Technical Memo

TO: David Falk, P.E. (CFX PM)

Jonathan Williamson, AICP (GEC PM) Kevin Koehler, P.E. (GEC Drainage)

FROM: Gregory Seidel, P.E.

DATE: 7/11/2023

SUBJECT: Pond Sizing for 528-307 SR 528 & Dallas Blvd. Interchange PD&E

The purpose of this memo is to provide documentation on the required pond sizes and the results of the conceptual drainage analysis in order to accommodate the proposed alternatives considered under this PD&E Study. For the purposes of this analysis, Alternative 2 (Signalized Braided) was used for the basis of consideration since it has more impervious area and smaller ponds than Alternative 1. Additionally, the median is considered paved for an ultimate 8-lane condition.

CFX is conducting a Project Development and Environment (PD&E) Study of the State Road (SR) 528 (Martin B. Anderson Beachline Expressway) & Dallas Boulevard interchange. Currently, the Dallas Boulevard interchange (Exit 24) is a half interchange consisting of a westbound on-ramp and an eastbound off-ramp. Completing a full interchange by adding a westbound off-ramp and eastbound on-ramp has been identified as a need to provide enhanced access and mobility to the Wedgefield community and eastern Orange County. Currently, residents within Wedgefield must travel north in the subdivision to access SR 520 and then south to access SR 528 in the eastbound direction, a distance ranging from approximately seven to thirteen miles, and vice versa when traveling westbound on SR 528. Therefore, this PD&E Study will analyze and evaluate the completion of the Dallas Boulevard interchange by adding a westbound off-ramp and eastbound on-ramp. The project study area is illustrated in **Plate 1.** The general objective of the PD&E Study is to provide documented information necessary for CFX to decide on the type, design, and location of the proposed improvement within the project limits.

The goals of the project include:

- Identify a Preferred Alternative design concept that is consistent with the current and future goals of CFX.
- Complete a full interchange for SR 528 at Dallas Boulevard.
- Enhance mobility for the area's design concept that is consistent with the current and future development.
- Ensure that conceptual designs accommodate current and future capacity improvements.
- Provide consistency with local plans and policies.
- Promote regional connectivity.

The PD&E is evaluating two potential Build Alternatives. Alternative 1 includes a roundabout intersection for Dallas Boulevard, while Alternative 2 involves a signalized intersection on the south side of SR 528. Both alternatives include shifting the SR 528 mainline to the south and the expansion of SR 528 to six lanes through the interchange. The two potential Build Alternatives are shown in **Attachment 1**.





EXISTING DRAINAGE CONDITIONS

The project area consists of open basins with the northern portion of the mainline within the WBID 3052 Ditches watershed, the southern portion of the mainline within the WBID 3054 Little Creek watershed, and a small portion at the beginning of the project within WBID 2991 Econlockhatchee River watershed. Refer to **Plate 1** for watershed boundaries. None of the WBIDs are impaired for nutrients.

This project is located within the jurisdiction of the St. Johns River Water Management District. The Econlockhatchee River is an Outstanding Florida Water (OFW). While the study area is also within the Econlockhatchee River Hydrologic basin, it does not contain any portions of the Econlockhatchee River Riparian Habitat Protection Zone. The Econlockhatchee River Hydrologic Basin has additional requirements to meet SJRWMD criteria related to peak discharge rates for both the mean annual and 25-year storm events, as well as providing floodplain compensation for any locations with upstream drainage area of one square mile or more.

There are two existing stormwater management facilities within the project limits that provide treatment and attenuation, existing ponds 403-1A and 403-1B. Both were constructed in 2007 as part of the SR 528 Dallas Mainline Toll Plaza and Dallas Ramp Toll Plaza project, CFX Project No. 528-403, and both are located within the Dallas Boulevard Ramps infield areas. Refer to **Plate 1** for location. Basin 403-1A was originally constructed as a dry pond, but later was modified to a wet detention pond to provide compensatory treatment for the road and bridge improvements over the Econlockhatchee River as part of SR 528 over Econlockhatchee River project completed in 2019 (Project No. 528-131). A summary of the permitted conditions for Pond 403-1A and 403-1B are included in **Table 1**.

The existing conveyance system over the bridge consists asphalt shoulders with Type 'D' curb and guardrail from the top of the hill conveying runoff to shoulder gutter and shoulder gutter inlets at the bottom. There is a significant cross drain west of the bridge running below the current gore area. The ditches in this area contain water and possible wetland species. The ditches east of bridge appear to be drier.





Plate 1 - Existing Drainage Map



Table 1 - Summary of Existing Treatment Facilities

Contract	Treatment Facility	Treatment Method	Treatment Criteria	Basin Area (ac)	Required Treatment (ac-ft)	Provided Treatment (ac-ft)	Discharge Location
528-403	Pond 403-1B	Dry Retention	0.5" x basin area + 0.5" x basin area for online + 50% to OFW	3.69	0.45	0.45	S-300: 3-42-inch cross drain under AAF
528-131	Pond 403-1A	Wet Detention	2.5" x impervious area + 50% to OFW	6.66	0.88	0.88	CD-1: 36-inch cross drain under SR 528

PROPOSED DRAINAGE CONDITIONS

The proposed Alternative 2 roadway improvements include 34.3 acres of impervious area which is 14.7 acres additional impervious area over the existing condition. The proposed improvements will impact the existing Pond 403-1B and include expansion of existing Pond 403-1A. The expanded Pond 403-1A will be renamed Pond 307-1A and a new pond, Pond 307-1B, will be located in the northeast corner of the interchange. Both proposed ponds will be wet detention.

The pond sizing approach included stacking the required treatment volume on top of the required attenuation volume. Treatment volume was governed by the 2.5-inches over the impervious area and includes the additional 50% OFW criteria. Together, Pond 307-1A and Pond 307-1B are sized to treat all proposed Alternative 2 impervious area plus the required compensatory treatment from 528-131 (0.88 ac-ft, refer to Attachment 1 for excerpt documentation from 528-131). For attenuation assumptions, the ponds are sized to attenuate the 25-year/24-hour storm event, which assumes to govern over the mean annual storm event, with a rainfall depth of 8.6 inches. The 8.6 inches rainfall depth was used for previous permits and is greater than the latest NOAA Point precipitation frequency estimate for this location; therefore, providing a more conservative estimate for attenuation volume. Attenuation was considered not only for the additional impervious but also for the normal water levels of the proposed ponds. Floodplain compensation was not required since the upstream contributing area is less than one square mile. Refer to **Table 2** for a summary of the required pond volume for the project. **Attachment 2** includes the supporting calculations.

Table 2 - Summary of Required Pond Volume

Basin	Pond	Required Treatment Volume (ac-ft)	Required Roadway Attenuation Volume (ac-ft)	Required Pond Attenuation Volume (ac-ft)	Existing Pond Impacts (ac-ft)(1)	Total Floodplain Compensation Volume (ac-ft)	Total Required Pond Volume (ac-ft)
Project Area	Pond Area	13.8	8.9	7.4	0.88	0.0	30.6



Conceptual layouts of the ponds for Alternative 2 were developed to determine if there was sufficient pond area north of the proposed interchange to accommodate the stormwater water quality and quantity needs for the ultimate 8 lane proposed Alterative 2 roadway improvements. With assumed normal water levels and top of berm elevations equal to the previously permitted Pond 403-1A of 60.90 feet NAVD and 63.4 feet NAVD, respectively, the combined provided storage volume is 32.43 Ac-ft which only provides 0.1 ft of freeboard for the 30.6 required Ac-ft. (See Pond Stage Area in Attachment 2). As there is additional area available, these calculations confirm that no additional R/W is needed for pond sites. The layout and optimization of these ponds will be finalized in design.

At a minimum, a nutrient analysis for this project is expected which results in a post-development loading which does not exceed the pre-development loading. If additional nutrient removal is required during final design, there are two options available for this project –

- 1. Utilize the approach of comparing the design condition to natural conditions and getting the full credit of reduction of the nutrients in the wet pond.
- 2. Utilize the approach of locating and providing dry retention pre-treatment swales/ponds from the mainline roadway which will have a much higher grade than natural ground.

The roadway profile will be finalized in design. To assist in profile development, the design high water elevation of the ponds should be established early by the drainage engineer to help set the profile since this will most likely govern the base clearance water elevation for the ramps and Dallas Boulevard (which will control the SR 528 bridge low member elevation). Stacking the treatment volume on top of the attenuation volume results in a design high water stage of 63.4 feet NAVD. The lowest existing mainline elevation within the project area is estimated to be 62.4 feet NAVD at Station 1430+00, while the majority of the mainline is around 64.0 ft NAVD. Additionally, the profile should maintain at least 1 1/2 feet between the bottom of roadside ditches and the seasonal high groundwater.

Attachment 1 – Alternative Interchange Concepts

Attachment 2 – Excerpt from 528-131 Drainage Documentation

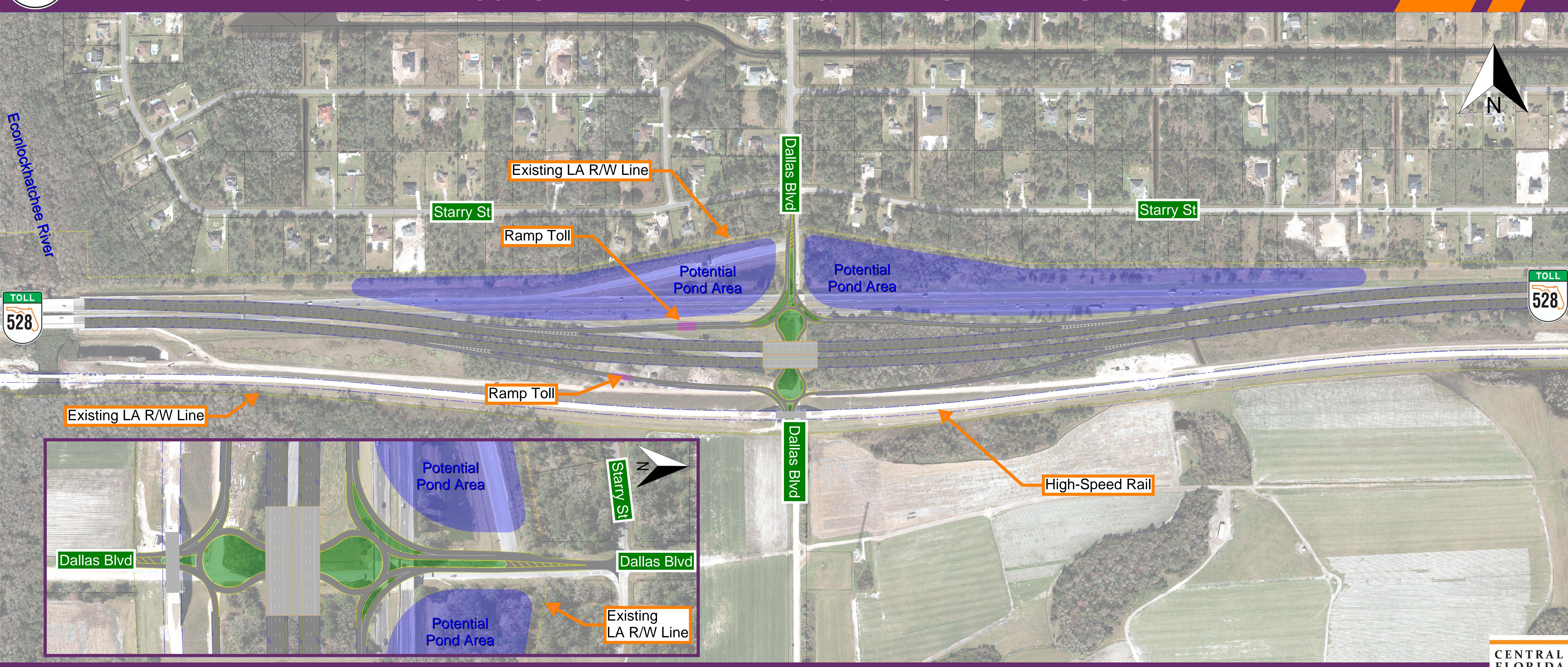
Attachment 3 – Pond Sizing Calculations





STATE ROAD 528/DALLAS BLVD INTERCHANGE

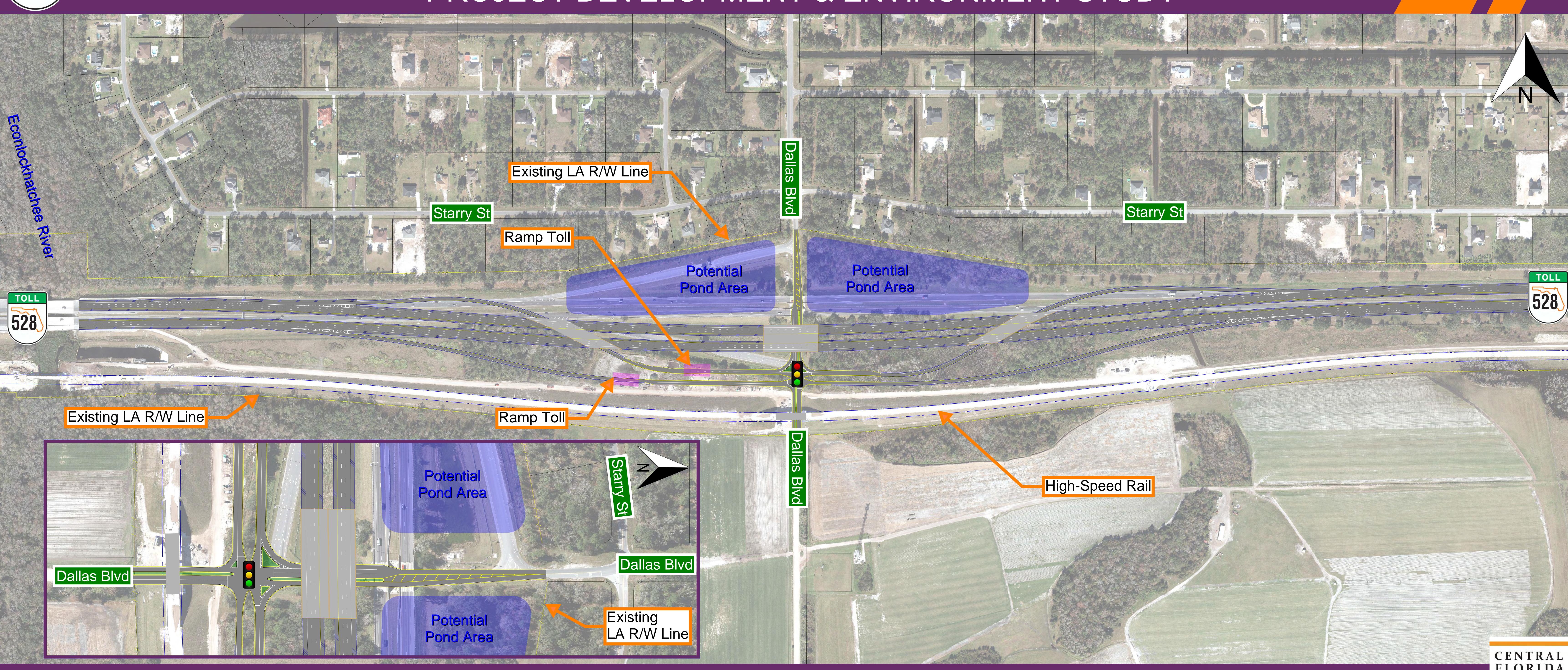
PROJECT DEVELOPMENT & ENVIRONMENT STUDY





STATE ROAD 528/DALLAS BLVD INTERCHANGE

PROJECT DEVELOPMENT & ENVIRONMENT STUDY





DRAINAGE DESIGN DOCUMENTATION

State Road (SR) 528 Over Econlockhatchee River

Central Florida Expressway Authority

Orange County, Florida

Prepared By:



Capital Plaza Two 301 E. Pine Street Suite 1020 Orlando, Florida 32801

July 2016

Table 4
Treatment Volume Summary

Basin	Pond	Required Treatment Volume (ac-ft)	Provided Treatment Volume (ac-ft)	Additional (ac-ft)	
Basin 1-A	1-A	0.88	0.88	0.00	

9.2.1 Outstanding Florida Water

Discharge from Pond 1-A ultimately flows into the Econlockhatchee River which is an Outstanding Florida Water (OFW) body. Therefore, an additional 50 percent treatment will be required.

9.2.2 Impaired Water Bodies

According to the Florida Department of Environmental Protection (FDEP), the project lies in the Middle St. Johns River (WBID 2991) watershed. The verified impairment in the watershed is Fecal Coliform and Mercury (in fish tissue). Since these pollutants do not have an effect on nutrient loadings, Total Maximum Daily Load (TMDL's) calculations have not been performed for this project.

The water body map and table for impairment as provided by FDEP are Appendix G.

9.3 Water Quantity

Pond 1-A is located in an open drainage basin that is not tidally influenced. The pond was designed to provide attenuation based on the following criteria.

 Attenuation: The post-development peak discharge rate for the SJRWMD Mean Annual and 25-year/24-hour storm event shall be attenuated to less than or equal to the pre-development peak discharge rate. The analysis shall include a Florida Modified rainfall distribution with a total rainfall depth of 4.5 and 8.6 inches, respectively.

The post development discharge rate is limited by the use of a proposed control structure located in the northwest corner of Pond 1-A. The proposed structure is a modified Type H ditch bottom inlet and is referred to as CS-1. A hydrologic-hydraulic model was developed using Interconnected Channel and Pond Routing (ICPR) software to demonstrate the post-development discharge rate to the roadside ditch does not exceed the pre-development rate. The ICPR analysis is included in Appendix H.

The following table provides a comparison of the maximum discharge rates for the SJRWMD Mean Annual and 25-year/24-hour storm event.

Table 5
Discharge Rate Comparison

Basin	Pond		an Annual SJRWMD 25yr/24h (cfs) (cfs)		Mean Annual (cfs) SJRWMD 25yr/24hr (cfs) Increase (cfs)			se (cfs)
		pre post pre post		post	Mean	25yr/24hr		
Basin 1-A	1-A	3.21	3.21	16.28	13.88	0.0	-2.40	

9.4 Basin and Pond Description

9.4.1 Basin 1-A

Basin 1-A is a 6.66 acre drainage basin that begins at station 1447+00 and extends east to approximately station 1458+00. The basin consists of the previous westbound on-ramp improvements and toll facility as well as roadway runoff from SR 528. The roadway runoff from SR 528 will be collected by curb and gutter and conveyed to Pond 1-A through a stormsewer system.

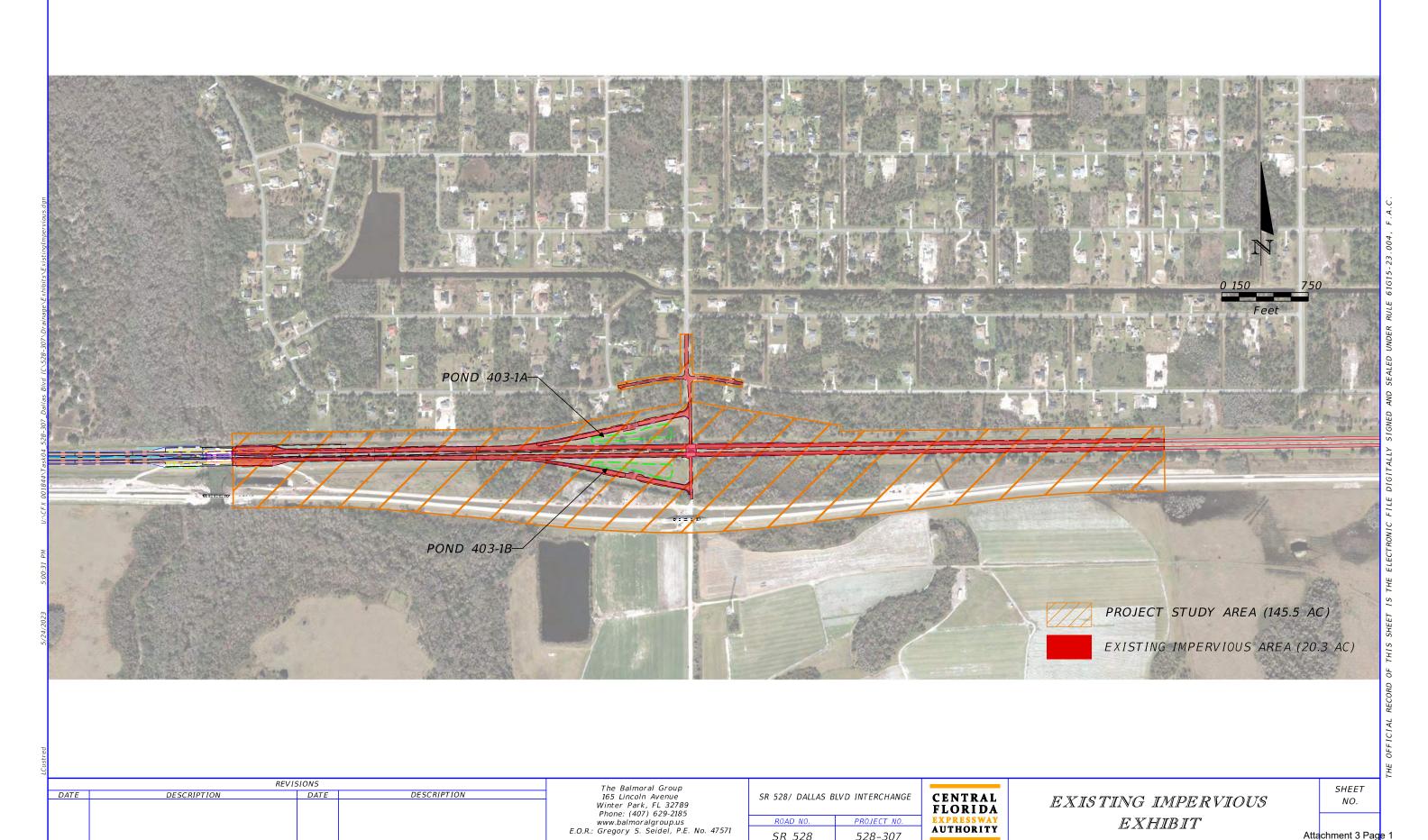
9.4.2 Pond 1-A

Pond 1-A is located in the northwest quadrant of Dallas Boulevard and SR 528 which is within the existing CFX right-of-way. The existing pond was originally designed and permitted (ERP No. 114678-1) as a dry retention facility. Results from the recent geotechnical investigation indicate the seasonal high water elevation is above the existing pond bottom of 61.0 feet. Therefore, to accommodate the proposed improvements will require converting the existing dry retention facility to a wet detention pond. This will be accomplished from excavating a portion of the pond to elevation 57.0 feet. The modified pond provides 0.88 acre-feet of treatment volume between the seasonal high water elevation of 60.9 feet and the weir elevation of 61.78 feet. The treatment and pond volume calculations are provided in Appendix E.

A modified Type H ditch bottom inlet has been designed to control the discharge rate from the pond. The outfall for Pond 1-A is the existing roadside ditch located adjacent to the westbound on-ramp from Dallas Boulevard. The ditch discharges west and ultimately outfalls to the Econlockhatchee River as in the existing condition.

The tailwater elevation for the proposed pond was set using the seasonal high water elevation in the existing roadside ditch adjacent to the westbound on-ramp. The seasonal high water elevation was established at 59.0 feet during the previous pond design using biological indicators. The seasonal high water elevation for the outfall ditch is shown on the drainage map for the previous pond design and is included in Appendix C.





CENTRAL FLORIDA

AUTHORITY

SR 528/ DALLAS BLVD INTERCHANGE

PROJECT NO.

528-307

ROAD NO.

SR 528

DESCRIPTION

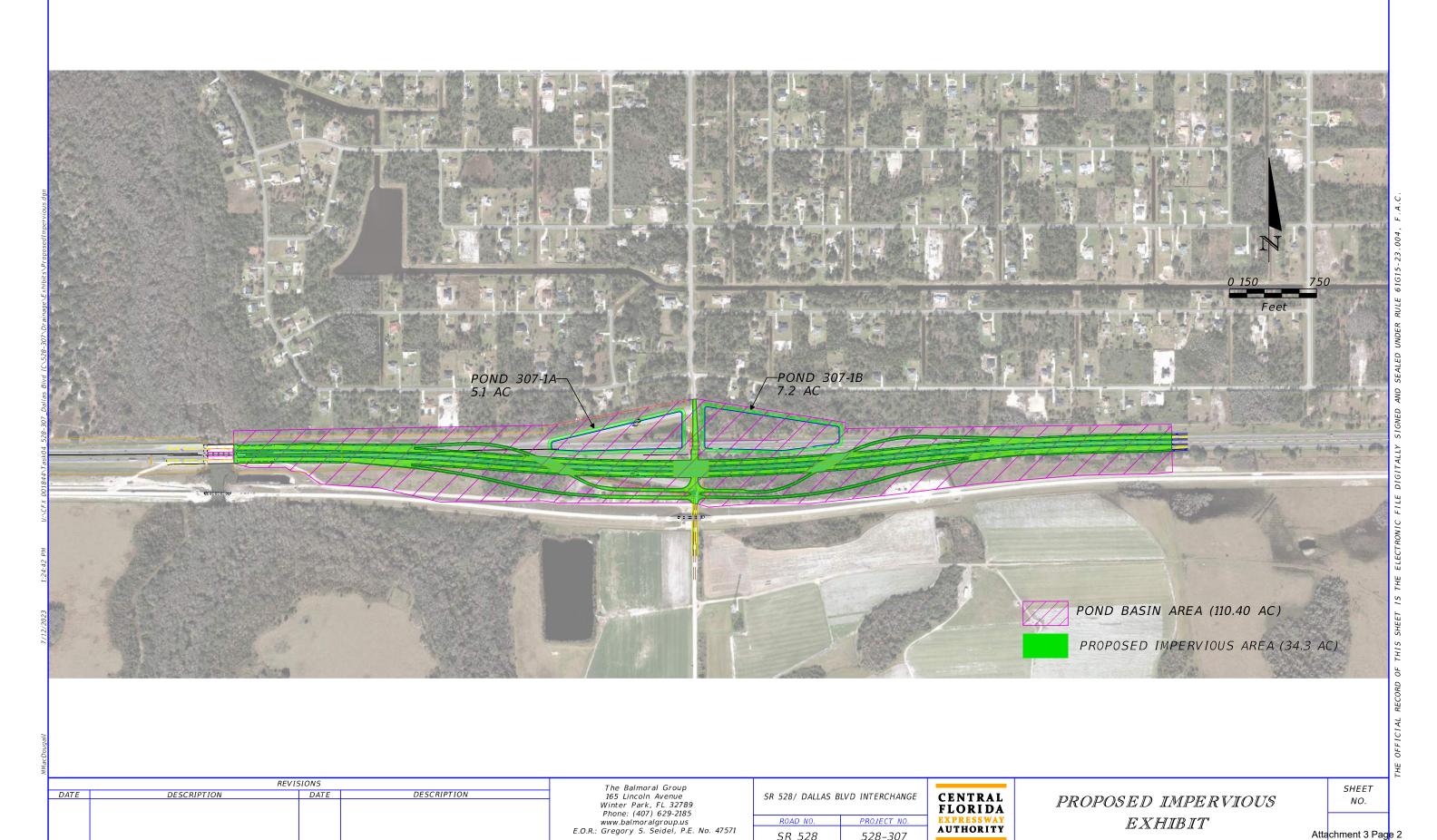
DESCRIPTION

Attachment 3 Page 1

NO.

EXISTING IMPERVIOUS

EXHIBIT



DESCRIPTION

DESCRIPTION

PROPOSED IMPERVIOUS EXHIBIT

CENTRAL FLORIDA

EXPRESSWAY AUTHORITY

SR 528/ DALLAS BLVD INTERCHANGE

PROJECT NO.

528-307

ROAD NO.

SR 528

SHEET NO.

Attachment 3 Page 2

Treatment Volume Summary

Project: SR 528 & Dallas Interchange PD&E

County: OrangePrepared: JANDate: 5/24/2023Project Number: 528-307Checked: GSSDate: 6/8/2023

Assumes Wet Detention with OFW Criteria

Basin	Area (ac)	Existing Impervious Area (ac)	Proposed Impervious Area (ac)	Treatment Volume - 1" over Basin Area + 50% (ac-ft)	Treatment Volume - 2.5" over Proposed Impervious Area + 50% (ac-ft)	Required Treatment Volume (ac-ft)
Project Area	110.40	19.6	34.3	13.8	10.7	13.8

Attenuation Volume Summary

Project: SR 528 & Dallas Interchange PD&EPrepared:JANDate: 5/24/2023County: OrangeChecked:GSSDate: 6/8/2023

Project Number: 528-307

Notes:

- (1) Attenuation calculation only considers the net additional impervious area, conversion from open space to impervious area
- (2) Pond Area assumes area converted from open space to water for the wet ponds
- (3) Pre-Development CN assumes open space for A/D; For Dual Hydrologic Soil group, the Type A classification is used to provide a conservative estimate.

Rainfall: Previous SJRWMD Permit (114678-2 SR 528 over the Econ River 2016)

8.6 25yr/24hr (NOAA Rainfall Point Precipitation Estimate = 8.39 inches)

				Existir	ng				Proposed			Results
Basin	Area (ac)	Weighted CN ⁽³⁾	ø	la	Runoff (in)	Runoff (ac-ft)	Weighted CN	s	la	Runoff (in)	Runoff (ac-ft)	Attenuation Volume (ac-ft)
Project Area	14.70 (1)	39.0	15.64	3.13	1.42	1.74	98.0	0.20	0.04	8.36	10.24	8.5
Pond Area	12.34	39.0	15.64	3.13	1.42	1.46	100.0	0.00	0.00	8.60	8.84	7.4

Total Pond Volume Summary

Project: SR 528 & Dallas Interchange PD&EPrepared: JANDate: 5/24/2023County: OrangeChecked: GSSDate: 6/8/2023

Project Number: 528-307

Basin	Pond	Required Treatment Volume (ac-ft)	Required Roadway Attenuation Volume (ac-ft)	Required Pond Attenuation Volume (ac-ft)	Existing Pond Impacts (ac-ft) ⁽¹⁾	Total Floodplain Compensation Volume (ac-ft)	Total Required Pond Volume (ac-ft)
Project Area	Pond Area	13.8	8.5	7.4	0.88	0.0	30.6

⁽¹⁾ Includes permitted compensatory treatment for 528-131 SR 528 over Econlockhatchee Rive

Project: SR 528 & Dallas Interchange PD&E

County: Orange Prepared: Date: 5/24/2023 **Project Number**: 528-307 Checked: Date: 6/8/2023

Preliminary Stage Storage Calculations for Proposed Ponds

Storage Calculations: Wet Detention Pond 307-1

Elev	h	Area	Area	Inc. Volume	Cumulative Vol.	
	ft	sf	ac	Ac-ft	Ac-ft	
63.40			6.98			
63.40	1.0	249,163	5.72	5.60	13.54	Ins
62.40	1.0	238,709	5.48	5.36	7.94	
61.40	0.5	227,819	5.23	2.59	2.59	
60.90	0.0	222,674	5.11	0.00	0.00	N۷

side Top of Berm

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Storage Calculations: Wet Detention Pond 307-2

Elev	h	Area	Area	Inc. Volume	Cumulative Vol.
	ft	sf	ac	Ac-ft	Ac-ft
63.40			9.22		
63.40	1.0	343,253	7.88	7.75	18.89
62.40	1.0	331,927	7.62	7.49	11.14
61.40	0.5	320,602	7.36	3.65	3.65
60.90	0.0	314,882	7.23	0.00	0.00

Inside Top of Berm

NWL

Storage Calculations: Combined

Elev	h	Area	Area	Inc. Volume	Cumulative Vol.
	ft	sf	ac	Ac-ft	Ac-ft
63.40			16.20		
63.40	1.0	592,416	13.60	13.35	32.43
62.40	1.0	570,636	13.10	12.85	19.08
61.40	0.5	548,420	12.59	6.23	6.23
60.90	0.0	537,557	12.34	0.00	0.00

Inside Top of Berm

NWL

Water Stage Elevation Estimates:				
Treatment Volume Elevation =	62.1	=	14.68	Ac-Ft
DHW Elevation =	63.3	=	30.60	Ac-Ft