant to Section 373.114, Florida Statutes, by the Florida Land and Water Adjudicatory Commission, by filing a request for review with the Commission and serving a copy on the Department of Environmental Protection and any person named in the order within 20 days of adoption of a rule or the rendering of the District order.
14. For appeals to the District Courts of Appeal, a District action is considered rendered after it is signed on behalf of the District, and is filed by the District Clerk
15. Failure to observe the relevant time frames for filing a petition for judicial review described in paragraphs #11 and #12, or for Commission review as described in paragraph #13, will result in waiver of that right to review

CERTIFICATE OF SERVICE

I hereby certify that copy of the foregoing notice of rights has been sent by U.S. Mail to:

CITY OF PALM BAY
ATTN: SUSAN HANN, P.E.
120 MALABAR ROAD, SE
PALM BAY, FLORIDA 32907

at 4:00 p.m. this October 28, 1999



Permit Data Services
Gloria Jean Lewis, Director,

St. Johns River Water Management District
Post Office Box 1429
Palatka, FL 32178-1429
(904) 329-4500

Permit 40-009-62395-1

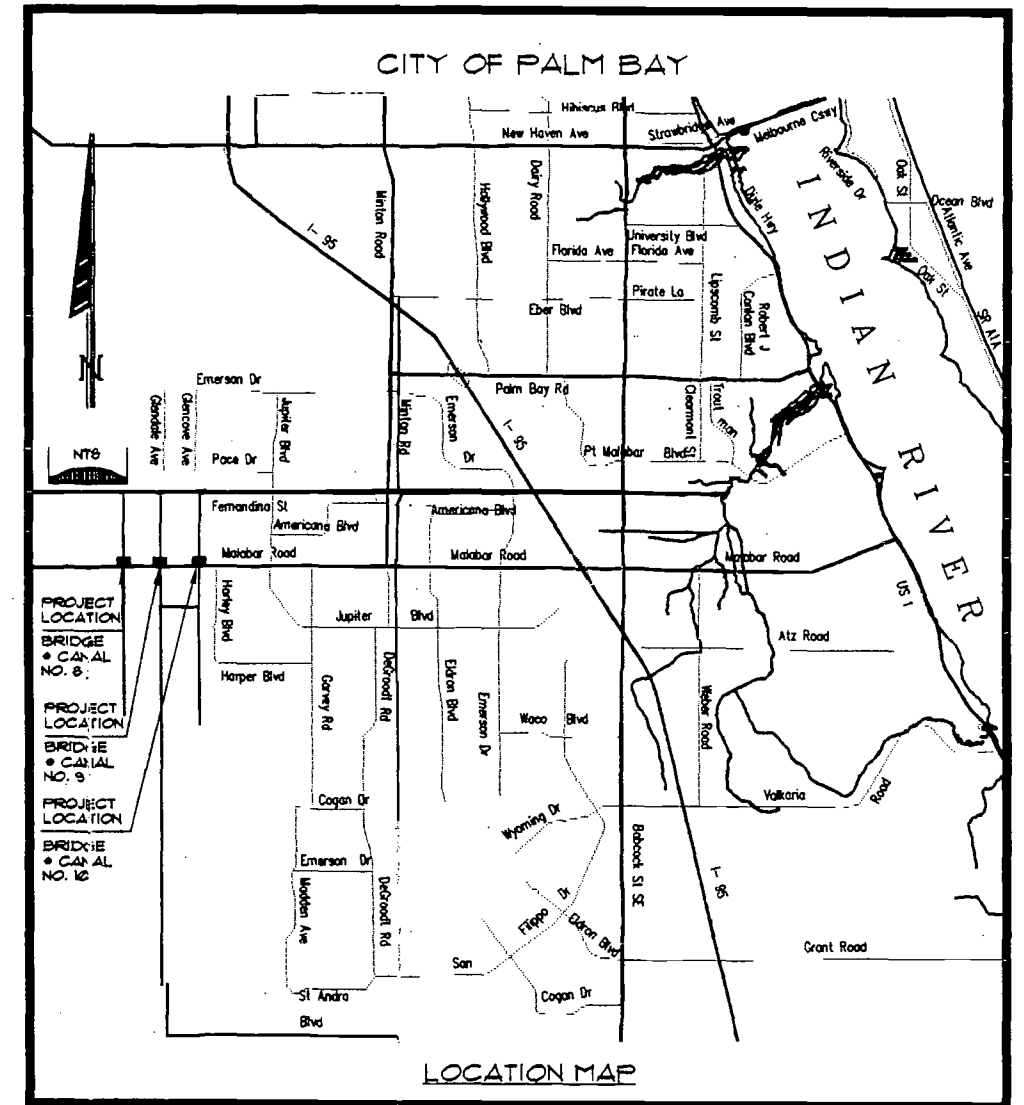
MALABAR ROAD PEDESTRIAN BRIDGES OVER

INDEX OF SHEETS

SHEET NO.	SHEET DESCRIPTION
B-1	KEY SHEET
B-2	GENERAL NOTES AND SUMMARY OF PAY ITEMS
B-3	GENERAL PLAN & ELEVATION, PILE LAYOUT AND BORINGS PEDESTRIAN BRIDGE OVER CANAL NO. 8
B-4	END BENT DETAILS (NOT INCLUDED IN THIS PLAN SET) PEDESTRIAN BRIDGE OVER CANAL NO. 8
B-5	GENERAL PLAN & ELEVATION, PILE LAYOUT AND BORINGS PEDESTRIAN BRIDGE OVER CANAL NO. 9
B-6	END BENT DETAILS (NOT INCLUDED IN THIS PLAN SHEET) PEDESTRIAN BRIDGE OVER CANAL NO. 9
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B-8	GENERAL PLAN & ELEVATION, PILE LAYOUT AND BORINGS PEDESTRIAN BRIDGE OVER CANAL NO. 10
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B-11	SUPERSTRUCTURE DETAILS (NOT INCLUDED IN THIS PLAN SET)

CANAL NO. 8, CANAL NO. 9
& CANAL NO. 10

FOR THE
CITY OF PALM BAY



LEGEND:

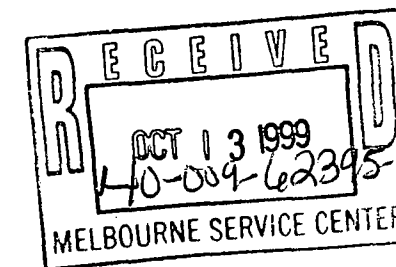
 STANDARD PENETRATION TEST BORINGS

REVISIONS		
DATE	BY	DESCRIPTION

UTILITIES ENCOUNTERED:
 Prior to any excavations the contractor shall comply with the Underground Facility Damage Prevention and Safety Act per Chapter 556 of Florida Law. Call the "Sunshine State One-Call Center" 1-800-432-4770 for underground utility locations.

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

CONTRACT PLANS: 100% SUBMITTAL
 DATE: AUGUST 1999



FRAZIER ENGINEERING, INC.
 CONSULTING ENGINEERS
 1682 N. Harbor City Boulevard, Melbourne, Florida 32935
 (407)-253-8131

A. NOTES

- ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.
- CONTRACTOR TO SAW CUT EXISTING PAVEMENT TO A NEAT EDGE IN ALL AREAS WHERE TYING INTO EXISTING PAVEMENT WITH PROPOSED PAVEMENT.
- REFER TO THE SOILS REPORT FOR LOCATION OF UNSUITABLE MATERIALS. GEOTECHNICAL DATA, DATED JUNE 16, 1999 OBTAINED FROM UNIVERSAL ENGINEERING SERVICES, 810 BREVARD AVENUE, ROCKLEDGE, FL 32955 (407) 338-0608. UNSUITABLE MATERIALS SHALL BE REMOVED AND PROPERLY/ LEGALLY DISPOSED OF FROM CONSTRUCTION AREAS AND BACKFILLED WITH SUITABLE MATERIALS.
- UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL FILL AND GRADE ALL SLOPES TO A MINIMUM OF EIGHT (8) FEET HORIZONTAL TO ONE (1) FOOT VERTICAL (8:1).
- THE CONTRACTOR IS REQUIRED TO PERFORM HIS WORK IN ACCORDANCE WITH THE REQUIREMENTS OF THE VARIOUS PERMITS. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS BEFORE COMMENCING CONSTRUCTION. ALL CONSTRUCTION AND SITE PRACTICES SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED RULES AND ORDINANCES OF THE CITY OF PALM BAY F.D.O.T. 1991 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND 1994 F.D.O.T. ROADWAY AND TRAFFIC DESIGN STANDARDS. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS BEFORE COMMENCING CONSTRUCTION.
- ALL PERSONAL PROPERTY WITHIN RIGHT-OF-WAYS OR EASEMENTS SHALL BE RELOCATED BY THE PROPERTY OWNER OR IT SHALL BE REMOVED BY THE CONTRACTOR AS NECESSARY TO CONSTRUCT THE PROJECT IN ACCORDANCE WITH THE PLANS. THE CONTRACTOR SHALL GIVE THESE PROPERTY OWNERS TWO WEEKS NOTICE PRIOR TO CLEARING AND GRUBBING OPERATIONS. SEE PROJECT SPECIFICATIONS.
- CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ANY EXISTING PAVEMENT, SIDEWALKS, CURBING AND DRAINAGE SYSTEMS DAMAGED DURING CONSTRUCTION. CONTRACTOR SHALL VIDEO EXISTING CONDITIONS AND RESTORE PRIVATE PROPERTY TO EQUAL OR BETTER CONDITION.
- DRIVEWAYS TO PRIVATE RESIDENCES, BUSINESSES AND ALL PUBLIC STREET CONNECTIONS SHALL REMAIN OPEN EXCEPT FOR PERIODS ASSOCIATED WITH CRITICAL POINTS OF CONSTRUCTION.
- ALL STATIONING IS FROM THE B.V. SURVEY UNLESS OTHERWISE NOTED.
- ANY PUBLIC LAND CORNERS WITHIN THE LIMITS OF CONSTRUCTION ARE TO BE PROTECTED. IF ANY CORNER MONUMENT IS IN DANGER OF BEING DESTROYED OR DISTURBED, THE CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER AND THE COUNTY'S ENGINEERING DEPARTMENT WITHOUT DELAY BY TELEPHONE. ANY LAND CORNER MONUMENT WITHIN THE LIMITS OF CONSTRUCTION IS TO BE PROTECTED OR REFERENCED. IF A CORNER MONUMENT IS IN DANGER OF BEING DESTROYED, THE CONTRACTOR'S SURVEYOR SHALL PROPERLY REFER TO THE EXISTING CORNER MONUMENT. IF THE CORNER MONUMENT IS DESTROYED, THE CONTRACTOR'S SURVEYOR SHALL RESTORE THE MONUMENT TO THE ORIGINAL REFERENCED CORNER LOCATION.
- ANY MAINTENANCE OF TRAFFIC OPERATIONS SHALL CONFORM TO THE LATEST EDITION OF THE MUTCD. COST SHALL BE INCLUDED IN THE UNIT PRICES OF BID ITEMS AS SHOWN IN THESE PLANS. MOT PLANS SHALL BE APPROVED BY THE CITY PRIOR TO THE START OF CONSTRUCTION.
- THE CONTRACTOR IS RESPONSIBLE FOR CHECKING DIMENSIONS AND SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCEMENT OR CONTINUATION OF ON-GOING CONSTRUCTION.
- THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING THE LATEST REVISED AND APPROVED DOCUMENTS FROM THE CITY, AND ANY QUESTIONS OR DESIGN DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO COMMENCEMENT OF WORK.

GENERAL NOTES

M. UTILITIES:

- THE UTILITY INFORMATION SHOWN ON THESE DRAWINGS CONCERNING TYPE AND LOCATION OF UTILITIES IS BASED ON AVAILABLE RECORDS AND FIELD MARKINGS PROVIDED BY THE UTILITY OWNER AND IS NOT GUARANTEED TO BE ALL INCLUSIVE.
- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR LOCATING ALL UTILITIES PRIOR TO CONSTRUCTION (OVERHEAD AND UNDER-GROUND). DISCREPANCIES BETWEEN EXISTING CONDITIONS AND PLAN CONDITIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.
- TO BE ACCURATE OR ALL INCLUSIVE, THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATION AS TO THE TYPE AND LOCATION OF UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. COORDINATION OF UTILITY RELOCATION WILL BE THE CONTRACTOR'S RESPONSIBILITY. UTILITIES ARE TO BE ADJUSTED OR RELOCATED BY THE UTILITY COMPANIES UNLESS OTHERWISE NOTED. SEE PLANS.
- THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS 48 HOURS PRIOR TO COMMENCEMENT OF THE WORK. PRIOR TO EXCAVATION THE CONTRACTOR SHALL COMPLY WITH THE UNDERGROUND FACILITY DAMAGE AND PREVENTION SAFETY ACT PER CHAPTER 956 OF FLORIDA LAW AND SHALL COMPLY WITH FLORIDA STATUTE 953.081 REGARDING NOTIFICATION OF EXISTING GAS AND OIL PIPELINE COMPANY OWNERS. PRIOR TO ANY EXCAVATION THE CONTRACTOR SHALL NOTIFY SUNSHINE STATE ONE CALL CENTER UTILITY NOTIFICATION CENTER AT 800-432-4170.
- CONTRACTOR SHALL COORDINATE WITH UTILITY OWNERS FOR HOLDING OF ANY UTILITY POLE. THE COST OF POLE HOLDING IN UTILITY EASEMENTS AND PRIVATE PROPERTY WILL BE INCLUDED IN CLEARING AND GRUBBING. UTILITY OWNERS ARE RESPONSIBLE FOR COSTS FOR HOLDING UTILITY POLES WITHIN PUBLIC RIGHT OF WAYS.
- UTILITY COMPANIES

BELL SOUTH TELECOMMUNICATIONS
112 FLORIDA AVENUE
COCOA FLORIDA 32922
407-690-2218
CONTACT: RICH MORALES

CITY GAS COMPANY OF FLORIDA
4100 U.S. HIGHWAY 1, SOUTH
ROCKLEDGE, FLORIDA 32955-5309
407-636-4644
CONTACT: JERROLD PIERCE

FLORIDA POWER & LIGHT COMPANY
1301 ELLIS ROAD
MELBOURNE, FLORIDA 32904
407-726-4023
CONTACT: TOBY MARCOTTE

TIME WARNER CABLE
120 MAGNOLIA STREET
MELBOURNE, FLORIDA 32935
407-294-8441
CONTACT: RICHARD BRIEL

CITY OF PALM BAY UTILITIES
1109 TROUTMAN BLVD. NE.
PALM BAY, FL 32909
407-392-3471
CONTACT: ROB BOLTON

THE INFORMATION SHOWN ON THESE DRAWINGS CONCERNING TYPE AND LOCATION OF UTILITIES IS BASED ON AVAILABLE RECORDS AND IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATION AS TO THE TYPE AND LOCATION OF UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. COORDINATION OF UTILITY RELOCATION WILL BE THE CONTRACTOR'S RESPONSIBILITY.

CAUTION: THERE MAY BE OTHER UTILITY OWNERS WITHIN THE PROJECT AREA WHICH ARE NOT LISTED ABOVE.

B. SPECIFICATIONS

- CONSTRUCTION: FLORIDA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 1991 EDITION AND SUPPLEMENTS THERETO.
- DESIGN:
 - AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1992 INCLUDING ALL INTERIMS.
 - FLORIDA DEPARTMENT OF TRANSPORTATION - STRUCTURES DESIGN OFFICE, STANDARD DRAWINGS, 1994 ENGLISH EDITION.
 - FLORIDA DEPARTMENT OF TRANSPORTATION STRUCTURES DESIGN GUIDELINES, JULY 1, 1997.

C. DESIGN LOADINGS

- DEAD LOADS:
 - UNIT WEIGHT OF REINFORCED CONCRETE: 150 PCF
- LIVE LOADS:
 - 88 PSF
- WIND LOADS:
 - BASIC WIND: IN ACCORDANCE WITH AASHTO
- THERMAL FORCES:
 - SEASONAL VARIATION FOR DESIGN, TEMP. RISE +25F
TEMP. FALL -25F
NORMAL TEMPERATURE: 70F
 - THERMAL COEFFICIENT = 0.000005 PER DEGREE F (BASED ON FLORIDA LIMEROCK AGGREGATE)

D. MATERIALS

- CONCRETE:
 - PROPERTIES
 - CLASS III (PRESTRESSED)
RELEASE STRENGTH (FCI) = 3500 PSI MIN.
28 DAY STRENGTH (FCI) = 6000 PSI
 - CLASS II (CIP) - SUBSTRUCTURE CONCRETE AT END BENT
FCI = 3400 PSI
 - CLASS I (CIP) - RETAINING WALL
FCI = 3400 PSI
- REINFORCING STEEL:
 - PRESTRESSING STRANDS USED FOR PRECAST BEAMS SHALL BE 710 KSI LOU RELAXATION, 1/2" DIAMETER STRANDS WITH NOMINAL STEEL AREA EQUAL TO 0.153 SQ. IN.
 - STANDARD REINFORCEMENT SHALL BE ASTM A615, GRADE 60 DEFORMED
 - ALL DIMENSIONS PERTAINING TO THE LOCATION OF REINFORCING, ARE TO THE CENTERLINE OF BAR EXCEPT WHERE THE CLEAR DIMENSION IS SHOWN TO FACE OF CONCRETE.
 - REINFORCEMENT DETAIL DIMENSIONS ARE OUT TO OUT OF BARS.
 - EF DENOTES "EACH FACE", NF DENOTES "NEAR FACE" AND FF DENOTES "FAR FACE".
 - CONCRETE COVER PRESTRESSED 1 1/2" MIN. CAST-IN-PLACE 3" MIN.
 - PROVIDE 3/4" CHAMFERS ON ALL EXPOSED EDGES EXCEPT AS OTHERWISE NOTED.
- NEOPRENE:
 - NEOPRENE RUBBER FOR BEARING PADS SHALL CONSIST OF GRADE 60 HARDNESS MATERIAL.

E. DESIGN METHOD

- STRENGTH DESIGN METHOD (LOAD FACTOR DESIGN) ALL ELEMENTS EXCEPT PRESTRESSED BEAMS.
- PRESTRESSED BEAMS ARE DESIGNED USING SERVICE LOAD AND CHECKED FOR ULTIMATE CAPACITY.

F. DATUM

- ALL ELEVATIONS REFER TO NGVD 1929 DATUM, U.O.N.

G. ANCHOR BOLTS

- ANCHOR BOLTS SHALL BE IN ACCORDANCE WITH ASTM A307.
- ANCHOR BOLTS, NUTS AND WASHERS SHALL BE IN HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.

H. PILE DRIVING NOTE

- ALL PILES ARE 14" PRECAST PRESTRESSED SQUARE CONCRETE PILES.
- DRIVE PILES TO 25 TONS EACH.

J. MISCELLANEOUS

- CONTRACTOR SHALL SOO ALL DISTURBED AREAS.

K. BID ITEMS NOTES

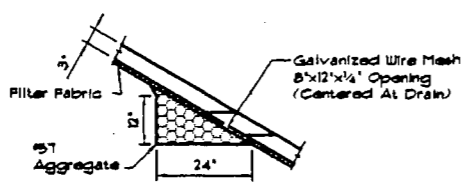
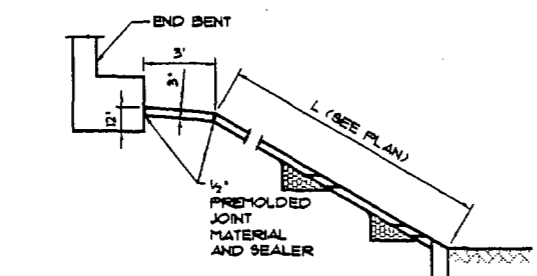
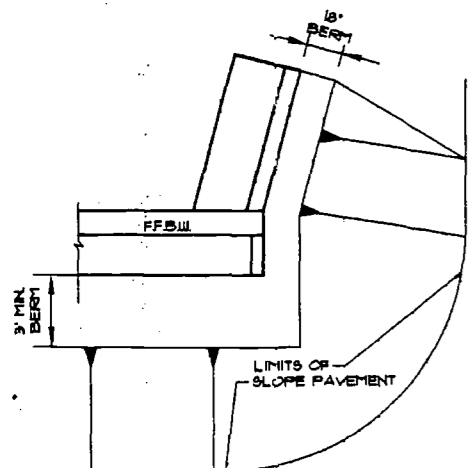
- PAYMENT FOR INCIDENTAL ITEMS NOT SPECIFICALLY COVERED IN THE INDIVIDUAL BID ITEMS SHALL BE INCLUDED IN THE CONTRACT PRICES FOR BID ITEMS.
- PAYMENT FOR BEARING PADS AND PLATES SHALL BE INCLUDED IN THE CONTRACT PRICE FOR THE BEAM.
- REFER TO THE SOILS REPORT.
- COST OF RETAINING WALL REINFORCING STEEL, FACE TEXTURE, FINISH & JOINT SEAL TO BE INCLUDED IN 400-1-II.

L. SHOP DRAWINGS

- SHOP DRAWINGS ARE REQUIRED:
- PRECAST DOUBLE T-BEAM
 - PRECAST PILING
 - ALUMINUM HANDRAIL
 - COMPOSITE NEOPRENE BEARING PADS

SUMMARY OF BRIDGE PAY ITEMS

ITEM NUMBER	ITEM	UNIT	BRIDGE OVER		
			CANAL NO.8	CANAL NO.9	CANAL NO.10
101-1	MOBILIZATION	L.S.	1	1	1
104-II	FLOATING TURBIDITY BARRIER	L.F.	150	120	200
120-1	REGULAR EXCAVATION	C.Y.	20	20	30
400-1-II	CLASS I CONCRETE RETAINING WALLS (4)	C.Y.	8	8	8
400-2-5	CLASS II CONCRETE (SUBSTRUCTURE)	C.Y.	5.84	7.48	9.12
400-14-1	COMPOSITE NEOPRENE BEARING PADS	EA.	4	6	8
415-1-5	REINFORCING STEEL (SUBSTRUCTURE)	LBS	900	1150	1400
430-1	PRECAST DOUBLE TEE BEAM (34" HIGH) (2)	L.F.	60	80	168
455-12-2	14" SQUARE PRESTRESSED CONCRETE PILING	L.F.	160	204	308
515-12	ALUMINUM HANDRAIL	L.F.	80	100	186
524-2-1	CONCRETE SLOPE PAVEMENT (3')	S.Y.	121	133	281



DETAIL - SLOPE PAVEMENT
SCALE: 1/4"=1'

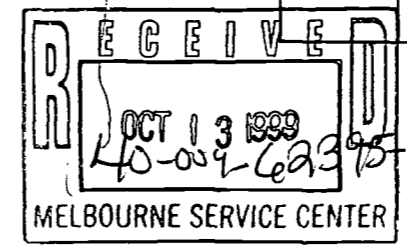
1. THE FILTER FABRIC SHALL BE TYPE D-6 IN ACCORDANCE WITH INDEX 199 OF PDOT ROADWAY & TRAFFIC DESIGN STANDARD.

NAME	DATE
DESIGNED BY: NCR	02/99
DRAWN BY: LJS	02/99
CHECKED BY: JEF	02/99
APPROVED BY: JEF	02/99
CADD FILE NAME	9864302.DWG

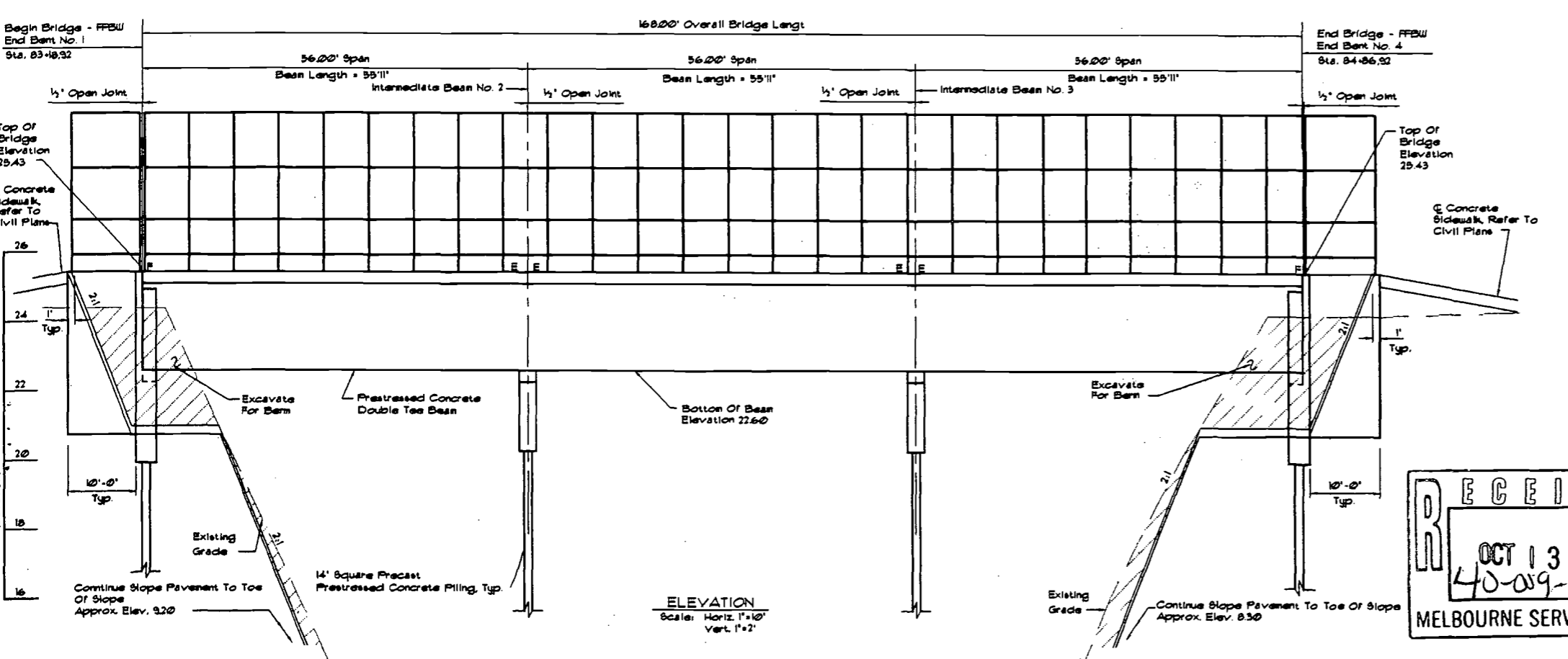
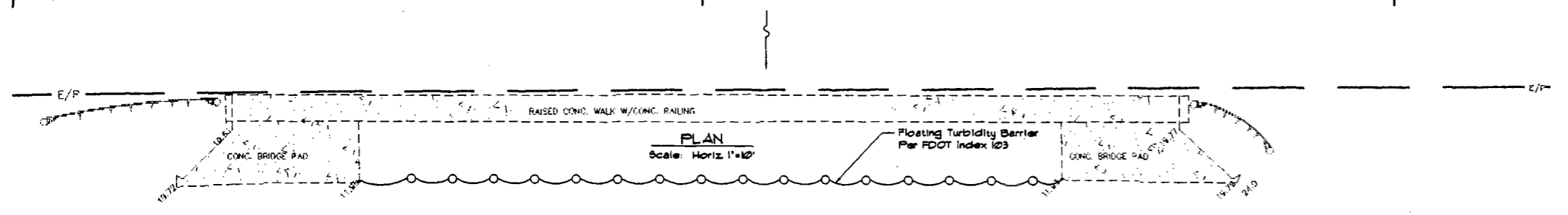
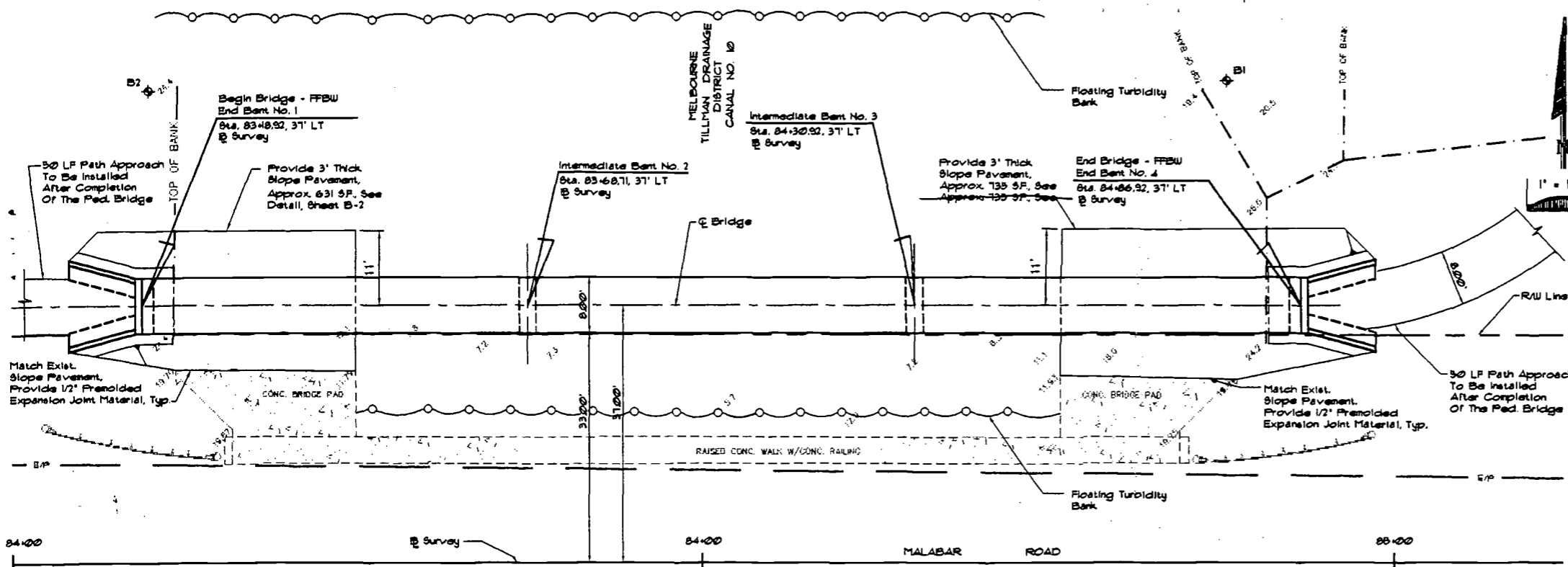
FRAZIER ENGINEERING, INC.
CONSULTING ENGINEERS AND LAND SURVEYORS
1682 North Harbor City Boulevard, Melbourne, Florida
TEL: (407) 253-8131, FAX: (407) 255-2231

MALABAR ROAD PEDESTRIAN BRIDGES
GENERAL NOTES &
SUMMARY OF BRIDGE PAY ITEMS
CITY OF PALM BAY
PALM BAY, FLORIDA

PROJECT NO. 9864.03
DATE: AUGUST 1999
SCALE: 1" = 1'
SHEET B-2 OF B-11

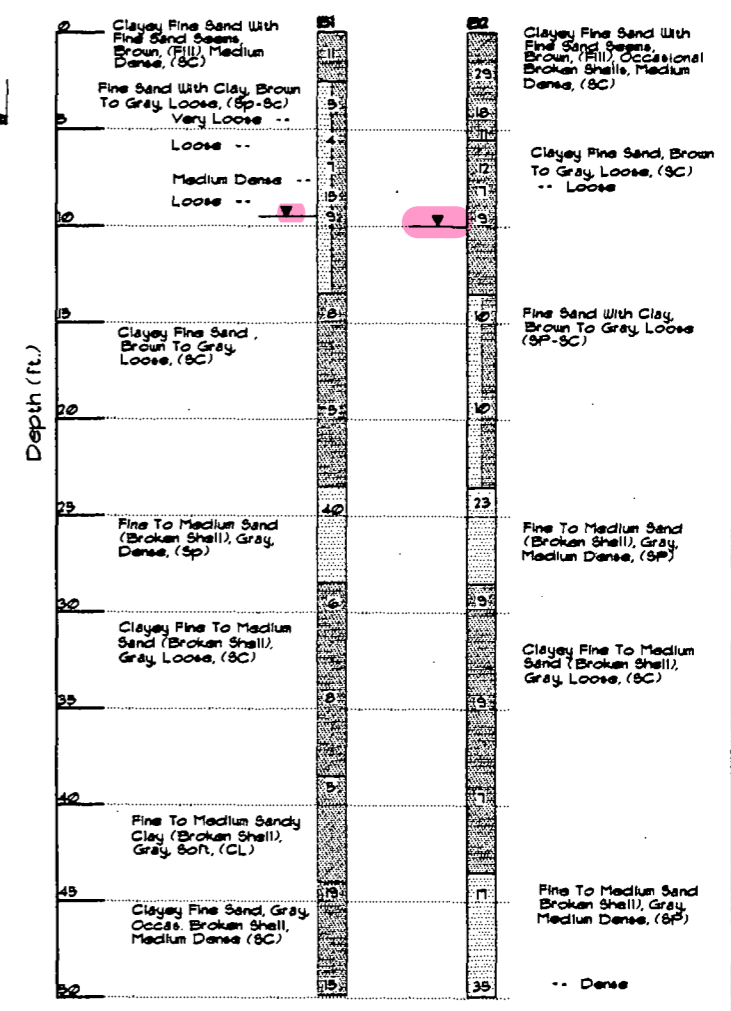


[Handwritten Signature]
AUG 30 1999



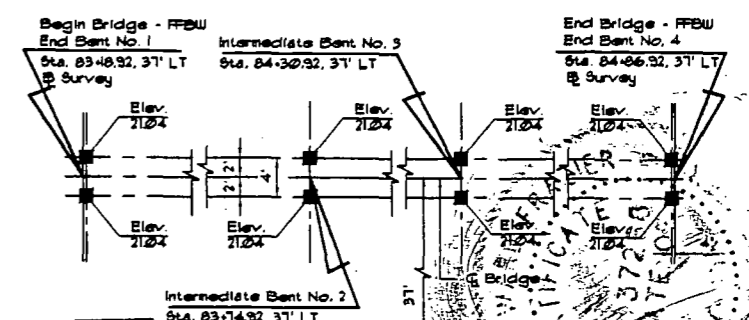
STANDARD PENETRATION TEST BORINGS
SCALE: 1" = 5' Vert.

(Refer To Soils Report Prepared By Universal Engineering Sciences, Dated June 16, 1999)



LEGEND:

- Standard Penetration Test Boring
- Proposed Pile W/Cutoff Elevation



RECEIVED
OCT 13 1999
40-019-62395
MELBOURNE SERVICE CENTER

Note: The Soils Report States That The Required Pile Capacity Can Be Achieved At The End Bents At Tip Elevation Between -5 And -10 Feet NGVD For Quantity Purposes, A 35' Pile Length At The End Bents Has Been Assumed And 42' Pile Length At The Intermediate Bent Has Been Assumed.

DATE	NAME	DATE	NAME
08/99	NCR	08/99	LJS
08/99	DESIGNED BY	08/99	JEF
08/99	DRAWN BY	08/99	JEF
08/99	CHECKED BY	08/99	JEF
08/99	APPROVED BY	08/99	JEF
	CADD FILE NAME		9864508.DWG

FRAZIER ENGINEERING, INC.
CONSULTING ENGINEERS AND LAND SURVEYORS
1682 North Harbor City Boulevard, Melbourne, Florida 32935
TEL (407) 253-8131, FAX (407) 255-2231

MALABAR ROAD PEDESTRIAN BRIDGE OVER MTUCD CANAL NO. 10
GENERAL PLAN & ELEVATION, FILE LAYOUT & SOIL BORINGS
CITY OF PALM BAY, FLORIDA
PROJECT NO. 3864203
DATE: AUGUST 1999
SCALE: 1" = 10' HORIZ, AS NOTED
SHEET B-8 OF B-11

G.7

Permit No. 156684-1



St. Johns River

Water Management District

Ann B. Shortelle, Ph.D., Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • 386-329-4500
On the internet at www.sjrwmd.com.

February 26, 2019

Lisa Morrell
City of Palm Bay
120 Malabar Rd SE #1
Palm Bay, FL 32907-3009

SUBJECT: General Permit Number: 156684-1

Dear Ms. Morrell:

The District has received your notice to use a general permit. Based on the submitted information, the proposed activity qualifies for a General Environmental Resource Permit pursuant to section 62-330.447, Florida Administrative Code, provided it is constructed and operated in accordance with that general permit and the general and special conditions set forth in section 62-330.447, Florida Administrative Code (attached).

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has determined your project qualifies for this general permit. Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the use of the general permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the use of the permit. To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.11 of the *Florida Statutes*. If you do not publish a newspaper notice to close the point of entry, the time to challenge your use of the permit will not expire and someone could file a petition even after your project is constructed.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to compliancesupport@sjrwmd.com (preferred method) or send a copy of the original affidavit to:

Margaret Daniels, Office Director
Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

GOVERNING BOARD

Fred N. Roberts Jr., VICE CHAIRMAN
OCALA

Douglas C. Bourmique
VERO BEACH

Chuck Drake, SECRETARY
ORLANDO

Douglas Burnett
ST. AUGUSTINE

Ron Howse, TREASURER
COCOA

Susan Dolan
SANFORD

A copy of your application was transmitted to the U.S. Army Corps of Engineers for review. This authorization to use a general environmental resource permit does not obviate the need for obtaining all necessary permits or approval from other agencies.

Sincerely,

A handwritten signature in cursive script that reads "Michelle Reiber".

Michelle Reiber, Bureau Chief
Regulatory Services

Enclosures: Notice of Rights
List of Newspapers for Publication

cc: District Permit File
Consultant: David A Bennett
Conzor Engineers, LLC
1511 E State Road 434 Ste 1001
Winter Springs, FL 32708-5643

**ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
GENERAL ENVIRONMENTAL RESOURCE PERMIT**

PERMIT NO: 156684-1

DATE ISSUED: February 26, 2019

PROJECT NAME: Palm Bay Safe Routes to School - Jupiter Elementary

A PERMIT AUTHORIZING:

Use of the General Permit for Florida Department of Transportation, Counties, and Municipalities for minor Activities within Existing Rights-of-Way or Easements for new sidewalks to be constructed as per plans received by the District on February 11, 2019.

LOCATION:

Section(s): 2, 3 Township(s): 28S Range(s): 36E
 2 29S 36E
Brevard County

Receiving Water Body:

Name	Class
Indian River Lagoon	III Marine, IW

ISSUED TO:

City of Palm Bay
120 Malabar Rd SE #1
Palm Bay, FL 32907-3009

The District received your notice to use a General Environmental Resource Permit pursuant to Chapter 62-330, Florida Administrative Code (F.A.C.) on October 7, 2014.

Based on the forms, design plans, and other documents submitted with your notice, it appears that the project meets the requirements for a General Environmental Resource Permit. Any activities performed under a General Environmental Resource Permit are subject to the general conditions and special conditions specified in rules 62-330.405 and 62-330.447, F.A.C. respectively (attached). Any deviations from these conditions may subject you to enforcement action and possible penalties.

Please be advised that the General Environmental Resource Permit expires 5 years from the date on which the notice of intent to use a General Environmental Resource Permit was received by the District.

A copy of your notice also has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action and possible penalties.

AUTHORIZED BY: St. Johns River Water Management District
Division of Regulatory Services



By:

Fariborz Zanganeh
Supervising Professional Engineer

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 156684-1
Palm Bay Safe Routes to School - Jupiter Elementary
DATED: February 26, 2019

1. The general permit is valid only for the specific activity indicated. Any deviation from the specified activity and the conditions for undertaking that activity shall constitute a violation of the permit and may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. The general permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any construction, alteration, operation, maintenance, removal or abandonment authorized by this permit; and it does not authorize any violation of any other applicable federal, state, local, or special district laws (including, but not limited to, those governing the "take" of listed species).
3. The general permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the general permit.
4. The general permit does not relieve the permittee from liability and penalties when the permitted activity causes harm or injury to: human health or welfare; animal, plant or aquatic life; or property. It does not allow the permittee to cause pollution that violates state water quality standards.
5. Section 253.77, F.S., provides that a person may not commence any excavation, construction, or other activity involving the use of state-owned or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required consent, lease, easement, or other form of authorization authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on state-owned lands.
6. The authorization to conduct activities under a general permit may be modified, suspended or revoked in accordance with Chapter 120, F.S., and Section 373.429, F.S.
7. The general permit is not transferable to a third party. To be used by a different permittee, a new notice to use a general permit must be submitted in accordance with Rule 62-330.402, F.A.C. Activities constructed in accordance with the terms and conditions of a general permit are automatically authorized to be operated and maintained by the permittee and subsequent owners in accordance with subsection 62-330.340(1), F.A.C. Any person holding the general permit, persons working under the general permit, and owners of land while work is conducted under the general permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to sale, conveyance, or other transfer of ownership or control of the permitted project, activity, or the real property at which the permitted project or activity is located.
8. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the permitted system to ensure conformity with the plans and specifications approved by the general permit.
9. The permittee shall maintain any permitted project or activity in accordance with the plans submitted to the Agency and authorized in the general permit.

10. A permittee's right to conduct a specific activity under the general permit is authorized for a duration of five years.
11. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be implemented and maintained immediately prior to, during, and after construction as needed to stabilize all disturbed areas, including other measures specified in the permit to prevent adverse impacts to the water resources and adjacent lands. Erosion and sediment control measures shall be installed and maintained in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), available at <https://www.flrules.org/Gateway/reference.asp?No=Ref-04227>, and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), available at http://publicfiles.dep.state.fl.us/DEAR/Stormwater_Training_Docs/erosion-inspectors-manual.pdf.
12. Unless otherwise specified in the general permit, temporary vehicular access within wetlands during construction shall be performed using vehicles generating minimum ground pressure to minimize rutting and other environmental impacts. Within forested wetlands, the permittee shall choose alignments that minimize the destruction of mature wetland trees to the greatest extent practicable. When needed to prevent rutting or soil compaction, access vehicles shall be operated on wooden, composite, metal, or other non-earthen construction mats. In all cases, access in wetlands shall comply with the following:
 - a. Access within forested wetlands shall not include the cutting or clearing of any native wetland tree having a diameter 4 inches or greater at breast height;
 - b. The maximum width of the construction access area shall be limited to 15 feet;
 - c. All mats shall be removed as soon as practicable after equipment has completed passage through, or work has been completed, at any location along the alignment of the project, but in no case longer than seven days after equipment has completed work or passage through that location; and
 - d. Areas disturbed for access shall be restored to natural grades immediately after the maintenance or repair is completed.
13. Barges or other work vessels used to conduct in-water activities shall be operated in a manner that prevents unauthorized dredging, water quality violations, and damage to submerged aquatic communities.
14. The construction, alteration, or use of the authorized project shall not adversely impede navigation or create a navigational hazard in the water body.
15. Except where specifically authorized in the general permit, activities must not:
 - a. Impound or obstruct existing water flow, cause adverse impacts to existing surface water storage and conveyance capabilities, or otherwise cause adverse water quantity or flooding impacts to receiving water and adjacent lands; or
 - b. Cause an adverse impact to the maintenance of surface or ground water levels or surface water flows established pursuant to Section 373.042, F.S., or a Works of the District established pursuant to Section 373.086, F.S.
16. If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains

that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850) 245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, F.S.

17. The activity must be capable, based on generally accepted engineering and scientific principles, of being performed and of functioning as proposed, and must comply with any applicable District special basin and geographic area criteria.
18. The permittee shall comply with the following when performing work within waters accessible to federally- or state-listed aquatic species, such as manatees, marine turtles, smalltooth sawfish, and Gulf sturgeon:
 - (a) All vessels associated with the project shall operate at "Idle Speed/No Wake" at all times while in the work area and where the draft of the vessels provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
 - (b) All deployed siltation or turbidity barriers shall be properly secured, monitored, and maintained to prevent entanglement or entrapment of listed species.
 - (c) All in-water activities, including vessel operation, must be shut down if a listed species comes within 50 feet of the work area. Activities shall not resume until the animal(s) has moved beyond a 50-foot radius of the in-water work, or until 30 minutes elapses since the last sighting within 50 feet. Animals must not be herded away or harassed into leaving. All on-site project personnel are responsible for observing water-related activities for the presence of listed species.
 - (d) Any listed species that is killed or injured by work associated with activities performed shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1(888)404-3922 and ImperiledSpecies@myFWC.com.
 - (e) Whenever there is a spill or frac-out of drilling fluid into waters accessible to the above species during a directional drilling operation, the FWC shall be notified at imperiledspecies@myfwc.com with details of the event within 24 hours following detection of the spill or frac-out.
19. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities which may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any activity authorized by the general permit.
20. The permittee shall immediately notify the Agency in writing of any submitted information that is discovered to be inaccurate.
21. Activities under this general permit must not diminish existing stormwater treatment, attenuation, or conveyance capacity.
22. The project must be constructed and operated as per plans received by the District on February 11, 2019.

Notice of Rights

1. A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-six (26) days of the District depositing the notice of District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing the notice of District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes, and Chapter 28-106, Florida Administrative Code. The District will not accept a petition sent by facsimile (fax), as explained in paragraph no. 4 below.
2. Please be advised that if you wish to dispute this District decision, mediation may be available and that choosing mediation does not affect your right to an administrative hearing. If you wish to request mediation, you must do so in a timely-filed petition. If all parties, including the District, agree to the details of the mediation procedure, in writing, within 10 days after the time period stated in the announcement for election of an administrative remedy under Sections 120.569 and 120.57, Florida Statutes, the time limitations imposed by Sections 120.569 and 120.57, Florida Statutes, shall be tolled to allow mediation of the disputed District decision. The mediation must be concluded within 60 days of the date of the parties' written agreement, or such other timeframe agreed to by the parties in writing. Any mediation agreement must include provisions for selecting a mediator, a statement that each party shall be responsible for paying its pro-rata share of the costs and fees associated with mediation, and the mediating parties' understanding regarding the confidentiality of discussions and documents introduced during mediation. If mediation results in settlement of the administrative dispute, the District will enter a final order consistent with the settlement agreement. If mediation terminates without settlement of the dispute, the District will notify all the parties in writing that the administrative hearing process under Sections 120.569 and 120.57, Florida Statutes, is resumed. Even if a party chooses not to engage in formal mediation, or if formal mediation does not result in a settlement agreement, the District will remain willing to engage in informal settlement discussions.
3. A person whose substantial interests are or may be affected has the right to an informal administrative hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must also comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

Notice of Rights

4. A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8:00 a.m. – 5:00 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8:00 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at sjrwmd.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile is prohibited and shall not constitute filing.
5. Failure to file a petition for an administrative hearing within the requisite timeframe shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, Florida Administrative Code).
6. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. A person whose substantial interests are or may be affected by the District's final action has the right to become a party to the proceeding, in accordance with the requirements set forth above.
7. Pursuant to Section 120.68, Florida Statutes, a party to the proceeding before the District who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.
8. A District action is considered rendered, as referred to in paragraph no. 7 above, after it is signed on behalf of the District and filed by the District Clerk.
9. Failure to observe the relevant timeframes for filing a petition for judicial review as described in paragraph no. 7 above will result in waiver of that right to review.

Notice of Rights

Certificate of Service

I HEREBY CERTIFY that a copy of the foregoing Notice of Rights has been sent to the permittee:

Lisa Morrell
City of Palm Bay
120 Malabar Rd SE #1
Palm Bay, FL 32907-3009

This 26th day of February 2019.



Margaret Daniels, Office Director
Office of Business and Administrative Services
St. Johns River Water Management District
4049 Reid Street
Palatka, FL 32177-2529
(386) 329-4570

Permit Number: 156684-1

NOTICING INFORMATION

Dear Permittee:

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice to close the point of entry, the time to challenge the issuance of your permit will not expire and someone could file a petition even after your project is constructed.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to compliancesupport@sjrwmd.com (preferred method) or send a copy of the original affidavit to:

Margaret Daniels, Office Director
Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

If you have any questions, please contact the Office of Business and Administrative Services at (386) 329-4570.

Sincerely,



Margaret Daniels, Office Director
Office of Business and Administrative Services

CONTRACT PLANS COMPONENTS

ROADWAY PLANS

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

CONTRACT PLANS

FINANCIAL PROJECT ID 439677-1-58-01

(FEDERAL FUNDS)

BREVARD COUNTY

PALM BAY SAFE ROUTES TO SCHOOL: JUPITER ELEMENTARY
MALABAR ROAD, WALMSLEY STREET, AND GEARY STREET

INDEX OF ROADWAY PLANS

SHEET NO.	SHEET DESCRIPTION
1	KEY SHEET
2	TYPICAL SECTIONS
3	TYPICAL SECTION DETAILS
4	SUMMARY OF DRAINAGE STRUCTURES
5 - 6	CURVE AND COORDINATE DATA
7	PROJECT LAYOUT
8	GENERAL NOTES
9 - 24	ROADWAY PLAN-PROFILE
25 - 55	CROSS SECTIONS
S-1 to S-2	SIGNING AND PAVEMENT MARKING PLANS
SQ-1 to SQ-9	SUMMARY OF QUANTITIES

GOVERNING STANDARD PLANS:

Florida Department of Transportation, FY2018-19 Standard Plans for Road and Bridge Construction and applicable Interim Revisions (IRs).

Standard Plans for Road Construction and associated IRs are available at the following website: <http://www.fdot.gov/design/standardplans>

APPLICABLE IRs: NA

Standard Plans for Bridge Construction are included in the Structures Plans Component

GOVERNING STANDARD SPECIFICATIONS:

Florida Department of Transportation, July 2018 Standard Specifications for Road and Bridge Construction at the following website: <http://www.fdot.gov/programmanagement/Implemented/SpecBooks>

END PROJECT
@ BSW MALABAR
STA. 80+65.69 =
@ MALABAR
STA. 40+50.00
33.00' (RT.)

BEGIN PROJECT
@ BSW MALABAR
STA. 50+13.13 =
@ MALABAR
STA. 10+13.13
39.50' (RT.)

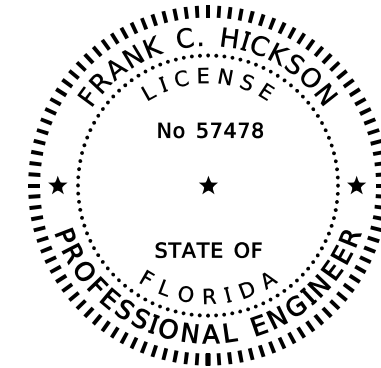
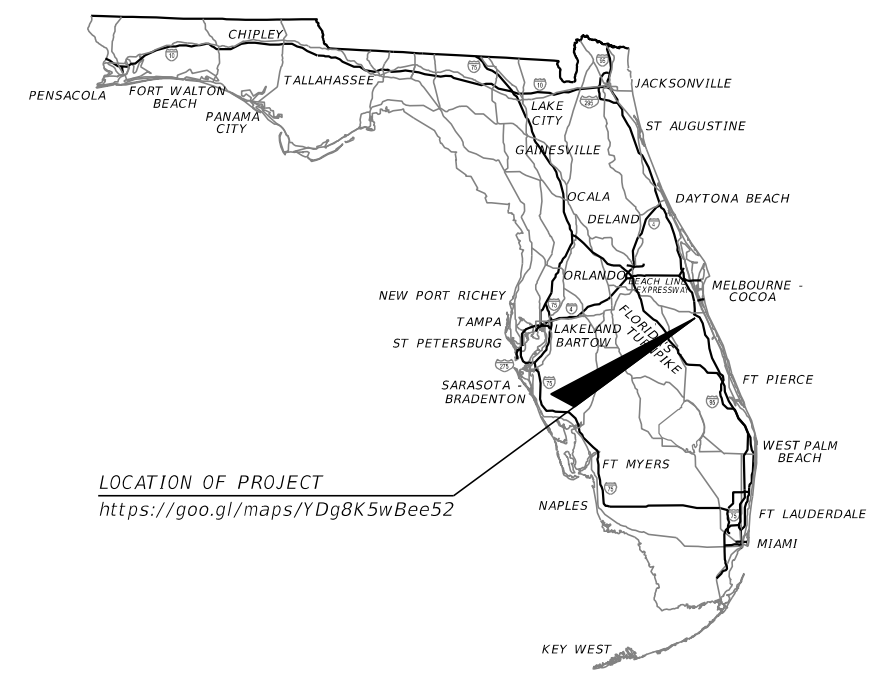
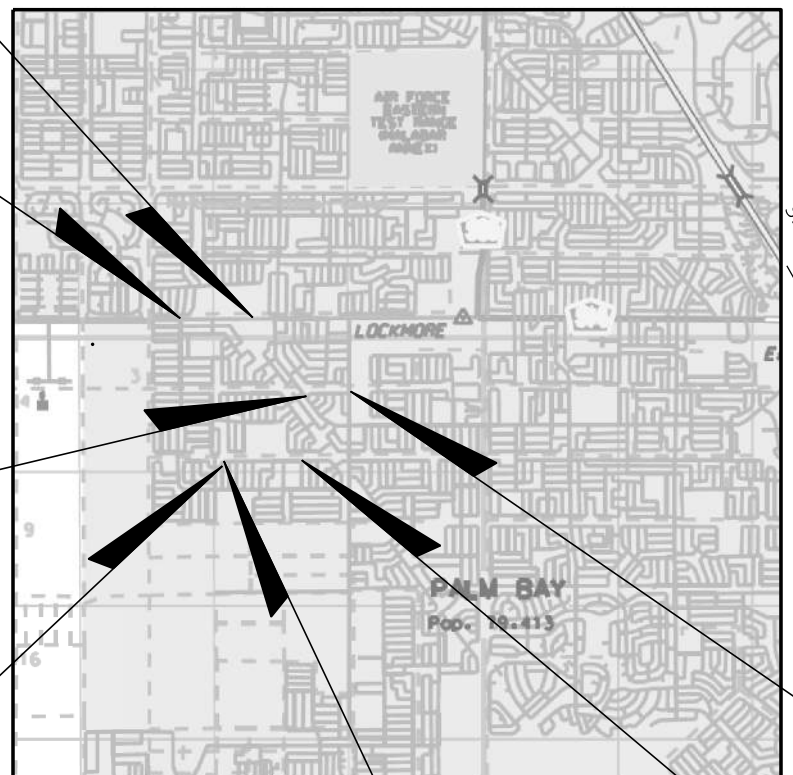
BEGIN PROJECT
@ BSW WALMSLEY
STA. 50+23.32 =
@ WALMSLEY
STA. 10+23.32
25.00' (LT.)

BEGIN PROJECT
BEGIN @ BSW GIBLIN
STA. 50+92.41 =
@ GEARY
STA. 10+63.00
20.00' (RT.)

END PROJECT
@ BSW WALMSLEY
STA. 68+22.45 =
@ WALMSLEY
STA. 28+10.59
18.25' (LT.)

END PROJECT
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STA. 83+64.57 =
@ GEARY
STA. 43+59.59
18.00' (RT.)

END @ BSW GIBLIN
BEGIN @ BSW GEARY
STA. 52+80.17 =
@ GEARY
STA. 12+80.17
18.00' (RT.)



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

ON THE DATE ADJACENT TO THE SEAL
PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

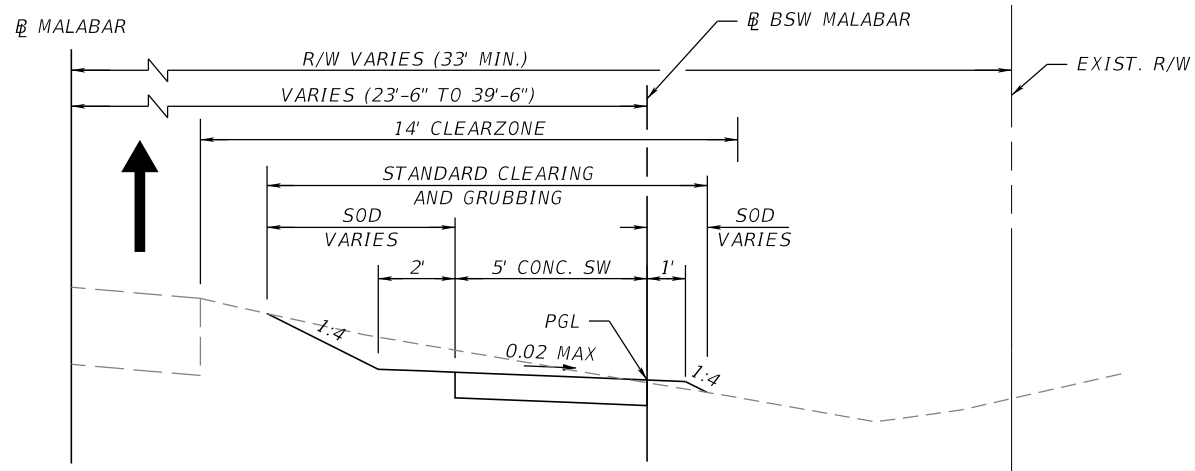
**ROADWAY PLANS
ENGINEER OF RECORD:**

FRANK C. HICKSON, P.E. NO.: 57478
INFRASTRUCTURE ENGINEERS, LLC
1069 MAIN STREET, SUITE 112
SEBASTIAN, FL 32958
CONTRACT NO.: C-8Z45
VENDOR NO.: F593221706-001
CERTIFICATE OF AUTHORIZATION NO.: 6876

**CITY OF PALM BAY
PROJECT MANAGER:**
FRANK WATANABE, P.E.

FISCAL YEAR	SHEET NO.
19	1

PHASE II SUBMITTAL

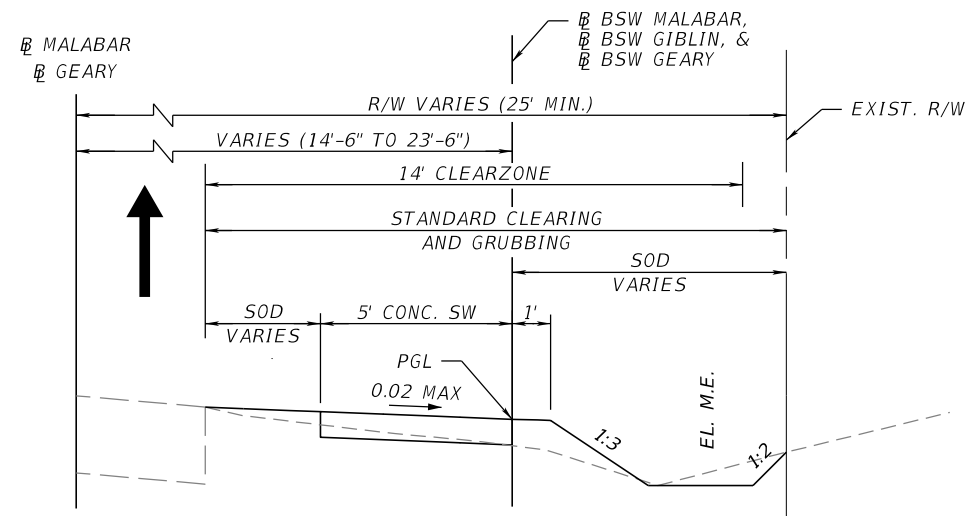


TYPICAL SECTION 1:

MALABAR RD.
 STA. 10+13.13 TO STA. 30+56.78 &
 STA. 40+36.83 TO STA. 40+72.74

SIDEWALK CONSTRUCTION

4" CONCRETE SIDEWALK

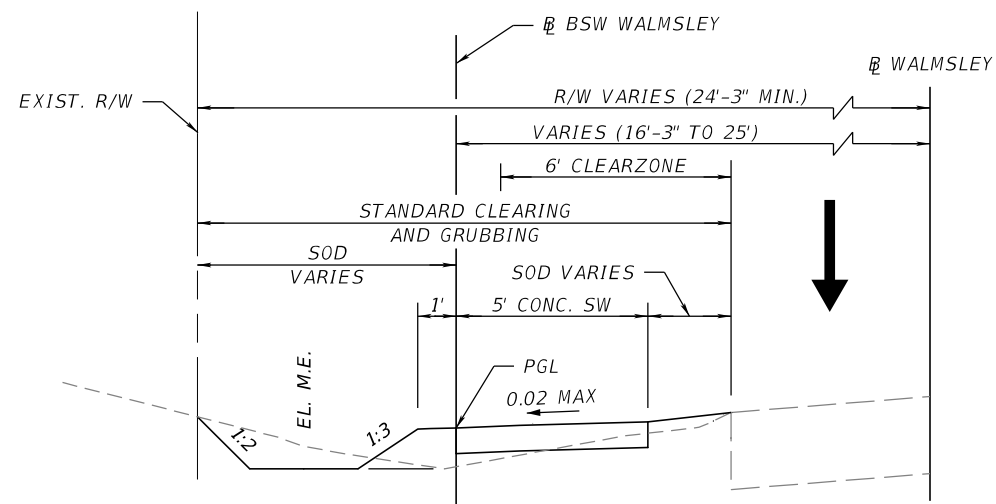


TYPICAL SECTION 2:

MALABAR RD.
 STA. 30+56.78 TO STA. 40+36.83
 GIBLIN ST.
 STA. 10+63.00 TO STA. 12+80.17
 GEARY ST.
 STA. 12+80.17 TO STA. 43+59.59

SIDEWALK CONSTRUCTION

4" CONCRETE SIDEWALK

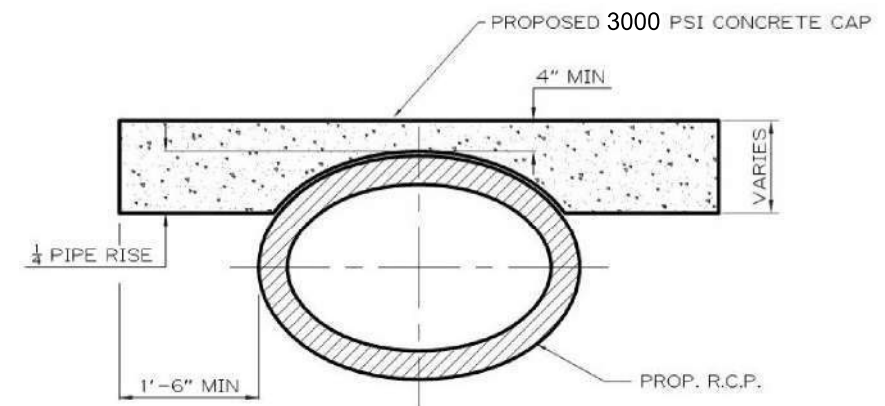


TYPICAL SECTION 3:

WALMSLEY ST.
 STA. 10+23.32 TO STA. 28+10.58

SIDEWALK CONSTRUCTION

4" CONCRETE SIDEWALK



CONCRETE ARMORED DETAIL
 (N.T.S.)

NOTE: CONCRETE ARMORED DETAIL TO BE USED WHEN MINIMUM COVER CAN NOT BE ACHIEVED UNDER CONCRETE DRIVEWAYS ONLY.

PHASE II SUBMITTAL

REVISIONS				INFRASTRUCTURE ENGINEERS, INC. FRANK C. HICKSON, P.E. - No. 57478 1069 MAIN STREET, SUITE 112 SEBASTIAN, FLORIDA 32958 Ph.: 772.388.1661 Fax: 407.957.8744 FL Certificate of Authorization No. 6876	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SHEET NO. 2
DATE	DESCRIPTION	DATE	ROAD NO.		COUNTY	FINANCIAL PROJECT ID		
					BREVARD	439677-1-58-01	TYPICAL SECTIONS	

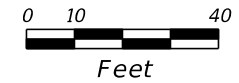
THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

QUANTITY	STR. NO.	STATION	SIDE	DESCRIPTION	BARRELS	STORM DRAIN OPTIONAL MATERIAL		DITCH BOTTOM INLETS		CLASS I CONC.	REMARKS	
						18"	24"	C	MOD			
								<10'		CY		
<i>MALABAR RD.</i>												
P	S-1	40+35.00	Rt.	Inlet, Pipe	1		27'	1				
F												
P	S-2	40+63.79	Rt.	Inlet	1				1			
<i>GEARY ST.</i>												
P	S-1	39+93.13	Rt.	Headwall, Pipe	1	8'				1.56	CONC. JACKET	
F												
GRAND TOTALS					<i>PLAN QUANTITY</i>		8'	27'	1	1	2	
					<i>FINAL QUANTITY</i>							

PHASE II SUBMITTAL

<i>REVISIONS</i>				INFRASTRUCTURE ENGINEERS, INC. FRANK C. HICKSON, P.E. - No. 57478 1069 MAIN STREET, SUITE 112 SEBASTIAN, FLORIDA 32958 Ph.: 772.388.1661 Fax: 407.957.8744 FL Certificate of Authorization No. 6876	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SUMMARY OF DRAINAGE STRUCTURES	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		4
						BREVARD	439677-1-58-01		

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



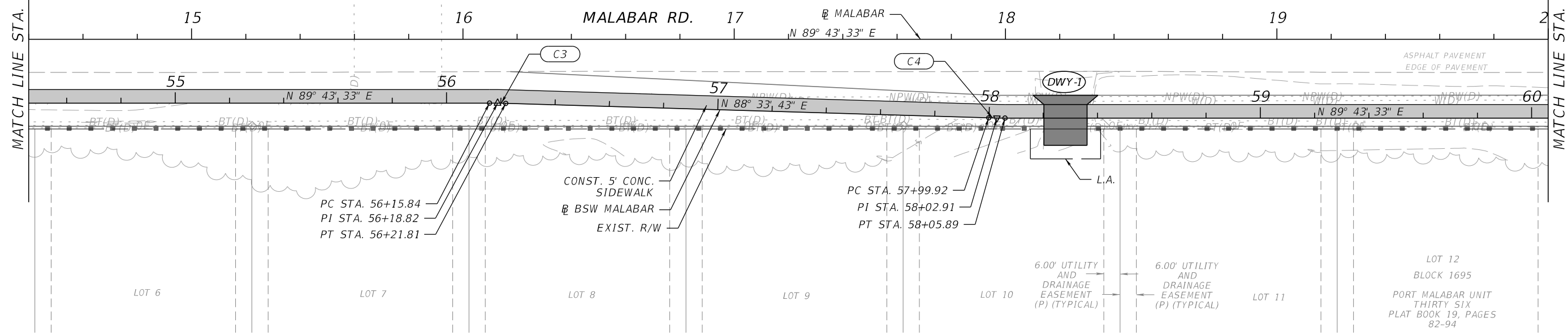
LEGEND:

- 4" CONCRETE
- 6" CONCRETE
- SEDIMENT BARRIER

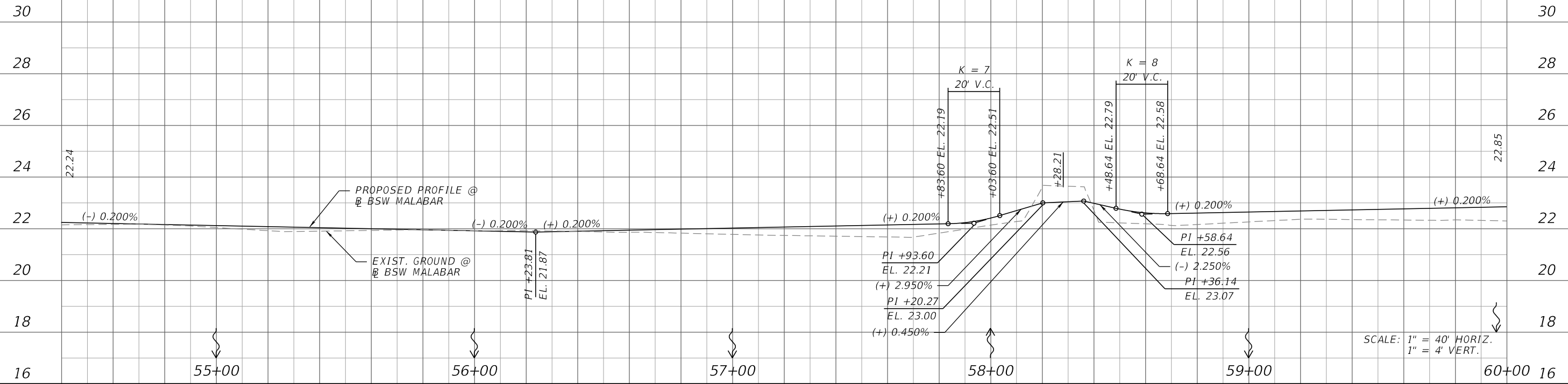
MATCH LINE STA. 14+40.00

MATCH LINE STA. 20+00.00

654-2-21 1 (AS)
STA. 14+66.10
20.00' (Lt.)



MALABAR (2)



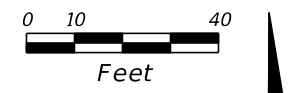
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

INFRASTRUCTURE ENGINEERS, INC.
FRANK C. HICKSON, P.E. - No. 57478
1069 MAIN STREET, SUITE 112
SEBASTIAN, FLORIDA 32958
Ph.: 772.388.1661
Fax: 407.957.8744
FL Certificate of Authorization No. 6876

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439677-1-58-01

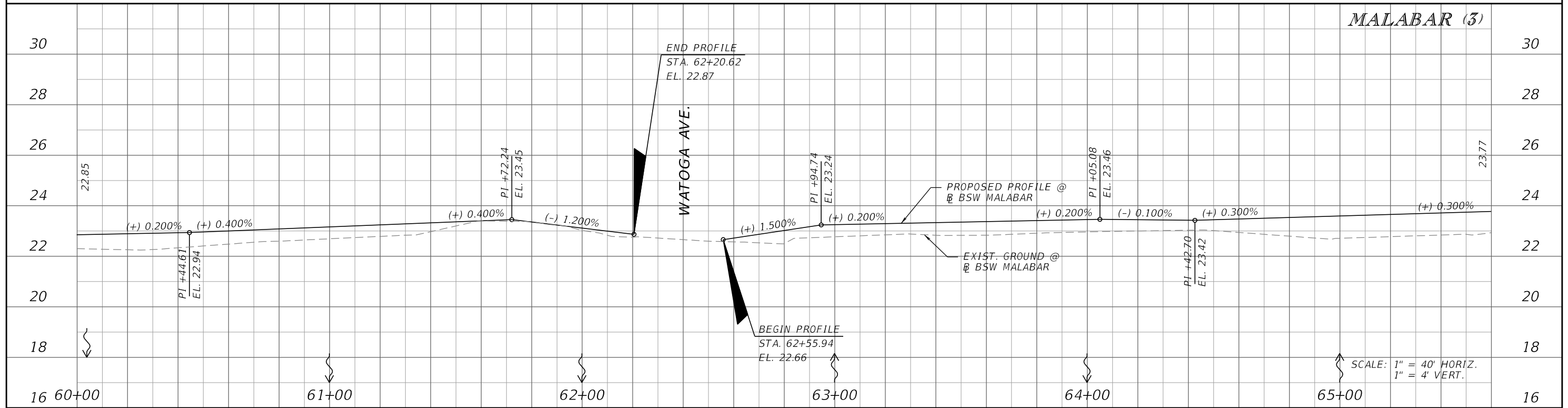
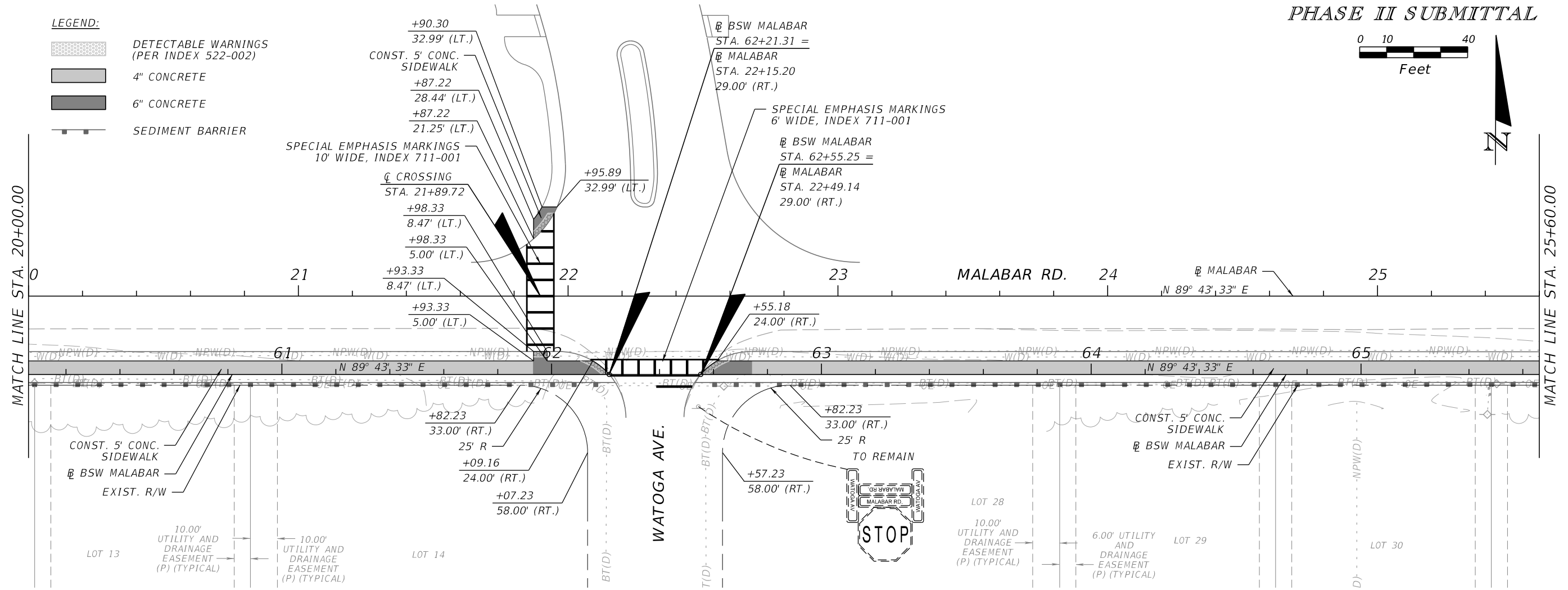
ROADWAY PLAN-PROFILE	SHEET NO. 10
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THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



LEGEND:

- DETECTABLE WARNINGS (PER INDEX 522-002)
- 4" CONCRETE
- 6" CONCRETE
- SEDIMENT BARRIER



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

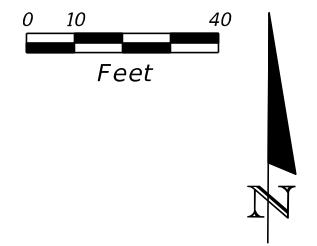
INFRASTRUCTURE ENGINEERS, INC.
 FRANK C. HICKSON, P.E. - No. 57478
 1069 MAIN STREET, SUITE 112
 SEBASTIAN, FLORIDA 32958
 Ph.: 772.388.1661
 Fax: 407.957.8744
 FL Certificate of Authorization No. 6876

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439677-1-58-01

ROADWAY PLAN-PROFILE

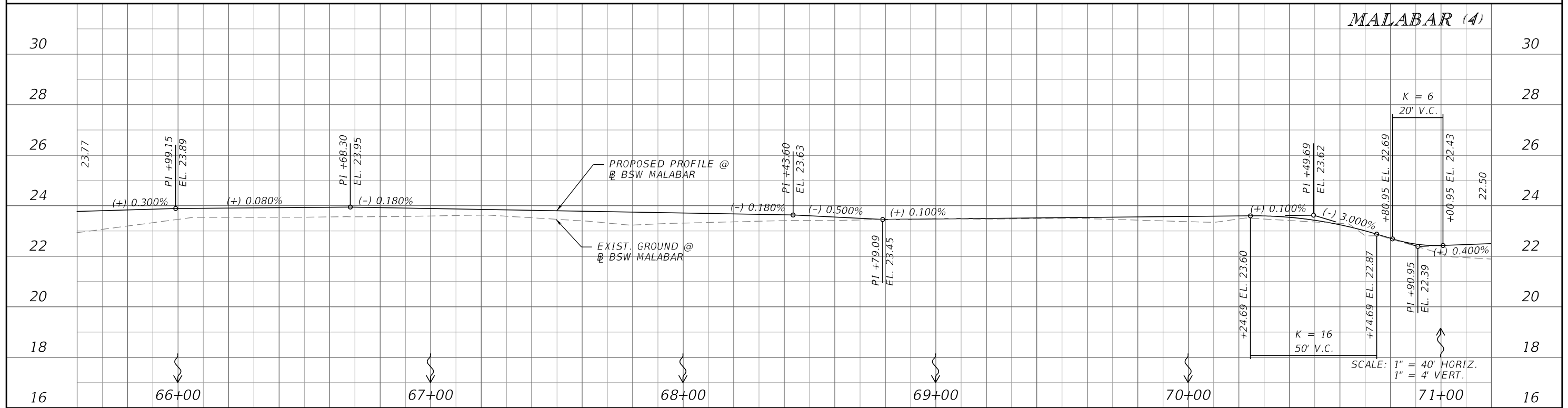
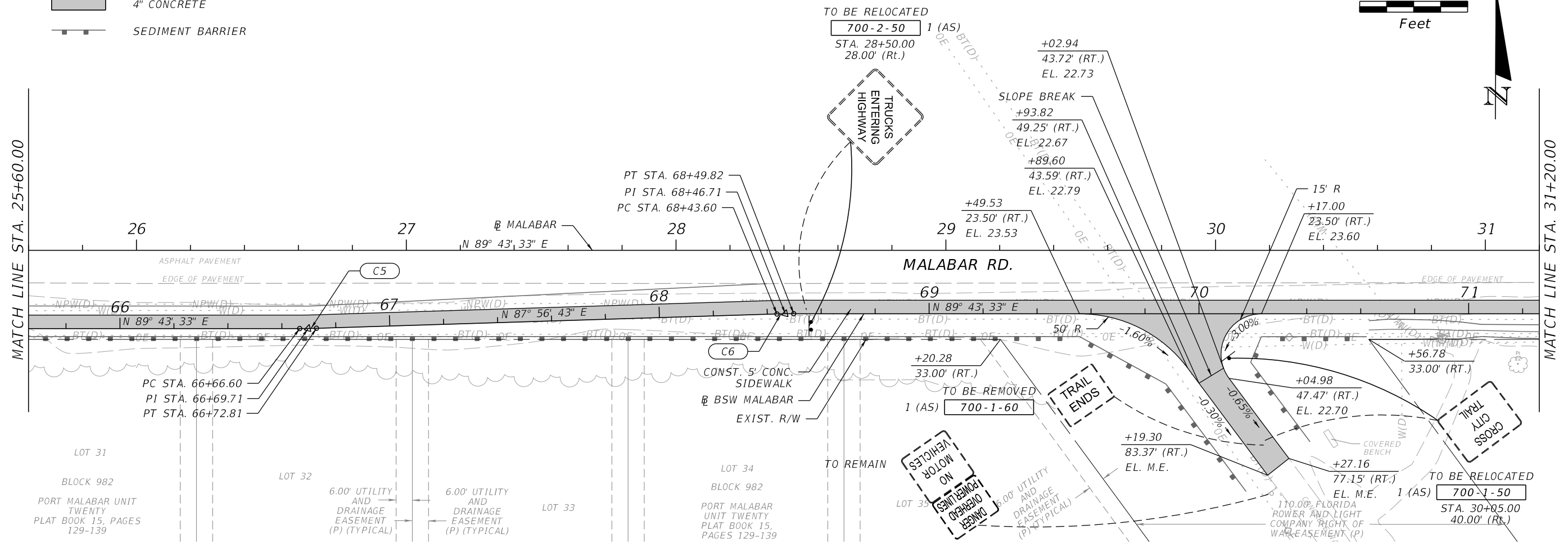
SHEET NO.
11

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



LEGEND:

- 4" CONCRETE
- SEDIMENT BARRIER



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

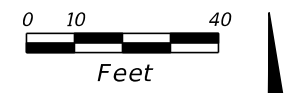
INFRASTRUCTURE ENGINEERS, INC.
 FRANK C. HICKSON, P.E. - No. 57478
 1069 MAIN STREET, SUITE 112
 SEBASTIAN, FLORIDA 32958
 Ph.: 772.388.1661
 Fax: 407.957.8744
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STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439677-1-58-01

ROADWAY PLAN-PROFILE

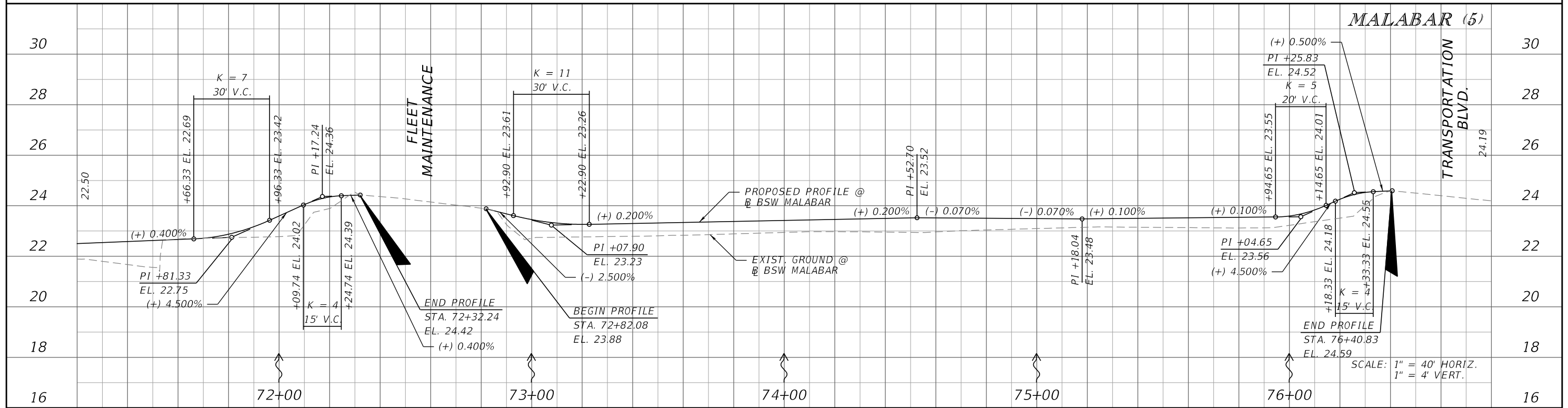
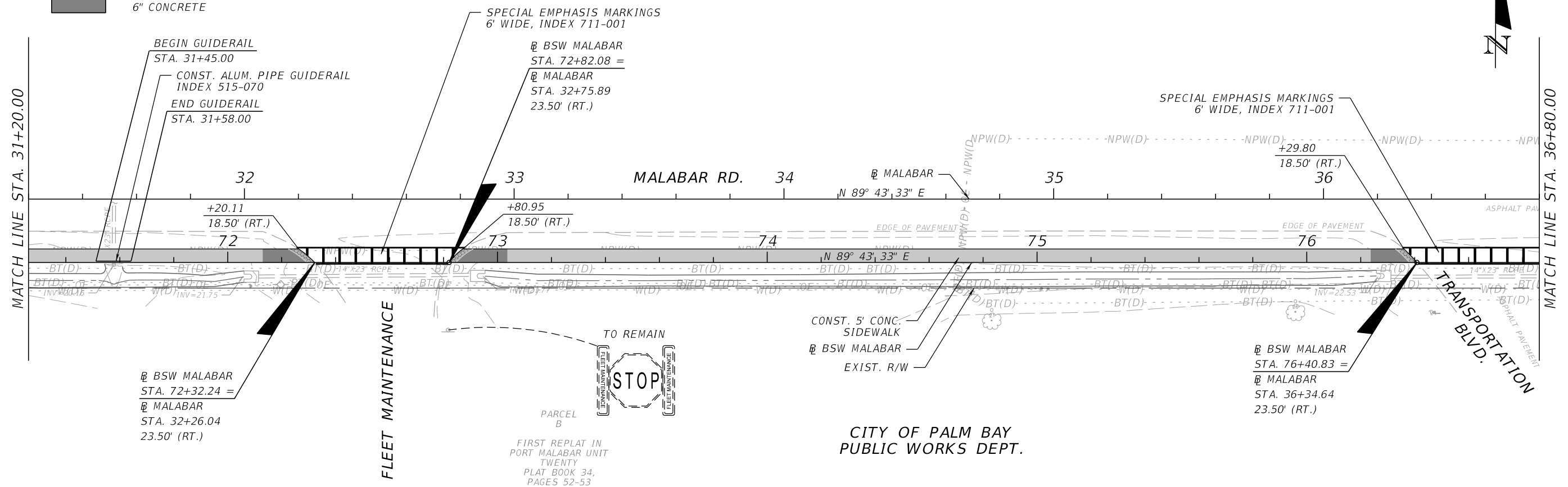
SHEET NO.
12

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



LEGEND:

- DETECTABLE WARNINGS (PER INDEX 522-002)
- 4" CONCRETE
- 6" CONCRETE



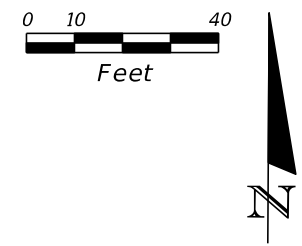
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

INFRASTRUCTURE ENGINEERS, INC.
 FRANK C. HICKSON, P.E. - No. 57478
 1069 MAIN STREET, SUITE 112
 SEBASTIAN, FLORIDA 32958
 Ph.: 772.388.1661
 Fax: 407.957.8744
 FL Certificate of Authorization No. 6876

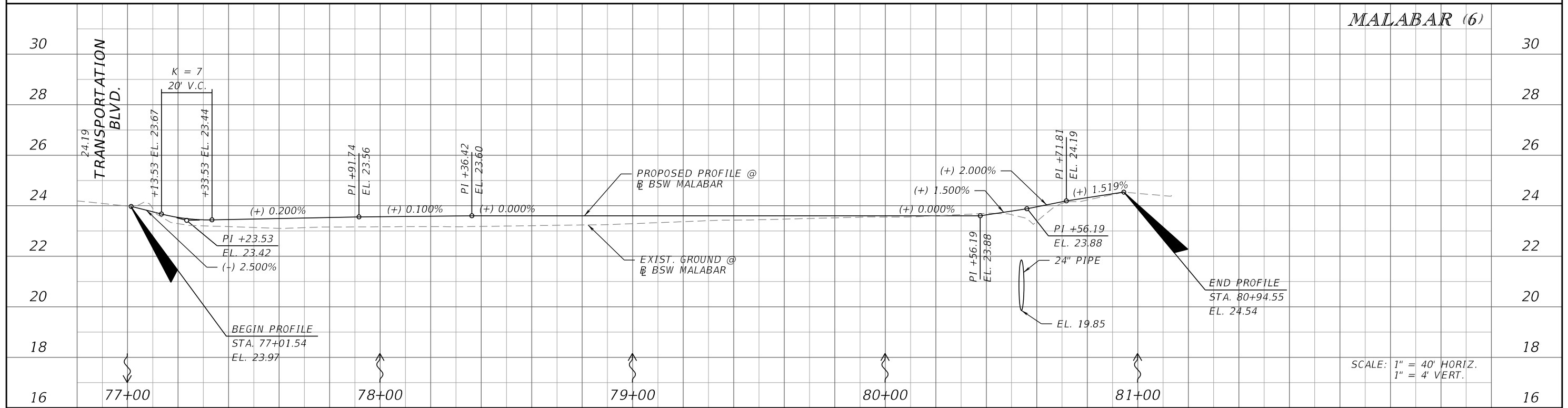
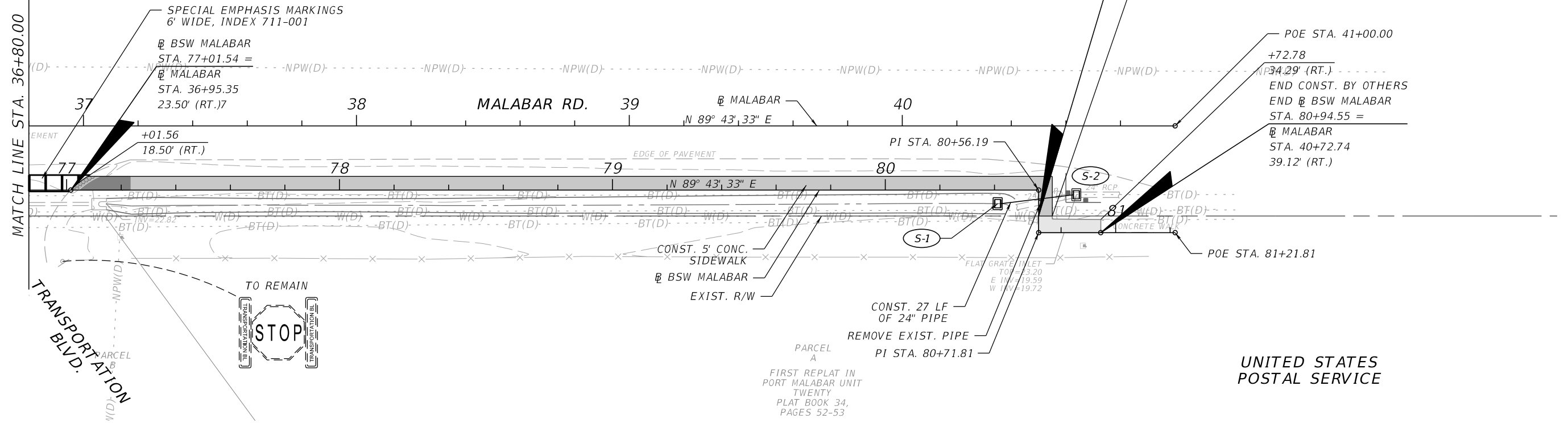
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439677-1-58-01

ROADWAY PLAN-PROFILE		SHEET NO. 13
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THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



- LEGEND:**
- DETECTABLE WARNINGS (PER INDEX 522-002)
 - 4" CONCRETE
 - 4" CONCRETE (BY OTHERS)
 - 6" CONCRETE
 - SEDIMENT BARRIER



SCALE: 1" = 40' HORIZ.
1" = 4' VERT.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

INFRASTRUCTURE ENGINEERS, INC.
FRANK C. HICKSON, P.E. - No. 57478
1069 MAIN STREET, SUITE 112
SEBASTIAN, FLORIDA 32958
Ph.: 772.388.1661
Fax: 407.957.8744
FL Certificate of Authorization No. 6876

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439677-1-58-01

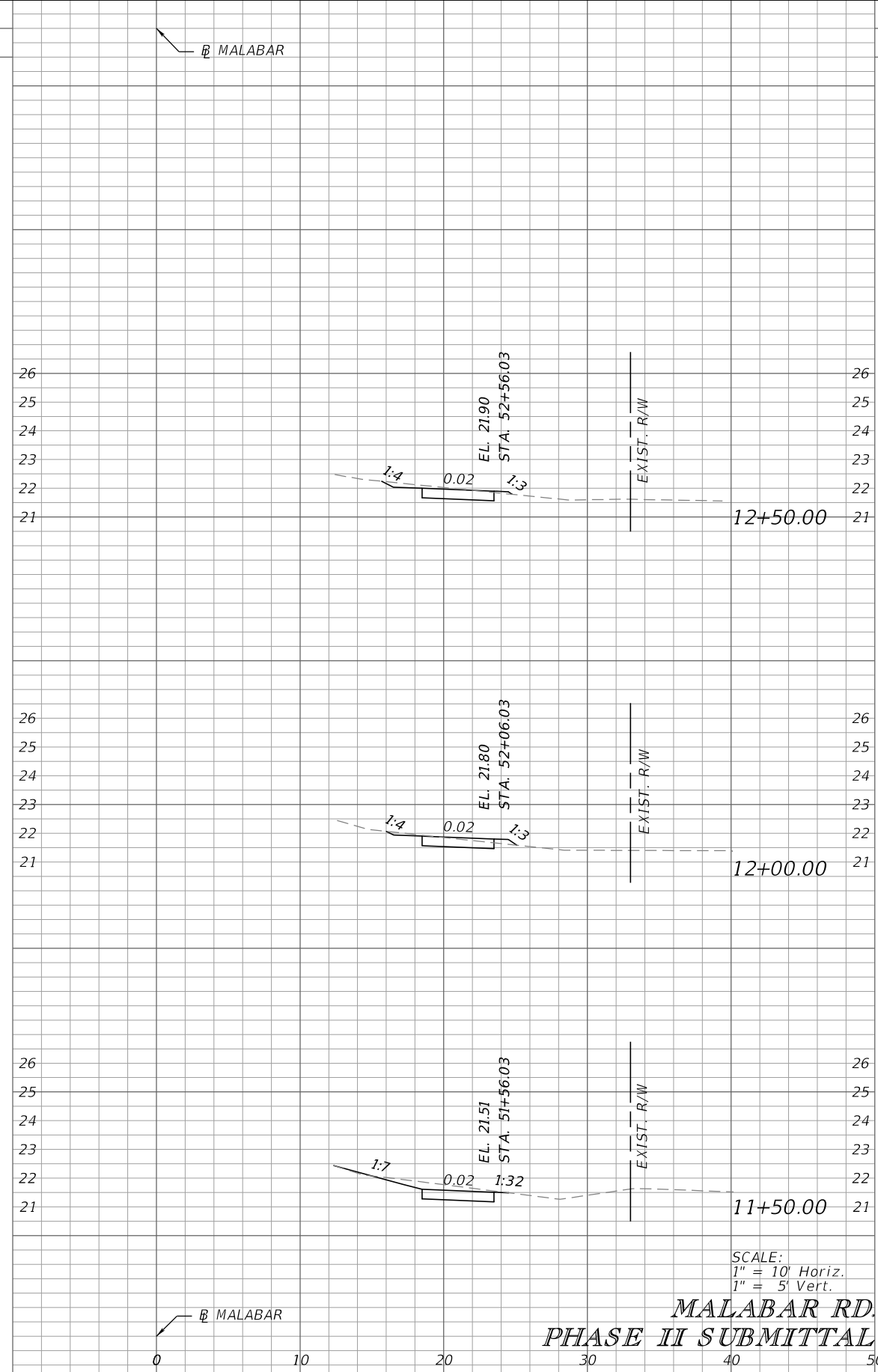
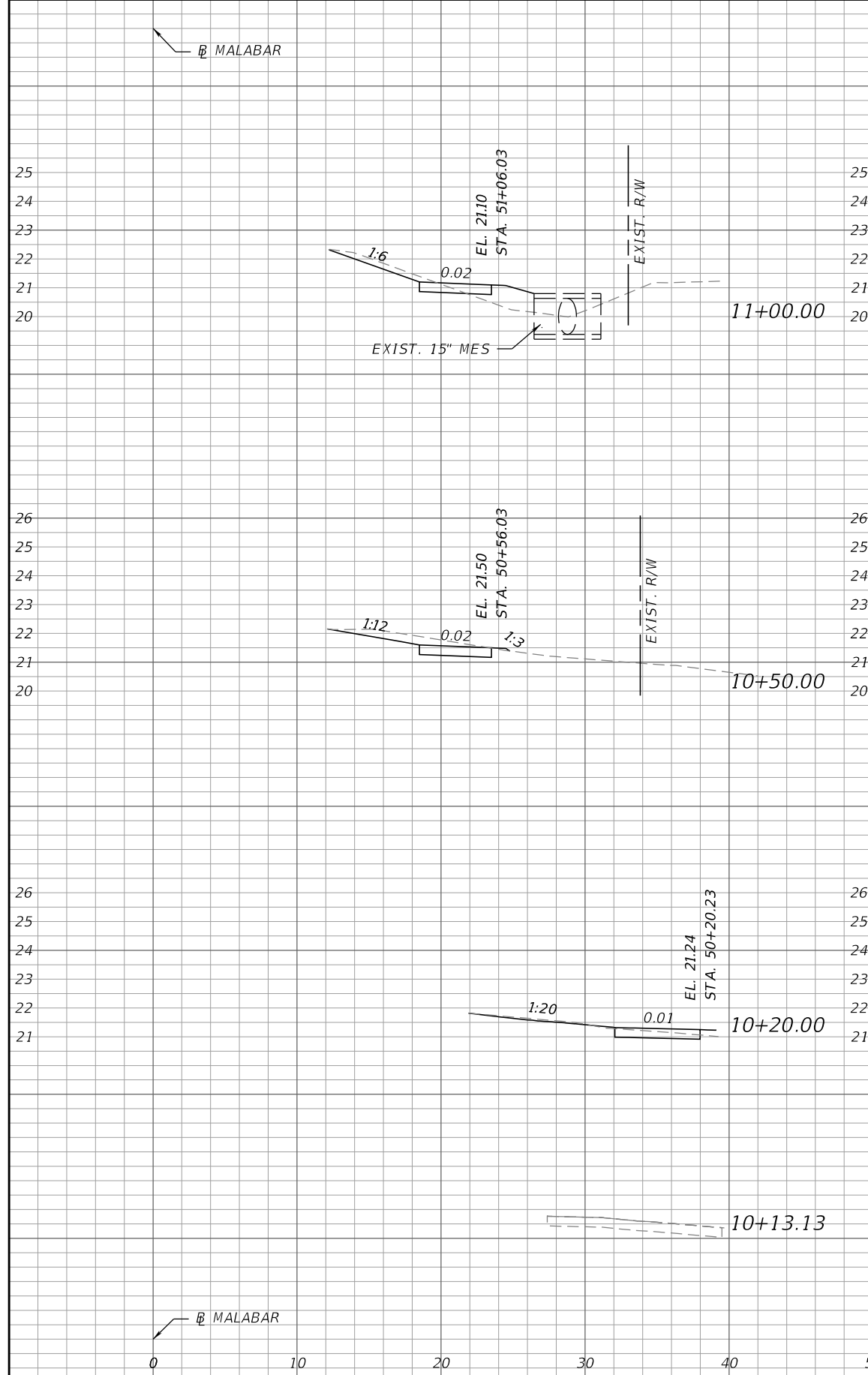
ROADWAY PLAN-PROFILE

SHEET NO.
14

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

Regular Exc. Embankment
A V A V

Regular Exc. Embankment
A V A V



SCALE:
1" = 10' Horiz.
1" = 5' Vert.
MALABAR RD.
PHASE II SUBMITTAL

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439667-1-58-01

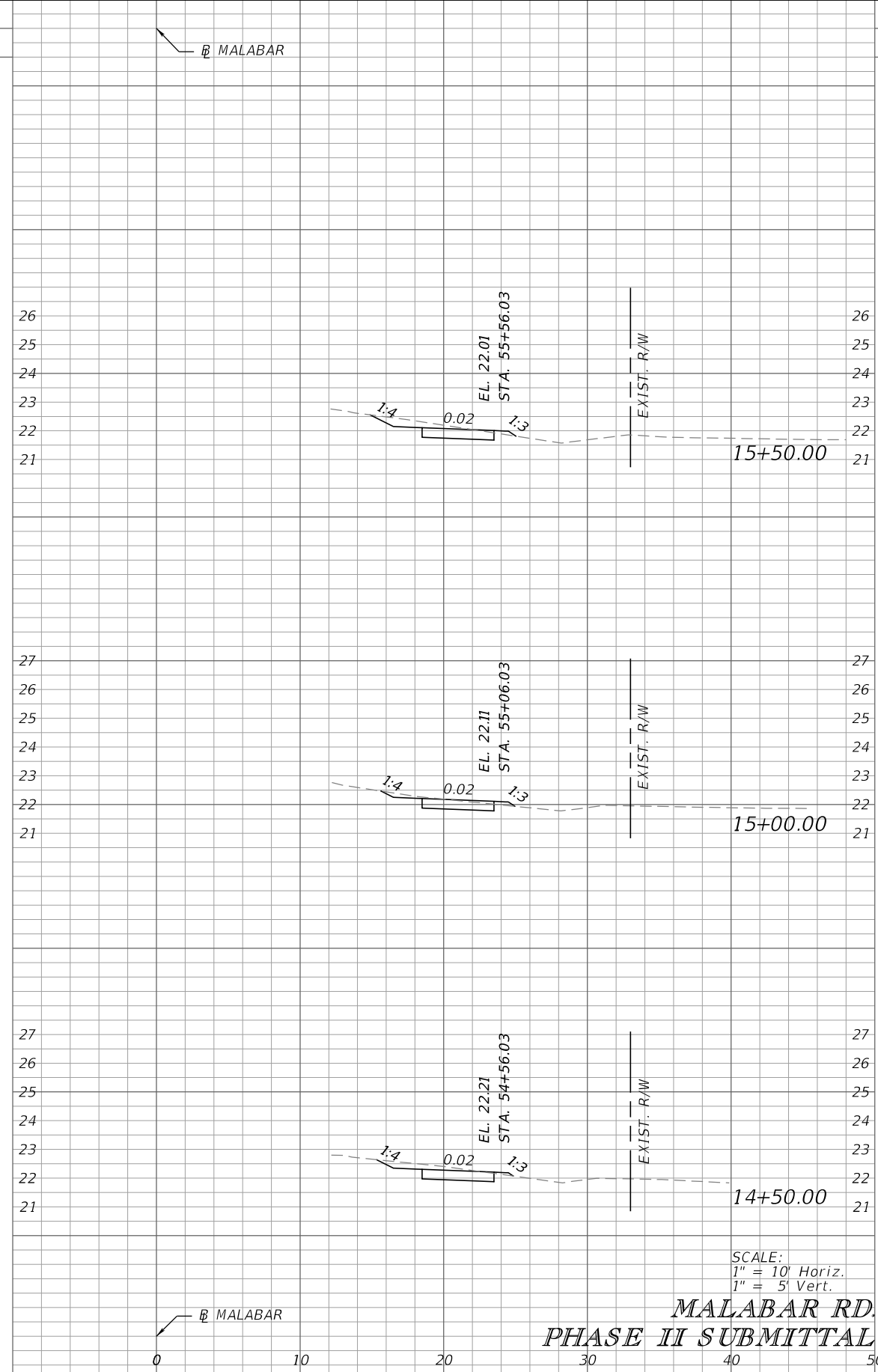
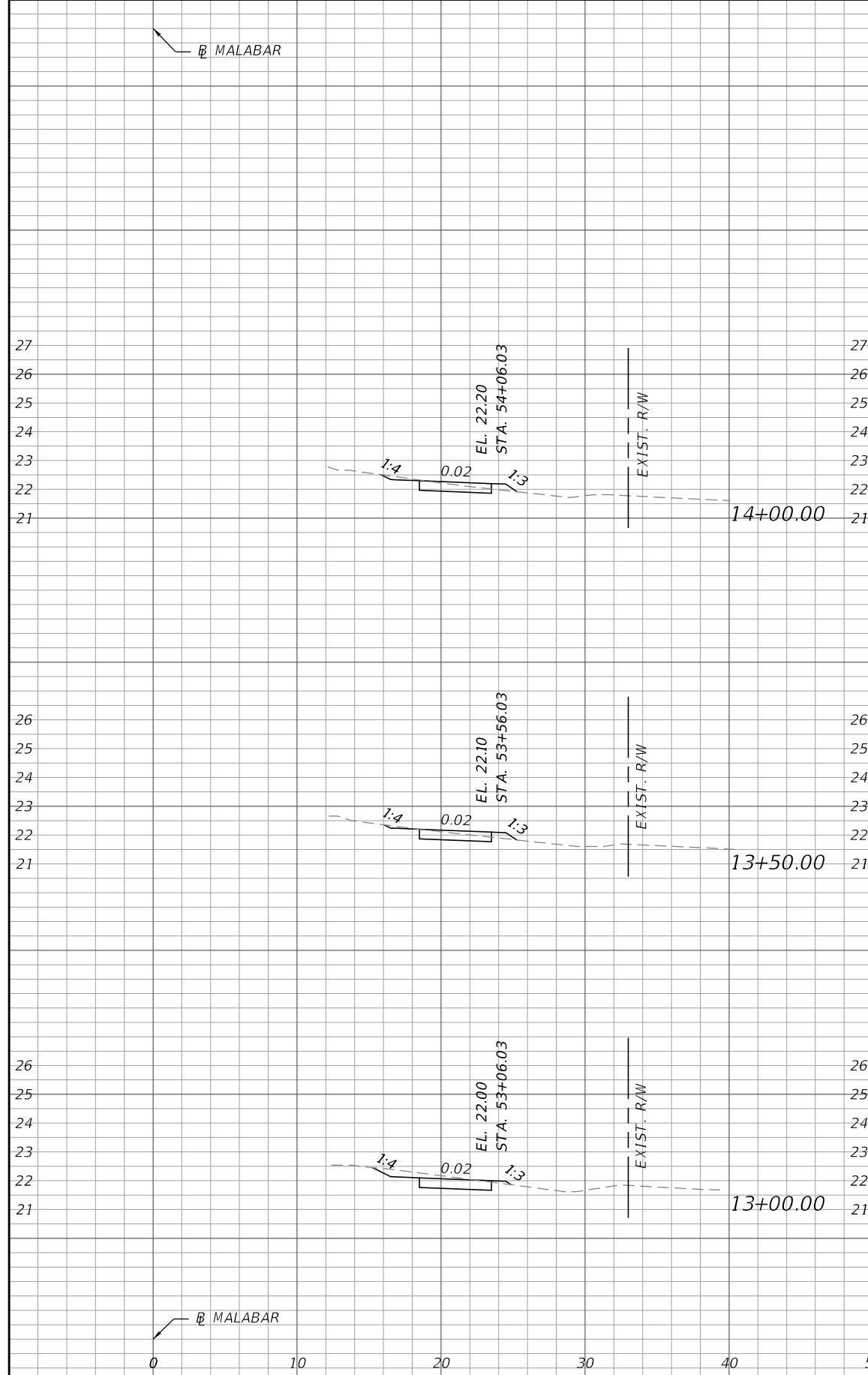
CROSS SECTIONS

SHEET NO.
25

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

Regular Exc. Embankment
A V A V

Regular Exc. Embankment
A V A V



SCALE:
1" = 10' Horiz.
1" = 5' Vert.

MALABAR RD.
PHASE II SUBMITTAL

REVISIONS			
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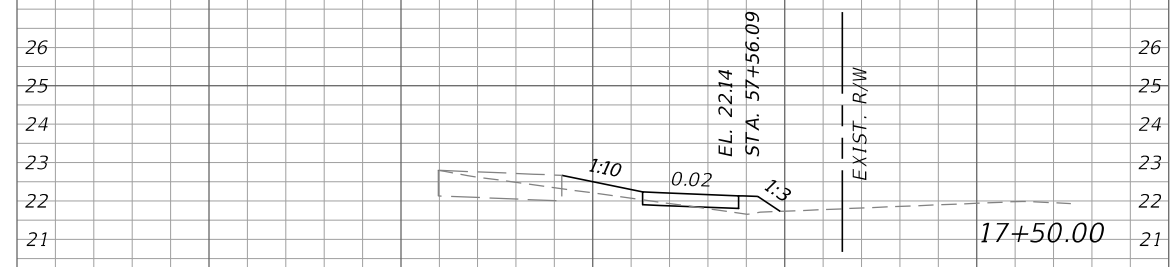
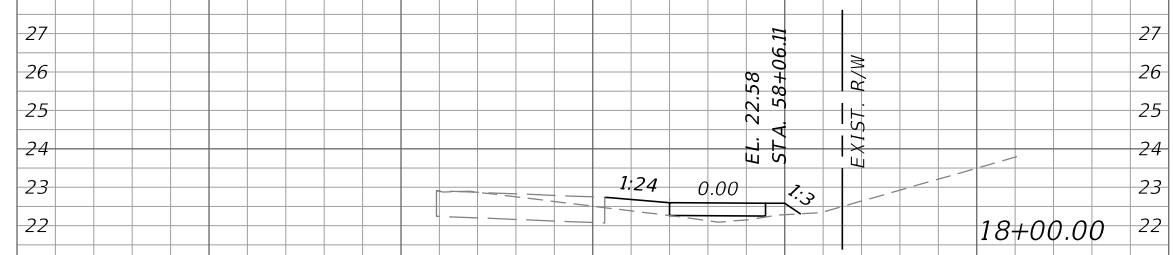
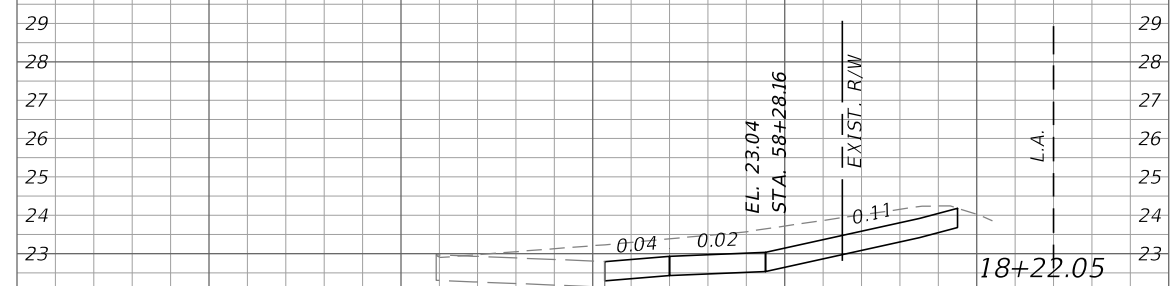
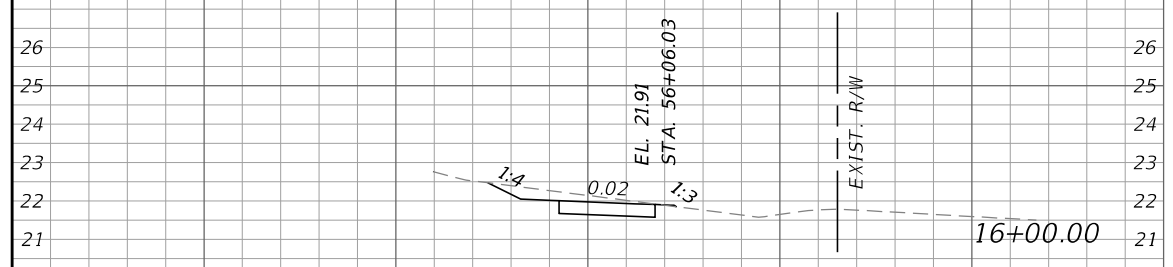
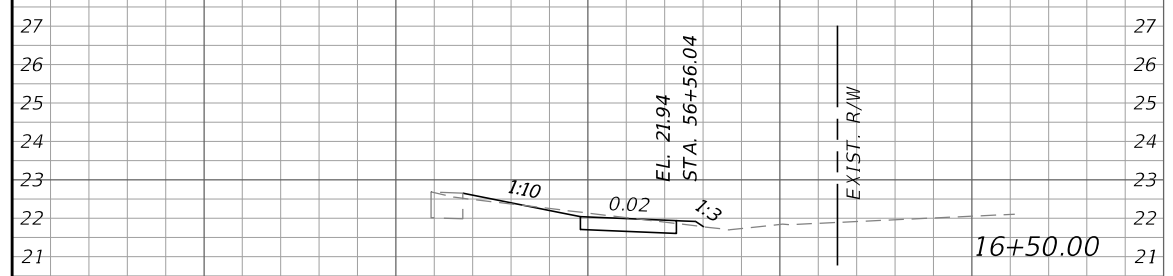
CROSS SECTIONS

SHEET NO.
26

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

Regular Exc. Embankment
A V A V

Regular Exc. Embankment
A V A V



SCALE:
1" = 10' Horiz.
1" = 5' Vert.

**MALABAR RD.
PHASE II SUBMITTAL**

REVISIONS			
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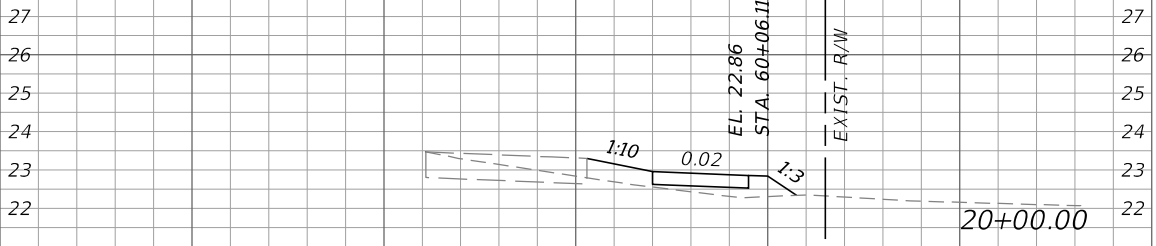
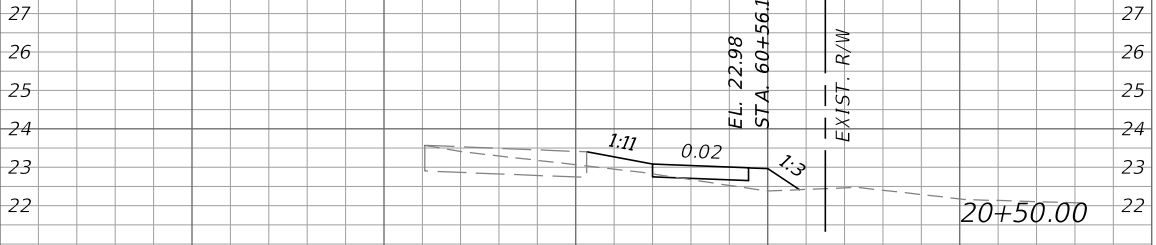
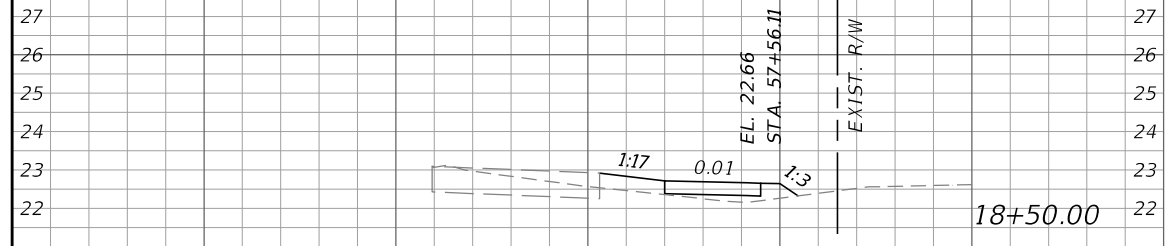
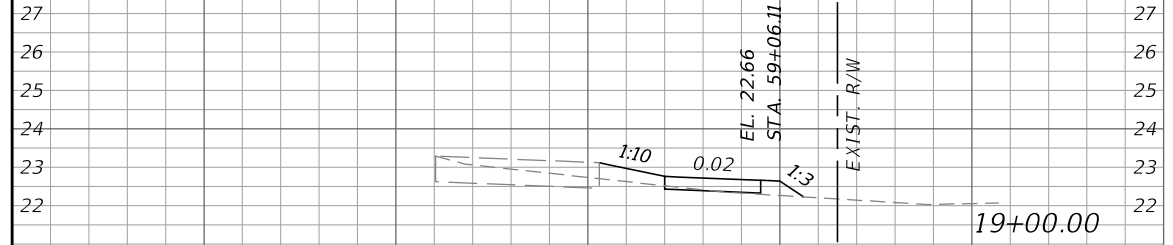
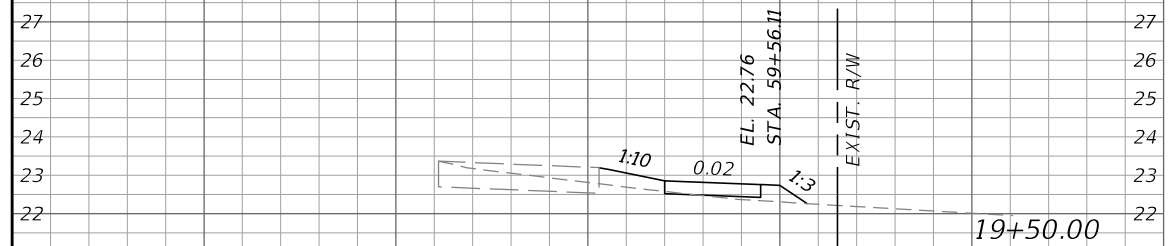
CROSS SECTIONS

SHEET NO.
27

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Regular Exc. Embankment
A V A V

Regular Exc. Embankment
A V A V



SCALE:
1" = 10' Horiz.
1" = 5' Vert.

**MALABAR RD.
PHASE II SUBMITTAL**

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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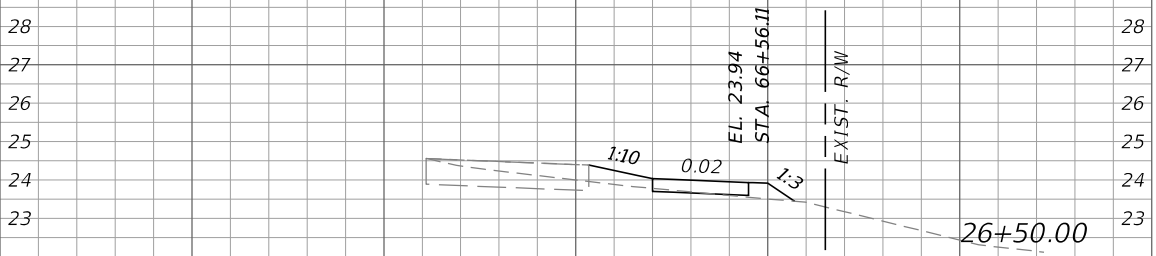
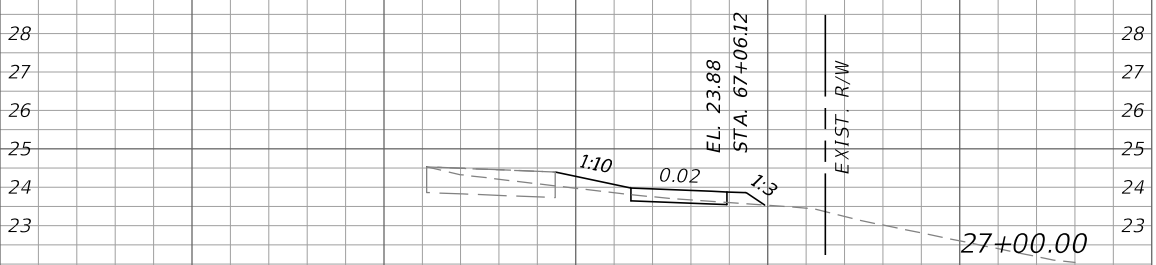
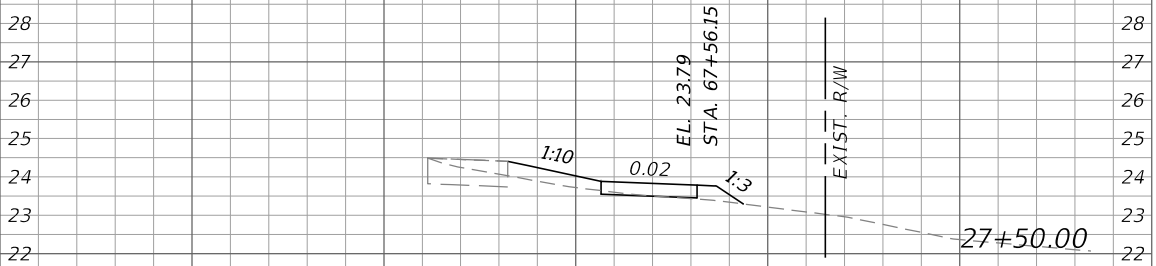
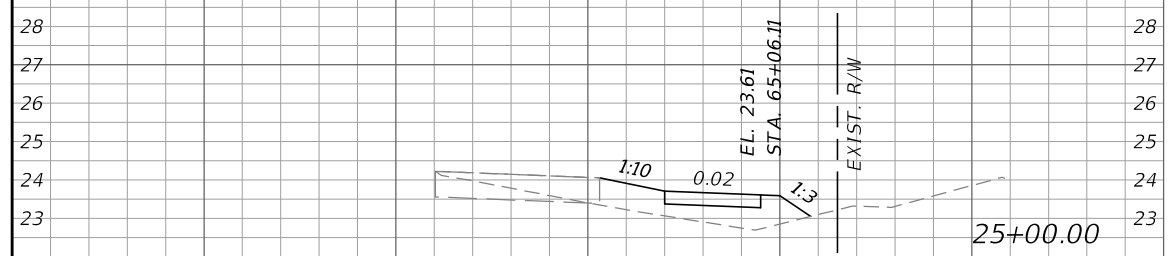
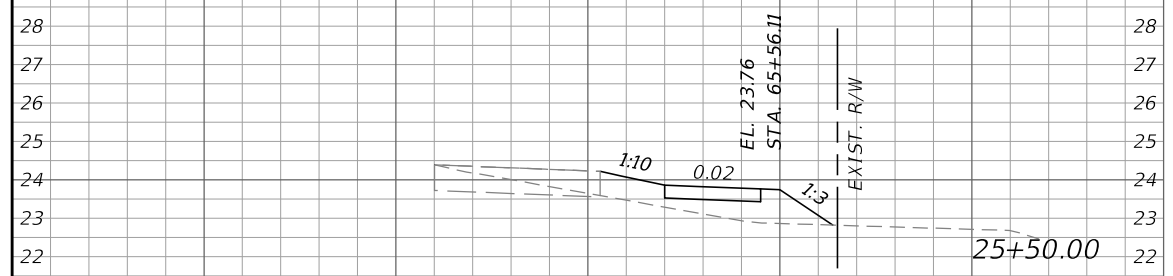
CROSS SECTIONS

SHEET NO.
28

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Regular Exc. Embankment
A V A V

Regular Exc. Embankment
A V A V



SCALE:
1" = 10' Horiz.
1" = 5' Vert.

MALABAR RD.
PHASE II SUBMITTAL

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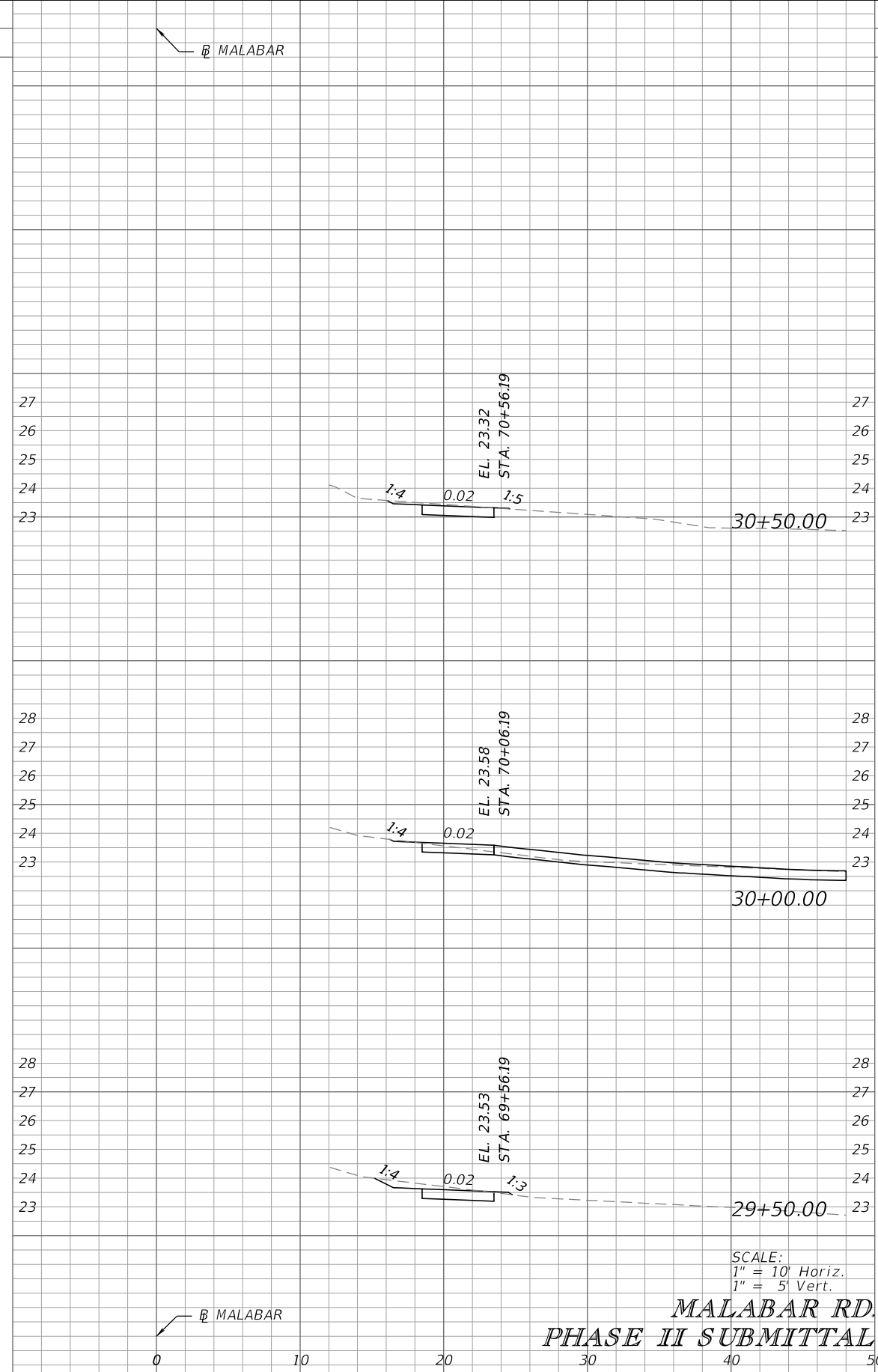
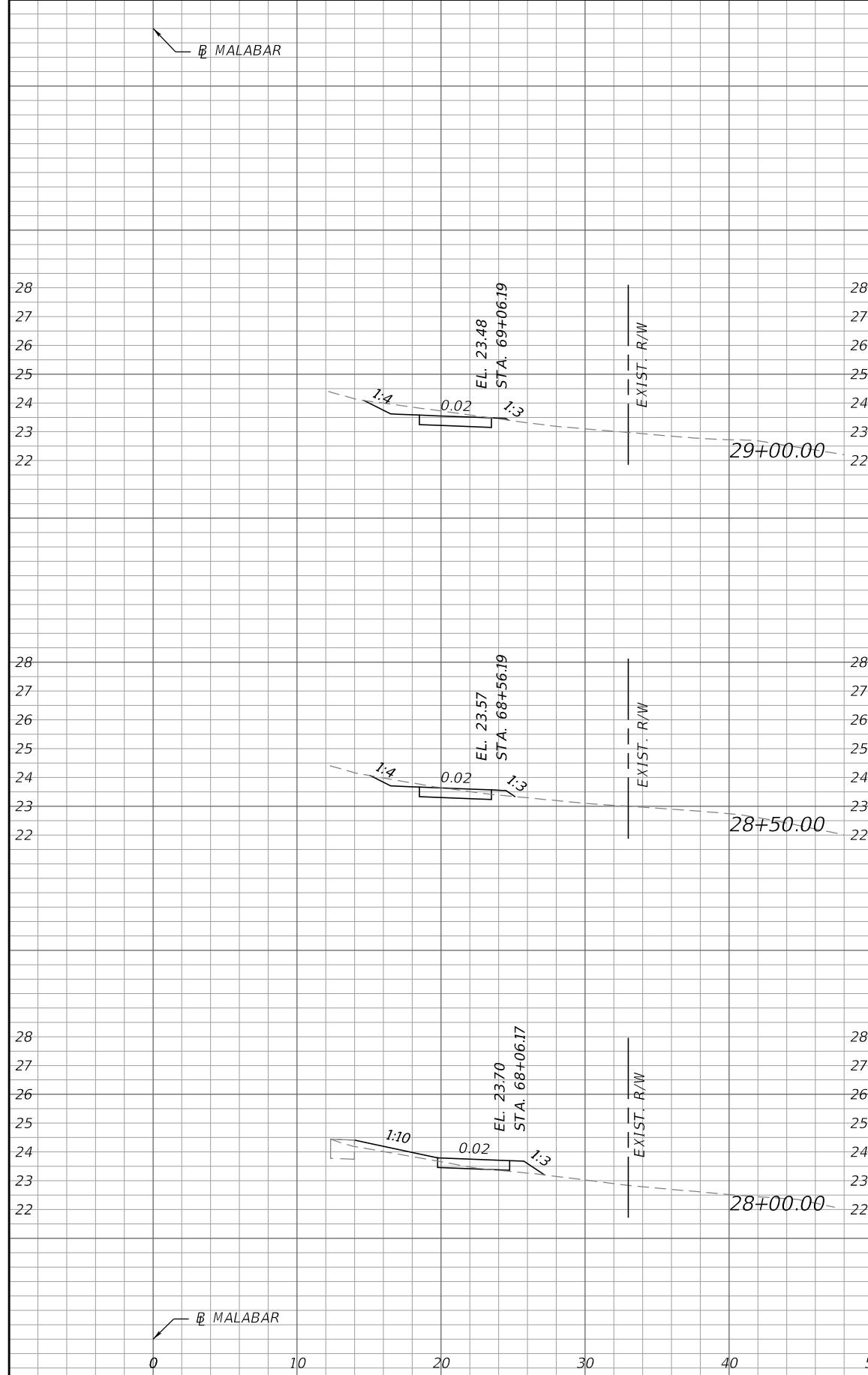
CROSS SECTIONS

SHEET NO.
30

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Regular Exc. Embankment
A V A V

Regular Exc. Embankment
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MALABAR RD.
PHASE II SUBMITTAL

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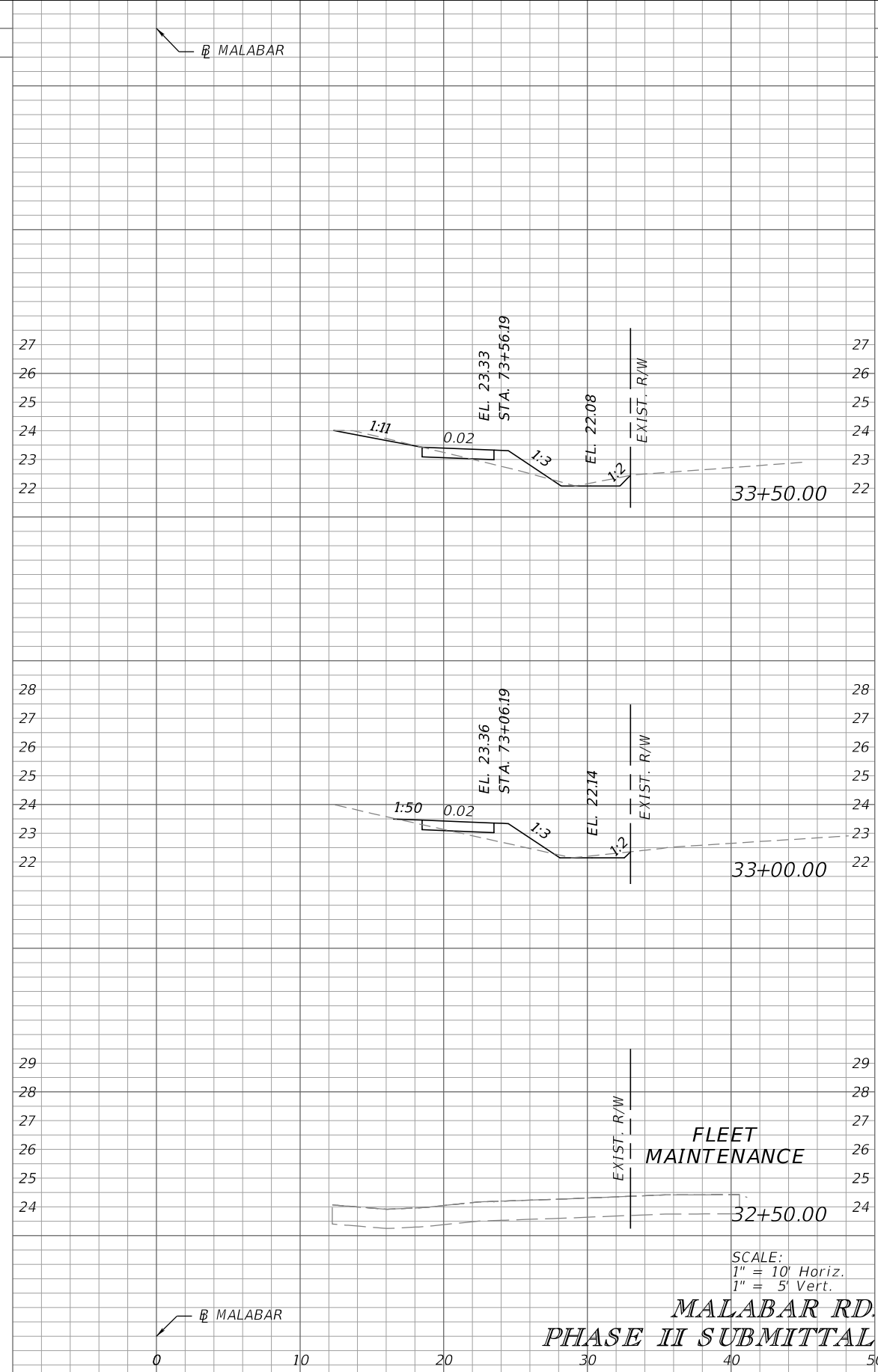
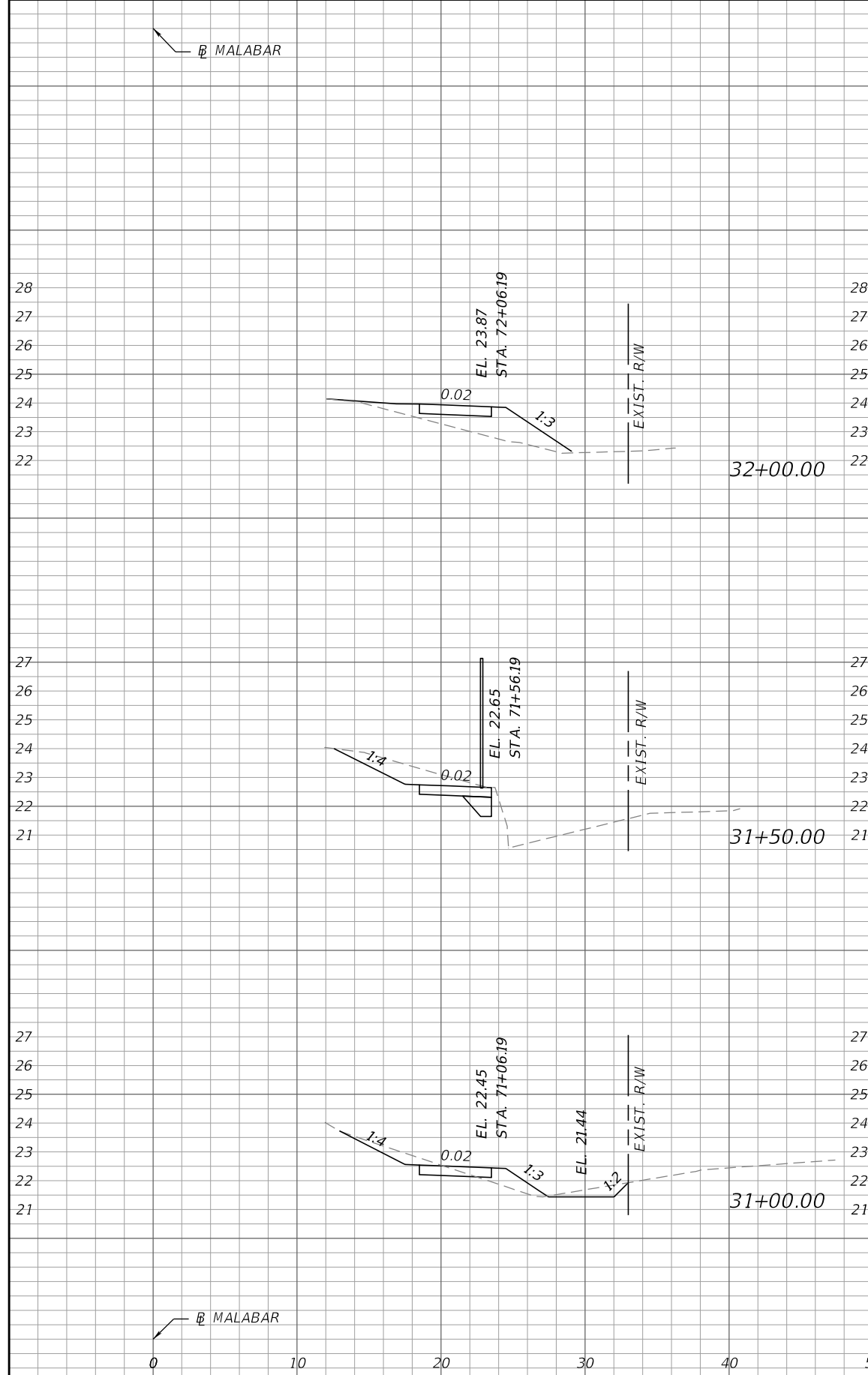
CROSS SECTIONS

SHEET NO.
31

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Regular Exc. Embankment
A V A V

Regular Exc. Embankment
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DEPARTMENT OF TRANSPORTATION

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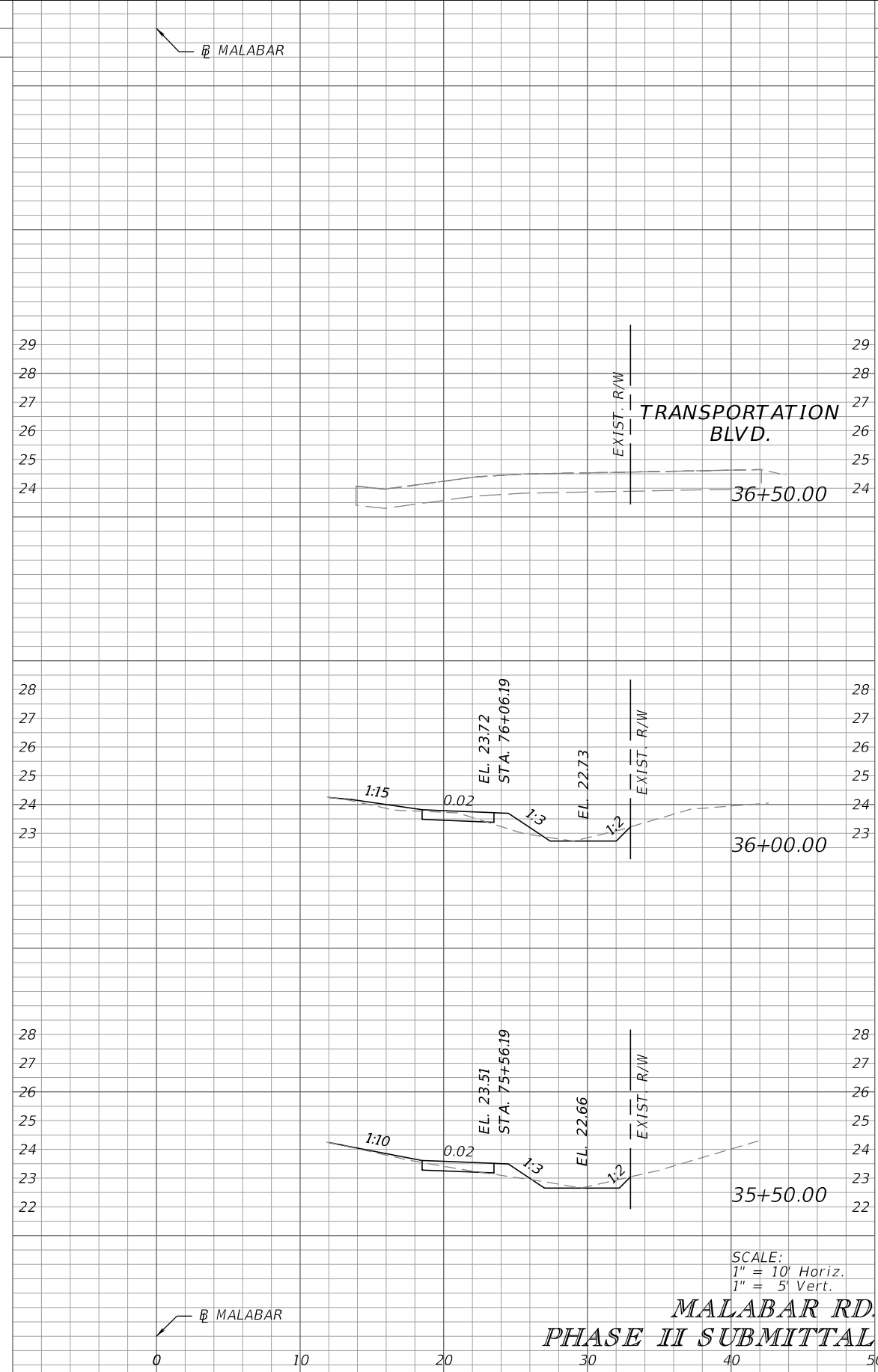
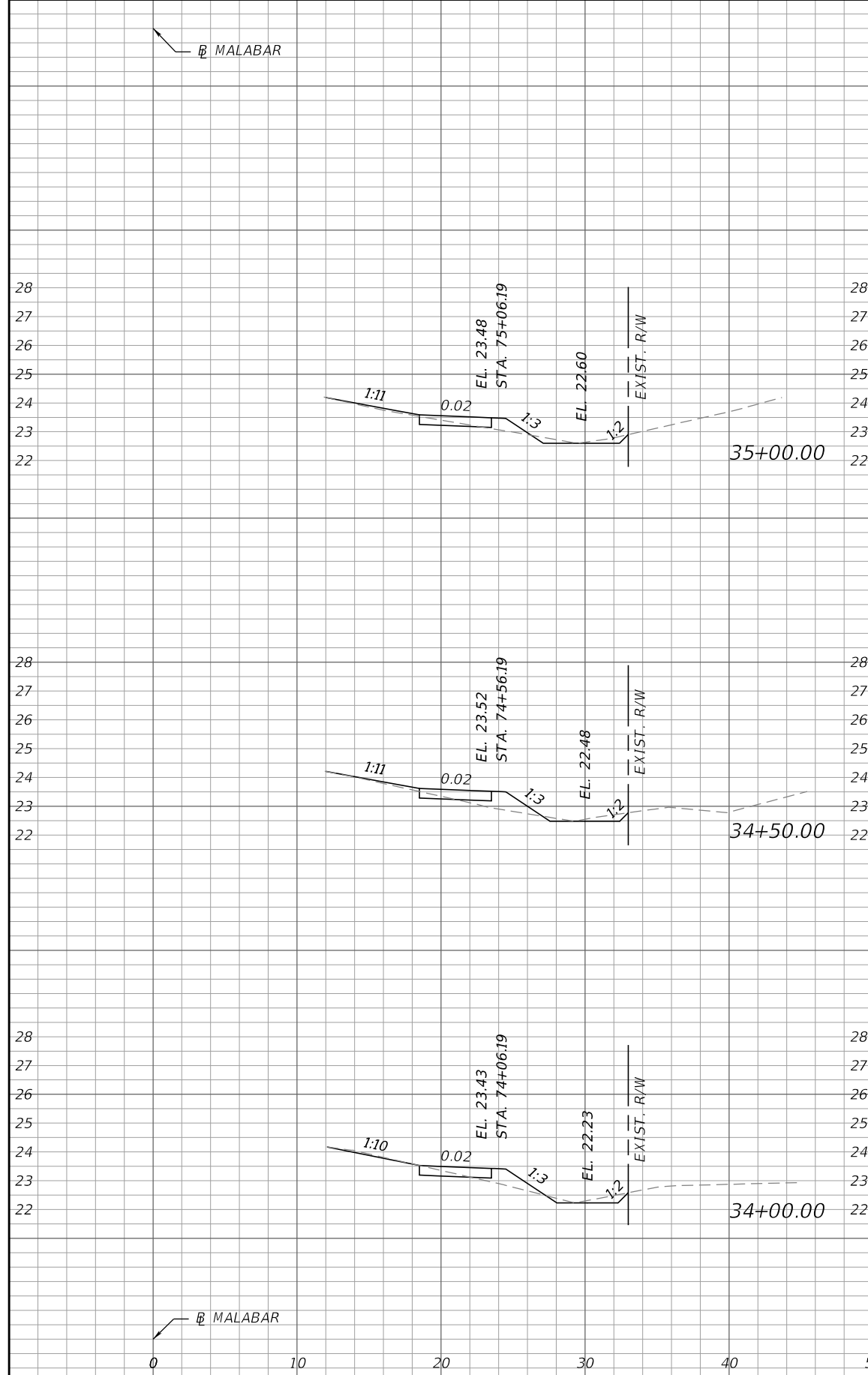
CROSS SECTIONS

SHEET NO.
32

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Regular Exc. Embankment
A V A V

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MALABAR RD.
PHASE II SUBMITTAL

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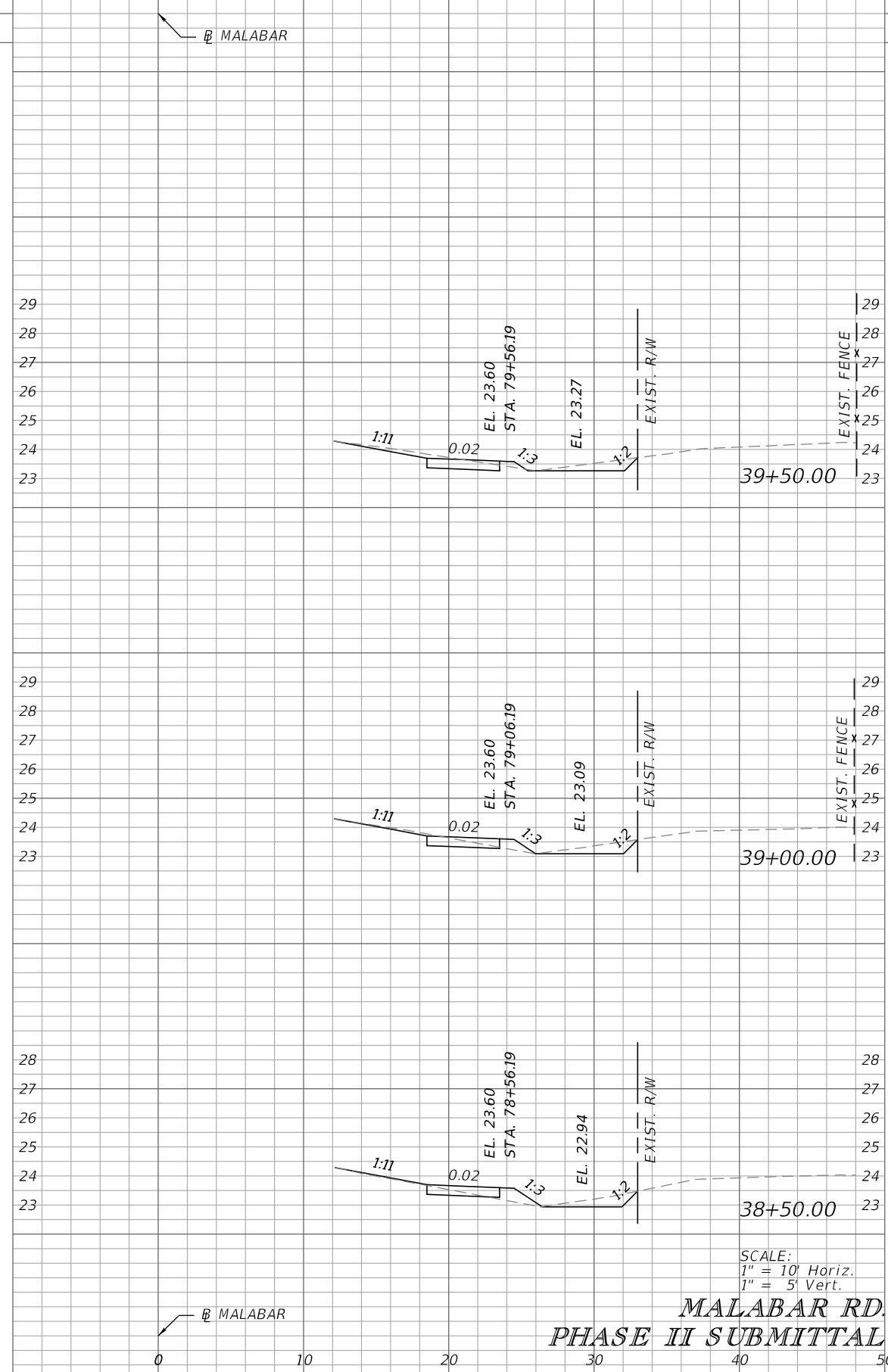
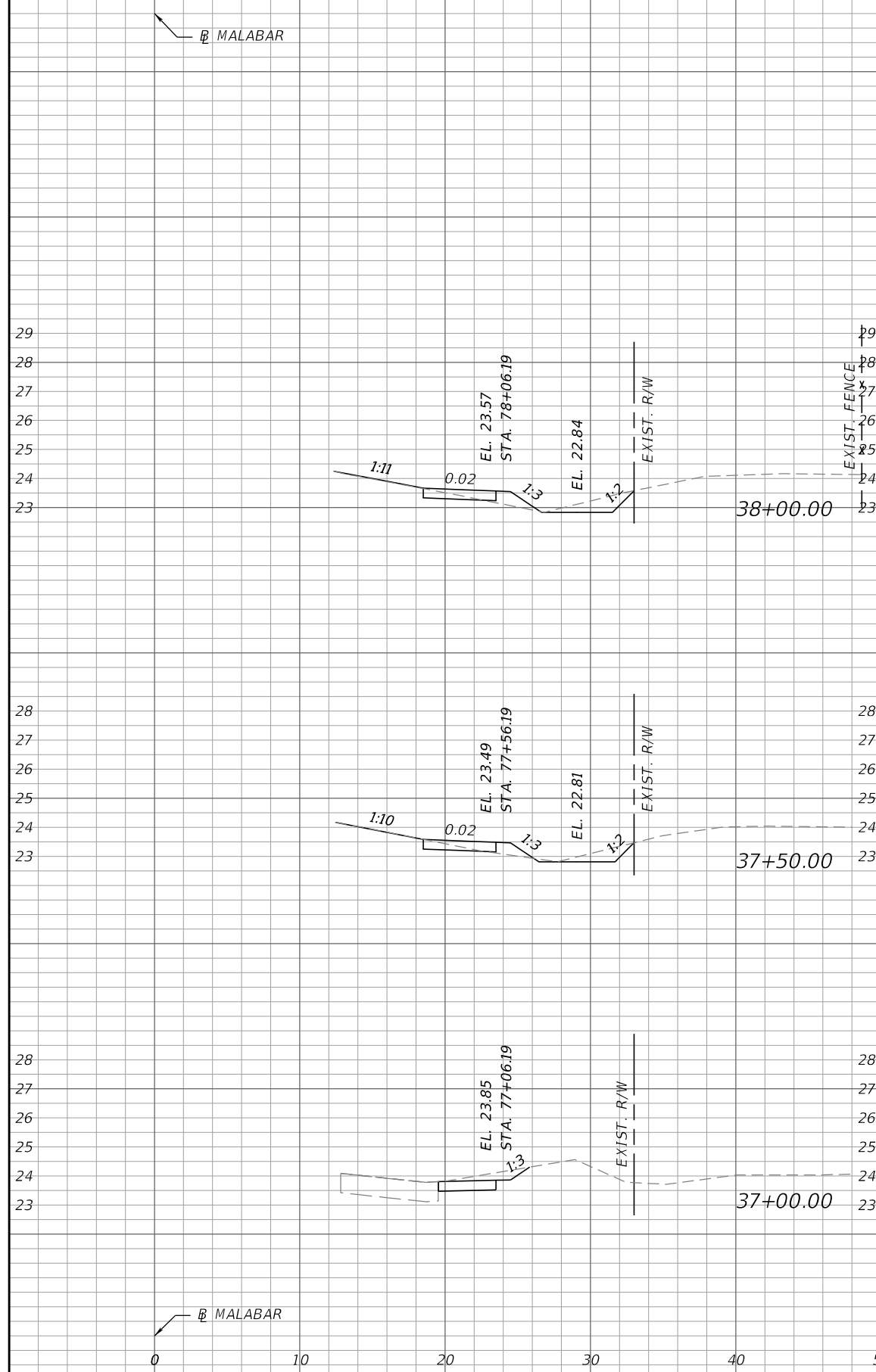
CROSS SECTIONS

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33

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**MALABAR RD.
PHASE II SUBMITTAL**

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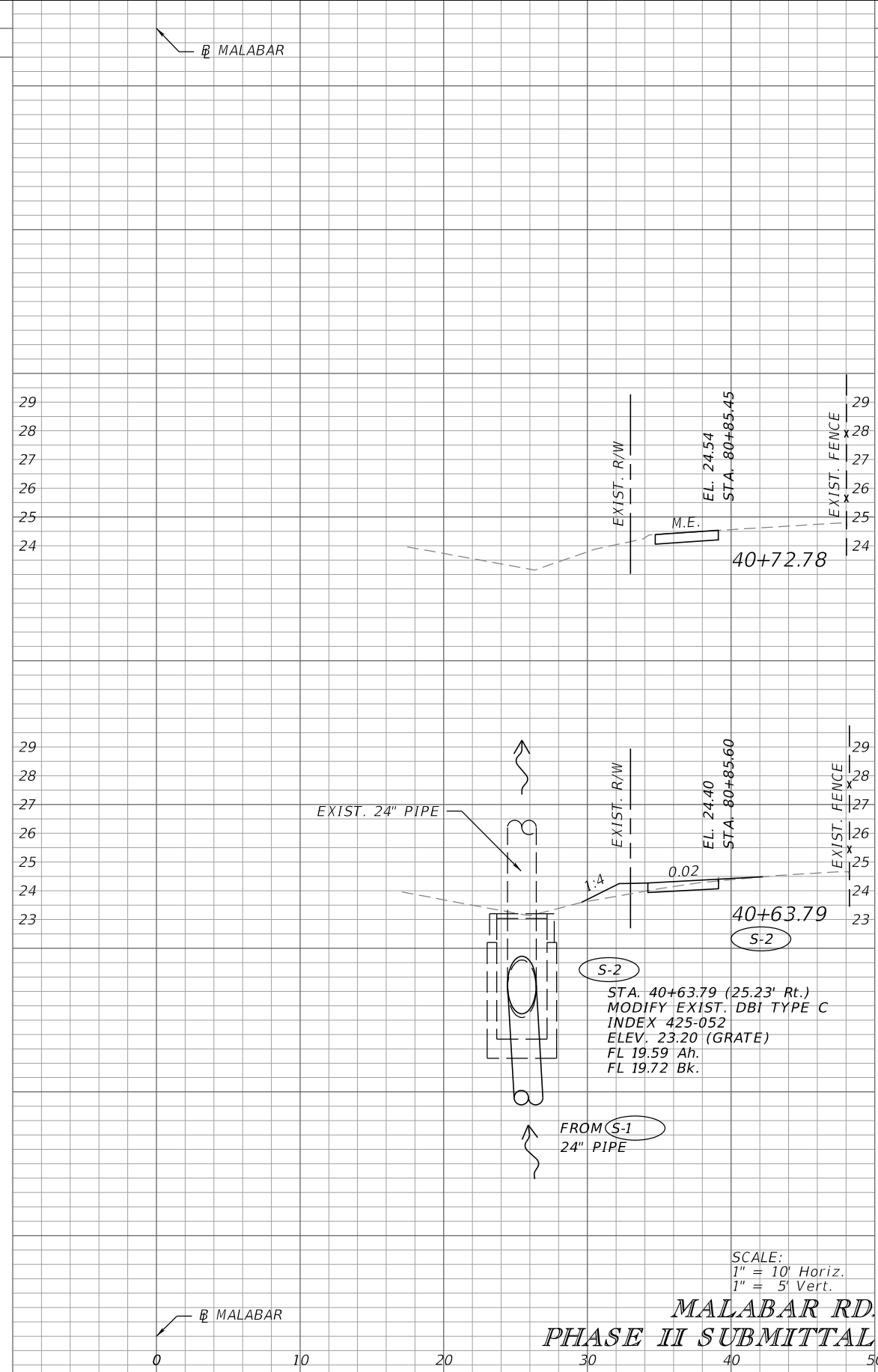
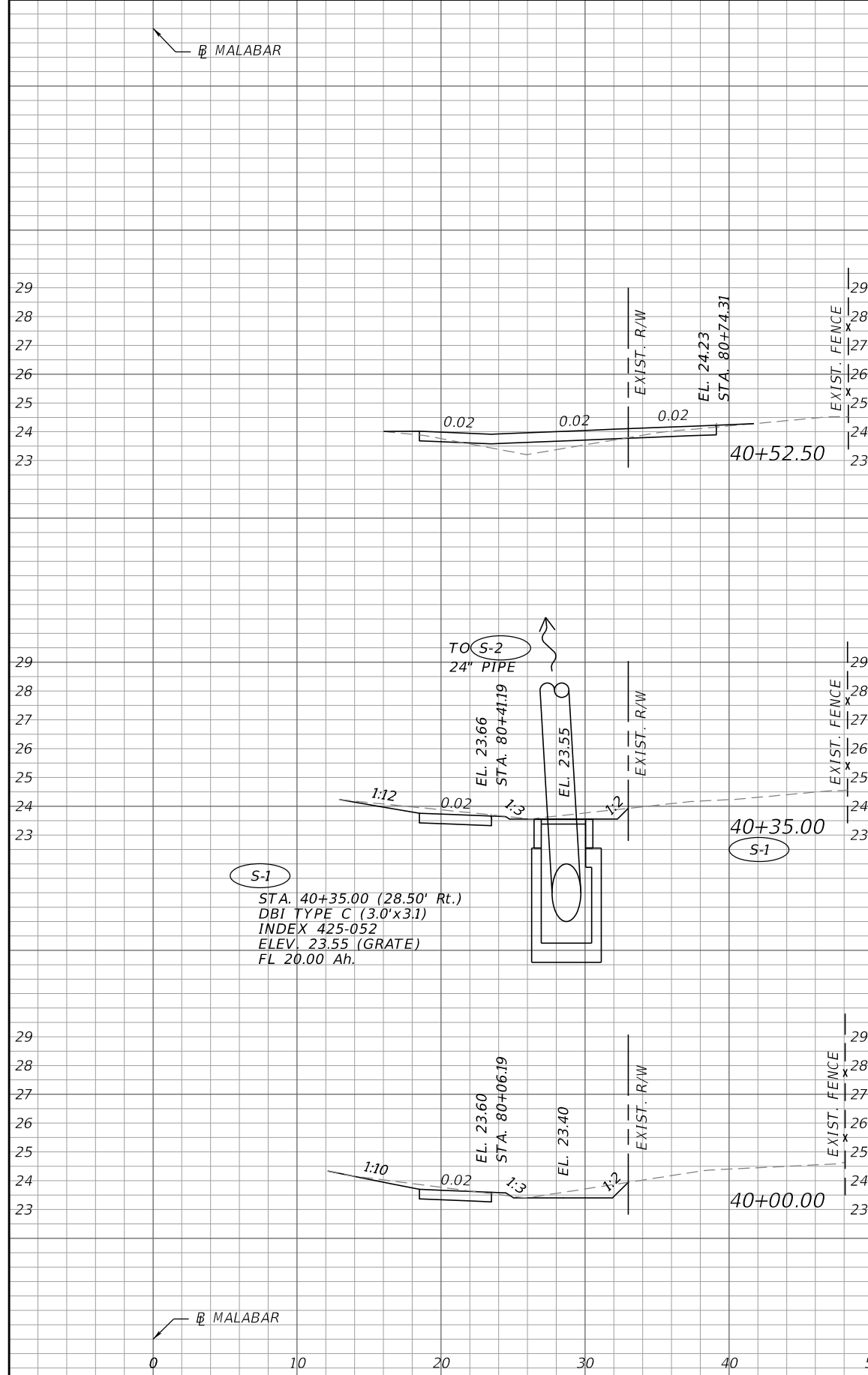
CROSS SECTIONS

SHEET NO.
34

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Regular Exc. Embankment
A V A V

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MALABAR RD.
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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	BREVARD	439667-1-58-01

CROSS SECTIONS

SHEET NO.
35

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

G.8

Permit No. 16558-5



POST OFFICE BOX 1429 PALATKA, FLORIDA 32178-1429
TELEPHONE 804-329-4500 SUNCOM 804-880-4500
TDD 804-329-4450 TDD SUNCOM 880-4450
FAX (Executive) 329-4125 (Legal) 329-4485 (Permitting) 329-4315 (Administration/Finance) 329-4508
(Planning and Acquisition) 329-4848

SERVICE CENTERS
618 E. South Street 7775 Baymeadows Way PERMITTING: OPERATIONS:
Orlando, Florida 32801 Suite 102 305 East Drive 2133 N. Wickham Road
407-897-4300 Jacksonville, Florida 32256 Melbourne, Florida 32904 Melbourne, Florida 32935-8100
TDD 407-897-5980 TDD 904-448-7900 TDD 407-722-5388 TDD 407-752-3100
TDD 407-752-3102

July 8, 1998

BREVARD COUNTY
ATTN PUBLIC WORKS/JOHN DENNINGHOFF
2725 JUDGE FRAN JAM. W BLD A SU 253
VIERA, FL 32940

16558-5

SUBJECT: Permit Number 4-009-0392GM4-ERP

Dear Sir:

Enclosed is your permit as authorized by the Governing Board of the St. Johns River Water Management District on July 8, 1998.

This permit is a legal document and should be kept with your other important documents. The attached MSSW/Stormwater As-Built Certification Form should be filled in and returned to the Palatka office within thirty days after the work is completed. By so doing, you will enable us to schedule a prompt inspection of the permitted activity.

In addition to the MSSW/Stormwater As-Built Certification Form, your permit also contains conditions which require submittal of additional information. All information submitted as compliance to permit conditions must be submitted to the Palatka office address.

Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state and/or local agencies asserting concurrent jurisdiction for this work.

In the event you sell your property, the permit will be transferred to the new owner, if we are notified by you within thirty days of the sale. Please assist us in this matter so as to maintain a valid permit for the new property owner.

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,

Gloria Lewis, Director
Permit Data Services Division

Enclosures: Permit with EN form(s), if applicable

cc: District Permit File
PROFESSIONAL ENGINEERING CONSULTANTS, INC.

Dan Roach, CHAIRMAN FERNANDINA BEACH
William M. Segel MAITLAND
Kathy Chinoy, VICE CHAIRMAN PONTE VEDRA
Griffin A. Greene VERO BEACH
James H. Williams Ocala
James T. Swann, TREASURER COCOA
Patricie T. Herden SANFORD
Otis Meson, SECRETARY ST. AUGUSTINE
Reld Hughes DAYTONA BEACH

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO. 4-009-0392GM4-ERP

DATE ISSUED July 8, 1998

PROJECT NAME: MALABAR ROAD PHASE 2

A PERMIT AUTHORIZING:

MODIFICATION OF A PORTION OF A PREVIOUSLY PERMITTED SURFACE WATER MANAGEMENT SYSTEM TO SERVE THE PROPOSED WIDENING OF MALABAR ROAD FROM TWO TO SIX LANES WITHIN BASIN B OF THE MASTER SYSTEM.

LOCATION:

Section 31, 32, Township 28 South, Range 37 East
Brevard County

ISSUED TO:
(owner)

BREVARD COUNTY
2725 JUDGE FRAN JAM. W BLD A SU 253
VIERA, FL 32940

Permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to permittee any property rights nor any rights or privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This Permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes:

PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated July 8, 1998

AUTHORIZED BY: St. Johns River Water Management District

Department of Resource Management

Governing Board

By: 

(DIRECTOR)

JEFF ELLEDGE

By: 

(ASSISTANT SECRETARY)

HENRY DEAN

"EXHIBIT A"

CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 4-009-0392GM4-ERP

BREVARD COUNTY

DATED JULY 8, 1998

1. All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.
2. This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by District staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.
3. Activities approved by this permit shall be conducted in a manner which do not cause violations of state water quality standards.
4. Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.
5. Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.

6. At least 48 hours prior to commencement of activity authorized by this permit, the permitted shall submit to the District a Construction Commencement Notice Form No. 40C-4.900(3) indicating the actual start date and the expected completion date.
7. When the duration of construction will exceed one year, the permittee shall submit construction status reports to the District on an annual basis utilizing an Annual Status Report Form No. 40C-4.900(4). These forms shall be submitted during June of each year.
8. For those systems which will be operated or maintained by an entity which will require an easement or deed restriction in order to provide that entity with the authority necessary to operate or maintain the system, such easement or deed restriction, together with any other final operation or maintenance documents as are required by subsections 7.1.1 through 7.1.4 of the Applicants Handbook: Management and Storage of Surface Waters, must be submitted to the District for approval. Documents meeting the requirements set forth in these subsections of the Applicants Handbook will be approved. Deed restrictions, easements and other operation and maintenance documents which require recordation either with the Secretary of State or the Clerk of the Circuit Court must be so recorded prior to lot or unit sales within the project served by the system, or upon completion of construction of the system, whichever occurs first. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the District when maintenance and operation of the system is accepted by the local governmental entity. Failure to submit the appropriate final documents referenced in this paragraph will result in the permittee remaining liable for carrying out maintenance and operation of the permitted system.
9. Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.
10. Within 30 days after completion of construction of the permitted system, or independent portion of the system, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing As Built Certification Form 40C-1.181(13) or 40C-1.181(14) supplied with

this permit. When the completed system differs substantially from the permitted plans, any substantial deviations shall be noted and explained and two copies of as-built drawings submitted to the District. Submittal of the completed form shall serve to notify the District that the system is ready for inspection. The statement of completion and certification shall be based on on-site observation of construction (conducted by the registered professional engineer, or other appropriate individual as authorized by law, or under his or her direct supervision) or review of as-built drawings for the purpose of determining if the work was completed in compliance with approved plans and specifications. As-built drawings shall be the permitted drawings revised to reflect any changes made during construction. Both the original and any revised specifications must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawing. All surveyed dimensions and elevations shall be certified by a registered surveyor. The following information, at a minimum, shall be certified on the as-built drawings:

- A. Dimensions and elevations of all discharge structures including all weirs, slots, gates, pumps, pipes, and oil and grease skimmers;
- B. Locations, dimensions, and elevations of all filter, exfiltration, or underdrain systems including cleanouts, pipes, connections to control structures, and points of discharge to the receiving waters;
- C. Dimensions, elevations, contours, or cross-sections of all treatment storage areas sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems, when appropriate;
- D. Dimensions, elevations, contours, final grades, or cross-sections of the system to determine flow directions and conveyance of runoff to the treatment system;
- E. Dimensions, elevations, contours, final grades, or cross-sections of all conveyance systems utilized to convey off-site runoff around the system;
- F. Existing water elevation(s) and the date determined; and
- G. Elevation and location of benchmark(s) for the survey.

11. The operation phase of this permit shall not become effective until the permittee has complied with the requirements of general condition No. 9 above, the District determines the system to be in compliance with the permitted plans, and the entity approved by the District in accordance with subsections 7.1.1 through 7.1.4 of the Applicants Handbook: Management and

Storage of Surface Waters, accepts responsibility for operation and maintenance of the system. The permit may not be transferred to such an approved operation and maintenance entity until the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the District, the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to section 7.1 of the Applicants Handbook: Management and Storage of Surface Waters, the permittee shall be liable for compliance with the terms of the permit.

12. Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the District of the changes prior to implementation so that a determination can be made whether a permit modification is required.
13. This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and chapter 40C-4 or chapter 40C-40, F.A.C.
14. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.
15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered specifically approved unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.
16. The permittee shall notify the District in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of section 40C-1.612, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to the sale, conveyance or other transfer.

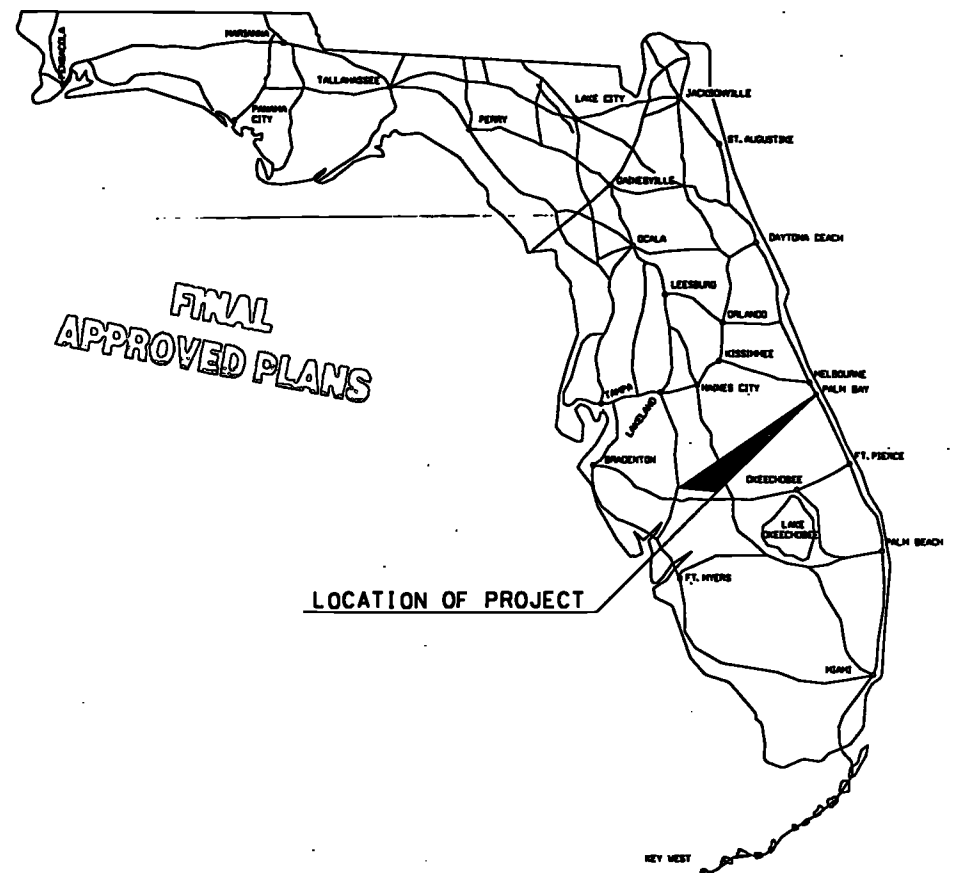
17. Upon reasonable notice to the permittee, District authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.
18. If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the District.
19. The permittee shall immediately notify the District in writing of any previously submitted information that is later discovered to be inaccurate.
20. This permit for construction will expire five years from the date of issuance.
21. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to building construction or placement of impervious surface within the area to be served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.
22. The operation and maintenance entity shall submit inspection reports to the District two years after the operation phase permit becomes effective and every two years thereafter on District form EN-46. The inspection form must be signed and sealed by an appropriate registered professional.
23. The proposed surface water management system must be constructed and operated in accordance with the plans received by the District on June 4, 1998.

THIS CONTRACT PLAN SET INCLUDES:

- ROADWAY PLANS
- SIGNING AND PAVEMENT MARKING PLANS
- BRIDGE PLANS
- SIGNALIZATION PLANS

A DETAILED INDEX APPEARS ON THE KEY SHEET OF EACH COMPONENT SET OF PLANS

BREVARD COUNTY, FLORIDA



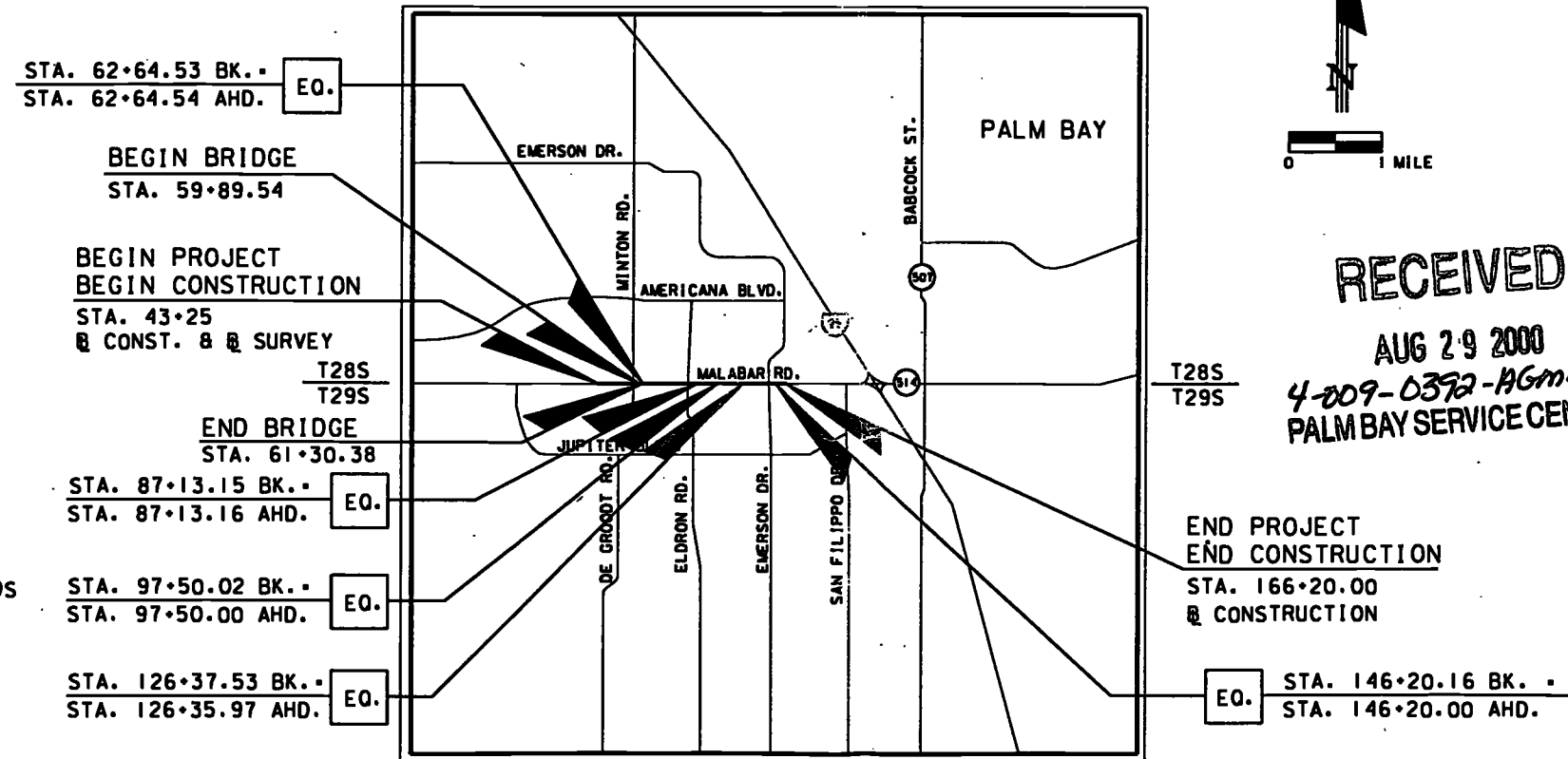
FINAL APPROVED PLANS

INDEX OF ROADWAY PLANS

SHEET NO.	SHEET DESCRIPTION
1	KEY SHEET
2-3	SUMMARY OF PAY ITEMS
4-6	DRAINAGE MAP
7-8	BOX CULVERT DATA SHEETS
9	SUMMARY OF QUANTITIES
10-14	SUMMARY OF DRAINAGE STRUCTURES
15-16	TYPICAL SECTIONS
17-22	MISCELLANEOUS DETAILS
23	AERIAL TARGET DATA SHEET
23A-42	PLAN SHEETS
43	MILLING AND RESURFACING DETAIL
44-53	PROFILE SHEETS
54	POND A DETAILS
55-55A	POND B DETAILS
56	POND C DETAILS
57	POND E DETAILS
58-59	EROSION CONTROL DETAILS
60-60A	SOIL SURVEY SHEETS
61-78	ROADWAY CROSS SECTIONS
79-97	UTILITY ADJUSTMENT SHEETS
98-127	INTERIM STANDARDS
MI-M22	TRAFFIC CONTROL PLANS

MALABAR ROAD (PHASE II)

1425' WEST OF MINTON ROAD TO CORPORATE CIRCLE SE.



THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH AND ARE GOVERNED BY THE STATE OF FLORIDA, DEPARTMENT OF TRANSPORTATION, ROADWAY AND TRAFFIC DESIGN STANDARDS (BOOKLET DATED JANUARY, 1994).

REVISIONS

- ROADWAY SHEET 2 (REVISED 8/14/98 UNDER ADDENDUM NO. 1)
- ROADWAY SHEET 3 (REVISED 8/14/98 UNDER ADDENDUM NO. 1)
- ROADWAY SHEET 9 (REVISED 8/14/98 UNDER ADDENDUM NO. 1)
- ROADWAY SHEETS 1, 2, 3, 9, 27, 28, 55A, 64, 82, 83, M17 & M18 (REVISED 8/24/99)
- ROADWAY SHEETS 1, 2, 3, 9, 26, 55A (REVISED 9/27/99)

LENGTH OF PROJECT		
	MALABAR RD.	
	LIN. FT.	MILES
ROADWAY	12155.72	2.302
BRIDGES	140.84	0.027
NET LENGTH OF PROJECT	12296.56	2.328
EXCEPTIONS	0.00	0.00
GROSS LENGTH OF PROJECT	12296.56	2.328

REVISIONS		
DATE	BY	DESCRIPTION
5/10/00	RSP	(A) PALM BAY CITY CENTER IMPROVEMENTS AS PROVIDED BY AVID ENGINEERING, INC.

ROADWAY PLANS
ENGINEER OF RECORD

KEVIN S. PERKO, P.E.
200 E. ROBINSON STREET, SUITE 1560
ORLANDO, FL. 32801

RECEIVED

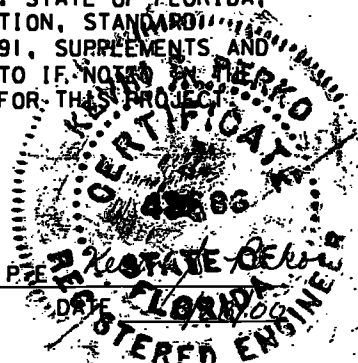
AUG 29 2000
4-209-0392-AGM4-ERP
PALM BAY SERVICE CENTER

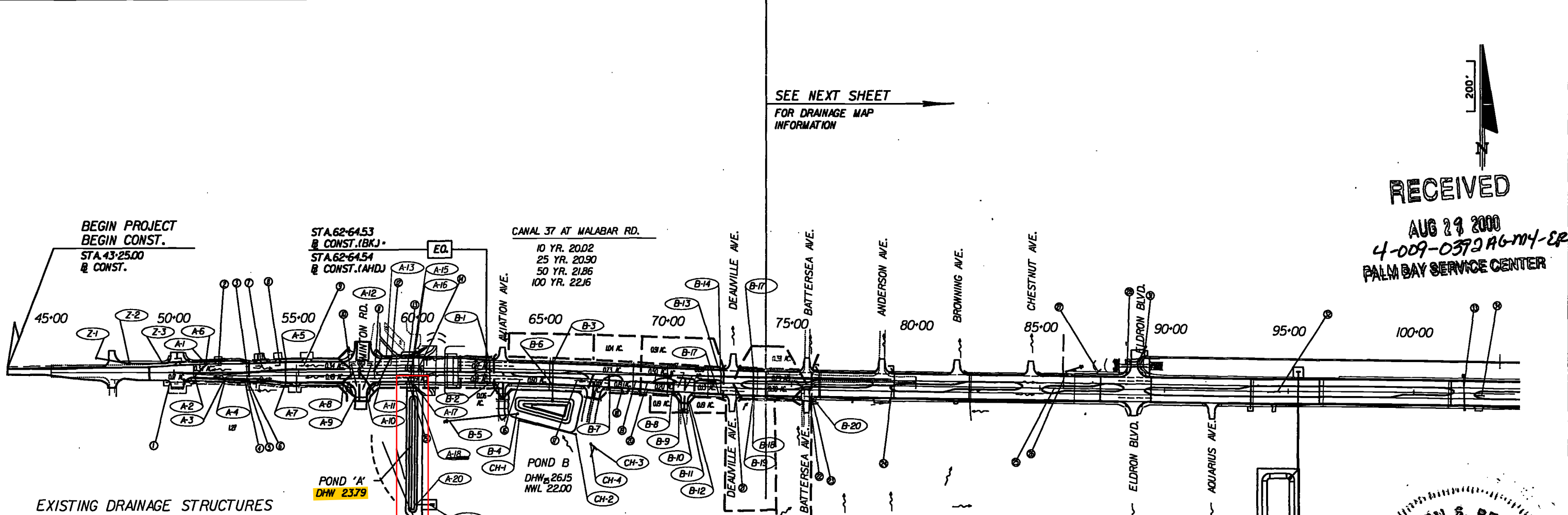
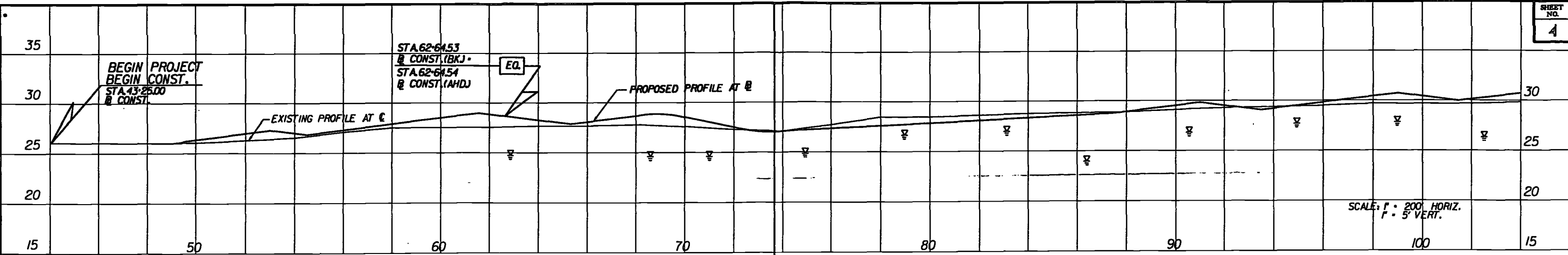
PLANS PREPARED BY:
PEC
PROFESSIONAL ENGINEERING CONSULTANTS, INC.
200 E. ROBINSON STREET, SUITE 1560
ORLANDO, FL. 32801

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

GOVERNING SPECIFICATIONS: STATE OF FLORIDA, DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS, DATED 1991, SUPPLEMENTS AND SPECIAL PROVISIONS THERETO IF NOTED IN PROJECT CONTRACT SPECIFICATIONS FOR THIS PROJECT.

ROADWAY PLANS
APPROVED BY KEVIN S. PERKO, P.E.
P.E. NO. 43386





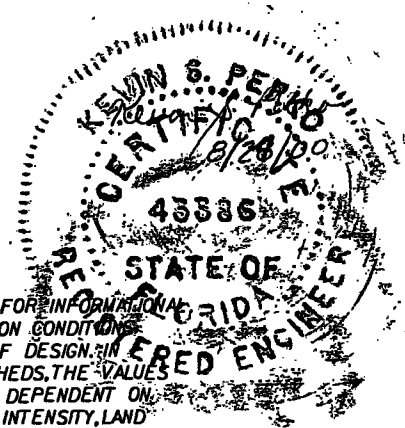
EXISTING DRAINAGE STRUCTURES

- 1. 18" RCP W/MES. W.INV.EL.2274 E.INV.EL.2318
- 2. 15" CMP W.INV.EL.2432 E.INV.EL.2418
- 3. HEADWALL TOP EL.2603 N.INV.EL.2350
- 4. 18" RCP W/MES W.INV.EL.2287
- 5. STORM MANHOLE N.RIM EL.2615 W.INV.EL.2316 E.INV.EL.2328 N.INV.EL.2324
- 6. 18" RCP W/MES E.INV.EL.2356
- 7. 12" RCP W.INV.EL.2432 E.INV.EL.2435
- 8. 15" CMP W.INV.EL.2438 E.INV.EL.2439
- 9. 15" CMP W.INV.EL.2476 E.INV.EL.2490
- 10. 14"X23" CMP W/MES EL.2414
- 11. CATCH BASIN TOP OF GRATE EL.2583 W.INV.EL.2405 E.INV.EL.2294
- 12. 15" CMP W.INV.EL.2398
- 13. 15" CMP TOP OF GRATE EL.2616
- 14. 15" CMP E.INV.EL.2101
- 15. 24" CMP E.INV.EL.1955
- 16. 24" CMP W.INV.EL.2488 E.INV.EL.2535
- 17. 24" CMP W.INV.EL.2488 E.INV.EL.2528
- 18. 24" RCP W.INV.EL.2469
- 19. CATCH BASIN TOP EL.2678 W.INV.EL.2448 E.INV.EL.2448
- 20. 24" RCP E.INV.EL.2379
- 21. 15"X24" CMP TOP OF HEAD WALL EL.2604 W.INV.EL.2425 TOP OF HEADWALL EL.2619 E.INV.EL.2442
- 22. 15"X24" CMP TOP OF HEADWALL EL.2633 W.INV.EL.2482 TOP OF HEADWALL EL.2643 E.INV.EL.2489
- 23. 15" CMP W.INV.EL.2466 S.INV.EL.2460
- 24. 18" CMP W.INV.EL.2572 E.INV.EL.2567
- 25. 15" CMP W.INV.EL.2480 E.INV.EL.2486
- 26. 18" RCP S.INV.EL.2485 N.INV.EL.2366
- 27. 27"X42" CMP (ARCH) S.INV.EL.2205 N.INV.EL.2061
- 28. 48"X72" CMP W.INV.EL.1888 E.INV.EL.1938
- 29. 18" CMP S.INV.EL.2341 N.INV.EL.2253
- 30. 24" CMP TOP OF HEADWALL EL.2798 W.INV.EL.2324 TOP OF HEADWALL EL.2874 E.INV.EL.2382
- 31. 48"X72" CMP W.INV.EL.1883 E.INV.EL.1941
- 32. 18"X24" HERCP W/MES W.INV.EL.2643 E.INV.EL.2624
- 33. 24" CMP TOP OF NORTH HEADWALLS EL.2621 TOP OF SOUTH HEADWALLS EL.2612 *29 N.INV.EL.2433 *30 N.INV.EL.2424 *29 S.INV.EL.2378 *30 S.INV.EL.2381
- 34. 24" CMP TOP OF HEADWALL EL.2798 W.INV.EL.2324 TOP OF HEADWALL EL.2874 E.INV.EL.2382
- 35. 16"X24" CMP TOP OF HEADWALL EL.2485 S.INV.EL.2309

NOTES:

- 1) THE DRAINAGE MAPS ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY AND ARE BASED ON CONDITIONS AND JUDGMENTS AT THE TIME OF DESIGN. IN URBAN AREAS AND SMALL WATERSHEDS, THE VALUES SHOWN ARE VARIABLE AND HIGHLY DEPENDENT ON ANTECEDENT CONDITIONS, RAINFALL INTENSITY, LAND USE AND OVERLAND FLOW.
- 2) ∇ ESTIMATED SEASONAL HIGH GROUNDWATER ELEVATION.

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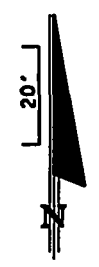
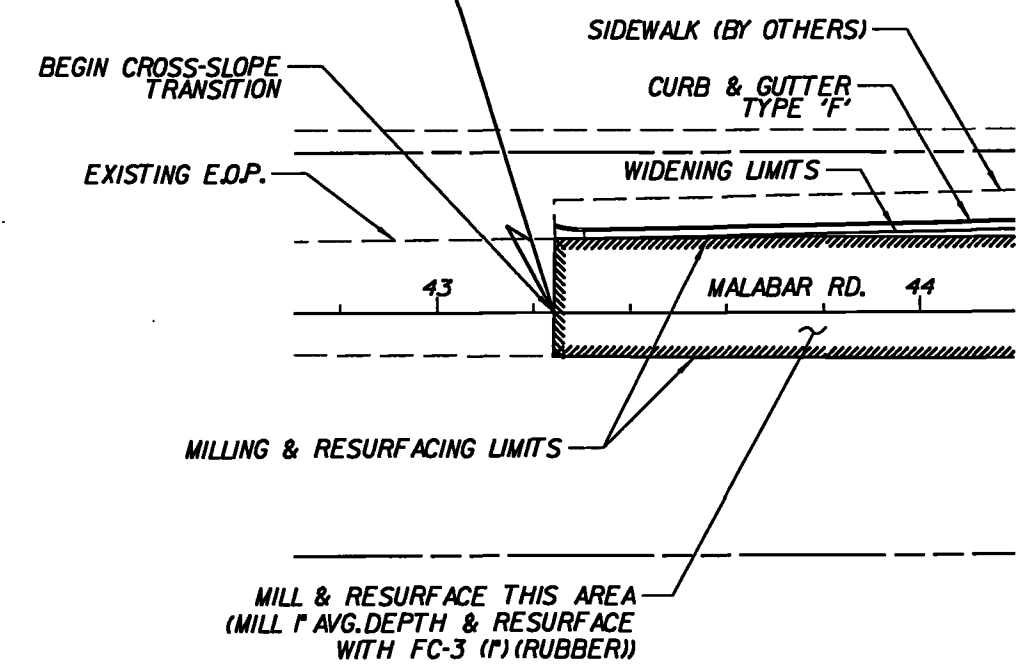
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8/24/99	FSM	REVISED MEDIAN OPENING STA. 69+00	5/18/00	KSP	1						

BREVARD COUNTY ENGINEERING PROJECT MANAGEMENT

PEC / PROFESSIONAL ENGINEERING CONSULTANTS

DRAINAGE MAP

BEGIN PROJECT
 BEGIN CONSTRUCTION
 BEGIN MILLING & RESURFACING
 BEGIN WIDENING
 STA. 43+25.00
 @ CONST. & B SURVEY
 MATCH EXISTING PAVT.



NOTE:
 DESIGN BASED ON PLANS PROVIDED BY
 AVID ENGINEERING, DATED 2/23/00.



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 PALM BAY SERVICE CENTER

REVISIONS											
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
5/10/00	KSP	① PALM BAY CITY CENTER IMPROVEMENTS AS PROVIDED BY AVID ENGINEERING, INC.									

BREVARD COUNTY
 ENGINEERING PROJECT MANAGEMENT
PEC PROFESSIONAL ENGINEERING CONSULTANTS

PLAN
 43+00 TO 44+00

- GRADES SHOWN ARE FINISHED GRADES.
- ALL STATIONS AND OFFSETS REFER TO BASELINE CONSTRUCTION UNLESS OTHERWISE NOTED.
- ALL PAVEMENT DIMENSIONS ARE TO THE EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
- BENCH MARK DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD - '29).
- ANY NGVD MONUMENT WITHIN THE LIMITS OF CONSTRUCTION IS TO BE PROTECTED. IF IN DANGER OF DAMAGE, THE CONTRACTOR SHALL NOTIFY IMMEDIATELY.

MR. RON TAYLOR
C/O BUREAU OF SURVEY & MAPPING
3900 COMMONWEALTH BLVD., MS105
TALLAHASSEE, FL 32399
TELEPHONE NO. (904) 488-2427

- THE INFORMATION SHOWN ON THESE DRAWINGS CONCERNING TYPE AND LOCATION OF UTILITIES IS BASED ON AVAILABLE RECORDS AND IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATION AS TO THE TYPE AND LOCATION OF UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. COORDINATION OF UTILITY RELOCATION WILL BE THE CONTRACTOR'S RESPONSIBILITY.
- THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS 48 HOURS PRIOR TO COMMENCEMENT OF THE WORK. THE EXCAVATORS SHALL COMPLY WITH FLORIDA STATUTE 553.851 REGARDING NOTIFICATION OF EXISTING GAS AND DIL PIPELINE COMPANY OWNERS AND SHALL ALSO NOTIFY "UNCLE" AT 1-800-432-4770 PRIOR TO EXCAVATING.
- UTILITIES ARE TO BE ADJUSTED OR RELOCATED BY THE UTILITY COMPANIES UNLESS OTHERWISE NOTED. SEE UTILITY ADJUSTMENT SHEETS FOR UTILITY ADDRESSES, NAMES AND TELEPHONE NUMBERS.
- LOCATION OF PROPOSED DRIVEWAYS IS APPROXIMATE. FINAL LOCATION AND TIE-IN ELEVATIONS TO BE DETERMINED IN THE FIELD.
- ALL SIDEWALK CONSTRUCTION WITHIN DRIVEWAYS SHALL BE 6" CONCRETE.
- PIPE LENGTHS SHOWN ASSUME TYPE P (ALT. B) (13'-6" WIDTH) AND TYPE J (ALT. B) STRUCTURE BOTTOMS FOR ALL STRUCTURES.

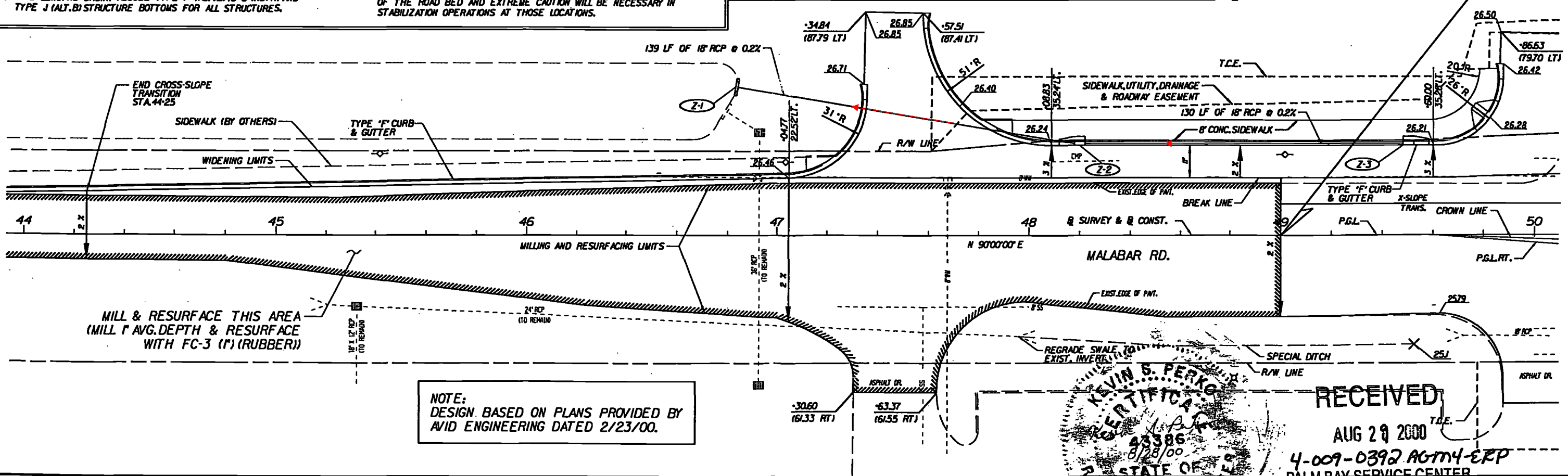
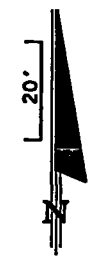
GENERAL NOTES

- PIPE LENGTHS ARE FROM INSIDE FACE OF STRUCTURE TO INSIDE FACE OF STRUCTURE. PIPE SLOPES ARE FROM Q STR. TO Q STR.
- CONTRACTOR TO SAWCUT EXISTING PAVEMENT TO A NEAT EDGE IN ALL AREAS WHERE TIEING INTO EXISTING PAVEMENT WITH PROPOSED PAVEMENT.
- SEE MISCELLANEOUS DETAILS SHEET FOR UNDERDRAIN LOCATIONS AND CONSTRUCTION DETAILS.
- "INLET" ELEV. FOR GUTTER INLETS IS THE "NORMAL" GUTTER GRADE AT THE CENTERLINE OF THE STRUCTURE.
- STA./ OFFSET FOR INLETS, MYS AND DBFS REFERS TO CENTERLINE STRUCTURE AND FOR MES'S REFERS TO CENTER OF TOE OF MES.
- ALL PERSONAL PROPERTY WITHIN THE RIGHT-OF-WAY SHALL BE RELOCATED BY THE PROPERTY OWNER OR IT SHALL BE REMOVED BY THE CONTRACTOR AS NECESSARY TO CONSTRUCT THE PROJECT IN ACCORDANCE WITH THE PLANS. THE CONTRACTOR SHALL GIVE THESE PROPERTY OWNERS TWO WEEKS NOTICE PRIOR TO CLEARING AND GRUBBING OPERATIONS. SEE PROJECT SPECIFICATIONS.
- SUBSURFACE INFORMATION SHOWN ON THESE DRAWINGS WAS OBTAINED FOR USE IN ESTABLISHING DESIGN CRITERIA FOR THE PROJECT. THE ACCURACY OF THIS INFORMATION IS NOT GUARANTEED AND IS NOT TO BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OF THE PROJECT. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO INQUIRE OF THE ENGINEER IF ADDITIONAL INFORMATION IS AVAILABLE, TO MAKE ARRANGEMENTS TO REVIEW SAME PRIOR TO BIDDING AND TO MAKE HIS OWN DETERMINATION AS TO ALL SUBSURFACE CONDITIONS.
- ALL ABANDONED PIPES AND CONTENTS THEREOF FOUND WITHIN THE RIGHT-OF-WAY NOT SHOWN ON THE PLANS ARE TO BE REMOVED AND PROPERLY DISPOSED OF BY THE CONTRACTOR
- EXISTING GUARDRAIL IS TO BE DISMANTLED AND DELIVERED TO COUNTY'S NEAREST ROAD & BRIDGE MAINTENANCE YARD (BARCOCK STREET SHOP). DELIVERY TO BE COORDINATED WITH OWNERS ENGINEER.
- THE CONTRACTOR SHALL INSPECT ALL EXISTING DRAINAGE STRUCTURES AND PIPES TO REMAIN WITHIN THE CONSTRUCTION LIMITS AND REMOVE ANY INTERNAL DEBRIS AND SAND/SILT THEREFROM.
- THE CONTRACTOR SHALL ENSURE POSITIVE DRAINAGE TO ALL EXISTING AND PROPOSED DRAINAGE STRUCTURES.
- SPECIAL ATTENTION IS DIRECTED TO THE FACT THAT PORTIONS OF SOME DRAINAGE STRUCTURES MAY EXTEND INTO THE STABILIZED PORTION OF THE ROAD BED AND EXTREME CAUTION WILL BE NECESSARY IN STABILIZATION OPERATIONS AT THOSE LOCATIONS.

- ALL R.C.P. (ROUND OR ELLIPTICAL) SHALL HAVE ITS JOINTS WRAPPED IN ACCORDANCE WITH FDOT INDEX NO. 280.
- THE CONTRACTOR SHALL BE AWARE THAT THE CLEARANCE BETWEEN STORM SEWER LATERALS AND THE PIPES ENCLOSING CANAL NO. 50 IS MINIMAL. THE CONTRACTOR SHALL USE EXTREME CAUTION IN LAYING OUT THE STORM SEWER SYSTEM SUCH THAT PIPE BELLS DO NOT CONFLICT AND CAUSE INSUFFICIENT CLEARANCE.
- EXISTING DRAINAGE STRUCTURES AND PIPES, INCLUDING ASBESTOS CEMENT PIPES, WITHIN CONSTRUCTION LIMITS SHALL BE REMOVED UNLESS OTHERWISE NOTED.
- ANY PUBLIC LAND CORNER WITHIN THE LIMITS OF CONSTRUCTION IS TO BE PROTECTED. IF A CORNER MONUMENT IS IN DANGER OF BEING DESTROYED AND HAS NOT BEEN PROPERLY REFERENCED, THE CONTRACTOR'S SURVEYOR SHALL REPLACE OR CORRECT.
- DURING CONSTRUCTION, TRAFFIC SHALL BE MAINTAINED IN ACCORDANCE WITH "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES," AND "FDOT" INDEX "600."
- UNSATURABLE MATERIALS SHALL BE REMOVED AND PROPERLY/LEGALLY DISPOSED OF FROM CONSTRUCTION AREAS AND BACKFILLED WITH SUITABLE MATERIALS.
- ALL MANHOLE TOPS SHALL BE TRAFFIC BEARING AND MANHOLE COVERS SHALL BE 3 FEET IN DIAMETER PER FDOT INDEX 201.
- ALL SIDEWALKS TO HAVE AN EXPANSION JOINT EVERY 50' OR LESS. NO SUPPFORMING OF SIDEWALK ALLOWED.
- CONTRACTOR SHALL COORDINATE WITH UTILITY OWNERS FOR HOLDING OF ANY UTILITY POLE. THE COST OF POLE HOLDING IN UTILITY EASEMENTS AND PRIVATE PROPERTY WILL BE INCLUDED IN PAY ITEM NO. 110-H-CLEARING AND GRUBBING. UTILITY OWNERS ARE RESPONSIBLE FOR COSTS FOR HOLDING UTILITY POLES WITHIN PUBLIC RIGHT-OF-WAY.
- THE AERIAL BACKGROUND SHOWN ON THESE PLANS IS PROVIDED FOR GENERAL ORIENTATION ONLY. VARIATIONS IN THE IMAGE EXIST AND IT SHOULD NOT BE MISCONSTRUED TO REPRESENT SURVEYED DATA.
- ALL CURB ENDS TO HAVE FLARED ENDS OR TIE-IN TO EXISTING CURB.
- THE CONTRACTOR SHALL MAINTAIN A NOISE LEVEL LESS THAN 95 dB OVER AMBIENT NOISE LEVELS (A-WEIGHED, FAST RESPONSE) AT OR BEYOND THE RIGHT-OF-WAY LINE, DURING THE NORMAL TEN (10) HOUR DAYLIGHT WORK PERIOD. THE CONTRACTOR SHALL MAINTAIN A NOISE LEVEL LESS THAN 15 dB OVER AMBIENT NOISE LEVELS (A-WEIGHED, SLOW RESPONSE) AT OR BEYOND THE RIGHT-OF-WAY LINE IN ANY OVERTIME (NIGHT WORK) PERIOD OUTSIDE THE NORMAL TEN (10) HOUR DAYLIGHT WORKING DAY. COMPENSATION FOR ADHERING TO THESE PARAMETERS SHALL BE INCLUDED IN THE CONTRACT UNIT PRICES OF OTHER ITEMS IN THIS CONTRACT. SHOULD THE NOISE LIMITS BE EXCEEDED, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE COST ASSOCIATED WITH THE TESTING & REMEDIATION OF THE VIOLATION.
- PRIOR TO COMMENCING WORK ON POND B, THE CONTRACTOR SHALL NOTIFY THE CITY OF PALM BAY (JEFF WHITEHEAD PARK SUPERVISOR, 407-952-3441) TO COORDINATE CAPPING THE EXISTING IRRIGATION CONDUITS WITHIN THE AFFECTED WORK AREA.
- NEITHER HEAVY EQUIPMENT NOR CONSTRUCTION MATERIALS, EXCEPT THOSE DIRECTLY ASSOCIATED WITH THE POND B CONSTRUCTION, MAY BE STORED ON THE CITY HALL SITE, UNLESS SPECIFICALLY APPROVED BY THE CITY PUBLIC WORKS DIRECTOR.

- Z-1 STA. 46+84.00 (58'6" LT.) CONST. CONC. ENDWALL FL. 21.00
- Z-2 STA. 48+20.00 (35'2" LT.) CONST. INLET TYPE P-5 INLET EL. 26.13 E. INV. EL. 21.28 W. INV. EL. 21.28
- Z-3 STA. 49+50.00 (35'2" LT.) CONST. INLET TYPE P-5 INLET EL. 26.20 W. INV. EL. 21.53

END MILLING & RESURFACING
END WIDENING
BEGIN FULL DEPTH CONSTRUCTION
STA. 49+00.00
@ CONST. & @ SURVEY



NOTE:
DESIGN BASED ON PLANS PROVIDED BY
AVID ENGINEERING DATED 2/23/00.



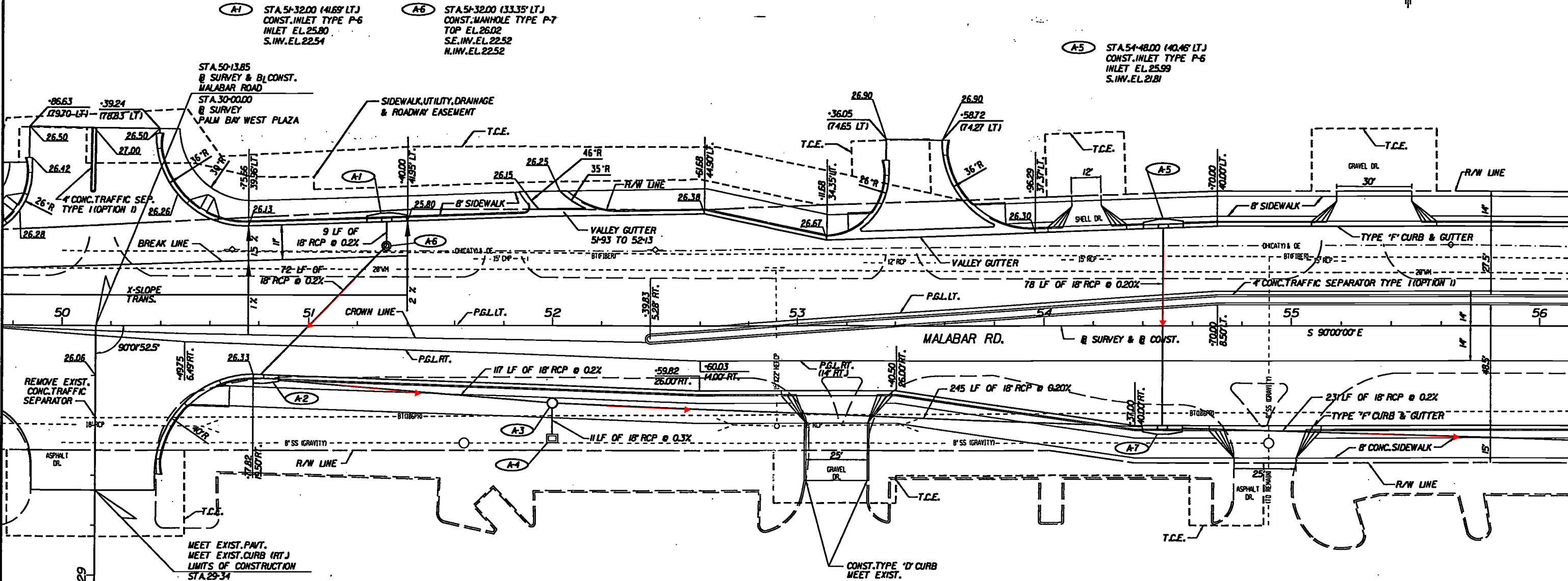
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PALM BAY SERVICE CENTER

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
5/10/00	RSP	(A) PALM BAY CITY CENTER IMPROVEMENTS AS PROVIDED BY AVID ENGINEERING, INC.									

FLORIDA PROFESSIONAL ENGINEERING CONSULTANTS
PEC/

PLAN 44+00 TO 50+00



A1 STA. 51-32.00 (41.69' LT.)
CONST. INLET TYPE P-6
INLET EL. 25.80
S. INV. EL. 22.54

A6 STA. 51-32.00 (33.35' LT.)
CONST. MANHOLE TYPE P-7
TOP EL. 26.02
S.E. INV. EL. 22.52
N. INV. EL. 22.52

A5 STA. 54-48.00 (40.46' LT.)
CONST. INLET TYPE P-6
INLET EL. 25.99
S. INV. EL. 21.81

STA. 50-13.85 @ SURVEY & B1 CONST.
MALABAR ROAD
STA. 30+00.00 @ SURVEY
PALM BAY WEST PLAZA

MEET EXIST. PAVT.
MEET EXIST. CURB (RT.)
LIMITS OF CONSTRUCTION
STA. 29-34

A2 STA. 50-80.32 (20.84' RT.)
CONST. INLET TYPE P-5
INLET EL. 26.21
N.E. INV. EL. 22.37
E. INV. EL. 22.37

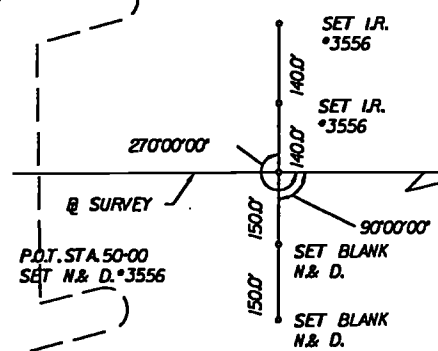
A3 STA. 52-00.00 (31.00' RT.)
CONST. MANHOLE TYPE P-7
RIM EL. 27.01
E. INV. EL. 22.14
S. INV. EL. 22.14
W. INV. EL. 22.14

NOTE:
DESIGN BASED ON PLANS PROVIDED BY
AVID ENGINEERING DATED 2/23/00.

RECEIVED
AUG 29 2003

A4 STA. 52-00.00 (45.0' RT.)
CONST. TYPE 'C' DITCH BOTTOM INLET
GRATE EL. 25.20
INV. EL. 22.17

A7 STA. 54-48.00 (41.25' RT.)
CONST. INLET TYPE P-6
INLET EL. 26.04
N.W. INV. EL. 22.53
S. INV. EL. 22.53
W. INV. EL. 22.53



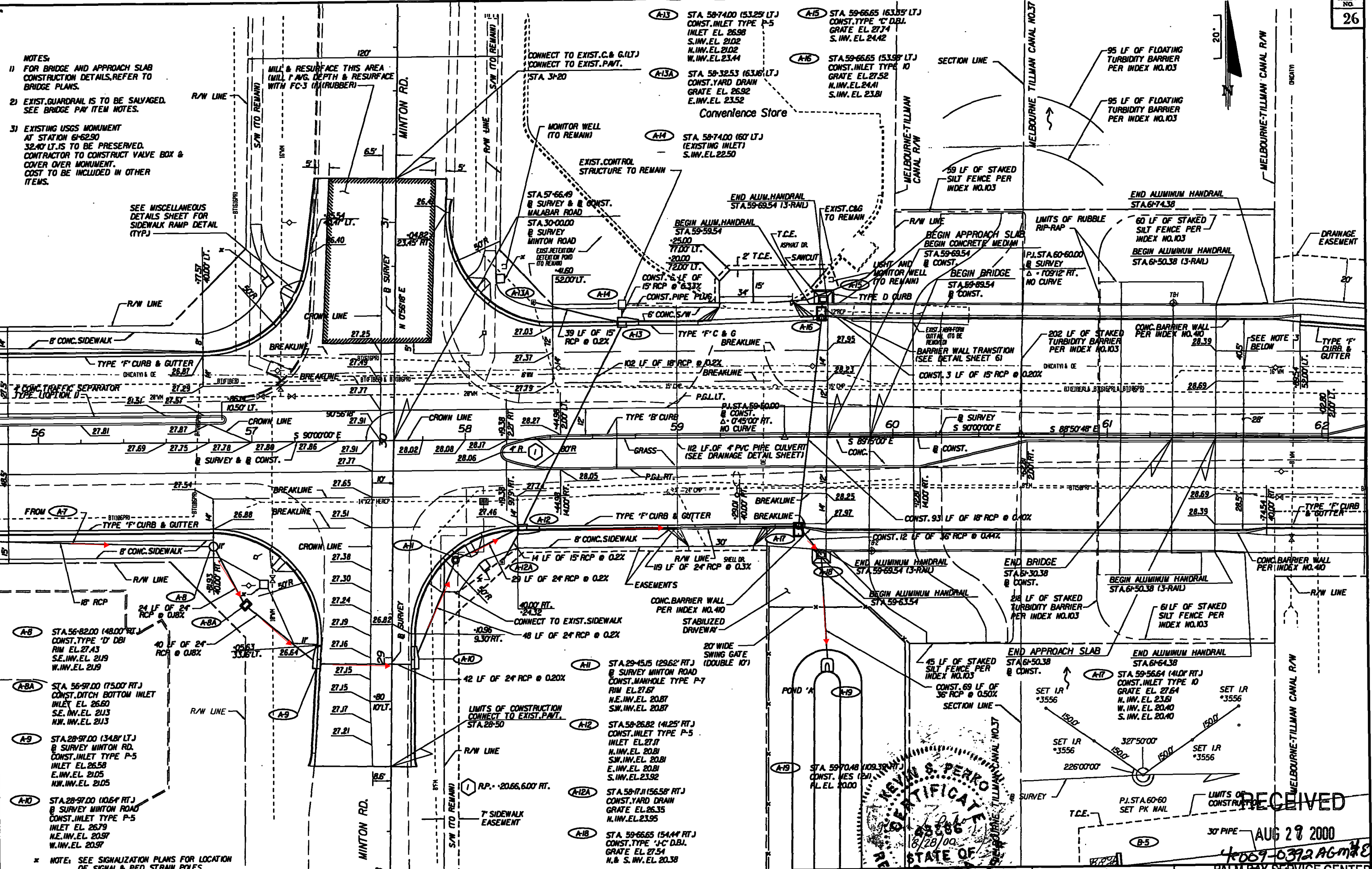
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
5/10/00	KSP	(A) PALM BAY CITY CENTER IMPROVEMENTS AS PROVIDED BY AVID ENGINEERING, INC.									

4-009-0392 AGM4-ERP
PALM BAY SERVICE CENTER
STATE OF FLORIDA
BREVARD COUNTY
ENGINEERING PROJECT MANAGEMENT
PEC PROFESSIONAL ENGINEERING CONSULTANTS
PLAN 50+00 TO 56+00

H:\Projects\BR-00V\PLAN\RD02.DGN 1001 Aug. 14, 2000 09:59:11

- NOTES:**
- FOR BRIDGE AND APPROACH SLAB CONSTRUCTION DETAILS, REFER TO BRIDGE PLANS.
 - EXIST. GUARDRAIL IS TO BE SALVAGED. SEE BRIDGE PAY ITEM NOTES.
 - EXISTING USGS MONUMENT AT STATION 6+62.90 32.40' LT. IS TO BE PRESERVED. CONTRACTOR TO CONSTRUCT VALVE BOX & COVER OVER MONUMENT. COST TO BE INCLUDED IN OTHER ITEMS.

SEE MISCELLANEOUS DETAILS SHEET FOR SIDEWALK RAMP DETAIL (TYP.)

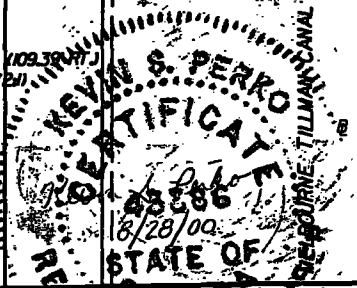


- A-8** STA. 56+82.00 (48.00' RT.) CONST. TYPE 'D' DBI RIM EL. 27.43 S.E. INV. EL. 21.9 W. INV. EL. 21.9
- A-8A** STA. 56+97.00 (75.00' RT.) CONST. DITCH BOTTOM INLET INLET EL. 26.60 S.E. INV. EL. 21.3 N.W. INV. EL. 21.3
- A-9** STA. 28+97.00 (34.8' LT.) @ SURVEY WINTON RD. CONST. INLET TYPE P-5 INLET EL. 26.58 E. INV. EL. 21.05 S.W. INV. EL. 21.05
- A-10** STA. 28+97.00 (10.6' RT.) @ SURVEY WINTON ROAD CONST. INLET TYPE P-5 INLET EL. 26.79 N.E. INV. EL. 20.97 W. INV. EL. 20.97

* NOTE: SEE SIGNALIZATION PLANS FOR LOCATION OF SIGNAL & PED. STRAIN POLES

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
5/24/99	KSP	SPOT ELEVATIONS, INLET ELEVATIONS A-13, A-15, A-16, A-17 AND A-18.	5/10/00	KSP	(A) PALM BAY CITY CENTER IMPROVEMENTS AS PROVIDED BY AVID ENGINEERING, INC.

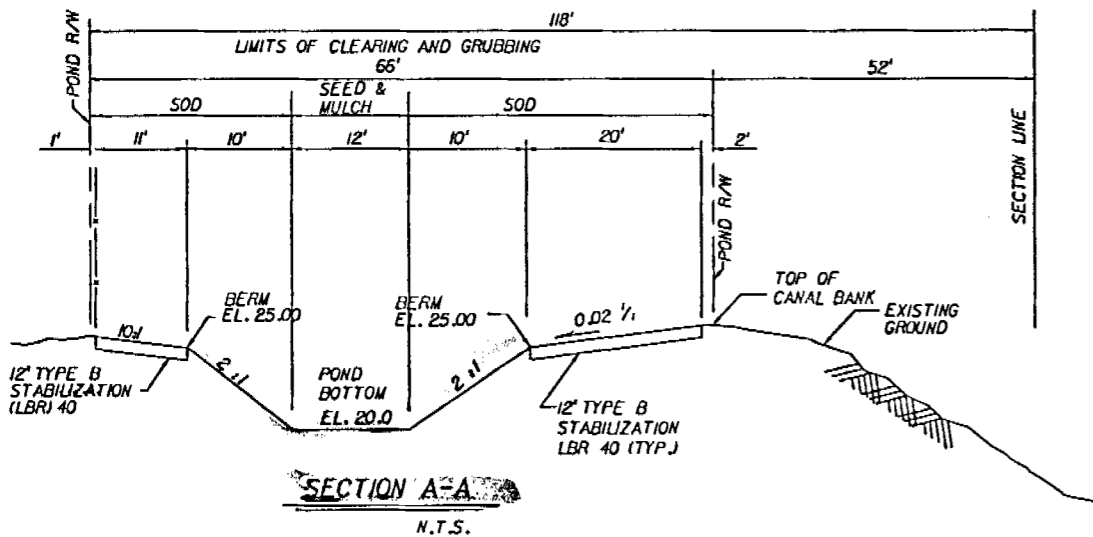
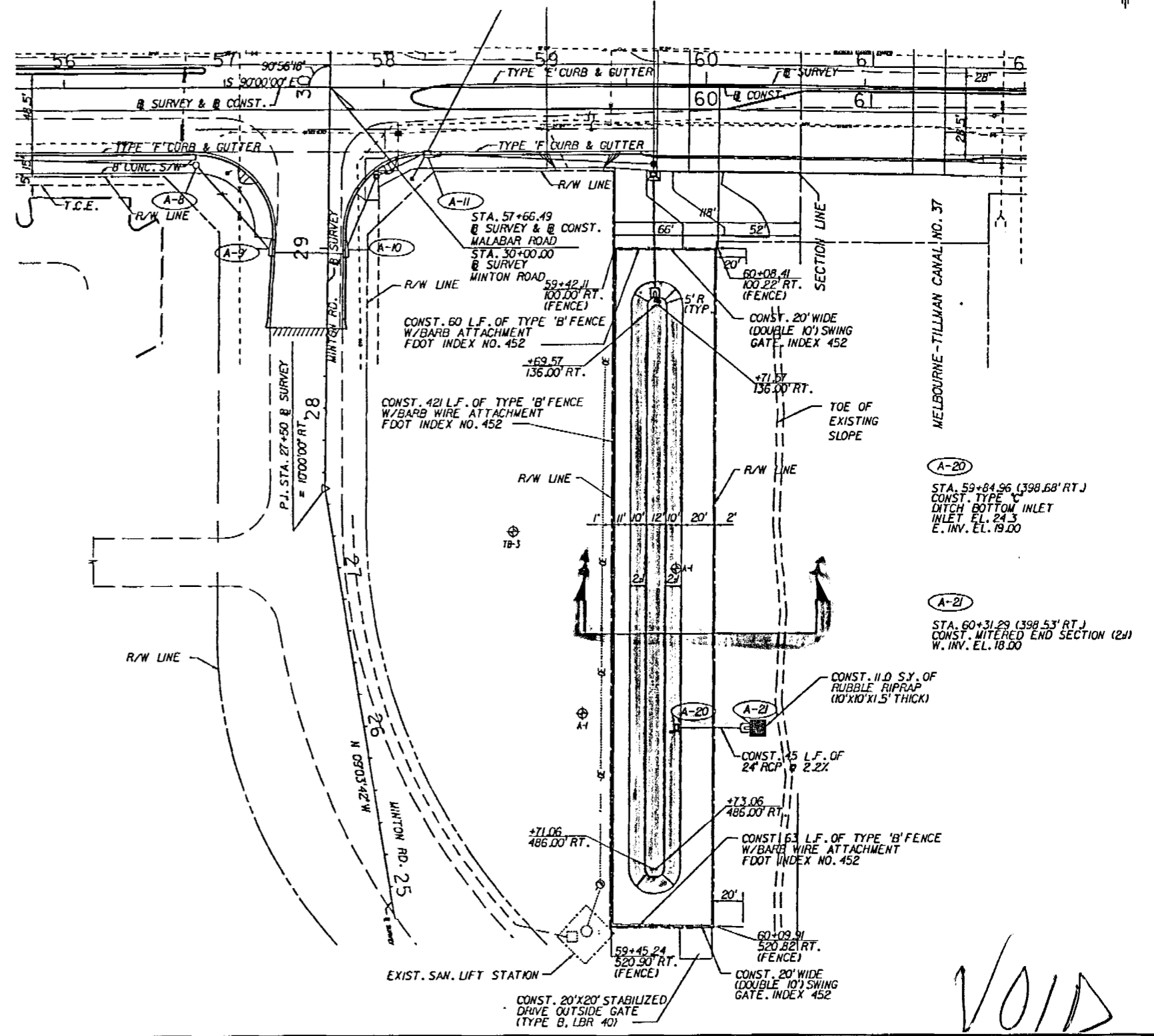
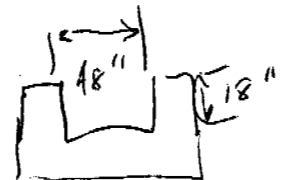
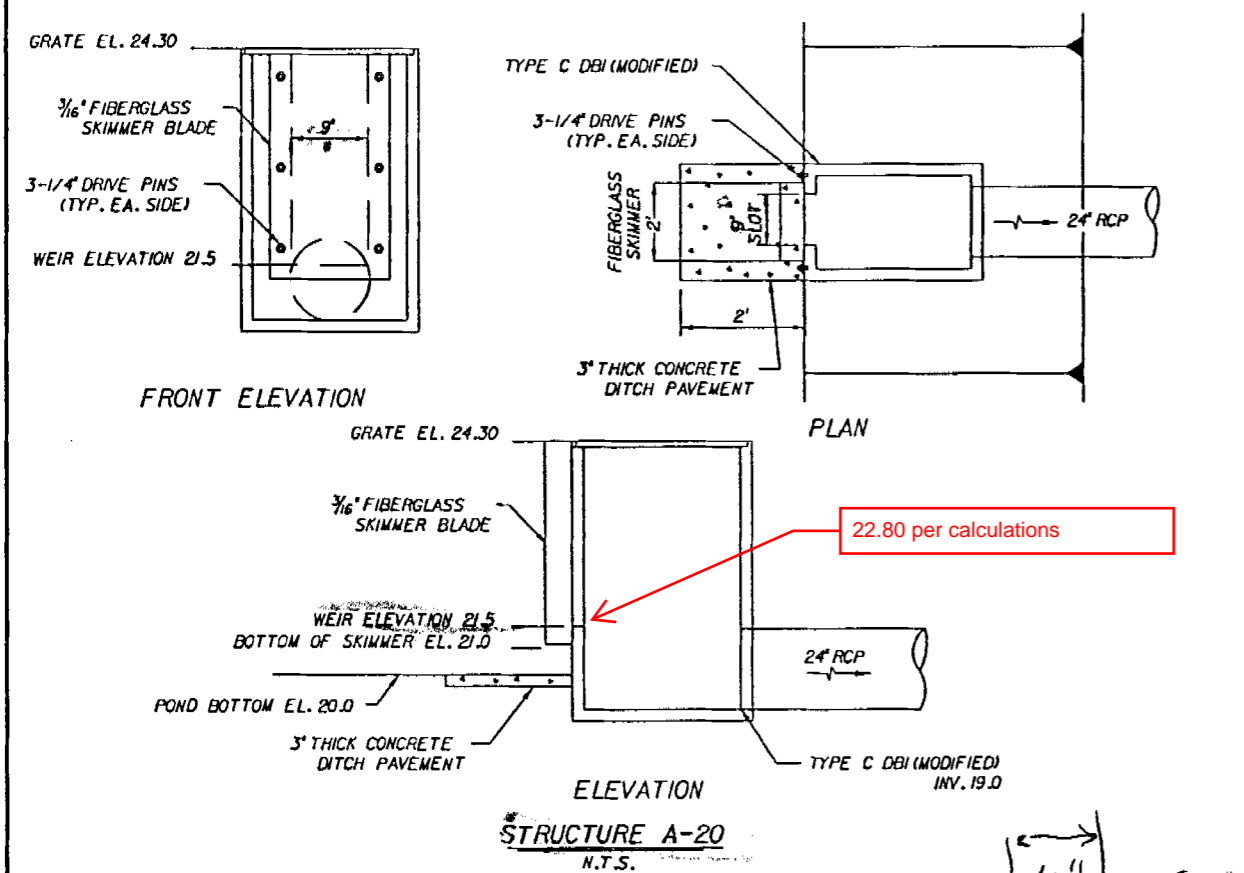
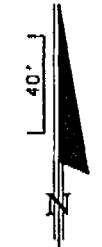


PEC PROFESSIONAL ENGINEERING CONSULTANTS
 56+00 TO 62+00
 RECEIVED AUG 29 2000
 PALM BAY SERVICE CENTER

65

BEST AVAILABLE POND CROSS SECTION

TAKEN FROM PERMIT 16558-4



VOID
POND "A"
DETAILS

REVISIONS											
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BREVARD COUNTY ENGINEERING PROJECT MANAGEMENT
PEC PROFESSIONAL ENGINEERING CONSULTANTS

RECEIVED

AUG 29 2000

4-009-0392ACM4ERP
PALM BAY SERVICE CENTER

16558-5

REVISED MALABAR ROAD DRAINAGE CALCULATIONS
POND A SYSTEM
(TO ACCOMMODATE PALM BAY CENTER RIGHT TURN LANE)

BREVARD COUNTY

AUGUST 28, 2000

PREPARED BY:

PROFESSIONAL ENGINEERING CONSULTANTS, INC.
200 E. ROBINSON STREET, SUITE 1560
ORLANDO, FLORIDA 32801
(407) 422-8062

Kevin S. Perko
Kevin S. Perko, P.E.
Florida Regist. No. 43386
Date: 8/28/00

<i>SECTION 1.0</i>	<i>SUMMARY OF WATER QUALITY/PEAK FLOW REVISIONS REVISED RUNOFF CURVE NUMBER - POND A</i>
<i>SECTION 2.0</i>	<i>REVISED 25-YEAR, 24-HOUR FLOOD ROUTING</i>
<i>SECTION 3.0</i>	<i>REVISED 3-YEAR, 24-HOUR FLOOD ROUTING</i>
<i>SECTION 4.0</i>	<i>REVISED NETWORKX MODEL (STORM SEWER - 3-YEAR)</i>

MALABAR ROAD - SEGMENT II
PALM BAY CENTER TURN LANE MODIFICATIONS

BY: KEVIN PERKO, P.E.
DATE: 8/28/00

REQUIRED WATER QUALITY VOLUME - POND A:

COMPONENT	PERMITTED	REVISED
BASIN AREA (Ac)	4.94	5.1
IMPERVIOUS AREA (Ac)	2.55	2.71
PERVIOUS AREA (Ac)	2.39	2.39
% IMPERVIOUS	51.62%	53.14%
REQUIRED WATER QUALITY VOLUME (Ac-Ft)	0.47	0.49
PROVIDED WATER QUALITY VOLUME (Ac-Ft)	0.49	0.49

Permitted W.Q. Volume at Weir Elevation 22.80 = 0.49 Ac-Ft

SUMMARY OF REVISED PRE- AND POST-DEVELOPMENT PEAK FLOW RATE

BASIN	OUTFALL	PRE-DEV PEAK FLOW RATE (cfs)	POST-DEV PEAK FLOW RATE (cfs)
A	MTC#37	19.72	20.29 (+2.9%)

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POND A INCL. PALM BAY CENTER (25YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

BASIN NAME	BASINA	JIFFY	A-13	A-12	A-17
NODE NAME	PONDA	JIFPOND	A-13	A-12	A-17
UNIT HYDROGRAPH	UH484	UH484	UH484	UH484	UH484
PEAKING FACTOR	484.	484.	484.	484.	484.
RAINFALL FILE	SCSIII	SCSIII	SCSIII	SCSIII	SCSIII
RAIN AMOUNT (in)	9.40	9.40	9.40	9.40	9.40
STORM DURATION (hrs)	24.00	24.00	24.00	24.00	24.00
AREA (ac)	4.51	.59	1.00	1.00	1.00
CURVE NUMBER	92.00	92.00	.00	.00	.00
DCIA (%)	.00	.00	.00	.00	.00
TC (mins)	31.70	10.00	10.00	10.00	10.00
LAG TIME (hrs)	.00	.00	.00	.00	.00
BASIN STATUS	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE
BASIN QMX (cfs)	22.85	3.68	.00	.00	.00
TMX (hrs)	12.40	12.22	.00	.00	.00
VOL (in)	8.42	8.42	.00	.00	.00
NOTES					

POND A INCL. PALM BAY CENTER (25YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

NODAL MIN/MAX/TIME CONDITIONS REPORT

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=====
|<-- MINIMUMS -->| |<-- MAXIMUMS -->|
NODE ID      PARAMETER      VALUE TIME (hr)    VALUE TIME (hr)
-----
PONDA        STAGE (ft):         20.00      1.75      24.16      12.50
              VOLUME (af):         .00         1.75         .86      12.50
              RUNOFF (cfs):        .00         1.75      21.10      12.25
              OFFSITE (cfs):       .00        24.00         .00      24.00
              OTHER (cfs):      -17.35     11.75         1.17       8.50
              OUTFLOW (cfs):      .00        10.75      20.29      12.50

MTC#37       STAGE (ft):         15.00       6.00      17.29      24.00
              VOLUME (af):         .00        10.75         3.01      24.00
              RUNOFF (cfs):        .00        24.00         .00      24.00
              OFFSITE (cfs):       .00        24.00         .00      24.00
              OTHER (cfs):       .00        10.75      20.29      12.50
              OUTFLOW (cfs):      .00        24.00         .00      24.00

JIFPOND      STAGE (ft):         22.50       1.75      25.68      12.50
              VOLUME (af):         .00         1.75         .16      12.50
              RUNOFF (cfs):        .00         1.75         3.67      12.25
              OFFSITE (cfs):       .00        24.00         .00      24.00
              OTHER (cfs):       .00        24.00         .00      24.00
              OUTFLOW (cfs):      .00         1.75         1.16      13.00

A-12        STAGE (ft):         20.81       6.75      24.25      12.50
              VOLUME (af):         .00         3.25         .01      12.50
              RUNOFF (cfs):        .00        24.00         .00      24.00
              OFFSITE (cfs):       .00        24.00         .00      24.00
              OTHER (cfs):      -2.45     11.25         .74       6.25
              OUTFLOW (cfs):      .00         6.75         6.70      13.00

A-13        STAGE (ft):         21.02       7.25      24.25      12.50
              VOLUME (af):         .00         2.25         .00      12.50
              RUNOFF (cfs):        .00        24.00         .00      24.00
              OFFSITE (cfs):       .00        24.00         .00      24.00
              OTHER (cfs):       .00         1.75         1.16      13.00
              OUTFLOW (cfs):     -2.45     11.25         .74       6.25
    
```

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POND A INCL. PALM BAY CENTER (25YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

NODAL MIN/MAX/TIME CONDITIONS REPORT

```

=====
|<-- MINIMUMS -->| |<-- MAXIMUMS -->|
NODE ID      PARAMETER      VALUE TIME (hr)  VALUE TIME (hr)
-----
A-17        STAGE (ft):      20.40      4.25      24.07      12.50
            VOLUME (af):      .00        4.00        .01        12.50
            RUNOFF (cfs): .00       24.00        .00       24.00
            OFFSITE (cfs): .00       24.00        .00       24.00
            OTHER (cfs): .00        6.75        6.70       13.00
            OUTFLOW (cfs): -17.35     11.75        1.17        8.50
  
```

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POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

CONTROL PARAMETERS

=====

START TIME: .00
END TIME: 24.00

TO TIME (hours)	SIMULATION INC (secs)	PRINT INC (mins)
----- 30.00	----- 1.00	----- 15.00

RUNOFF HYDROGRAPH FILE: DEFAULT
OFFSITE HYDROGRAPH FILE: DEFAULT
BOUNDARY DATABASE FILE: NONE

NOTE:

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POND A INCL. PALM BAY CENTER (25YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

NODE NAME	NODE TYPE	INI STAGE (ft)	X-COOR (ft)	Y-COOR (ft)	LENGTH (ft)	STAGE (ft)	AR/TM/STR (ac/hr/af)
PONDA	AREA	20.000	.000	.000	.000	20.000	.120
						21.000	.160
						22.000	.200
						23.000	.240
						24.000	.280
						25.000	.330
MTC#37	TIME	15.000	.000	.000	.000	15.000	.000
						15.000	6.000
						18.050	30.000
JIFPOND	AREA	22.500	.000	.000	.000	22.500	.050
						23.000	.050
						24.000	.050
						25.000	.050
						26.000	.050
						27.000	.050
A-12	AREA	20.810	.000	.000	.000	20.810	.001
						27.170	.001
A-13	AREA	21.020	.000	.000	.000	21.020	.001
						26.860	.001
A-17	AREA	20.400	.000	.000	.000	20.400	.001
						27.720	.001

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POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

>>REACH NAME : RO-1
FROM NODE : JIFPOND
TO NODE : A-13
REACH TYPE : CIRCULAR WEIR/GATE/ORIFICE, MAVIS EQ.
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
INVERT EL. (ft): 22.500 SPAN (ins): 6.000 RISE (ins): 6.000
WEIR COEF.: 3.000 GATE COEF.: .600 NUMBER OF ELEM.: 1.000
NOTE:

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POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

>>REACH NAME : RC-13
FROM NODE : A-13
TO NODE : A-12
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 18.000 RISE (in): 18.000 LENGTH (ft): 106.000
U/S INVERT (ft): 21.020 D/S INVERT (ft): 20.810 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

>>REACH NAME : RC-12
FROM NODE : A-12
TO NODE : A-17
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 24.000 RISE (in): 24.000 LENGTH (ft): 141.000
U/S INVERT (ft): 20.810 D/S INVERT (ft): 20.400 MANNING N: .012
ENTRNC LOSS: -.300 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

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POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

>>REACH NAME : RC-17
FROM NODE : A-17
TO NODE : PONDA
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 36.000 RISE (in): 36.000 LENGTH (ft): 84.000
U/S INVERT (ft): 20.400 D/S INVERT (ft): 20.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

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POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

>>REACH NAME : RW-1
FROM NODE : PONDA
TO NODE : MTC#37
REACH TYPE : DROP STRUCTURE w/ CIRC. CULVERT
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 24.000 RISE (in): 24.000 LENGTH (ft): 50.000
U/S INVERT (ft): 19.000 D/S INVERT (ft): 18.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : RECTANGULAR RISER SLOT
CREST EL. (ft): 22.800 CREST LN. (ft): 4.000 OPENING (ft): 999.000
WEIR COEF.: 3.200 GATE COEF.: .600 NUMBER OF ELEM.: 1.000

POSITION B : NOT USED

NOTE: PROPOSED OUTFALL STRUCTURE A-20

>>REACH NAME : RW-2
FROM NODE : JIFPOND
TO NODE : A-13
REACH TYPE : DROP STRUCTURE w/ CIRC. CULVERT
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 15.000 RISE (in): 15.000 LENGTH (ft): 6.000
U/S INVERT (ft): 22.380 D/S INVERT (ft): 22.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : RECTANGULAR RISER SLOT
CREST EL. (ft): 26.880 CREST LN. (ft): 10.170 OPENING (ft): 999.000
WEIR COEF.: 3.200 GATE COEF.: .600 NUMBER OF ELEM.: 1.000

POSITION B : NOT USED

NOTE:

POND A INCL. PALM BAY CENTER (25YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA25)

REACH SUMMARY

=====

INDEX	RCHNAME	FRMNODE	TONODE	REACH TYPE
1	RO-1	JIFPOND	A-13	CIRCULAR WEIR/GATE/ORIFICE, MAVIS EQ.
2	RC-13	A-13	A-12	CULVERT, CIRCULAR w/ ROADWAY
3	RC-12	A-12	A-17	CULVERT, CIRCULAR w/ ROADWAY
4	RC-17	A-17	PONDA	CULVERT, CIRCULAR w/ ROADWAY
5	RW-1	PONDA	MTC#37	DROP STRUCTURE w/ CIRC. CULVERT
6	RW-2	JIFPOND	A-13	DROP STRUCTURE w/ CIRC. CULVERT

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POND A INCL. PALM BAY CENTER (3YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

BASIN NAME	BASINA	JIFFY	A-13	A-12	A-17
NODE NAME	PONDA	JIFPOND	A-13	A-12	A-17
UNIT HYDROGRAPH	UH484	UH484	UH484	UH484	UH484
PEAKING FACTOR	484.	484.	484.	484.	484.
RAINFALL FILE	SCSIII	SCSIII	SCSIII	SCSIII	SCSIII
RAIN AMOUNT (in)	5.64	5.64	5.64	5.64	5.64
STORM DURATION (hrs)	24.00	24.00	24.00	24.00	24.00
AREA (ac)	4.51	.59	1.00	1.00	1.00
CURVE NUMBER	92.00	92.00	.00	.00	.00
DCIA (%)	.00	.00	.00	.00	.00
TC (mins)	31.70	10.00	10.00	10.00	10.00
LAG TIME (hrs)	.00	.00	.00	.00	.00
BASIN STATUS	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE

BASIN	QMX (cfs)	TMX (hrs)	VOL (in)	NOTES
BASINA	13.20	12.40	4.71	
JIFFY	2.14	12.24	4.71	
A-13	.00	.00	.00	
A-12	.00	.00	.00	
A-17	.00	.00	.00	

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POND A INCL. PALM BAY CENTER (3YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

NODAL MIN/MAX/TIME CONDITIONS REPORT

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=====
|<-- MINIMUMS -->| |<-- MAXIMUMS -->|
NODE ID      PARAMETER      VALUE TIME (hr)      VALUE TIME (hr)
-----
PONDA        STAGE (ft):      20.00      3.00      23.65      12.50
              VOLUME (af):      .00        2.75        .72        12.50
              RUNOFF (cfs):      .00        2.75      12.10      12.25
              OFFSITE (cfs):      .00      24.00        .00      24.00
              OTHER (cfs):     -1.82      10.75      18.44      12.75
              OUTFLOW (cfs):      .00      12.00      10.09      12.50

MTC#37       STAGE (ft):      15.00      6.00      17.29      24.00
              VOLUME (af):      .00      12.00        1.44      24.00
              RUNOFF (cfs):      .00      24.00        .00      24.00
              OFFSITE (cfs):      .00      24.00        .00      24.00
              OTHER (cfs):      .00      12.00      10.09      12.50
              OUTFLOW (cfs):      .00      24.00        .00      24.00

JIFPOND      STAGE (ft):      22.50      3.00      24.08      12.50
              VOLUME (af):      .00        2.75        .08      12.50
              RUNOFF (cfs):      .00        2.75        2.14      12.25
              OFFSITE (cfs):      .00      24.00        .00      24.00
              OTHER (cfs):      .00      24.00        .00      24.00
              OUTFLOW (cfs):     -.05      24.00        .63      12.00

A-12        STAGE (ft):      20.81      9.00      23.64      12.50
              VOLUME (af):      .00        5.00        .01      12.50
              RUNOFF (cfs):      .00      24.00        .00      24.00
              OFFSITE (cfs):      .00      24.00        .00      24.00
              OTHER (cfs):      .00        9.75        2.52      24.00
              OUTFLOW (cfs):     -6.40      24.00        .33      10.75

A-13        STAGE (ft):      21.02      9.75      23.74      12.50
              VOLUME (af):      .00        3.25        .00      12.50
              RUNOFF (cfs):      .00      24.00        .00      24.00
              OFFSITE (cfs):      .00      24.00        .00      24.00
              OTHER (cfs):     -.05      24.00        .63      12.00
              OUTFLOW (cfs):      .00        9.75        2.52      24.00
    
```

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POND A INCL. PALM BAY CENTER (3YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

NODAL MIN/MAX/TIME CONDITIONS REPORT
 =====

NODE ID	PARAMETER	<-- MINIMUMS -->		<-- MAXIMUMS -->	
		VALUE	TIME (hr)	VALUE	TIME (hr)
A-17	STAGE (ft):	20.40	6.25	23.76	12.50
	VOLUME (af):	.00	5.75	.01	12.50
	RUNOFF (cfs):	.00	24.00	.00	24.00
	OFFSITE (cfs):	.00	24.00	.00	24.00
	OTHER (cfs):	-6.40	24.00	.33	10.75
	OUTFLOW (cfs):	-1.82	10.75	18.44	12.75

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

CONTROL PARAMETERS

=====

START TIME: .00
END TIME: 24.00

TO TIME (hours)	SIMULATION INC (secs)	PRINT INC (mins)
----- 30.00	----- 1.00	----- 15.00

RUNOFF HYDROGRAPH FILE: DEFAULT
OFFSITE HYDROGRAPH FILE: DEFAULT
BOUNDARY DATABASE FILE: NONE

NOTE:

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POND A INCL. PALM BAY CENTER (3YR/24HR)
 AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

NODE NAME	NODE TYPE	INI STAGE (ft)	X-COOR (ft)	Y-COOR (ft)	LENGTH (ft)	STAGE (ft)	AR/TM/STR (ac/hr/af)
PONDA	AREA	20.000	.000	.000	.000	20.000	.120
						21.000	.160
						22.000	.200
						23.000	.240
						24.000	.280
						25.000	.330
MTC#37	TIME	15.000	.000	.000	.000	15.000	.000
						15.000	6.000
						18.050	30.000
JIFPOND	AREA	22.500	.000	.000	.000	22.500	.050
						23.000	.050
						24.000	.050
						25.000	.050
						26.000	.050
						27.000	.050
A-12	AREA	20.810	.000	.000	.000	20.810	.001
						27.170	.001
A-13	AREA	21.020	.000	.000	.000	21.020	.001
						26.860	.001
A-17	AREA	20.400	.000	.000	.000	20.400	.001
						27.720	.001

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

>>REACH NAME : RO-1
FROM NODE : JIFPOND
TO NODE : A-13
REACH TYPE : CIRCULAR WEIR/GATE/ORIFICE, MAVIS EQ.
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
INVERT EL. (ft): 22.500 SPAN (ins): 6.000 RISE (ins): 6.000
WEIR COEF.: 3.000 GATE COEF.: .600 NUMBER OF ELEM.: 1.000
NOTE:

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

>>REACH NAME : RC-13
FROM NODE : A-13
TO NODE : A-12
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 18.000 RISE (in): 18.000 LENGTH (ft): 106.000
U/S INVERT (ft): 21.020 D/S INVERT (ft): 20.810 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

>>REACH NAME : RC-12
FROM NODE : A-12
TO NODE : A-17
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 24.000 RISE (in): 24.000 LENGTH (ft): 141.000
U/S INVERT (ft): 20.810 D/S INVERT (ft): 20.400 MANNING N: .012
ENTRNC LOSS: -.300 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

>>REACH NAME : RC-17
FROM NODE : A-17
TO NODE : PONDA
REACH TYPE : CULVERT, CIRCULAR w/ ROADWAY
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 36.000 RISE (in): 36.000 LENGTH (ft): 84.000
U/S INVERT (ft): 20.400 D/S INVERT (ft): 20.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : NOT USED

POSITION B : NOT USED

NOTE:

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

>>REACH NAME : RW-1
FROM NODE : PONDA
TO NODE : MTC#37
REACH TYPE : DROP STRUCTURE w/ CIRC. CULVERT
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 24.000 RISE (in): 24.000 LENGTH (ft): 50.000
U/S INVERT (ft): 19.000 D/S INVERT (ft): 18.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : RECTANGULAR RISER SLOT
CREST EL. (ft): 22.800 CREST LN. (ft): 4.000 OPENING (ft): 999.000
WEIR COEF.: 3.200 GATE COEF.: .600 NUMBER OF ELEM.: 1.000

POSITION B : NOT USED

NOTE: PROPOSED OUTFALL STRUCTURE A-20

>>REACH NAME : RW-2
FROM NODE : JIFPOND
TO NODE : A-13
REACH TYPE : DROP STRUCTURE w/ CIRC. CULVERT
FLOW DIRECTION : POSITIVE AND NEGATIVE FLOWS ALLOWED
TURBO SWITCH : OFF

CULVERT DATA :
SPAN (in): 15.000 RISE (in): 15.000 LENGTH (ft): 6.000
U/S INVERT (ft): 22.380 D/S INVERT (ft): 22.000 MANNING N: .012
ENTRNC LOSS: -.500 # OF CULVERTS: 1.000

POSITION A : RECTANGULAR RISER SLOT
CREST EL. (ft): 26.880 CREST LN. (ft): 10.170 OPENING (ft): 999.000
WEIR COEF.: 3.200 GATE COEF.: .600 NUMBER OF ELEM.: 1.000

POSITION B : NOT USED

NOTE:

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POND A INCL. PALM BAY CENTER (3YR/24HR)
AUGUST 28, 2000 (FN:G:\..\BR-10\PONDA\PONDA3)

REACH SUMMARY
=====

INDEX	RCHNAME	FRMNODE	TONODE	REACH TYPE
1	RO-1	JIFPOND	A-13	CIRCULAR WEIR/GATE/ORIFICE, MAVIS EQ.
2	RC-13	A-13	A-12	CULVERT, CIRCULAR w/ ROADWAY
3	RC-12	A-12	A-17	CULVERT, CIRCULAR w/ ROADWAY
4	RC-17	A-17	PONDA	CULVERT, CIRCULAR w/ ROADWAY
5	RW-1	PONDA	MTC#37	DROP STRUCTURE w/ CIRC. CULVERT
6	RW-2	JIFPOND	A-13	DROP STRUCTURE w/ CIRC. CULVERT

POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** NODE INFORMATION *** STORM TABS PART "A"

NODE NAME	A-1	A-6	A-2	A-4	A-3
STATION (ft)	5132.00	.00	.00	.00	.00
OFFSET (ft)	-41.69	.00	.00	.00	.00
EASTING (ft)	0.	0.	0.	0.	0.
NORTHING (ft)	0.	0.	0.	0.	0.
NODE TYPE	0	1	1	0	1
GUTTER/GROUND EL. (ft)	25.80	26.02	26.21	25.20	27.01
MAXIMUM SURCHARGE (ft)	999.00	999.00	999.00	999.00	999.00
BOTTOM EL. (ft)	.00	.00	.00	.00	.00
STRUCTURE DIA. (ft)	.00	.00	.00	.00	.00
MAXIMUM INLET FLOW (cfs)	9.00	9.00	9.00	9.00	9.00
INLET EFFICIENCY	1.00	1.00	1.00	1.00	1.00
CATCHMENT AREA (ac)	.44	.00	.17	1.27	.00
RUNOFF COEFFICIENT	.84	.00	.86	.20	.00
TIME of CONC. (min)	10.00	10.00	10.00	25.00	10.00
RNFALL INTENSITY (iph)	6.50	6.50	6.50	4.39	6.50
FLOW TO INLET (cfs)	2.40	.00	.95	1.12	.00
POTENTIAL FLOWBY (cfs)	.00	.00	.00	.00	.00
BASE FLOW (cfs)	.00	.00	.00	.00	.00
SUM of AREAS (ac)	.44	.44	.61	1.27	1.88
SUM of CxA (ac)	.37	.37	.52	.25	.77
SUM of TCs (min)	10.00	10.15	11.07	25.00	25.37
SUM of RNFALL INT. (iph)	6.50	6.47	6.26	4.39	4.36
SUM of SURFACE FLOW (cfs)	2.40	2.40	3.36	1.12	4.47
SUM of BASE FLOW (cfs)	.00	.00	.00	.00	.00
DESIGN FLOW (cfs)	2.40	2.39	3.23	1.12	3.36
ACTUAL FLOW (cfs)	2.40	2.39	3.23	1.12	3.36

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POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** REACH INFORMATION *** STORM TABS PART "B"

REACH NAME	1	6	2	4	3
FROM NODE NAME	A-1	A-6	A-2	A-4	A-3
TO NODE NAME	A-6	A-2	A-3	A-3	A-7
GEOMETRIC CONFIGURATION	CIRC.	CIRC.	CIRC.	CIRC.	CIRC.
GEOMETRIC PARAMETER "A"	18.00	18.00	18.00	18.00	18.00
GEOMETRIC PARAMETER "B"	18.00	18.00	18.00	18.00	18.00
LENGTH (ft)	12.00	75.00	120.00	14.00	248.00
MANNINGS N	.012	.012	.012	.012	.012
NUMBER OF IDENTICAL RCHs	1	1	1	1	1
DNSTREAM INVERT EL. (ft)	22.52	22.37	22.14	22.14	21.65
DNSTREAM CROWN EL. (ft)	24.02	23.87	23.64	23.64	23.15
DNSTREAM COVER DPTH (ft)	2.00	2.34	3.37	3.37	2.89
DNSTREAM HGL EL. (ft)	25.50	25.45	25.32	25.32	25.06
DNSTREAM EGL EL. (ft)	25.53	25.50	25.38	25.38	25.25
DNSTREAM FREEBOARD (ft)	.52	.76	1.69	1.69	.98
UPSTREAM INVERT EL. (ft)	22.54	22.52	22.37	22.17	22.14
UPSTREAM CROWN EL. (ft)	24.04	24.02	23.87	23.67	23.64
UPSTREAM COVER DPTH (ft)	1.76	2.00	2.34	1.53	3.37
UPSTREAM HGL EL. (ft)	25.50	25.50	25.45	25.33	25.32
UPSTREAM EGL EL. (ft)	25.50	25.53	25.50	25.33	25.38
UPSTREAM FREEBOARD (ft)	.30	.52	.76	-.13	1.69
DESIGN FLOW (cfs)	2.40	2.39	3.23	1.12	3.36
REACH SLOPE (%)	.17	.20	.19	.21	.20
CRITICAL DEPTH (ft)	.59	.59	.68	.39	.70
NORMAL DEPTH (ft)	.77	.72	.88	.47	.89
EXIT LOSS COEFFICIENT	.00	.00	.00	.00	.00
ENTRANCE LOSS COEFFICIENT	.00	.00	.00	1.00	.00
MINOR LOSS COEFFICIENT	.00	.00	.00	.00	.00
STRUC. LOSS COEFFICIENT	.90	.60	.60	.50	.70
EXIT VELOCITY (fps)	1.36	1.35	1.83	.63	1.90
ENTRANCE VELOCITY (fps)	1.36	1.35	1.83	.63	1.90
AVERAGE VELOCITY (fps)	1.36	1.35	1.83	.63	1.90
STRUCTURE VELOCITY (fps)	.00	1.36	1.83	.00	1.90
EXIT LOSS (ft)	.000	.000	.000	.000	.000
ENTRANCE LOSS (ft)	.000	.000	.000	.006	.000
OTHER MINOR LOSS (ft)	.000	.000	.000	.000	.000
FRICTION LOSS (ft)	.005	.033	.097	.001	.216
STRUCTURE LOSS (ft)	.000	.017	.031	.000	.039
TOTAL LOSSES (ft)	.005	.050	.128	.008	.255
CONTROL ELEVATION (ft)	25.498	25.448	25.320	25.320	25.065
UPSTREAM HGL (ft)	25.503	25.498	25.448	25.327	25.320

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POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** NODE INFORMATION *** STORM TABS PART "A"

NODE NAME	:	A-5	A-7	A-8A	A-8	A-9
STATION (ft)	:	.00	.00	.00	.00	.00
OFFSET (ft)	:	.00	.00	.00	.00	.00
EASTING (ft)	:	0.	0.	0.	0.	0.
NORTHING (ft)	:	0.	0.	0.	0.	0.
NODE TYPE	:	0	1	0	1	0
GUTTER/GROUND EL. (ft)	:	25.99	26.04	26.60	27.43	26.58
MAXIMUM SURCHARGE (ft)	:	999.00	999.00	999.00	999.00	999.00
BOTTOM EL. (ft)	:	.00	.00	.00	.00	.00
STRUCTURE DIA. (ft)	:	.00	.00	.00	.00	.00
MAXIMUM INLET FLOW (cfs)	:	9.00	9.00	9.00	9.00	9.00
INLET EFFICIENCY	:	1.00	1.00	1.00	1.00	1.00
CATCHMENT AREA (ac)	:	.34	.49	.10	.00	.13
RUNOFF COEFFICIENT	:	.86	.84	.25	.00	.79
TIME of CONC. (min)	:	10.00	10.00	10.00	10.00	10.00
RNFALL INTENSITY (iph)	:	6.50	6.50	6.50	6.50	6.50
FLOW TO INLET (cfs)	:	1.90	2.68	.16	.00	.67
POTENTIAL FLOWBY (cfs)	:	.00	.00	.00	.00	.00
BASE FLOW (cfs)	:	.00	.00	.00	.00	.00
SUM of AREAS (ac)	:	.34	2.71	.10	2.81	.13
SUM of CxA (ac)	:	.29	1.47	.03	1.50	.10
SUM of TCs (min)	:	10.00	27.54	10.00	28.66	10.00
SUM of RNFALL INT. (iph)	:	6.50	4.19	6.50	4.11	6.50
SUM of SURFACE FLOW (cfs)	:	1.90	9.05	.16	9.21	.67
SUM of BASE FLOW (cfs)	:	.00	.00	.00	.00	.00
DESIGN FLOW (cfs)	:	1.90	6.17	.16	6.15	.67
ACTUAL FLOW (cfs)	:	1.90	6.17	.16	6.15	.67

POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** REACH INFORMATION *** STORM TABS PART "B"

REACH NAME	5	7	8A	8	9
FROM NODE NAME	A-5	A-7	A-8A	A-8	A-9
TO NODE NAME	A-7	A-8	A-8	A-11	A-10
GEOMETRIC CONFIGURATION	CIRC.	CIRC.	CIRC.	CIRC.	CIRC.
GEOMETRIC PARAMETER "A"	18.00	18.00	18.00	24.00	18.00
GEOMETRIC PARAMETER "B"	18.00	18.00	18.00	24.00	18.00
LENGTH (ft)	82.00	234.00	41.00	114.00	45.00
MANNINGS N	.012	.012	.012	.012	.012
NUMBER OF IDENTICAL RCHs	1	1	1	1	1
DNSTREAM INVERT EL. (ft)	21.65	21.19	24.10	20.87	20.97
DNSTREAM CROWN EL. (ft)	23.15	22.69	25.60	22.87	22.47
DNSTREAM COVER DPTH (ft)	2.89	4.74	1.83	4.80	4.32
DNSTREAM HGL EL. (ft)	25.06	24.28	24.28	24.08	24.09
DNSTREAM EGL EL. (ft)	25.25	24.47	24.47	24.15	24.10
DNSTREAM FREEBOARD (ft)	.98	3.15	3.15	3.59	2.70
UPSTREAM INVERT EL. (ft)	21.81	21.65	24.18	21.19	21.05
UPSTREAM CROWN EL. (ft)	23.31	23.15	25.68	23.19	22.55
UPSTREAM COVER DPTH (ft)	2.68	2.89	.92	4.24	4.03
UPSTREAM HGL EL. (ft)	25.11	25.06	24.38	24.28	24.09
UPSTREAM EGL EL. (ft)	25.11	25.25	24.40	24.47	24.09
UPSTREAM FREEBOARD (ft)	.88	.98	2.22	3.15	2.49
DESIGN FLOW (cfs)	1.90	6.17	.16	6.15	.67
REACH SLOPE (%)	.20	.20	.20	.28	.18
CRITICAL DEPTH (ft)	.52	.96	.15	.88	.30
NORMAL DEPTH (ft)	.64	10000.00	.18	.97	.38
EXIT LOSS COEFFICIENT	.00	.00	.00	.00	.00
ENTRANCE LOSS COEFFICIENT	1.00	.00	.00	.00	.00
MINOR LOSS COEFFICIENT	.00	.00	.00	.00	.00
STRUC. LOSS COEFFICIENT	.50	.50	.50	.70	.60
EXIT VELOCITY (fps)	1.08	3.49	1.34	1.96	.38
ENTRANCE VELOCITY (fps)	1.08	3.49	1.30	1.96	.38
AVERAGE VELOCITY (fps)	1.08	3.49	1.32	1.96	.38
STRUCTURE VELOCITY (fps)	.00	3.49	1.30	3.49	.38
EXIT LOSS (ft)	.000	.000	.000	.000	.000
ENTRANCE LOSS (ft)	.018	.000	.000	.000	.000
OTHER MINOR LOSS (ft)	.000	.000	.000	.000	.000
FRICTION LOSS (ft)	.023	.689	.084	.072	.002
STRUCTURE LOSS (ft)	.000	.095	.013	.133	.001
TOTAL LOSSES (ft)	.041	.783	.097	.205	.003
CONTROL ELEVATION (ft)	25.065	24.281	24.281	24.076	24.088
UPSTREAM HGL (ft)	25.105	25.065	24.378	24.281	24.091

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PCND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** NODE INFORMATION *** STORM TABS PART "A"

NODE NAME	A-10	A-11	A-13	A-12	A-15
STATION (ft)	.00	.00	.00	.00	.00
OFFSET (ft)	.00	.00	.00	.00	.00
EASTING (ft)	0.	0.	0.	0.	0.
NORTHING (ft)	0.	0.	0.	0.	0.
NODE TYPE	1	1	0	0	0
GUTTER/GROUND EL. (ft)	26.79	27.67	26.95	27.17	27.82
MAXIMUM SURCHARGE (ft)	999.00	999.00	999.00	999.00	999.00
BOTTOM EL. (ft)	.00	.00	.00	.00	.00
STRUCTURE DIA. (ft)	.00	.00	.00	.00	.00
MAXIMUM INLET FLOW (cfs)	9.00	9.00	9.00	9.00	9.00
INLET EFFICIENCY	1.00	1.00	1.00	1.00	1.00
CATCHMENT AREA (ac)	.13	.00	.42	.39	.02
RUNOFF COEFFICIENT	.79	.00	.88	.83	.95
TIME of CONC. (min)	10.00	10.00	10.00	10.00	10.00
RNFALL INTENSITY (iph)	6.50	6.50	6.50	6.50	6.50
FLOW TO INLET (cfs)	.67	.00	2.40	2.11	.12
POTENTIAL FLOWBY (cfs)	.00	.00	.00	.00	.00
BASE FLOW (cfs)	.00	.00	.00	.00	.00
SUM of AREAS (ac)	.26	3.07	.42	3.88	.02
SUM of CxA (ac)	.21	1.70	.37	2.40	.02
SUM of TCs (min)	11.98	29.63	10.00	29.88	10.00
SUM of RNFALL INT. (iph)	6.07	4.04	6.50	4.02	6.50
SUM of SURFACE FLOW (cfs)	1.34	10.55	2.40	15.06	.12
SUM of BASE FLOW (cfs)	.00	.00	.00	.00	.00
DESIGN FLOW (cfs)	1.25	6.88	2.40	9.64	.12
ACTUAL FLOW (cfs)	1.25	6.88	2.40	9.64	.12

POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** REACH INFORMATION *** STORM TABS PART "B"

REACH NAME	10	11	13	12	15
FROM NODE NAME	A-10	A-11	A-13	A-12	A-15
TO NODE NAME	A-11	A-12	A-12	A-17	A-16
GEOMETRIC CONFIGURATION	CIRC.	CIRC.	CIRC.	CIRC.	CIRC.
GEOMETRIC PARAMETER "A"	18.00	24.00	18.00	24.00	15.00
GEOMETRIC PARAMETER "B"	18.00	24.00	18.00	24.00	15.00
LENGTH (ft)	52.00	33.00	106.00	141.00	6.00
MANNINGS N	.012	.012	.012	.012	.012
NUMBER OF IDENTICAL RCHs	1	1	1	1	1
DNSTREAM INVERT EL. (ft)	20.87	20.81	20.81	20.40	24.41
DNSTREAM CROWN EL. (ft)	22.37	22.81	22.31	22.40	25.66
DNSTREAM COVER DPTH (ft)	5.30	4.36	4.86	5.32	1.94
DNSTREAM HGL EL. (ft)	24.08	24.01	24.01	23.71	24.37
DNSTREAM EGL EL. (ft)	24.15	24.15	24.15	23.88	24.37
DNSTREAM FREEBOARD (ft)	3.59	3.16	3.16	4.01	3.23
UPSTREAM INVERT EL. (ft)	20.97	20.87	21.02	20.81	24.42
UPSTREAM CROWN EL. (ft)	22.47	22.87	22.52	22.81	25.67
UPSTREAM COVER DPTH (ft)	4.32	4.80	4.43	4.36	2.15
UPSTREAM HGL EL. (ft)	24.09	24.08	24.08	24.01	24.61
UPSTREAM EGL EL. (ft)	24.10	24.15	24.08	24.15	24.61
UPSTREAM FREEBOARD (ft)	2.70	3.59	2.87	3.16	3.21
DESIGN FLOW (cfs)	1.25	6.88	2.40	9.64	.12
REACH SLOPE (%)	.19	.18	.20	.29	.17
CRITICAL DEPTH (ft)	.42	.93	.59	1.11	.14
NORMAL DEPTH (ft)	.51	1.18	.73	1.27	.18
EXIT LOSS COEFFICIENT	.00	.00	.00	.00	.00
ENTRANCE LOSS COEFFICIENT	.00	.00	1.00	.00	1.00
MINOR LOSS COEFFICIENT	.00	.00	.00	.00	.00
S'TRUC. LOSS COEFFICIENT	.70	.60	.60	.50	.50
EXIT VELOCITY (fps)	.71	2.19	1.36	3.07	1.72
ENTRANCE VELOCITY (fps)	.71	2.19	1.36	3.07	1.33
AVERAGE VELOCITY (fps)	.71	2.19	1.36	3.07	1.49
S'TRUCTURE VELOCITY (fps)	.71	2.19	.00	3.07	.00
EXIT LOSS (ft)	.000	.000	.000	.000	.000
ENTRANCE LOSS (ft)	.000	.000	.029	.000	.027
OTHER MINOR LOSS (ft)	.000	.000	.000	.000	.000
FRICITION LOSS (ft)	.006	.026	.047	.218	.037
S'TRUCTURE LOSS (ft)	.005	.045	.000	.073	.000
TOTAL LOSSES (ft)	.012	.071	.076	.291	.064
CONTROL ELEVATION (ft)	24.076	24.006	24.006	23.715	24.545
UPSTREAM HGL (ft)	24.088	24.076	24.082	24.006	24.609

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POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** NODE INFORMATION *** STORM TABS PART "A"

NODE NAME	A-16	A-17	A-18
STATION (ft)	.00	.00	.00
OFFSET (ft)	.00	.00	.00
EASTING (ft)	0.	0.	0.
NCRTHING (ft)	0.	0.	0.
NCDE TYPE	1	1	1
GUTTER/GROUND EL. (ft)	27.60	27.72	27.62
MAXIMUM SURCHARGE (ft)	999.00	999.00	999.00
BCTTOM EL. (ft)	.00	.00	.00
STRUCTURE DIA. (ft)	.00	.00	.00
MAXIMUM INLET FLOW (cfs)	9.00	9.00	9.00
INLET EFFICIENCY	1.00	1.00	1.00
CATCHMENT AREA (ac)	.23	.00	.04
RUNOFF COEFFICIENT	.95	.00	.95
TIME of CONC. (min)	10.00	10.00	10.00
RNFALL INTENSITY (iph)	6.50	6.50	6.50
FLOW TO INLET (cfs)	1.42	.00	.25
POTENTIAL FLOWBY (cfs)	.00	.00	.00
BASE FLOW (cfs)	.00	.00	.00
SUM of AREAS (ac)	.25	4.13	4.17
SUM of CxA (ac)	.24	2.63	2.67
SUM of TCs (min)	10.07	30.65	30.74
SUM of RNFALL INT. (iph)	6.49	3.97	3.96
SUM of SURFACE FLOW (cfs)	1.54	16.60	16.85
SUM of BASE FLOW (cfs)	.00	.00	.00
DESIGN FLOW (cfs)	1.54	10.45	10.58
ACTUAL FLOW (cfs)	1.54	10.45	10.58

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PCND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

*** REACH INFORMATION *** STORM TABS PART "B"

REACH NAME	:	16	17	18
FROM NODE NAME	:	A-16	A-17	A-18
TO NODE NAME	:	A-17	A-18	A-19
GEOMETRIC CONFIGURATION	:	CIRC.	CIRC.	CIRC.
GEOMETRIC PARAMETER "A"	:	18.00	36.00	36.00
GEOMETRIC PARAMETER "B"	:	18.00	36.00	36.00
LENGTH (ft)	:	104.00	8.00	30.00
MANNINGS N	:	.012	.012	.012
NUMBER OF IDENTICAL RCHs	:	1	1	1
DNSTREAM INVERT EL. (ft)	:	23.61	20.38	20.00
DNSTREAM CROWN EL. (ft)	:	25.11	23.38	23.00
DNSTREAM COVER DPTH (ft)	:	2.61	4.24	.57
DNSTREAM HGL EL. (ft)	:	23.71	23.63	23.57
DNSTREAM EGL EL. (ft)	:	23.88	23.66	23.57
DNSTREAM FREEBOARD (ft)	:	4.01	3.99	.00
UPSTREAM INVERT EL. (ft)	:	23.81	20.40	20.38
UPSTREAM CROWN EL. (ft)	:	25.31	23.40	23.38
UPSTREAM COVER DPTH (ft)	:	2.29	4.32	4.24
UPSTREAM HGL EL. (ft)	:	24.37	23.71	23.63
UPSTREAM EGL EL. (ft)	:	24.37	23.88	23.66
UPSTREAM FREEBOARD (ft)	:	3.23	4.01	3.99
DESIGN FLOW (cfs)	:	1.54	10.45	10.58
REACH SLOPE (%)	:	.19	.25	1.27
CRITICAL DEPTH (ft)	:	.47	1.02	1.03
NORMAL DEPTH (ft)	:	.57	1.10	.73
EXIT LOSS COEFFICIENT	:	.00	.00	1.00
ENTRANCE LOSS COEFFICIENT	:	.00	.00	.00
MINOR LOSS COEFFICIENT	:	.00	.00	.00
STRUC. LOSS COEFFICIENT	:	.50	.50	.50
EXIT VELOCITY (fps)	:	3.29	1.48	1.50
ENTRANCE VELOCITY (fps)	:	2.57	1.48	1.50
AVERAGE VELOCITY (fps)	:	2.87	1.48	1.50
STRUCTURE VELOCITY (fps)	:	.00	3.29	1.50
EXIT LOSS (ft)	:	.000	.000	.035
ENTRANCE LOSS (ft)	:	.000	.000	.000
OTHER MINOR LOSS (ft)	:	.000	.000	.000
FRICITION LOSS (ft)	:	.293	.002	.006
STRUCTURE LOSS (ft)	:	.000	.084	.017
TOTAL LOSSES (ft)	:	.293	.086	.059
CONTROL ELEVATION (ft)	:	24.076	23.629	23.570
UPSTREAM HGL (ft)	:	24.369	23.715	23.629

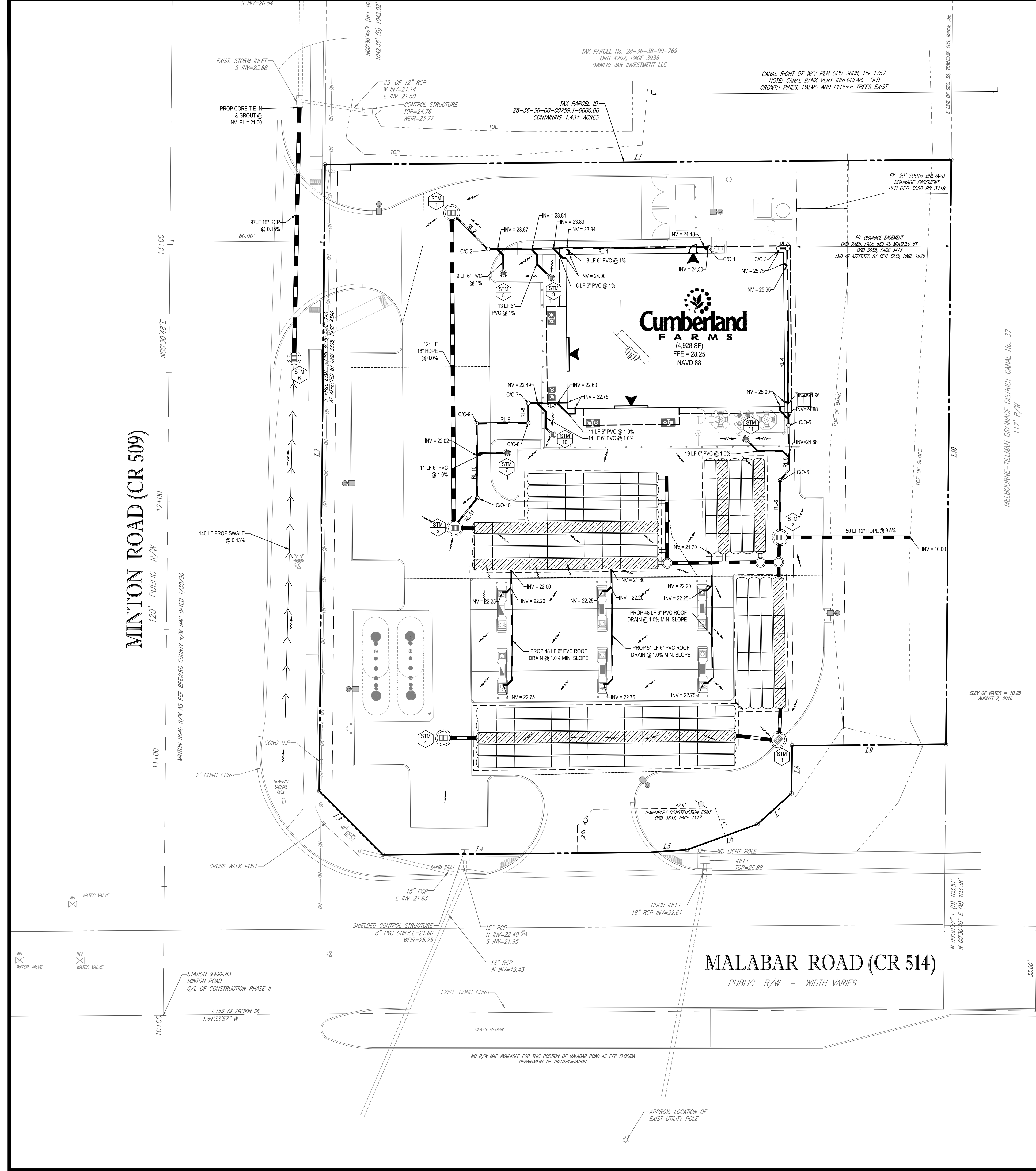
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POND A - 3YR/24HR POST-DEV STORMSEWER (PBCC W/EAST INLET)
 AUGUST 28, 2000 (FN:\NETWORX\BR-10\POND_A\3YRPBCC)

NCDE	DIST-ft	GRND-ft	MXSR-ft	DSGN-ft	HGL-ft	FREE-ft	FLAG
A-19	.00	23.57	.00	23.57	23.57	.00	**
A-18	30.00	27.62	999.00	1026.62	23.63	1002.99	
A-17	38.00	27.72	999.00	1026.72	23.71	1003.01	
A-16	142.00	27.60	999.00	1026.60	24.37	1002.23	
A-15	148.00	27.82	999.00	1026.82	24.61	1002.21	
A-17	.00	27.72	999.00	1026.72	23.71	1003.01	
A-12	141.00	27.17	999.00	1026.17	24.01	1002.16	
A-13	247.00	26.95	999.00	1025.95	24.08	1001.87	
A-12	.00	27.17	999.00	1026.17	24.01	1002.16	
A-11	33.00	27.67	999.00	1026.67	24.08	1002.59	
A-10	85.00	26.79	999.00	1025.79	24.09	1001.70	
A-9	130.00	26.58	999.00	1025.58	24.09	1001.49	
A-11	.00	27.67	999.00	1026.67	24.08	1002.59	
A-8	114.00	27.43	999.00	1026.43	24.28	1002.15	
A-8A	155.00	26.60	999.00	1025.60	24.38	1001.22	
A-8	.00	27.43	999.00	1026.43	24.28	1002.15	
A-7	234.00	26.04	999.00	1025.04	25.06	999.98	
A-5	316.00	25.99	999.00	1024.99	25.11	999.88	
A-7	.00	26.04	999.00	1025.04	25.06	999.98	
A-3	248.00	27.01	999.00	1026.01	25.32	1000.69	
A-4	262.00	25.20	999.00	1024.20	25.33	998.87	
A-3	.00	27.01	999.00	1026.01	25.32	1000.69	
A-2	120.00	26.21	999.00	1025.21	25.45	999.76	
A-6	195.00	26.02	999.00	1025.02	25.50	999.52	
A-1	207.00	25.80	999.00	1024.80	25.50	999.30	

G.9

Permit No. 150560-1



ROOF DRAIN SCHEDULE:

PIPE No.	SIZE (IN)	TYPE	LENGTH (FT)	SLOPE (%)
RL-1	6"	PVC	85'	1.0
RL-2	6"	PVC	18'	1.7
RL-3	6"	PVC	3'	1.3
RL-4	6"	PVC	68'	1.3
RL-5	6"	PVC	23'	1.5
RL-6	6"	PVC	20'	1.0
RL-7	6"	PVC	16'	2.0
RL-8	6"	PVC	8'	2.0
RL-9	6"	PVC	20'	1.0
RL-10	6"	PVC	29'	1.0
RL-11	6"	PVC	10'	1.0

STORM STRUCTURE SCHEDULE

NUMBER	TYPE	GRATE ELEV.	INVERTS
1	TYPE 'C' INLET	26.10'	(SE) INV = 23.30' (S) INV = 21.50'
2	CONTROL STRUCTURE (TYPE 'E' INLET)	26.83'	(E) INV = 14.79' (S) INV = 21.50' (N) INV = 24.30'
3	TYPE 'C' CURB INLET	26.90'	(N) INV = 21.50' (W) INV = 21.50'
4	TYPE 'C' INLET	26.01'	(E) INV = 21.50'
5	TYPE 'C' INLET	26.16'	(N) INV = 21.50' (E) INV = 21.50' (NE) INV = 21.75'
6	TYPE 'C' INLET	24.00'	(N) INV = 21.15'
7	ADS YARD DRAIN	27.30'	(W) INV = 22.12'
8	ADS YARD DRAIN	27.27'	(N) INV = 23.76'
9	ADS YARD DRAIN	28.05'	(NW) INV = 23.94'
10	ADS YARD DRAIN	27.95'	(NW) INV = 22.63'
11	ADS YARD DRAIN	27.91'	(SE) INV = 24.90'



LEGEND:

- PROPERTY LINE
- - - PROP. RIDGE LINE
- - - EXIST. DRAINAGE STRUCTURES
- - - EXIST. STORM SEWER
- - - PROP. DRAINAGE ARROW
- - - PROP. STORM SEWER
- - - PROP. STORM STRUCTURES
- - - PROP. STORMTECH CHAMBER
- - - PROP. STORM STRUCTURE LABEL

STORM DRAINAGE NOTES:

- GENERAL:
 - DISTANCES AND LENGTHS OF PIPE SHOWN ON PLANS ARE REFERENCED TO THE CENTER OF STRUCTURES.
- MATERIALS:
 - ALL PVC DRAINAGE PIPE AND FITTINGS SHALL BE NON-PRESSURE POLYVINYL CHLORIDE (PVC) PIPE CONFORMING TO ASTM D 3034, SDR 35, WITH PUSH-ON RUBBER GASKET JOINTS.
 - ALL HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS SHALL MEET THE REQUIREMENTS OF AASHTO M - 294 LATEST REVISIONS. ALL PIPING TO BE NON-PERFORATED TUBING.
 - PROPOSED 'GRATE INLETS' SHALL BE STANDARD FDOT TYPE 'C' DITCH BOTTOM INLETS, PER FDOT INDEX #232.
- INSTALLATION:
 - PIPE SHALL BE PLACED ON A MINIMUM OF 8 INCHES STABLE GRANULAR MATERIAL FREE OF ROCK FORMATION AND OTHER FOREIGN FORMATIONS, AND CONSTRUCTED TO A UNIFORM GRADE AND LINE.
 - BACKFILL MATERIAL SHALL BE WELL GRADED GRANULAR MATERIAL, WELL TAMPED IN LAYERS NOT TO EXCEED 6 INCHES TO A HEIGHT OF 12 INCHES ABOVE PIPE AS SHOWN ON THE PLANS.
 - PROVIDE A MINIMUM PROTECTIVE COVER OF 18 INCHES OVER STORM SEWER AND AVOID UNNECESSARY CROSSING BY HEAVY CONSTRUCTION VEHICLES DURING CONSTRUCTION.

GENERAL NOTES:

- ALL CONSTRUCTION AND RESTORATION WORK WITHIN BREVARD COUNTY RIGHT-OF-WAY SHALL COMPLY WITH THE LATEST EDITION OF FDOT DESIGN STANDARDS AND THE FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
- EXISTING SITE DRAINAGE SYSTEM TO REMAIN SHALL BE CLEANED TO ENSURE EFFICIENT OPERATION. EXISTING STORM PIPES NOT IN USE SHALL BE REMOVED.
- ALL ROOF DRAIN LINES NOT SPECIFICALLY CALLED OUT MUST MAINTAIN A MINIMUM 1% SLOPE TO DRAIN PROPERLY.

DATUM NOTE:

CONTROL BENCHMARK ELEVATIONS SHOWN HEREON ARE BASED ON CITY OF PALM BAY BENCHMARK '7-001' BEING AT AN ELEVATION OF 25.828 FEET NAVD 1988. THE CITY FURNISHED ELEVATION OF 27.183 FEET NGVD WAS CONVERTED TO NAVD 1988 VIA THE NATIONAL GEODETIC SURVEY VERTICAL CONVERSION UTILITY. (NGVD 1929 - 1.355 = NAVD 1988)

FEMA MAP INFORMATION:

THE PROPERTY SHOWN HEREON APPEARS TO LIE IN FLOOD ZONE 'X' ACCORDING TO THE FLOOD INSURANCE RATE MAP No. 12009C066G, COMMUNITY NUMBER 120404, EFFECTIVE MARCH 17, 2014, FOR BREVARD COUNTY, FLORIDA.

STORM CLEANOUT SCHEDULE:

C.O.-1 RIM ELEV = AT GRADE I.E. = 24.50	C.O.-2 RIM ELEV = AT GRADE I.E. = 23.63	C.O.-3 RIM ELEV = AT GRADE I.E. = 25.75	C.O.-4 RIM ELEV = AT GRADE I.E. = 25.71
C.O.-5 RIM ELEV = AT GRADE I.E. = 24.85	C.O.-6 RIM ELEV = AT GRADE I.E. = 24.50	C.O.-7 RIM ELEV = AT GRADE I.E. = 22.42	C.O.-8 RIM ELEV = AT GRADE I.E. = 22.34
C.O.-9 RIM ELEV = AT GRADE I.E. = 22.14	C.O.-10 RIM ELEV = AT GRADE I.E. = 21.85		

BOHLER ENGINEERING

SITE CIVIL AND CONSULTING ENGINEERING ARCHITECTURE
LAND SURVEYING DESIGN PERMITTING SERVICES TRANSPORTATION SERVICES
SUSTAINABLE DESIGN

RALEIGH NC
CHARLOTTE NC
TAMPA FL
SOUTH FLORIDA
LEHIGH VALLEY PA
SOUTHEASTERN PA
SOUTH WEST FLORIDA
BALTIMORE MD
SOUTHERN MARYLAND
NEW YORK METRO
NEW JERSEY
PHILADELPHIA PA
NEW YORK NY

REVISIONS

REV	DATE	COMMENT	BY
1	12/01/16	REV PER 90% SUBMISSION	DJE
2	01/05/17	REV PER 90% COMMENTS	DJE
3	03/29/2017	PER CITY & COUNTY COMMENTS	PMP
4	04/25/2017	PER CITY COMMENTS	PMP
5	05/19/17	REV PER CITY AND COUNTY COMMENTS	DJE
6	06/01/17	REV DRY UTILITIES PER UTILITY AUTHORITY	CM
7	06/20/17	REV PER CLIENT COMMENTS	DJE
8	06/22/17	REV PER CLIENT COMMENTS	CM

811

KNOW WHAT'S BELOW
ALWAYS CALL 811
BEFORE YOU DIG

It's fast. It's free. It's the law.

PERMIT SET

PROJECT No.: FLB150025
DRAWN BY: DJE
CHECKED BY: GB
DATE: 10/13/16
SCALE: AS NOTED
CAD I.D.: CFG05.1

SITE DEVELOPMENT PLANS

FOR

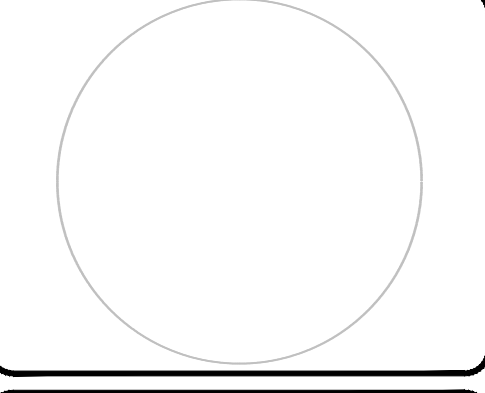
Cumberland FARMS

LOCATION OF SITE

**105 MALABAR ROAD
NORTHEAST
PALM BAY, FL 32907
BREVARD COUNTY**

BOHLER ENGINEERING

2255 GLADES ROAD, SUITE 305E
BOCA RATON, FLORIDA 33431
Phone: (561) 571-0280
Fax: (561) 571-0281
FLORIDA BUSINESS CERT. OF AUTH. No. 30780
LANDSCAPE ARCHITECT BUSINESS LIC. No. LC20000551



SHEET TITLE:

DRAINAGE PLAN

SHEET NUMBER:

CFG05.1

DRAINAGE CALCULATION BOOK

for

**Minton & Malabar
Palm Bay, FL**

Brevard County

Prepared for:

Cumberland Farms, Inc.

Prepared by



BOHLER
ENGINEERING

2255 Glades Road, Suite 305E
Boca Raton, FL 33431

John Lapointe, P.E.
Florida Professional Engineer License No. 64211

March 28, 2017

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Appendix B Vicinity Map

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Appendix G Stormwater Calculations

Appendix H Net Improvement

Appendix I Pre vs. Post ICPR

Appendix J PONDS Drawdown

STORMWATER NARRATIVE

Project Name: Cumberland Farms- Minton & Malabar
Location: Brevard County, S36/T28S/R36E
Permittee: Cumberland Farms, Inc.
Operating Entity: Cumberland Farms, Inc.
Project Area: 1.07 acres
Project Land Use: Commercial

I. Introduction

This project proposes the development of a Cumberland Farms Convenience Store with gas sales, as well as necessary infrastructure and utilities. A stormwater management system is proposed consisting of underground chamber dry detention system. There are no existing ERPs covering the project area. The existing parcel is composed of an existing convenience store with gas sales including associated asphalt, landscape and stormwater features necessary to support the existing development. Please refer to the Appendix A - E for aerial and other maps.

II. Existing Features

The existing project site is relatively flat with elevations ranging from 24.5'-26.50' NAVD. Runoff associated with the site is split into two basins. One is contained in an above ground walled detention pond which discharges to the south via an existing pipe connection into Malabar Rd. The other basin overland flows in to the adjacent Canal to the east. An exhibit showing the areas associated with these existing basins can be found on Exhibit 1.

The site discharges to Melbourne-Tillman C-1 Canal, which is an impaired waterbody. WBID # 3090. Net Improvement Calculations have been provided however, presumptive criteria will govern per SJRWMD.

III. Proposed Drainage

The proposed stormwater conveyance system will collect stormwater and attenuate and treat runoff in underground chamber dry detention system. The runoff will be collected via grate inlets within the drive aisles of the parking infrastructure. The stormwater management system will provide water quality and quantity in accordance with the municipality requirements below. The water quality treatment will then infiltrate into the sites in-situ soil stratum.

Per meetings and emails with the City of Palm Bay the two existing basin flows are to be routed directly to the Melbourne-Tillman C-1 Canal to the east. During these discussions, the side bank of the canal shall also be re-stabilized with Sod & Rip Rap.

Seasonal High Water Table (SHWT) elevation determined to be approximately 6.5' below existing grade near boring B-4 & EX-3. Boring B-4 elevation is 26' setting the SHWT at an approximate elevation of 19.50' (NAVD). This also agrees with the High water levels in the Canal

Ponds recovery inputs for hydraulic conductivity value is lowest value of the K values provided by the site specific Geotech report.

SJRWMD – Provide 0.5” of treatment over contributing basin and 1.25” over the impervious area. Provide attenuation for the 25yr-24hr storm event.

FDOT – Site does not discharge to a FDOT ROW; therefore, no permit will be required.

City of Palm Bay- Provide 0.5” of treatment over contributing basin or 1.50” over the impervious area. Provide attenuation for the 10yr-24hr storm event (7.9” of Rainfall as provided by City).

IV. City of Palm Bay & SJRWMD Results

	10YR/24HR Q (cfs)	10YR/24HR Stage (ft)	25YR/24HR Q (cfs)	25YR/24HR Stage (ft)	100YR/24HR Stage (ft)
PRE BASIN A	1.90	N/A	2.36	N/A	N/A
PRE BASIN B	1.78	22.73	2.04	23.07	23.78
PRE COMBINE	3.68	22.73	4.40	23.07	23.78
POST	3.40	23.50	4.36	24.05	24.31

V. Environmental / FEMA Considerations

There are no wetlands or other surface waters located within or affected by the proposed project. The project is not located within any known floodplains.

Appendix G

Stormwater Calculations

PROJECT NAME: CF-Minton & Malabar
PROJECT #: FLB150025

SUMMARY OF GROUND COVER DATA

Basin	Land Use Description	CN	Area (ac.)	Total Area (ac)	Weighted CN	Weighted Runoff Coefficient
PRE-DEVELOPMENT BASIN A	Impervious	98	0.12	0.47	84.6	0.39
	Open Space (Good Condition)	80	0.35			
	Open Water	100	0.00			
PRE-DEVELOPMENT BASIN B	Impervious	98	0.53	0.60	97.6	0.84
	Open Space (Good Condition)	80	0.02			
	Open Water	100	0.05			
POST-DEVELOPMENT	Impervious	98	0.93	1.07	95.6	0.85
	Open Space (Good Condition)	80	0.14			
	Open Water	100	0.00			

Notes:

- 1.) See Appendix D for NRCS Soils Map
- 2.) CN Values based on Hydrologic Soil Group D based on information provided within the geotechnical report
- 3.) CN numbers per TR-55, Urban Hydrology for Small Watersheds

PROJECT: CF-Minton & Malabar
PROJECT #: FLB150025

Stage - Storage Calculations

Existing Pond

Elevation (ft NAVD)	Area (sq ft)	Area (acres)	Incremental Volume (ac-ft)	Cumulative Volume (ac-ft)
21.40	2052	0.047		0.000
22.40	2052	0.047	0.047	0.047
23.40	2052	0.047	0.047	0.094
24.40	2052	0.047	0.047	0.141
25.40	2052	0.047	0.047	0.188

PROJECT: CF-Minton & Malabar
 PROJECT #: FLB150025

PROPOSED POND VOLUMES & TREATMENT VOLUMES

Stage - Storage Calculations

UNDERGROUND CHAMBERS

Elevation (ft NGVD)	Area (sq ft)	Area (acres)	Incremental Volume (ac-ft)	Cumulative Volume (ac-ft)	Cumulative Volume (cu-ft)
21.00	0	0.000	0.000	0.000	0
21.50	5800	0.133	0.033	0.033	1437
22.00	6200	0.142	0.069	0.102	4443
22.50	5200	0.119	0.065	0.167	7275
23.00	5350	0.123	0.061	0.228	9932
23.50	4200	0.096	0.055	0.283	12327
24.00	3000	0.069	0.041	0.324	14113
24.50	2800	0.064	0.033	0.357	15551

SJRWMD REQUIRED TREATMENT (1)

IMPERVIOUS AREA	(ac)	0.93
DEPTH OF TREATMENT	(in)	1.25
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.097 4220

SJRWMD REQUIRED TREATMENT (2)

SITE AREA	(ac)	1.07
DEPTH OF TREATMENT	(in)	0.50
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.045 1942

SITE AREA	(ac)	1.07
DEPTH OF TREATMENT	(in)	0.50
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.045 1942

SITE AREA	(ac)	1.07
DEPTH OF TREATMENT	(in)	0.50
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.045 1942

*TOTAL QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.141 6162
------------------------------------	----------------------------	---------------

TOTAL QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.089 3884
-----------------------------------	----------------------------	---------------

* USE SJRWMD 1.25" OVER IMPERVIOUS PLUS 0.5" OVER THE SITE AREA FOR LARGEST TREATMENT SJRWMD REQUIRED TREATMENT (1)

WATER QUALITY ELEVATION	(ft)	22.30
--------------------------------	-------------	-------

PALM BAY REQUIRED TREATMENT (1)

IMPERVIOUS AREA	(ac)	0.93
DEPTH OF TREATMENT	(in)	1.50
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.116 5064

PAML BAY REQUIRED TREATMENT (2)

SITE AREA	(ac)	1.07
DEPTH OF TREATMENT	(in)	0.50
PART 1 OF QUALITY WATER VOLUME	(ac-ft) (cu-ft)	0.045 1942

* USE SJRWMD 1.25" OVER IMPERVIOUS PLUS 0.5" OVER THE SITE AREA FOR LARGEST TREATMENT
 SJRWMD REQUIRED TREATMENT (1)

Project: CF- Minton & Malabar



Chamber Model -
Units -

SC-740
Imperial Click Here for Metric

Number of chambers -
Voids in the stone (porosity) -
Base of STONE Elevation -

197
40 %
21.00 ft

Amount of Stone Above Chambers -
Amount of Stone Below Chambers -
Area of system -

6 in
6 in
7230 sf

 Include Perimeter Stone in Calculations

Min. Area - 6659 sf min. area

StormTech SC-740 Cumulative Storage Volumes

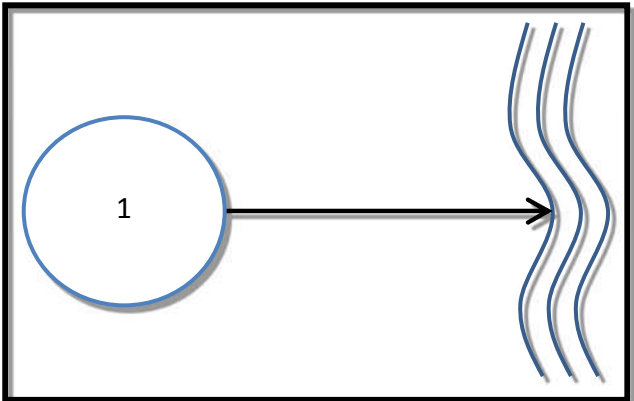
Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Total Chamber (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch & St (cubic feet)	Cumulative Chamber (cubic feet)	Elevation (feet)
42	0.00	0.00	241.00	241.00	15553.39	24.50
41	0.00	0.00	241.00	241.00	15312.39	24.42
40	0.00	0.00	241.00	241.00	15071.39	24.33
39	0.00	0.00	241.00	241.00	14830.39	24.25
38	0.00	0.00	241.00	241.00	14589.39	24.17
37	0.00	0.00	241.00	241.00	14348.39	24.08
36	0.05	10.83	236.67	247.50	14107.39	24.00
35	0.16	32.10	228.16	260.26	13859.89	23.92
34	0.28	55.54	218.78	274.33	13599.63	23.83
33	0.60	118.98	193.41	312.39	13325.31	23.75
32	0.80	157.94	177.83	335.76	13012.92	23.67
31	0.95	187.28	166.09	353.37	12677.16	23.58
30	1.07	211.68	156.33	368.01	12323.79	23.50
29	1.18	232.56	147.98	380.53	11955.78	23.42
28	1.27	249.33	141.27	390.60	11575.24	23.33
27	1.36	266.94	134.23	401.16	11184.64	23.25
26	1.45	286.46	126.42	412.87	10783.48	23.17
25	1.52	300.37	120.85	421.22	10370.61	23.08
24	1.58	311.72	116.31	428.03	9949.38	23.00
23	1.64	323.53	111.59	435.12	9521.35	22.92
22	1.70	334.80	107.08	441.88	9086.24	22.83
21	1.75	345.33	102.87	448.20	8644.35	22.75
20	1.80	355.15	98.94	454.09	8196.16	22.67
19	1.85	365.43	94.83	460.26	7742.06	22.58
18	1.89	372.94	91.82	464.76	7281.80	22.50
17	1.93	381.00	88.60	469.60	6817.04	22.42
16	1.97	389.07	85.37	474.44	6347.44	22.33
15	2.01	395.95	82.62	478.57	5873.00	22.25
14	2.04	402.86	79.85	482.72	5394.42	22.17
13	2.07	408.77	77.49	486.26	4911.71	22.08
12	2.10	414.67	75.13	489.80	4425.44	22.00
11	2.13	419.96	73.01	492.98	3935.64	21.92
10	2.15	424.31	71.28	495.59	3442.67	21.83
9	2.18	428.88	69.45	498.33	2947.08	21.75
8	2.20	433.08	67.77	500.85	2448.75	21.67
7	2.21	434.84	67.06	501.91	1947.91	21.58
6	0.00	0.00	241.00	241.00	1446.00	21.50
5	0.00	0.00	241.00	241.00	1205.00	21.42
4	0.00	0.00	241.00	241.00	964.00	21.33
3	0.00	0.00	241.00	241.00	723.00	21.25
2	0.00	0.00	241.00	241.00	482.00	21.17
1	0.00	0.00	241.00	241.00	241.00	21.08

Appendix H

Net Improvement

GENERAL SITE INFORMATION: V 8.0		GO TO INTRODUCTION PAGE	1/4/2017	Blue Numbers = Red Numbers =	Input data Calculated or Carryover
Select the appropriate Meteorological Zone, input the appropriate Mean Annual Rainfall amount and select the type of analysis		NAME OF PROJECT CF-Minton & Malabar		HELP	
Meteorological Zone (Please use zone map): <input type="text" value="Zone 2"/>		<input type="text" value="52.00"/> Inches		VIEW ZONE MAP	
Mean Annual Rainfall (Please use rainfall map):		<input type="text" value="Net improvement"/>		VIEW MEAN ANNUAL RAINFALL MAP	
Type of analysis: Treatment efficiency (N, P) (ex 80 70 (no decimal points) use only for specified removal efficiency): <input type="text"/> <input type="text"/> %				GO TO WATERSHED CHARACTERISTICS	
Select the STORMWATER TREATMENT ANALYSIS Button below to begin analyzing the effectiveness of Best Management Practices.			Model documentation and example problems.		
<div style="border: 2px solid black; padding: 5px; display: inline-block;">STORMWATER TREATMENT ANALYSIS</div>			<p>There is a user's manual for the BMPTRAINS model. It can be downloaded from www.stormwater.ucf.edu. The results from the example problems shown in the manual however may not reflect current model results due to ongoing updates of the model.</p>		
Systems available for analysis: Retention Basin with option for calculating effluent concentration Wet Detention Exfiltration Trench Pervious Pavement Stormwater Harvesting Biofiltration Greenroof Rainwater Harvesting Managed Aquatic Plants Detention Vegetated Natural Buffer Vegetated Filter Strip Swale Rain Garden Tree Well Lined reuse pond User Defined BMP			<div style="border: 2px solid black; padding: 10px; display: inline-block;">RESET INPUT FOR STORMWATER TREATMENT ANALYSIS</div>		
			METHODOLOGY FOR CALCULATING REQUIRED TREATMENT EFFICIENCY		
			METHODOLOGY FOR RETENTION SYSTEMS		METHODOLOGY FOR WET DETENTION SYSTEMS
			METHODOLOGY FOR GREENROOF SYSTEMS		METHODOLOGY FOR WATER HARVESTING SYSTEMS

WATERSHED CHARACTERISTICS V 8.0		GO TO STORMWATER TREATMENT ANALYSIS		Blue Numbers =	Input data	HELP - LAND USES/EMC																		
SELECT CATCHMENT CONFIGURATION 1/4/2017		CLICK ON CELL BELOW TO SELECT CONFIGURATION		Red Numbers =	Calculated																			
		A - Single Catchment		VIEW CATCHMENT CONFIGURATION																				
<p><small>For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of concentration at a one inch/hour rain</small></p> <p>Delay [hrs] <input type="text"/></p> <p>CATCHMENT NO.1 NAME: <input type="text"/></p> <p>Pre-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Post-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Total pre-development catchment area: <input type="text"/> AC</p> <p>Total post-development catchment or BMP analysis area: <input type="text"/> AC</p> <p>Pre-development Non DCIA CN: <input type="text"/></p> <p>Pre-development DCIA percentage: <input type="text"/> %</p> <p>Post-development Non DCIA CN: <input type="text"/></p> <p>Post-development DCIA percentage: <input type="text"/> %</p> <p>Estimated BMPArea (No loading from this area) <input type="text"/> AC</p>		VIEW AVERAGE ANNUAL RUNOFF "C" Factor		GO TO GENERAL SITE INFORMATION PAGE																				
		VIEW EMC & FLUCCS		OVERWRITE DEFAULT CONCENTRATIONS USING:																				
		GO TO GIS LANDUSE DATA		USE DEFAULT CONCENTRATIONS																				
				EMC(N): <input type="text"/> mg/L	PRE: <input type="text"/>	POST: <input type="text"/> mg/L																		
				EMC(P): <input type="text"/> mg/L		<input type="text"/> mg/L																		
				<table border="1"> <tr><td>Average annual pre runoff volume:</td><td>2.477</td><td>ac-ft/year</td></tr> <tr><td>Average annual post runoff volume (note no BMP area):</td><td>3.292</td><td>ac-ft/year</td></tr> <tr><td>Pre-development Annual Mass Loading - Nitrogen:</td><td>7.331</td><td>kg/year</td></tr> <tr><td>Pre-development Annual Mass Loading - Phosphorus:</td><td>1.054</td><td>kg/year</td></tr> <tr><td>Post-development Annual Mass Loading - Nitrogen:</td><td>9.742</td><td>kg/year</td></tr> <tr><td>Post-development Annual Mass Loading - Phosphorus:</td><td>1.400</td><td>kg/year</td></tr> </table>			Average annual pre runoff volume:	2.477	ac-ft/year	Average annual post runoff volume (note no BMP area):	3.292	ac-ft/year	Pre-development Annual Mass Loading - Nitrogen:	7.331	kg/year	Pre-development Annual Mass Loading - Phosphorus:	1.054	kg/year	Post-development Annual Mass Loading - Nitrogen:	9.742	kg/year	Post-development Annual Mass Loading - Phosphorus:	1.400	kg/year
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Post-development Annual Mass Loading - Phosphorus:	1.400	kg/year																						
<p>CATCHMENT NO.2 NAME: <input type="text"/></p> <p>Pre-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Post-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Total pre-development catchment area: <input type="text"/> AC</p> <p>Total post-development catchment or BMP analysis area: <input type="text"/> AC</p> <p>Pre-development Non DCIA CN: <input type="text"/></p> <p>Pre-development DCIA percentage: <input type="text"/> %</p> <p>Post-development Non DCIA CN: <input type="text"/></p> <p>Post-development DCIA percentage: <input type="text"/> %</p> <p>Estimated BMPArea (No loading from this area) <input type="text"/> AC</p>		OVERWRITE DEFAULT CONCENTRATIONS:		USE DEFAULT CONCENTRATIONS																				
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Post-development Annual Mass Loading - Phosphorus:		kg/year																						
<p>CATCHMENT NO.3 NAME: <input type="text"/></p> <p>Pre-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Post-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Total pre-development catchment area: <input type="text"/> AC</p> <p>Total post-development catchment or BMP analysis area: <input type="text"/> AC</p> <p>Pre-development Non DCIA CN: <input type="text"/></p> <p>Pre-development DCIA percentage: <input type="text"/> %</p> <p>Post-development Non DCIA CN: <input type="text"/></p> <p>Post-development DCIA percentage: <input type="text"/> %</p> <p>Estimated BMPArea (no loading from this area) <input type="text"/> AC</p>		OVERWRITE DEFAULT CONCENTRATIONS:		USE DEFAULT CONCENTRATIONS																				
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<p>CATCHMENT NO.4 NAME: <input type="text"/></p> <p>Pre-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Post-development land use: <input type="text"/></p> <p>with default EMCs <input type="text"/></p> <p>Total pre-development catchment area: <input type="text"/> AC</p> <p>Total post-development catchment or BMP analysis area: <input type="text"/> AC</p> <p>Pre-development Non DCIA CN: <input type="text"/></p> <p>Pre-development DCIA percentage: <input type="text"/> %</p> <p>Post-development Non DCIA CN: <input type="text"/></p> <p>Post-development DCIA percentage: <input type="text"/> %</p> <p>Estimated BMPArea (no loading from this area) <input type="text"/> AC</p>		OVERWRITE DEFAULT CONCENTRATIONS:		USE DEFAULT CONCENTRATIONS																				
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Post-development Annual Mass Loading - Phosphorus:		kg/year																						

STORMWATER TREATMENT ANALYSIS:		V 8.0	GO TO GENERAL SITE INFORMATION PAGE	Blue Numbers =	Input data
				Red Numbers =	Calculated
If not done, specify pre- and post-development watershed characteristics.			1/4/2017		
GO TO WATERSHED CHARACTERISTICS					
<p><u>Total Required Treatment Efficiency:</u></p> <p>Required Treatment Eff (Nitrogen): 25 %</p> <p>Required Treatment Eff (Phosphorus): 25 %</p>					
Select one of the BMPs below to analyze efficiency or review the summary data.					
RETENTION BASIN	WET DETENTION / MAP	EXFILTRATION TRENCH	RAIN GARDEN	SWALE	USER DEFINED BMP
PERVIOUS PAVEMENT	STORMWATER HARVESTING	FILTRATION	View Media Mixes	<p>NOTE !!!: All individual system must be sized prior to being analyzed in conjunction with other systems. Please read instructions in the CATCHMENT AND TREATMENT SUMMARY RESULTS tab for more information.</p>	
GREENROOF	RAINWATER HARVESTING	LINED REUSE POND & UNDERDRAIN INPUT	GO TO COST ANALYSIS WORKSHEET		
VEGETATED NATURAL BUFFER	VEGETATED FILTER STRIP	TREE WELL	CATCHMENT AND TREATMENT SUMMARY		

RETENTION BASIN:

1/4/2017 V 8.0

Blue Numbers =

Input data

Red Numbers =

Calculated or Carryover

RETENTION BASIN SERVING:

CF-Minton & Malabar

GO TO STORMWATER TREATMENT ANALYSIS

Loadings from BMP area are contained by the BMP, thus no BMP area load.

Watershed area cotributing to basin:

Required Treatment Eff (**Nitrogen**):

Required Treatment Eff (**Phosphorus**):

Required retention depth over the watershed to meet required efficiency:

Required water quality retention volume:

Catchment 1	Catchment 2	Catchment 3	Catchment 4	
1.070	0.000	0.000	0.000	ac
24.750				%
24.750				%
0.211	0.000	0.000	0.000	in
0.019	0.000	0.000	0.000	ac-ft

RETENTION BASIN FOR MULTIPLE TREATMENT SYSTEMS (if there is a need for additional removal efficiencies in a series of BMPs):

Retention volume based on retention depth and Total area - BMP area

Provided retention depth (0.1-3.99 inches over the watershed)

Provided treatment efficiency (**Nitrogen**):

Provided treatment efficiency (**Phosphorus**):

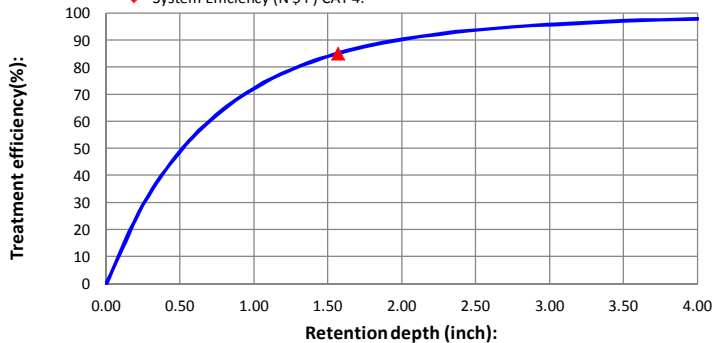
Remaining treatment efficiency (**Nitrogen**):

Remaining treatment efficiency (**Phosphorus**):

Remaining retention depth needed:

Catchment 1	Catchment 2	Catchment 3	Catchment 4	
0.140	0.000	0.000	0.000	ac-ft
1.570				in
85.090	0.000	0.000	0.000	%
85.090	0.000	0.000	0.000	%
0.000				%
0.000				%
0.000	0.000	0.000	0.000	in

- Efficiency Curve:
- System Efficiency (N \$ P) CAT 2:
- ◆ System Efficiency (N \$ P) CAT 4:
- ▲ System Efficiency (N \$ P) CAT 1:
- System Efficiency (N \$ P) CAT 3:



NOTE FOR TREATMENT EFFICIENCY GRAPH:

The purpose of this graph is to help illustrate the treatment efficiency of the retention system as the function of retention depth **for a single BMP and in a single catchment**. The graph illustrates that there is a diminished return as the retention depth is increased. Thus evaluations of other alternatives in "treatment trains" and compensatory treatment should be considered. **NOTE:** the retention volume can not exceed 3.99 inches to be within the range of data used to determine effectiveness.

HELP - EXAMPLE PROBLEM 3

[View Media Mixes](#)

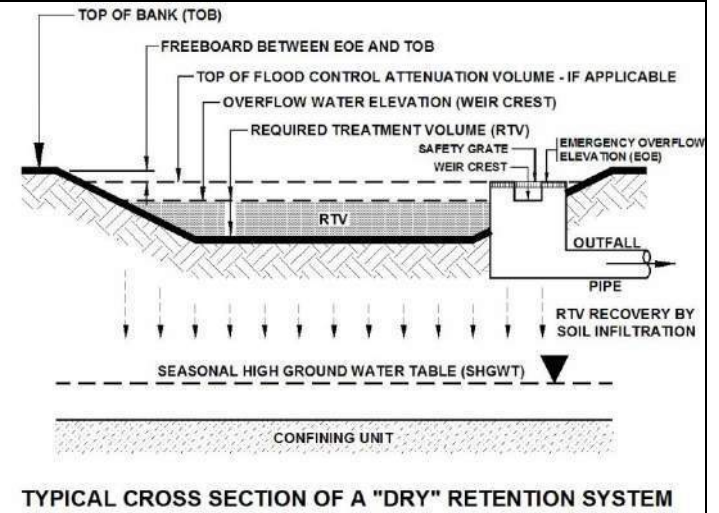
Estimate of groundwater impacts

Use only down flow media mix before water enters the ground, specify type

Nitrogen mass reduction in groundwater discharge (%)

Phosphorus mass reduction in groundwater discharge (%)

Catchment 1	Catchment 2	Catchment 3	Catchment 4



TYPICAL CROSS SECTION OF A "DRY" RETENTION SYSTEM

Source of Graphic: draft **STORMWATER QUALITY APPLICANT'S HANDBOOK** dated March 2010, by the Department of Environmental Protection, available at: <http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater>, March 2010.

CATCHMENTS AND TREATMENT SUMMARY RESULTS

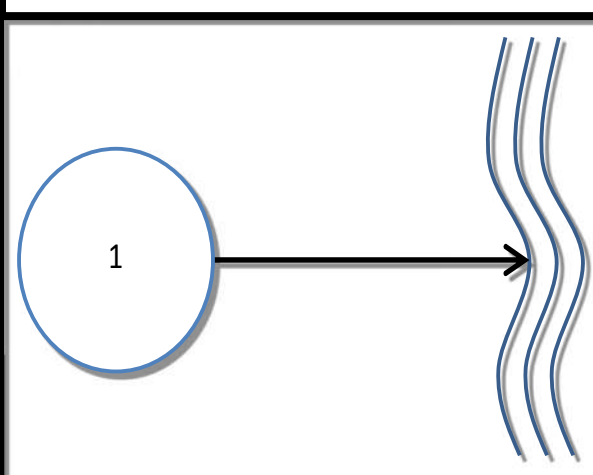
V 8.0

CALCULATION METHODS:

1. The effectiveness of each BMP in a single catchment is converted to an equivalent capture volume.
2. Certain BMP treatment train combinations have not been evaluated and in practice they are at this time not used, an example is a greenroof following a tree well.
3. Wet detention is last when used in a single catchment with other BMPs, except when followed by filtration

PROJECT TITLE	CF-Minton & Malabar		Optional Identification	
	Catchment 1	Catchment 2	Catchment 3	Catchment 4
BMP Name	Retention Basin	Wet Detention/ MAPs		
BMP Name				
BMP Name				

Summary Performance of Entire Watershed

Catchment Configuration	A - Single Catchment		Treatment Objectives or Target MET	1/4/2017
Nitrogen Pre Load (kg/yr)	7.33			BMPTRAINS MODEL
Phosphorus Pre Load (kg/yr)	1.05			
Nitrogen Post Load (kg/yr)	9.74			
Phosphorus Post Load (kg/yr)	1.40			
Target Load Reduction (N) %	25			
Target Load Reduction (P) %	25			
Target Discharge Load, N (kg/yr)	7.31			
Target Discharge Load, P (kg/yr)	1.05			
Provided Overall Efficiency, N (%):	85			
Provided Overall Efficiency, P (%):	85			
Discharged Load, N (kg/yr & lb/yr):	1.45	3.20		
Discharged Load, P (kg/yr & lb/yr):	0.21	0.46		
Load Removed, N (kg/yr & lb/yr):	8.29	18.26		
Load Removed, P (kg/yr & lb/yr):	1.19	2.62		

Appendix I

Pre vs. Post ICPR

Pre vs. Post
CF - Minton & Malabar
Routing Network

Nodes

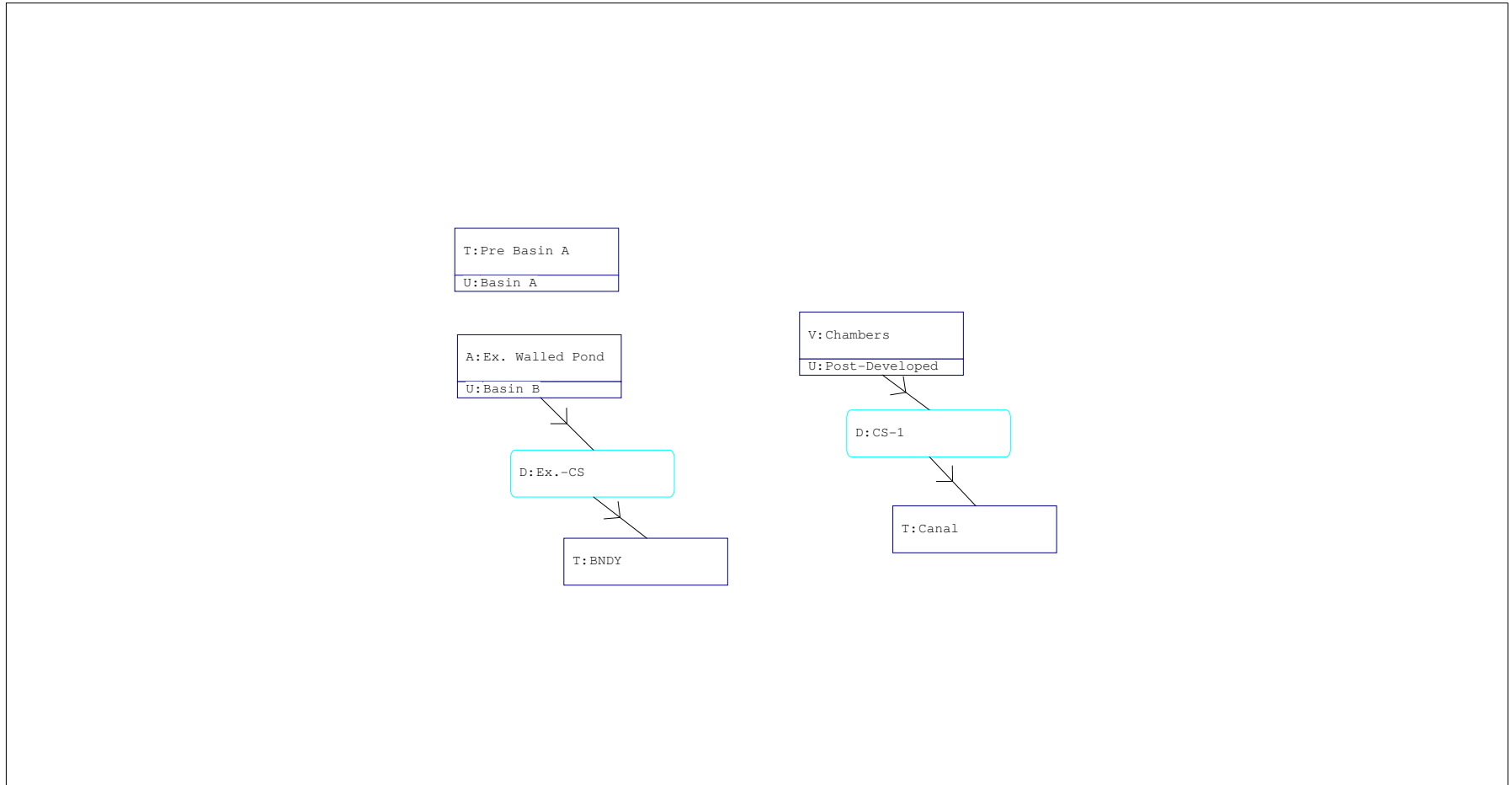
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins

O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links

P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



=====
 Basins
 =====

Name: Basin A Node: Pre Basin A Status: Onsite
 Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
 Rainfall File: Storm Duration(hrs): 0.00
 Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
 Area(ac): 0.470 Time Shift(hrs): 0.00
 Curve Number: 84.60 Max Allowable Q(cfs): 999999.000
 DCIA(%): 0.00

Name: Basin B Node: Ex. Walled Pond Status: Onsite
 Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
 Rainfall File: Storm Duration(hrs): 0.00
 Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
 Area(ac): 0.600 Time Shift(hrs): 0.00
 Curve Number: 97.40 Max Allowable Q(cfs): 999999.000
 DCIA(%): 0.00

Name: Post-Developed Node: Chambers Status: Onsite
 Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
 Rainfall File: Storm Duration(hrs): 0.00
 Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
 Area(ac): 1.070 Time Shift(hrs): 0.00
 Curve Number: 95.40 Max Allowable Q(cfs): 999999.000
 DCIA(%): 0.00

=====
 Nodes
 =====

Name: BNDY Base Flow(cfs): 0.000 Init Stage(ft): 20.680
 Group: BASE Warn Stage(ft): 20.680
 Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	20.680
999.00	20.680

Name: Canal Base Flow(cfs): 0.000 Init Stage(ft): 15.750
 Group: BASE Warn Stage(ft): 15.750
 Type: Time/Stage

Time (hrs)	Stage (ft)
0.00	15.750
999.00	15.750

Name: Chambers Base Flow(cfs): 0.000 Init Stage(ft): 21.000
 Group: BASE Warn Stage(ft): 24.500
 Type: Stage/Volume

Stage (ft)	Volume (af)
21.000	0.0000
21.500	0.0330
22.000	0.1020
22.500	0.1670
23.000	0.2280
23.500	0.2830
24.000	0.3240
24.500	0.3570

Pre vs. Post
 CF - Minton & Malabar
 Inputs: ALL

```
-----
Name: Ex. Walled Pond      Base Flow(cfs): 0.000      Init Stage(ft): 21.400
Group: BASE                Warn Stage(ft): 25.400
Type: Stage/Area
```

Stage(ft)	Area(ac)
21.400	0.0471
22.400	0.0471
23.400	0.0471
24.400	0.0471
25.400	0.0471

```
-----
Name: Pre Basin A         Base Flow(cfs): 0.000      Init Stage(ft): 15.750
Group: BASE                Warn Stage(ft): 15.750
Type: Time/Stage
```

Time(hrs)	Stage(ft)
0.00	15.750
999.00	15.750

==== Drop Structures =====

```
-----
Name: CS-1                From Node: Chambers      Length(ft): 50.00
Group: BASE                To Node: Canal           Count: 1

      UPSTREAM          DOWNSTREAM          Friction Equation: Automatic
Geometry: Circular        Circular            Solution Algorithm: Most Restrictive
Span(in): 15.00           15.00              Flow: Both
Rise(in): 15.00           15.00              Entrance Loss Coef: 0.000
Invert(ft): 14.750       12.250             Exit Loss Coef: 1.000
Manning's N: 0.012000    0.012000           Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000      0.000              Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000      0.000              Solution Incs: 10
```

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

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

*** Weir 1 of 2 for Drop Structure CS-1 ***

```
TABLE
Count: 1                Bottom Clip(in): 0.000
Type: Vertical: Mavis   Top Clip(in): 0.000
Flow: Both              Weir Disc Coef: 3.200
Geometry: Rectangular   Orifice Disc Coef: 0.600

Span(in): 8.00          Invert(ft): 22.300
Rise(in): 6.00          Control Elev(ft): 22.300
```

*** Weir 2 of 2 for Drop Structure CS-1 ***

```
TABLE
Count: 1                Bottom Clip(in): 0.000
Type: Vertical: Mavis   Top Clip(in): 0.000
Flow: Both              Weir Disc Coef: 3.200
Geometry: Rectangular   Orifice Disc Coef: 0.600

Span(in): 30.00         Invert(ft): 23.600
Rise(in): 999.00       Control Elev(ft): 23.600
```

```
-----
Name: Ex.-CS              From Node: Ex. Walled Pond Length(ft): 2.00
Group: BASE                To Node: BNDY           Count: 1

      UPSTREAM          DOWNSTREAM          Friction Equation: Automatic
Geometry: Circular        Circular            Solution Algorithm: Most Restrictive
Span(in): 15.00           15.00              Flow: Both
Rise(in): 15.00           15.00              Entrance Loss Coef: 0.000
Invert(ft): 19.430       19.430             Exit Loss Coef: 1.000
Manning's N: 0.012000    0.012000           Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000      0.000              Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000      0.000              Solution Incs: 10
```

Upstream FHWA Inlet Edge Description:

Pre vs. Post
CF - Minton & Malabar
Inputs: ALL

Circular Concrete: Square edge w/ headwall

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

*** Weir 1 of 2 for Drop Structure Ex.-CS ***

Count: 1	Bottom Clip(in): 0.000	TABLE
Type: Horizontal	Top Clip(in): 0.000	
Flow: Both	Weir Disc Coef: 3.200	
Geometry: Circular	Orifice Disc Coef: 0.600	
Span(in): 8.00	Invert(ft): 21.600	
Rise(in): 8.00	Control Elev(ft): 21.600	

*** Weir 2 of 2 for Drop Structure Ex.-CS ***

Count: 1	Bottom Clip(in): 0.000	TABLE
Type: Vertical: Mavis	Top Clip(in): 0.000	
Flow: Both	Weir Disc Coef: 3.200	
Geometry: Rectangular	Orifice Disc Coef: 0.600	
Span(in): 24.00	Invert(ft): 25.250	
Rise(in): 9.00	Control Elev(ft): 25.250	

=====
=== Hydrology Simulations ===
=====

Name: 100yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\100yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 12.50

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 10yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\10yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 7.90

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 25yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\25yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 9.50

Time(hrs)	Print Inc(min)
30.000	5.00

=====
=== Routing Simulations ===
=====

Name: 100yr-24hr Hydrology Sim: 100yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\100yr-24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 60.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Pre vs. Post
CF - Minton & Malabar
Inputs: ALL

Time(hrs)	Print Inc(min)
999.000	15.000
Group	Run
BASE	Yes

Name: 10yr-24hr Hydrology Sim: 10yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\10yr-24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 60.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000
Group	Run
BASE	Yes

Name: 25yr-24hr Hydrology Sim: 25yr-24hr
Filename: H:\2015\FLB150025-CF Minton & Malabar\Project Documents\Engineering\Drainage\iCPR\25yr-24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 60.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000
Group	Run
BASE	Yes

Pre vs. Post
 CF - Minton & Malabar
 Outputs: Nodes Min/Max

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDY	BASE	100yr-24hr	0.00	20.68	20.68	0.0000	0	12.39	2.48	0.00	0.00
BNDY	BASE	10yr-24hr	0.00	20.68	20.68	0.0000	0	12.34	1.78	0.00	0.00
BNDY	BASE	25yr-24hr	0.00	20.68	20.68	0.0000	0	12.36	2.04	0.00	0.00
Canal	BASE	100yr-24hr	0.00	15.75	15.75	0.0000	0	12.14	6.89	0.00	0.00
Canal	BASE	10yr-24hr	0.00	15.75	15.75	0.0000	0	12.38	2.86	0.00	0.00
Canal	BASE	25yr-24hr	0.00	15.75	15.75	0.0000	0	12.26	4.36	0.00	0.00
Chambers	BASE	100yr-24hr	12.14	24.31	24.50	0.0050	2794	12.00	7.80	12.14	6.89
Chambers	BASE	10yr-24hr	12.38	23.85	24.50	0.0050	3502	12.00	4.89	12.38	2.86
Chambers	BASE	25yr-24hr	12.26	24.05	24.50	0.0050	3156	12.00	5.90	12.26	4.36
Ex. Walled Pond	BASE	100yr-24hr	12.39	23.78	25.40	-0.0050	2051	12.00	4.39	12.39	2.48
Ex. Walled Pond	BASE	10yr-24hr	12.34	22.73	25.40	-0.0050	2051	12.00	2.77	12.34	1.78
Ex. Walled Pond	BASE	25yr-24hr	12.36	23.07	25.40	-0.0050	2051	12.00	3.33	12.36	2.04
Pre Basin A	BASE	100yr-24hr	0.00	15.75	15.75	0.0000	0	12.00	3.23	0.00	0.00
Pre Basin A	BASE	10yr-24hr	0.00	15.75	15.75	0.0000	0	12.00	1.90	0.00	0.00
Pre Basin A	BASE	25yr-24hr	0.00	15.75	15.75	0.0000	0	12.00	2.36	0.00	0.00

Pre vs. Post
 CF - Minton & Malabar
 Outputs: Links Min/Max

Name	Group	Simulation	Max Time Flow hrs	Max Flow cfs	Max Delta Q cfs	Max Time US Stage hrs	Max US Stage ft	Max Time DS Stage hrs	Max DS Stage ft
CS-1	BASE	100yr-24hr	12.14	6.89	-0.033	12.14	24.31	0.00	15.75
CS-1	BASE	10yr-24hr	12.38	2.86	-0.016	12.38	23.85	0.00	15.75
CS-1	BASE	25yr-24hr	12.26	4.36	-0.032	12.26	24.05	0.00	15.75
Ex.-CS	BASE	100yr-24hr	12.39	2.48	0.018	12.39	23.78	0.00	20.68
Ex.-CS	BASE	10yr-24hr	12.34	1.78	0.016	12.34	22.73	0.00	20.68
Ex.-CS	BASE	25yr-24hr	12.36	2.04	0.018	12.36	23.07	0.00	20.68

Appendix J
PONDS Drawdown

PONDS Version 3.3.0276
Retention Pond Recovery - Refined Method
Copyright 2012
Devo Seereeram, Ph.D., P.E.

Project Data

Project Name: CF - Minton & Malabar
Simulation Description:
Project Number: FLB150025
Engineer : Adam Zions, E.I.
Supervising Engineer: John Lapointe, P.E.
Date: 03-28-2017

Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum): 10.00
Water Table Elevation, [WT] (ft datum): 19.50
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day): 9.00
Fillable Porosity, [n] (%): 25.00
Vertical infiltration was not considered.

Geometry Data

Equivalent Pond Length, [L] (ft): 100.0
Equivalent Pond Width, [W] (ft): 50.0
Ground water mound is expected to intersect the pond bottom

Stage vs Area Data

Stage (ft datum)	Area (ft ²)
21.00	0.0
21.50	5800.0
22.00	6200.0
22.50	5200.0
23.00	5350.0
23.50	4200.0
24.00	3000.0
24.50	2800.0

Discharge Structures

Discharge Structure #1 is inactive
Discharge Structure #2 is inactive
Discharge Structure #3 is inactive

PONDS Version 3.3.0276
Retention Pond Recovery - Refined Method
Copyright 2012
Devo Seereeram, Ph.D., P.E.

Scenario Input Data

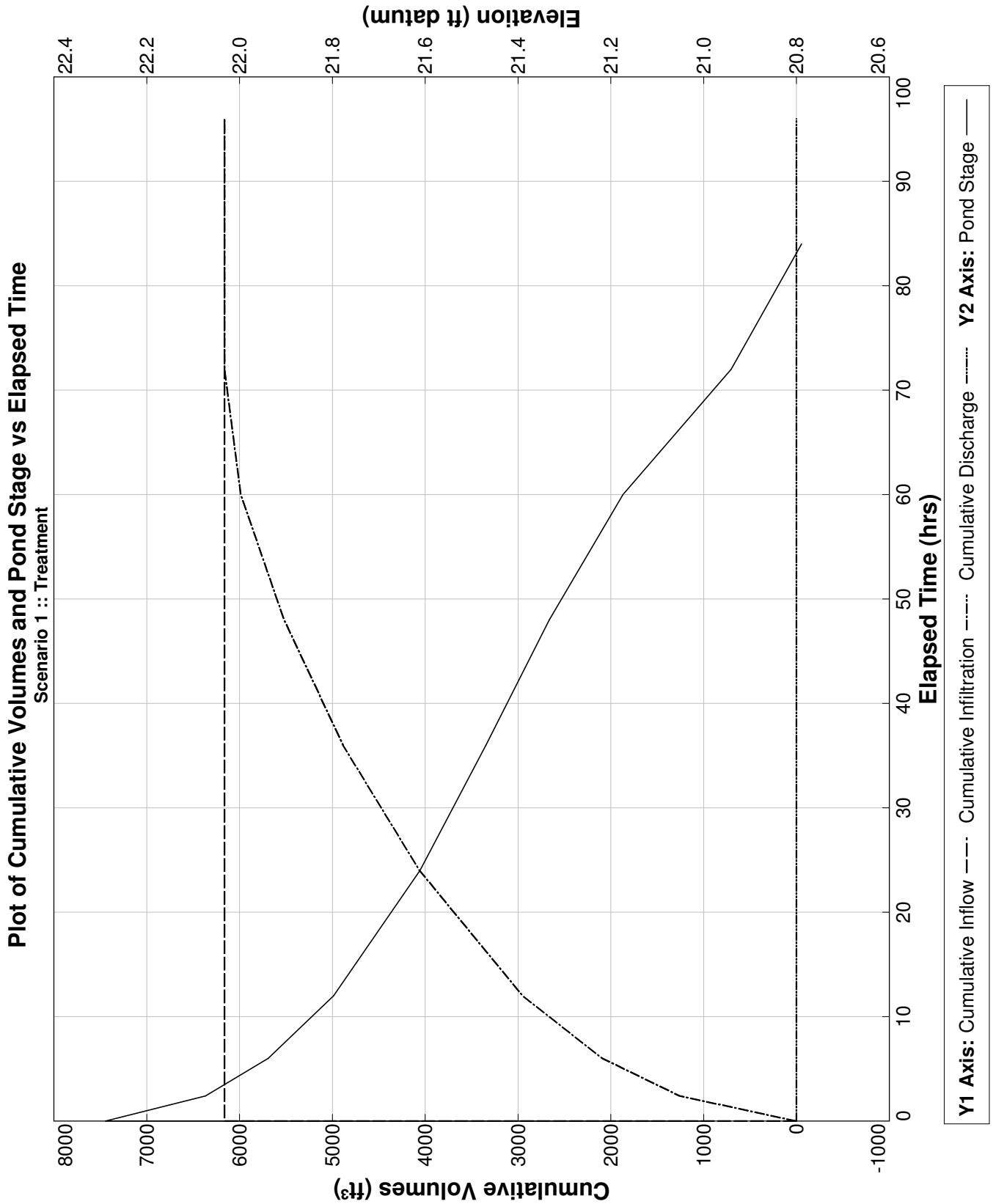
Scenario 1 :: Treatment

Hydrograph Type:	Slug Load
Modflow Routing:	Routed with infiltration
Treatment Volume (ft ³)	6162
Initial ground water level (ft datum)	19.50 (default)
<u>Time After Storm Event (days)</u>	<u>Time After Storm Event (days)</u>
0.100	2.000
0.250	2.500
0.500	3.000
1.000	3.500
1.500	4.000

PONDS Version 3.3.0276
Retention Pond Recovery - Refined Method
Copyright 2012
Devo Seereeram, Ph.D., P.E.

Summary of Results :: Scenario 1 :: Treatment

	Time (hours)	Stage (ft datum)	Rate (ft ³ /s)	Volume (ft ³)
Stage				
Minimum	96.000	20.67		
Maximum	0.002	22.29		
Inflow				
Rate - Maximum - Positive	0.002		1027.0000	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			6162.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			6162.0
Infiltration				
Rate - Maximum - Positive	0.002		0.8206	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	72.000			6162.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			6162.0
Combined Discharge				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			0.0
Discharge Structure 1 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 2 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	36.000	21.47		4885.6
72 Hour Stage and Infiltration Volume	72.000	20.94		6162.0



Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX H

Cultural Resources Analysis

Malabar Road PD&E Study

FM No. 437210-1-28-01

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MEMO

To: All

From: Jessica Fish, MSt, RPA, Principal Investigator (SEARCH)

Date: January 6, 2022

Re: Cultural Resource Assessment Survey of the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida (Financial Management No. 437210-1)

The cultural resource assessment survey (CRAS) report contained herein was submitted to the Florida State Historic Preservation Officer (SHPO) and federally recognized tribes of Florida in July 2021. At that time, the proposed alternatives were referenced as Alternative A and Alternative B.

Following completion of the CRAS report, the designations for these alternatives were revised. The alignments and their associated ponds are now referenced as Alternative 1 (old Alternative A) and Alternative 2 (old Alternative B). As this report had been submitted and received concurrence from SHPO prior to these changes being made, this memo is included with the CRAS report to clarify the changes in nomenclature. No other changes to these alignments have been made since the original submittal of this report.

**CULTURAL RESOURCE DESKTOP ANALYSIS FOR THE
MALABAR ROAD PONDS PROJECT DEVELOPMENT AND ENVIRONMENT STUDY,
BREVARD COUNTY, FLORIDA**

CONSULTANT:	SEARCH 700 N. 9 th Avenue, Pensacola, Florida 32501
PRINCIPAL INVESTIGATOR:	Jessica Fish, MSt, RPA
CLIENT:	Kittelson & Associates
DATE:	January 2021
FINANCIAL MANAGEMENT #:	437210-1-28-01
SEARCH PROJECT #:	T20003

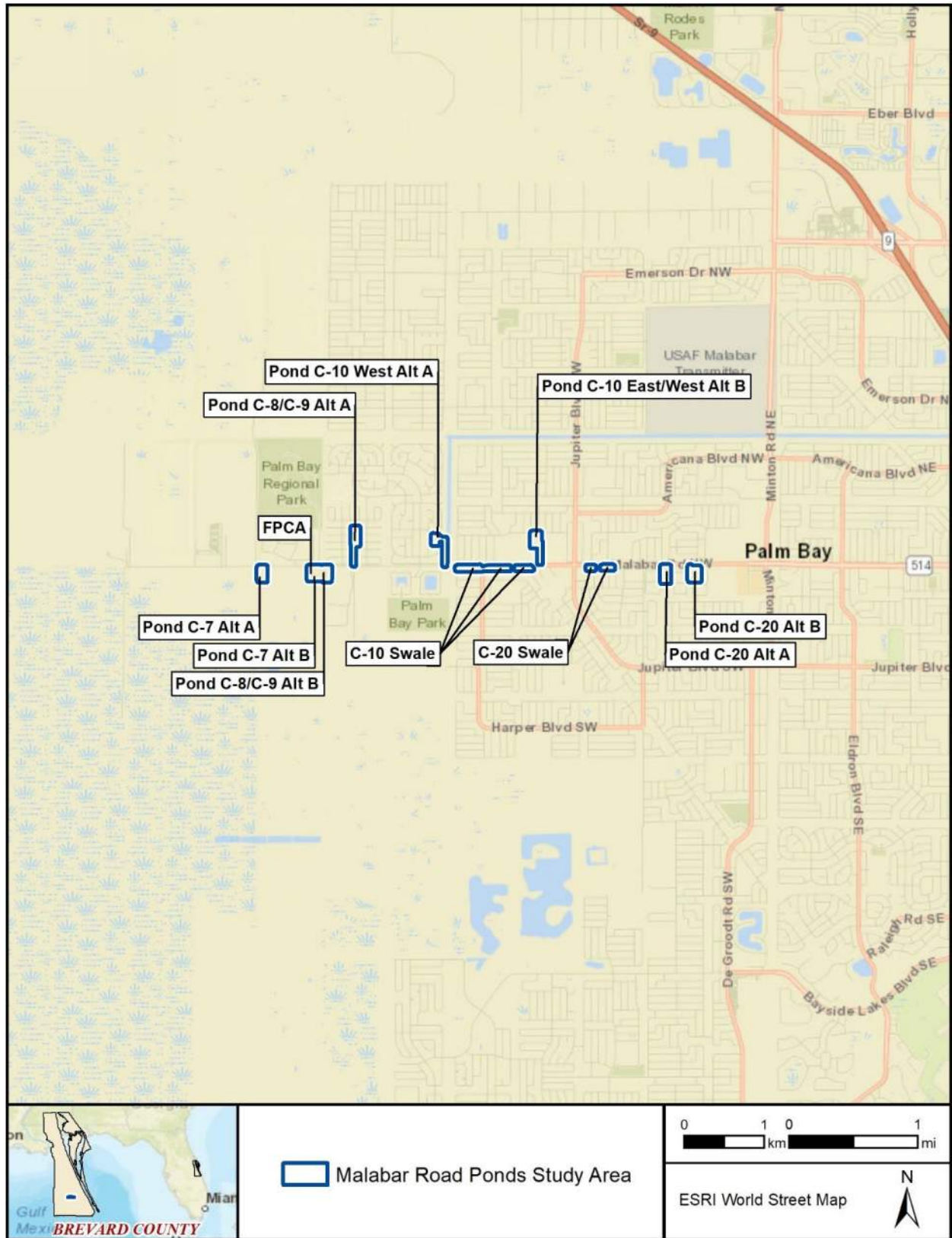
In January 2021, SEARCH completed a cultural resource desktop analysis in support of proposed ponds and drainages associated with the Malabar Road Project Development and Environment (PD&E) study in Brevard County, Florida (**Figure 1**). The Florida Department of Transportation (FDOT), District 5, is conducting a PD&E study for the proposed widening of Malabar Road from Minton Road to east of St. Johns Heritage Parkway in Brevard County, Florida. The PD&E study includes 10 proposed pond locations and four supplemental swales (see **Figure 1**). SEARCH has been tasked by Kittelson & Associates with evaluating the proposed ponds and swales with the purpose of identifying cultural resource potential and previously recorded historic properties that are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). The Florida Master Site File (FMSF) database was reviewed for any previous cultural resource surveys or previously recorded resources. Archaeological site probability was evaluated based on various environmental conditions demonstrated to be reliable indicators for past human occupation, including topography, soil drainage, distance to water, and prior disturbance. In addition, the Brevard County Property Appraiser’s Geographic Information System (GIS) database was reviewed to determine if parcels containing structures constructed prior to 1977 are located in the study area. For the purposes of this desktop analysis, the study area was defined as the construction footprint for each of the ponds and swales, plus a 100-foot (30.5-meter) buffer (**Figure 2**).

ENVIRONMENT

Location and Modern Conditions

The Malabar Road Ponds Study Area is located in Sections 1, 2, 3, and 4 of Township 29 South, Range 36 East and Sections 33, 34, 35, and 36 of Township 28 South, Range 36 East in southern Brevard County. The total acreage for the proposed drainages is 38.95 acres. **Table 1** provides additional detail regarding the size of each individual drainage.

Malabar Road is currently a two-lane, paved route bounded to the north by a large canal. Development in proximity to the study area is primarily residential, with commercial



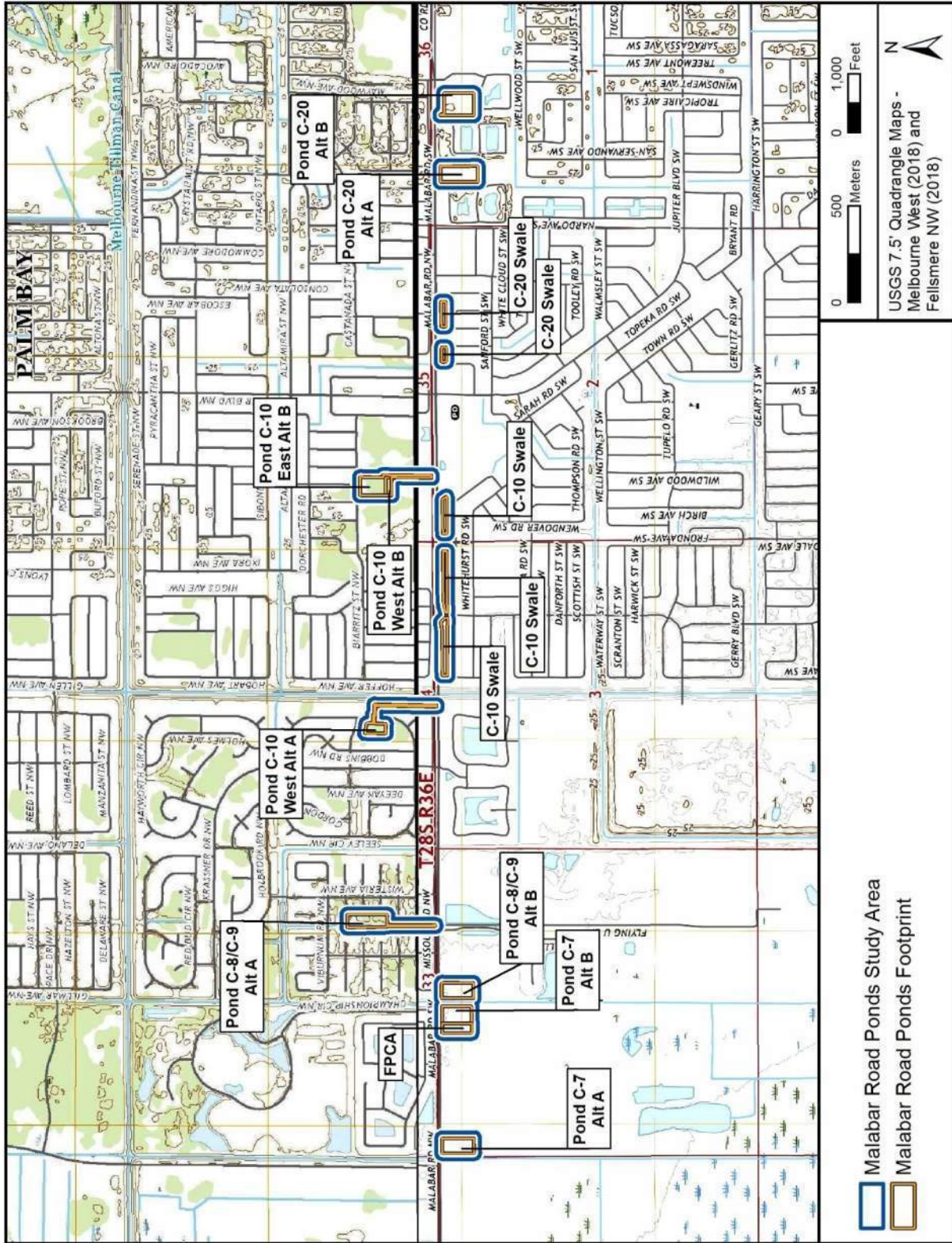


Table 1. Soil Conditions within the Malabar Road Ponds Study Area.

Area Name	Acreage	Soil Drainage	Soil Type
C-20 Alt A	4.02 acres	Poorly drained	EauGallie sand
C-20 Alt B	4.42 acres	Poorly drained	Malabar, Holopaw, and Pineda soils; EauGallie sand
C-20 Swale	1.23 acres	Poorly drained	Pineda sand; Wabasso sand
C-10 West Alt A	1.97 acres	Poorly drained	Malabar, Holopaw, and Pineda soils; EauGallie sand
C-10 East Alt B	3.47 acres	Poorly drained and very poorly drained	EauGallie sand
C-10 West Alt B	4.17 acres	Poorly drained	EauGallie sand
C-10 Swale	4.74 acres	Poorly drained	Malabar, Holopaw, and Pineda soils; EauGallie sand
C-8/C-9 Alt A	3.81 acres	Poorly drained	Malabar, Holopaw, and Pineda soils
C-8/C-9 Alt B	3.14 acres	Poorly drained	Pineda sand
FPCA	1.64 acres	Poorly drained	Pineda sand
C-7 Alt A	3.04 acres	Poorly drained	Pineda sand
C-7 Alt B	3.30 acres	Poorly drained	Pineda sand

development at the east end. The majority of structures along the roadway are separated from the corridor by trees and other vegetation. Ponds are generally located on vacant parcels, although the swales are situated on parcels that already contain residential structures.

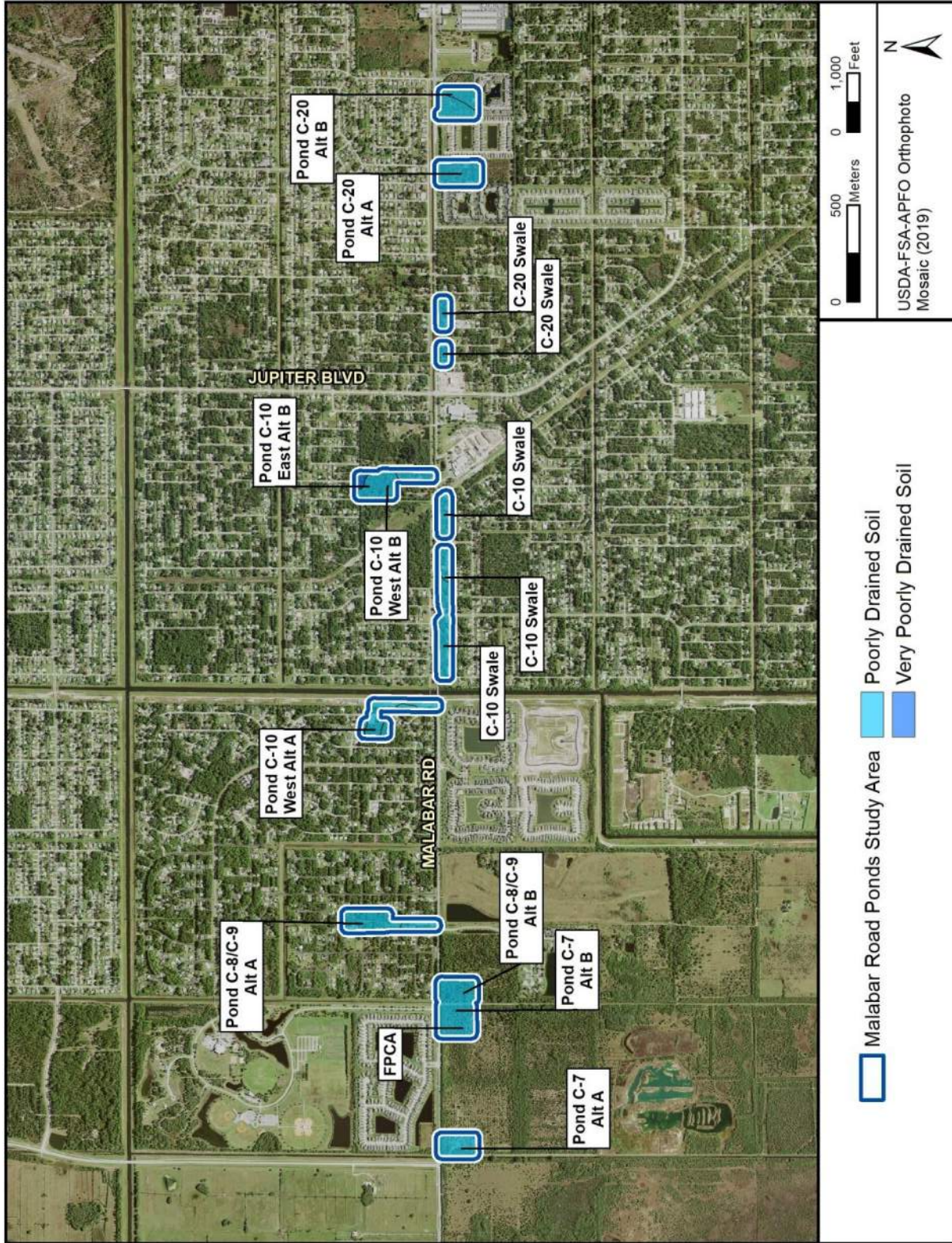
Geologically, the study area is located within the St. Johns Marsh province, a part of the larger Eastern Flatwoods District (Brooks 1981). This region is typically vegetated by marshes and grass prairies with cabbage palms and willow. Seasonal flooding is common, and soils consist of fine sand, silty sand and clayey sand. Elevations are typically around 18 feet (5.5 meters) above mean sea level (amsl). No natural drainages are present within the study area, although several canals are present. All soils have been classified as poorly drained (see **Table 1; Figure 3**).

BACKGROUND RESEARCH

Florida Master Site File Review

A review of the FMSF database (updated October 2020) indicates that 16 previous cultural resource surveys have been conducted within 1.0 mile (1.6 kilometers) of the Malabar Road Ponds Study Area. Of these, only one intersects a portion of the Malabar Road Ponds Study Area (**Table 2; Figure 4**). [REDACTED]

[REDACTED]



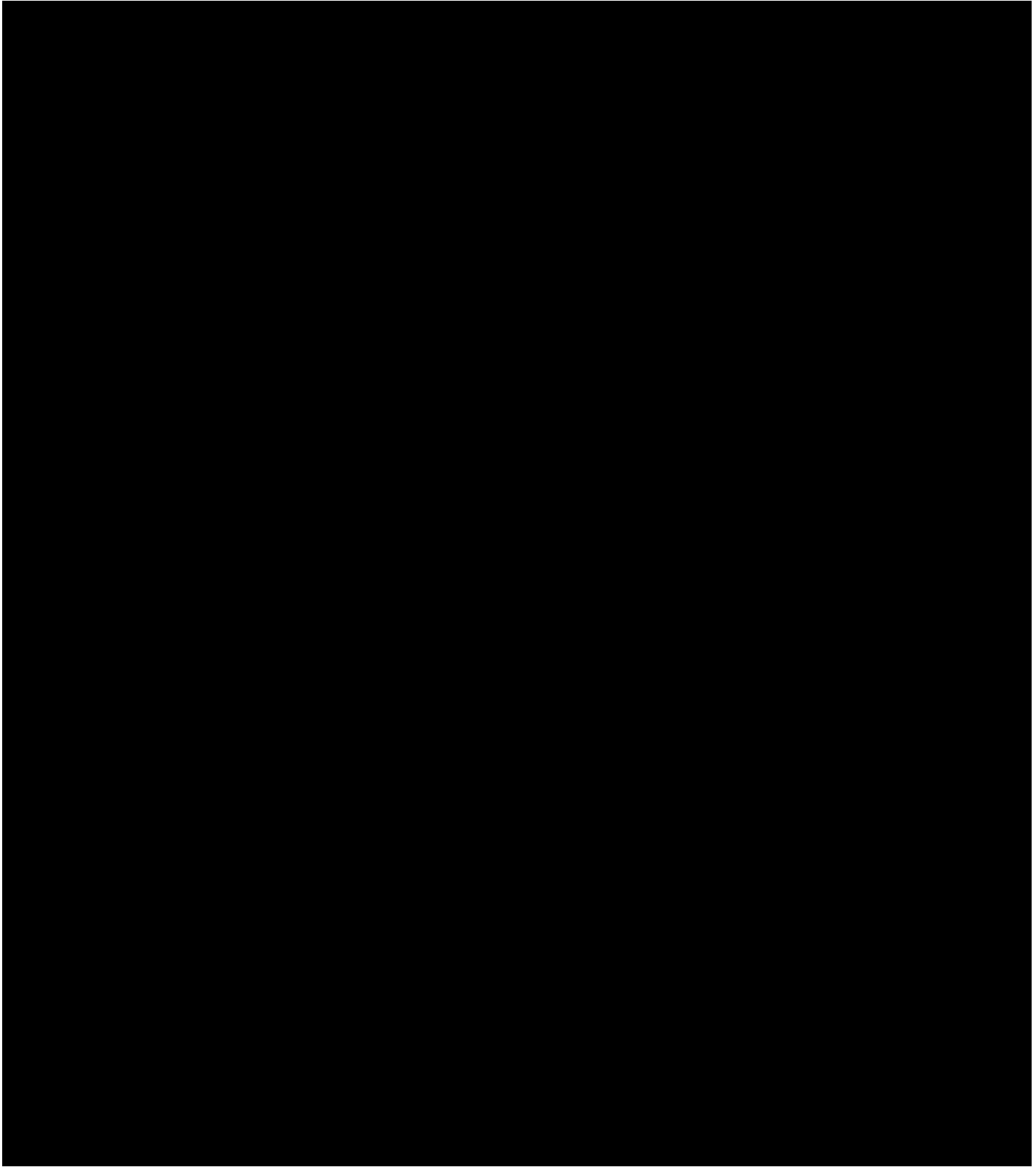


Table 2. Cultural Resource Surveys within 1.0 Mile (1.6 Kilometers) of the Malabar Road Ponds Study Area.

FMSF No.	Title	Year	Author
1152	Reconnaissance Survey in the Upper St. Johns River Flood Control Project: Osceola, Brevard and Indian River Counties, Florida	1984	New World Research, Inc.
1646	Proposed Response to Future Area Development for GDCs West Malabar Tract, Brevard County, Florida	1981	CCC Enterprises, Inc.
8791	Cultural Resource Assessment Survey of the Palm Bay Parkway PD&E Study from Malabar Road to Ellis Road, Brevard County	2003	Janus Research
10376	A Cultural Resource Reconnaissance Survey of the Palmer Tract, Brevard County, Florida	2004	Environmental Services, Inc. (ESI)
10535	A Cultural Resource Reconnaissance Survey of the West Malabar Tract, Brevard County, Florida	2004	ESI
11829	An Archaeological and Historical Survey of the Purcell Property Project Area in Brevard County, Florida	2004	Panamerican Consultants, Inc.
12516	A Cultural Resource Survey of the Chaparral Project Area, Brevard County, Florida	2006	SEARCH
13370	A Phase I Cultural Resource Assessment Survey of the Palmer PUD, Brevard County, Florida	2006	SEARCH
14219	A Phase I Cultural Resource Survey of the Lennar South Development Property, Brevard County, Florida	2006	SEARCH
14220	A Cultural Resource Survey of the Chaparral Lakes Area, Brevard County, Florida	2006	SEARCH
18063	Cultural Resource Reconnaissance Assessment of the Precision Rock and Dredge, Inc. Property in Brevard County, Florida	2010	SEARCH
18311	Phase I Cultural Resources Survey, Three Forks Marsh Conservation Area, Brevard County, Florida	2010	New South Associates
20793	Cultural Resource Survey and Assessment, Palm Island Subdivision, Brevard County, Florida	2014	SouthArc, Inc.
21940	Cultural Resource Assessment Survey of the C-10 Retention Area, Brevard County, Florida	2015	Archaeological Consultants, Inc.
24194	A Cultural Resources Assessment Survey for the Proposed Avery Springs Development, Palm Bay, Brevard County, Florida	2017	Thomas Penders & Associates, Inc.
25794	Cultural Resource Assessment Survey Malabar-Midway 230 kV Transmission Line, Brevard County, Florida	2017	Janus Research

Highlighted surveys included portions of the current study area.

Table 3. Previously Recorded Resources within 1.0 Mile (1.6 Kilometers) of the Malabar Road Ponds Study Area.

<i>Historic Structures</i>				
FMSF No.	Address	Year Built	Surveyor Recommendation	SHPO Evaluation
8BR01931	1650 Malabar Road South	ca. 1930	Ineligible for NRHP	Ineligible for NRHP
8BR01932	1650 Malabar Road South	ca. 1930	Ineligible for NRHP	Ineligible for NRHP

Table 3. Previously Recorded Resources within 1.0 Mile (1.6 Kilometers) of the Malabar Road Ponds Study Area.

Resource Groups			
FMSF No.	Name	Period of Significance	SHPO Evaluation
8BR01817	Melbourne-Tillman Canal	Twentieth century American, 1900-present	Ineligible for NRHP
8BR03134	Melbourne-Tillman Canal MTA Lateral	Twentieth century American, 1900-present; Boom Times 1921-1929	Ineligible for NRHP
8BR03280	C-6 Canal	n/a	Ineligible for NRHP
8BR03281	C-7 Canal	n/a	Ineligible for NRHP
8BR03282	C-8 Canal	n/a	Ineligible for NRHP
8BR03283	C-9R Canal	n/a	Ineligible for NRHP
8BR03535	Melbourne-Tillman Canal No. 20	Boom Times, 1921-1929; Twentieth century American, 1900-present	Ineligible for NRHP

Highlighted resources intersect the Malabar Road Ponds Study Area.

No other cultural resource surveys have been conducted within the study area. One previously recorded linear resource, the Melbourne-Tillman Canal No. 20 (8BR03535), also is present within the study area. This resource intersects the easement for C-10 East Alt B and C-10 West Alt B. This resource was determined to be ineligible for the NRHP by the SHPO.

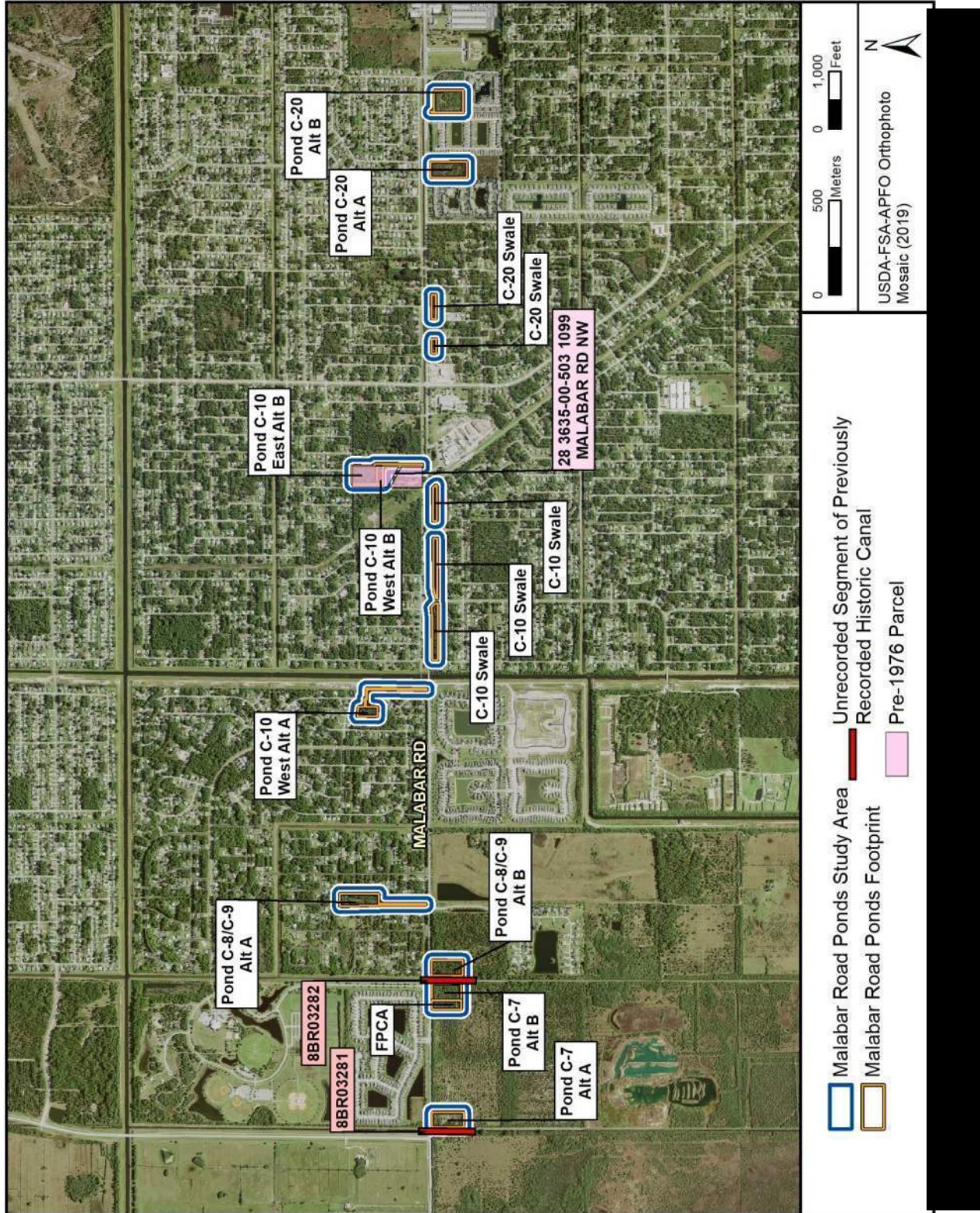
Unrecorded Architectural Resources

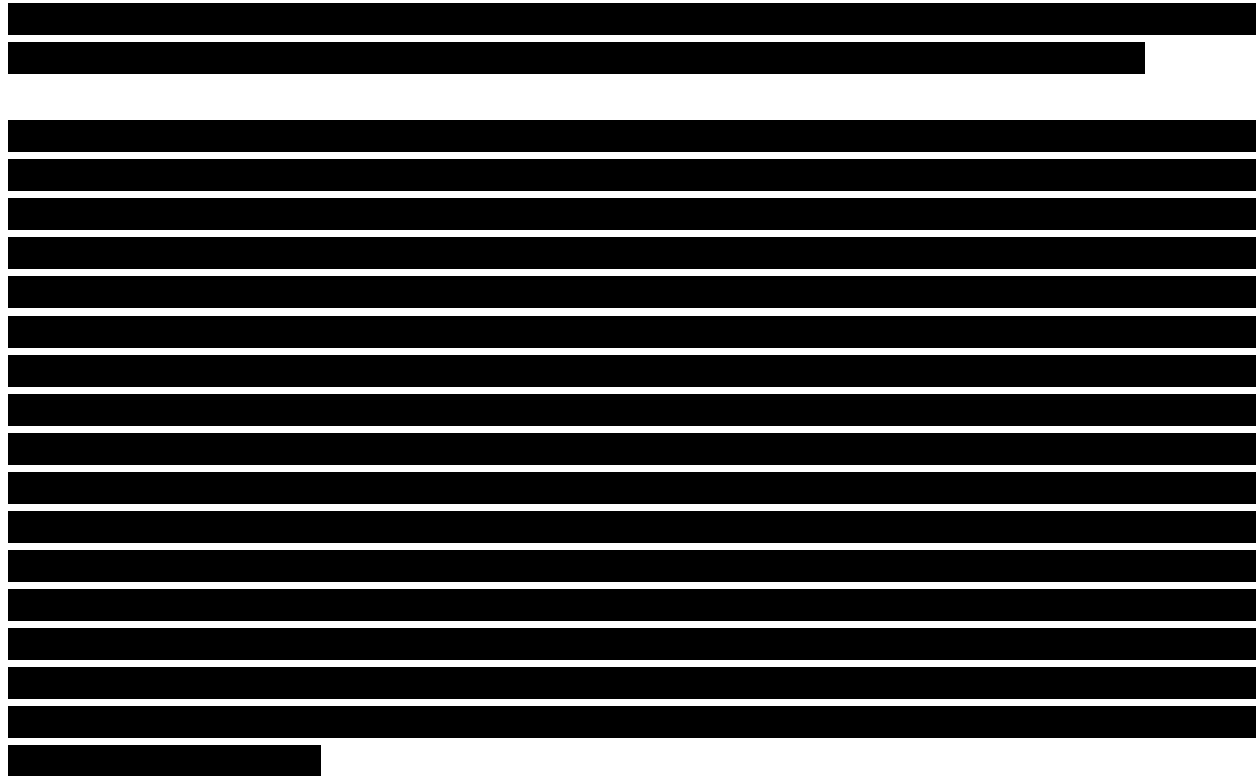
In addition to the FMSF, the Brevard County Property Appraiser’s database was reviewed to identify parcels containing unrecorded structures of historic age (i.e., structures with Actual Year Built dates earlier than 1976). This search identified one within the study area that has an Actual Year Built date earlier than 1976 (**Figure 5**). This parcel is located in Pond C-10 West Alt B and is located at 1099 Malabar Road Northwest.

In addition, historic maps were reviewed to identify any unrecorded historic-aged canals present within the study area. Two canals were identified (see **Figure 5**); segments of both canals have been previously recorded on the FMSF, but the sections within the current study area have not been evaluated. The C-7 Canal (8BR03281) intersects Pond C-7 Alt A. This canal was constructed prior to 1943, and evaluated sections of the canal have been determined to be ineligible for the NRHP by the SHPO. The C-8 Canal (8BR03282) is located within Pond C-7 Alt B and Pond C-8/C-9 Alt B. This canal also was built before 1943, and the evaluated sections of the canal have been determined to be ineligible for the NRHP by the SHPO.

Archaeological and Historic Resource Potential

The potential for prehistoric sites to be identified within the Malabar Road Ponds Study Area was assessed based on an examination of environmental variables (soil drainage, access to streams and wetlands and marine resources, relative elevation), as well as the results of previously conducted surveys. Due to the poor soil drainage throughout the study area and the results of previously conducted cultural resource surveys, the potential for unrecorded prehistoric sites within the study area is considered to be generally low. [REDACTED]





Historic maps and aerial photographs were examined in order to identify past land use in the vicinity of the Malabar Road Ponds Study Area. Historic maps consulted include nineteenth-century GLO survey maps, general county maps, Florida State Road Department (FSRD) highway maps, and US Geological Survey (USGS) topographic maps. GLO maps from 1845 show no features in this area; a vast majority of the land within the township surveys are covered by marshland, including most of the study area (GLO 1845a, 1845b). An 1890 map of Brevard County illustrates a large “sawgrass lake” south of the study area, with Malabar noted to the east, and no features are evident within the study area (Norton 1890). A 1917 state highway map shows a road traveling westward from Malabar, though it is unclear from this map if it reached the study area; a more detailed county map illustrates the road traveling through the extent of the study area by 1934 (Florida State Road Department [FSRD] 1917, 1934). A system of unnamed canals is evident on topographic maps from the early 1950s; many of these travel north-south on either side of Malabar Road, while one runs east-west on the north side of the road. North-south canals cross through the study areas for Ponds C-7 Alt B and C-9/C-9 Alt B, as well as Pond C-10 West Alt A. The east-west canal may cross through the study areas of all ponds east of Pond C-10 West Alt A. Additionally, numerous structures are illustrated along the roadway. Two buildings, one shown as an agricultural structure, are evident within a grove; these structures and part of the grove fall within the study area for Ponds C-7 Alt B and C-9/C-9 Alt B. Two more buildings—with one, again, noted as agricultural—fall within the study area for Pond C-20 Alt B (USGS 1951, 1954). While numerous new roads were under construction that resemble their present-day patterns, no other changes are evident on early 1970s topographic maps (USGS 1971a, 1971b).



CULTURAL RESOURCE SUMMARY MATRIX

The findings of this desktop analysis relative to each of the proposed drainage locations are summarized in the cultural resource matrix (**Table 4**).

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
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RECOMMENDATIONS AND CONCLUSIONS

This desktop analysis has evaluated the proposed ponds and swales associated with the Malabar Road PD&E Study. Once preferred ponds have been selected, the project APE should be defined, and a Phase I cultural resource assessment survey (CRAS) should be conducted. Historic buildings, cemeteries, and other historic resources within the APE should be recorded and evaluated for NRHP eligibility. The construction area also should be subjected to subsurface testing according to probability for archaeological resources to determine if any prehistoric or historic archaeological sites are present. [REDACTED]



[REDACTED] Historic resources and archaeological sites identified during survey of the Malabar Road ponds project should be assessed for their potential eligibility for listing in the NRHP. As the project involves federal funds administered by the FDOT, the resulting CRAS report should be submitted to the SHPO for review and comment.

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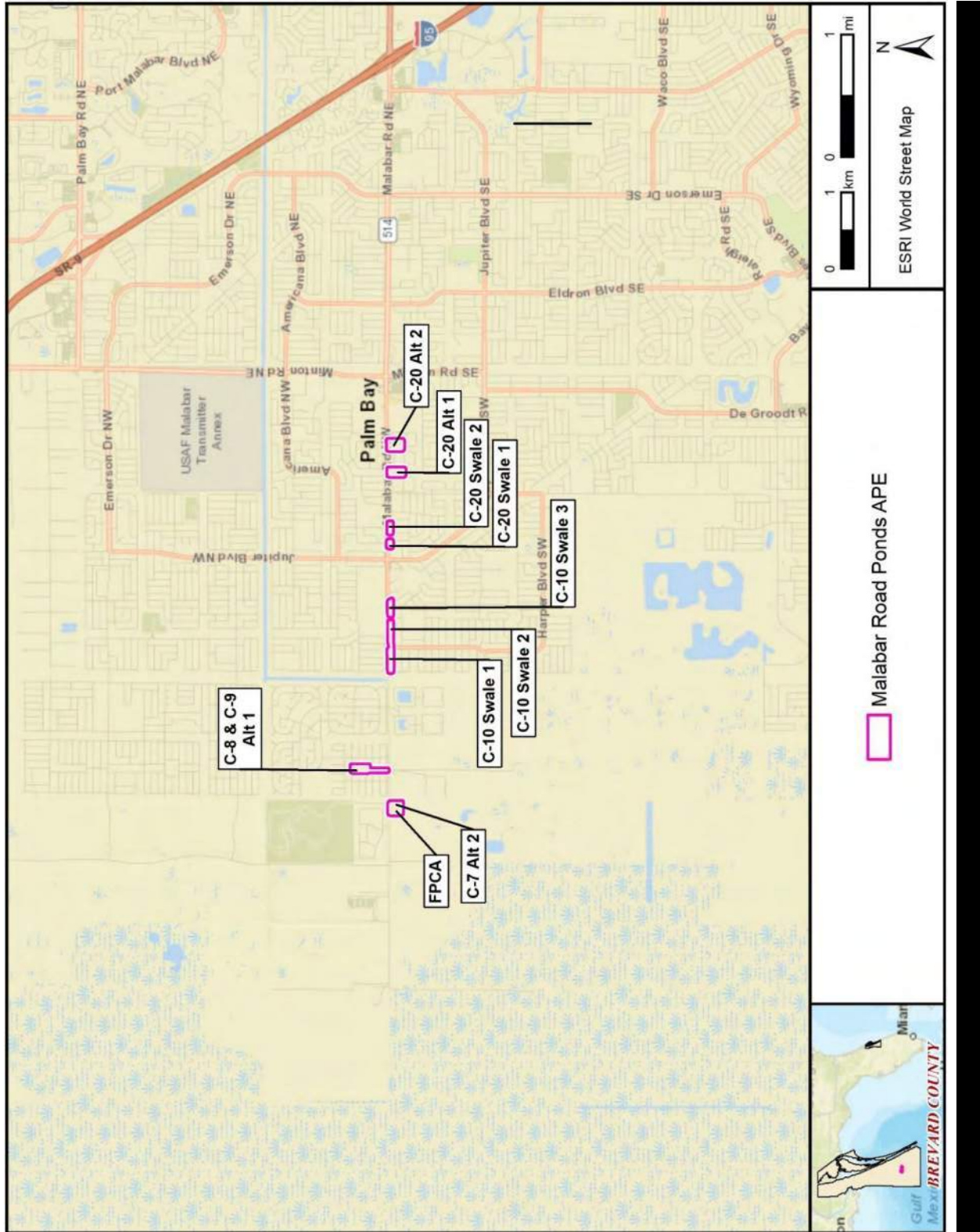
TECHNICAL MEMORANDUM
CULTURAL RESOURCE ASSESSMENT SURVEY
IN SUPPORT OF MALABAR ROAD IMPROVEMENTS PONDS,
BREVARD COUNTY, FLORIDA

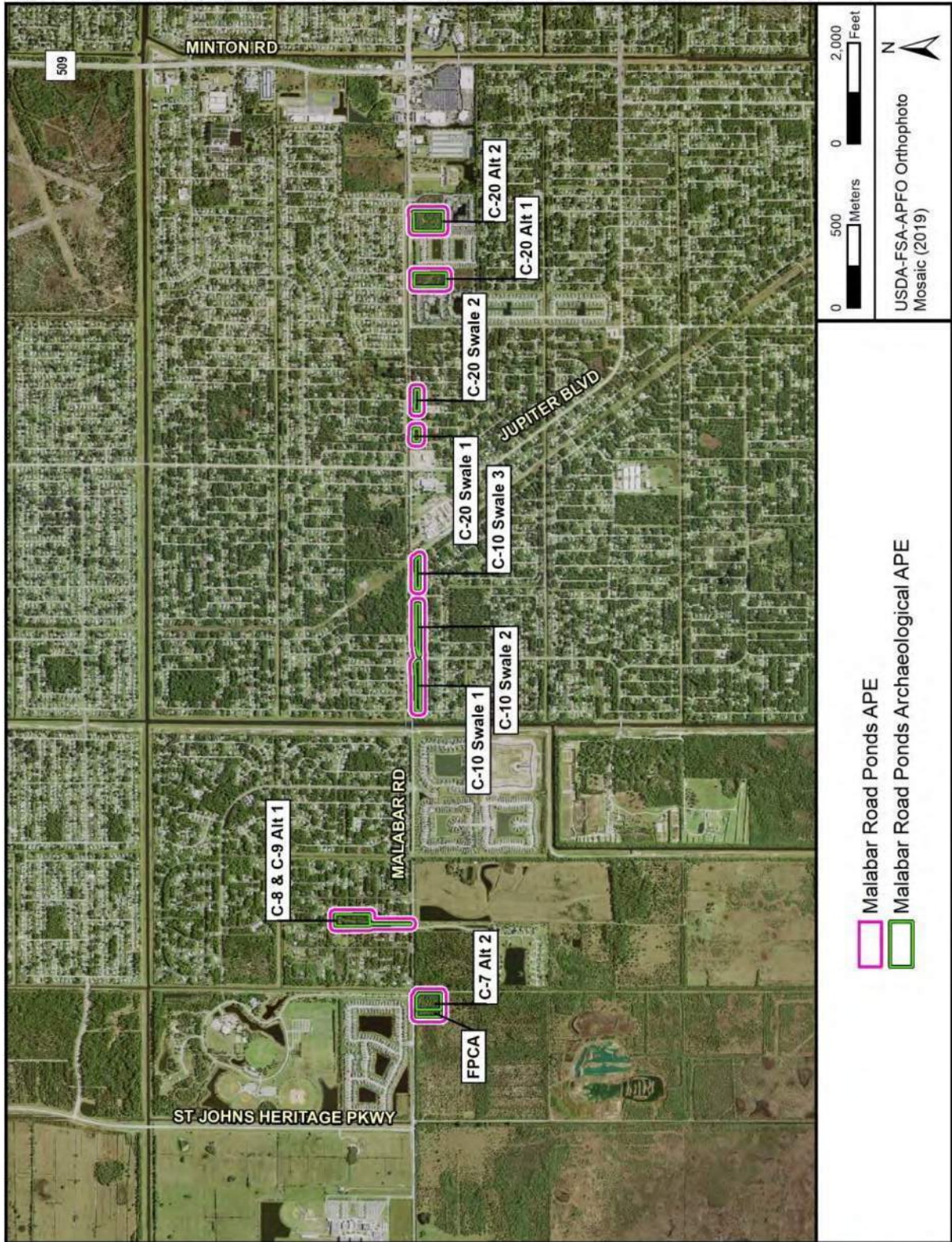
CONSULTANT:	SEARCH 700 N. 9 th Avenue, Pensacola, Florida 32501
PRINCIPAL INVESTIGATOR:	Jessica Fish, MSt, RPA
ARCHITECTURAL HISTORIAN:	Mikel Travisano, MS
PROJECT ARCHAEOLOGIST:	Dave Boschi, MA, RPA
CLIENT:	Kittelson & Associates and the City of Palm Bay, Florida
DATE:	October 2021
FINANCIAL MANAGEMENT #:	437210-1
SEARCH PROJECT #:	T20003

This technical memorandum details the results of a cultural resource assessment survey (CRAS) of preferred pond and swale locations in Brevard County, Florida, associated with improvements to Malabar Road (**Figure 1**). The City of Palm Bay, Florida, is proposing to widen Malabar Road from Minton Road to east of St. Johns Heritage Parkway in Brevard County, Florida, as well as the construction of associated ponds, swales, and floodplain compensation areas (FPCAs). The current report serves as an addendum to the 2021 SEARCH survey titled *Cultural Resource Assessment Survey for the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida* (Florida Master Site File [FMSF] Survey No. TBD). The FPCA is 1.64 acres, the four pond locations cover 24.52 acres, and the five swales encompass 26.26 acres. The total area tested for the current survey is 52.42 acres. The discussions of regional prehistory and history, research design, and laboratory methods provided in the previous report applies to the current CRAS and are not repeated in this technical memorandum. This is a Local Area Program (LAP) project being conducted by the City of Palm Bay using federal funds administered by the Florida Department of Transportation (FDOT), District 5.

The area of potential effects (APE) defines the area within which visual, audible, and atmospheric effects that the roadway improvements and subsequent maintenance may have on historic properties. The APE defined for this project includes the proposed pond, FPCA, and swale footprints, plus a 100-foot (30.5-meter) buffer (**Figure 2**). The archaeological survey was conducted within the proposed footprints; the architectural history survey included the entire APE.

The purpose of the survey was to locate, identify, and bound any archaeological resources, historic structures, and potential districts within the project's APE and assess their potential for listing in the National Register of Historic Places (NRHP). The work was conducted to comply with Public Law 113-287 (Title 54 USC), which incorporates the provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, including Section 106 (54 U.S.C. §306108), the





Archaeological and Historic Preservation Act of 1979, as amended, 36 CFR Part 800 (Protection of Historic Properties), and all laws, regulations, and guidelines promulgated by the State of Florida governing cultural resources work, in particular Chapters 267.031(1) and 267.12, Florida Statutes and 1A-46, Florida Administrative Code. All work was performed in accordance with Part 2, Chapter 8 of the Florida Department of Transportation’s (FDOT) Project Development & Environment (PD&E) Manual (revised July 2020), as well as the Florida Division of Historical Resources’ (FDHR) recommendations for such projects, as stipulated in the FDHR’s *Cultural Resource Management Standards & Operations Manual, Module Three: Guidelines for Use by Historic Preservation Professionals*. The work was performed by professional archaeologists who meet the qualifications established in the Secretary of the Interior’s *Standards and Guidelines* (48 FR 44716, 29 September 1983).

ENVIRONMENT AND MODERN CONDITIONS

The Malabar Road Ponds APE is located along an approximately 4.0-mile (6.4-kilometer) long corridor in southern Brevard County, Florida, within Sections 1, 2, 3, and 4 of Township 29 South, Range 36 East and Section 33 of Township 28 South, Range 36 East. The total acreage for the proposed drainages is 52.42 acres. Pond C-7 Alt 2 and the floodplain conservation area are located on wooded parcels that were formerly groves; the remaining ponds and most of the swales are within forested parcels bordering residential developments. C-10 Swale 2 includes a parcel with an existing residential structure (see **Figure 2**). **Table 1** provides additional detail regarding the size, soils, and setting of each individual drainage.

Table 1. Acreage, Location, Soils, and Setting of the Malabar Road Ponds APE.

Area	Acreage	Section, Township and Range	Soil Drainage Characteristic	Soil	Setting
FPCA	1.64	Sec 4, T29S, R 36E	Poorly drained	Pineda sand	wooded/former silviculture
C-7 Alt 2	3.43 acres	Sec 4, T29S, R36E	Poorly drained	Pineda sand	wooded/former silviculture
C-8 & C-9 Alt 1	12.35 acres	Sec 33, T28S, R36E	Poorly drained Poorly drained	Malabar, Holopaw, and Pineda soils Pineda sand	wooded, partially residential
C-10 Swale 1	7.34 acres	Sec 3, T29S, R36E	Poorly drained	Malabar, Holopaw, and Pineda soils	wooded, and residential
C-10 Swale 2	7.15 acres	Sec 3, R29S, T36E	Poorly drained Poorly drained	Malabar, Holopaw, and Pineda soils EauGallie sand	wooded, and residential
C-10 Swale 3	4.90 acres	Sec 2, T29S, R36E	Poorly drained	EauGallie sand	wooded, and residential
C-20 Swale 1	3.00 acres	Sec 2, T29S, R36E	Poorly drained	Wabasso sand	wooded, partially residential
C-20 Swale 2	3.87 acres	Sec 2, T29S, R36E	Poorly drained Poorly drained Poorly drained	Pineda sand Malabar, Holopaw, and Pineda soils Wabasso sand	wooded, partially residential

Table 1. Acreage, Location, Soils, and Setting of the Malabar Road Ponds APE.

Area	Acreage	Section, Township and Range	Soil Drainage Characteristic	Soil	Setting
C-20 Alt 1	3.74 acres	Sec 1, T29S, R36E	Poorly drained Poorly drained	EauGallie sand Malabar, Holopaw, and Pineda soils	wooded, adjacent to residential
C-20 Alt 2	5 acres	Sec 1, T29S, R36E	Poorly drained Poorly drained	EauGallie sand Malabar, Holopaw, and Pineda soils	wooded, adjacent to residential

Geologically, the APE is located within the St. Johns Marsh province, a part of the larger Eastern Flatwoods District (Brooks 1981). This region is typically vegetated by marshes and grass prairies with cabbage palms and willow. Seasonal flooding is common, and soils consist of fine sand, silty sand, and clayey sand. Elevations are typically around 18 feet (5.5 meters) above mean sea level (amsl). No natural drainages are present within the APE, although several canals are present. All soils within the APE have been classified as poorly drained and include Pineda sand, EauGallie sand, Wabasso sand, and Malabar, Holopaw, and Pineda soils (see **Table 1; Figure 3**).

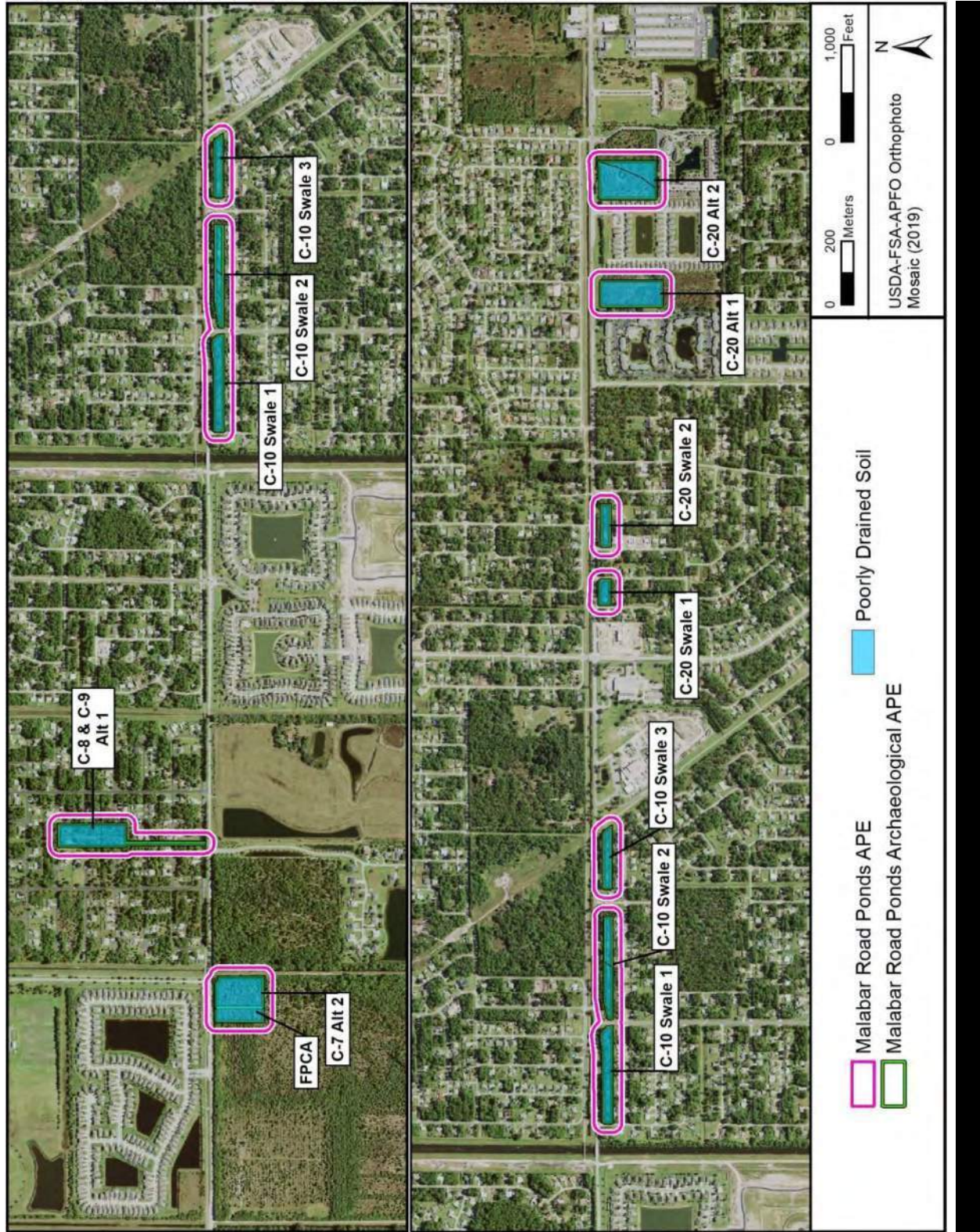
FLORIDA MASTER SITE FILE REVIEW

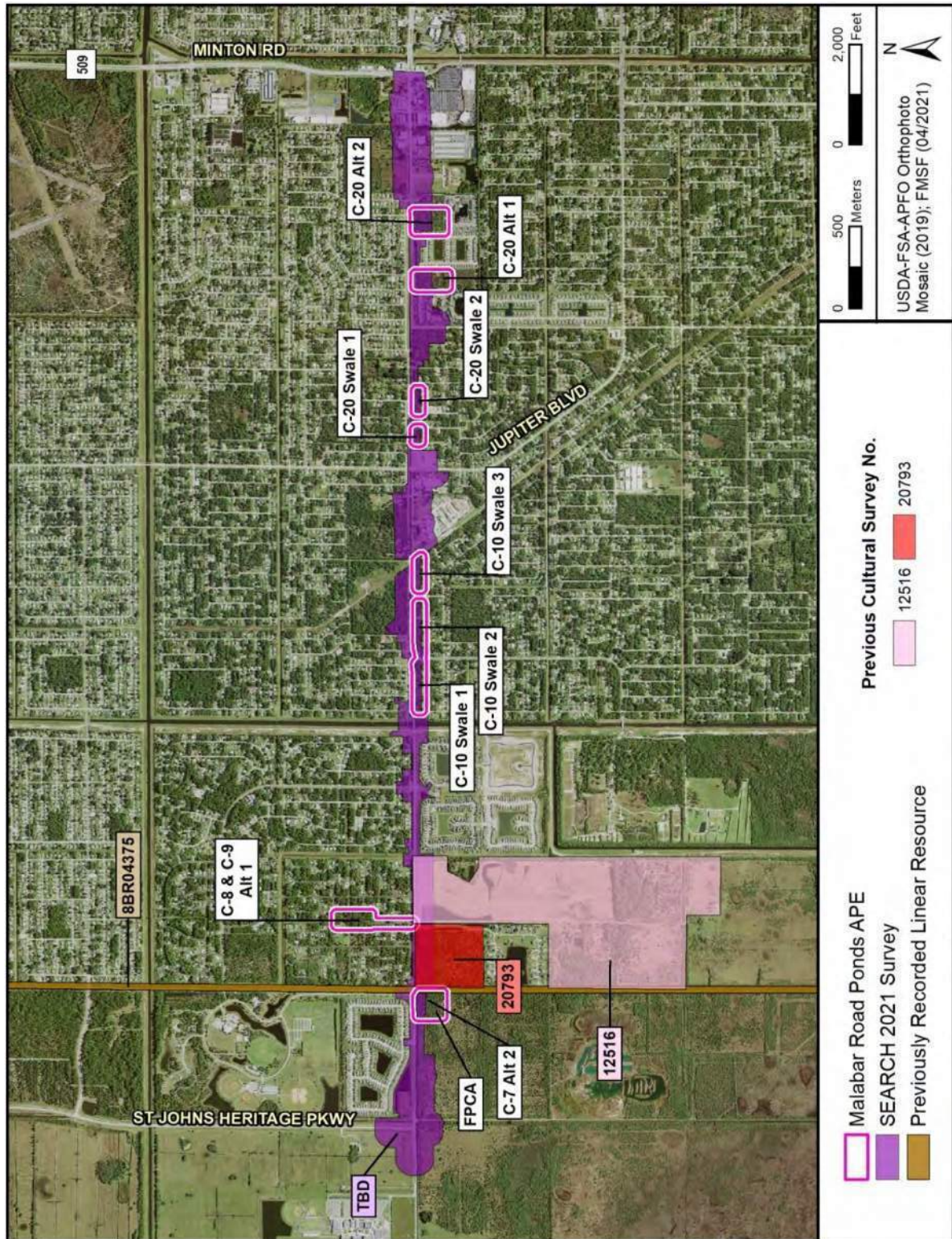
A review of the FMSF database (updated April 2021) indicates that three cultural resource surveys have been conducted within the current Malabar Road Ponds APE (**Table 2; Figure 4**). Of these, the most relevant to the current study is the 2021 SEARCH survey (FMSF Survey No. TBD) for which the current report serves as an addendum. This survey included small portions of each pond location (see **Figure 4**), but did not include any subsurface testing within the current archaeological APE.

Table 2. Previous Cultural Resource Surveys Conducted within the Malabar Road Ponds APE.

FMSF No.	Title	Intersecting Pond	Year	Reference
12516	<i>A Cultural Resource Survey of the Chaparral Project Area, Brevard County, Florida</i>	C-8 & C-9 Alt 1	2006	SEARCH
20793	<i>Cultural Resources Survey and Assessment, Palm Island Subdivision, Brevard County Florida</i>	C-8 & C-9 Alt 1	2014	SouthArc, Inc.
TBD	<i>Cultural Resource Assessment Survey of the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida</i>	All ponds	2021	SEARCH

Two previous surveys (FMSF Survey No. 12516 and 20793) intersect the southern end of the easement associated with C-8 and C-9 Alt 1 (see **Figure 4**). FMSF Survey No. 12516 was a CRAS conducted in 2006 by SEARCH; this survey intersects approximately 545 square meters (0.13 acres) of roadside embankment and landscaped right-of-way on the south side of Malabar Road.





FMSF Survey No. 20793 was a CRAS conducted by SouthArc, Inc. in 2014; this survey intersects approximately 215 square meters (0.05 acres) of roadside embankment on the south side of Malabar Road, between Allison Drive and Flying U Lane (see **Figure 4**). Neither of these surveys included subsurface testing within the current APE.

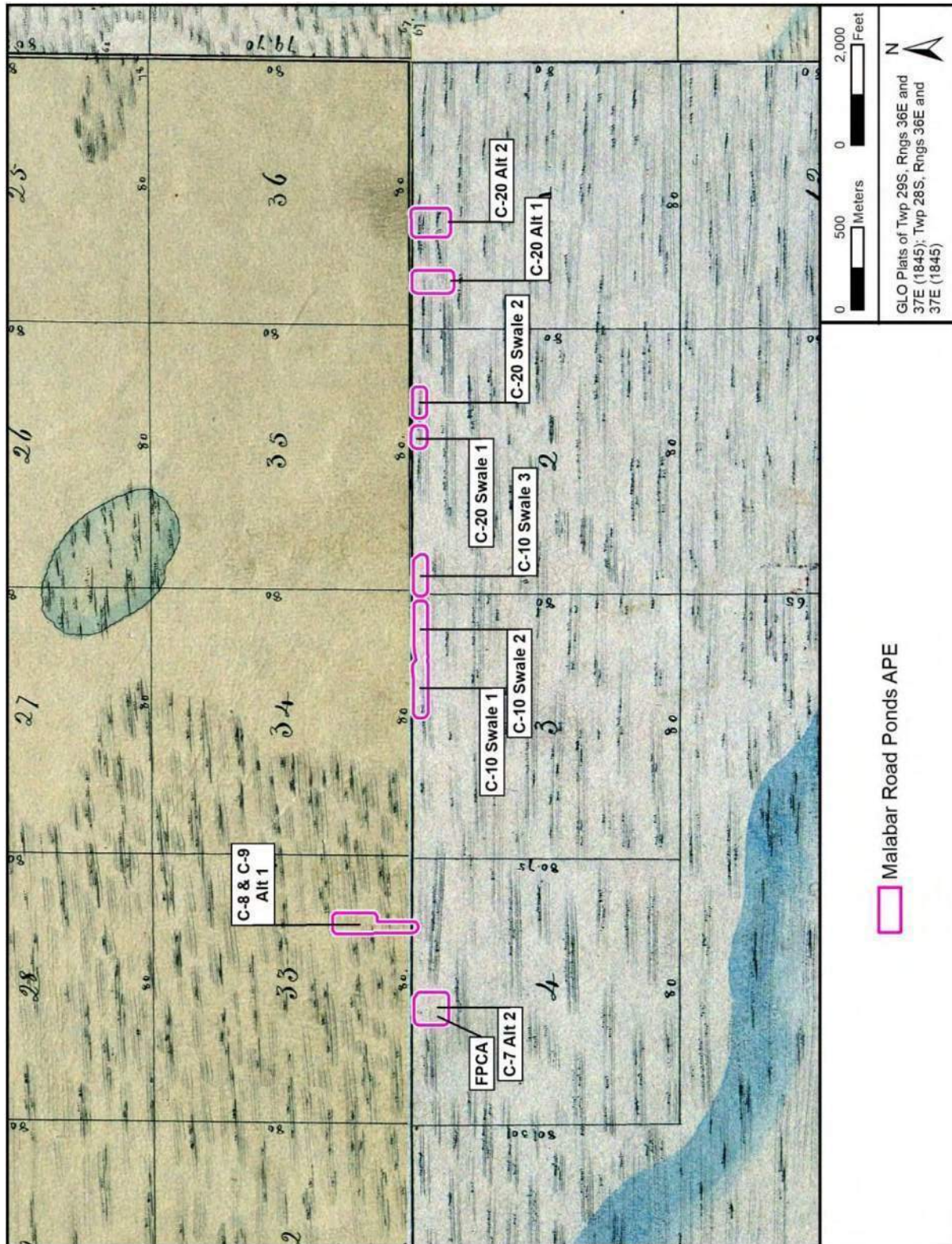
Further review of the most recent FMSF data indicates that no previously recorded archaeological sites, historic structures, bridges, cemeteries, or resource groups fall within any of the proposed pond locations. However, the 2021 SEARCH survey (FMSF Survey No. TBD) identified one newly recorded linear resource (8BR04375) running along the eastern edge of Pond C-7 Alt 2. Linear resource 8BR04375, the Melbourne-Tillman Canal No. 8 (also known as the C-8 Canal), is a historic man-made carrier canal with an overgrown earthen embankment of similar design and purpose common in the region. Failing to meet any criterion for NRHP listing, 8BR04375 was recommended not eligible for listing in the NRHP (SEARCH 2021). As of submittal of this report, the State Historic Preservation Officer (SHPO) has not yet made a determination of eligibility on the NRHP for 8BR04375. In this report, the C-8 Canal will be referred to its FMSF resource name, the Melbourne-Tillman Canal No. 8.

Historic Map and Aerial Imagery Review

Historic maps and aerial photographs were examined in order to identify past land use in the vicinity of the Malabar Road Ponds APE. The earliest detailed maps consulted were General Land Office (GLO) survey maps. The GLO maps were created by government land surveyors during the nineteenth century as part of the surveying, platting, and sale of public lands. In Florida, these maps characteristically show landscape features such as vegetation, bodies of water, roads, and Spanish land grants. The level of detail in GLO maps varies, with some also depicting structures, Native American villages, railroads, and agricultural fields. A GLO map of Florida Townships 28 and 29 South, Range 36 East from 1845 shows no development within the APE. All features within the APE are naturally occurring (**Figure 5**) (GLO 1845a, 1845b, 1845c, 1845d).

Late nineteenth-century maps show no development in the area of the APE. There are several towns on the east coast, several miles east of the current project (Folger 1883). An 1890 map of Brevard County illustrates a large “sawgrass lake” south of the APE, but no features are evident within the APE (Norton 1890). A 1917 state highway map shows a road traveling westward from Malabar, though it is unclear from this map if it reaches the APE (Florida State Road Department [FSRD] 1917). A more detailed county map from 1934 illustrates the road traveling through area near the APE (FSRD 1934).

An aerial photograph from 1943 shows development. Malabar Road is evident on its current east-west path and a canal runs east-west on the north side of the road, although both of these features are obscured by the edge of the APE. FPCA and C-7 Alt 2 covered an improved field and a structure is evident within the APE near Malabar Road. The western border of C-7 Alt 2 obscures a north-south canal that extends to Malabar Road. In C-8 and C-9 Alt 1, no improvements are evident. The southern border of this pond obscures a north-south road that intersects Malabar Road. The five swales near the center of the APE contain no improvements. These sections may



be crossed by small north-south roads from the improved fields to the north that intersect Malabar Road. C-120 Alt 2 contains two improved fields and three structures. A north-south road is evident crossing this pond before intersecting an east-west road evident within the APE. Outside the APE, several canals and roads are evident. An airport also is evident to the northeast of the APE (**Figure 6**) (US Department of Agriculture [USDA] 1943).

A topographic map from the 1950s shows continued development. FPCA and C-7 Alt 2 cover an orchard, and two structures are evident within the APE in the northeast corner. C-8 and C-9 Alt 1 shows no change from 1941. There are no major changes within the swales. C-20 Alt 2 contains one structure, and a second structure is obscured by the western border of the APE. The improved fields are no longer evident within this section of the APE. Outside the APE, more structures are evident near Malabar Road (**Figure 7**) (US Geological Survey [USGS] 1951, 1953). A topographic map from the 1970s shows continued development outside the APE. Several new north-south roads are under construction within the swales and resemble their present-day pattern. No other changes are evident in the remaining sections of the APE (**Figure 8**) (USGS 1970a, 1970b).

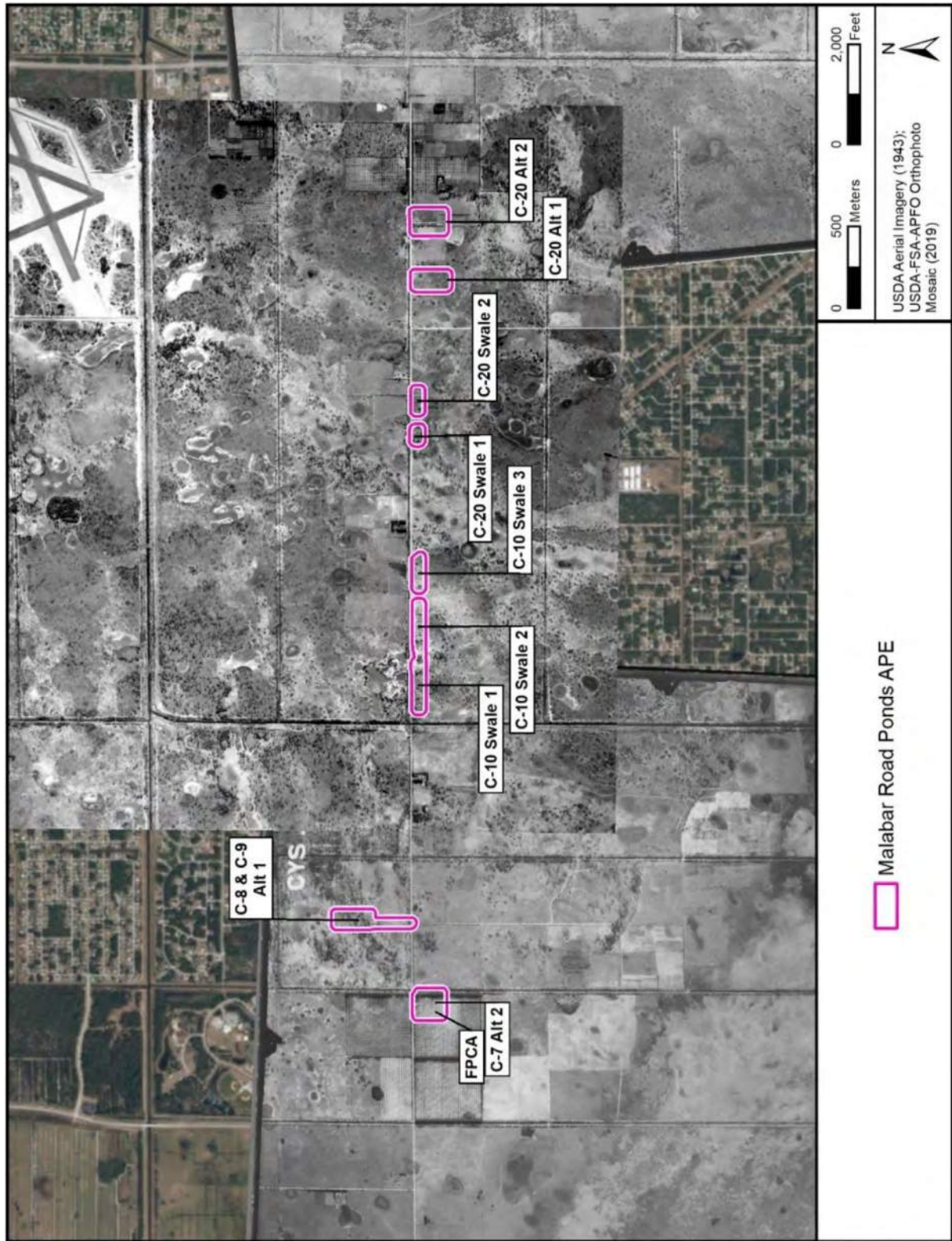
SURVEY METHODOLOGY

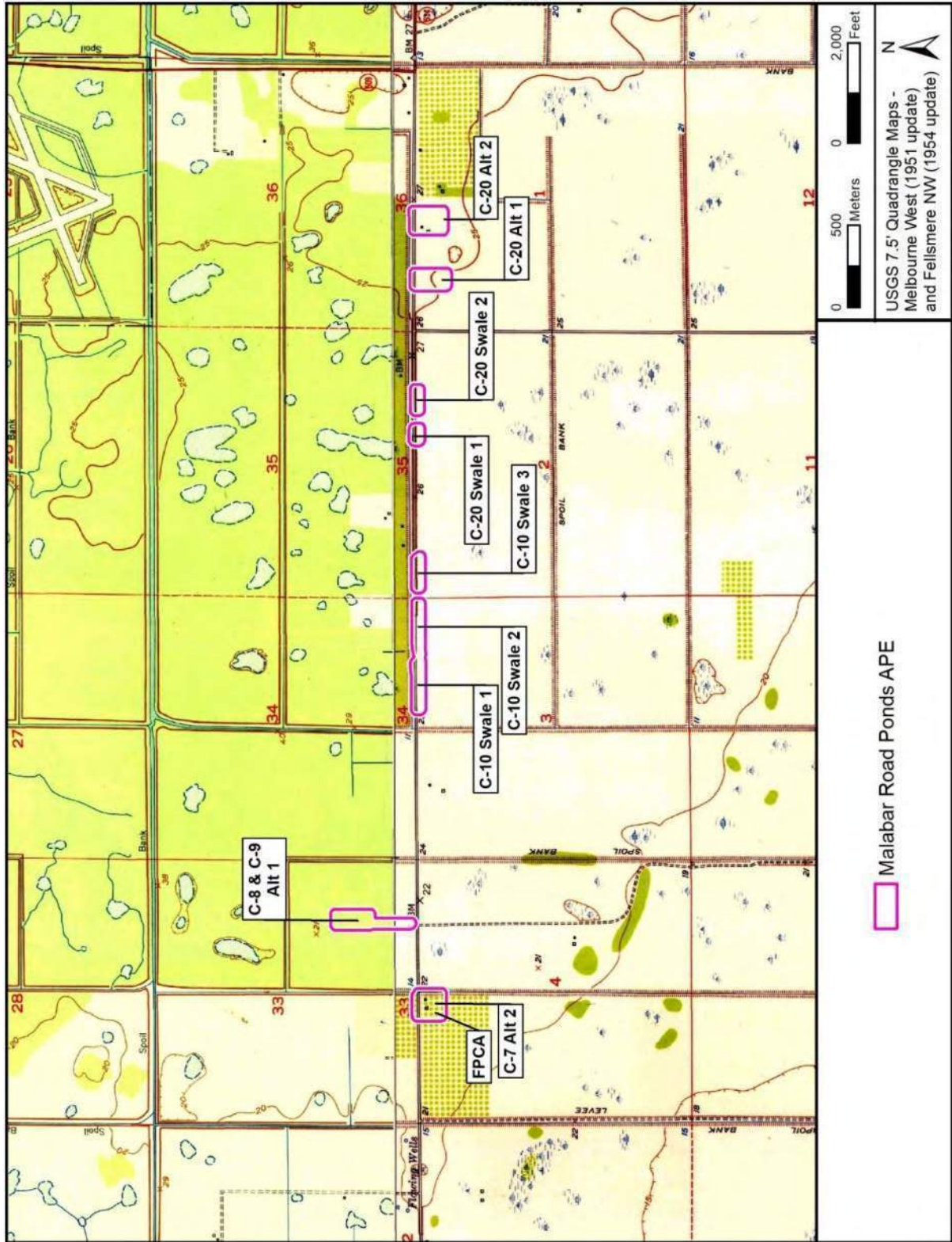
Archaeological Field Methods

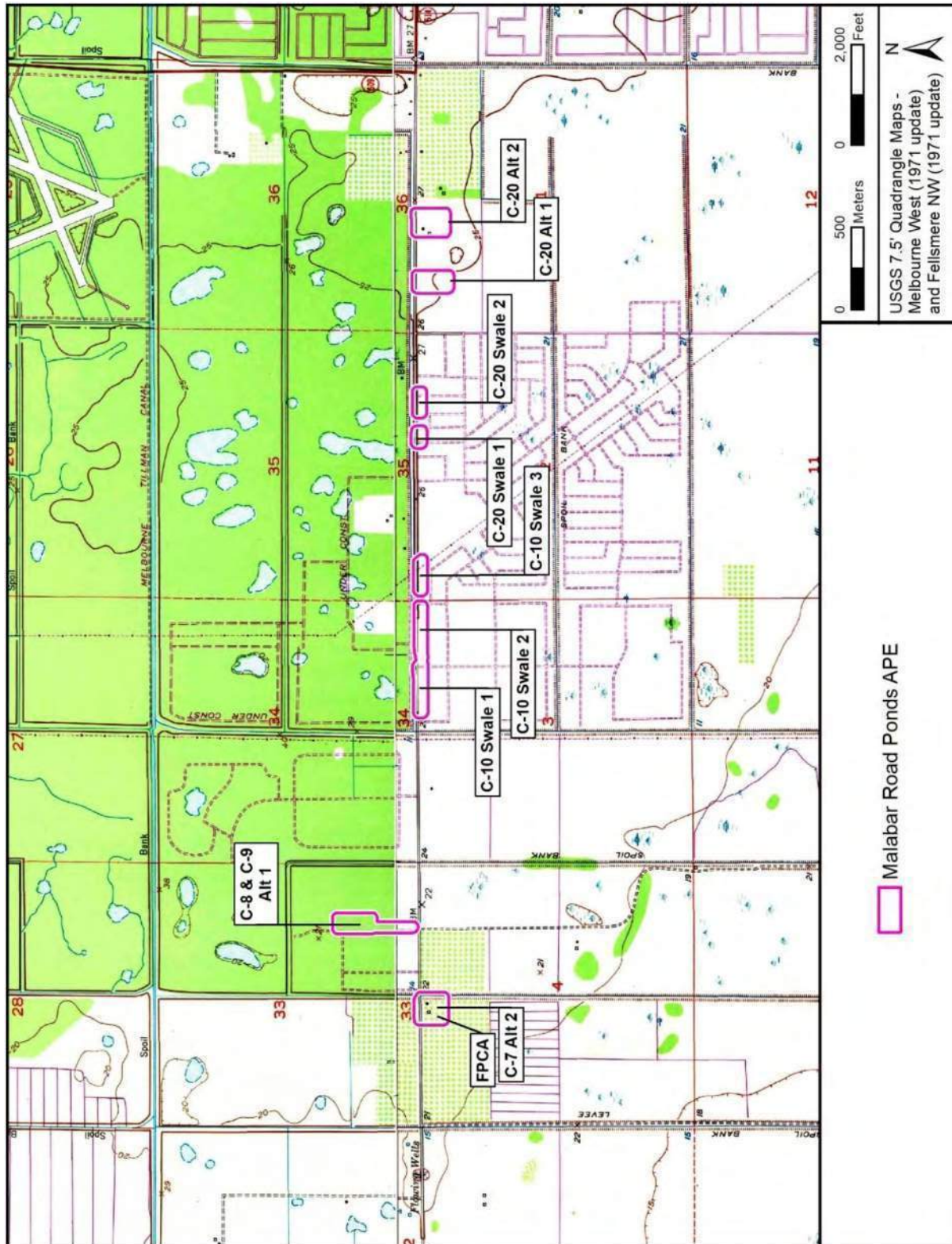
The Phase I field survey consisted of subsurface shovel testing within the proposed pond locations at varying intervals according to the potential for containing buried archaeological sites. Shovel tests were judgmentally placed to achieve coverage within each pond APE. The FDHR manual specifies that non-systematic testing (i.e., judgmental testing) is appropriate in “geographically restricted areas such as proposed pond sites” (FDHR 2002:17–18). The pond locations were visually examined via pedestrian survey for the presence of exposed artifacts and aboveground features (e.g., structural remains and prehistoric mounds).

The potential for archaeological sites to be present within the pond footprints was evaluated based on an examination of environmental variables (i.e., soil drainage, relative elevation, proximity to water or wetland resources), as well as the generally negative results of previously conducted surveys. Soils within the current APE were poorly drained (see **Figure 3**); therefore, the potential for encountering archaeological deposits was determined to be generally low. The FPCA and Pond C-7 Alt 2 were assessed at a moderate probability due to the proximity of previously recorded archaeological site 8BR00025. This site is located approximately 574 feet (175 meters) east of the FPCA and approximately 253 feet (77 meters) east of the Pond C-7 Alt 2 and has been determined ineligible for inclusion on the NRHP.

Shovel tests measured approximately 50 centimeters (19.7 inches) in diameter and were excavated to a minimum depth of 100 centimeters (39.4 inches) below surface (cmbs), subsurface conditions permitting. All excavated sediments were screened through 6.4-millimeter







(1/4-inch) mesh hardware cloth. “No-dig” points were recorded in locations where testing was attempted, but confirmed to be infeasible due to buried utilities or disturbances. The location of each shovel test and “no-dig” point was marked on aerial photographs of the project area (Attachment A). Global Positioning System (GPS) coordinates were recorded for each shovel test and “no-dig” location with handheld units that used Wide Area Augmentation System (WAAS). The cultural content, stratigraphy, and environmental setting of each shovel test were recorded in field notebooks.

Architectural Field Methods

The architectural survey for the project utilized standard procedures for the location, investigation, and recording of historic properties. In addition to a search of the FMSF database for previously recorded historic properties within the project area, USGS quadrangle maps were reviewed for structures that were constructed prior to 1977. The field survey inventoried existing buildings, structures, and other aspects of the built environment within the project APE. Each historic resource was plotted with a GPS unit on USGS quadrangle maps and on project aerials. All identified historic resources were photographed with a digital camera, and all pertinent information regarding the architectural style, distinguishing characteristics, and condition was recorded on FMSF structure forms. Upon completion of fieldwork, forms and photographs were returned to the SEARCH offices for analysis. Date of construction, design, architectural features, condition, and integrity of the structure, as well as how the resources relate to the surrounding landscape, were carefully considered. The resources were evaluated regarding their eligibility for listing in the NRHP and then recommended eligible, potentially eligible, or not eligible.

Procedures to Deal with Unexpected Discoveries

Every reasonable effort has been made during this investigation to identify and evaluate possible locations of prehistoric and historic archaeological sites; however, the possibility exists that evidence of cultural resources may yet be encountered within the project limits. Should evidence of unrecorded cultural resources be discovered during construction activities, all work in that portion of the project area must stop. Evidence of cultural resources includes aboriginal or historic pottery, prehistoric stone tools, bone or shell tools, historic trash pits, and historic building foundations. If such evidence is found, the FDHR will be notified within two working days. In the unlikely event that human skeletal remains or associated burial artifacts are uncovered within the project area, all work in that area must stop. The discovery must be reported to local law enforcement, who will in turn contact the medical examiner. The medical examiner will determine whether or not the State Archaeologist should be contacted per the requirements of Chapter 872.05, Florida Statutes.

Curation

The original maps and field notes are presently housed at the Newberry, Florida, office of SEARCH. The original maps and field notes will be turned over to the City of Palm Bay upon project completion; copies will be retained by SEARCH.

Informant Interviews

SEARCH archaeologist Dave Boschi, MA, RPA, contacted the South Brevard Historical Society (SBHS) via email on April 27, 2021, in an attempt to inquire about potential areas that may be of local importance. As of the submission of this report, the SBHS replied to note that this would be brought to the attention of their Board.

Certified Local Government Consultation

As no Certified Local Government (CLG) exists for Brevard County or the City of Palm Bay, no CLG consultation was necessary.

SURVEY RESULTS

Archaeological Results

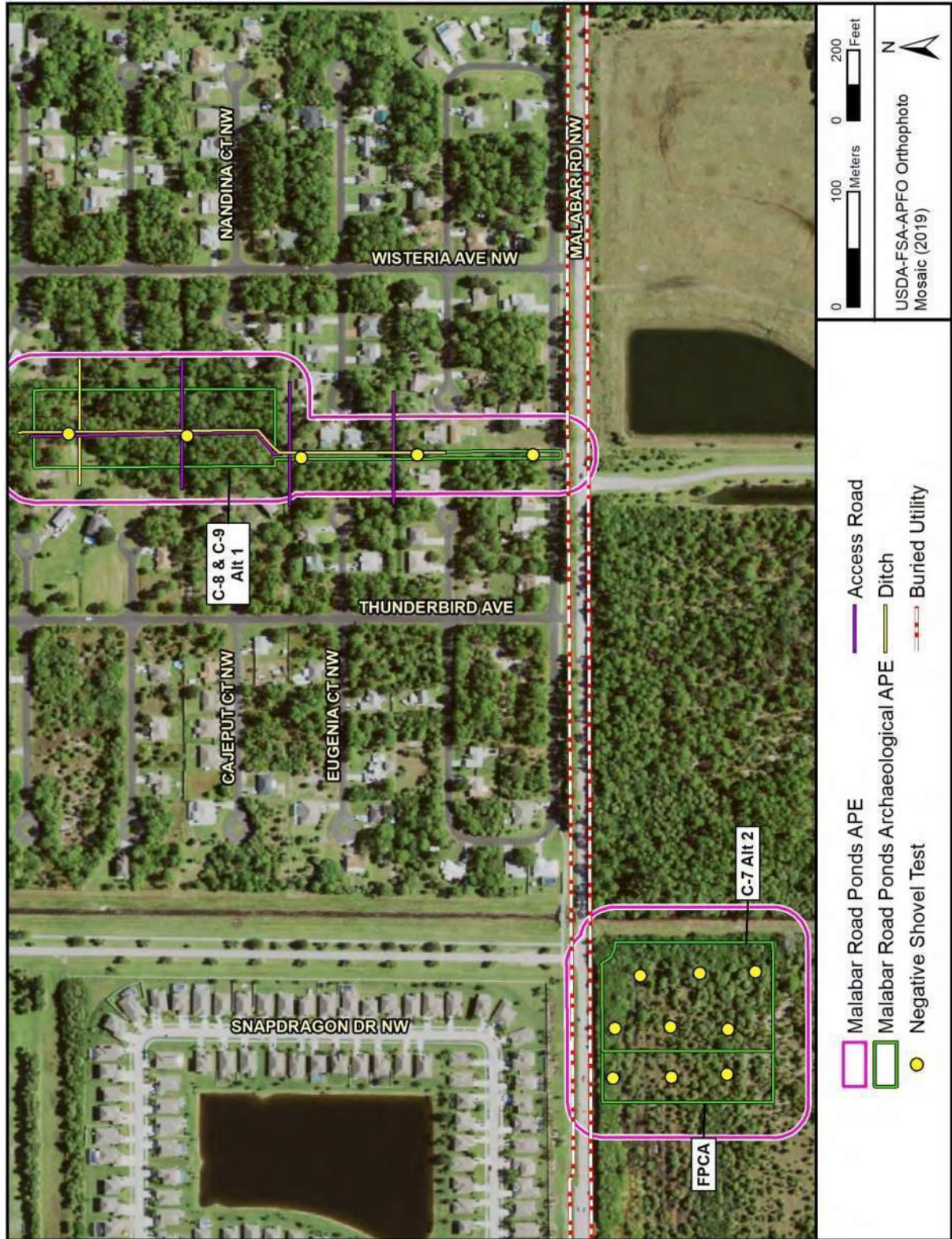
The Malabar Road Ponds archaeological APE is located in a mostly wooded area between residential neighborhoods in the City of Palm Bay, Florida. The APE includes wooded parcels adjacent to single-family residences and former silvicultural tracts at the west end of the APE. Disturbances noted within the APE included past silvicultural use, access roads, and residential development (**Figures 9 and 10**; see **Figures 3 and 6-8**).

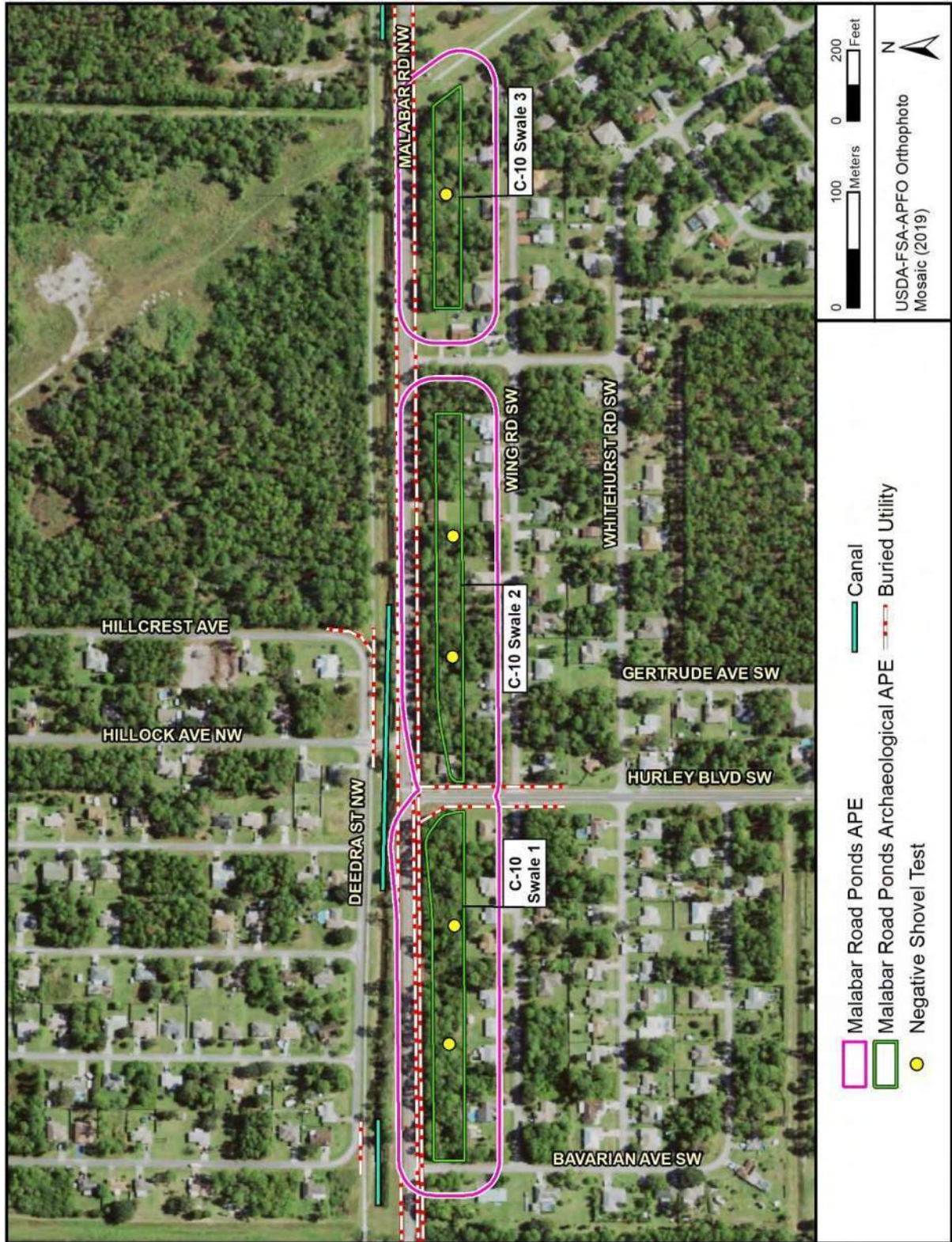
A total of 25 shovel tests were excavated within the Malabar Road Ponds archaeological APE, all of which were negative for cultural material (**Figures 11-13**; see **Figure 10**). Discussion of individual ponds is provided below. Soil profiles varied by location (**Figures 14-16**). The fieldwork results of the survey are summarized in **Table 3** and shown in **Figures 10-13**.

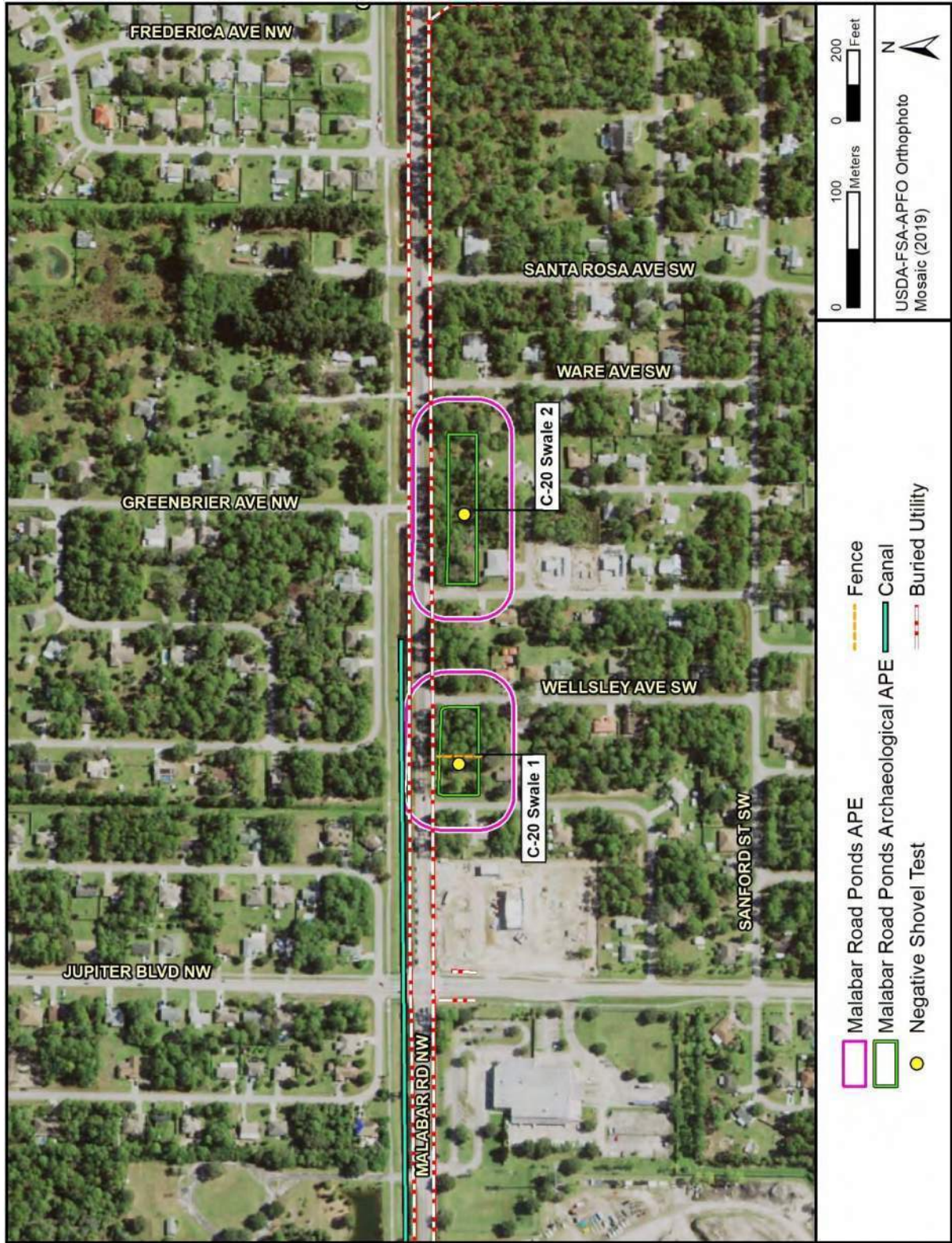
Table 3. Survey Results by Area within the Archaeological APE.

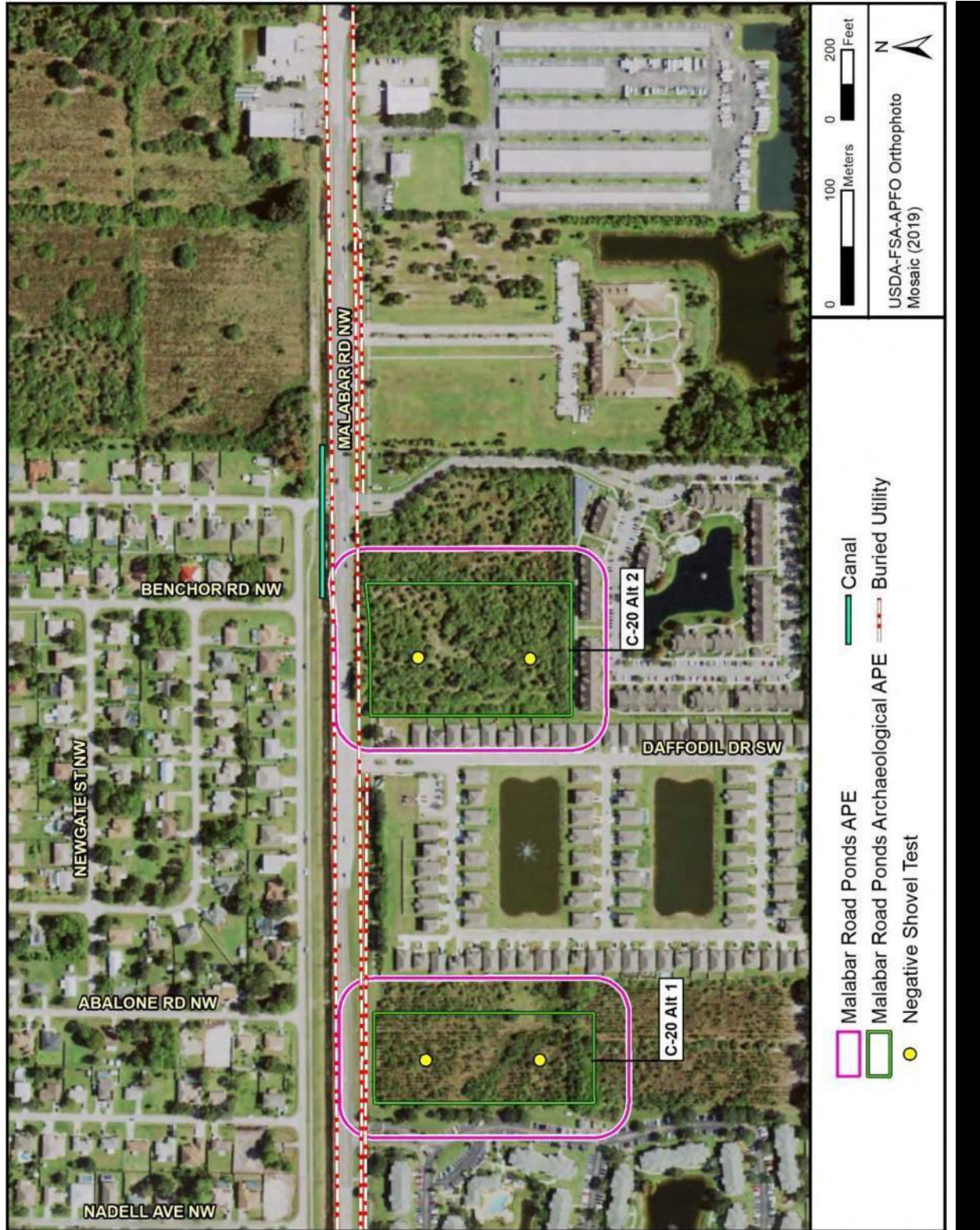
Area	Footprint Acreage	Soil Drainage Characteristic	Archaeological Probability	Field Results	Result	Recommendation
FPCA	1.64 acres	Poorly drained	Moderate	3 STPs	Negative	No further work
C-7 Alt 2	3.43 acres	Poorly drained	Moderate	6 STPs	Negative	No further work
C-8 & C-9 Alt 1	3.83 acres	Poorly drained	Low	5 STPs	Negative	No further work
C-10 Swale 1	2.1 acres	Poorly drained	Low	2 STPs	Negative	No further work
C-10 Swale 2	1.67 acres	Poorly drained	Low	2 STPs	Negative	No further work
C-10 Swale 3	1.1 acres	Poorly drained	Low	1 STP	Negative	No further work
C-20 Swale 1	0.63 acres	Poorly drained	Low	1 STP	Negative	No further work
C-20 Swale 2	0.79 acres	Poorly drained	Low	1 STP	Negative	No further work
C-20 Alt 1	3.74 acres	Poorly drained	Low	2 STPs	Negative	No further work
C-20 Alt 2	5.0 acres	Poorly drained	Low	2 STPs	Negative	No further work

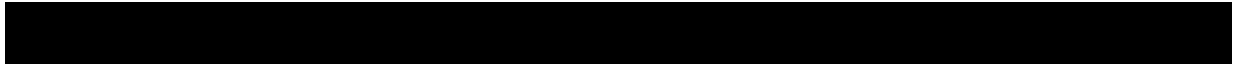














FPCA

The FPCA consists of 1.64 acres of pine, oak, and palmetto (**Figure 17**) located on the south side of Malabar Road, approximately 279 feet (85 meters) west of Championship Circle NW and adjacent to C-7 Alt 2 (see **Figure 2**). Soils are poorly drained, and the area has been previously used for silvicultural purposes (see **Figures 6-8**). The terrain is relatively flat. Previously recorded site 8BR00025 is located approximately 574 feet (175 meters) east of the FPCA. Based on these factors, the FPCA was assessed at a moderate probability for archaeological deposits.



A total of three shovel tests were conducted within the FPCA. Of these three, all were negative for cultural materials (see **Figure 10**). Soils consisted of gray (10YR 5/1) sand from 0 to 40 cmbs (15.7 inches), grayish-brown (10YR 5/2) sand from 40 to 50 cmbs (15.7 to 19.7 inches, Stratum II), brownish-yellow (10YR 6/8) sandy loam from 50 to 80 cmbs (19.7 to 31.5 inches, Stratum III), thick light yellowish-brown (10YR 6/4) sandy loam from 80 to 90 cmbs (31.5 to 35.4 inches, Stratum IV), and gray (10YR 6/1) sandy loam from 90 to at least 100 cmbs (35.4 to 39.4 inches, Stratum V) (see **Figure 14**). No further work is recommended at the FPCA.

C-7 Alt 2

C-7 Alt 2 is a 3.43-acre proposed pond located south of Malabar Road; the FPCA is adjacent to the west, and the Melbourne-Tillman Canal No. 8 (8BR04375) flows along the east side (see **Figure 2**). Vegetation consists of young pine and palmetto, with occasional dense underbrush on flat terrain (**Figure 18**). Soils are poorly drained and the area has been previously used for silviculture (see **Figures 6-8**). Previously recorded site 8BR00025 is located approximately 253 feet (77 meters) east of Pond C-7 Alt 2. Based on these factors, C-7 Alt 2 was assessed at a moderate probability for archaeological deposits.



A total of six shovel tests were conducted within C-7 Alt 2 (see **Figure 10**). All six tests were negative for cultural materials. Soils consisted of gray (7.5YR 6/1) fine sand from 0 to 15 cmbs (5.9 inches, Stratum I), gray (7.5YR 5/1) loamy sand from 15 to 45 cmbs (5.9 to 17.7 inches, Stratum II), pink (7.5YR 8/4) fine sand with ferrous staining from 45 to 80 cmbs (17.7 to 31.5 inches, Stratum III), and dark brown (7.5YR 3/2) loamy sand from 80 to at least 100 cmbs (31.5 to 39.4 inches, Stratum IV) (see **Figure 14**). No further archaeological work at C-7 Alt 2 is recommended.

C-8 & C-9 Alt 1

C-8 & C-9 Alt 1 is a 3.83-acre proposed pond and easement located north of Malabar Road, south of Viburnum Road NW, east of Thunderbird Avenue, and west of Wisteria Avenue NW (see **Figure 2**). The forested area includes east-west oriented access roads connecting adjacent residential lots, and a drainage feature within the north half (**Figure 19**). The soils are poorly drained and the elevation is relatively flat. Based on these factors, C-8 & C-9 Alt 1 was assessed with low probability.



A total of five shovel tests were conducted within C-8 & C-9 Alt 1, and all were negative for cultural materials (see **Figure 10**). Soils consisted of gray (7.5YR 5/1) coarse sand from 0 to 12 cmbs (4.7 inches, Stratum I), white (7.5YR 8/1) mottled with light brown (7.5YR 6/4) coarse sand from 12 to 65 cmbs (4.7 to 25.6 inches, Stratum II), and brown (7.5YR 5/3) coarse sand with gray (7.5YR 5/1) sandy clay from 65 to at least 100 cmbs (25.6 to 39.4 inches, Stratum III) (see **Figure 14**). No further archaeological work at C-8 & C-9 Alt 1 is recommended.

C-10 Swale 1

C-10 Swale 1 is a 2.1-acre proposed swale located south of Malabar Road and north of Wing Road SW, between Bavarian Avenue SW and Hurley Boulevard SW (see **Figure 2**). The relatively flat area is adjacent to residences, forested with oaks, palmetto, and pines with tall grasses and contains poorly drained soils (**Figure 20**). Based on these factors, C-10 Swale 1 was assessed at a low probability for archaeological deposits.



A total of two shovel tests were conducted within C-10 Swale 1 (see **Figure 11**); both were negative for cultural materials. Soils consisted of dark gray (10YR 4/1) sand from 0 to 35 cmbs (13.8 inches, Stratum I), gray (10YR 5/1) sandy loam from 35 to 65 cmbs (13.8 to 25.6 inches, Stratum II), and black (10YR 2/1) sandy loam from 65 to at least 100 cmbs (25.6 to 39.4 inches, Stratum III) (see **Figure 15**). No further archaeological work at C-10 Swale 1 is recommended.

C-10 Swale 2

C-10 Swale 2 is a 1.67-acre proposed swale located south of Malabar Road and north of Wing Road SW, between Hurley Boulevard and Watoga Avenue SW (see **Figure 2**). The area has mature pine and young palmetto on relatively flat terrain with poorly drained soils (**Figure 21**). Based on these factors, C-10 Swale 2 was assessed at a low probability for archaeological deposits.

A total of two shovel tests were conducted within C-10 Swale 2 (see **Figure 11**); both were negative for cultural materials. Soils consisted of gray (7.5YR 6/1) loamy sand from 0 to 55 cmbs (21.7 inches, Stratum I), dark brown (7.5YR 3/2) loamy sand from 55 to 80 cmbs (21.7 to 31.5 inches, Stratum II), and very dark brown (7.5YR 2.5/2) loamy sand from 80 to at least 100 cmbs (31.5 to 39.4 inches, Stratum III) (see **Figure 15**). No further archaeological work at C-10 Swale 2 is recommended.



C-10 Swale 3

C-10 Swale 3 is a 1.1-acre proposed swale located south of Malabar Road and north of Wing Road SW, between Watoga Avenue SW and the City of Palm Bay Public Works Department (see **Figure 2**). The area is wooded with oak, palmetto, and pine on relatively flat terrain with poorly drained soils (**Figure 22**). Based on these factors, C-10 Swale 3 was assessed at a low probability for archaeological deposits.

A single shovel test was excavated within C-10 Swale 3 (see **Figure 11**). The shovel



test was negative for cultural materials. Soils consisted of gray (10YR 5/1) fine sand from 0 to 32 cmbs (12.6 inches, Stratum I), dark grayish-brown (10YR 4/2) sandy loam from 32 to 49 cmbs (12.6 to 19.3 inches, Stratum II), very pale brown (10YR 8/2) sandy loam from 49 to 71 cmbs (19.3 to 28 inches, Stratum III), and dark brown (10YR 3/3) sandy loam from 71 to at least 100 cmbs (28 to 39.4 inches, Stratum IV) (see **Figure 15**). No further archaeological work at C-10 Swale 3 is recommended.

C-20 Swale 1

C-20 Swale 1 is a 0.63-acre proposed swale located south of Malabar Road, between White Road SW and Wellsley Avenue SW (see **Figure 2**). The area is wooded, relatively flat, and has poorly drained soil (**Figure 23**). Based on these factors, C-20 Swale 1 was assessed at a low probability for archaeological deposits.



A single shovel test was conducted within C-20 Swale 1 (see **Figure 12**). The test was negative for cultural materials. Soils consisted of very dark gray (10YR 3/1) loamy clay sand with shell and modern trash from 0 to 18 cmbs (7.1 inches, Stratum I), light grayish-brown (10YR 6/2) sand mottled with gray (10YR 5/1) clay from 18 to 80 cmbs (7.1 to 31.5 inches, Stratum II), and dark gray (10YR 4/1) clay from 80 to at least 100 cmbs (31.5 to 39.4 inches, Stratum III) (see **Figure 16**). No further archaeological work at C-20 Swale 1 is recommended.

C-20 Swale 2

C-20 Swale 2 is a 0.79-acre proposed swale located south of Malabar Road, between Tile Avenue SW and Ware Avenue SW, and north of Turk Road SW (see **Figure 2**). The area is wooded with pines and palmetto, is relatively flat, and has poorly drained soils (**Figure 24**). Based on these factors, C-20 Swale 2 was assessed with a low probability for archaeological deposits.



One shovel test was conducted within C-20 Swale 2 (see **Figure 12**). The test was

negative for cultural materials. Soils consisted of light brownish-gray (10YR 6/2) fine sand from 0 to 20 cmbs (7.9 inches, Stratum I), light yellowish-brown (10YR 6/4) fine sand from 20 to 40 cmbs (7.9 to 15.7 inches, Stratum II), very pale brown (10YR 8/3) sandy loam with ferrous staining from 40 to 68 cmbs (15.7 to 26.8 inches, Stratum III), and very dark brown (10YR 2/2) sandy loam from 68 to at least 100 cmbs (26.8 to 39.4 inches, Stratum IV) (see **Figure 16**). No further archaeological work at C-20 Swale 2 is recommended.

C-20 Alt 1

C-20 Alt 1 is a 3.74-acre proposed pond located south of Malabar Road and west of Alamere Drive SW (see **Figure 2**). The area has rows of planted pine and mature palmetto with poorly drained soils on level terrain (**Figure 25**). Based on the poor soil drainage and disturbance from the pine plantation, C-20 Alt 1 was assessed with a low probability for archaeological deposits.

A total of two shovel tests were conducted within C-20 Alt 1 (see **Figure 13**); both were negative for cultural materials. Soils consisted of black (7.5YR 2.5/1) loamy sand from 0 to 25 cmbs (9.8 inches, Stratum I), light gray (10YR 7/1) damp loamy sand from 25 to 60 cmbs (9.8 to 23.6 inches, Stratum II), and light gray (10YR 7/2) wet sand from 60 to 95 cmbs (23.6 to 37.4 inches, Stratum V) (see **Figure 25**). Some subsurface disturbance was noted and both shovel tests were inundated before reaching 100 cmbs (39.4 inches). No further archaeological work at C-20 Alt 1 is recommended.

C-20 Alt 2

C-20 Alt 2 is a 5.0-acre proposed pond located south of Malabar Road, east of Sutherland Drive SW, and north of Daffodil Drive SW (see **Figure 2**). The area has mature palmetto with poorly drained soils on level terrain (**Figure 26**). Based on these factors, C-20 Alt 2 was assessed with a low probability for archaeological deposits.



A total of two shovel tests were conducted within C-20 Alt 2 (see **Figure 13**); both were negative for cultural materials. Soils consisted of brown (7.5YR 4/2) loamy sand from 0 to 25 cmbs (9.8 inches, Stratum I), light brown (7.5YR 6/4) damp loamy sand with concretions from 25 to 40 cmbs (9.8 to 15.7 inches, Stratum II), black (7.5YR 2.5/1) damp loamy sand from 40 to 60 cmbs (15.7 to 23.6 inches, Stratum III), light gray (7.5YR 7/1) damp loamy sand from 60 to 90 cmbs (23.6 to 35.4 inches, Stratum IV), and pinkish-gray (7.5YR 6/2) damp loamy sand from 90 to at least 100 cmbs (35.4 to 39.4 inches, Stratum V) (see **Figure 14**). Modern trash and shell were noted in Strata I and II. No further archaeological work at C-20 Alt 2 is recommended.



Architectural Results

The architectural survey resulted in the identification and evaluation of one newly recorded historic resource within the Malabar Road Ponds APE (**Figure 27**). The newly recorded historic resource is a canal (8BR04375). This resource also was documented during the 2021 CRAS (FMSF Survey No. TBD), for which the current study serves as an addendum. The evaluation of this resource (below) expands upon the documentation provided in the 2021 report.

A description and evaluation are provided below for Resource 8BR04375. The FMSF resource form and its associated maps and photographs are provided in **Attachment B**. The FDHR survey log sheet is provided in **Attachment C**.

NRHP EVALUATIONS

Linear Resources

8BR04375, Melbourne-Tillman Canal No. 8

The Melbourne-Tillman Canal No. 8 (8BR04375) is a newly recorded historic canal located in Brevard County (see **Figure 27**). Resource 8BR04375 is situated in Section 4 of Township 29 South, Range 36 East, as shown on the 2021 *Fellsmere NW, Fla.* USGS quadrangle map. Resource 8BR04375 runs north-south for approximately 600.8 feet (183.12 meters) and is approximately 16.85 feet (5.13 meters) wide within the APE (**Figure 28**). The resource is carried beneath



Malabar Road via a non-historic culvert. It is a dug-out canal with overgrown earthen embankments. Resource 8BR04375 is owned and maintained by the Melbourne-Tillman Water Control District.



Resource 8BR04375 was constructed prior to 1943 based on historic aerial imagery (USDA 1943). It is part of an overall canal network designed to drain the wetlands between the St. Johns River and Turkey Creek. The resource was constructed by the Melbourne-Tillman Water Control District, which was established by Brevard County in 1922. Today, the District controls 162 miles of canals between Palm Bay and West Melbourne and is presided over by representatives from those cities and from Brevard County (Melbourne-Tillman Water Control District n.d.).

Assessment

In order to facilitate an NRHP evaluation of Melbourne-Tillman Canal No. 8 (8BR04375), a discussion about the relationship between historic canal function, period of construction, and historic integrity is presented here.

A 2005 memorandum on canals by Sherry Anderson, which was revised in 2012 by Ginny Jones and is Appendix E to the 2010 FMSF's *Guide to the Resource Group Form*, was used as a guide to aid in the evaluation of Resource 8BR04375 (Jones 2012). The memorandum provides guidance on establishing the historic context for Florida's canal resources to aid in the evaluation of their eligibility to the NRHP. According to the FMSF memorandum, canals are common throughout Florida and "most of those built as drainage ditches in the twentieth century will probably not be considered significant" (Jones 2012:24). The memorandum further states:

It is usually the older canals (19th c.), transportation canals, larger regional canals dug as part of the early 20th c. reclamation activities, or canals used in industry (such as logging, cotton) that may be potentially eligible (Jones 2012:24-25).

Changes that could potentially alter the integrity of a canal include the following:

- Re-routing of the canal.
- Disruption of canal (cutting off or filling in).
- Substantial widening or substantial loss of width.
- Concentrated number of roadways and other crossovers that prohibit navigability (only important if navigability was part of its historic use).

- Severing of canal from other waterways (larger canals, turning basins, etc.), which results in change of historic function.
- Removal of historic ancillary structures original to canal's design and purpose (pumping stations, locks, railroads, docks, etc.). The loss of one feature may not be enough to substantially damage integrity, but the removal of many such features may collectively inhibit the resource's ability to convey its significance (Jones 2012:25).

Finally, the memorandum states:

Types of changes that may not substantially damage the integrity include loss of a single historic ancillary feature, routine maintenance and rebuilding of canal walls using same material type, addition of non-historic features (pumping station, etc.), addition of several roads that do not prohibit navigability throughout the majority of the canal. Canals can have 'non-contributing' portions as well but that the overall canal may still be considered potentially eligible (Jones 2012:25).

Based on the field survey and further research, it is the opinion of SEARCH that Resource 8BR04375 is not significant under NRHP Criterion A because it is not indicative of a particular era and is not associated with any significant period, event, or theme. Furthermore, the resource is not significant under Criterion B because it lacks association with any person(s) significant in history. Also, the resource is not significant under Criterion C due to its lack of engineering distinction. The canal was part of a mid-twentieth-century drainage system, and other canals of similar design and purpose are common in the region. The canal is a man-made earthen carrier channel with no outstanding features or design. Finally, 8BR04375 is not significant under Criterion D because it lacks the potential to yield further information of historical importance. It is the opinion of SEARCH that Resource 8BR04375 is not eligible for listing in the NRHP.

CONCLUSIONS

This technical memorandum details the results of a CRAS of four preferred pond locations, five swales, and one FPCA associated with proposed improvements to Malabar Road in Brevard County, Florida. This technical memorandum serves as an addendum to the previous CRAS report completed by SEARCH in support of the Malabar Road PD&E study in 2021 (FMSF Survey No. TBD). The APE defined for this project includes the proposed pond, FPCA, and swale footprints plus a 100-foot (30.5-meter) buffer (see **Figure 2**). The archaeological survey was conducted within the proposed footprints; the architectural history survey included the entire APE.

The current archaeological survey included the excavation of 25 shovel tests within the proposed ponds, swales, and floodplain conservation area. All testing was negative for cultural materials. No archaeological sites, features, or occurrences were identified during the archaeological survey. No further archaeological survey is recommended for the Malabar Road ponds, swales, or floodplain conservation area.

The architectural survey resulted in the identification and evaluation of one newly recorded historic resource within the Malabar Road Ponds APE. The newly recorded historic resource is a linear resource (8BR04375). Based on the results of the current survey, it is the opinion of SEARCH that the Melbourne-Tillman Canal No. 8 (8BR04375) is ineligible for the NRHP due to a lack of significant historic associations and architectural distinction. No further architectural work is recommended.

No NRHP-eligible or -listed resources were identified within the Malabar Road Ponds APE. In the opinion of SEARCH, the proposed construction will have no effect on cultural resources listed or eligible for listing in the NRHP. No further work is recommended.

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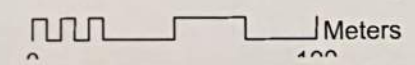
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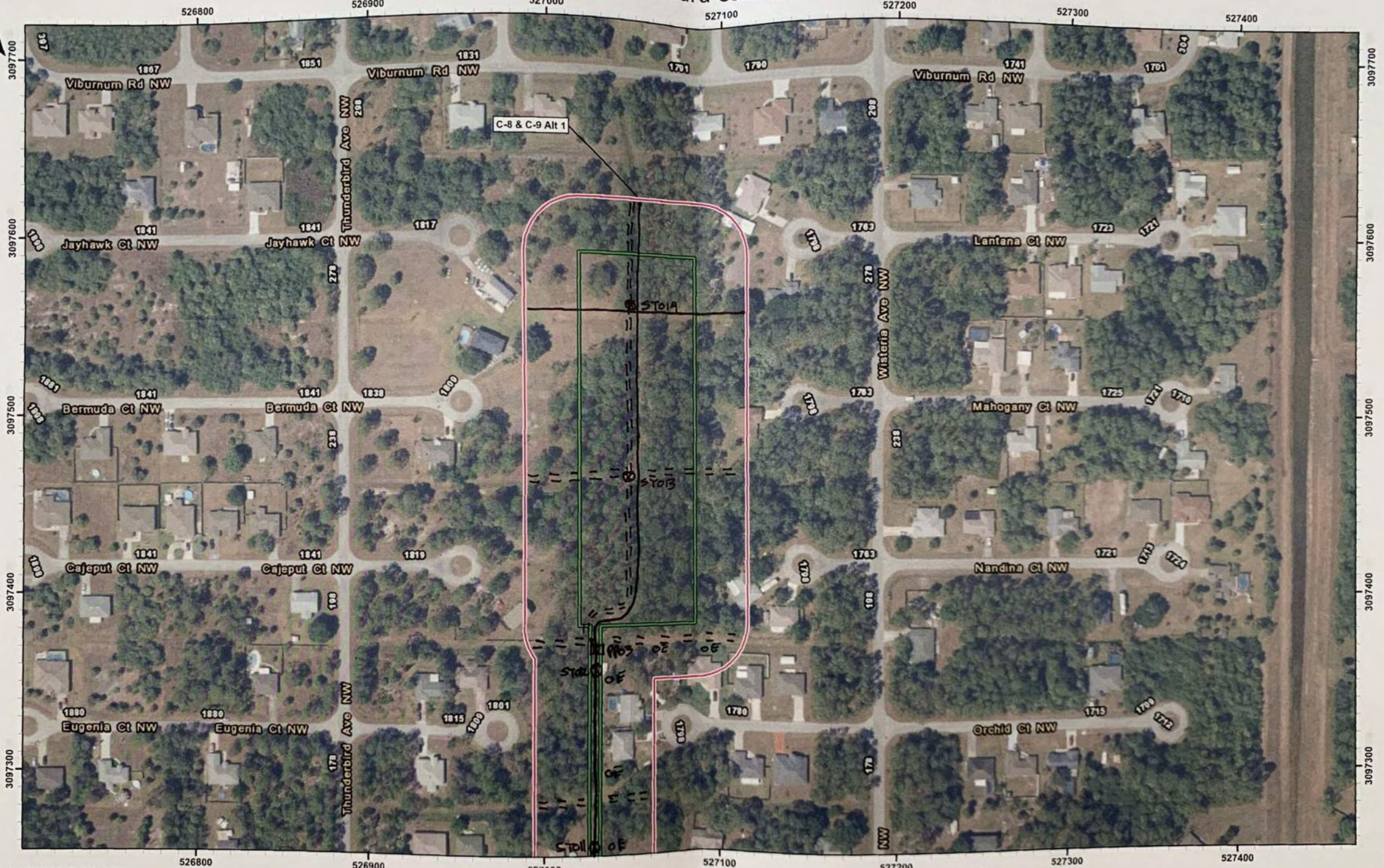
ATTACHMENT A:
MARKED FIELD MAPS



Grid UTM WGS 84 17N
Major ticks: 100m interval;

- Malabar Road Ponds APE
- Malabar Road Ponds Footprint
- ⊗ = Negative ST
- ⊙ = Positive ST
- = photo point
- = Culvert
- = Access Road
- = Utility Box
- = Water
- = Ditch
- = slope
- ☁ = Berm
- OB = Overhead Electric

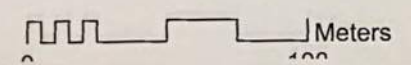




Grid UTM WGS 84 17N
Major ticks: 100m interval;

Malabar Road Ponds APE
Malabar Road Ponds Footprint

--- = Ditch
OE = Overhead Electric
== = Access Road
⊗ = Negative ST
⊙ = Positive ST
⊞ = Photo Point





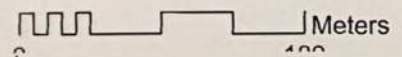
Grid UTM WGS 84 17N
Major ticks: 100m interval;

Malabar Road Ponds APE
Malabar Road Ponds Footprint

⊖ = Negative ST
● = Positive ST
↘ = slope

OE = overhead electric
CF = Culvert
PP = Photo Point

S = Sewer line
SW = Sidewalk
FOC = Fiber optic cable line





Grid UTM WGS 84 17N
Major ticks: 100m interval;

Malabar Road Ponds APE
 Malabar Road Ponds Footprint

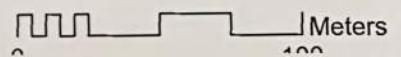
⊗ = Negative ST
 ● = Positive ST
 OE = Overhead Electric
 FOC = Fiber optic Cable Line
 SW = Sidewalk
 S = Sewer line
 CC = Culvert
 FH = Fire Hydrant





Grid UTM WGS 84 17N
Major ticks: 100m interval;

Malabar Road Ponds APE
 Malabar Road Ponds Footprint
⊗ = Negative ST
● = Positive ST
 Foc = Fiber optic cable
 OB = Overhead Electric
 = Photo Point
 --- = Fence



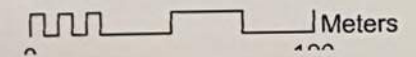


Grid UTM WGS 84 17N
Major ticks: 100m interval;

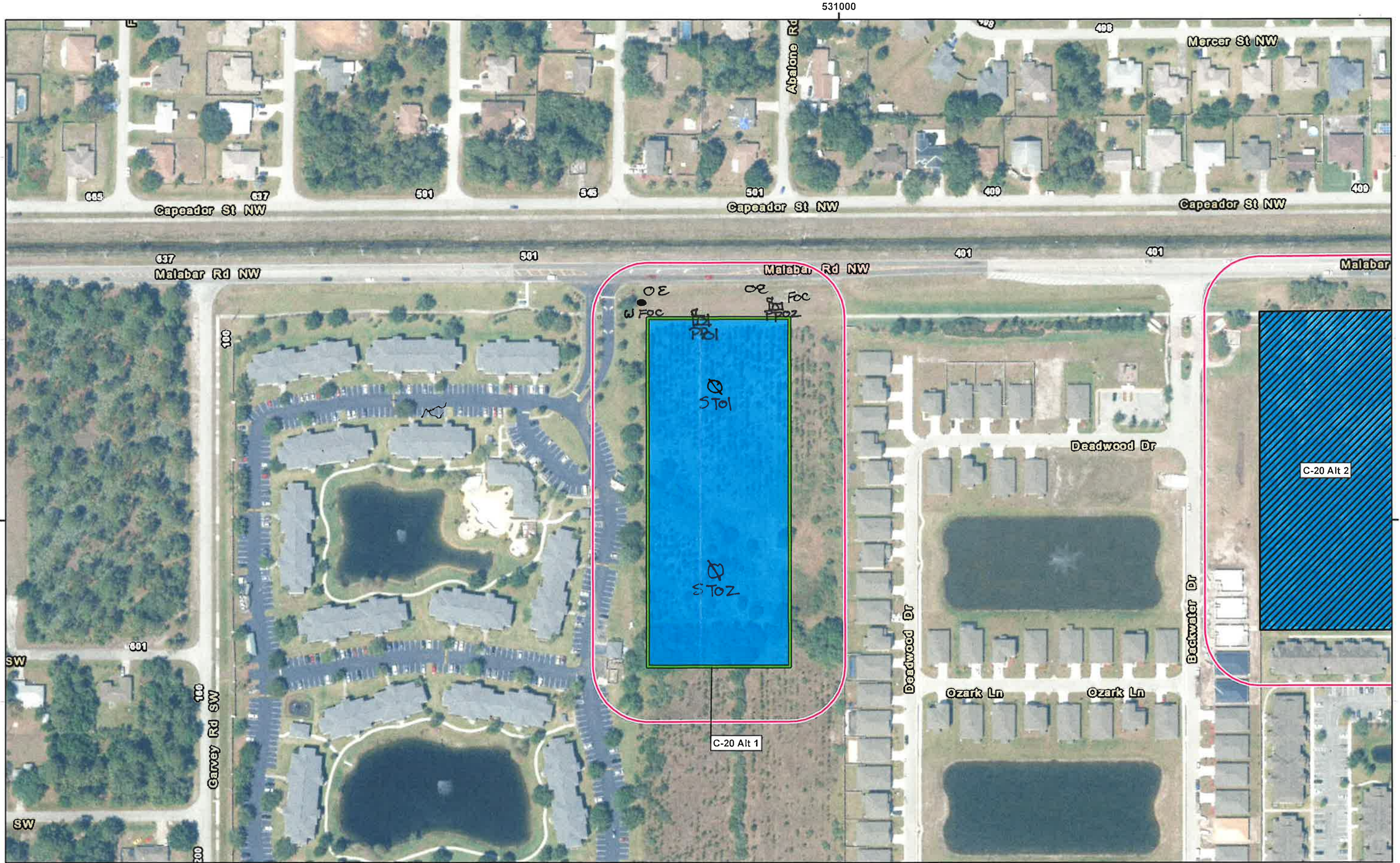
Malabar Road Ponds APE
 Malabar Road Ponds Footprint

X = Negative ST
 ● = Positive ST
 [] = Photo Point

OB = overhead electric
 IC = culvert
 Foc = Fiber optic Cable



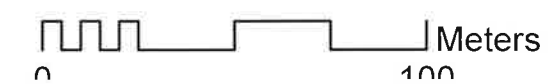
Project #T20003 - Malabar Road Ponds, Brevard County - Field Map - Overview



Grid UTM WGS 84 17N
 Major ticks: 500m interval;
 Minor ticks: 100m interval

- Malabar Road Ponds APE
- Poorly Drained Soil
- Previously Tested Footprint
- Newly Added Footprint

OE = overhead Electric
 W = water line
 ● = Manhole
 FOC = Fiber Optic Cable
 ⊗ = Negative
 [] = Shovel Test
 [] = Photo Point



ATTACHMENT B:
FMSF RESOURCE FORM



RESOURCE GROUP FORM
FLORIDA MASTER SITE FILE
Version 5.0 3/19

Site #8 BR04375
Field Date 4-26-2021
Form Date 4-30-2021
Recorder#

Original
Update

Consult the Guide to the Resource Group Form for additional instructions

NOTE: Use this form to document districts, landscapes, building complexes and linear resources as described in the box below. Cultural resources contributing to the Resource Group should also be documented individually at the Site File. Do not use this form for National Register multiple property submissions (MPSs). National Register MPSs are treated as Site File manuscripts and are associated with the individual resources included under the MPS cover using the Site File manuscript number.

Check ONE box that best describes the Resource Group:

- Historic district (NR category "district"): buildings and NR structures only: NO archaeological sites
Archaeological district (NR category "district"): archaeological sites only: NO buildings or NR structures
Mixed district (NR category "district"): includes more than one type of cultural resource (example: archaeological sites and buildings)
Building complex (NR category usually "building(s)": multiple buildings in close spatial and functional association
Designed historic landscape (NR category usually "district" or "site"): can include multiple resources (see National Register Bulletin #18, page 2 for more detailed definition and examples: e.g. parks, golf courses, campuses, resorts, etc.)
Rural historic landscape (NR category usually "district" or "site"): can include multiple resources and resources not formally designed (see National Register Bulletin #30, Guidelines for Evaluating and Documenting Rural Historic Landscapes for more detailed definition and examples: e.g. farmsteads, fish camps, lumber camps, traditional ceremonial sites, etc.)
Linear resource (NR category usually "structure"): Linear resources are a special type of structure or historic landscape and can include canals, railways, roads, etc.

Resource Group Name Melbourne-Tillman Canal No. 8 Multiple Listing [DHR only]
Project Name Malabar Road Ponds FMSF Survey #
National Register Category (please check one): building(s) structure district site object
Linear Resource Type (if applicable): canal railway road other (describe):
Ownership: private-profit private-nonprofit private-individual private-nonspecific city county state federal Native American foreign unknown

LOCATION & MAPPING

Address: Street Number Direction Street Name Street Type Suffix Direction
City/Town (within 3 miles) Palm Bay In Current City Limits? yes no unknown
County or Counties (do not abbreviate) Brevard
Name of Public Tract (e.g., park)
1) Township 29S Range 36E Section 4 1/4 section: NW SW SE NE Irregular-name:
2) Township Range Section 1/4 section: NW SW SE NE
3) Township Range Section 1/4 section: NW SW SE NE
4) Township Range Section 1/4 section: NW SW SE NE
USGS 7.5' Map(s) 1) Name FELLSMERE NW USGS Date 2021
2) Name USGS Date
Plat, Aerial, or Other Map (map's name, originating office with location)
Landgrant
Verbal Description of Boundaries (description does not replace required map)
Within the APE, 8BR04375 runs N-S for approx. 600.80 ft (183.12 m), beginning S of Malabar Rd and continuing S. It is 16.85 ft (5.13 m) wide.

Table with 3 columns: DHR USE ONLY, OFFICIAL EVALUATION, DHR USE ONLY. Rows include NR List Date, Owner Objection, SHPO - Appears to meet criteria for NR listing, KEEPER - Determined eligible, and NR Criteria for Evaluation.

HISTORY & DESCRIPTION

Construction Year: 1943 [] approximately [x] year listed or earlier [] year listed or later
Architect/Designer: Builder:
Total number of individual resources included in this Resource Group: # of contributing 0 # of non-contributing 1
Time period(s) of significance (choose a period from the list or type in date range(s), e.g. 1895-1925)
1. 3.
2. 4.

Narrative Description (National Register Bulletin 16A pp. 33-34; attach supplementary sheets if needed)
Resource 8BR04375 was constructed in 1943 or earlier as part of a network of dug-out drainage canals which drained the wetlands from St. Johns River to Turkey Creek. Today, it is largely dried up and runs beneath Malabar Rd via a non-historic culvert.

RESEARCH METHODS (check all that apply)

- [x] FMSF record search (sites/surveys) [] library research [] building permits [] Sanborn maps
[] FL State Archives/photo collection [] city directory [] occupant/owner interview [] plat maps
[x] property appraiser / tax records [] newspaper files [] neighbor interview [] Public Lands Survey (DEP)
[x] cultural resource survey [x] historic photos [] interior inspection [] HABS/HAER record search
[x] other methods (specify) Pedestrian/windshield survey

Bibliographic References (give FMSF Manuscript # if relevant)

OPINION OF RESOURCE SIGNIFICANCE

Potentially eligible individually for National Register of Historic Places? [] yes [x] no [] insufficient information
Potentially eligible as contributor to a National Register district? [] yes [x] no [] insufficient information
Explanation of Evaluation (required, see National Register Bulletin 16A p. 48-49. Attach longer statement, if needed, on separate sheet.)

Due to lack of sufficient historic significance and engineering distinction, 8BR04375 is ineligible for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.

Area(s) of Historical Significance (see National Register Bulletin 15, p. 8 for categories: e.g. "architecture", "ethnic heritage", "community planning & development", etc.)
1. 3. 5.
2. 4. 6.

DOCUMENTATION

Accessible Documentation Not Filed with the Site File - including field notes, analysis notes, photos, plans and other important documents
1) Document type All materials at one location Maintaining organization Southeastern Archaeological Research
Document description Photos, Maps, Field Notes, Aerial File or accession #'s T20003
2) Document type Maintaining organization
Document description File or accession #'s

RECORDER INFORMATION

Recorder Name Guerrieri, Kelly Affiliation Southeastern Archaeological Research
Recorder Contact Information 3117 Edgewater Dr., Orlando, FL 32804/4072367711/4076032425/kelly.guerrieri@
(address / phone / fax / e-mail)

Required Attachments
1 PHOTOCOPY OF USGS 7.5' MAP WITH DISTRICT BOUNDARY CLEARLY MARKED
2 LARGE SCALE STREET, PLAT OR PARCEL MAP WITH RESOURCES MAPPED & LABELED
3 TABULATION OF ALL INCLUDED RESOURCES - Include name, FMSF #, contributing? Y/N, resource category, street address or other location information if no address.
4 PHOTOS OF GENERAL STREETScape OR VIEWS (Optional: aerial photos, views of typical resources) When submitting images, they must be included in digital AND hard copy format (plain paper grayscale acceptable). Digital images must be at least 1600 x 1200 pixels, 24-bit color, jpeg or tiff.



8BR04375_a Facing North



8BR04375_b Facing Northeast



8BR04375_c Facing South



8BR04375_d Facing Northwest



8BR04375_e Facing South

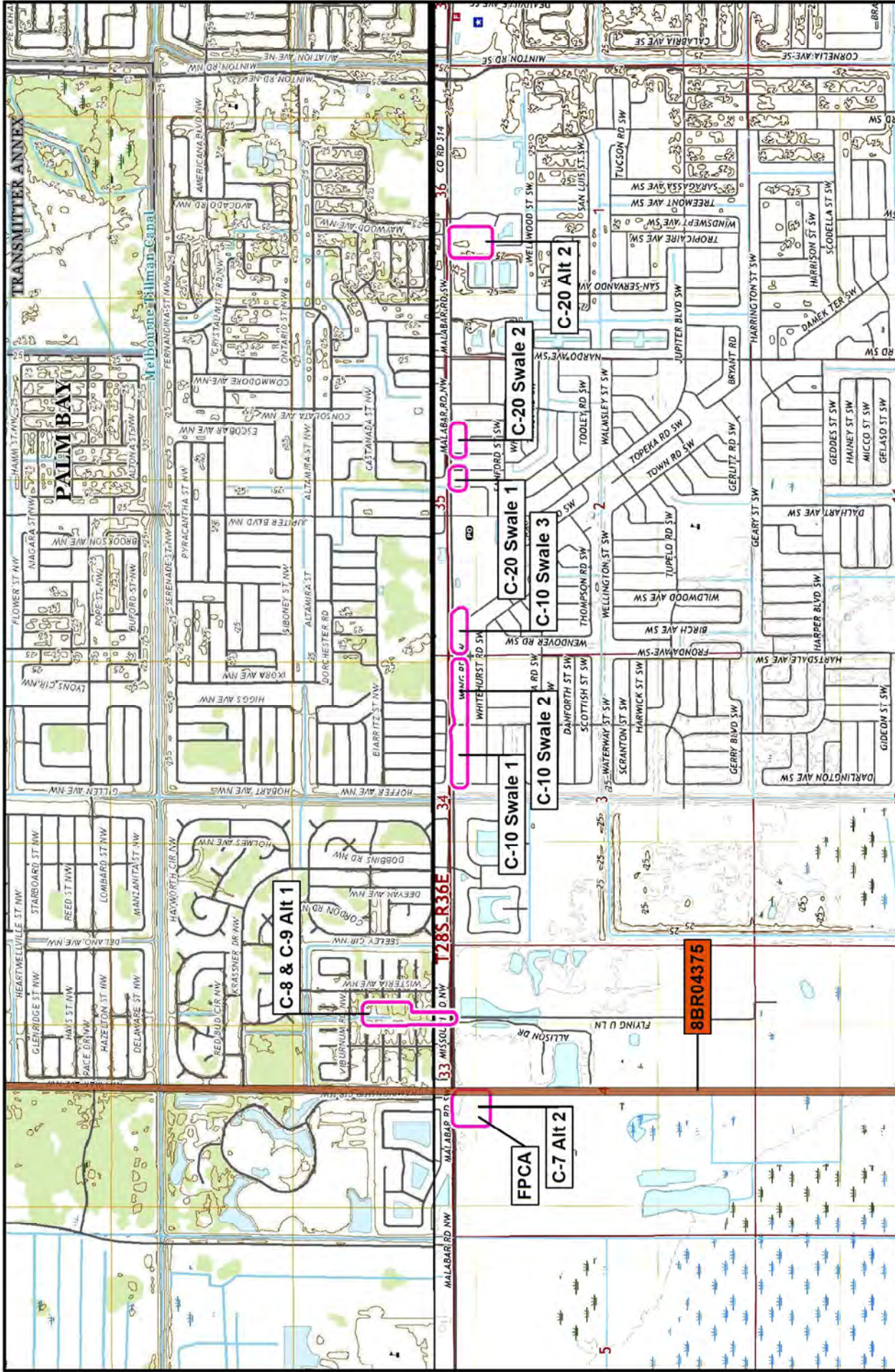


0 100 200
Meters Feet

USDA-FSA-APFO Orthophoto Mosaic (2019)
N

Malabar Road Ponds APE Newly Recorded Linear Resource

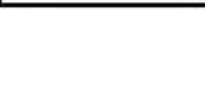




Malabar Road Ponds APE
 Newly Recorded Linear Resource

USGS 7.5' Quadrangle Maps -
 Melbourne West (2018) and
 Fellsmere NW (2018)

0 500 2,000 Feet
 0 500 Meters



ATTACHMENT C:

FDHR SURVEY LOG SHEET

Ent D (FMSF only) _____



Survey Log Sheet

Florida Master Site File
Version 5.0 3/19

Survey # (FMSF only) _____

Consult *Guide to the Survey Log Sheet* for detailed instructions.

Manuscript Information

Survey Project (name and project phase)

Malabar Road Ponds CRAS Addendum

Report Title (exactly as on title page)

Technical Memorandum: Cultural Resource Assessment Survey in Support of Malabar Road Improvements Ponds, Brevard County, Florida

Report Authors (as on title page)

1. Jessica Fish3. Dave Boschi2. Mikel Travisano4. Kelly GuerrieriPublication Year 2021Number of Pages in Report (do not include site forms) 34

Publication Information (Give series, number in series, publisher and city. For article or chapter, cite page numbers. Use the style of *American Antiquity*.)

Report on file at SEARCH, Newberry, Florida. SEARCH Project No. T20003. Financial Management No. 437210-1.

Supervisors of Fieldwork (even if same as author) Names Jessica Fish

Affiliation of Fieldworkers: Organization Southeastern Archaeological Research City Orlando

Key Words/Phrases (Don't use county name, or common words like *archaeology, structure, survey, architecture, etc.*)

1. Malabar Road 3. _____ 5. _____ 7. _____
2. Ponds 4. _____ 6. _____ 8. _____

Survey Sponsors (corporation, government unit, organization, or person funding fieldwork)

Name Kittleson and Associates

Organization _____

Address/Phone/E-mail _____

Recorder of Log Sheet Dave BoschiDate Log Sheet Completed 6-1-2021

Is this survey or project a continuation of a previous project? No Yes: Previous survey #s (FMSF only) TBD

Project Area Mapping

Counties (select every county in which field survey was done; attach additional sheet if necessary)

1. Brevard 3. _____ 5. _____
2. _____ 4. _____ 6. _____

USGS 1:24,000 Map Names/Year of Latest Revision (attach additional sheet if necessary)

1. Name MELBOURNE WEST Year 1971 4. Name _____ Year _____
2. Name FELLSMERE NW Year 1971 5. Name _____ Year _____
3. Name _____ Year _____ 6. Name _____ Year _____

Field Dates and Project Area Description

Fieldwork Dates: Start 4-22-2021 End 10-8-2021 Total Area Surveyed (fill in one) _____ hectares 52.42 acres

Number of Distinct Tracts or Areas Surveyed 10

If Corridor (fill in one for each) Width: _____ meters _____ feet Length: _____ kilometers _____ miles

Research and Field Methods

Types of Survey (select all that apply): archaeological architectural historical/archival underwater
damage assessment monitoring report other(describe): _____

Scope/Intensity/Procedures

Shovel testing conducting at low-moderate probability and recording structures 45 years or older

Preliminary Methods (select as many as apply to the project as a whole)

Florida Archives (Gray Building) library research- local public local property or tax records other historic maps LIDAR
Florida Photo Archives (Gray Building) library-special collection newspaper files soils maps or data other remote sensing
Site File property search Public Lands Survey (maps at DEP) literature search windshield survey
Site File survey search local informant(s) Sanborn Insurance maps aerial photography
other (describe): _____

Archaeological Methods (select as many as apply to the project as a whole)

Check here if NO archaeological methods were used.
surface collection, controlled shovel test-other screen size block excavation (at least 2x2 m) metal detector
surface collection, uncontrolled water screen soil resistivity other remote sensing
shovel test-1/4" screen posthole tests magnetometer pedestrian survey
shovel test-1/8" screen auger tests side scan sonar unknown
shovel test 1/16" screen coring ground penetrating radar (GPR)
shovel test-unscreened test excavation (at least 1x2 m) LIDAR
other (describe): _____

Historical/Architectural Methods (select as many as apply to the project as a whole)

Check here if NO historical/architectural methods were used.
building permits demolition permits neighbor interview subdivision maps
commercial permits windshield survey occupant interview tax records
interior documentation local property records occupation permits unknown
other (describe): pedestrian survey

Survey Results

Resource Significance Evaluated? Yes No

Count of Previously Recorded Resources 1 Count of Newly Recorded Resources 0

List Previously Recorded Site ID#s with Site File Forms Completed (attach additional pages if necessary)

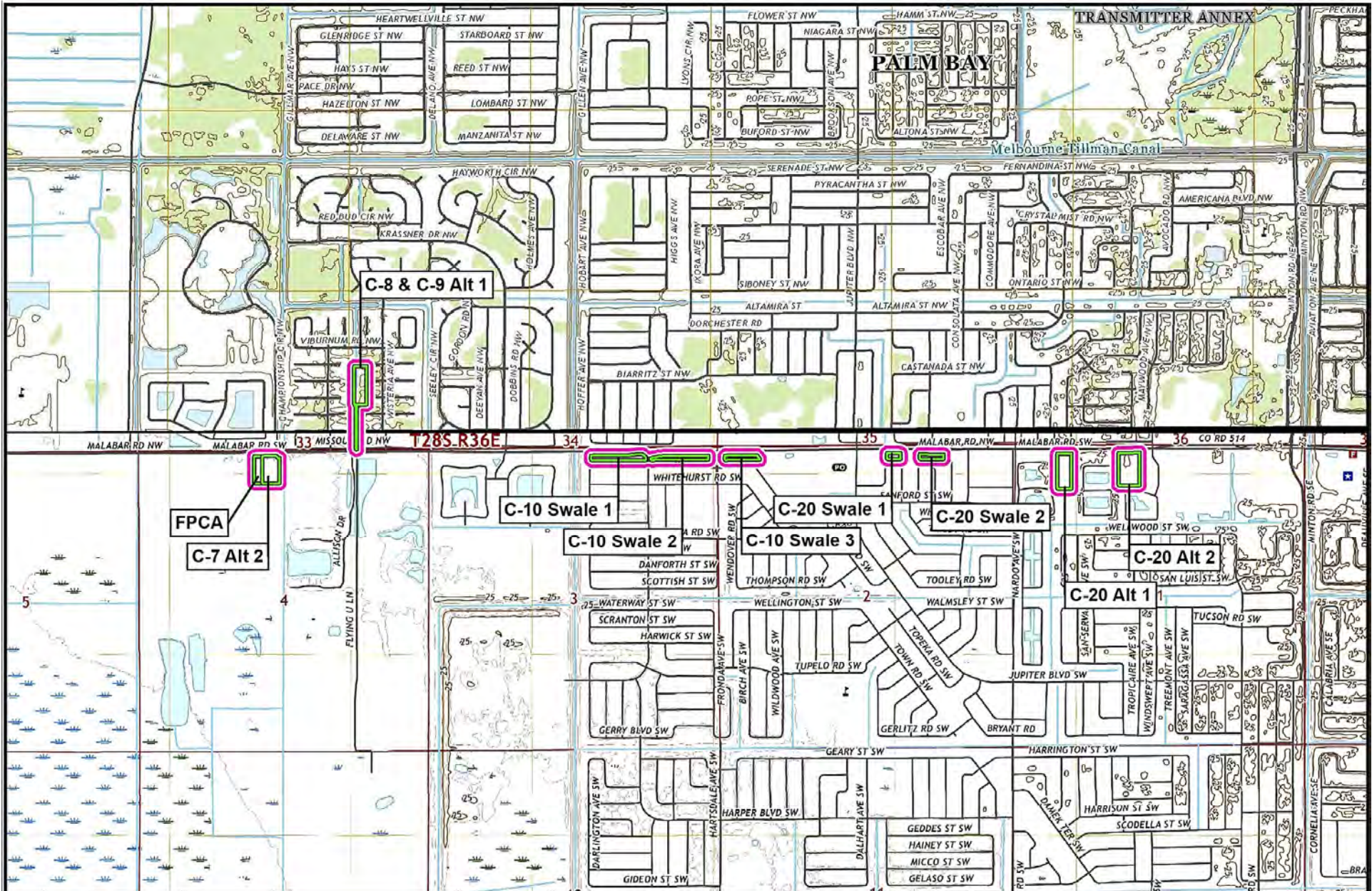
BR04375

List Newly Recorded Site ID#s (attach additional pages if necessary)

Site Forms Used: Site File Paper Forms Site File PDF Forms

REQUIRED: Attach Map of Survey or Project Area Boundary

SHPO USE ONLY SHPO USE ONLY SHPO USE ONLY
Origin of Report: 872 Public Lands UW 1A32 # _____ Academic Contract Avocational
Grant Project # _____ Compliance Review: CRAT # _____
Type of Document: Archaeological Survey Historical/Architectural Survey Marine Survey Cell Tower CRAS Monitoring Report
Overview Excavation Report Multi-Site Excavation Report Structure Detailed Report Library, Hist. or Archival Doc
Desktop Analysis MPS MRA TG Other: _____
Document Destination: Plottable Projects Plotability: _____



- Malabar Road Ponds APE
- Malabar Road Ponds Archaeological APE



USGS 7.5' Quadrangle Maps -
 Melbourne West (2018) and
 Fellsmere NW (2018)



**CULTURAL RESOURCE ASSESSMENT SURVEY ADDENDUM
IN SUPPORT OF THE MALABAR ROAD POND C-7 ALT 3
BREVARD COUNTY, FLORIDA**

**FINANCIAL MANAGEMENT No. 437210-1
SEARCH PROJECT No. T20003**

PREPARED FOR

**KITTELSON & ASSOCIATES
AND
THE CITY OF PALM BAY, FLORIDA**

BY

SEARCH

JUNE 2023

THE ENVIRONMENTAL REVIEW, CONSULTATION, AND OTHER ACTIONS REQUIRED BY APPLICABLE FEDERAL ENVIRONMENTAL LAWS FOR THIS PROJECT ARE BEING, OR HAVE BEEN, CARRIED OUT BY THE FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT) PURSUANT TO 23 U.S.C. §327 AND A MEMORANDUM OF UNDERSTANDING DATED MAY 26, 2022, AND EXECUTED BY THE FEDERAL HIGHWAY ADMINISTRATION (FHWA) AND FDOT.

**CULTURAL RESOURCE ASSESSMENT SURVEY ADDENDUM
IN SUPPORT OF THE MALABAR ROAD POND C-7 ALT 3
BREVARD COUNTY, FLORIDA**

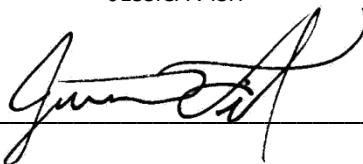
**FINANCIAL MANAGEMENT No. 437210-1
SEARCH PROJECT No. T20003**

PREPARED FOR

**KITTELSON & ASSOCIATES
AND
THE CITY OF PALM BAY, FLORIDA**

PREPARED BY

**SEARCH
JESSICA FISH**

A handwritten signature in black ink, appearing to read 'Jessica Fish', is written over a horizontal line.

**JESSICA FISH, MST, RPA
PRINCIPAL INVESTIGATOR, ARCHAEOLOGY**

WWW.SEARCHINC.COM

JUNE 2023

EXECUTIVE SUMMARY

This report presents the findings of a Phase I cultural resource assessment survey addendum conducted in support of the proposed C-7 Alt 3 pond location in Brevard County, Florida, which is associated with improvements to Malabar Road. The City of Palm Bay, Florida, is proposing to widen Malabar Road from Minton Road to east of St. Johns Heritage Parkway in Brevard County, Florida, and to construct associated ponds, swales, and floodplain compensation areas. The current report is an addendum to the 2021 SEARCH surveys titled *Cultural Resource Assessment Survey for the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida* (Florida Master Site File Survey No. 28025, Boschi et al. 2021) and *Technical Memorandum: Cultural Resource Assessment Survey in Support of Malabar Road Improvements Ponds, Brevard County, Florida* (Florida Master Site File Survey No. 28024, Fish et al. 2021). The current survey was limited to the relocated footprint of Pond C-7 Alt 3, along with an associated easement and floodplain compensation area. For the current survey, SEARCH tested 2.23 hectares (5.52 acres) total. The discussions of regional context, historic map review, research design, and laboratory methods provided in the previous report apply to the current cultural resource assessment survey and are not repeated in this report (Boschi et al. 2021). The City of Palm Bay is conducting this Local Area Program project using federal funds administered by the Florida Department of Transportation, District 5.

To encompass potential improvements, the area of potential effects (APE) was defined to include the proposed C-7 Alt 3 pond, easement, and floodplain compensation area footprint. A 30.5-meter (100-foot) buffer was used to evaluate the potential to affect any adjacent historic buildings or structures. SEARCH conducted the archaeological survey within the proposed construction footprint.

The archaeological survey consisted of the excavation of nine shovel tests. No artifacts or archaeological sites or occurrences were identified within the APE. SEARCH recommends no further archaeological survey in support of the proposed Malabar Road improvements.

No historic buildings or structures are within or adjacent to the area of potential effects. SEARCH conducted no architectural survey for the current survey and recommends no further architectural work.

No NRHP-listed or -eligible cultural resources were identified within the project APE. No further cultural resources work is recommended.

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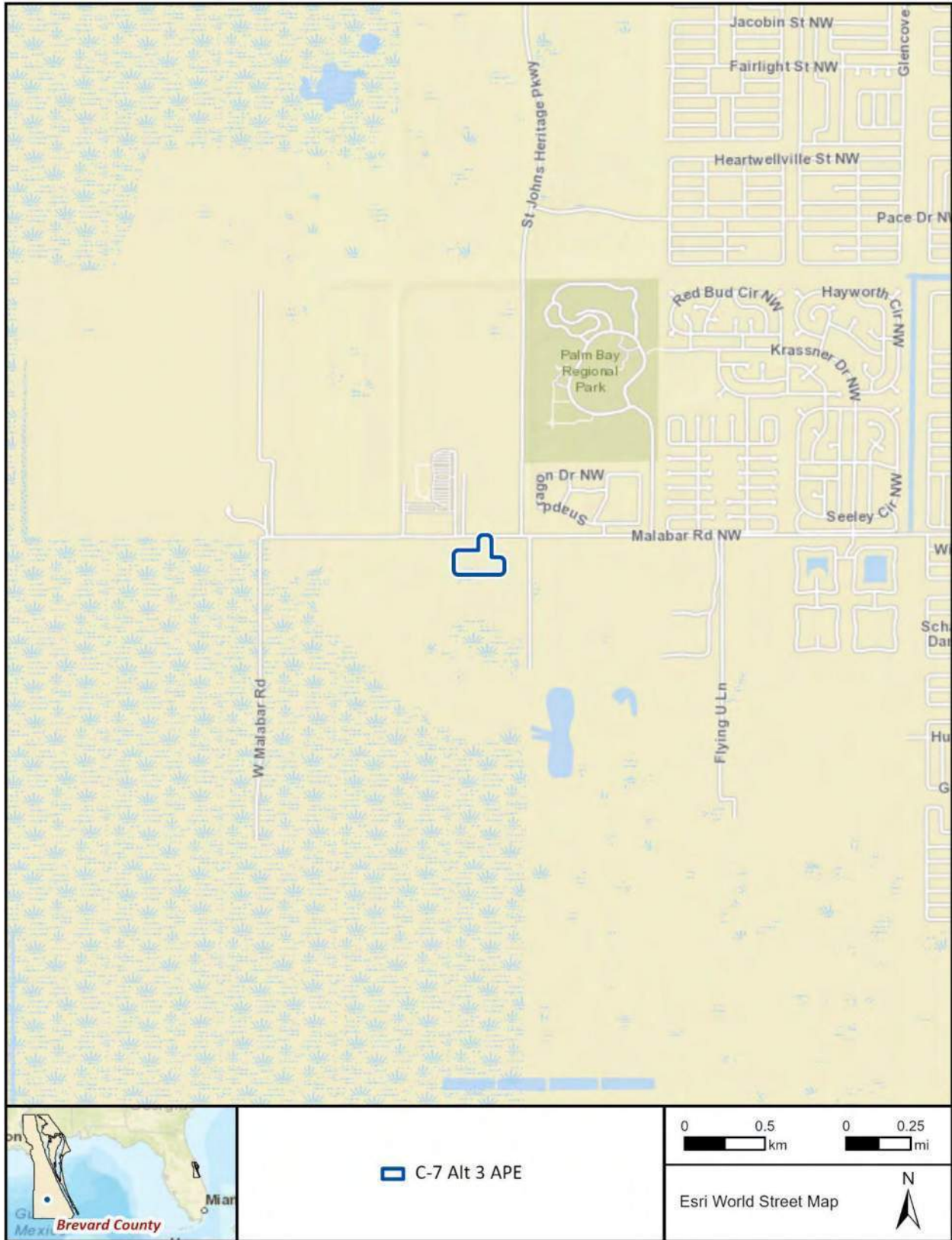
INTRODUCTION

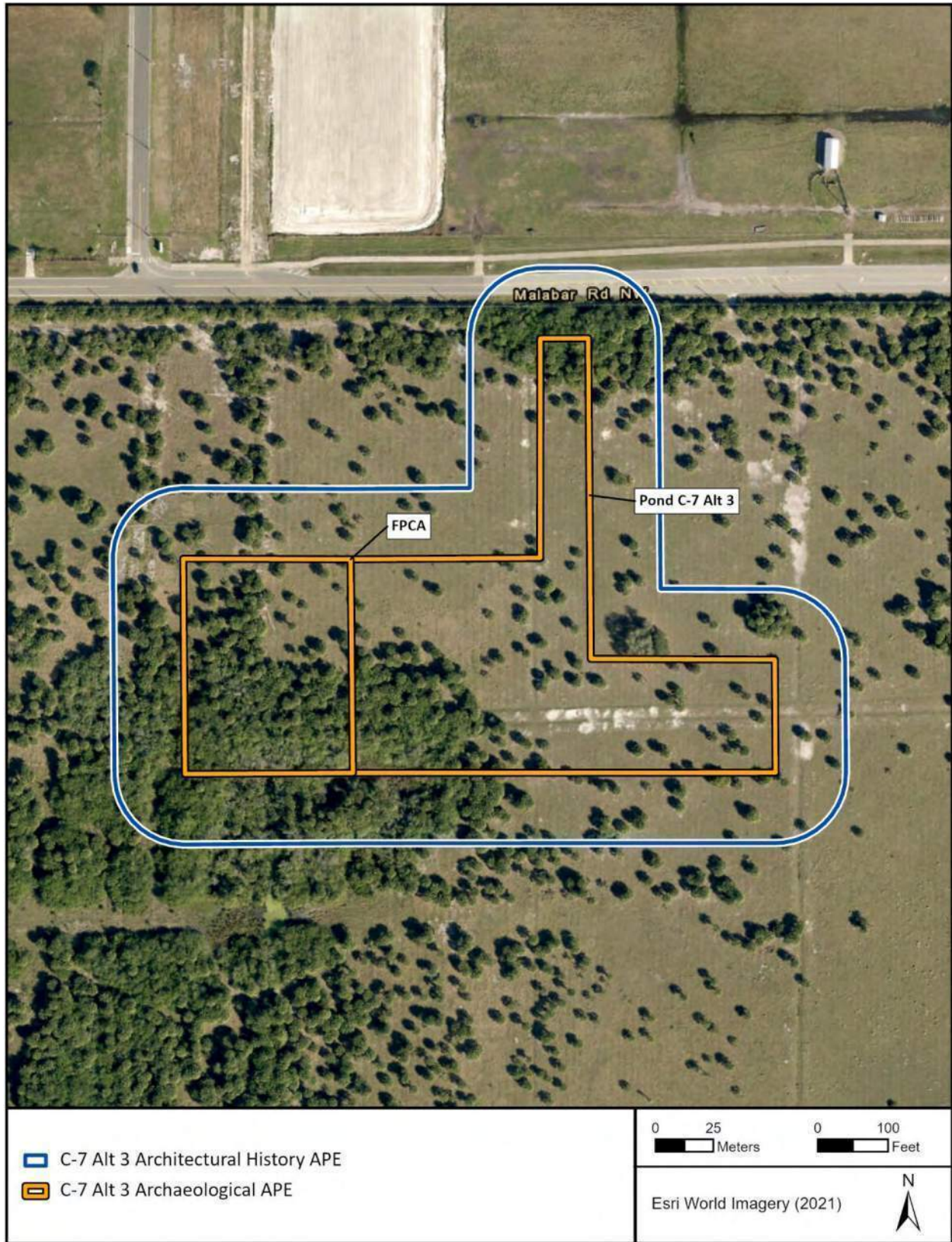
This report presents the findings of a Phase I cultural resource assessment survey (CRAS) addendum conducted in support of the proposed pond C-7 Alt 3 location in Brevard County, Florida, which is associated with improvements to Malabar Road (**Figure 1**). The City of Palm Bay, Florida, is proposing to widen Malabar Road from Minton Road to east of St. Johns Heritage Parkway in Brevard County, Florida, and to construct associated ponds, swales, and floodplain compensation areas. The current report is an addendum to the 2021 SEARCH surveys titled *Cultural Resource Assessment Survey for the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida* (Florida Master Site File [FMSF] Survey No. 28025) and *Technical Memorandum: Cultural Resource Assessment Survey in Support of Malabar Road Improvements Ponds, Brevard County, Florida* (FMSF Survey No. 28024). The current survey was limited to the relocated footprint of Pond C-7 Alt 3, along with an associated easement and floodplain compensation area (FPCA). For the current survey, SEARCH tested 2.23 hectares (ha) (5.52 acres [ac]) total. The discussions of regional context, research design, and laboratory methods provided in the previous report apply to the current CRAS and are not repeated in this report. The City of Palm Bay is conducting this Local Area Program project using federal funds administered by the Florida Department of Transportation (FDOT), District 5.

The project's area of potential effects (APE) was developed to consider visual, audible, and atmospheric effects the project may have on historic resources. The APE was defined to include the proposed C-7 Alt 3 pond, easement, and FPCA footprint (**Figure 2**). A 30.5-meter (m) (100-foot [ft]) buffer was used to evaluate the potential to affect any adjacent historic buildings or structures. SEARCH conducted the archaeological survey within the proposed construction footprint.

The purpose of the survey was to locate, identify, and bound archaeological resources, historic buildings or structures, and potential historic districts within the project's APE and assess their potential for listing in the National Register of Historic Places (NRHP). SEARCH conducted this study to comply with Public Law 113-287 (Title 54 US Code), which incorporates the provisions of the National Historic Preservation Act of 1966, as amended, and the Archeological and Historic Preservation Act of 1974, as amended. The study also meets the regulations for implementing National Historic Preservation Act Section 106 found in 36 Code of Federal Regulations Part 800 (*Protection of Historic Properties*). This study also complies with Chapter 267 of the Florida Statutes and Rule Chapter 1A-46, Florida Administrative Code. SEARCH performed all work in accordance with Part 2, Chapter 8, of the FDOT's Project Development & Environment Manual (revised July 2020) and the Florida Division of Historical Resources' (FDHR) recommendations for such projects as stipulated in the FDHR's *Cultural Resource Management Standards & Operations Manual, Module Three: Guidelines for Use by Historic Preservation Professionals*. The principal investigator for this project meets the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Federal Register 44716-42).

Jessica Fish MSt, RPA, served as the principal investigator. Ms. Fish wrote the report. Kaleb Wells, BA, and Brianna Jean-Baptiste, BA, conducted the fieldwork. Angelica Costa, BA, produced the field maps and report figures. Varna Boyd, MA, RPA, conducted the quality-control review, and Charles Sterchi, MFA, edited and produced the document.





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PROJECT LOCATION AND ENVIRONMENT

LOCATION AND MODERN CONDITIONS

The current project area is south of Malabar Road in the City of Palm Bay, Brevard County, Florida, within Section 5 of Township 29 South, Range 36 East. The APE is on a partially forested parcel northeast of a small natural pond. Elevation is flat and 5.5 m (18 ft) above mean sea level throughout the APE.

Geologically, the APE is within the St. Johns Marsh province, a part of the larger Eastern Flatwoods District (Brooks 1981). This area is characterized by marshes and grass prairies with seasonal flooding. Soils within the APE consist of poorly drained Eaugallie sand (**Figure 3**). There are many man-made ponds and canals in the vicinity, and the St. Johns River is 3.2 kilometers (2.0 miles) southwest of the proposed pond location.



BACKGROUND RESEARCH

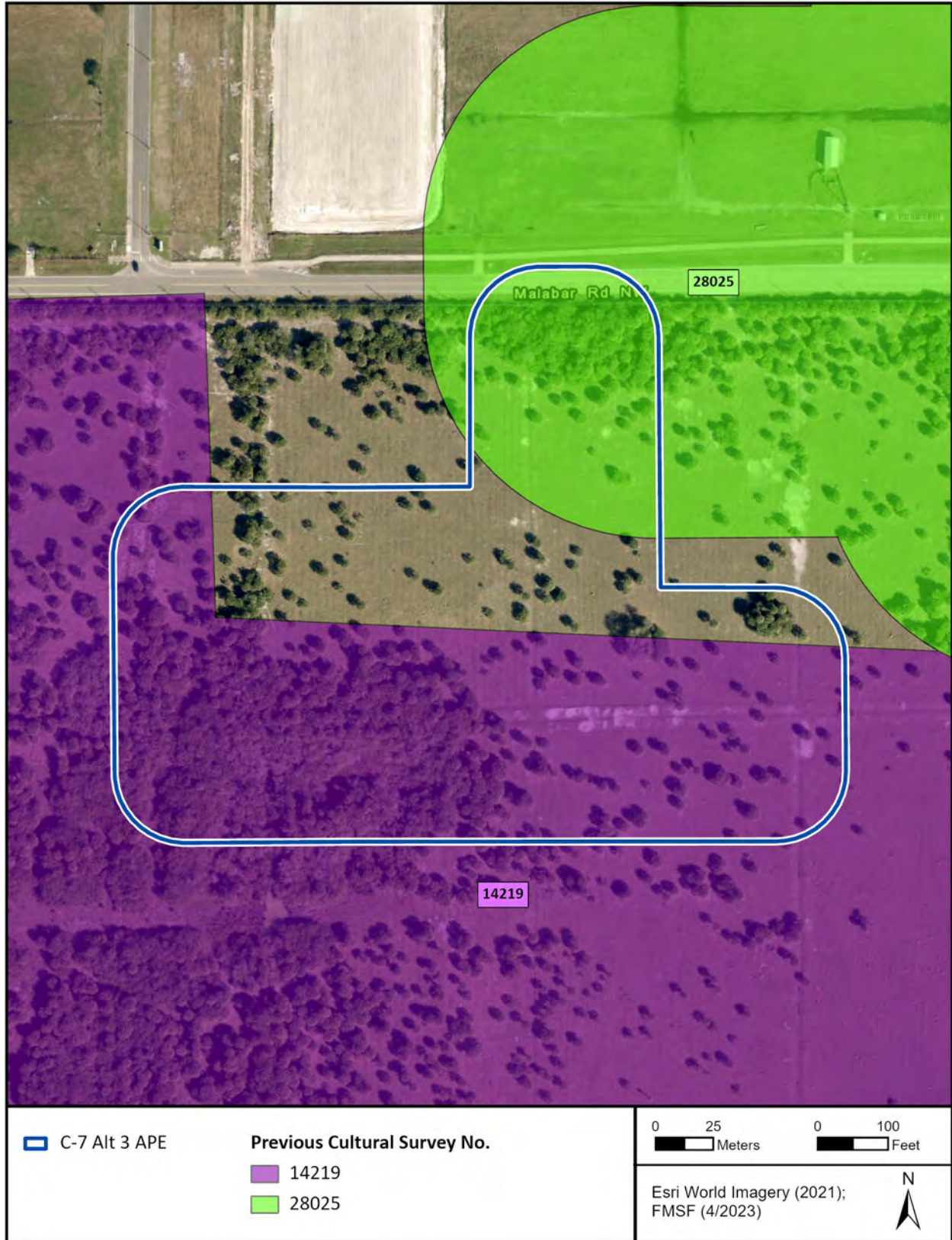
FLORIDA MASTER SITE FILE REVIEW

SEARCH reviewed FMSF data from April 2023 to identify previously recorded cultural resources within the APE. The FMSF review indicates that two previous cultural resource surveys have been conducted within the APE (**Table 1; Figure 4**). FMSF Survey No. 28025 is the 2021 CRAS for which this survey is an addendum (Boschi et al. 2021). The survey consisted of systematic survey of the Malabar Road project corridor according to current Module Three standards. No shovel tests associated with this study fall within the current APE. FMSF Survey No. 14219 is a 2006 study completed by SEARCH for a proposed development (Endonino 2006). This survey also did not include testing within the current APE.

Table 1. Cultural Resource Surveys within the Pond C-7 Alt 3 APE.

FMSF No.	Title	Year	Author/Consultant
14219	<i>A Phase I Cultural Resource Survey of the Lennar South Development Property, Brevard County, Florida.</i>	2006	Endonino, Jon
28025	<i>Cultural Resource Assessment Survey of the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida.</i>	2021	Boschi et al.

The FMSF review also indicates that no cultural resources have been recorded within the current project APE (see **Figure 4**). The nearest resources are an unevaluated precontact shell midden (8BR00024) located on the north side of Malabar Road, approximately 200 m (700 ft) north of the APE, and the Melbourne-Tillman Canal No. 7 (8BR04374), which is approximately 150 m (500 ft) east of the APE and has been recommended ineligible for the NRHP by the State Historic Preservation Officer.



NRHP CRITERIA

As defined by the National Park Service, the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- A. that are associated with events or activities that have made a significant contribution to the broad patterns of our history; or
- B. that are associated with the lives of persons significant in our past; or
- C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. that have yielded, or may be likely to yield, information important in prehistory or history.

NRHP-eligible districts must possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. NRHP-eligible districts and buildings must also possess historic significance, historic integrity, and historical context.

CULTURAL RESOURCE POTENTIAL

Based on an examination of environmental variables (soil drainage, access to wetlands and marine resources, and relative elevation) and the results of previously conducted surveys (FMSF Survey No. 28025, Boschi et al. 2021), the potential for precontact archaeological sites was moderate to low. Based on the results of the FMSF review and the previously conducted historic map review of the original survey, SEARCH judged the APE to have a low potential for historic archaeological sites and historic buildings or structures.

SURVEY METHODS

Archaeological Field Methods

The Phase I field survey consisted of systematic shovel testing consistent with the low archaeological potential. Shovel tests were excavated at 50 and 100 m (164 and 328 ft) intervals, supplemented by pedestrian survey. Shovel tests measured approximately 50 centimeters (cm) (19.7 inches [in]) in diameter and were excavated to a minimum depth of 100 cm (39.4 in) below surface, subsurface conditions permitting. Excavated sediments were screened through 6.4-millimeter (0.25 in) mesh hardware cloth. The location of each shovel test was marked on an

aerial photograph and recorded with a Wide Area Augmentation System-enabled handheld GPS unit.

Architectural Field Methods

SEARCH included an architectural survey in the original 2021 survey (FMSF Survey No. 28025, Boschi et al. 2021). Due to the negative results of the previous survey and absence of historic resources (recorded or unrecorded) in proximity to proposed pond C-7 Alt 3, SEARCH did not conduct an architectural survey as a part of the current survey.

Curation

The original maps and field notes are housed at SEARCH's Newberry office. The original maps and field notes will be turned over to the City of Palm Bay upon project completion; SEARCH will retain copies.

Procedures to Deal with Unexpected Discoveries

Every reasonable effort has been made during this investigation to identify and evaluate possible locations of Native American and historic archaeological sites; however, the possibility exists that evidence of cultural resources may yet be encountered within the project limits. Should any evidence of unrecorded cultural resources be discovered during construction activities, all work in that portion of the project area must stop. Evidence of cultural resources includes precontact or historic pottery, stone tools, bone or shell tools, historic trash pits, and historic building foundations. Should potential cultural artifacts or features be uncovered during the excavation of the project area, representatives of FDOT, District 5, will assist in the identification and preliminary assessment of the resources. If such evidence is found, the FDHR will be notified within two working days.

In the unlikely event that human skeletal remains or associated burial artifacts are uncovered within the project area, all work in that area must stop. The FDOT, District 5, cultural resources coordinator must be contacted. The discovery must be reported to local law enforcement, who will in turn contact the medical examiner. The medical examiner will determine whether the state archaeologist should be contacted per the requirements of Chapter 872.05, Florida Statutes.

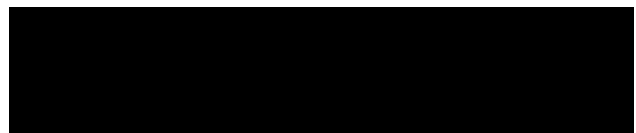
RESULTS

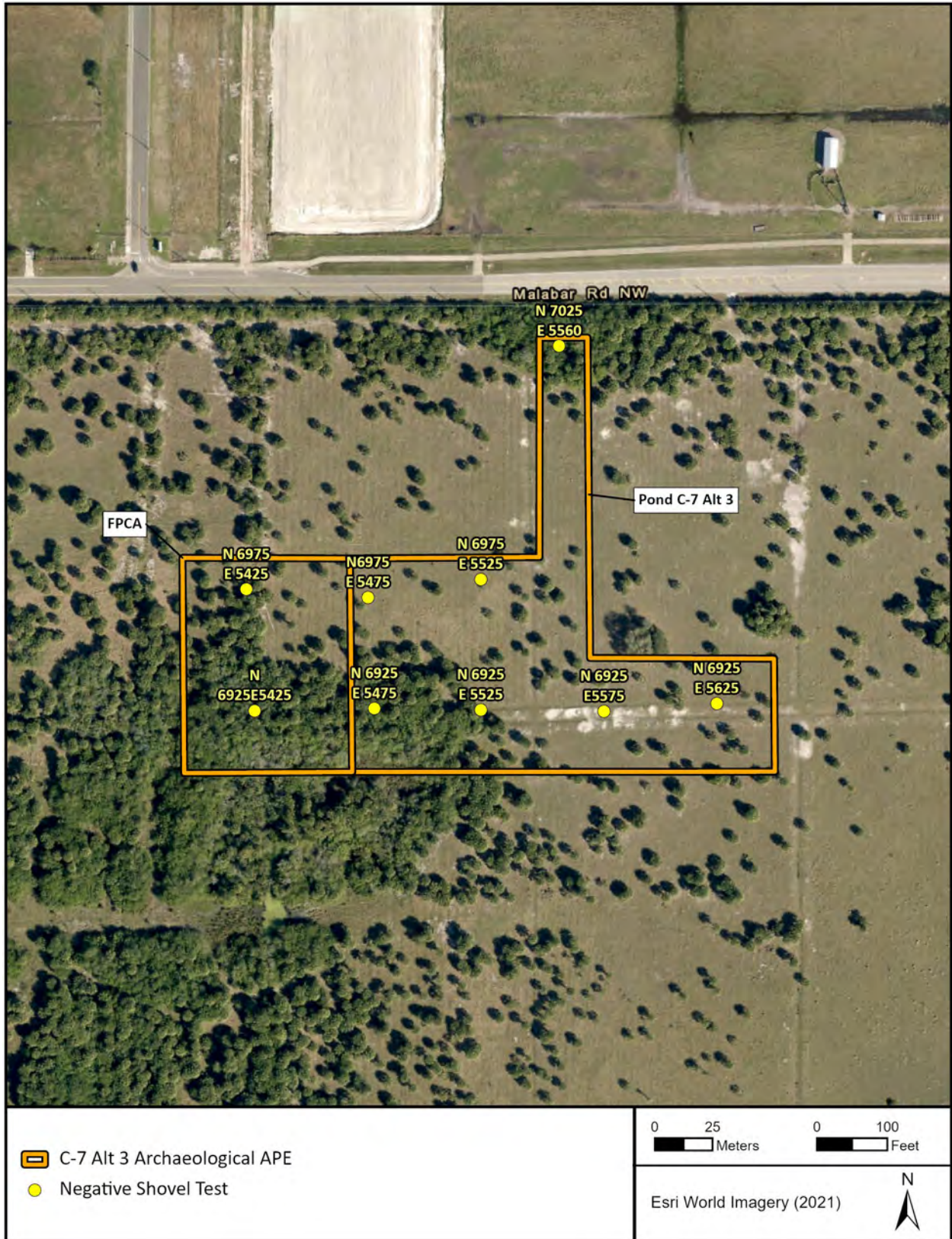
ARCHAEOLOGICAL SURVEY

The APE includes 2.23 ha (5.52 ac) of undeveloped property in an area of open field and forest along the south side of Malabar Road. Soils are recorded as poorly drained, and a small pond or wetland is near the southwest corner of the project (**Figure 5**). Marked field maps are included in **Appendix A**. An FDHR Survey Log is included in **Appendix B**.

Nine shovel tests were excavated (**Figure 6**); none contained artifacts. Natural soil stratigraphy consisted of dark grayish brown (10YR 4/2) sand from approximately 0 to 30 cm below surface (cmbs; 0 to 11.8 in below surface [inbs], Stratum I), very pale brown or gray (10YR 7/3 or 10YR 6/1) sand from approximately 30 to 45 cmbs (11.8 to 17.7 inbs, Stratum II), very pale brown (10YR 7/3 or 10YR 7/4) sand from approximately 45 to 70 cmbs (17.7 to 27.6 inbs, Stratum III), and terminated in brown (10YR 4/3) wet sand or sandy clay at 100 cmbs (39.3 inbs, Stratum IV) (see **Figure 5**). Spodic soils reflected the naturally wet conditions of this area.

No archaeological sites or archaeological occurrences were identified.





CONCLUSION AND RECOMMENDATIONS

This report presents the findings of a Phase I CRAS addendum conducted in support of the proposed C-7 Alt 3 pond location in Brevard County, Florida, which is associated with improvements to Malabar Road. The City of Palm Bay, Florida, is proposing to widen Malabar Road from Minton Road to east of St. Johns Heritage Parkway in Brevard County, Florida, and construct associated ponds, swales, and floodplain compensation areas. The current report is an addendum to the 2021 SEARCH surveys titled *Cultural Resource Assessment Survey for the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida* (FMSF Survey No. 28025) and *Technical Memorandum: Cultural Resource Assessment Survey in Support of Malabar Road Improvements Ponds, Brevard County, Florida* (FMSF Survey No. 28024). The current survey was limited to the relocated footprint of Pond C-7 Alt 3. For the current survey, SEARCH tested a total of 2.23 ha (5.52 ac). The City of Palm Bay is conducting this Local Area Program project using federal funds administered by the FDOT, District 5.

The archaeological survey consisted of the excavation of nine shovel tests. No artifacts or archaeological sites or occurrences were identified. SEARCH recommends no further archaeological survey in support of the proposed Malabar Road improvements.

No architectural survey was conducted as part of the current survey because no existing or potential historic resources were identified in the vicinity. SEARCH recommends no further architectural history survey.

No NRHP-listed or -eligible cultural resources were identified within the project APE. No further cultural resources work is recommended.

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REFERENCES CITED

Boschi, Dave, Kelly Guerrieri, Allen Kent, Jessica Fish, and Mikel Travisano

2021 *Cultural Resource Assessment Survey of the Malabar Road Improvements Project Development and Environment Study, Brevard County, Florida*. Florida Master Site File Survey No. 28025. On file, Florida Division of Historical Resources, Tallahassee.

Brooks, H. K.

1981 *Guide to the Physiographic Divisions of Florida*. Florida Cooperative Extension Service. University of Florida, Gainesville.

Endonino, Jon

2006 *A Phase I Cultural Resource Survey of the Lennar South Development Property, Brevard County, Florida*. Florida Master Site File Survey No. 14219. On file, Florida Division of Historical Resources, Tallahassee.

Fish, Jessica, Mikel Travisano, Dave Boschi, and Kelly Guerrieri

2021 *Technical Memorandum: Cultural Resource Assessment Survey in Support of Malabar Road Improvements Ponds, Brevard County, Florida*. Florida Master Site File Survey No. 28024. On file, Florida Division of Historical Resources, Tallahassee.

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APPENDIX A.

MARKED FIELD MAPS

Project #T20003 - Pond C-7 Alt 3 Addendum, Brevard County - Field Map

525200 525300 525400 525500 525600 525700 525800 525900



Grid UTM WGS 84 17N
Major ticks: 100m Interval;
Minor ticks: 10m Interval

- C-7 Alt 3 APE
- Preplotted Shovel Test
- Moderate Probability
- Low Probability
- Wetland
- negative Shovel Test
- Photo Point



APPENDIX B.

FDHR SURVEY LOG SHEET

Ent D (FMSF only) _____



Survey Log Sheet

Florida Master Site File
Version 4.1 1/07

Survey # (FMSF only) _____

Consult *Guide to the Survey Log Sheet* for detailed instructions.

Identification and Bibliographic Information

Survey Project (name and project phase) Phase I CRAS Addendum for the Malabar Road Pond C-7 Alt 3, Brevard County, Florida

Report Title (exactly as on title page) Cultural Resource Assessment Survey Addendum in Support of the Malabar Road Pond C-7 Alt 3, Brevard County, Florida

Report Authors (as on title page, last names first) 1. Fish, Jessica 3. _____
2. _____ 4. _____

Publication Date (year) 2032 Total Number of Pages in Report (count text, figures, tables, not site forms) 16

Publication Information (Give series, number in series, publisher and city. For article or chapter, cite page numbers. Use the style of *American Antiquity*.)
Financial Management No. 437210-1; SEARCH Project No. T20003

Supervisors of Fieldwork (even if same as author) Names Jessica Fish

Affiliation of Fieldworkers: Organization Southeastern Archaeological Research City Orlando, Florida

Key Words/Phrases (Don't use county name, or common words like *archaeology, structure, survey, architecture, etc.*)

1. Pond 3. _____ 5. _____ 7. _____
2. Malabar Road 4. _____ 6. _____ 8. _____

Survey Sponsors (corporation, government unit, organization or person directly funding fieldwork)

Name _____ Organization Florida Dept of Transportation - District 5

Address/Phone/E-mail 719 S. Woodland Blvd, DeLand, FL 32720

Recorder of Log Sheet Jessica Fish Date Log Sheet Completed 6-2-2023

Is this survey or project a continuation of a previous project? No Yes: Previous survey #s (FMSF only) 28025, 28024

Mapping

Counties (List each one in which field survey was done; attach additional sheet if necessary)

1. Brevard 3. _____ 5. _____
2. _____ 4. _____ 6. _____

USGS 1:24,000 Map Names/Year of Latest Revision (attach additional sheet if necessary)

1. Name <u>FELLSMERE</u>	Year <u>2018</u>	4. Name _____	Year _____
2. Name <u>MELBOURNE WEST</u>	Year <u>2018</u>	5. Name _____	Year _____
3. Name _____	Year _____	6. Name _____	Year _____

Description of Survey Area

Dates for Fieldwork: Start 5-26-2023 End 5-26-2023 Total Area Surveyed (fill in one) 2.23 hectares _____ acres

Number of Distinct Tracts or Areas Surveyed 1

If Corridor (fill in one for each) Width: _____ meters _____ feet Length: _____ kilometers _____ miles

Research and Field Methods

Types of Survey (check all that apply): archaeological architectural historical/archival underwater
damage assessment monitoring report other(describe): _____

Scope/Intensity/Procedures archaeological testing at 50- and 100-m intervals. no historic buildings in APE

Preliminary Methods (check as many as apply to the project as a whole)

Florida Archives (Gray Building) library research- local public local property or tax records other historic maps
Florida Photo Archives (Gray Building) library-special collection - nonlocal newspaper files soils maps or data
Site File property search Public Lands Survey (maps at DEP) literature search windshield survey
Site File survey search local informant(s) Sanborn Insurance maps aerial photography
other (describe): _____

Archaeological Methods (check as many as apply to the project as a whole)

Check here if NO archaeological methods were used.
surface collection, controlled shovel test-other screen size block excavation (at least 2x2 m)
surface collection, uncontrolled water screen soil resistivity
shovel test-1/4" screen posthole tests magnetometer
shovel test-1/8" screen auger tests side scan sonar
shovel test 1/16" screen coring pedestrian survey
shovel test-unscreened test excavation (at least 1x2 m) unknown
other (describe): _____

Historical/Architectural Methods (check as many as apply to the project as a whole)

Check here if NO historical/architectural methods were used.
building permits demolition permits neighbor interview subdivision maps
commercial permits exposed ground inspected occupant interview tax records
interior documentation local property records occupation permits unknown
other (describe): _____

Survey Results (cultural resources recorded)

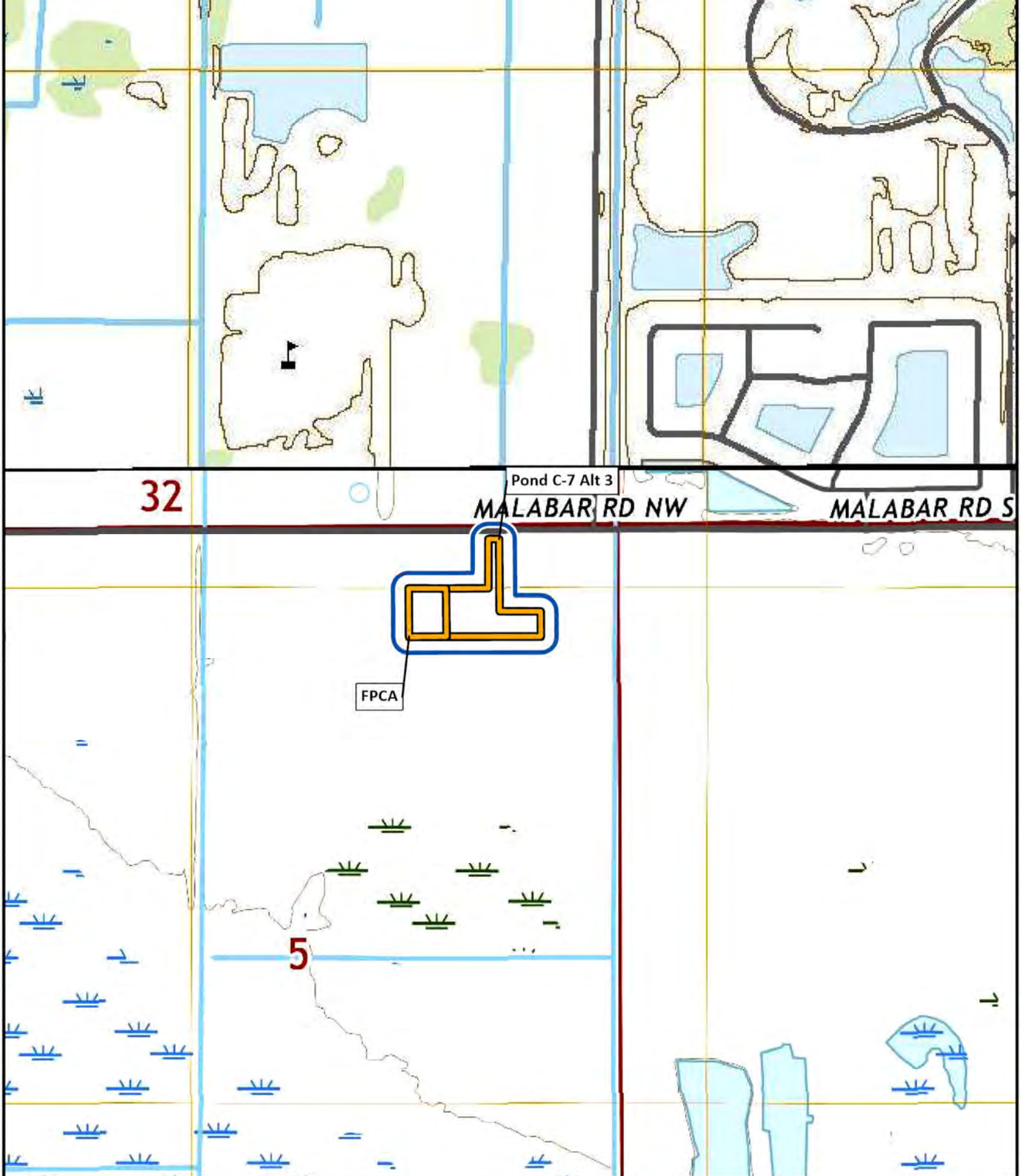
Site Significance Evaluated? Yes No
Count of Previously Recorded Sites 0 Count of Newly Recorded Sites 0
Previously Recorded Site #'s with Site File Update Forms (List site #'s without "8". Attach additional pages if necessary.) _____

Newly Recorded Site #'s (Are all originals and not updates? List site #'s without "8". Attach additional pages if necessary.) _____

Site Forms Used: Site File Paper Form Site File Electronic Recording Form

REQUIRED: ATTACH PLOT OF SURVEY AREA ON PHOTOCOPY OF USGS 1:24,000 MAP(S)

SHPO USE ONLY SHPO USE ONLY SHPO USE ONLY
Origin of Report: 872 CARL UW 1A32 # _____ Academic Contract Avocational
Grant Project # _____ Compliance Review: CRAT # _____
Type of Document: Archaeological Survey Historical/Architectural Survey Marine Survey Cell Tower CRAS Monitoring Report
Overview Excavation Report Multi-Site Excavation Report Structure Detailed Report Library, Hist. or Archival Doc
MPS MRA TG Other: _____
Document Destination: _____ Plotability: _____



32


Pond C-7 Alt 3

MALABAR RD NW

MALABAR RD S

FPCA

5

 C-7 Alt 3 Architectural History APE

 C-7 Alt 3 Archaeological APE



USGS 7.5' Quadrangle Maps:
Fellsmere NW (2018) and
Melbourne West (2018)



Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX I

Natural Resources Evaluation Report

Malabar Road PD&E Study

FM No. 437210-1-28-01

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NATURAL RESOURCES EVALUATION

The City of Palm Bay

Malabar Road Project Development and Environment (PD&E) Study

Limits of Project: St. Johns Heritage Parkway to Minton Road

Brevard County, Florida

Financial Management Number: 437210-1-28-01

ETDM Number: 14396

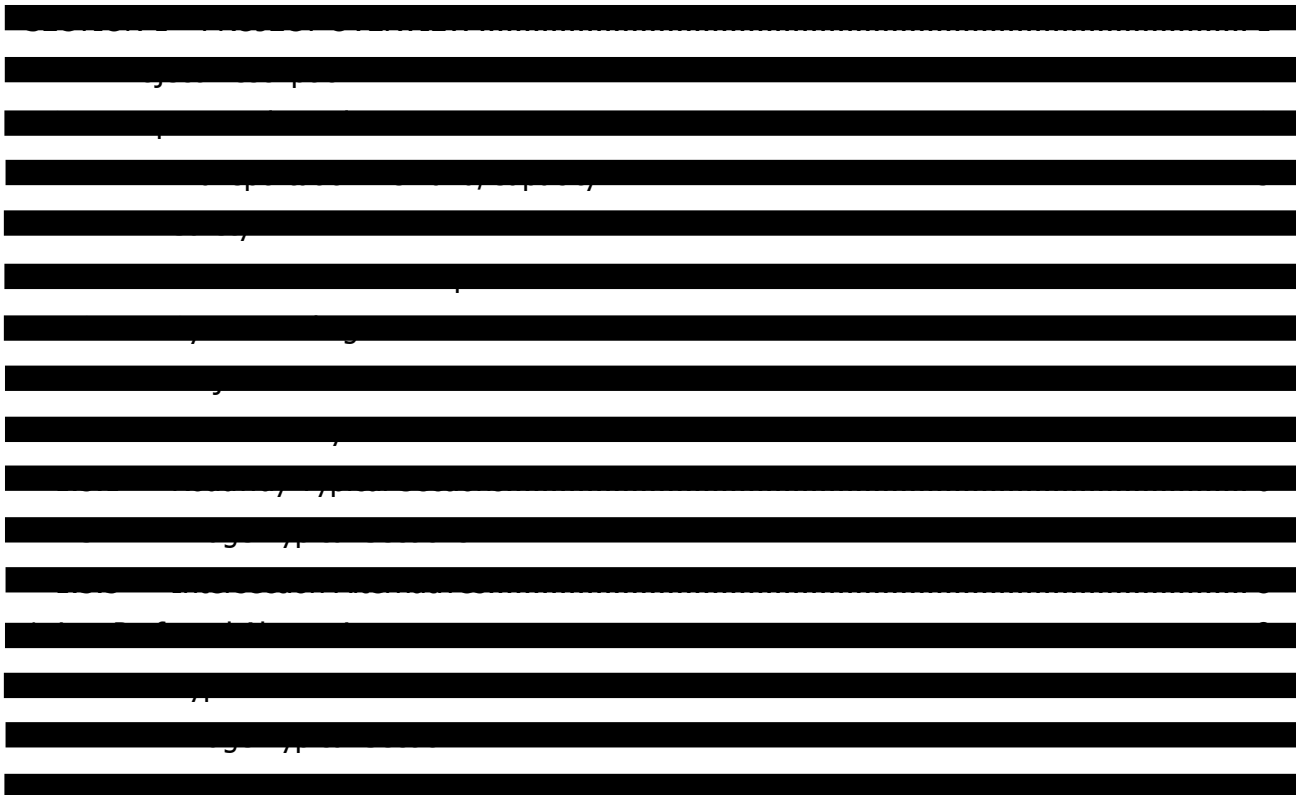
Date: June 2021

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by FDOT pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated December 14, 2016, and executed by FHWA and FDOT.

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EXECUTIVE SUMMARY

The City of Palm Bay in cooperation with the Florida Department of Transportation (FDOT), District 5, is conducting a Project Development and Environment (PD&E) Study to evaluate the proposed widening of Malabar Road from St. Johns Heritage Parkway to Minton Road in Brevard County, Florida. The proposed project is approximately four miles long and will widen Malabar Road from two to four lanes in order to improve safety, increase capacity and accommodate multi-modal features along the corridor. The project occurs within Sections 32, 33, 33, 34, and 35 of Township 28 South, and Range 36 East; and Sections 1, 2, 3, 4, and 5 of Township 29 South, and Range 36 East.

Malabar Road is an east-west regional roadway connecting western Brevard County/City of Palm Bay to US 1 in Malabar. The roadway's maintaining jurisdiction is Brevard County at its western edge, before transitioning to the City of Palm Bay for several miles, and then becoming a state road (S.R. 514) between I-95 and US 1. Malabar Road has an existing diamond interchange with I-95. Within the study area, Malabar Road is an urban minor arterial. The existing typical section is a two-lane undivided roadway with 11-foot or 12-foot travel lanes within a 66-foot right-of-way which extends to 112 feet in some areas, with an 8-foot sidewalk which runs along the north side of Canal C-20. East of the C-10 Canal, the C-20 Canal parallels the north side of Malabar Road.

The alternatives analysis includes evaluation of two widening alternatives, Alternatives A and B, and a no-build alternative; existing and proposed right-of-way widths; intersection alternatives including signals and roundabouts; C-20 Canal impacts; a new bridge over the C-10 Canal; and a shared-use path along the north side of Malabar Road.

Alternative B was selected as the Recommended Preferred Alternative because it provides the wider median plus a 4' grass buffer, both meeting 2021 FDOT Design Manual (FDM) standards, while having a negligible impact on right-of-way and only a slighter higher project cost when compared to Alternative A. The right-of-way required for the recommended preferred alternative typical section is 102' from the St. Johns Heritage Parkway to Canal C-10 and 105' from Canal C-10 to Station 256+80. This will require approximately 34 to 37.5 feet of additional right-of-way. This alternative minimizes impacts to wetlands and surface waters, and protected species and their habitats. The recommended preferred pond sites were chosen to eliminate or reduce wetland impacts and avoid caracara nesting and foraging habitat.

The stormwater runoff from the project will be collected and conveyed via curb and gutter to the preferred pond alternative in each basin. The various pond alternatives consist of dry retention ponds, wet detention ponds, and dry linear swales. Pond sites and configurations may change during the final design phase as more detailed information becomes available.

This Natural Resources Evaluation (NRE) has been prepared as part of the PD&E Study to assess the widening alternatives and identify potential impacts to natural resources throughout the Malabar Road corridor. The purpose of this NRE is to document protected species and habitat and identify the location of wetlands and surface waters within the project corridor in order to determine potential impacts to these resources, provide rationale to support species effect determinations, identify avoidance and minimization measures, and quantify mitigation necessary

for the recommended preferred alternative. This NRE has been prepared in accordance with the *Wetlands and Other Surface Waters* and *Protected Species and Habitat* chapters of the FDOT's *PD&E Manual* (FDOT, 2020) and the current Natural Resources Evaluation Outline and Guidance (FDOT, 2020).

The Recommended Preferred Alternative is located within the following US Fish and Wildlife Service (FWS) Consultation Areas: Audubon's crested caracara (*Polyborus plancus audubonii*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), Florida scrub-jay (*Aphelocoma coerulescens*), and red-cockaded woodpecker (*Dryobates borealis*). The Recommended Preferred Alternative falls within Core Foraging Areas (CFA) for seven wood stork colonies. The existing habitats in the study area may also support other federally protected species, as well as many state protected species. Based on the results of the general wildlife and species-specific surveys, data collection and USFWS' effect determination key, the Recommended Preferred Alternative will not jeopardize the continued existence of a protected species and/or result in the destruction or adverse modification of critical habitat. However, additional coordination with wildlife agencies will be required during the design and permitting phase and additional wildlife surveys may be required prior to or during construction. **Table ES-1** identifies the protected species that were evaluated in this document, their regulatory status, and the effect determination under the recommended preferred alternative.

Figure ES-1: Effect Determinations for Protected Species

Common Name	Scientific Name	Status	Effect Determination
Reptiles			
American alligator	<i>Alligator mississippiensis</i>	FT (S/A)	MANLAA
Eastern indigo snake	<i>Drymarchon couperi</i>	FT	MANLAA
Florida pine snake	<i>Pituophis melanoleucus</i>	ST	NAEA
Gopher tortoise	<i>Gopherus polyphemus</i>	C / ST	MANLAA
Birds			
Audubon's crested caracara	<i>Polyborus plancus audubonii</i>	FT	MANLAA
Bald eagle	<i>Haliaeetus leucocephalus</i>	BGEPA / MBTA	NO EFFECT
Everglade snail kite	<i>Rostrhamus sociabilis plumbeus</i>	FE	NO EFFECT
Florida burrowing owl	<i>Athene cunicularia floridana</i>	ST	NAEA
Florida grasshopper sparrow	<i>Ammodramus savannarum floridanus</i>	FE	NO EFFECT
Florida sandhill crane	<i>Antigone canadensis pratensis</i>	ST	NAEA
Florida scrub-jay	<i>Aphelocoma coerulescens</i>	FT	MANLAA
Little blue heron	<i>Egretta caerulea</i>	ST	NAEA
Red-cockaded woodpecker	<i>Dryobates borealis</i>	FE	NO EFFECT
Reddish egret	<i>Egretta rufescens</i>	ST	NAEA
Roseate spoonbill	<i>Platalea ajaja</i>	ST	NAEA
Southeastern American kestrel	<i>Falco sparverius Paulus</i>	ST	NAEA

Common Name	Scientific Name	Status	Effect Determination
Tricolored heron	<i>Egretta tricolor</i>	ST	NAEA
Wood stork	<i>Mycteria americana</i>	FT	MANLAA
Mammals			
Florida black bear	<i>Ursus americanus floridanus</i>	M	NAEA
Southern fox squirrel	<i>Sciurus niger</i>	M	NAEA
Plants			
Blue-flowered butterwort	<i>Deeringothamnus pulchellus</i>	ST	NAEA
Carter's warea	<i>Warea carteri</i>	FE	NO EFFECT
Celestial lily	<i>Nemastylis floridana</i>	SE	NEA
Coastal vervain	<i>Glandularia maritima</i>	SE	NEA
Cut-throat grass	<i>Panicum abscissum</i>	SE	NEA
Florida beargrass	<i>Nolina atopocarpa</i>	ST	NEA
Giant Orchid	<i>Pteroglossaspis ecristata</i>	ST	NEA
Large-flowered rosemary	<i>Conradina grandiflora</i>	ST	NEA
Lewton's polygala	<i>Polygala lewtonii</i>	FE	NO EFFECT
Many-flowered grass pink	<i>Calopogon multiflorus</i>	ST	NAEA
Nodding pinweed	<i>Lechea cernua</i>	ST	NEA
Plume polypody	<i>Polypodium plumula</i>	SE	NEA
Redmargin Zephyrlily	<i>Zephranthes simpsonii</i>	ST	NEA
Sand butterfly pea	<i>Centrosema Arenicola</i>	SE	NEA
Short-leaved rosemary	<i>Conradina brevifolia</i>	FE	NO EFFECT
Small's flax	<i>Linum carteri var. smallii</i>	SE	NEA
Swamp plume polypody	<i>Polypodium ptilodon</i>	SE	NEA
Widespread polypody	<i>Polypodium dispersum</i>	SE	NEA
Yellow-flowered butterwort	<i>Pinguicula lutea</i>	SE	NEA

MANLAA = May Affect, Not Likely to Adversely Affect

NEA = No Effect Anticipated

NAEA = No Adverse Effect Anticipated

Wetlands and other surface waters (OSWs) with potential to be affected by the proposed project were identified within the Malabar study area. An assessment was performed for wetlands and OSWs in accordance with the Uniform Mitigation Assessment Method (UMAM), pursuant to Chapter 62-345, F.A.C., to determine the functional value provided by the wetlands and OSWs and determine the amount of mitigation required to offset adverse impacts. The impacted OSWs are considered upland cut components of the existing manmade drainage system and were not included in the assessment as mitigation will not be required for impacts to these surface waters. The Preferred Alternative, including the preferred pond sites, will directly impact 0.46 acres of wetlands and 4.08 acres of OSWs.

No Essential Fish Habitat (EFH) has been identified within the study area. According to their ETDM Summary Report No. 14396, dated October 25, 2019, NMFS staff concluded that the project will not impact EFH; therefore, an EFH assessment is not required.

1.5 Proposed Drainage

The project is within the St. Johns River Water Management District (SJRWMD) and the Melbourne-Tillman Water Control District (MTWCD) jurisdiction. The MTWCD maintains a network of canals in Brevard County including several crossing underneath Malabar Road (Canals C-7, C-8, C-9, and C-10) and one that runs parallel to Malabar Road (Canal C-20) for a portion of the study corridor. The City of Palm Bay also maintains smaller canals within the vicinity of the project (Canals 26-06, 14-03b and 13-05).

The design of stormwater management facilities for the PD&E is governed by the rules established by the SJRWMD, City of Palm Bay, and MTWCD. FDOT designs stormwater management facilities to meet water treatment and attenuation requirements to comply with SJRWMD rule Chapter 62-330, F.A.C. and the Statewide Environmental Resource Permit Applicant’s Handbook.

The stormwater runoff from the project limits will be collected and conveyed via curb and gutter to the recommended preferred pond alternative for each basin. The various pond alternatives consist of dry retention ponds, wet detention ponds, and dry linear swales. The ponds will discharge at or near the same cross drains that carry the roadway runoff in the existing condition, or directly into canals where appropriate. The proposed ponds have been sized to achieve the required water quality treatment and water quantity attenuation and serve as a budget tool for right-of-way estimation for the project to the City of Palm Bay. There are currently six proposed drainage basins within the project limits. Two pond alternatives were analyzed for each basin with the exception of Basin A for which the existing Pond A will be utilized. In addition to pond alternatives, one floodplain compensation (FPC) site was also investigated to provide compensation for one Floodplain Impact Area (FIA) located at the western end of the project. The results of the preliminary analysis are provided in the associated **Pond Siting Report**. The **Pond Site Assessment** detailing impacts to wetlands and listed species is included in **Appendix A**. The recommended preferred pond alternatives are listed in **Table 1-2** below.

Table 1-2: Recommended Preferred Pond Alternatives

Basin	Recommended Preferred Alternative
C-7	Alt. 2
C-8 & C-9	Alt. 1
C-10 West	Alt 2. Option 1 - Use C-10 East Swales
C-10 East	Alt. 1
C-20	Supplemental Swales
	Alt. 1
A	Use Existing City of Palm Bay Pond A
FPC	C- 7

1.6 Report Contents and Purpose

This Natural Resources Evaluation (NRE) has been prepared as part of the PD&E Study to assess the various Malabar Road widening alternatives and identify potential impacts to natural resources throughout the corridor. The purpose of this NRE is to document protected species and habitat and identify the location of wetlands and surface waters within the project corridor in order to determine potential impacts to these resources, provide rationale to support species effect determinations, identify avoidance and minimization measures, and quantify mitigation necessary for the recommended preferred alternative. This NRE has been prepared in accordance with the *Wetlands and Other Surface Waters* and *Protected Species and Habitat* chapters of the FDOT's PD&E Manual (FDOT, 2020) and the current Natural Resources Evaluation Outline and Guidance (FDOT, 2020).

SECTION 2 EXISTING ENVIRONMENTAL CONDITIONS

Prior to field surveys, staff ecologists reviewed the most currently available information to identify existing conditions within the study area. Land use, soils and other natural features were identified to determine what resources occur or have the potential to occur within the Malabar Road Study Area. This information included land use maps provided by the St. Johns River Water Management District (SJRWMD). The land use descriptions were based on the Florida Land Use, Cover and Forms Classification System (FLUCFCS) (FDOT, 1999). Other information included but was not limited to:

- U.S. Geographic Survey (USGS) Topographic Maps
(<https://viewer.nationalmap.gov/launch/>)
- Natural Resources Conservation Service (NRCS) Soil Maps
(<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>)
- Florida Natural Areas Inventory (FNAI) Cooperative Land Cover Maps
(<http://www.fnai.org/landcover.cfm>)
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Maps
(<https://www.fws.gov/wetlands/data/mapper.html>)
- USFWS Consultation Area and Critical Habitats Maps
(<https://crithab.fws.gov/>)
- USFWS Wood Stork Nesting Colonies and Core Foraging Areas Maps
(<https://www.fws.gov/northflorida/woodstorks/wood-storks/.htm>)
- National Marine Fisheries Service (NMFS) Essential Fish Habitat (EFH) Maps
(<https://www.habitat.noaa.gov/protection/efh/habitatmapper.html>)
- Florida Fish and Wildlife Conservation Commission (FWC) Scrub-Jay Observation Maps
(<http://myfwc.com/research/gis/>)
- FWC Bald Eagle Nesting Territory Maps
(<https://publictemp.myfwc.com/FWRI/EagleNests/nestlocator.aspx>)
- FWC Red-Cockaded Woodpecker Observation Maps
(<http://geodata.myfwc.com/datasets/red-cockaded-woodpecker-observation-locations>)
- FWC Wildlife Occurrence Maps
(<http://geodata.myfwc.com/datasets>)
- FWC Species Action Plans

(<http://myfwc.com/wildlifehabitats/imperiled/species-action-plans/>)

- FDOT Efficient Transportation Decision Making (ETDM) Summary Report #14396 (<https://etdmpub.flas-estat.org/est/#>)

2.1 Environmental Assessment Study Area

The Malabar Road study area was considered to be the areas directly or indirectly affected by the proposed action and not merely the immediate area involved in the action. It encompassed the geographic extent of the environmental changes that may result from the action. For purposes of this study, the study area included all lands within 2000 feet of the current City right-of-way and included the proposed pond and flood plain compensation sites. Additionally, a 1500-meter (4920 feet) buffer was added to the study area where suitable Audubon's crested caracara habitat occurred in order to fulfill the requirements of the survey protocol outlined by the USFWS.

2.2 Land Use

The land uses within the Malabar Road study area were first characterized by SJRWMD online resources and later modified or delineated by ecologists to reflect field observations made at the time of the study. The Malabar Road study area contains a mixture of several FLUCFCS types including urban and built-up, agriculture, range land, upland forests, water, wetland, barren land, and transportation or other linear utilities (**Figures 2-1A - 2-1C**). **Figure 2-2** shows the topographic map of the study area. A detailed list of the land uses within the study area is provided in **Table 2-1** along with additional descriptions of the land uses in **Appendix B**. Photographs of representative habitats in the study area are provided in **Appendix C**.

Table 2-1: FLUCFCS within the Malabar Study Area

FLUCFCS CODE	FLUCFCS DESCRIPTION	AREA (ac)	FLUCFCS CODE	FLUCFCS DESCRIPTION	AREA (ac)
110	RESIDENTIAL, LOW DENSITY	198	434	HARDWOOD - CONIFER MIXED	56
120	RESIDENTIAL, MEDIUM DENSITY	1088	440	TREE PLANTATIONS	11
130	RESIDENTIAL, HIGH DENSITY	35	510	STREAMS AND WATERWAYS	50
140	COMMERCIAL AND SERVICES	92	530	RESERVOIRS	57
170	INSTITUTIONAL	88	630	WETLAND FORESTED MIXED	1
211	IMPROVED PASTURES	106	641	FRESHWATER MARSHES	1
212	UNIMPROVED PASTURES	58	646	EMERGENT AQUATIC VEGETATION	2
215	FIELD CROPS	7	743	SPOIL AREAS	3
320	SHRUB AND BRUSHLAND	11	814	ROADS AND HIGHWAYS	54
330	MIXED RANGELAND	82	820	COMMUNICATIONS	3
411	PINE FLATWOODS	82	832	ELECTRICAL POWER TRANSMISSION LINES	22
420	UPLAND HARDWOOD FOREST	14	837	SURFACE WATER COLLECTION BASIN	1
428	CABBAGE PALM	101	TOTAL ACREAGE		2223

Figure 2-1: FLUCFCS Map

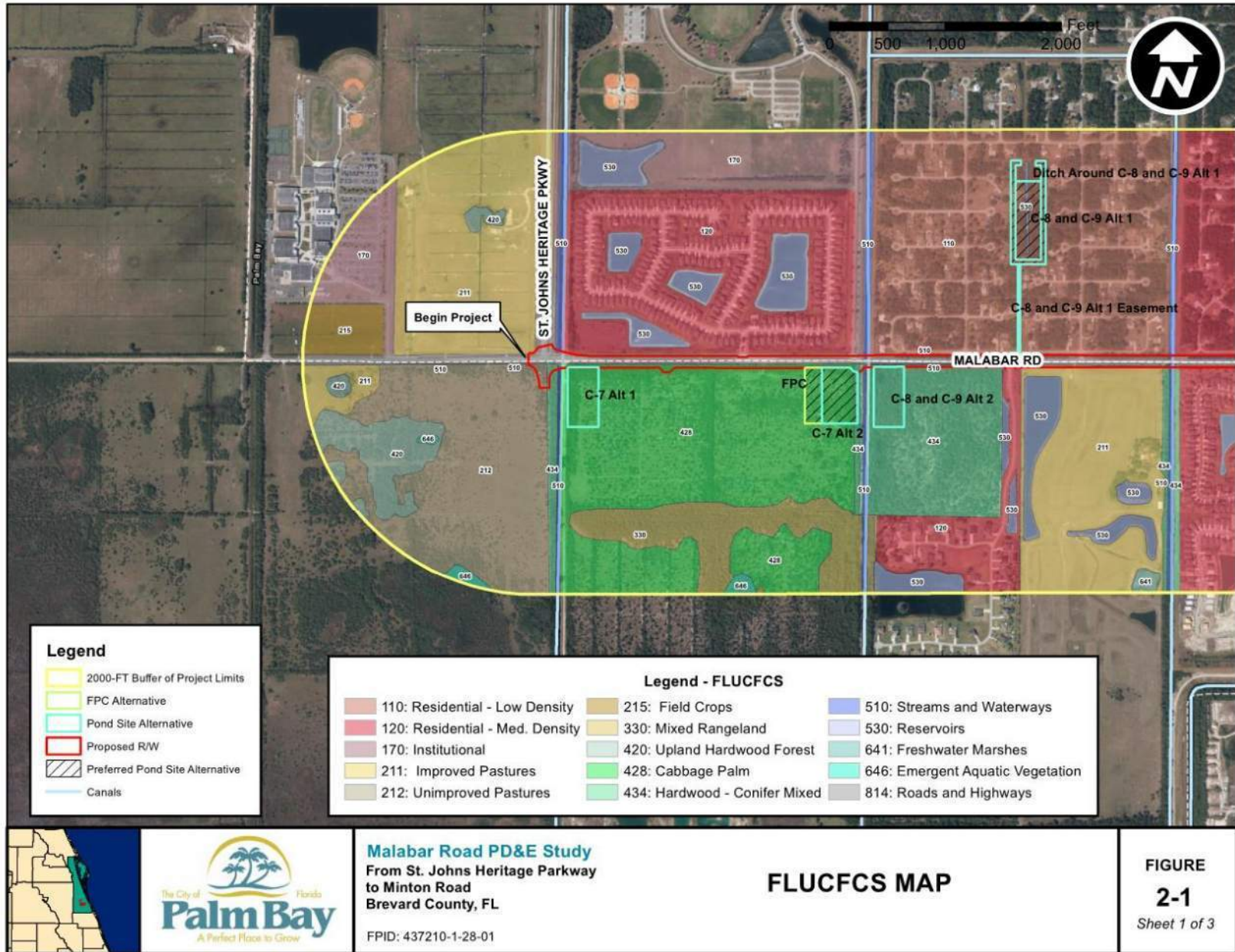


Figure 2-1: FLUCFCS Map

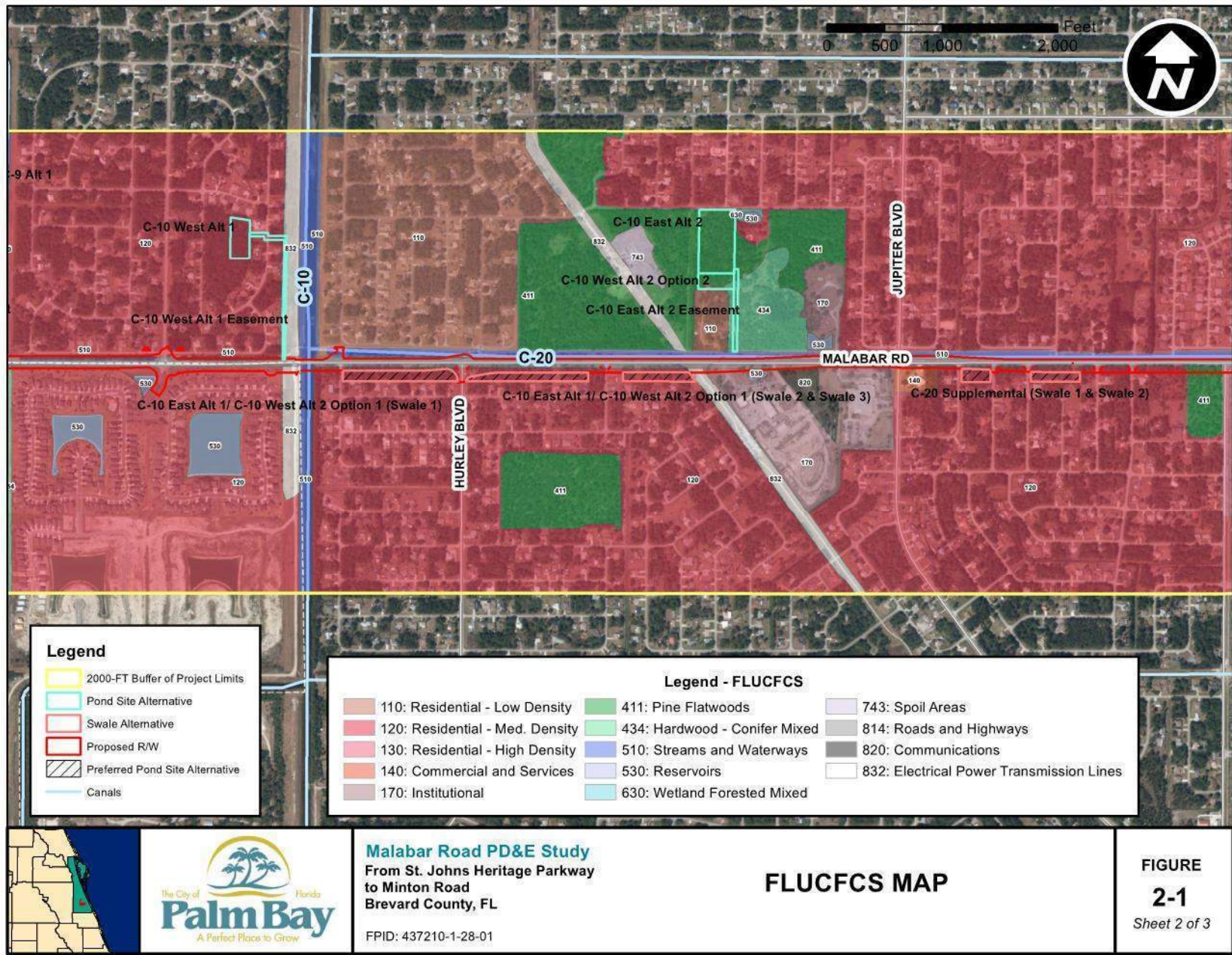
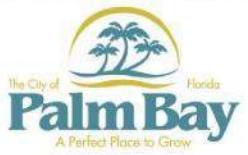
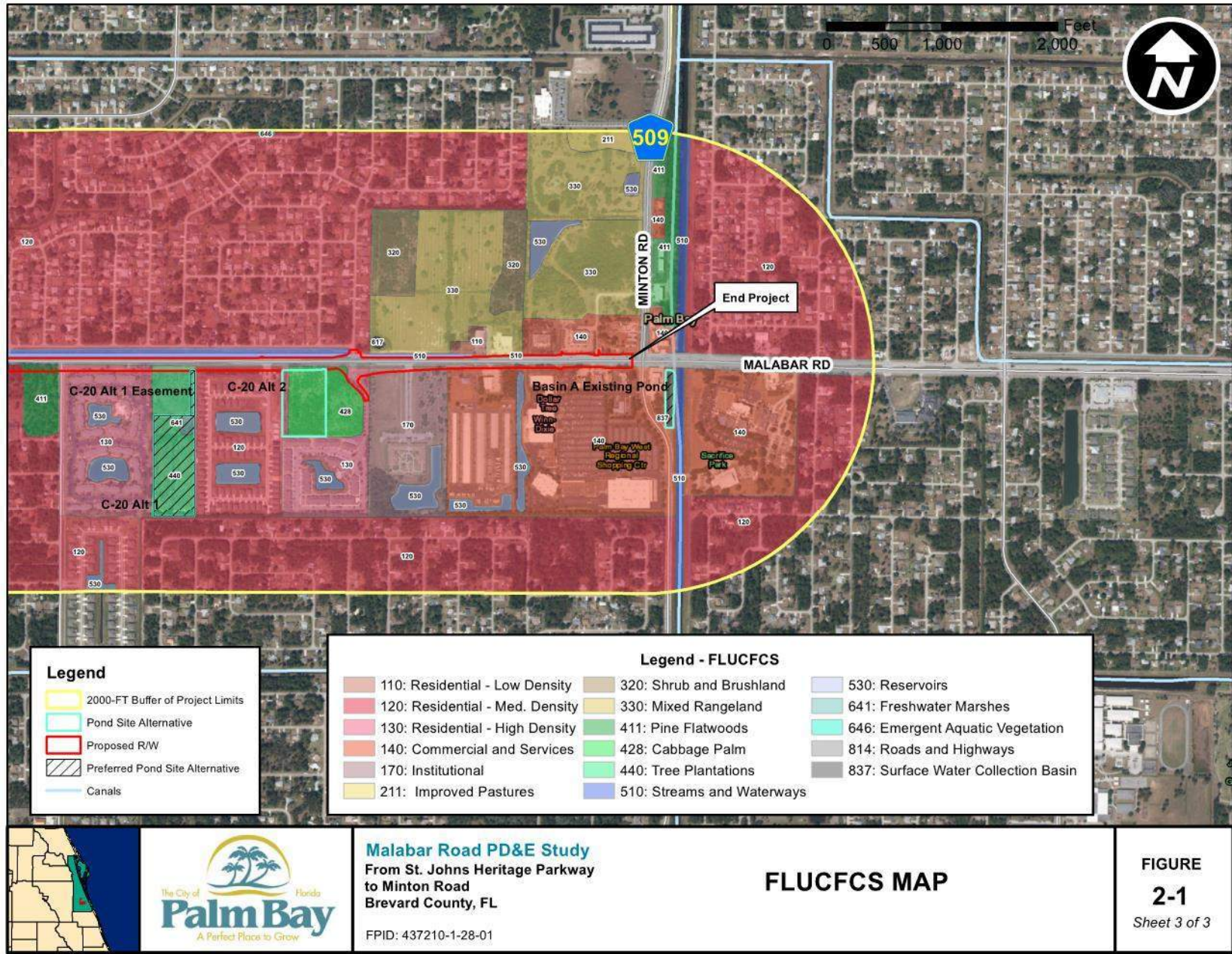


Figure 2-1: FLUCFCS Map

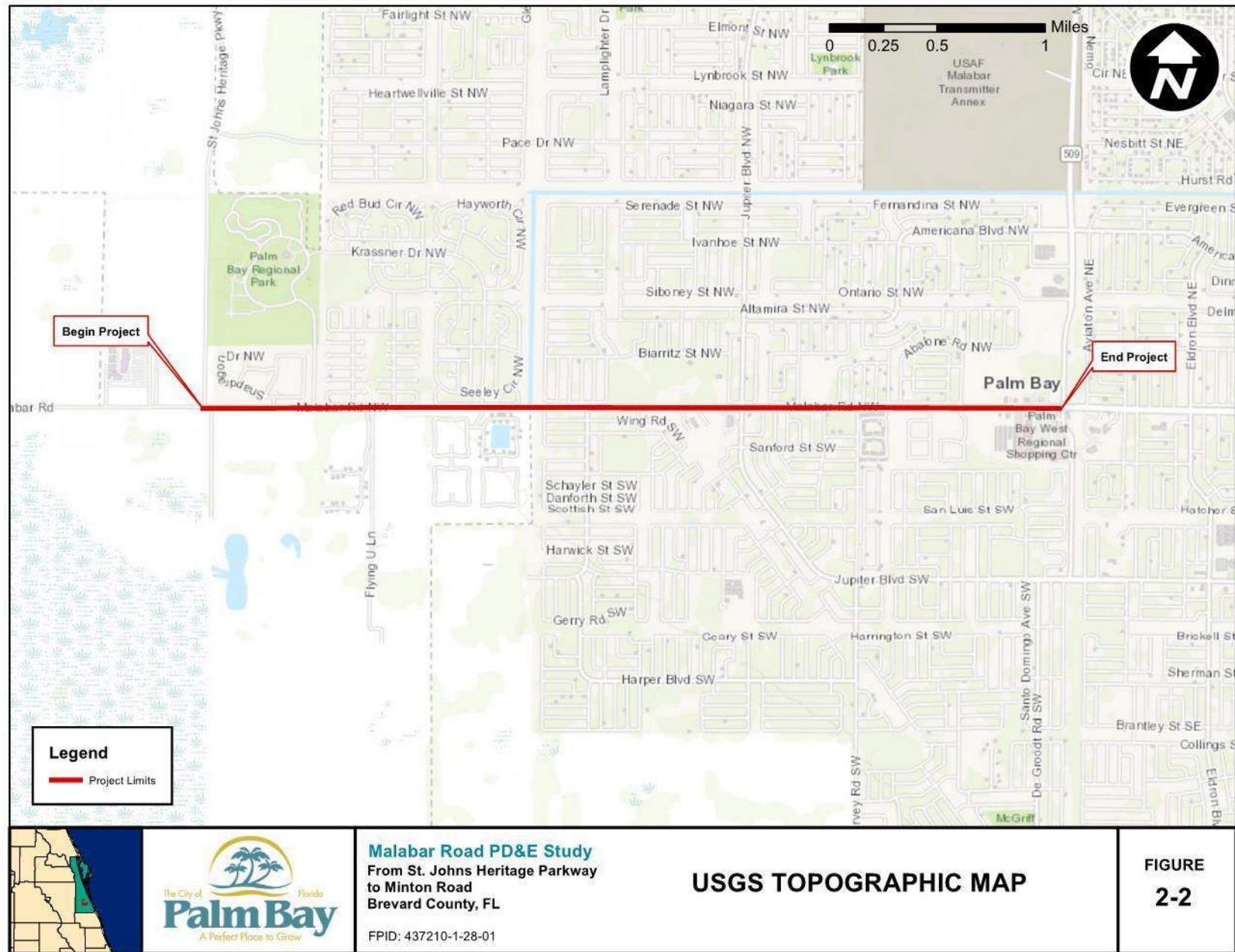


Malabar Road PD&E Study
 From St. Johns Heritage Parkway
 to Minton Road
 Brevard County, FL
 FPID: 437210-1-28-01

FLUCFCS MAP

FIGURE
2-1
 Sheet 3 of 3

Figure 2-2: USGS Topography Map



2.3 Soils

The soil survey of Brevard County, Florida (USDA NRCS 2016) was reviewed to determine the soil types and characteristics within the Malabar Road study area. According to the soil survey, there are 8 different soil types within the Malabar Road study area. **Table 2-2** summarizes and lists the soil types within the study area. The soil types and locations are depicted on **Figures 2.3**.

The soils encountered along the project limits include Hydrologic Soil Group (HSG) A/D and C/D. For soils assigned a dual HSG, the first letter applies to the drained condition and the second to the undrained condition.

Table 2-2: Soil Types Within the Malabar Study Area

Soil No.	USDA Soil Name	Seasonal High Ground Water		HSG	Soil Classification		
		Depth (inches)	Duration (months)		Depth (inches)	Unified	AASHTO
2	Anclote Sand, Depressional, 0 to 1 percent slopes	0-10	---	A/D	0-19	SP, SP-SM	A-3
					19-72	SP, SP-SM	A-3
17	EauGallie Sand	0-10	---	A/D	0-22	SP, SP-SM	A-3
					22-35	SP-SM, SM	A-2-4, A-3
					35-55	SP, SP-SM	A-3
					55-61	SM, SM-SC, SC	A-2-4
					61-84	SM, SM-SC	A-2-4
18	EauGallie, Winder, and Riviera Soils, Depressional	0-10	---	A/D	0-22	SP, SP-SM	A-3
					22-35	SP-SM, SM	A-2-4, A-3
					35-55	SP, SP-SM	A-3
					55-61	SM, SM-SC, SC	A-2-4
					61-84	SM, SM-SC	A-2-4
19	Riviera Sand	0.25-1.5	---	C/D	N/A	SP-SM	A-3
31	Malabar, Holopaw, and Pineda Soils	0-1.0	---	A/D	N/A	SP	A-3
33	Micco, mucky peat, frequently flooded	0-10.		A/D	0-30	PT	A-8
47	Pineda Sand, 0 to 2 percent slopes	0-10	---	C/D	0-19	SP, SP-SM	A-3
					19-35	SP, SP-SM	A-3
					35-38	SP-SM, SM	A-2-4
					38-60	SM, SM-SC, SC	A-2-4
					60-64	SM, SP-SM	A-2-4, A-3
71	Wabasso Sand	0-10	---	C/D	0-23	SP, SP-SM	A-3
					23-28	SP-SM	A-2-4, A-3
					28-34	SM, SP-SM	A-2-4, A-3
					34-62	SC, SM-SC	A-2

Figure 2-3: NRCS Soils Map

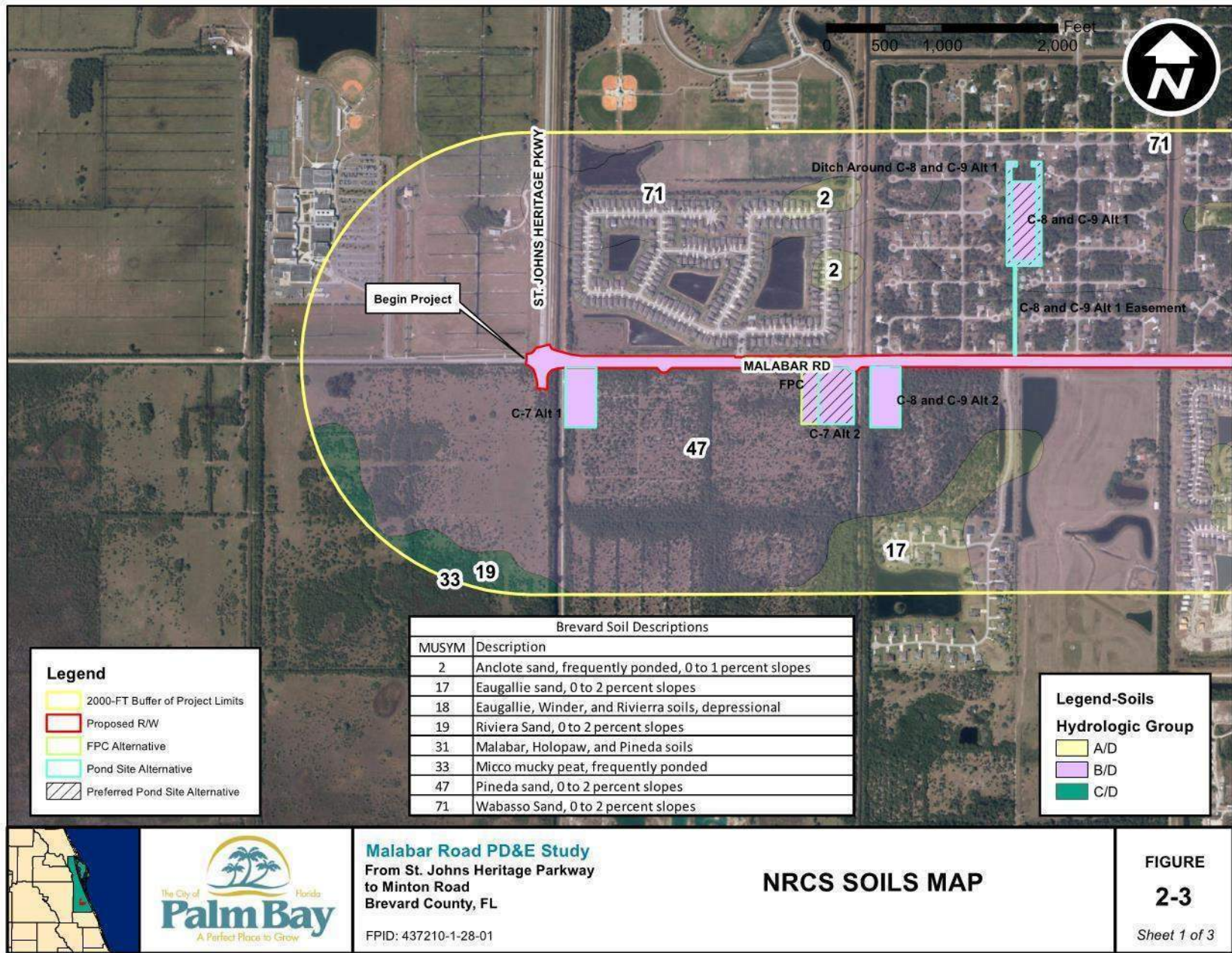


Figure 2-3: NRCS Soils Map

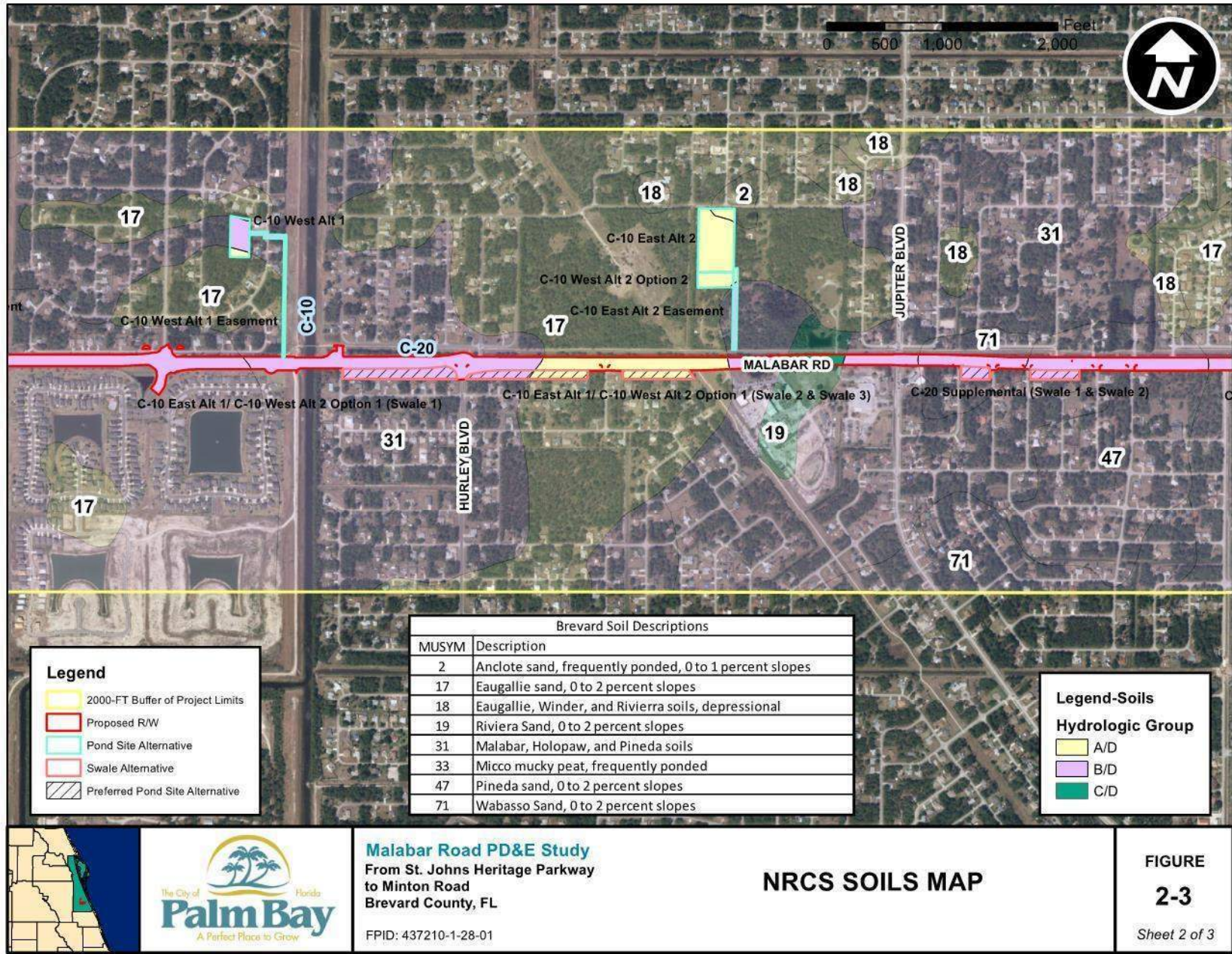
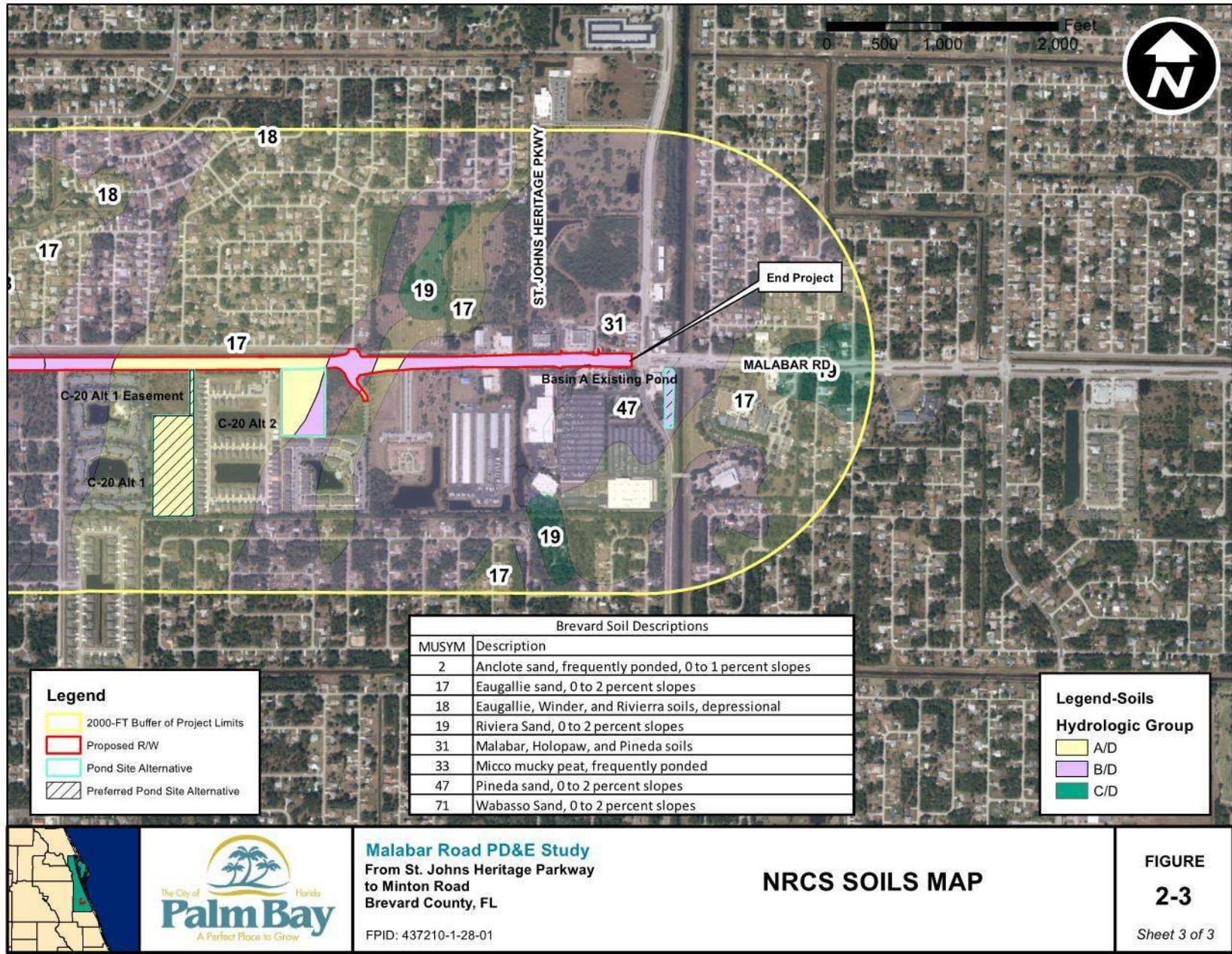


Figure 2-3: NRCS Soils Map



2.4 Other Natural Features

No other significant natural features were identified within the limits of the Malabar Road study area including public and private conservation land; special aquatic sites, including sanctuaries and refuges, Wild and Scenic Rivers, Aquatic Preserves, and Outstanding Florida Waters; nor does it provide designated critical habitat or Essential Fish Habitat to federally protected or managed species. However, the proposed project is located near the Three Forks Conservation Area (TFCA).

The TFCA is a 53,335-acre property owned and managed by the SJRWMD. This conservation area lies within the Upper St. Johns River Basin and comprises a significant portion of the Upper St. Johns River Basin Project, a cooperative effort with the USACE to provide flood control and environmental protection in the region. Comprised mostly of floodplain marsh and wet prairie, the TFCA provides habitat for protected species including the Audubon's crested caracara, Everglade snail kite, wood stork, bald eagle, southeastern American kestrel, Florida sandhill crane and wading birds. While the project area does not include the TFCA, adjacent parcels abut the TFCA boundary, which is approximately 0.25 miles west of the western terminus of the proposed project. No impacts to the TFCA are anticipated as a result of the proposed roadway improvements.

SECTION 3 PROTECTED SPECIES AND HABITAT

A protected species and habitat assessment was conducted in accordance with the PD&E Manual, *Protected Species and Habitat* (FDOT, 2019), to determine the potential effects of the proposed transportation project on protected species and habitat. The term protected species refers to those species that are protected by law, regulation, or rule. The term listed species refers to species that are threatened or endangered at the federal or state level and identified in the Endangered Species Act (ESA) of 1973, as amended; the Florida Endangered and Threatened Species Act, Section 379.2291, Florida Statutes (F.S.); the Florida Regulated Plant Index (5B-40.0055, Florida Administrative Code (FAC).

3.1 Efficient Transportation Decision Making

During the ETDM process, Planning and Programming Screens were prepared for the Malabar Road study area. Environmental Technical Advisory Team (ETAT) representatives reviewed project information and provided comments about potential direct and indirect effects to resources under their jurisdiction. Additionally, they selected a Degree of Effect (DOE) for each alternative and issue. According to the ETDM Summary Report No. 14396, dated October 25, 2019, the USFWS indicated the project alternatives may create a "Moderate" DOE on wildlife and habitat resources while the FWC assigned a DOE of "Minimal".

3.2 Methodology

The study methodology included GIS analyses, ETAT comments review, agency coordination, agency database searches, and field surveys. Section 1.3 lists the data sources utilized for review. Ecologists familiar with Florida's protected species and natural habitats conducted general field surveys and species-specific surveys November 2019 through August 2020 as part of the Malabar Road Study. The field surveys were performed utilizing pedestrian surveys conducted during daylight hours over multiple seasons to document the presence or evidence of protected species utilizing the study area. Species-specific surveys included the Audubon's crested caracara and

the Florida scrub-jay. The species-specific surveys were conducted in accordance with the survey protocols outlined by the USFWS (Appendices D, G) . The ecologists also documented habitat types and predominant plant species, including general wetland limits, during the field reviews.

3.3 Potentially Occurring Listed Species

A total of 40 protected species have the potential to occur in the Malabar Road study area, according to the information obtained during the preliminary data collection. These include the 15 avian, 1 mammal, 5 reptile, and 19 plant species shown on **Table 3-1**. Ecologists determined a species' potential occurrence in the study area based on its habitat preferences and distributions, existing site conditions, historical data, and multiple field surveys. The likelihood of occurrence was rated as low, moderate, high, or observed. A low rating indicates that the species occurs in Brevard County, but suitable habitat is not present within the study area and the species has not been observed or documented within the study area. A moderate rating indicates that the species occurs in Brevard County, suboptimal habitat or limited suitable habitat occurs within the study area, but the species has not been observed in species-specific surveys or documented within the study area. A high rating indicates that the species occurs within Brevard County, suitable habitat is present within the study area and the species is suspected to occur or has been previously documented within the study area. Observed species are those that have been observed during the evaluation for this PD&E study. Protected species occurrences within the Malabar Road study area are shown on **Figure 3-1**.

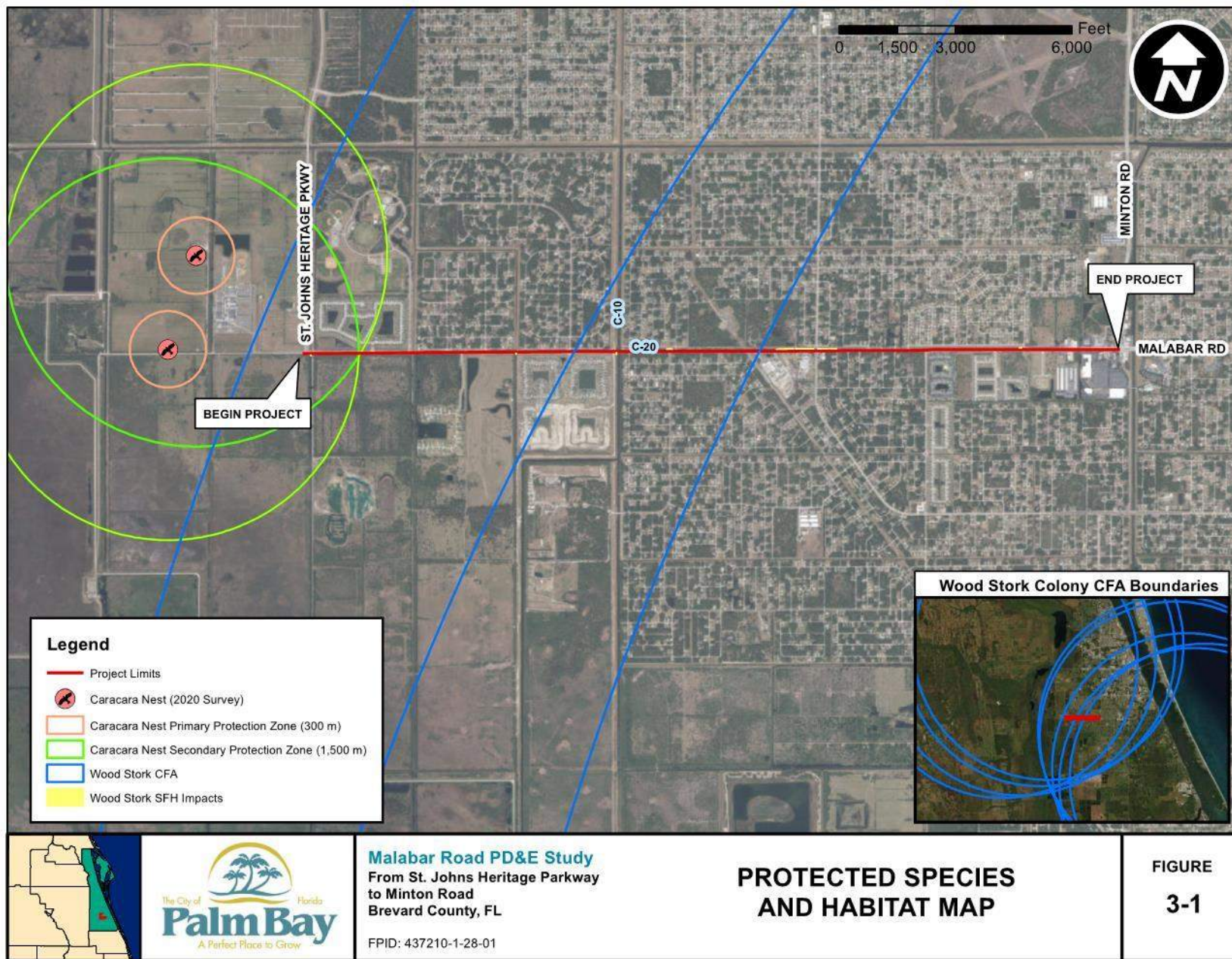
Table 3-1: Protected Species with Potential to Occur in the Malabar Study Area

GROUP	SCIENTIFIC NAME	COMMON NAME	USFWS	FFWCC	FDACS	Potential Occurrence
Avian	<i>Ammodramus savannarum floridanus</i>	Florida grasshopper sparrow	E	E		Low
	<i>Aphelocoma coerulescens</i>	Florida scrub jay	T	T		Low
	<i>Athene cunicularia floridana</i>	Burrowing owl		T		Moderate
	<i>Egretta caerulea</i>	Little blue heron		T		Observed
	<i>Egretta rufescens</i>	Reddish Egret		T		Moderate
	<i>Egretta tricolor</i>	Tricolored heron		T		High
	<i>Falco sparverius paulus</i>	Southeastern American kestrel		T		High
	<i>Antigone canadensis pratensis</i>	Florida sandhill crane	MBTA	T		Observed
	<i>Haliaeetus leucocephalus</i>	Southern bald eagle	BGEMA	M		Observed
	<i>Mycteria americana</i>	Wood stork	E	E		Observed
	<i>Pandion haliaetus</i>	Osprey	MBTA	M		Observed
	<i>Picoides borealis</i>	Red-cockaded woodpecker	E	E		Low
	<i>Platalea ajaja</i>	Roseate spoonbill		T		Observed
	<i>Polyborus plancus audubonii</i>	Audubon's crested caracara	T	T		Observed
<i>Rostrhamus sociabilis plumbeus</i>	Everglades snail kite	E	E		Low	
Mammal	<i>Sciurus niger</i>	Southern fox squirrel		M		Moderate
	<i>Ursus americanus floridanus</i>	Florida black bear		M		Low
Reptile	<i>Alligator mississippiensis</i>	American alligator	T(S/A)	SSC		High
	<i>Drymarchon corais couperi</i>	Eastern indigo snake	T	T		High
	<i>Gopherus polyphemus</i>	Gopher tortoise	C	T		Moderate
	<i>Pituophis melanoleucus mugitis</i>	Florida pine snake		T		Moderate
	<i>Stilosoma extenuatum</i>	Short-tailed snake		T		Low
Plants	<i>Calopogon multiflorus</i>	Many-flowered grass-pink			T	Low
	<i>Centrosema Arenicola</i>	Sand butterfly pea			E	Low
	<i>Conradina brevifolia</i>	Short-leaved rosemary	E		E	Low
	<i>Conradina grandiflora</i>	Large-flowered rosemary			T	Low
	<i>Glandularia maritima</i>	Coastal vervain			E	Low
	<i>Lechea cernua</i>	Nodding pinweed			T	Low
	<i>Linum carteri var. smallii</i>	Small's flax			E	Low
	<i>Nemastylis floridana</i>	Celestial lily			E	Low
<i>Nolina atopocarpa</i>	Florida beargrass			T	Low	

GROUP	SCIENTIFIC NAME	COMMON NAME	USFWS	FFWCC	FDACS	Potential Occurrence
Plants	<i>Panicum abscissum</i>	Cut-throat grass			E	Low
	<i>Pinguicula caerulea</i>	Blue-flowered butterwort			T	Moderate
	<i>Pinguicula lutea</i>	Yellow-flowered butterwort			T	Moderate
	<i>Polygala lewtonii</i>	Lewton's polygala	E		E	Low
	<i>Polypodium dispersum</i>	Widespread polypody			E	Low
	<i>Polypodium plumula</i>	Plume polypody			E	Low
	<i>Polypodium ptilodon</i>	Swamp plume polypody			E	Low
	<i>Pteroglossaspis ecristata</i>	Giant orchid			T	Low
	<i>Warea carteri</i>	Carter's warea	E		E	Low
	<i>Zephyranthes simpsonii</i>	Redmargin Zephyrlily			T	Low

E = Endangered T = Threatened M = Managed C = Candidate
 BGEMA = Bald and Golden Eagle Protection Act
 MBTA = Migratory Bird Treaty Act
 T(S/A) = Threatened due to Similarity of Appearance
 USFWS = United States Fish and Wildlife Service
 FWC = Florida Fish and Wildlife Conservation Commission
 FDACS = Florida Department of Agriculture and Consumer Services

Figure 3-1: Protected Species and Habitat



Malabar Road PD&E Study
 From St. Johns Heritage Parkway
 to Minton Road
 Brevard County, FL
 FPID: 437210-1-28-01

**PROTECTED SPECIES
 AND HABITAT MAP**

**FIGURE
 3-1**

3.4 Federally Listed Species and Designated Critical Habitat

The study area is located within or partially within the USFWS Consultation Area (CA) of the Audubon's crested caracara, Everglade snail kite, Florida grasshopper sparrow, Florida scrub-jay, and red-cockaded woodpecker. A Consultation Area is intended to identify the geographical landscape where each federally listed species is most likely to occur. Portions of the study area also fall within seven wood stork Core Foraging Areas (CFA), which include suitable foraging areas important to the reproductive success of known wood stork nesting colonies. The existing habitats in the study area may also support other federally protected species including the American alligator, bald eagle, eastern indigo snake, and gopher tortoise, a candidate species.

3.4.1 Audubon's Crested Caracara

USFWS Audubon's crested caracara CA is located over the entire project. It is a resident, non-migratory species in Florida that prefers grasslands and pastures in the south-central region of the state, particularly in Glades, DeSoto, Highlands, Okeechobee, and Osceola Counties (USFWS, 1999). Historically, caracara inhabited dry or wet prairies with scattered cabbage palms (*Sabal palmetto*) and occasionally used lightly wooded areas next to those prairies. Many of those areas were converted and frequently replaced by pastures with non-native sod-forming grasses that still support caracaras. The caracara is classified as threatened because of habitat losses and population declines (Layne, 1996). No critical habitat has been designated for the Audubon's crested caracara.

A species-specific caracara survey was conducted from January through April 2020 in accordance with the caracara survey methodology developed by Morrison (2001), supplemental information established by the USFWS (2004a), and additional survey guidance prepared by the USFWS (2015, 2016). Prior to the start of the survey, biologists conducted site visits of the proposed project area to determine the best vantage points to observe caracara activity along the roadways and up to 1,500 meters from the project boundaries. Based on the preliminary field analysis, an Audubon's Caracara Survey Methodology for the Malabar Road PD&E Study was developed and submitted to the USFWS on December 9, 2019, (**Appendix D**), that was subsequently approved on December 11, 2019. Surveys were conducted by qualified biologists at least 15 minutes prior to sunrise for at least three hours per survey block. Biologists spent the entire three-hour survey session in the bed of a pick-up truck observing and recording caracara activity with the assistance of binoculars and a Nikon PROSTAFF 5 scope with 16-48 power. A total of eight survey sessions were conducted for each survey block. The survey map depicting the overall project area, survey blocks, and 1,500-meter buffer; data sheets; caracara activity maps; and photographs are included in **Appendix E**.

Adult and juvenile caracara were observed on multiple days of the survey. Caracara activity included foraging in the pastures and along the roadsides, perching on trees and power poles, traveling over and between pastures, and demonstrating mating behavior, such as pairs perching together, preening, and sharing food was observed. Nesting activity was documented on several occasions (**Appendix E**), resulting in the positive identification of two caracara nests along the north side of Malabar Road (**Figure 3-2**). The nests range from approximately 1041 meters to approximately 1105 meters from proposed project activities, which are within the USFWS's 1,500-meter nest protection zone for crested caracara (USFWS, 2015). As a result, the proposed project

“may affect” the crested caracara and further consultation with the USFWS is warranted. There are five “may affect” scenarios, with four providing for a “may affect, not likely to adversely affect” determination. The fifth scenario is a “may affect, and is likely to adversely affect” determination and requires formal consultation.

The Standard Local Operating Procedures for Endangered Species (SLOPES) for Audubon’s crested caracara (**Appendix F**) and the USFWS Guidelines provide a series of recommended restrictions for activities in the primary and secondary zones both during nesting season and outside nesting season. These recommendations are the basis for the USFWS’s concurrence determination. In evaluating impacts to the caracara, the USFWS defines a primary zone as 300 meters (985 feet) and a secondary zone as 1,500 meters (4,952 feet). Projects within 1,500 meters of a nest that can avoid adverse impacts and/or implement conservation measures would provide a “may affect, but not likely to adversely affect” determination. If impacts are considered adverse and conservation measures cannot be implemented, the project “may affect, and is likely to adversely affect” the caracara and formal consultation is required. Mitigation to offset proposed impacts to caracara habitat will be discussed during formal consultation with the USFWS under section 7 of the ESA.

The Guidelines and SLOPES flowchart were utilized to determine the impacts on the caracara as a result of the Recommended Preferred Alternative. The survey identified two caracara nests located within 1500 meters of the Recommended Preferred Alternative; and therefore, avoidance or implementation of conservation measures must be utilized to ensure the project is not likely to adversely affect the caracara. Both strategies will be utilized to eliminate adverse effects to the caracara. To avoid and minimize impacts to caracara foraging habitat, the recommended preferred pond site (C8 and C9 Atl. 1) was chosen to eliminate impacts to suitable habitat within 1,500 meters from the nests. Conservation measures will be implemented for areas within the protection zone where avoidance was not practicable. The SLOPES flowchart followed the sequence which concluded with conservation measures and actions proposed outside nesting season in order to obtain a not likely to adversely affect determination.

The Guidelines identify conservation measures that help reduce the impact of a project on the caracara and are compatible with caracara survival. The conservation measures are defined below along with project-specific measures and conditions in **bold text**.

Conservation Measures

- Management Zones – In evaluating project impacts to the caracara, the USFWS defines a primary zone as 300 m (985 ft), and a secondary zone as 1,500 m (4,920 ft) outward from the nest tree. Protection of the primary zone is very important particularly during the nesting season and must be maintained in order to provide conditions for successful reproduction. **The Recommended Preferred Alternative will not impact the primary zone.**
- Secondary Zone –This zone is generally defined as the foraging territory in which the nest site is located. This secondary zone is used by caracaras for the collection of nest material, roosting, and feeding. This amount of suitable habitat contiguous to the nest site may be

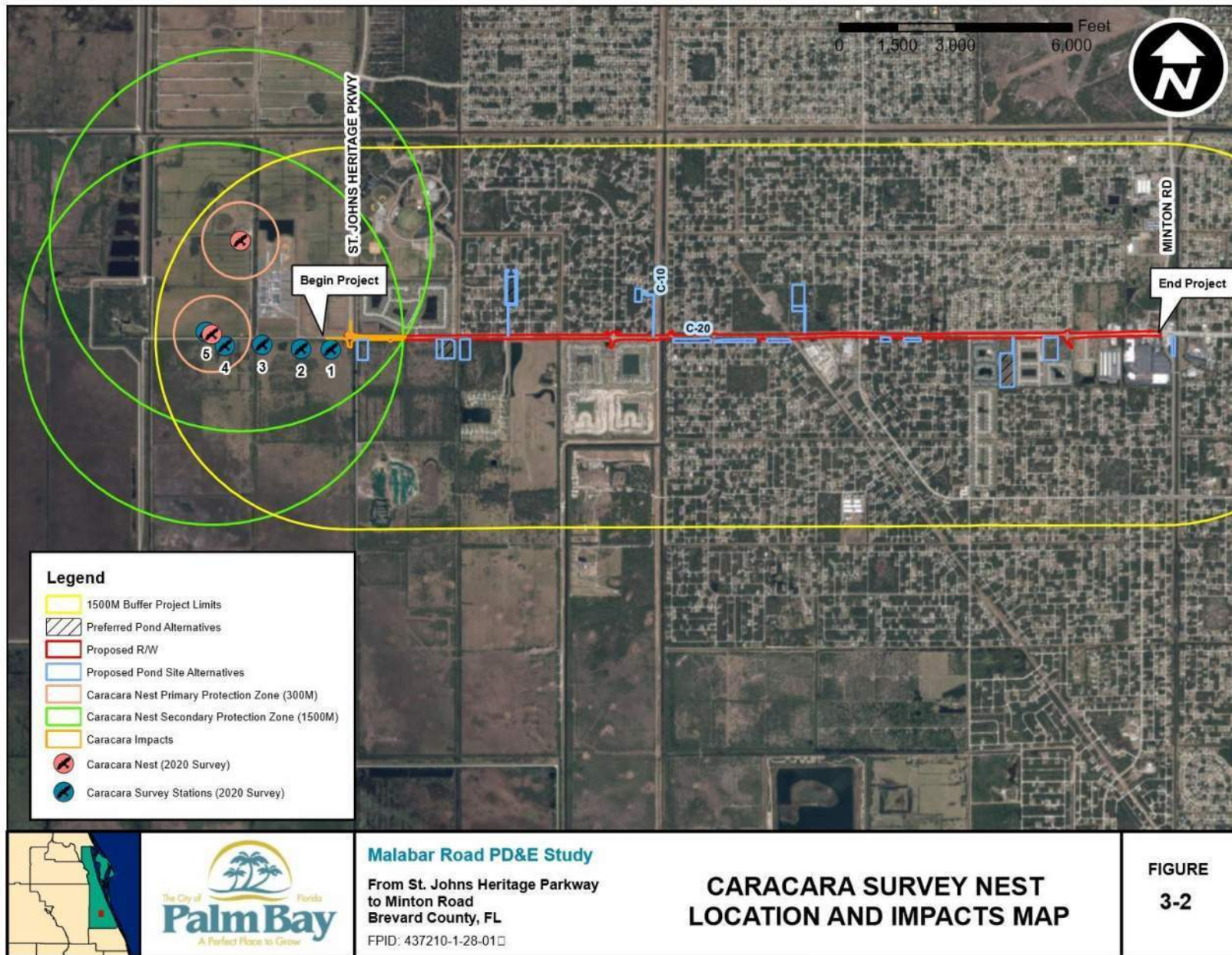
required to maintain the ecologic function of the nesting territory. Conservation measures for this zone are directed at maintaining the foraging capacity of the area.

- Maintain pasture, grassland, and wetlands that are necessary for caracara foraging. **All suitable foraging habitat will remain. The impacts within the secondary protection zone are primarily located within the existing roadway and disturbed right-of-way. Construction activities that extend beyond the existing right-of-way to accommodate the roundabout at Malabar Road and St. Johns Heritage Parkway (SJHP) impact approximately 3.01 acres of land which is dominated by dense Brazilian pepper (*Schinus terebinthifolia*) and provides no suitable foraging habitat. Based on the location of the nests, current conditions including road traffic, farming activities and activities associated with the school, do not appear to affect life history requirements of the caracara. Construction activities including clearing have commenced for the St. Johns Preserve, a single-family home subdivision located just west of St. Johns Heritage Parkway and north of Malabar Road. This development is located between the nests and proposed project impacts, thus limiting utilization to the east where the roadway construction activities occur. The disturbance from the surrounding land uses and construction of the previously mentioned development have not inhibited nesting activity, therefore it is unlikely that disturbance from the construction of the Recommended Preferred Alternative would have an adverse effect. Based on observations in the field, including documented flight activity, caracara are utilizing the large tracts of suitable habitat located to the north, west and south of the nest. Most of these lands are part of the Three Forks Conservation Area and provide optimal caracara nesting and foraging habitat. Foraging capacity will not decrease as a result of the Recommended Preferred Alternative.**
- Limit use of chemicals toxic to wildlife, including pesticides, fertilizers, or herbicides, as they may impact the caracara through its food supply. **Due to the nature of the project, use of pesticides, fertilizers, or herbicides are not anticipated.**
- Non-nesting Season (May to October) – Impacts during the active nesting season can be avoided by timing of activities near the nest site. **Construction activities associated with the Malabar Road and St. Johns Heritage Parkway intersection occur within the secondary protection zone and will be conducted during the non-nesting season.**

Based on the distance of the proposed construction activities from the nest; existing disturbances which do not appear to affect caracara nesting; lack of caracara utilization due to unsuitable foraging habitat within the proposed construction footprint; remaining foraging capacity;

implementation of conservation measures, including constructing outside of nesting season as described above, the Recommended Preferred Alternative “**may affect, but is unlikely to adversely affect**” the Audubon’s crested caracara.

Figure 3-2: Caracara Nest Location and Impacts Map



3.4.2 Everglade Snail Kite

USFWS Everglade snail kite CA is located over the entire project. The Everglade snail kite is classified as endangered due to a “very small population and increasingly limited amount of fresh marsh with sufficient water to ensure an adequate supply of snails” (Bureau of Sport Fisheries and Wildlife, 1973, p. 120). The USFWS has designated critical habitat for snail kites, which consists mostly of marshes near south Florida. The Everglade snail kite is a non-migratory subspecies only found in Florida, particularly near large watersheds (e.g., Everglades, Lake Okeechobee) and the shallow vegetated edges of lakes that support apple snail, the primary component of the snail kite’s diet. The corridor is highly developed and lacks the marshes and large waterbodies suited for snails and snail kites. No critical habitat for the snail kite occurs within the project corridor. No suitable habitat and no individuals were observed during the field surveys; therefore, the proposed project alternatives will have “**no effect**” on the Everglade snail kite.

3.4.3 Florida Grasshopper Sparrow

USFWS Florida grasshopper sparrow CA is located over the entire project. The Florida grasshopper sparrow was listed as endangered because of habitat loss and degradation resulting from conversion of native vegetation to improved pasture and agriculture (51 FR 27492). The Florida grasshopper sparrow is a subspecies of grasshopper sparrow that is endemic to the dry prairie region of central and south Florida. This subspecies is extremely habitat specific and relies on fire every two or three years to maintain its habitat (USFWS, 1999). The primary habitat consists of large (>50 hectares), treeless (less than one tree per acre), and relatively poorly drained prairies dominated by saw palmetto and dwarf oaks (Delany et al., 1985). It is known to occur only in Highlands, Okeechobee, Osceola, and Polk counties (Robertson & Woolfenden, 1992; Delany, 1996) and has been extirpated from Collier and Hendry counties (USFWS, 1999). Even though the study area is within the Florida grasshopper sparrow CA, it is outside the USFWS’s current range for this species. No suitable habitat or individuals were observed during the field surveys. The proposed project alternatives will have “**no effect**” on the Florida grasshopper sparrow.

3.4.4 Florida Scrub-Jay

USFWS Florida scrub-jay CA is located over the entire project. The scrub-jay is classified as threatened due to habitat loss, degradation, and fragmentation (USFWS, 1987). They only occur on ancient dune ecosystems and scrub habitats of peninsular Florida. The USFWS and FWC have documented occurrences of the scrub-jay east of Minton Road, outside the proposed project limits. These populations are surveyed yearly as part of the City Palm Bay’s Habitat Conservation Plan (HCP) and Incidental Take Permit (ITP). According to the HCP, no scrub-jay occurrences have been documented within the proposed project area. As part of the ETDM Summary Report, the USFWS recommended a scrub-jay survey in areas of suitable habitat due to the proximity of documented occurrences.

According to the scrub-jay habitats described by Fitzpatrick et al. (1991), the habitats adjacent to Malabar Road consist mostly of Type III or non-ranked (i.e., non-suitable) scrub-jay habitats. One area of Type II scrub-jay habitat was observed. Scrub-jay habitat classifications include the following:

Type I- any upland plant community in which scrub oak species is greater than or equal to 15 percent cover.

Type II – any plant community in which one or more scrub oak species is present but is less than or equal to 15 percent cover.

Type III – any upland or seasonally dry wetland within 400 meters (0.25 miles) of any area designated as TYPE I or Type II habitat.

Areas of suitable habitat were surveyed in accordance with the Florida Scrub-Jay Survey Guidelines and Protocols (USFWS, 2007). Using GIS, call-stations were established on a 200 meter grid in potential scrub-jay habitat in and adjacent to the limits of construction. Those call-stations were transferred to a Trimble GPS with sub-meter accuracy so that biologists could determine in the field whether or not the GIS-based call-stations were suitable for the survey. The GIS-based call-station was moved in the field if the topography or density of vegetation would impede a biologist’s ability to visually observe a scrub-jay. The geographic coordinates and corresponding land use and cover and scrub-jay habitat class have been provided in **Table 3-2**.

Table 3-2: Scrub-jay Survey Stations

Call Station	Latitude	Longitude	FLUCFCS Code	Habitat Type	FSJ Observation
FSJ 1	27.998428	-80.685213	440	III	NONE
FSJ 2	27.997592	-80.685091	440	III	NONE
FSJ 3	27.996862	-80.685686	440	III	NONE
FSJ 4	27.9965	-80.684843	440	III	NONE
FSJ 5	27.996048	-80.685648	440	III	NONE
FSJ 6	27.995595	-80.684856	440	III	NONE
FSJ 7	27.99879	-80.681994	428	III	NONE
FSJ 8	27.997546	-80.682167	428	III	NONE
FSJ 9	27.998178	-80.680496	428	III	NONE
FSJ 10	27.997627	-80.680943	428	III	NONE
FSJ 11	27.998584	-80.678373	170	I	NONE
FSJ 12	27.99769	-80.678271	170	I	NONE

Surveys were conducted on calm, clear days about one hour after sunrise in March and April of 2020. Florida scrub-jay vocalizations, including the territorial scolds and the female “hiccup,” were broadcast through a JBL speaker for one minute in each cardinal direction. The scrub-jay vocalizations were acquired from the Macaulay Library at the Cornell Lab of Ornithology. If accipiters or other scrub-jay predators were observed near a call station, the survey was temporarily suspended until the accipiters or predators cleared the area. Biologists did not observe Florida scrub-jays nor hear an auditory response to the broadcasts from scrub-jays. The survey station location map, scrub-jay survey data sheets, and scrub-jay habitat assessment sheets with photographs are provided in **Appendix G**. Based on the scrub-jay survey results as

well as the current site conditions and limits of proposed impacts, the proposed project alternatives **"may affect, but are not likely to adversely affect"** the Florida scrub-jay.

3.4.5 Red-Cockaded Woodpecker

The USFWS red-cockaded woodpecker (RCW) CA only covers the eastern project terminus near the intersection of Malabar Road and Minton Road, and includes less than 0.08 miles of the project. The RCW is listed by the USFWS as endangered due to habitat loss, degradation and fragmentation (35 FR 16047). The species is still widely distributed throughout the state, but the largest populations occur on federally managed lands in the panhandle (USFWS, 1999). RCW habitat consists of pine stands or pine-dominated forests with little to no understory and numerous old growth pines, particularly longleaf pines. It excavates cavities in the living part of pine trees, typically choosing trees greater than 80 years old. No critical habitat has been designated for the RCW.

No RCW habitat was observed in the study area. While there are areas within the study corridor that contain longleaf pine and pine dominated forests, the trees are too young and located in habitats not suitable for red-cockaded woodpeckers. No RCWs or suitable habitat were observed. The proposed project alternatives will have **"no effect"** on the red-cockaded woodpecker.

3.4.6 Wood Stork

The wood stork is listed by the USFWS threatened. Wood storks are associated with freshwater and estuarine wetlands that are used for nesting, roosting, and foraging. Nesting typically occurs in medium to tall trees that occur in stands located in swamps or islands surrounded by open water (Odgen, 1991; Rodgers et al. 1996). Preferred foraging habitat includes wetlands with a mosaic of submerged and/or emergent aquatic vegetation, and shallow open-water areas. Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of receding water levels. No critical habitat has been designated for the wood stork.

According to the USFWS's North Florida Ecological Service Office, the habitats within 15 miles of a wood stork breeding colony are considered to be wood stork CFAs. Portions of the study area fall within the CFA of seven wood stork breeding colonies: Deseret Ranch, Grange Island, Grant Farm Island, Kemper Ranch, Micco North, Micco South, and US 192 East. Wood storks were observed flying over and foraging within the study area. Ecologists observed Suitable Foraging Habitat (SFH) throughout the study area including roadside ditches and canals, and areas within proposed pond site locations. The Recommended Preferred Alternative will impact 0.69 acres of SFH. According to the Wood Stork Effect Determination Key for Central and North Peninsular Florida (USFWS, 2008) (Appendix H), the proposed project "may affect, but is not likely to adversely affect" the wood stork. This effect determination was made using the following sequence from the key: A-B-C-D-E(1). Unavoidable impacts greater than 0.5 acres will be offset at an USFWS-approved mitigation bank within the appropriate CFA to satisfy the elements detailed in the key to ensure that the proposed project does not adversely affect the wood stork. Currently, there are banks with available credits to satisfy the mitigation requirements.

3.4.7 American Alligator

The American alligator is listed as threatened due to its similarity of appearance to the American crocodile (*Crocodylus actus*). This listing status allows for state-approved management and control programs in addition to federal protections. Alligators occur throughout Florida but prefer to use freshwater lakes and slow-moving rivers and their associated wetlands. No critical habitat has been designated for the American alligator.

Suitable habitat for the American alligator was observed within the study area. Most of the habitat consists of canals and reservoirs, including proposed pond site locations. No alligators were observed during the surveys. While the project will impact suitable alligator habitat, the extent of impacts relative to habitat within the corridor will be minimal and alligators will be able to continue to fulfill their life history strategies. Based on the information provided above, the proposed project “**may affect, but is not likely to adversely affect**” the American alligator.

3.4.8 Eastern Indigo Snake

The eastern indigo snake is listed by the USFWS as threatened due to over-collecting for the pet trade as well as habitat loss and fragmentation (USFWS, 1999.) The eastern indigo snake is widely distributed throughout central and south Florida. They occur in a broad range of habitats, from scrub and sandhill to wet prairies and mangrove swamps. Indigo snakes are most closely associated with habitats occupied by gopher tortoises whose burrows provide refugia from cold or desiccating conditions (USFWS, 1999). No critical habitat has been designated for the eastern indigo snake.

Suitable habitat for the indigo snake was observed within the study area, including proposed pond site locations. No indigo snakes were observed during the field reviews. Suitable habitat for the gopher tortoise was observed; however, no gopher tortoise burrows were identified within the proposed project limits. A 100% gopher tortoise survey was not conducted during this PD&E Study, but will be required before construction activities commence. To address any potential effects to the eastern indigo snake, all potentially occupied gopher tortoise burrows within the limits of construction will be excavated and the *Standard Protection Measures for the Indigo Snake* (USFWS, 2013; **Appendix I**) will be implemented during construction activities. As a result, the proposed alternatives “**may affect, but are not likely to adversely affect**” the eastern indigo snake. This effect determination was made using the following sequence from the *Eastern Indigo Snake Effect Determination Key* (**Appendix I**): A–B–C–D–E.

3.4.9 Gopher Tortoise

The gopher tortoise is a Candidate for listing under the ESA by the USFWS and listed as threatened by the FWC. They occur in the southeastern Coastal Plain from Louisiana to South Carolina; the largest portion of the total population is located in Florida (FWC 2012). Gopher tortoises require well-drained, sandy soils for burrowing and nest construction, with a generally open canopy and an abundance of herbaceous groundcover, particularly broadleaf grasses, wiregrass (*Aristida stricta*), legumes and fruits for foraging. Gopher tortoises can be found in most types of upland communities including disturbed areas and pastures. No critical habitat has been designated for the gopher tortoise.

Suitable gopher tortoise habitat was observed within the study area, including proposed pond site locations. A 100% gopher tortoise survey was not conducted. Gopher tortoise burrows were observed within the study area, but not within the proposed project limits. No gopher tortoises were observed during the field surveys. A permit may be necessary from the FWC if tortoises are present within any permanent or temporary construction area. Based on the information provided above, the proposed project **“may affect, but is not likely to adversely affect”** the gopher tortoise.

3.4.10 Federally Protected Plant Species

According to the FNAI and USFWS, 3 federally protected plants have the potential to occur within the study area (**Table 3-1**). These species are listed as Endangered and include Carter’s warea (*Warea carteri*), Lewton’s polygala (*Polygala lewtonii*) and short-leaved rosemary (*Conradina brevifolia*). These species are restricted to sandy habitats maintained by periodic fire, such as scrub, high pine, and sandhill. Limited habitat occurs within the project footprint. Due to development and the agricultural nature of non-developed areas within and adjacent to the study area, these species are unlikely to occur within the project area. Ecologists did not observe federally protected plants during the field surveys. The FNAI database listed no Elemental Occurrences of protected plants within the study area. ETAT comments from the USFWS state that surveys for federally listed plant species should be conducted by a trained botanist. Additional surveys for listed plant species will be conducted during design and permitting. Due to no protected plants being observed during the field surveys, the proposed project **“may affect, but is not likely to adversely affect”** federally protected plants.

3.5 State Listed Species

The FWC maintains the list of animals designated as federally endangered, federally threatened, state threatened, or species of special concern. While the USFWS has primary responsibility for federally endangered or threatened species in Florida, the FWC works as a cooperating agency to help conserve these species and other imperiled species found in the state. Some listed and non-listed species are considered ‘managed species’ because of the well-developed programs that address their species’ conservation, management, or recovery. The FWC has developed a comprehensive management plan and species action plans for the state’s 59 state-listed species (FWC, 2016, 2020).

3.5.1 Florida Burrowing Owl

The FWC listed the Florida burrowing owl as threatened due to loss of native habitat, dependence on altered habitat, and lack of regulatory protections (FWC, 2013a). The burrowing owl is a non-migratory, year-round breeding resident of Florida, and maintains home ranges and territories while nesting. Burrowing owls inhabit upland areas that are sparsely vegetated. Natural habitats include dry prairie and sandhill, but they will make use of ruderal areas such as pastures, airports, parks, and road rights-of-way because much of their native habitat has been altered or converted to other uses.

Ecologists did not observe burrowing owls during the general wildlife and species-specific surveys of the project area. Suitable habitat was observed throughout the study area including proposed pond site locations. Burrowing owls usually dig their own burrows but are known to utilize gopher tortoise burrows and armadillo burrows as well. Gopher tortoise burrows and mammal burrows

were observed within the study area. If burrowing owls are observed onsite, coordination with the FWC will occur to discuss avoidance, minimization, and permitting options. Avoidance measures that eliminate the need for FWC incidental take permitting include: avoiding acts that kill or injure burrowing owls or eggs; maintaining a minimum 10-foot buffer during non-breeding season (July 11-February 14) and a minimum 33-foot buffer during breeding season (February 15 – July 10) around the entrance of Potentially Occupied Burrows (POB); and ensuring that the project does not impact 50% or greater of foraging habitat within a 1,970-foot radius of a POB. Pre-construction surveys will be conducted to adhere to the components of the Imperiled Species Management Plan (ISMP) and permitting guidelines; therefore, **“No adverse effect is anticipated”** for the burrowing owl resulting from the proposed project.

3.5.2 Florida Pine Snake

The Florida pine snake is listed by the FWC as threatened due to habitat loss, fragmentation, and degradation to upland habitats from development and fire suppression (FWC, 2013b). They inhabit areas that feature well-drained sandy soils with a moderate to open canopy (Franz 1992, Ernst and Ernst 2003). Preferred habitats include sandhill and former sandhill, including old fields and pastures, sand pine scrub, and scrubby flatwoods. The pine snake often coexists with gopher tortoise and pocket gophers, spending the majority of its time underground.

No pine snakes were observed during the field surveys. Minimal suitable habitat was observed within the project corridor, and mostly occurs within the proposed pond site locations. Gopher tortoise, mammal burrows and pocket gopher mounds were observed. All gopher tortoise burrows within the construction limits will be excavated. Current FWC guidelines for the relocation of the Florida pine snake state that any incidentally captured pine snake should be released on-site or allowed to escape unharmed if habitat will remain post-development. **“No adverse effect is anticipated”** for the Florida pine snake resulting from the proposed project since suitable habitat will remain and current guidelines for relocating commensal species will be followed.

3.5.3 Florida Sandhill Crane

The FWC listed the Florida sandhill crane as threatened due to the loss and degradation to nesting and foraging habitat from development and hydrologic alteration to their potential nesting habitat (FWC, 2013c). It is widely distributed throughout most of peninsular Florida. Sandhill cranes rely on shallow marshes for roosting and nesting and open upland and wetland habitats for foraging (Wood and Nesbitt 2001).

Florida sandhill cranes were observed on multiple occasions throughout the study area during the general wildlife and species specific surveys. Nesting and roosting habitats are limited within the project corridor due to the lack of wetlands. The marshes and wet prairies adjacent to the study area provide potential nesting and roosting habitat for the sandhill crane. The pastures and other open uplands, including the roadway right-of-way, provide foraging habitat. Ecologists observed sandhill cranes, including juveniles, foraging in these areas and roadside ditches during numerous field surveys. Avoidance measures that eliminate the need for FWC take permitting include: avoid impacts to natural wetlands used for breeding, feeding, or sheltering; avoid activities within 400 feet of an active nest; and avoid land used conversion within 1,500 feet of the nest site until after young are capable of sustained flight. Due to the lack of wetland impacts and suitable nesting

habitat within 400 feet of the project limits, “**No adverse effect is anticipated**” for the Florida sandhill crane resulting from the Recommended Preferred Alternative.

3.5.4 Southeastern American Kestrel

The southeastern American kestrel is listed by the FWC as threatened due to habitat loss, degradation and fragmentation, as well as lack of regulatory protection (FWC 2013d). The southeastern American kestrel is the only non-migratory, permanent resident kestrel in Florida. However, the seasonal occurrence of a migratory subspecies of the northern American kestrel (*Falco sparverius sparverius*) occurs from September through March in Florida. Confident identification of southeastern American kestrels can only be made during the portion of the breeding season when migratory species are not present (FWC, 2013d). The southeastern American kestrel is a secondary cavity nester, preferring habitats of sandhill and open pine savannah maintained by fire. They can be found in open pine habitats, woodland edges, prairies, pastures, and other agricultural lands.

Ecologists observed suitable habitat throughout the study area, including proposed pond site locations. Kestrels were observed on multiple occasions at multiple locations. Some of the observations occurred during the winter and spring when the migratory subspecies could be present. Activities within the 492 feet (150 meter) buffer of an active nest are considered to cause take. Pre-construction surveys will be conducted to adhere to the components of the ISMP; therefore, “**No adverse effect is anticipated**” for the southeastern American kestrel resulting from the proposed project.

3.5.5 Imperiled Wading Birds

Four wading birds have the potential to occur in the study area. These species are the little blue heron, reddish egret, roseate spoonbill, and tricolored heron. All four are listed by the FWC as threatened due to the loss and degradation of habitat, particularly from hydrologic alterations to their essential foraging areas (FWC, 2013e). Little blue herons, roseate spoonbills and tricolored herons are widely distributed throughout peninsular Florida. Reddish egrets are found almost exclusively in coastal areas (Greenlaw, 2014). Wading birds depend on healthy wetlands and vegetated areas suitable for resting and breeding which are near foraging areas (FWC, 2013e). They forage in freshwater, brackish, and saltwater habitats. They tend to nest in multi-species colonies of a variety of woody vegetation types including cypress, willow, maple, black mangrove, and cabbage palm (FNAI, 2001).

Ecologists observed suitable foraging with minimal nesting habitat for wading birds throughout the study area, including proposed pond sites. Little blue herons and roseate spoonbills were observed. These observations include fly-overs and foraging in roadside ditches, existing ponds, and drainage ditches in adjacent pastures. No wading bird rookeries are located within the project area. Due to the lack of wetlands within the project limits, potential nesting habitat only occurs in habitats adjacent to the project. No nesting activity was observed during the field reviews. An updated wildlife survey for wading birds may be warranted prior to construction, since wading birds can build new nests each year. Additional components of the ISMP include the Species Action Plans. Specifically, Action 8, among others, identified in A Species Action Plan for Six Imperiled Wading Birds: Little Blue Heron (*Egretta caerulea*), Reddish Egret (*Egretta rufescens*), Roseate Spoonbill (*Platalea ajaja*), Snowy Egret (*Egretta thula*), Tricolored Heron (*Egretta tricolor*), White Ibis (*Eudocimus albus*) (FWC 2013) addresses coordination between the

FWC and other state agencies to promote water quality in stormwater retention facilities. As the FWC is a commenting agency under the Statewide Environmental Resource Permit Program, inclusion of a stormwater management system will provide a net benefit to water quality that will have a carryover benefit to state listed wading birds that will be addressed during permitting. **“No adverse effect is anticipated”** for wading birds resulting from the proposed project.

3.5.6 State Listed Plant Species

Through regulation by the FDACS Division of Plant Industry, Florida protects plant species native to the state that are endangered, threatened, or commercially exploited. The Florida Regulated Plant Index includes all plants listed as endangered, threatened, or commercially exploited as defined in Chapter 5B-40.0055, F.A.C. According to the FNAI, and FDACS 16 state protected plant species have the potential to occur in the study area (**Table 3-1**). However, the FNAI database listed no Elemental Occurrences of protected plants within the study area. Many of these plant species occur in open sandy habitats maintained by periodic fire, such as high pine, turkey oak barrens, sandhill, and xeric scrub. These habitats were rarely observed within the study area, but especially limited within the project footprint. Other state listed species prefer mesic and wetland habitats which are limited within the study area. Due to the agricultural nature within and adjacent to the study area, these species are unlikely to occur within the project footprint. Ecologists did not observe state listed plants during the field surveys. Additional surveys for listed plant species will be conducted during design and permitting. **“No adverse effect is anticipated”** for state listed plant species resulting from the proposed project.

3.6 Other Protected Species or Habitats

3.6.1 Bald Eagle

The bald eagle was removed from the ESA in 2007 and Florida’s Endangered and Threatened Species list in 2008; however, it remains protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The bald eagle is a member of the Accipitridae family. Bald eagles tend to nest in the tops of very tall trees that provide unobstructed lines of sight to nearby habitats, particularly lakes and other open waters. Because eagles are piscivorous (fish-eating) raptors, nearly all eagles’ nests occur within 1.8 miles of water (Wood et al., 1989). No critical habitat has been designated for the bald eagle.

According to the FWC’s Eagle Nest locator, which maintains the location of known eagles’ nests in the state, no nests are located within the study area. The nearest eagle’s nest (Nest BE010) is located over 3.5 miles from the project area. Suitable habitat for the bald eagle was observed throughout the study area. Several bald eagles were observed during the field reviews. No nests were observed. The proposed project will have **“no effect”** on the bald eagle since the proposed activities are well outside the 660-foot eagle nest protection buffer.

3.6.2 Florida Black Bear

The Florida black bear was removed from Florida’s Endangered and Threatened Species list in 2012; however, it remains protected under Chapter 68A-4.009 F.A.C., Florida Black Bear Conservation Plan. The study area is located in the occasional range of the Central Bear Management Unit (BMU).

The black bear requires large amounts of space for its home range and a variety of forested habitats, including flatwoods, swamps, scrub oak ridges, bayheads, and hammocks. Self-sustaining populations of bears are generally found on large tracks of contiguous forests with understories of berry producing shrubs or trees. These types of habitats are limited within and adjacent to the study area and are restricted to the western terminus of the project. Roadkill data, nuisance incidence data, and telemetry data published by FWC provide evidence that the Ocala/St. Johns subpopulation as well as the core population of the Central BMU do not commonly utilize the study area habitats. The FWC data shows no occurrences along the Malabar Road corridor. The closest data points include 4 reports of nuisance bears between one to two miles away from Malabar Road occurring in 1990, 2012 and 2013. Due to the lack of bear utilization and habitat within the project area, **“No adverse effect is anticipated”** for the Florida black bear resulting from the proposed project.

3.6.3 Southern Fox Squirrel

The southern fox squirrel was removed from Florida’s Endangered and Threatened Species list in 2018; however, it remains protected under Chapter 68A-4.001, 68A-1.004. and 68A-29.002(1)c F.A.C. It is a member of the Sciuridae family. The southern fox squirrel can be found throughout the Florida peninsula and up to central Georgia. They inhabit open, fire-maintained longleaf pine, turkey oak, sandhills, and flatwoods (FNAI 2001; FWC, 2013f). They will also utilize mixed hardwood – conifer forest, open areas with pines and oaks, cypress swamps, pastures, and other agricultural lands including the ecotones between these habitats. Southern fox squirrels typically have two breeding seasons each year. The winter breeding season occurs from October to February while the summer breeding season occurs from April to August (Woodling, 1997).

Ecologists observed suitable habitat for the southern fox squirrel within the study area, including proposed pond site locations. No individuals or nests were observed. Pre-construction surveys will be conducted to adhere to the components of the ISMP and permitting guidelines; therefore, **“No adverse effect is anticipated”** for the southern fox squirrel resulting from the proposed project.

3.6.4 Strategic Habitat Conservation Areas

Strategic Habitat Conservation Areas (SHCA) are lands in need of protection to maintain natural communities and viable populations of many species that are indicators of the state’s biological diversity. In 1994, FWC biologists completed a project entitled *Closing the Gaps in Florida’s Wildlife Habitat Conservation System* (Cox et al 1994), which assessed the security of rare and imperiled species on existing conservation lands in Florida. This research identified important habitat areas in Florida with no conservation protection. These SHCA serve as a foundation for conservation planning for species protection through habitat conservation. No SHCA occur within the study area.

3.6.5 Wildlife Management Areas

As previously mentioned in Section 1.3.3, the Three Forks Conservation Area is located near the western terminus of the project corridor. The proposed project will not impact the TFCA.

3.6.6 Aquatic Preserves and Outstanding Waters

Special protection is given to Outstanding Florida Waters (OFW) per Section 62-302.700, F.A.C. Activities or discharges within an OFW, or which significantly degrade an OFW, must meet a more stringent public interest test as outlined in Section 373.414 (1)(a), F.S. (2020). There are no aquatic preserves or OFWs within the Malabar Road study area.

SECTION 4 WETLANDS AND OTHER SURFACE WATERS

Ecologists performed a wetland evaluation of the study area. The wetland evaluation relied on literature reviews and field surveys to identify the location, extent, and functional value of wetlands in the study area; the potential direct, indirect, or cumulative effects of the project's actions to those wetlands; and available mitigation options to satisfy permit requirements from regulatory agencies. This wetland evaluation was performed in accordance with the Presidential Executive Order 11990 ("Protection of Wetlands"); U.S. Department of Transportation Order 5560.1A ("Preservation of the Nation's Wetlands"); Federal Highway Administration Technical Advisory T6640.8A regarding the preservation of environmental documents; and the *Wetlands and Other Surface Waters* chapter of the FDOT's PD&E Manual.

4.1 Efficient Transportation Decision Making

According to the ETDM Summary Report No. 14396, dated October 25, 2019, the EPA and USFWS indicated the project alternatives may create a "Moderate" DOE, while the NMFS, USACE, and SJTWMD indicated a "Minimal" DOE to wetlands and surface waters. The primary issues were the potential loss of wildlife habitat for wetland dependent species, degradation of water quality in wetlands and surface waters, and floodplain impacts that would alter discharge capacity. Alternatively, the FDEP indicated the project alternatives may create a DOE of "None" to wetlands and surface waters.

4.2 Methodology

The study methodology included GIS analysis, ETAT comments review, agency coordination, agency database searches, and field surveys. Section 1.3 lists the data sources utilized for review. Ecologists familiar with Florida's natural plant communities conducted a wetland evaluation to identify wetland vegetation, wetland hydrology, and hydrologic indicators to determine the presence of wetlands and other surface waters as part of the Malabar Road Study. A formal wetland delineation to determine jurisdictional boundaries was not performed; however, the general limits of wetlands and other surface waters were identified in the field using the criteria established in Rule 62-340, F.A.C, and the USACE's Corps of Engineers Wetland Delineation Manual (USACE, 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (USACE, 2010). Additionally, wetland boundaries were identified by existing environmental permits throughout the corridor. The wetland limits have not been reviewed by the SJRWMD, FDEP, or USACE. Wetlands and surface waters were classified per the FLUCFCS (FDOT, 1999) and the Classification of Wetlands and Deepwater Habitats of the United States (NWI) (Cowardin et al. 1979). The UMAM was utilized, per Chapter 62-345, F.A.C, for the functional assessment of wetlands within the Malabar Road Study.

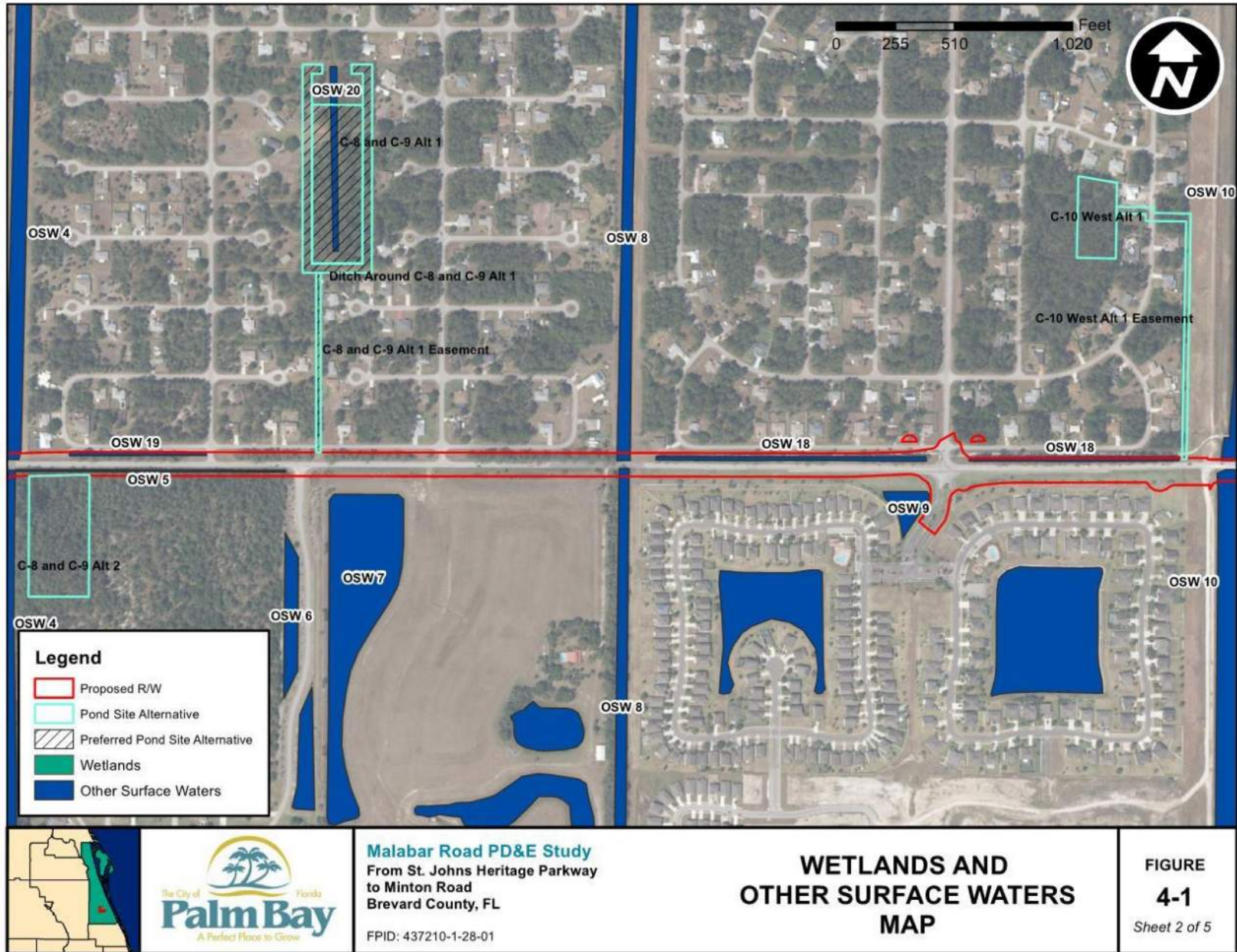
4.3 Wetland Habitats and Surface Waters

Wetlands and other surface waters with potential to be affected the proposed project were identified within the study area (**Figure 4-1**). The project corridor is highly developed with limited natural wetland systems identified within the project area. The following section includes a brief description of each wetland type and other surface water within the study area. **Table 4-1** provides details identifying each wetland, including the wetland number, FLUCFCS classification and NWI classification. FLUCFCS classifications are based on the results of the data analysis and field reviews of the study area. NWI classifications were not altered and are based on the listed classification of the nearest NWI wetland system as applicable.

Figure 4-1: Wetlands and Other Surface Waters Map



Figure 4-1: Wetlands and Other Surface Waters Map



Malabar Road PD&E Study
 From St. Johns Heritage Parkway
 to Minton Road
 Brevard County, FL
 FPID: 437210-1-28-01

**WETLANDS AND
 OTHER SURFACE WATERS
 MAP**

**FIGURE
 4-1**
 Sheet 2 of 5

Figure 4-1: Wetlands and Other Surface Waters Map

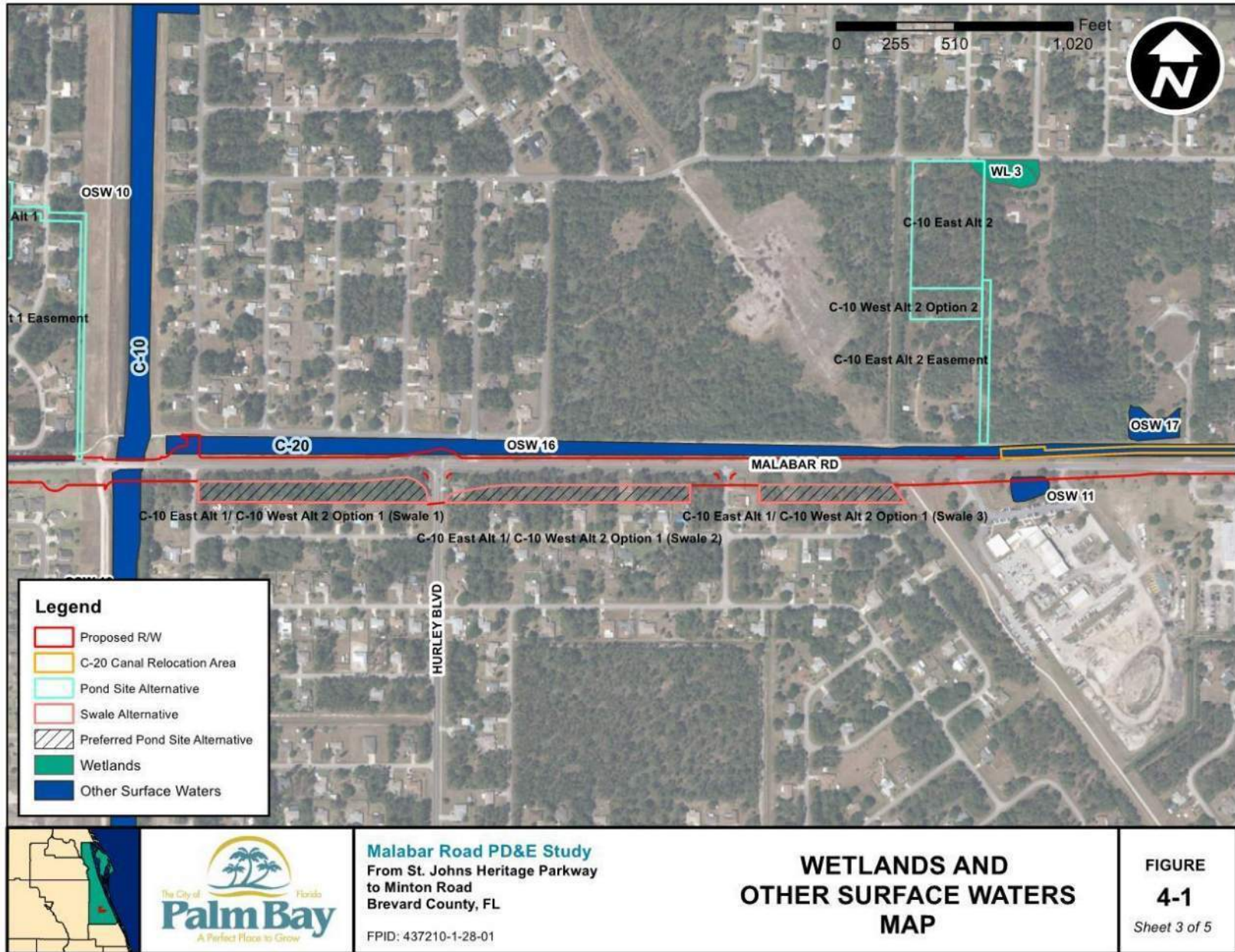


Figure 4-1: Wetlands and Other Surface Waters Map

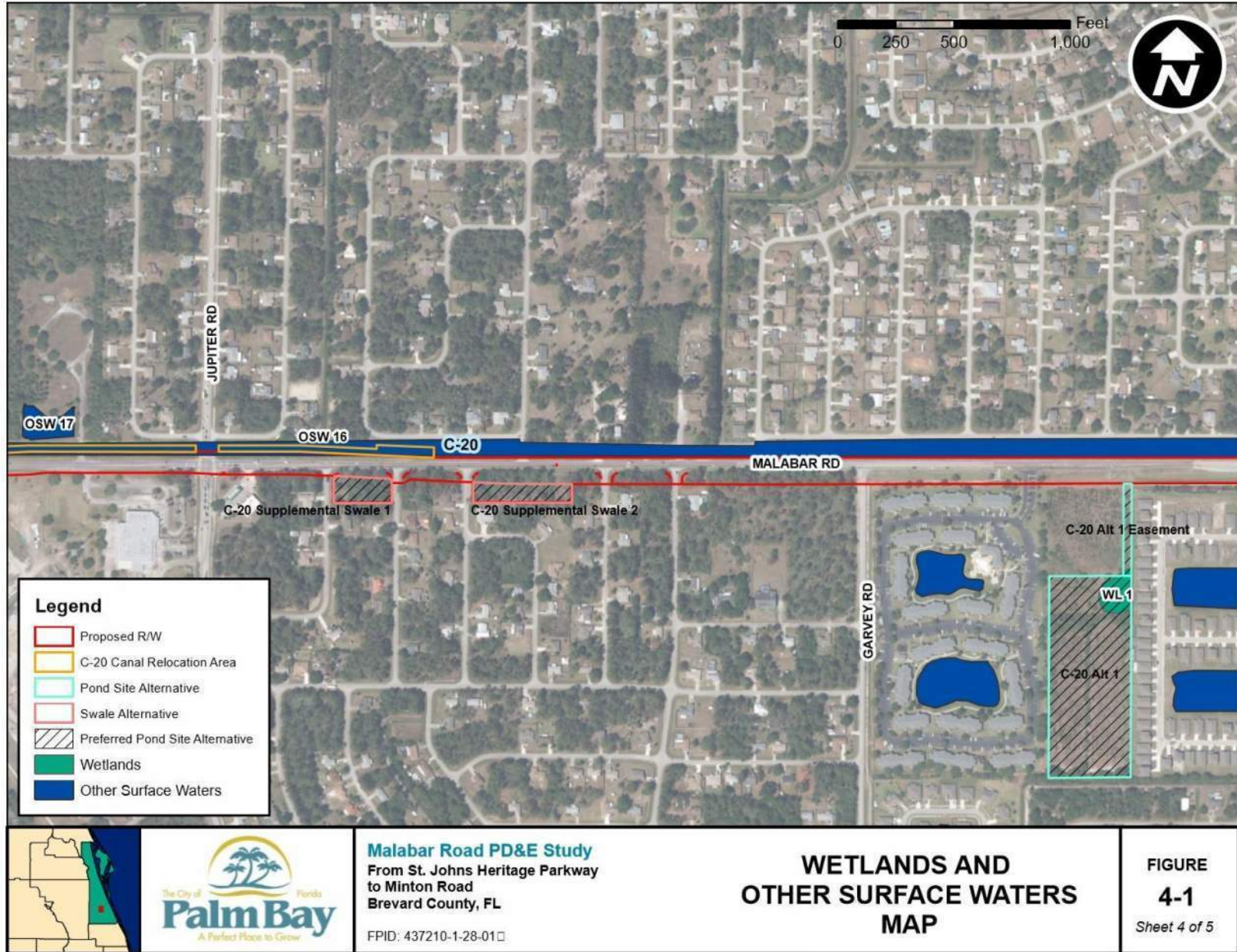


Figure 4-1: Wetlands and Other Surface Waters Map

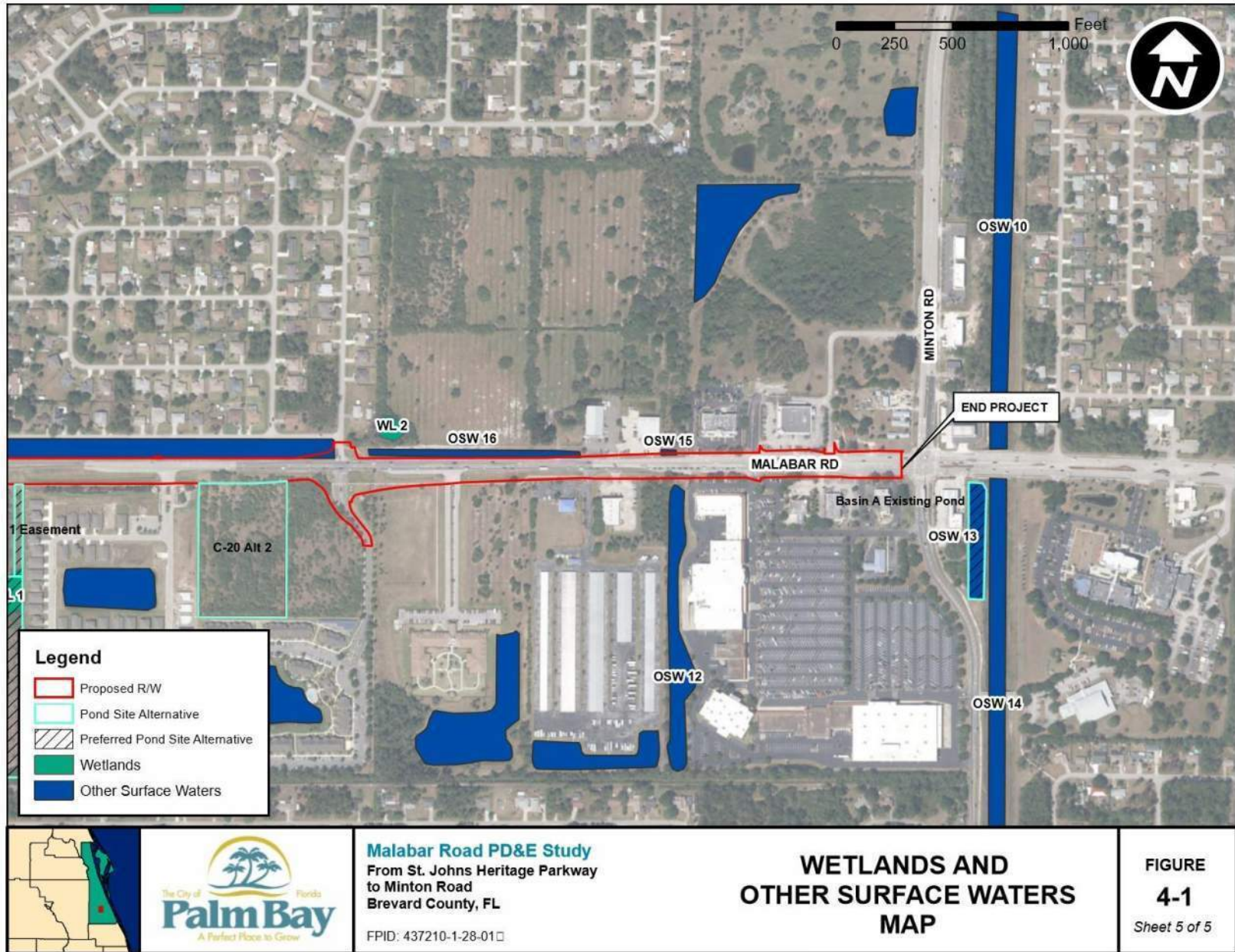


Table 4-1: Wetlands and Other Surface Waters in the Malabar Study Area

Wetland Number	FLUCFCS Classification	USFWS NWI Classification	Description
WL 1	641	N/A	Freshwater Marshes
WL 2	617	N/A	Mixed Wetland Hardwoods
WL 3	630	N/A	Wetland Forested Mixed
OSW 1	510	R5UBFx	Streams and Waterways
OSW 2	510	R5UBFx	Streams and Waterways
OSW 3	510	R5UBFx	Streams and Waterways
OSW 4	510	R5UBFx	Streams and Waterways
OSW 5	510	R5UBFx	Streams and Waterways
OSW 6	530	PUBHx	Reservoirs
OSW 7	530	PUBHx	Reservoirs
OSW 8	510	R5UBFx	Streams and Waterways
OSW 9	530	PUBHx	Reservoirs
OSW 10	510	R5UBFx	Streams and Waterways
OSW 11	530	PUBHx	Reservoirs
OSW 12	530	PUBHx	Reservoirs
OSW 13	837	N/A	Surface Water Collection Basin
OSW 14	510	R5UBFx	Streams and Waterways
OSW 15	510	R5UBFx	Streams and Waterways
OSW 16	510	R5UBFx	Streams and Waterways
OSW 17	530	PUBHx	Reservoirs
OSW 18	510	R5UBFx	Streams and Waterways
OSW 19	510	R5UBFx	Streams and Waterways
OSW 20	510	R5UBFx	Streams and Waterways
OSW 21	530	PUBHx	Reservoirs

4.3.1 Mixed Wetland Hardwoods

FLUCFCS: 617

NWI: N/A

Wetlands: Wetland 2 (WL 2)

Mixed wetland hardwood habitat is located in the southwestern corner of the abandoned citrus grove north of Malabar and just east of Maywood Avenue. This habitat consists of hardwood species with cabbage palm, slash pine (*Pinus elliotti*) and dense Brazilian pepper encroachment. The hydroperiod of this system has been severely diminished due to the internal agricultural ditches and drainage associated with the citrus grove. The proposed alternatives will have no impacts to WL 2.

4.3.2 Wetland Forested Mixed

FLUCFCS: 630
NWI: PUBHx
Wetlands: Wetland 3 (WL 3)

Wetland forested mixed habitat is located north of Malabar Road near proposed pond alternative C 10 East Alt 2. In addition to the forested wetland, a freshwater pond was also identified. Observed vegetation includes red maple (*Acer rubrum*), Brazilian pepper, wax myrtle (*Myrica cerifera*), saltbush (*Baccharis halimifolia*), swamp fern (*Blechnum serrulatum*), pennywort (*Hydrocotyle* spp.), white-top star rush (*Rhynchospora colorata*) and torpedo grass (*Panicum repens*).

4.3.3 Freshwater Marsh

FLUCFCS: 641
NWI: N/A
Wetlands: Wetland 1 (WL 1)

Freshwater marsh habitat within the project corridor is located south of Malabar Road near proposed pond site C-20 Alt 1. Observed vegetation includes wax myrtle, saltbush, primrose willow (*Ludwigia peruviana*), swamp smartweed (*Persicaria hydropiperoides*), torpedo grass, rush (*Juncus* sp.), winged loosestrife (*Lythrum alatum*), and prairie iris (*Iris savannarum*). The proposed pond site C-20 Alt 1 may result in 0.46 acres of direct impacts to WL 1.

4.3.4 Streams and Waterways

FLUCFCS: 510
NWI: R2UBHx, RU5BFx
Surface Waters: OSW 1, OSW 2, OSW 3, OSW 4, OSW 5, OSW 8, OSW 9, OSW 10, OSW 14, OSW 15, OSW 16, OSW 18, OSW 19, OSW 20

Streams and waterways include rivers, creeks, canals, and other linear bodies of water. There is a network of canals throughout the study area. Most of these canals were excavated in uplands for agricultural activities or stormwater collection. These canals ultimately collect stormwater runoff from roadside ditches. Mitigation is unlikely to be required for impacts to these OSWs. The Recommended Preferred Alternative may result in 4.03 acres of direct impacts to OSWs, which include the C-20 Canal (OSW 16) relocation areas.

4.3.5 Reservoirs

FLUCFCS: 530
NWI: PUBHx, PUSC_x,
Surface Waters: OSW 6, OSW 7, OSW 11, OSW 12, OSW 13, OSW 17, OSW 21

Reservoirs are artificial impoundments of water used for irrigation, flood control, municipal and rural water supplies. Reservoirs are located throughout the study area. Many of the reservoirs are permitted stormwater ponds. Impacts to these surface waters will not require mitigation. The Recommended Preferred Alternative may result in 0.05 acres of direct impacts to OSW 11.

4.4 Wetland and Surface Water Impacts

The following subsection examines the proposed direct, indirect, and cumulative effects of the proposed project alternatives on wetlands and other surface waters. The No-Build Alternative will not result in direct or indirect impacts to wetlands or other surface waters in the project area; however, this alternative is not consistent with existing long-range transportation plans and does not meet the stated purpose and need for the Malabar Road Study.

4.4.1 Direct Impacts

The Recommended Preferred Alternative will result in 0.46 acres of direct wetland impacts and 4.08 acres of direct impacts to other surface waters (**Table 4-2**).

Table 4-2: Potential Direct Wetland and OSW Impacts from the Recommended Preferred Alternative and Pond Site Alternatives

Wetland ID	FLUCFCS	Description	Impact Type	Impact Area (ac.)
WL 1	641	Freshwater Marshes	Pond C-20 Alt. 1	0.46
OSW 2	510	Streams and Waterways	ROW	0.01
OSW 3	510	Streams and Waterways	ROW	0.06
OSW 4	510	Streams and Waterways	ROW	0.06
OSW 5	510	Streams and Waterways	ROW	0.17
OSW 8	510	Streams and Waterways	ROW	0.07
OSW 10	510	Streams and Waterways	ROW	0.15
OSW 11	530	Reservoirs	ROW	0.05
OSW 15	510	Streams and Waterways	ROW	0.01
OSW 16 (C-20 Canal)	510	Streams and Waterways	ROW	2.23
OSW 18	510	Streams and Waterways	ROW	0.72
OSW 19	510	Streams and Waterways	ROW	0.19
OSW 20	510	Streams and Waterways	Pond C-8 & C-9 Atl. 1	0.36
Total Wetland Impacts				0.46
Total Other Surface Waters				4.08
Total Proposed Impacts				4.54

4.4.2 Indirect Impacts

The Recommended Preferred Alternative may create indirect impacts to OSWs; however, these impacts are not considered adverse. Indirect impacts may be addressed by UMAM and offset by mitigation during the design and permitting phase if needed to address any adverse impacts incurred during the final design.

4.4.3 Cumulative Impacts

Cumulative impacts can result from incremental but collectively significant impacts within the basin over time. Cumulative impacts are not anticipated as a result of the proposed project because the project does not incur adverse impacts to wetlands or OSWs. In order to provide reasonable assurances that the project will not cause unacceptable cumulative impacts, mitigation

for adverse impacts will be provided within the same drainage pursuant to Section 373.4137, F.S.

4.5 Avoidance and Minimization

The Recommended Preferred Alternative was designed to avoid and minimize wetlands, OSWs, and protected species habitat impacts to the greatest extent practicable. This was accomplished by utilizing the existing right-of-way when practicable. Pond and floodplain compensation sites were selected to minimize impacts to wetlands. Additionally, the Audubon’s crested caracara occupies habitat within the corridor. Pond site locations were adjusted based on the results of the 2020 caracara survey to avoid impacts to caracara nesting habitat. Additionally, the selected design team may offer to change the proposed typical section and/or drainage design so long as it meets design and permitting criteria.

4.6 Wetland Assessment

Wetlands and OSWs with potential to be affected by the proposed project were identified within the Malabar study area. The wetland assessment was conducted in accordance with the UMAM, as described in Chapter 62-345, F.A.C. The UMAM is the state-wide methodology for determining the functional value provided by wetlands and other surface waters and the amount of mitigation required to offset adverse impacts to those areas for regulatory permits. The impacted OSWs are considered upland cut components of the existing manmade drainage system; and therefore, these OSWs were not included in the wetland assessment as mitigation is not anticipated. The results of the UMAM assessment are provided in **Table 4-3**.

Table 4-3: Proposed Wetland Functional Loss Due to Impacts from Recommended Preferred Alternative

Wetland ID	Wetland Type	Impact Type	LLS	WE	CS	Impact Area (ac.)	Functional Loss
WL 1	641	Herbaceous	5	6	6	0.46	0.26

LLS = Location and Landscape Support

WE = Water Environment

CS = Community Structure

4.7 Conceptual Mitigation

Wetland impacts which will result from the construction of this project will be mitigated pursuant to Section 373.4137, F.S., to satisfy all mitigation requirements of Part IV of Chapter 373, F.S., and U.S.C. §1344. Compensatory mitigation for this project will be completed through the use of mitigation banks and any other mitigation options that satisfy state and federal requirements.

The Recommended Preferred Alternative will impact approximately 0.69 acre of wood stork SFH. Mitigation will be required for impacts greater than 0.5 acre based on guidance from the Effect Determination Key for the Wood Stork in Central and North Florida (USACE, 2008). Unavoidable impacts may be compensated in accordance with Section 404(b)(1) of the Clean Water Act via the purchase of wetland mitigation at a USFWS-approved wetland mitigation bank whose service area coincides with the CFA of the affected wood stork SFH. Currently, multiple banks have available credits to provide the appropriate mitigation.

SECTION 5 ESSENTIAL FISH HABITAT

The National Marine Fisheries Service (NMFS) is the regulatory agency responsible for the nation's living marine resources and their habitats, including essential fish habitat (EFH). This authority is designated by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended. The MSFCMA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. § 1802(10)).

In accordance with the MSFCMA, Section 7 of the ESA, and the FDOT's PD&E Manual, the Malabar Road Study Area was evaluated for potential EFH. According to their ETDM Summary Report No. 14396, dated October 25, 2019, NMFS staff concluded that the project will not impact EFH; therefore, an EFH assessment is not required.

SECTION 6 ANTICIPATED PERMITS

Most land alteration projects, including construction and maintenance activities, are regulated by numerous state and federal agencies and require environmental permits prior to the commencement of construction. Permit applications are reviewed by regulatory agencies for their consistency with regulatory criteria and/or the project's effect on resources (e.g., navigation, wetland function, protected species, and their habitats). During the permit application process, the lead regulatory agencies may request input from other agencies to ensure the project will not adversely impact a regulated or protected resource under their purview. For protected species, a species-specific permit may be required prior to issuance of the environmental permit. The following is a list of anticipated permits needed from state and federal agencies for the proposed project.

6.1 General State 404 Permit (62-331.248)

Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Day-to-day responsibility for Section 404 is typically handled by the USACE. However, the State of Florida requested and was granted authority on December 22, 2020 (85 FR 83553), to operate the Section 404 Program for work in most non-tidal waters in the state. Based on the amount of potential direct impacts and location of the project, a General State 404 is anticipated for the proposed work. The State 404 Program is administered by the FDEP.

6.2 National Pollutant Discharge Elimination System Permit

As authorized by the CWA, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources discharges from construction activities. The EPA has delegated its authority to implement the NPDES program to the FDEP. Based on potential impacts to at least one acre of land, it is anticipated that a NPDES permit will be required for the proposed project.

6.3 Individual Environmental Resource Permit

Section 373, FS, and Chapter 62-330, FAC, outline the rules and regulations and establish thresholds for when an environmental permit is required from the state. The Environmental Resource Permit (ERP) program is jointly administered by FDEP and the five water management districts in the state. The project is located within the jurisdiction of the SJRWMD. Based on the

project area and proposed stormwater management facilities, an Individual ERP is anticipated for this project. The ERP is considered to be the Water Quality Certification under Section 401 of the CWA and is required for the 404 permit, above.

6.4 Gopher Tortoise Relocation Permit

Gopher tortoises and their burrows are protected by Chapter 68A-27.003, F.A.C. A gopher tortoise relocation permit must be obtained from FWC before disturbing burrows and construction activities within 25 feet of a gopher tortoise burrow. The number of gopher tortoise burrows located within 25 feet of the project footprint will determine the type of gopher tortoise relocation permit that is needed. Based on the results from the pedestrian field surveys, it is anticipated that the proposed project will require a “10 or Fewer Burrows” permit from FWC. A 100% gopher tortoise survey should be completed during the design of the project to finalize the type of permit needed. Surveys, permitting, excavation, and relocation must be performed by an FWC Authorized Gopher Tortoise Agent.

SECTION 7 CONCLUSION

The Recommended Preferred Alternative will provide additional capacity on Malabar Road, consistent with existing long-range transportation plans for the roadway and region and the stated purpose and need for this PD&E Study. The Recommended Preferred Alternative avoids and minimizes impacts to wetlands, OSWs, protected species, and their habitats to the greatest extent practicable. Based on existing information and both general and species-specific surveys, the Recommended Preferred Alternative will not jeopardize the continued existence of a protected species and/or result in the destruction or adverse modification of critical habitat (**Table 7-1**). However, additional coordination with wildlife agencies will be required during the design and permitting phase and additional wildlife surveys may be required prior to or during construction.

Table 7-1: Effect Determinations for Listed Species

Common Name	Scientific Name	Status	Effect Determination
Reptiles			
American alligator	<i>Alligator mississippiensis</i>	FT (S/A)	MANLAA
Eastern indigo snake	<i>Drymarchon couperi</i>	FT	MANLAA
Florida pine snake	<i>Pituophis melanoleucus</i>	ST	NAEA
Gopher tortoise	<i>Gopherus polyphemus</i>	C / ST	MANLAA
Birds			
Audubon’s crested caracara	<i>Polyborus plancus audubonii</i>	FT	MANLAA
Bald eagle	<i>Haliaeetus leucocephalus</i>	BGEPA / MBTA	NO EFFECT
Everglade snail kite	<i>Rostrhamus sociabilis plumbeus</i>	FE	NO EFFECT
Florida burrowing owl	<i>Athene cunicularia floridana</i>	ST	NAEA
Florida grasshopper sparrow	<i>Ammodramus savannarum floridanus</i>	FE	NO EFFECT
Florida sandhill crane	<i>Antigone canadensis pratensis</i>	ST	NAEA
Florida scrub-jay	<i>Aphelocoma coerulescens</i>	FT	MANLAA
Little blue heron	<i>Egretta caerulea</i>	ST	NAEA
Red-cockaded woodpecker	<i>Dryobates borealis</i>	FE	NO EFFECT

Reddish egret	<i>Egretta rufescens</i>	ST	NAEA
Roseate spoonbill	<i>Platalea ajaja</i>	ST	NAEA
Southeastern American kestrel	<i>Falco sparverius Paulus</i>	ST	NAEA
Tricolored heron	<i>Egretta tricolor</i>	ST	NAEA
Wood stork	<i>Mycteria americana</i>	FT	MANLAA
Mammals			
Florida black bear	<i>Ursus americanus floridanus</i>	M	NAEA
Southern fox squirrel	<i>Sciurus niger</i>	M	NAEA

Plants			
Blue-flowered butterwort	<i>Deeringothamnus pulchellus</i>	ST	NAEA
Carter's werea	<i>Warea carteri</i>	FE	NO EFFECT
Celestial lily	<i>Nemastylis floridana</i>	SE	NEA
Coastal vervain	<i>Glandularia maritima</i>	SE	NEA
Cut-throat grass	<i>Panicum abscissum</i>	SE	NEA
Florida beargrass	<i>Nolina atopocarpa</i>	ST	NEA
Giant Orchid	<i>Pteroglossaspis ecristata</i>	ST	NEA
Large-flowered rosemary	<i>Conradina grandiflora</i>	ST	NEA
Lewton's polygala	<i>Polygala lewtonii</i>	FE	NO EFFECT
Many-flowered grass pink	<i>Calopogon multiflorus</i>	ST	NAEA
Nodding pinweed	<i>Lechea cernua</i>	ST	NEA
Plume polypody	<i>Polypodium plumula</i>	SE	NEA
Redmargin Zephyrlily	<i>Zephranthes simpsonii</i>	ST	NEA
Sand butterfly pea	<i>Centrosema Arenicola</i>	SE	NEA
Short-leaved rosemary	<i>Conradina brevifolia</i>	FE	NO EFFECT
Small's flax	<i>Linum carteri var. smallii</i>	SE	NEA
Swamp plume polypody	<i>Polypodium ptilodon</i>	SE	NEA
Widespread polypody	<i>Polypodium dispersum</i>	SE	NEA
Yellow-flowered butterwort	<i>Pinguicula lutea</i>	SE	NEA

The Recommended Preferred Alternative will directly impact 4.08 acres of OSWs. No direct impacts to natural wetland systems are anticipated. The anticipated impacts to OSWs within the Recommended Preferred Alternative are not considered adverse, as these OSWs are upland cut components of the existing manmade drainage system; and therefore, mitigation is not anticipated.

7.1 Implementation Measures

To ensure the project will not adversely affect protected species or contribute to water quality degradation, the following measures will be implemented.

- Conduct surveys for listed plants in suitable habitat prior to construction and coordinate with the appropriate agency as needed if listed plants are observed within the project area.
- Conduct species-specific pre-construction survey for gopher tortoises and coordinate with FWC to receive the necessary permit authorizations prior to construction.

- Conduct specific-species pre-construction surveys for the Florida burrowing owl and coordinate with FWC to receive the necessary authorizations and implement the appropriate conservation measures as needed prior to construction.
- Conduct specific-species pre-construction surveys for the Southern fox squirrel and coordinate with FWC to receive the necessary authorizations if applicable.
- Provide compensatory mitigation for wetland impacts resulting from project design and construction, per 373.4137, FS and 33 USC § 1344.
- Apply erosion and sediment controls to other best management practices prior to and throughout construction to prevent adverse impacts to wetland and aquatic resources adjacent to the project area.

7.2 Commitments

To ensure the project will not adversely affect protected species and their habitats, the following commitments will be implemented.

- Conduct a species-specific survey for the Audubon's crested caracara per USFWS protocol during the design and permitting phase of the proposed project.
- Avoid construction within 1,500 meters of caracara nests during nesting season by avoiding construction activities from November 1st to April 30th for areas within 1,500 of the potential nests.
- Implement the Standard Protection Measures for the Eastern Indigo Snake during project construction.
- Provide appropriate mitigation for impacts to wood stork SFH, per the Wood Stork Effect Determination Key (USFWS, 2008).
- Conduct specific-species pre-construction surveys for the southeastern American kestrel and coordinate with FWC to receive the necessary authorizations and implement appropriate conservation measures prior to construction if applicable.

7.3 Agency Coordination

7.3.1 Prior Coordination

In October of 2019, comments from the ETAT were provided in the ETDM Summary Report No. 14396. ETAT members submitted comments related to protected species and their habitats, noting the need for protected species surveys and coordination during the PD&E Study, and implementation of protection measures during construction. ETAT members also commented on potential impacts to wetlands and surface waters, noting the need to avoid and/or minimize impacts to wetlands, document cumulative impact criteria, meet water quality and quantity requirements, and implement proper best management practices during construction. Through the PD&E process, these issues have been addressed and documented in this report.

As previously mentioned in Section 3.4.1, the USFWS approved the Audubon's Caracara Survey Methodology for the Malabar Road PD&E Study on December 11, 2019. The USFWS also approved the survey results to be accepted for two years after the survey completion. During this coordination, the USFWS stated if caracara were found using the site, a survey would be needed, as noted in Section 7.2.

7.3.2 Continuing Coordination


The final NRE report will be provided to the relevant resource agencies for review and concurrence with the proposed effect determinations for listed species and potential impacts to wetland resources. Agency coordination will continue during and throughout the design phase of the project when environmental permitting typically occurs. Environmental permits will be required from the FDEP and SJRWMD for the proposed project. Permit applications will be reviewed by the regulatory agencies for potential impacts to environmental resources. During the permitting process, the regulatory agencies will likely request input from the commenting agencies to ensure consistency with regulatory criteria under their purview. Consultation with, or technical assistance by the USFWS shall be required for potential impacts to federally protected species, particularly the Audubon's crested caracara and wood stork.

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APPENDIX A

Pond Site Assessment

Malabar Road PD&E Study Pond Site Assessment

C-7 Alt 1

C-7 Alt 1 is located south of Malabar Road at approximately station 63+58 (RT.). This pond site is located in upland cabbage palm forests with dominated by cabbage palm (*Sabal palmetto*) and Brazilian pepper (*Schinus terebinthifolia*). Shrub layer and ground cover species includes saw palmetto (*Serenoa repens*), broom sedge (*Carex spp.*), cogongrass (*Imperata cylindrica*), dogfennel (*Eupatorium capillifolium*), and bahiagrass (*Paspalum notatum*). No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated to be associated with C-7 Alt 1.

Suitable habitat was observed for the caracara (*Polyborus plancus audubonii*), gopher tortoise (*Gopherus polyphemus*), eastern indigo snake (EIS) (*Drymarchon corais couperi*), Florida pine snake (*Pituophis melanoleucus mugitus*), southern fox squirrel (*Sciurus niger niger*) and southeastern American kestrel (*Falco sparverius*). A caracara survey was conducted for the proposed project in 2020, during which two (2) caracara nests were identified. The C-7 Alt 1 proposed pond site is entirely within the foraging habitat of both identified nests. Site C-7 Alt 1 will incur impacts to the caracara. Furthermore, site C-7 Alt 1 may also incur impacts to the gopher tortoise, EIS, Florida pine snake, southern fox squirrel, and southeastern American kestrel. Additional, species specific surveys will likely be required to confirm the absence and minimize impacts to these species should construction activities occur within this pond site.

C-7 Alt 2

C-7 Alt 2 is located south of Malabar Road at approximately station 85+64 (RT.). This pond site is located in upland cabbage palm forests dominated by cabbage palm and Brazilian pepper. Shrub layer and ground cover species includes saw palmetto broom sedge, cogongrass, dogfennel, and bahiagrass. No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated to be associated with C-7 Alt 2.

Suitable habitat was observed for the caracara, gopher tortoise, EIS, Florida pine snake, and southeastern American kestrel. No protected species were observed within the pond site during the field reviews. Site C-7 Alt 2 may incur impacts to the caracara, gopher tortoise, EIS, Florida pine snake, southern fox squirrel, and southeastern American kestrel. Species specific surveys will likely be required to confirm the absence and minimize impacts to these species should construction activities occur within this pond site.

C-8 & C-9 Combined Alt 1

C-8 & C-9 Combined Alt 1 is located north of Malabar Road at approximately station 101+65 (LT.). This pond site consists of forested uplands with a canopy dominated by slash pine (*Pinus elliottii*), cabbage palm, and Brazilian pepper. Shrub layer consists of winged sumac (*Rhus copallinum*), American beautyberry (*Callicarpa americana*), and wax myrtle (*Myrica cerifera*). Ground cover

species includes muscadine grape (*Vitis rotundifolia*), greenbrier (*Smilax spp.*), goldenrod (*Solidago spp.*), beggarticks, dogfennel, and Virginia creeper (*Parthenocissus quinquefolia*). This site also includes two upland cut ditches. One ditch runs north/south and contains standing water along with wetland vegetation such as pickerelweed (*Pontederia cordata*), duck potato (*Sagittaria lancifolia*), pennywort (*Hydrocotyle spp.*), primrose willow (*Ludwigia peruviana*), and torpedo grass (*Panicum repens*). The second ditch runs east/west and consists of cogon-grass throughout. Approximately **0.36** acres of direct impacts to other surface waters are anticipated for C-8 & C-9 Combined Alt 1.

Suitable habitat for the gopher tortoise, EIS, southern fox squirrel, wood stork, and wading birds was observed within the pond site. No protected species were observed within the C-8 & C-9 Combined Alt 1 during the field reviews. C-8 & C-9 Combined Alt 1 may incur impacts to the gopher tortoise, EIS, southern fox squirrel, wood stork, and wading birds. Species specific surveys will likely be required to confirm absence and minimize impacts to these species should construction activities occur within this pond site.

C-8 & C-9 Combined Alt 2

C-8 & C-9 Combined Alt 2 is located south of Malabar Road at approximately station 89+98 (RT.). This pond site consists of forested uplands with a dense canopy comprised of cabbage palm, slash pine, laurel oak (*Quercus laurifolia*), and live oak (*Quercus virginiana*). Understory species consist of immature canopy species, American beauty berry, and saw palmetto. Groundcover is dominantly comprised of leaf litter and includes bahiagrass, dog fennel, and broom sedge. No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated for C-8 & C-9 Combined Alt 2.

Suitable habitat was observed for the gopher tortoise, EIS, Florida pine snake, and southern fox squirrel. No protected species were observed within the pond site during field reviews. Site C-8 & C-9 Combined Alt 2 may incur impacts to the gopher tortoise, EIS, Florida pine snake, and southern fox squirrel. Species specific surveys will likely be required to confirm absence and minimize impacts to these species should construction activities occur within this pond site.

C-10 West Alt 1

C-10 West Alt 1 is located north of Malabar Road at approximately station 135+09 (LT.). The site is located in pine flatwoods and completely surrounded by private residences. Canopy species include slash pine and cabbage palm. Understory species consists of saw palmetto. Ground cover consists of greenbrier, and muscadine grape and fallen pine needles and palm fronds. No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated for C-10 West Alt 1.

Suitable habitat for the gopher tortoise, EIS, Florida pine snake, and southern fox squirrel was observed within this pond site. No protected species were observed within the pond site during the field reviews. Site C-10 West Alt 1 may incur impacts to the gopher tortoise EIS, Florida pine

snake, and southern fox squirrel. Species specific survey will likely be required to confirm absence and minimize impacts to this species should construction activities occur within this pond site.

C-10 East Alt 1 (Swale Part 1-3)/C-10 West Alt 2 Option 1

C-10 East Alt 1 (Swale Part 1-3)/C-10 West Alt 2 Option 1 is located south of Malabar Road at approximately station 144+97 (Rt.). This proposed swale is located in forested upland. Canopy species include slash pine, longleaf pine (*Pinus palustris*), cabbage palm, and laurel oak. The understory is comprised of saw palmetto. Groundcover species include bracken fern (*Pteridium aquilinum*), rosary pea, greenbrier, muscadine grape, shiny blueberry (*Vaccinium myrsinites*), and goldenrod. No wetlands were observed within the proposed swale; therefore, no impacts to wetlands are anticipated for C-10 East Alt 1 (Swale Part 1).

Suitable habitat for the gopher tortoise and EIS were observed within this proposed swale. No protected species were observed within the pond site during the field reviews. C-10 East Alt 1 (Swale Part 1-3)/C-10 West Alt 2 Option 1 may incur impacts to the gopher tortoise and EIS. Species specific surveys will likely be required to confirm absence and minimize impacts to this species should construction activities occur within this proposed swale.

C-10 West Alt 2, Option 2

C-10 East Alt 2 is located north of Malabar Road at approximately station 175+65 (LT.). This pond site is located in upland forest and forested wetlands. Vegetative species within the uplands include a canopy comprised of slash pine, long leaf pine, laurel oak, live oak, and cabbage palm. Understory species consist of immature canopy species and saw palmetto. Ground cover comprised of goldenrod, bahiagrass, muscadine grape, greenbrier, and dogfennel. Observed vegetation within the forested wetland includes a canopy comprised of red maple (*Acer rubrum*). Understory consists of Brazilain pepper, wax myrtle, and salt bush (*Baccharis halimifolia*). Groundcover includes swamp fern (*Thelypteris confluens*), white-top star rush (*Rhynchospora colorata*), torpedo grass. Approximately **0.07** acres of direct impacts to wetlands are anticipated for C-10 East Alt 2.

Suitable habitat for the gopher tortoise, EIS, Florida pine snake, and southern fox squirrel was observed within this pond site. No protected species were observed within the pond site during the field reviews. Site C-10 East Alt 2 may incur impacts to the gopher tortoise EIS, Florida pine snake, and southern fox squirrel. Species specific survey will likely be required to confirm absence and minimize impacts to this species should construction activities occur within this pond site.

C-10 West Alt 2 (Option 2)

C-10 West Alt 2 (Option 2) is located north of Malabar Road at approximately station 175+65 (Lt.). This pond site is located in forested uplands. Observed vegetation includes a canopy comprised of slash pine, long leaf pine, laurel oak, live oak, and cabbage palm. Understory species consist of immature canopy species and saw palmetto. Ground cover comprised of goldenrod, bahiagrass, muscadine grape, greenbrier, and dogfennel. No wetlands were observed within the

proposed pond site; therefore, no impacts to wetlands are anticipated for C-10 West Alt 2 (Option 2).

Suitable habitat for the gopher tortoise, EIS, Florida pine snake, and southern fox squirrel was observed within this pond site. No protected species were observed within the pond site during the field reviews. Site C-10 West Alt 2 (Option 2) may incur impacts to the gopher tortoise EIS, Florida pine snake, and southern fox squirrel. Species specific survey will likely be required to confirm absence and minimize impacts to this species should construction activities occur within this pond site.

C-20 Supplemental Swale (1 and 2)

C-20 Supplemental Swale (1 and 2) is located south of Malabar Road at approximately station 198+44 (Rt.). This proposed swale consists of forested upland immediately adjacent to private residences. Canopy species include longleaf pine, slash pine, and laurel oak. The understory consists of saw palmetto, cabbage palm, and Brazilian pepper. Ground cover species include golden rod, muscadine grape, and bahiagrass. No wetlands were observed within the proposed swale; therefore, no impacts to wetlands are anticipated for C-20 Supplemental Swale (1 and 2).

Suitable habitat for the gopher tortoise and EIS were observed within this proposed swale. No protected species were observed within the pond site during the field reviews. C-20 Supplemental Swale (1 and 2) may incur impacts to the gopher tortoise and EIS. Species specific surveys will likely be required to confirm absence and minimize impacts to this species should construction activities occur within this proposed swale.

C-20 Alt 1

C-20 East Alt 1 is located south of Malabar Road at approximately station 229+06 (RT.). The northern portion of this pond site is located in a stand of planted slash pine. Other vegetative species observed within the planted pine includes canopy species such as laurel oak; understory species including wax myrtle; and groundcover consisting of dog fennel and bahiagrass. A wetland was observed toward the northern portion of the proposed pond site. Vegetation observed in the wetland includes a canopy comprised of red maple; understory consisting of wax myrtle and primrose willow; and ground cover comprised of torpedo grass, smartweed (*Persicaria spp.*), iris (*Iris spp.*), and winged loosestrife (*Lythrum alatum*). Approximately **0.46** acres of direct impacts to wetlands are anticipated for C-20 East Alt 1.

Suitable habitat was observed for the gopher tortoise, EIS, Florida scrub-jay (*Aphelocoma coerulescens*), southern fox squirrel wood stork, southeastern American kestrel, wood stork, and wading birds. No scrub-jays were observed in this pond site area during the 2020 scrub-jay survey. No protected species were observed within the pond site during the field reviews. Site C-20 East Alt 1 may incur impacts to the gopher tortoise, southern fox squirrel, wood stork, and wading birds. Species specific surveys will likely be required to confirm absence and minimize impacts to these species should construction activities occur within this pond site.

C-20 Alt 2

C-20 East Alt 2 is located south of Malabar Road at approximately station 240+39 (RT.). This pond site is located in shrub and brushland with patches of exposed white sand and areas of dense cabbage palm growth. Observed vegetation includes a shrub layer comprised of cabbage palm and Brazilian pepper. Groundcover consisting of ragweed (*Ambrosia spp.*), dogfennel, sedges, Guinea grass, and bahiagrass. No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated for C-20 East Alt 2.

Suitable habitat for the gopher tortoise, EIS, Florida scrub-jay, southern fox-squirrel, and southeastern American kestrel was observed within the pond site. No scrub-jays were observed in this pond site area during the 2020 scrub-jay survey. No protected species were observed within the pond site during the field reviews. Site C-20 East Alt 2 may incur impacts to the gopher tortoise and southeastern American kestrel. Species specific surveys will likely be required to confirm absence and minimize impacts to these species should construction activities occur within this pond site.

FPCA

The FPCA is located south of Malabar Road at approximately station 84+17 (RT.). The FPCA is located in upland cabbage palm forests dominated by cabbage palm and Brazilian pepper. Shrub layer and ground cover species includes saw palmetto broom sedge, cogongrass, dogfennel, and bahiagrass. No wetlands were observed within the proposed pond site; therefore, no impacts to wetlands are anticipated to be associated with the FPCA.

Suitable habitat was observed for the caracara, gopher tortoise, EIS, Florida pine snake, and southeastern American kestrel. No protected species were observed within the pond site during the field reviews. The FPCA may incur impacts to the caracara, gopher tortoise, EIS, Florida pine snake, southern fox squirrel, and southeastern American kestrel. Species specific surveys will likely be required to confirm the absence and minimize impacts to these species should construction activities occur within this pond site.

DATE: 6/27/2023

TO: Project File

FROM: Riley Campana, Ecologist

RE: Pond Site C-7 Alt 3 and FPCA Environmental Assessment

Malabar Road PD&E Study from St. Johns Heritage Parkway to Minton Road

FPID: 437210-1-28-0

Brevard County, FL

This memorandum is intended to supplement the Natural Resources Evaluation (NRE) for Malabar Road Project Development and Environment (PD&E) Study. Inwood Consulting Engineers, Inc. (Inwood) performed an assessment of the proposed C-7 Alt 3 pond site to evaluate the area for the presence of wetlands and other surface waters, as well as protected species and their habitats. C-7 Alt 3 is located south of Malabar Road and to the west of the intersection with St. Johns Heritage Parkway. This pond site was not included in the original PD&E Study. A new floodplain compensation area (FPCA) is also proposed adjacent to the western edge of pond site C-7 Alt 3. The location of the proposed pond and FPCA is depicted in **Figure 1**.

Inwood ecologists performed a field review of the pond site and FPCA on May 31, 2023. The eastern portion of the pond is located in unimproved pasture. The pasture consists of sparse cabbage palms (*Sabal palmetto*) and live oaks (*Quercus virginiana*), with a dominant groundcover of bahia grass (*Paspalum notatum*). Other vegetation includes witchgrass (*Panicum oligosanthes*), shrubby false buttonweed (*Spermacoce verticillata*), caesarweed (*Urena lobata*), Brazilian pepper (*Schinus terebinthifolia*), broomsedge bluestem (*Andropogon virginicus*), and American beautyberry (*Callicarpa americana*).

A wetland was observed within the western portion of the proposed pond site and the FPCA. A portion of the wetland (particularly the western area) is forested and is dominated by cabbage palm and Brazilian pepper with no understory vegetation. The wetland also contains a non-forested component. Vegetation observed in the non-forested area of the wetland includes wax myrtle (*Morella cerifera*), rushes (*Juncus* spp.), smartweed (*Persicaria setacea*), duck potato (*Sagittaria latifolia*), maidencane (*Panicum hemitomon*), Fakahatchee grass (*Tripsacum dactyloides*), dogfennel (*Eupatorium capillifolium*), frog's bit (*Limnobium spongia*), barnyard grass (*Echinochloa crus-galli*), swamp fern (*Telmatoblechnum serrulatum*), knotweed (*Persicaria glabra*), dwarf St. John's wort (*Hypericum mutilum*), white top starrush (*Rhynchospora colorata*), Colombian waxweed (*Cuphea carthagenesis*), pickerelweed (*Pontederia cordata*), eastern black nightshade (*Solanum americanum*), sweetscent (*Pluchea odorata*), and swamp flatsedge (*Cyperus ligularis*).

One other surface water was observed within the FPCA. This surface water is a north-south running ditch that is cut through wetlands. The dominant vegetation within the ditch consists of smartweed, rushes, and barnyard grass. Other plant species present include pennywort (*Hydrocotyle* spp.), white top starrush, thistle (*Cirsium* spp.), and false daisy (*Eclipta prostrata*). Approximately **0.28** acres of direct impacts to wetlands are anticipated for pond C-7 Alt 3. Approximately **0.61** acres of direct impacts to wetlands and **0.04** acres of direct impacts to other surface waters are anticipated for the associated FPCA. Wetlands and other surface waters observed within the pond site and FPCA are shown in **Figure 2**.

Unavoidable wetland and other surface water impacts which will result from the construction of this project will be mitigated pursuant to Section 373.4137, Florida Statutes (F.S.), to satisfy all mitigation requirements of Part IV of Chapter 373, F.S., and United States Code (U.S.C.) §1344. Compensatory mitigation for this project will be completed through the use of mitigation banks and any other mitigation options that satisfy state and federal requirements. Mitigation for adverse impacts will be provided within the same drainage basin to provide reasonable assurances that the project will not cause unacceptable cumulative impacts.

Suitable habitat was observed for the Audubon's crested caracara, wood stork, gopher tortoise, Florida burrowing owl, Florida sandhill crane, listed wading birds, and southern fox squirrel within the C-7 Alt 3 pond site and adjacent FPCA. A species-specific caracara survey was conducted from January through April 2020. Details on the survey methodology can be found in the NRE document. Adult and juvenile caracara were observed on multiple days of the survey, including observations of adults within the proposed C-7 Alt 3 pond site. The survey resulted in the positive identification of two caracara nests along the north side of Malabar Road, shown in **Figure 3**. The subject pond site and FPCA are within the United States Fish and Wildlife Service's (USFWS) 1,500-meter nest protection zone for crested caracara. Conservation measures will be implemented for areas within the protection zone where avoidance was not practicable. The Standard Local Operating Procedures for Endangered Species flowchart for Audubon's crested caracara followed the sequence which concluded with conservation measures and actions proposed outside nesting season in order to obtain a not likely to adversely affect determination. The conservation measures are defined in the NRE along with project-specific measures and conditions.

The addition of the C-7 Alt 3 pond site and adjacent FPCA will not impact the primary zone. The pond site and FPCA will impact approximately 5.75 acres of caracara habitat within the 1,500-meter nest protection zone. The NRE includes a commitment to conduct a species-specific survey for the Audubon's crested caracara per USFWS protocol during the design and permitting phase of the proposed project. Final impacts to caracara foraging and nesting habitat may change as a result of this survey and will be calculated in design following the completion of the survey. Commitments also include avoiding construction within 1,500 meters of caracara nests during nesting season. Based on the distance of the proposed construction activities from the nest; existing disturbances which do not appear to affect caracara nesting; remaining foraging capacity; implementation of conservation measures, including constructing outside of nesting season as described above, the Recommended Preferred Alternative, including proposed pond sites, **"may affect, but is not likely to adversely affect"** the Audubon's crested caracara.

No other protected species were observed within the pond site during the field review in May of 2023, however wood storks were observed flying over and foraging within the study area during previous field reviews and caracara surveys. According to the Wood Stork Effect Determination Key for Central and North Peninsular Florida, the proposed project **"may affect, but is not likely to adversely affect"** the wood stork. This effect determination was made using the following sequence from the key: A-B-C-D-E(1). Unavoidable impacts to suitable wood stork foraging habitat will be offset at an USFWS-approved mitigation bank within the appropriate CFA to satisfy the elements detailed in the key to ensure that the proposed project does not adversely affect the wood stork.

Suitable gopher tortoise habitat was observed within the pond site location. A 100% gopher tortoise survey was not conducted. No gopher tortoise burrows were observed within the subject pond site or FPCA. The NRE includes an implementation measure to conduct species-specific pre-construction survey for gopher tortoises and coordinate with FWC to receive the necessary permit authorizations prior to construction. Based on the information provided above, the proposed project **"no adverse effect is anticipated"** for the gopher tortoise.

Suitable habitat for the Florida burrowing owl was observed within the pond site and FPCA, however ecologists did not observe burrowing owls during field reviews, general wildlife surveys, and species-specific surveys of the project area. If burrowing owls are observed onsite, coordination with the FWC will occur to discuss avoidance, minimization, and permitting options. The NRE includes an implementation measure to conduct specific-species pre-construction

surveys for the Florida burrowing owl and coordinate with FWC to receive the necessary authorizations and implement the appropriate conservation measures as needed prior to construction. Therefore, **“no adverse effect is anticipated”** for the burrowing owl resulting from the proposed project.

Florida sandhill cranes were observed on multiple occasions throughout the study area during the general wildlife and species-specific surveys. The non-forested wetland area within the pond site and FPCA could provide nesting and roosting habitat for the sandhill crane, and the unimproved pasture provides foraging habitat. Avoidance measures that eliminate the need for FWC take permitting include: avoid impacts to natural wetlands used for breeding, feeding, or sheltering; avoid activities within 400 feet of an active nest; and avoid land use conversion within 1,500 feet of the nest site until after young are capable of sustained flight. **“No adverse effect is anticipated”** for the Florida sandhill crane resulting from the project.

Four imperiled wading bird species have the potential to occur in the study area: the little blue heron, reddish egret, roseate spoonbill, and tricolored heron. Little blue herons and roseate spoonbills were observed during general wildlife and species-specific surveys. Ecologists observed suitable foraging with minimal nesting habitat for wading birds within the pond site and FPCA. No wading bird rookeries are located within the project area. No nesting activity was observed during the field reviews. Inclusion of a stormwater management system will provide a net benefit to water quality that will have a carryover benefit to state listed wading birds that will be addressed during permitting. **“No adverse effect is anticipated”** for wading birds resulting from the proposed project.

Ecologists observed suitable habitat for the southern fox squirrel within the C-7 Alt 3 pond site and adjacent FPCA. No individuals or nests were observed during field reviews of the site. The NRE document includes an implementation measure to conduct specific-species pre-construction surveys for the Southern fox squirrel and coordinate with FWC to receive the necessary authorizations if applicable. **“No adverse effect is anticipated”** for the southern fox squirrel resulting from the proposed project.

The C-7 Alt 3 pond site and FPCA will result in additional impacts to wetlands and other surface waters that were not included in the original NRE document. Mitigation will be provided for these impacts. The addition of the pond site and FPCA will not alter the effect determinations of any protected species as detailed in the NRE.

Enclosures: Photo Document, Figure 1, Figure 2, Figure 3



Photo 1: Representative of Unimproved Pasture within C-7 Alt 3 Pond Site



Photo 2: Representative of Surface Water within FPCA



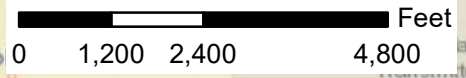
Photo 3: Representative of Forested Wetland within C-7 Alt 3 Pond Site and FPCA



Photo 4: Representative of Non-Forested Wetland within C-7 Alt 3 Pond Site and FPCA



Pond Site Vicinity



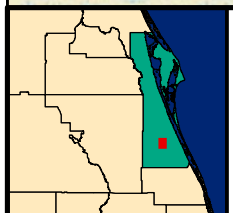
BEGIN PROJECT



END PROJECT

Legend

- Pond Alternative C-7 Alt 3
- Floodplain Compensation Area
- Malabar Road Project Limits



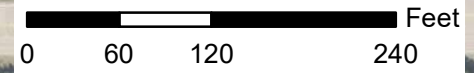
Malabar Road PD&E Study
 From St. Johns Heritage Parkway
 to Minton Road
 Brevard County, FL

FPID: 437210-1-28-01






**POND C-7 ALT 3
 LOCATION MAP**

**FIGURE
 1**

MALABAR RD



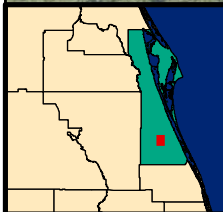
Legend

-  Pond Alternative C-7 Alt 3
-  Floodplain Compensation Area
-  Surface Water
-  Forested Wetland
-  Non-Forested Wetland

Total Forested Wetland Impacts:
0.60 acres

Total Non-Forested Wetland Impacts:
0.29 acres

Total Surface Water Impacts:
0.04 acres

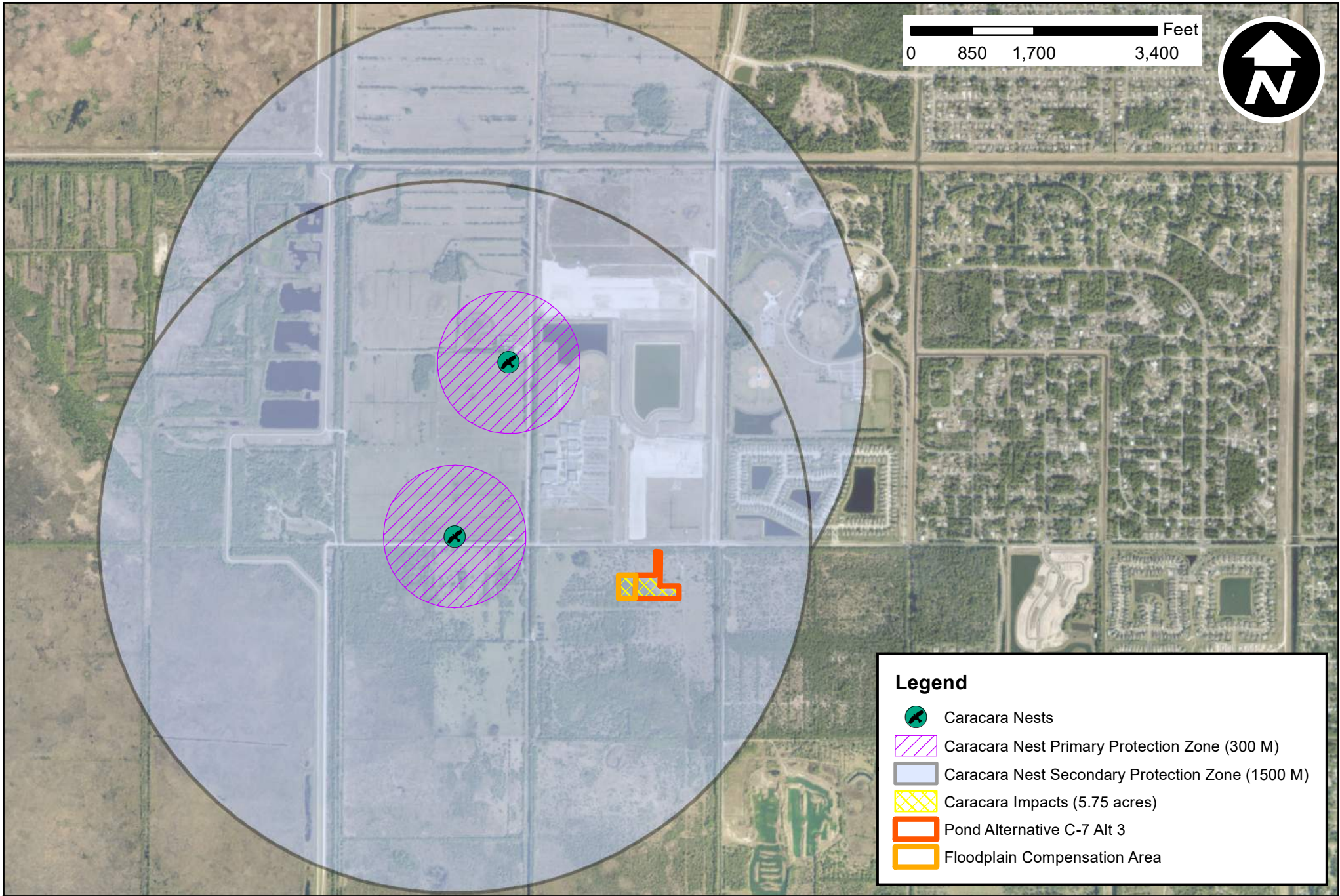


Malabar Road PD&E Study
From St. Johns Heritage Parkway
to Minton Road
Brevard County, FL

FPID: 437210-1-28-01

**POND C-7 ALT 3
WETLANDS AND OTHER
SURFACE WATERS MAP**







**FIGURE
2**

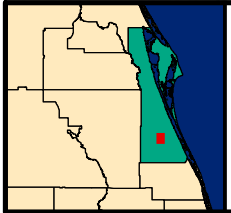


0 850 1,700 3,400 Feet



Legend

-  Caracara Nests
-  Caracara Nest Primary Protection Zone (300 M)
-  Caracara Nest Secondary Protection Zone (1500 M)
-  Caracara Impacts (5.75 acres)
-  Pond Alternative C-7 Alt 3
-  Floodplain Compensation Area



Malabar Road PD&E Study
 From St. Johns Heritage Parkway
 to Minton Road
 Brevard County, FL

FPID: 437210-1-28-01

**POND C-7 ALT 3
 CARACARA NEST
 LOCATION MAP**

**FIGURE
 3**

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX J

Contamination Screening Evaluation Report

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Level I Contamination Screening Evaluation Report

MALABAR ROAD PD&E STUDY

From St. Johns Heritage Parkway to Minton Road

Palm Bay, Florida

Project No. 23773

FIN ID No. 437210-1-28-01

RFQ No. 23-0-2019/SB

GEC Project No. 4511E

Prepared for:

Kittelson & Associates, Inc.
225 East Robinson Street, Suite 355
Orlando, Florida 32801

Prepared by:

Geotechnical and Environmental Consultants, Inc. (GEC)
919 Lake Baldwin Lane
Orlando, FL 32814

February 2021
Revised December 2021
Revised June 2023



February 24, 2021
Revised December 30, 2021
Revised June 20, 2023

Kittelson & Associates, Inc.
225 East Robinson Street, Suite 355
Orlando, Florida 32801

Attention: Mr. John R. Freeman, Jr., P.E., PTOE, RSP
Senior Principal

Subject: Level I Contamination Screening Evaluation Report
MALABAR ROAD PD&E STUDY
From St. Johns Heritage Parkway to Minton Road
Palm Bay, Florida
Project No. 23773
FIN ID No. 437210-1-28-01
RFQ No. 23-0-2019/SB
GEC Project No. 4511E

Dear Mr. Freeman:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to present this Level I Contamination Screening Evaluation Report (CSER) for the above-referenced project. This report describes our evaluation procedures, presents the information we obtained and assigns Contamination Risk Potential Ratings to 21 sites. The report also includes a Level II Impact to Construction Assessment that was performed for Pond C-20 Alternative I. This report also includes Pond Alternative C-7 Alt. 3.

We appreciate the opportunity to work with Kittelson & Associates, Inc. and the City of Palm Bay on this project. If you have any questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC.

DRAFT

Lani A. Frith
Scientist

DRAFT

Alexis E. Perry, E.I.
Engineer Intern

DRAFT

Richard P. McCormick, P.G.
Chief Geologist

DRAFT

Gary L. Kuhns, P.E.
Chief Engineer

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Appendix A: Historical Aerial Photographs

Appendix B: Definitions of Common Report Terms

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Appendix E: EDR Certified Sanborn Map Report

Appendix F: EDR Radius Map Report with GeoCheck

Appendix G: FDEP Database List

Appendix H: Federal Database List

Appendix I: FDEP OCULUS, Map Direct, and Nexus Portal Information

Appendix J: Interview Documentation

Appendix K: Level II Impact to Construction Assessment Report

EXECUTIVE SUMMARY

This Level I Contamination Screening Evaluation Report (CSER) for the Malabar Road Project Development and Environment (PD&E) Study from St. Johns Heritage Parkway to Minton Road project was performed as part of the Financial ID No. 437210-1-28-01.

The purpose of this evaluation was to assess the risk of encountering petroleum or hazardous substance contamination of soil, groundwater, surface water, or sediment that could adversely affect this project. The CSER activities included a review of public regulatory files and historical data sources, and a site reconnaissance of the project study area.

As a result of this evaluation, we have assigned Contamination Risk Ratings to 21 sites.

As a result of this evaluation, we have assigned Contamination Risk Ratings to 21 sites. The 21 site locations are shown on **Figures 4A** and **4B** and the contamination status, a detailed description and a photograph of each site are summarized in **Table 1**.

Using the FDOT Risk Ratings presented in **Appendix C**, we have identified **12 Low Risk** sites and **9 Medium Risk** as shown below. Level II Impact to Construction Assessments (ICA) may be required for the **Medium Risk** sites and **Medium Risk** pond sites in this project. A Level II ICA was performed for Pond C-20 Alternative 1 and is attached as **Appendix K**.

Low Risk Sites (12)

Site Number	Site Name	Site Address	Risk Potential
4	Biarritz Disaster Debris Management Site	1224 - 1228 Biarritz Street	Low
5	City of Palm Bay - Public Works	1050 Malabar Road	Low
8	O'Reilly Auto Parts	235 Malabar Road	Low
9	Autozone	260 Malabar Road	Low
10	Coastal Biosystem	270 Malabar Road	Low
11	Sun Clean Dry Cleaners	190 Malabar Road #123	Low
12	Winn-Dixie Store #2230	190 Malabar Road	Low
13	Bennett Auto Supply	142 Malabar Road	Low
15	SPILLS Site	Malabar Road & Minton Road	Low
18	Lubrication Specialist Inc.	6369 Minton Road	Low
19	Construction Yard	120 Malabar Road	Low
20	Palm Bay City Hall	120 Malabar Road	Low

Medium Risk Sites (9)

Site Number	Site Name	Site Address	Risk Potential
1	Cattle Pen	Malabar Road	Medium
2	Agricultural Barn	2200 Malabar Road	Medium
3	Cattle Pen	Malabar Road	Medium
6	Circle K #2726513	900 Malabar Road	Medium
7	Malabar Cove	3 NW Malabar Road	Medium
14	Bob Youtzy Landclearing	201 Malabar Road	Medium
16	7-Eleven Food Store #32756	6405 Minton Road	Medium
17	Cumberland Farms	105 Malabar Road / 6375 Minton Road	Medium
21	Historical Citrus	N/A	Medium

Pond Sites (15)

Pond Name	Location	Risk Potential	Relevant Site Number
C-7 Alt. 1	Station 63+50 – 66+17 Right	Medium	21
FPCA	Station 84+00 – 85+65 Right	Medium	2, 21
C-7 Alt. 2	Station 85+65 – 88+60 Right	Medium	2, 21
C-7 Alt. 3	Station 53+80 – 55+53 Right	Low	N/A
C-7 Alt. 3 FPCA	Station 53+80 – 55+53 Right	Low	N/A
C-8 & C-9 Combined Alt. 2	Station 90+00 – 92+60 Right	Low	N/A
C-8 & C-9 Combined Alt. 1	Station 102+00 – 104+40 Left	Low	N/A
C-10 West Alt. 1	Station 135+00 – 136+80 Left	Low	N/A
C-10 East Alt. 1 (Swale 1)	Station 145+00 – 155+00 Right	Low	N/A
C-10 East Alt. 1 (Swale 2)	Station 155+70 – 166+20 Right	Low	N/A
C-10 East Alt. 1 (Swale 3) C-10 West Alt. 2 (Option 1)	Station 169+15 – 175+45 Right	Low	N/A
C-10 East Alt. 2 C-10 West Alt. 2 (Option 2 – Expand Pond)	Station 175+45 – 179+00 Left	Medium	21
C-20 Supplemental Swale	Station 198+45 – 201+00 Right Station 204+40 – 208+70 Right	Low	N/A
C-20 Alt. 1	Station 229+00 – 231+85 Right	Medium	21
C-20 Alt. 2	Station 240+35 – 244+25 Right	Medium	7, 21

1.0 INTRODUCTION

1.1 Contract Information

This Level I Contamination Screening Evaluation Report (CSER) for the Malabar Road Project Development and Environment (PD&E) Study from St. Johns Heritage Parkway to Minton Road project was performed as part of the Financial ID No. 437210-1-28-01.

1.2 Purpose

The purpose of this evaluation is the early identification of potential contamination sites that could impact this project...

The presence of contaminated environmental media (soil, groundwater, surface water, and sediment) can have a significant negative impact on the cost and schedule to complete a roadway improvement project.

The purpose of this evaluation is the early identification of potential contamination sites that could impact this project and to provide valuable input for the design, right-of-way acquisition, and construction phases.

2.0 PROJECT DESCRIPTION

The following sections describe the current study area conditions, the project construction plans and elements of the project that could be impacted by soil or groundwater contamination. Common terms used in this report can be found in **Appendix B**.

2.1 Site Description

The proposed roadway improvements for Malabar Road extend from St. Johns Heritage Parkway to Minton Road, approximately 4 miles...

The proposed roadway improvements for Malabar Road extend from St. Johns Heritage Parkway to Minton Road, approximately 4 miles, located in Palm Bay, Brevard County, Florida. The properties adjacent to the proposed roadway improvement and stormwater pond footprints are commercial

businesses, residential properties, agricultural land, and vacant land. The project corridor is shown on excerpts of the U.S. Geological Survey (USGS) Melbourne West and Fellsmere NW Florida Quadrangle maps as **Figure 1**.

2.2 Current Land Use

The current land uses within the study area are shown on **Figure 2** and are summarized as follows:

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial and Services
- Institutional
- Open Land
- Inactive Land, No Structures
- Improved Pastures
- Unimproved Pastures
- Rural Open Lands
- Field Crops
- Shrub and Brushland
- Mixed Scrub-Shrub Wetland
- Mixed Rangeland
- Pine Flatwoods
- Upland Mixed Coniferous/Hardwood
- Streams and Waterways
- Reservoirs
- Spoil Areas
- Roads and Highways
- Communications
- Electrical Power Transmission Lines
- Surface Water Collection Basin
- Upland Hardwood Forest
- Freshwater Marshes

The spoil areas depicted on the land use map are likely from the excavation of drainage canals along Malabar Road and are not considered a contamination concern at this time.

2.3 Project Description

As described in the Contract Plans, the project plans include the following:

- Right of way acquisition
- Roadway widening and re-alignment from Station 36+41 to Station 274+63
- Stormwater pond construction along the Malabar Road alignment. The alternative stormwater ponds and flood plain compensation areas are shown on **Figures 1 – 4A/B**.

2.4 Potential Contamination Impacts

The project elements that could be impacted by soil and/or groundwater contamination include the following:

- Right of way acquisition
- Soil excavation for stormwater pond construction
- Soil excavation for pavement construction
- Excavation dewatering

3.0 CONTAMINATION SCREENING METHODOLOGY

GEC conducted this evaluation in general accordance with Part 2, Chapter 20 of the FDOT PD&E Manual dated July 1, 2020. The study area is defined by the following distances from the right of way:

- All sites within 500 feet
- Non-landfill solid waste sites within 1,000 feet
- Solid waste landfills, CERCLA, or National Priorities List (NPL) sites within ½ mile

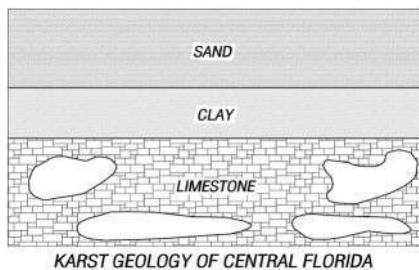
GEC reviewed relevant information from the FDEP, USEPA, and local agencies in Brevard County to identify known or potential contamination sites within the study area. Historical aerial photographs and other published historical sources were reviewed as part of this CSER. GEC performed a site reconnaissance of the properties within the study area and attempted to interview individuals with knowledge of the study area's environmental status.

Based on the results of the contamination screening activities, GEC assigned Contamination Risk Ratings (CRRs) to sites. The risk rating system was developed by FDOT and incorporates four levels of risk: **No, Low, Medium and High**. For a description of the four risk levels please refer to **Appendix C**.

A Level II Impact to Construction Assessment was prepared for Pond C-20 Alternative 1 and is attached as Appendix K.

4.0 GEOLOGIC AND GEOGRAPHIC CONDITIONS

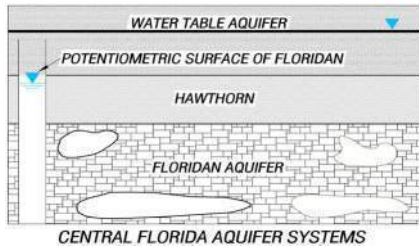
4.1 Central Florida Geology



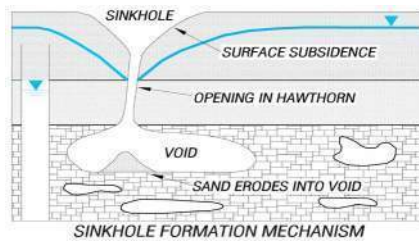
Due to its prevalent geology, referred to as karst, Central Florida is prone to the formation of sinkholes, or large, circular depressions created by local subsidence of the ground surface. The nature and relationship of the three sedimentary layers typical of Central Florida geology cause sinkholes. The deepest, or basement, layer is a massive cavernous limestone formation known as the Floridan

aquifer. The Floridan aquifer limestone is overlain by a silty or clayey sand, clay, phosphate, and limestone aquitard (or flow-retarding layer) ranging in thickness from nearly absent to greater than 100 feet and locally referred to as the Hawthorn Group (Hawthorn). The Hawthorn is in turn overlain by a 40 to 70-foot thick surficial layer of sand, bearing the water

table aquifer. The likelihood of sinkhole occurrence at a given site within the region is determined by the relationship among these three layers, specifically by the water (and soil)-transmitting capacity of the Hawthorn at that location.



The water table aquifer is comprised of Recent and Pleistocene sands and is separated from the Eocene limestone of the Floridan aquifer by the Miocene sands, clays and limestone of the Hawthorn. Since the thickness and consistency of the Hawthorn is variable across Central Florida, the likelihood of groundwater flow from the upper to the lower aquifer (known as aquifer recharge) will also vary by geographical location.



In areas where the Hawthorn is absent, water table groundwater (and associated sands) can flow downward to cavities within the limestone aquifer, like sand through an hourglass, recharging the Floridan aquifer, and sometimes causing the formation of surface sinkholes. This process of subsurface erosion associated with recharging the Floridan aquifer is known as raveling. Thus, in Central Florida, areas of effective groundwater recharge to the Floridan aquifer have a higher potential for the formation of surface sinkholes.

Based on the U.S. Geological Survey Map entitled "Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida," 1984, the study area lies in a generally no recharge area; therefore, we can conclude based solely on this data that it also lies in an area where the relative risk of sinkhole formation is low compared to the overall risk across Central Florida.

4.2 USGS Quadrangle Map

The study area has been transposed onto the USGS Melbourne West and Fellsmere NW, Florida Quadrangle maps for this area, as shown on **Figure 1**. According to the quadrangle maps, the natural ground surface elevation in the vicinity of the study area is between +20 feet and +27 feet National Geodetic Vertical Datum (NGVD), 1929.

- Citrus groves are visible within the western and eastern portions of the study area.
- Spoil banks are shown along the canals in the study area. The spoil banks depicted on the land use map are likely from the excavation of drainage canals along Malabar Road and are not considered a contamination concern at this time.

No additional conditions are depicted that would represent potential contamination concerns on, or in the immediate vicinity of, the study area.

4.3 NRCS Soil Survey Review

The NRCS Soil Survey of Brevard County, Florida was reviewed for information regarding near-surface soil conditions within the project limits, as shown on **Figure 3**. The following soil types were identified within the study area:

Unit No.	Soil Name
2	Anclote sand, frequently ponded, 0 to 1 percent slopes
17	EauGallie sand, 0 to 2 percent slopes
18	EauGallie, Winder, and Riviera soils, depressional
19	Riviera sand, 0 to 2 percent slopes
31	Malabar, Holopaw, and Pineda soils
47	Pineda sand, 0 to 2 percent slopes
71	Wabasso sand, 0 to 2 percent slopes

These soil types are not indicative of contamination risk. No landfills, borrow pits, quarries, or other conditions are depicted that would represent potential contamination concerns on, or in the immediate vicinity of, the study area.

Information contained in the NRCS Soil Survey is very general and may be outdated. It may not therefore be reflective of actual soil and groundwater conditions, particularly if recent development in the site vicinity has modified soil conditions or surface/subsurface drainage.

4.4 Geotechnical Investigation

GEC is conducting a geotechnical engineering exploration including hand auger borings to 5 feet in depth at the proposed stormwater pond and flood plain compensation locations. GEC will submit a geotechnical report under separate cover. Please refer to that report for the geotechnical findings and recommendations.

5.0 HISTORICAL DATA REVIEW

5.1 Historical Aerial Photographs

Historical aerial photographs of the study area were reviewed to evaluate past land use and to identify features that may indicate hazardous material or petroleum contamination. Available historical aerial photographs of the study area were accessed from Google Earth, the Florida

Department of Transportation, and the University of Florida websites. Aerial photographs for the following years were reviewed: 1943, 1951, 1972, 1980, 1986, 1994, 1999, 2004, 2009, 2014 and 2020. Excerpts of the aerial photographs are included in **Appendix A**.

1943 - 1972

- Malabar Road is visible along with several irrigation / drainage canals running parallel and perpendicular to Malabar Road. Several dirt roads are also visible connecting Malabar Road to the adjacent properties. Minton Road is visible north of Malabar Road.
- Most of the study area is citrus groves and vacant land. Several residences are visible, mainly in conjunction with the citrus groves.
- Two cattle pens are visible and discussed as **Site Nos. 1 and 3** in **Table 1**.
- In 1943, **Pond C-7 Alt. 3** is an undeveloped vacant field. In 1972, a drainage ditch is visible running east to west through the southern portion of the pond. Striations as apparent drainage features are visible throughout the pond. Cattle are visible on the pond site in 1972.

1980 – 1986

- Malabar Road appears to have been paved.
- A construction yard is visible to the southeast of the Malabar Road and Minton Road intersection. This construction yard is discussed as **Site No. 19** in **Table 1**.
- Citrus groves and agricultural land use are declining in the study area.
- Drainage ditches are visible running north to south through the center of **Pond C-7 Alt. 3** in 1980. In 1994, the southwest portion of the pond is wooded land.

1994 – 2004

- Minton Road is visible south of Malabar Road. Malabar Road appears to have been widened and re-paved.
- Most of the study area is residential and commercial land use. Citrus groves have declined and are only visible on the far eastern and western portions of the alignment.

2009

- Land clearing for development is visible on the far west side of the study area.
- Additional residential developments are under construction and associated stormwater ponds are visible.
- The eastern portion of **Pond C-7 Alt. 3** contains sparse trees.

2014

- Malabar Road has been paved on the far western portion of the alignment. St. Johns Heritage Parkway is visible and under construction.

- Citrus groves are no longer visible.
- The western border of **Pond C-7 Alt. 3** has been cleared of trees.

2020

- The aerial photographs reflect the current condition of the project corridor.
- The western border of **Pond C-7 Alt. 3** is heavily wooded. Sandy areas are visible in the eastern portion of the pond.

5.2 City Directories

City Directories are historical listings of businesses and residences in a given area, similar to a standard telephone book. The site occupant and addresses listed for previous years can identify past land uses. GEC contracted with Environmental Data Resources (EDR) to provide a city directory review for the study area. EDR researched city directories from 1955 through 2017 at approximately 5-year intervals.

Table 3 summarizes the historical city directory listings within the study area. Not all CRR sites were listed in the City Directories. The EDR City Directory Report is included in **Appendix D**.

5.3 Fire Insurance Maps

Fire insurance maps are used by insurance companies in assessing fire risk. These maps contain details about building construction, business type, building contents, fuel storage tanks, and other factors affecting fire risk.

Fire insurance maps were not available for the study area. The fire insurance map search confirmation is included in **Appendix E**.

5.4 Historical Quadrangle Maps

GEC reviewed historical quadrangle maps at the www.Historicaerials.com website. The maps for 1951, 1954, 1958, 1966, 1969, 1971, 1972, 1981, 1986, 1988, 2012, 2015, and 2018 were reviewed. Malabar Road is visible in the 1954, 1969, 1971, 2012, 2015, and 2018 maps. The remaining maps stopped just north of Malabar Road.

Malabar Road and Minton Road (north of Malabar Road) are visible dating back to 1954. The portion of Minton Road south of Malabar Road is visible in 2012.

Historical citrus areas are shown along the alignment from 1954 through 1988. These historical citrus groves are discussed as **Site No. 22** in **Table 1**.

Spoil banks are visible dating back to 1954. These spoil banks are from the excavation of drainage canals and are not considered a contamination concern at this time.

Residential development is shown in the project vicinity on the 1971 and later maps.

No additional conditions are depicted that would represent contamination concerns on, or in the immediate vicinity of, the study area.

5.5 Historical Contamination Screening Evaluation Report

No historical Contamination Screening Evaluation Reports were available for the study area.

6.0 PUBLIC RECORD REVIEW

GEC conducted a review of the public record for the study area including information obtained from the USEPA and the FDEP. As a part of our review, GEC subcontracted with EDR for a regulatory database search. The EDR Radius Map Report is included in **Appendix F**.

6.1 Florida Department of Environmental Protection (FDEP) Databases

The FDEP has compiled several databases that are useful in identifying potential sources of hazardous material or petroleum product contamination. The FDEP databases reviewed for this study and their common abbreviations are provided in **Appendix G**.

6.2 United States Environmental Protection Agency (USEPA) Databases

The federal government has compiled several databases that are useful in identifying potential sources of hazardous material or petroleum product contamination. The federal databases reviewed for this study and their common abbreviations are provided in **Appendix H**.

6.3 FDEP OCULUS Document Management System, Map Direct Website, and Nexus Portal

The FDEP uses the OCULUS Document Management System, Map Direct Website, and Nexus Portal to provide public record information for petroleum or hazardous material releases to the environment, generators of hazardous waste, and solid waste facilities. Information contained in this data management system includes the status of active and abandoned storage tanks, tank inspection reports, tank closure reports, environmental assessment reports, remedial

action reports, hazardous waste generator compliance details, and solid waste facility compliance details.

GEC reviewed the OCULUS Document Management System, Map Direct Website, and Nexus Portal within the search distances provided in Section 3.0. The results of our review have been incorporated in our Potential Contamination Site Descriptions in **Table 1**. The FDEP OCULUS, Map Direct and Nexus Portal Information can be found in **Appendix I**.

6.4 EDB Delineated Areas

The Florida Legislature had the FDEP implement the Delineated Areas Program in 1988 under Chapter 62-524, FAC. The purpose of the program was to protect public health and groundwater resources by regulating potable water well construction and testing standards for areas of known groundwater contamination. During the period 1962 to 1980, the Florida Department of Agriculture and Consumer Services (FDACS) conducted widespread applications of ethylene dibromide (EDB), an agricultural pesticide, to control nematodes in citrus groves. In 1983, the FDEP began testing groundwater in potable wells throughout Florida due to the discovery of EDB in wells in other states. The delineated areas of EDB groundwater contamination are shown on the FDEP Map Direct website. The potable wells, agricultural or residential, with confirmed impacts were shown on the website with a 1,000-foot buffer zone in an attempt to project future migration of contaminants. However, this does not mean that there is not EDB contamination outside of that 1,000-foot zone.

After reviewing these EDB-delineated areas on the FDEP Map Direct website, in the vicinity of the study area, GEC found that no EDB-delineation areas appear within the study area.

6.5 Agricultural Land Use

Historical citrus groves were along the study area from 1943 to 2019. These properties were adjacent to Malabar Road and were redeveloped for residential and commercial usage on the eastern portion of the alignment and are currently vacant land on the western portion. Agricultural land use and the effects it can have on a redevelopment project is discussed as **Site No. 22** in **Table 1**.

Two cattle pens and one agricultural barn were identified during the historical aerial photograph review. No cattle dipping vats were observed in the vicinity of the cattle pens and barn. Based on the available information and the historical aerial review, the cattle pens and barn are considered a contamination risk to the proposed roadway widening and are discussed as **Site Nos. 1** through **3** in **Table 1**.

GEC did not identify any additional row crops, cattle grazing, additional cattle pens, farm/ranch buildings, irrigation wells, or water towers in the study area during the site reconnaissance.

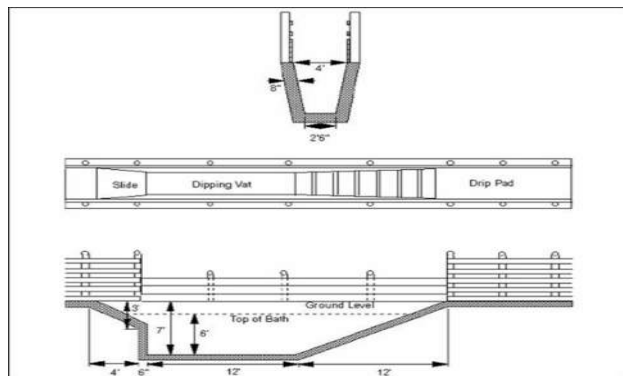
6.6 Railroad Corridors

There are no railroad corridors within the study area.

6.7 Cattle Dip Vats

Cattle dip vats were a response to cattle tick fever in the 1890s. The USDA initiated the cattle dip vat program in 1906 and approximately 3,200 cattle dip vats had been constructed by 1940.

Cattle dip vats were used until the 1960s and many vats have not been located or documented. Cattle dip vats were used to apply pesticides to cattle and other livestock, kill ticks, and thereby eliminate tick-borne diseases. The vats were typically constructed of concrete. They consisted of four sections; the entrance slide, dipping vat, exit stairs and drip pad. Cattle were funneled into a chute leading to the entrance slide, then slid down into the pesticide-filled vat, swam or walked across the vat and up the exit stairs to the drip pad. The vats were roughly four feet wide, seven feet deep, and 40 feet long as shown on the following diagram.



Due to the relatively small size of the vat and the narrow profile, it is difficult to identify a cattle dip vat from aerial photographs, or in a wooded area. Cattle dip vats are typically identified when the land owner reveals the location, when they are located near historical cattle pens and chutes, and by happening upon them. To add to the difficulty in identifying historical cattle dip vats, many

landowners removed the vats when the program was closed. They either dug up the vat or broke up the concrete and covered it with soil.

Two cattle pens and one agricultural barn were identified during the historical aerial photograph review. No cattle dipping vats were observed in the vicinity of the cattle pens and barn. Based on the available information and the historical aerial review, the cattle pens and barn are considered a contamination risk to the proposed roadway widening and are discussed as **Site Nos. 1** through **3** in **Table 1**.

No cattle dip vats were identified within the study area through public record and database review, historical aerial photograph review, or site reconnaissance. Based on available

information, we found no evidence that cattle dip vats within the study area contribute to contamination risk for this project.

7.0 INTERVIEWS

On February 2, 2021, GEC interviewed Mr. Shane Gibbs Government Operations Consultant Office of Emergency Response regarding the petroleum spill (discussed as **Site No. 15** in **Table 1**) at the intersection of Malabar Road and Minton Road. Mr. Gibbs provided documentation on the incident and stated that due to the age of the incident, that was the only available information. Mr. Gibbs indicated this incident is closed.

On February 9, 2021, GEC contacted the Waste Operations at the Florida Department of Environmental Protection regarding any history of contamination concerns within the study area. As of the date of this report, GEC has not received a response.

On February 9, 2021, GEC interviewed Ms. Maryann Civil, P.G. with the Small Quantity Generator Hazardous Waste Program with Brevard County Natural Resources Management, concerning any hazardous waste concerns within the study area. Ms. Civil forwarded our request to Ms. Sandra SanzGarcia. GEC provided more information to Ms. SanzGarcia regarding the study area and received a response from Mr. Jeffery Grantham stating that he did not identify any hazardous waste contamination concerns or any related potential conditions of environmental concerns within the study area.

On February 9, 2021, GEC interviewed Mr. Doug Divers, Local Program Manager with Brevard County Natural Resources Management, concerning any contamination concerns within the study area. Mr. Divers forwarded our information request to Mr. Jeffrey Grantham, Environmental Specialist 1. Mr. Grantham responded indicating he did not identify any hazardous waste contamination concerns or any related potential conditions of environmental concerns within the study area.

On May 23, 2023, GEC contacted Mr. Doug Divers, Program Manager of the Brevard County Natural Resources Management Department, regarding possible cattle dip vats in the vicinity of **Pond C-7 Alt. 3**. Mr. Divers stated his office no longer had records of cattle dip vats.

No additional interviews were performed in the preparation of this assessment. The interview documentation is included in **Appendix J**.

8.0 SITE RECONNAISSANCE

GEC representatives performed a reconnaissance of the study area on February 4, 2021. The purpose of the reconnaissance was to document existing conditions and evaluate whether current land uses could result in hazardous material or petroleum product contamination of environmental media.

A reconnaissance was performed for **Pond C-7 Alt 3** on June 6, 2023, to whether current land uses could result in hazardous material or petroleum product contamination of environmental media.

The properties within the project study area were visually inspected for evidence of contamination such as stressed vegetation, underground tank vent and fill pipes, dumping, accumulated areas of debris, evidence of buried materials, and ground staining.

Details of the site reconnaissance and photographs obtained are incorporated in the Potential Contamination Site Descriptions in **Table 1**.

9.0 CONCLUSIONS AND RECOMMENDATIONS

This CSER has identified the 21 sites that, in GEC's opinion, have some risk of contamination impacts to this project. The site locations are shown on **Figures 4A** and **4B**. **Table 1** summarizes the findings for each rated site.

9.1 Potential Contamination Sites

Low Risk Sites (12)

Site Number	Site Name	Site Address	Risk Potential
4	Biarritz Disaster Debris Management Site	1224 - 1228 Biarritz Street	Low
5	City of Palm Bay - Public Works	1050 Malabar Road	Low
8	O'Reilly Auto Parts	235 Malabar Road	Low
9	Autozone	260 Malabar Road	Low
10	Coastal Biosystem	270 Malabar Road	Low
11	Sun Clean Dry Cleaners	190 Malabar Road #123	Low
12	Winn-Dixie Store #2230	190 Malabar Road	Low
13	Bennett Auto Supply	142 Malabar Road	Low
15	SPILLS Site	Malabar Road & Minton Road	Low
18	Lubrication Specialist Inc.	6369 Minton Road	Low
19	Construction Yard	120 Malabar Road	Low
20	Palm Bay City Hall	120 Malabar Road	Low

Medium Risk Sites (9)

Site Number	Site Name	Site Address	Risk Potential
1	Cattle Pen	Malabar Road	Medium
2	Agricultural Barn	2200 Malabar Road	Medium
3	Cattle Pen	Malabar Road	Medium
6	Circle K #2726513	900 Malabar Road	Medium
7	Malabar Cove	3 NW Malabar Road	Medium
14	Bob Youtzy Landclearing	201 Malabar Road	Medium
16	7-Eleven Food Store #32756	6405 Minton Road	Medium
17	Cumberland Farms	105 Malabar Road / 6375 Minton Road	Medium
21	Historical Citrus	N/A	Medium

Pond Sites (15)

Pond Name	Location	Risk Potential	Relevant Site Number
C-7 Alt. 1	Station 63+50 – 66+17 Right	Medium	21
FPCA	Station 84+00 – 85+65 Right	Medium	2, 21
C-7 Alt. 2	Station 85+65 – 88+60 Right	Medium	2, 21
C-7 Alt. 3	Station 53+80 – 55+53 Right	Low	N/A
C-7 Alt. 3 FPCA	Station 53+80 – 55+53 Right	Low	N/A
C-8 & C-9 Combined Alt. 2	Station 90+00 – 92+60 Right	Low	N/A
C-8 & C-9 Combined Alt. 1	Station 102+00 – 104+40 Left	Low	N/A
C-10 West Alt. 1	Station 135+00 – 136+80 Left	Low	N/A
C-10 East Alt. 1 (Swale 1)	Station 145+00 – 155+00 Right	Low	N/A
C-10 East Alt. 1 (Swale 2)	Station 155+70 – 166+20 Right	Low	N/A
C-10 East Alt. 1 (Swale 3) C-10 West Alt. 2 (Option 1)	Station 169+15 – 175+45 Right	Low	N/A
C-10 East Alt. 2 C-10 West Alt. 2 (Option 2 – Expand Pond)	Station 175+45 – 179+00 Left	Medium	21
C-20 Supplemental Swale	Station 198+45 – 201+00 Right Station 204+40 – 208+70 Right	Low	N/A
C-20 Alt. 1	Station 229+00 – 231+85 Right	Medium	21
C-20 Alt. 2	Station 240+35 – 244+25 Right	Medium	7, 21

9.2 Level II Impact to Construction (ICA) Recommendations

Based on our current knowledge of the design plans, Level II ICAs may be required for the **nine Medium Risk** sites and **six Medium Risk** pond sites listed above to evaluate the presence of contamination.

A Level II ICA was performed for Pond C-20 Alternative 1 and is attached as **Appendix K**.

9.3 CSER Update

This CSER should be updated if right of way acquisition or construction will occur more than **one year** from the date of this report to determine if additional assessment is warranted due to significant changes in site conditions or project design.

10.0 LIMITATIONS

The findings, opinions, conclusions and recommendations presented herein are based in part on reasonably ascertainable information contained in the public record. GEC does not warrant or guarantee the accuracy or completeness of this information. Some of this public record information may be dated and not representative of conditions at the time of this report was prepared (January, February, November, and December 2021, and May and June 2023), or in the future. Additional limitations are as follows:

- Not discussed in this report are properties that have been historically undeveloped land, are associated with residential use and do not appear to pose a contamination risk, or are professional/commercial establishments that are not associated with hazardous materials or petroleum products.
- This study also does not include surveys of wetlands, endangered species, asbestos containing materials, lead-based paints, or other potential hazardous building materials.

11.0 USE OF THIS REPORT

GEC has prepared this report for the exclusive use of our client, Kittelson & Associates, Inc. and the City of Palm Bay, and for application to our client's project. GEC will not be held responsible for any other party's interpretation or use of this report's data or recommendations without our written authorization.

GEC has performed the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

The conclusions and recommendations should be disregarded if the final project design differs from the project description in this report. If such changes are contemplated, GEC should be retained to review the new plans to assess the applicability of this report in light of proposed changes.

FIGURES

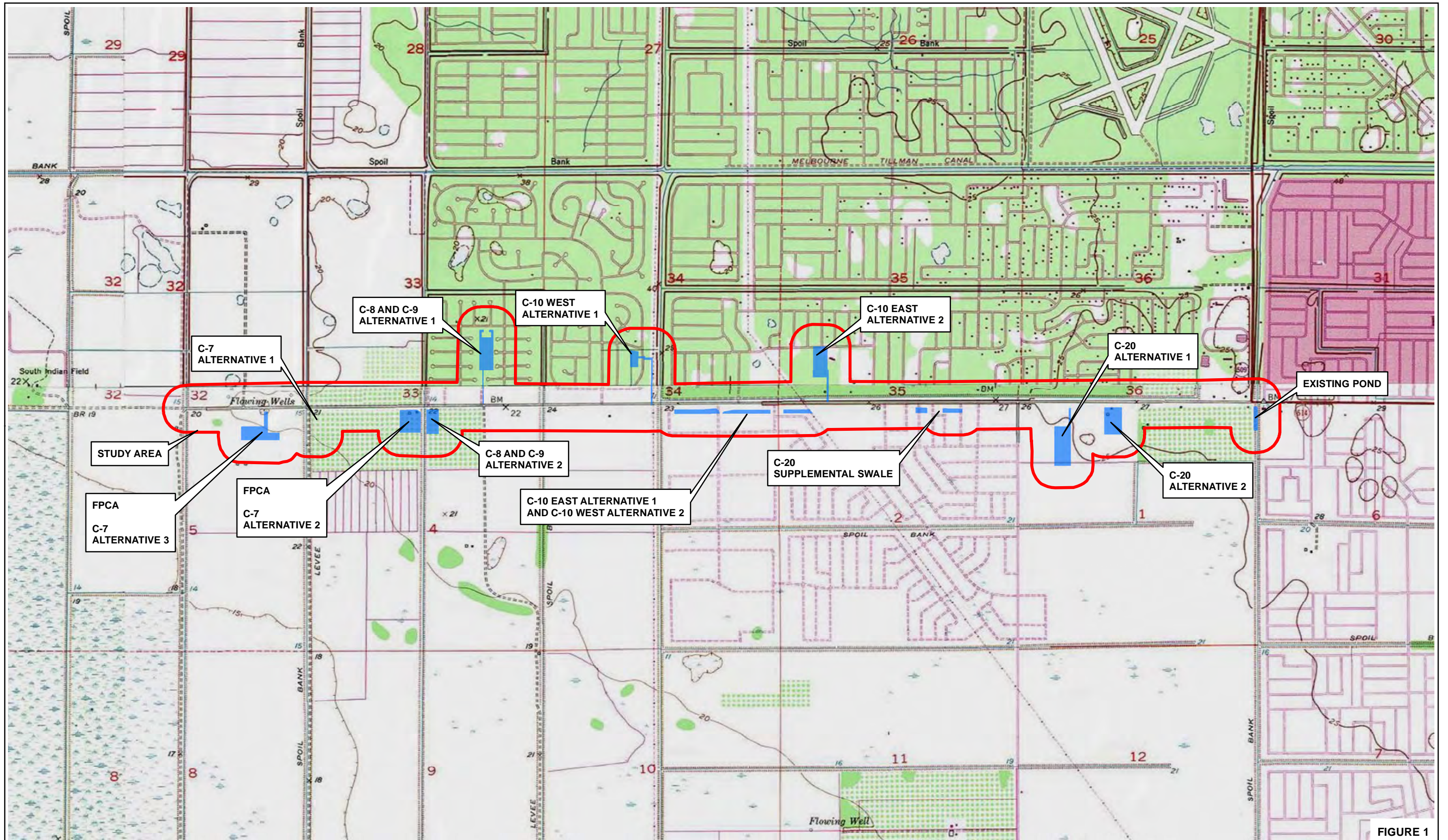
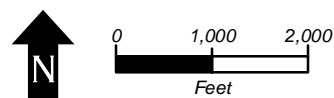


FIGURE 1

Melbourne West Quadrangle
 Dated: 1988
Fellsmere NW Quadrangle
 Dated: 1970

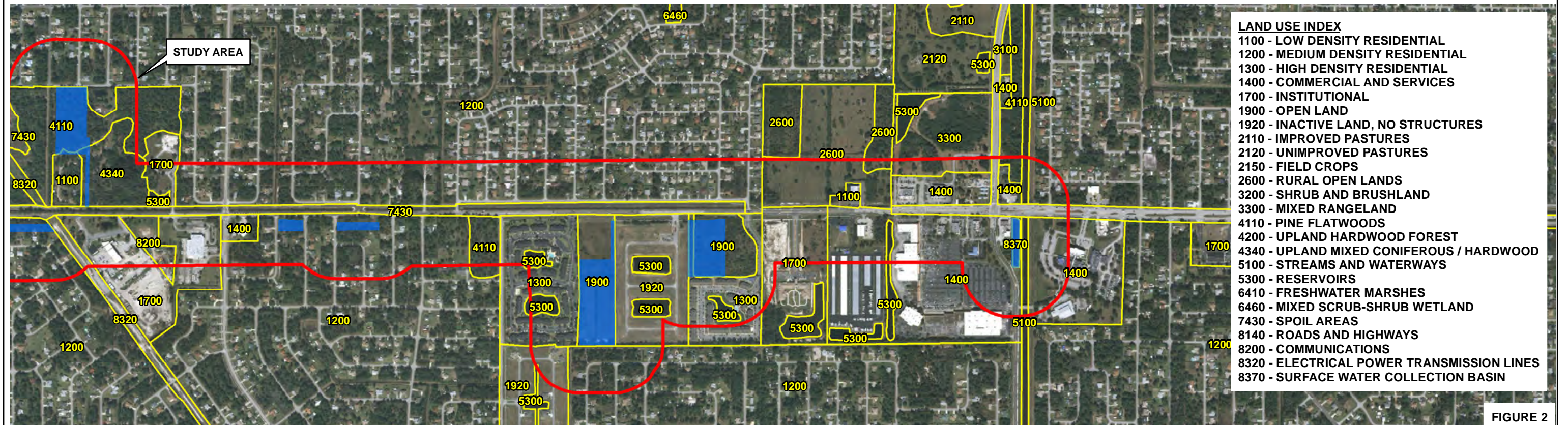


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STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

USGS QUADRANGLE MAP

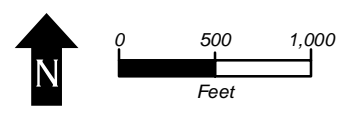
SHEET NO.



LAND USE INDEX

- 1100 - LOW DENSITY RESIDENTIAL
- 1200 - MEDIUM DENSITY RESIDENTIAL
- 1300 - HIGH DENSITY RESIDENTIAL
- 1400 - COMMERCIAL AND SERVICES
- 1700 - INSTITUTIONAL
- 1900 - OPEN LAND
- 1920 - INACTIVE LAND, NO STRUCTURES
- 2110 - IMPROVED PASTURES
- 2120 - UNIMPROVED PASTURES
- 2150 - FIELD CROPS
- 2600 - RURAL OPEN LANDS
- 3200 - SHRUB AND BRUSHLAND
- 3300 - MIXED RANGELAND
- 4110 - PINE FLATWOODS
- 4200 - UPLAND HARDWOOD FOREST
- 4340 - UPLAND MIXED CONIFEROUS / HARDWOOD
- 5100 - STREAMS AND WATERWAYS
- 5300 - RESERVOIRS
- 6410 - FRESHWATER MARSHES
- 6460 - MIXED SCRUB-SHRUB WETLAND
- 7430 - SPOIL AREAS
- 8140 - ROADS AND HIGHWAYS
- 8200 - COMMUNICATIONS
- 8320 - ELECTRICAL POWER TRANSMISSION LINES
- 8370 - SURFACE WATER COLLECTION BASIN

FIGURE 2



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MALABAR	BREVARD	437210-1-28-01

LAND USE MAP

SHEET NO.

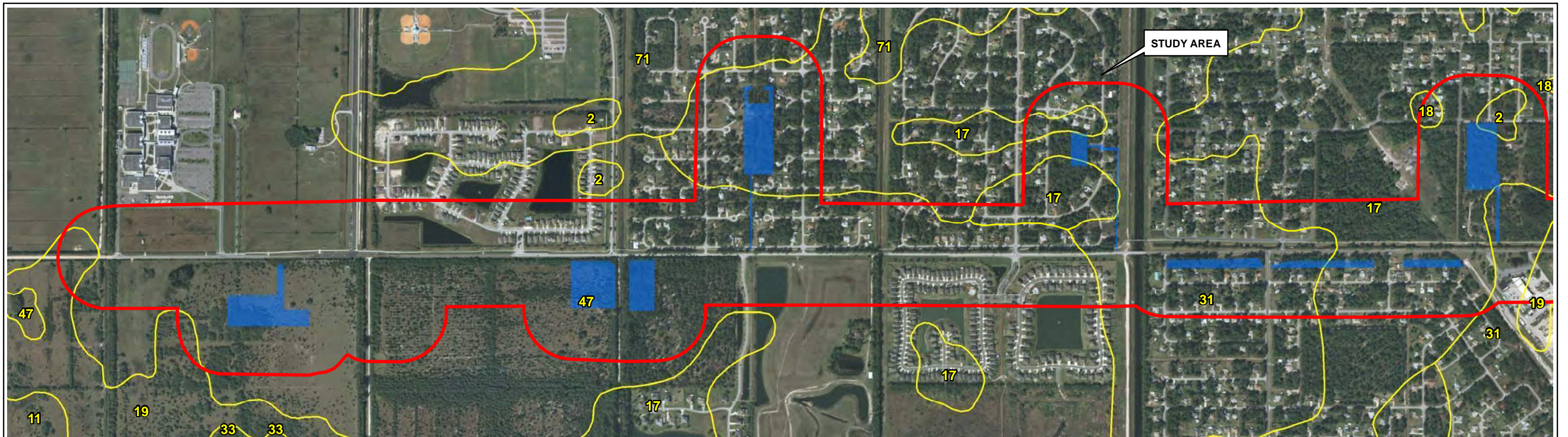
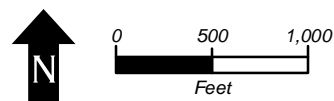


FIGURE 3



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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

NRCS SOIL SURVEY MAP

SHEET NO.

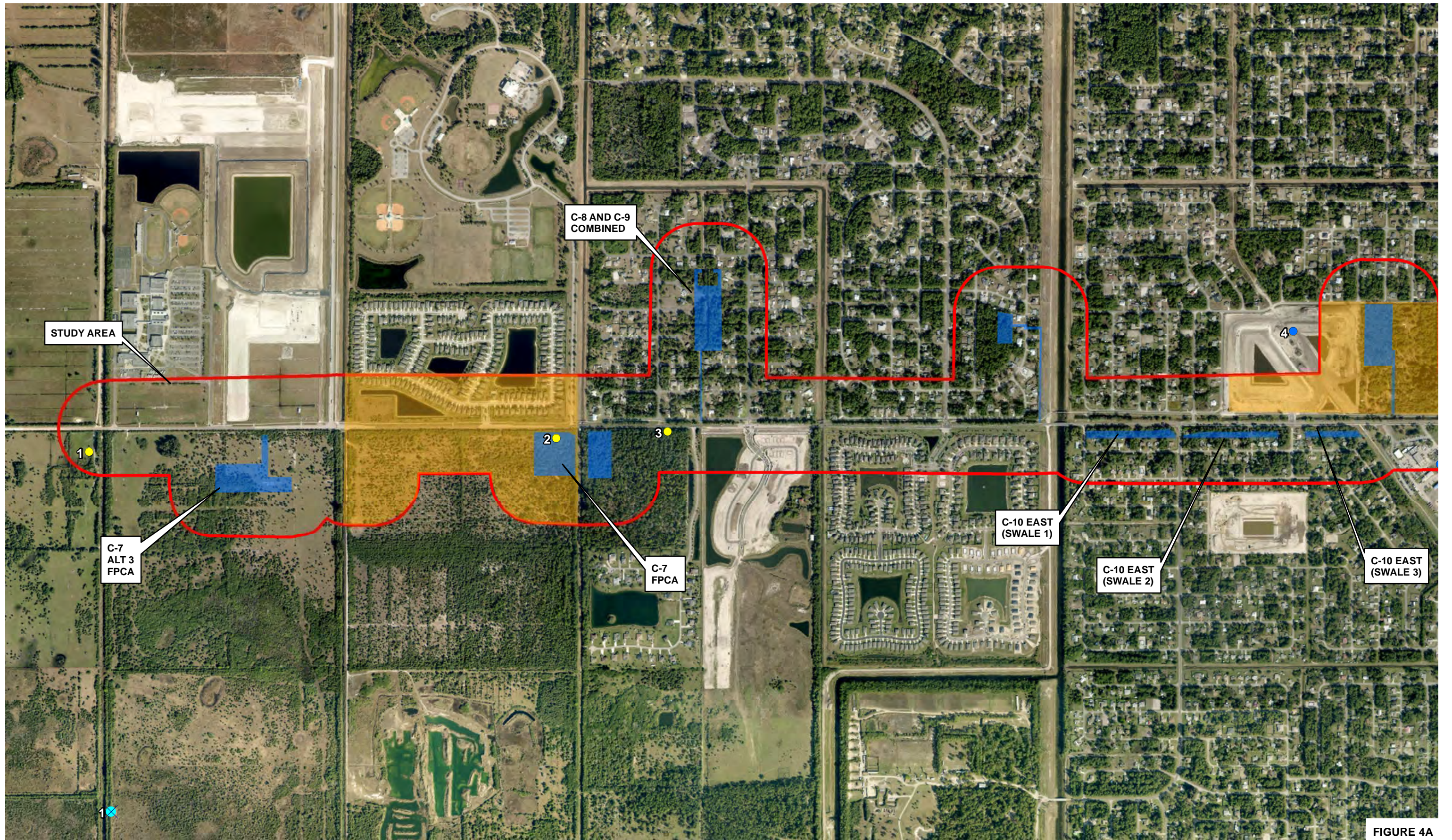


FIGURE 4A

<ul style="list-style-type: none"> ● SITE WITH HIGH RISK RATING ● SITE WITH MEDIUM RISK RATING ● SITE WITH LOW RISK RATING 	<p> SITE 21 (MEDIUM RISK RATING) HISTORICAL CITRUS GROVES</p>			<p>RICHARD P. McCORMICK, P.G. P.G. LICENSE NUMBER 2096 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. 2510 MICHIGAN AVENUE, SUITE D KISSIMMEE, FL 34744-1933</p>	<p>STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="font-size: small;">ROAD NO.</th> <th style="font-size: small;">COUNTY</th> <th style="font-size: small;">FINANCIAL PROJECT ID</th> </tr> <tr> <td style="text-align: center;">MALABAR</td> <td style="text-align: center;">BREVARD</td> <td style="text-align: center;">437210-1-28-01</td> </tr> </table>	ROAD NO.	COUNTY	FINANCIAL PROJECT ID	MALABAR	BREVARD	437210-1-28-01	<p><i>POTENTIAL CONTAMINATION SITE MAP</i></p>	<p>SHEET NO.</p>
ROAD NO.	COUNTY	FINANCIAL PROJECT ID											
MALABAR	BREVARD	437210-1-28-01											

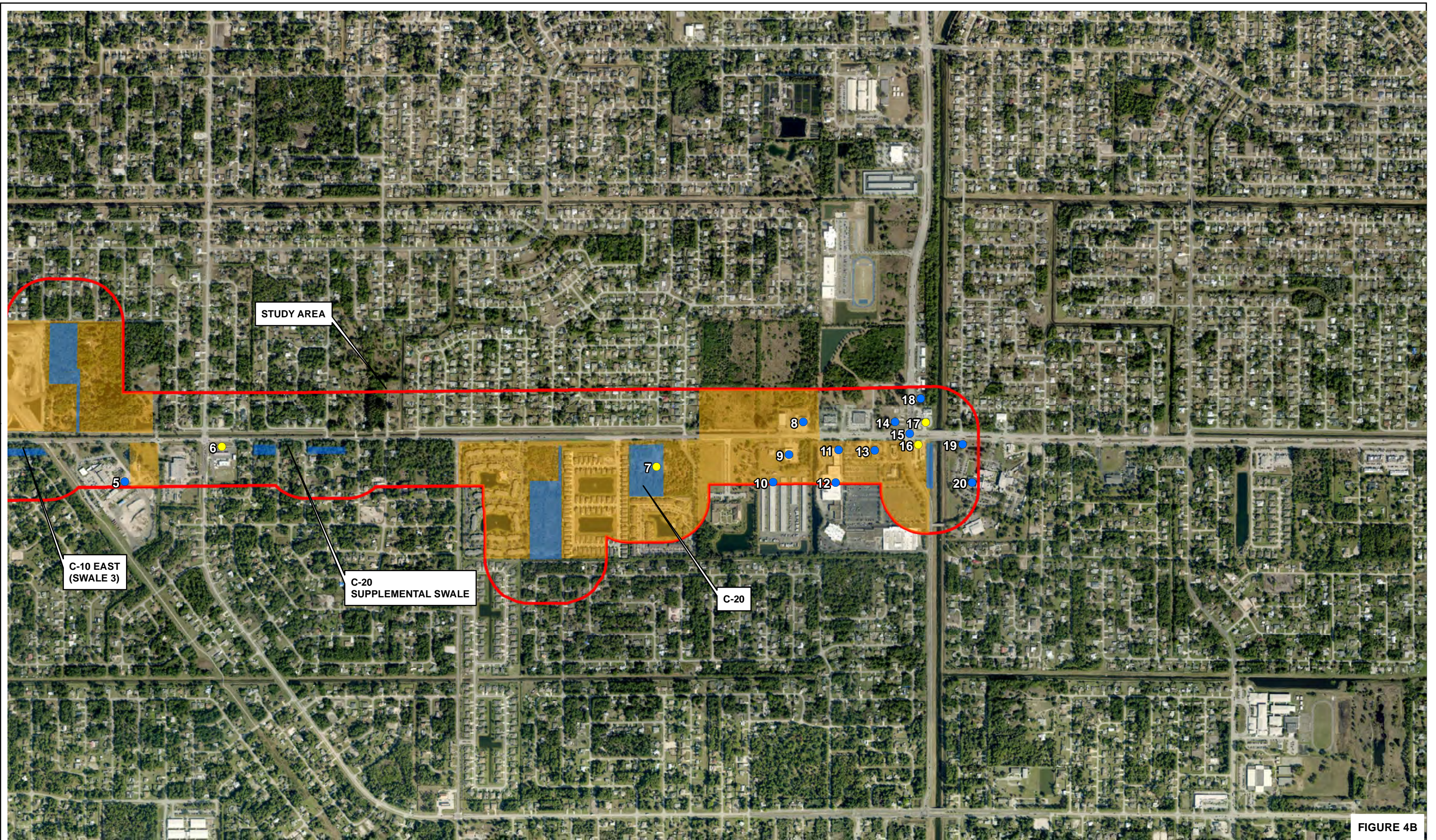


FIGURE 4B

- SITE WITH HIGH RISK RATING
- SITE WITH MEDIUM RISK RATING
- SITE WITH LOW RISK RATING
- SITE 21 (MEDIUM RISK RATING)
HISTORICAL CITRUS GROVES



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 KISSIMMEE, FL 34744-1933

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

*POTENTIAL CONTAMINATION
SITE MAP*

SHEET
NO.

TABLES

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	1		Risk Potential:	MEDIUM		
Site Name	Cattle Pen					
Site Address	Malabar Road					
Site Location	400 Feet South of Malabar Road					
Distance/Direction	Station: 62+00 Offset: 400' Right					
Facility ID Nos:	N/A					
Database Listings/Sources:	Historical Aerial Photograph Review					
Historical Land Use	Agricultural/Cattle Pen					
Current Land Use	Agricultural/Cattle Pen					
Contaminants	Hazardous Materials					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
N/A	N/A	N/A	N/A	N/A	N/A	
Discharge Date	N/A		Cleanup Date:	N/A		
	Soil			Groundwater		
Documented/ Known Impacts:	NO			NO		

PUBLIC RECORDS: This site was identified through the historical aerial photograph review. The cattle pen is visible from 1943 through 2004. The cattle pen is no longer visible from 2004 through 2014 due to vegetation growth. In 2020 the cattle pen is visible with the addition of a new fence on the north side of the cattle pen. Cattle were historically treated with pesticides while contained in pens. Residual pesticide impacts may exist on-site.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site appears to be an active cattle pen. The fencing and gates appear to have been maintained.

CONCLUSIONS: Based on the agricultural use of this site, the potential for residual pesticide impacts, and its proximity to Malabar Road, this site has been assigned a Contamination Risk Rating (CRR) of **Medium**.

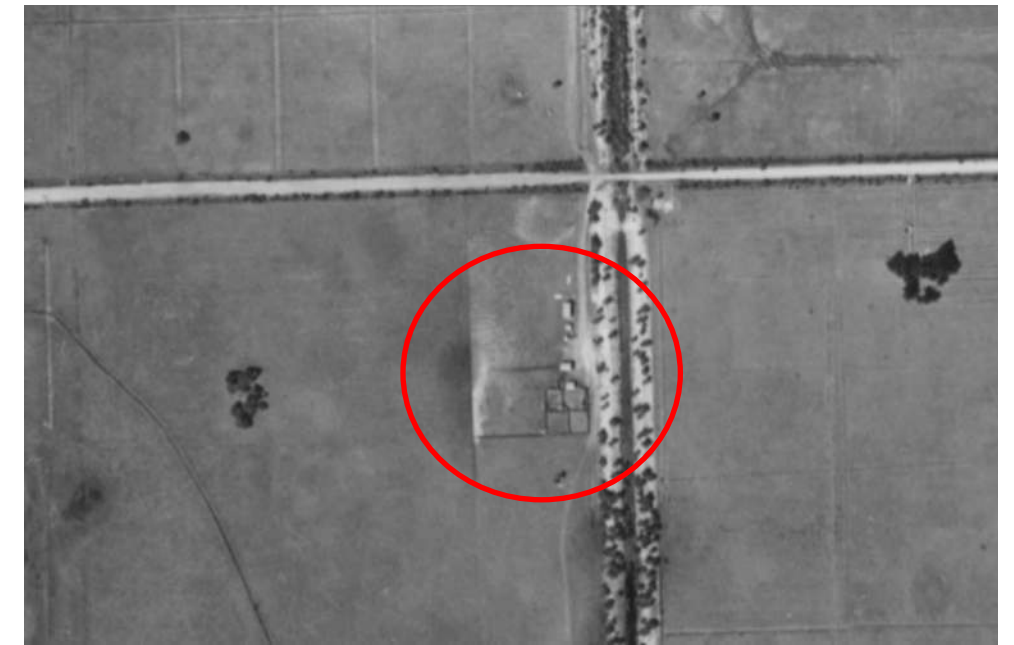


Photo taken from 1953 historical aerial showing the cattle pen.

Site No:	2		Risk Potential:	MEDIUM		
Site Name	Agricultural Barn					
Site Address	2200 Malabar Road					
Site Location	Southwest quadrant of the Malabar Road and Allison Drive Intersection					
Distance/Direction	Station: 85+50 Offset: 130' Right					
Facility ID Nos:	N/A					
Database Listings/Sources:	Historical Aerial Photograph Review					
Historical Land Use	Agricultural Use / Citrus Grove					
Current Land Use	Vacant Land					
Contaminants	Petroleum Products and Hazardous Materials					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
N/A	N/A	N/A	N/A	N/A	N/A	
Discharge Date	N/A		Cleanup Date:	N/A		
	Soil			Groundwater		
Documented/ Known Impacts:	NO			NO		

PUBLIC RECORDS: This site was identified through the historical aerial photograph review. This site is visible dating back to 1943 and appears to be a residence and barn with an adjacent citrus grove. The barn was dismantled and pieces of the barn appear to be stored on site from 1994 through 2020.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently vacant land with overgrown vegetation. The barn appears to have been demolished due to weather or manually. Aluminum roofing materials and wooden planks are visible in piles along the northern portion of the site.

CONCLUSIONS: Based on the agricultural use of this site, the location of Flood Plain Compensation Area (FPCA) and Pond C-7 Alt 2, and its proximity to Malabar Road, this site has been assigned a CRR of **Medium**.



Photo taken from 1972 historical aerial showing agricultural barn.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	3		Risk Potential:	MEDIUM	
Site Name	Cattle Pen				
Site Address	Malabar Road				
Site Location	Southwest quadrant of the Malabar Road and Allison Drive Intersection				
Distance/Direction	Station: 98+80 Offset: 60' Right				
Facility ID Nos:	N/A				
Database Listings/Sources:	Historical Aerial Photograph Review				
Historical Land Use	Agricultural/Cattle Pen				
Current Land Use	Vacant Land				
Contaminants	Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A		Cleanup Date:	N/A	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: This site was identified through the historical aerial photograph review and was visible only in 1943. From 1951 through 2020 the site is vacant land with light to heavy vegetation coverage. Cattle were historically treated with pesticides while contained in pens. Residual pesticide impacts may exist on-site.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site was difficult to see due to overgrown vegetation and dense woods. No evidence of a cattle pen was found on site.

CONCLUSIONS: Based on the potential for residual pesticide impacts at this site, and its proximity to Malabar Road, this site has been assigned a CRR of **Medium**.



Photo taken from 1943 historical aerial showing the cattle pen.

Site No:	4		Risk Potential:	LOW	
Site Name	Biarritz Disaster Debris Management Site				
Site Address	1224 – 1228 Biarritz Street				
Site Location	North of Malabar Road				
Distance/Direction	Station: 170+00 Offset: 1000' Left				
Facility ID Nos:	99910				
Database Listings/Sources:	SWF/LF				
Historical Land Use	Vacant Land				
Current Land Use	Vacant Land – Under Construction				
Contaminants	Petroleum Products and Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A		Cleanup Date:	N/A	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: In 2017, the site was pre-authorized as a disaster debris management site and in 2018 the registration was complete. There are no records indicating this site was utilized for disaster debris. Historical aerial photographs show this site as having been raised with fill soil in about 2009. The property is currently under construction for residential development.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site has been cleared and appears to be under construction.

CONCLUSIONS: Based on the lack of contamination records and its distance from the roadway widening project, this site has been assigned a CRR of **Low**.



Photo taken from north of the site facing south. The area is under construction and currently contains concrete and PVC pipes.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	5		Risk Potential:	LOW	
Site Name	City of Palm Bay – Public Works				
Site Address	1050 Malabar Road				
Site Location	Southwest quadrant of the Malabar Road and Jupiter Boulevard Intersection				
Distance/Direction	Station: 181+00 Offset: 400' Right				
Facility ID Nos:	FLD982077737, 1000440371, 8518277				
Database Listings/Sources:	RCRA-VSQG, LUST, UST, AST, FINDS, TIER 2				
Historical Land Use	Citrus Grove				
Current Land Use	Public Works				
Contaminants	Petroleum Products and Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
1	U	10,000	Leaded Gas	9/1984	9/1988
1	U	10,000	Unleaded Gas	9/1984	9/1988
2	U	10,000	Unleaded Gas	9/1988	1/2010
1	U	10,000	Vehicular Diesel	11/1988	1/2010
1	U	10,000	Vehicular Diesel	9/1984	9/1988
1	A	275	New/Lube Oil	7/1988	1/2010
2	U	15,000	Unleaded Gas	1/2010	In-Use
1	U	15,000	Vehicular Diesel	1/2010	In-Use
1	A	275	New/Lube Oil	Unk.	9/1988
1	A	275	New/Lube Oil	9/1988	In-Use
2	A	550	New/Lube Oil	Unk.	In-Use
1	A	550	Waste Oil	Unk.	Unk.
1	U	1,000	Unleaded Gas	Unk.	Unk.
2	U	2,000	Leaded Gas	Unk.	Unk.
1	U	2,000	Unleaded Gas	Unk.	Unk.
1	U	2,500	Leaded Gas	Unk.	Unk.
1	A	2,500	Vehicular Diesel	Unk.	Unk.
Discharge Date	02/1994 & 02/2010		Cleanup Date:	01/2014	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: A discharge was reported for this site on February 9, 1994 due to a vapor detection of unleaded gasoline leaking from one of the tanks. The discharge was later reclassified as a vapor release and granted a “cleanup not required” status. A second discharge was reported on February 2, 2010 due to the discovery of contamination during tank removal activities. In August 2012, approximately 600-cubic yards of soil was excavated from the south and west sides of the underground storage tank area. Additionally, temporary dewatering was performed in the area via a well point system. In January 2014, groundwater sampling activities found no contamination detections exceeding cleanup target levels. An SRCO was issued for this site in August 2014. In addition, this site operates as a conditionally exempt small quantity generator. Based on the most recent tank inspection dated May 2018, the facility appears to be in compliance.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently the City of Palm Bay Public Works facility.

CONCLUSIONS: Based on the distance (the fueling tanks are > 400 feet south of Malabar Road) of the facility from the roadway widening activities, and the SRCO issued for the site in January 2014, the site has been issued a CRR of **Low**.



Photo taken from north of the site facing south. The Public Works building and parking area are visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	6		Risk Potential:	MEDIUM	
Site Name	Lil Champ Store #513 / Circle K #2726513 / Kangaroo Express Inc #6513 / Pantry Inc #6513				
Site Address	900 Malabar Road SW				
Site Location	Southeast corner of the Malabar Road and Jupiter Boulevard Intersection				
Distance/Direction	Station: 195+00 Offset: 75' Right				
Facility ID Nos:	8732741, FLD984192237				
Database Listings/Sources:	LUST, UST, NPDES, RCRA-VSQQ, EDR Hist Auto, City Directories				
Historical Land Use	Gas Station				
Current Land Use	Gas Station				
Contaminants	Petroleum Products				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
1	U	6,000	Unleaded Gas	May-87	6/2010
2	U	10,000	Unleaded Gas	May-87	6/2010
1	U	6,000	Vehicular Diesel	May-87	6/2010
2	U	16,000	Unleaded Gas	Jun-10	2/2020
1	U	20,000	Vehicular Diesel	Feb-20	In-Use
2	U	20,000	Unleaded Gas	Feb-20	In-Use
Discharge Date	04/1993 & 02/2005		Cleanup Date:	9/2002 & 9/2011	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: While the 16,000-gallon tanks are listed as being in use at the site, an Underground Storage Tank Closure Assessment Report dated November 12, 2019 shows the tanks were removed in October 2019. Assessment conducted at the time of the tank removal did not find any excessively contaminated soil or groundwater. Two historical discharges were reported on-site. The first discharge occurred in April 1993 and was reported in response to vapor detection. The discharge was granted No Further Action status in September 2002. The second discharge was reported in February 2005 in response to the discovery of damaged tank equipment. After the removal of contaminated soil from the site, the discharge was granted an SRCO in September 2011.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a Circle K gas station.

CONCLUSIONS: Based on the site's proximity to Malabar Road, the projects roadway widening and re-alignment, and the gas station nature of the property, this site has been assigned a CRR of **Medium**.



Photo taken from north of the site facing south. The Circle K gas station is visible.

**Table 1
Potential Contamination Site Summary**

GEC Project No. 4511E

Site No:	7		Risk Potential:	MEDIUM	
Site Name	Malabar Cove				
Site Address	NW Malabar Road				
Site Location	Southeast quadrant of the Malabar Road and Sutherland Drive intersection				
Distance/Direction	Station: 242+00 Offset: 300' Right				
Facility ID Nos:	Cleanup Site, FAC				
Database Listings/Sources:	COM_383098				
Historical Land Use	Citrus Grove				
Current Land Use	Landscape Storage				
Contaminants	Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A		Cleanup Date:	N/A	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		YES		

PUBLIC RECORDS: This site is the location of an arsenic groundwater contamination plume originating from this property due to its former agricultural use. Site assessment activities conducted in October 2019 documented an arsenic groundwater contamination plume. A letter from FDEP dated April 3, 2020 indicated cleanup was not required.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is vacant land and is currently being used by a landscaping company for storage.

CONCLUSIONS: Based on the footprint of the C-20 Alternative 2 pond, and the known arsenic plume, this site has been assigned a CRR of **Medium**.



Photo taken from north of the site facing south. Large unplanted palm trees are visible across the vacant site.

Site No:	8		Risk Potential:	LOW	
Site Name	O'Reilly Auto Parts				
Site Address	235 Malabar Road				
Site Location	North of Malabar Road				
Distance/Direction	Station: 260+00 Offset: 125' Left				
Facility ID Nos:	1018111595, 1017815670				
Database Listings/Sources:	ECHO, FINDS, Site Reconnaissance				
Historical Land Use	Citrus Grove				
Current Land Use	Auto Parts Store				
Contaminants	Petroleum Products and Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A		Cleanup Date:	N/A	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: This site was identified through our site reconnaissance. This location is not listed within any of the reviewed regulatory databases and does not have a public record or any record of storage tanks.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently an O'Reilly Auto Parts.

CONCLUSIONS: Based on the lack of documented contamination impacts, and no observable signs of contamination during the site reconnaissance, this site has been assigned a CRR of **Low**.



Photo taken from west of the site facing east. The O'Reilly Auto Parts store is visible.

**Table 1
Potential Contamination Site Summary**

GEC Project No. 4511E

Site No:	9		Risk Potential:	LOW		
Site Name	AutoZone					
Site Address	260 Malabar Road					
Site Location	South of Malabar Road					
Distance/Direction	Station: 258+00 Offset: 130' Right					
Facility ID Nos:	N/A					
Database Listings/Sources:	City Directories					
Historical Land Use	Citrus Grove					
Current Land Use	Auto Parts Store					
Contaminants	Petroleum Products and Hazardous Materials					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
N/A	N/A	N/A	N/A	N/A	N/A	
Discharge Date	N/A		Cleanup Date:	N/A		
	Soil			Groundwater		
Documented/ Known Impacts:	NO			NO		

PUBLIC RECORDS: The city directories listed this site between 2000 and 2017 as an auto supply shop. This location is not listed within any of the reviewed regulatory databases and does not have a public record or any record of storage tanks.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently an Auto Zone auto parts store.

CONCLUSIONS: Based on the lack of documented contamination impacts, and no observable signs of contamination during the site reconnaissance, this site has been assigned a CRR of **Low**.



Photo taken from north of the site facing south. The Auto Zone is visible.

Site No:	10		Risk Potential:	LOW		
Site Name	Coastal Biosystem					
Site Address	270 Malabar Road					
Site Location	South of Malabar Road					
Distance/Direction	Station: 257+00 Offset: 450' Right					
Facility ID Nos:	FLR0000089342					
Database Listings/Sources:	RCRA NonGen / NLR, FINDS, ECHO, City Directories					
Historical Land Use	Citrus Grove					
Current Land Use	Storage Facility					
Contaminants	Hazardous Materials					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
N/A	N/A	N/A	N/A	N/A	N/A	
Discharge Date	N/A		Cleanup Date:	N/A		
	Soil			Groundwater		
Documented/ Known Impacts:	NO			NO		

PUBLIC RECORDS: The site was formerly registered as a conditionally exempt small quantity generator of hazardous waste. As of May 2011, the site was listed as closed and no longer generates hazardous waste. No record of registered tanks or documented contamination impacts was found in the public record. The city directories list this site from 2005 to 2017 as a storage facility.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site appears to be a storage facility. The site has an electric gate and we were unable to enter the site.

CONCLUSIONS: Based on the closed hazardous waste status, the lack of documented contamination impacts, and the site's location outside of the stormwater pond footprint, this site has been assigned a CRR of **Low**.



Photo taken from north of the site facing south. Coastal Biosystem is visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	11	Risk Potential:	LOW
Site Name	Sun Clean Dry Cleaners		
Site Address	190 Malabar Road #123		
Site Location	South of Malabar Road		
Distance/Direction	Station: 263+80 Offset: 140' Right		
Facility ID Nos:	9502881		
Database Listings/Sources:	EDR Hist Cleaner, City Directories		
Historical Land Use	Citrus Grove		
Current Land Use	Dry Cleaner		
Contaminants	Hazardous Materials		
TANKS	U/A	Capacity (gal)	Content
N/A	N/A	N/A	N/A
Discharge Date	N/A	Cleanup Date:	N/A
		Soil	Groundwater
Documented/ Known Impacts:	NO		NO

PUBLIC RECORDS: The site is listed as a dry-cleaning facility from 1995 through 2017. A tank facility registration number was issued and no record of any registered tanks or documented contamination impacts were found.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a dry cleaners facility.

CONCLUSIONS: Based on the lack of documented contamination impacts, the site has been issued a CRR of **Low**.



Photo taken from northeast of the site facing southwest. The Sun Clean Dry Cleaners is visible.

Site No:	12	Risk Potential:	LOW
Site Name	Winn-Dixie Store #2230		
Site Address	190 Malabar Road		
Site Location	South of Malabar Road		
Distance/Direction	Station: 263+70 Offset: 500' Right		
Facility ID Nos:	A100308139, 9809265, 1016447907, FLR000203208, S109332761		
Database Listings/Sources:	AST, RCRA-VSQQ, FINDS, ECHO, Financial Assurance		
Historical Land Use	Citrus Grove		
Current Land Use			
Contaminants	Petroleum Products and Hazardous Materials		
TANKS	U/A	Capacity (gal)	Content
1	A	2,600	Emergency Generator Diesel
Discharge Date	N/A	Cleanup Date:	N/A
		Soil	Groundwater
Documented/ Known Impacts:	NO		NO

PUBLIC RECORDS: The site has an aboveground tank for fueling an emergency generator. The site is also registered as a conditionally exempt small quantity generator. No record of discharges or contamination impacts were found.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a Winn-Dixie grocery store.

CONCLUSIONS: Based on the lack of contamination impacts and its distance from the Malabar Road widening, the site has been issued a CRR of **Low**.



Photo taken of the site while facing west. The Winn-Dixie Store is visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	13	Risk Potential:	LOW		
Site Name	Bennett Auto Supply				
Site Address	142 Malabar Road				
Site Location	Southwest quadrant of the Malabar Road and Minton Road Intersection				
Distance/Direction	Station: 268+00 Offset: 125' Right				
Facility ID Nos:	N/A				
Database Listings/Sources:	City Directories				
Historical Land Use	Citrus Grove				
Current Land Use	Loan Office				
Contaminants	Petroleum Products and Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A	Cleanup Date:	N/A		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: The city directories listed this site between 2014 and 2017 as an auto supply shop. This location is not listed within any of the reviewed regulatory databases and does not have a public record or any record of storage tanks.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site was formerly an auto supply shop. It currently is an Amscot loan office.

CONCLUSIONS: Based on the lack of documented contamination impacts and the site being located outside of the footprint of a stormwater pond, this site has been assigned a CRR of **Low**.



Photo taken from southeast of the site facing northwest. An Amscot is visible.

Site No:	14	Risk Potential:	MEDIUM		
Site Name	Bob Youtzy Landclearing				
Site Address	201 Malabar Road / 6372 Minton Road				
Site Location	Northwest quadrant of the Malabar Road and Minton Road Intersection				
Distance/Direction	Station: 270+00 Offset: 100' Left				
Facility ID Nos:	8736724				
Database Listings/Sources:	AST, City Directories				
Historical Land Use	Landscaping Facility				
Current Land Use	Vacant Land				
Contaminants	Petroleum Products				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
1	A	300	Vehicular Diesel	Unk.	Unk.
1	A	300	Unleaded Gas	Unk.	Unk.
1	A	1,000	Vehicular Diesel	09/1987	Unk.
Discharge Date	N/A	Cleanup Date:	N/A		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: This site was formerly a landscaping company and is listed as Sod Service in the 2005 City Directories. The tanks were removed prior to 1991. No record of site assessment activities or documented contamination impacts were found.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The property has been cleared. Concrete slabs are visible along with de-energized power boxes.

CONCLUSIONS: Based on the unknown locations of the aboveground tanks and lack of contamination assessments, the site has been issued a CRR of **Medium**.



Photo taken from east of the site facing west. The site appears to be vacant.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	15		Risk Potential:	LOW		
Site Name	SPILLS Site					
Site Address	Malabar Road and Minton Road Intersection					
Site Location	Malabar Road and Minton Road Intersection					
Distance/Direction	Station: 271+75 Offset: 30' Left					
Facility ID Nos:	S106803564, 24654					
Database Listings/Sources:	SPILLS					
Historical Land Use	Intersection					
Current Land Use	Intersection					
Contaminants	Petroleum Products					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
N/A	N/A	N/A	N/A	N/A	N/A	
Discharge Date	N/A		Cleanup Date:	N/A		
	Soil			Groundwater		
Documented/ Known Impacts:	NO			NO		

PUBLIC RECORDS: This site is listed by EDR as a spill incident.

INTERVIEW INFORMATION: GEC interviewed Mr. Shane Gibbs with the Office of Emergency Response concerning this petroleum spills incident. Mr. Gibbs provided documentation regarding the spill indicating that there was a vehicle accident with no petroleum discharge. In addition, due to the spill occurring on June 24, 2004, Mr. Gibbs indicated this incident is closed and no additional records are available.

SITE OBSERVATIONS: N/A

CONCLUSIONS: Based on the lack of documented contamination impacts and the documentation provided by Mr. Gibbs stating no petroleum was released during the incident, this site has been assigned a CRR of **Low**.



Photo taken from a 2020 aerial photograph showing the intersection of Malabar Road and Minton Road.

Site No:	16		Risk Potential:	MEDIUM		
Site Name	7-Eleven Food Store #32756					
Site Address	6405 Minton Road					
Site Location	Southeast corner of Malabar Road and Minton Road Intersection					
Distance/Direction	Station: 272+50 Offset: 110' Right					
Facility ID Nos:	9802043					
Database Listings/Sources:	LUST, UST, CLEANUP SITES					
Historical Land Use	Citrus Grove					
Current Land Use	Gas Station					
Contaminants	Petroleum Products					
TANKS	U/A	Capacity (gal)	Content	Installed	Removed	
3	U	10,000	Unleaded Gas	09/1999	In-Use	
Discharge Date	09/2018		Cleanup Date:	-		
	Soil			Groundwater		
Documented/ Known Impacts:	YES			YES		

PUBLIC RECORDS: A discharge was reported for this site in September 2018 after a hydrostatic failure of the containment at dispenser 9/10 was reported. Based on initial groundwater and soil testing, contamination was found in both. Monitoring wells were installed and soil samples were collected for further analysis. In June 2019, contamination was found in both the soil samples and groundwater samples. Additional testing has been recommended.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a 7-Eleven gas station.

CONCLUSIONS: Based on the site's proximity to Malabar Road, and the known soil and groundwater contamination at the property, this site has been assigned a CRR of **Medium**.



Photo taken from southwest of the site facing northeast. The 7-Eleven gas station is visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	17	Risk Potential:	MEDIUM		
Site Name	Cumberland Farms				
Site Address	105 Malabar Road / 6375 Minton Road				
Site Location	Northeast corner of Malabar Road and Minton Road Intersection				
Distance/Direction	Station: 272+85 Offset: 120' Left				
Facility ID Nos:	FLD984231456, 9045599				
Database Listings/Sources:	EDR Hist Auto RGA LUST, RCRA-VSQG, FINDS, ECHO, HMIRS, UST, City Directories				
Historical Land Use	Gas Station				
Current Land Use	Gas Station				
Contaminants	Petroleum Products and Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
1	U	6,000	Unleaded Gas	01/1990	3/2013
2	U	10,000	Unleaded Gas	01/1990	3/2013
1	U	20,000	Unleaded Gas	08/2017	In-Use
1	U	20,000	Vehicular Diesel	08/2017	In-Use
Discharge Date	07/1993, 02/1994	Cleanup Date:	02/1994, 04/2002, & 11/2016		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: A discharge was reported in July 1993 in response to a tanker truck spill. A second discharge was reported in February 1994. The second discharge was assigned a "no cleanup required" status. The site was issued a Site Rehabilitation Completion Order (SRCO) in April 2002. A third discharge was reported in May 2006 based on the discovery of petroleum contamination in soil samples. The third discharge was deleted and the 2002 SRCO rescinded after the 2006 discharge was determined to be a re-report of the 1993 discharge. The site was issued another SRCO in November 2016.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a Cumberland Farms gas station.

CONCLUSIONS: Based on the site's proximity to Malabar Road and the gas station use of the property, this site has been assigned a CRR of **Medium**.



Photo taken from southwest of the property facing northeast. The Cumberland Farms gas station is visible.

Site No:	18	Risk Potential:	LOW		
Site Name	Lubrication Specialist Inc.				
Site Address	6369 Minton Road				
Site Location	Northeast Quadrant of the Malabar Road and Minton Road Intersection				
Distance/Direction	Station: 272+85 Offset: 425' Left				
Facility ID Nos:	9602011				
Database Listings/Sources:	AST, City Directories				
Historical Land Use	Auto Service Center				
Current Land Use	Auto Service Center				
Contaminants	Petroleum Products				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
1	A	950	Waste Oil	04/1995	In-Use
Discharge Date	N/A	Cleanup Date:	N/A		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: The site is an active auto oil change facility. This site is listed in the city directories from 2000 to 2010. According to public records, the single tank has been removed and this site has no history of documented contamination impacts. A 1997 inspection form indicated that the tank is inside the building and is not a regulated tank.

INTERVIEW INFORMATION: The site is currently an Oils & Lube Service Center.

SITE OBSERVATIONS: The site is an active auto service center.

CONCLUSIONS: Based on the lack of documented contamination impacts and the distance from Malabar Road to the site, this site has been assigned a CRR of **Low**.



Photo taken from west of the property facing east. The Oil & Lube Center is visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

Site No:	19	Risk Potential:	LOW		
Site Name	Construction Yard				
Site Address	120 Malabar Road				
Site Location	Southeast corner of the Malabar Road and Aviation Avenue NE Intersection				
Distance/Direction	50 feet south of Malabar Road				
Facility ID Nos:	N/A				
Database Listings/Sources:	Historical Aerial Photograph Review				
Historical Land Use	Construction Yard				
Current Land Use	Grassy Area, Parking Lots, and Stormwater Pond				
Contaminants	Petroleum Products				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A	Cleanup Date:	N/A		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: This site was identified through the historical aerial photograph review. This site appears in the 1972 and 1980 aerial photographs and appears to be a construction yard associated with the development of Minton Road. There appears to be tanks on site along with a fueling area in the southern half of the property. This site was removed and developed with the Palm Bay City Hall and other public offices.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently a stormwater pond directly adjacent to the Palm Bay City Hall.

CONCLUSIONS: Based on a lack of documented contamination impacts and the location of the site on the east side of the canal at Minton Road outside of the Malabar Road alignment construction area, this site has been assigned a CRR of **Low**.

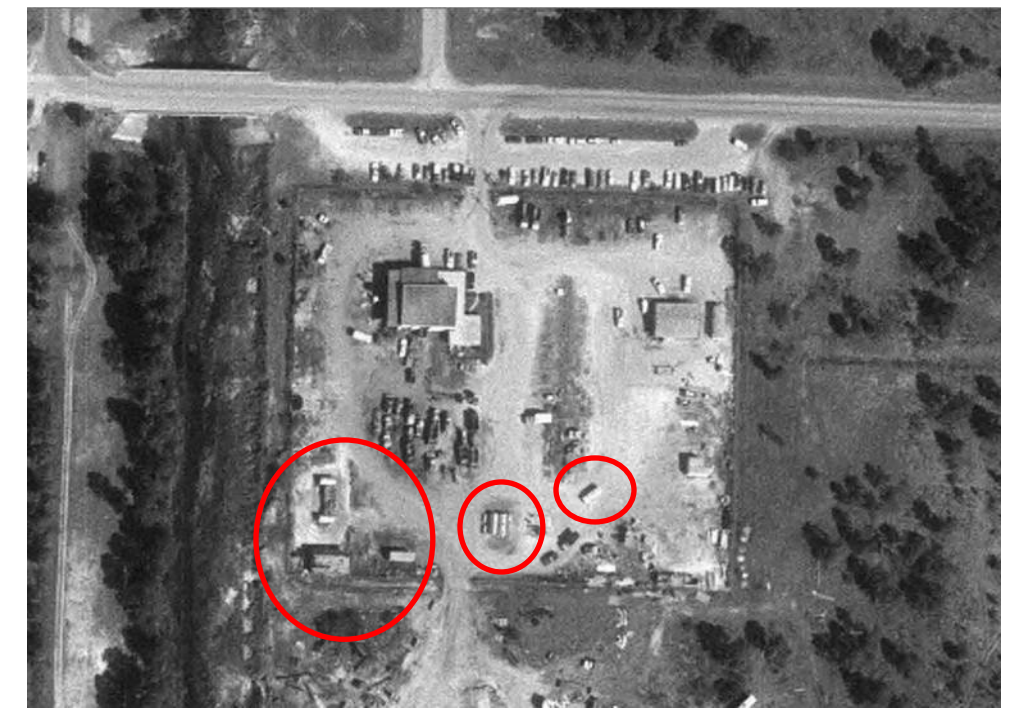


Photo taken from 1980 historical aerial showing the construction yard and apparent fueling area and tanks are circled in red.

Site No:	20	Risk Potential:	LOW		
Site Name	Palm Bay City Hall				
Site Address	100 – 130 Malabar Road				
Site Location	Southeast quadrant of the Malabar Road and Aviation Avenue NE Intersection				
Distance/Direction	450 feet south of Malabar Road				
Facility ID Nos:	9811537, 9046145, 8943858				
Database Listings/Sources:	AST, FIND, ECHO, UST, SPILLS, Financial Assurance				
Historical Land Use	City Hall, Fire Station, Police Station				
Current Land Use	City Hall, Fire Station, Police Station				
Contaminants	Petroleum Products				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
2	A	275	New/Lube Oil	Unk.	04/1989
1	A	550	New/Lube Oil	Unk.	04/1989
1	A	1,000	Emerg. Gen. Diesel	2007	In-Use
1	A	2,000	Emerg. Gen. Diesel	2010	In-Use
1	U	2,000	Emerg. Gen. Diesel	1990	Unk.
Discharge Date	N/A	Cleanup Date:	N/A		
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: The public records revealed a total of six historical and existing fuel tanks on-site at the city hall, fire station, and police station. Two emergency generator fuel tanks exist, the remaining four tanks were removed. No contamination impacts are documented at the former or current tank locations. The tanks are/were located outside the 500-foot study radius.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: The site is currently the Palm Bay City Hall.

CONCLUSIONS: Based on the location of the site on the east side of the canal at Minton Road, outside of the Malabar Road construction area but inside the 500-foot study area, and a lack of documented contamination impacts on-site, this site has been assigned a CRR of **Low**.



Photo taken from northeast of the site facing southwest. The Palm Bay City Hall is visible.

Table 1
Potential Contamination Site Summary

GEC Project No. 4511E

MALABAR ROAD PD&E STUDY
Kittelson & Associates, Inc.
 Financial Management No: 437210-1-28-01

Site No:	21		Risk Potential:	MEDIUM	
Site Name	Historical Citrus Groves				
Site Address	Malabar Road				
Site Location	North and south of the Malabar Road alignment				
Distance/Direction	N/A				
Facility ID Nos:	N/A				
Database Listings/Sources:	Historical Aerial Photograph Review, Quadrangle Maps				
Historical Land Use	Historical Citrus Groves				
Current Land Use	Residential, Commercial, Vacant Land Uses				
Contaminants	Hazardous Materials				
TANKS	U/A	Capacity (gal)	Content	Installed	Removed
N/A	N/A	N/A	N/A	N/A	N/A
Discharge Date	N/A		Cleanup Date:	N/A	
	Soil		Groundwater		
Documented/ Known Impacts:	NO		NO		

PUBLIC RECORDS: Historical citrus groves are visible within the study area on the historical aerial photographs and the USGS Quadrangle Maps.

Agricultural land and citrus groves typically have environmental concerns associated with them. These concerns include pesticide/herbicide storage and usage, grove heating during cooler winter months (smudge pots and other grove heating equipment), tractor and equipment maintenance and fueling, underground and aboveground fuel storage tanks, irrigation pumps and maintenance, and asbestos irrigation lines.

INTERVIEW INFORMATION: N/A

SITE OBSERVATIONS: During the site reconnaissance, no citrus grove locations were visible within the study area. The locations of the historical citrus groves are currently vacant land or were developed with residential and commercial properties.

CONCLUSIONS: Based on the historical citrus groves being within the footprint of several proposed stormwater ponds, this site has been assigned a CRR of **Medium**.



Photo taken from 1951 historical aerial. Historical Citrus is visible.

Table 2
Aerial Photograph Review Summary
Malabar Road PD
GEC Project No. 4511E
Page 1 of 2

Site No.	Site Name	Site Address	Year First Observed in Aerial Photographs	Comments
1	Cattle Pen	Malabar Road	1943	The cattle pen is visible from 1943 through 2004. The pen is not visible in 2009 and 2014 due to dense tree coverage. In 2020 the pen becomes visible again and a new fence appears to have been constructed on the north side.
2	Agricultural Barn	2200 Malabar Road	1943	The barn is visible from 1943 through 1980. In 1986 the barn has been dismantled and from 1994 through 2020 pieces of the barn are stacked on the property.
3	Cattle Pen	Malabar Road	1943	The cattle pen is only visible in 1943. From 1951 through 2020 the land is vacant with light to heavy vegetation coverage.
4	Biarritz DMS	1224 - 1226 Biarritz Street	2004	This site is vacant land from 1943 through 1986. From 1994 through 1999 the site is a utility easement. In 2004 the site appears to contain debris with areas of clearing and soil fill visible in 2009. The site returns to a vacant utility easement in 2014 with no significant changes through 2020.
5	Palm Bay City Public Works	1050 Malabar Road	1994	The property is used for agricultural purposes from 1943 through 1951. In 1972 the site becomes vacant land through 1986. In 1994 the site is under construction with structures visible on the northwest corner of the site and cleared land to the south. The Public Works center is visible from 1999 through 2020 with soil storage mounds also observed on the southern portion of the site from 2004 through 2020.
6	Circle K #2726513	900 Malabar Road SW	1994	The site is vacant land from 1943 through 1986. From 1994 through 2014 a gas station is visible. The gas station was replaced with a larger gas station with a different footprint in 2020.
7	Malabar Cove	3 NW Malabar Road	1943	The property is a citrus grove from 1943 through 1951, vacant land in 1972 and used for agricultural purposes in 1980. In 1986 the site is vacant land with truck storage on the northern portion adjacent to Malabar Road. The trucks are no longer visible in 1994 and the site is vacant land from 1994 through 2020.
8	O'Reilly Auto Parts	235 Malabar Road	2020	From 1943 through 1994 the property is historical citrus groves. The site is then vacant land from 1999 through 2014 with the auto parts store visible in 2020.
9	AutoZone	260 Malabar Road	1999	The property is citrus groves from 1943 through 1980 with a residential structure with associated parking lot in 1986 and 1994. The auto supply store is visible from 1999 through 2020.
10	Coastal Biosystem	270 Malabar Road SW	2004	The site is historical citrus groves from 1943 through 1986. In 1994 and 1999 the site appears to be vacant land. A large storage facility is visible from 2004 through 2020.
11	Sun Clean Dry Cleaners	190 Malabar Road #123	1994	Prior to 1994 the site was historical citrus groves and vacant land in the 1943 through 1986 aerial photographs. The shopping plaza is visible in 1994 with no significant changes through 2020.
12	Winn-Dixie Store #2230	190 Malabar Road SW	1994	Prior to 1994 the site was historical citrus groves and vacant land in the 1943 through 1986 aerial photographs. The shopping plaza is visible in 1994 with no significant changes through 2020.
13	Bennett Auto Supply	142 Malabar Road	1999	The auto supply shop is first visible in 1999. Prior to that, the site is historical citrus groves from 1943 through 1980 and vacant land from 1986 through 1994. From 1994 through 2020 no significant changes are observed.
14	Bob Youtzy Landclearing	201 Malabar Road NW	1943	The site is historical citrus groves in 1943. Multiple structures are visible on-site between 1951 and 2014. In 2020 the site appears to be vacant land with a few concrete pads on the east side of the property.
15	Spill Site	Malabar Road and Minton Road Intersection	1994	The intersection appears on Malabar Road dating back to 1951. In 1994, Minton Road extends south of Malabar Road.
16	7-Eleven Food Store #32756	6405 Minton Road	2004	Prior to 1986, the site is historical citrus groves with a single structure visible from 1986 through 1999. The gas station is first seen in 2004 and was reconstructed with a different footprint in 2009. From 2009 through 2020 no significant changes are observed.
17	Cumberland Farms	105 Malabar Road NE	1994	Prior to 1994, the site is historical citrus groves from 1943 through 1980 and vacant land in 1986. A gas station is visible from 1994 through 2009, with the station under construction in 2014 where the fuel canopy has been removed. The gas station has been reconstructed with a different footprint in 2020.
18	Lubrication Specialist Inc	6369 Minton Road NW	1999	The site is historical citrus groves from 1943 through 1980 and vacant land from 1986 through 1994. The oil change facility is visible in 1999 with no significant changes through 2020.

Table 2
Aerial Photograph Review Summary
Malabar Road PD
GEC Project No. 4511E
Page 2 of 2

Site No.	Site Name	Site Address	Year First Observed in Aerial Photographs	Comments
19	Construction Yard	120 Malabar Road	1972	The site is vacant land from 1943 through 1972, when construction activities are visible. In 1980 a construction yard is visible with a fueling area and tanks. This construction yard appears to be for the construction of Minton Road and is visible from 1980 through 1986. The site is vacant land and a parking area in 1994 and 1999, and includes a stormwater pond from 2004 through 2020. This site is part of the Palm Bay City Hall property.
20	Palm Bay City Hall	120 Malabar Road	1994	The site is vacant land from 1943 through 1986. City Hall appears in 1994 with no significant changes through 2020.
21	Historical Citrus Groves	N/A	1943	Citrus groves are visible within the study area dating back to 1943. Beginning in 1972, citrus groves are on the decline with a significant decrease in 1994. Citrus groves are not visible from 2014 through 2020.

Table 3
EDR City Directory Image Report Summary
Malabar Road PD
GEC Project No. 4511E
Page 1 of 1

x	Site No.	Year of Polk City Directory Review					
		1995	2000	2005	2010	2014	2017
		Malabar Road					
142	13	---	Blockbuster Video	---	Blockbuster Video	Bennett Auto Supply	Bennett Auto Supply
190	11/12	Commercial Listings, Sun Clean Dry Cleaners	Commercial Listings, Sun Clean Dry Cleaners and Launderers, Winn-Dixie	Commercial Listings, Winn-Dixie	Commercial Listings, Sun Clean Dry Cleaners, Winn-Dixie	Commercial Listings, Sun Clean Dry Cleaners, Winn-Dixie	Commercial Listings, Sun Clean Dry Cleaners, Winn-Dixie
260	9	---	Autozone	Autozone	Autozone	Autozone	Autozone
270	10	---	---	Additional Storage of Palm Bay	Additional Storage of Palm Bay	Additional Storage of Palm Bay	Extra Space Storage
900	6	Jiffy Food Store	Lil Champ Food Store	Lil Champ Food Store	Kangaroo Express	Lil Champ	Kangaroo Express, Lil Champ
1050	5	Palm Bay Transportation Division	Palm Bay City of Administrative / Legislative	City of Palm Bay	Palm Bay City Fleet Dept, Palm Bay Public Works Department	---	---
Minton Road							
6369	18	---	Lubrication Specialist	---	Oil & Lube Express of Palm Bay	---	---
6372	14	---	---	Rodney L Stalvey Sod Service	---	Vizion Automotive LLC	Vizion Automotive LLC
6375	17	Huntley Jiffy Food Store, Jiffy Food Store	Lil Champ Food Store No 292	---	---	---	---

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX K

Geotechnical Report

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Report of Preliminary Geotechnical Engineering Exploration

MALABAR ROAD PD&E STUDY

From St. Johns Heritage Parkway to Minton Road

Palm Bay, Brevard County, Florida

Kittelson & Associates, Inc. Project No 23773

FIN No. 437210-1-28-01

RFQ No. 230-2019/SB

GEC Project No. 4511G



February 25, 2021
Revised June 14, 2023
Revised June 26, 2023

Kittelson & Associates, Inc.
225 East Robinson Street, Suite 355
Orlando, Florida 32801

Attention: Mr. John R. Freeman, Jr., P.E., PTOE, RSP
Senior Principal

Subject: Report of Preliminary Geotechnical Engineering Exploration
MALABAR ROAD PD&E STUDY
From St. Johns Heritage Parkway to Minton Road
Palm Bay, Brevard County, Florida
Kittelson & Associates, Inc. Project No. 23773
FIN No. 437210-1-28-01
RFQ No. 23-0-2019/SB
GEC Project No. 4511G

Dear Mr. Freeman:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to provide this Report of Preliminary Geotechnical Engineering Exploration for the above-referenced project. The purpose of this investigation was to evaluate soil and groundwater conditions at the potential stormwater management locations and to use the information obtained to guide planning and selection of stormwater facilities for the upcoming widening of this section of Malabar Road. This report describes our exploration procedures, exhibits the data obtained and presents our findings.

A full geotechnical exploration and evaluation will be necessary to support roadway and stormwater management design. In particular, auger borings will be required in the proposed roadway widening areas in addition to the selected stormwater pond locations for use in developing pavement and stormwater management design and construction.

GEC appreciates the opportunity to work with Kittelson & Associates, Inc. and the City of Palm Bay on this project. Should there be any questions regarding the contents of this report, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC.
919 Lake Baldwin Lane
Orlando, Florida 32814



Alexis E. Perry, E.I.
Engineer Intern



Rachel F. André, P.E.
President
Florida License No. 62418

This Report has been digitally signed and sealed by Rachel F. André, P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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1.0 SITE AND PROJECT DESCRIPTION

The proposed widening of Malabar Road extends from St. Johns Heritage Parkway to Minton Road, approximately 4 miles, in Palm Bay, Brevard County, Florida. The vicinity includes commercial businesses, residential properties, agricultural land and vacant land. The project corridor is shown on excerpts of the U.S. Geological Survey (USGS) Melbourne West and Fellsmere NW, Florida Quadrangle maps on **Figure 1**.

This report includes preliminary soil and groundwater data for the potential stormwater pond and swale locations. It also describes our exploration procedures, exhibits the data obtained and presents preliminary groundwater level information at these locations.

2.0 REVIEW OF AVAILABLE DATA

To obtain general information on soil and groundwater conditions at the pond sites, GEC reviewed available data including the USGS Quadrangle Map, the Natural Resources Conservation Service (NRCS) Soil Survey of Brevard County and other published sources. A summary of this information is presented in the following report sections.

2.1 USGS Quadrangle Map

Based on our review of the USGS Melbourne West and Fellsmere NW, Florida Quadrangle map (dated 1988 and 1970, respectively), ground surface elevations at the potential pond locations range from +20 to +27 feet NGVD from east to west. Flowing wells are shown at the western terminus (St. Johns Heritage Parkway) of the roadway section.

The potential pond locations are depicted on the U.S. Geological Survey (USGS) Melbourne West and Fellsmere NW Florida Quadrangle maps (**Figure 1**) in the **Appendix**.

2.2 NRCS Soil Survey

The Natural Resources Conservation Service (NRCS) Soil Survey of Brevard County was reviewed to obtain near-surface soils information in the vicinity of the locations of interest. According to the NRCS map, the soil types are summarized below. The NRCS Soil Survey map of the project area is shown on **Figure 1** in the **Appendix**.

Table 1
Brevard County NRCS Soil Survey Classifications

Soil Unit No.	Soil Name	Depth (inches)	Soil Description	AASHTO Classification Symbol	Depth to Seasonal High Groundwater (feet)	Hydrologic Group
17	Eau Gallie sand, 0 to 2 percent slopes	0 – 22 22 – 58 58 – 80	Sand Sand, fine sand Sandy loam, fine sandy loam	A-2-4, A-3 A-2-4, A-3 A-4, A-2-4	0.5 – 1.5	A/D
19	Riviera sand, 0 to 2 percent slopes	0 – 28 28 – 39 39 – 55 55 – 80	Sand Sandy loam, sandy clay loam Sandy loam, fine sandy loam, sandy clay loam Sandy loam, sandy clay loam	A-3, A-2-4 A-2-4, A-4, A-6 A-2-4, A-4, A-6 A-4, A-6	0.3 – 1.5	C/D
31	Malabar fine sand	0 – 45 45 – 54 54 – 61 61 – 65	Sand Sandy clay loam, fine sandy loam, clay loam Sandy loam, sandy clay loam Sand, fine sand, loamy fine sand	A-3 A-2, A-6 A-2, A-6 A-2, A-3	0.0 – 1.0	A/D
	Holopaw fine sand	0 – 7 7 – 45 45 – 62 62 – 71	Sand Fine sand, sand Sandy loam, sandy clay loam, fine sandy loam Loamy sand, loamy fine sand, fine sand	A-3 A-3 A-2 A-2, A-3		
	Pineda fine sand	0 – 5 5 – 35 35 – 38 38 – 60 60 – 65	Sand Sand, fine sand Loamy sand, sandy loam Sandy loam, sandy clay loam, fine sandy loam Loamy sand, sand, sandy loam	A-3 A-3 A-2 A-2 A-2, A-3		
47	Pineda sand, 0 to 2 percent slopes	0 – 35 35 – 60 60 – 80	Sand Sandy clay loam, sandy loam Sandy loam, sand, loamy sand	A-2-4, A-3 A-4, A-6, A-2-4 A-2-4	0.3 – 1.5	C/D
71	Wabasso sand, 0 to 2 percent slopes	0 – 6 6 – 25 25 – 30 30 – 58 58 – 80	Sand Sand Sand Sandy clay loam Loamy sand, sandy loam	A-2-4, A-3 A-3, A-2-4 A-2-4, A-3 A-7-6, A-6 A-2-4, A-2-6	0.5 – 1.5	C/D

*Information from Web Soil Survey in June 2023

Information contained in the NRCS Soil Survey is very general and may be outdated. It may not therefore be reflective of actual soil and groundwater conditions, particularly if recent development in the site vicinity has modified soil conditions or surface/subsurface drainage. The NRCS seasonal high groundwater levels, summarized in **Table 1**, do not account for changes in groundwater due to development and are only relevant for the natural, undisturbed condition of the soils. The soils and groundwater data collected as part of this study should be considered a more accurate representation of soil conditions at the project site.

2.3 FDEP Potentiometric Map Data

According to the Florida Department of Environmental Protection (FDEP) September 2019 Upper Floridan Aquifer Potentiometric Surface map, the potentiometric surface of the Floridan Aquifer is approximately +38 feet NGVD at the project location. Since natural ground surface elevations in the study area are consistently below the potentiometric surface (see Section 2.1 which indicates a range between +20 and +27 ft NGVD), artesian flow conditions can be expected at locations where the confining layers are breached. This is evidenced by the presence of flowing wells shown near the intersection with St Johns Heritage Parkway on the USGS Quadrangle Map in Figure 1.

3.0 SUBSURFACE EXPLORATION

In addition to consulting the sources of information previously discussed for regional and site-specific soils data, GEC conducted a subsurface exploration to evaluate soil and groundwater conditions at the locations of interest.

Subsurface conditions at each of the potential stormwater pond, floodplain compensation area and swale locations were evaluated by performing a manual auger boring at an approximate rate of one 5-foot auger boring for every acre, for a total of thirty-six borings (AB-1 through AB-36).

A subsequent subsurface investigation was conducted at pond C-7 Alternative 3 by performing three machine auger borings to depths of 40 feet and an additional manual auger boring to 5 feet in the adjacent floodplain compensation area.

3.1 Boring Locations

Boring and locations were established in the field using a sub-meter accuracy handheld Global Positioning Satellite (GPS) unit. The approximate method used to locate them is sufficient to meet the intent of this study. If greater accuracy is desired, a registered professional land surveyor should survey the locations. Boring locations are shown on **Figures 2A** through **2H** in the **Appendix**.

3.2 Machine Auger Borings

Machine auger borings were performed in general accordance with ASTM Standard D1452. Machine auger borings were performed by hydraulically turning a continuous flight, solid-stem, auger into the ground in 5-foot increments until the desired boring termination depth was achieved. The auger flights were retrieved in 5-foot increments, without further rotation of the auger, and the retrieved soil was examined by our technician prior to collection of representative samples. Representative samples were collected for further visual examination and classification in the GEC laboratory.

3.3 Manual Auger Borings

A GEC engineering technician performed standard barrel manual auger borings in general accordance with ASTM D-1452, by manually turning a 3-inch diameter, 6-inch long sampler into the soil until it was full. He then retrieved the sampler and visually examined and classified the soil. This procedure was repeated until the desired termination depth was achieved. Representative samples were collected for further visual examination and classification in the GEC laboratory.

3.4 Groundwater Measurement

A GEC engineering technician measured the depth to groundwater in the boreholes where groundwater was encountered at the time of drilling and again after approximately 24 hours. Once the 24-hour groundwater measurement was recorded, the boreholes were then backfilled with soil cuttings to prevailing ground surface. Boring locations where groundwater was not encountered to the termination depth were backfilled on the same day.

4.0 LABORATORY TESTING

Selected soil samples retrieved from the borings were tested in accordance with Florida Standard Testing Methods (FM), and American Association of the State Highway Transportation Officials (AASHTO) testing methods. Our laboratory testing program is summarized on the following table:

Table 2
Summary of Laboratory Testing Program

Type of Test	Test No.
Percent Fines	AASHTO - T88
Atterberg Limits	AASHTO - T89/90
Organic Content	FM 1 - T267
Natural Moisture Content	AASHTO - T265

The results of our laboratory testing are summarized on the Pond Soil Survey sheet (**Figure 3**) and Laboratory Test Results Table (**Table 5**) in the **Appendix**.

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

The results of our borings are presented on the Pond Soil Boring Results sheets (**Figures 4A to 4B**) in the **Appendix**. The soils encountered at the auger boring locations were classified in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System (A-3, A-2-4, etc.). Soils were described using the ASTM soil descriptions (e.g., sand with silt). We based our classifications on visual examination and the limited laboratory testing performed.

The boring logs indicate subsurface conditions only at the specific boring locations at the time of our field exploration. Subsurface conditions, including groundwater levels, at other locations of the project site may differ from conditions we encountered at the boring locations. Moreover, conditions at the boring locations can change over time. Groundwater levels fluctuate seasonally, and soil conditions can be altered by earthmoving operations.

The depths and thicknesses of the subsurface strata indicated on the boring logs were interpolated between samples obtained at different depths in the borings. The actual transition between soil layers may be different than indicated. *These stratification lines were used for our analytical purposes and actual earthwork quantities measured during construction should be expected to vary from quantities calculated based on the information in this report.*

5.1 Soil Stratigraphy

The descriptions and stratum numbers used for the encountered soils are summarized as follows:

Table 3
Soil Stratigraphy

Stratum No.	Soil Description	AASHTO Classification
1	Light gray to brown to light brown to gray fine sand to fine sand with silt, occasional trace organic material and trace to some roots	A-3
2	Gray to light gray silty fine sand, some cemented sand	A-2-4
3	Light brown to brown to light gray to gray clayey fine sand to sandy clay, trace shell	A-2-6, A-6
4	Light gray to gray to brown silty fine sand, trace to some shell	A-2-4

For detailed results of the auger borings, please refer to **Figures 4A to 4B** in the **Appendix**.

5.2 Boring Results

The borings (AB-1 to AB-36, PB-4) typically encountered fine sand to fine sand with silt (A-3) (Stratum 1) to depths typically ranging from 3 to 44 feet, underlain by silty fine sand to clayey fine sand (A-2-4, A-2-6) (Strata 2, 3 and 4) to depths ranging from 5 to 6 feet below the existing ground surface.

The deeper borings performed in pond C-7 Alternative 3 (PB-1 to PB-3) encountered fine sand to fine sand with silt (A-3) (Stratum 1) to 2 to 3 feet, underlain by silty fine sand to clayey fine sand to sandy clay (A-2-4, A-2-6, A-6) to a maximum depth of 40 feet below the ground surface.

The boring results are presented on **Figures 4A to 4B** in the **Appendix**.

5.3 Groundwater Levels

The groundwater levels at the boring locations were measured approximately 24 hours after the borings were performed. Groundwater levels can vary seasonally and with changes in subsurface conditions between boring locations. Alterations in surface and/or subsurface drainage brought about by site development can also affect groundwater levels. *Therefore, groundwater depths measured at different times or at different locations can be expected to vary from those measured by GEC during this investigation.*

For the purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season of a “normal rainfall” year under current site conditions. We define a “normal rainfall” year as a year in which rainfall quantity and distribution were at or near historical rainfall averages.

Measured groundwater depths and estimated seasonal high groundwater depths at the boring locations are summarized in the table below:

Table 4
Summary of Groundwater Levels

Location	Encountered Groundwater Depth Range in the Borings (feet)	Estimated Seasonal High Groundwater Depth Range in the Borings (feet)
C-7 Alternative 3	4.6 – 6.1	1.6 – 2.6
FPCA	3.5 – 3.8	1.5 – 1.8

Location	Encountered Groundwater Depth Range in the Borings (feet)	Estimated Seasonal High Groundwater Depth Range in the Borings (feet)
C-7 Alternative 2	4.1 – 4.7	2.1 – 2.7
C-9 and C-9 Alternative 2	4.4 - GNE to 5	2.0 – 2.9
C-8 and C-9 Alternative 1	GNE to 5	1.5 to 2.5
C-10 West Alternative 1	GNE to 6	1.5
C-10 East Alternative 1 and C-10 West Alternative 2	4.0 – GNE to 5	2.0 – 3.2
C-10 East Alternative 2	3.4 – GNE to 5	1.4 – 2.5
C-20 Supplemental Swale	4.8 – GNE to 5	2.5 - 2.8
C-20 Alternative 1	2.5 – 3.0	0.5 – 1.0
C-20 Alternative 2	3.1 – 4.2	1.1 – 2.2

*GNE – Groundwater not encountered

The encountered and estimated seasonal high groundwater depths at the boring locations are presented adjacent to the boring logs on the Pond Soil Boring Results sheets (**Figures 4A to 4B**) in the **Appendix**. If soil borings can be surveyed, updates to estimated seasonal high groundwater tables can be provided.

5.4 Potential Perched Groundwater Conditions

As mentioned above, the borings typically encountered fine sands (A-3) to approximately three to four feet of depth, underlain by silty/clayey sand to termination. These silty/clayey sand layers can cause perching of groundwater for extended periods over these low-permeability soils (Strata 3 and 4). This will need to be further explored during the design phase, especially along the roadway, where shallow groundwater can lead to premature pavement deterioration.

5.5 Preliminary Considerations

As described in the report, clayey sands and sandy clays (A-2-6, A-6) were encountered at several boring locations. These soils should help with pond sides slope and pipe trench stability. However, some concerns to be taken into consideration during design include:

- The clay soils have limitations for fill usage and pipe bedding; the clay soils will likely need to be over-excavated two feet below the pipe bottoms and replaced with “Select” sand soils.
- Penetrating clay layers during construction should be avoided, as the Floridan Aquifer Potentiometric Level is around + 38 ft NGVD, and the ground surface elevations along the project range between approximately +20 and +27. During construction, excavations

should not fully penetrate the Stratum 3 (clay soils) that extended to 40 feet in the Pond C-7 Alternate 3 borings, or artesian conditions could occur.

- The clay soils may also be encountered at other locations during the geotechnical investigation for final design, and these considerations will also apply.

During final design, we anticipate that additional borings and further testing will be conducted in order to verify these findings and finalize design and construction recommendations.

6.0 USE OF THIS REPORT

GEC has prepared this report for the exclusive use of our client Kittelson & Associates, Inc. and the City of Palm Bay, and for specific application to this project. GEC will not be held responsible for any other party's interpretation or use of this report's subsurface data or engineering analysis without our written authorization.

The sole purpose of the borings performed was to obtain preliminary indications of subsurface conditions at potential stormwater management sites as part of a preliminary geotechnical exploration program in support of a PD&E study. The preliminary conclusions of this report should be disregarded if the nature, design or location of the facilities is changed. GEC has evaluated the site for the potential presence of contaminated soil or groundwater and submitted the report under a separate cover.

GEC has strived to provide the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

APPENDIX

**USGS QUADRANGLE AND
NRCS SOIL SURVEY MAPS**

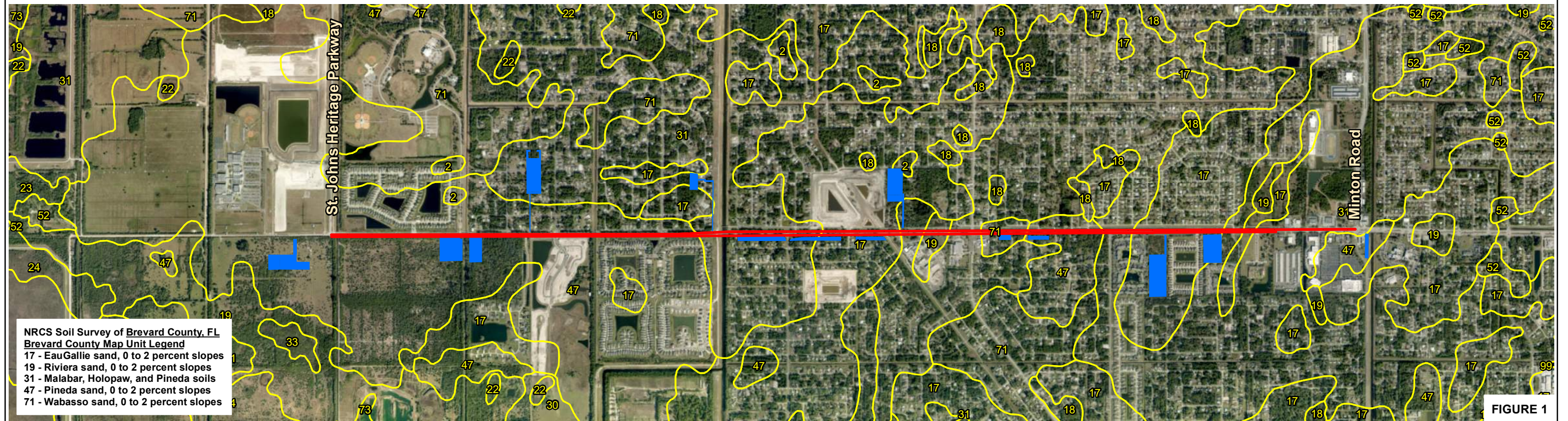
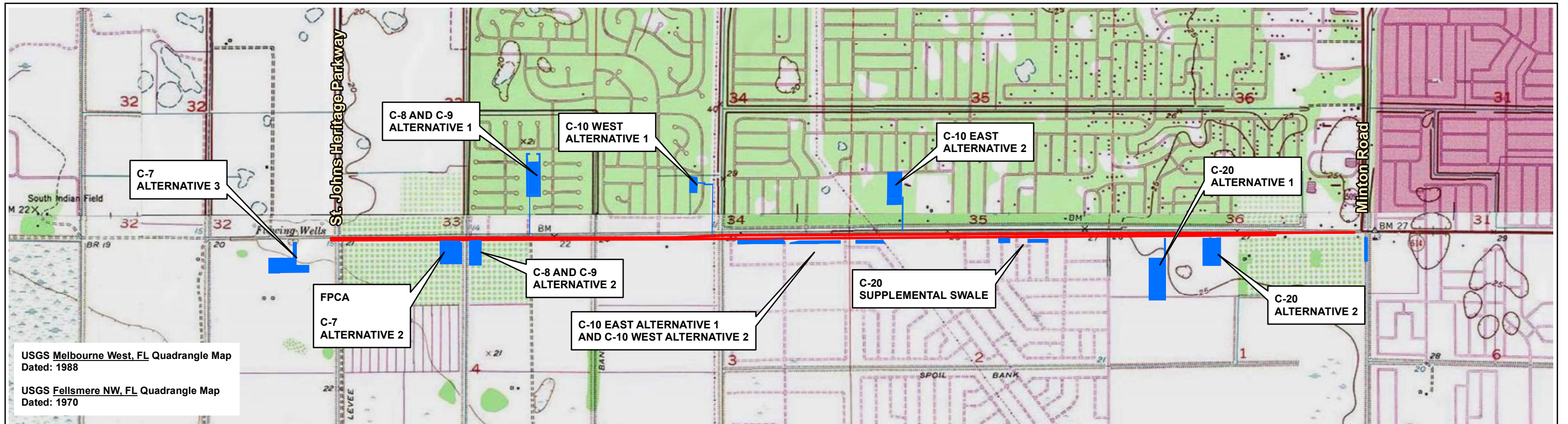
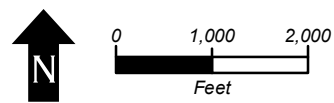


FIGURE 1



RACHEL F. ANDRE, P.E.
P.E. LICENSE NUMBER 62418
GEOTECHNICAL AND ENVIRONMENTAL
CONSULTANTS, INC.
919 LAKE BALDWIN LANE
ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

USGS QUADRANGLE AND
NRCS SOIL SURVEY MAPS

SHEET
NO.

BORING LOCATION PLAN

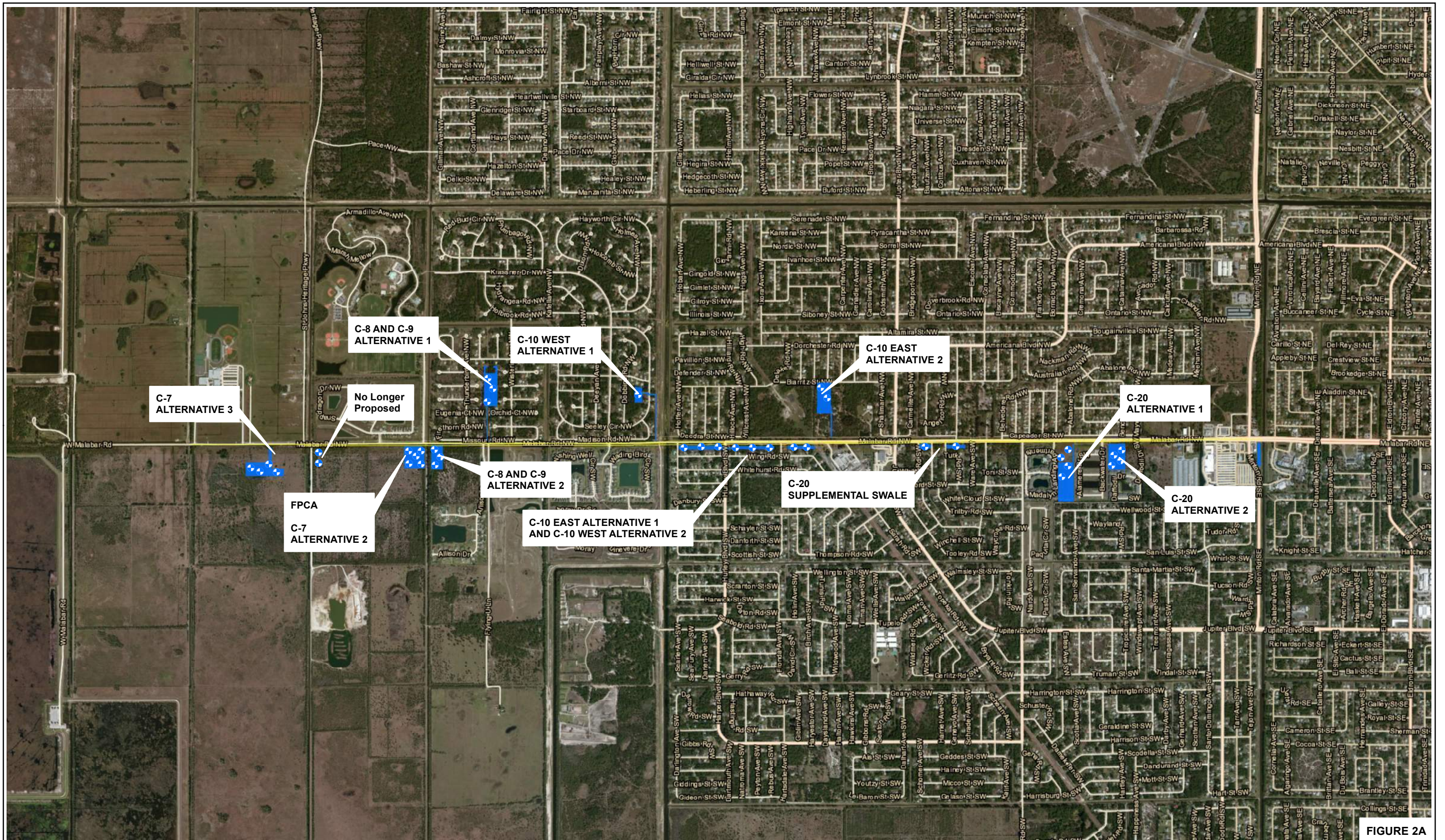
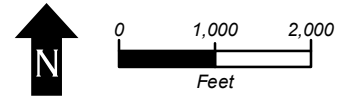


FIGURE 2A

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

**BORING LOCATION PLAN
(OVERALL MAP)**

SHEET NO.

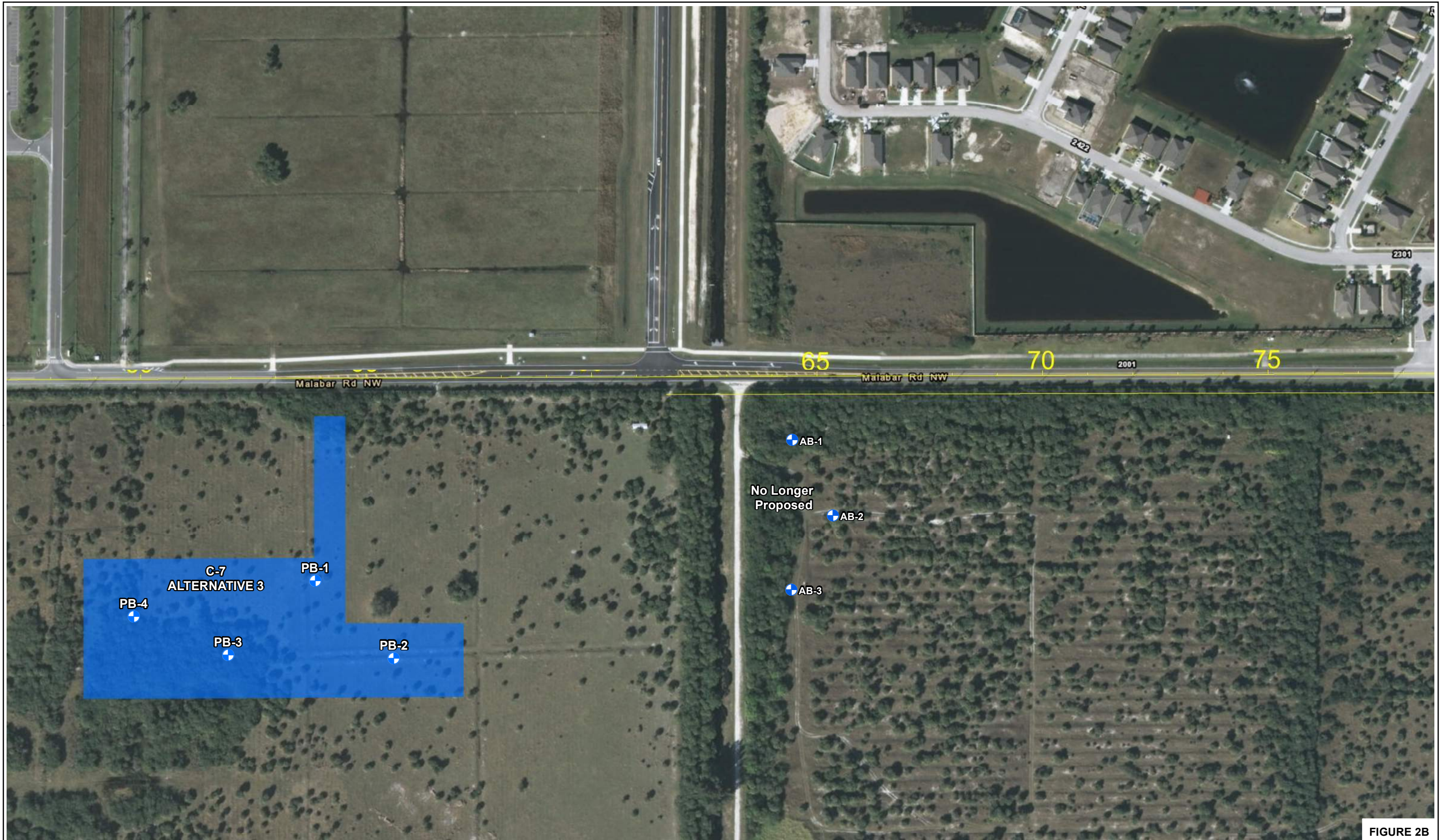
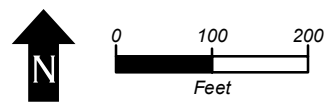


FIGURE 2B

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

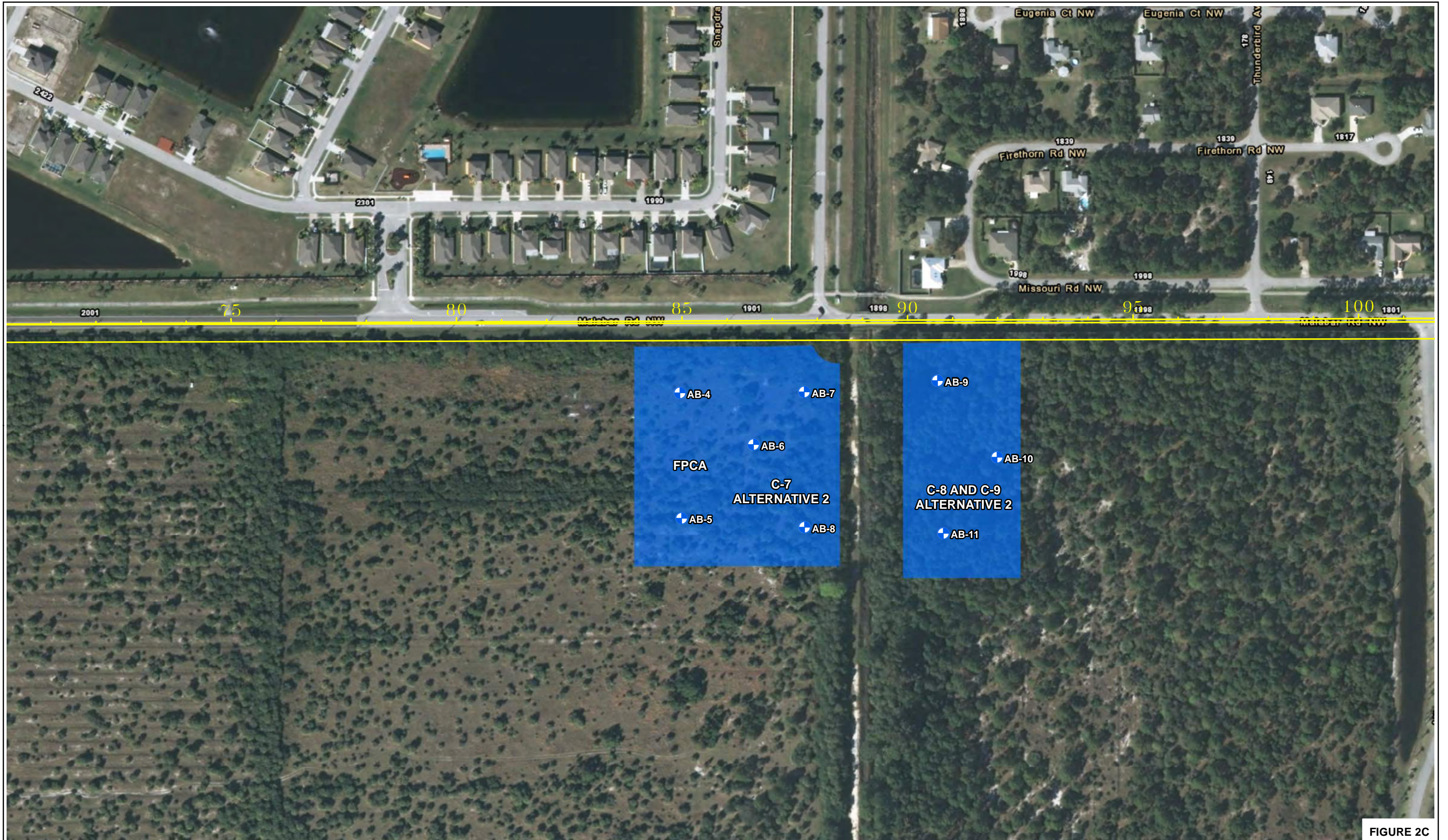
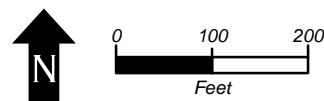


FIGURE 2C

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA
 DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

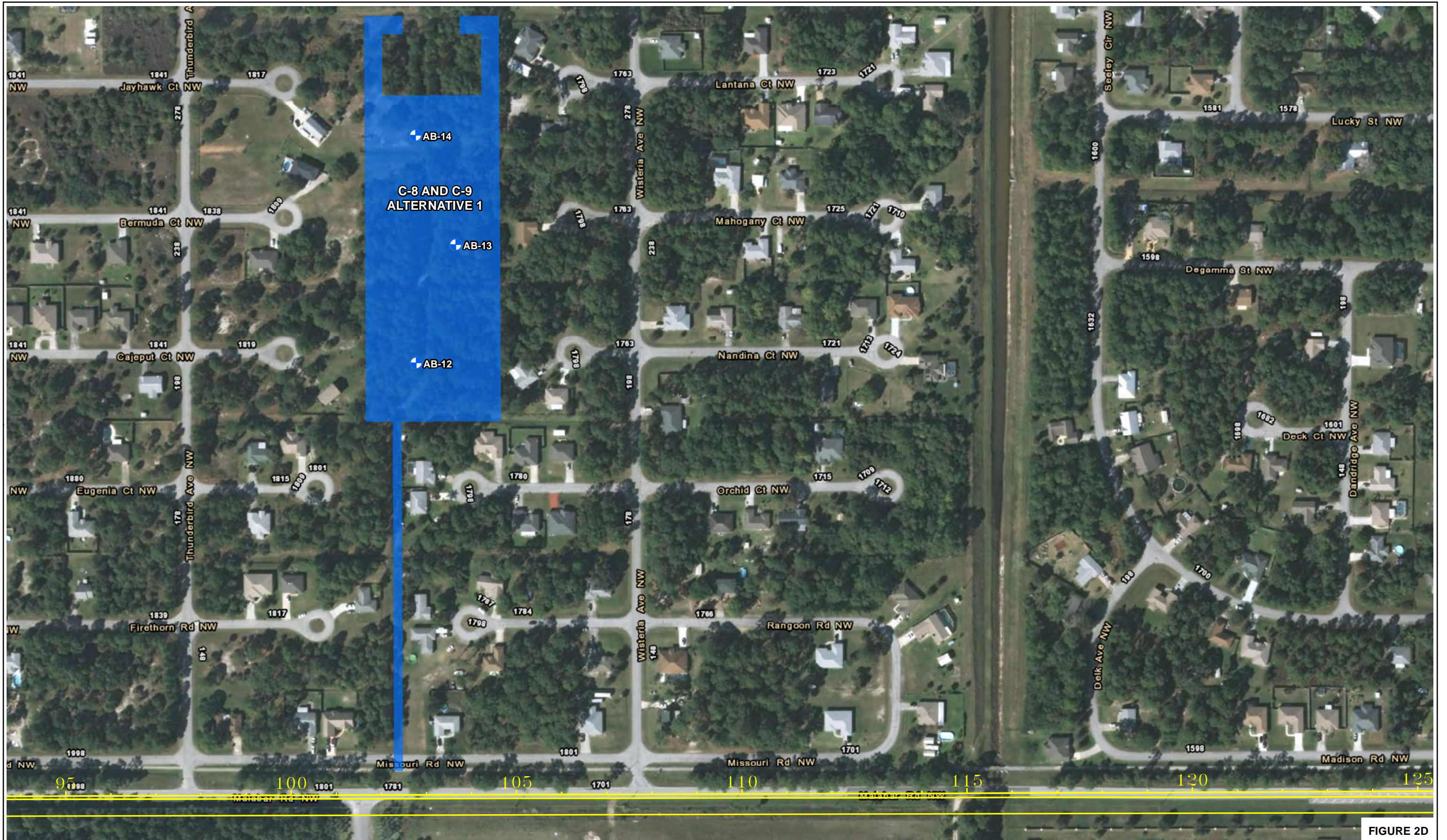
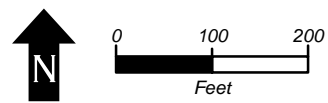


FIGURE 2D

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA
 DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

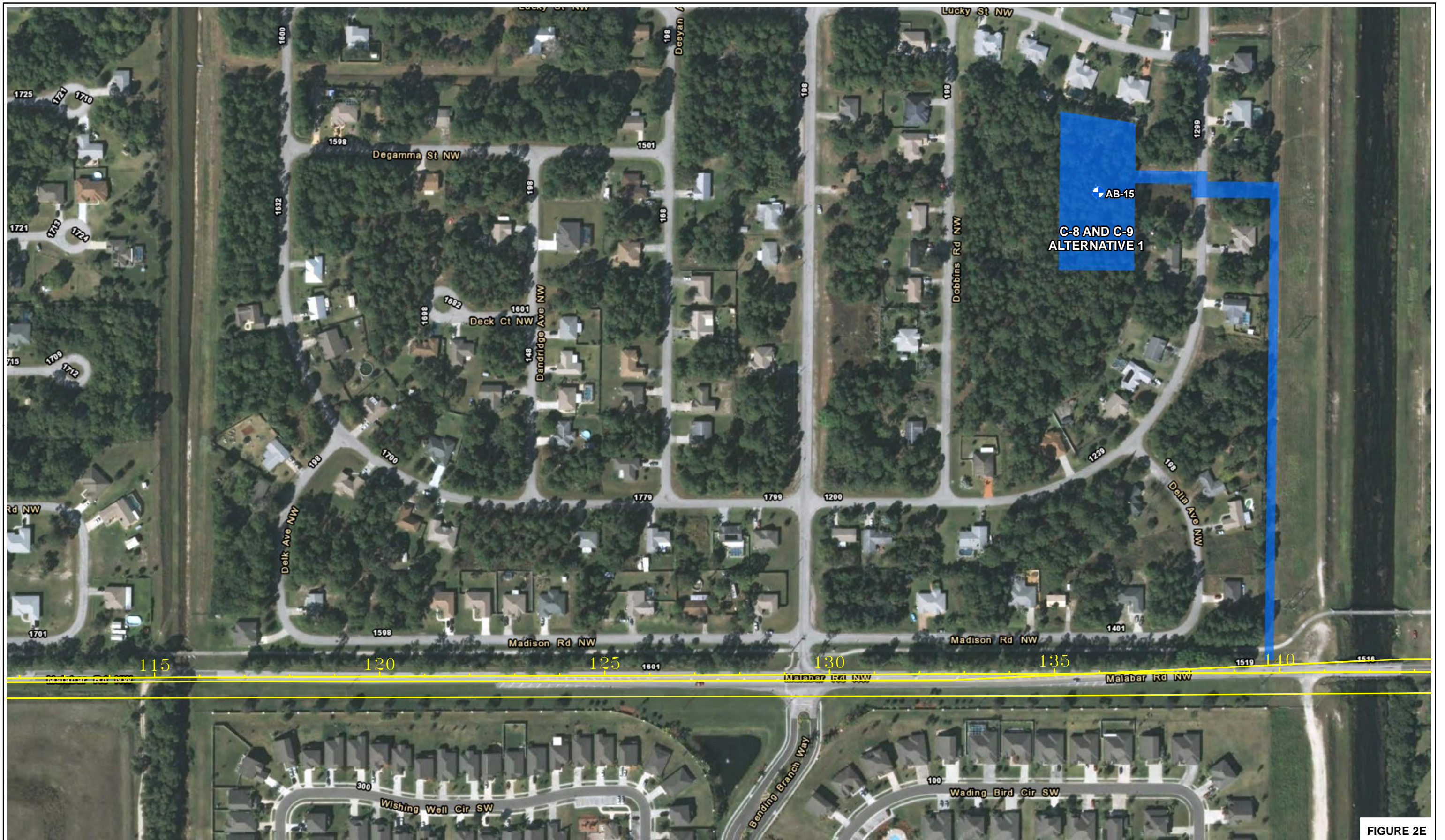
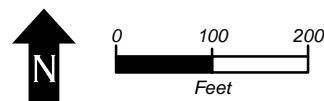


FIGURE 2E

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA
 DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

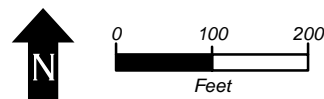
BORING LOCATION PLAN

SHEET NO.



FIGURE 2F

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 514	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

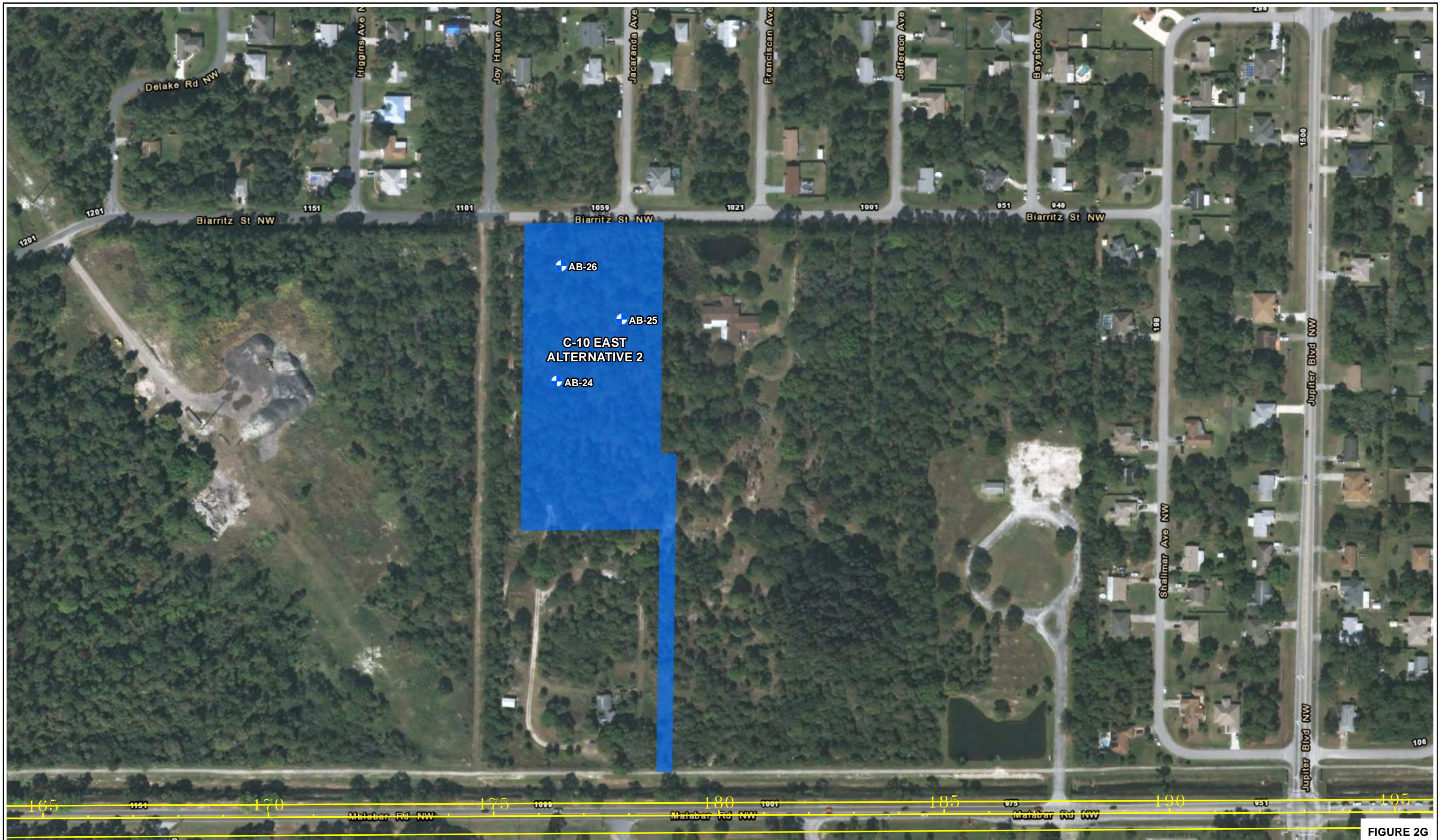
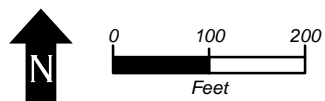


FIGURE 2G

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

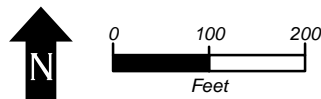
BORING LOCATION PLAN

SHEET NO.



FIGURE 2H

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

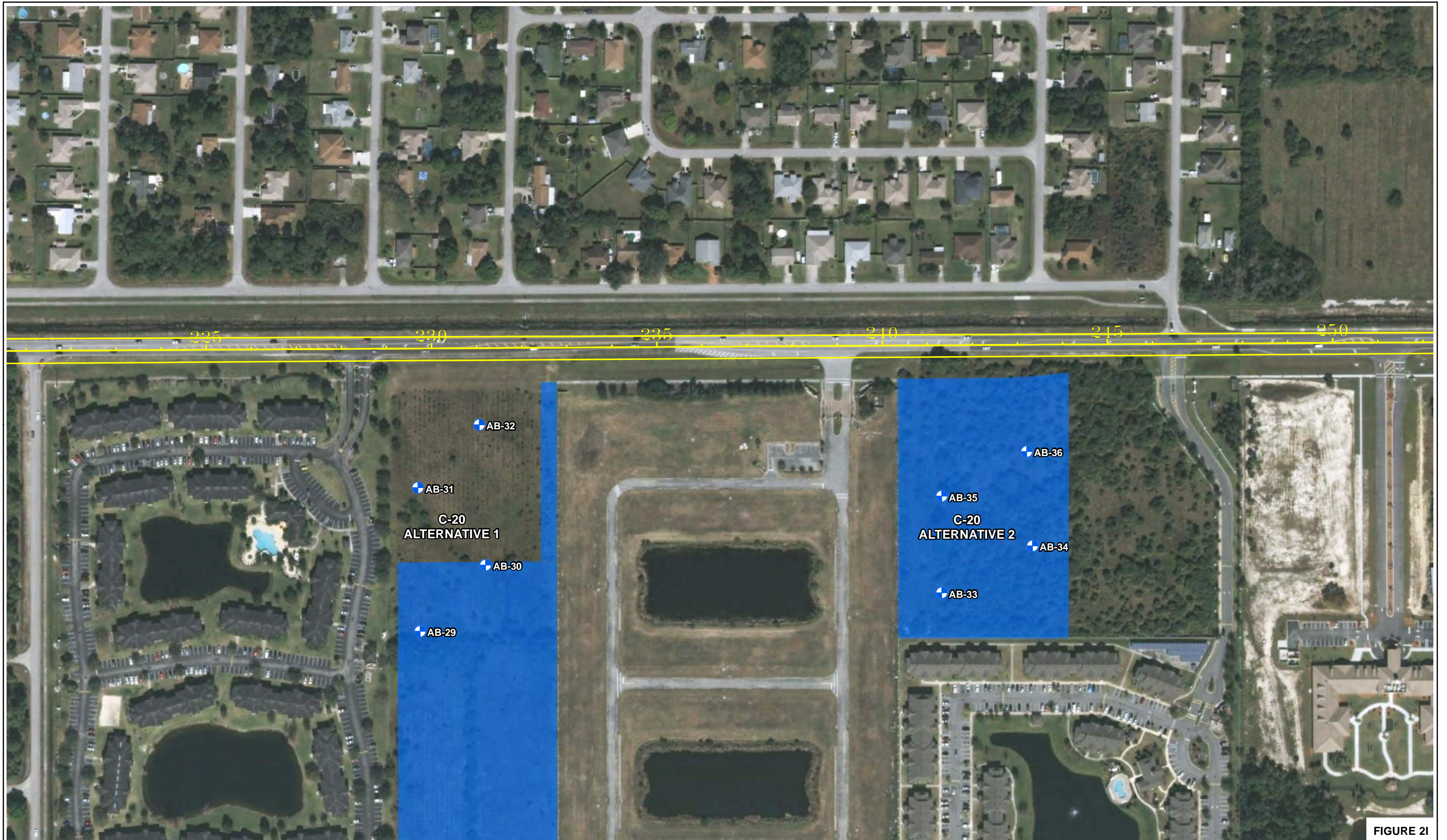
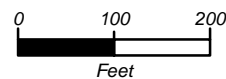


FIGURE 2I

APPROXIMATE AUGER BORING LOCATION



RACHEL F. ANDRE, P.E.
 P.E. LICENSE NUMBER 62418
 GEOTECHNICAL AND ENVIRONMENTAL
 CONSULTANTS, INC.
 919 LAKE BALDWIN LANE
 ORLANDO, FL 32814

STATE OF FLORIDA
 DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
MALABAR	BREVARD	437210-1-28-01

BORING LOCATION PLAN

SHEET NO.

POND SOIL SURVEY

DATE OF SURVEY: JANUARY 2021 AND MAY 2023
 SURVEY MADE BY: GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC.
 SUBMITTED BY: RACHEL F. ANDRE, P.E.

**STATE OF FLORIDA
 DEPARTMENT OF TRANSPORTATION
 MATERIALS AND RESEARCH**

DISTRICT: 5
 ROAD NO.: SR 514
 COUNTY: BREVARD

FINANCIAL PROJECT ID: 437210-1-28-01

PROJECT NAME: MALABAR ROAD PD&E STUDY FROM ST. JOHNS HERITAGE PARKWAY
 TO MINTON ROAD

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF PONDS

APPROXIMATE BEGIN STA.: 37+00 APPROXIMATE END STA.: 274+62

STATIONS REFERENCE: ALTERNATIVE B CENTERLINE OF CONSTRUCTION

STRATUM NO.	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS PERCENT PASS (%)					ATTERBERG LIMITS (%)				DESCRIPTION	CORROSION TEST RESULTS					
	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX		AASHTO GROUP	NO. OF TESTS	RESISTIVITY ohm-cm	CHLORIDE ppm	SULFATES ppm	pH
1	2	1.4-4.9	2	8-20	9	100	80-92	48-61	14-29	2-8	0	-	-	A-3	LIGHT GRAY TO BROWN TO LIGHT BROWN TO GRAY FINE SAND TO FINE SAND WITH SILT, OCCASIONAL TRACE ORGANIC MATERIAL AND TRACE TO SOME ROOTS	0	-	-	-	-
2	0	-	0	-	2	80-100	66-89	48-65	29-38	13-14	0	-	-	A-2-4	GRAY TO LIGHT GRAY SILTY FINE SAND, SOME CEMENTED SAND	0	-	-	-	-
3	0	-	6	12-34	6	97-100	85-95	66-75	37-64	20-56	6	27-34	11-23	A-2-6, A-6	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY CLAYEY FINE SAND TO SANDY CLAY, TRACE SHELL	0	-	-	-	-
4	0	-	2	14-16	3	88-100	80-95	58-69	32-39	16-25	2	NP-32	NP-14	A-2-4	LIGHT GRAY TO GRAY TO BROWN SILTY FINE SAND, TRACE TO SOME SHELL	0	-	-	-	-

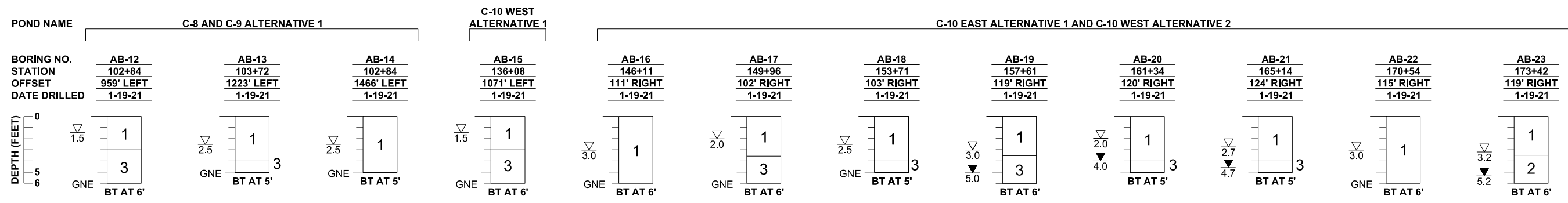
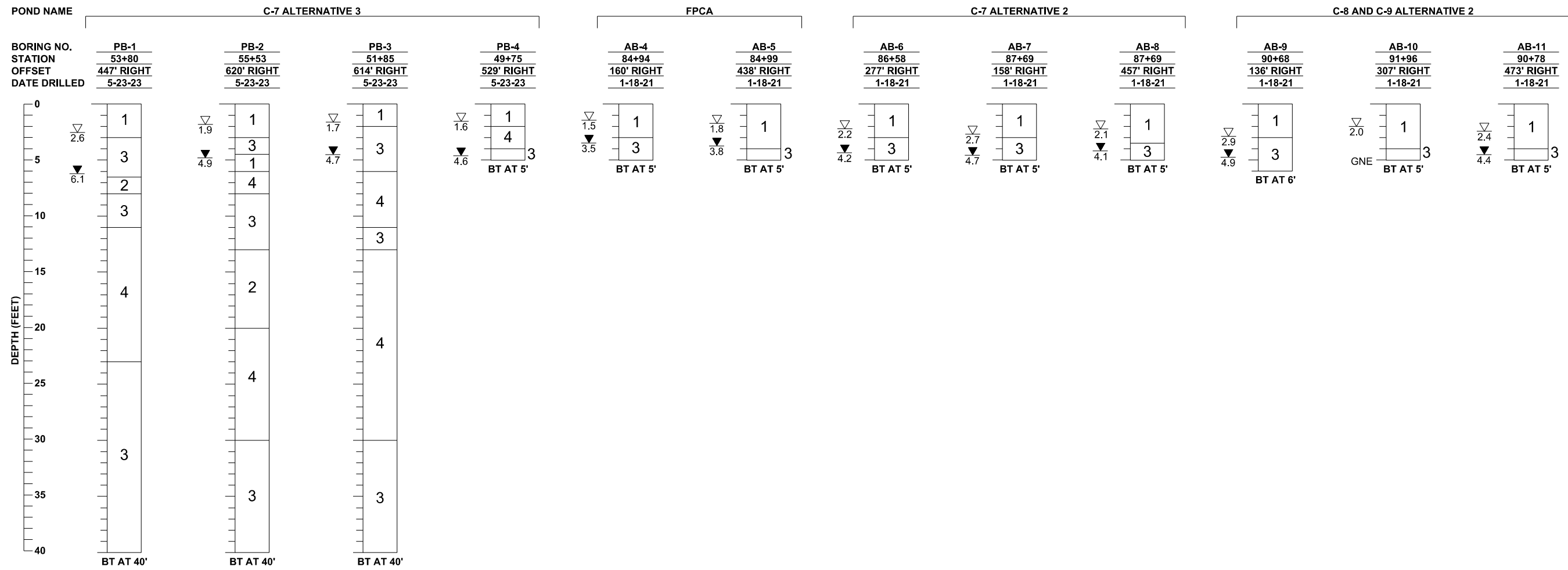
NOTES

1. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN ARTICLE 2-4 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION. FOR FURTHER DETAILS SEE ARTICLE 120-3.
2. WATER TABLE SHOWN AS ▼ WHERE ENCOUNTERED AT TIME OF SURVEY. GROUNDWATER NOT ENCOUNTERED SHOWN AS "GNE". ESTIMATED SEASONAL HIGH SHOWN AS ▽.
3. REMOVAL OF MUCK AND PLASTIC MATERIAL SHALL BE ACCOMPLISHED IN ACCORDANCE WITH FDOT INDEX NO. 120-002 OF THE FDOT DESIGN STANDARDS UNLESS OTHERWISE SHOWN ON PLANS. THE MATERIAL USED IN EMBANKMENT CONSTRUCTION SHALL BE IN ACCORDANCE WITH INDEX NO. 120-002 OF THE FDOT DESIGN STANDARDS.
4. SOIL ANALYSIS INCLUDES DATA FROM POTENTIAL POND AREAS ONLY.
5. THE SYMBOL "-" REPRESENTS AN UNMEASURED PARAMETER.
6. STRATA 1, 2, AND 4 SHALL BE TREATED AS SELECT (S) MATERIAL IN ACCORDANCE WITH FDOT INDEX 120-001.
7. STRATA 2 AND 4 MAY RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT.
8. STRATUM 3 SHALL BE TREATED AS PLASTIC (P) MATERIAL IN ACCORDANCE WITH INDEX 120-001.
9. THE SYMBOL "NP" REPRESENTS NON-PLASTIC.

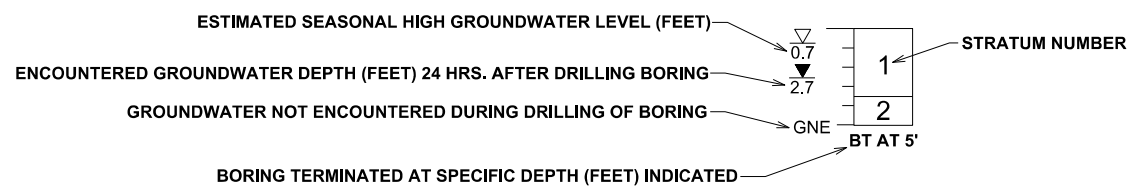
FIGURE 3

REVISIONS				RACHEL F. ANDRE, P.E. P.E. LICENSE NUMBER 62418 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. 919 LAKE BALDWIN LANE ORLANDO, FL 32814	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			POND SOIL SURVEY	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
						SR 514	BREVARD		437210-1-28-01

POND SOIL BORING RESULTS



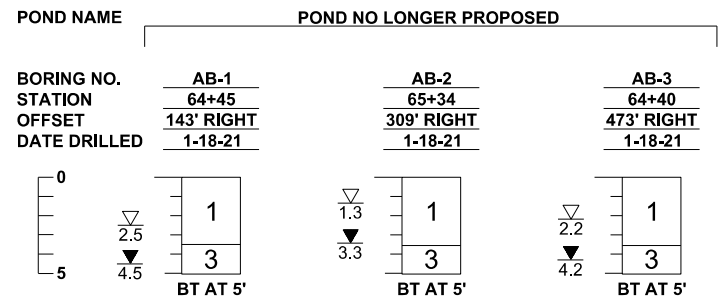
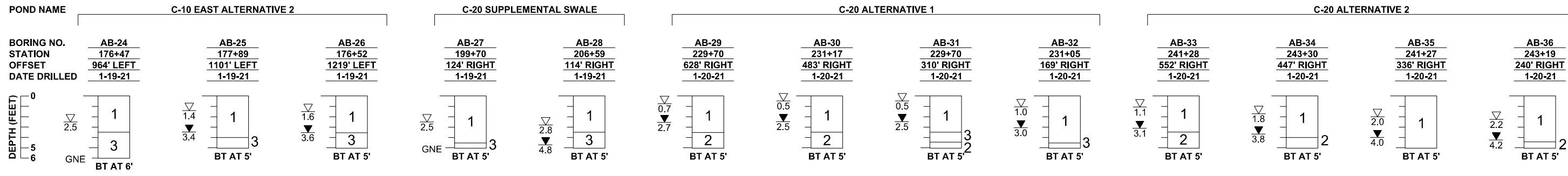
BORING LEGEND



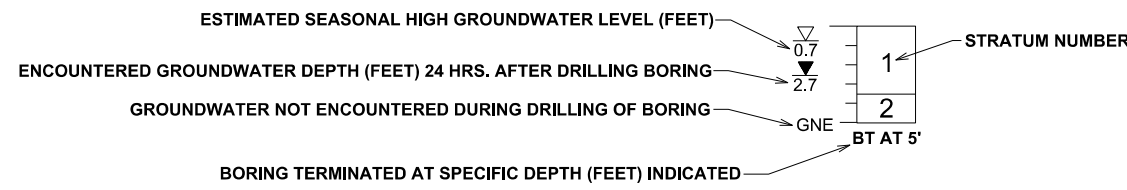
STRATUM NO.	AASHTO CLASSIFICATION	SOIL DESCRIPTION
1	A-3	LIGHT GRAY TO BROWN TO LIGHT BROWN TO GRAY FINE SAND TO FINE SAND WITH SILT, OCCASIONAL TRACE ORGANIC MATERIAL AND TRACE TO SOME ROOTS
2	A-2-4	GRAY TO LIGHT GRAY SILTY FINE SAND, SOME CEMENTED SAND
3	A-2-6, A-6	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY CLAYEY FINE SAND TO SANDY CLAY, TRACE SHELL
4	A-2-4	LIGHT GRAY TO GRAY TO BROWN SILTY FINE SAND, TRACE TO SOME SHELL

FIGURE 4A

REVISIONS				RACHEL F. ANDRE, P.E. P.E. LICENSE NUMBER 62418 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. 919 LAKE BALDWIN LANE ORLANDO, FL 32814	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			POND SOIL BORING RESULTS	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 514	BREVARD	437210-1-28-01		



BORING LEGEND



STRATUM NO.	AASHTO CLASSIFICATION	SOIL DESCRIPTION
1	A-3	LIGHT GRAY TO BROWN TO LIGHT BROWN TO GRAY FINE SAND TO FINE SAND WITH SILT, OCCASIONAL TRACE ORGANIC MATERIAL AND TRACE TO SOME ROOTS
2	A-2-4	GRAY TO LIGHT GRAY SILTY FINE SAND, SOME CEMENTED SAND
3	A-2-6, A-6	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY CLAYEY FINE SAND TO SANDY CLAY, TRACE SHELL
4	A-2-4	LIGHT GRAY TO GRAY TO BROWN SILTY FINE SAND, TRACE TO SOME SHELL

FIGURE 4B

REVISIONS				RACHEL F. ANDRE, P.E. P.E. LICENSE NUMBER 62418 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. 919 LAKE BALDWIN LANE ORLANDO, FL 32814	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			POND SOIL BORING RESULTS	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 514	BREVARD	437210-1-28-01		

SUMMARY OF LABORATORY TEST RESULTS

Table 5
Summary of Laboratory Test Results
Malabar Road PD&E Study
From St. Johns Heritage Parkway to Minton Road
GEC Project No. 4511G
Page 1 of 1

Stratum No.	Station	Offset	Boring No.	Sample Depth (ft)	Percent Passing by Weight					Moisture Content (%)	Atterberg Limits		Organic Content (%)	AASHTO Class.
					#10 Sieve	#40 Sieve	#60 Sieve	#100 Sieve	#200 Sieve		Liquid Limit	Plasticity Index		
1	102+84	1466' LT	AB-14	0 - 5	100	87	50	14	2	---	---	---	---	A-3 ²
1	136+08	1071' LT	AB-15	2.5 - 3	100	84	53	21	7	8	---	---	1.4	A-3 ³
1	153+71	103' RT	AB-18	0 - 3	100	81	49	18	3	---	---	---	---	A-3 ²
1	176+47	964' LT	AB-24	2.5 - 3.5	100	82	53	24	8	20	---	---	4.9	A-3
1	206+59	114' RT	AB-28	0 - 2.5	100	80	48	21	2	---	---	---	---	A-3 ³
1	241+28	552' RT	AB-33	0 - 2	100	85	56	29	5	---	---	---	---	A-3 ²
1	53+80	447' RT	PB-1	0 - 2	100	92	61	22	4	---	---	---	---	A-3
1	84+99	438' RT	AB-5	0 - 4	100	92	60	23	3	---	---	---	---	A-3 ¹
1	90+68	136' RT	AB-9	0 - 3	100	88	54	19	2	---	---	---	---	A-3 ²
2	231+17	483' RT	AB-30	3.5 - 5	100	89	65	38	13	---	---	---	---	A-2-4
2	55+53	620' RT	PB-2	15 - 20	80	66	48	29	14	---	---	---	---	A-2-4 ⁵
3	51+85	614' RT	PB-3	11 - 13	97	85	74	64	56	29	34	23	---	A-6 ⁴
3	51+85	614' RT	PB-3	30 - 35	100	87	63	48	34	27	27	11	---	A-2-6 ⁴
3	53+80	447' RT	PB-1	25 - 30	100	92	67	58	47	34	34	14	---	A-6 ⁴
3	55+53	620' RT	PB-2	8 - 10	100	95	75	48	25	17	28	13	---	A-2-6
3	65+34	309' RT	AB-2	3.5 - 5	100	94	72	41	22	14	30	16	---	A-2-6
3	90+78	473' RT	AB-11	4 - 5	100	91	66	37	20	12	28	14	---	A-2-6
4	173+42	119' RT	AB-23	3.5 - 6	100	84	58	32	16	14	NP	NP	---	A-2-4
4	49+75	529' RT	PB-4	2 - 4	100	95	69	38	24	16	32	14	---	A-2-4
4	51+85	614' RT	PB-3	6 - 8	88	80	60	39	25	---	---	---	---	A-2-4 ⁴

1 - Some Roots

2 - Trace Roots

3 - Trace Organic Material

4 - Trace Shell

5 - Some Cemented Sand

Summary of Groundwater Levels

Malabar Road PD&E

GEC Project No. 4511G

Page 1 of 1

Pond Name:	Boring ID:	Depth Drilled: (feet)	Date Drilled:	¹ Encountered Groundwater Depth: (feet)	² Estimated Seasonal High Groundwater Depth: (feet)
C-7 Alternative 1	AB-1	5	1/18/2021	4.5	2.5
	AB-2	5	1/18/2021	3.3	1.3
	AB-3	5	1/18/2021	4.2	2.2
FPCA	AB-4	5	1/18/2021	3.5	1.5
	AB-5	5	1/18/2021	3.8	1.8
C-7 Alternative 2	AB-6	5	1/18/2021	4.2	2.2
	AB-7	5	1/18/2021	4.7	2.7
	AB-8	5	1/18/2021	4.1	2.1
C-8 and C-9 Alternative 2	AB-9	6	1/18/2021	4.9	2.9
	AB-10	5	1/18/2021	GNE	---
	AB-11	5	1/18/2021	4.4	2.4
C-8 and C-9 Alt 1	AB-12	6	1/19/2021	GNE	---
	AB-13	5	1/19/2021	GNE	---
	AB-14	5	1/19/2021	GNE	---
C-10 Alternative 1	AB-15	6	1/19/2021	GNE	---
C-10 East Alternative 1 and C-10 West Alternative 2	AB-16	6	1/19/2021	GNE	---
	AB-17	6	1/19/2021	GNE	---
	AB-18	5	1/19/2021	GNE	---
	AB-19	6	1/19/2021	5.0	3.0
	AB-20	5	1/19/2021	4.0	2.0
	AB-21	5	1/19/2021	4.7	2.7
	AB-22	6	1/19/2021	GNE	---
C-10 East Alternative 2	AB-23	6	1/19/2021	5.2	3.2
	AB-24	6	1/19/2021	GNE	---
	AB-25	5	1/19/2021	3.4	1.4
C-20 Supplemental Swale	AB-26	5	1/19/2021	3.6	1.6
	AB-27	5	1/19/2021	GNE	---
C-20 Alternative 1	AB-28	5	1/19/2021	4.8	2.8
	AB-29	5	1/20/2021	2.7	0.7
C-20 Alternative 2	AB-30	5	1/20/2021	2.5	0.5
	AB-31	5	1/20/2021	2.5	0.5
	AB-32	5	1/20/2021	3.0	1.0
C-20 Alternative 2	AB-33	5	1/20/2021	3.1	1.1
	AB-34	5	1/20/2021	3.8	1.8
	AB-35	5	1/20/2021	4.0	2.0
	AB-36	5	1/20/2021	4.2	2.2

1 - GNE – Groundwater Not Encountered

2 - Seasonal high groundwater levels marked as “---” could not be estimated at boring locations where the groundwater level was not encountered within the boring depth.

Malabar Road PD&E Study

FM No. 437210-1-28-01

APPENDIX L

Correspondence

Malabar Road PD&E Study

FM No. 437210-1-28-01

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Meeting Minutes

3000 Dovera Drive, Suite 200, Oviedo, Florida 32765 | P:407-971-8850 | F: 407-971-8955 |
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Project: Malabar Road – PD&E Study

Date: August 5th, 2020

FPID: 437210-1-28-01

Time: 11:00 AM

Description: From St. Johns Heritage Pkwy. To Minton Rd.

Location: Microsoft Teams (Virtual)

Meeting Title: Alternative Pond Site Review

MEETING ATTENDEES:

- Frank Watanabe, City of Palm Bay
- Corrina Gumm, Brevard County
- Mike McCabe, MTWCD
- Dayna Duffy, Inwood Consulting Engineers
- Renato Chuw, Inwood Consulting Engineers
- Jack Freeman, Kittelson
- Brandon Kelley, Kittelson

MEETING SUMMARY

Renato Chuw began the meeting with a brief overview of the purpose of the meeting which was to present preliminary pond site locations to the City, County and MTWCD. Dayna Duffy presented a CADD file to show the proposed alternative pond sites that were developed by Inwood. Pond sizing was based on the most conservative ROW width concept (110' at the time of developing these sites but has since been reduced to 102') and ICPR models to ensure that MTWCD discharge criteria is met. Each pond site was discussed and changes were proposed by the various stakeholders. The changes emphasize consolidating pond sites into parcels that are already owned by the City of Palm Bay and reducing residential impacts within the Port Malabar subdivisions. Please see the attached basin maps for an overview of the pond sites that were presented. The following is a summary of comments and recommendations:

- In Basin C-7, there has been discussion of a future commercial development on the site of C-7 Alt. A. No permits or plans have been filed; however, C-7 Alt. B will be considered a viable site for this basin. Alternative options for Alt. A include:
 - Relocate the pond to the south side of Malabar Rd. and move it closer to the C-8 Canal. In the pond graphics presented during the meeting, this location was also identified as a potential floodplain compensation site. The new Alt. A option would abut the floodplain comp. site. Mike is ok with changing the outfall for this basin from the C-7 to the C-8 canal, if discharge criteria can still be met.
 - Look into expanding/utilizing the pond at the Palm Bay Regional Park to the north, adjacent to the C-7 Canal. Renato mentioned that this might trigger Section 4(f) and further investigation will be conducted.
- In Basin C-8, it is preferable to use the City parcel that is surrounded by the residential lots and add an easement instead of using the residential parcels for C-8 Alt. B. Frank mentioned that this would be supported by the City Council. This pond site will be relocated. It was mentioned there is an existing ditch running through the City

parcel to collect runoff from the adjacent surrounding residential homes. Locating a proposed pond within the City parcel will also require examining replacement of the ditch so that the existing drainage patterns remain. Alternatively, the pond could be sized to accept the offsite runoff from the residential lots.

- Both proposed pond sites in Basin C-9 have significant residential impacts. Inwood will look at options to combine this basin with one or both of the adjoining basins to eliminate these impacts. The C-8 Canal merges with the C-9 Canal just north of the project, so Mike is conceptually ok with discharging to the C-8 instead.
- Mike mentioned that there is a large parcel at the NE corner where the C-8 and C-9 Canals merge. The parcel is owned by Brevard County Schools but might revert to County ownership. Mike suggested the use of this parcel for regional or secondary treatment. Renato indicated that one option would be for Malabar Road to discharge directly into one of the canals and to provide compensating treatment using this parcel. However, since this parcel is not currently available, we would still need to provide pond sites specifically for the Malabar Road PD&E Study. This parcel's potential for regional stormwater use will be documented in the PSR but not investigated further.
- In the C-10 West Basin, the City parcel is a viable site for a pond (Alt. A). Inwood will determine whether this parcel is suitable to also treat runoff from some or all of basin C-9. Alt. B site (currently shown located within residential lots) will be eliminated for further evaluation.
- In the C-10 East Basin, the swale option (Alt. A) is a viable option. It was recommended to utilize the rest of the remnant parcels as additional swale area to provide compensation for other basins. For Alt. B, there is already a City canal easement along the west side that can be used as access for the pond. Mike mentioned that there might be plans to enclose/pipe this canal due to the Avery Springs development.
- In the C-20 West Basin, several changes were suggested. Neither of the proposed pond site alternatives shown in the meeting were desirable due to the residential impacts.
 - One option is to eliminate the pond sites in this basin and compensate in either of the adjacent basins. Discharging to the C-10 or C-20 would be acceptable, but discharge criteria would still need to be met.
 - Utilize the remnant parcels on the south side of Malabar Road for swales, even if they are not large enough to provide the full amount of treatment. They can be used to supplement the compensation options.
 - Depending on the selected concept around the Post Office, the church parcel on the north side of Malabar Road might be impacted. If so, there could be potential for a pond site or even a regional pond site in this location. This will be investigated further once the concept is more finalized.
- Mike mentioned that the C-20 backs up into some of the residential properties during large storm events. This should be taken into consideration when sizing side drain replacements or developing concepts to relocate the canal.
- Both pond alternatives for the C-20 East Basin are viable and can be expanded to compensate for the C-20 West Basin.
- For Basin A (the last basin at the terminus with Minton Road), Inwood discussed their intent to avoid any modifications to the existing Palm Bay pond located between the 7-11 and C-37 Canal (east of Minton Road). The existing pond treats runoff from Malabar Road but is located on private property and there have been past disputes over property ownership and easements (per Mike). Additionally, the 7-11 is planning to expand in the near future. Inwood will move the basin boundary as needed to ensure the pond continues to receive the same



Meeting Minutes

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amount of stormwater in the widened condition, and route the rest of the runoff back west to the C-20 East Basin. This approach was mutually agreed upon by all stakeholders.

Action Items:

Inwood will review the recommended changes to pond site alternatives and develop new or modified pond site alternatives as appropriate. Inwood will also complete the ICPR modeling of the updated pond alternatives. The revised alternatives will be reviewed again by stakeholders by the end of August, then sent to subconsultants for review. Preliminary pond sites will be shown at the public meeting in September.

*****END OF MEETING*****

Note: The above reflects the writer's understanding of the contents of the meeting. If any misinterpretation or inaccuracies are included, please contact Renato Chuw at (407) 971-8850 as soon as possible for resolution and revisions if necessary.

Project Name: Malabar Road PD&E Study

Project Description: Project Review Meeting

Event Date: October 20, 2020 @ 9:00 am

Event Location: Virtual Meeting

MEETING ATTENDEES

- Frank Watanabe, PE – City of Palm Bay
- Corrina Gumm, PE – Brevard County
- Mike McCabe, PE – MTWCD
- Debbie Leclair – MTWCD
- John Gergen – MTWCD
- Laura Carter – SCTPO
- Lorena Cucek – FDOT District 5
- Jack Freeman, PE, PTOE, RSP1 – Kittelson
- Brandon Kelley, PE - Kittelson
- Sigal Carmenate - Kittelson
- Travis Hills, PE - Kittelson

MEETING NOTES

Below is a summary of meeting discussion topics.

Jack Freeman started the meeting saying there would be two agenda items. The first discussion would be to review the public meeting comments and the proposed responses. The second item would be to discuss initial thoughts toward a recommended preferred alternative.

A total of eight public comments were received before, during and following the September 24th public meeting. Each of the comments received and proposed responses were discussed. It was noted the response to the Melbourne-Tillman Water Control District (MTWCD) letter would be discussed last. As the responses were discussed, comments from the meeting attendees were as follows:

1. Some of the public comments regarded not providing buffered bicycle lanes. The response noted the new FDM section allowing to use a shared use path instead of bicycle lanes. The SCTPO stated with their new Vision Zero plan, they are focused on improving multimodal mobility and would like to see further pedestrian and bicycle safety enhancements in this corridor. It was suggested to increase the southside sidewalk width to 8-ft or 10-ft to allow cyclists to use.
2. It was discussed the Avery Springs development is bringing a sidewalk along the Canal C-20 crossing's western side to Malabar Road. The proposed Cross City trail extension should connect to this proposed sidewalk.

MTWCD provided several comments and the proposed responses were discussed. A draft response letter had been provided to MTWCD for their review a day in advance of the meeting. The first comment regarded access to Canal C-10's south side especially for tractor-trailers. Two options were discussed. MTWCD requested a bulb-out for u-turn movements be added at the Hoffer Ave. intersection which will be considered. MTWCD was asked the frequency access to the canal was

needed. They said it varies. There can be several weeks where there is no access and other days of high activity where there are 15 trucks or more accessing the canal. These are mostly dump trucks but can have some tractor trailers. It was acknowledged if roundabouts are provided at Bending Branch Lane/Krassner Drive and Hurley Blvd. this would facilitate truck u-turns.

The second MTWCD comment regarded the overlapping right-of-way (ROW) along Malabar Road. It was agreed this is public ROW and the ownership would be determined when title searches are conducted during the final design phase. The next comment regarded having the shared use path along the north side and the location of guardrail. The MTWCD noted Malabar Road east of Eldron Blvd where there is a 4-ft bike lane and guardrail at the back of curb as is seen below. This allows their mowers to better access the canal for maintenance activities. MTWCD also noted the overhead power is on the south side of Malabar Road from St. Johns Heritage Parkway to the City of Palm Bay Public Works complex and then crosses to the north side along Canal C-20's south bank to Minton Road. MTWCD noted the difficulty of avoiding the power lines during maintenance operations and noted since the overhead power lines would be relocated as part of the widening, they asked about relocating to the Malabar Roads south side.



MTWCD's next comment regarded the Canal C-20's potential impacts due to roundabouts and specifically at the Jupiter Boulevard intersection. The response noted the proposed concrete retaining wall with either guardrail or concrete barrier mounted on top. MTWCD did not have any comments regarding the response. The final comment regarded Canal C-20 being stressed and occasional backwater issues between Belvedere Road to Maywood Ave. The response noted the project is considering replacing the existing 48" culverts with larger pipes for the private driveways across from Ware Ave and Santa Rosa Ave and the pipe sizing will be done in design. MTWCD did not have any comments regarding the response.

We discussed the comparative evaluation matrix prepared for alternatives public meeting and the differences between Alternatives A and B. Jack Freeman noted Alternative A has a 15.5-ft wide median and has the roadway's southside sidewalk at the back of curb. Alternative B has a 22-ft wide median

and provides a 4-ft grass buffer between the back of curb and the roadway's southside sidewalk. It was discussed, Alternative B is approximately \$1.5M to \$3M or about 2% to 3% more costly. Alternative B's wider median would facilitate u-turn movements at the directional median openings not having a bulb-out. Also, the 4-ft grass buffer enhances pedestrian safety from an errant vehicle and also more comfort to the pedestrian in the sidewalk. The attendees were generally supportive of Alternative B with consideration for some modifications as previously noted.

We discussed the traffic signal and roundabout alternatives at five intersections along the corridor. The attached summary matrix was presented and discussed. There was general support for roundabouts except at Jupiter Boulevard. It was generally felt the impacts to the Canal C-20 with the need for an extended box culvert and cul-de-sacs at two local streets required for the roundabout did not make it a suitable intersection form at the Jupiter Boulevard location. Other locations were more favorably received. Kittelson was asked to revisit the LOS analysis at Garvey Road as the traffic signal shows a better LOS than the roundabout. Also, MTWCD expressed concern regarding the proposed roundabouts at Hurley Blvd and Garvey Road would have to Canal C-20. We also discussed pedestrian access at Hurley Blvd with the roundabout concept and crossing Canal C-20. This would be a sidewalk added at the new Hillcrest Ave. crossing.

Additional follow-up.

1. Kittelson to investigate changing the 6-ft sidewalk on Malabar Road's southside to be either 8-ft or 10-ft wide.
2. Kittelson to show the sidewalk between Watoga Ave and the Cross City Trail to be 10-ft wide. A pedestrian crossing is to be added to this intersection.
3. Kittelson is to investigate adding a bulb-out at Hoffer Ave capable of handling tractor-trailer vehicles making a u-turn.
4. Kittelson/Inwood to evaluate the feasibility of relocating the overhead power lines to Malabar Road's south side east of the City of Palm Bay Public Works complex.
5. Kittelson to check the intersection LOS analysis at Garvey Road.

The foregoing represents Jack Freeman's understanding of discussion items at the October 20, 2020 project review meeting. If any edits are desired, please contact him at jfreeman@kittelson.com.

Malabar Road Traffic Signal vs Roundabout Operational, Safety and Cost Estimates Comparison										
Location	Traffic Signal		Roundabout			Alternative A 89.5' Minimum Right-of-Way			Alternative B 100' Desired Right-of-Way	
	2050 LOS	2050 FI Crashes/Year	2050 LOS	2050 FI Crashes/Year	Traffic Signal	Roundabout	Difference	Traffic Signal	Roundabout	Cost Difference between Alternatives
St. John's Heritage Parkway	E	29.81	C	25.98	\$3,351,200	\$4,446,000	\$1,094,800	\$3,411,500	\$4,529,200	\$1,117,700
Krassner Drive/ Bending Branch Lane	D	42.29	A	17.64	\$3,667,700	\$5,726,500	\$2,058,800	\$3,729,000	\$5,770,500	\$2,041,500
Hurley Boulevard*	A	29.20	A	16.55	\$1,637,800	\$3,422,300	\$1,784,500	\$1,644,300	\$3,759,000	\$2,114,700
Jupiter Boulevard	D	92.53	D	49.77	\$7,624,500	\$8,444,800	\$820,300	\$7,624,500	\$8,694,400	\$1,069,900
Garvey Road	B	46.59	C	23.63	\$2,674,000	\$3,993,100	\$1,319,100	\$2,703,800	\$4,655,200	\$1,951,400

* Hurley Boulevard will remain an unsignalized intersection in the traffic signal alternative.



Meeting Notes

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Project: Malabar Road – PD&E Study

Date: March 31st, 2021

FPID: 437210-1-28-01

Time: 3:00 PM

Description: From St. Johns Heritage Pkwy. To Minton Rd.

Location: Microsoft Teams (Virtual)

Meeting Title: Preferred Pond Site Review

MEETING ATTENDEES:

- Frank Watanabe, City of Palm Bay
- Stephanie Kelly, City of Palm Bay
- Vincent Colombo, City of Palm Bay
- Corrina Gumm, Brevard County
- Mike McCabe, MTWCD
- Dayna Duffy, Inwood Consulting Engineers
- Renato Chuw, Inwood Consulting Engineers
- Jack Freeman, Kittelson
- Brandon Kelley, Kittelson
- Travis Hills, Kittelson

MEETING SUMMARY

Renato Chuw began the meeting with a brief overview of the purpose of the meeting which was to present alternative pond site locations and the locations that have been identified as recommended preferred sites. Dayna Duffy presented a KMZ file to show the proposed alternative pond sites that were developed by Inwood, with the recommended preferred alternatives represented in cyan. Alternative pond sites were shown in orange and the only floodplain compensation site was green. KMZ files containing the pond site locations, text labels, and the recommended preferred roadway concept are attached.

General Notes:

- Inwood explained that all of the pond sites include an upside contingency factor (20%) to account for preliminary data and refinements during the design such as radii around berms, curvatures, etc.
- MTWCD asked how much the roadway would be elevated as part of this project. Kittelson indicated that the roadway will be constructed close to existing grade and no substantial elevation change is expected.

Site Specific Notes:

- The preferred pond site for Basin C-7 is Pond C-7 Alt. 2, located adjacent to Canal 8 and south of Malabar Road. Adjacent to the pond is a proposed floodplain compensation site.
 - *The City, MTWCD or the County did not have any comments on this recommended preferred pond site location.*

- Basins C-8 and C-9 were combined per comments from the previous pond alternatives meeting. They are now represented as Basin C-8 & C-9. The recommended preferred site for this basin (Alt. 1) is the City owned parcel centered on the north side of Malabar Road between Canal C-8 and Canal C-9, within a residential neighborhood.
 - A perimeter ditch has been allocated surrounding the recommended preferred site to accommodate offsite runoff from the adjacent neighborhoods that currently flows to the existing ditch in the middle of the parcel. The ditch is shown in dark blue.
 - An easement is required from Malabar Road to the pond for the storm drain conveyance pipe.
 - The pond is anticipated to discharge to the existing ditch to the north.
 - It was explained that this site is slightly more expensive than the Alt. 2 pond site because of the construction cost of the pond and the pipe within the easement.
 - The City asked whether this would be a wet or dry pond. Inwood responded that it would be a wet pond, and the City indicated that they do not anticipate that this pond will get push back from the adjacent residents.
 - Inwood mentioned that this pond could be reshaped to be curvilinear and have aesthetic features during the design phase.
 - *Everyone in the meeting concurred that Alt. 1 is the recommended preferred pond for this basin.*
 - MTWCD asked if the runoff from the eastern limit of Basin C-8 & C-9 would be piped across Canal C-9 to the recommended preferred pond on the City parcel. Inwood responded that a couple of options are available such as crossing under the existing Canal C-9 with a storm drain pipe to the recommended preferred pond or applying compensating treatment by not treating the portion of the basin east of Canal C-9 and overtreating or doing compensating treatment west of Canal C-9.
 - MTWCD mentioned that the existing cross drain under Canal C-9 may be oversized and they are looking at reducing the size, which may allow crossing the canal above the cross drain.
- Basin C-10 is split between C-10 East and C-10 West due to the bridge over Canal C-10 making it difficult to convey stormwater from one side to the other. Some alternatives use a compensating treatment approach to combine the basins. For Basin C-10 West, MTWCD indicated that there are some drainage issues between Krassner Drive and Canal C-10 along the north side of Malabar and the area lacks an outfall to the canal.
 - Inwood mentioned that they anticipate that the C-10 West Basin between Krassner Dr. and Canal C-10 is proposed to be untreated and discharged directly to the canal. An outfall will be proposed for the offsite conveyance north of Malabar Road.
 - Compensating treatment is proposed to be provided for this untreated basin. The recommended preferred stormwater pond for this basin is C-10 East Alt. 1, which is a series of swales along the south side of Malabar Road utilizing remnant parcels created by the roadway widening. Several of these are already City owned. The swales will be approximately 5 feet deep and the bottom width will vary from 9.5 feet to 23 feet.
 - There are three other alternative combinations for these basins. C-10 West Alt. 1 would be a standalone pond located in a City owned parcel. This pond can be used in conjunction with the C-10 East Alt. 1 swales, or with C-10 East Alt. 2. C-10 East Alt. 2 is a standalone pond located north of Malabar Road. This pond also has a potential expansion option (C-10 West Alt. 2, Option 2) which can replace the standalone C-10 West Alt. 1 pond.
 - *Everyone in the meeting concurred that C-10 East Alt. 1, utilizing the swales with compensation for C-10 West, is the recommended preferred alternative.*
- For Basin C-20, Inwood mentioned that the two previous pond site alternatives (Alt. 1 and Alt. 2) had to be slightly adjusted in size due to new geotechnical information for the water table. Control elevations of the ponds were adjusted, however, the parcels where the ponds are situated remained the same.

- For Pond C-20 Alt. 1, the size of the pond increased to 7.04 acres. The pond was reshaped and moved toward the back of the parcel and an easement is proposed for pipe conveyance along the eastern side of the parcel, towards Malabar Road.
- For Pond C-20 Alt. 2, the size also increased and now the proposed pond occupies the entire parcel (whole take).
- Two supplemental dry swales are proposed for this basin. These swales will occupy remnant parcels created by the roadway widening. A few of these parcels are owned by the City. The treatment volume available in these swales has been subtracted from the required treatment volume for the Alt. 1 and Alt. 2 ponds, and it is intended that the selected pond would be used in conjunction with the swales.
- Contamination screenings from the Draft CSER show that Pond C-20 Alt. 2 contains an arsenic groundwater plume. If this pond site is chosen as the preferred, remediations for the arsenic plume will be required during excavation and dewatering of the site.
- The total pond costs shown for Alt. 1 are substantially more than Alt. 2. Remediation costs for the arsenic plume are not anticipated to be more than the difference in total pond costs between the two alternatives.
- Therefore, Pond C-20 Alt. 2 will be the recommended preferred stormwater pond for this basin.
- MTWCD asked how the pond will outfall. Inwood mentioned that it is anticipated that the outfall will be to Canal C-20 with a crossing under Malabar Road.
- MTWCD asked if a retaining wall will be needed for Canal C-20 for the proposed bulb out for the road, just across from Sutherland Dr. SW. Kittelson mentioned that this area will be refined and there is a possibility that a retaining wall may not be needed at this location.
- MTWCD advised that it will be good if the maintenance vehicles could use the proposed sidewalk along the north side of Malabar for canal access. It is also noted along Canal C-20, the existing sidewalk along the canal's north side will be maintained and can be used for canal access.
- *Everyone in the meeting concurred that Pond C-20 Alt. 2 and the two supplemental swales will be the recommended preferred stormwater ponds.*
- At the eastern end of the study, a portion of Malabar Road is already collected and conveyed to an existing pond by the 7-11 gas station (west of Canal C-37).
 - Inwood indicated that the additional improvements in this area will have minimal to no impacts to the existing pond capacity. Treatment and attenuation volumes from Malabar Road are anticipated to remain similar to the permitted conditions.
 - Furthermore, existing permitted calculations for the pond show basin areas including the 7-11 gas station and the Cumberland Farms Gas Station site. With the development of the Cumberland Farms Gas Station, contributing areas were removed to the existing pond, thereby creating additional storage capacity for Malabar Road improvements (if needed).
 - *The City indicated that they own and maintain the existing pond and concur with using the pond for the minor improvements in this area.*
 - The 7-11 gas station also discharges to a retention pond south of the site. It is believed this retention pond was constructed as a temporary pond.
 - MTWCD discussed that the 7-11 gas station may want to expand their site. MTWCD asked if we were proposing to expand or modify the existing pond. Inwood indicated that the existing pond is not proposed to be expanded or modified.

Action Items:

Inwood will move forward with the recommended preferred pond sites as identified and begin finalizing draft reports. Kittelson will update the preferred concept documents and maps to show only the recommended preferred sites that have been identified.



Meeting Notes

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*****END OF MEETING*****

Note: The above reflects the writer's understanding of the contents of the meeting. If any misinterpretation or inaccuracies are included, please contact Renato Chuw at (407) 971-8850 as soon as possible for resolution and revisions if necessary.



Meeting Minutes

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Project: Malabar Road – PD&E Study

Date: December 9th, 2022

FPID: 437210-1-28-01

Time: 10:00 AM

Description: From St. Johns Heritage Pkwy. To Minton Rd.

Location: Microsoft Teams (Virtual)

Meeting Title: ELA Discussion with SJRWMD

MEETING ATTENDEES:

- Marc Van Heden, SJRWMD
- Gretchen Kelley, SJRWMD
- Rebecca Trudeau, SJRWMD
- Sheila Theus, SJRWMD
- Frank Watanabe, City of Palm Bay
- Mike McCabe, MTWCD
- Jack Freeman, Kittelson
- Dayna Duffy, Inwood Consulting Engineers
- Renato Chuw, Inwood Consulting Engineers

MEETING SUMMARY

- Renato Chuw began the meeting with a brief overview of the project including a KMZ file showing the proposed roadway concept, project limits, and pond site alternatives. The study plans to widen Malabar Road from two to four lanes starting at St. Johns Heritage Parkway (SJHP) to Minton Road. Pedestrian accommodations and drainage improvements are also proposed.
- Renato then explained the purpose of the meeting and the Environmental Look Arouds (ELA) process established by FDOT. The main goal of the meeting is to discuss with SJRWMD whether their upcoming C-10 Reservoir project has any potential for joint-use/regional stormwater treatment with the Malabar Road study. Additionally, if SJRWMD is aware of any other nearby projects that would satisfy ELA requirements, those can be discussed.
- Renato explained that preliminary plans were provided by MTWCD for the C-10 Reservoir a few months ago. Inwood inquired if more information is available including:
 - What is the purpose of the project?
 - How is the project set up/how does it work?
 - What is the timing for completing design and going to construction?
- Marc first mentioned that it appears the Malabar Road study project will not impact the district lands. Frank explained the intent for the City to do a land swap with the property owner at the SW corner of SJHP and Malabar Road but that also won't affect the district lands.

- Renato also mentioned that the current pond alternatives for the basin between the C-7 and C-8 canals are located to the east of the C-7 canal, but planned development on those parcels will impact both pond site alternatives.
- Marc explained that SJRWMD is trying to determine whether or not the C-10 project will meet resiliency criteria to receive state funding and that a meeting will be held to discuss this. If it qualifies for state funding to meet the resiliency criteria, they will be able to move forward and are looking at a 2-year timeline. If not, they will need to re-design the C-10 project, which will take 4-5 years. Marc will follow up next week on the project status.
- Marc indicated that the C-10 was not designed specifically as a regional stormwater management site. It was mostly designed for nutrient reduction to the C-1 Canal and the Indian River Lagoon. It could be possible to have a pumped system coming in from Malabar Road, but it's never been looked at or considered. In addition, a pump system may face regulatory hurdles.
- Renato explained that on other projects with nutrient loading reduction requirements, we would calculate the nutrient load requirements and include them in the design of the regional stormwater project. This is sometimes done as a cost-share. Marc mentioned that there is a rule that allows for this, but it hasn't been considered for this project.
- Renato discussed that there is also the concern of runoff attenuation. MTWCD has discharge criteria for their canal systems that has to be met. In order for this to work as a regional stormwater approach, MTWCD would need to waive the discharge criteria or allow the increased runoff to be accepted in their canals. Another option would be to provide smaller ponds for attenuation only. Marc agreed with attenuation concerns.
- Mike indicated that the MTWCD would not waive the discharge criteria for new impervious area. He believes all the new development in the area will continue to increase flows in the canals. He has not recently looked at the hydraulic models, but he is aware that the C-1 Canal has backed up into the C-7 during peak stages.
- Renato asked if there is a report/narrative available for the C-10 reservoir project. Marc will look and see what is available. He is only aware of the modeling calculations.
- Mike asked if the C-1 reservoir was maxed out and whether it could handle additional runoff/treatment from Malabar Road. He believes that when the C-1 reservoir was completed, it was not fully excavated due to sawgrass being restored in the area. SJRWMD did not know whether this would be an option but the C-1 reservoir is about a mile west of the Malabar study project and doesn't seem very feasible.
- Renato also explained that the middle basins of the project utilize City of Palm Bay owned parcels as well as remnant parcels impacted by the roadway widening and FDOT agreed that it was not necessary to investigate ELA for these basins. The main concerns are the C-7 basin and C-20 basin on each end of the project.

Action Items:

SJRWMD to provide calculations/narrative for the C-10 Reservoir Project. Inwood to document ELA discussion in PSR.

*****END OF MEETING*****

Note: The above reflects the writer's understanding of the contents of the meeting. If any misinterpretation or inaccuracies are included, please contact Renato Chuw at (407) 971-8850 as soon as possible for resolution and revisions if necessary.

Dayna Duffy

From: Hickson, Ferrell <Ferrell.Hickson@dot.state.fl.us>
Sent: Friday, December 16, 2022 3:05 PM
To: Renato Chuw
Subject: RE: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arouds - C-10 Water Management Area (Meeting Minutes)

Thanks Renato...

FERRELL

Ferrell L. Hickson, Jr. P.E.
District Drainage Design Engineer, District Five
Florida Department of Transportation
719 South Woodland Boulevard, MS 2-553
DeLand, FL 32720
Office (386) 943-5433
Cell (386) 956-5087

From: Renato Chuw <rchuw@inwoodinc.com>
Sent: Friday, December 16, 2022 1:59 PM
To: Hickson, Ferrell <Ferrell.Hickson@dot.state.fl.us>
Cc: Freeman, Jack <jfreeman@kittelton.com>
Subject: FW: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arouds - C-10 Water Management Area (Meeting Minutes)

EXTERNAL SENDER: Use caution with links and attachments.

Hi Ferrell,

Just wanted to forward you the email with the attached meeting minutes. This is for the Malabar Road P&E study that we are doing with the City of Palm Bay. About a month ago we had met with you to discuss some ELA comments from ERC on our Pond Siting Report. Just wanted to let you know that we are going through the process.

Thanks,

Renato

From: Renato Chuw
Sent: Friday, December 16, 2022 1:39 PM
To: Marc Van Heden <mvanhede@sjrwmd.com>; stheus@sjrwmd.com; rtrudeau@sjrwmd.com; gkelley@sjrwmd.com; Frank.Watanabe@palmbayflorida.org; Mike McCabe <mike@melbournetillman.org>; Graeber, David <David.Graeber@dot.state.fl.us>; Jack Freeman <jfreeman@kittelton.com>; Travis Hills <thills@kittelton.com>; Dayna Duffy <dduffy@inwoodinc.com>

Subject: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arouns - C-10 Water Management Area (Meeting Minutes)

Good afternoon all,

Attached are the meeting minutes for the Environmental Look Around / potential regional stormwater discussion meeting held on Friday, December 9th, with SJRWMD, the City of Palm Bay, MTWCD, and consultant staff for the study.

Please let me know if there are any questions or edits on the minutes.

Thanks,

Renato

Renato E. Chuw, PE

Associate Principal – Drainage Section Manager

INWOOD CONSULTING ENGINEERS

3000 Dovera Dr., Suite 200, Oviedo, FL 32765

P: 407-971-8850

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Dayna Duffy

From: Gerena, Rachel <Rachel.Gerena@brevardfl.gov>
Sent: Monday, January 9, 2023 2:47 PM
To: Renato Chuw
Cc: Frank.Watanabe@palmbayflorida.org; Jack Freeman; Travis Hills; Dayna Duffy
Subject: RE: RE: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arounds

Renato,

Thank you for reaching out. I do not believe that we have any regional studies or plans occurring in that area of the County. We do have the ACE for the SJHP down there but it is not far enough along to consider combined stormwater and is not funded for any future phases at this time.

Thanks,
Rachel

From: Renato Chuw <rchuw@inwoodinc.com>
Sent: Monday, January 9, 2023 1:22 PM
To: Gerena, Rachel <Rachel.Gerena@brevardfl.gov>
Cc: Frank.Watanabe@palmbayflorida.org; Jack Freeman <jfreeman@kittelton.com>; Travis Hills <thills@kittelton.com>; Dayna Duffy <dduffy@inwoodinc.com>
Subject: RE: RE: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arounds

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Hi Rachel,

I had sent the email below prior to the holidays regarding having a meeting with appropriate county staff regarding if there were any potential regional stormwater opportunities with any County projects and our PD&E study for the Malabar Road project that we are doing for the City.

Thanks,

Renato

From: Renato Chuw
Sent: Friday, December 16, 2022 2:12 PM
To: Gerena, Rachel <Rachel.Gerena@brevardfl.gov>
Cc: Frank.Watanabe@palmbayflorida.org; Jack Freeman <jfreeman@kittelton.com>; Travis Hills <thills@kittelton.com>; Dayna Duffy <dduffy@inwoodinc.com>
Subject: RE: FPID 437210-1 – Malabar Road PD&E Study – Environmental Look Arounds

Good afternoon Rachel,

Kittelton and Associates along with Inwood Consulting Engineers are working on the PD&E Study for improvements on Malabar Road for the City of Palm Bay. The limits of the study is from the St. Johns Heritage Pkwy (SJHP) to Minton Road. We are nearing towards completion of the study and have completed our Pond Siting Report.

During the reviews from FDOT, it was requested to document the Environmental Look Around (ELA) process which is investigating if regional stormwater opportunities / joint use options are available.

We would like to set up a virtual (Teams) meeting with the county to discuss if any opportunities are available. I was not sure who the appropriate county person would be best to have this meeting (stormwater, planning, land management, engineering?)

We are looking to hold this meeting after the holiday in early to mid January. Could you give us some potential dates/times to meet?

Thanks,

Renato

Renato E. Chuw, PE

Associate Principal – Drainage Section Manager

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