

DRAFT LOCATION HYDRAULIC REPORT

Florida Department of Transportation

District 1

Bradenton-Palmetto Connector

Limits of Project: US 41/SR 55

from US 301/SR 683 at 9th Street East to North of 25th Street East

Manatee, Florida

Financial Management Number: 444843-1-22-01

ETDM Number: 14507

Date: June 2026

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.

EXECUTIVE SUMMARY

The Florida Department of Transportation (FDOT), District One (D1) is conducting a Project Development and Environment (PD&E) study, known as the Bradenton-Palmetto Connector (BPC), to evaluate capacity and mobility improvements to United States (US) 41/State Road (SR) 55/1st Street (St)/Tamiami Trail (Trl) and US 301/SR 683 including roadway widening, bridge reconstruction, new stormwater management facilities (SMF), new floodplain compensation (FPC) sites, and bicycle and pedestrian accommodations. This PD&E study begins at US 301/SR 683 at 9th St East in the City of Bradenton, Florida and continues north to US 41 north of 25th St East in the City of Palmetto, Florida. The project also crosses the Manatee River. The study limits extend approximately 4.5 miles, all within Manatee County.

In 2025, FDOT D1 completed a PD&E study for the Hernando DeSoto Bridge (structure #130053) Replacement from westbound SR 64 to Haben Boulevard (Blvd) in Manatee County, Florida (FPID 442630-1-22-01, ETDM 14510). That study evaluated replacing the existing four lane DeSoto Bridge with a new four lane bridge that included wider shoulders, upgraded pedestrian facilities and other safety features. The DeSoto Bridge Replacement PD&E study limits fall within the BPC PD&E study limits; however, it did not include adding lanes for capacity improvements. This BPC PD&E study does include adding additional lanes both on the roadway and the DeSoto Bridge to accommodate capacity needed within the project study area.

This Location Hydraulics Report (LHR) was prepared to evaluate the hydraulic, drainage, floodplain, and cross drain impacts associated with the proposed improvements to US 41/SR 55 from US 301/SR 683 at 9th Street East to north of 25th Street East in Manatee County, Florida. The report supports the PD&E Study by documenting existing drainage conditions, assessing floodplain impacts, and evaluating the hydraulic performance of existing and proposed cross drains.

Data collection and evaluation included reviews of existing drainage conditions, Federal Emergency management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), floodplain limits from watershed modeling data, and existing cross-drain infrastructure. Hydraulic analyses were completed for nine existing cross drains to evaluate peak flows and water surface elevations under existing and proposed conditions. Floodplain impacts associated with roadway widening, bridge replacement, and stormwater management improvements were also assessed, and floodplain compensation sites were identified to satisfy regulatory requirements.

Summary of improvements,

- Floodplain impacts for Interim Improvements - 0.013 ac-ft of floodplain impact identified; 0.017 ac-ft of compensation provided.
- Floodplain impacts for Ultimate Improvements - 0.675 ac-ft of floodplain impact identified; 1.123 ac-ft of compensation provided.
- Cross drain Improvements: Nine cross drains were evaluated throughout the corridor; CD-1 will be replaced with a 3' x 6' box culvert, CD-2 will be upsized to a 42-inch pipe, and several cross drains will be extended to accommodate roadway widening; Peak stages are reduced or maintained under proposed conditions, and no roadway overtopping is anticipated for the 50-year design storm.

In conclusion, the proposed drainage, floodplain compensation, and cross drain improvements adequately support the interim and ultimate widening of US 41 and the replacement of the DeSoto Bridge. The evaluation demonstrates compliance with applicable FDOT, FEMA, and Southwest Florida Water Management District (SWFWMD) criteria while minimizing floodplain impacts, maintaining hydraulic performance, and supporting the project's transportation and safety objectives.

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SECTION 1 INTRODUCTION

1.1 PD&E STUDY PURPOSE

The objective of this Project Development & Environment (PD&E) study is to assist the Florida Department of Transportation (FDOT) Office of Environmental Management (OEM) in reaching a decision on the type, location, and conceptual design of the proposed improvements for the widening of United States (US) 41 and US 301. This study documents the need for improvements as well as the procedures utilized to develop and evaluate various improvements, including elements such as proposed typical sections, preliminary horizontal alignments, and intersection enhancements.

The PD&E study satisfies all applicable requirements, including the National Environmental Policy Act (NEPA), to qualify for federal-aid funding of subsequent development phases (design, right-of-way acquisition, and construction).

1.2 PROJECT PURPOSE AND NEED

The purpose of the project is to provide additional capacity and accommodate transportation demand across the Manatee River, specifically between the cities of Bradenton and Palmetto and the numerous communities in western Manatee County, as part of the regional transportation system. Another project goal is to enhance safety. The need for the project is based on the following criteria: capacity, transportation demand, and safety.

1.3 PROJECT DESCRIPTION

The FDOT District One (D1) is conducting a PD&E study, known as the Bradenton-Palmetto Connector (BPC), to evaluate capacity and mobility improvements to US 41/State Road (SR) 55/1st Street (St)/Tamiami Trail (Trl) and US 301/SR 683 including roadway widening, bridge reconstruction, new stormwater management facilities (SMF), new floodplain compensation (FPC) sites, and bicycle and pedestrian accommodations. The study limits begin at US 301/SR 683 from 9th St East, north of the City of Bradenton, Florida, and continue along US 41 to north of 25th St East, north of the City of Palmetto, Florida. The project also crosses the Manatee River. The study limits extend approximately 4.5 miles, all within Manatee County. The project location and study limits are shown in **Figure 1-1**.

In 2025, FDOT D1 completed a PD&E study for the Hernando DeSoto Bridge (structure #130053) Replacement from westbound SR 64 to Haben Boulevard (Blvd) in Manatee County, Florida (FPID 442630-1-22-01, ETDM 14510). That study evaluated replacing the existing four-lane DeSoto Bridge with a new four-lane bridge that included wider shoulders, upgraded pedestrian facilities, and other safety features. The DeSoto Bridge Replacement PD&E study limits fall within the BPC PD&E study limits; however, it did not include adding lanes for capacity improvements. This BPC PD&E study does include adding additional lanes both on the roadway and the DeSoto Bridge to accommodate capacity needed within the project study area.



Figure 1-1 Project Location Map

1.4 EXISTING FACILITY AND PROPOSED IMPROVEMENTS

1.4.1 Existing Facility

The study begins on US 301 at 9th St East, where the alignment traverses west, turns north, and crosses the northbound leg of South Tamiami Trl. US 301 then combines with US 41 north of the CSX Railroad at-grade crossing (RR#624712-B). US 301 is a four-lane divided roadway where the median alternates between grassed vegetation and a concrete barrier. The facility contains open drainage and paved shoulders. There are no bicycle lanes or sidewalks. A representation of the lane arrangement is shown in **Figure 1-2**.

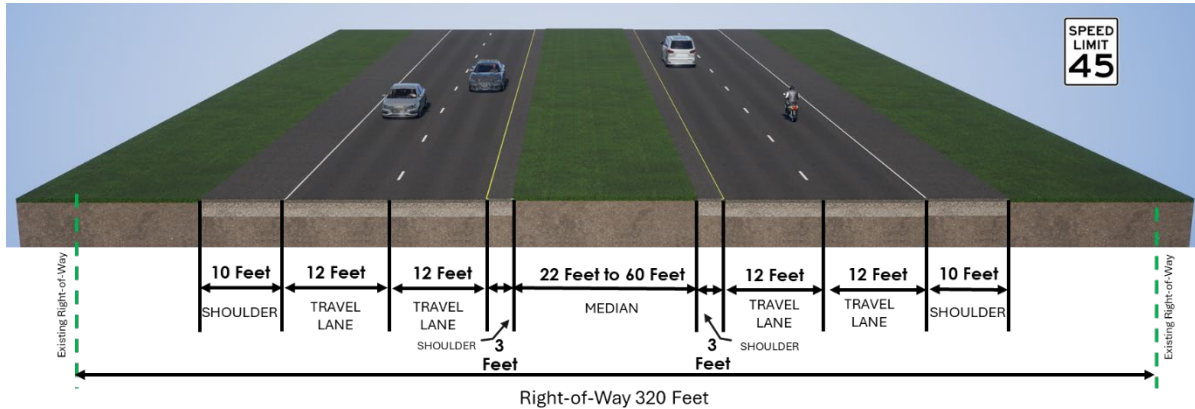


Figure 1-2 Existing Roadway Typical Section: US 301

North of the US 301 junction with US 41, from the CSX Railroad at-grade crossing (RR#624712-B) to north of westbound SR 64, the US 41/US 301 roadway varies between a maximum of four northbound lanes to a minimum of two northbound lanes and a maximum of three southbound lanes to a minimum of two southbound lanes. The median varies between a grassed median, concrete separator, and concrete barrier. Stormwater runoff is conveyed through a closed drainage system, and there are sidewalks along both sides of the roadway until north of westbound SR 64, where there is no sidewalk on the east side and sporadic sidewalk on the west side. There are no bicycle lanes within these limits. Exclusive right- and left-turn lanes are used at select intersections, including all signalized intersections at 13th Avenue (Ave), 9th Ave, eastbound SR 64/6th Ave, and westbound SR 64. Although the roadway's right-of-way width varies, it is generally 125 feet wide. The posted speed limit is 45 miles per hour (mph). A representation of the lane arrangements is shown in **Figure 1-3**.

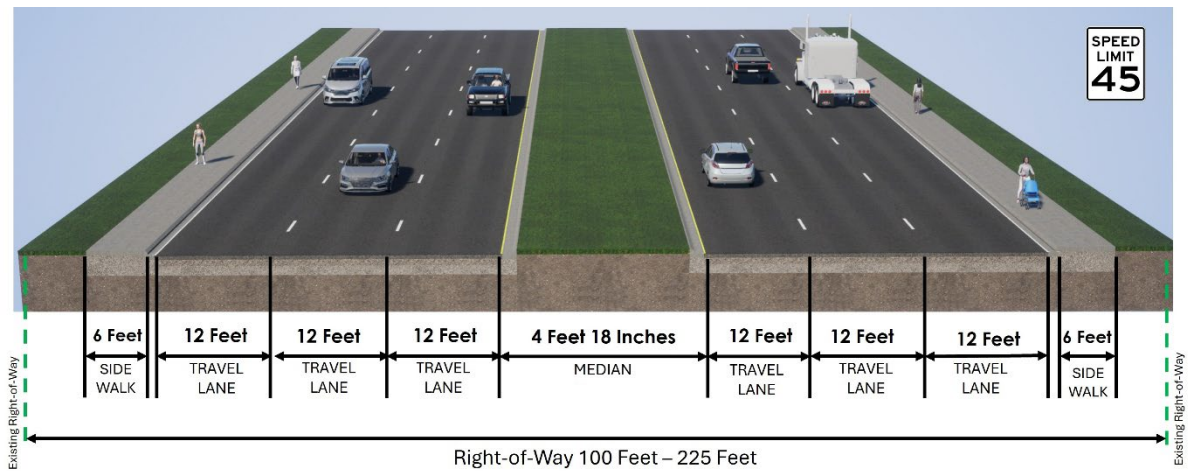


Figure 1-3 Existing Roadway Typical Section: South of DeSoto Bridge

North of westbound SR 64, US 41 continues as a four-lane divided roadway and crosses the Manatee River via the DeSoto Bridge. The bridge has substandard elements with design deficiencies, including narrow shoulders, discontinuous pedestrian facilities, and substandard bridge rails.

The existing typical section for the DeSoto Bridge is a divided four-lane highway comprised of two 12-foot travel lanes, a two-foot outside shoulder in each direction, and a four-foot raised median and barrier wall, as shown in **Figure 1-4**. The total bridge width is approximately 62 feet. The posted speed limit is 50 mph.

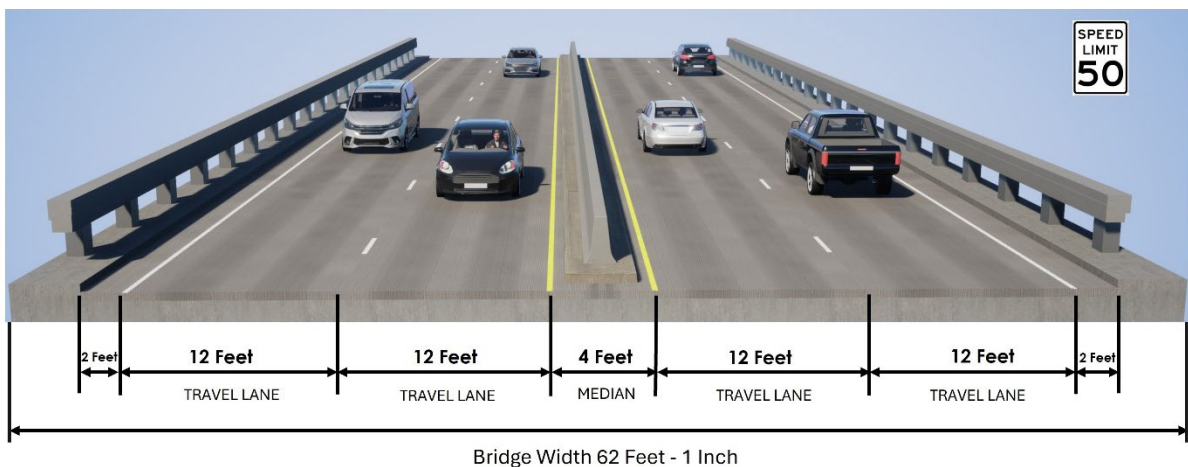


Figure 1-4 Existing Structure Typical Section: DeSoto Bridge

North of the DeSoto Bridge to north of 25th St East, the typical roadway section consists of two 12-foot travel lanes in each direction. The median varies between a grass median and a concrete traffic separator. The roadway transitions from paved shoulders and open drainage to curb and gutter and closed drainage north of the US 301/10th St East interchange. There are no sidewalks from north of the DeSoto Bridge to 17th St East, there are continuous sidewalks from 17th St East to 25th St East, and there are no sidewalks north of 25th St East to the end of the project limits. There are no bicycle lanes.

The roadway's right-of-way width varies, but it is generally 120 feet. The posted speed limit is 50 mph. A representation of the lane arrangements is shown in **Figure 1-5**.

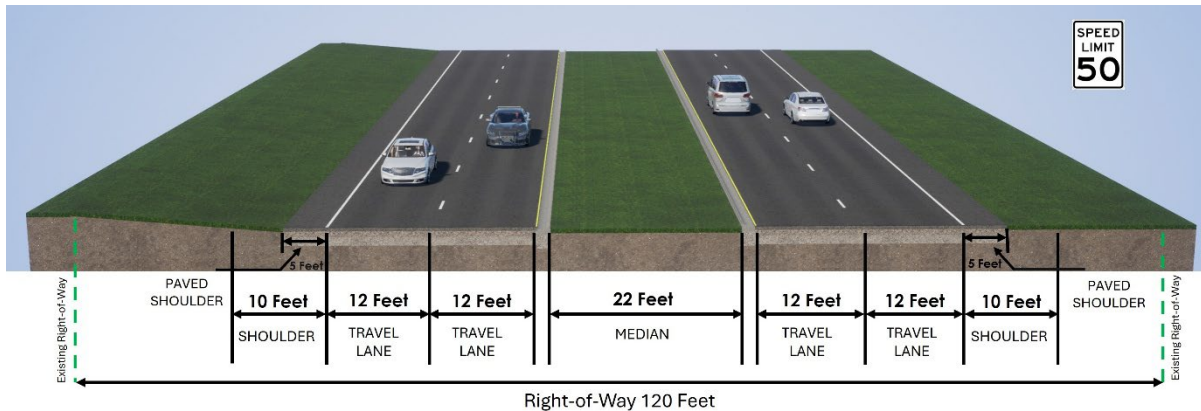


Figure 1-5 Existing Roadway Typical Section: North of DeSoto Bridge

1.4.2 Proposed Improvements

The proposed improvements associated with the Preferred Alternative include widening the roadway from four to six general-purpose lanes and adding two elevated proposed express lanes supported by median piers. Additional improvements include drainage upgrades and enhanced bicycle and pedestrian facilities, including sidewalks south of the DeSoto Bridge and shared-use paths north of the DeSoto Bridge. In addition to the Preferred Alternative, due to funding constraints and the potential need to toll the Preferred Alternative's elevated lanes, an Interim Improvement is proposed between westbound SR 64 and US 301. This Interim Improvement would widen the roadway from four to six lanes and remove and replace the DeSoto Bridge with six travel lanes and a shared-use path on both sides. The Interim Improvements comprise 1.7 miles of the total project length and do not include the elevated proposed express lanes.

Analysis of the Preferred Alternative does not assume any of the Interim Improvements are constructed. Instead, the study compares the Preferred Alternative to the existing/No-Build condition. This PD&E study evaluates the No-Build alternative and the Preferred Alternative. However, this study also includes information on the Interim Improvements to clearly quantify the impacts of both the Preferred Alternative and Interim Improvements. The Preferred Alternative and Interim Improvement limits are shown in **Figure 1-6**.



Figure 1-6 Preferred Alternative and Interim Improvements

Preferred Alternative

Corridor improvements begin at US 301 and 9th St East, which travels west to intersect US 41, continues north, crossing the Manatee River, and ends north of 25th St East. The improvements are divided into three typical sections: south of the DeSoto Bridge, the DeSoto Bridge, and north of the DeSoto Bridge, to demonstrate the roadway and bridge configurations along the Preferred Alternative.

South of the DeSoto Bridge: The proposed typical section consists of six 11-foot lanes divided by a median that widens to 22 feet to accommodate the elevated structure. The at-grade roadway includes six-foot sidewalks on both sides and no bicycle lanes. The proposed right-of-way is approximately 120 feet wide. The proposed design speed is 45 mph from 9th St East on US 301 to 13th Ave on US 41, 40 mph from 13th Ave to westbound SR 64, and 45 mph from westbound SR 64 to the DeSoto Bridge. Two 15-foot proposed express lanes are provided in the US 301 median via an elevated structure that begins just west of 9th St East. The elevated structure follows US 301 through a northern curve near US 41/SR 45/S Tamiami Trail, where US 301 joins US 41. This typical section is shown in **Figure 1-7**.

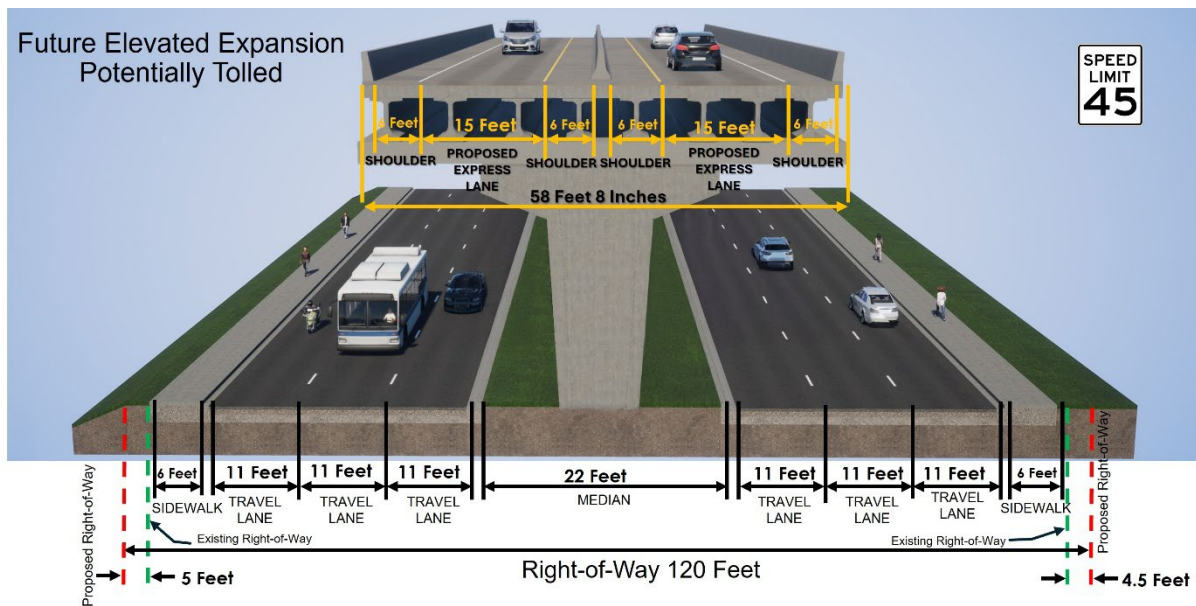


Figure 1-7 Preferred Roadway Typical Section: South of DeSoto Bridge

DeSoto Bridge: The proposed express lanes transition from an elevated structure to match the elevation of the travel lanes on DeSoto Bridge. The transition occurs just north of westbound SR 64. The new DeSoto Bridge consists of eight travel lanes (six travel lanes and two proposed express lanes), plus a barrier-separated 12-foot shared-use path on both sides. The bridge is approximately 164 feet wide. The proposed design speed is 45 mph. In addition, the proposed express lanes are buffer-separated from the travel lanes via flexible tubular markers as shown in **Figure 1-8**.

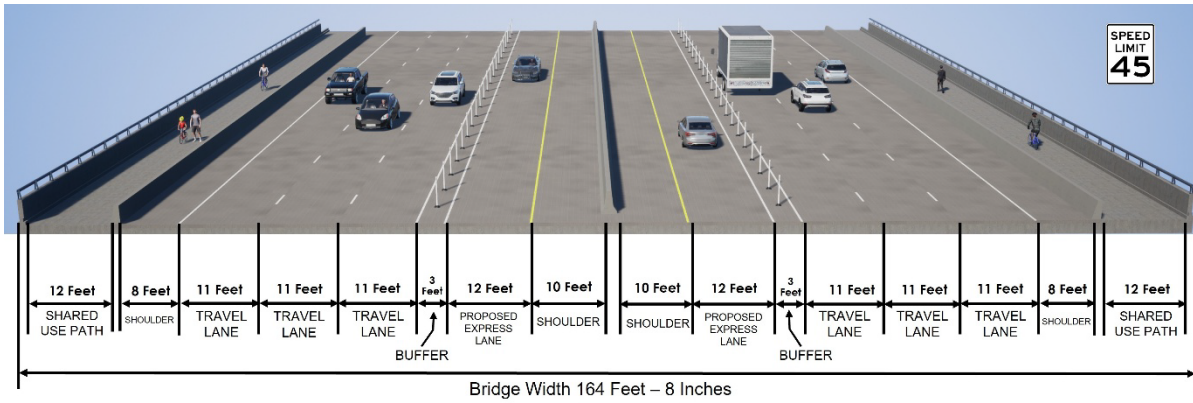


Figure 1-8 Preferred Roadway Typical Section: DeSoto Bridge

North of the DeSoto Bridge: This typical section is comprised of six 11-foot lanes divided by a median that widens to 32.5 feet to accommodate the elevated structure. The at-grade roadway includes a 12-foot shared-use path on both sides of US 41. The proposed right-of-way is approximately 176 feet, and the proposed design speed is 45 mph. The proposed express lanes transition back to an elevated structure in the roadway median, north of the bridge over the CSX Railroad Short Line, spanning the intersections from 17th St East to 25th St East. A conceptual view of the proposed express lanes elevated above the travel lanes is shown in **Figure 1-9**.

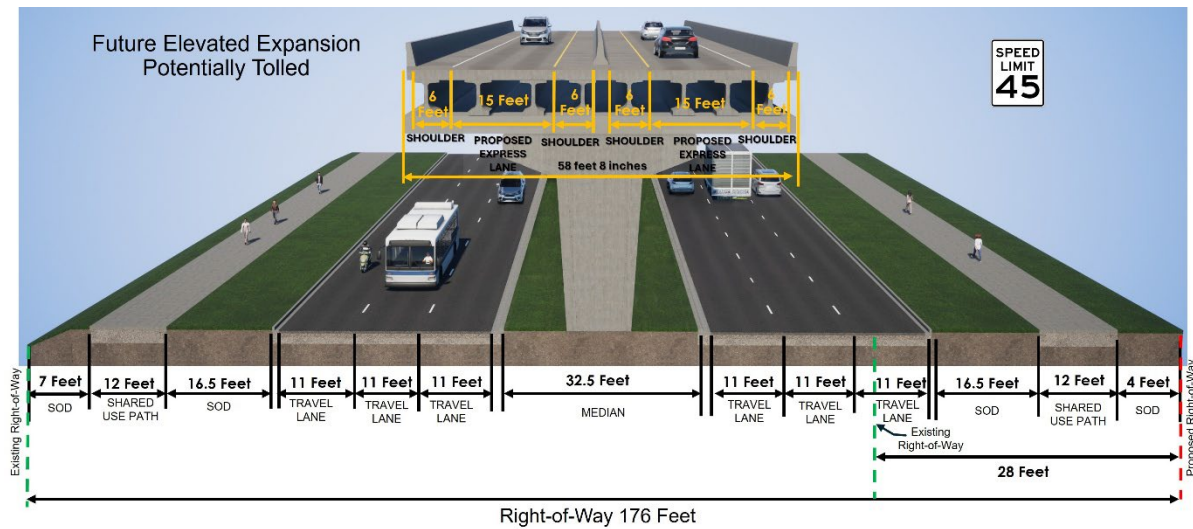


Figure 1-9 Preferred Roadway Typical Section: North of DeSoto Bridge

Interim Improvements:

The limits of the Interim Improvements are from westbound SR 64 to US 301, as shown in **Figure 1-10**. The improvements are divided into three typical sections: south of the DeSoto Bridge, the DeSoto Bridge, and north of the DeSoto Bridge, to demonstrate the roadway and bridge configurations. The Interim Improvements are consistent with the full limits of the previously approved DeSoto Bridge Replacement PD&E Study (FPID 442630-1-22-01, ETDM 14510). The difference between the prior study and the Interim Improvements is that the prior DeSoto Bridge Replacement PD&E studied only replacing the DeSoto Bridge with a new four-lane structure but did not evaluate capacity improvements. Whereas the Interim Improvement would widen the roadway from four to six lanes and remove and replace the DeSoto Bridge with six travel lanes and a shared-use path on both sides.

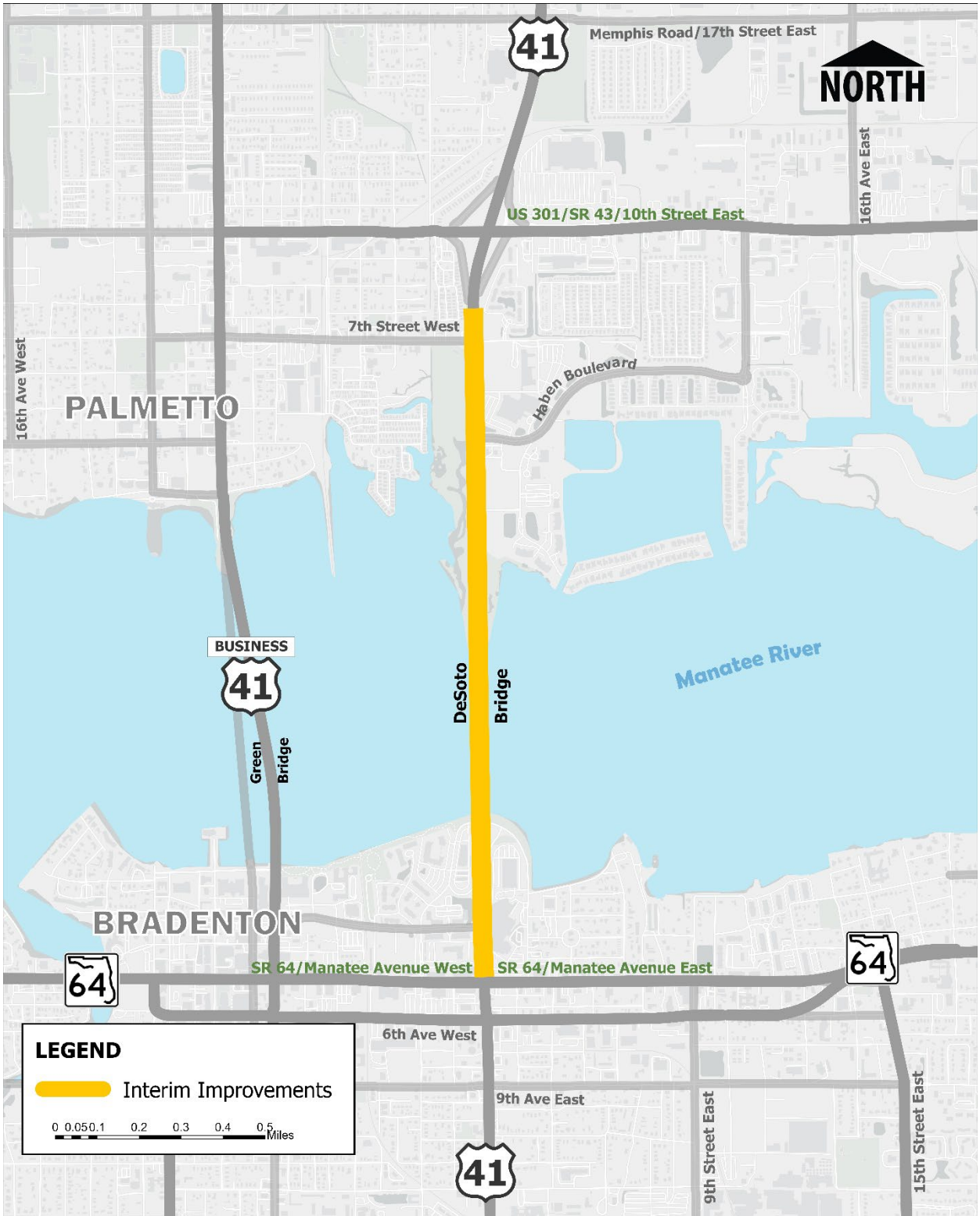


Figure 1-10 Interim Improvements Project Limits

South of the DeSoto Bridge: The typical section consists of six 11-foot travel lanes, divided by a median ranging from eight to 18 feet, and provides six-foot sidewalks on both sides of US 41 with no bike lanes. The proposed right-of-way is approximately 136 feet wide, sufficient to accommodate the elevated structure for future proposed express lanes when the Preferred Alternative is constructed. The proposed design speed is 45 mph. The conceptual lane arrangements for the Interim Improvement south of the DeSoto Bridge are shown in **Figure 1-11**.

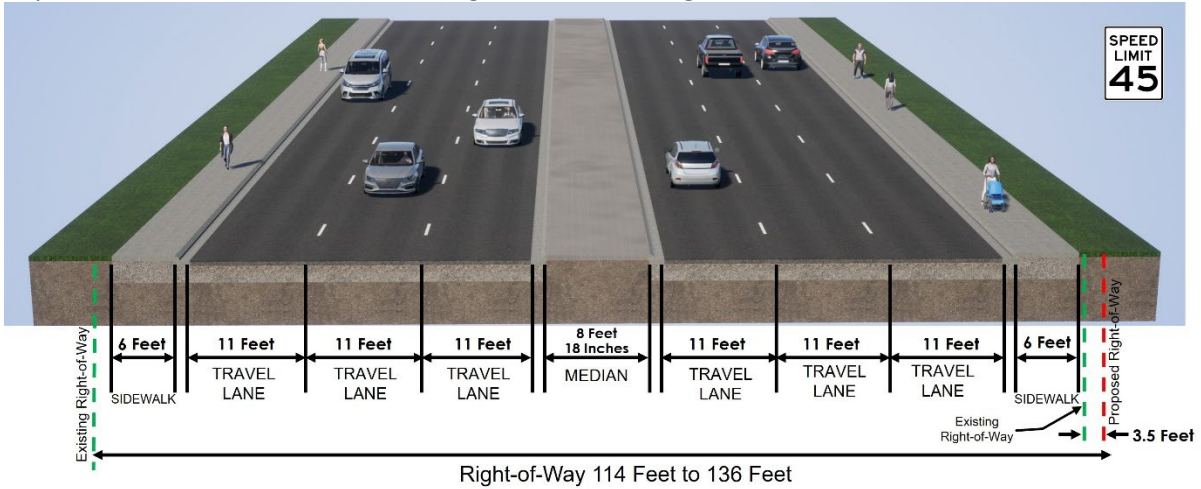


Figure 1-11 Interim Improvements South of DeSoto Bridge

DeSoto Bridge: The Interim Improvement includes the replacement of the DeSoto Bridge, where six 11-foot travel lanes divided by a concrete barrier median and eight-foot inside shoulders in each direction are proposed. The typical section also includes a 12-foot shared-use path and outside shoulders on both sides of the bridge. The bridge will be designed to accommodate future widening of the structure so that proposed express lanes could be added when the Preferred Alternative is constructed. The proposed right-of-way is approximately 128 feet, and the proposed design speed is 45 mph. The lane arrangements on the DeSoto Bridge with the Interim Improvements are shown in **Figure 1-12**.

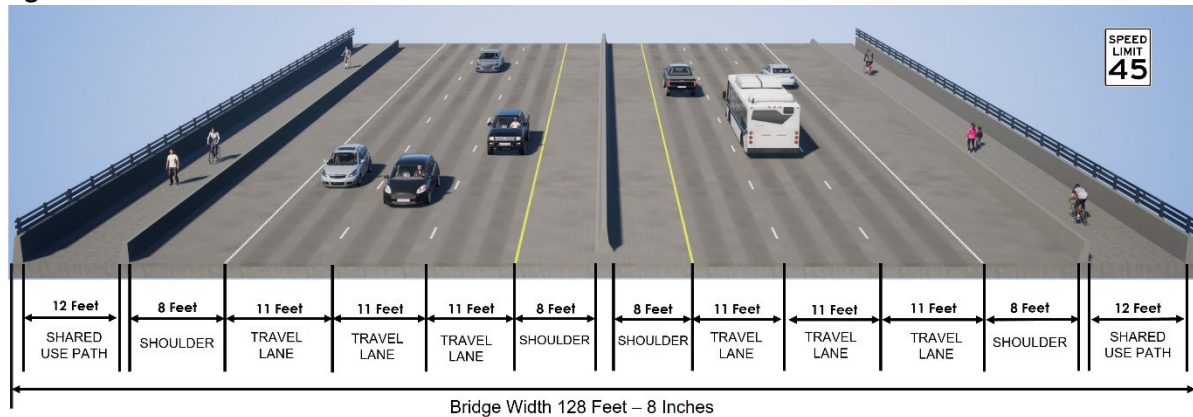


Figure 1-12 Interim Improvements DeSoto Bridge

North of the DeSoto Bridge: The typical section consists of six 11-foot travel lanes divided by a 32.5-foot median, which is wide enough to accommodate the elevated structure for future proposed express lanes when the Preferred Alternative is constructed. A 12-foot shared-use path is provided on both sides of the roadway. The proposed right-of-way is approximately 176 feet, and the proposed design speed is 45 mph. The conceptual lane arrangements for the Interim Improvements north of the DeSoto Bridge are shown in **Figure 1-13**.

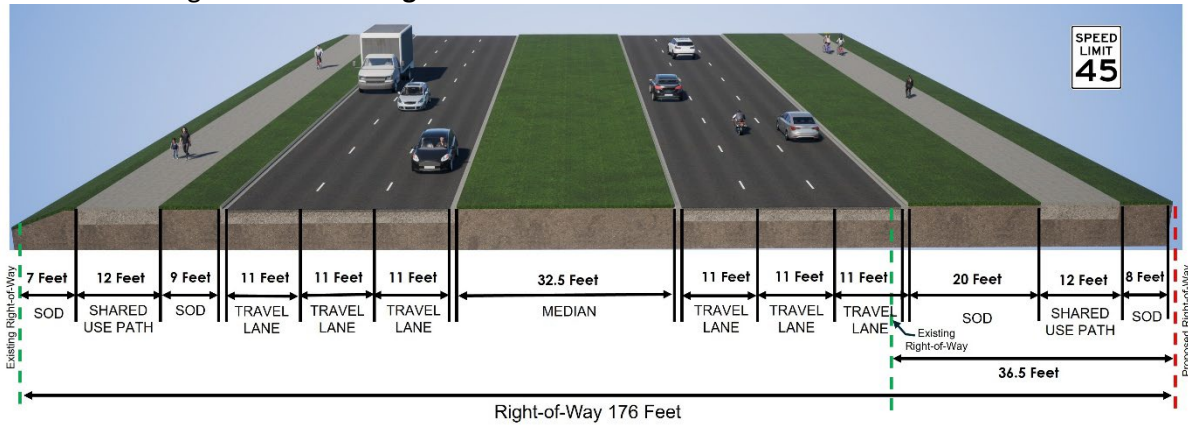


Figure 1-13 Interim Improvements North of DeSoto Bridge

1.5 REPORT PURPOSE

The purpose of this Location Hydraulics Report (LHR) is to document existing drainage patterns, evaluate floodplain impacts, and assess the potential effects of the proposed US 41/SR 55 roadway, bridge, stormwater management, and multimodal improvements on cross drains within the project corridor. The report supports the PD&E Study for the BPC and provides hydraulic analyses, floodplain evaluations, and drainage design recommendations necessary to accommodate the proposed improvements. This LHR was conducted in accordance with the FDOT PD&E Manual, the FDOT Drainage Manual, Federal Emergency Management Agency (FEMA) requirements, and applicable Southwest Florida Water Management District (SWFWMD) regulations and guidelines.

SECTION 2 EXISTING CONDITIONS

2.1 DRAINAGE PATTERNS

The US 41 project corridor is a 4-lane divided urban roadway that crosses the Manatee River between Bradenton and Palmetto via DeSoto Bridge.

South of the bridge, the existing drainage system is urban in nature and consists of curb inlets and a storm sewer network extending from the US 301 bridge to the Manatee River. Refer to **Figure 1-3** for the existing typical section at South of Desoto Bridge. Drainage basins located between the US 301 bridge and 9th Street discharge through a series of ditches, storm sewer connections, and channels that ultimately outfall to the Manatee River. Refer to **Figure 1-2** for the existing typical section at US 301.

North of the bridge, roadway runoff is primarily conveyed through roadside ditches. The ultimate outfall for both the northern and southern drainage systems is the Manatee River. Currently, no stormwater management facilities serve the US 41 roadway or the DeSoto Bridge. The northernmost basin within the project corridor extends from approximately 19th Street in the south to the northern project limit at the intersection of US 41 and Bayshore Road. The general stormwater flow direction within this basin is from north to south, with the outfall located approximately 100 feet north of 19th Street on the east side of the roadway. Stormwater in this basin is primarily conveyed through a system of pipes, catch basins, and manholes. Refer to **Figure 1-5** for the existing typical section at North of Desoto Bridge.

The bridge over the Manatee is a four-lane divided urban roadway, originally built in 1957. The bridge deck is drained through scuppers that allow runoff to discharge directly into the river below. Pavement conditions within the project limits are fair, with minimal rutting and light to moderate full-depth cracking. Access management is limited along the corridor. The south end is surrounded by commercial, retail, recreational, high-density residential, and institutional land uses, while the north end is largely undeveloped, zoned for community development and public use. Refer to **Figure 1-4** for the existing bridge typical section.

The National Oceanic and Atmospheric Administration (NOAA) monitoring at Redfish Point on the Manatee River recorded Mean High and Mean Low water levels at 2.04 ft and 0.33 ft, respectively.

2.2 FEMA INFORMATION

The project's drainage design is to provide floodplain compensation in compliance with FEMA, SWFWMD, and FDOT guidelines. No net encroachment shall occur as a result of the proposed activity.

All floodplain within the right-of-way is assumed to be completely impacted. This includes both existing right-of-way as well as areas where additional right-of-way has been proposed for roadway or use as stormwater management facilities.

The following floodplain information for the project area was reviewed:

- FEMA Flood Maps – The Flood Insurance Rate Map (FIRM) Community-Panel Number that

includes the project area is 12081C0168F, 12081C0164F, 12081C0306F, 12081C0302F, effective August 10, 2021. Please refer to the project FEMA FIRMs included in Appendix A.

- City of Bradenton Watershed Study – The City of Bradenton Watershed model was used for floodplain evaluations and impacts for US 41, South of DeSoto Bridge. Please refer to Appendix A.

2.3 CROSS DRAINS

There is a total of nine cross drains located along the project corridor. Please see below Table for a list of cross drains within the project corridor. Refer to Appendix A for straight line diagrams. Please refer to the Pond Siting Report (PSR) for the detailed basin discussion.

TABLE 2-1 CROSS DRAIN SUMMARY FOR THE EXISTING CONDITION

| Pipe ID | Station | Road | Basin | Existing Condition | | | |
|---------|---------|-------|-------|--------------------|------------|------------|-------------|
| | | | | Size | US FL (ft) | DS FL (ft) | Length (ft) |
| CD-1 | 508+04 | US301 | 1 | (2) 36" | 20.02 | 19.62 | 188 |
| CD-2 | 242+37 | US41 | 4 | 24" | -0.80 | -0.85 | 171 |
| CD-3 | 251+00 | US41 | 6N | 24" | 4.50 | 4.03 | 70 |
| CD-4 | 252+07 | US41 | 5N | 24" | 7.09 | 6.75 | 49 |
| CD-5 | 260+54 | US41 | 7 | 30" | 4.71 | 4.50 | 143 |
| CD-6 | 258+21 | US41 | 7 | 30" | 4.48 | 4.12 | 162 |
| CD-7 | 258+87 | US41 | 8 | 30" | 3.94 | 3.53 | 65 |
| CD-8 | 259+86 | US41 | 8 | 30" | 3.40 | 3.04 | 100 |
| CD-9 | 269+09 | US41 | 9 | 24" | 8.95 | 8.41 | 195 |

CD-1

A double 36" RCP located in Basin 1 at US 301 station 508+04 that brings a total contributing area of 51.86 ac. from south of US 301 to north of US 301, then discharges to the existing channel north through "Tropicana" private property. CD-1 contributing area includes half of on-site Basin 1C (4.65 ac.) and off-site Basin 1F (47.21 ac.). Basin 1F consists of pasture lands, roadways, commercial sites, and residential properties. Existing channel geometry property at the downstream of CD-1 is used as the tailwater condition.

CD-2

A 24" RCP located in Basin 4 at US 41, Station 242+37, conveys runoff from a total contributing area of 20.62 ac. from the east side to the west side of US 41. The flow then discharges to an existing channel that ultimately connects to the downstream Manatee River. The CD-2 contributing drainage area includes on-site Basins 4A (2.10 ac.), 6N (3.28 ac.), and 6S (3.72 ac.), as well as off-site Basin 4C (11.52 ac.). Basin 4C consists of an existing apartment complex, with attenuation systems that discharge to CD-2 via three 18" cross drains, and ultimately to CD-2. Existing channel geometry property at the downstream of CD-2 is used as the tailwater condition.

CD-3

A 24" RCP located in Basin 6N at US 41 station 251+00 on the right side below the northbound exit ramp that brings a total contributing area of 3.28 ac. from Basin 6N to Basin 6S, then discharges to the existing ditch that connects to Basin 4 and eventually outfalls to the Manatee River. CD-3 contributing area includes the entire on-site Basin 6N (3.28 ac.). Basin 6N consists of roadway and open space areas (US 301 interchange infield). Crown of pipe is used as the tailwater condition.

CD-4

A 24" RCP located in Basin 5S and 5N at US 41 Station 252+07 on the left side below the southbound entrance ramp that brings a total contributing area of 3.51 ac. from Basin 5N to Basin 5S, then discharges to the existing ditch that connects to Basin 4 and eventually outfalls to the Manatee River. CD-4 contributing area includes on-site Basin 5S (3.51 ac.). Basin 5S consists of roadway and open space areas (US 301 interchange infield). Crown of pipe is used as the tailwater condition.

CD-5

A 30" RCP located in Basin 7 at US 41 Station 260+54 that brings a total contributing area of 4.43 ac. from off-site Basin 7C and Basin 7A to the east of US 41 off-ramp, then discharges to the existing downstream cross drains (CD-6, CD-7, and CD-8), storm sewer system, channel, and ultimately outfalls to the Manatee River. CD-5 contributing area includes on-site Basin 7A (2.63 ac.) and off-site Basin 7C (1.80 ac.). Contributing area to CD-5 consists of roadway, open space area, and residential properties. Headwater results from CD-6 are used as a rating curve for the tailwater condition of CD-5.

CD-6

A 30" RCP located in Basin 7 and Basin 8 at US 41 Station 258+21 that brings all areas through CD-5 (4.43 ac.) and additional area of 3.10 ac. from Basin 7B, then discharges to the existing downstream cross drain (CD-7 and CD-8), storm sewer system, channel, and ultimately outfalls to the Manatee River. Basin 7B to CD-6 consists of roadway and open space area (US 301 interchange infield). Headwater results from CD-7 are used as a rating curve for the tailwater condition of CD-6.

CD-7

A 30" RCP located in Basin 8 at US 41 Station 258+87 that brings all areas through CD-6 and additional area of 2.55 ac. from Basin 8A located at the east of US 41 on-ramp, then discharges to the existing downstream cross drain (CD-8) storm sewer system, channel, and ultimately outfalls to the Manatee River. Basin 8A consists of roadway and open space area (US 301 interchange infield). Headwater results from CD-8 are used as a rating curve for the tailwater condition of CD-7.

CD-8

A 30" RCP located in Basin 8 at US 41 Station 259+86 that brings all areas through CD-7 and additional area of 0.66 ac. from Basin 8B located at the east of US 41 on-ramp, then discharges to the existing downstream storm sewer system, channel, and ultimately outfalls to the Manatee River. Basin 8B consists of roadway and open space area (US 301 interchange infield). Crown of pipe is used as the tailwater condition.

CD-9

A 24" RCP located in Basin 9 at US 41 Station 269+09 that brings a total contributing area of 1.43 ac. from off-site Basin 9C and on-site Basin 9D to the east of US 41, then discharges to the existing downstream channel, and ultimately outfalls to the Manatee River. CD-9 contributing area includes portion of on-site Basin 9D (0.43 ac.) and off-site Basin 9C (1.00 ac.). Contributing area to CD-9 consists of rail, open space area, residential properties and woodlands. Crown of pipe is used as the tailwater condition.

Additionally, a 12' X 8' Concrete Box Culvert (CBC) located in Basin 9 at US 41 Station 274+76 serves as a pedestrian tunnel connecting west and east of US 41. No contributing drainage area is anticipated through the pedestrian tunnel. Therefore, no hydraulic analysis is required for this 12' X 8' CBC.

See table below for the summary of existing cross drain peak flows and peak stages. Stages highlighted in red indicate overtopping at the crest elevation to the roadway.

TABLE 2-2 PEAK FLOW AND PEAK STAGE SUMMARY FOR THE EXISTING CONDITION

| PIPE ID | Crest Elevation (ft) | EXISTING CONDITION | | | | | | | |
|---------|----------------------|--------------------|--------|--------|--------|-----------------|-------|--------|--------|
| | | PEAK FLOW (cfs) | | | | PEAK STAGE (ft) | | | |
| | | 25-YR | 50-YR | 100-YR | 500-YR | 25-YR | 50-YR | 100-YR | 500-YR |
| CD-1 | 27.50 | 146.73 | 173.61 | 205.42 | 349.21 | 26.93 | 27.64 | 27.79 | 28.25 |
| CD-2 | 5.50 | 69.94 | 82.75 | 97.91 | 166.45 | 5.76 | 5.81 | 5.87 | 6.09 |
| CD-3 | 10.00 | 6.29 | 7.45 | 8.81 | 14.98 | 6.18 | 6.24 | 6.32 | 6.84 |
| CD-4 | 11.10 | 10.65 | 12.61 | 14.92 | 25.36 | 9.12 | 9.26 | 9.46 | 10.99 |
| CD-5 | 16.00 | 13.50 | 15.98 | 18.90 | 32.14 | 10.09 | 11.32 | 11.95 | 15.06 |
| CD-6 | 10.00 | 22.20 | 26.26 | 31.08 | 52.83 | 9.34 | 10.27 | 10.48 | 10.82 |
| CD-7 | 10.00 | 31.35 | 37.10 | 43.89 | 74.62 | 8.46 | 9.63 | 10.18 | 10.54 |
| CD-8 | 10.00 | 33.51 | 39.65 | 46.91 | 79.75 | 7.19 | 7.85 | 8.78 | 10.29 |
| CD-9 | 39.00 | 3.71 | 4.39 | 5.19 | 8.83 | 10.49 | 10.52 | 10.57 | 10.90 |

SECTION 3 PROPOSED DESIGN

3.1 WETLAND IMPACTS

The Wetland impacts are as indicated in Appendix A. There are estuary impacts along the project corridor, which are associated with the bridge and roadway widen only. No wetland impacts caused by the proposed drainage upgrades are anticipated.

3.2 DESIGN CRITERIA AND APPROACH

Agencies having jurisdiction over the design of the stormwater management facilities include the FDOT, and the SWFWMD.

Cross drain:

- Design frequency: 50-year design frequency is used for all cross drain design based on the FDOT Drainage Manual Section 4.3.1.
- Tailwater: Use Mean High water when downstream is tidally influenced. Use crown of pipe when there is no available downstream information. Use downstream channel geometry where applicable.
- Clearances: No overtopping the roadway at the 50-year design frequency.
- Clear zone for end walls: 24' for travel lanes & multi-lane ramps and 14' for auxiliary lanes & single lane ramps for design speed of 45 mph. A 4' clear zone is also used on the outside of Shared Use Paths when all roadway clear zones are met. Refer to FDOT Design Manual Section 215.2.3.
- Cross drain sizing: Rational method is used to determine the estimated flow rate. Use National Oceanic and Atmospheric Administration (NOAA) Atlas data for estimating precipitation intensity.

Floodplain: This project crosses several known floodplains. Floodplain impact storage is calculated by using volumetric method between the Seasonal High Water Table (SHWT) and 100-year 24-hour Base Flood Elevation (BFE) from City of Bradenton Watershed Model. The FPC site alternatives were sized to provide cup-for-cup compensation in order to avoid any net encroachment into the floodplain. The project was reviewed for SHWT values versus existing ground within existing floodplain limits, which yielded the existing ground being a higher value. In lieu of this, the existing ground elevation was used for setting the bottom stratum for both impact calculations and FPC design. To determine how the proposed roadway improvements would affect the 100-year floodplain a preliminary analysis was performed using City of Bradenton model. No watershed riverine model is available North of the Desoto Bridge. However, all floodplains at the Palmetto section are considered tidal influence areas, which will not be required to provide any FPC sites for any tidal floodplain impact.

Encroachment Type: Minimal Encroachments - Minimal encroachments on a floodplain occur when there is floodplain involvement but the impacts on human life, transportation facilities, and natural

and beneficial floodplain values are not significant and can be resolved with minimal efforts. Normally, these minimal efforts to address the impacts consist of applying FDOT’s drainage design standards and following the WMD’s procedures to achieve results that will not increase or significantly change the flood elevations and/or limits.

FPC alternatives: Two FPC alternatives will be provided per each base flood elevation impact for the Ultimate Improvements. One FPC will be provided for the Interim Improvements.

Sea Level Impact: Sea Level Impact Projection (SLIP) study report was prepared and determined year 2100’s High Sea level (6.69) will have adverse impacts to stormwater management facilities (higher than the pond design stage as well as the lowest US 41 edge of pavement) based on the regional sea level rise scenarios. Refer to Appendix I for SLIP study.

3.3 FLOODPLAIN COMPENSATION SITES FOR THE INTERIM IMPROVEMENTS

The Interim Improvements contain Basin 3, Basin 4, Basin 5, and Basin 6. There are no improvements within Basin 5 and Basin 6 from 7th St. E. to US 301 for the Interim Improvements. Therefore, FPCs for Basin 5 and Basin 6 are not evaluated for the Interim Improvements. FPC sites are proposed for areas South of DeSoto Bridge that impact the watershed floodplains. One FPC site per floodplain impact will be provided. North of DeSoto Bridge, the project falls within a FEMA tidal zone, avoiding the need to provide for any floodplain compensation. Therefore, FPCs for Basin 4 are not evaluated for the Interim Improvements. Please refer to the Pond Siting Report for each basin discussion.

3.3.1 Basin 3

Basin 3 is an open basin that begins at US 41 with station 163+06 and extends approximately to station 193+08. One floodplain impact is determined at the south end of the Desoto Bridge crossing Riverfront Blvd (from station 180+32 to station 182+23) with BFE = 4.08. No floodplain impact is anticipated beyond the elevated bridge limit. Floodplain compensation is required to accommodate for 0.013 ac-ft of floodplain volume impact.

FPC 1

FPC 1 is located at the southeast corner of Riverfront Blvd and US 41 crossing from station 181+08 to station 181+59. Approximately 0.06 ac. with 0.017 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation. FPC 1 is within the US 41 right-of-way.

The Interim Improvements floodplain impact and compensation are summarized below in Table 3-1.

TABLE 3-1: FPC SUMMARY FOR THE INTERIM IMPROVEMENTS

| FPC name | Baseline | Side | Begin Station | End Station | BFE (ft) | Watershed Node | Impacted Volume (ac-ft) | Compensation Volume (ac-ft) |
|----------|----------|------|---------------|-------------|----------|----------------|-------------------------|-----------------------------|
| FPC 1 | US 41 | RT. | 181+08 | 181+59 | 4.08 | ND0700 | 0.013 | 0.017 |
| Total: | | | | | | | 0.013 | 0.017 |

3.4 FLOODPLAIN COMPENSATION SITES FOR THE ULTIMATE IMPROVEMENTS

Two alternative FPC sites per each floodplain impact are proposed for areas south of DeSoto Bridge that impact the watershed floodplains. Alternative One is proposed to be the Preferred Alternative out of the two alternatives for all basins. North of DeSoto Bridge, the project falls within a FEMA tidal zone, avoiding the need to provide for any floodplain compensation.

3.4.1 Basin 1

Basin 1 is an open basin that begins at US 301 with station 501+97 and extends approximately to US 41 with station 114+56. Two floodplain impacts are determined along the eastbound of US 301 from station 501+97 to station 510+24 with the BFE of 24.65 and 24.68. Use BFE of 24.68 for conservation purposes at this location since those two floodplains are connected with the existing roadside ditch. Floodplain compensation is required to accommodate for 0.311 ac-ft of floodplain volume impact.

FPC Alternative One

FPC 1 Alt. 1 is located along the roadside of US 301 eastbound from station 507+30 to 513+09. Approximately 0.85 ac. with 0.482 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation. FPC 1 Alt. 1 is within US 41 right-of-way.

FPC Alternative Two

FPC 1 Alt. 2 is located along the roadside of US 301 eastbound from station 408+86 to 505+50. Approximately 0.65 ac. with 0.415 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation. FPC 1 Alt. 2 is within US 41 right-of-way.

3.4.2 Basin 2

Basin 2 is an open basin that begins at US 41 with station 114+56 and extends approximately to US 41 with station 155+27. One floodplain impact is determined for alternative 1 from Dry Pond 2 Alt. 1. Floodplain impact starts from station 154+73 to station 157+37 with BFE of 16.63. Floodplain compensation is required to accommodate for 0.024 ac-ft of floodplain volume impact. No floodplain impact is anticipated for SMF Alternative Two and SMF Alternative Three in Basin 2. Therefore, FPC Alternative Two is not required.

FPC Alternative One

FPC 2 Alt. 1 is located at the same parcel as Dry Pond 2 Alt. 1 (parcel ID: 3175000059) from station 155+69 to station 155+89. Approximately 0.70 ac. with 0.159 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation.

3.4.3 Basin 3

Basin 3 is an open basin that begins at station 155+27 and extends approximately to station 191+61. One floodplain impact is determined at the south end of the Desoto Bridge crossing Riverfront Blvd (from station 180+32 to station 182+23) with the Base Flood Elevation (BFE = 4.08). No floodplain

impact is anticipated beyond the elevated bridge limit. Floodplain compensation is required to accommodate for 0.014 ac-ft of floodplain volume impact.

FPC Alternative One

FPC 3 Alt. 1 is located at the southeast corner of Riverfront Blvd and US 41 crossing from station 181+08 to station 181+59. Approximately 0.06 ac. with 0.017 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation. FPC 3 Alt. 1 is within US 41 right-of-way.

FPC Alternative Two

FPC 3 Alt. 2 is located along roadside US 41 northbound from station 172+94 to 174+53. Approximately 0.13 ac. with 0.050 ac-ft of floodplain compensation volume are required to provide adequate floodplain compensation. FPC 3 Alt. 2 is within US 41 right-of-way.

The Ultimate Improvements floodplain impact and compensation are summarized below in Table 3-2.

TABLE 3-2: FPC SUMMARY FOR THE ULTIMATE IMPROVEMENTS

| FPC name | Baseline | Side | Begin Station | End Station | BFE (ft) | Watershed Node | Impacted Volume (ac-ft) | Compensation Volume (ac-ft) |
|--------------|----------|------|---------------|-------------|----------|----------------|-------------------------|-----------------------------|
| FPC 1 Alt. 1 | US 301 | LT. | 507+30 | 513+09 | 24.68 | ND0910 | 0.311 | 0.482 |
| FPC 1 Alt. 2 | US 301 | LT. | 408+86 | 505+50 | 24.68 | ND0910 | 0.311 | 0.415 |
| FPC 2 Alt. 1 | US 41 | LT. | 155+69 | 155+89 | 16.63 | ND0750 | 0.024 | 0.159 |
| FPC 3 Alt. 1 | US 41 | LT. | 181+08 | 181+59 | 4.08 | ND0700 | 0.014 | 0.017 |
| FPC 3 Alt. 2 | US 41 | LT. | 172+94 | 174+53 | 4.08 | ND0700 | 0.014 | 0.050 |
| Total: | | | | | | | 0.675 | 1.123 |

3.5 CROSS DRAIN FOR THE INTERIM IMPROVEMENTS

The Interim Improvements contain Basin 3, Basin 4, Basin 5, and Basin 6. There are no improvements within Basin 5 and Basin 6 from 7th St. E. to US 301 for the Interim Improvements. Therefore, cross drains for Basin 5 and Basin 6 are not evaluated for the Interim Improvements. No cross drain identified in Basin 3 and one cross drain CD-2 identified in Basin 4. Please refer to the Pond Siting Report for each basin discussion.

CD-2

A 24" RCP located in Basin 4 at US 41 station 242+37. Existing upstream and downstream end walls at CD-2 will provide approximately 1:10 slope to tie into the proposed roadway widening including shoulders and sidewalk. No adverse impact to CD-2 is anticipated in the Interim Improvements. Contributing area and cross drain properties will remain the same. Therefore, no cross drain analysis will be evaluated for CD-2 for the interim Improvements.

3.6 CROSS DRAIN FOR THE ULTIMATE IMPROVEMENTS

There is a total of nine cross drains located along the project corridor. Please see the table below for a summary of existing and proposed cross drain properties. Refer to Appendix C for the cross drain analysis. Refer to the PSR for the detailed basin discussion.

TABLE 3-3: CROSS DRAIN SUMMARY FOR THE ULTIMATE IMPROVEMENTS

| Pipe ID | Station | Road | Basin | Proposed Condition | | | |
|---------|---------|-------|-------|--------------------|------------|------------|-------------|
| | | | | Size | US FL (ft) | DS FL (ft) | Length (ft) |
| CD-1 | 508+04 | US301 | 1 | 3'x6' | 20.00 | 19.60 | 212.00 |
| CD-2 | 242+37 | US41 | 4 | 42" | -0.80 | -0.85 | 181.00 |
| CD-3 | 251+00 | US41 | 6N | 24" | 4.50 | 3.77 | 88.40 |
| CD-4 | 252+07 | US41 | 5N | 24" | 7.09 | 6.72 | 53.50 |
| CD-5 | 260+54 | US41 | 7 | 30" | 4.71 | 4.50 | 143.00 |
| CD-6 | 258+21 | US41 | 7 | 30" | 4.48 | 4.12 | 175.00 |
| CD-7 | 258+87 | US41 | 8 | 30" | 3.94 | 3.53 | 65.00 |
| CD-8 | 259+86 | US41 | 8 | 30" | 3.40 | 3.04 | 100.00 |
| CD-9 | 269+09 | US41 | 9 | 24" | 9.10 | 8.20 | 266.00 |

CD-1

Based on the existing culvert hydraulic analysis, CD-1 already overtops at storm events between 25-year design event and 50-year design event. On-site Basin 1C is rerouted to treat in the proposed SMFs and directly discharge to the downstream of CD-1 to reduce the flow rate going through the current cross drain. Please refer to the PSR for SMF design. Only off-site Basin 1F will contribute flow rate to the proposed CD-1. Culvert upsizes from double 36" cross drain to 3'x6' box culvert is necessary to meet the minimal 50-year design event. Cross drain length is increased, and crest elevation is reduced to accommodate the roadway widening. Location of the cross drain will remain the same. Existing channel geometry property at the downstream of CD-1 is used as the tailwater condition.

CD-2

CD-2 is upsized to a 42" RCP and will continue to receive discharge from the off-site apartment complex. Under the Ultimate Improvements, contributing drainage to CD-2 will include on-site Basins 6N (3.28 ac.) and 6S (3.72 ac.), as well as off-site Basin 4C (11.52 ac.). Basin 4A will be rerouted to discharge to the SMF and outfalls to the Manatee River and will no longer contribute flow to CD-2 in the Ultimate Improvements. Cross drain length is increased, and crest elevation is reduced to accommodate the roadway widening. Location of the cross drain will remain the same. Existing channel geometry property at the downstream of CD-2 is used as the tailwater condition.

CD-3

New Stormwater Management Facilities such as Wet Pond 6N Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving the Basin 6N. Therefore, proposed flow rates at CD-3 are assumed to remain the same as the Existing Condition to provide realistic cross drain analysis. This cross drain is extended to accommodate the Shared Use Path. Cross

drain crest elevation will remain the same in the Ultimate Improvements. Crown of pipe is used as the tailwater condition.

CD-4

New Stormwater Management Facilities such as Wet Pond 5N Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving the Basin 5N. Therefore, proposed flow rates at CD-4 are assumed to remain the same as the Existing Condition to provide realistic cross drain analysis. This cross drain is extended to accommodate the Shared Use Path. Cross drain crest elevation will remain the same in the Ultimate Improvements. Crown of pipe is used as the tailwater condition.

CD-5

New Stormwater Management Facilities such as Wet Pond 7 Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving the Basin 7. Therefore, proposed flow rates at CD-5 are assumed to remain the same as the Existing Condition to provide realistic cross drain analysis. Existing end walls provide more than minimal clear zone requirement with the proposed Shared Use Path. Therefore, no culvert extension is required for CD-5. Cross drain crest elevation will remain the same in the Ultimate Improvements. Headwater results from CD-6 are used as a rating curve for the tailwater condition of CD-5.

CD-6

New Stormwater Management Facilities such as Wet Pond 7 Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving the Basin 7. Therefore, proposed flow rates at CD-6 are assumed to remain the same as the Existing Condition to provide realistic cross drain analysis. CD-6 is extended to accommodate the US 41 widening. Vertical abutments are anticipated at the bridge ends and along the sides to significantly minimize the cross drain extension and avoid complete replacement with a larger cross drain. Cross drain crest elevation will remain the same in the Ultimate Improvements. Headwater results from CD-7 are used as a rating curve for the tailwater condition of CD-6.

CD-7

New Stormwater Management Facilities such as Dry Pond 8 Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving Basin 8. Therefore, proposed flow rates at CD-7 are assumed to remain the same as the Existing Condition to provide realistic cross drain analysis. No adverse impact to CD-7 from the roadway widening. Therefore, no culvert extension is required for CD-7. Cross drain crest elevation will remain the same in the Ultimate Improvements. Headwater results from CD-8 are used as a rating curve for the tailwater condition of CD-7.

CD-8

New Stormwater Management Facilities such as Dry Pond 8 Alt. 1 will be provided in the Ultimate Improvements, which will meet the pre and post discharge rates leaving Basin 8. Therefore, proposed flow rates at CD-8 are assumed to remain the same as the Existing Condition to provide realistic cross

drain analysis. Existing end walls provide more than minimal clear zone requirement with the proposed Shared Use Path. Therefore, no culvert extension is required for CD-8. Cross drain crest elevation will remain the same in the Ultimate Improvements. Crown of pipe is used as the tailwater condition.

CD-9

On-site Basin 9D is rerouted to treat in the proposed SMFs and drains away from CD-8. Please refer to the PSR for SMF design. Only off-site Basin 9C will contribute flow rate to the proposed CD-8. Cross drain extension is required to accommodate the roadway widening. Crest elevation and size of the cross drain will remain the same. Crown of pipe is used as the tailwater condition.

Please see the table below for the summary of peak flow and stage at each cross drain. Stages highlighted in red indicate overtopping at the crest elevation to the roadway.

TABLE 3-4: PEAK FLOW AND PEAK STAGE SUMMARY FOR THE ULTIMATE IMPROVEMENTS

| PIPE ID | Crest Elevation (ft) | Overtopping Storm Event (YR) | ULTIMATE IMPROVEMENTS | | | | | | | |
|---------|----------------------|------------------------------|-----------------------|--------|--------|--------|-----------------|-------|--------|--------|
| | | | PEAK FLOW (cfs) | | | | PEAK STAGE (ft) | | | |
| | | | 25-YR | 50-YR | 100-YR | 500-YR | 25-YR | 50-YR | 100-YR | 500-YR |
| CD-1 | 26.50 | 99 | 132.03 | 156.22 | 184.84 | 314.24 | 24.50 | 25.37 | 26.53 | 27.07 |
| CD-2 | 5.00 | 95 | 61.84 | 73.17 | 86.57 | 147.17 | 3.61 | 4.40 | 5.06 | 5.31 |
| CD-3 | 10.00 | NA | 6.29 | 7.45 | 8.81 | 14.98 | 6.17 | 6.22 | 6.29 | 6.78 |
| CD-4 | 11.10 | NA | 10.65 | 12.61 | 14.92 | 25.36 | 9.06 | 9.19 | 9.36 | 10.74 |
| CD-5 | 16.00 | NA | 13.50 | 15.98 | 18.90 | 32.14 | 10.12 | 10.95 | 11.95 | 15.06 |
| CD-6 | 10.00 | 59 | 22.20 | 26.26 | 31.08 | 52.83 | 9.37 | 9.90 | 10.48 | 10.82 |
| CD-7 | 10.00 | 84 | 31.35 | 37.10 | 43.89 | 74.62 | 8.46 | 9.63 | 10.18 | 10.54 |
| CD-8 | 10.00 | 423 | 33.51 | 39.65 | 46.91 | 79.75 | 7.19 | 7.85 | 8.78 | 10.29 |
| CD-9 | 39.00 | NA | 3.01 | 3.56 | 4.21 | 7.15 | 10.48 | 10.51 | 10.55 | 10.78 |

Please see the table below for the peak stage comparison between the Existing Condition and the Ultimate Improvements at each cross drain. No overtopping at the 50-year design frequency is anticipated for all cross drains in the Ultimate Improvements.

TABLE 3-5: PEAK STAGE COMPARISON

| Pipe ID | Peak Stage Comparison Table | | | | | | | | | | | |
|---------|-----------------------------|-------|--------|--------|--------------------|-------|--------|--------|-------|-------|--------|--------|
| | Existing Condition | | | | Proposed Condition | | | | Delta | | | |
| | 25-YR | 50-YR | 100-YR | 500-YR | 25-YR | 50-YR | 100-YR | 500-YR | 25-YR | 50-YR | 100-YR | 500-YR |
| CD-1 | 26.93 | 27.64 | 27.79 | 28.25 | 24.50 | 25.37 | 26.53 | 27.07 | -2.43 | -2.27 | -1.26 | -1.18 |
| CD-2 | 5.76 | 5.81 | 5.87 | 6.09 | 3.61 | 4.40 | 5.06 | 5.31 | -2.15 | -1.41 | -0.81 | -0.78 |
| CD-3 | 6.18 | 6.24 | 6.32 | 6.84 | 6.17 | 6.22 | 6.29 | 6.78 | -0.01 | -0.02 | -0.03 | -0.06 |
| CD-4 | 9.12 | 9.26 | 9.46 | 10.99 | 9.06 | 9.19 | 9.36 | 10.74 | -0.06 | -0.07 | -0.10 | -0.25 |
| CD-5 | 10.09 | 11.32 | 11.95 | 15.06 | 10.12 | 10.95 | 11.95 | 15.06 | 0.03 | -0.37 | 0.00 | 0.00 |
| CD-6 | 9.34 | 10.27 | 10.48 | 10.82 | 9.37 | 9.90 | 10.48 | 10.82 | 0.03 | -0.37 | 0.00 | 0.00 |
| CD-7 | 8.46 | 9.63 | 10.18 | 10.54 | 8.46 | 9.63 | 10.18 | 10.54 | 0.00 | 0.00 | 0.00 | 0.00 |
| CD-8 | 7.19 | 7.85 | 8.78 | 10.29 | 7.19 | 7.85 | 8.78 | 10.29 | 0.00 | 0.00 | 0.00 | 0.00 |
| CD-9 | 10.49 | 10.52 | 10.57 | 10.90 | 10.48 | 10.51 | 10.55 | 10.78 | -0.01 | -0.01 | -0.02 | -0.12 |

SECTION 4 CONCLUSIONS

The hydraulic, drainage, floodplain, and cross drain analyses conducted for the BPC PD&E study demonstrate that the proposed interim and ultimate improvements, including roadway widening, DeSoto Bridge replacement, SMFs, FPC sites, and cross drain modifications, can be implemented while maintaining acceptable hydraulic performance throughout the project corridor. Floodplain impacts have been quantified and fully mitigated through the provision of adequate floodplain compensation, resulting in no net loss of floodplain storage. Evaluation of the nine cross drains indicates that the proposed replacements, upsizing, and extensions will maintain or improve drainage conveyance and reduce or maintain peak water surface elevations under proposed conditions. Additionally, the analysis confirms that no roadway overtopping is anticipated for the 50-year design storm. Based on the results of this study, the proposed improvements are consistent with applicable FDOT, FEMA, and SWFWMD criteria and support the project's capacity, safety, and multimodal transportation objectives while minimizing impacts to floodplain resources and preserving the functionality of the existing drainage system.

APPENDICES

Appendix A Figures

- Wetland Map
- FEMA FIRM Map
- Watershed Model Map
- Straight-Line Diagram
- Precipitation Frequency Data

Appendix B Typical Sections

Appendix C Floodplain Impact & FPC Exhibits

Appendix D Floodplain Impact & FPC Calculations

Appendix E Existing Cross Drain Exhibit

Appendix F Ultimate Cross Drain Exhibit

Appendix G Cross Drain Analysis

Appendix H Field Review

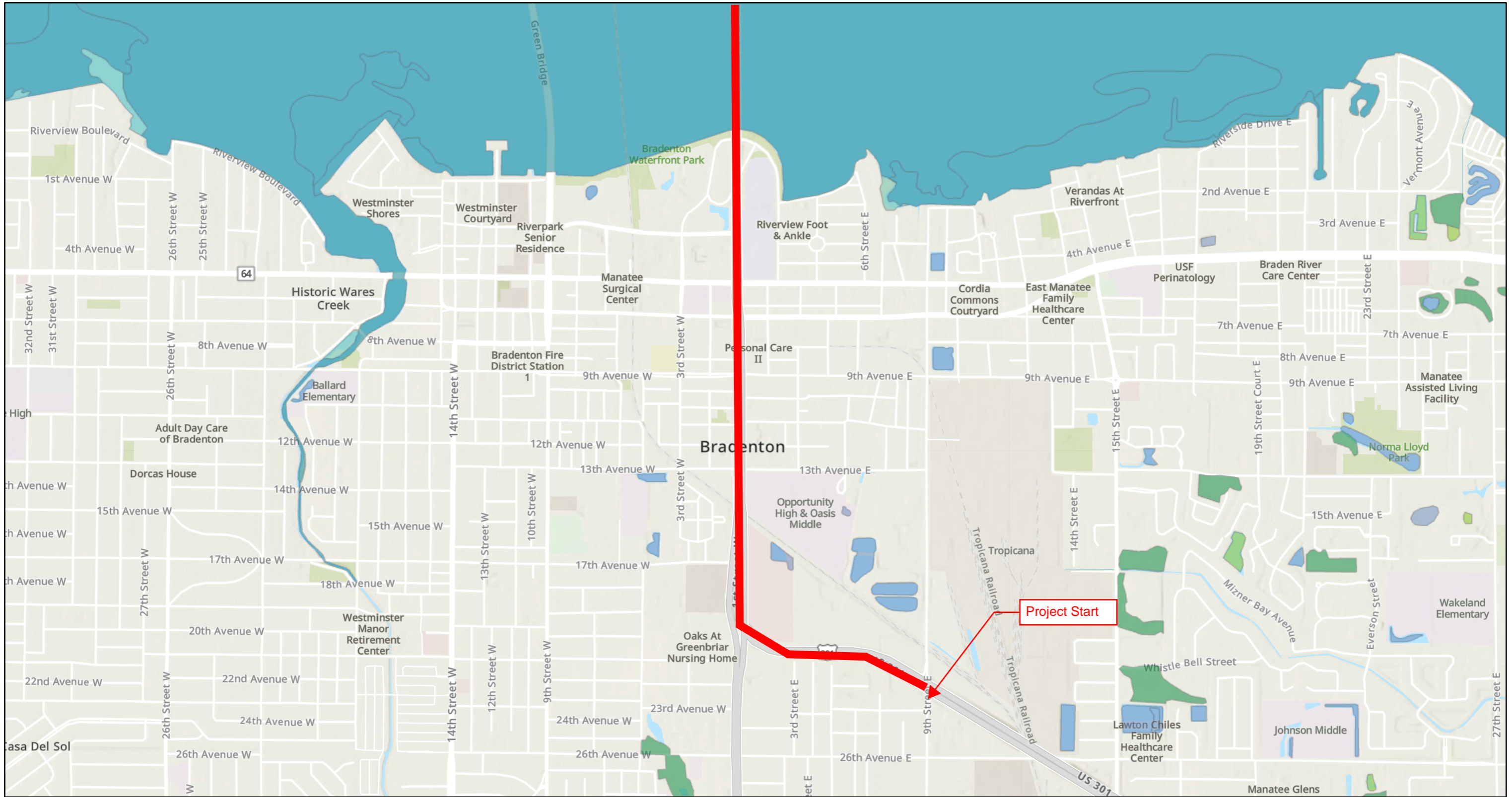
Appendix I Sea Level Impact Project Study

APPENDIX A

Maps

- Wetland Map
- FEMA FIRM Map
- Watershed Model Map
- Straight-Line Diagram
- Precipitation Frequency Data

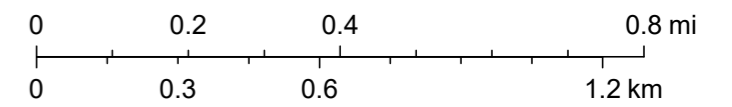
Wetland Map 1



March 27, 2026

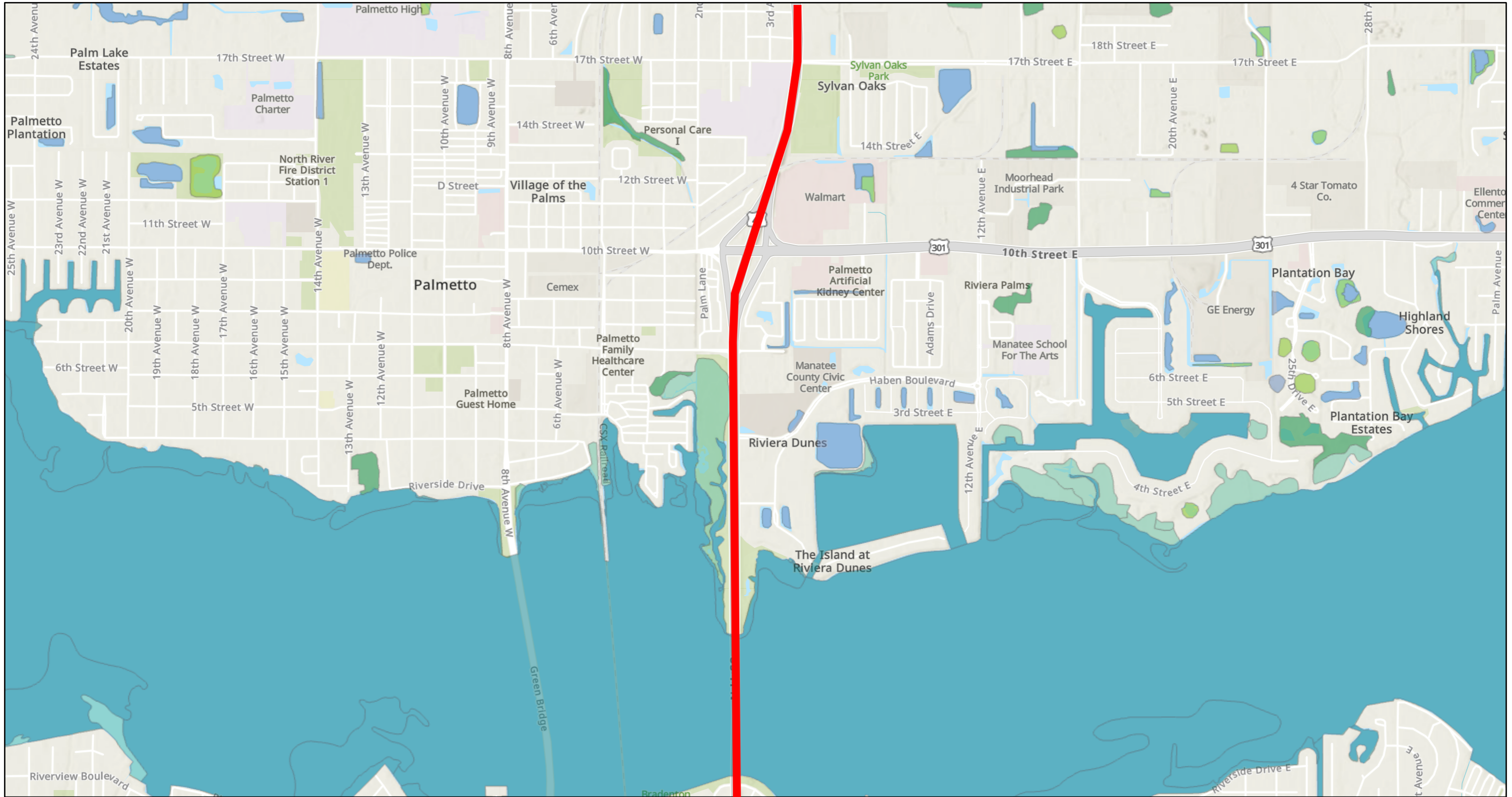
1:18,056

- | | |
|---|--|
| National Wetlands Inventory (areas) | Freshwater Forested/Shrub Wetland |
| Estuarine and Marine Deepwater | Freshwater Pond |
| Estuarine and Marine Wetland | Riverine |
| Freshwater Emergent Wetland | |



FDEP, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Esri, NASA, NGA, USGS, FEMA

Wetland Map 2



March 27, 2026

1:18,056

National Wetlands Inventory (areas)

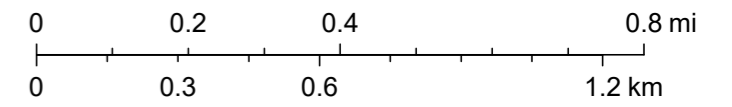
Estuarine and Marine Deepwater

Estuarine and Marine Wetland

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

Freshwater Pond

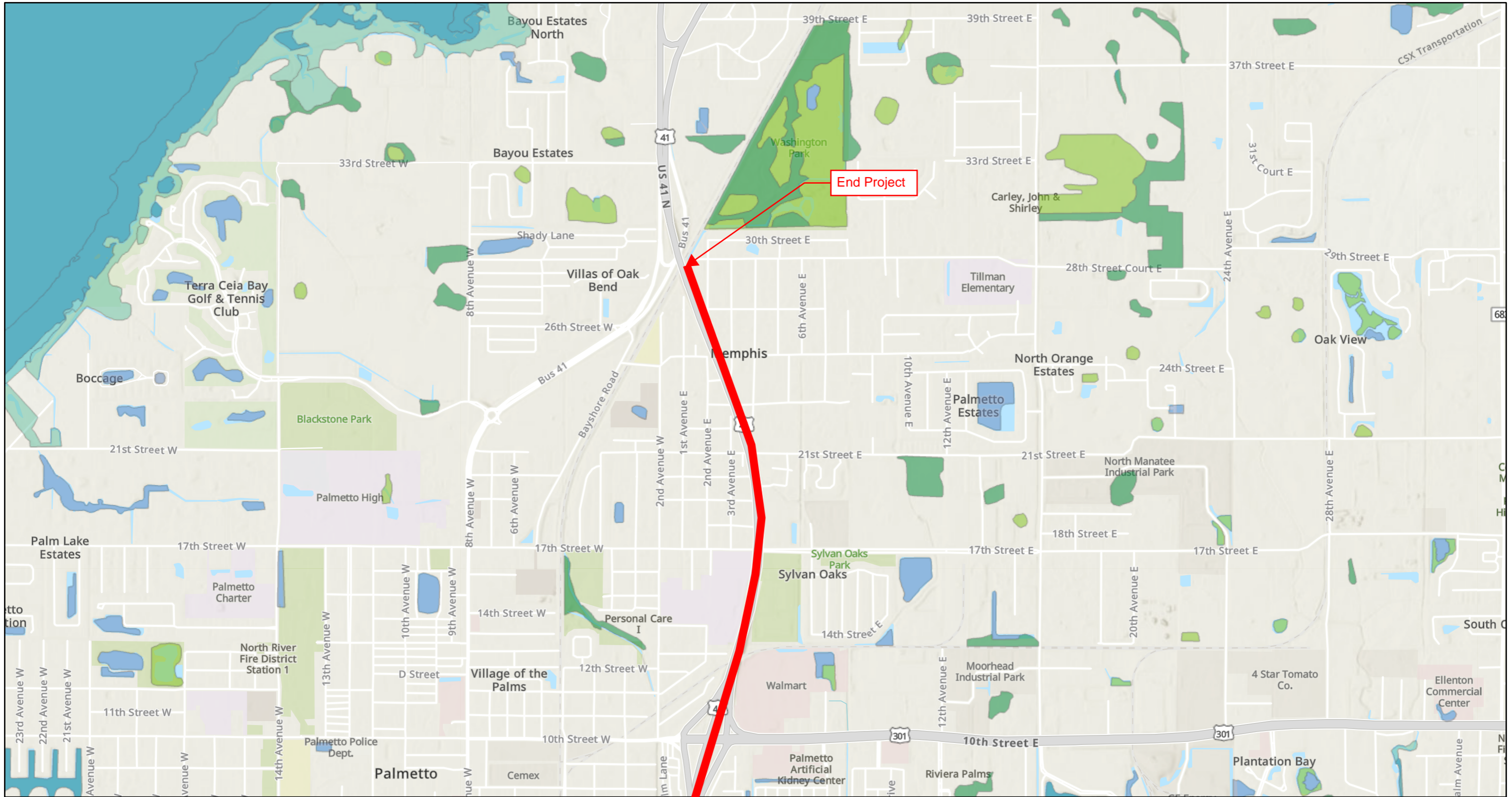


FDEP, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Esri, NASA, NGA, USGS, FEMA

Map created by Map Direct, powered by ESRI.

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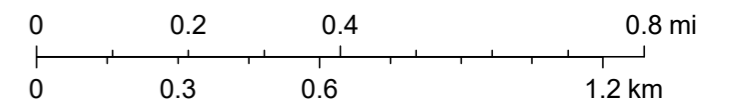
Wetland Map 3



March 27, 2026

1:18,056

- | | |
|---|--|
| National Wetlands Inventory (areas) | Freshwater Emergent Wetland |
| Estuarine and Marine Deepwater | Freshwater Forested/Shrub Wetland |
| Estuarine and Marine Wetland | Freshwater Pond |

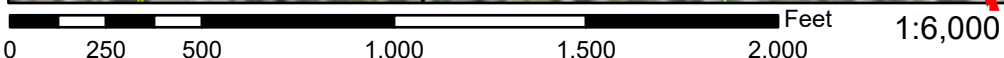
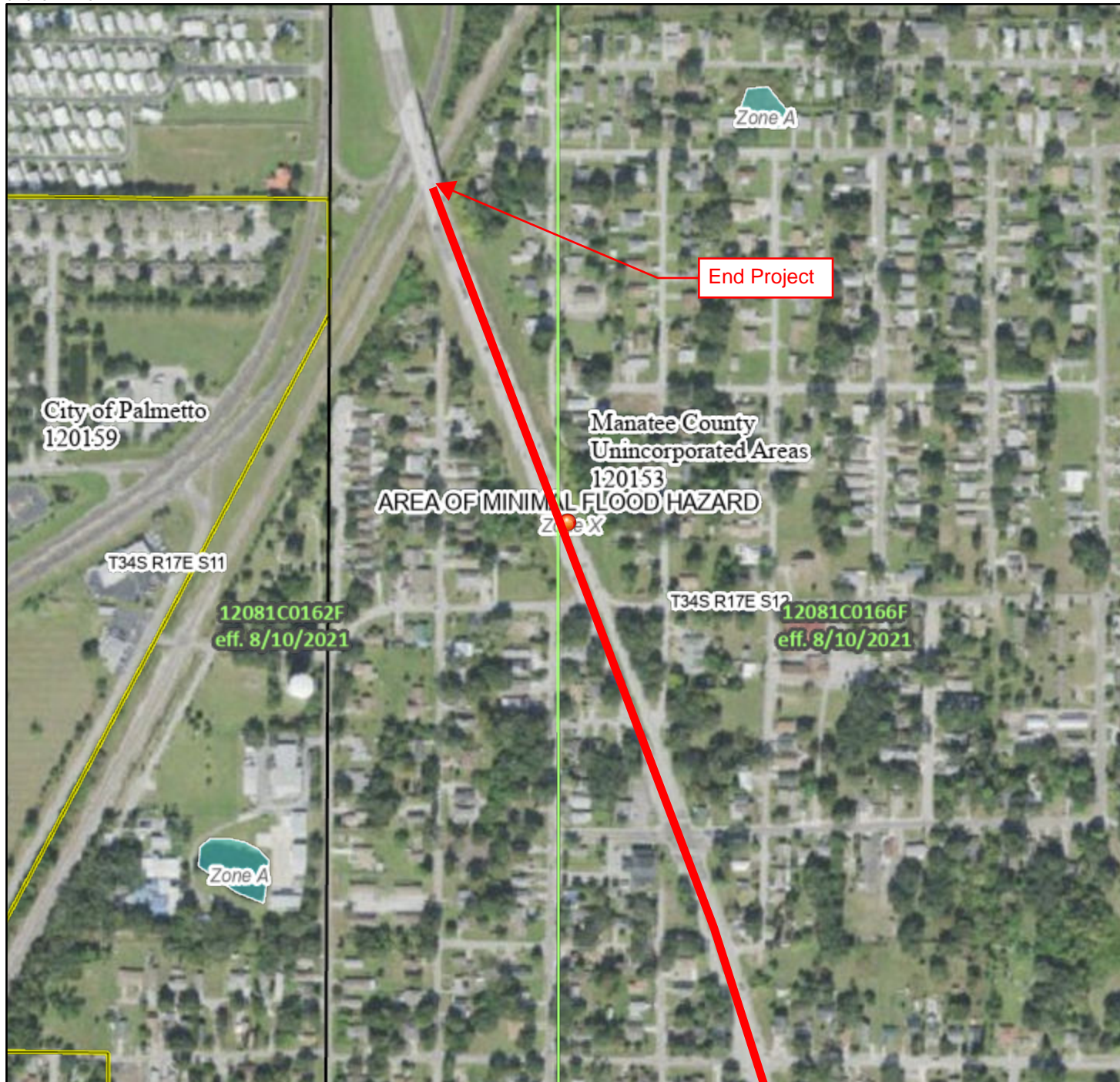


FDEP, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Esri, NASA, NGA, USGS, FEMA

National Flood Hazard Layer FIRMMette



82°34'3"W 27°32'27"N



82°33'26"W 27°31'55"N

Basemap Imagery Source: USGS National Map 2023

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 |
| OTHER FEATURES | | Levee, Dike, or Floodwall |
| | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| MAP PANELS | | 17.5 Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| | | 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

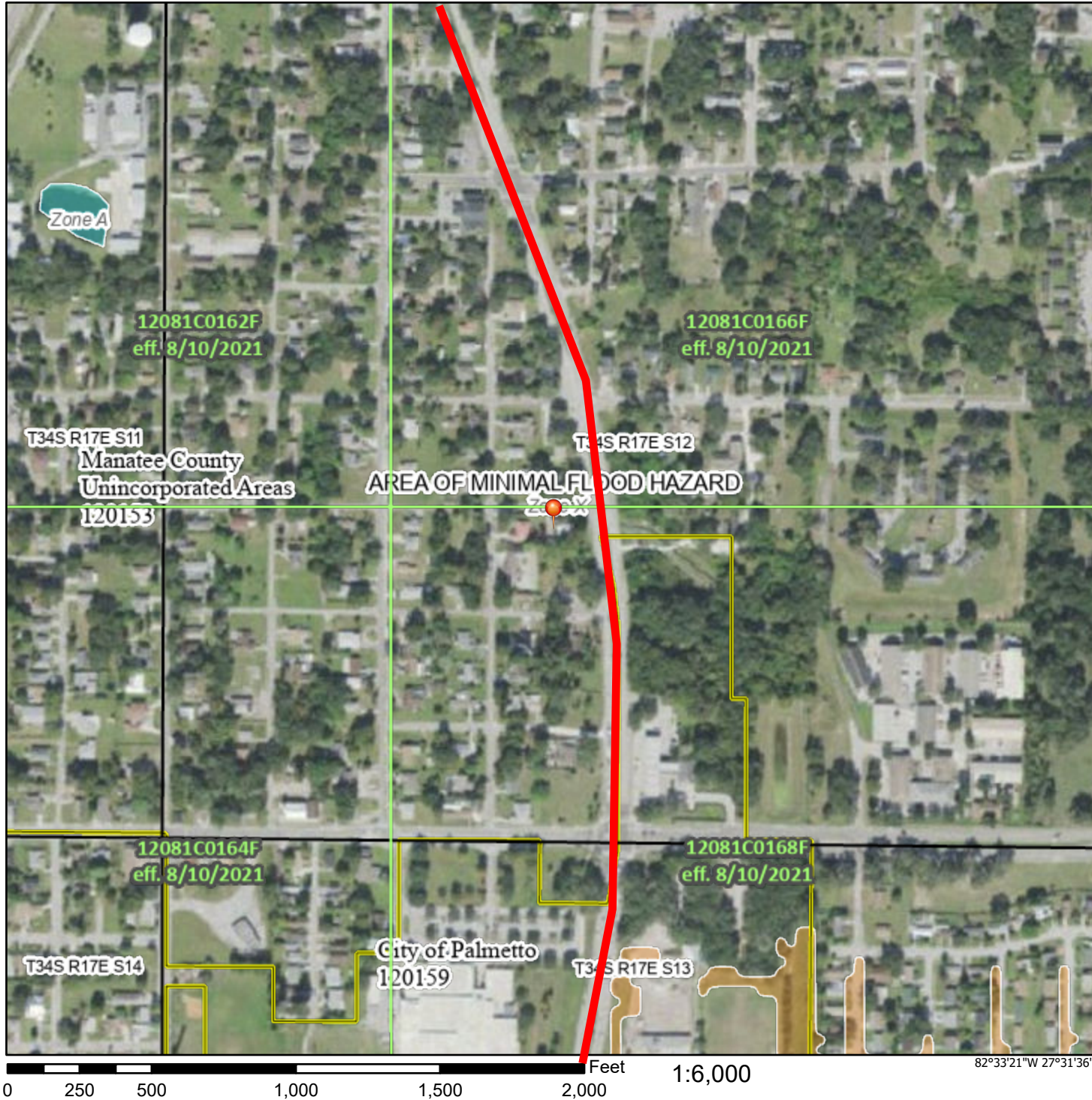
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/27/2026 at 2:10 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by 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.

National Flood Hazard Layer FIRMMette



82°33'58"W 27°32'8"N



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 | Area of Undetermined Flood Hazard Zone D |
|-------------|---|-----------------|--|
| | | | |

| GENERAL STRUCTURES | Channel, Culvert, or Storm Sewer | Levee, Dike, or Floodwall |
|--------------------|----------------------------------|---------------------------|
| | | |

| OTHER FEATURES | Cross Sections with 1% Annual Chance Water Surface Elevation | Coastal Transect | Base Flood Elevation Line (BFE) | Limit of Study | Jurisdiction Boundary | Coastal Transect Baseline | Profile Baseline | Hydrographic Feature |
|----------------|--|------------------|---------------------------------|----------------|-----------------------|---------------------------|------------------|----------------------|
| | | | | | | | | |

| 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

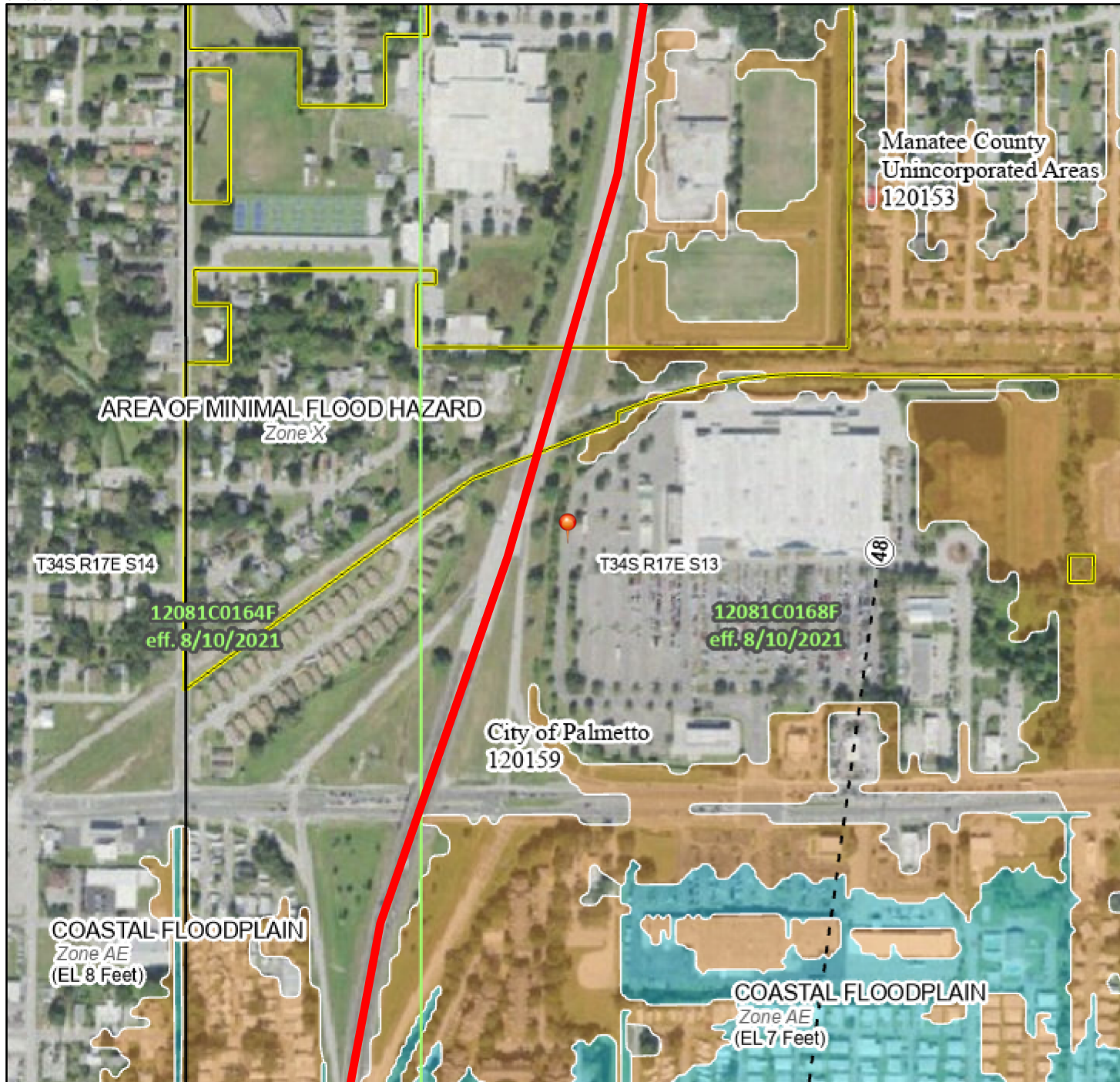
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/27/2026 at 2:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by 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.

National Flood Hazard Layer FIRMMette



82°33'59"W 27°31'40"N



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 | | Profile Baseline |
| | | Hydrographic Feature |
| | | 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. |



82°33'21"W 27°31'8"N

Basemap Imagery Source: USGS National Map 2023

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

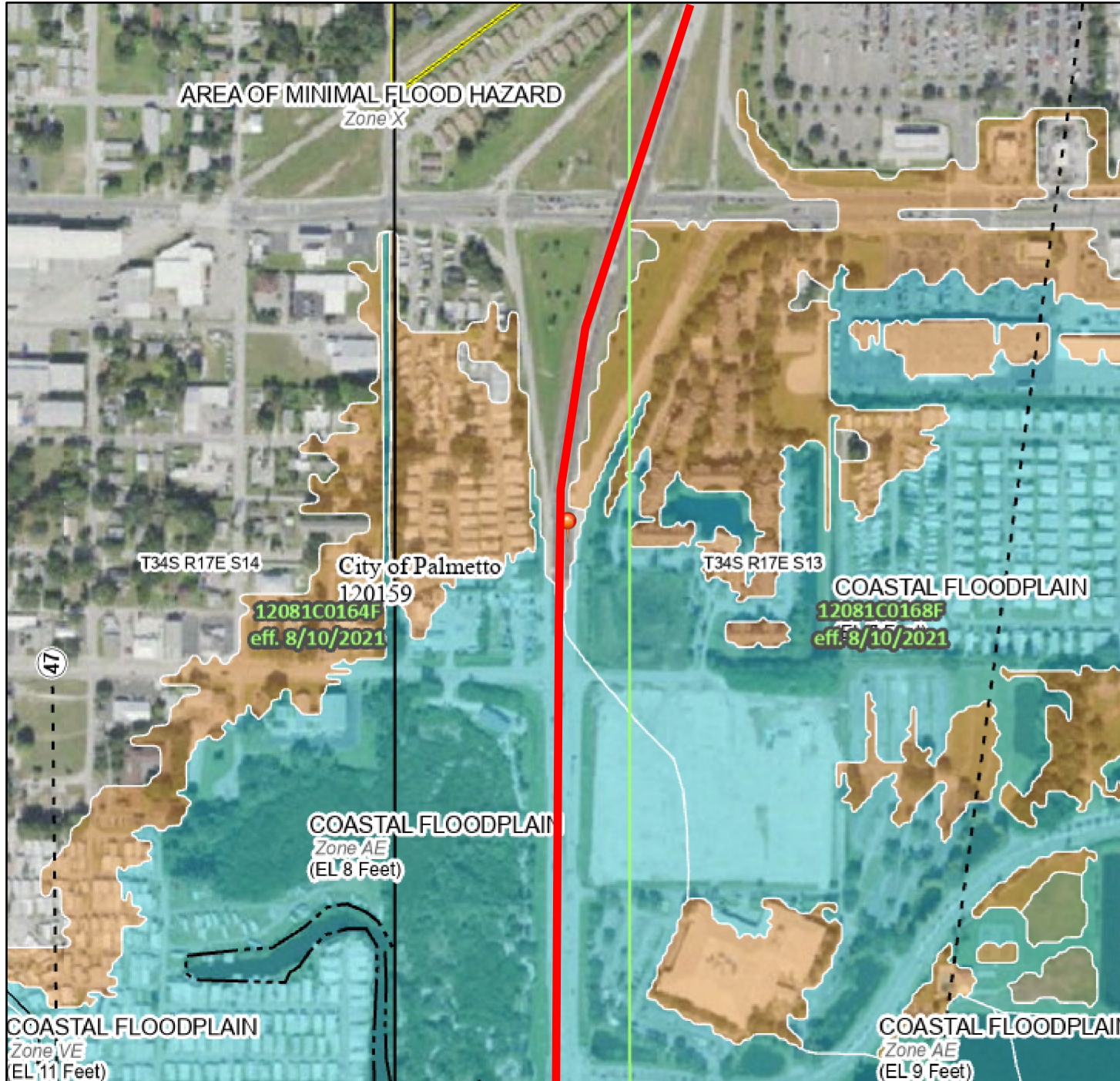
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/14/2026 at 2:06 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by 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.

National Flood Hazard Layer FIRMMette



82°34'6"W 27°31'22"N



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 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| MAP PANELS | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| | | 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 1/14/2026 at 2:05 PM 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.

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0 250 500 1,000 1,500 2,000 Feet 1:6,000

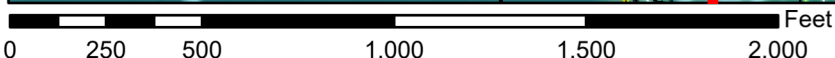
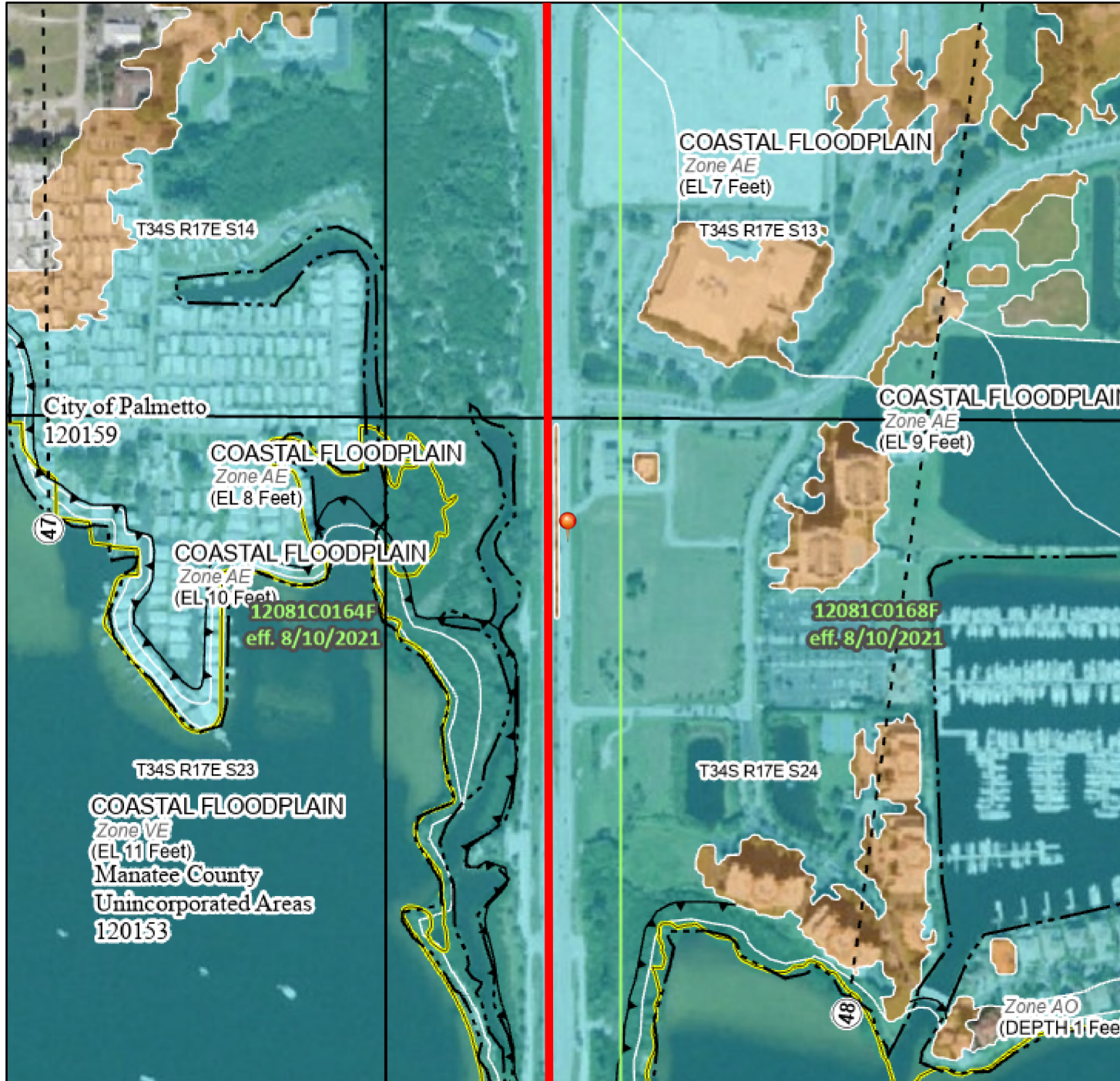
82°33'28"W 27°30'51"N

Basemap Imagery Source: USGS National Map 2023

National Flood Hazard Layer FIRMette



82°34'5"W 27°31'2"N



1:6,000 82°33'28"W 27°30'31"N

Basemap Imagery Source: USGS National Map 2023

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 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| 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

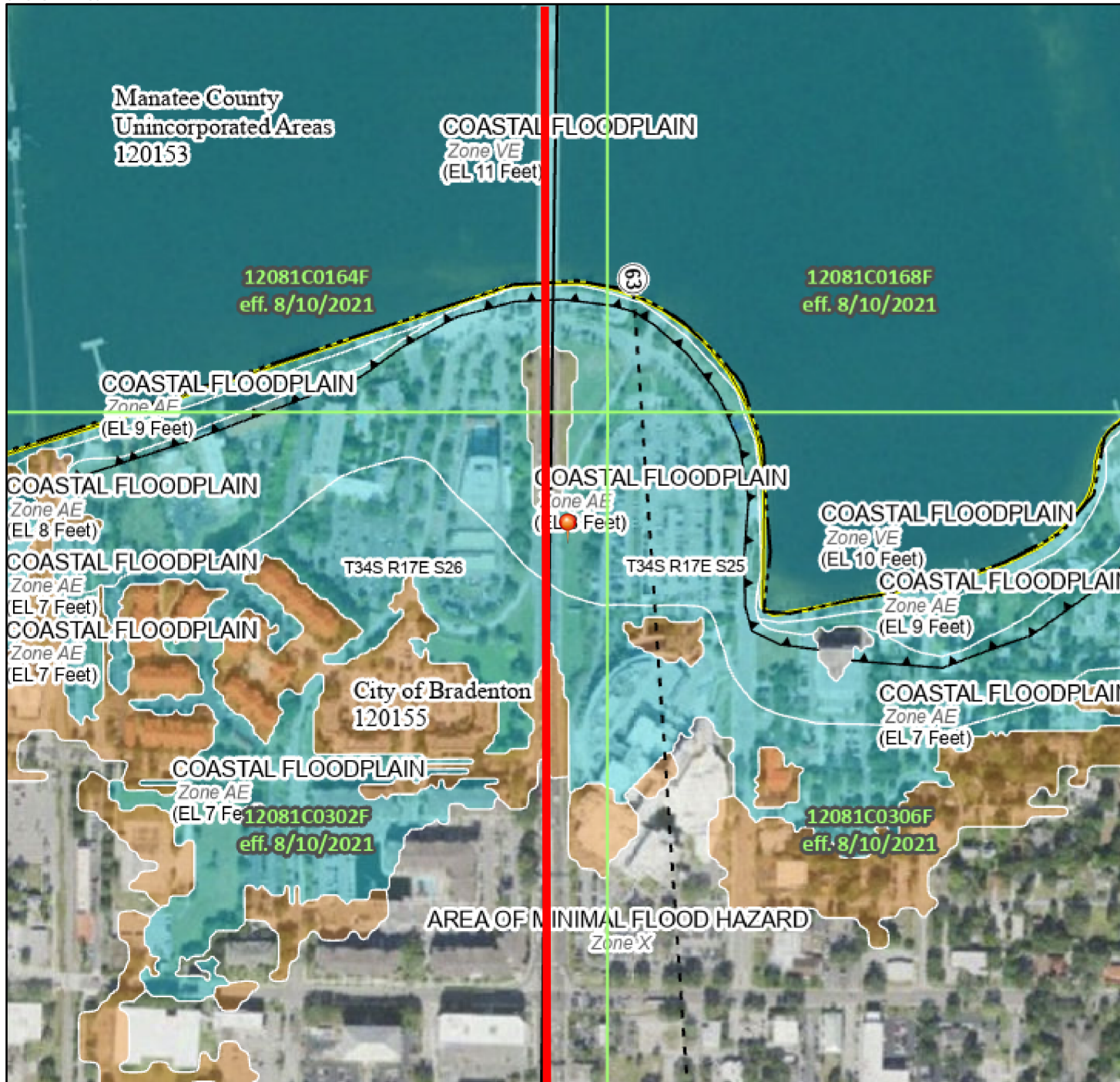
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/14/2026 at 2:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by 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.

National Flood Hazard Layer FIRMette



82°34'5"W 27°30'12"N



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 |
| | | 17.5 Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |

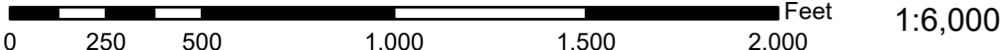
| | | |
|------------|--|---------------------------|
| MAP PANELS | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |

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 1/14/2026 at 2:03 PM 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.

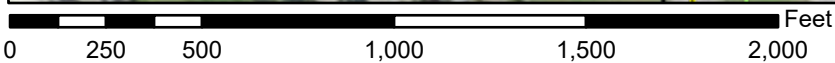
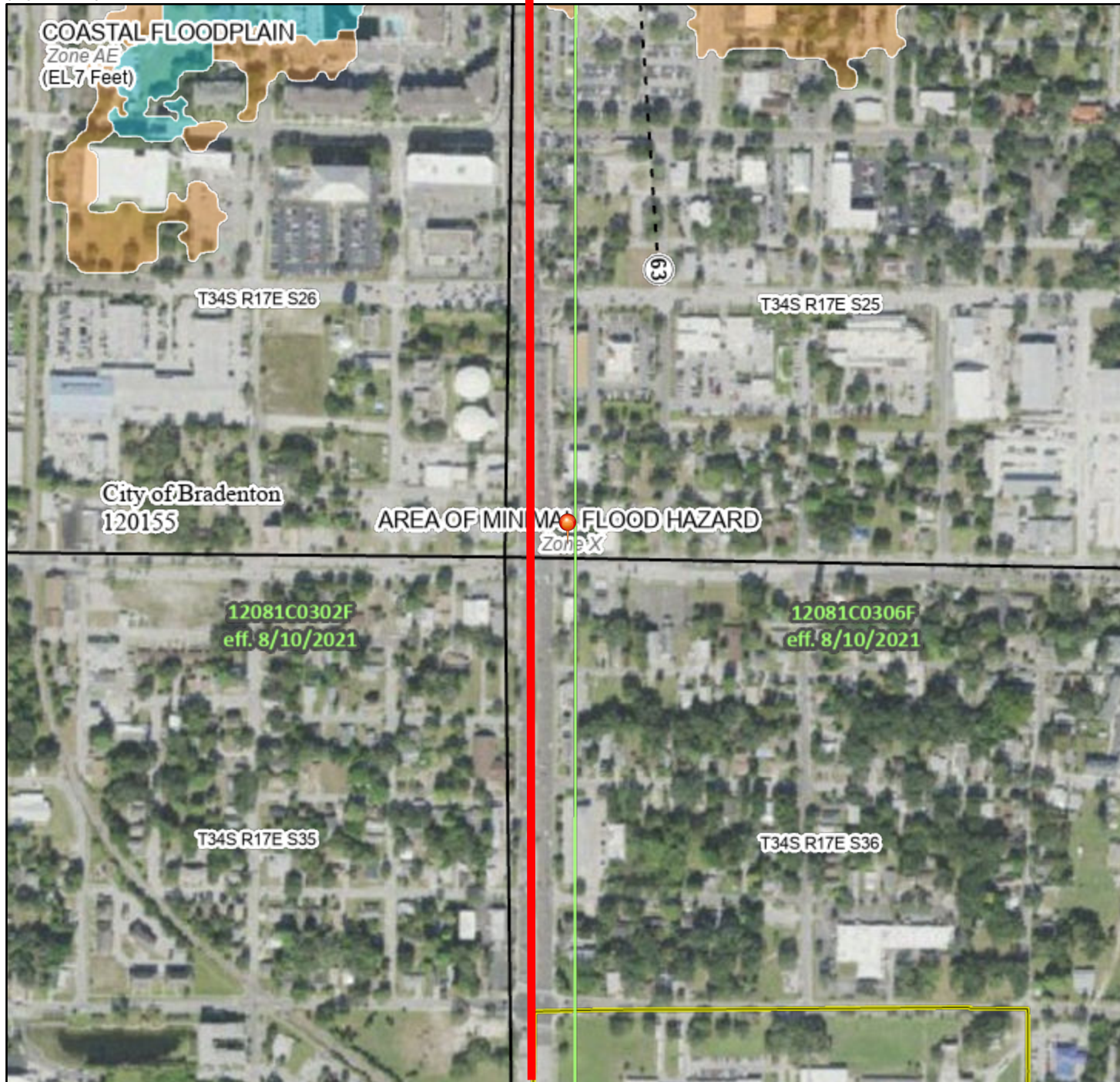


82°33'28"W 27°29'40"N

National Flood Hazard Layer FIRMMette



82°34'4"W 27°29'47"N



1:6,000

82°33'27"W 27°29'15"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

| | | |
|-----------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | 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 <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance |
| | | 17.5 Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| MAP PANELS | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| | | 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

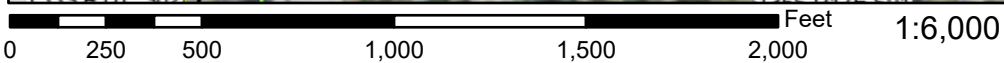
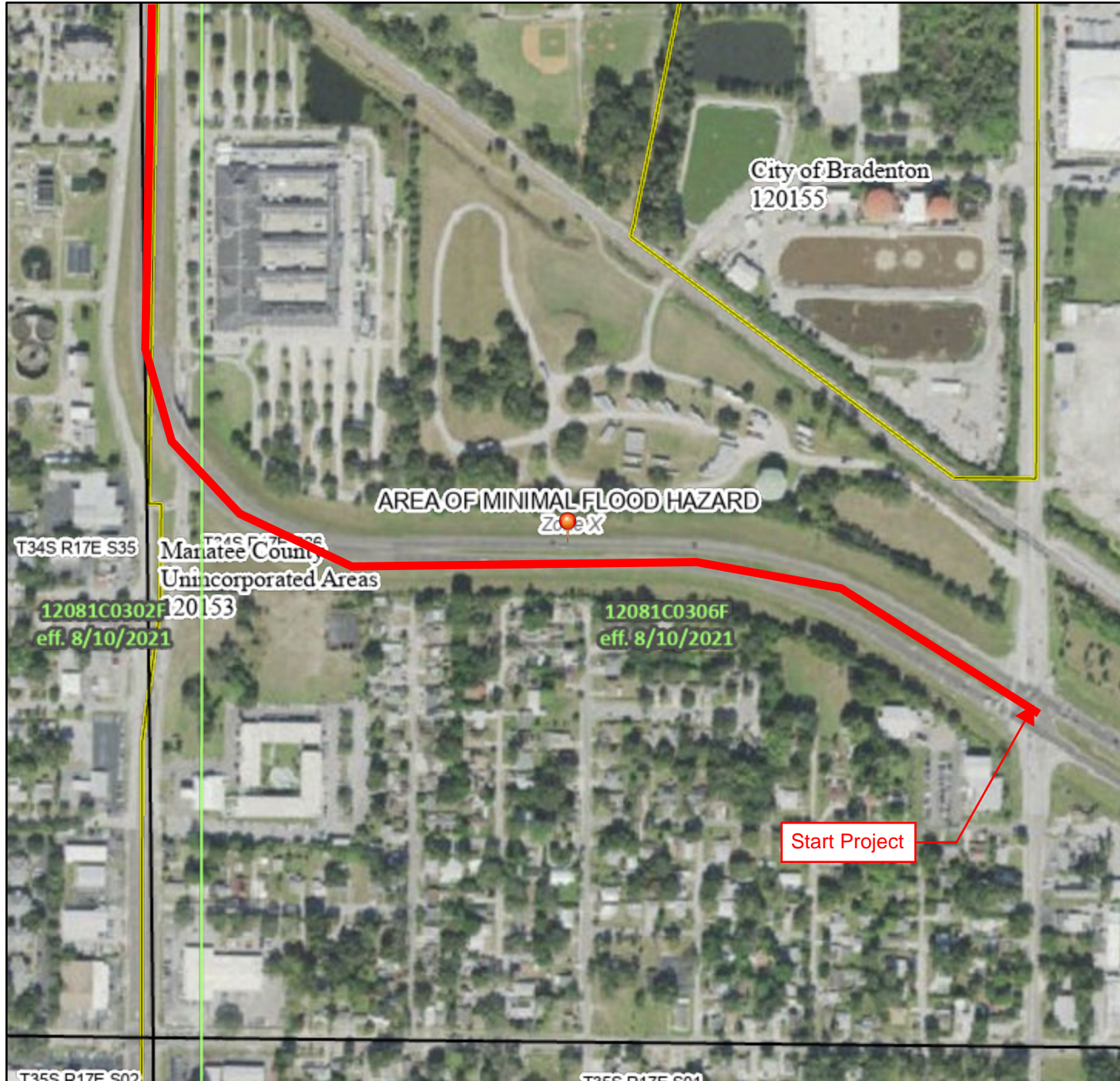
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **3/27/2026 at 2:06 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded 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.

National Flood Hazard Layer FIRMMette



82°33'52"W 27°29'8"N



Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | 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 <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| GENERAL STRUCTURES | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance |
| | | 17.5 Water Surface Elevation |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| 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 **3/27/2026 at 2:04 PM** 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.



Legend

- ICPR_NODE
- ICPR_BASIN
- GWIS_FLOOD

City of Bradenton Watershed Map



Project Continues to the North

End of Watershed Model

BFE=4.08
BFE at ND0700 is used for Floodplain Impact Estimate

BFE=3.97

BFE=6.24

BFE=6.77

BFE=14.66

BFE=14.77

BFE=16.63
BFE at ND0750 is used for Floodplain Impact Estimate

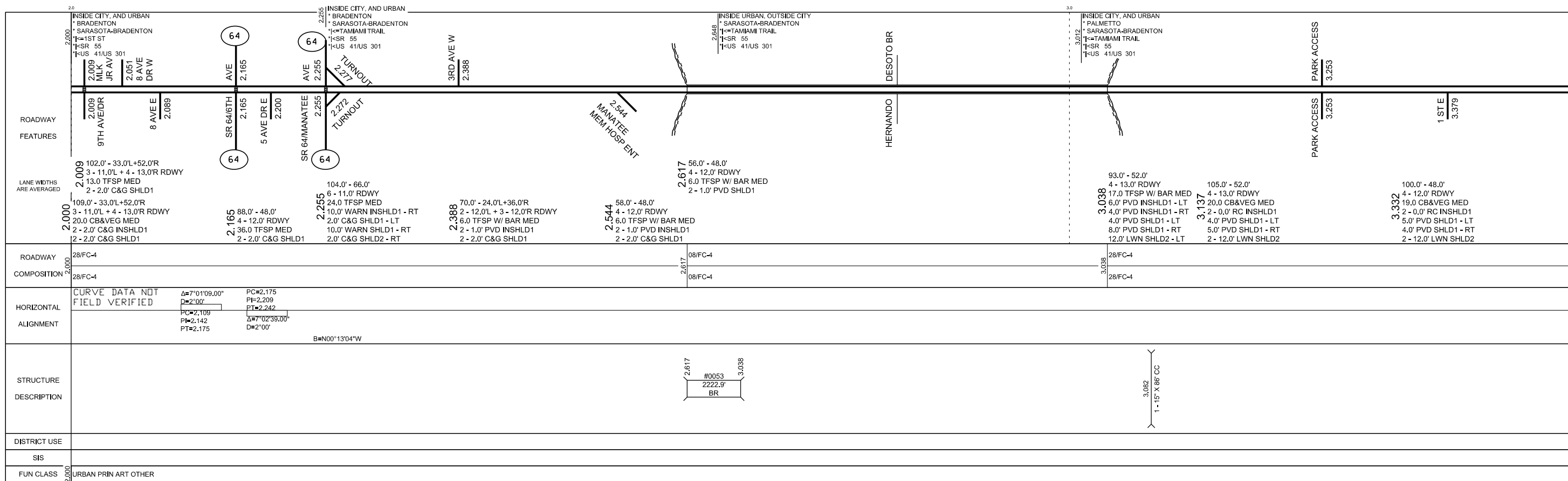
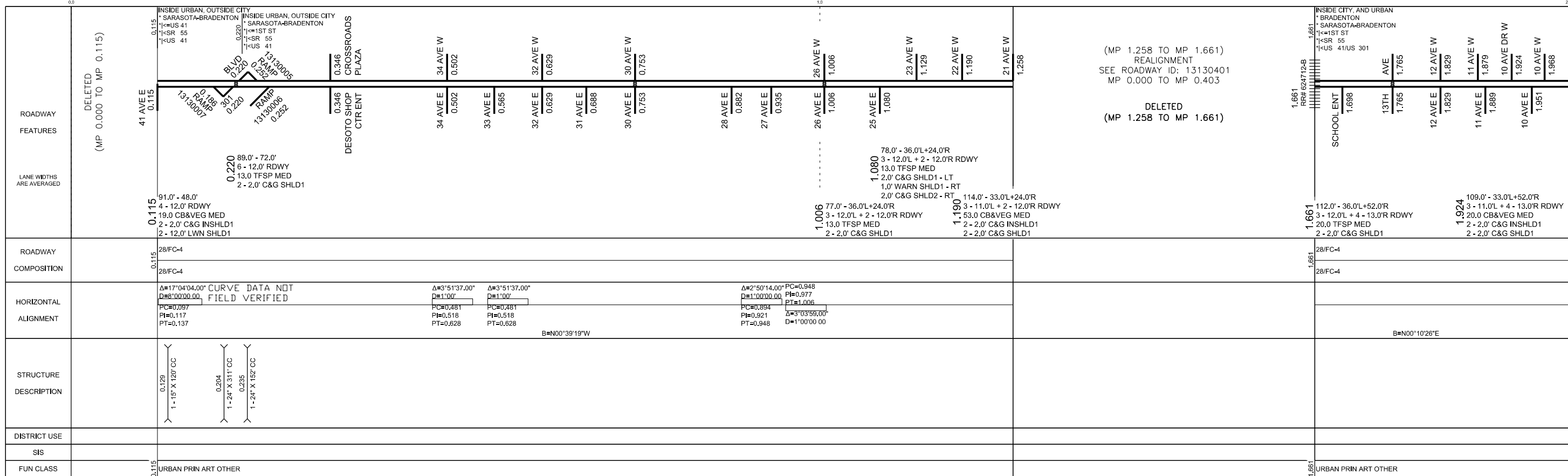
BFE=16.29

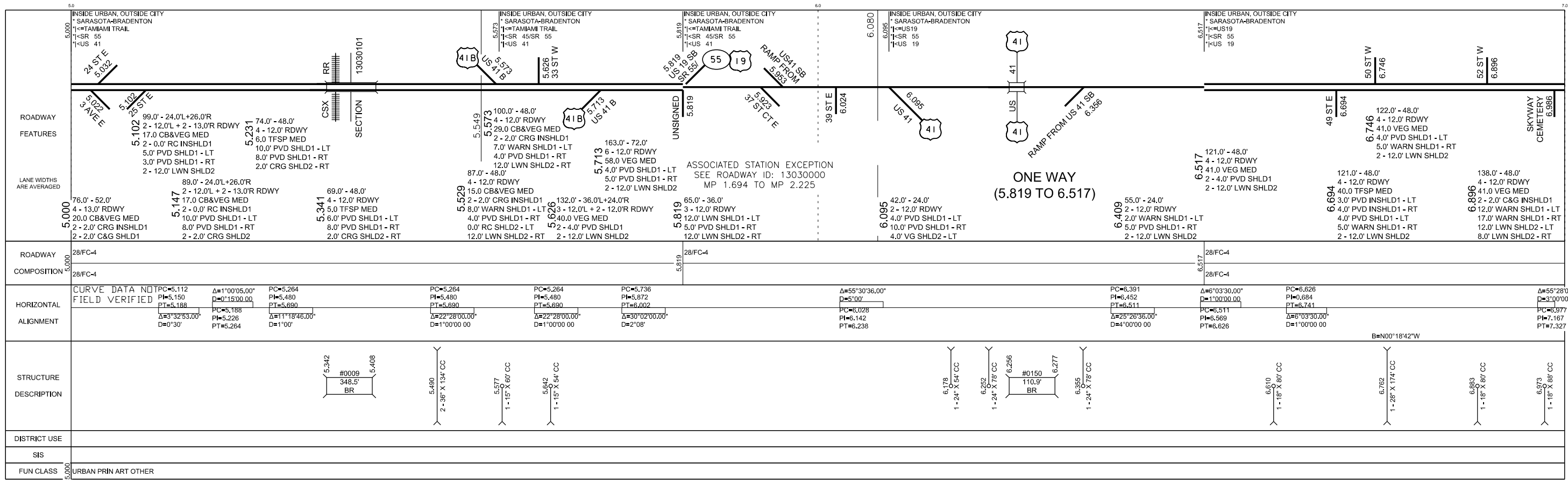
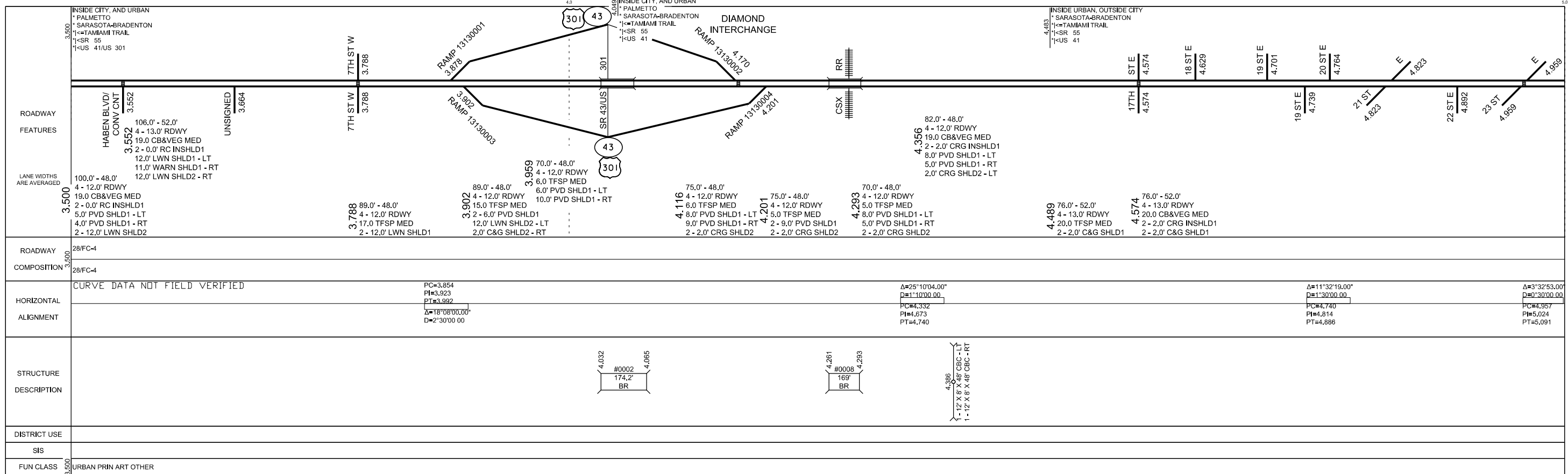
Legend

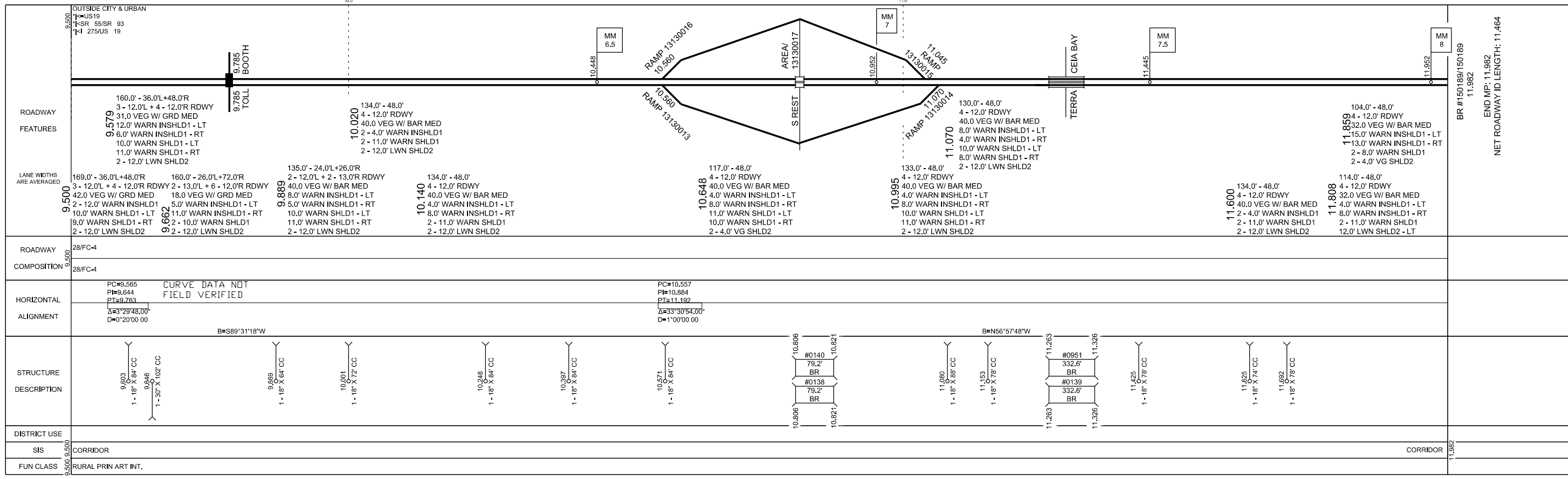
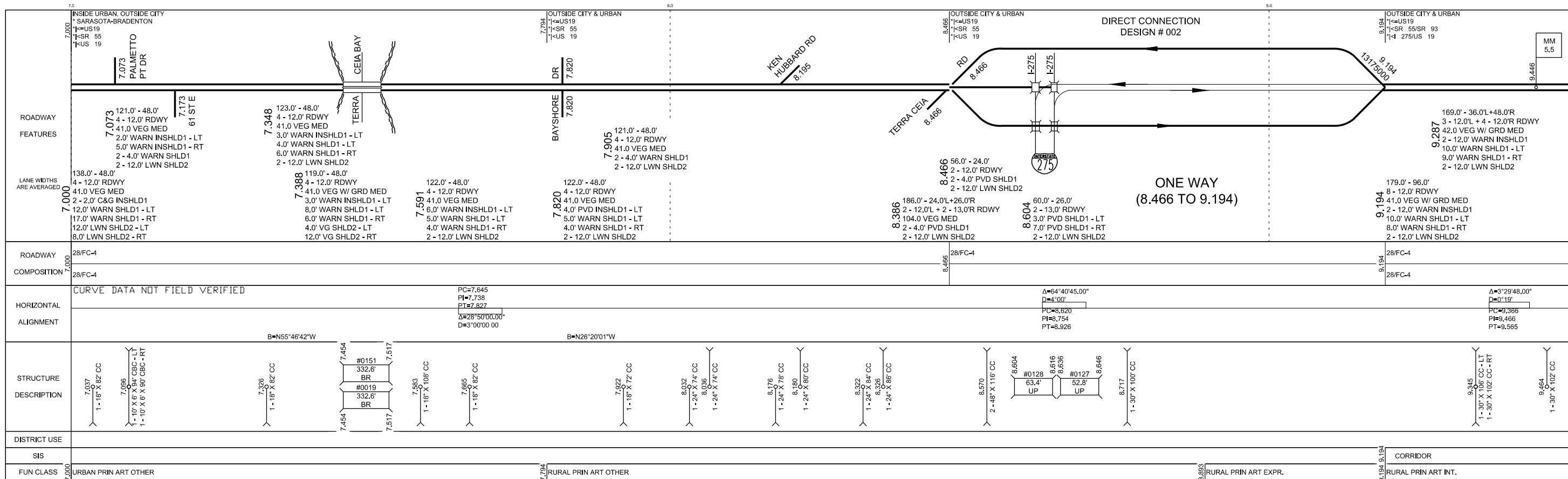
- ICPR_NODE
- ▭ ICPR_BASIN
- GWIS_FLOOD

City of Bradenton Watershed Map

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, State of Florida, Microsoft, Vantor



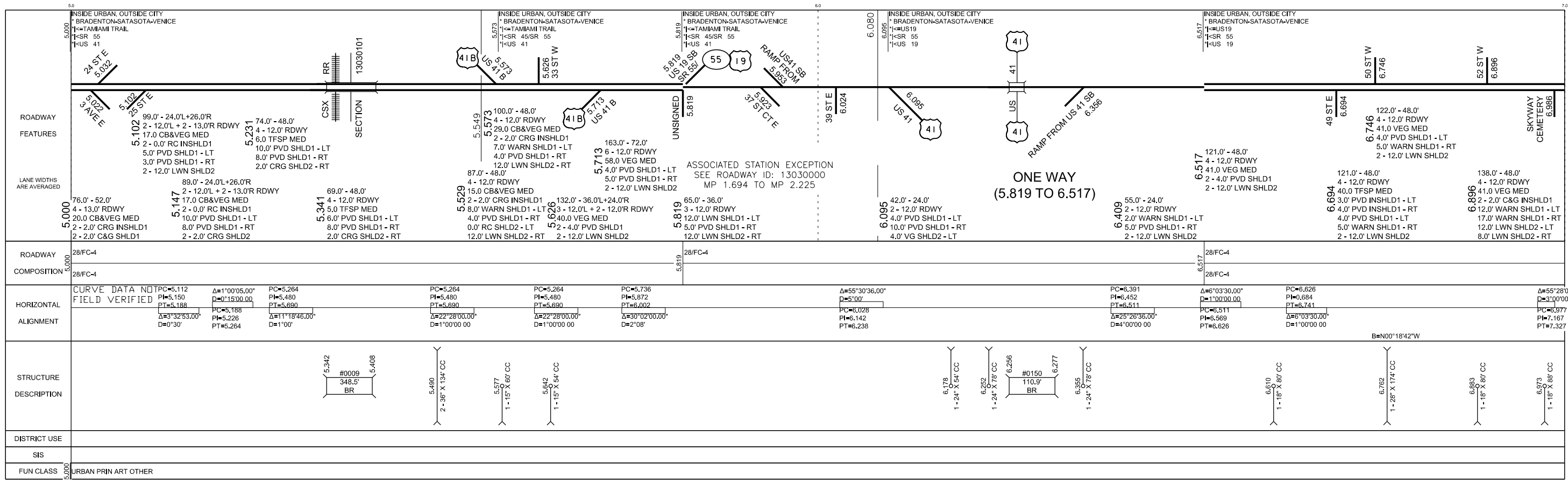
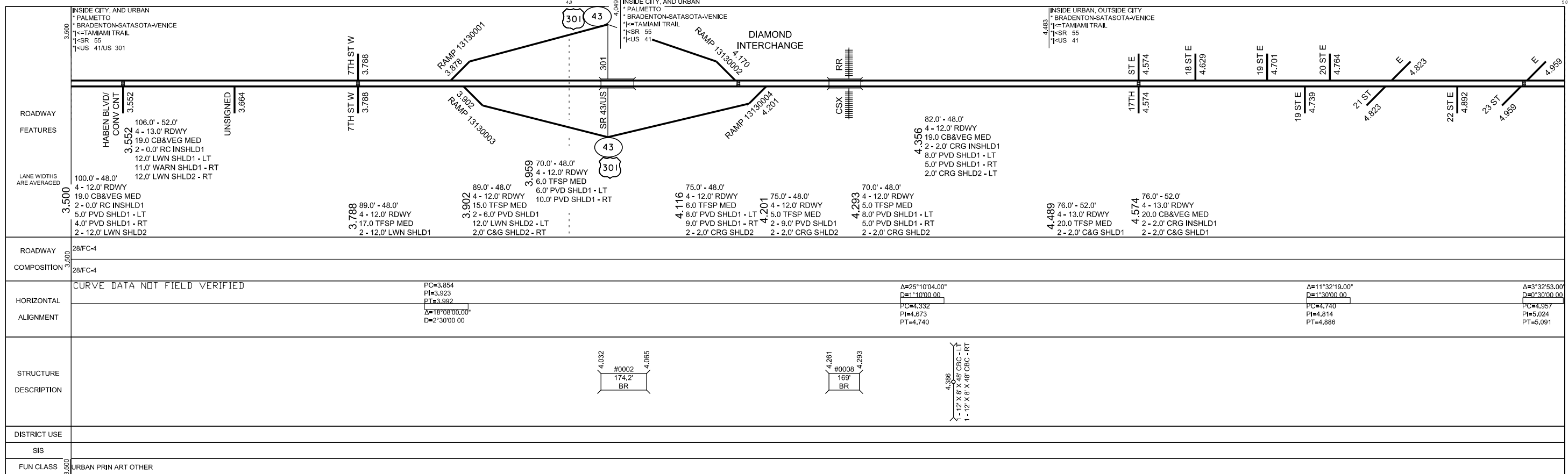


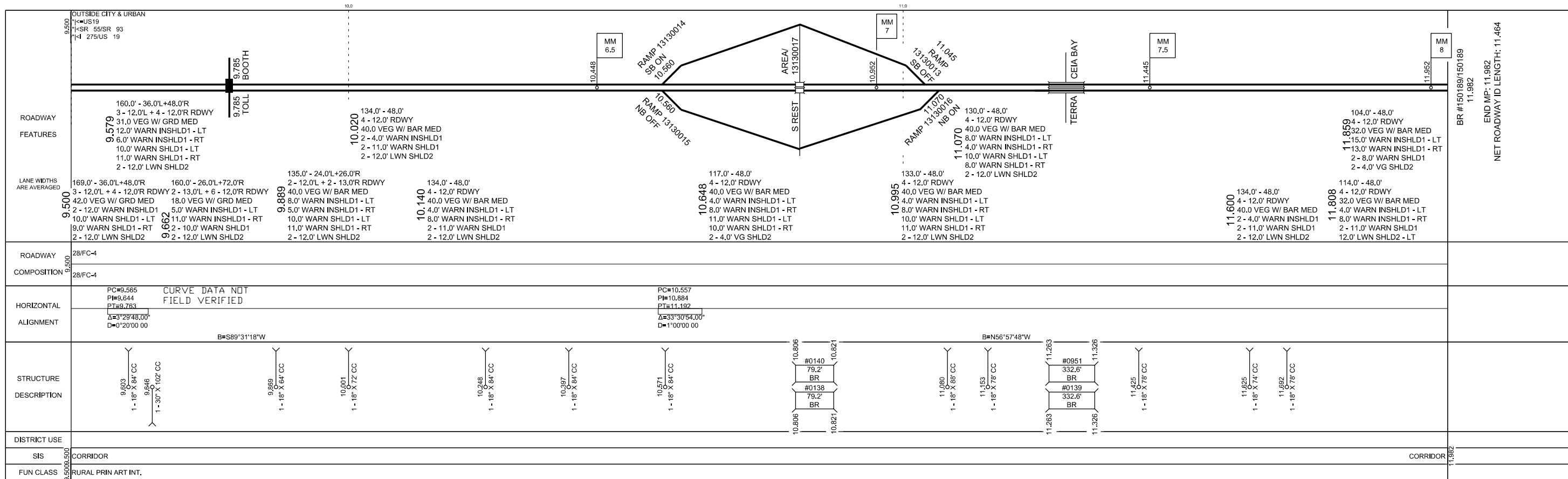
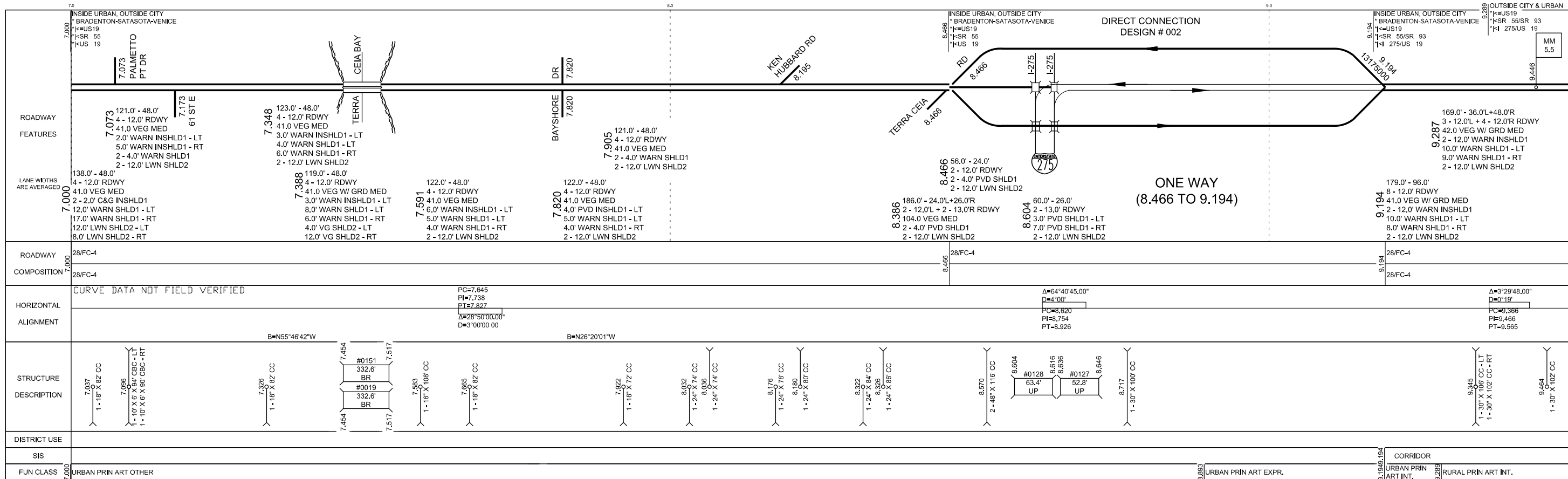


| 5 YR INV | SLD REV | BMP | EMP | INV | SLD REV | SECTION STATUS | INT. or US ROUTE NO. | STATE ROAD NO. | COUNTY | DISTRICT | ROADWAY ID | SHEET NO: |
|----------|------------|------------|-------|--------|-------------------|----------------|--------------------------|-------------------|---------|----------|------------|-----------|
| DATE | 01/08/2024 | 03/22/2024 | 0.115 | 11.982 | 6/27/25(F121/124) | 12 | US 41/US 301/US 19/1 275 | SR 55/SR 45/SR 93 | MANATEE | 01 | 13130000 | 1 OF 3 |
| BY | FTE | FTE | | | | | | | | | | |

| ROADWAY FEATURES | LANE WIDTHS ARE AVERAGED | ROADWAY COMPOSITION | HORIZONTAL ALIGNMENT | STRUCTURE DESCRIPTION | DISTRICT USE | SIS | FUN CLASS | |
|-----------------------------------|--|---------------------|---|--|--------------|-----|----------------------|----------------------|
| DELETED (MP 0.000 TO MP 0.115) | <p>INSIDE URBAN, OUTSIDE CITY BRADENTON-SATASOTA-VENICE 1=US 41 1=SR 55 1=US 41</p> <p>INSIDE URBAN, OUTSIDE CITY BRADENTON-SATASOTA-VENICE 1=1ST ST 1=SR 55 1=US 41</p> <p>0.115 41 AVE E 0.115</p> <p>0.186 RAMP 13130007</p> <p>0.220 RAMP 13130006</p> <p>0.220 89.0' - 72.0' 6 - 12.0' RDWY 13.0 TFSP MED 2 - 2.0' C&G SHLD1</p> <p>0.220 91.0' - 48.0' 4 - 12.0' RDWY 19.0 CB&VEG MED 2 - 2.0' C&G INSHLD1 2 - 12.0' LWN SHLD1</p> <p>0.346 CROSSROADS PLAZA</p> <p>0.346 DESOTO SHOP CTR ENT</p> <p>0.502 34 AVE W 0.502</p> <p>0.566 33 AVE E 0.566</p> <p>0.629 32 AVE W 0.629</p> <p>0.688 31 AVE E 0.688</p> <p>0.753 30 AVE W 0.753</p> <p>0.882 28 AVE E 0.882</p> <p>0.935 27 AVE E 0.935</p> <p>1.006 26 AVE W 1.006</p> <p>1.080 25 AVE E 1.080</p> <p>1.129 23 AVE W 1.129</p> <p>1.190 22 AVE W 1.190</p> <p>1.258 21 AVE W 1.258</p> <p>(MP 1.258 TO MP 1.661) REALIGNMENT SEE ROADWAY ID: 13130401 MP 0.000 TO MP 0.403</p> <p>DELETED (MP 1.258 TO MP 1.661)</p> <p>78.0' - 36.0'L+24.0'R 3 - 12.0'L + 2 - 12.0'R RDWY 13.0 TFSP MED 2.0' C&G SHLD1 - LT 1.0' WARN SHLD1 - RT 2.0' C&G SHLD2 - RT</p> <p>1.080 77.0' - 36.0'L+24.0'R 3 - 12.0'L + 2 - 12.0'R RDWY 13.0 TFSP MED 2 - 2.0' C&G SHLD1</p> <p>1.190 114.0' - 33.0'L+24.0'R 3 - 11.0'L + 2 - 12.0'R RDWY 53.0 CB&VEG MED 2 - 2.0' C&G INSHLD1 2 - 2.0' C&G SHLD1</p> <p>INSIDE CITY, AND URBAN BRADENTON BRADENTON-SATASOTA-VENICE 1=1ST ST 1=SR 55 1=US 41/US 301</p> <p>1.661 12.0' - 36.0'L+52.0'R 3 - 12.0'L + 4 - 13.0'R RDWY 20.0 TFSP MED 2 - 2.0' C&G SHLD1</p> <p>1.661 109.0' - 33.0'L+52.0'R 3 - 11.0'L + 4 - 13.0'R RDWY 20.0 CB&VEG MED 2 - 2.0' C&G INSHLD1 2 - 2.0' C&G SHLD1</p> | 28/FC-4 28/FC-4 | <p>$\Delta=17^{\circ}04'04.00''$ CURVE DATA NOT FIELD VERIFIED</p> <p>$\Delta=3^{\circ}51'37.00''$ $D=1^{\circ}00'$ PC=0.481 PI=0.518 PT=0.628</p> <p>$\Delta=3^{\circ}51'37.00''$ $D=1^{\circ}00'$ PC=0.481 PI=0.518 PT=0.628</p> <p>$\Delta=2^{\circ}50'14.00''$ PC=0.948 $D=1^{\circ}00'00.00''$ PI=0.977 PT=1.006</p> <p>$\Delta=3^{\circ}03'58.00''$ $D=1^{\circ}00'00.00''$</p> <p>B=N00°39'19"W</p> | <p>0.128 1-15' X 120' CC</p> <p>0.204 1-24' X 311' CC</p> <p>0.235 1-24' X 152' CC</p> | | | | URBAN PRIN ART OTHER |
| | | | | | | | URBAN PRIN ART OTHER | |

| ROADWAY FEATURES | LANE WIDTHS ARE AVERAGED | ROADWAY COMPOSITION | HORIZONTAL ALIGNMENT | STRUCTURE DESCRIPTION | DISTRICT USE | SIS | FUN CLASS |
|--|---|---------------------|--|--|--------------|-----|----------------------|
| <p>INSIDE CITY, AND URBAN BRADENTON BRADENTON-SATASOTA-VENICE 1=1ST ST 1=SR 55 1=US 41/US 301</p> <p>2.009 9TH AVE/DR 2.009</p> <p>2.051 MLK JR AV 2.051</p> <p>2.051 8 AVE DR W 2.051</p> <p>2.165 SR 64/6TH AVE 2.165</p> <p>2.200 5 AVE DR E 2.200</p> <p>2.255 SR 64/MANATEE AVE 2.255</p> <p>2.255 TURNOUT 2.272</p> <p>2.388 3RD AVE W 2.388</p> <p>2.544 MANATEE MEM HOSP ENT 2.544</p> <p>2.617 HERNANDO 2.617</p> <p>2.617 DESOTO BR 2.617</p> <p>3.038 PARK ACCESS 3.253</p> <p>3.038 PARK ACCESS 3.253</p> <p>3.137 1ST E 3.379</p> <p>INSIDE CITY, AND URBAN BRADENTON BRADENTON-SATASOTA-VENICE 1=TAMIAMI TRAIL 1=SR 55 1=US 41/US 301</p> <p>INSIDE URBAN, OUTSIDE CITY BRADENTON-SATASOTA-VENICE 1=TAMIAMI TRAIL 1=SR 55 1=US 41/US 301</p> <p>INSIDE CITY, AND URBAN PALMETTO BRADENTON-SATASOTA-VENICE 1=TAMIAMI TRAIL 1=SR 55 1=US 41/US 301</p> | <p>2.009 102.0' - 33.0'L+52.0'R 3 - 11.0'L + 4 - 13.0'R RDWY 13.0 TFSP MED 2 - 2.0' C&G SHLD1</p> <p>2.000 109.0' - 33.0'L+52.0'R 3 - 11.0'L + 4 - 13.0'R RDWY 20.0 CB&VEG MED 2 - 2.0' C&G INSHLD1 2 - 2.0' C&G SHLD1</p> <p>2.165 88.0' - 48.0' 4 - 12.0' RDWY 36.0 TFSP MED 2 - 2.0' C&G SHLD1</p> <p>2.255 104.0' - 66.0' 6 - 11.0' RDWY 24.0 TFSP MED 10.0' WARN INSHLD1 - RT 2.0' C&G SHLD1 - LT 10.0' WARN SHLD1 - RT 2.0' C&G SHLD2 - RT</p> <p>2.388 70.0' - 24.0'L+36.0'R 2 - 12.0'L + 3 - 12.0'R RDWY 6.0 TFSP W/ BAR MED 2 - 1.0' PVD INSHLD1 2 - 2.0' C&G SHLD1</p> <p>2.544 58.0' - 48.0' 4 - 12.0' RDWY 6.0 TFSP W/ BAR MED 2 - 1.0' PVD INSHLD1 2 - 2.0' C&G SHLD1</p> <p>2.617 56.0' - 48.0' 4 - 12.0' RDWY 6.0 TFSP W/ BAR MED 2 - 1.0' PVD SHLD1</p> <p>3.038 93.0' - 52.0' 4 - 13.0' RDWY 17.0 TFSP W/ BAR MED 6.0' PVD INSHLD1 - LT 4.0' PVD INSHLD1 - RT 8.0' PVD SHLD1 - RT 12.0' LWN SHLD2 - LT</p> <p>3.137 105.0' - 52.0' 4 - 13.0' RDWY 20.0 CB&VEG MED 2 - 0.0' RC INSHLD1 4.0' PVD SHLD1 - LT 5.0' PVD SHLD1 - RT 2 - 12.0' LWN SHLD2</p> <p>3.332 100.0' - 48.0' 4 - 12.0' RDWY 19.0 CB&VEG MED 2 - 0.0' RC INSHLD1 5.0' PVD SHLD1 - LT 4.0' PVD SHLD1 - RT 2 - 12.0' LWN SHLD2</p> | 28/FC-4 28/FC-4 | <p>CURVE DATA NOT FIELD VERIFIED</p> <p>$\Delta=7^{\circ}01'09.00''$ $D=2^{\circ}00'$ PC=2.109 PI=2.142 PT=2.175</p> <p>$\Delta=7^{\circ}02'39.00''$ $D=2^{\circ}00'$ PC=2.175 PI=2.209 PT=2.242</p> <p>$\Delta=7^{\circ}02'39.00''$ $D=2^{\circ}00'$</p> <p>B=N00°13'04"W</p> | <p>2.617 #0053 2222.9 BR</p> <p>3.038 1-15' X 86' CC</p> | | | URBAN PRIN ART OTHER |







POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹ | | | | | | | | | | |
|---|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 6.79 (5.65-8.29) | 7.64 (6.36-9.35) | 8.98 (7.44-11.0) | 10.0 (8.27-12.4) | 11.4 (9.01-14.4) | 12.4 (9.58-15.9) | 13.4 (9.94-17.6) | 14.3 (10.1-19.3) | 15.4 (10.5-21.5) | 16.2 (10.7-23.1) |
| 10-min | 4.97 (4.14-6.08) | 5.60 (4.65-6.84) | 6.58 (5.45-8.06) | 7.35 (6.05-9.05) | 8.36 (6.60-10.5) | 9.10 (7.01-11.7) | 9.80 (7.27-12.9) | 10.5 (7.42-14.2) | 11.3 (7.67-15.7) | 11.9 (7.86-16.9) |
| 15-min | 4.04 (3.36-4.94) | 4.55 (3.78-5.56) | 5.34 (4.43-6.55) | 5.98 (4.92-7.36) | 6.80 (5.36-8.56) | 7.40 (5.70-9.48) | 7.97 (5.91-10.5) | 8.52 (6.03-11.5) | 9.19 (6.24-12.8) | 9.67 (6.39-13.8) |
| 30-min | 3.09 (2.57-3.77) | 3.48 (2.89-4.25) | 4.10 (3.39-5.02) | 4.58 (3.77-5.64) | 5.22 (4.12-6.58) | 5.69 (4.38-7.28) | 6.13 (4.54-8.05) | 6.55 (4.64-8.86) | 7.08 (4.80-9.85) | 7.44 (4.92-10.6) |
| 60-min | 2.00 (1.67-2.45) | 2.26 (1.88-2.76) | 2.66 (2.21-3.27) | 3.00 (2.47-3.69) | 3.45 (2.73-4.37) | 3.80 (2.93-4.88) | 4.13 (3.07-5.45) | 4.47 (3.17-6.06) | 4.91 (3.33-6.85) | 5.23 (3.46-7.45) |
| 2-hr | 1.23 (1.03-1.49) | 1.39 (1.16-1.68) | 1.64 (1.37-2.00) | 1.85 (1.53-2.27) | 2.15 (1.71-2.70) | 2.37 (1.84-3.04) | 2.60 (1.94-3.41) | 2.83 (2.02-3.82) | 3.14 (2.15-4.36) | 3.37 (2.24-4.77) |
| 3-hr | 0.892 (0.749-1.08) | 1.00 (0.842-1.21) | 1.20 (0.999-1.45) | 1.36 (1.13-1.66) | 1.60 (1.28-2.01) | 1.78 (1.40-2.28) | 1.98 (1.49-2.60) | 2.18 (1.57-2.95) | 2.47 (1.70-3.43) | 2.69 (1.79-3.79) |
| 6-hr | 0.513 (0.434-0.615) | 0.579 (0.489-0.695) | 0.698 (0.587-0.840) | 0.808 (0.675-0.976) | 0.975 (0.793-1.24) | 1.12 (0.882-1.43) | 1.27 (0.964-1.67) | 1.44 (1.04-1.94) | 1.67 (1.16-2.32) | 1.86 (1.25-2.61) |
| 12-hr | 0.294 (0.250-0.350) | 0.333 (0.283-0.397) | 0.409 (0.346-0.488) | 0.482 (0.405-0.579) | 0.599 (0.493-0.761) | 0.701 (0.559-0.899) | 0.814 (0.625-1.07) | 0.940 (0.689-1.27) | 1.12 (0.788-1.56) | 1.28 (0.863-1.78) |
| 24-hr | 0.172 (0.147-0.203) | 0.195 (0.166-0.231) | 0.242 (0.206-0.287) | 0.289 (0.244-0.344) | 0.366 (0.305-0.466) | 0.435 (0.350-0.557) | 0.513 (0.397-0.672) | 0.600 (0.443-0.807) | 0.729 (0.515-1.01) | 0.836 (0.569-1.16) |
| 2-day | 0.100 (0.086-0.118) | 0.114 (0.098-0.134) | 0.142 (0.122-0.168) | 0.171 (0.145-0.202) | 0.218 (0.183-0.276) | 0.261 (0.211-0.332) | 0.308 (0.240-0.402) | 0.362 (0.269-0.485) | 0.442 (0.314-0.607) | 0.508 (0.348-0.699) |
| 3-day | 0.074 (0.064-0.086) | 0.084 (0.073-0.099) | 0.106 (0.091-0.124) | 0.127 (0.108-0.149) | 0.161 (0.135-0.203) | 0.192 (0.156-0.243) | 0.226 (0.177-0.294) | 0.265 (0.198-0.353) | 0.322 (0.230-0.440) | 0.369 (0.254-0.506) |
| 4-day | 0.060 (0.052-0.070) | 0.069 (0.059-0.080) | 0.086 (0.074-0.100) | 0.102 (0.088-0.120) | 0.130 (0.109-0.162) | 0.154 (0.125-0.193) | 0.180 (0.141-0.233) | 0.210 (0.157-0.279) | 0.254 (0.181-0.345) | 0.290 (0.200-0.396) |
| 7-day | 0.041 (0.036-0.048) | 0.047 (0.041-0.054) | 0.057 (0.050-0.067) | 0.068 (0.058-0.079) | 0.084 (0.070-0.103) | 0.098 (0.080-0.122) | 0.113 (0.089-0.145) | 0.130 (0.098-0.171) | 0.155 (0.111-0.209) | 0.175 (0.121-0.238) |
| 10-day | 0.033 (0.029-0.038) | 0.037 (0.032-0.043) | 0.045 (0.039-0.052) | 0.053 (0.045-0.061) | 0.064 (0.054-0.078) | 0.074 (0.060-0.091) | 0.084 (0.066-0.107) | 0.096 (0.072-0.125) | 0.112 (0.081-0.151) | 0.126 (0.087-0.170) |
| 20-day | 0.023 (0.020-0.026) | 0.025 (0.022-0.029) | 0.030 (0.026-0.034) | 0.034 (0.029-0.039) | 0.040 (0.033-0.048) | 0.044 (0.036-0.054) | 0.049 (0.039-0.062) | 0.054 (0.041-0.070) | 0.062 (0.044-0.082) | 0.067 (0.047-0.091) |
| 30-day | 0.019 (0.017-0.022) | 0.021 (0.018-0.024) | 0.024 (0.021-0.028) | 0.027 (0.024-0.031) | 0.031 (0.026-0.037) | 0.035 (0.028-0.042) | 0.038 (0.030-0.047) | 0.041 (0.031-0.053) | 0.046 (0.033-0.060) | 0.049 (0.034-0.066) |
| 45-day | 0.016 (0.014-0.018) | 0.017 (0.015-0.020) | 0.020 (0.018-0.023) | 0.023 (0.020-0.026) | 0.026 (0.022-0.030) | 0.028 (0.023-0.034) | 0.030 (0.024-0.037) | 0.033 (0.025-0.041) | 0.035 (0.026-0.046) | 0.037 (0.026-0.050) |
| 60-day | 0.014 (0.012-0.016) | 0.015 (0.014-0.017) | 0.018 (0.016-0.020) | 0.020 (0.018-0.023) | 0.023 (0.019-0.027) | 0.025 (0.020-0.029) | 0.027 (0.021-0.032) | 0.028 (0.021-0.036) | 0.030 (0.022-0.040) | 0.032 (0.022-0.042) |

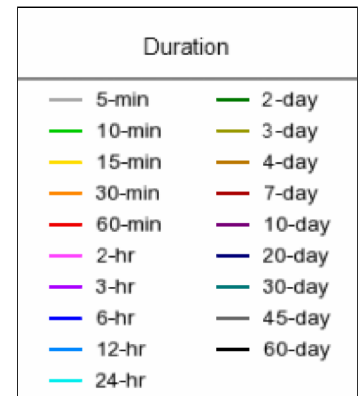
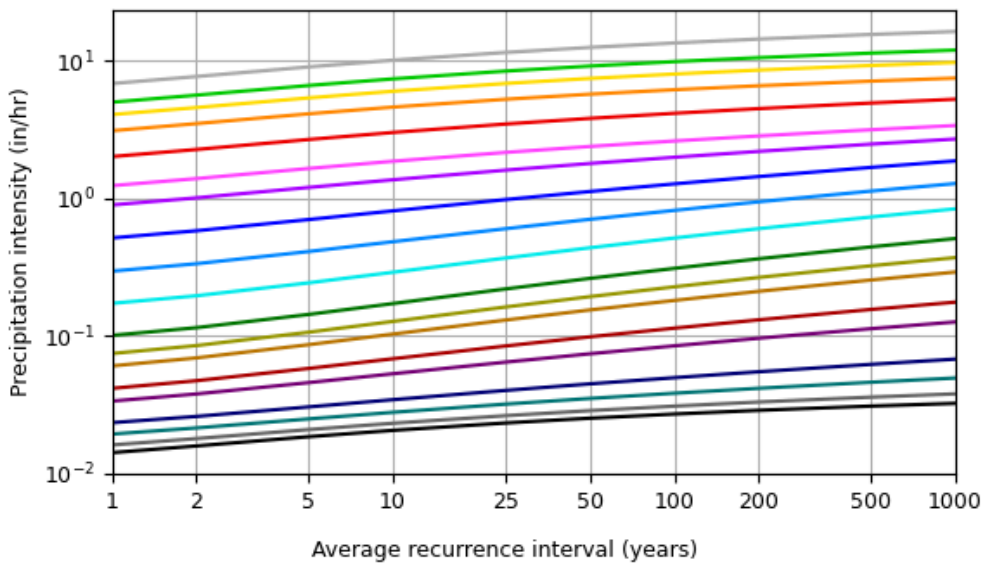
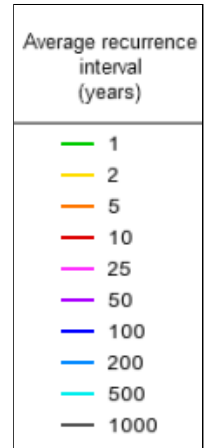
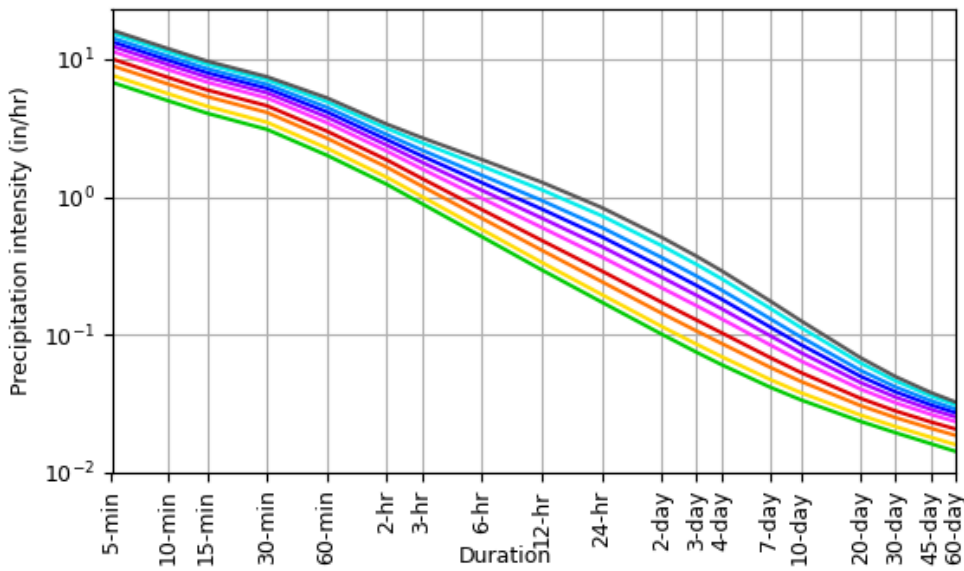
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based intensity-duration-frequency (IDF) curves

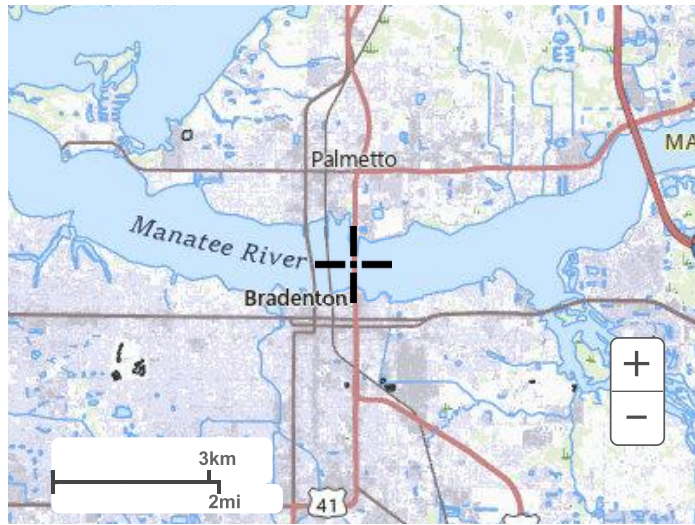
Latitude: 27.5047°, Longitude: -82.5631°



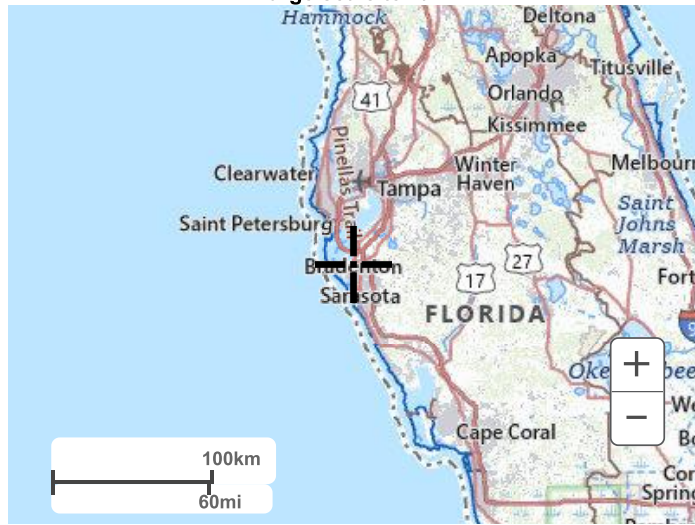
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Maps & aerials

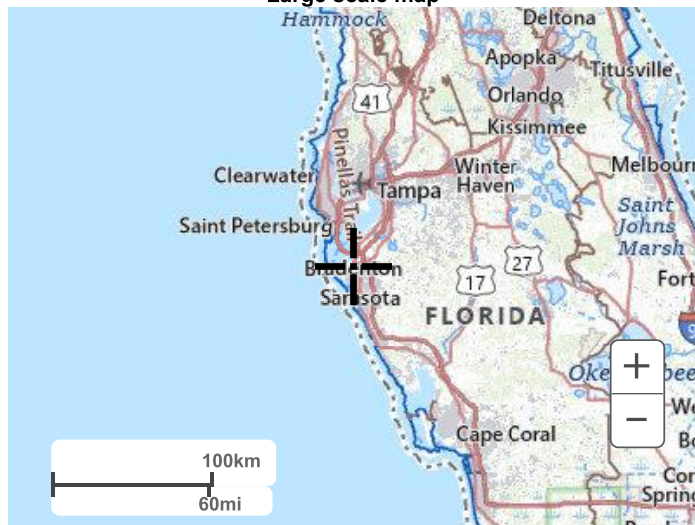
Small scale terrain



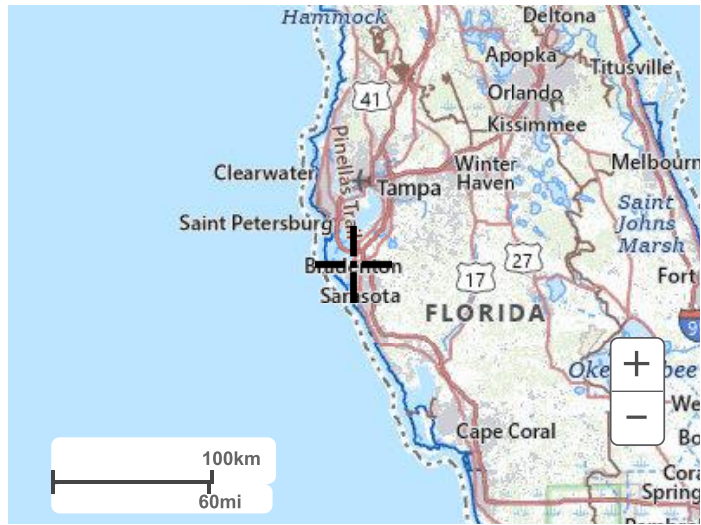
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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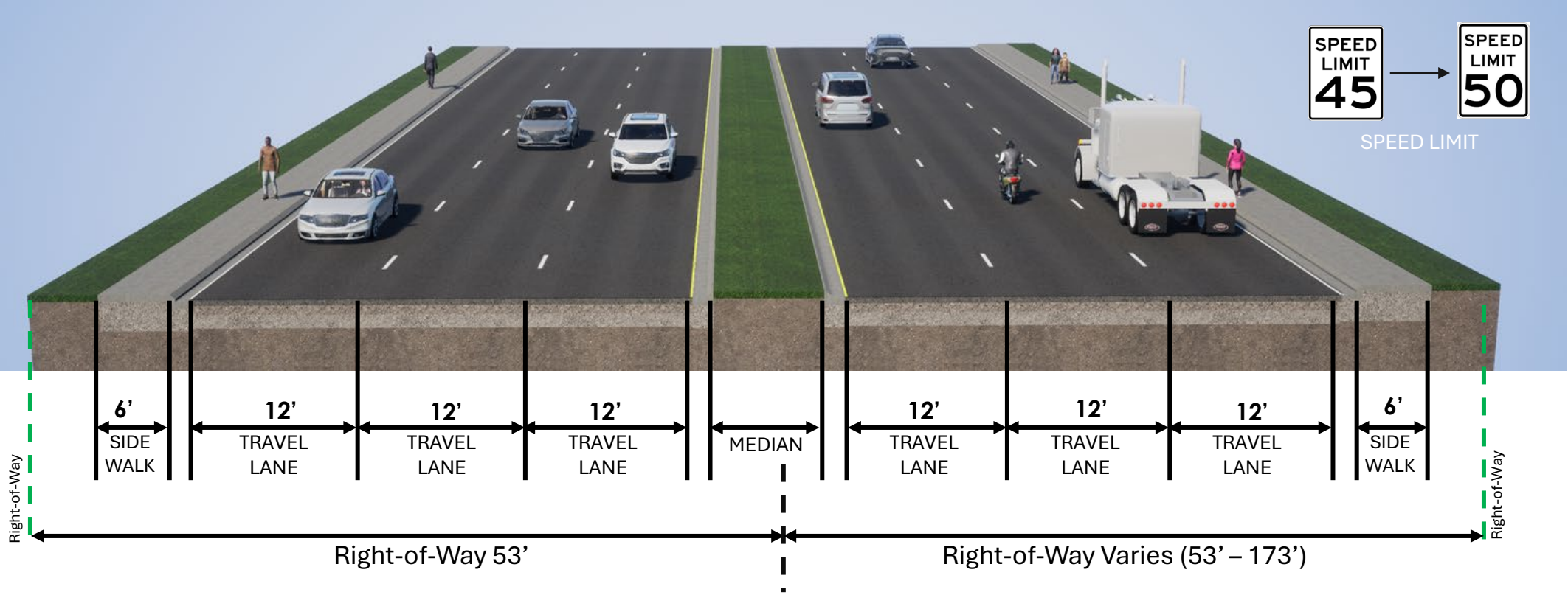
APPENDIX B

Typical Sections

Existing conditions

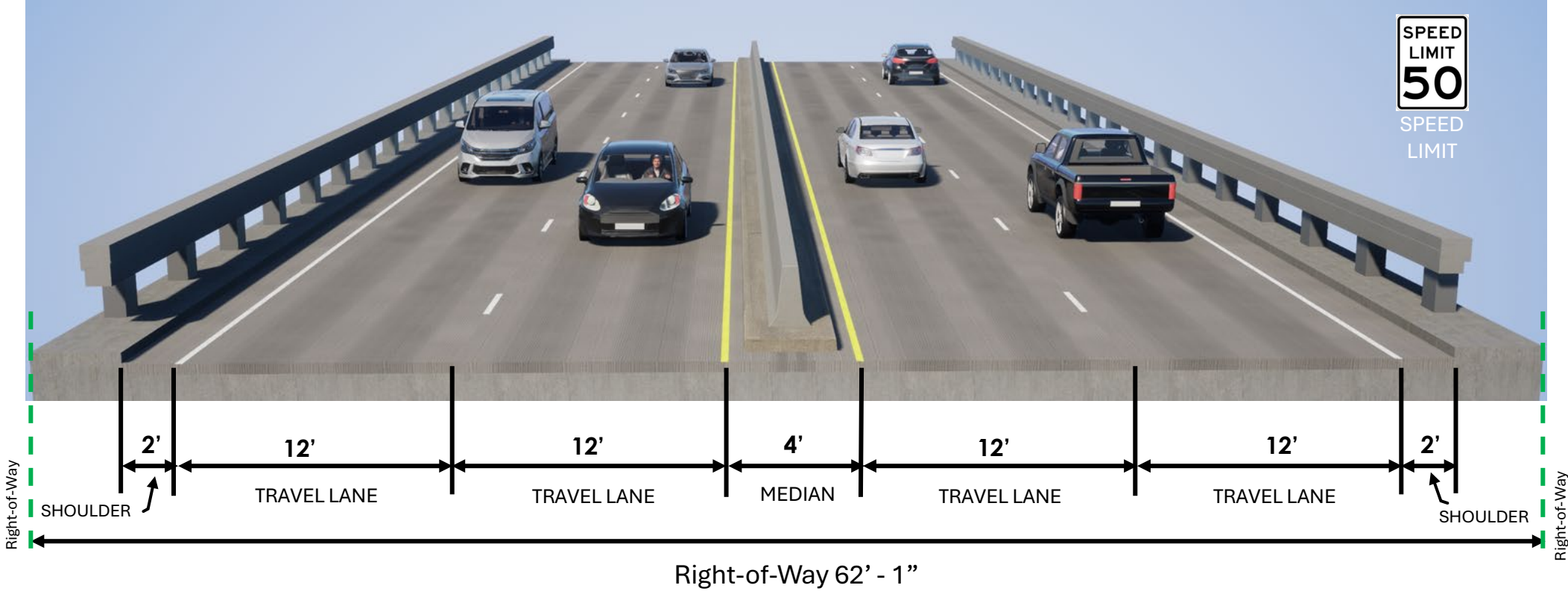
Corridor A: No-Build

Existing Typical Section: South of DeSoto Bridge



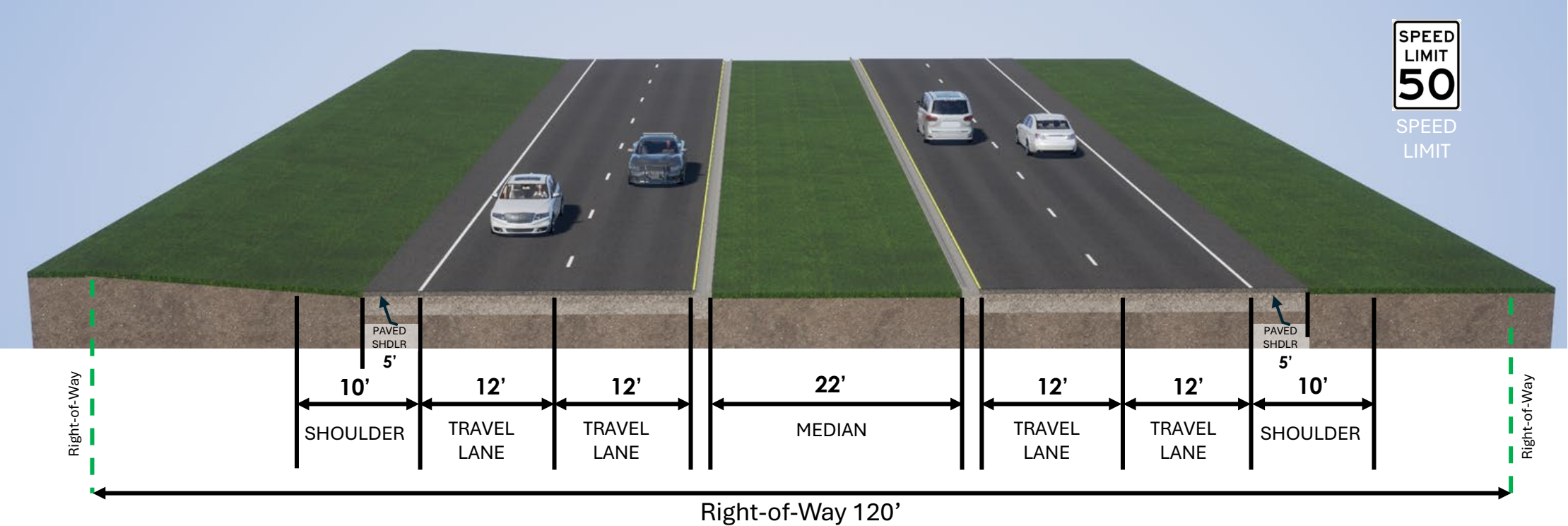
From 9th Street East to South of DeSoto Bridge

Existing Typical Section: DeSoto Bridge



From South of DeSoto Bridge to North of DeSoto Bridge

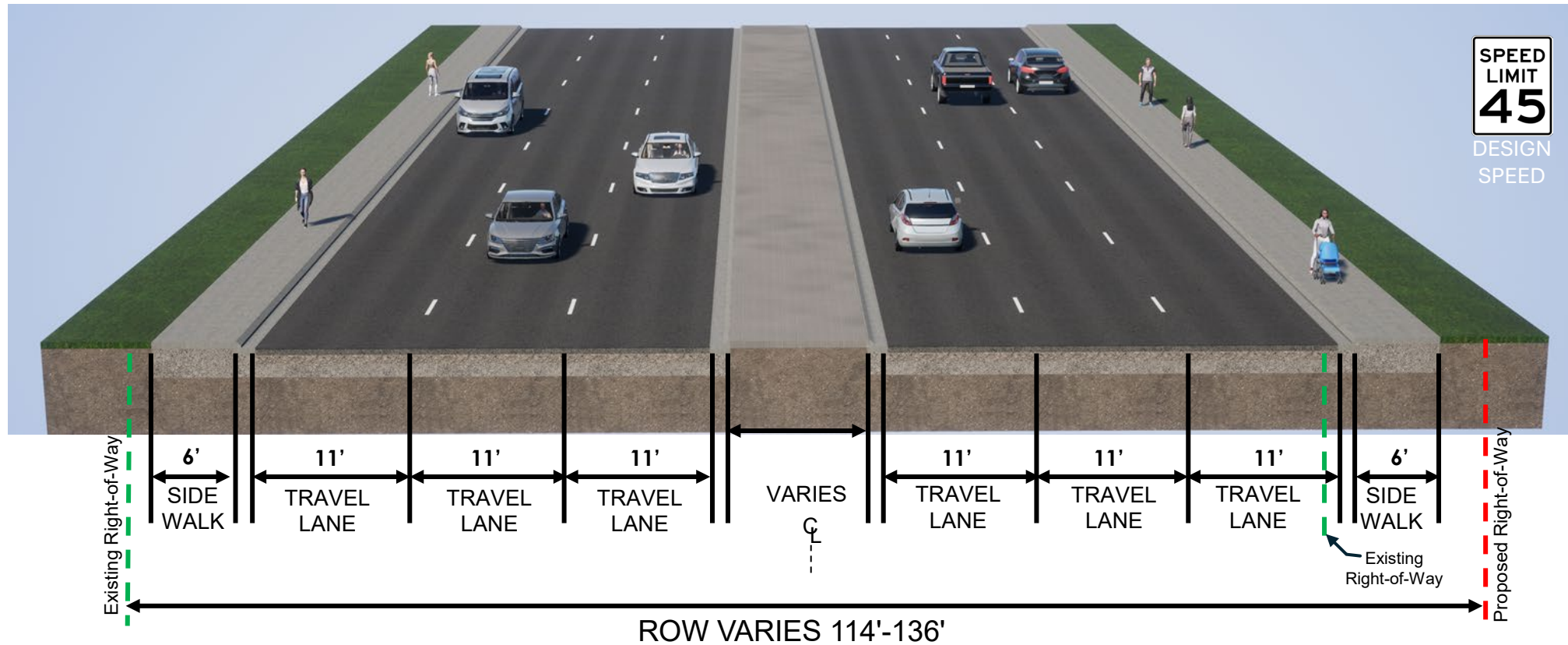
Existing Typical Section: North of Desoto Bridge



From North of DeSoto Bridge to CSX

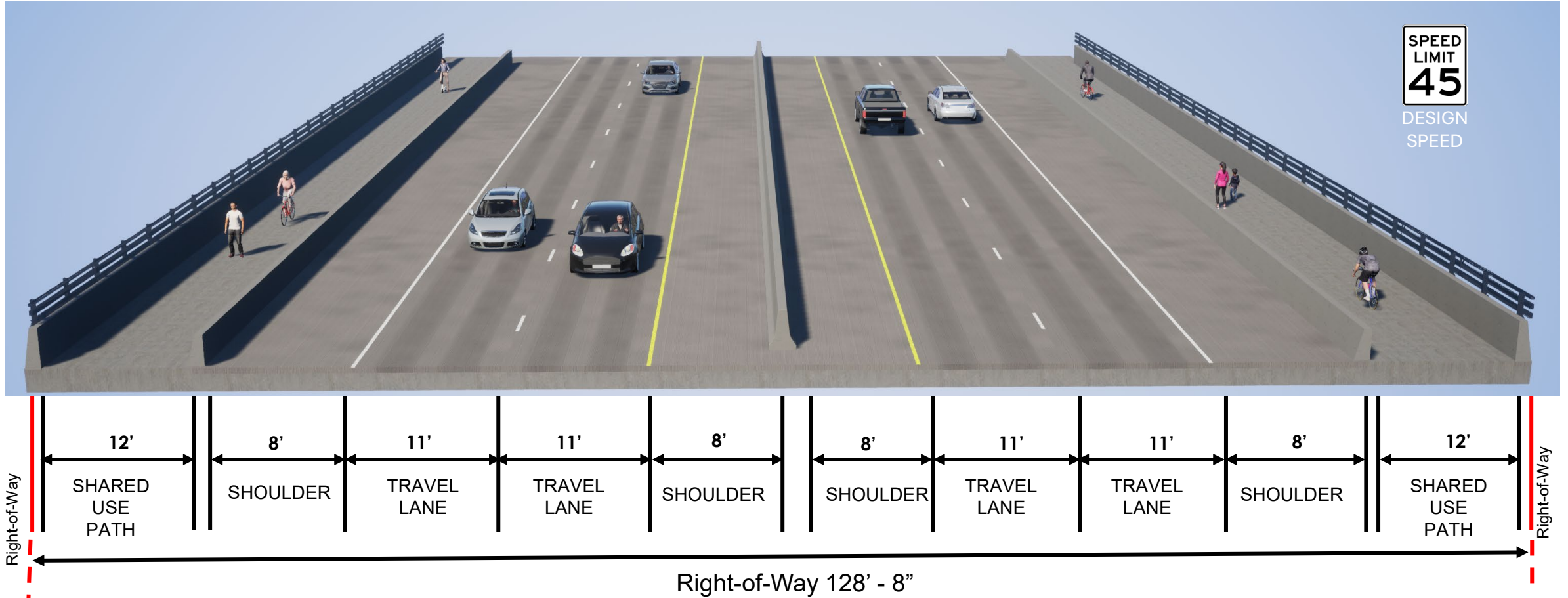
Proposed Corridor A: 6-Lanes At-Grade (Interim)

Corridor A: 6-Lane At-Grade (Interim) Typical Section: South of DeSoto Bridge

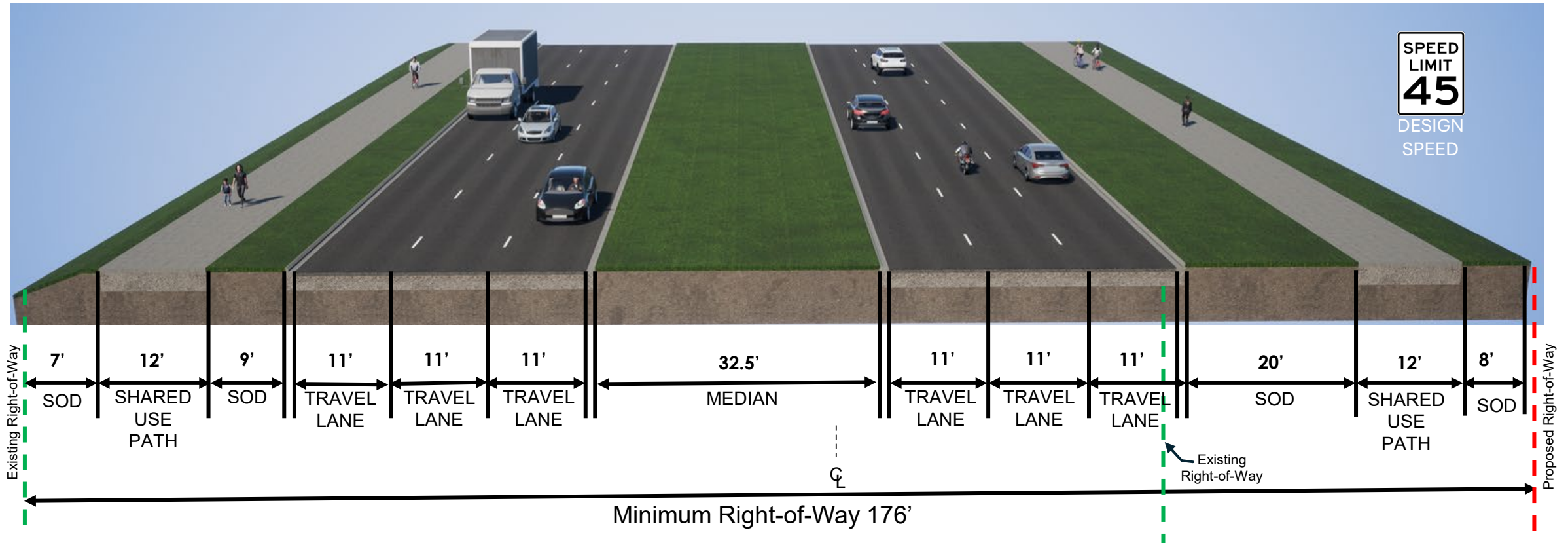


From S.R. 64/Manatee Avenue to South of DeSoto Bridge

Corridor A: 6-Lane At-Grade (Interim) Typical Section: DeSoto Bridge



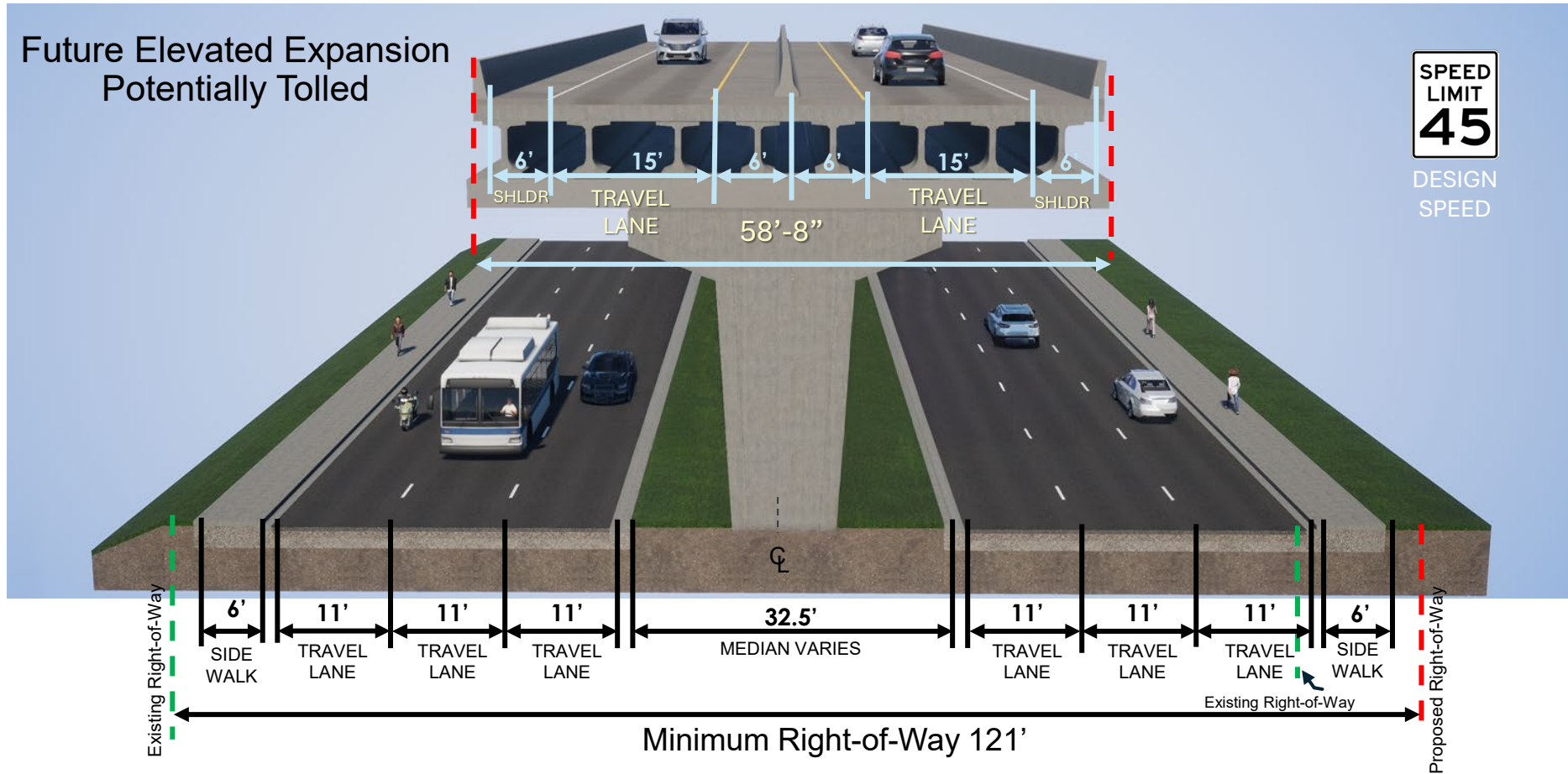
Corridor A: 6-Lane At-Grade (Interim) Typical Section: North of DeSoto Bridge



From North of DeSoto Bridge to Haben Boulevard

**Proposed
Corridor A: 6-Lanes At-Grade + 2-Lanes Elevated
(Ultimate)**

Corridor A: 6-Lane At-Grade + 2-Lanes Elevated (Ultimate) Typical Section: South of DeSoto Bridge

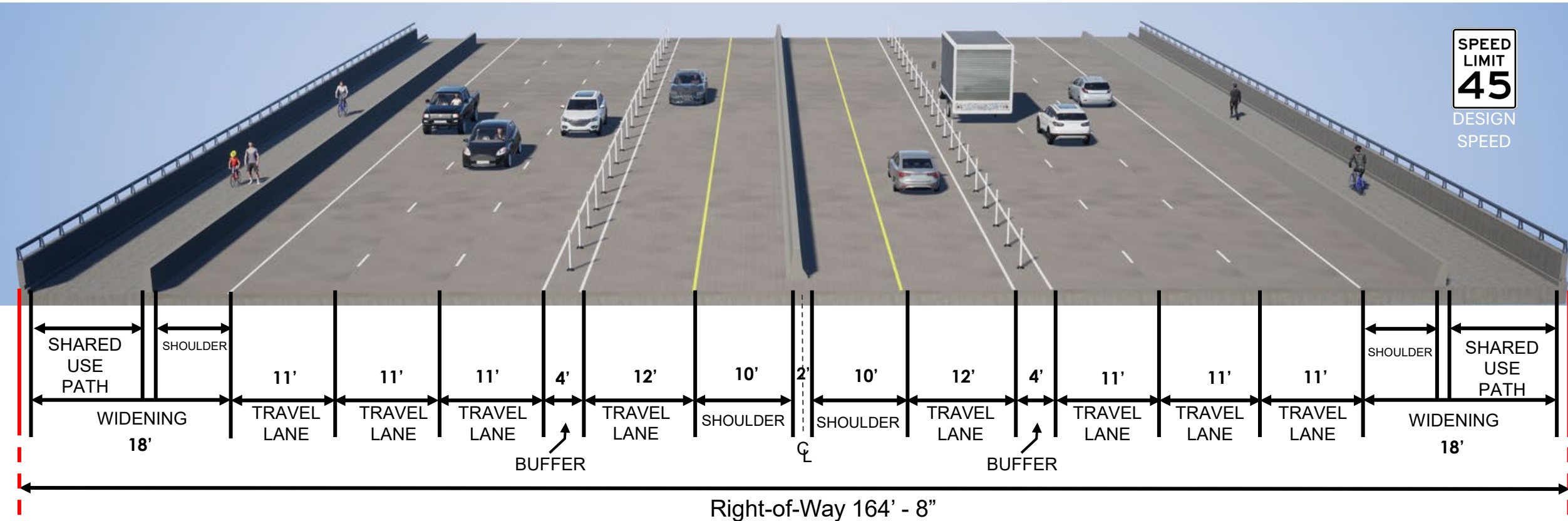


From 9th Street East to South of DeSoto Bridge

Corridor A: 6-Lane At-Grade + 2-Lanes Elevated (Ultimate) Typical Section: DeSoto Bridge

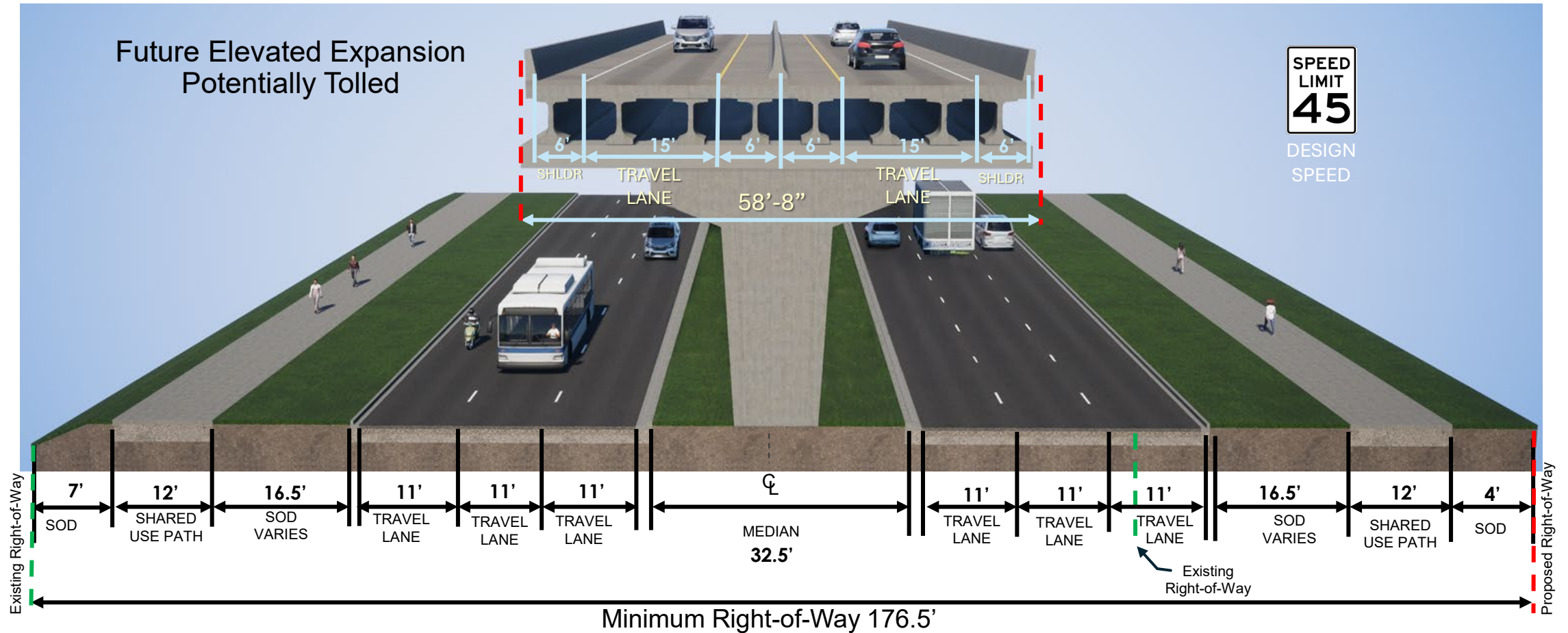
SPEED
LIMIT
45

DESIGN
SPEED



From South of DeSoto Bridge to North of DeSoto Bridge

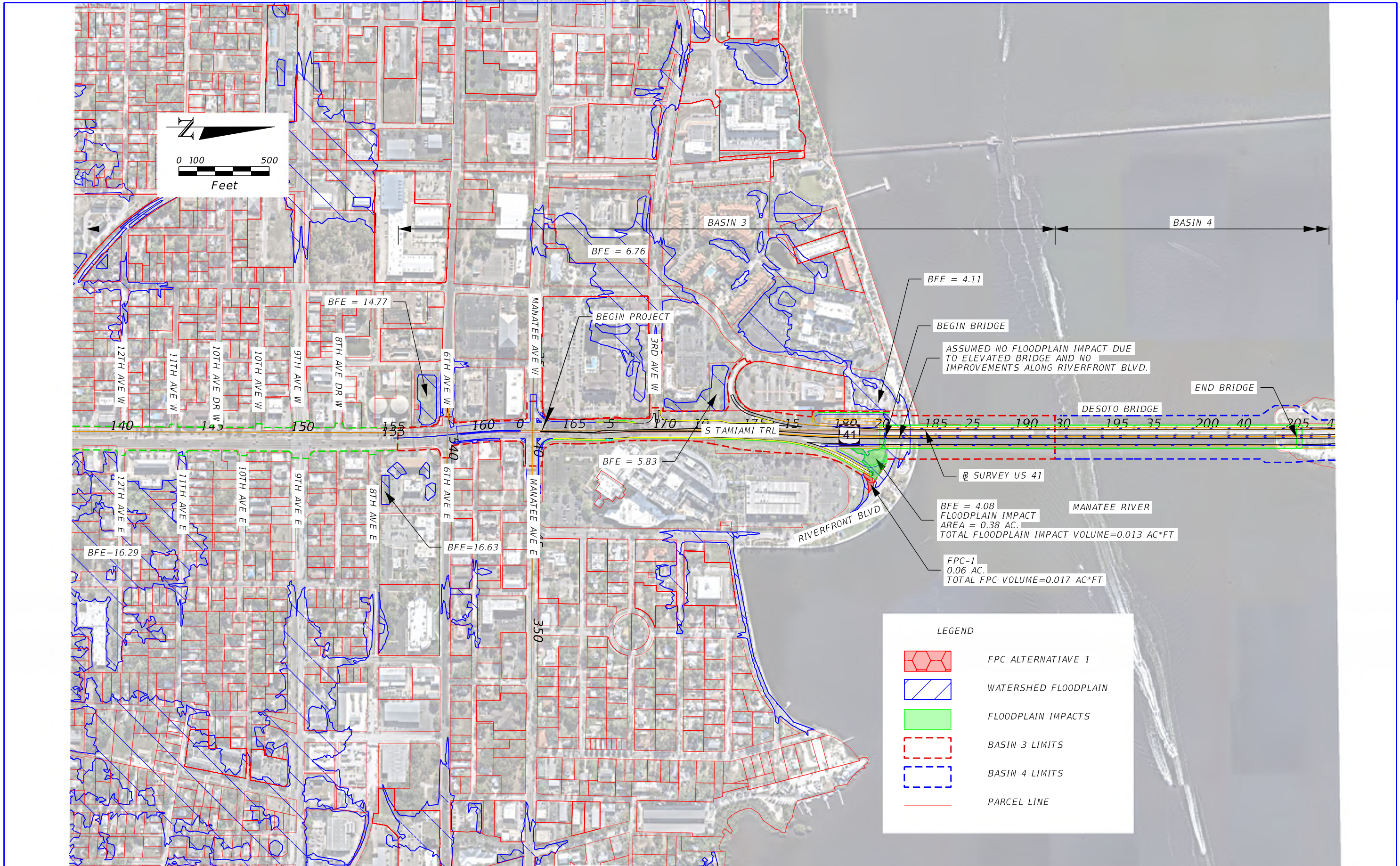
Corridor A: 6-Lane At-Grade + 2-Lanes Elevated (Ultimate) Typical Section: North of DeSoto Bridge



From North of DeSoto Bridge to CSX

APPENDIX C

Floodplain Impact & FPC Exhibits



| REVISIONS | |
|-----------|-------------|
| DATE | DESCRIPTION |
| | |

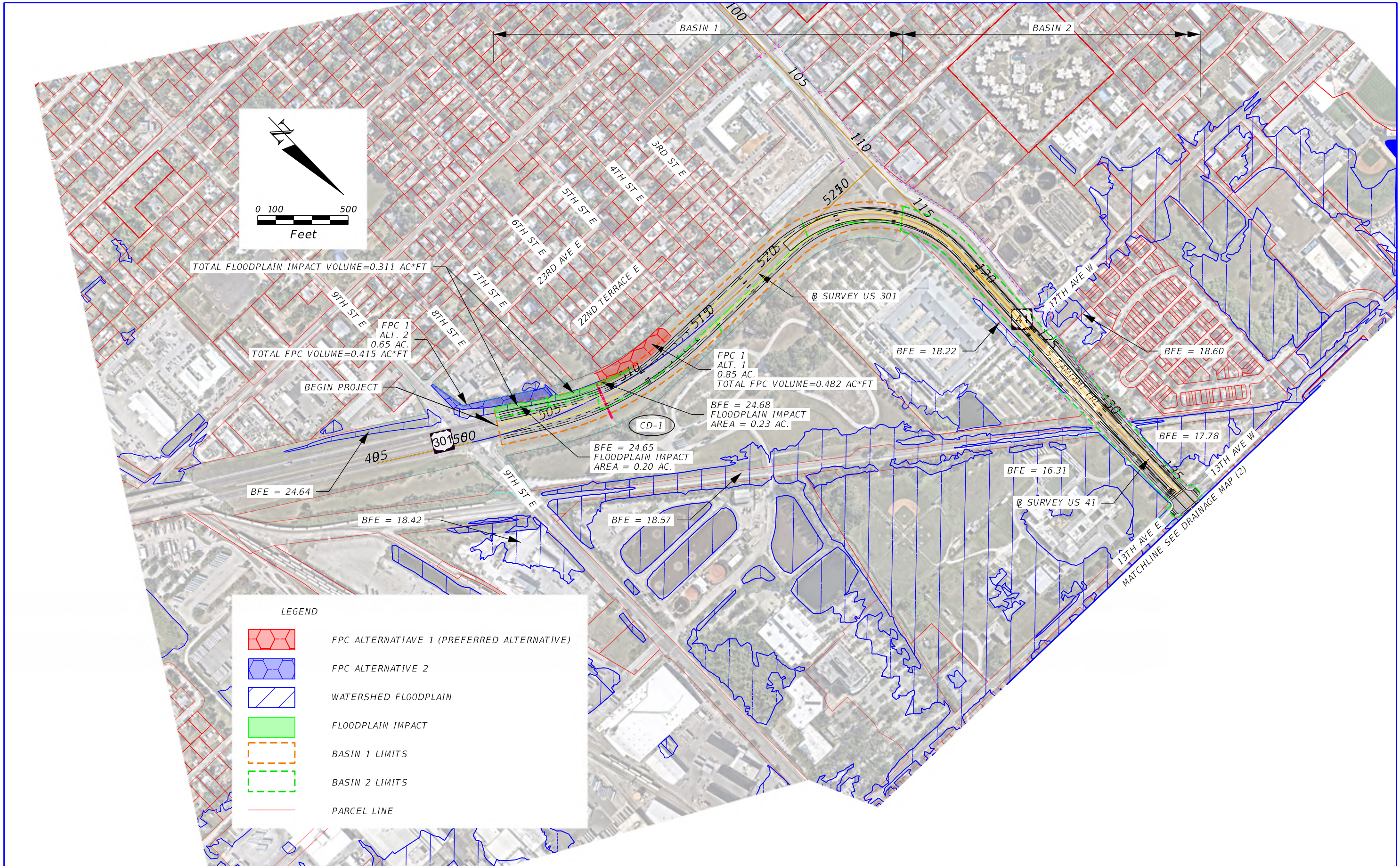
ENGINEER OF RECORD
 JIANYUN WANG, P.E.
 LICENSE NUMBER: 86554
 BURGESS & NIPLE, INC.
 1511 N. WESTSHORE BLVD., SUITE 500
 TAMPA, FL 33607

| STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | |
|--|---------|----------------------|
| ROAD NO. | COUNTY | FINANCIAL PROJECT ID |
| 41 | MANATEE | 444843-1-22-01 |

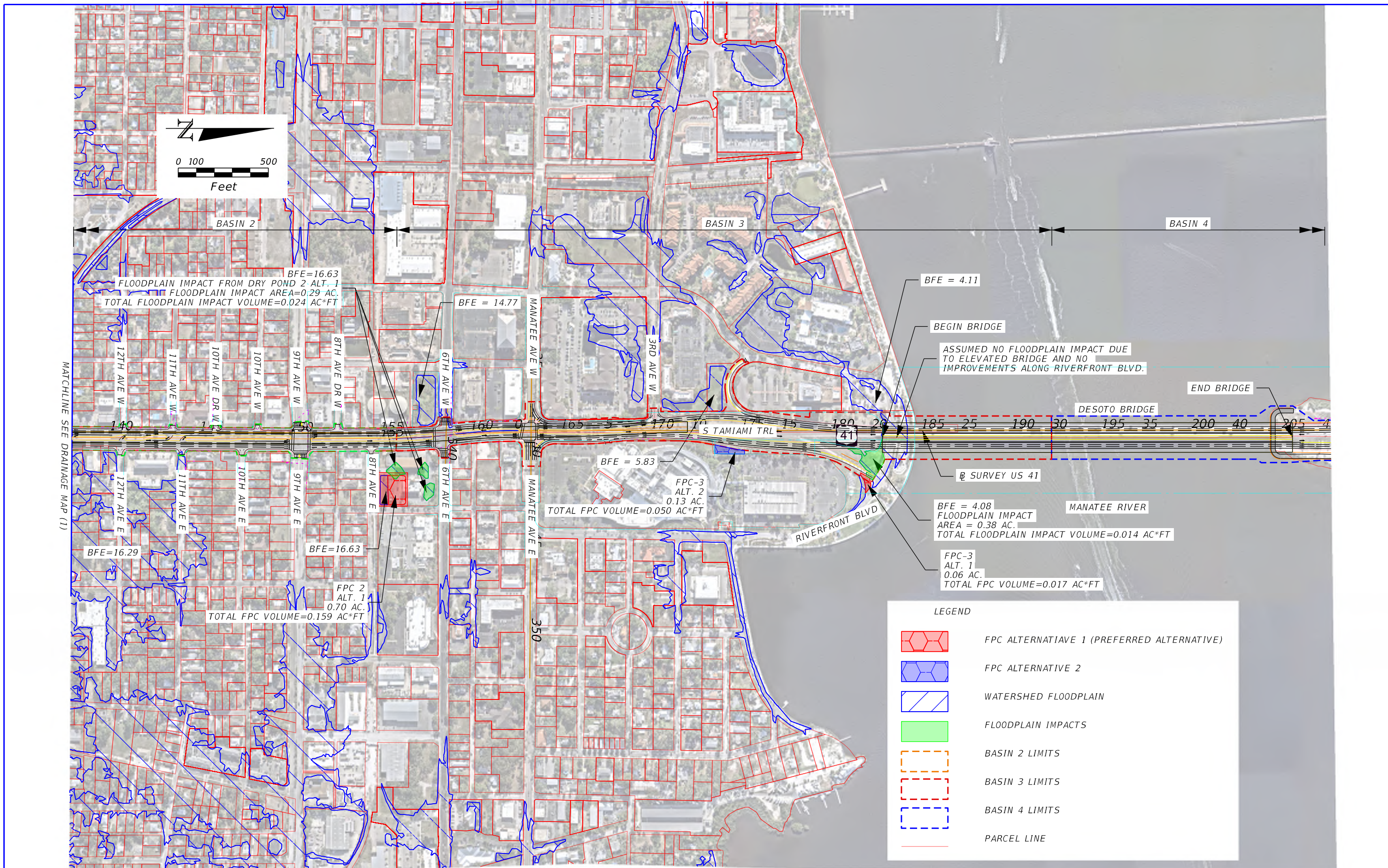
**FLOODPLAIN IMPACT
 INTERIM CONDITION
 EXHIBIT**

SHEET NO.
 1

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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.



MATCHLINE SEE DRAINAGE MAP (1)

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

| REVISIONS | | | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | FLOODPLAIN IMPACT ULTIMATE CONDITION EXHIBIT (2) | SHEET NO. 2 |
|-----------|-------------|------|-------------|---|--|--|---------|----------------------|---|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLE, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | 41 | MANATEE | 444843-1-22-01 | | |

APPENDIX D

Floodplain Impact & FPC Calculations

| Interim Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|---------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC-1 | | | |
| BFE =4.08 | | | | | | | |
| Watershed Node: ND0700 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 5.00 | 0.33 | | | 5.00 | 0.04 | | |
| 4.08 | 0.17 | 0.013 | 0.013 | 4.08 | 0.02 | 0.002 | 0.017 |
| 4.00 | 0.16 | 0.000 | | 4.00 | 0.02 | 0.015 | 0.015 |
| | | | | 3.00 | 0.01 | 0.000 | |

| Ultimate Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|--------------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC 1 ALT. 1 | | | |
| BFE =24.68 | | | | | | | |
| Watershed Node: ND0910 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 25.00 | 0.40 | | | 25.00 | 0.38 | | |
| 24.68 | 0.34 | 0.191 | 0.311 | 24.68 | 0.35 | 0.222 | 0.482 |
| 24.00 | 0.22 | 0.120 | 0.120 | 24.00 | 0.30 | 0.260 | 0.260 |
| 23.00 | 0.02 | 0.000 | 0.000 | 23.00 | 0.22 | 0.000 | |

| Ultimate Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|--------------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC 1 ALT. 2 | | | |
| BFE =24.68 | | | | | | | |
| Watershed Node: ND0910 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 25.00 | 0.40 | | | 25.00 | 0.38 | | |
| 24.68 | 0.34 | 0.191 | 0.311 | 24.68 | 0.34 | 0.205 | 0.415 |
| 24.00 | 0.22 | 0.120 | 0.120 | 24.00 | 0.26 | 0.210 | 0.210 |
| 23.00 | 0.02 | 0.000 | | 23.00 | 0.16 | 0.000 | |

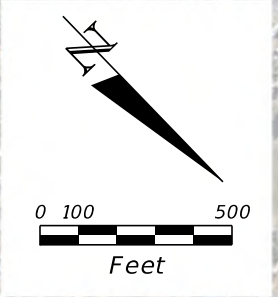
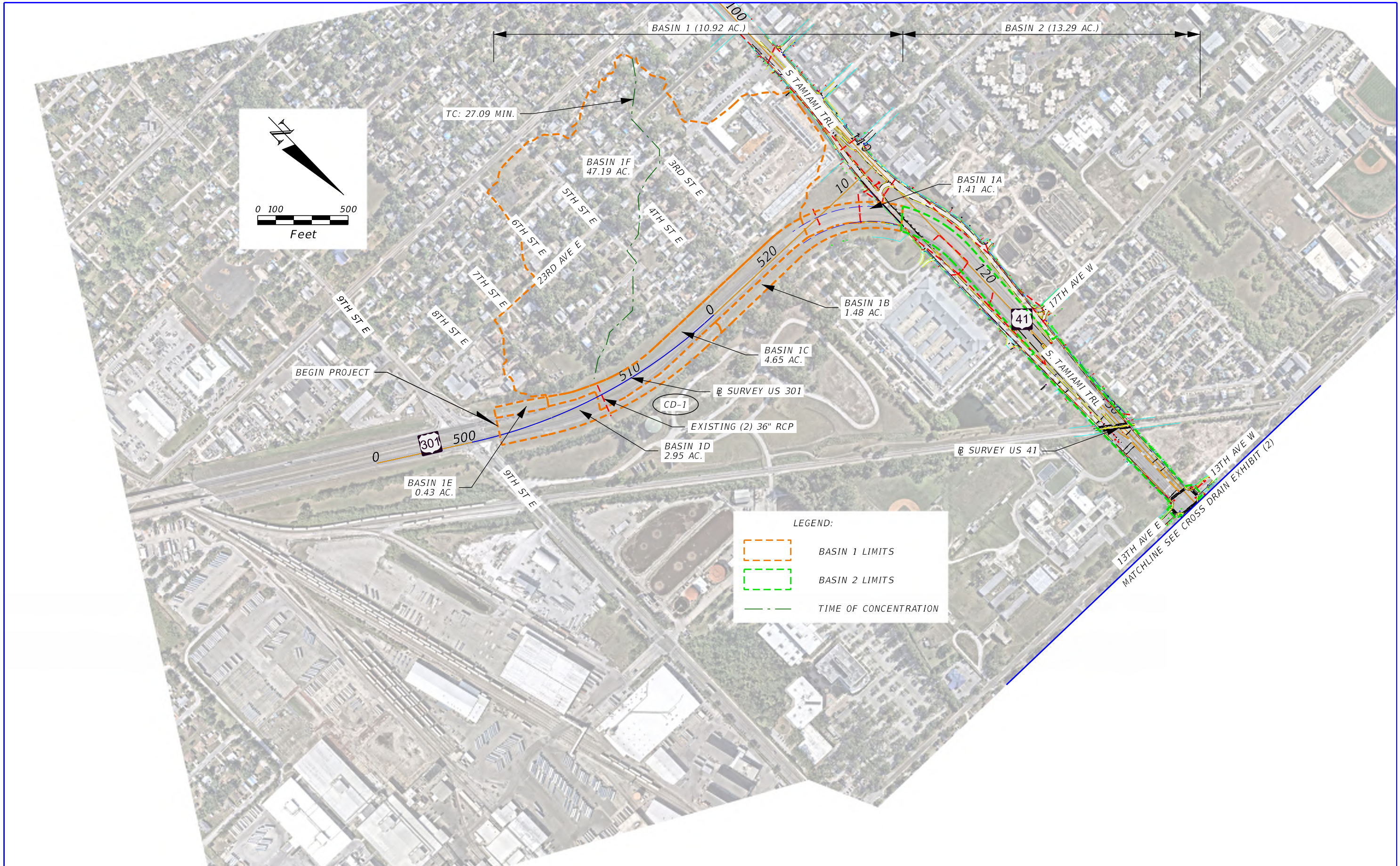
| Ultimate Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|--------------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC 2 ALT. 1 | | | |
| BFE =16.63 | | | | | | | |
| Watershed Node: ND0750 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 17.00 | 0.12 | | | 17.00 | 0.28 | | |
| 16.63 | 0.08 | 0.024 | 0.024 | 16.63 | 0.27 | 0.159 | 0.159 |
| 16.00 | 0.00 | 0.000 | | 16.00 | 0.24 | 0.000 | |

| Ultimate Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|--------------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC-3 ALT. 1 | | | |
| BFE =4.08 | | | | | | | |
| Watershed Node: ND0700 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 5.00 | 0.38 | | | 5.00 | 0.04 | | |
| 4.08 | 0.19 | 0.014 | 0.014 | 4.08 | 0.02 | 0.002 | 0.017 |
| 4.00 | 0.17 | 0.000 | | 4.00 | 0.02 | 0.015 | 0.015 |
| | | | | 3.00 | 0.01 | 0.000 | |

| Ultimate Condition | | | | | | | |
|------------------------|-----------|---------------------|----------------------|--------------|-----------|---------------------|----------------------|
| FP Impact | | | | FPC-3 ALT. 2 | | | |
| BFE =4.08 | | | | | | | |
| Watershed Node: ND0700 | | | | | | | |
| EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) | EL (ft) | Area (ac) | Inc. volume (ac-ft) | Total Volume (ac-ft) |
| 5.00 | 0.38 | | | 5.00 | 0.10 | | |
| 4.08 | 0.19 | 0.014 | 0.014 | 4.08 | 0.06 | 0.005 | 0.050 |
| 4.00 | 0.17 | 0.000 | | 4.00 | 0.06 | 0.045 | 0.045 |
| | | | | 3.00 | 0.03 | 0.000 | |

APPENDIX E

Existing Cross Drain Exhibit

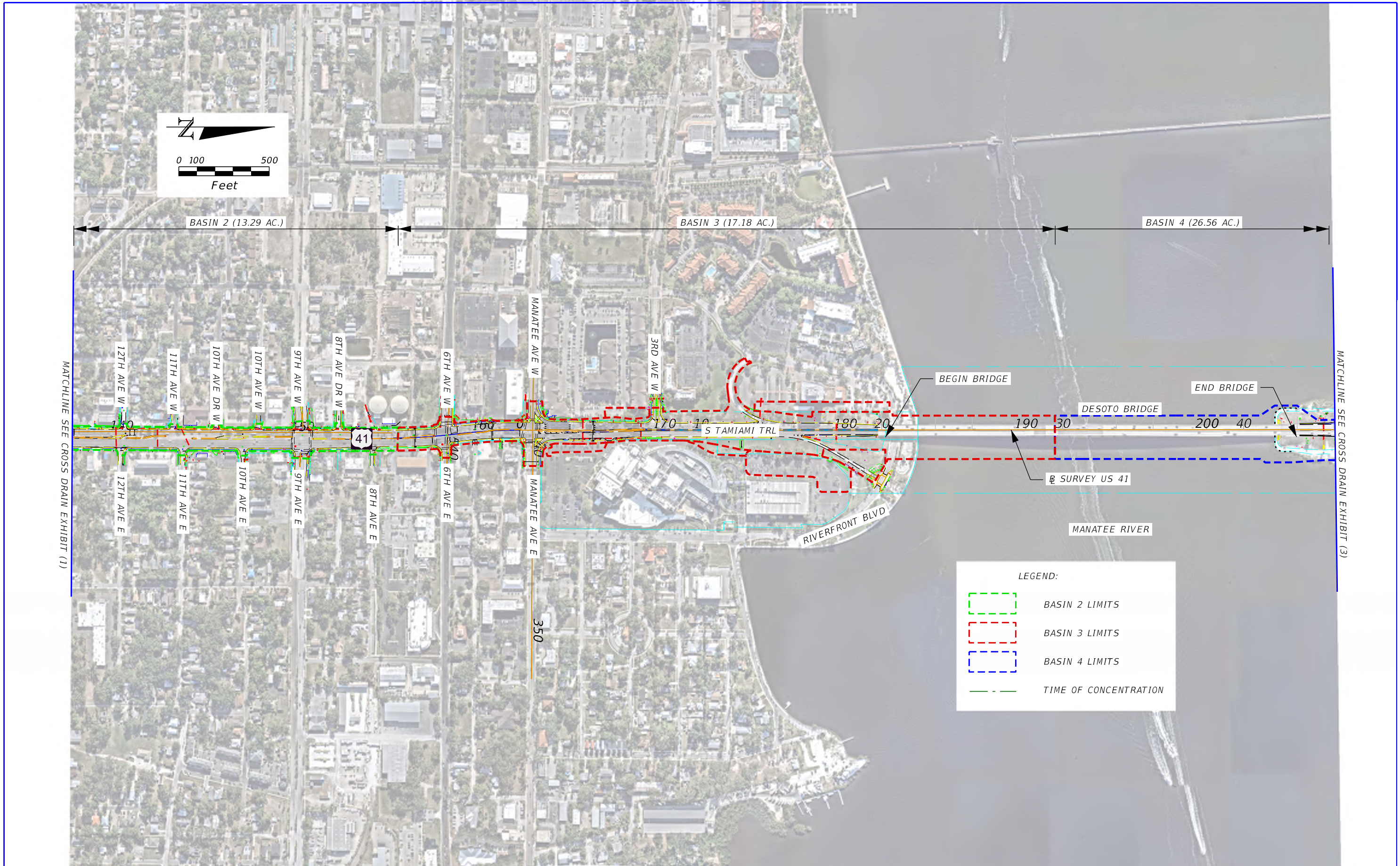


LEGEND:

| | |
|--|-----------------------|
| | BASIN 1 LIMITS |
| | BASIN 2 LIMITS |
| | TIME OF CONCENTRATION |

| REVISIONS | | | | ENGINEER OF RECORD | | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | CROSS DRAIN EXISTING CONDITION EXHIBIT (1) | SHEET NO. 1 |
|-----------|-------------|------|-------------|---|--|--|--|---------|----------------------|--|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | | | | | 41 | MANATEE | 444843-1-22-01 | | |

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| REVISIONS | | REVISIONS | |
|-----------|-------------|-----------|-------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION |
| | | | |

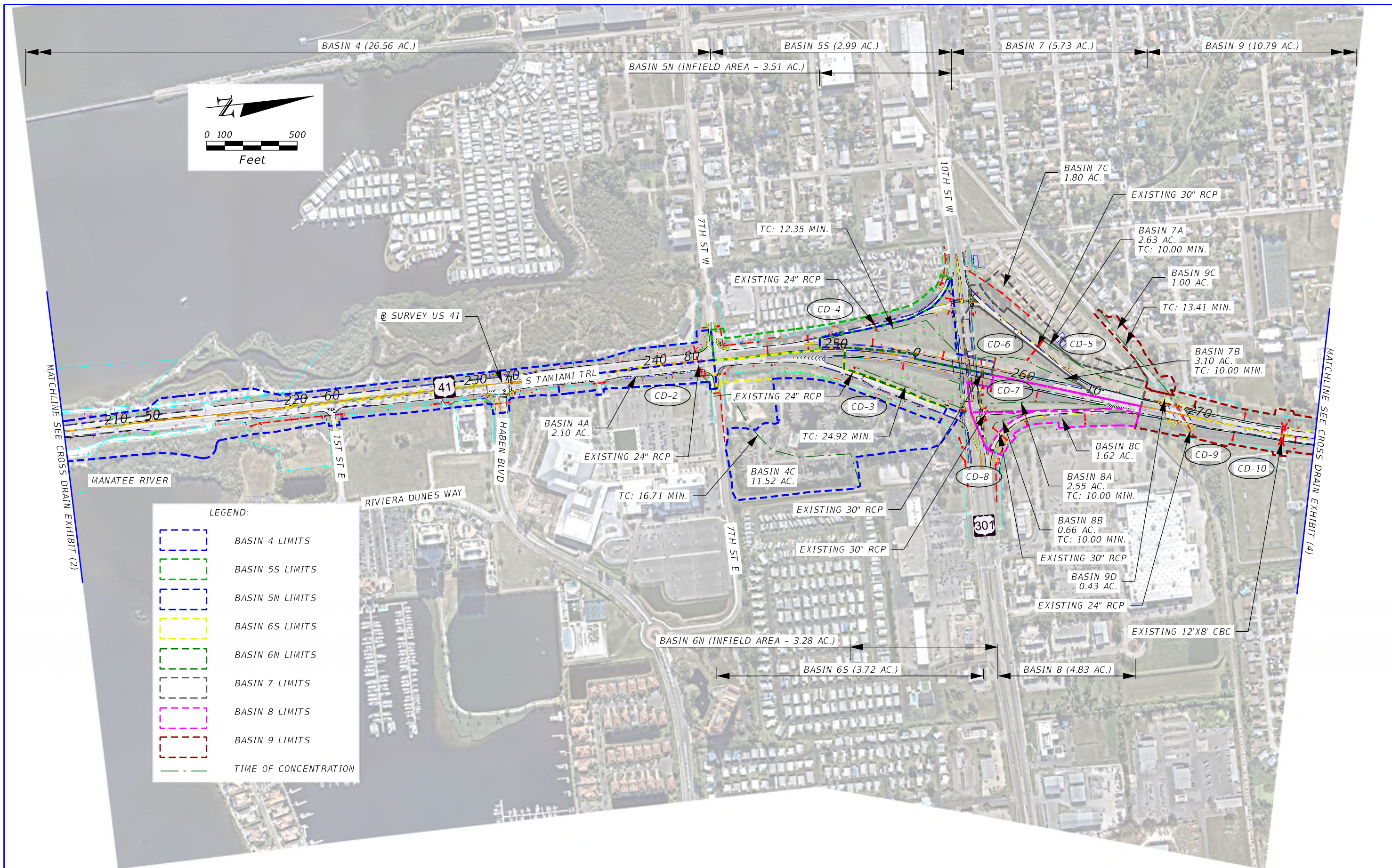
ENGINEER OF RECORD
 JIANYUN WANG, P.E.
 LICENSE NUMBER: 86554
 BURGESS & NIPLÉ, INC.
 1511 N. WESTSHORE BLVD., SUITE 500
 TAMPA, FL 33607

| STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | |
|--|---------|----------------------|
| ROAD NO. | COUNTY | FINANCIAL PROJECT ID |
| 41 | MANATEE | 444843-1-22-01 |

**CROSS DRAIN
 EXISTING CONDITION
 EXHIBIT (2)**

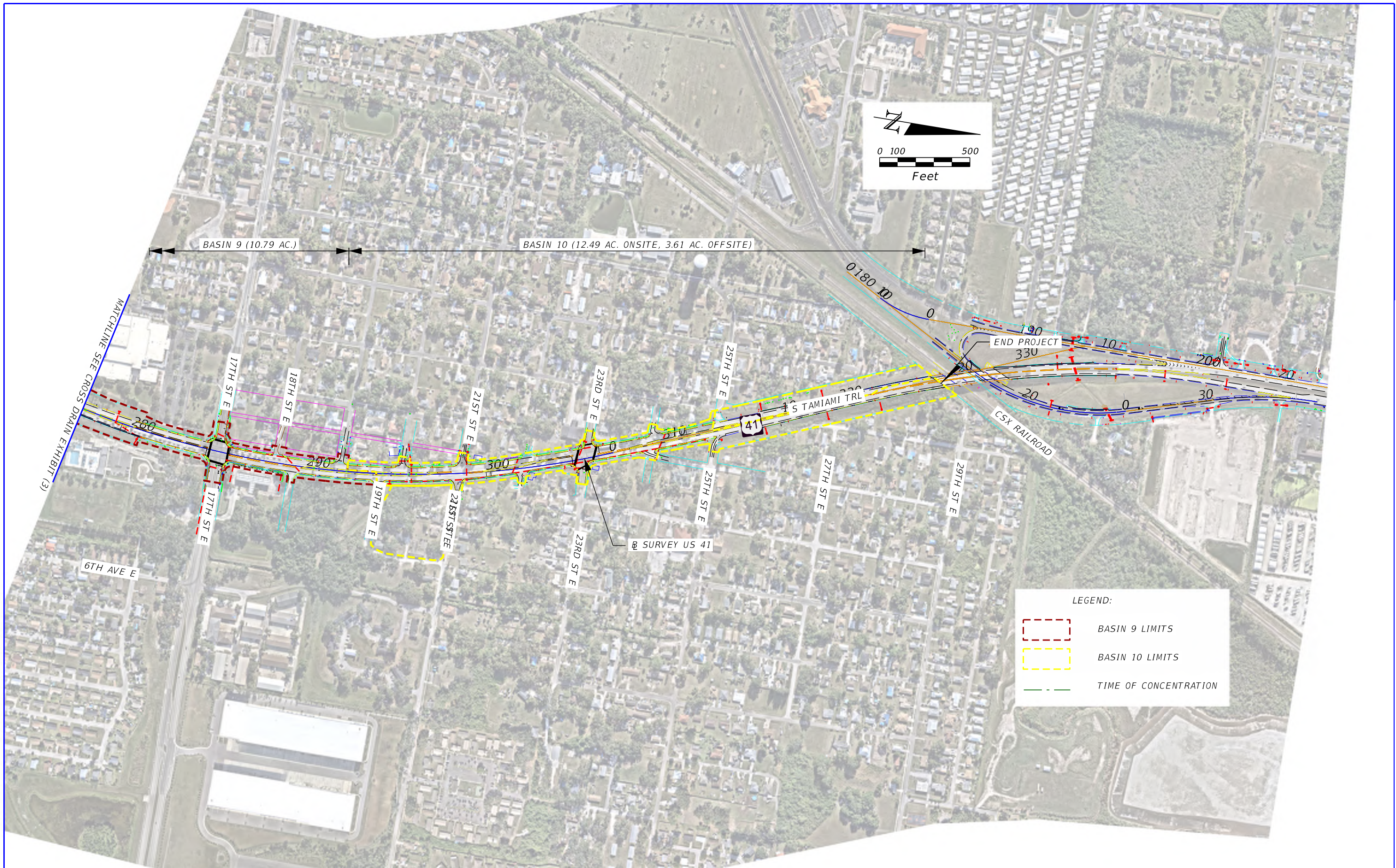
SHEET NO.
2

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



| REVISIONS | | | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | CROSS DRAIN EXISTING CONDITION EXHIBIT (3) | SHEET NO. 3 |
|-----------|-------------|------|-------------|---|--|--|---------|----------------------|--|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | | | | 41 | MANATEE | 444843-1-22-01 | | |

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



| REVISIONS | | REVISIONS | |
|-----------|-------------|-----------|-------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION |
| | | | |

ENGINEER OF RECORD
 JIANYUN WANG, P.E.
 LICENSE NUMBER: 86554
 BURGESS & NIPLÉ, INC.
 1511 N. WESTSHORE BLVD., SUITE 500
 TAMPA, FL 33607

| STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | |
|--|---------|----------------------|
| ROAD NO. | COUNTY | FINANCIAL PROJECT ID |
| 41 | MANATEE | 444843-1-22-01 |

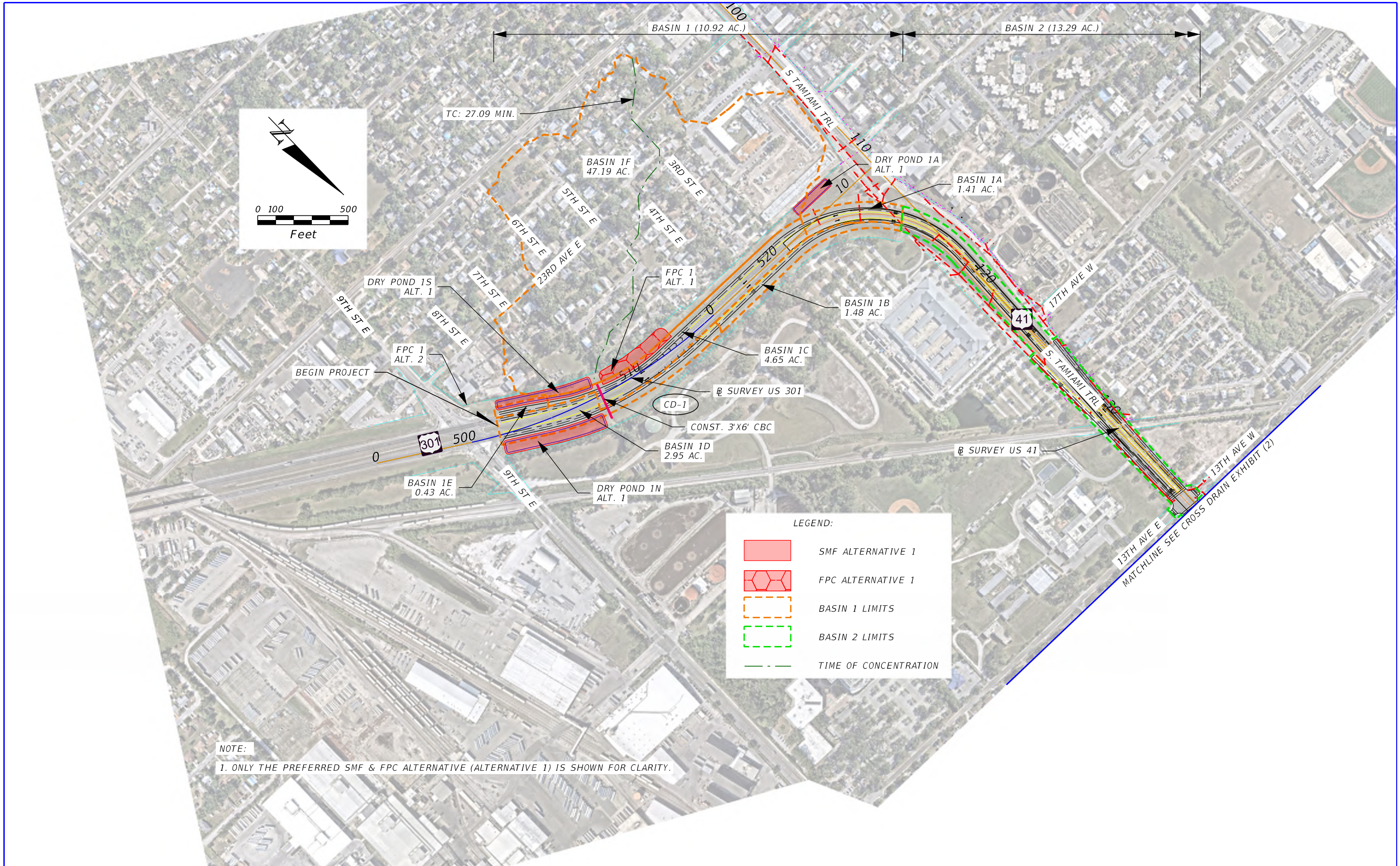
**CROSS DRAIN
 EXISTING CONDITION
 EXHIBIT (4)**

SHEET NO.
4

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

APPENDIX F

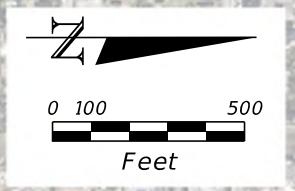
Ultimate Cross Drain Exhibit



NOTE:
 1. ONLY THE PREFERRED SMF & FPC ALTERNATIVE (ALTERNATIVE 1) IS SHOWN FOR CLARITY.

| REVISIONS | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | CROSS DRAIN ULTIMATE CONDITION EXHIBIT (1) | SHEET NO. 1 |
|-----------|-------------|--------------------|---|--|---------|----------------------|--|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | 41 | MANATEE | 444843-1-22-01 | | |

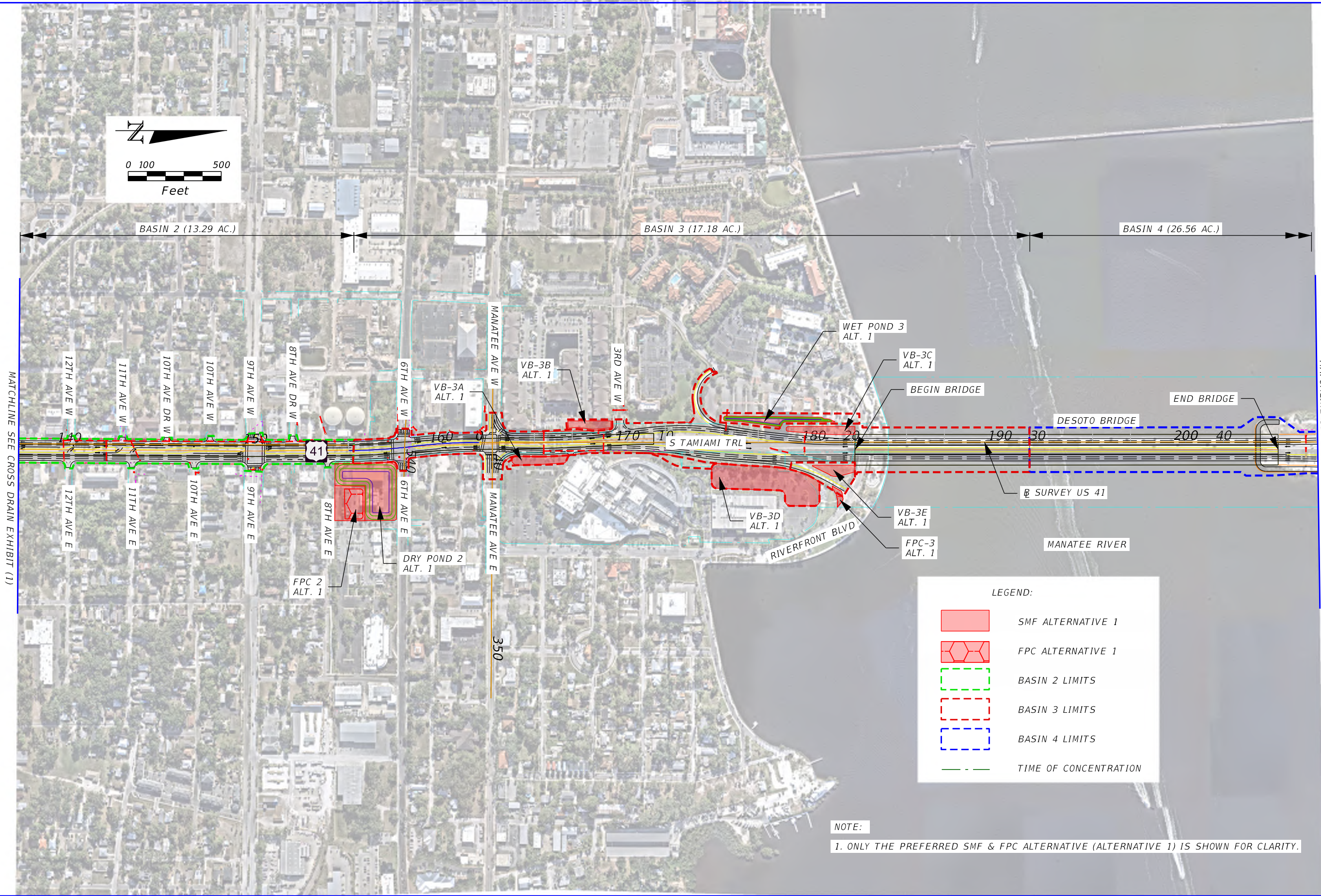
THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



BASIN 2 (13.29 AC.) BASIN 3 (17.18 AC.) BASIN 4 (26.56 AC.)

MATCHLINE SEE CROSS DRAIN EXHIBIT (1)

MATCHLINE SEE CROSS DRAIN EXHIBIT (3)



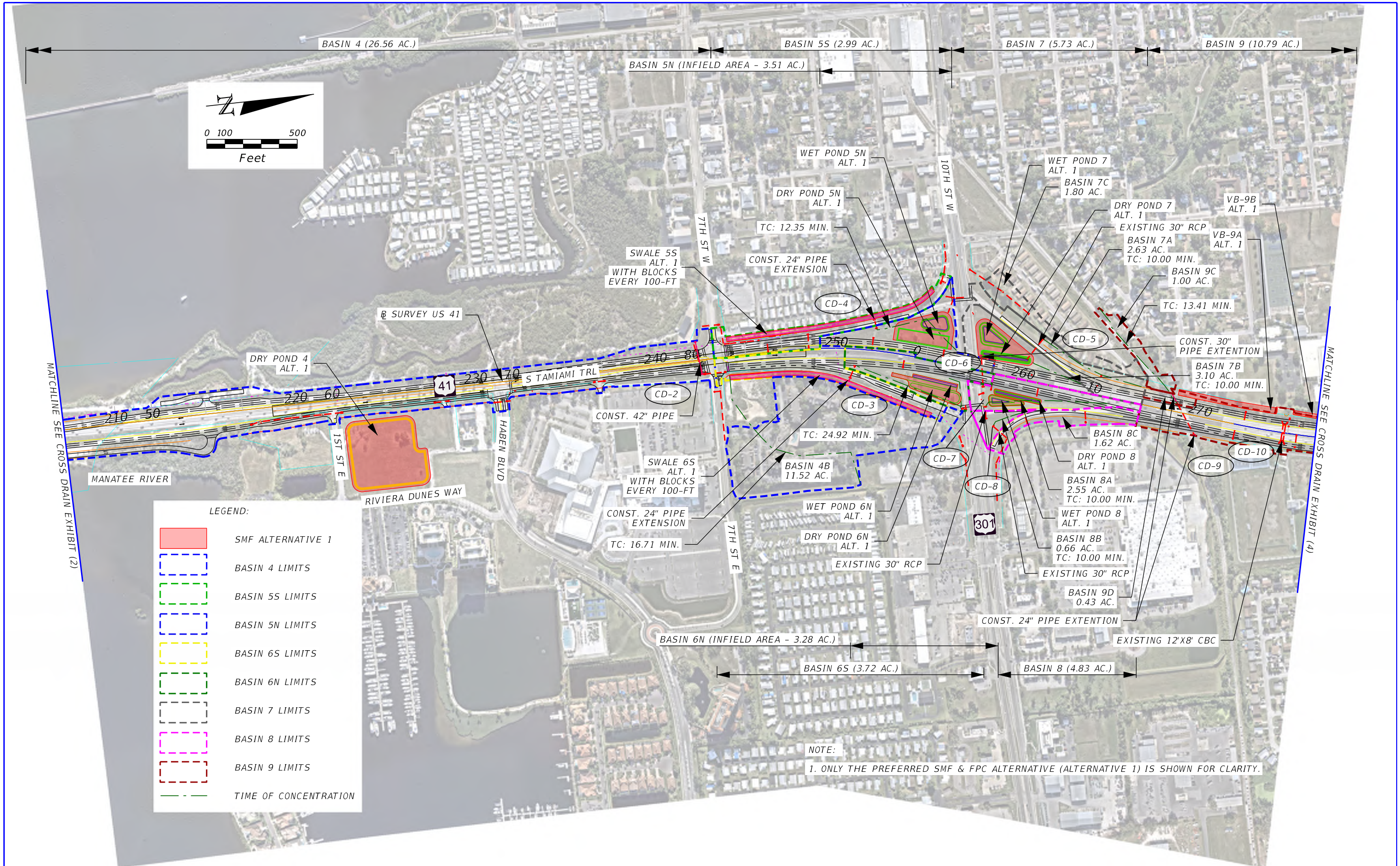
LEGEND:

- SMF ALTERNATIVE 1
- FPC ALTERNATIVE 1
- BASIN 2 LIMITS
- BASIN 3 LIMITS
- BASIN 4 LIMITS
- TIME OF CONCENTRATION

NOTE:
1. ONLY THE PREFERRED SMF & FPC ALTERNATIVE (ALTERNATIVE 1) IS SHOWN FOR CLARITY.

| REVISIONS | | | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | CROSS DRAIN ULTIMATE CONDITION EXHIBIT (2) | SHEET NO. 2 |
|-----------|-------------|------|-------------|---|--|--|--------|----------------------|---|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | | | | | | 41 | | |

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



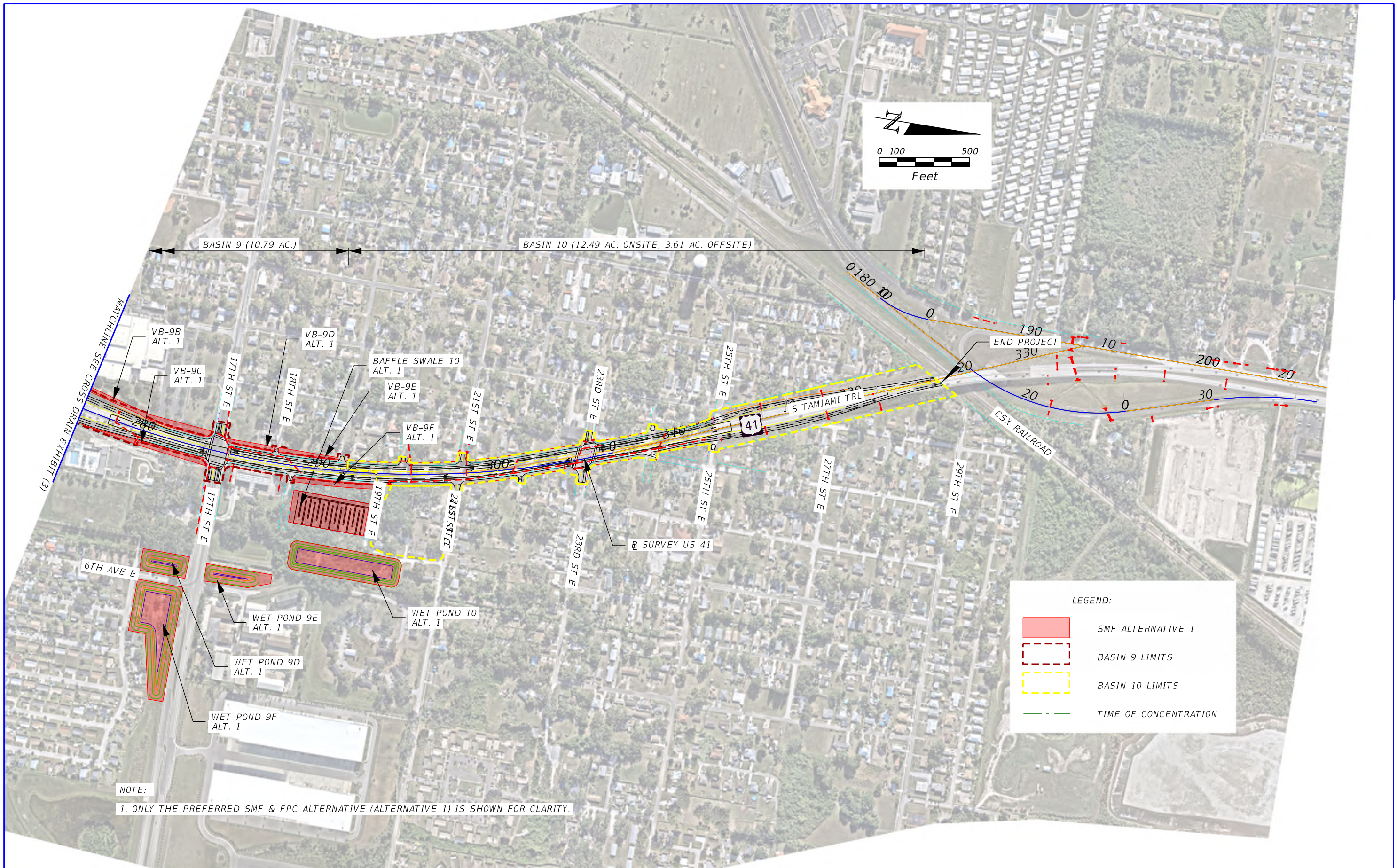
LEGEND:

- SMF ALTERNATIVE 1
- BASIN 4 LIMITS
- BASIN 5S LIMITS
- BASIN 5N LIMITS
- BASIN 6S LIMITS
- BASIN 6N LIMITS
- BASIN 7 LIMITS
- BASIN 8 LIMITS
- BASIN 9 LIMITS
- TIME OF CONCENTRATION

NOTE:
1. ONLY THE PREFERRED SMF & FPC ALTERNATIVE (ALTERNATIVE 1) IS SHOWN FOR CLARITY.

| REVISIONS | | | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | CROSS DRAIN ULTIMATE CONDITION EXHIBIT (3) | SHEET NO. 3 |
|-----------|-------------|------|-------------|---|--|--|--------|----------------------|---|-----------------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | | |
| | | | | | | | | 41 | | |

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| REVISIONS | | REVISIONS | | ENGINEER OF RECORD | | STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION | | | SHEET NO. 4 |
|-----------|-------------|-----------|-------------|---|--|--|---------|----------------------|----------------|
| DATE | DESCRIPTION | DATE | DESCRIPTION | | | ROAD NO. | COUNTY | FINANCIAL PROJECT ID | |
| | | | | JIANYUN WANG, P.E. LICENSE NUMBER: 86554 BURGESS & NIPLÉ, INC. 1511 N. WESTSHORE BLVD., SUITE 500 TAMPA, FL 33607 | | 41 | MANATEE | 444843-1-22-01 | |

**CROSS DRAIN
ULTIMATE CONDITION
EXHIBIT (4)**

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

APPENDIX G

Cross Drain Analysis

CD-1

CD #: 1 (Existing)
STATION: 508+04
SIZE: (2) 36"

| | | | |
|--|------------------|-------|--------------------------|
| Total Drainage Area (ac) | | 51.86 | Basin 1F +Basin 1C |
| RUNOFF COEFFICIENT CALCULATIONS | | | |
| | Sub-Area | | Coefficient |
| | Impervious | 7.86 | 0.95 |
| | Pasture (F) | 4.66 | 0.2 |
| | Commercial (F) | 8.95 | 0.5 |
| | Smaller Lots (F) | 30.39 | 0.45 |
| | | | Less than 50% impervious |
| Weighted Runoff Coefficient | | 0.51 | |

| |
|------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|------------------|
| Surface Description | Light underbrush |
| Mannings Coefficient, n | 0.40 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 40 |
| Ending Elevation (ft) | 39.7 |
| Land Slope, s (ft/ft) | 0.003 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 26 |
| Travel Time, (mins) | 3.85 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|---------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 1352 | 522 | |
| Starting Elevation (ft) | 39.2 | 32 | |
| Ending Elevation (ft) | 32 | 23 | |
| Slope, s (ft/ft) | 0.005 | 0.017 | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.177 | 2.119 | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 19.14 | 4.11 | |

TIME OF CONCENTRATION (mins) = 27.09

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: 5.53

Flow Calculations

| | | | | |
|----------|--------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 146.73 | 173.61 | 205.42 | 349.21 |

CD #: 1 (Proposed)
 STATION: 508+04
 SIZE: 3'x6'

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 47.19 | Basin 1F |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 5.57 | 0.95 |
| Pasture (F) | 2.31 | 0.2 |
| Commercial (F) | 8.95 | 0.5 |
| Smaller Lots (F) | 30.36 | 0.45 |
| Weighted Runoff Coefficient | 0.51 | |

Less than 50% impervious

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|------------------|
| Surface Description | Light underbrush |
| Mannings Coefficient, n | 0.4 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 40 |
| Ending Elevation (ft) | 39.7 |
| Land Slope, s (ft/ft) | 0.003 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 26 |
| Travel Time, (mins) | 3.85 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|--------------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 1352 | 522 | |
| Starting Elevation (ft) | 39.2 | 32 | |
| Ending Elevation (ft) | 32 | 23 | |
| Slope, s (ft/ft) | 0.005 | 0.017 | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.177 | 2.119 | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 19.14 | 4.11 | |

TIME OF CONCENTRATION (mins) = 27.09

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: 5.53

Flow Calculations

| | | | | |
|----------|---------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 132.03 | 156.22 | 184.84 | 314.24 |

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Exist. CD-1 | (2) 36 | 500-YR | 349.21 | 154.53 | 28.25 | 6.73 | 8.225 | 2.74 | 3.00 | 2.74 | 3.00 | 10.93 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Exist. CD-1

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | (2) 36 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|-------------------------------|--------------------------------|-------------------|
| 26.93 | 25-YR | 146.73 | 146.73 | 0.00 | 1 |
| 27.64 | 50-YR | 173.61 | 157.58 | 15.99 | 10 |
| 27.79 | 100-YR | 205.42 | 159.62 | 45.74 | 7 |
| 28.25 | 500-YR | 349.21 | 154.53 | 194.65 | 5 |
| 27.50 | Overtopping | 155.44 | 155.44 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Exist. CD-1

Total Rating Curve
Crossing: Exist. CD-1

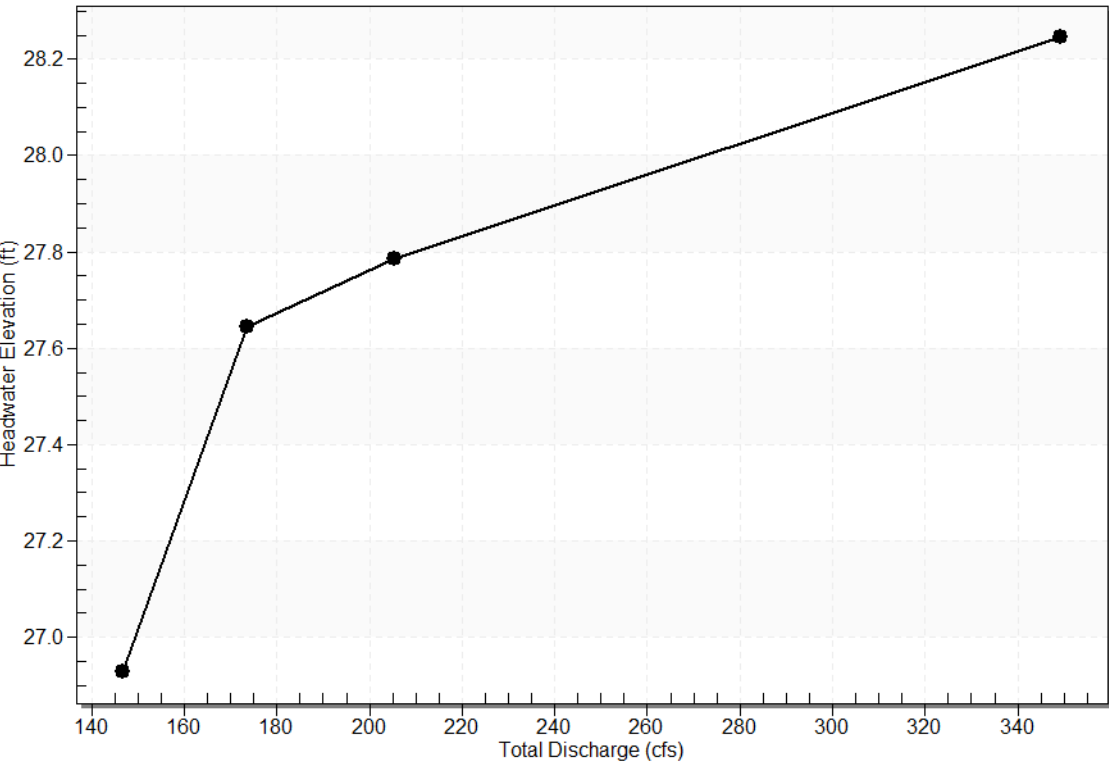


Table 3 - Culvert Summary Table: (2) 36

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 146.73 | 146.73 | 26.93 | 6.26 | 6.909 | 2.30 | 7-M2c | 3.00 | 2.70 | 2.70 | 2.40 | 10.95 | 2.49 |
| 50-YR | 173.61 | 157.58 | 27.64 | 6.92 | 7.624 | 2.54 | 7-M2c | 3.00 | 2.76 | 2.76 | 2.61 | 11.58 | 2.61 |
| 100-YR | 205.42 | 159.62 | 27.79 | 7.05 | 7.766 | 2.59 | 7-M2t | 3.00 | 2.77 | 2.85 | 2.85 | 11.51 | 2.74 |
| 500-YR | 349.21 | 154.53 | 28.25 | 6.73 | 8.225 | 2.74 | 4-FFf | 3.00 | 2.74 | 3.00 | 3.70 | 10.93 | 3.16 |
| Overtopping | 349.21 | 154.53 | 28.25 | 6.73 | 8.225 | 2.74 | 4-FFf | 3.00 | 2.74 | 3.00 | 3.70 | 10.93 | 3.16 |

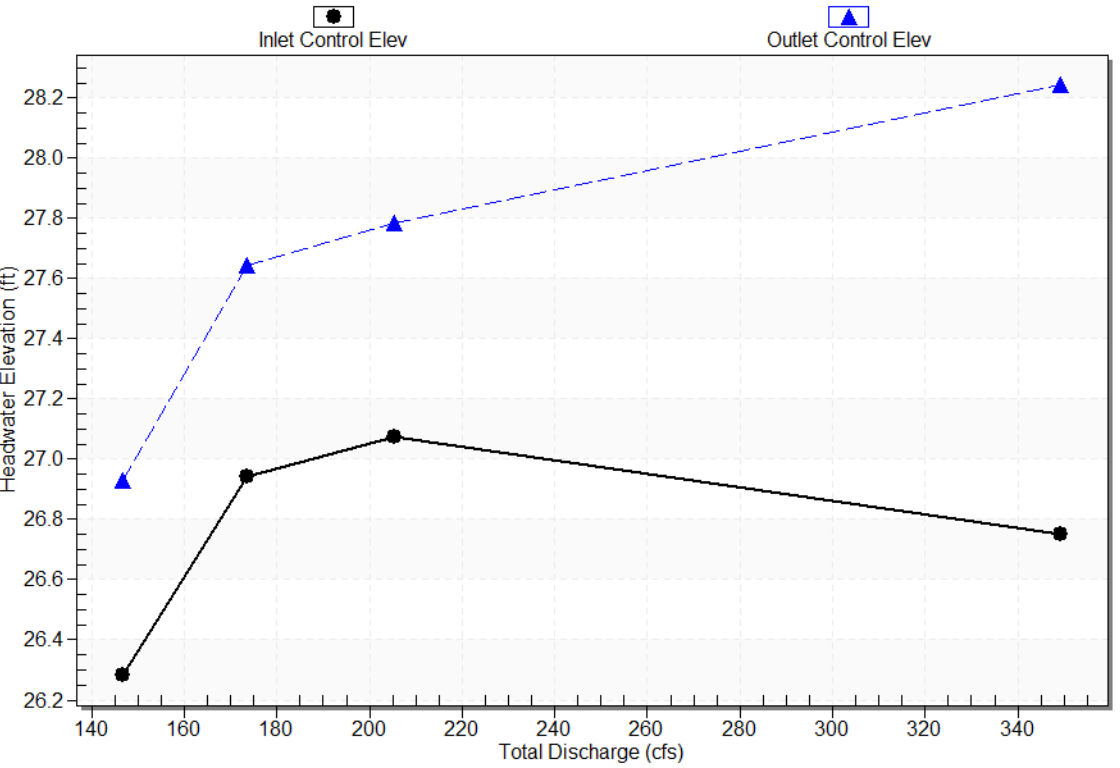
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 20.02 ft
Outlet Elevation (invert): 19.62 ft
Culvert Length: 188.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: (2) 36

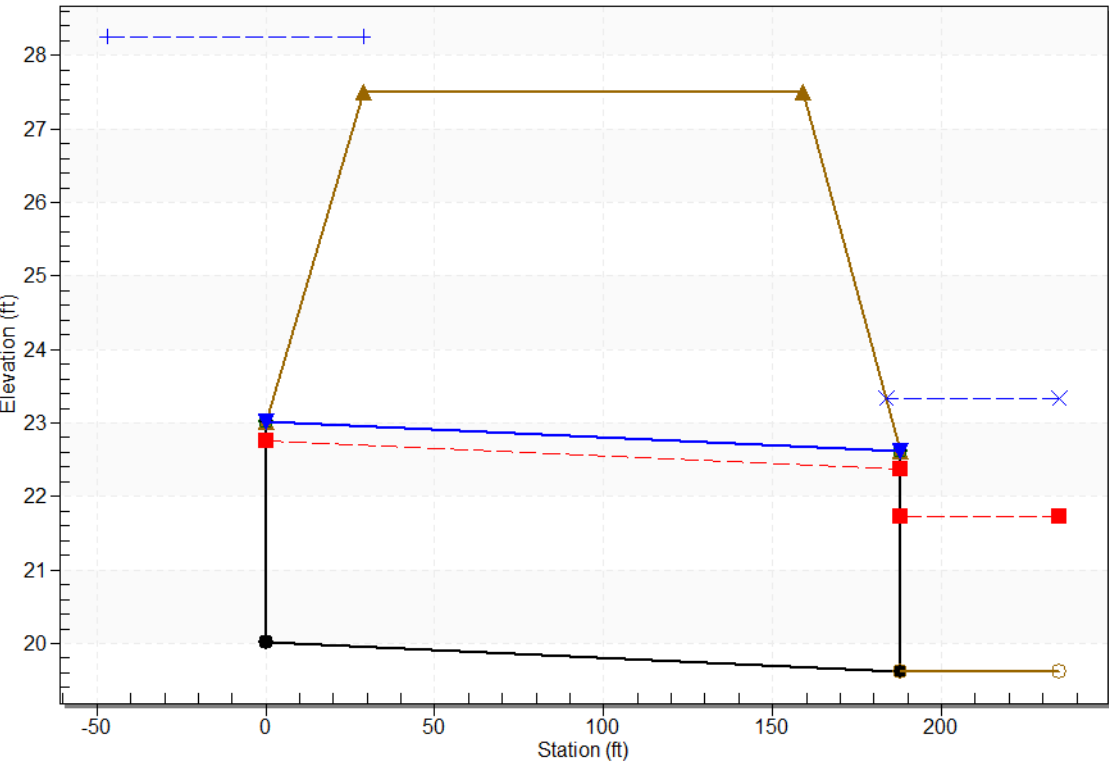
Performance Curve

Culvert: (2) 36



Water Surface Profile Plot for Culvert: (2) 36

Crossing - Exist. CD-1, Design Discharge - 349.2 cfs
Culvert - (2) 36, Culvert Discharge - 154.5 cfs



Site Data - (2) 36

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 20.02 ft
Outlet Station: 188.00 ft
Outlet Elevation: 19.62 ft
Number of Barrels: 2

Culvert Data Summary - (2) 36

Barrel Shape: Circular
Barrel Diameter: 3.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Exist. CD-1

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 15.00 ft
a_side Slope (H:V): 4.00 (_:1)
Channel Slope: 0.01 ft/ft
Channel Manning's n: 0.0600
Channel Invert Elevation: 19.62 ft

Table 4 - Downstream Channel Rating Curve (crossing: Exist. CD-1)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) | Shear (psf) | Froude Number |
|------------|-------------------------|------------|-----------------|-------------|---------------|
| 146.73 | 22.02 | 2.40 | 2.49 | 0.75 | 0.33 |
| 173.61 | 22.23 | 2.61 | 2.61 | 0.82 | 0.34 |
| 205.42 | 22.47 | 2.85 | 2.74 | 0.89 | 0.34 |
| 349.21 | 23.32 | 3.70 | 3.16 | 1.16 | 0.35 |

Roadway Data for crossing: Exist. CD-1

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 27.50 ft
Roadway Surface: Paved
Roadway Top Width: 130.00 ft

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Prop. CD-1 | 3'x6' | 500-YR | 314.24 | 185.39 | 27.07 | 6.61 | 7.067 | 2.36 | 3.00 | 3.00 | 3.00 | 10.30 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Prop. CD-1

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 3'x6' Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|------------------------------|--------------------------------|-------------------|
| 24.50 | 25-YR | 132.03 | 132.03 | 0.00 | 1 |
| 25.37 | 50-YR | 156.22 | 156.22 | 0.00 | 1 |
| 26.53 | 100-YR | 184.84 | 183.49 | 1.19 | 22 |
| 27.07 | 500-YR | 314.24 | 185.39 | 128.83 | 6 |
| 26.50 | Overtopping | 182.92 | 182.92 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-1

Total Rating Curve

Crossing: Prop. CD-1

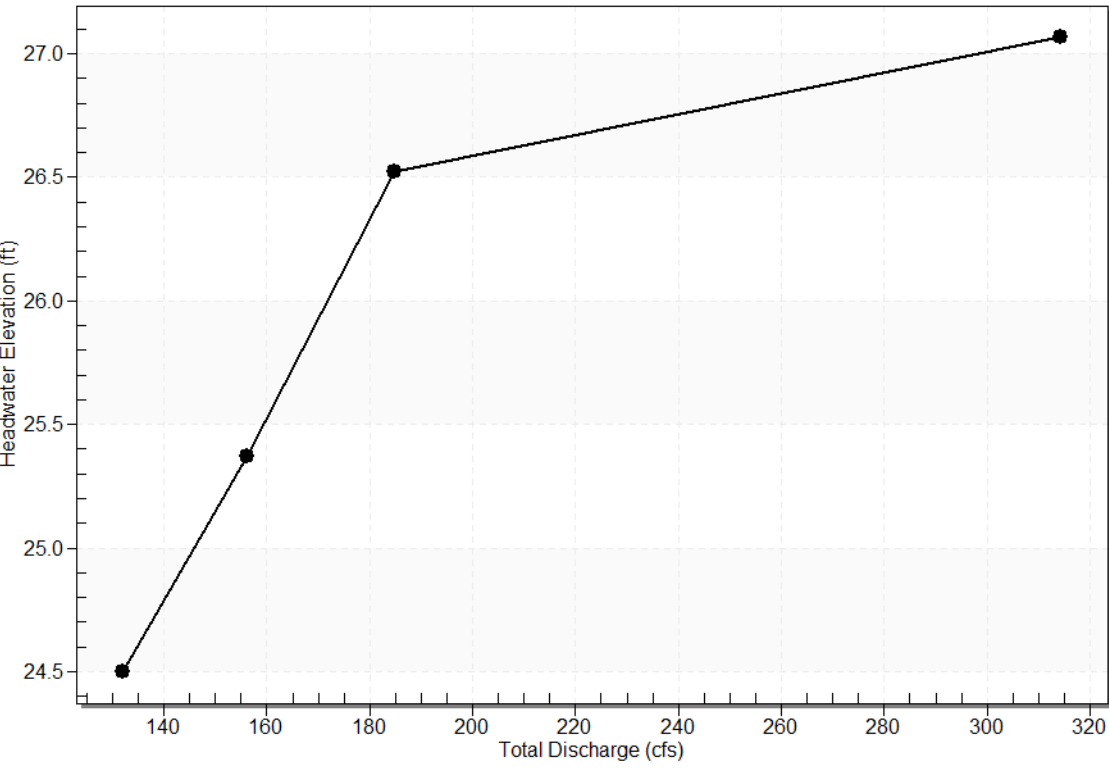


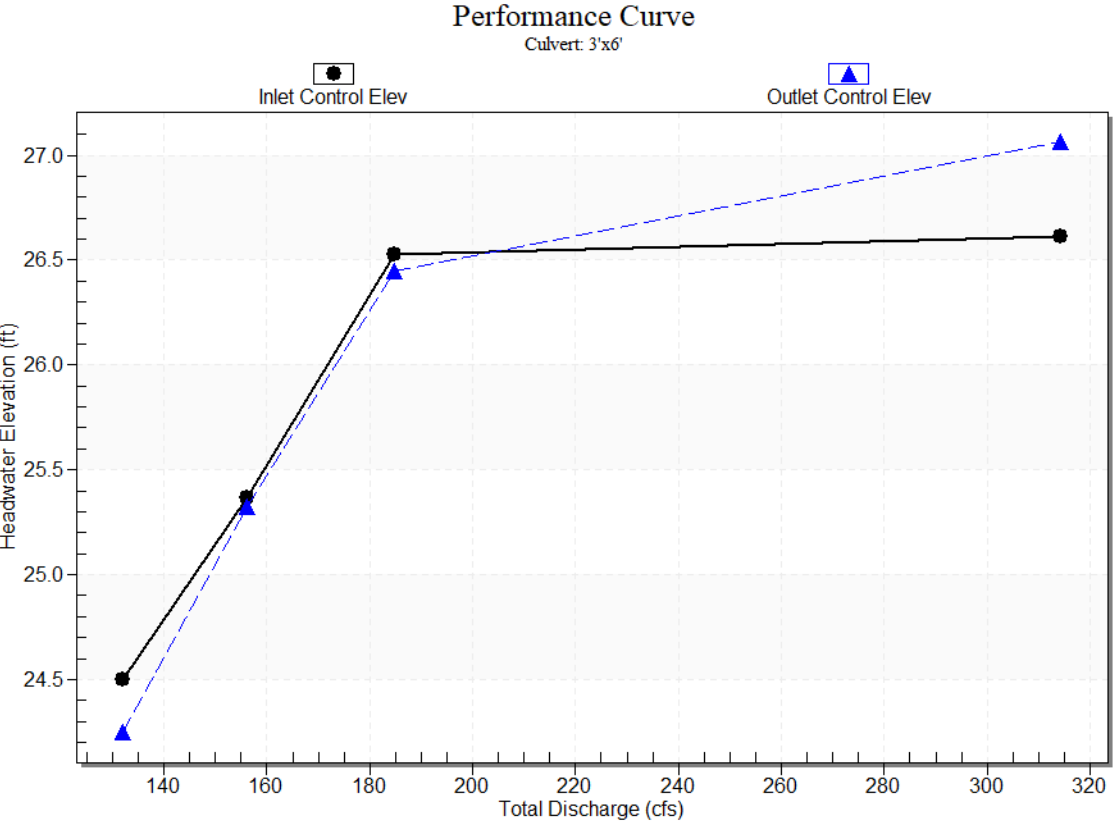
Table 3 - Culvert Summary Table: 3'x6'

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 132.03 | 132.03 | 24.50 | 4.50 | 4.247 | 1.50 | 7-M2c | 3.00 | 2.47 | 2.47 | 2.27 | 8.92 | 2.42 |
| 50-YR | 156.22 | 156.22 | 25.37 | 5.37 | 5.324 | 1.79 | 7-M2c | 3.00 | 2.76 | 2.76 | 2.48 | 9.43 | 2.53 |
| 100-YR | 184.84 | 183.49 | 26.53 | 6.53 | 6.449 | 2.18 | 6-FFc | 3.00 | 3.00 | 3.00 | 2.70 | 10.19 | 2.66 |
| 500-YR | 314.24 | 185.39 | 27.07 | 6.61 | 7.067 | 2.36 | 4-FFf | 3.00 | 3.00 | 3.00 | 3.52 | 10.30 | 3.07 |
| Overtopping | 314.24 | 185.39 | 27.07 | 6.61 | 7.067 | 2.36 | 4-FFf | 3.00 | 3.00 | 3.00 | 3.52 | 10.30 | 3.07 |

Culvert Barrel Data

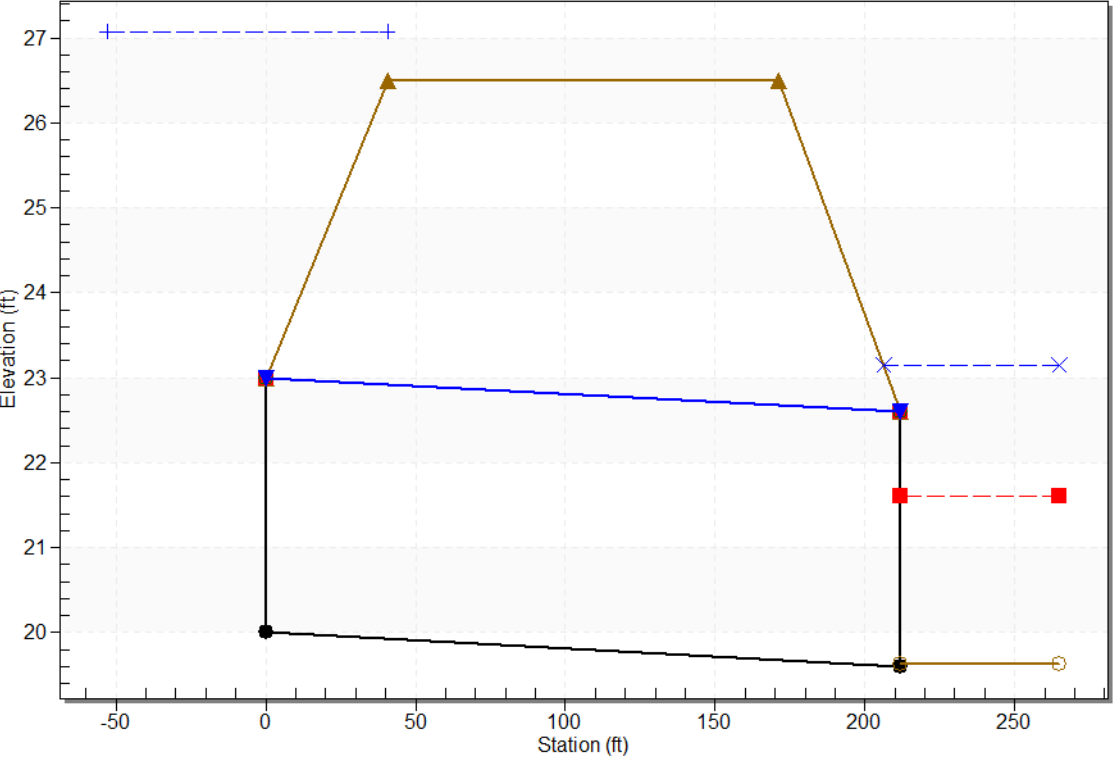
Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 20.00 ft
Outlet Elevation (invert): 19.60 ft
Culvert Length: 212.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 3'x6'



Water Surface Profile Plot for Culvert: 3'x6'

Crossing - Prop. CD-1, Design Discharge - 314.2 cfs
Culvert - 3'x6', Culvert Discharge - 185.4 cfs



Site Data - 3'x6'

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 20.00 ft
Outlet Station: 212.00 ft
Outlet Elevation: 19.60 ft
Number of Barrels: 1

Culvert Data Summary - 3'x6'

Barrel Shape: Concrete Box
Barrel Span: 6.00 ft
Barrel Rise: 3.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-1

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 15.00 ft
a_side Slope (H:V): 4.00 (_:1)
Channel Slope: 0.01 ft/ft
Channel Manning's n: 0.0600
Channel Invert Elevation: 19.62 ft

Table 4 - Downstream Channel Rating Curve (crossing: Prop. CD-1)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) | Shear (psf) | Froude Number |
|-------------------|--------------------------------|-------------------|------------------------|--------------------|----------------------|
| 132.03 | 21.89 | 2.27 | 2.42 | 0.71 | 0.33 |
| 156.22 | 22.10 | 2.48 | 2.53 | 0.77 | 0.34 |
| 184.84 | 22.32 | 2.70 | 2.66 | 0.84 | 0.34 |
| 314.24 | 23.14 | 3.52 | 3.07 | 1.10 | 0.35 |

Roadway Data for crossing: Prop. CD-1

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 26.50 ft
Roadway Surface: Paved
Roadway Top Width: 130.00 ft

CD-2

CD #: 2 (Existing)
STATION: 242+37
SIZE: 24"

Total Drainage Area (ac) 20.62 Basin 4A + Basin 4C + Basin 6N + Basin 6S

RUNOFF COEFFICIENT CALCULATIONS

| | Sub-Area | Coefficient |
|-------------|----------|-------------|
| Impervious | 3.69 | 0.95 |
| Pasture (F) | 5.4 | 0.2 |
| MFR (F) | 10.11 | 0.45 |
| Water | 1.42 | 1 |

Multi Family with plenty of green space

Weighted Runoff Coefficient 0.51

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION

SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 9 |
| Ending Elevation (ft) | 8.9 |
| Land Slope, s (ft/ft) | 0.001 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 29.5 |
| Travel Time, (mins) | 3.39 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|--------------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 912.5 | 136.27 | |
| Starting Elevation (ft) | 8.9 | 3 | |
| Ending Elevation (ft) | 3 | 1 | |
| Slope, s (ft/ft) | 0.006 | 0.015 | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.297 | 1.955 | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 11.72 | 1.16 | |

CHANNEL FLOW

| | | | |
|---|---------------|--|--|
| Pipe Diameter (ft) | 1.5 | | |
| Cross Sectional Area, A (sqft) | 1.77 | | |
| Wetted Perimeter, P (ft) | 4.71 | | |
| Hydraulic Radius (R = A/P) | 0.38 | | |
| Starting Elevation (ft) | 1.41 | | |
| Ending Elevation (ft) | 0.86 | | |
| Channel Slope, s (ft/ft) | 0.0052 | | |
| Mannings Coefficient, n | 0.012 | | |
| Velocity, eq. 2.2-8, FDOT Drainage Design Guide (ft/s) | 4.64 | | |
| Flow Length, L (ft) | 105.3 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 0.38 | | |

TIME OF CONCENTRATION (mins) = 16.65

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: 6.63

Flow Calculations

| | | | | |
|------------------------------------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q ₂₅ =C _i A: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 69.94 | 82.75 | 97.91 | 166.45 |

CD #: 2 (Proposed)
STATION: 242+37
SIZE: 42"

Total Drainage Area (ac) **18.52** Basin 4C +Basin 6N +Basin 6S

RUNOFF COEFFICIENT CALCULATIONS

| Sub-Area | Coefficient |
|-------------|-------------|
| Impervious | 0.95 |
| Pasture (F) | 0.2 |
| MFR (F) | 0.45 |
| Water | 1 |

Multi Family with plenty of green space

Weighted Runoff Coefficient **0.50**

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION

SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 9 |
| Ending Elevation (ft) | 8.9 |
| Land Slope, s (ft/ft) | 0.001 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 29.5 |
| Travel Time, (mins) | 3.39 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|--------------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 912.5 | 136.27 | |
| Starting Elevation (ft) | 8.9 | 3 | |
| Ending Elevation (ft) | 3 | 1 | |
| Slope, s (ft/ft) | 0.006 | 0.015 | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.297 | 1.955 | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 11.72 | 1.16 | |

CHANNEL FLOW

| | | | |
|---|---------------|--|--|
| Pipe Diameter (ft) | 1.5 | | |
| Cross Sectional Area, A (sqft) | 1.77 | | |
| Wetted Perimeter, P (ft) | 4.71 | | |
| Hydraulic Radius (R = A/P) | 0.38 | | |
| Starting Elevation (ft) | 1.41 | | |
| Ending Elevation (ft) | 0.86 | | |
| Channel Slope, s (ft/ft) | 0.0052 | | |
| Mannings Coefficient, n | 0.012 | | |
| Velocity, eq. 2.2-8, FDOT Drainage Design Guide (ft/s) | 4.64 | | |
| Flow Length, L (ft) | 105.3 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 0.38 | | |

TIME OF CONCENTRATION (mins) = 16.65

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **6.63**

Flow Calculations

| | | | | |
|------------------------------------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q ₂₅ =C _i A: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 61.84 | 73.17 | 86.57 | 147.17 |

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Exist. CD-2 | (1) 24 | 500-YR | 166.45 | 30.17 | 6.09 | 5.00 | 6.887 | 3.44 | 2.00 | 1.87 | 2.00 | 9.60 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Exist. CD-2

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | (1) 24 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|-------------------------------|--------------------------------|-------------------|
| 5.76 | 25-YR | 69.94 | 29.97 | 39.92 | 11 |
| 5.81 | 50-YR | 82.75 | 30.14 | 52.59 | 5 |
| 5.87 | 100-YR | 97.91 | 30.31 | 67.59 | 5 |
| 6.09 | 500-YR | 166.45 | 30.17 | 136.27 | 4 |
| 5.50 | Overtopping | 29.14 | 29.14 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Exist. CD-2

Total Rating Curve
Crossing: Exist. CD-2

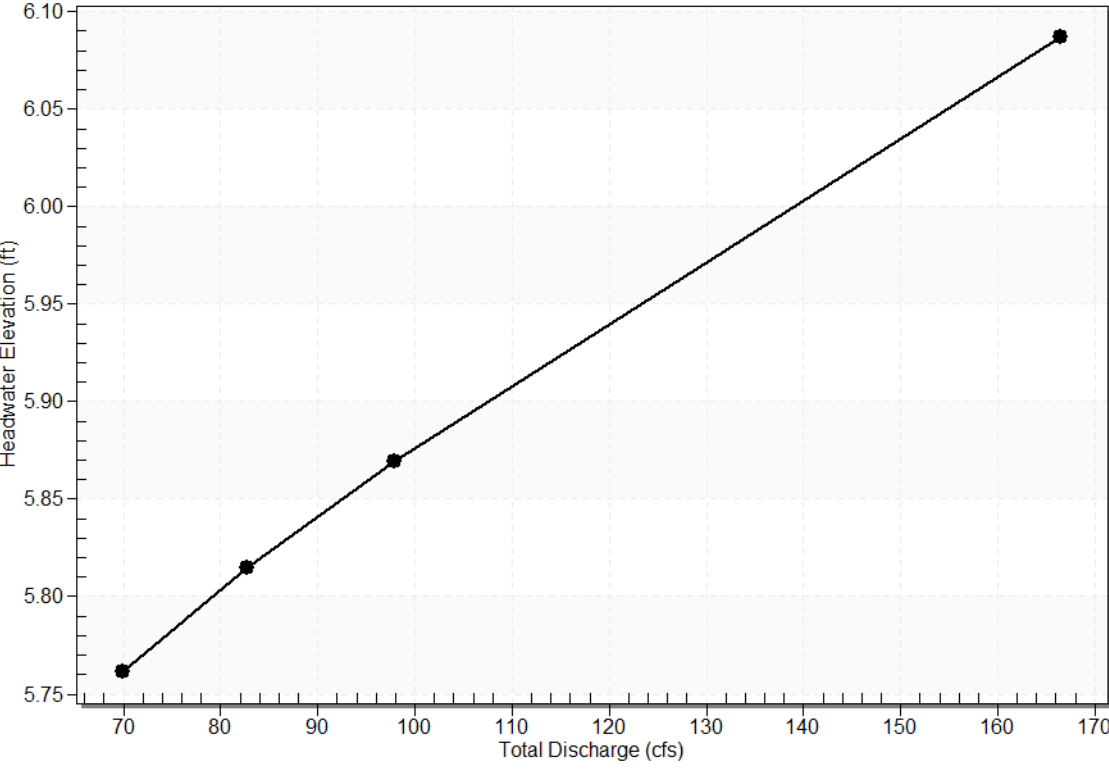


Table 3 - Culvert Summary Table: (1) 24

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 69.94 | 29.97 | 5.76 | 4.95 | 6.562 | 3.28 | 7-M2c | 2.00 | 1.86 | 1.86 | 1.44 | 9.84 | 1.76 |
| 50-YR | 82.75 | 30.14 | 5.81 | 4.99 | 6.615 | 3.31 | 7-M2c | 2.00 | 1.86 | 1.86 | 1.57 | 9.88 | 1.85 |
| 100-YR | 97.91 | 30.31 | 5.87 | 5.03 | 6.669 | 3.33 | 7-M2c | 2.00 | 1.87 | 1.87 | 1.71 | 9.93 | 1.94 |
| 500-YR | 166.45 | 30.17 | 6.09 | 5.00 | 6.887 | 3.44 | 4-FFf | 2.00 | 1.87 | 2.00 | 2.21 | 9.60 | 2.24 |
| Overtopping | 166.45 | 30.17 | 6.09 | 5.00 | 6.887 | 3.44 | 4-FFf | 2.00 | 1.87 | 2.00 | 2.21 | 9.60 | 2.24 |

Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): -0.80 ft
Outlet Elevation (invert): -0.85 ft
Culvert Length: 171.00 ft
Culvert Slope: 0.00 ft/ft

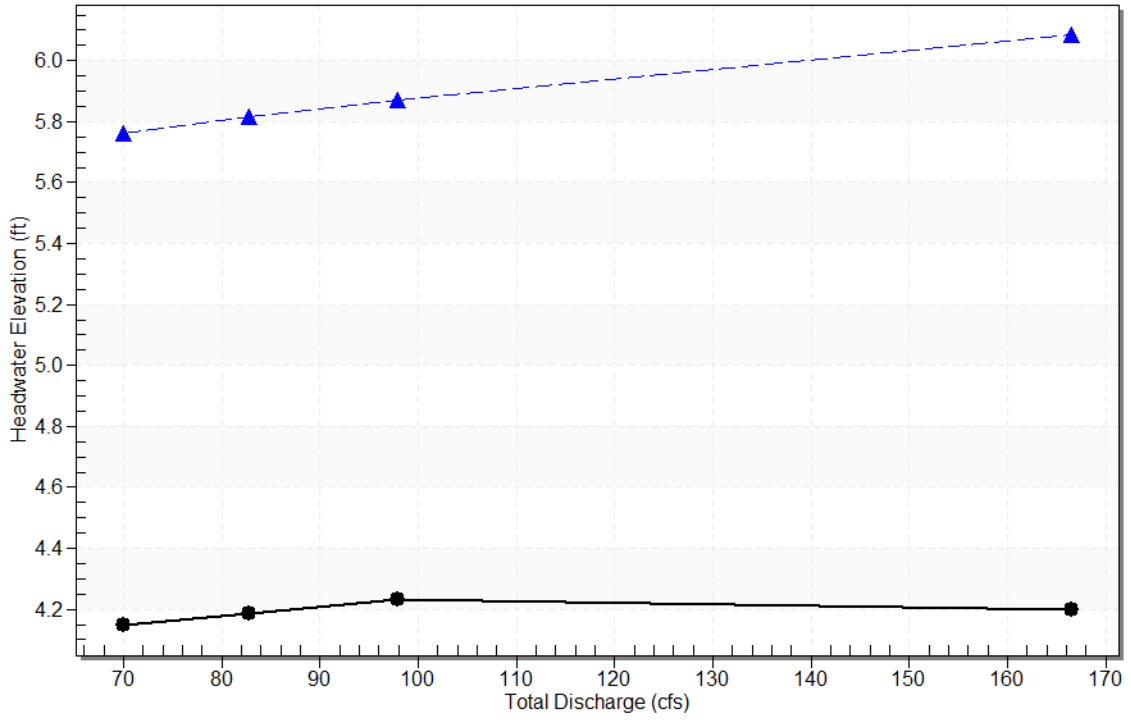
Culvert Performance Curve Plot: (1) 24

Performance Curve

Culvert: (1) 24

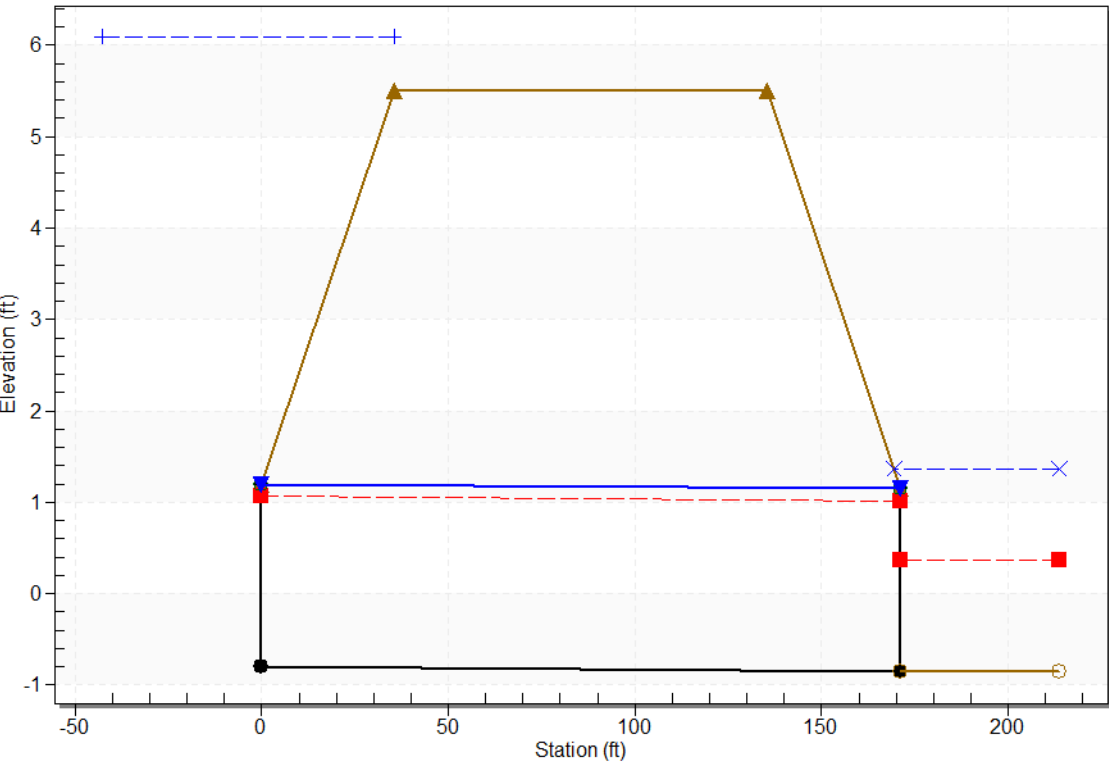
Inlet Control Elev

Outlet Control Elev



Water Surface Profile Plot for Culvert: (1) 24

Crossing - Exist. CD-2, Design Discharge - 166.4 cfs
Culvert - (1) 24, Culvert Discharge - 30.2 cfs



Site Data - (1) 24

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: -0.80 ft
Outlet Station: 171.00 ft
Outlet Elevation: -0.85 ft
Number of Barrels: 1

Culvert Data Summary - (1) 24

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Exist. CD-2

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 16.00 ft
a_side Slope (H:V): 8.00 (_:1)
Channel Slope: 0.01 ft/ft
Channel Manning's n: 0.0600
Channel Invert Elevation: -0.85 ft

Table 4 - Downstream Channel Rating Curve (crossing: Exist. CD-2)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) | Shear (psf) | Froude Number |
|------------|-------------------------|------------|-----------------|-------------|---------------|
| 69.94 | 0.59 | 1.44 | 1.76 | 0.45 | 0.31 |
| 82.75 | 0.72 | 1.57 | 1.85 | 0.49 | 0.31 |
| 97.91 | 0.86 | 1.71 | 1.94 | 0.53 | 0.32 |
| 166.45 | 1.36 | 2.21 | 2.24 | 0.69 | 0.33 |

Roadway Data for crossing: Exist. CD-2

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 5.50 ft
Roadway Surface: Paved
Roadway Top Width: 100.00 ft

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Prop. CD-2 | (1) 42 | 500-YR | 147.17 | 85.33 | 5.31 | 5.45 | 6.110 | 1.75 | 3.50 | 2.88 | 2.88 | 10.09 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Prop. CD-2

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | (1) 42 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|-------------------------------|--------------------------------|-------------------|
| 3.61 | 25-YR | 61.84 | 61.84 | 0.00 | 1 |
| 4.40 | 50-YR | 73.17 | 73.17 | 0.00 | 1 |
| 5.06 | 100-YR | 86.57 | 82.02 | 4.49 | 19 |
| 5.31 | 500-YR | 147.17 | 85.33 | 61.84 | 6 |
| 5.00 | Overtopping | 81.58 | 81.58 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-2

Total Rating Curve
Crossing: Prop. CD-2

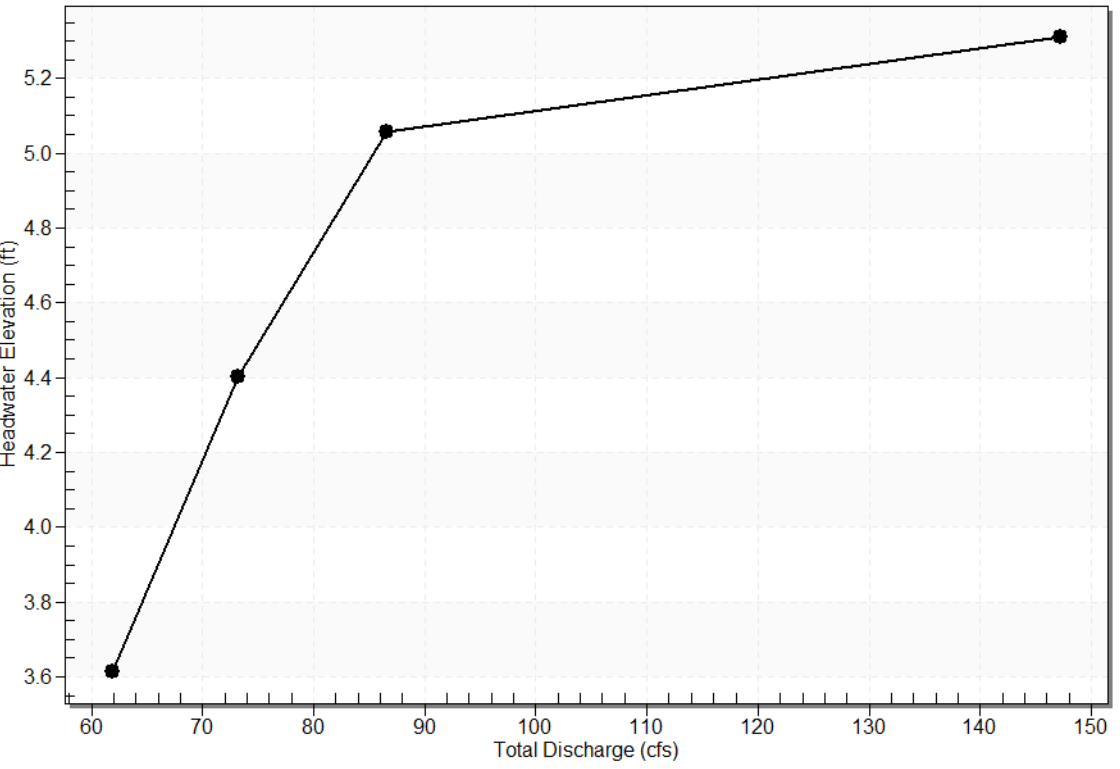


Table 3 - Culvert Summary Table: (1) 42

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 61.84 | 61.84 | 3.61 | 4.01 | 4.415 | 1.26 | 7-M2c | 3.50 | 2.46 | 2.46 | 1.41 | 8.54 | 1.80 |
| 50-YR | 73.17 | 73.17 | 4.40 | 4.65 | 5.201 | 1.49 | 7-M2c | 3.50 | 2.68 | 2.68 | 1.54 | 9.26 | 1.89 |
| 100-YR | 86.57 | 82.02 | 5.06 | 5.22 | 5.856 | 1.67 | 7-M2c | 3.50 | 2.83 | 2.83 | 1.68 | 9.85 | 1.98 |
| 500-YR | 147.17 | 85.33 | 5.31 | 5.45 | 6.110 | 1.75 | 7-M2c | 3.50 | 2.88 | 2.88 | 2.20 | 10.09 | 2.30 |
| Overtopping | 147.17 | 85.33 | 5.31 | 5.45 | 6.110 | 1.75 | 7-M2c | 3.50 | 2.88 | 2.88 | 2.20 | 10.09 | 2.30 |

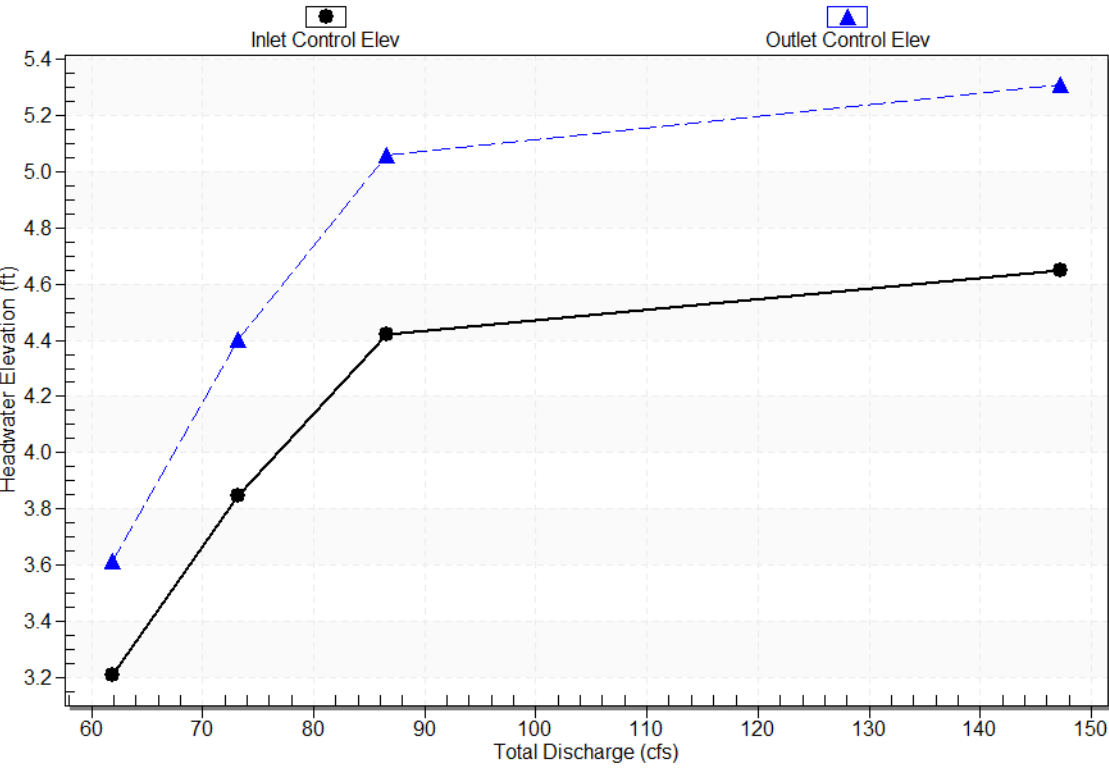
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): -0.80 ft
Outlet Elevation (invert): -0.85 ft
Culvert Length: 181.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: (1) 42

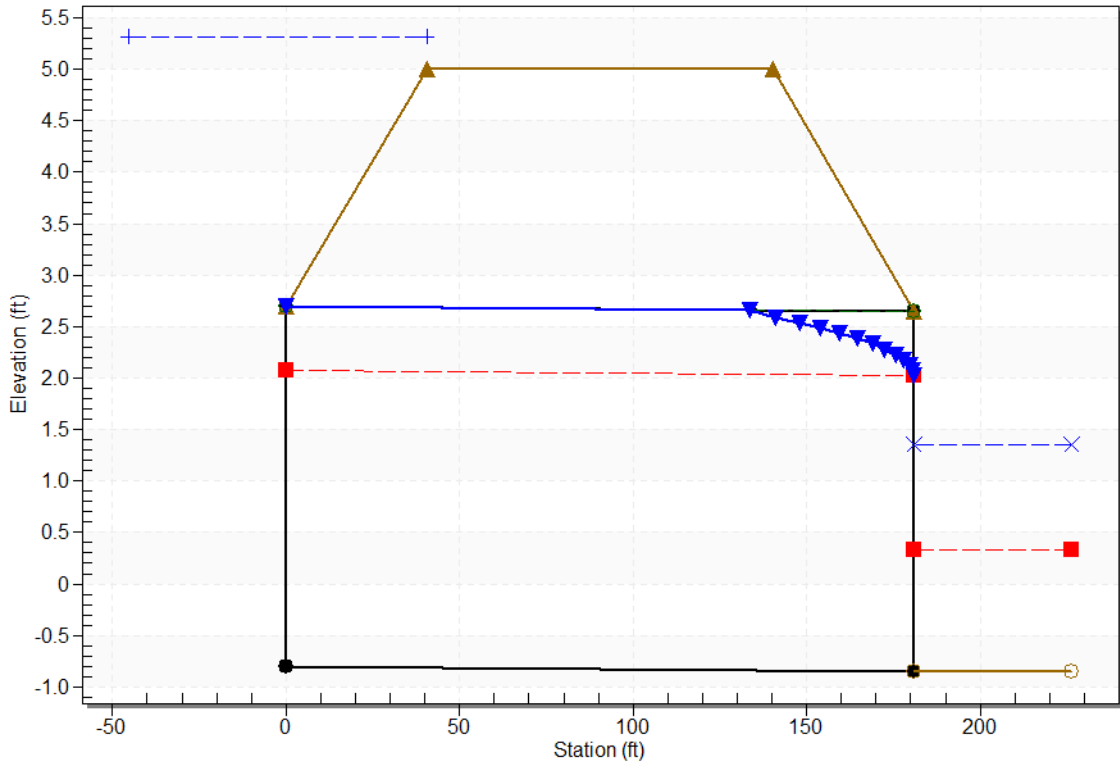
Performance Curve

Culvert: (1) 42



Water Surface Profile Plot for Culvert: (1) 42

Crossing - Prop. CD-2, Design Discharge - 147.2 cfs
Culvert - (1) 42, Culvert Discharge - 85.3 cfs



Site Data - (1) 42

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: -0.80 ft
Outlet Station: 181.00 ft
Outlet Elevation: -0.85 ft
Number of Barrels: 1

Culvert Data Summary - (1) 42

Barrel Shape: Circular
Barrel Diameter: 3.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-2

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 16.00 ft
a_side Slope (H:V): 6.00 (_:1)
Channel Slope: 0.01 ft/ft
Channel Manning's n: 0.0600
Channel Invert Elevation: -0.85 ft

Table 4 - Downstream Channel Rating Curve (crossing: Prop. CD-2)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) | Shear (psf) | Froude Number |
|------------|-------------------------|------------|-----------------|-------------|---------------|
| 61.84 | 0.56 | 1.41 | 1.80 | 0.44 | 0.31 |
| 73.17 | 0.69 | 1.54 | 1.89 | 0.48 | 0.31 |
| 86.57 | 0.83 | 1.68 | 1.98 | 0.52 | 0.32 |
| 147.17 | 1.35 | 2.20 | 2.30 | 0.69 | 0.33 |

Roadway Data for crossing: Prop. CD-2

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 120.00 ft
Crest Elevation: 5.00 ft
Roadway Surface: Paved
Roadway Top Width: 100.00 ft

CD-3

CD #: 3 (Existing & Proposed)
STATION: 251+00
SIZE: 24"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 3.28 | Basin 6N |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.69 | 0.95 |
| Pasture (F) | 2.19 | 0.2 |
| Commercial (F) | 0 | 0.5 |
| Smaller Lots (F) | 0 | 0.45 |
| Weighted Runoff Coefficient | 0.33 | |

| |
|------------|
| Area Check |
| Check Area |

TIME OF CONCENTRATION CALCULATION

SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 62 |
| Starting Elevation (ft) | 11 |
| Ending Elevation (ft) | 9.5 |
| Land Slope, s (ft/ft) | 0.024 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 37 |
| Travel Time, (mins) | 1.68 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 136 | | |
| Starting Elevation (ft) | 9.5 | | |
| Ending Elevation (ft) | 6.1 | | |
| Slope, s (ft/ft) | 0.025 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 2.551 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 0.89 | | |

CHANNEL FLOW

| | | | |
|---|---------------|--|--|
| Pipe Diameter (ft) | 0 | | |
| Cross Sectional Area, A (sqft) | 12.75 | | |
| Wetted Perimeter, P (ft) | 10.56 | | |
| Hydraulic Radius (R = A/P) | 1.21 | | |
| Starting Elevation (ft) | 6.1 | | |
| Ending Elevation (ft) | 5 | | |
| Channel Slope, s (ft/ft) | 0.0017 | | |
| Mannings Coefficient, n | 0.15 | | |
| Velocity, eq. 2.2-8, FDOT Drainage Design Guide (ft/s) | 0.47 | | |
| Flow Length, L (ft) | 630 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 22.36 | | |

TIME OF CONCENTRATION (mins) = **24.92**

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **5.76**

Flow Calculations

| | | | | |
|----------|-------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 6.29 | 7.45 | 8.81 | 14.98 |

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| CD 3 Existing | CD 3 Existing | 500-YR | 14.98 | 14.98 | 6.84 | 2.25 | 2.338 | 1.17 | 1.28 | 1.39 | 2.00 | 4.77 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: CD 3 Existing

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | CD 3 Existing Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|--------------------------------------|--------------------------------|-------------------|
| 6.18 | 25-YR | 6.29 | 6.29 | 0.00 | 1 |
| 6.24 | 50-YR | 7.45 | 7.45 | 0.00 | 1 |
| 6.32 | 100-YR | 8.81 | 8.81 | 0.00 | 1 |
| 6.84 | 500-YR | 14.98 | 14.98 | 0.00 | 1 |
| 10.00 | Overtopping | 32.18 | 32.18 | 0.00 | Overtopping |

Rating Curve Plot for crossing: CD 3 Existing

Total Rating Curve
Crossing: CD 3 Existing

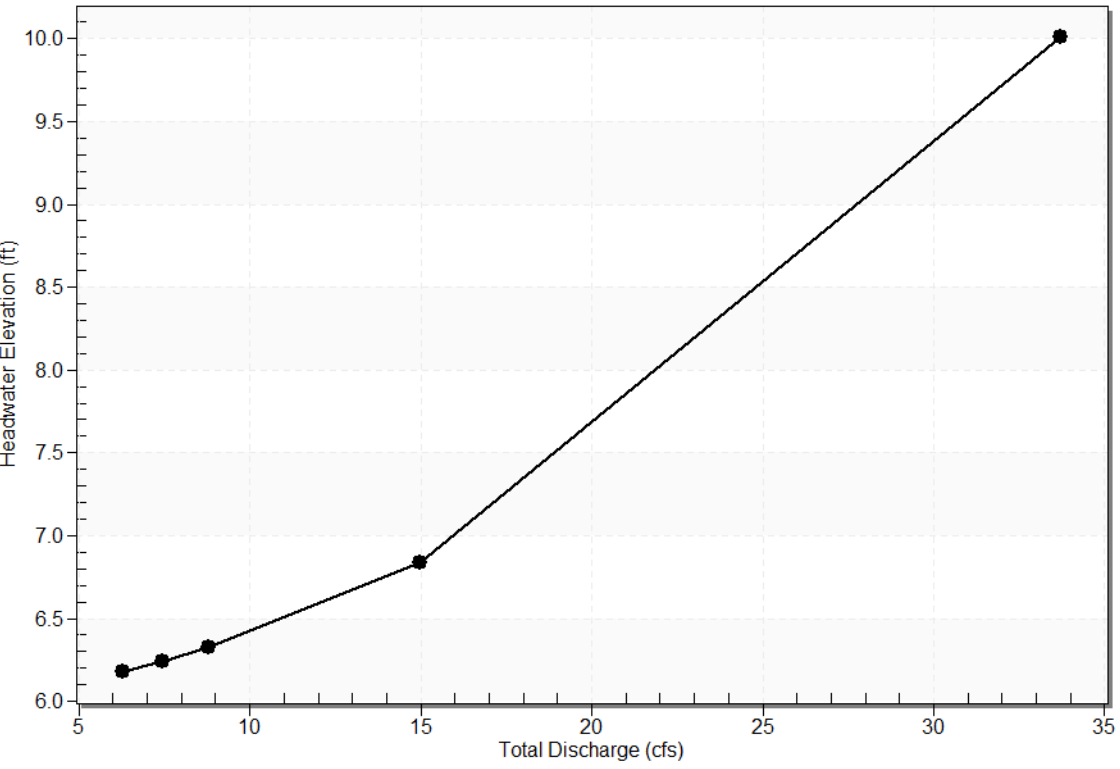


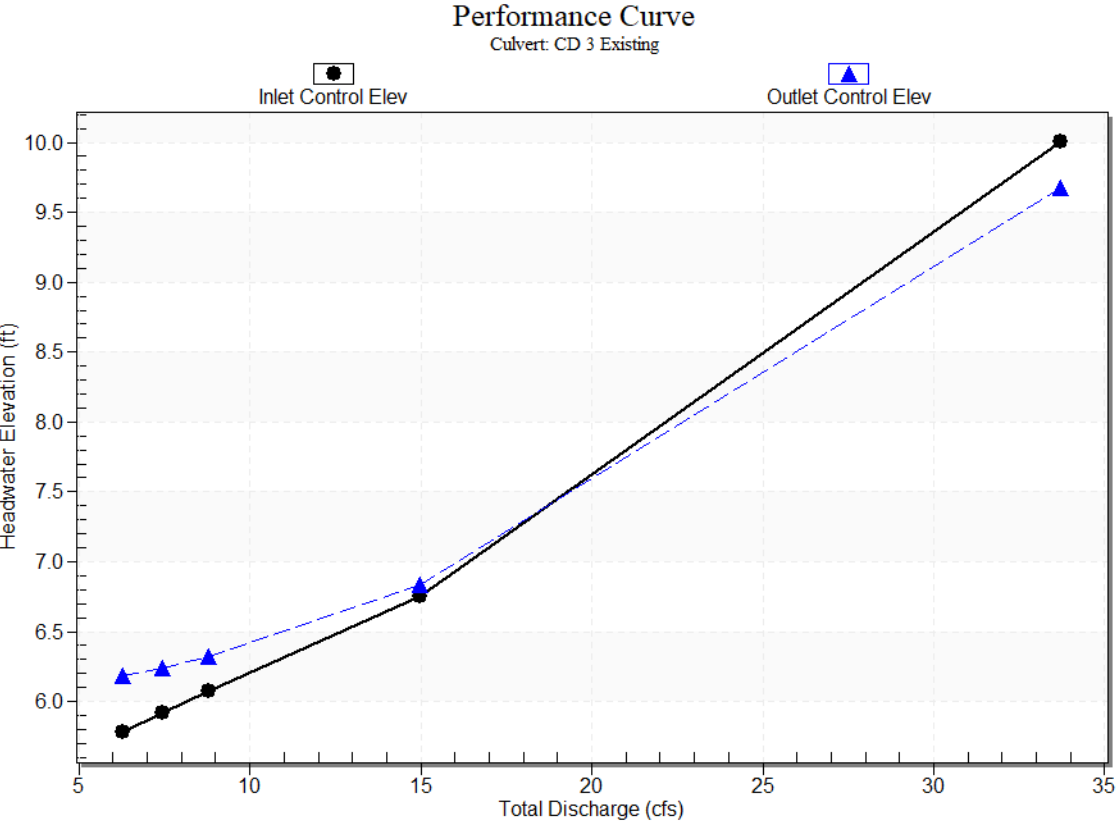
Table 3 - Culvert Summary Table: CD 3 Existing

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 6.29 | 6.29 | 6.18 | 1.28 | 1.681 | 0.84 | 1-S1f | 0.77 | 0.89 | 2.00 | 2.26 | 2.00 | 0.00 |
| 50-YR | 7.45 | 7.45 | 6.24 | 1.42 | 1.741 | 0.87 | 1-S1f | 0.84 | 0.97 | 2.00 | 2.26 | 2.37 | 0.00 |
| 100-YR | 8.81 | 8.81 | 6.32 | 1.57 | 1.823 | 0.91 | 1-S1f | 0.92 | 1.06 | 2.00 | 2.26 | 2.80 | 0.00 |
| 500-YR | 14.98 | 14.98 | 6.84 | 2.25 | 2.338 | 1.17 | 1-S1f | 1.28 | 1.39 | 2.00 | 2.26 | 4.77 | 0.00 |
| Overtopping | 33.71 | 32.22 | 10.01 | 5.51 | 5.177 | 2.75 | 4-FFf | 2.00 | 1.89 | 2.00 | 2.26 | 10.25 | 0.00 |

Culvert Barrel Data

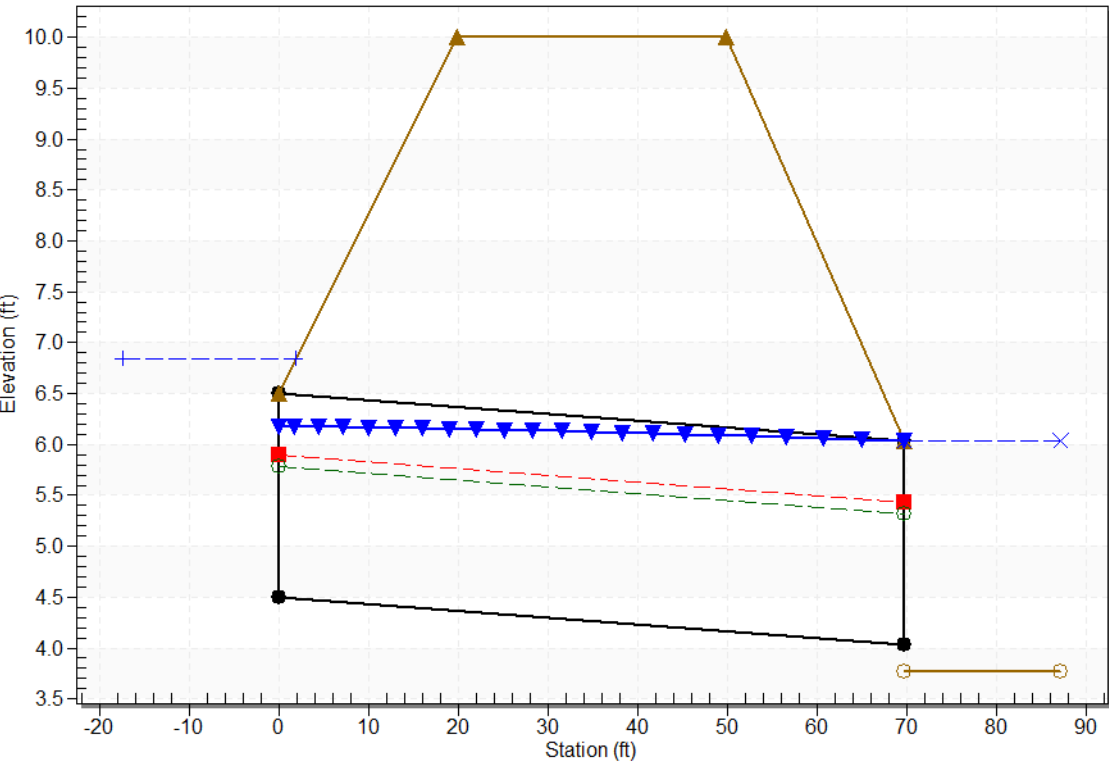
Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.50 ft
Outlet Elevation (invert): 4.03 ft
Culvert Length: 69.70 ft
Culvert Slope: 0.01 ft/ft

Culvert Performance Curve Plot: CD 3 Existing



Water Surface Profile Plot for Culvert: CD 3 Existing

Crossing - CD 3 Existing, Design Discharge - 15.0 cfs
Culvert - CD 3 Existing, Culvert Discharge - 15.0 cfs



Site Data - CD 3 Existing

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.50 ft
Outlet Station: 69.70 ft
Outlet Elevation: 4.03 ft
Number of Barrels: 1

Culvert Data Summary - CD 3 Existing

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: CD 3 Existing

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 6.03 ft

Table 4 - Downstream Channel Rating Curve (crossing: CD 3 Existing)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 6.29 | 6.03 | 2.26 |
| 7.45 | 6.03 | 2.26 |
| 8.81 | 6.03 | 2.26 |
| 14.98 | 6.03 | 2.26 |

Roadway Data for crossing: CD 3 Existing

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 600.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 30.00 ft

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| CD 3 Proposed | CD 3 Proposed | 500-YR | 14.98 | 14.98 | 6.78 | 2.14 | 2.279 | 1.14 | 1.20 | 1.39 | 2.00 | 4.77 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: CD 3 Proposed

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | CD 3 Proposed Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|--------------------------------------|--------------------------------|-------------------|
| 6.17 | 25-YR | 6.29 | 6.29 | 0.00 | 1 |
| 6.22 | 50-YR | 7.45 | 7.45 | 0.00 | 1 |
| 6.29 | 100-YR | 8.81 | 8.81 | 0.00 | 1 |
| 6.78 | 500-YR | 14.98 | 14.98 | 0.00 | 1 |
| 10.00 | Overtopping | 34.31 | 34.31 | 0.00 | Overtopping |

Rating Curve Plot for crossing: CD 3 Proposed

Total Rating Curve
Crossing: CD 3 Proposed

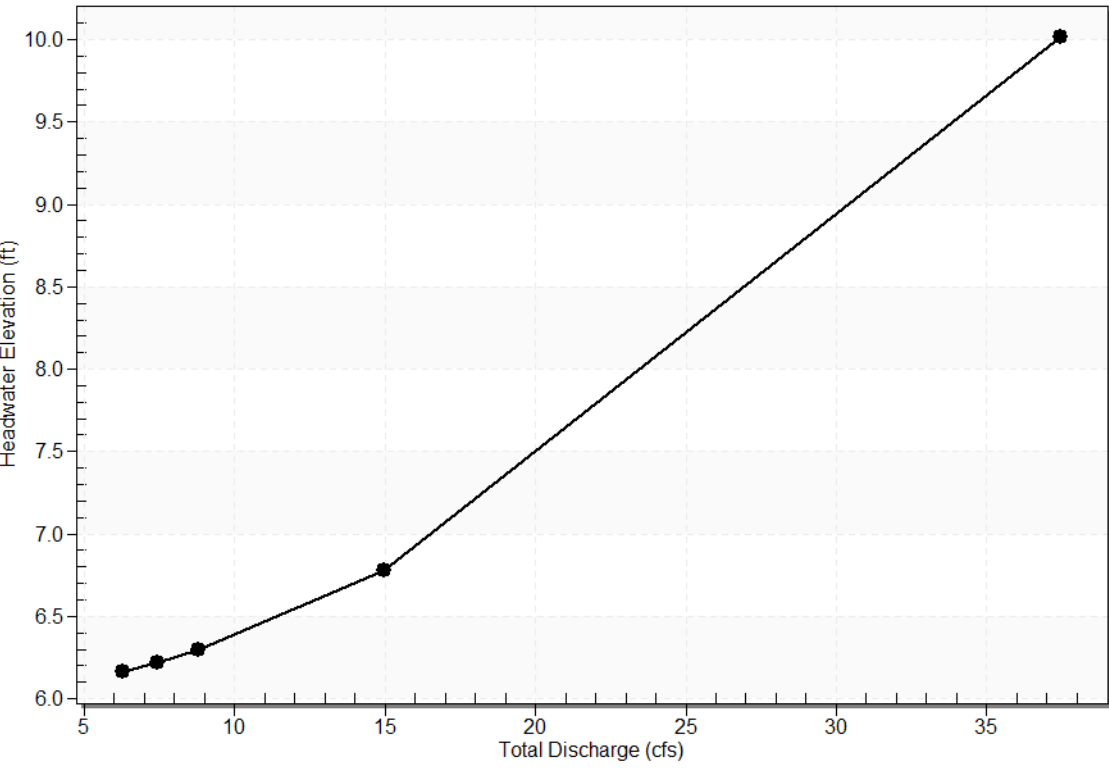


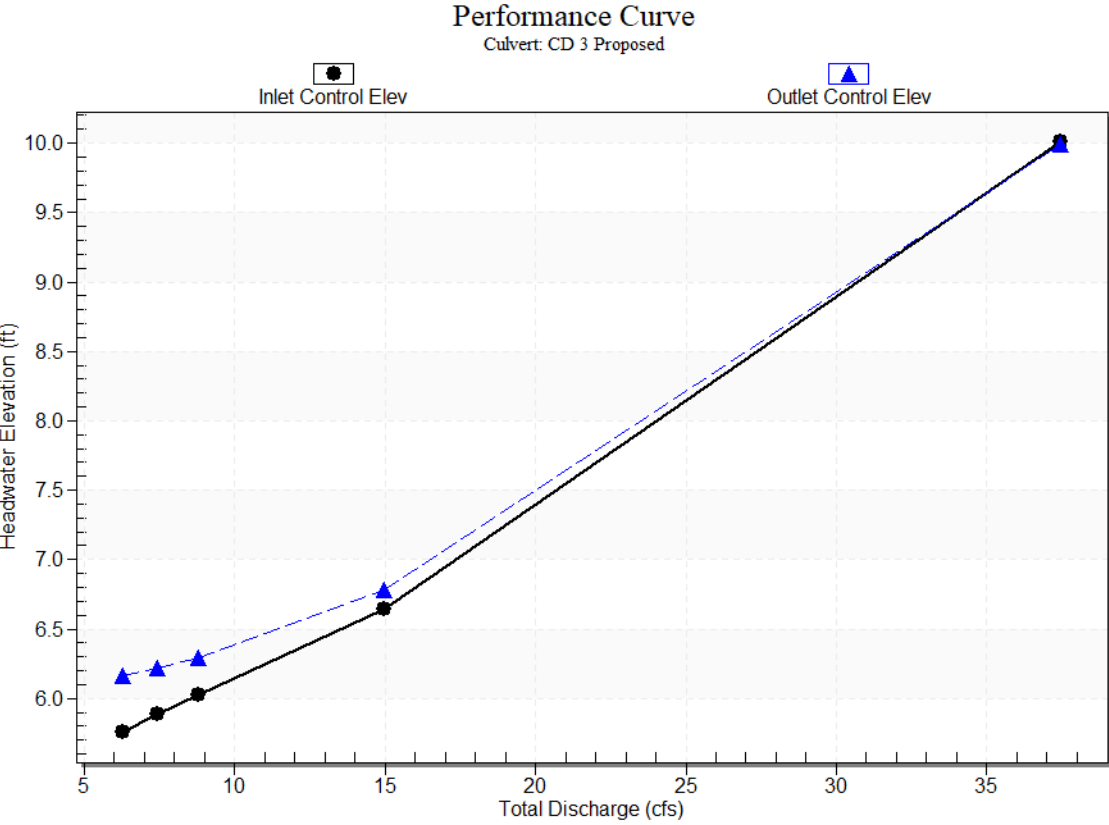
Table 3 - Culvert Summary Table: CD 3 Proposed

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 6.29 | 6.29 | 6.17 | 1.25 | 1.666 | 0.83 | 1-S1f | 0.73 | 0.89 | 2.00 | 2.26 | 2.00 | 0.00 |
| 50-YR | 7.45 | 7.45 | 6.22 | 1.39 | 1.720 | 0.86 | 1-S1f | 0.80 | 0.97 | 2.00 | 2.26 | 2.37 | 0.00 |
| 100-YR | 8.81 | 8.81 | 6.29 | 1.53 | 1.795 | 0.90 | 1-S1f | 0.87 | 1.06 | 2.00 | 2.26 | 2.80 | 0.00 |
| 500-YR | 14.98 | 14.98 | 6.78 | 2.14 | 2.279 | 1.14 | 1-S1f | 1.20 | 1.39 | 2.00 | 2.26 | 4.77 | 0.00 |
| Overtopping | 37.45 | 34.38 | 10.01 | 5.51 | 5.490 | 2.76 | 4-FFf | 2.00 | 1.88 | 2.00 | 2.26 | 10.94 | 0.00 |

Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.50 ft
Outlet Elevation (invert): 3.77 ft
Culvert Length: 88.40 ft
Culvert Slope: 0.01 ft/ft

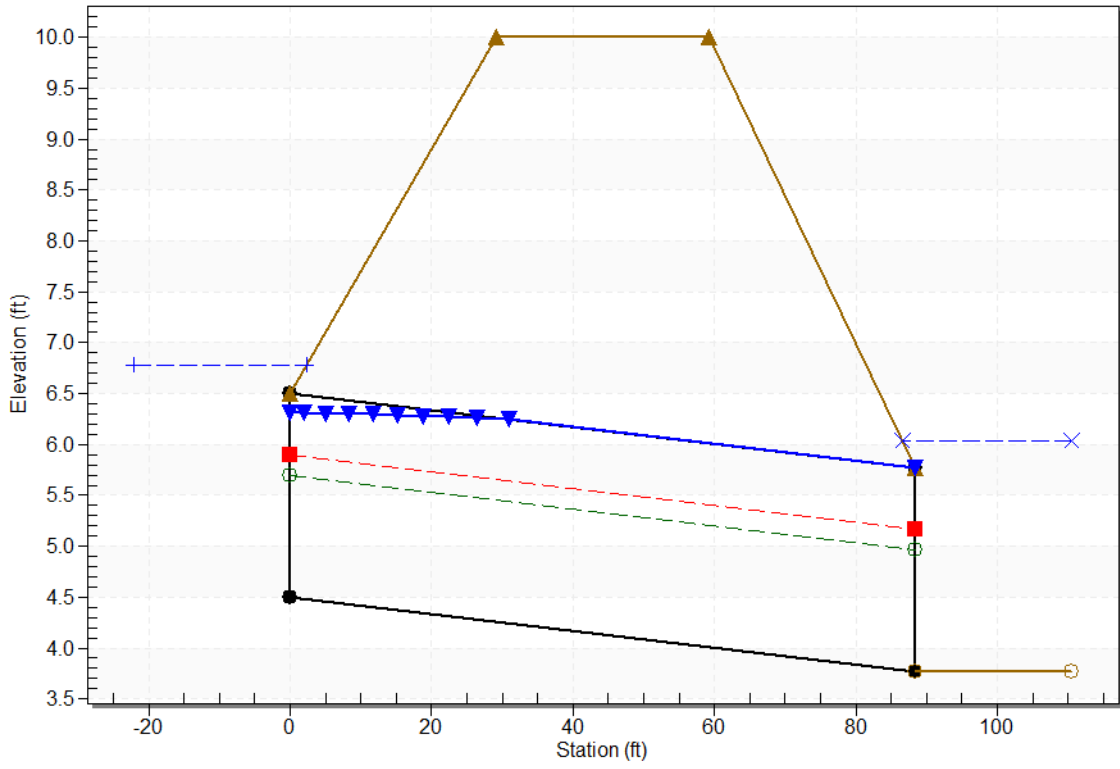
Culvert Performance Curve Plot: CD 3 Proposed



Water Surface Profile Plot for Culvert: CD 3 Proposed

Crossing - CD 3 Proposed, Design Discharge - 15.0 cfs

Culvert - CD 3 Proposed, Culvert Discharge - 15.0 cfs



Site Data - CD 3 Proposed

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.50 ft
Outlet Station: 88.40 ft
Outlet Elevation: 3.77 ft
Number of Barrels: 1

Culvert Data Summary - CD 3 Proposed

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Beveled Edge (1:1) (Ke=0.2)
Inlet Depression: None

Tailwater Channel Data for Crossing: CD 3 Proposed

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 6.03 ft

Table 4 - Downstream Channel Rating Curve (crossing: CD 3 Proposed)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 6.29 | 6.03 | 2.26 |
| 7.45 | 6.03 | 2.26 |
| 8.81 | 6.03 | 2.26 |
| 14.98 | 6.03 | 2.26 |

Roadway Data for crossing: CD 3 Proposed

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 600.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 30.00 ft

CD-4

CD #: 4 (Existing & Proposed)
STATION: 252+07
SIZE: 24"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 3.51 | Basin 5N |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.92 | 0.95 |
| Pasture (F) | 2.57 | 0.2 |
| Commercial (F) | 0 | 0.5 |
| Smaller Lots (F) | 0.02 | 0.45 |
| Weighted Runoff Coefficient | 0.40 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION

SHEET FLOW

| | |
|---|-----------------|
| Surface Description | Smooth surfaces |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 11 |
| Ending Elevation (ft) | 10.5 |
| Land Slope, s (ft/ft) | 0.005 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 27.5 |
| Travel Time, (mins) | 3.64 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 230 | | |
| Starting Elevation (ft) | 10.5 | | |
| Ending Elevation (ft) | 9 | | |
| Slope, s (ft/ft) | 0.007 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.303 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 2.94 | | |

CHANNEL FLOW

| | | | |
|---|---------------|--|--|
| Pipe Diameter (ft) | 0 | | |
| Cross Sectional Area, A (sqft) | 2.50 | | |
| Wetted Perimeter, P (ft) | 4.50 | | |
| Hydraulic Radius (R = A/P) | 0.56 | | |
| Starting Elevation (ft) | 9 | | |
| Ending Elevation (ft) | 7.09 | | |
| Channel Slope, s (ft/ft) | 0.0016 | | |
| Mannings Coefficient, n | 0.012 | | |
| Velocity, eq. 2.2-8, FDOT Drainage Design Guide (ft/s) | 3.38 | | |
| Flow Length, L (ft) | 1169 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 5.77 | | |

TIME OF CONCENTRATION (mins) = **12.35**

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **7.63**

Flow Calculations

| | | | | |
|----------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 10.65 | 12.61 | 14.92 | 25.36 |

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| CD 4 Existing | Existing CD 4 | 500-YR | 25.36 | 25.36 | 10.99 | 3.90 | 3.703 | 1.95 | 2.00 | 1.77 | 2.00 | 8.07 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: CD 4 Existing

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | Existing CD 4 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|--------------------------------------|--------------------------------|-------------------|
| 9.12 | 25-YR | 10.65 | 10.65 | 0.00 | 1 |
| 9.26 | 50-YR | 12.61 | 12.61 | 0.00 | 1 |
| 9.46 | 100-YR | 14.92 | 14.92 | 0.00 | 1 |
| 10.99 | 500-YR | 25.36 | 25.36 | 0.00 | 1 |
| 11.10 | Overtopping | 25.87 | 25.87 | 0.00 | Overtopping |

Rating Curve Plot for crossing: CD 4 Existing

Total Rating Curve
Crossing: CD 4 Existing

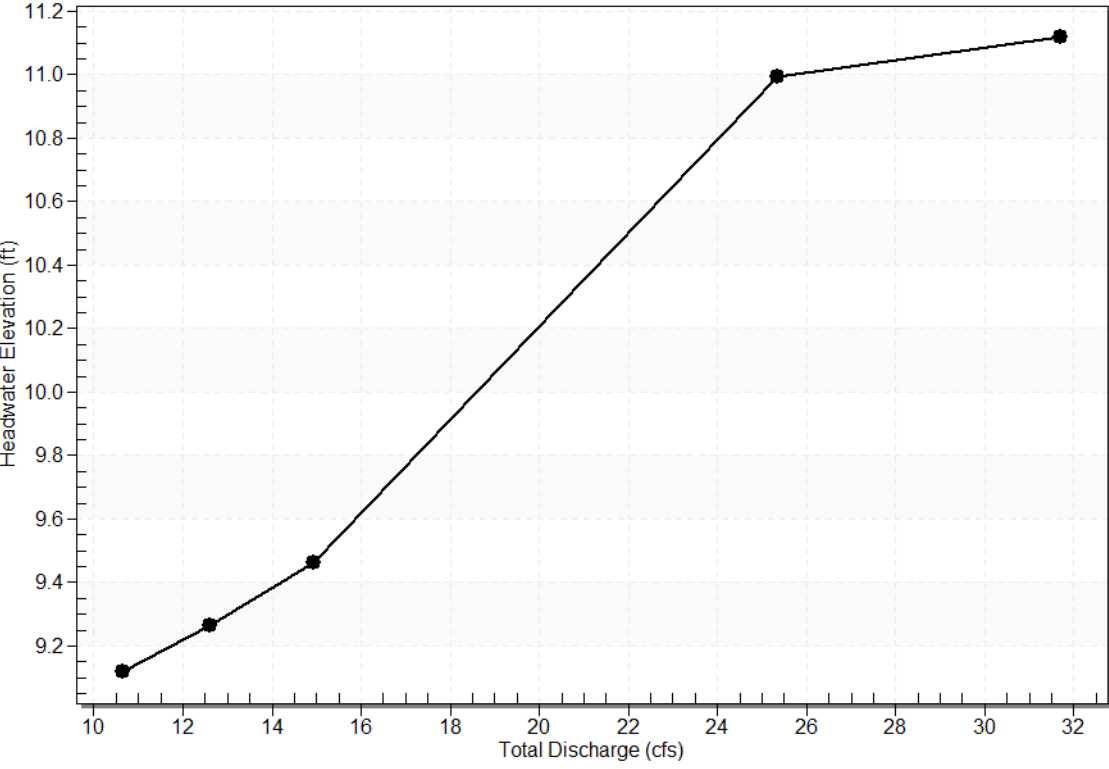


Table 3 - Culvert Summary Table: Existing CD 4

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 10.65 | 10.65 | 9.12 | 1.77 | 2.030 | 1.01 | 1-S1f | 1.03 | 1.17 | 2.00 | 2.03 | 3.39 | 0.00 |
| 50-YR | 12.61 | 12.61 | 9.26 | 1.98 | 2.174 | 1.09 | 1-S1f | 1.14 | 1.28 | 2.00 | 2.03 | 4.01 | 0.00 |
| 100-YR | 14.92 | 14.92 | 9.46 | 2.24 | 2.372 | 1.19 | 1-S1f | 1.27 | 1.39 | 2.00 | 2.03 | 4.75 | 0.00 |
| 500-YR | 25.36 | 25.36 | 10.99 | 3.90 | 3.703 | 1.95 | 4-FFf | 2.00 | 1.77 | 2.00 | 2.03 | 8.07 | 0.00 |
| Overtopping | 31.70 | 25.96 | 11.12 | 4.03 | 3.800 | 2.01 | 4-FFf | 2.00 | 1.79 | 2.00 | 2.03 | 8.26 | 0.00 |

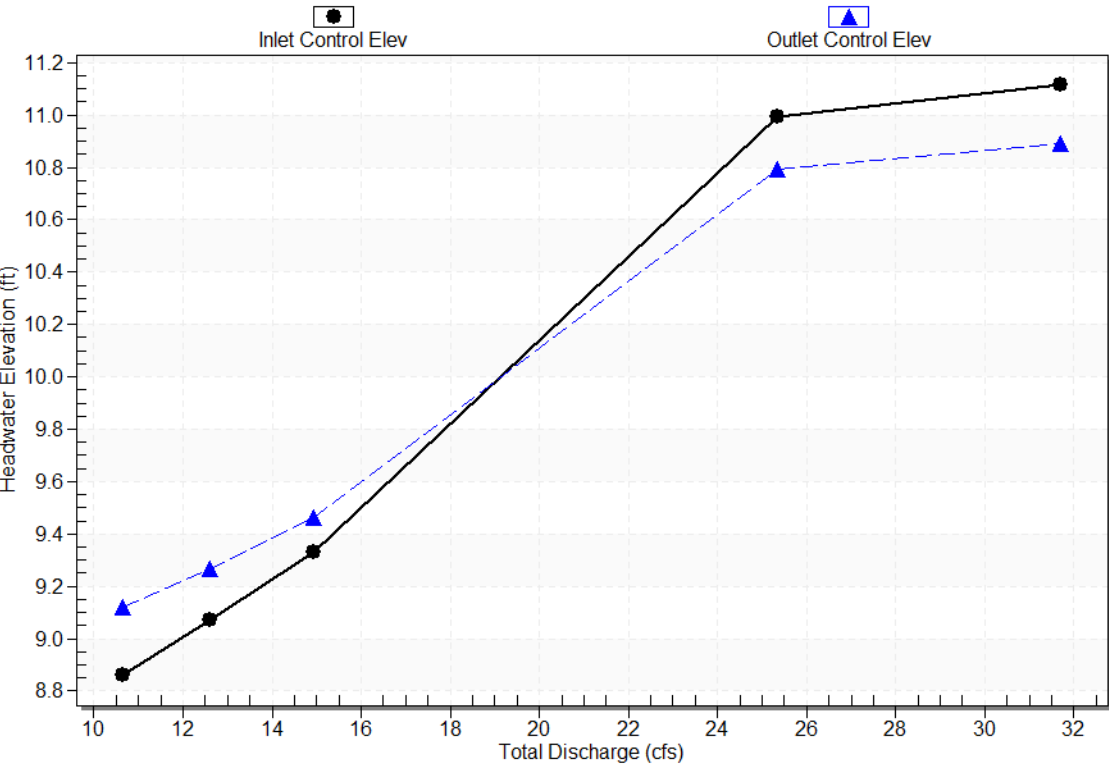
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 7.09 ft
Outlet Elevation (invert): 6.75 ft
Culvert Length: 49.30 ft
Culvert Slope: 0.01 ft/ft

Culvert Performance Curve Plot: Existing CD 4

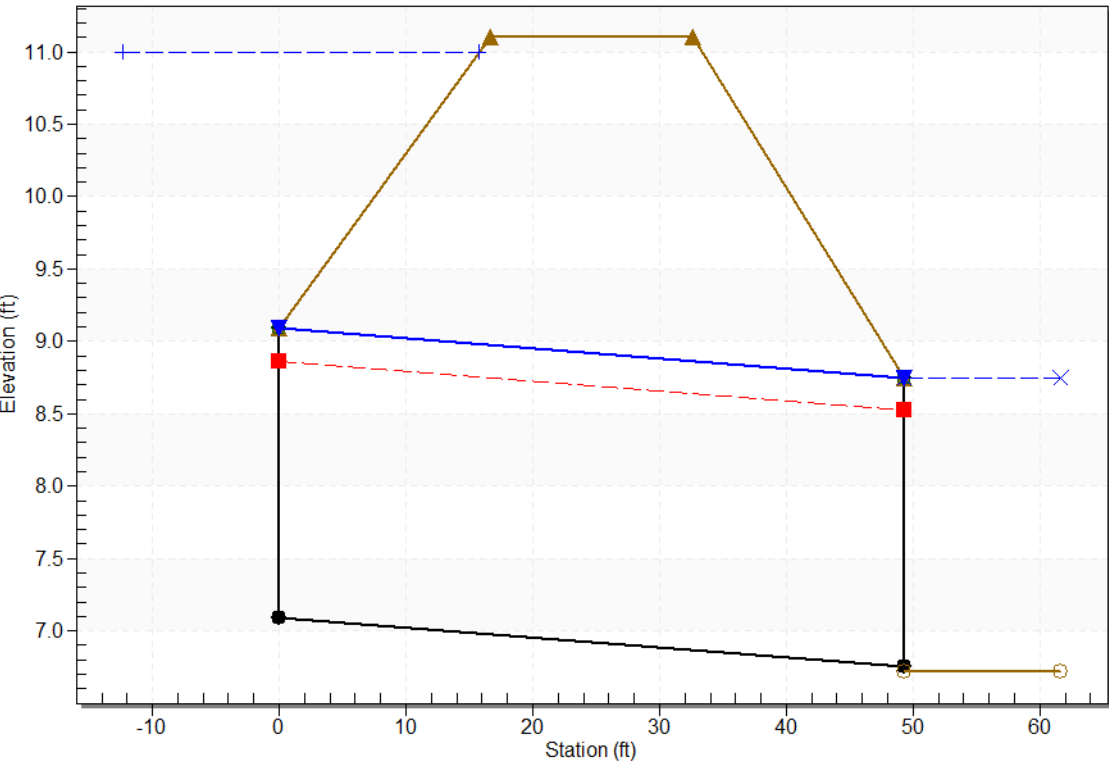
Performance Curve

Culvert: Existing CD 4



Water Surface Profile Plot for Culvert: Existing CD 4

Crossing - CD 4 Existing, Design Discharge - 25.4 cfs
Culvert - Existing CD 4, Culvert Discharge - 25.4 cfs



Site Data - Existing CD 4

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 7.09 ft
Outlet Station: 49.30 ft
Outlet Elevation: 6.75 ft
Number of Barrels: 1

Culvert Data Summary - Existing CD 4

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: CD 4 Existing

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 8.75 ft

Table 4 - Downstream Channel Rating Curve (crossing: CD 4 Existing)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 10.65 | 8.75 | 2.03 |
| 12.61 | 8.75 | 2.03 |
| 14.92 | 8.75 | 2.03 |
| 25.36 | 8.75 | 2.03 |

Roadway Data for crossing: CD 4 Existing

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 800.00 ft
Crest Elevation: 11.10 ft
Roadway Surface: Paved
Roadway Top Width: 16.00 ft

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Proposed CD 4 | Proposed CD 4 | 500-YR | 25.36 | 25.36 | 10.74 | 3.65 | 3.444 | 1.82 | 2.00 | 1.77 | 2.00 | 8.07 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Proposed CD 4

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | Proposed CD 4 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|--------------------------------------|--------------------------------|-------------------|
| 9.06 | 25-YR | 10.65 | 10.65 | 0.00 | 1 |
| 9.19 | 50-YR | 12.61 | 12.61 | 0.00 | 1 |
| 9.36 | 100-YR | 14.92 | 14.92 | 0.00 | 1 |
| 10.74 | 500-YR | 25.36 | 25.36 | 0.00 | 1 |
| 11.10 | Overtopping | 27.28 | 27.28 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Proposed CD 4

Total Rating Curve
Crossing: Proposed CD 4

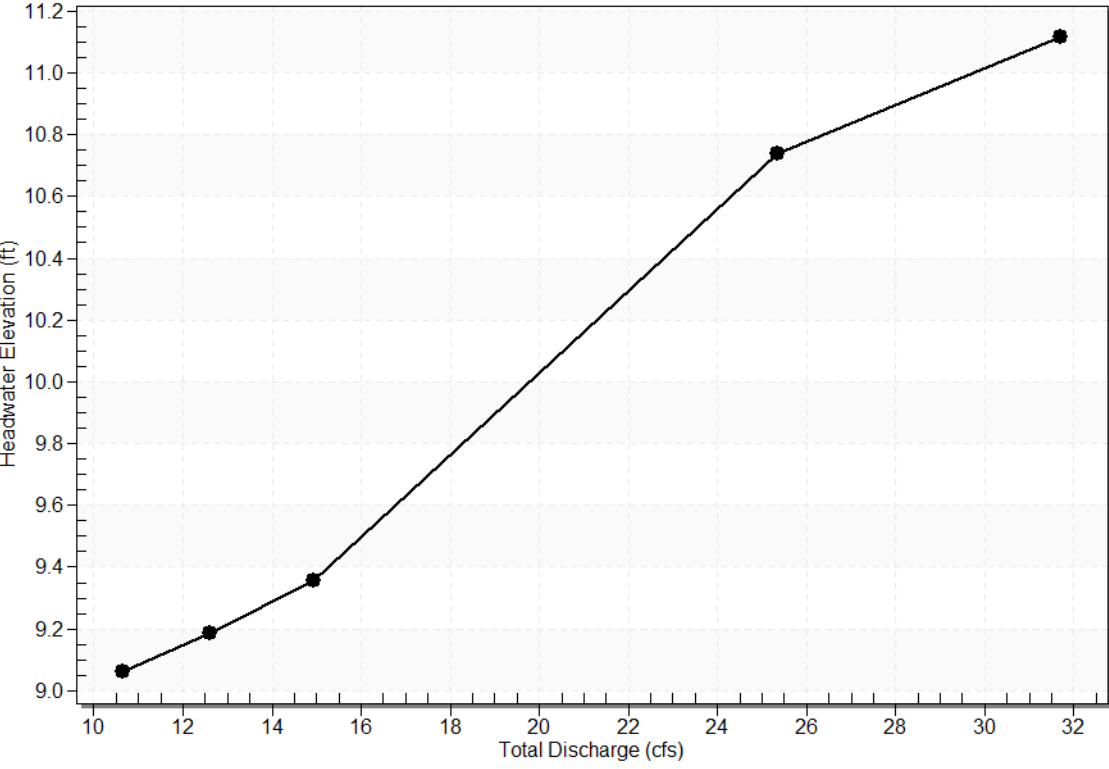


Table 3 - Culvert Summary Table: Proposed CD 4

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 10.65 | 10.65 | 9.06 | 1.71 | 1.973 | 0.99 | 1-S1f | 1.03 | 1.17 | 2.00 | 2.03 | 3.39 | 0.00 |
| 50-YR | 12.61 | 12.61 | 9.19 | 1.90 | 2.096 | 1.05 | 1-S1f | 1.14 | 1.28 | 2.00 | 2.03 | 4.01 | 0.00 |
| 100-YR | 14.92 | 14.92 | 9.36 | 2.14 | 2.268 | 1.13 | 1-S1f | 1.27 | 1.39 | 2.00 | 2.03 | 4.75 | 0.00 |
| 500-YR | 25.36 | 25.36 | 10.74 | 3.65 | 3.444 | 1.82 | 4-FFf | 2.00 | 1.77 | 2.00 | 2.03 | 8.07 | 0.00 |
| Overtopping | 31.70 | 27.36 | 11.11 | 4.02 | 3.737 | 2.01 | 4-FFf | 2.00 | 1.82 | 2.00 | 2.03 | 8.71 | 0.00 |

Culvert Barrel Data

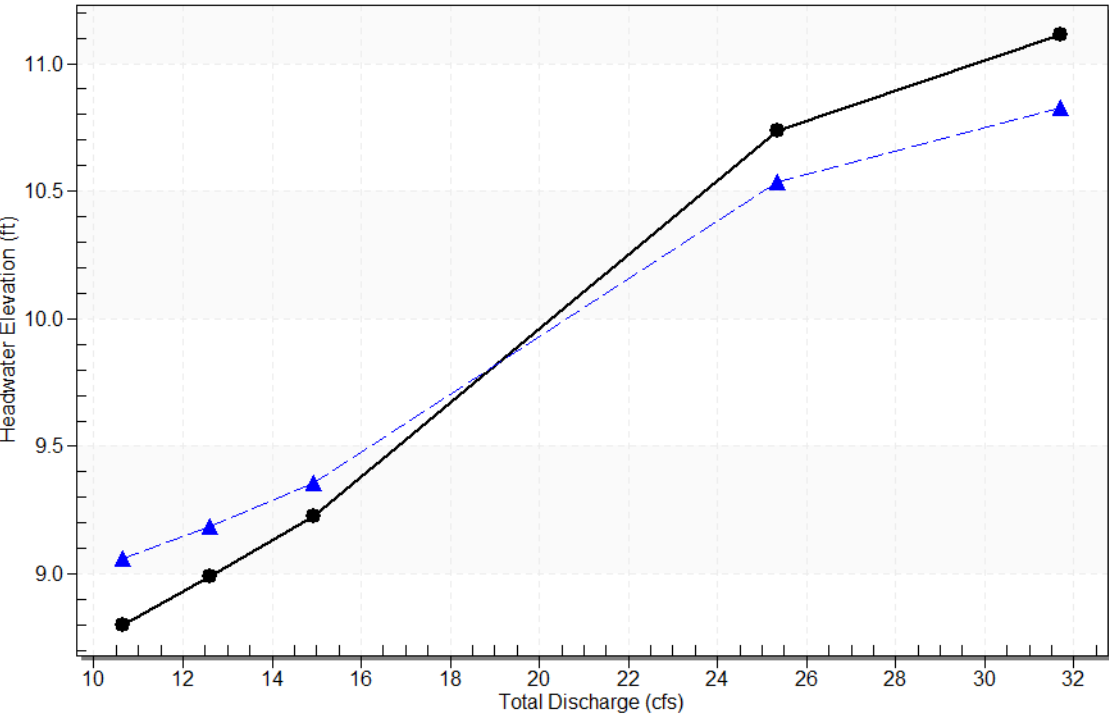
Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 7.09 ft
Outlet Elevation (invert): 6.72 ft
Culvert Length: 53.50 ft
Culvert Slope: 0.01 ft/ft

Culvert Performance Curve Plot: Proposed CD 4

Performance Curve

Culvert: Proposed CD 4

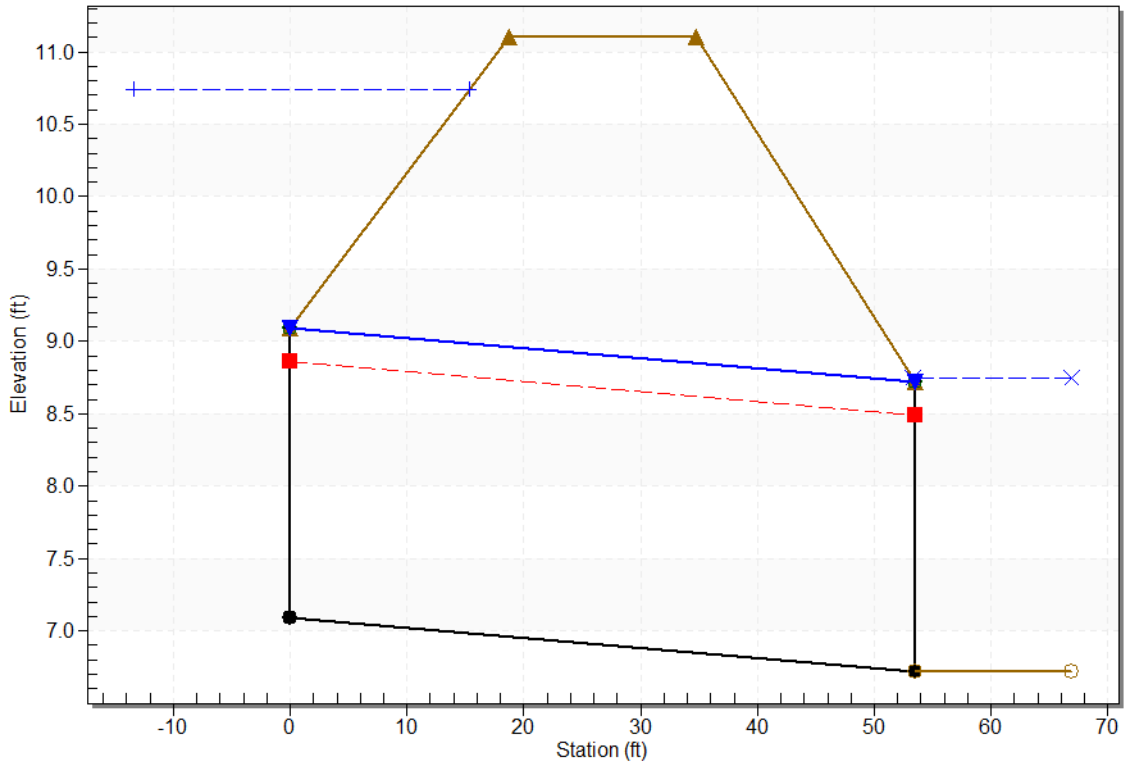
Inlet Control Elev Outlet Control Elev



Water Surface Profile Plot for Culvert: Proposed CD 4

Crossing - Proposed CD 4, Design Discharge - 25.4 cfs

Culvert - Proposed CD 4, Culvert Discharge - 25.4 cfs



Site Data - Proposed CD 4

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 7.09 ft
Outlet Station: 53.50 ft
Outlet Elevation: 6.72 ft
Number of Barrels: 1

Culvert Data Summary - Proposed CD 4

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Beveled Edge (1:1) (Ke=0.2)
Inlet Depression: None

Tailwater Channel Data for Crossing: Proposed CD 4

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 8.75 ft

Table 4 - Downstream Channel Rating Curve (crossing: Proposed CD 4)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 10.65 | 8.75 | 2.03 |
| 12.61 | 8.75 | 2.03 |
| 14.92 | 8.75 | 2.03 |
| 25.36 | 8.75 | 2.03 |

Roadway Data for crossing: Proposed CD 4

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 800.00 ft
Crest Elevation: 11.10 ft
Roadway Surface: Paved
Roadway Top Width: 16.00 ft

CD-5

CD #: 5 (Existing & Proposed)
STATION: 260+54
SIZE: 30"

| | | | |
|--|------------------|-------------|---------------------|
| Total Drainage Area (ac) | | 4.43 | Basin 7A + Basin 7C |
| RUNOFF COEFFICIENT CALCULATIONS | | | |
| | Sub-Area | | Coefficient |
| | Impervious | 0.67 | 0.95 |
| | Woodlands (R) | | 0.2 |
| | Smaller Lots (F) | 0.9 | 0.45 |
| | Pasture (F) | 2.86 | 0.2 |
| Weighted Runoff Coefficient | | 0.36 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 15 |
| Ending Elevation (ft) | 13.5 |
| Land Slope, s (ft/ft) | 0.015 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 33 |
| Travel Time, (mins) | 3.03 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 510 | | |
| Starting Elevation (ft) | 13.5 | | |
| Ending Elevation (ft) | 4.71 | | |
| Slope, s (ft/ft) | 0.017 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 2.118 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 4.01 | | |

TIME OF CONCENTRATION (mins) = **7.04** Use 10 min if it is less than 10

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **8.36**

Flow Calculations

| | | | | |
|----------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 13.50 | 15.98 | 18.90 | 32.14 |

Table 2 - Summary of Culvert Flows at crossing: Pre CD-5

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 10.09 | 25-YR | 13.50 | 13.50 | 0.00 | 1 |
| 11.32 | 50-YR | 15.98 | 15.98 | 0.00 | 1 |
| 11.95 | 100-YR | 18.90 | 18.90 | 0.00 | 1 |
| 15.06 | 500-YR | 32.14 | 32.14 | 0.00 | 1 |
| 16.00 | Overtopping | 35.52 | 35.52 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Pre CD-5

Total Rating Curve
Crossing: Pre CD-5

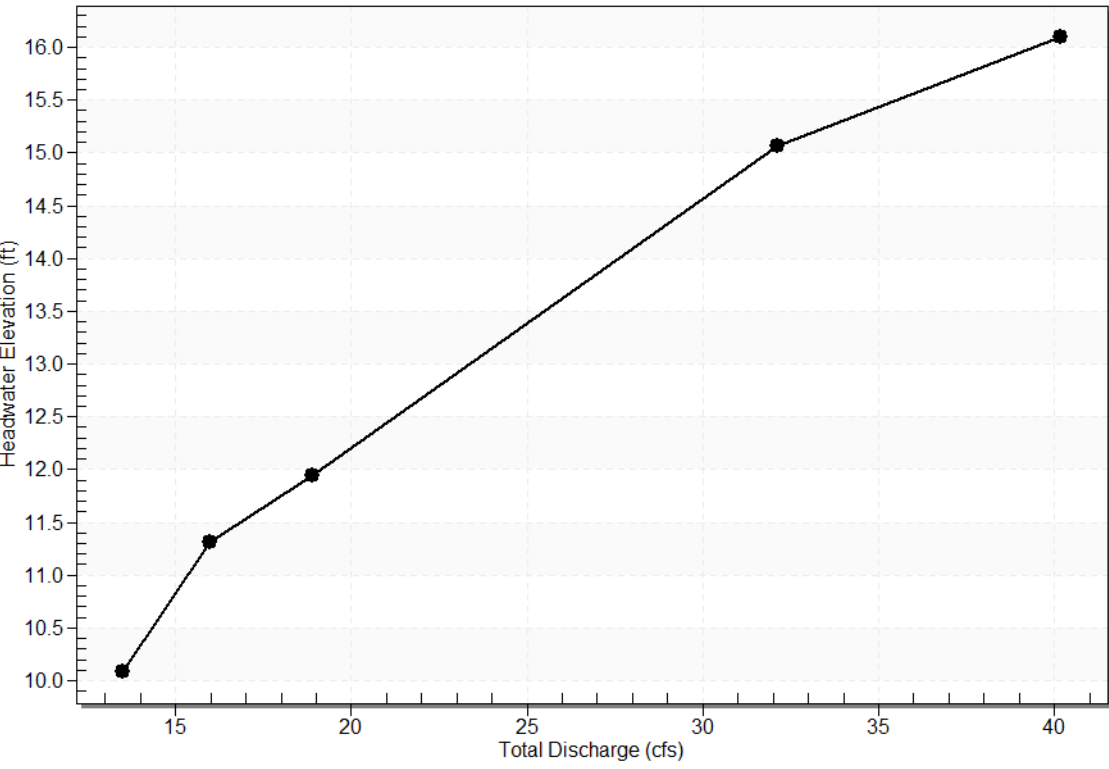


Table 3 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 13.50 | 13.50 | 10.09 | 1.93 | 5.378 | 2.15 | 4-FFf | 2.50 | 1.24 | 2.50 | 4.59 | 2.75 | 0.00 |
| 50-YR | 15.98 | 15.98 | 11.32 | 2.15 | 6.608 | 2.64 | 4-FFf | 2.50 | 1.35 | 2.50 | 5.52 | 3.26 | 0.00 |
| 100-YR | 18.90 | 18.90 | 11.95 | 2.42 | 7.236 | 2.89 | 4-FFf | 2.50 | 1.47 | 2.50 | 5.73 | 3.85 | 0.00 |
| 500-YR | 32.14 | 32.14 | 15.06 | 3.91 | 10.350 | 4.14 | 4-FFf | 2.50 | 1.93 | 2.50 | 6.07 | 6.55 | 0.00 |
| Overtopping | 40.17 | 35.85 | 16.10 | 4.45 | 11.385 | 4.55 | 4-FFf | 2.50 | 2.03 | 2.50 | 6.07 | 7.30 | 0.00 |

Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.71 ft
Outlet Elevation (invert): 4.50 ft
Culvert Length: 143.00 ft
Culvert Slope: 0.00 ft/ft

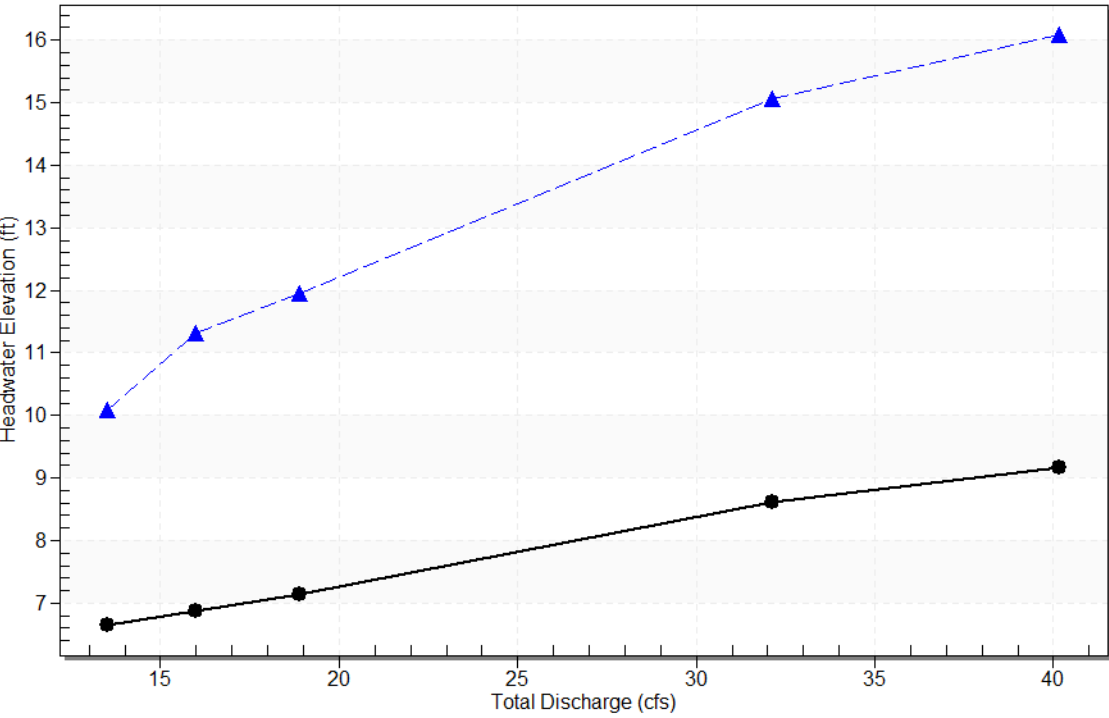
Culvert Performance Curve Plot: 30

Performance Curve

Culvert: 30

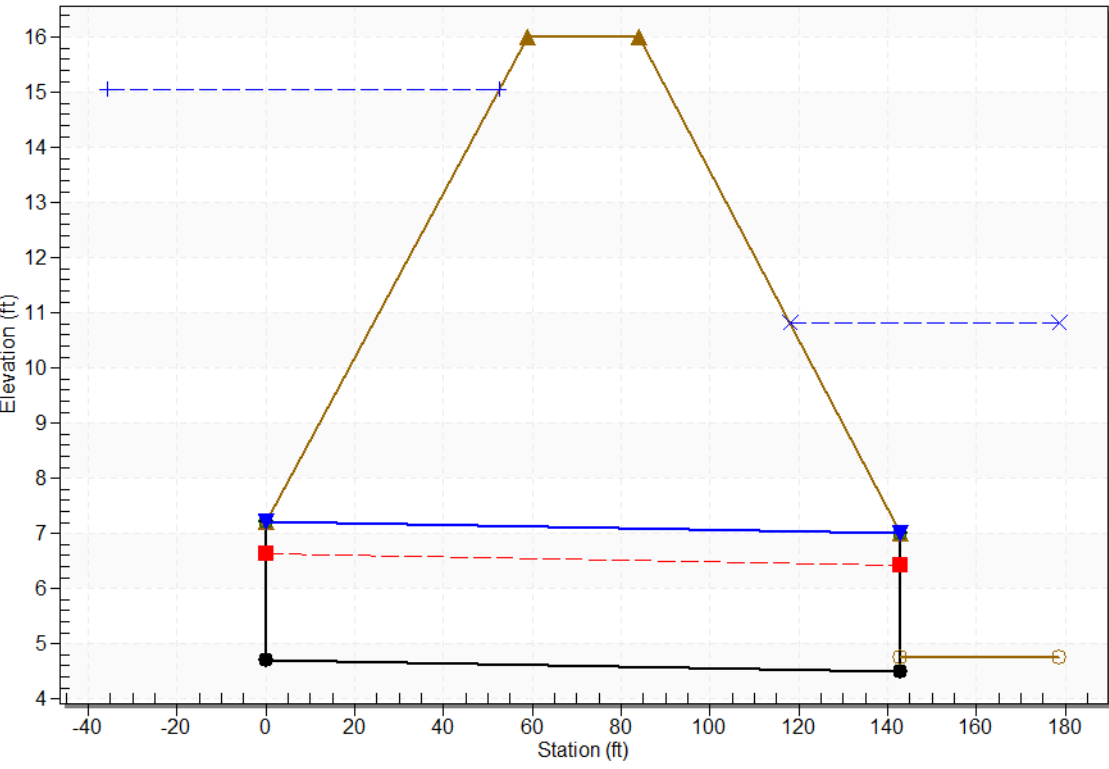
● Inlet Control Elev

▲ Outlet Control Elev



Water Surface Profile Plot for Culvert: 30

Crossing - Pre CD-5, Design Discharge - 32.1 cfs
Culvert - 30, Culvert Discharge - 32.1 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.71 ft
Outlet Station: 143.00 ft
Outlet Elevation: 4.5 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Culvert Type: Straight
Inlet Configuration: Thin Edge Projecting (Ke=0.9)
Inlet Depression: None

Tailwater Channel Data for Crossing: Pre CD-5

Tailwater Channel Option: Enter Rating Curve
Channel Invert Elevation: 4.75 ft

Table 4 - Downstream Channel Rating Curve (crossing: Pre CD-5)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 13.50 | 9.34 | 9.34 | 0.00 |
| 15.98 | 10.27 | 10.27 | 0.00 |
| 18.90 | 10.48 | 10.48 | 0.00 |
| 32.14 | 10.82 | 10.82 | 0.00 |

Roadway Data for crossing: Pre CD-5

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 16.00 ft
Roadway Surface: Paved
Roadway Top Width: 25.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Prop. CD-5

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 10.12 | 25-YR | 13.50 | 13.50 | 0.00 | 1 |
| 10.95 | 50-YR | 15.98 | 15.98 | 0.00 | 1 |
| 11.95 | 100-YR | 18.90 | 18.90 | 0.00 | 1 |
| 15.06 | 500-YR | 32.14 | 32.14 | 0.00 | 1 |
| 16.00 | Overtopping | 35.52 | 35.52 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-5

Total Rating Curve
Crossing: Prop. CD-5

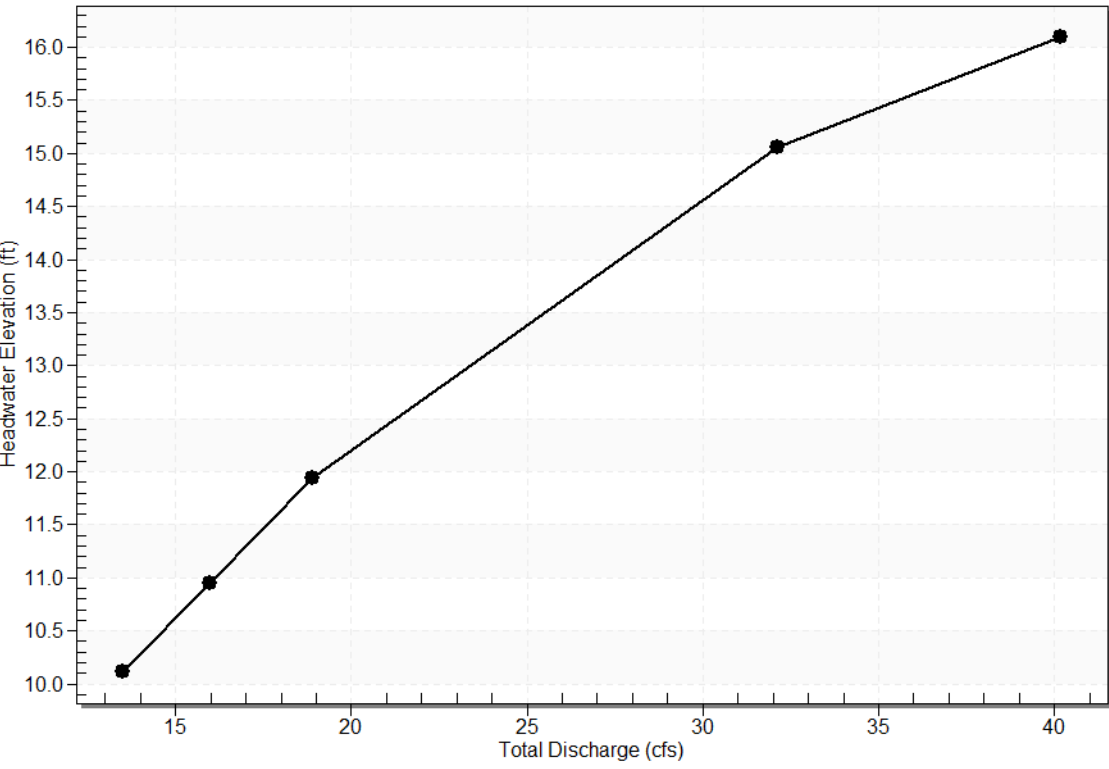


Table 3 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 13.50 | 13.50 | 10.12 | 1.93 | 5.408 | 2.16 | 4-FFf | 2.50 | 1.24 | 2.50 | 4.62 | 2.75 | 0.00 |
| 50-YR | 15.98 | 15.98 | 10.95 | 2.15 | 6.238 | 2.50 | 4-FFf | 2.50 | 1.35 | 2.50 | 5.15 | 3.26 | 0.00 |
| 100-YR | 18.90 | 18.90 | 11.95 | 2.42 | 7.236 | 2.89 | 4-FFf | 2.50 | 1.47 | 2.50 | 5.73 | 3.85 | 0.00 |
| 500-YR | 32.14 | 32.14 | 15.06 | 3.91 | 10.350 | 4.14 | 4-FFf | 2.50 | 1.93 | 2.50 | 6.07 | 6.55 | 0.00 |
| Overtopping | 40.17 | 35.85 | 16.10 | 4.45 | 11.385 | 4.55 | 4-FFf | 2.50 | 2.03 | 2.50 | 6.07 | 7.30 | 0.00 |

Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.71 ft
Outlet Elevation (invert): 4.50 ft
Culvert Length: 143.00 ft
Culvert Slope: 0.00 ft/ft

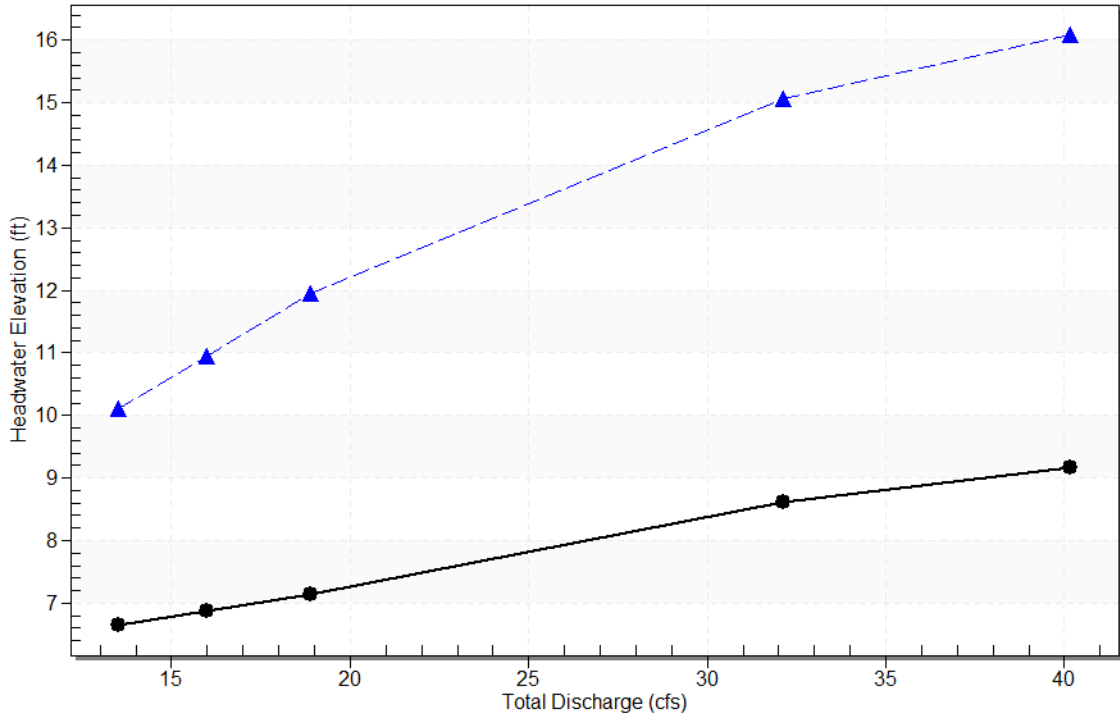
Culvert Performance Curve Plot: 30

Performance Curve

Culvert: 30

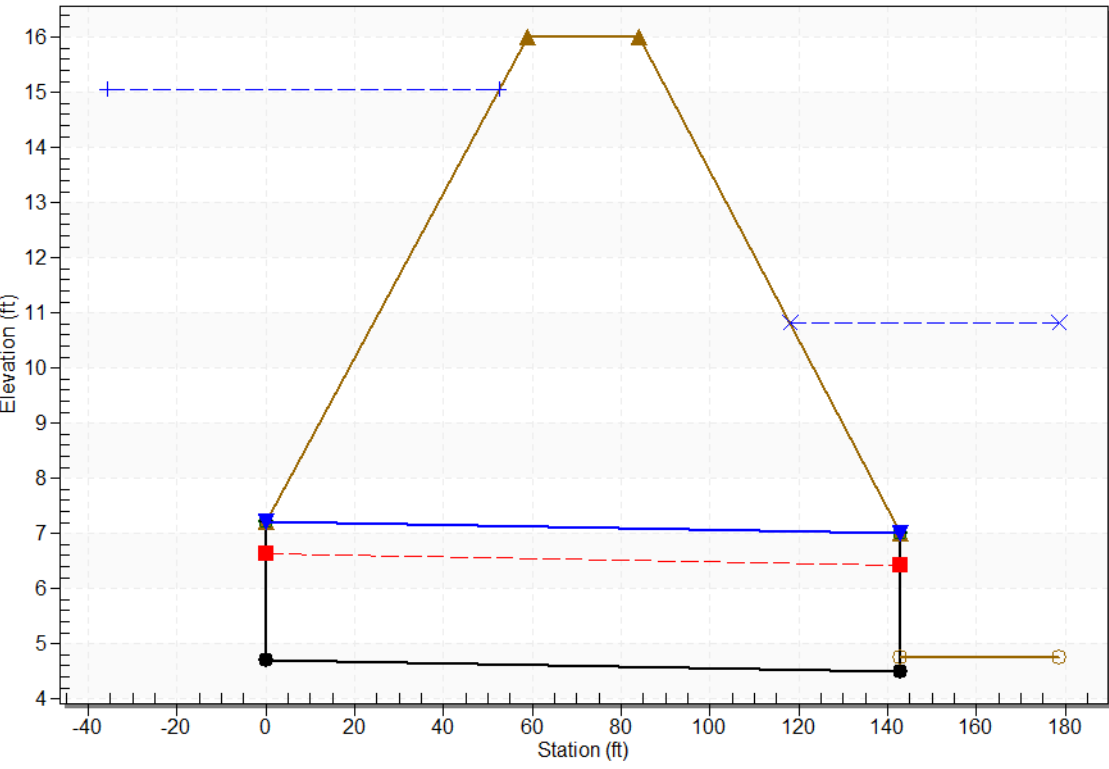
● Inlet Control Elev

▲ Outlet Control Elev



Water Surface Profile Plot for Culvert: 30

Crossing - Prop. CD-5, Design Discharge - 32.1 cfs
Culvert - 30, Culvert Discharge - 32.1 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.71 ft
Outlet Station: 143.00 ft
Outlet Elevation: 4.50 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Culvert Type: Straight
Inlet Configuration: Thin Edge Projecting
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-5

Tailwater Channel Option: Enter Rating Curve
Channel Invert Elevation: 4.75 ft

Table 4 - Downstream Channel Rating Curve (crossing: Prop. CD-5)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 13.50 | 9.37 | 9.37 | 0.00 |
| 15.98 | 9.90 | 9.90 | 0.00 |
| 18.90 | 10.48 | 10.48 | 0.00 |
| 32.14 | 10.82 | 10.82 | 0.00 |

Roadway Data for crossing: Prop. CD-5

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 16.00 ft
Roadway Surface: Paved
Roadway Top Width: 25.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

CD-6

CD #: 6 (Existing & Proposed)
STATION: 258+21
SIZE: 30"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 3.1 | Basin 7B |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.56 | 0.95 |
| Woodlands (R) | | 0.2 |
| SRF: 1/2 acre (F) | | 0.35 |
| Pasture (F) | 2.54 | 0.2 |
| Weighted Runoff Coefficient | 0.34 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 37.5 |
| Ending Elevation (ft) | 30.5 |
| Land Slope, s (ft/ft) | 0.070 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 50 |
| Travel Time, (mins) | 2.00 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 484 | | |
| Starting Elevation (ft) | 30.5 | | |
| Ending Elevation (ft) | 4.48 | | |
| Slope, s (ft/ft) | 0.054 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 3.741 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 2.16 | | |

TIME OF CONCENTRATION (mins) = **4.16** Use 10 min if it is less than 10

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **8.36**

Flow Calculations

| | | | | |
|---------------------------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 8.69 | 10.29 | 12.17 | 20.69 |
| Plus Upstream Flow (CD-5) | 22.20 | 26.26 | 31.08 | 52.83 |

Table 5 - Summary of Culvert Flows at crossing: Pre CD-6

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 9.34 | 25-YR | 22.20 | 22.20 | 0.00 | 1 |
| 10.27 | 50-YR | 26.26 | 18.89 | 7.37 | 5 |
| 10.48 | 100-YR | 31.08 | 12.96 | 18.11 | 5 |
| 10.82 | 500-YR | 52.83 | 12.47 | 40.35 | 4 |
| 10.00 | Overtopping | 23.98 | 23.98 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Pre CD-6

Total Rating Curve
Crossing: Pre CD-6

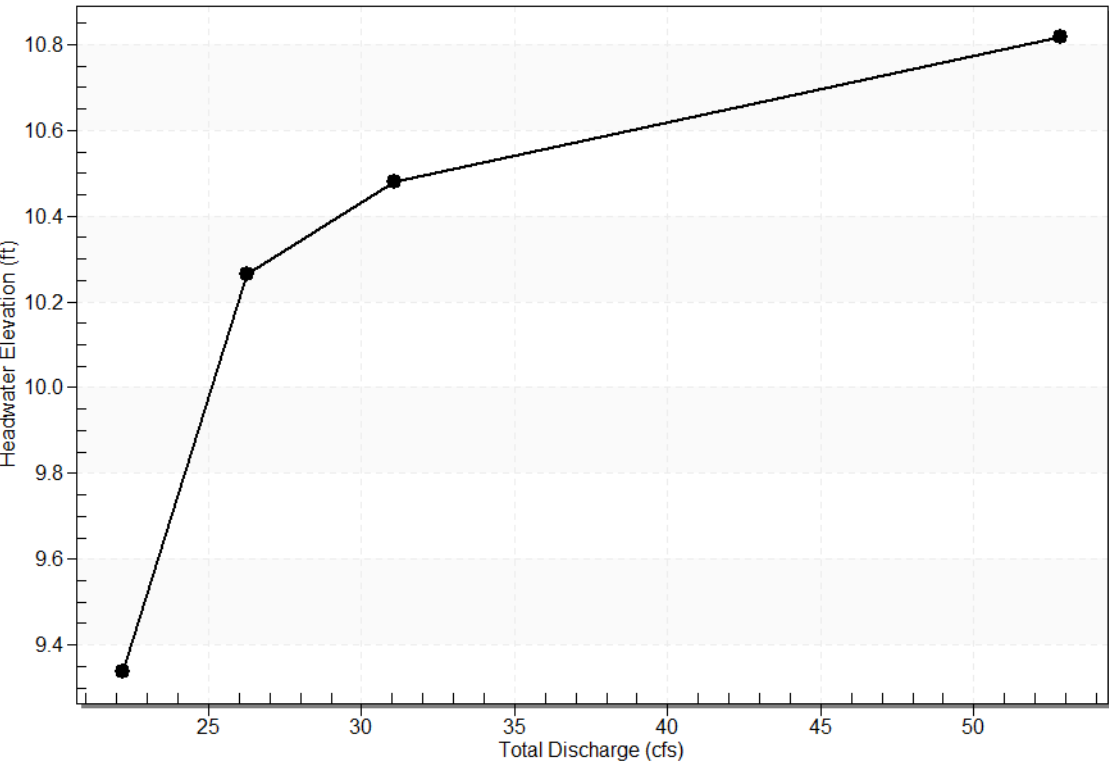


Table 6 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|--------------------|-----------------------|-------------------------|--------------------------|--------------------------|---------------------------|-------------|-----------|-------------------|---------------------|-------------------|----------------------|------------------------|---------------------------|
| 25-YR | 22.20 | 22.20 | 9.34 | 2.49 | 4.858 | 1.94 | 4-FFf | 2.22 | 1.60 | 2.50 | 3.98 | 4.52 | 0.00 |
| 50-YR | 26.26 | 18.89 | 10.27 | 2.24 | 5.786 | 2.31 | 4-FFf | 1.85 | 1.47 | 2.50 | 5.15 | 3.85 | 0.00 |
| 100-YR | 31.08 | 12.96 | 10.48 | 1.77 | 5.999 | 2.40 | 4-FFf | 1.42 | 1.21 | 2.50 | 5.70 | 2.64 | 0.00 |
| 500-YR | 52.83 | 12.47 | 10.82 | 1.73 | 6.337 | 2.53 | 4-FFf | 1.39 | 1.19 | 2.50 | 6.06 | 2.54 | 0.00 |
| Overtopping | 52.83 | 12.47 | 10.82 | 1.73 | 6.337 | 2.53 | 4-FFf | 1.39 | 1.19 | 2.50 | 6.06 | 2.54 | 0.00 |

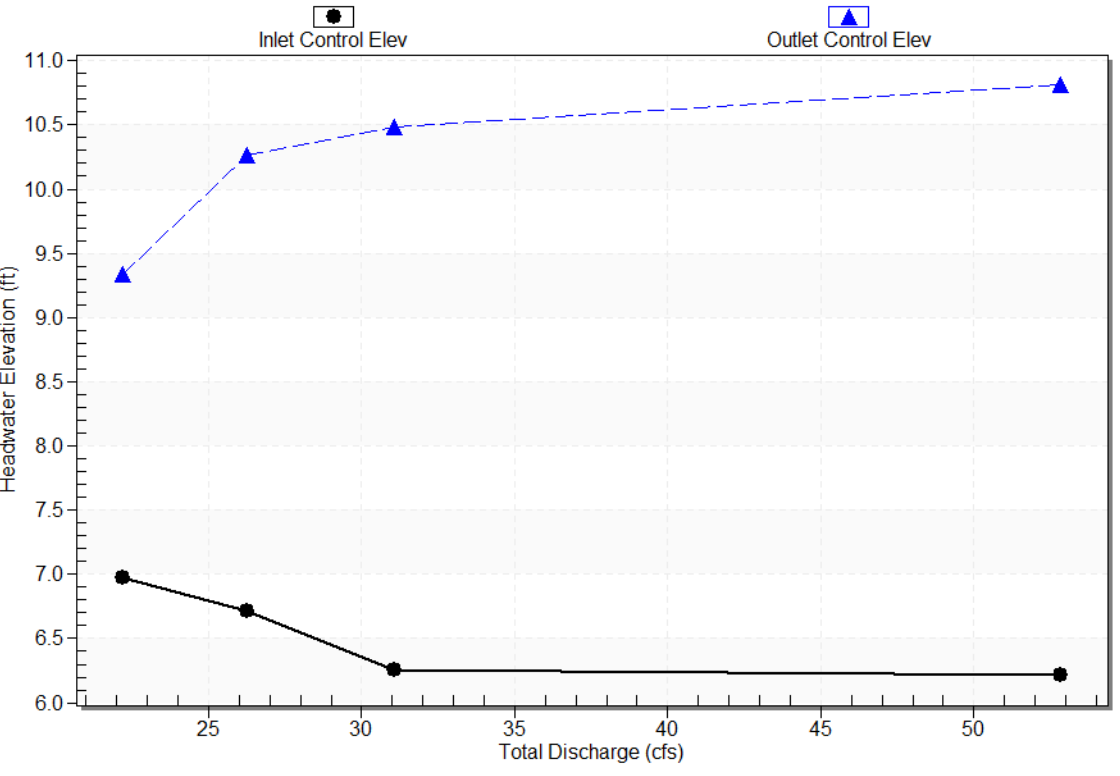
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.48 ft
Outlet Elevation (invert): 4.12 ft
Culvert Length: 162.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 30

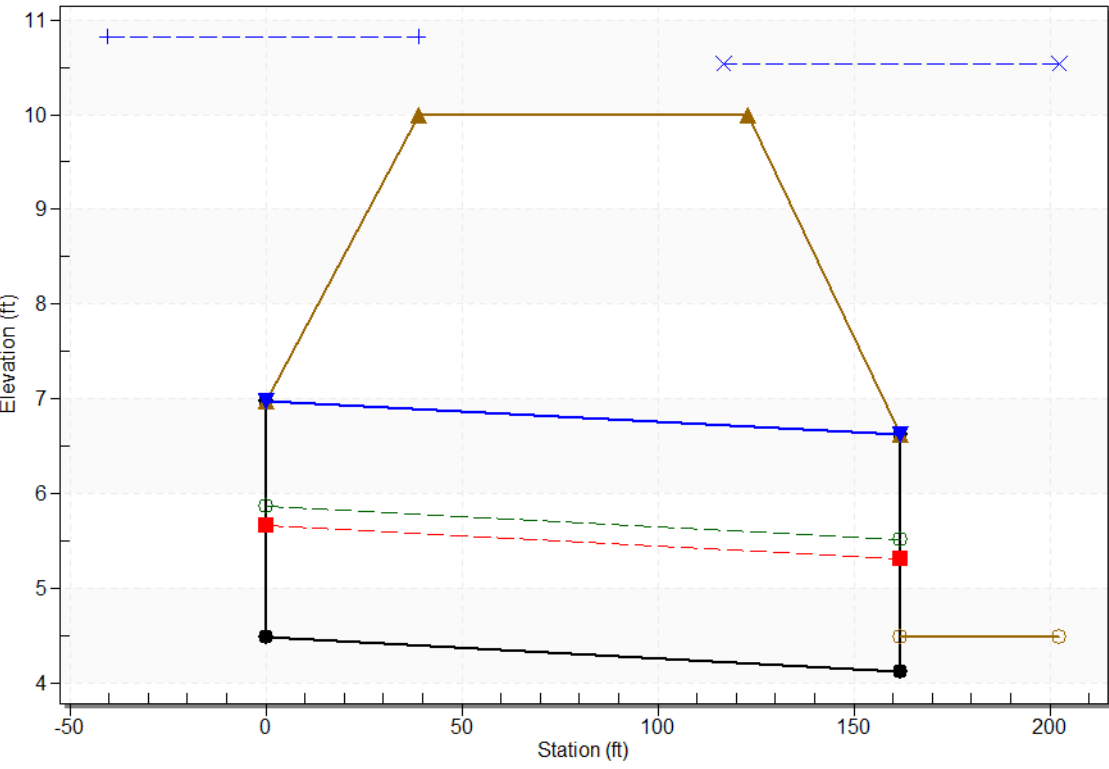
Performance Curve

Culvert: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Pre CD-6, Design Discharge - 52.8 cfs
Culvert - 30, Culvert Discharge - 12.5 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.48 ft
Outlet Station: 162.00 ft
Outlet Elevation: 4.12 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Pre CD-6

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 4.48 ft

Table 7 - Downstream Channel Rating Curve (crossing: Pre CD-6)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 22.20 | 8.46 | 8.46 | 0.00 |
| 26.26 | 9.63 | 9.63 | 0.00 |
| 31.08 | 10.18 | 10.18 | 0.00 |
| 52.83 | 10.54 | 10.54 | 0.00 |

Roadway Data for crossing: Pre CD-6

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 18.00 ft

Crest Elevation: 10.00 ft

Roadway Surface: Paved

Roadway Top Width: 84.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 5 - Summary of Culvert Flows at crossing: Prop. CD-6

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 9.37 | 25-YR | 22.20 | 22.20 | 0.00 | 1 |
| 9.90 | 50-YR | 26.26 | 26.26 | 0.00 | 1 |
| 10.48 | 100-YR | 31.08 | 12.80 | 18.28 | 6 |
| 10.82 | 500-YR | 52.83 | 12.30 | 40.53 | 4 |
| 10.00 | Overtopping | 26.48 | 26.48 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-6

Total Rating Curve
Crossing: Prop. CD-6

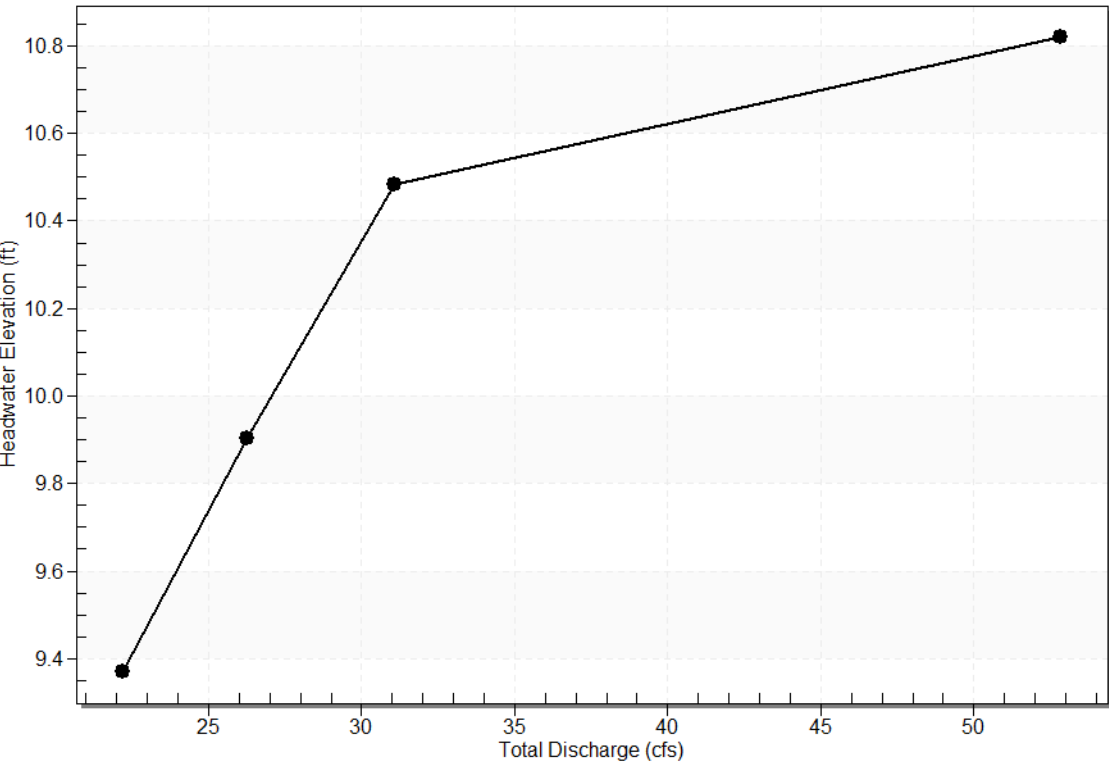


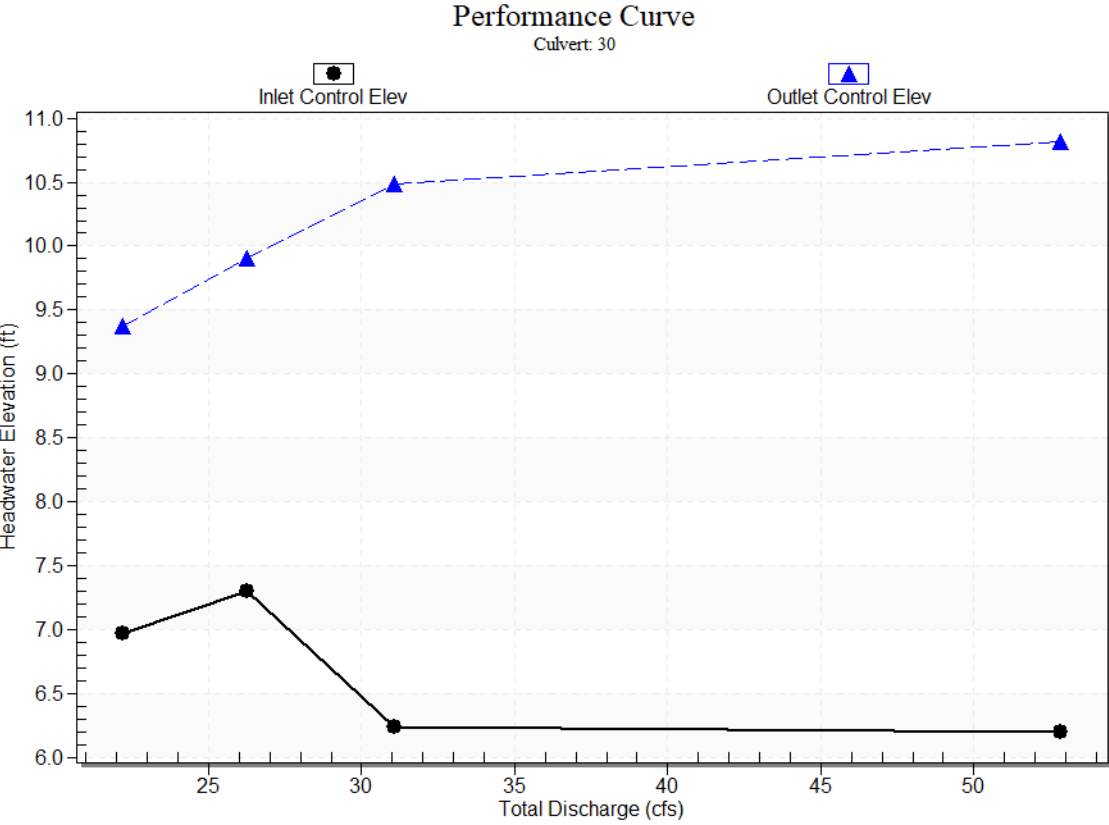
Table 6 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 22.20 | 22.20 | 9.37 | 2.49 | 4.891 | 1.96 | 4-FFf | 2.50 | 1.60 | 2.50 | 3.98 | 4.52 | 0.00 |
| 50-YR | 26.26 | 26.26 | 9.90 | 2.83 | 5.424 | 2.17 | 4-FFf | 2.50 | 1.75 | 2.50 | 4.15 | 5.35 | 0.00 |
| 100-YR | 31.08 | 12.80 | 10.48 | 1.76 | 6.003 | 2.40 | 4-FFf | 1.44 | 1.20 | 2.50 | 5.70 | 2.61 | 0.00 |
| 500-YR | 52.83 | 12.30 | 10.82 | 1.72 | 6.340 | 2.54 | 4-FFf | 1.41 | 1.18 | 2.50 | 6.06 | 2.51 | 0.00 |
| Overtopping | 52.83 | 12.30 | 10.82 | 1.72 | 6.340 | 2.54 | 4-FFf | 1.41 | 1.18 | 2.50 | 6.06 | 2.51 | 0.00 |

Culvert Barrel Data

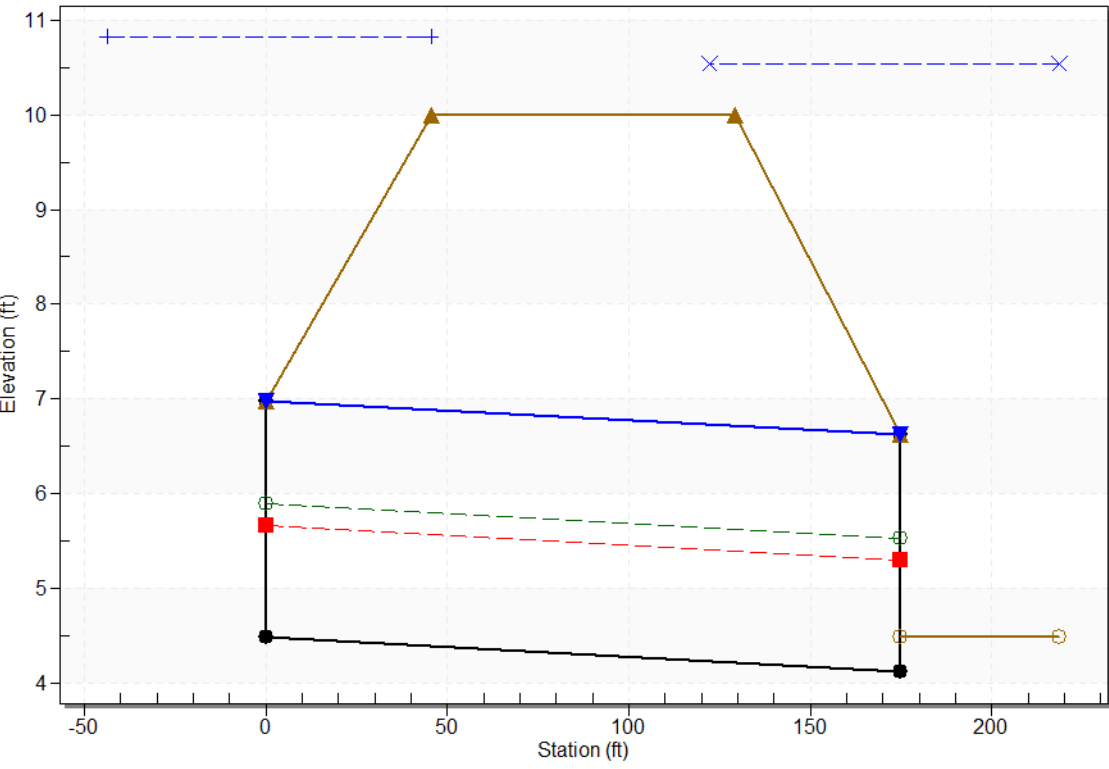
Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 4.48 ft
Outlet Elevation (invert): 4.12 ft
Culvert Length: 175.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Prop. CD-6, Design Discharge - 52.8 cfs
Culvert - 30, Culvert Discharge - 12.3 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 4.48 ft
Outlet Station: 175.00 ft
Outlet Elevation: 4.12 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-6

Tailwater Channel Option: Enter Rating Curve
Channel Invert Elevation: 4.48 ft

Table 7 - Downstream Channel Rating Curve (crossing: Prop. CD-6)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 22.20 | 8.46 | 8.46 | 0.00 |
| 26.26 | 8.63 | 8.63 | 0.00 |
| 31.08 | 10.18 | 10.18 | 0.00 |
| 52.83 | 10.54 | 10.54 | 0.00 |

Roadway Data for crossing: Prop. CD-6

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 18.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 84.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

CD-7

CD #: 7 (Existing & Proposed)
STATION: 258+87
SIZE: 30"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 2.55 | Basin 8A |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.78 | 0.95 |
| Woodlands (F) | | 0.15 |
| Smaller Lots (F) | | 0.45 |
| Pasture (F) | 1.77 | 0.2 |
| Weighted Runoff Coefficient | 0.43 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 40.8 |
| Ending Elevation (ft) | 36.5 |
| Land Slope, s (ft/ft) | 0.043 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 44 |
| Travel Time, (mins) | 2.27 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 587 | | |
| Starting Elevation (ft) | 36.5 | | |
| Ending Elevation (ft) | 3.94 | | |
| Slope, s (ft/ft) | 0.055 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 3.800 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 2.57 | | |

TIME OF CONCENTRATION (mins) = **4.85** Use 10 min if it is less than 10

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **8.36**

Flow Calculations

| | | | | |
|---------------------------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 9.15 | 10.83 | 12.82 | 21.79 |
| Plus Upstream Flow (CD-6) | 31.35 | 37.10 | 43.89 | 74.62 |

Table 8 - Summary of Culvert Flows at crossing: Pre CD-7

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 8.46 | 25-YR | 31.35 | 31.35 | 0.00 | 1 |
| 9.63 | 50-YR | 37.10 | 37.10 | 0.00 | 1 |
| 10.18 | 100-YR | 43.89 | 32.86 | 11.01 | 10 |
| 10.54 | 500-YR | 74.62 | 13.99 | 60.63 | 4 |
| 10.00 | Overtopping | 38.67 | 38.67 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Pre CD-7

Total Rating Curve
Crossing: Pre CD-7

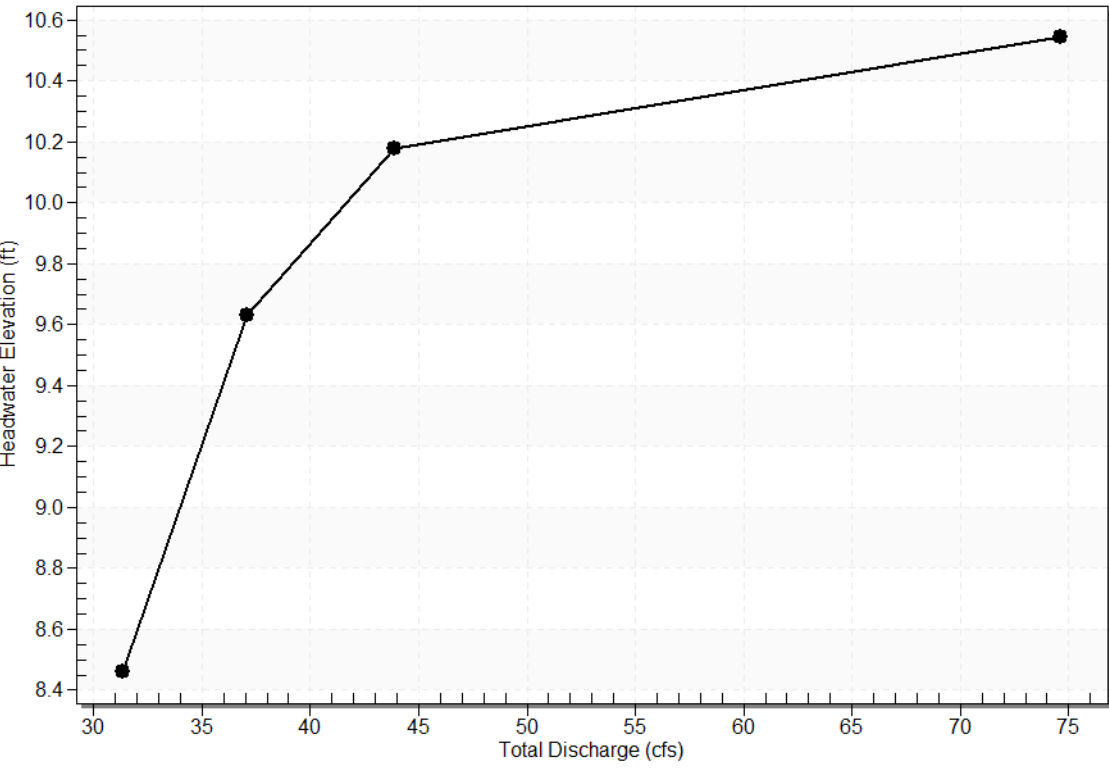


Table 9 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|--------------------|-----------------------|-------------------------|--------------------------|--------------------------|---------------------------|-------------|-----------|-------------------|---------------------|-------------------|----------------------|------------------------|---------------------------|
| 25-YR | 31.35 | 31.35 | 8.46 | 3.29 | 4.522 | 1.81 | 4-FFf | 1.83 | 1.91 | 2.50 | 3.66 | 6.39 | 0.00 |
| 50-YR | 37.10 | 37.10 | 9.63 | 3.92 | 5.691 | 2.28 | 4-FFf | 2.18 | 2.06 | 2.50 | 4.32 | 7.56 | 0.00 |
| 100-YR | 43.89 | 32.86 | 10.18 | 3.45 | 6.237 | 2.49 | 4-FFf | 1.91 | 1.95 | 2.50 | 5.25 | 6.69 | 0.00 |
| 500-YR | 74.62 | 13.99 | 10.54 | 1.85 | 6.603 | 2.64 | 4-FFf | 1.09 | 1.26 | 2.50 | 6.76 | 2.85 | 0.00 |
| Overtopping | 74.62 | 13.99 | 10.54 | 1.85 | 6.603 | 2.64 | 4-FFf | 1.09 | 1.26 | 2.50 | 6.76 | 2.85 | 0.00 |

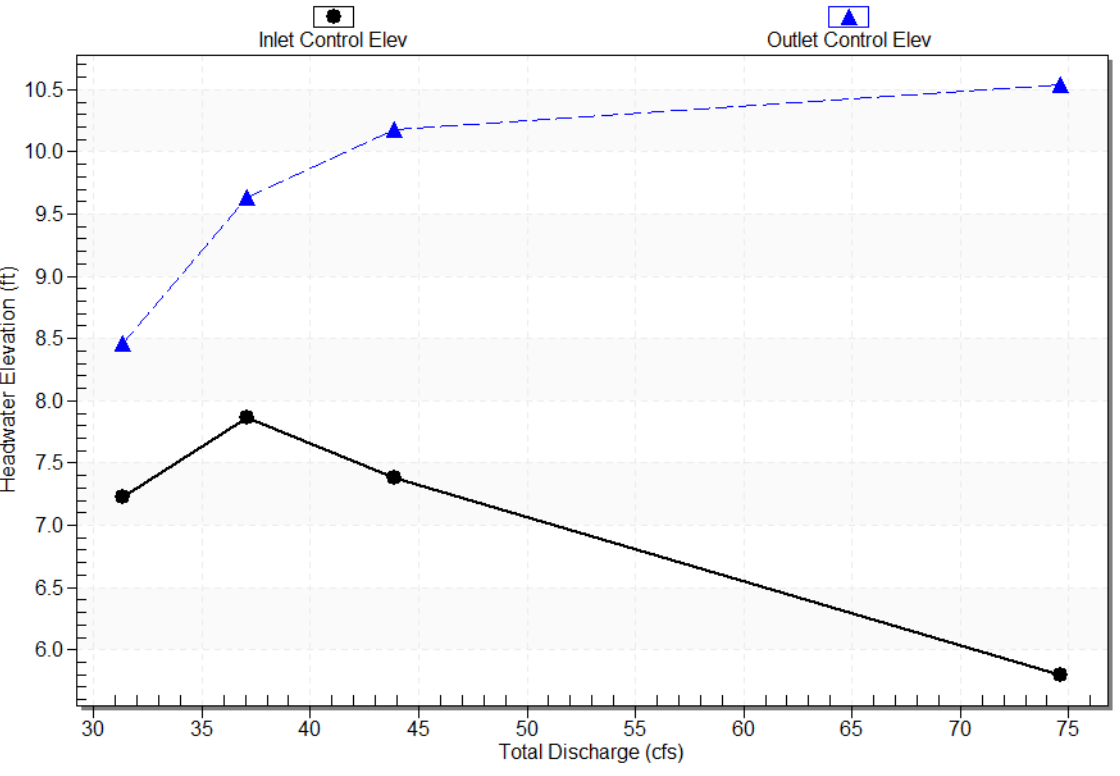
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 3.94 ft
Outlet Elevation (invert): 3.53 ft
Culvert Length: 65.00 ft
Culvert Slope: 0.01 ft/ft

Culvert Performance Curve Plot: 30

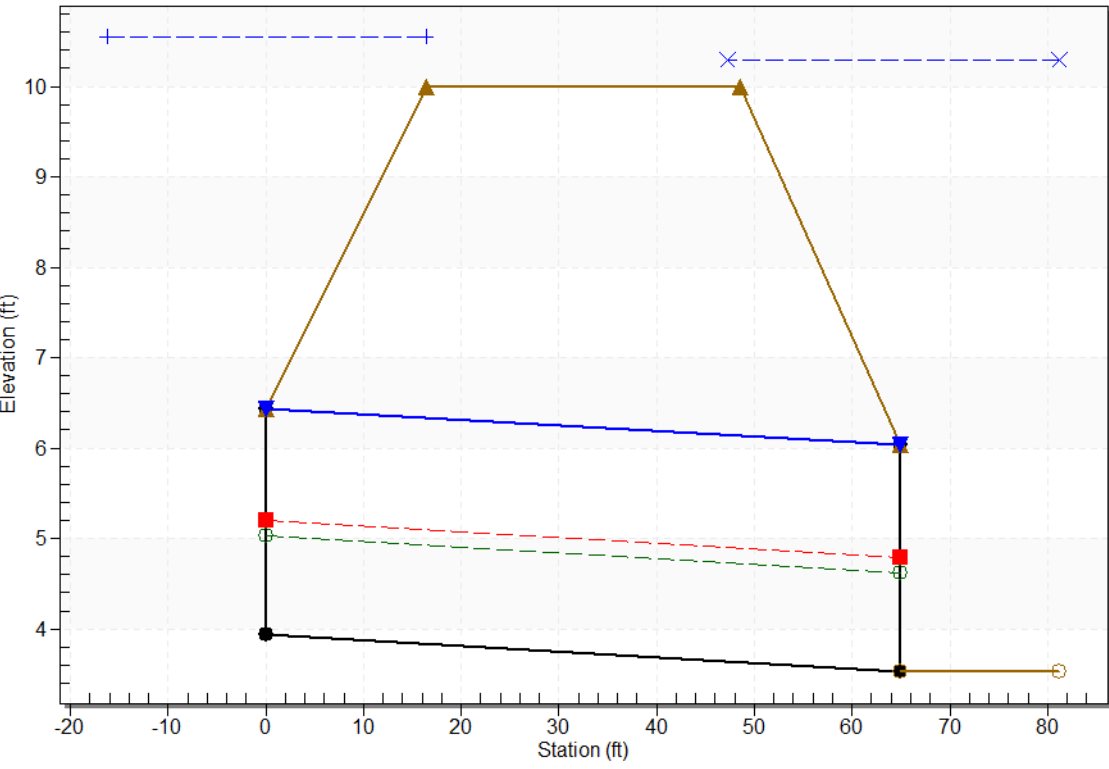
Performance Curve

Culvert: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Pre CD-7, Design Discharge - 74.6 cfs
Culvert - 30, Culvert Discharge - 14.0 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 3.94 ft
Outlet Station: 65.00 ft
Outlet Elevation: 3.53 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Pre CD-7

Tailwater Channel Option: Enter Rating Curve
Channel Invert Elevation: 3.53 ft

Table 10 - Downstream Channel Rating Curve (crossing: Pre CD-7)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 31.35 | 7.19 | 7.19 | 0.00 |
| 37.10 | 7.85 | 7.85 | 0.00 |
| 43.89 | 8.78 | 8.78 | 0.00 |
| 74.62 | 10.29 | 10.29 | 0.00 |

Roadway Data for crossing: Pre CD-7

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 8 - Summary of Culvert Flows at crossing: Prop. CD-7

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 8.46 | 25-YR | 31.35 | 31.35 | 0.00 | 1 |
| 9.63 | 50-YR | 37.10 | 37.10 | 0.00 | 1 |
| 10.18 | 100-YR | 43.89 | 32.86 | 11.01 | 10 |
| 10.54 | 500-YR | 74.62 | 13.99 | 60.63 | 4 |
| 10.00 | Overtopping | 38.67 | 38.67 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-7

Total Rating Curve
Crossing: Prop. CD-7

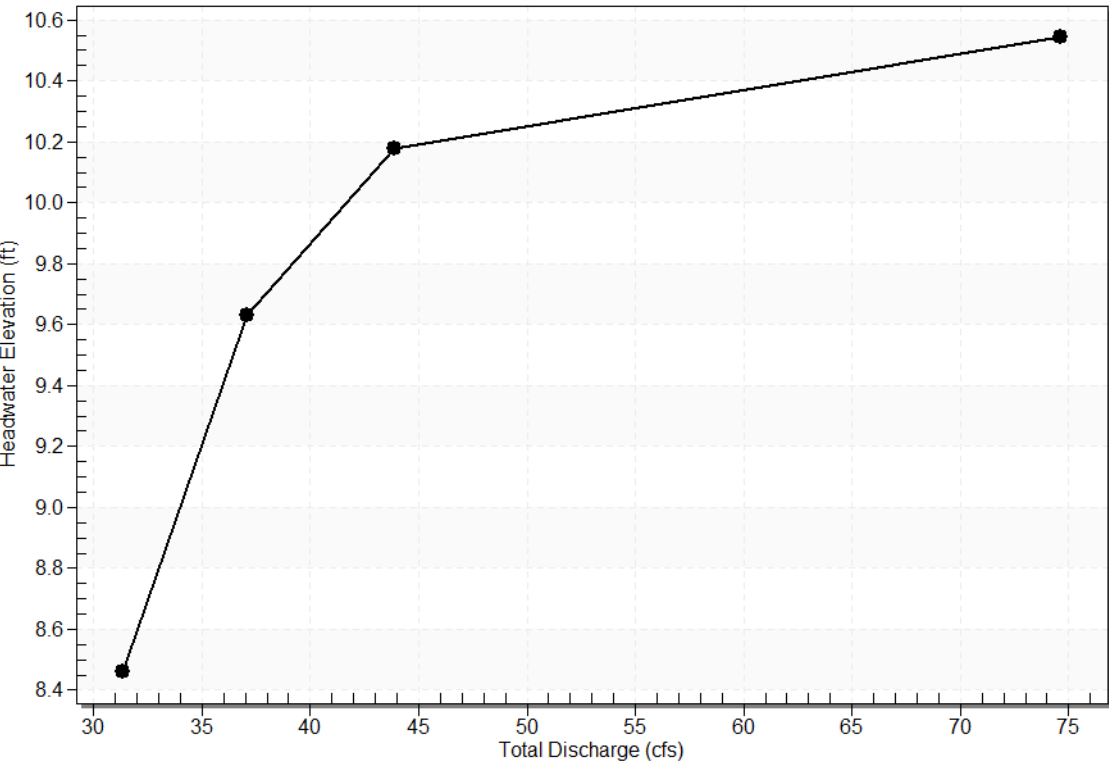


Table 9 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|--------------------|-----------------------|-------------------------|--------------------------|--------------------------|---------------------------|-------------|-----------|-------------------|---------------------|-------------------|----------------------|------------------------|---------------------------|
| 25-YR | 31.35 | 31.35 | 8.46 | 3.29 | 4.522 | 1.81 | 4-FFf | 1.83 | 1.91 | 2.50 | 3.66 | 6.39 | 0.00 |
| 50-YR | 37.10 | 37.10 | 9.63 | 3.92 | 5.691 | 2.28 | 4-FFf | 2.18 | 2.06 | 2.50 | 4.32 | 7.56 | 0.00 |
| 100-YR | 43.89 | 32.86 | 10.18 | 3.45 | 6.237 | 2.49 | 4-FFf | 1.91 | 1.95 | 2.50 | 5.25 | 6.69 | 0.00 |
| 500-YR | 74.62 | 13.99 | 10.54 | 1.85 | 6.603 | 2.64 | 4-FFf | 1.09 | 1.26 | 2.50 | 6.76 | 2.85 | 0.00 |
| Overtopping | 74.62 | 13.99 | 10.54 | 1.85 | 6.603 | 2.64 | 4-FFf | 1.09 | 1.26 | 2.50 | 6.76 | 2.85 | 0.00 |

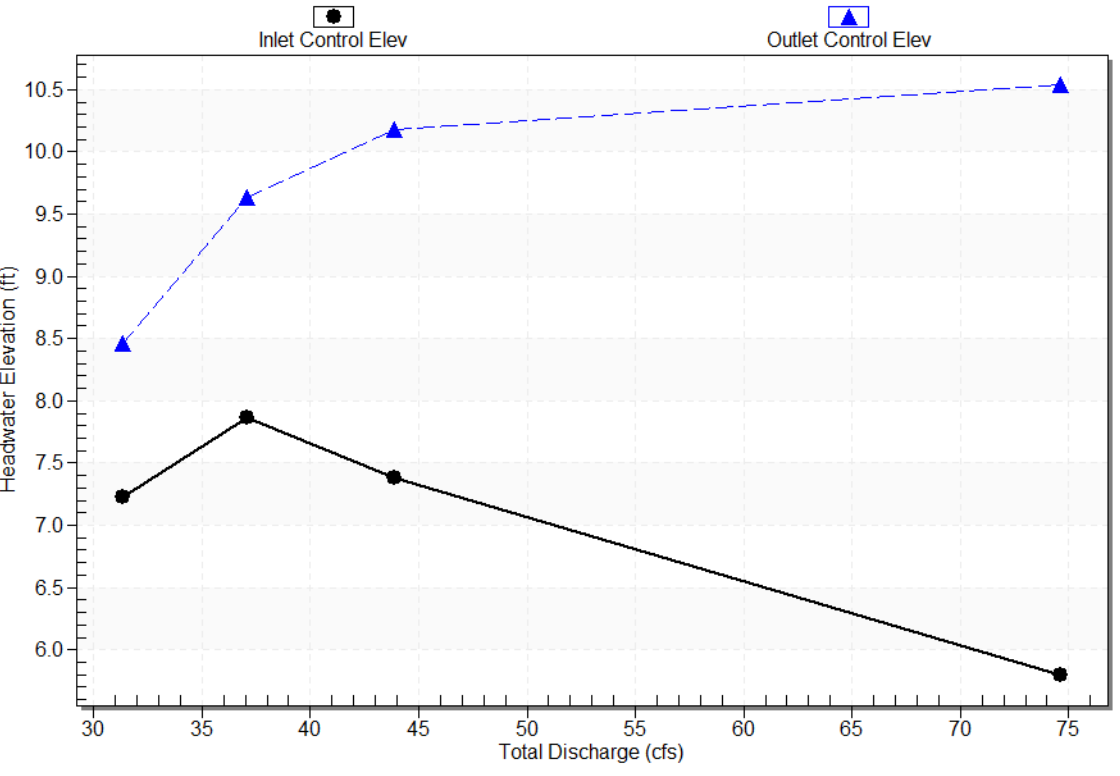
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 3.94 ft
Outlet Elevation (invert): 3.53 ft
Culvert Length: 65.00 ft
Culvert Slope: 0.01 ft/ft

Culvert Performance Curve Plot: 30

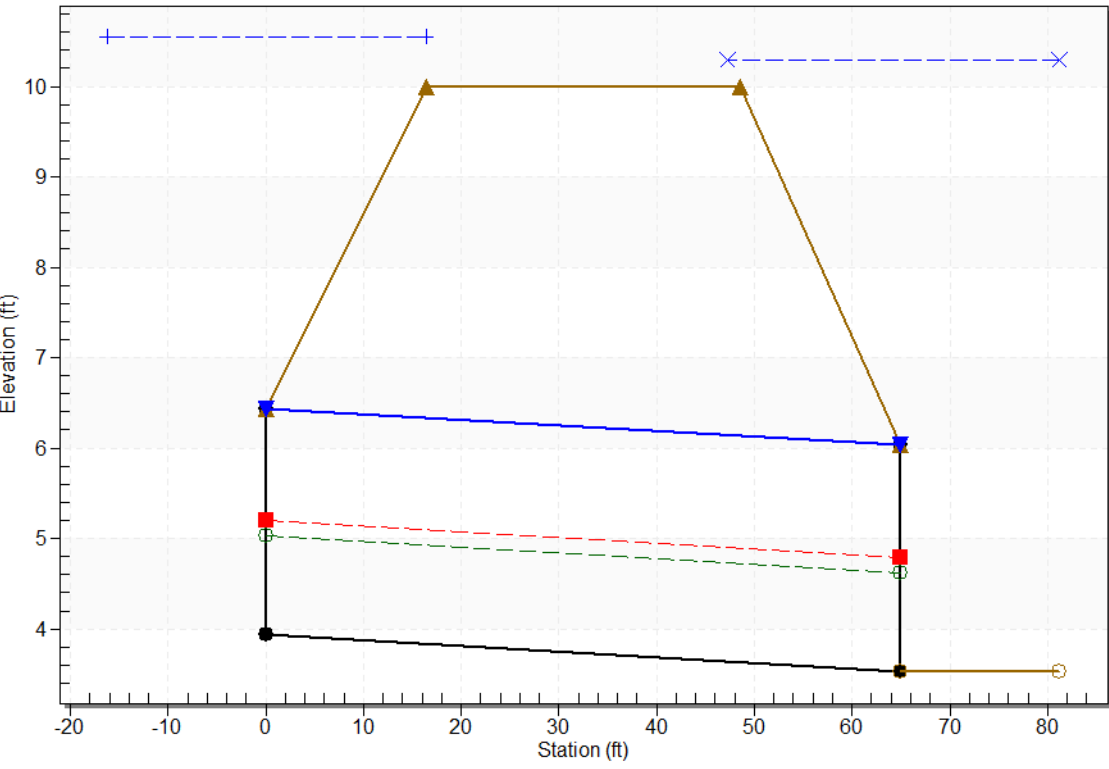
Performance Curve

Culvert: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Prop. CD-7, Design Discharge - 74.6 cfs
Culvert - 30, Culvert Discharge - 14.0 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 3.94 ft
Outlet Station: 65.00 ft
Outlet Elevation: 3.53 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-7

Tailwater Channel Option: Enter Rating Curve
Channel Invert Elevation: 3.53 ft

Table 10 - Downstream Channel Rating Curve (crossing: Prop. CD-7)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) | Velocity (ft/s) |
|------------|-------------------------|------------|-----------------|
| 31.35 | 7.19 | 7.19 | 0.00 |
| 37.10 | 7.85 | 7.85 | 0.00 |
| 43.89 | 8.78 | 8.78 | 0.00 |
| 74.62 | 10.29 | 10.29 | 0.00 |

Roadway Data for crossing: Prop. CD-7

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

CD-8

CD #: 8 (Existing & Proposed)
STATION: 259+86
SIZE: 30"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 0.66 | Basin 8B |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.17 | 0.95 |
| Woodlands (R) | | 0.2 |
| SRF: 1/2 acre (F) | | 0.35 |
| Pasture (F) | 0.49 | 0.2 |
| Weighted Runoff Coefficient | 0.39 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|---------------------|
| Surface Description | Short grass prairie |
| Mannings Coefficient, n | 0.15 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 20.5 |
| Ending Elevation (ft) | 14.8 |
| Land Slope, s (ft/ft) | 0.057 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 48 |
| Travel Time, (mins) | 2.08 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|--|
| Surface Description | Unpaved | Unpaved | |
| Flow Length, L (ft) | 110 | | |
| Starting Elevation (ft) | 14.8 | | |
| Ending Elevation (ft) | 3.4 | | |
| Slope, s (ft/ft) | 0.104 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 5.194 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 0.35 | | |

TIME OF CONCENTRATION (mins) = **2.44** Use 10 min if it is less than 10

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **8.36**

Flow Calculations

| | | | | |
|---------------------------|--------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 2.16 | 2.55 | 3.02 | 5.13 |
| Plus Upstream Flow (CD-7) | 33.51 | 39.65 | 46.91 | 79.75 |

Table 11 - Summary of Culvert Flows at crossing: Pre CD-8

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 7.19 | 25-YR | 33.51 | 33.51 | 0.00 | 1 |
| 7.85 | 50-YR | 39.65 | 39.65 | 0.00 | 1 |
| 8.78 | 100-YR | 46.91 | 46.91 | 0.00 | 1 |
| 10.29 | 500-YR | 79.75 | 56.28 | 23.45 | 8 |
| 10.00 | Overtopping | 54.71 | 54.71 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Pre CD-8

Total Rating Curve
Crossing: Pre CD-8

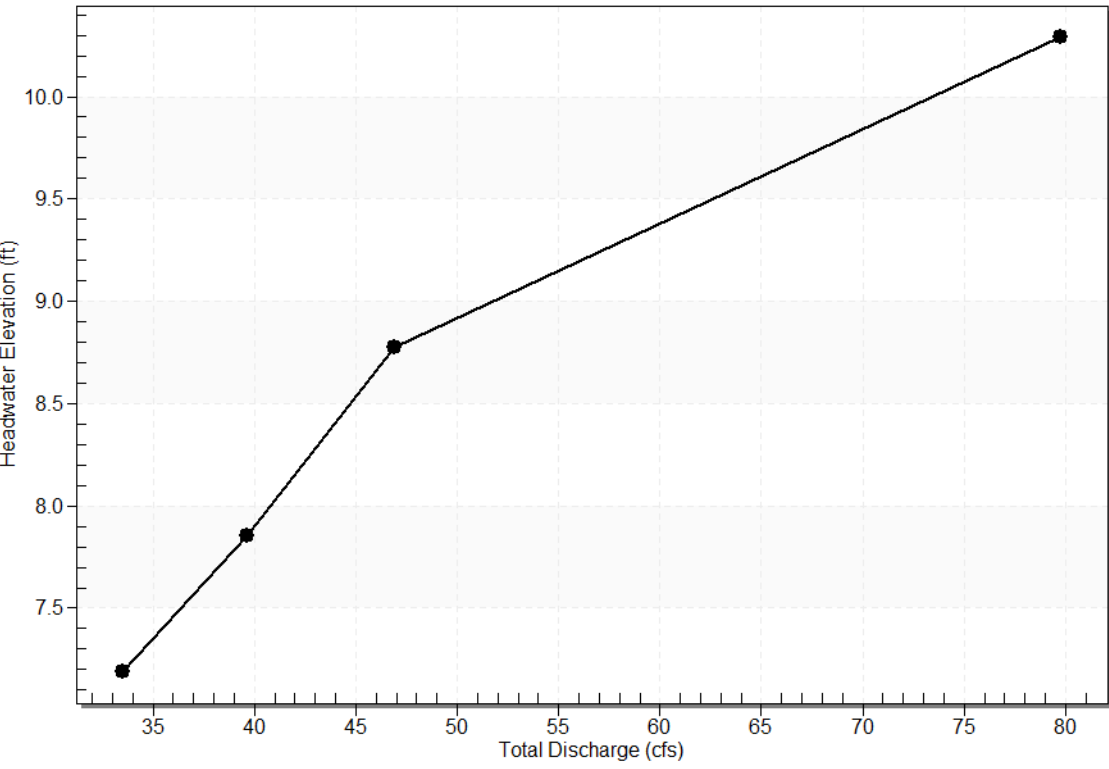


Table 12 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 33.51 | 33.51 | 7.19 | 3.52 | 3.791 | 1.52 | 4-FFf | 2.50 | 1.97 | 2.50 | 2.50 | 6.83 | 0.00 |
| 50-YR | 39.65 | 39.65 | 7.85 | 4.24 | 4.451 | 1.78 | 4-FFf | 2.50 | 2.12 | 2.50 | 2.50 | 8.08 | 0.00 |
| 100-YR | 46.91 | 46.91 | 8.78 | 5.28 | 5.375 | 2.15 | 4-FFf | 2.50 | 2.26 | 2.50 | 2.50 | 9.56 | 0.00 |
| 500-YR | 79.75 | 56.28 | 10.29 | 6.89 | 6.797 | 2.76 | 4-FFf | 2.50 | 2.37 | 2.50 | 2.50 | 11.47 | 0.00 |
| Overtopping | 79.75 | 56.28 | 10.29 | 6.89 | 6.797 | 2.76 | 4-FFf | 2.50 | 2.37 | 2.50 | 2.50 | 11.47 | 0.00 |

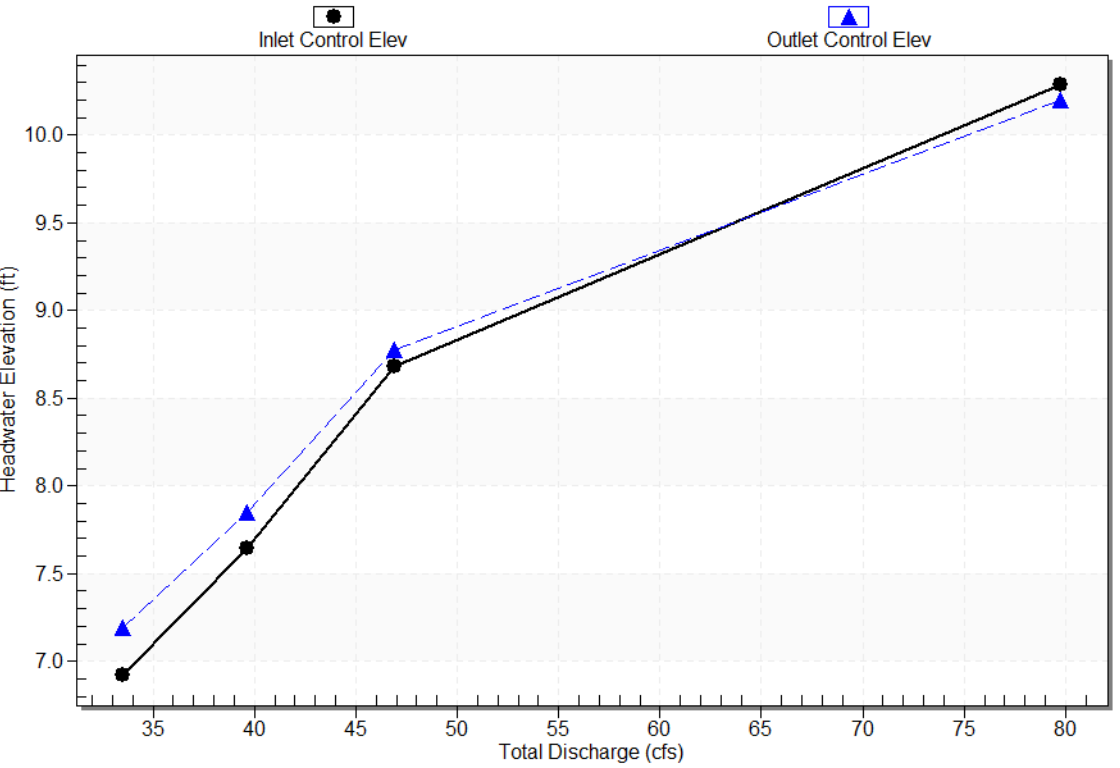
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 3.40 ft
Outlet Elevation (invert): 3.04 ft
Culvert Length: 100.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 30

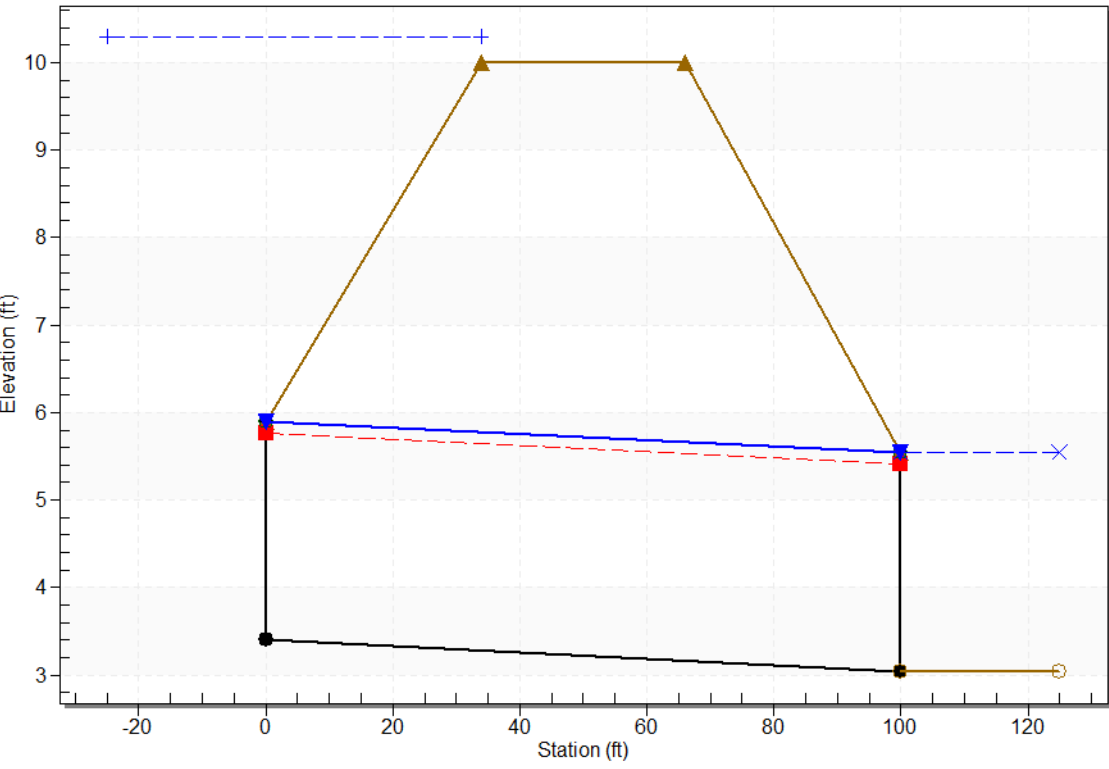
Performance Curve

Culvert: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Pre CD-8, Design Discharge - 79.8 cfs
Culvert - 30, Culvert Discharge - 56.3 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 3.40 ft
Outlet Station: 100.00 ft
Outlet Elevation: 3.04 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Pre CD-8

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 5.54 ft

Table 13 - Downstream Channel Rating Curve (crossing: Pre CD-8)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 33.51 | 5.54 | 2.50 |
| 39.65 | 5.54 | 2.50 |
| 46.91 | 5.54 | 2.50 |
| 79.75 | 5.54 | 2.50 |

Roadway Data for crossing: Pre CD-8

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 32.00 ft

Table 11 - Summary of Culvert Flows at crossing: Prop. CD-8

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 30 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 7.19 | 25-YR | 33.51 | 33.51 | 0.00 | 1 |
| 7.85 | 50-YR | 39.65 | 39.65 | 0.00 | 1 |
| 8.78 | 100-YR | 46.91 | 46.91 | 0.00 | 1 |
| 10.29 | 500-YR | 79.75 | 56.28 | 23.45 | 8 |
| 10.00 | Overtopping | 54.71 | 54.71 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-8

Total Rating Curve
Crossing: Prop. CD-8

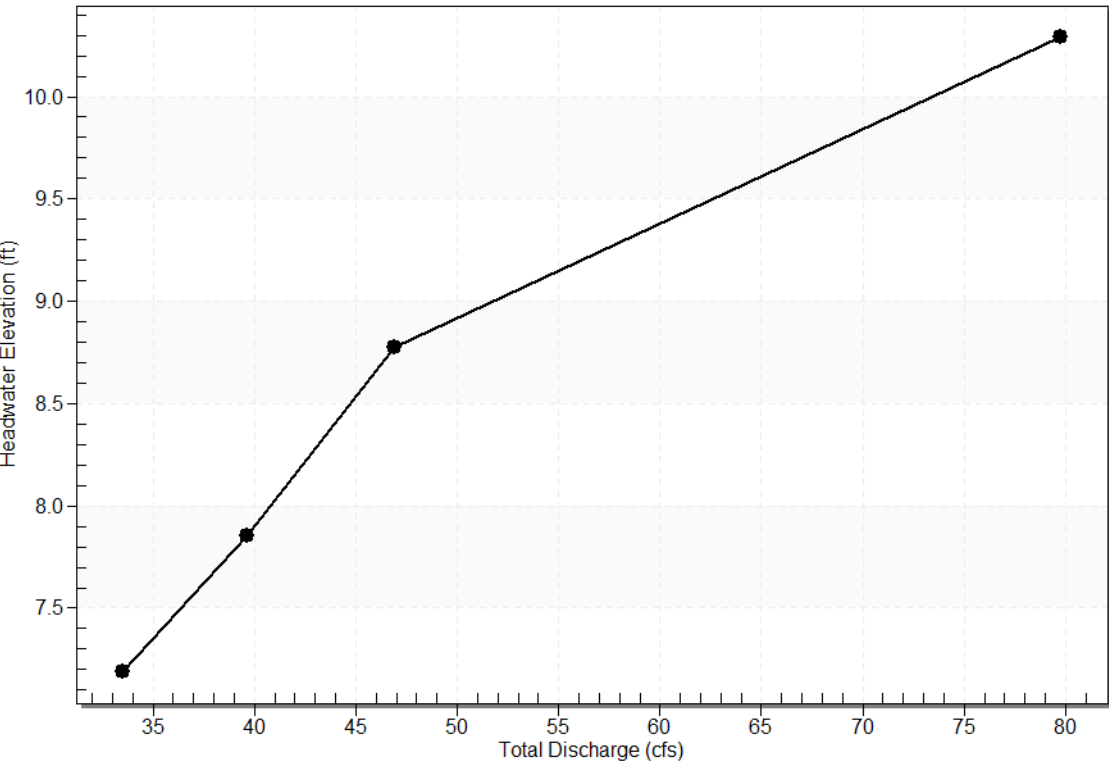


Table 12 - Culvert Summary Table: 30

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 33.51 | 33.51 | 7.19 | 3.52 | 3.791 | 1.52 | 4-FFf | 2.50 | 1.97 | 2.50 | 2.50 | 6.83 | 0.00 |
| 50-YR | 39.65 | 39.65 | 7.85 | 4.24 | 4.451 | 1.78 | 4-FFf | 2.50 | 2.12 | 2.50 | 2.50 | 8.08 | 0.00 |
| 100-YR | 46.91 | 46.91 | 8.78 | 5.28 | 5.375 | 2.15 | 4-FFf | 2.50 | 2.26 | 2.50 | 2.50 | 9.56 | 0.00 |
| 500-YR | 79.75 | 56.28 | 10.29 | 6.89 | 6.797 | 2.76 | 4-FFf | 2.50 | 2.37 | 2.50 | 2.50 | 11.47 | 0.00 |
| Overtopping | 79.75 | 56.28 | 10.29 | 6.89 | 6.797 | 2.76 | 4-FFf | 2.50 | 2.37 | 2.50 | 2.50 | 11.47 | 0.00 |

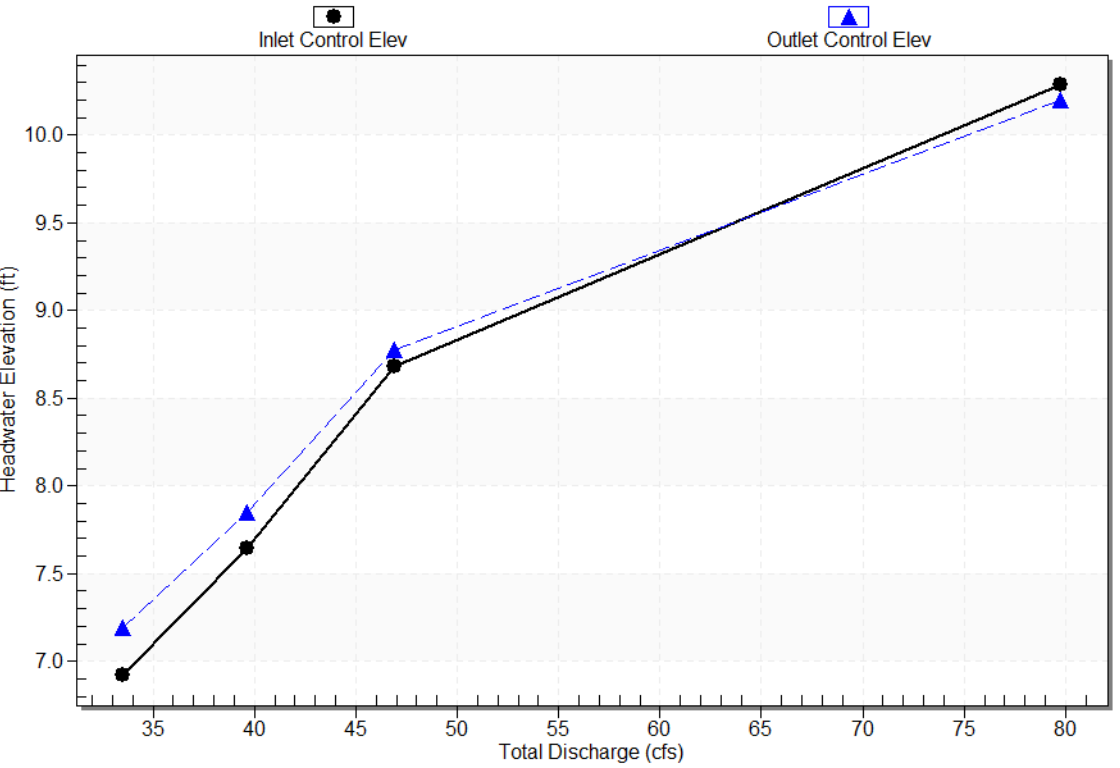
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 3.40 ft
Outlet Elevation (invert): 3.04 ft
Culvert Length: 100.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 30

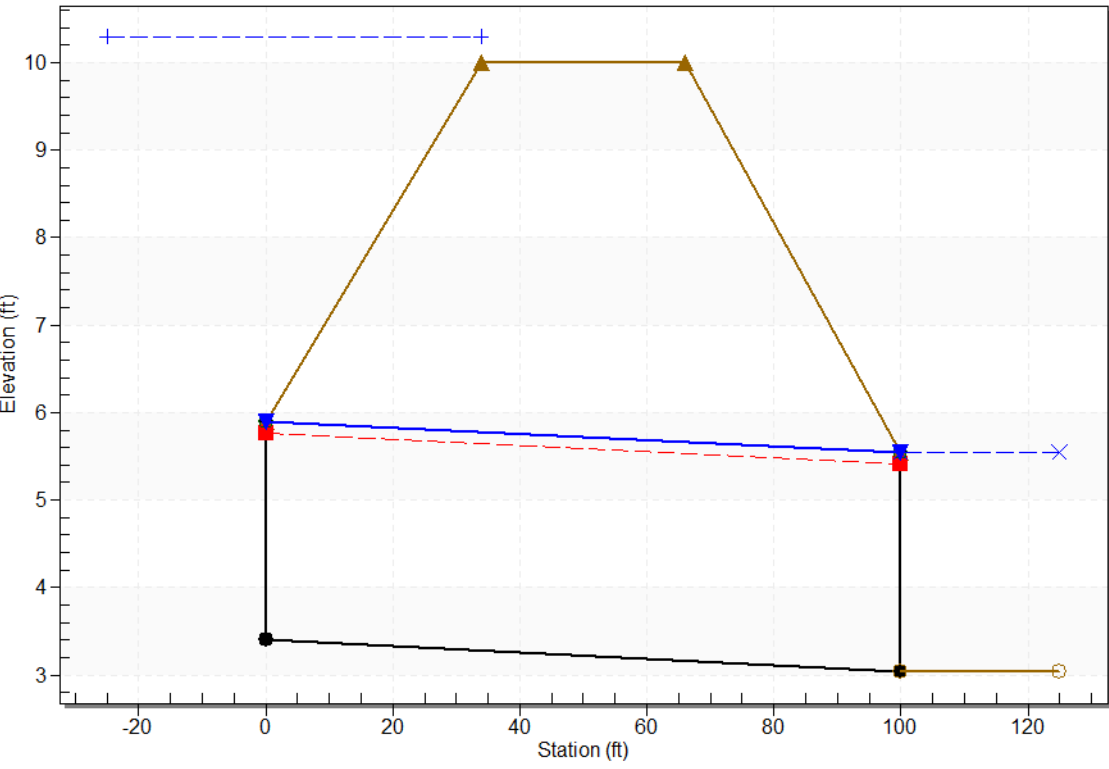
Performance Curve

Culvert: 30



Water Surface Profile Plot for Culvert: 30

Crossing - Prop. CD-8, Design Discharge - 79.8 cfs
Culvert - 30, Culvert Discharge - 56.3 cfs



Site Data - 30

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 3.40 ft
Outlet Station: 100.00 ft
Outlet Elevation: 3.04 ft
Number of Barrels: 1

Culvert Data Summary - 30

Barrel Shape: Circular
Barrel Diameter: 2.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-8

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 5.54 ft

Table 13 - Downstream Channel Rating Curve (crossing: Prop. CD-8)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 33.51 | 5.54 | 2.50 |
| 39.65 | 5.54 | 2.50 |
| 46.91 | 5.54 | 2.50 |
| 79.75 | 5.54 | 2.50 |

Roadway Data for crossing: Prop. CD-8

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Paved
Roadway Top Width: 32.00 ft

CD-9

CD #: 9 (Existing)
STATION: 269+09
SIZE: 24"

| | | |
|--|----------|-------------------|
| Total Drainage Area (ac) | 1.43 | Basin 9C+Basin 9D |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.3 | 0.95 |
| Woodlands (F) | 0.95 | 0.15 |
| Smaller Lots (F) | 0.18 | 0.45 |
| Commercial (F) | 0.00 | 0.5 |
| Weighted Runoff Coefficient | 0.36 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|------------------|
| Surface Description | Dense underbrush |
| Mannings Coefficient, n | 0.8 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 12.2 |
| Ending Elevation (ft) | 11.9 |
| Land Slope, s (ft/ft) | 0.003 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 21 |
| Travel Time, (mins) | 4.76 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|---------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 588 | | |
| Starting Elevation (ft) | 11.9 | | |
| Ending Elevation (ft) | 9 | | |
| Slope, s (ft/ft) | 0.005 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.133 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 8.65 | | |

TIME OF CONCENTRATION (mins) = 13.41

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: 7.30

Flow Calculations

| | | | | |
|----------|-------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 3.71 | 4.39 | 5.19 | 8.83 |

CD #: 9 (Proposed)
STATION: 269+09
SIZE: 24"

| | | |
|--|-------------|-------------|
| Total Drainage Area (ac) | 1 | Basin 9C |
| RUNOFF COEFFICIENT CALCULATIONS | | |
| | Sub-Area | Coefficient |
| Impervious | 0.26 | 0.95 |
| Woodlands (F) | 0.56 | 0.15 |
| Smaller Lots (F) | 0.18 | 0.45 |
| Commercial (F) | 0.00 | 0.5 |
| Weighted Runoff Coefficient | 0.41 | |

| |
|-------------|
| Area Check |
| O.K. |

TIME OF CONCENTRATION CALCULATION
SHEET FLOW

| | |
|---|------------------|
| Surface Description | Dense underbrush |
| Mannings Coefficient, n | 0.8 |
| Flow Length, L, (Maximum 100 ft) | 100 |
| Starting Elevation (ft) | 12.2 |
| Ending Elevation (ft) | 11.9 |
| Land Slope, s (ft/ft) | 0.003 |
| Velocity, Figure B-2, FDOT Drainage Design Guide (ft/min) | 21 |
| Travel Time, (mins) | 4.76 |

SHALLOW CONCENTRATED FLOW

| | | | |
|--|--------------|---------|---------|
| Surface Description | Unpaved | Unpaved | Unpaved |
| Flow Length, L (ft) | 588 | | |
| Starting Elevation (ft) | 11.9 | | |
| Ending Elevation (ft) | 9 | | |
| Slope, s (ft/ft) | 0.005 | | |
| Avg. Velocity, Figure B-3, FDOT Drainage Design Guide (ft/s) | 1.133 | | |
| Travel Time, eq. 2.2-5, FDOT Drainage Design Guide (mins) | 8.65 | | |

TIME OF CONCENTRATION (mins) = 13.41

RAINFALL INTENSITY

25-yr Rainfall Intensity (i) from NOAA Atlas 14: **7.30**

Flow Calculations

| | | | | |
|----------|-------------|-----------------------------|-------------------------------|-----------------------------------|
| Q25=CiA: | 25-yr | 50-yr (Log Interpolated) | 100-yr (1.4*Q ₂₅) | 500-yr (1.7*Q ₁₀₀) |
| | 3.01 | 3.56 | 4.21 | 7.15 |

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Exist. CD-9 | 24 | 500-YR | 8.83 | 8.83 | 10.90 | 1.58 | 1.954 | 0.98 | 1.21 | 1.06 | 2.00 | 2.81 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Exist. CD-9

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 24 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 10.49 | 25-YR | 3.71 | 3.71 | 0.00 | 1 |
| 10.52 | 50-YR | 4.39 | 4.39 | 0.00 | 1 |
| 10.57 | 100-YR | 5.19 | 5.19 | 0.00 | 1 |
| 10.90 | 500-YR | 8.83 | 8.83 | 0.00 | 1 |
| 39.00 | Overtopping | 71.53 | 71.53 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Exist. CD-9

Total Rating Curve
Crossing: Exist. CD-9

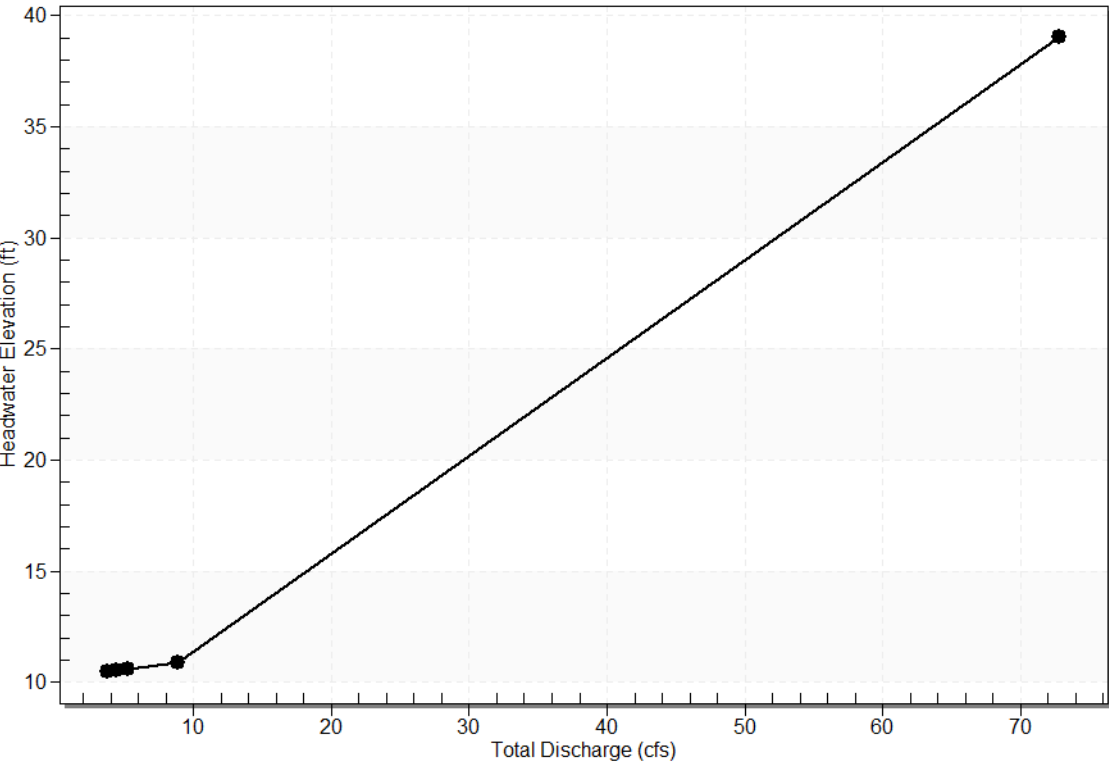


Table 3 - Culvert Summary Table: 24

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 3.71 | 3.71 | 10.49 | 0.93 | 1.542 | 0.77 | 3-M1f | 0.73 | 0.67 | 2.00 | 2.00 | 1.18 | 0.00 |
| 50-YR | 4.39 | 4.39 | 10.52 | 1.02 | 1.574 | 0.79 | 3-M1f | 0.80 | 0.74 | 2.00 | 2.00 | 1.40 | 0.00 |
| 100-YR | 5.19 | 5.19 | 10.57 | 1.14 | 1.617 | 0.81 | 3-M1f | 0.88 | 0.80 | 2.00 | 2.00 | 1.65 | 0.00 |
| 500-YR | 8.83 | 8.83 | 10.90 | 1.58 | 1.954 | 0.98 | 3-M1f | 1.21 | 1.06 | 2.00 | 2.00 | 2.81 | 0.00 |
| Overtopping | 72.85 | 71.56 | 39.03 | 23.10 | 30.077 | 15.04 | 4-FFf | 2.00 | 2.00 | 2.00 | 2.00 | 22.78 | 0.00 |

Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 8.95 ft
Outlet Elevation (invert): 8.41 ft
Culvert Length: 195.00 ft
Culvert Slope: 0.00 ft/ft

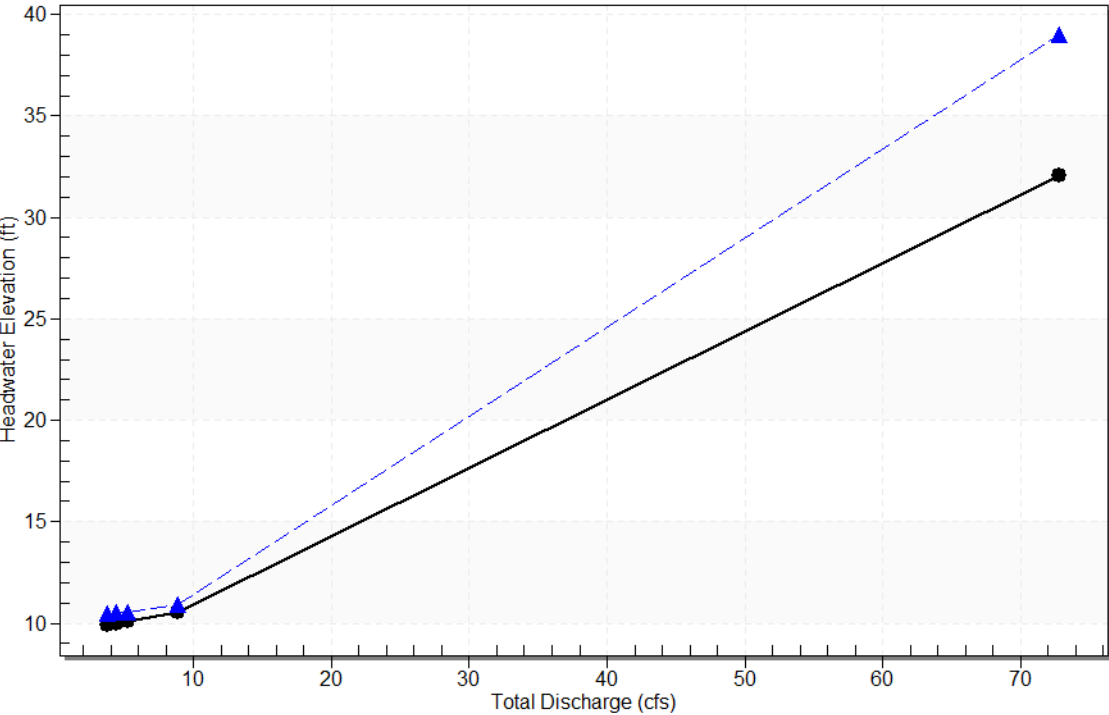
Culvert Performance Curve Plot: 24

Performance Curve

Culvert: 24

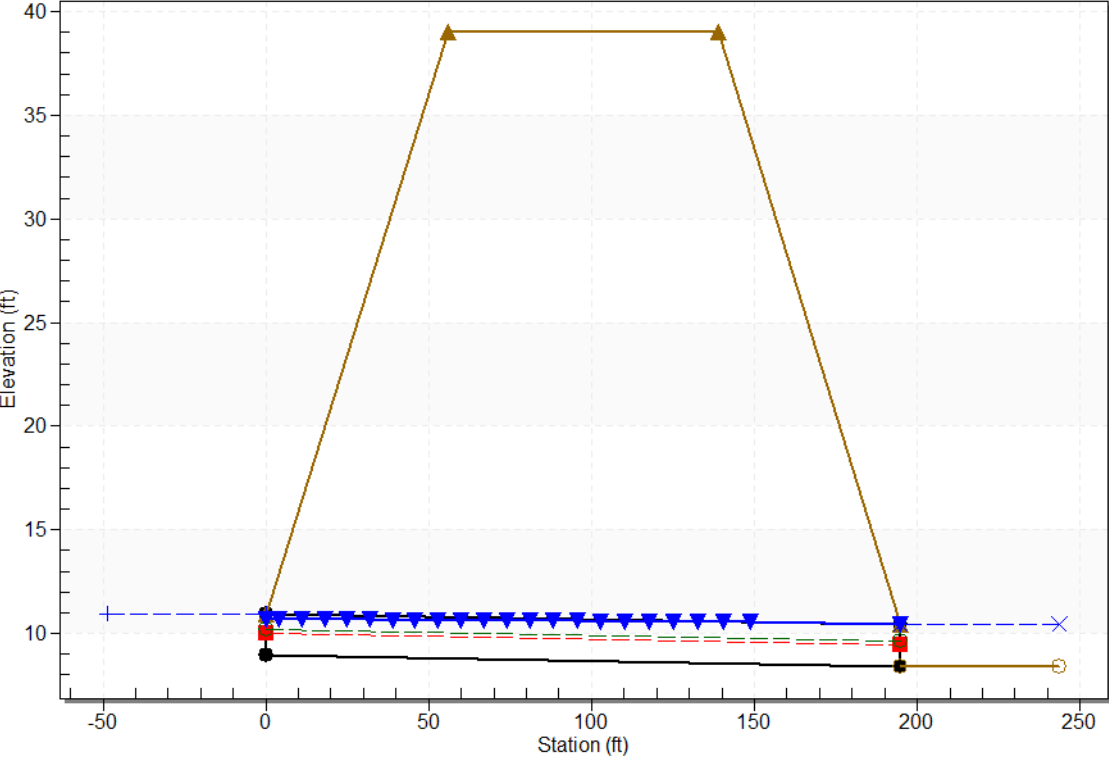
Inlet Control Elev

Outlet Control Elev



Water Surface Profile Plot for Culvert: 24

Crossing - Exist. CD-9, Design Discharge - 8.8 cfs
Culvert - 24, Culvert Discharge - 8.8 cfs



Site Data - 24

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 8.95 ft
Outlet Station: 195.00 ft
Outlet Elevation: 8.41 ft
Number of Barrels: 1

Culvert Data Summary - 24

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Exist. CD-9

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 10.41 ft

Table 4 - Downstream Channel Rating Curve (crossing: Exist. CD-9)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 3.71 | 10.41 | 2.00 |
| 4.39 | 10.41 | 2.00 |
| 5.19 | 10.41 | 2.00 |
| 8.83 | 10.41 | 2.00 |

Roadway Data for crossing: Exist. CD-9

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 39.00 ft
Roadway Surface: Paved
Roadway Top Width: 83.00 ft

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

| Crossing Name | Culvert Name | Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Outlet Velocity (ft/s) |
|----------------------|---------------------|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|--------------------------|----------------------------|--------------------------|-------------------------------|
| Prop. CD-9 | 24 | 500-YR | 7.15 | 7.15 | 10.78 | 1.39 | 1.675 | 0.84 | 1.00 | 0.95 | 2.00 | 2.28 |

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 2 - Summary of Culvert Flows at crossing: Prop. CD-9

| Headwater Elevation (ft) | Discharge Names | Total Discharge (cfs) | 24 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---------------------------------|------------------------|------------------------------|---------------------------|--------------------------------|-------------------|
| 10.48 | 25-YR | 3.01 | 3.01 | 0.00 | 1 |
| 10.51 | 50-YR | 3.56 | 3.56 | 0.00 | 1 |
| 10.55 | 100-YR | 4.21 | 4.21 | 0.00 | 1 |
| 10.78 | 500-YR | 7.15 | 7.15 | 0.00 | 1 |
| 39.00 | Overtopping | 65.01 | 65.01 | 0.00 | Overtopping |

Rating Curve Plot for crossing: Prop. CD-9

Total Rating Curve
Crossing: Prop. CD-9

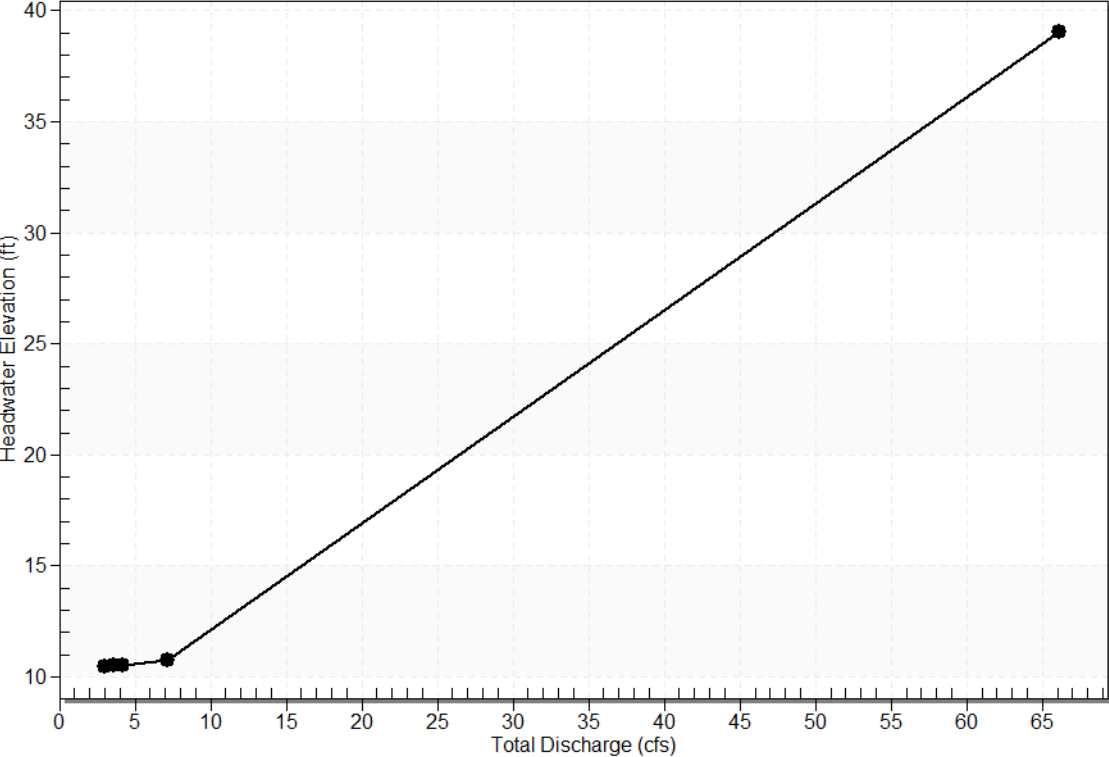


Table 3 - Culvert Summary Table: 24

| Discharge Names | Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | HW / D (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|------------------------|------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|------------------|--------------------------|----------------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25-YR | 3.01 | 3.01 | 10.48 | 0.83 | 1.380 | 0.69 | 3-M1f | 0.62 | 0.61 | 2.00 | 2.00 | 0.96 | 0.00 |
| 50-YR | 3.56 | 3.56 | 10.51 | 0.91 | 1.408 | 0.70 | 3-M1f | 0.68 | 0.66 | 2.00 | 2.00 | 1.13 | 0.00 |
| 100-YR | 4.21 | 4.21 | 10.55 | 0.99 | 1.445 | 0.72 | 3-M1f | 0.74 | 0.72 | 2.00 | 2.00 | 1.34 | 0.00 |
| 500-YR | 7.15 | 7.15 | 10.78 | 1.39 | 1.675 | 0.84 | 3-M1f | 1.00 | 0.95 | 2.00 | 2.00 | 2.28 | 0.00 |
| Overtopping | 66.14 | 65.04 | 39.02 | 19.25 | 29.924 | 14.96 | 4-FFf | 2.00 | 2.00 | 2.00 | 2.00 | 20.70 | 0.00 |

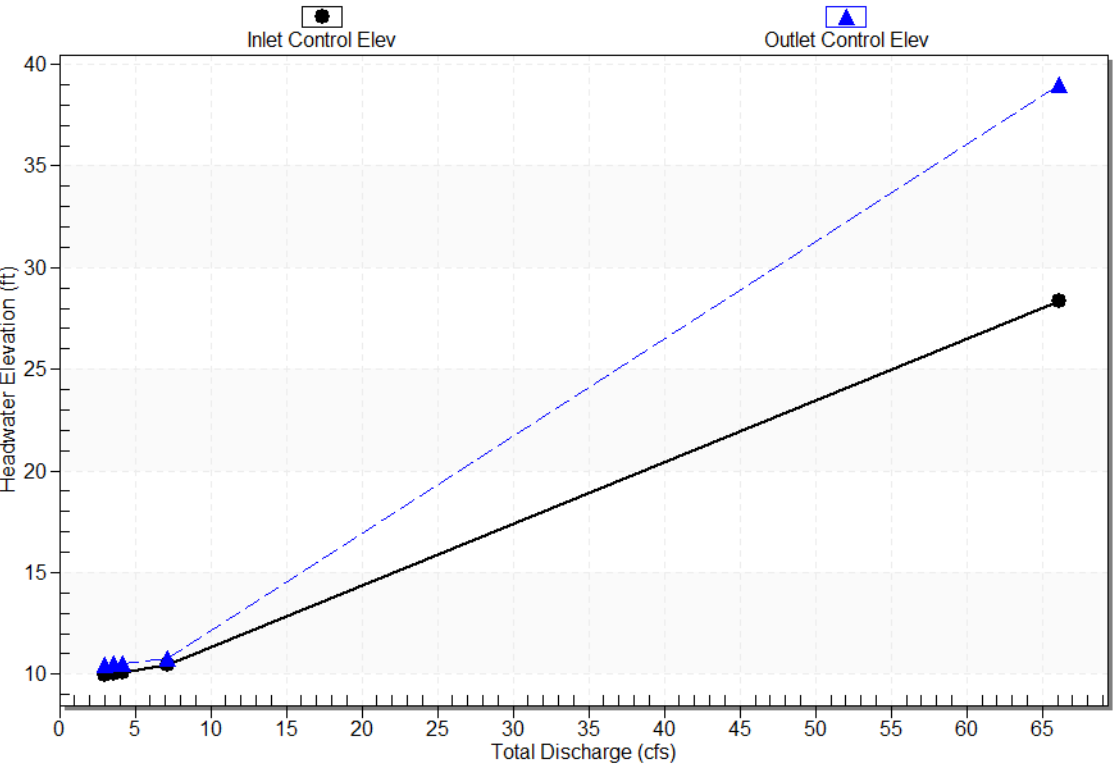
Culvert Barrel Data

Culvert Barrel Type: Straight Culvert
Inlet Elevation(invert): 9.10 ft
Outlet Elevation (invert): 8.20 ft
Culvert Length: 266.00 ft
Culvert Slope: 0.00 ft/ft

Culvert Performance Curve Plot: 24

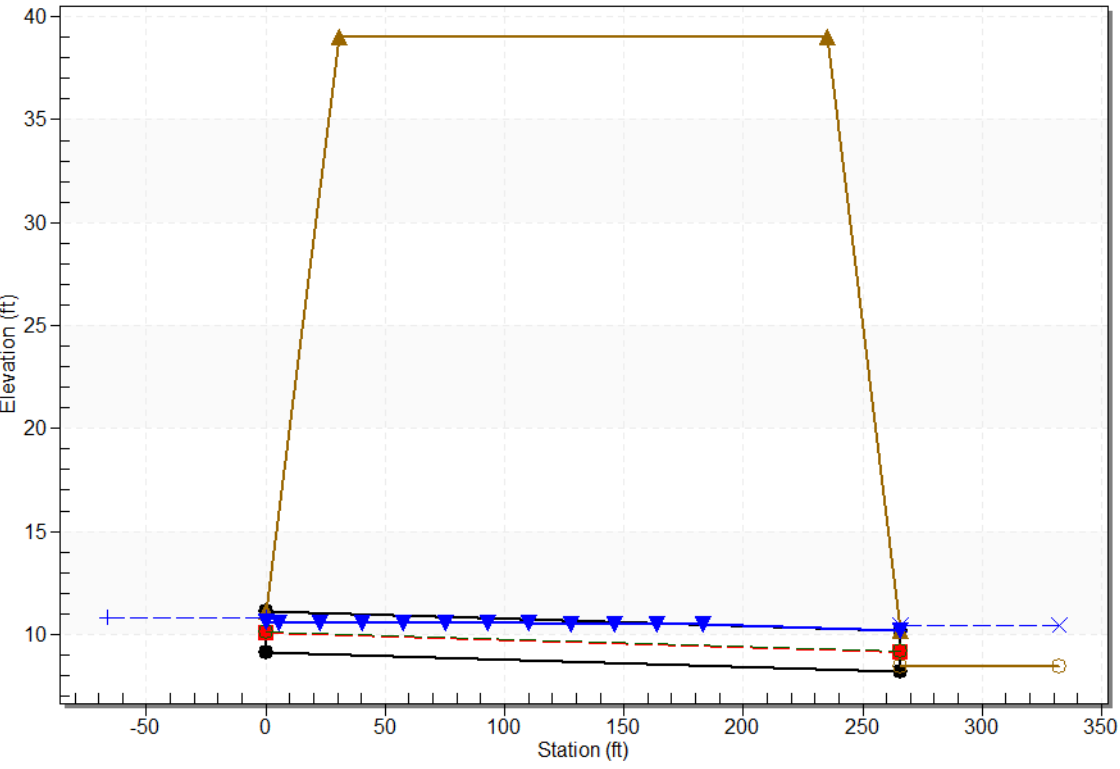
Performance Curve

Culvert: 24



Water Surface Profile Plot for Culvert: 24

Crossing - Prop. CD-9, Design Discharge - 7.2 cfs
Culvert - 24, Culvert Discharge - 7.2 cfs



Site Data - 24

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 9.10 ft
Outlet Station: 266.00 ft
Outlet Elevation: 8.20 ft
Number of Barrels: 1

Culvert Data Summary - 24

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data for Crossing: Prop. CD-9

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 10.41 ft

Table 4 - Downstream Channel Rating Curve (crossing: Prop. CD-9)

| Flow (cfs) | Water Surface Elev (ft) | Depth (ft) |
|------------|-------------------------|------------|
| 3.01 | 10.41 | 2.00 |
| 3.56 | 10.41 | 2.00 |
| 4.21 | 10.41 | 2.00 |
| 7.15 | 10.41 | 2.00 |

Roadway Data for crossing: Prop. CD-9

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 39.00 ft
Roadway Surface: Paved
Roadway Top Width: 204.00 ft

APPENDIX H

Field Review



CD-1 2-36" RCP at US 301 station 508+04 facing north



CD-1 2-36" RCP at US 301 station 508+04 facing south



CD-2 24" RCP at US 41 station 242+37 facing west



CD-2 24" RCP at US 41 station 242+37 facing east



CD-3 24" RCP at US 41 station 251+00 facing east



CD-3 24" RCP at US 41 station 251+00 facing southwest



CD-4 24" RCP at US 41 station 252+07 facing east



CD-4 24" RCP at US 41 station 252+07 facing southwest



CD-5 30" at US 41 station 258+21 facing north
Submerged pipe with no outfall structure



CD-6 30" RCP at US 41 station 258+21 facing north



CD-6 30" RCP at US 41 station 258+21 facing west



CD-7 30" RCP at US 41 station 258+87 facing northeast



CD-7 30" RCP at US 41 station 258+87 facing south



CD-8 30" RCP at US 41 station 259+86 facing northeast



CD-9 24" RCP at US 41 Station 269+09 facing west

This cross drain is completely overgrown with dense bushes and vegetation. Maintenance is required.



12'x8' CBC at US 41 Station 274+76 facing west

This CBC is served as pedestrian crossing. No stormwater runoff crossing is anticipated.

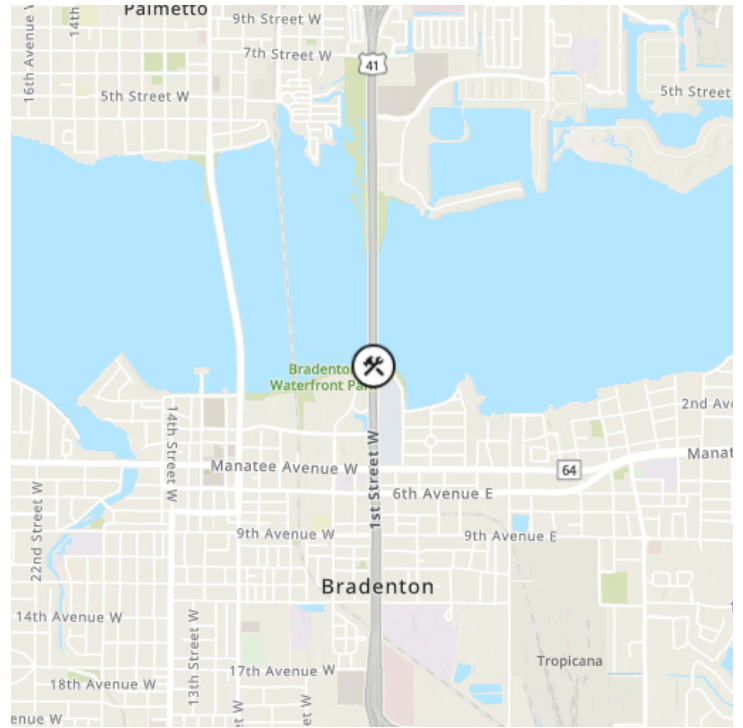
APPENDIX I

Sea Level Impact Project Study



Sea Level Impact Projection (SLIP) Study Report

| | |
|------------------------------------|---|
| Project Name | Bradenton Palmetto Connector - FPID 444843-1 |
| County | MANATEE |
| Coordinates | 27.5007441, -82.56306052 |
| Project Category | TransportationAndEvacuation |
| Risk Category | Risk Category II |
| Construction Start Year | 2030 |
| Expected Life | 75 Years |
| Estimated Construction Cost | \$680,488,000 |
| Critical Elevation | 7.3 ft NAVD88 |
| Organization | Florida Department of Transportation District 1 |
| Report Date | Mar 10, 2026 |
| Published Date | Pending |



Results

N/A



| Metric | value |
|---|-----------|
| FEMA Flood Hazard Zone | AE |
| Base Flood Elevation (ft NGVD29) | 8 |
| Terrain Elevation (ft NAVD88) | 2.52 |
| Int-High Sea Level Rise (year 2100) (ft NAVD88) | 3.4776905 |
| Wind Zone (mph) | 160.0 |

Average Annual Chance of Substantial Flood Damage (AACSF) is calculated using NOAA sea level projections, FEMA coastal storm surge events, and associated wave heights. This flood risk probability does not include high-tide flooding, precipitation (stormwater), or riverine flooding.

Mitigation Strategies Evaluated

The following mitigation strategies were considered as part of this SLIP Study:

A living shoreline may be implemented in the northern area of the bridge.

Potential Beneficial Adaptation Strategies

Based on the results of the SLIP Study, the following adaptation strategies may be beneficial to consider in the construction design. These are not recommendations, merely standard strategies used to mitigate risk.

Build on Partially Elevated Areas

Sea level varies based on the rate of sea level rise relative to land elevation in a particular location. It amplifies near-term vulnerability to storm surge and increases long-term flood and inundation risks. Building on partially elevated areas can mitigate and reduce these risks.

| | |
|----------------------------------|------------------|
| Solution Timeline | Long Term |
| Scale | Micro |
| Adaptation Interface | Hybrid |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$ |

Check Valve / Non-Return Valves

A check valve or non-return valve can be installed in pipes that are vulnerable to backflow during various flood conditions. The valve will work by blocking the flow of water if it is entering in the wrong direction. This will help with flooding control, standing water control, and water quality issues. Different size and shape valves can be used, as needed.

| | |
|----------------------------------|---------------------|
| Solution Timeline | Intermediate |
| Scale | Macro |
| Adaptation Interface | Gray |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$\$ |

Projects:

[R1928 - St. Augustine Stormwater Outfall Resiliency Retrofit](#)

Elevated Flood Wall / Flood Gate

A flood wall can be constructed to protect individual buildings or facilities against flooding. Flood walls can either be permanent or dismountable depending on short or long-term goals. Sometimes flood gates are built in a flood wall to create space for roads. These gates are only closed during a flood event.

| | |
|----------------------------------|------------------|
| Solution Timeline | Long Term |
| Scale | Macro |
| Adaptation Interface | Gray |
| Degree of Protection | High |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$\$ |

Resources:

[FEMA - Floodwall with Passive Floodgates Signals Commitment](#)

Flood Barriers (Passive or Active)

| | |
|-------------------|---------------------|
| Solution Timeline | Intermediate |
|-------------------|---------------------|

Flood barriers are used around a building or its utility components to protect from flooding. Flood barriers can be categorized as either passive or active devices. Passive flood barriers operate automatically during a flood or storm event and do not require any human intervention or power source. An example of a passive flood barrier is a floodwall or levee. Active flood barriers require warnings in advance to deploy during a flood or storm event. This strategy is of limited value when flash floods are frequent. FEMA recommends passive flood barrier devices when planning and building.

Resources:

[FEMA - Floodwall with Passive Floodgates Signals Commitment](#)

Flood Damage-Resistant Materials

Flood damage-resistant materials such as non-paper-faced gypsum board and terrazzo tile flooring for building materials and furnishings located below the base flood elevation help to reduce structural and nonstructural damage and post-flood event cleanup. The useful life of flood damage-resistant materials ranges between 10 and 20 years with annual maintenance costs depending on the type of material.

Raising Land

Raising land is often used to increase the difference between water levels and construction levels. Usually, sand is used to raise the new roads above the existing ground level. This measure reduces the flood risk for that area and structure. Raising land also provides added time during a flood event for ground and surface waters to rise, slowing down the time it would take for exponential damage to take place.

Projects:

[R1930- Marina Boat Ramp Resiliency Improvements](#)

Reduced Paved Surfaces

Paved surfaces like roofs, roads, and parking lots reduce the infiltration capacity of the soil and increase the surface water

| | |
|----------------------------------|---------------|
| Scale | Micro |
| Adaptation Interface | Gray |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$ |

| | |
|----------------------------------|---------------------|
| Solution Timeline | Intermediate |
| Scale | Micro |
| Adaptation Interface | Gray |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$ |

| | |
|----------------------------------|------------------|
| Solution Timeline | Long Term |
| Scale | Macro |
| Adaptation Interface | Hybrid |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$\$ |

| | |
|-------------------|------------------|
| Solution Timeline | Long Term |
| Scale | Macro |

runoff. Consequently, flood risk and the need for additional water retention capacity are increased. By decreasing the total area of paved surfaces, more water can infiltrate the soil and extra green space is created.

Utility Elevation

Installing or locating utility systems and components at or above the flood protection level can lessen the impacts/damage to units during flood events. The flood protection level is set by local flood plain management regulations or building codes. Floodproofing building utilities will work best when all utility meters are elevated as well.

Resources:

[FEMA - Protecting Building Utilities from Flood Damage](#)

Foundation Flood Vents

Flood vents can reduce the overall structural damage caused by flooding. These permanent openings allow for water to pass into or out of a building's exterior foundation walls, lessening erosion impacts to the foundation elements.

Resources:

[FEMA – Reducing Flood Risk to Residential Buildings that Cannot be Elevated](#)

Elevate Finished First Floor

A common method in mitigating flood damage to structures is elevating the first floor to the required Flood Protection Elevation (FPE). An FPE is generally above the base flood elevation plus freeboard level required by the local municipality where the structure is located. Another method is to abandon the lowest floor, given that the building is at least two stories tall. Here the lowest floor walls must be retrofitted with flood openings that allow automatic entry and exit of floodwaters and any utility systems and associated equipment on the lowest floor must be elevated to protect utilities from damage or loss of function from flooding.

Adaptation Interface **Green**
 Degree of Protection **Medium**
 Relative Cost (\$, \$\$, \$\$\$) **\$\$**

Solution Timeline **Long Term**
 Scale **Micro**
 Adaptation Interface **Gray**
 Degree of Protection **High**
 Relative Cost (\$, \$\$, \$\$\$) **\$**

Solution Timeline **Intermediate**
 Scale **Micro**
 Adaptation Interface **Gray**
 Degree of Protection **Low**
 Relative Cost (\$, \$\$, \$\$\$) **\$\$**

Solution Timeline **Long Term**
 Scale **Macro**
 Adaptation Interface **Gray**
 Degree of Protection **High**
 Relative Cost (\$, \$\$, \$\$\$) **\$\$\$**

Resources:

[FEMA - Elevating Your House](#)

[FEMA – Reducing Flood Risk to Residential Buildings that Cannot be Elevated](#)

Floodable Park / Water Square

This type of park or square can combine water storage with the added benefits of an urban public space. A floodable park or water square is considered a twofold strategy: (1) It makes money invested in water storage facilities visible and enjoyable, and (2) it generates opportunities to create quality environmentally friendly spaces central in neighborhoods.

Most of the time the park or square can be used as a recreational space. When heavy rains occur, rainwater that is collected from the surrounding area will flow into the floodable park or water square for a short duration. After it has been used as a buffering space for floodwaters, this water is filtered by the vegetation and soils, and the filtered water is returned to the water system.

Projects:

[R1933 - Good Neighbor Stormwater Park](#)

Increase Plantings

Using groundcover and shrubbery has many benefits compared to unplanted and paved surfaces. The velocity of floodwaters is reduced, which in turn can reduce damage from floating debris. Infiltration and uptake of floodwaters are improved and accelerated by plants, which resolves the flood event sooner and more effectively than bare ground. And, erosion occurring as flooding recedes is reduced when the soil is held in place by plant roots.

Projects:

[R1804 - Fruit Farm Creek Mangrove Restoration Project](#)

| | |
|----------------------------------|---------------------|
| Solution Timeline | Intermediate |
| Scale | Macro |
| Adaptation Interface | Hybrid |
| Degree of Protection | Medium |
| Relative Cost (\$, \$\$, \$\$\$) | \$\$ |

| | |
|----------------------------------|------------------|
| Solution Timeline | Long Term |
| Scale | Macro |
| Adaptation Interface | Green |
| Degree of Protection | Low |
| Relative Cost (\$, \$\$, \$\$\$) | \$ |

Potential Public Safety and Environmental Impacts

Based on the results of the SLIP Study, consider the following potential public safety and environmental impacts:

Flood Risk

When factoring in the flood zone, base flood elevation, terrain, and sea level rise trends for the project location, a moderate flood risk is present.

Wind Risk

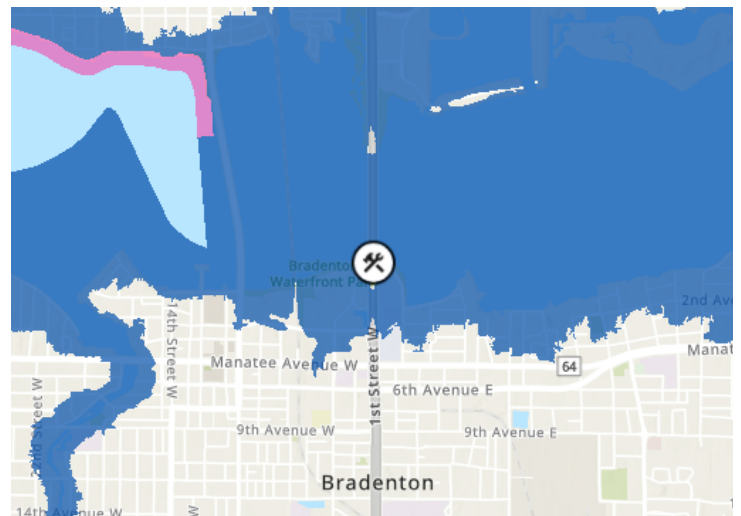
The project location was found to be located in an area of moderate wind risk with a maximum wind speed of 160.0mph. There is potential risk from flying debris.

Explosion Risk

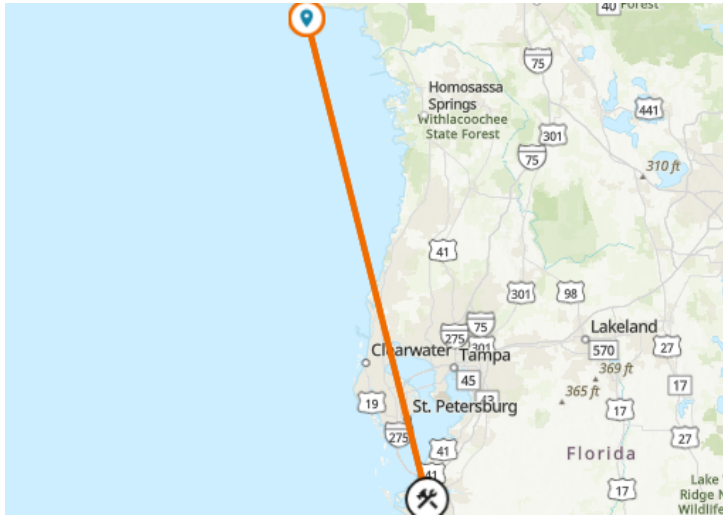
The moderate wind risk in this project location may contribute to a higher risk of explosion due to potential downed powerlines.

FEMA Flood Hazard Information

| | |
|------------------------|--------------------|
| Flood Zone | AE |
| Zone Subtype | COASTAL FLOODPLAIN |
| Static BFE (ft NAVD88) | 8 |
| Vertical Datum | NAVD88 |

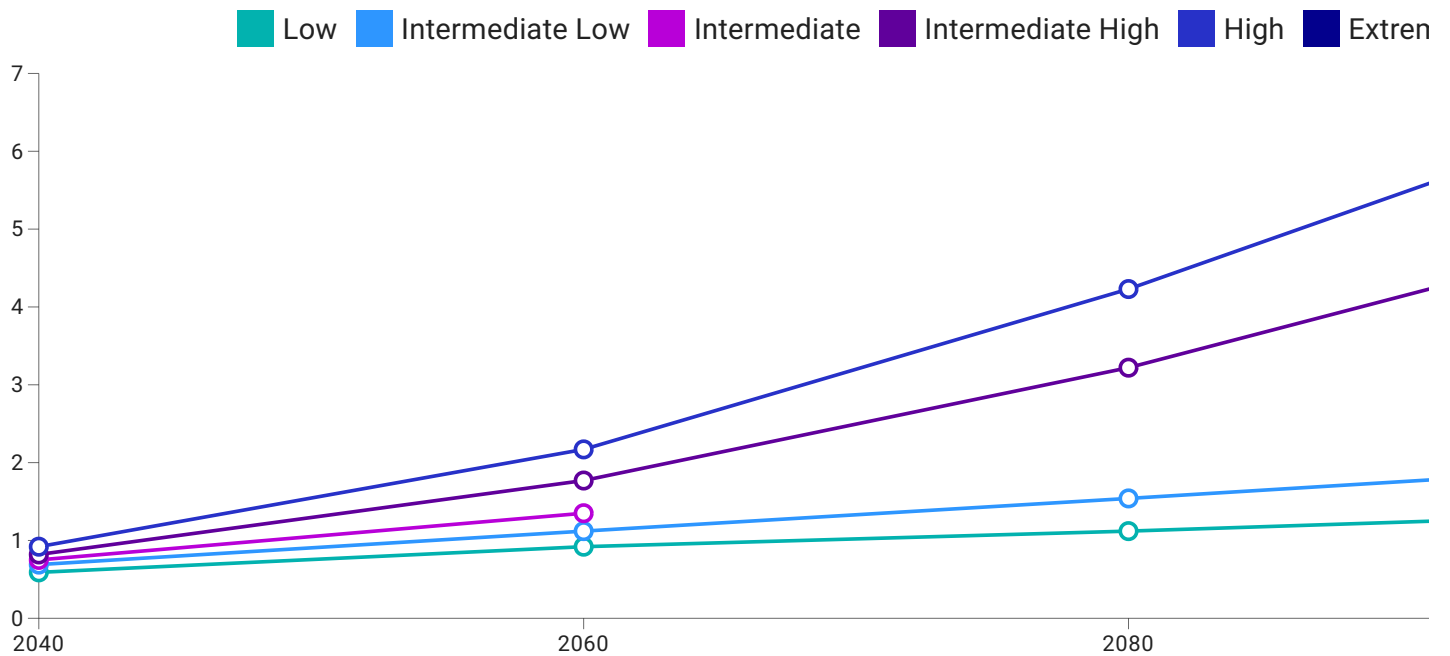


Regional Sea Level Rise Scenarios



NOAA Regional Scenarios (ft NAVD88)

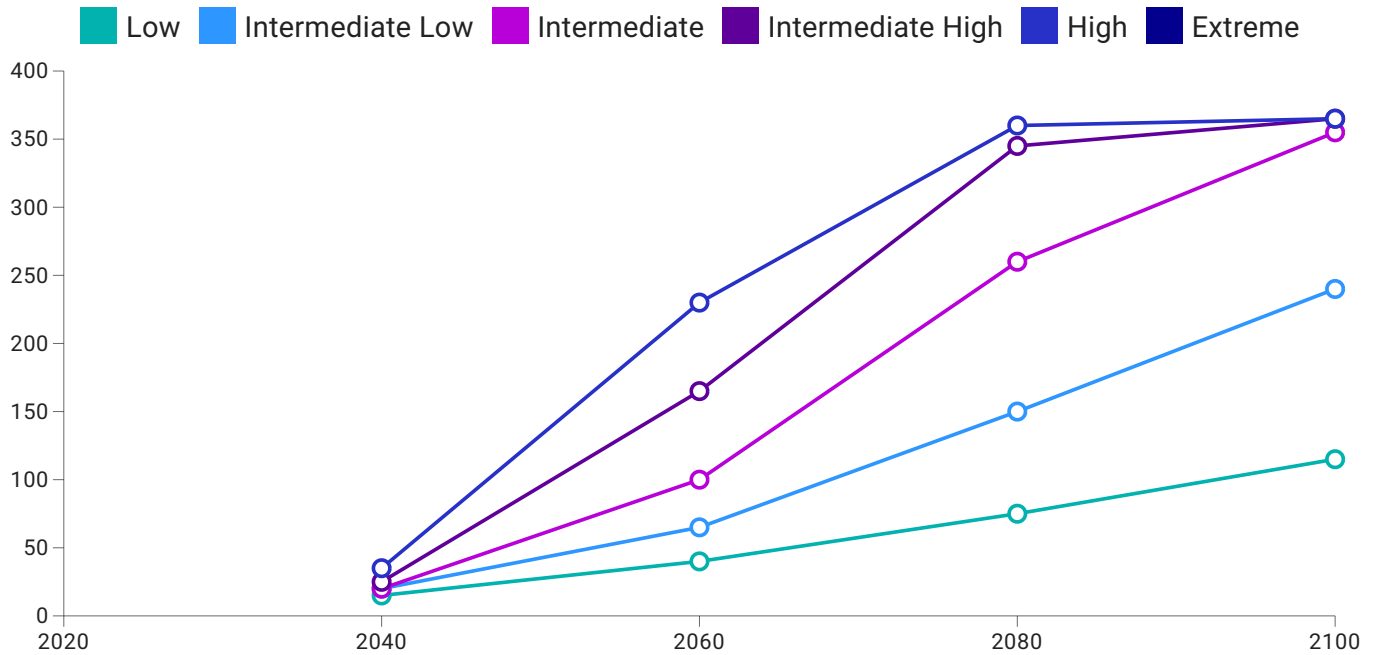
| Scenario | 2040 | 2060 | 2080 | 2100 |
|-------------------|------|------|------|------|
| Low | 0.59 | 0.92 | 1.12 | 1.35 |
| Intermediate Low | 0.69 | 1.12 | 1.54 | 1.97 |
| Intermediate | 0.75 | 1.35 | | |
| Intermediate High | 0.82 | 1.77 | 3.22 | 5.05 |
| High | 0.92 | 2.17 | 4.23 | 6.69 |
| Extreme | | | | |



The five relative sea level rise (RSL) scenarios shown in this report are derived from NOAA Technical Report NOS CO-OPS 083 "Global and regional sea level rise scenarios for the United States" using the same methods as the USACE Sea Level Rise Calculator. These new scenarios were developed by the Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force, jointly convened by the U.S. Global Change Research Program (USGCRP) and the National Ocean Council as input to the USGCRP Sustained Assessment process and 4th National Climate Assessment. These RSL scenarios provide a revision to the (Parris et. al, 2012) global scenarios which were developed as input to the 3rd National Climate Assessment.

These RSL scenarios begin in year 2020 and take into account global mean sea level rise (GMSL), regional changes in ocean circulation, changes in Earth’s gravity field due to ice melt redistribution, and local vertical land motion.

NOAA High Tide Flooding Information

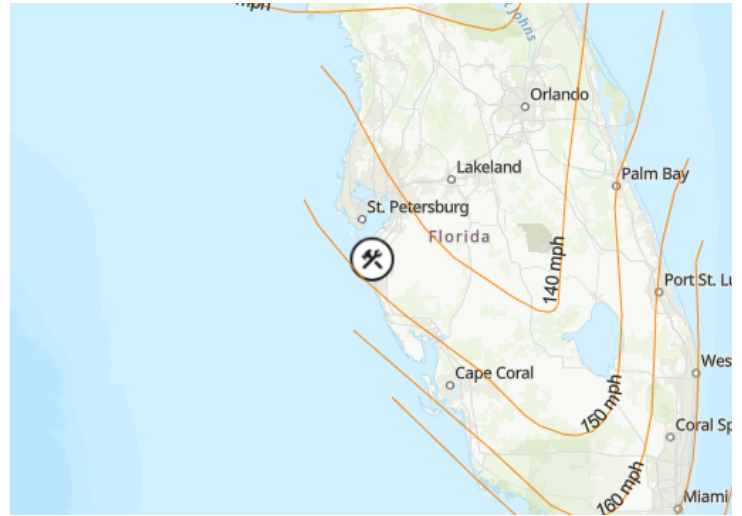


Annual occurrences of tidal flooding—exceeding local thresholds for minor impacts to infrastructure—have increased 5- to 10-fold since the 1960s in several U.S. coastal cities. The changes in high tide flooding over time are greatest where elevation is lower, local RSL rise is higher, or extreme variability is less.

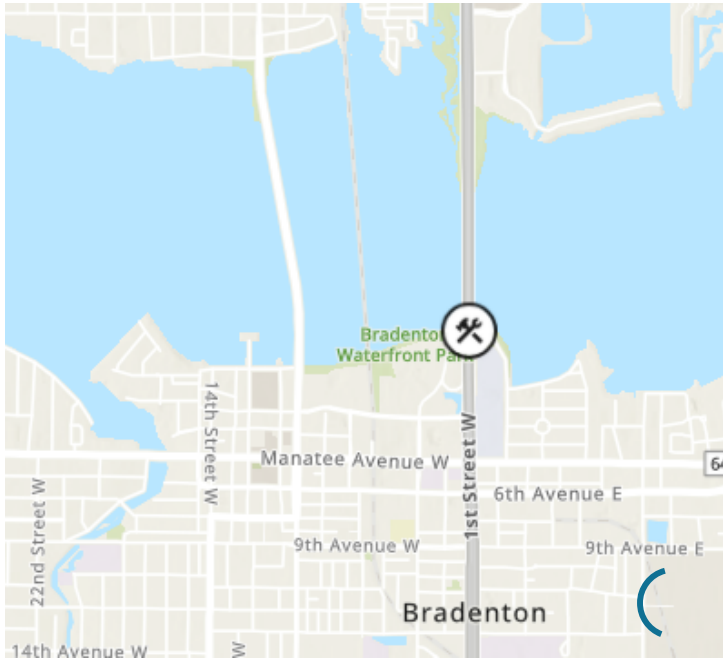
In a sense, today’s flood will become tomorrow’s high tide, as sea level rise will cause flooding to occur more frequently and last for longer durations of time.

Wind Zones

| Metric | value |
|--------------------|-------|
| Maximum Wind Speed | 160.0 |



Terrain



| Metric | value |
|----------------|--------|
| Elevation (ft) | 2.52 |
| Vertical Datum | NAVD88 |

This terrain elevation is derived from the latest compilation of terrain data from NOAA. This dataset contains the best publicly available terrain data in a 3m resolution.

Design Alternatives

The selection of a construction project location involves a considerable number of factors, including but not limited to regulatory issues, engineering, and logical decisions. The SLIP Study Tool may be run multiple times with different project locations and critical elevations, to achieve a desired result. Please use the SLIP Map along with the Coastal Hazard layers to assist you in selecting the optimal location. Review this report and assess the risks which may be mitigated by changing the design parameters, then run the SLIP Study Tool again