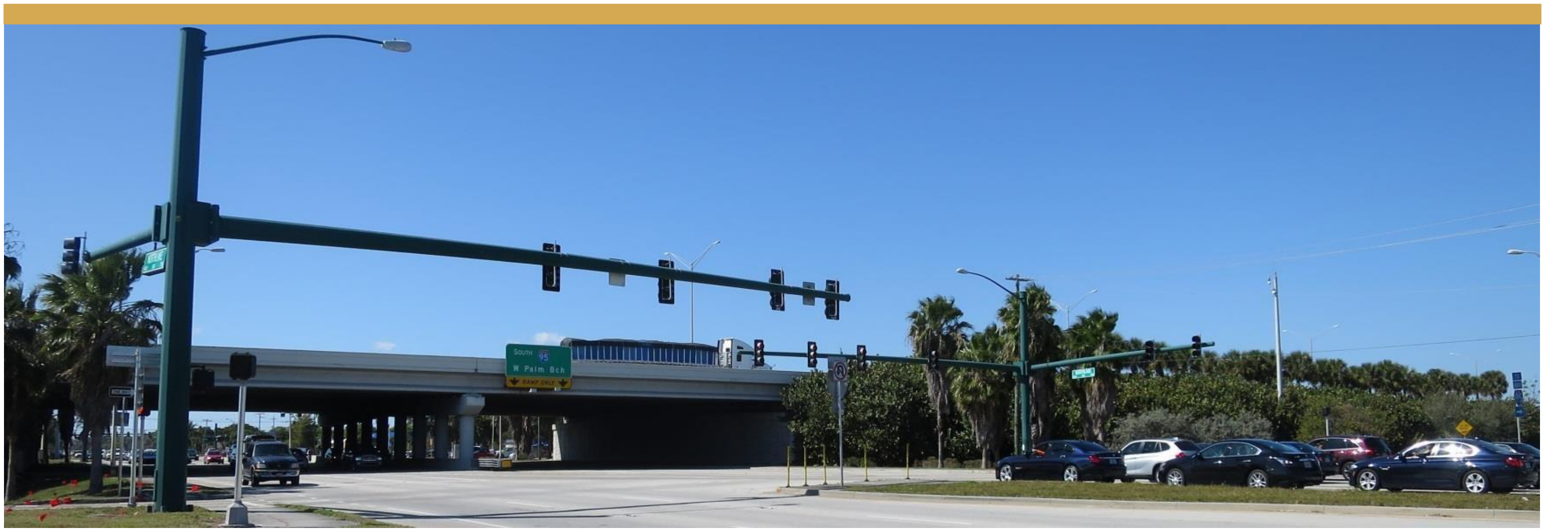
Project Development & Environment (PD&E) Study
For SR 9/I-95 @ Northlake Boulevard Interchange
Palm Beach County

Conceptual Drainage / Pond Siting Report

FM No: 435803-1-22-02 **ETDM No: 14182**



May 2017

Florida Department of Transportation | District IV
3400 West Commercial Boulevard | Fort Lauderdale, FL 33309

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Date: May 2017

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

Renaud Olivier, P.E.   No. 58127   Date

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Pages or sheets covered by this seal: Entire Report

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Prepared for

Florida Department of Transportation

District IV

Prepared by:

Stanley Consultants Inc.
1641 Worthington Road, Suite 400
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July 2017

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by FDOT pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated December 14, 2016, and executed by FHWA and FDOT.

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Executive Summary

The Florida Department of Transportation (FDOT) conducted a PD&E Study to evaluate alternatives which will enhance overall traffic operations at the existing interchange of SR 9/I-95 and Northlake Boulevard. The project is located along SR 9/I-95 (MP 34.122 to MP 35.639) between the Blue Heron Boulevard (SR 708) interchange and the PGA Boulevard (SR 786) interchange. The vertical datum for this project is the North American Vertical Datum of 1988 (NAVD88).

The recommended roadway alternative is Alternative 1 – Modified Concept. Alternative 1 improvements will widen the off-ramps to provide triple left and triple right turn lanes and will extend both two lane off-ramps to serve as two lane exit-only ramps by creating additional auxiliary lanes along I-95. This recommended roadway alternative will also extend the northbound on-ramp with an added auxiliary lane and will widen Northlake Boulevard from 3-lanes to 4-lanes in each direction between Military Trail and Sandtree Drive.

For the proposed I-95 roadway improvements, all of the drainage requirements can be accommodated within the I-95 right-of-way. The roadway improvements proposed along Northlake Boulevard will require an offsite pond. Pond siting alternatives analysis was conducted and the Pond B site is recommended. The Pond B site is an undeveloped parcel located adjacent to Roan Lane.

The existing triple cell box culvert across I-95 at the Earman River Canal (Station 1877+40) will need to be extended to provide maintenance access south of the canal. Finally, there will be no net floodplain encroachments for this project.

Section 1

Introduction

A Project Development and Environment (PD&E) Study was conducted in accordance with the Florida Department of Transportation and Federal Highway Administration requirements for the SR 9/I-95 at Northlake Boulevard interchange in Palm Beach County.

The purpose of this Report is to document the conceptual stormwater management design and pond siting recommendation. The design of the stormwater management facilities complies with the FDOT Drainage Manual, FDOT Drainage Design Guide, FDOT District 4 Pond Siting Procedures and the Environmental Resource Permit Applicant's Handbook Volumes I and II (SFWMD).

Section 2

Project Description

The Florida Department of Transportation (FDOT) conducted a PD&E Study to evaluate alternatives which will enhance overall traffic operations at the existing interchange of SR 9/I-95 and Northlake Boulevard by providing improvements to achieve acceptable Levels of Service in the future condition (2040 Design Year). The recommended roadway alternative is Alternative 1 – Modified Concept.

Alternative 1 improvements will widen the off-ramps to provide triple left and triple right turn lanes and extend both two lane off-ramps to serve as two lane exit-only ramps by creating additional auxiliary lanes along I-95. This recommended roadway alternative will also extend the northbound on-ramp with an added auxiliary lane and will widen Northlake Boulevard from 3-lanes to 4-lanes in each direction between Military Trail and Sandtree Drive. Typical sections are included in **Appendix A**.

The project is located along SR 9/I-95 (MP 34.122 to MP 35.639) between the Blue Heron Boulevard (SR 708) interchange and the PGA Boulevard (SR 786) interchange within Sections 13, 18, 19 and 24 of Township 42S and Range 43E in the City of Palm Beach Gardens, Florida. The project location is illustrated in **Figure 2-1**.

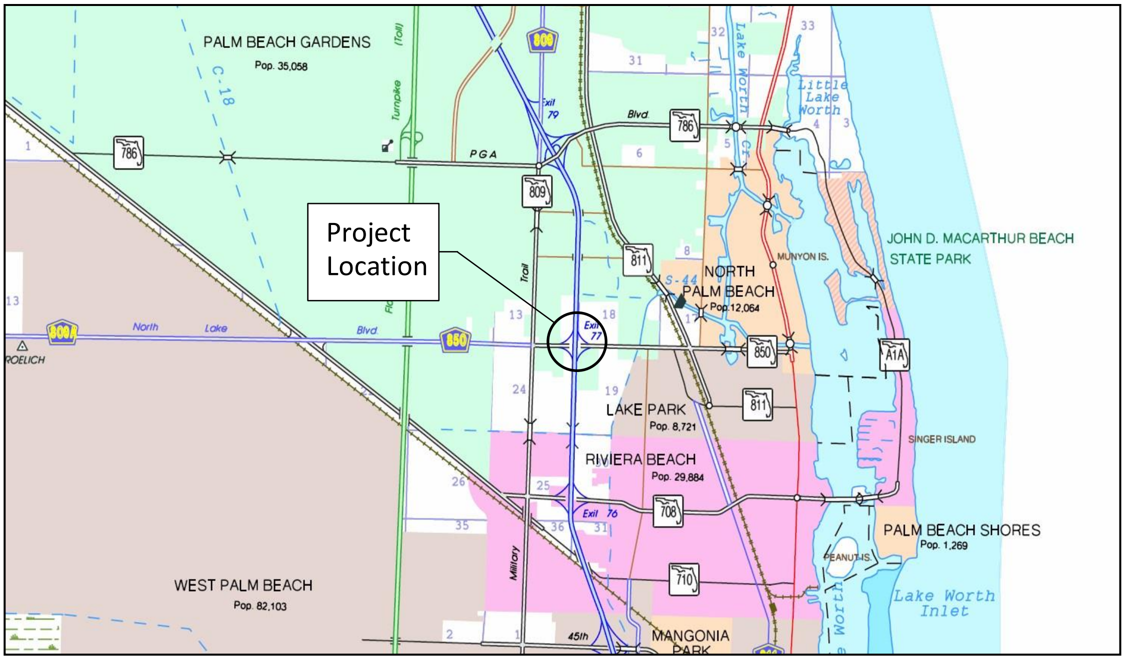


Figure 2-1 Location Map

The vertical datum for this project is the North American Vertical Datum of 1988 (NAVD88). Elevations can be converted from the National Geodetic Vertical Datum of 1929 (NGVD29) to NAVD88 by subtracting 1.52 feet. NAVD elevations are lower than NGVD elevations. For instance, elevation 10.00 ft-NGVD = 8.48 ft-NAVD.

Section 3

Data Collection

The following documents were collected and reviewed for this report:

- FDOT Drainage Manual, January 2017
- FDOT Drainage Design Guide, January 2017
- FDOT District 4 Pond Siting Procedures
- Environmental Resource Permit Applicant's Handbook, Volume I, October 01, 2013
- Environmental Resource Permit Applicant's Handbook (SFWMD Geographic area), Volume II, August 10, 2014
- FDOT I-95 Plans (from North of Blue Heron Blvd to South of PGA Blvd), FPID No. 231921-1-52-01
- I-95 Drainage Report (N. of Blue Heron Blvd to S. of PGA Blvd.), FPID 231921-1-52-01, Dec. 2001
- FDOT Design Survey of project area, August 2015
- FDOT Straight Line Diagram, Roadway ID 93220000 for I-95, Palm Beach County
- Palm Beach County Northlake Boulevard Plans (I-95 to Sandtree Drive) Project No. 97103
- SFWMD Environmental Resources Permit No. 50-03527-S (I-95 HOV Widening)
- SFWMD Environmental Resources Permit No. 50-04686-P (Northlake Boulevard)
- SFWMD Environmental Resources Permit No. 50-01482-S (Northlake Commons)
- SFWMD Environmental Resources Permit No. 50-04465-P (NorthMil Plaza)
- FEMA Flood Insurance Rate Map Panel Nos. 1201920130B, 1202210002B and 1202210004B

- USDA Natural Resources Conservation Service (NRCS) Soil Survey for Palm Beach County
- FDEP Map Direct: Verified Impaired WBIDs and TMDLs website
- Field Visits (Nov 2015 and Dec 2016)
- Palm Beach County Thoroughfare Road Design Procedures, February 2006.

Section 4

Design Criteria

The resources of criteria for the project can be found in the Environmental Resource Permit Information Manual 2014, Environmental Resource Permit Applicant's Handbook (A.H.) Volume I and the Environmental Resource Permit Applicant's Handbook Volume II. The project is located within South Florida Water Management District (SFWMD) and Northern Palm Beach County Improvement District (NPBCID) jurisdictions.

4.1 Stormwater Management Permitting

Existing SFWMD permits were found for both I-95 and Northlake Boulevard. In addition, SFWMD permits of interest were found for both NorthMil Plaza and Northlake Commons. NorthMil Plaza is located at the northeast corner of Military Trail and Northlake Boulevard. This plaza includes a 0.78 acre wet retention pond located 200-ft north of Northlake Boulevard which manages stormwater runoff from 11.5 acres of the plaza shopping center. Northlake Commons is located at the southeast corner of I-95 and Northlake Boulevard. This shopping plaza includes a 1.2 acre wet detention pond located adjacent to the I-95/Northlake Boulevard right-of-way line.

Table 4-1 summarizes these SFWMD permits.

Table 4-1 Existing Permits

SFWMD Permit Number	Project Area	Type of Stormwater Management Facility	Discharge Point
50-03527-S	I-95	French Drain and Dry Detention areas within the interchange infields and roadside linear ponds	NPBCID 6A Canal, Earman River Canal and Northlake Boulevard System. These outfall to the C-17 Canal.
50-04686-P	Northlake Boulevard	French Drain	Piped to the C-17 Canal
50-01482-S	Northlake Commons	Wet Detention	Piped to the C-17 Canal
50-04465-P	NorthMil Plaza	Wet Detention	Earman River Canal to the C-17

Work in canals is expected and other surface water impacts are anticipated at the Earman River Canal (on both sides of I-95) to extend the existing triple cell box culvert. Therefore, a USACE dredge and fill permit will be required.

A permit with NPBCID is not anticipated since the proposed improvements do not occur within their right-of-way. Post development stormwater discharges to the NPBCID canals from FDOT right-of-way would be designed to meet pre-development discharges from the existing right-of-way as previously permitted.

The permits anticipated for construction of this project include a modification to the SFWMD Environmental Resources Permit (No. 50-03527-S) for the I-95 improvements per Rules 62-330.315, F.A.C and as summarized in the A.H. Volume 1, Section 6.2. The Northlake Boulevard improvements may be included in the I-95 permit modification.

However, the Northlake Boulevard improvements may result in a modification to the SFWMD Environmental Resources Permit (No. 50-04686-P). The permitting approach will be finalized during the design phase. An Interagency meeting with SFWMD was held on January 19, 2017. At this meeting, Alternative 2 (DDI) was exclusively discussed since it was the preferred alternative at the time. The meeting minutes are included in **Appendix G**. Since then, Alternative 1, Modified Concept has become the recommended alternative.

4.2 Water Quality Criteria

Based on the Environmental Resource Permit Applicant's Handbook, Volume II (SFWMD), water quality volumetric requirements for wet detention shall be such to provide for (1") inch over the entire developed area or 2.5 inches times the percent impervious area, whichever is greater. For dry detention, 75% of the wet detention volume shall be provided. For retention systems, 50% of the wet detention volume shall be provided.

The project does not discharge to an Outstanding Florida Water. However, the project is located within Water Body ID (WBID) number 3242A which is impaired for nutrients (both Dissolved Oxygen and Chlorophyll-a) located within the C-17 Basin (Ref. FDEP Statewide comprehensive Verified List). Therefore a pre versus post pollutant loading analysis is required to demonstrate a net reduction in annual pollutant loading from the project.

4.3 Water Quantity

The project is located within the C-17 Basin, which has a discharge limit of 62.7 cfs per square mile (CSM) for the 25 year event. However, as previously permitted and documented during the interagency meeting, the post development flows will be designed to be at or below the pre development discharge rates.

4.4 Specific Drainage Conditions

The following summarizes the conceptual drainage approach analysis.

4.4.1 Treatment Volume

For I-95, the treatment volume required was calculated based on all the impervious area since the existing roadside swales and infields along I-95 currently provide water quality and is permitted as such. For Northlake Boulevard the treatment volume required was calculated based on 2.5 inches over the additional impervious area for wet detention. Also, water quality that is obtained within the existing exfiltration trench (0.30 ac-ft) along Northlake Boulevard was included in the pond size requirements assuming the trench would not function after the roadway is widened.

4.4.2 Attenuation Volume

The attenuation volume was estimated by calculating the difference in runoff volume between the post-developed conditions and the pre-developed conditions using the NRCS equation for runoff. The 100 year/24 hour rainfall depth is used to evaluate alternative drainage schemes. The rainfall amount of 16.2 inches for this rainfall event.

4.4.3 Surface Water Area Estimates

The estimate of the water surface area used the sum of the attenuation volume requirements and the treatment volume requirements. This calculation estimate utilized the existing pond (dry detention areas) bottom elevations and maximum allowable elevation data documented in the I-95 permit (ERP No. 50-03527-S). A five foot maintenance berm width was assumed for the dry detention areas within the infields and roadside swales which either have MSE wall, sound barrier wall and/or roadway paved shoulder adjacent to the areas. A 20 foot maintenance berm width was used for the offsite pond analysis. An average side slope of 1V:4H was used. Also, a 10% increase in the pond area estimate was factored into the conceptual design to account for assumptions.

The freeboard requirements are found in the FDOT Drainage Manual, Chapter 5. A minimum one foot freeboard is required for detention and retention areas. For the interchange infields and roadside treatment areas along the ramps and mainline I-95, a minimum 0.5 foot freeboard was used since these are effectively linear treatment areas.

For the offsite pond analysis, one foot freeboard was used in the analysis.

4.4.4 Infields/I-95 MSE Wall

Finally, it should be noted the MSE walls along I-95 do not extend down to the bottom of the interchange infields. This limits the amount of volume that can be used within the infields. A drainage structure cross section from the existing plans is included in **Figure 4-1** to highlight the potential volume that could be utilized if the MSE walls were extended vertically to the bottom of the interchange infield.

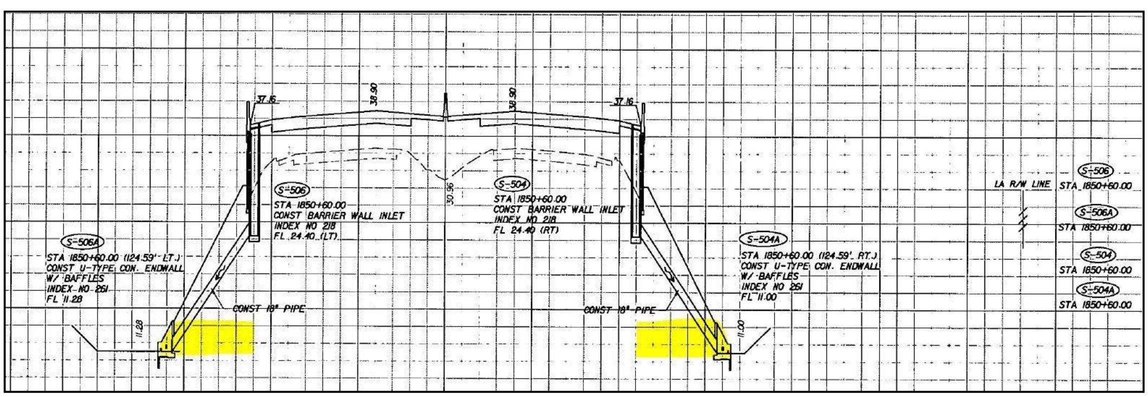


Figure 4-1 Drainage Structure Cross Section

The conceptual design assumed the fill slope adjacent to the MSE wall would remain and not be reconstructed to create additional volume for stormwater management.

Section 5

Existing Conditions

I-95 was widened in the early 2000s to include HOV lanes. This work was completed under the authorization of SFWMD Permit No. 50-03527-S. Northlake Boulevard is a major drainage divide for this Study. The project is split into three major basins. See the drainage map and sub-basin naming exhibit located in **Appendix A**. The sub-basin naming exhibit can be helpful when reviewing the calculations.

5.1 Topography

The project area is urbanized and well developed. Generally overland flow is from west to east towards the Atlantic Ocean. The major outfall is the C-17 Canal. The drop in elevation between Military Trail and the C-17 Canal is approximately 5 feet. An excerpt of the USGS map for this area is included in **Appendix B**.

5.2 Hydrologic Data

The 100 year/24 hour rainfall depth is 16.2 inches. The 25 year/3 day rainfall depth is 13.3 inches. These values were derived from the NOAA website for the specific project area. A printout of the rainfall data is included in **Appendix B**.

5.3 Wetlands

No wetland impacts are anticipated with this project.

5.4 Hazardous Material Assessment

Six sites along the project corridor have a High-Risk ranking, 13 sites have a Medium Risk ranking, and 18 sites have a Low Risk ranking for potential contamination. A contamination map is included in **Appendix I**.

<u>High-Risk Sites</u>

- Chevron – Petroleum and Storage Tanks
- Snow White Dry Cleaners – RCRA and Dry Cleaner
- Amoco Service Station – Petroleum and Storage Tanks
- MDNOW Urgent Care (reported as HEC Cleaning, LLC) – Dry Cleaner
- Mobil Oil Corp – Petroleum and Storage Tanks
- I-95 Shell – Petroleum and Storage Tanks

<u>Medium-Risk Site</u>

- Premiere Cleaners – Dry Cleaner
- Shel – Petroleum and Storage Tanks
- Tires Plus – RCRA
- Exxon Co – Petroleum and Storage Tanks
- Dry Cleaning USA – Dry Cleaner
- Sunoco – Petroleum, Storage Tanks, and RCRA
- Starbucks – Petroleum, Storage Tanks, and RCRA
- Schumacher Automotive – RCRA and Storage Tanks
- Napleton’s North Palm Auto Park – RCRA and Storage Tanks
- Sansone Auto Galleria – RCRA
- Napleton Northlake Kia – RCRA and Storage Tanks
- Kauffs Ventures Property – Storage Tanks
- BMT Realty – Storage Tanks

These contamination sites should be considered during the design of exfiltration trench and ponds as stormwater management facilities. The location of existing contamination sites were considered during the pond siting alternative analysis.

5.5 Habitat Assessment

No adverse effects to any protected or listed species that are known to occur or have the potential to occur in the project area are anticipated.

5.6 Historical and Archeological Assessment

No archaeological sites were identified during the Study and the area of potential effect does not contain areas of contiguous historic resources which would comprise a National Register-eligible historic district.

5.7 Utilities and ITS

Utilities within the corridor include water, sewer, gas, power distribution, fiber-optic and communication facilities. The utility agency owners identified during the Study include:

- AT&T Distribution
- Comcast
- Fiber Light, LLC
- FPL Distribution
- FPL Fibernet, LLC
- Level 3 Communications
- Palm Beach County Traffic Division
- Seacoast Utility Authority
- TECO Peoples Gas

These utilities should be field located/verified during the design phase to evaluate potential conflicts with extending pipe laterals and constructing new storm drain/curb inlets.

FDOT has ITS facilities within the project limits primarily located along the east side of mainline I-95 and along the northbound on and off ramps. These include underground conduit/cable and ITS facilities on concrete poles. Impacts to these facilities are anticipated due to the improvements identified in the preferred alternative, primarily adjacent to Ramp ‘B’ and Ramp ‘C’. Coordination during the design phase between ITS, roadway and drainage disciplines is recommended.

5.8 Existing Drainage Basins

5.8.1 Basin 1

From the beginning of the project to Northlake Boulevard stormwater is discharged to the NPBCID EPB-6A Canal. This canal discharges to the C-17 Canal.

Contributing areas in this basin include mainline I-95, Ramp ‘A’ infields and Ramp ‘B’ infields. Prior to discharge, water quality and attenuation is provided by several methods. Stormwater runoff is managed within roadside swales, interchange infields and a French drain (FD) system located under the median barrier wall of I-95. The FD system provides water quality for the HOV lanes and median shoulder for both directions of travel. Stormwater runoff from the remaining I-95 FDOT R/W is managed separately within the mainline roadside swales and the infields of Ramp ‘A’ and Ramp ‘B’. Discharge to the NPB-6A Canal is via typical FDOT control structures and pipe located on each side of mainline I-95. As such, the analysis in this report further sub-divides Basin 1 into Area A and Area B, associated with Ramp ‘A’ and Ramp ‘B’, respectively.

5.8.2 Basin 2

From Northlake Boulevard to the end of the project, stormwater is discharged to the Earman River Canal with two exceptions. These exceptions include the Ramp ‘C’ and Ramp ‘D’ infields which discharge to the Northlake Boulevard system (discussed below). The Earman River Canal converges with the C-17 Canal which leads to the Intracoastal Waterway. Prior to discharge, water quality and attenuation is provided by several methods. Contributing areas in this basin include mainline I-95, Ramp ‘C’ infields and Ramp ‘D’ infields. In addition, there are offsite contributing areas from residential neighborhoods along both the east and west side of I-95. Runoff from these offsite areas connect to the I-95 system via slots in the sound barrier walls. Stormwater runoff is managed within roadside swales, interchange infields and a French drain (FD) system located under the median barrier wall of I-95. The FD system provides water quality for the HOV lanes and median shoulder for both directions of travel. Stormwater runoff from the remaining I-95 FDOT R/W is managed separately within the mainline roadside swales and the infields of Ramp ‘C’ and Ramp ‘D’. Discharge to the Earman River Canal is via typical FDOT control structures and pipe located on each side of mainline I-95. The Ramp ‘C’ and Ramp ‘D’ infields discharge via typical FDOT control structures and pipe to the Northlake Boulevard system. As such, the analysis in this report further sub-divides Basin 2 into Area C and Area D, associated with Ramp ‘C’ and Ramp ‘D’, respectively.

5.8.3 Basin Northlake

Within the Northlake Boulevard right-of-way, runoff is captured in curb inlets and conveyed to the C-17 Canal via a storm drain system. Prior to discharging to the C-17 canal, water quality is provided in approximately 1,200 feet of french drain located within the limited access right-of-way of I-95/Northlake Boulevard. The infields of Ramp ‘C’ and Ramp ‘D’ provide attenuation and water quality prior to discharging to the Northlake Boulevard system.

5.9 Soils

The soils consists primarily of Immokalee fine sand Basinger sand that is characterized as nearly level, poorly drained, deep sandy soil. The hydrologic soil group is A/D. The AASHTO classification is A-3. The exfiltration rates documented in past permits are summarized below. These values indicate the existing soils provide suitable conditions for the use of french drain. A soils map of the area is included in **Appendix E**.

Table 5-1 Exfiltration Rate Data

Location	Exfiltration Rate (cfs/sf-ft. head)	Remarks
Mainline I-95 STA 1848+00	$3.4x10^{-4}$	Drainage Report dated Dec 2001 (FPID 231921-1)
Northlake Blvd. STA 26+00	$5.0x10^{-5}$	SFWMD Permit No. 50-04686-P
Northlake Blvd. STA 43+00	$7.0x10^{-5}$	SFWMD Permit No. 50-04686-P

The wet season water table (WSWT) documented in past permits are summarized below:

Table 5-2 Water Table Data

Location	WSWT Elev. (NAVD)	Remarks
Mainline I-95 STA 1848+00	9.00 ft	Drainage Report dated Dec 2001 (FPID 231921-1)
Northlake Blvd. STA 26+00	8.98 ft	SFWMD Permit No. 50-04686-P
Northlake Blvd. STA 43+00	8.28 ft	SFWMD Permit No. 50-04686-P

Section 6

Proposed Drainage System

6.1 Alternative 1 – Modified Concept

For this alternative, all the stormwater needs for the I-95 improvements can be accommodated within the I-95 right-of-way. The existing French drain system under the I-95 median barrier wall is not impacted by this alternative and will remain. Existing roadside swales and the interchange infields will be used and will remain as dry detention areas to provide water quality and attenuation. Runoff would be conveyed overland to the interchange infields. Along the ramps, barrier wall inlets will be used to capture runoff adjacent to the barrier wall mounted retaining wall. The roadside swales along the ramps will remain between the existing sound barrier wall and proposed retaining wall that supports the widened ramps.

Maintenance access has to be considered along I-95. Maintenance access exists at Holly Drive and access the Earman River Canal. The existing three cell 10' x 12' concrete box culvert at the Earman Canal will be extended to maintain access over the Earman River Canal on each side of I-95. A preliminary analysis of the box culvert extension was performed. The results indicate an insignificant headwater increase of 0.01 feet. Therefore, extending the box culvert will not cause adverse impacts.

For the improvements proposed along Northlake Boulevard, an offsite pond is required to provide water quality and attenuation. A wet detention pond with an area of 2.2 acres is estimated for this alternative to satisfy the treatment volume and attenuation volume requirements. Pond siting alternative analysis was completed for the recommended roadway alternative, Alternative 1 Modified Concept. The summary of the pond siting alternative analysis and recommendations are further discussed in Section 7 of this report. The recommendations are based on pond sizes and locations determined from preliminary data, engineering judgement and assumptions. Pond sizes may change during the design phase as more detailed information is determined on the final roadway geometrics, agency criteria, existing utilities, contamination sites and existing drainage systems. As such, if the following requirements are met, an offsite pond may not be required. The following items can be evaluated during the design phase.

a. SFWMD would need to waive the requirements listed in **Appendix E** of the Environmental Resource Permit Applicant's Handbook Volume II, SFWMD (i.e. Annual Nutrient Loading Analysis). Further discussion between SFWMD and FDOT during the design phase will be required.

b. Exfiltration rates along the corridor are suitable for the use of French drain. Design sufficient length of French drain to satisfy water quality requirements for the additional impervious area with proper consideration of buried utilities and contamination sites. This would be in addition to the existing 1,230 feet of French drain.

c. Demonstrate the additional runoff from the proposed widening will not flood the roadway, by checking the hydraulic grade line in the storm drain system, to meet the Palm Beach County Thoroughfare Standards, **Appendix B** – Drainage Design Guidelines. Design level survey of all existing drainage structures and storm tabs would be used by the design team to demonstrate this requirement.

d. Demonstrate the post development discharge rate is less than or equal to the pre development discharge rate. This could be accomplished by evaluating the discharge from an overall project standpoint, including the I-95 stormwater management facilities.

6.2 Alternative 2 – DDI Concept

For this alternative, the I-95 improvements along Ramp A and Ramp B (Basin1) can be accommodated within the I-95 right-of-way. In Basin 2, the pond size estimate for improvements along Ramp C is 0.3 acres and along Ramp D is 0.5 acres. The existing French drain system under the I-95 median barrier wall is not impacted by this alternative and will remain. Runoff would be conveyed overland to the interchange infields. Along the ramps, barrier wall inlets will be used to capture runoff adjacent to the barrier wall mounted retaining wall. Note the roadside swales along the ramps will remain between the existing noise barrier wall and proposed retaining wall that supports the widened ramps, therefore maintenance access should considered during the design phase at the Earman River Canal. For the improvements proposed along Northlake Boulevard, an offsite pond would be required. A wet detention pond with an area of 3.3 acres is estimated for this alternative to provide both the treatment volume and estimated attenuation volume. Pond siting alternative analysis was not performed on this alternative since it is not recommended.

6.3 Alternative 3E – Dual Flyover Concept

For this alternative, the I-95 improvements along Ramp A and Ramp C require offsite ponds. The improvements along Ramp B and Ramp D can be accommodated for within the I-95 right-of-way. The pond size estimate for improvements along Ramp A is 0.3 acres and along Ramp C is also 0.3 acres. The existing French drain system under the I-95 median barrier wall is not impacted by this alternative and will remain. Runoff would be conveyed overland to the interchange infields. Along the ramps, barrier wall inlets will be used to capture runoff adjacent to the barrier wall mounted retaining wall. Note the roadside swales along the ramps will remain between the existing noise barrier wall and proposed retaining wall that supports the widened ramps, therefore maintenance access at the Earman River Canal should considered during the design phase.

For the improvements proposed along Northlake Boulevard an offsite pond would be required. A wet detention pond with an area of 4.4 acres is estimated for this alternative to provide both the treatment volume and estimated attenuation volume. Pond siting alternative analysis was not performed on this alternative since it is not recommended.

Table 6-1 summarizes the pond estimates for each alternative. The conceptual calculations are summarized in **Appendix C** and **Appendix D**.

Table 6-1 Summary of Pond Estimates for each Alternative

Alternative	Basin1		Basin 2		Basin	Total
	Area A	Area B	Area C	Area D	Northlake Boulevard	
	acres	acres	acres	acres	acres	acres
Modified Concept (ALT 1)	0	0	0	0	2.2	2.2
DDI Concept (ALT 2)	0	0	0.3	0.5	3.3	4.1
Dual Flyover Concept (ALT 3E)	0.3	0	0.3	0	4.4	5.0

6.4 Shared Use Pond Considerations

A review of existing offsite ponds was considered for the shared use pond concept. Three ponds exist within a few hundred feet of the Northlake Boulevard right-of-way. The first pond is located approximately 300 feet east of Military Trail along the south side of Northlake Boulevard (Station 13+50). It is a small shallow dry detention pond surrounded by development serving a bank. There is no room for expansion without impacting adjacent property, therefore this pond was considered not suitable for shared use.

The second pond is located approximately 1000 feet east of Military Trail along the north side of Northlake Boulevard (Station 20+00). It is a wet detention pond serving a large retail space surrounded by business and residential property. There is potential for this pond to provide additional volume by raising the bleeder elevation. This would require a permit modification and a drainage easement. The drainage easement would provide a pipe connection from the road to the pond. However, the easement would need to bisect business property and create impacts, therefore this pond was considered not suitable for shared use.

The third location is adjacent to Ramp B along the south side of Northlake Boulevard (Station 42+00). It is a wet detention pond serving a large retail space surrounded by business and I-95. The outfall for this pond is the C-17 Canal via a 3,000 feet long storm drain pipe within the Northlake Commons parking lot and an east-west drainage easement located approximately 420 feet north of Constellation Boulevard. The storm drain pipe “daylights” as a 48” CMP into a conveyance ditch along Burma Road which connects to the C-17. Based on SFWMD permits, there have been previous complaints of street flooding within residential streets. Although the complaints were related to lack of maintenance activities, this shared use pond location was not further considered since it could be difficult to enforce maintenance activities within the boundaries of the conveyance system to the C-17.

Section 7

Pond Siting Alternative Analysis

Pond siting alternative analysis was performed to identify a preferred pond site for Alternative 1 – Modified Concept. This is the recommended roadway alternative. A pond siting alternative analysis was not performed on the other roadway alternatives. The pond siting methods follow the FDOT District 4 Pond Siting Procedures, July 2010. A pond siting team was assembled and consisted of members from the following disciplines: roadway, drainage, environmental, right-of-way, construction and legal counsel. The multi-discipline team attendee list, meeting notes, exhibits and pond siting matrix are included in **Appendix I**.

This project includes drainage basins along I-95 and Northlake Boulevard. All the drainage requirements for the I-95 improvements can be accommodated within the existing I-95 interchange infields and roadside linear ponds. Based on conceptual analysis, the improvements along Northlake Boulevard will require an offsite pond. The pond siting alternative analysis focused on Northlake Boulevard.

The limits of the Northlake Boulevard basin for this project are from Military Trail to Sunrise Drive. The Northlake Boulevard right-of-way varies in width from 140 feet to 210 feet. The Northlake Boulevard roadway basin is approximately 16.4 acres, not including the pond parcel. The pond was sized to accommodate the widening of Northlake Boulevard from 6-lanes to 8-lanes within the proposed road right-of-way. The additional impervious area is approximately 1.01 acres, also it was assumed all offsite runoff would continue to be managed within existing offsite facilities. The discharge point for the Northlake Boulevard runoff is the C-17 Canal located 4,000 feet east of I-95. The pond size estimate for Northlake Boulevard is 2.2 acres.

Seven pond sites were initially reviewed by the multi-discipline team. These pond sites are named A through G. These initial seven pond sites were selected based on vicinity to the I-95 Northlake Boulevard interchange, drainage requirements, availability of undeveloped parcels and proximity to the C-17 Canal. Pond sites A, B and F were selected from the initial seven pond sites for further evaluation.

Pond site A - This site is located adjacent to Ramp D on the northwest quadrant of I-95 and Northlake Boulevard. The pond site would encompass four residential parcels and one parcel developed with a hotel. The team decided on this site/shape to not encroach within the adjacent parcel to the west (ABC Fine Liquors and Spirits, Nutrition Smart) and also utilize the residential parcels to the north that are being impacted due to the proposed Ramp D improvements. The hotel parcel would be a whole take and there is an outdoor advertising sign located on this parcel. The advantage of this site from a drainage standpoint is its proximity to both Northlake Boulevard and I-95 which is directly adjacent to the FDOT right-of-way eliminating the need for drainage easement(s). The total pond site area available for drainage with a maintenance berm is 2.30 acres.

Pond site B – This site is located adjacent to Roan Lane on the northeast quadrant of I-95 and Northlake Boulevard. The team decided on this site/shape since it would only impact one parcel that is currently undeveloped and is for sale. The advantage of this site from a drainage standpoint is it located closer to the C-17 outfall and would be easier to construct. The total pond site area available for drainage with a maintenance berm is 2.39 acres.

Pond site F – This site is located along the north side frontage of Northlake Boulevard, adjacent to Roan Lane. Although one developed parcel (Edwin Watts) would be impacted, the team decided on this site/shape in conjunction with an adjacent undeveloped parcel. Overall, this potential pond site would occur on two parcels. The advantage of this site from a drainage standpoint is its proximity to Northlake Boulevard eliminating the need for drainage easement(s) and it is located closest to the C-17 outfall. The total area available for drainage with maintenance berm is 2.2 acres. A 35 foot right-of-way width would be available between Roan Lane and Sunrise Drive. Conceptually this would accommodate the existing “alley” that connects these two local streets.

The remaining potential pond sites (See **Appendix I** for map identifying the pond locations) were eliminated from further evaluation as follows:

- Pond site C – eliminated due to adjacent high risk contamination site.
- Pond site D – eliminated due to business impacts.
- Pond site E – eliminated due to business impacts and impacts to access along Sunset Drive

- Pond site G – eliminated due to business impacts.

A pond siting matrix was used by the multi-discipline team to weigh and score each of the three pond sites based on several factors, including:

- Zoning
- Land Use
- Right-of-Way Net Cost for pond parcel
- Drainage Considerations
- Flood Zone FEMA
- Contamination and Hazardous Materials
- Utilities
- Threatened and Endangered Species
- Outdoor Advertising (ODA)
- Noise
- Wetlands and Protected Uplands
- Cultural Resources Involvement
- Section 4(f)
- Public Wellfield
- Construction
- Maintenance
- Aesthetics
- Public Opinion and Adjacent Residency Concerns

Criteria factors that were determined to have similar significance at each of the three pond sites, or determined not applicable, were given a weight of zero.

Those factors include:

- Flood Zone FEMA (flood zones will not influence any pond sites)
- Noise (N/A),
- Wetlands and Protected Uplands and Associated Costs (no wetlands in the project)
- Section 4(f) (Section 4(f) lands will not influence any pond sites)
- Public Wellfield (well fields will not influence any pond sites)

The weighing and scoring for the remaining factors were determined based on the multi-discipline team discussion. Lower scores means a better or more desired alternative.

Zoning (Right-of-Way) – Pond site F and Pond site B have the same zoning but Pond site F is more prominent due to its highway frontage location. Therefore Pond site B was scored lower than Pond site F. Pond site A had mixed zoning and was scored in the middle.

Land Use – Due to Pond site B currently being vacant it was scored the lowest. Pond site F would leave an uneconomic remainder, therefore it scored the highest between the three ponds.

Right-of-Way Costs – Pond site F would have the highest right-of-way cost. Pond site A right-of-way cost falls between Pond site F and Pond site B. Pond site B would have the lowest right-of-way cost, therefore it was scored the lowest.

Drainage Considerations – Pond site A is located further upstream and the shape would be constrained by the remaining residential parcels along Ramp D. Pond site B would require a drainage easement and piping along Roan Lane. Pond site F is hydraulically closer to the C-17 Canal, furthest downstream and adjacent to Northlake Boulevard, awarding it the lowest score.

Contamination and Hazardous Materials – Pond site B and Pond site F are located near a high rated risk site. Pond site F is down gradient of the groundwater flow from the high risk contaminated site giving it the highest score. Pond site A is adjacent to a parcel rated with a median risk rating. Pond site A was scored the lowest compared to the other alternative pond sites.

Utilities – Existing underground utilities located on the Pond site A parcel service the hotel and overhead utilities. Pond site A was scored the lowest out of the three alternative pond sites. Pond site B currently has no existing utilities but would require a drainage easement along Roan lane in order to have the runoff reach the pond. Underground utilities are located on Pond site F for a local water utility company giving Pond site F the highest score.

Threatened and Endangered Species and Associated Costs – all three pond sites were scored the same as all three have minimal/no impact to threatened or endangered species.

Construction – Pond site A was giving the highest score due to construction access that would likely occur through the residential area along Rochester Street. Pond site B has good construction access and will require storm drain along Roan Lane. Pond site F received the lowest score due to the best construction access and ease of storm drain connections.

Maintenance – All pond sites received the same score for maintenance.

Aesthetics – Pond sites would be designed consistent with the FDOT Highway Beautification Policy. Pond site A could have more requirements due to proximity of local residences. Pond site B would require a fence due to the adjacent Church but may require the least amount of beatification compared to the other sites. Pond site F received the highest score due to it being on the frontage of Northlake Boulevard with the City of Palm Beach Gardens likely requesting specific landscaping.

Public Opinion and Adjacent Residency Concerns – Pond site A received a medium score due to residence possibly not favoring a pond in this location. Pond site B is currently vacant and received the lowest score. Pond site F was scored the highest due to it being on the frontage of Northlake Boulevard. The weight factor was increased from 5 to 6 during the third meeting to capture the public's comments generated during the December 08, 2016 Alternatives Public Workshop.

The pond site with the lowest ranking was chosen as the preferred pond site. Pond site B received a score of 220. Pond site A came in second with a score of 298 and Pond site F received a score of 312. The pond siting multi-discipline team unanimously selected Pond site B as the preferred pond site alternative. The completed pond siting matrix for this project is included in **Figure 7-2**. The pond site matrix with incorporated notes from the pond siting meetings is included in **Appendix I**.

The wet detention pond typical section documented in the FDOT Drainage Manual can be used for this project. Fencing should be considered since the pond is located adjacent to a church and within a residential area where children could have access.

A preliminary nutrient loading analysis was completed using the BMPTRAINS program supplied by the UCF Stormwater Management Academy. This analysis compares the annual removal efficiency provided in the existing exfiltration trench to that of a wet detention pond. The results demonstrate that a net improvement in annual removal efficiency for both Total Nitrogen and Total Phosphorus can be achieved in a wet detention pond. The minimum parameters for the wet detention pond would include a residence time of 2.2 days, a pond depth of 10 feet (permanent pool) with a surface water area of 1.3 acres.

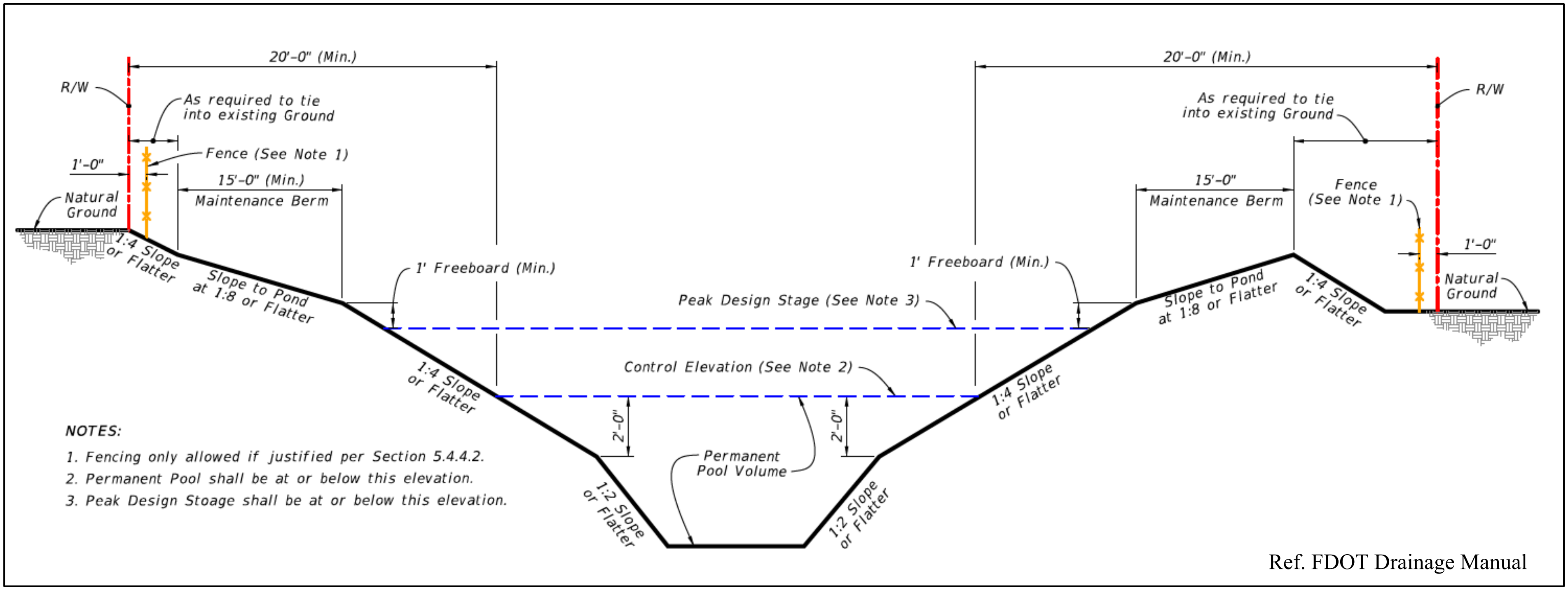


Figure 7-1 Pond Cross Section

	Weight of Factor	Factor	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
	1-10		1-10		1-10		1-10	
		Alternative Number	A		B		F	
		Brief Description of Alternative	2.2 Acres at NW quadrant Comm/Resid. parcels		2.2 acres at NE quadrant Undeveloped parcel		2.2 acres Roan Ln & Sunrise Dr. comm. parcels	
		Parcel Number						
		Parcel Size (Acres)	# Acres		# Acres		# Acres	
1	4	Zoning (Right of Way)	5	20	2	8	8	32
2	3	Land Use	5	15	2	6	8	24
3	8	Right of Way Costs	8	64	4	32	9	72
4	8	Drainage Considerations	6	48	4	32	2	16
5	0	Flood Zone FEMA	0	0	0	0	0	0
6	7	Contamination and Hazardous Materials	6	42	8	56	9	63
7	5	Utilities	3	15	5	25	4	20
8	1	Threatened and Endangered Species and Associated Costs	1	1	1	1	1	1
9	0	Noise	0	0	0	0	0	0
10	0	Wetlands and Protected Uplands and Associated Costs	0	0	0	0	0	0
11	0	Cultural Resources Involvement and Associated Costs	0	0	0	0	0	0
12	0	Section 4(f)	0	0	0	0	0	0
13	0	Public Wellfield	0	0	0	0	0	0
14	6	Construction	6	36	4	24	2	12
15	4	Maintenance	3	12	3	12	3	12
16	3	Aesthetics	5	15	4	12	6	18
17	6	Public Opinion and Adjacent Residency Concerns	5	30	2	12	7	42
18		Other		0		0		0
		Comments						
		Score	298		220		312	
		Ranking	2		1		3	

Figure 7-2 Pond Site Matrix – Alt 1 Modified Concept

Section 8

Floodplains

There will be no net floodplain encroachments for this project. Both I-95 and Northlake Boulevard are located within Zone B according to FEMA Map 1202210004B. Zone B are areas between the limits of the 100-year and 500-year flood; or certain areas subject to 100yr flooding with average depths less than one foot; or areas protected by levees from the base flood. The FEMA maps for this project are included in **Appendix F**.

Section 9

Conclusions

All of the drainage requirements can be provided within the I-95 right-of-way for the I-95 roadway improvements identified in the recommended alternative, Alternative 1 – Modified Concept. For the improvements along Northlake Boulevard, pond site alternatives were identified and Pond siting alternatives analysis was conducted using District 4's Pond Siting Procedures.

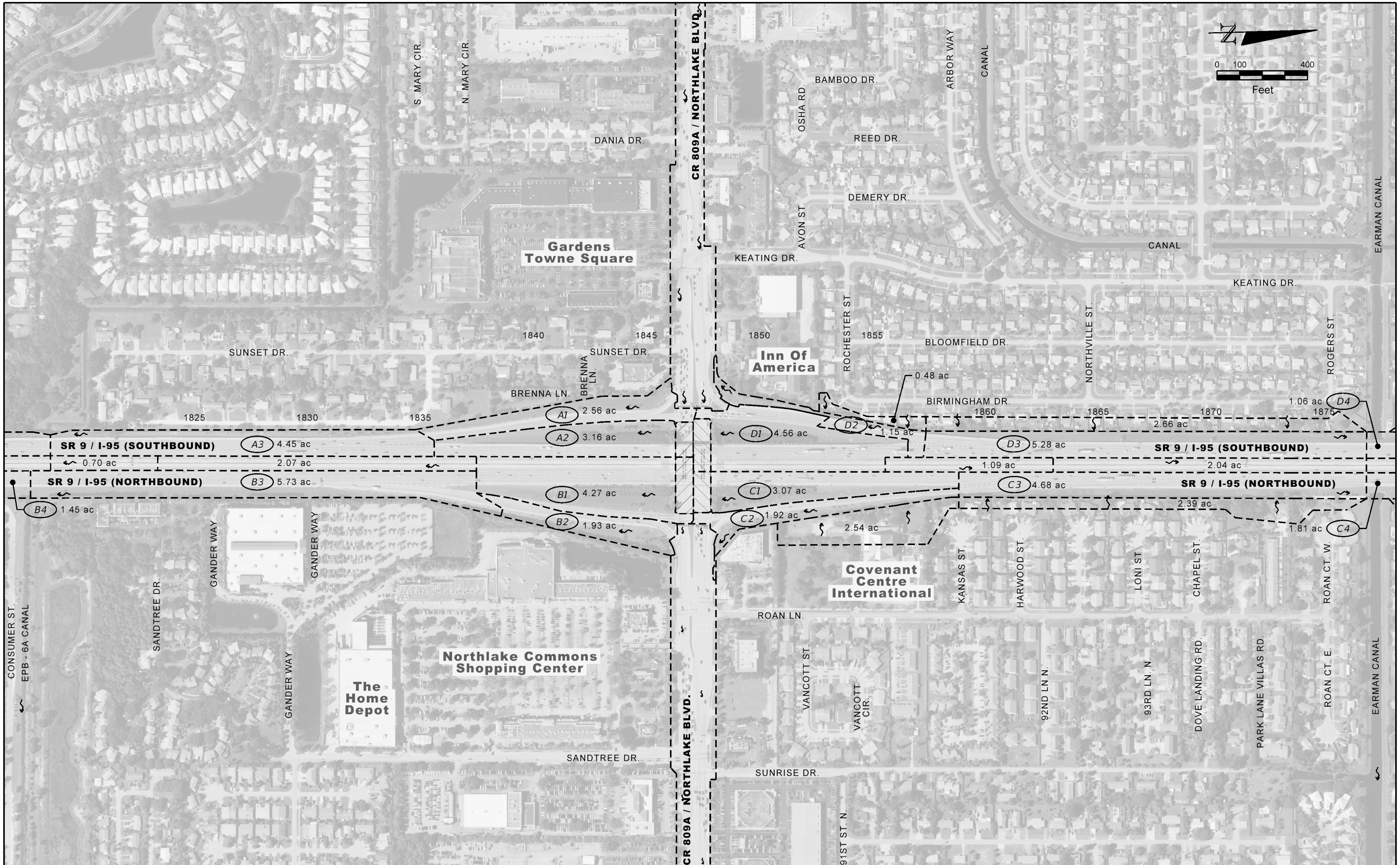
A pond size right-of-way requirement of 2.2 acres is estimated for the Northlake Boulevard widening improvements between Military Trail and Sunrise Drive. Pond site B is the recommended pond site. The Pond Site B is a 2.39 acre undeveloped parcel located adjacent to Roan Lane which will satisfy the estimated pond size right-of-way requirement.

The existing triple cell box culvert at the Earman River Canal (Station 1877+40) will need to be extended to provide maintenance access south of the canal. There will be no net floodplain encroachments for this project.

The conceptual drainage analysis to estimate the right-of-way requirements uses a volumetric analysis which accounts for both water quality treatment and quantity for runoff attenuation. The recommendations are based on pond sizes and locations determined from preliminary data, engineering judgement and assumptions. Pond sizes may change during the design phase as more detailed information is determined on the final roadway geometrics, agency criteria, existing utilities and existing drainage system.

Appendix A

Typical Sections, Drainage Map, Sub-Basin Naming Exhibit



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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

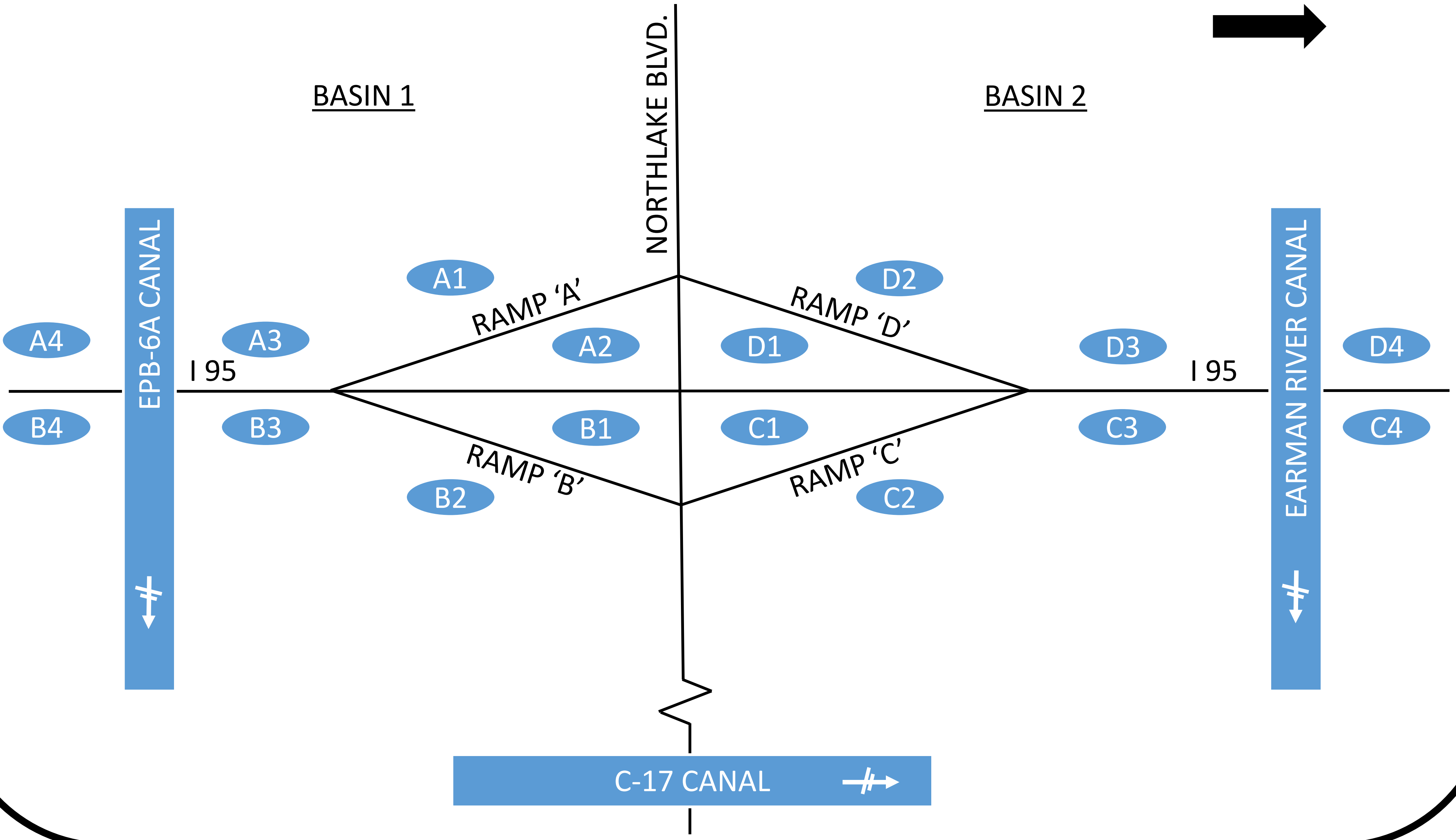
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	PALM BEACH	435803-1-22-02

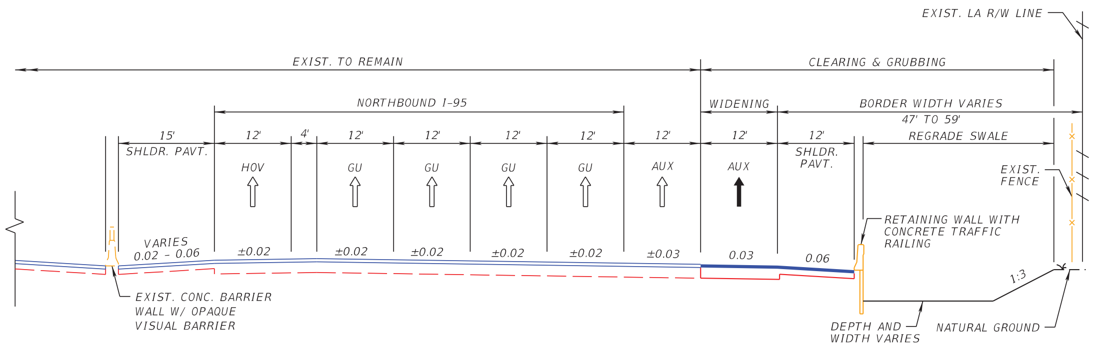
EXISTING CONDITIONS
DRAINAGE MAP

SHEET NO.
1

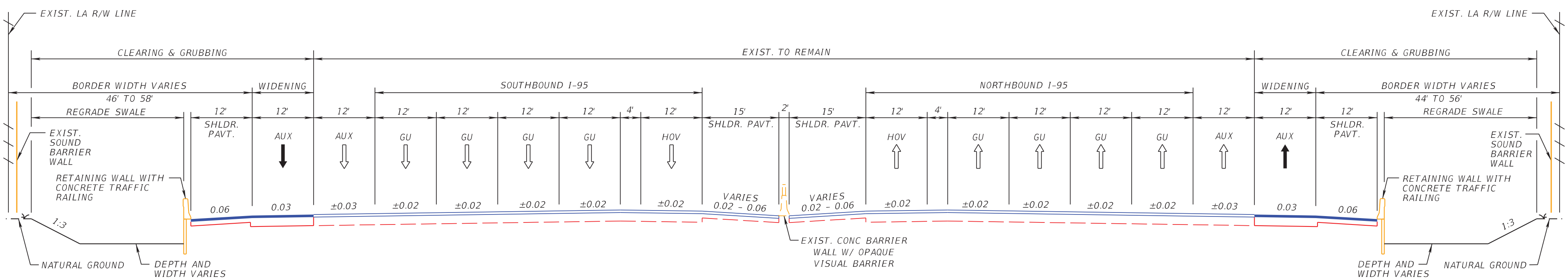
5177 2/23/2017 2:24:39 PM 0:\CADD\43580312202\drainage\DRMPRD01.DGN

Sub-Basin Naming Exhibit





TYPICAL SECTION
I-95
SOUTH OF NORTHLAKE BLVD INTERCHANGE
DESIGN SPEED = 70 MPH



TYPICAL SECTION
I-95
NORTH OF NORTHLAKE BLVD INTERCHANGE
DESIGN SPEED = 70 MPH

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TYPICAL SECTION

SHEET NO.
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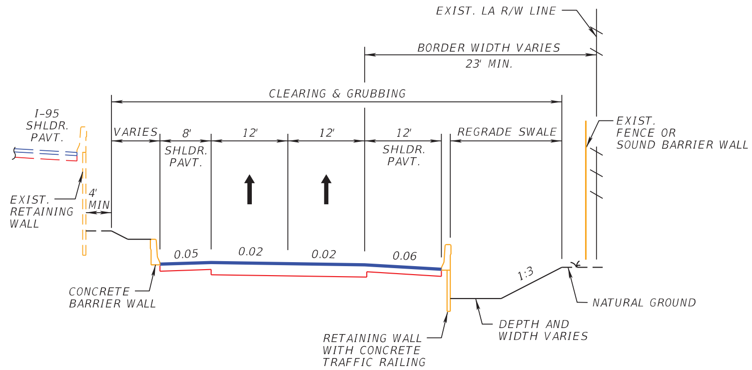

TYPICAL SECTION
TWO-LANE RAMP
(INSIDE NORTHLAKE BLVD INTERCHANGE)

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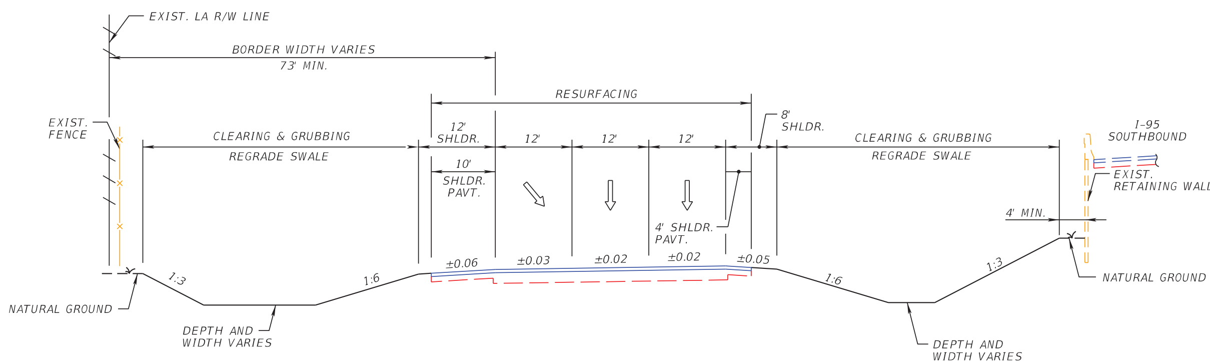

TYPICAL SECTION
I-95 RAMP A (SB ENTRANCE)

DESIGN SPEED = 35 - 55 MPH

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TYPICAL SECTION

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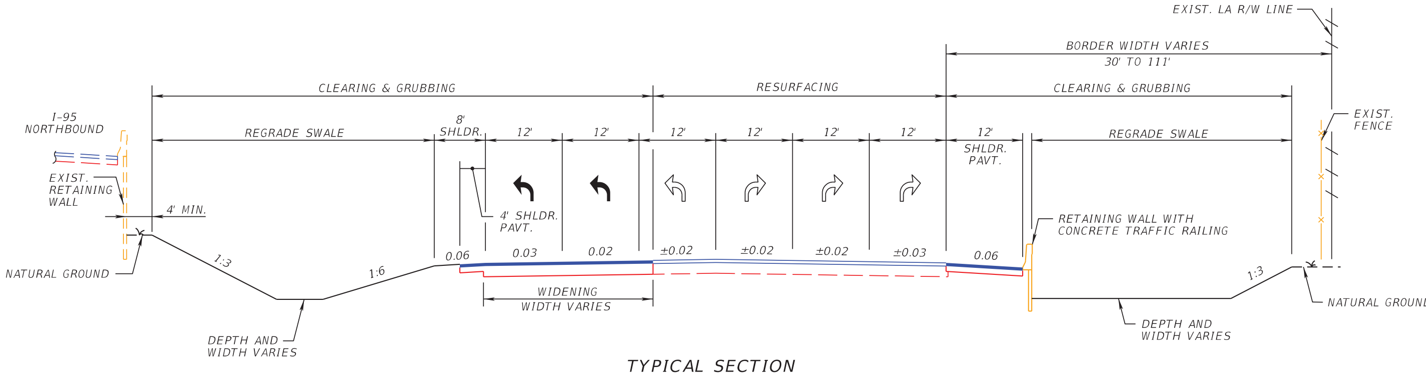

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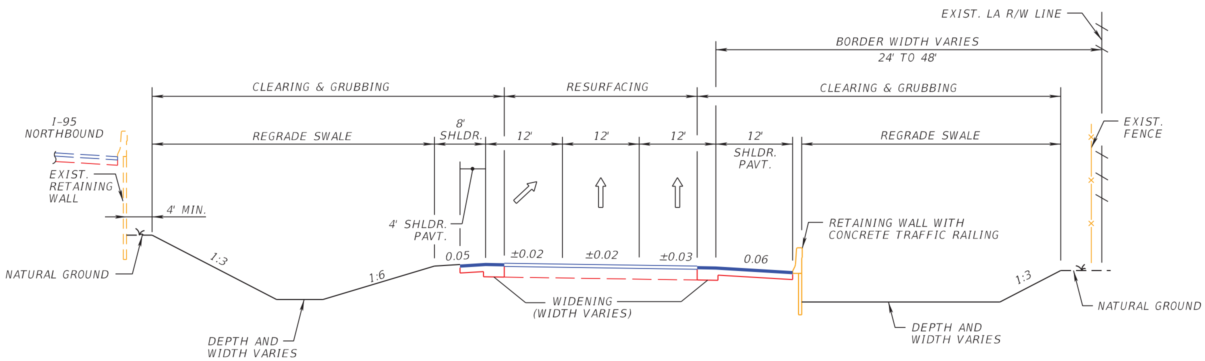

TYPICAL SECTION
I-95 RAMP C (NB ENTRANCE)
DESIGN SPEED = 35 - 55 MPH

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TYPICAL SECTION

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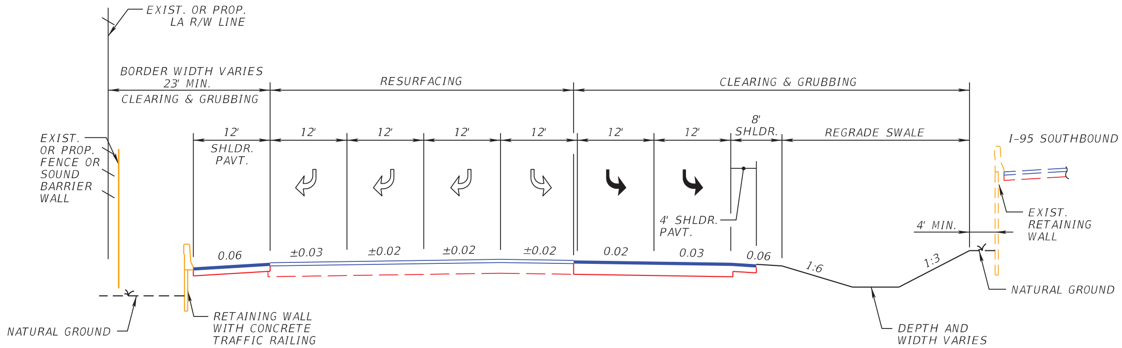
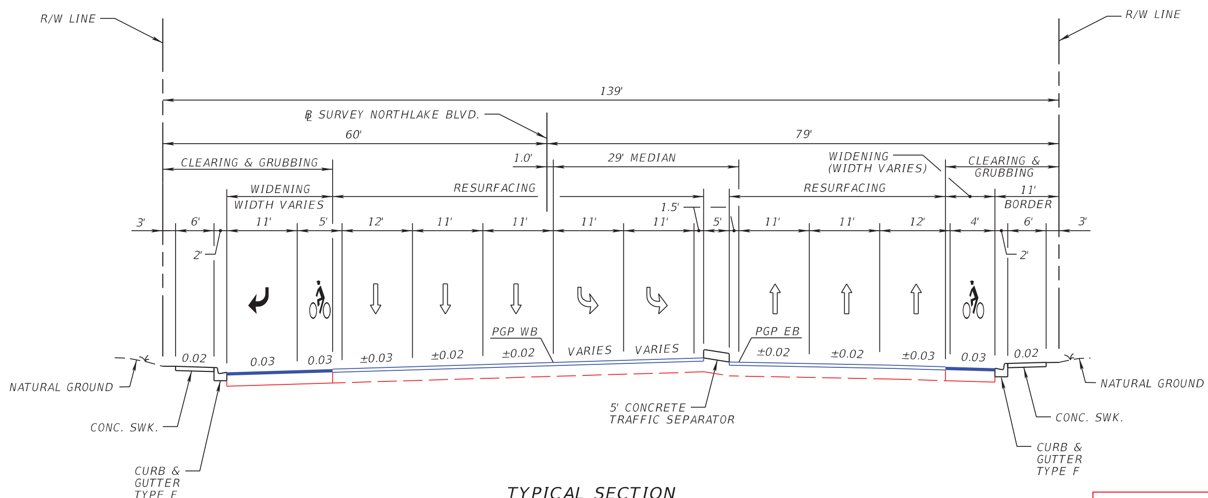


TYPICAL SECTION
I-95 RAMP D (SB EXIT)

DESIGN SPEED = 35 - 55 MPH



TYPICAL SECTION
NORTHLAKE BOULEVARD
EAST OF MILITARY TRAIL

DESIGN SPEED = 45 MPH

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TYPICAL SECTION

SHEET NO.
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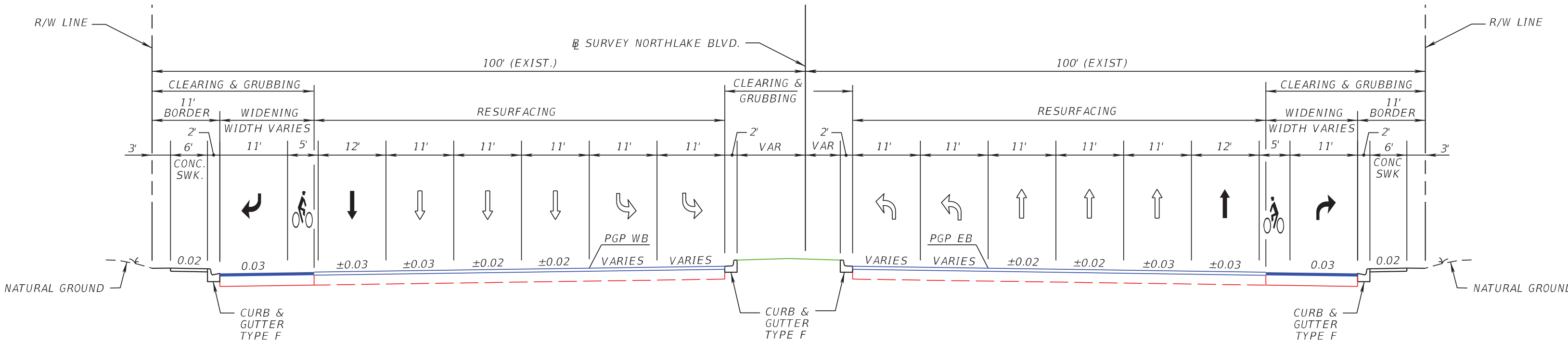
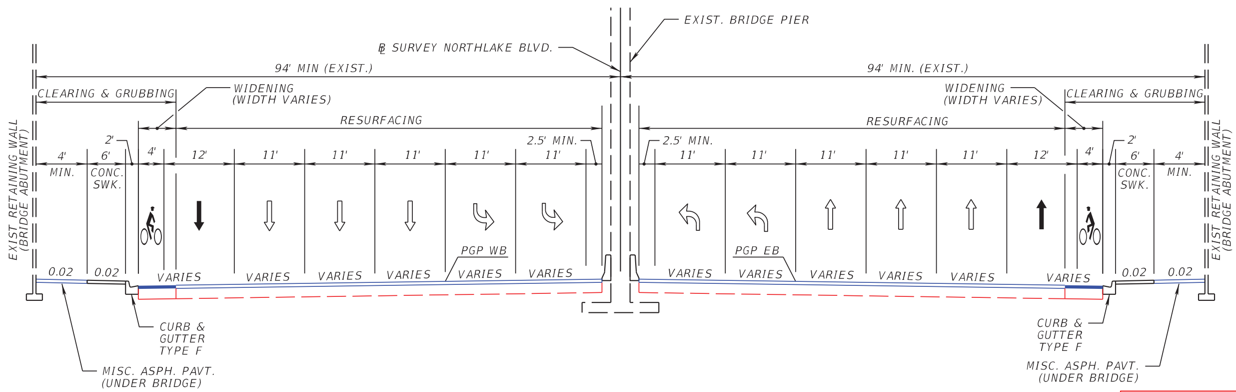


TYPICAL SECTION
NORTHLAKE BOULEVARD
WEST AND EAST APPROACHES TO I-95 INTERCHANGE

DESIGN SPEED = 45 MPH



TYPICAL SECTION
NORTHLAKE BOULEVARD
I-95 UNDERPASS

DESIGN SPEED = 45 MPH

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SR 9	PALM BEACH	435803-1-22-02

TYPICAL SECTION

SHEET NO.
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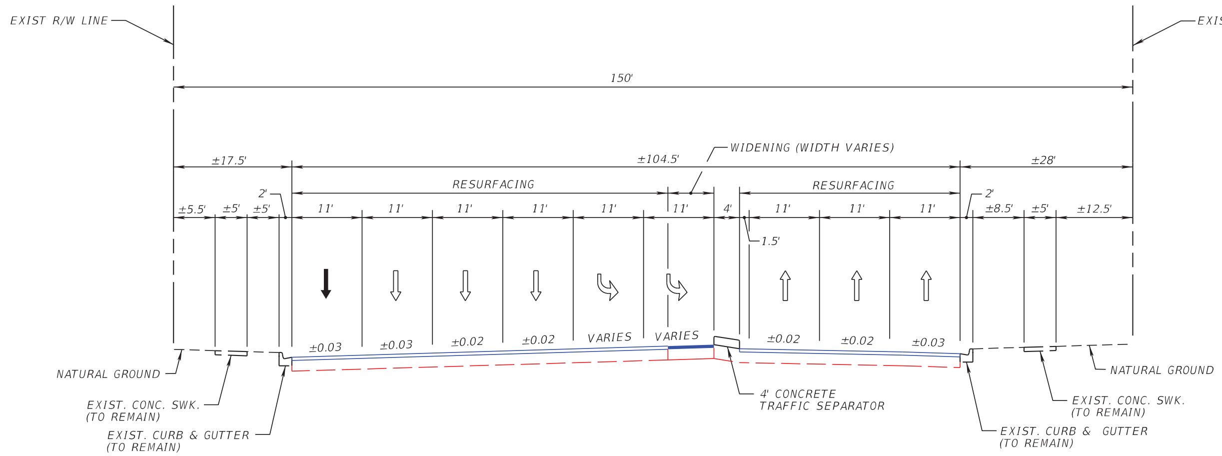

TYPICAL SECTION
NORTHLAKE BOULEVARD
EAST OF SUNRISE DRIVE

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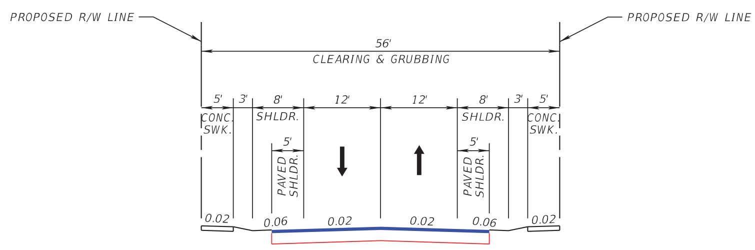

TYPICAL SECTION
SUNSET DRIVE CONNECTOR

DESIGN SPEED = 30 MPH

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TYPICAL SECTION

SHEET NO. 7

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Appendix B

Rainfall Data USGS Map

NOAA Atlas 14, Volume 9, Version 2
Location name: Palm Beach Gardens, Florida, USA*
Latitude: 26.8083°, Longitude: -80.0975°
Elevation: 15.74 ft**
* source: ESRI Maps
** source: USGS

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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.549 (0.431-0.694)	0.633 (0.496-0.802)	0.772 (0.603-0.981)	0.887 (0.690-1.13)	1.05 (0.790-1.39)	1.17 (0.865-1.58)	1.30 (0.928-1.80)	1.42 (0.982-2.04)	1.59 (1.06-2.36)	1.72 (1.12-2.60)
10-min	0.803 (0.630-1.02)	0.927 (0.727-1.17)	1.13 (0.883-1.44)	1.30 (1.01-1.66)	1.53 (1.16-2.03)	1.72 (1.27-2.31)	1.90 (1.36-2.63)	2.09 (1.44-2.98)	2.33 (1.55-3.45)	2.52 (1.64-3.80)
15-min	0.980 (0.769-1.24)	1.13 (0.886-1.43)	1.38 (1.08-1.75)	1.58 (1.23-2.02)	1.87 (1.41-2.48)	2.09 (1.55-2.82)	2.32 (1.66-3.21)	2.54 (1.75-3.64)	2.85 (1.89-4.21)	3.08 (2.00-4.64)
30-min	1.51 (1.19-1.92)	1.75 (1.37-2.22)	2.14 (1.67-2.72)	2.47 (1.92-3.15)	2.92 (2.20-3.86)	3.27 (2.41-4.40)	3.62 (2.59-5.02)	3.98 (2.75-5.70)	4.46 (2.97-6.60)	4.83 (3.14-7.28)
60-min	2.08 (1.63-2.64)	2.39 (1.88-3.03)	2.90 (2.27-3.69)	3.34 (2.59-4.26)	3.94 (2.97-5.22)	4.41 (3.26-5.94)	4.88 (3.50-6.77)	5.37 (3.71-7.69)	6.03 (4.01-8.92)	6.53 (4.25-9.85)
2-hr	2.65 (2.10-3.33)	3.03 (2.40-3.82)	3.67 (2.89-4.63)	4.20 (3.29-5.33)	4.95 (3.77-6.53)	5.54 (4.13-7.43)	6.14 (4.44-8.47)	6.76 (4.70-9.63)	7.60 (5.10-11.2)	8.24 (5.40-12.3)
3-hr	2.99 (2.38-3.75)	3.43 (2.72-4.30)	4.16 (3.29-5.24)	4.79 (3.77-6.06)	5.68 (4.34-7.47)	6.39 (4.78-8.54)	7.11 (5.16-9.79)	7.87 (5.50-11.2)	8.90 (6.00-13.1)	9.70 (6.39-14.5)
6-hr	3.51 (2.81-4.37)	4.12 (3.29-5.13)	5.16 (4.10-6.44)	6.06 (4.80-7.62)	7.38 (5.70-9.69)	8.45 (6.38-11.3)	9.57 (7.01-13.1)	10.7 (7.58-15.2)	12.4 (8.43-18.1)	13.7 (9.08-20.3)
12-hr	3.96 (3.19-4.90)	4.83 (3.88-5.97)	6.34 (5.08-7.87)	7.69 (6.13-9.59)	9.68 (7.56-12.7)	11.3 (8.64-15.1)	13.1 (9.66-17.9)	14.9 (10.6-21.1)	17.6 (12.1-25.6)	19.7 (13.2-29.0)
24-hr	4.60 (3.73-5.65)	5.62 (4.55-6.91)	7.45 (6.02-9.19)	9.13 (7.34-11.3)	11.7 (9.24-15.4)	13.9 (10.7-18.4)	16.2 (12.1-22.1)	18.7 (13.5-26.3)	22.3 (15.5-32.4)	25.3 (17.0-37.0)
2-day	5.61 (4.58-6.84)	6.55 (5.35-8.00)	8.33 (6.78-10.2)	10.0 (8.13-12.4)	12.8 (10.2-16.7)	15.1 (11.8-20.0)	17.7 (13.4-24.1)	20.6 (15.0-28.9)	24.8 (17.4-35.8)	28.2 (19.2-41.0)
3-day	6.27 (5.14-7.61)	7.17 (5.88-8.73)	8.92 (7.29-10.9)	10.6 (8.64-13.0)	13.3 (10.7-17.4)	15.7 (12.3-20.8)	18.4 (13.9-24.9)	21.3 (15.6-29.8)	25.6 (18.0-36.8)	29.1 (19.9-42.1)
4-day	6.81 (5.60-8.25)	7.68 (6.32-9.31)	9.38 (7.69-11.4)	11.1 (9.02-13.5)	13.7 (11.1-17.9)	16.1 (12.7-21.2)	18.7 (14.3-25.4)	21.7 (15.9-30.2)	26.0 (18.4-37.3)	29.6 (20.3-42.7)
7-day	8.14 (6.75-9.81)	8.90 (7.36-10.7)	10.4 (8.61-12.6)	12.0 (9.86-14.6)	14.6 (11.9-18.9)	16.9 (13.4-22.2)	19.6 (15.0-26.3)	22.5 (16.6-31.3)	26.9 (19.2-38.4)	30.6 (21.1-43.9)
10-day	9.18 (7.63-11.0)	9.95 (8.27-12.0)	11.5 (9.54-13.9)	13.1 (10.8-15.9)	15.7 (12.8-20.2)	18.1 (14.3-23.5)	20.7 (15.9-27.7)	23.7 (17.6-32.7)	28.1 (20.1-39.9)	31.7 (22.0-45.4)
20-day	11.8 (9.85-14.0)	13.0 (10.9-15.6)	15.3 (12.8-18.3)	17.3 (14.4-20.8)	20.4 (16.6-25.7)	22.9 (18.2-29.3)	25.6 (19.8-33.8)	28.6 (21.3-38.8)	32.7 (23.5-45.9)	36.1 (25.2-51.3)
30-day	14.1 (11.8-16.7)	15.8 (13.3-18.8)	18.7 (15.7-22.3)	21.1 (17.6-25.3)	24.6 (20.0-30.6)	27.4 (21.8-34.6)	30.2 (23.3-39.3)	33.1 (24.6-44.5)	37.0 (26.6-51.5)	40.1 (28.2-56.7)
45-day	17.3 (14.6-20.5)	19.5 (16.5-23.1)	23.1 (19.4-27.4)	26.0 (21.7-31.0)	29.9 (24.3-36.8)	32.8 (26.2-41.2)	35.8 (27.7-46.2)	38.7 (28.9-51.6)	42.5 (30.6-58.6)	45.3 (32.0-63.8)
60-day	20.3 (17.2-24.0)	22.8 (19.4-27.0)	26.8 (22.7-31.8)	30.0 (25.2-35.7)	34.2 (27.8-41.9)	37.3 (29.8-46.6)	40.4 (31.3-51.9)	43.3 (32.4-57.5)	47.0 (34.0-64.5)	49.7 (35.2-69.8)

[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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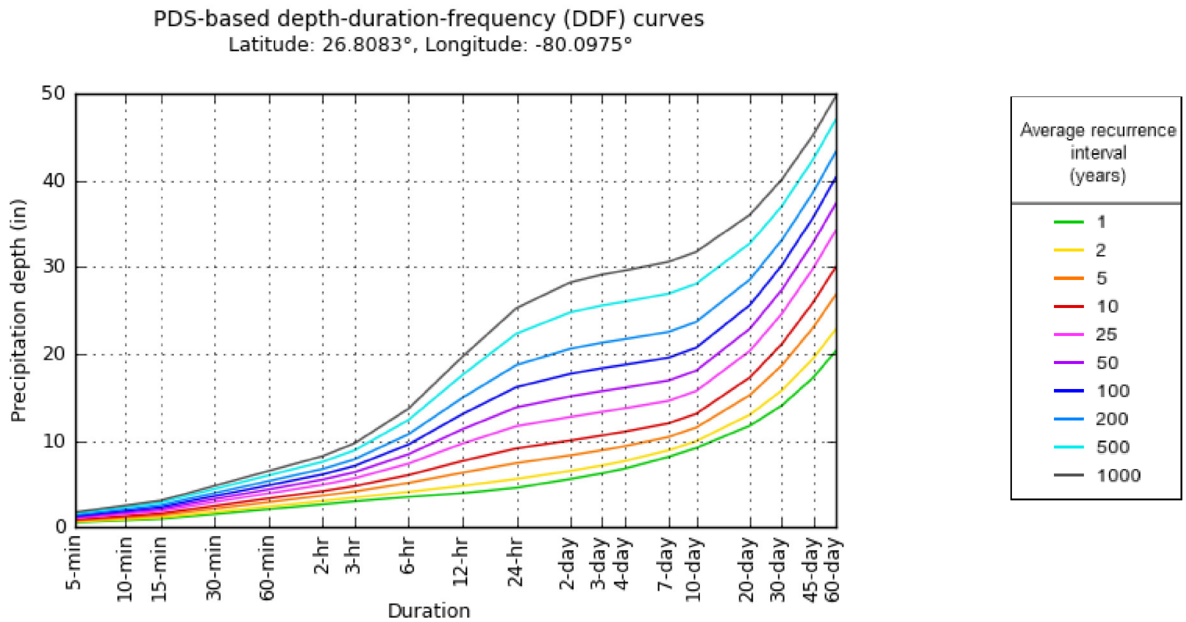
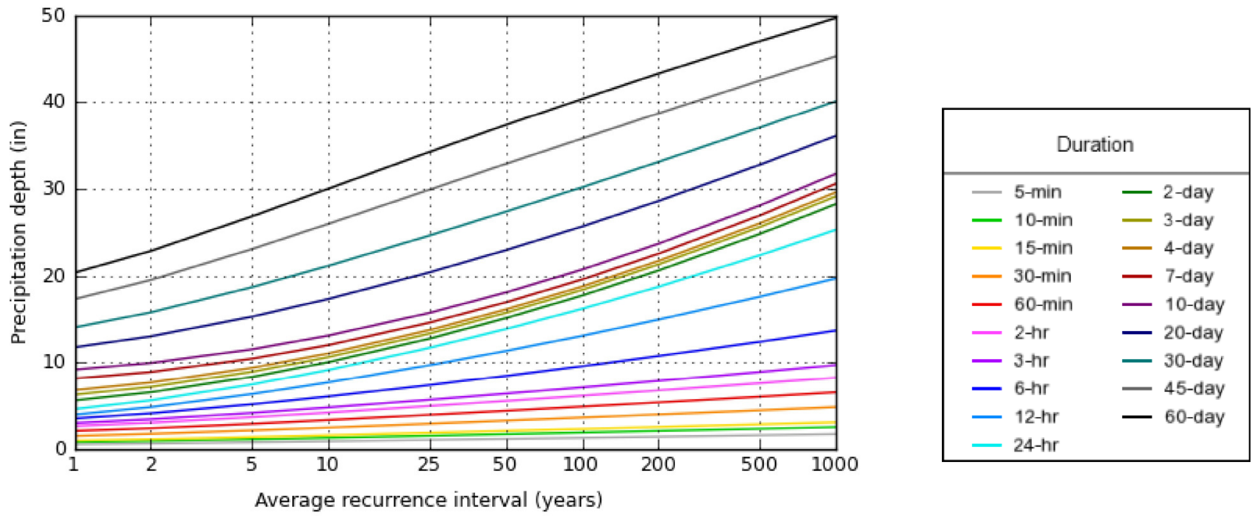
PF graphical





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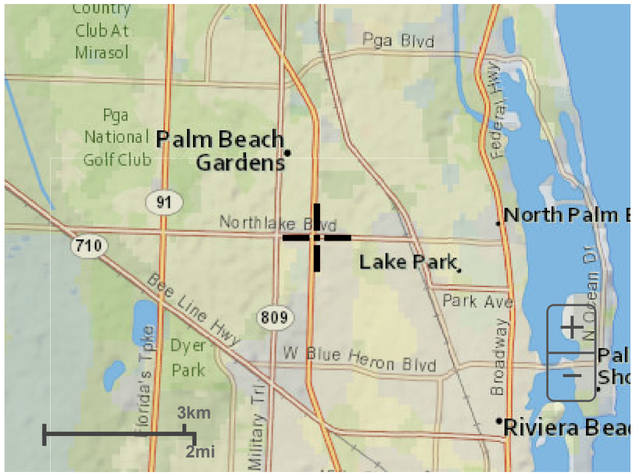
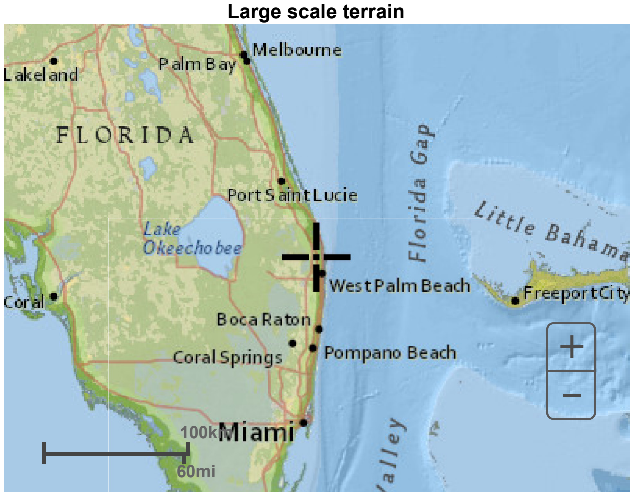
Maps & aerials

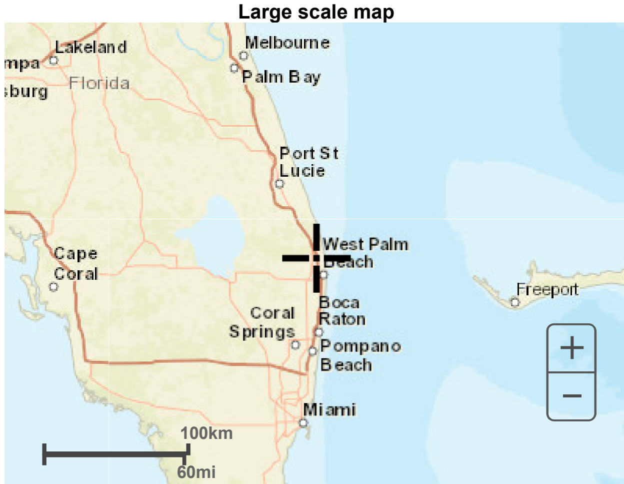
Small scale terrain



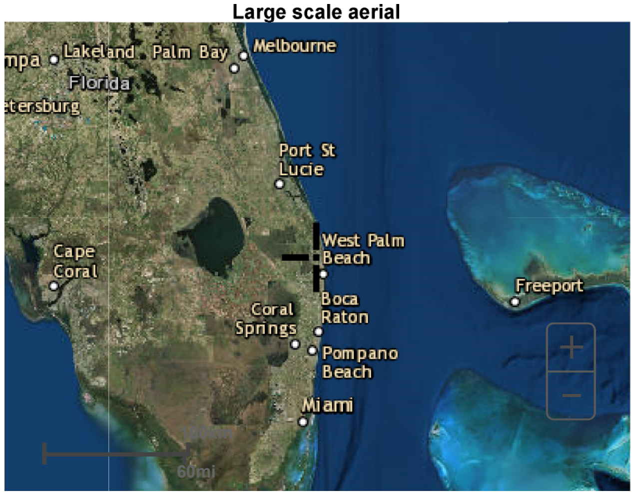
Large scale terrain



Large scale map



Large scale aerial



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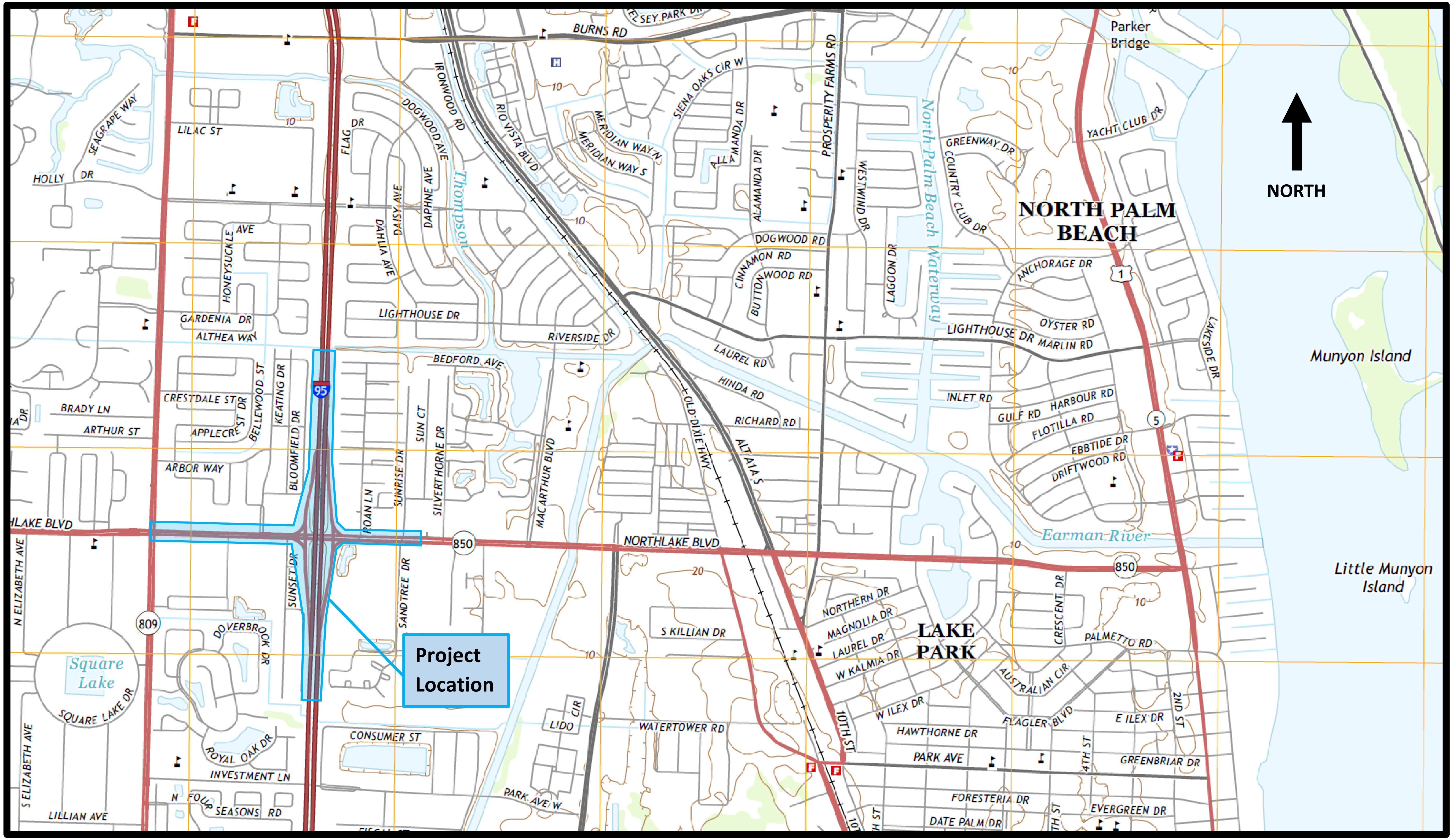


NORTH
NORTH PALM BEACH
LAKE PARK
Project Location
NORTHLAKE BLVD
Munyon Island
Little Munyon Island
Parker Bridge
Square Lake
North Palm Beach Waterway
Earman River
Thompson
BURNS RD
PROSPERITY FARMS RD
LIGHTHOUSE DR
ALT A1A S
OLD DIXIE HWY

Appendix C

Treatment Volume Calculations

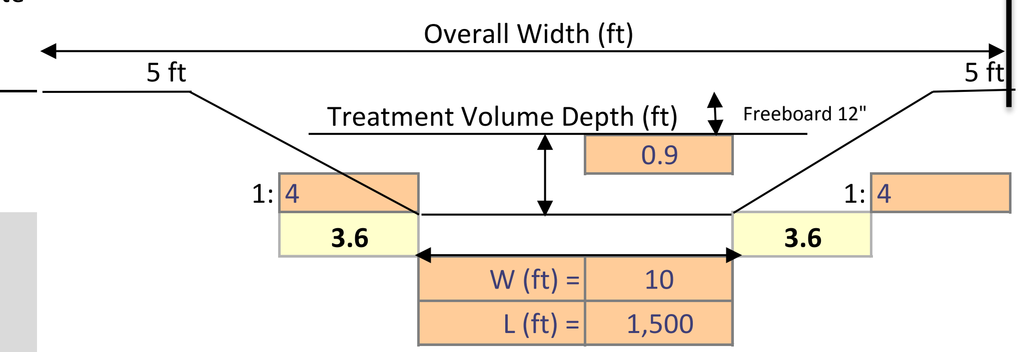
Designed By: R Olivier
Reviewed By: ___________

TREATMENT VOLUME REQUIRED -- MODIFIED CONCEPT ALTERNATIVE

Basin Area Name	Roadway ID	Total Basin Area	Pervious Area	Impervious Area to be treated[1]	2.5" x Impervious area (Wet Detention)[4]	1" x Basin area (Wet Detention)[4]	Greater of 1" or 2.5" (Wet Detention)[4]	Is Basin Discharging to an OFW?	Proposed type of treatment	Treatment Volume Required[2]	Available Volume (Roadside Swales or Infields)	Avg. Bottom Width Pond	Length Pond	Treat Vol Satisfied?	See Note
		(acres)	(acres)	(acres)	(ac-ft)	(ac-ft)	(ac-ft)		(ac-ft)	(ac-ft)	(ac-ft)	(ft)	(ft)		
A1	Ramp A	There are no proposed improvements in this basin						No		There are no proposed improvements in this basin				N/A	
A2	Ramp A	There are no proposed improvements in this basin						No		There are no proposed improvements in this basin				N/A	
A3	Ramp A	There are no proposed improvements in this basin						No		There are no proposed improvements in this basin				N/A	
B1	Ramp B	4.27	1.13	3.14	0.65	0.36	0.65	No	Dry Detention[2]	0.49	0.58	20	650	Yes	
B2	Ramp B	1.93	1.12	0.81	0.17	0.16	0.17	No	Dry Detention[2]	0.13	0.56	20	630	Yes	
B3	Ramp B	5.76	1.38	4.38	0.91	0.48	0.91	No	Dry Detention[2]	0.68	0.84	12	1,350	Yes	
B4	Ramp B	1.45	0.54	0.91	0.19	0.12	0.19	No	Dry Detention[2]	0.14	0.33	12	530	Yes	
C1	Ramp C	3.07	1.24	1.83	0.38	0.26	0.38	No	Dry Detention[2]	0.29	0.49	20	550	Yes	
C2	Ramp C	1.92	0.75	1.17	0.24	0.16	0.24	No	Dry Detention[2]	0.18	0.37	8	775	Yes	
C3	Ramp C	4.68	1.08	3.60	0.75	0.39	0.75	No	Dry Detention[2]	0.56	0.83	10	1,500	Yes	
C4	Ramp C	4.16	1.43	2.73	0.57	0.35	0.57	No	Dry Detention[2]	0.43	0.56	15	1,450	Yes	
D1	Ramp D	4.56	1.43	3.13	0.65	0.38	0.65	No	Dry Detention[2]	0.49	0.64	35	450	Yes	3
D2	Ramp D	1.15	0.55	0.60	0.13	0.10	0.13	No	Dry Detention[2]	0.09	0.30	5	800	Yes	
D3	Ramp D	5.28	1.15	4.13	0.86	0.44	0.86	No	Dry Detention[2]	0.65	0.77	10	1,400	Yes	
D4	Ramp D	1.06	0.21	0.85	0.18	0.09	0.18	No	Dry Detention[2]	0.13	0.13	10	240	No	
Total		39.29	12.01	27.28						4.26	6.40			Yes	

Notes:
1. The areas were determined using Microstation Area Tool with TOPORD and DSGNRD files.
2. The proposed BMP is Dry Detention. The minimum treatment volume is based on 75% of wet detention calculation.
3. Need to regrade/excavate close to MSE wall for larger infield area for drainage. Clear/grub landscape required.
4. The project is permitted and existing infields/swales already provide water quality. Therefore, estimate ALL the POST impervious area for each sub-basin to determine TV req'd

WORK SHEET



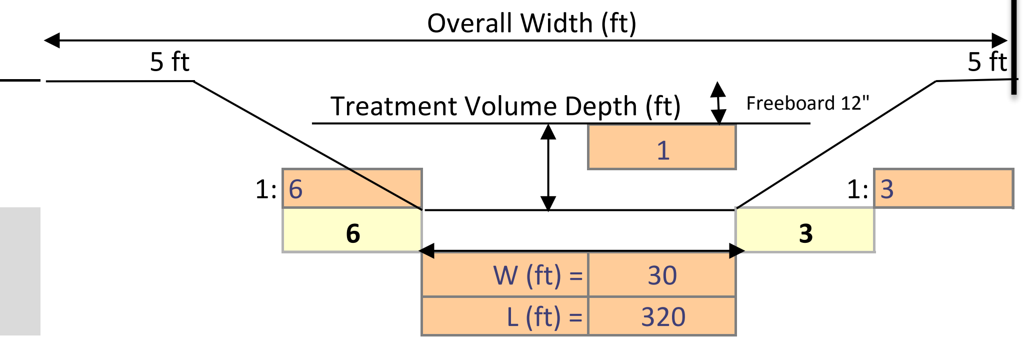
Volume = 12.24 sq.ft.
Volume = 0.42 ac-ft
Overall W = 29.2 ft

Approach:
Calculate total basin area and available green space for SWM.
Calculate treatment volume required for total basin areas.
Estimate increased runoff and attenuation volume for total basin areas.
Compare available green space for SWM vs. total TV and AV required.
If available green space is > total volume required, ok.
If not, then need offsite area to manage stormwater.

TREATMENT VOLUME REQUIRED -- DIVERGING DIAMOND ALTERNATIVE

Basin Area Name	Roadway ID	Total Basin Area (acres)	Pervious Area (acres)	Impervious Area to be treated[1] (acres)	2.5" x Impervious area (Wet Detention)[4] (ac-ft)	1" x Basin area (Wet Detention)[4] (ac-ft)	Greater of 1" or 2.5" (Wet Detention)[4] (ac-ft)	Is Basin Discharging to an OFW?	Proposed type of treatment (ac-ft)	Treatment Volume Required[2] (ac-ft)	Available Volume (Roadside Swales or Infields) (ac-ft)	Avg. Bottom Width Pond (ft)	Length Pond (ft)	Treat Vol Satisfied?	See Note
A1	Ramp A	2.56	1.21	1.35	0.28	0.21	0.28	No	Dry Detention[2]	0.21	0.79	18	930	Yes	
A2	Ramp A	3.16	1.58	1.58	0.33	0.26	0.33	No	Dry Detention[2]	0.25	0.51	30	350	Yes	
A3	Ramp A	There are no proposed improvements in this basin						No		There are no proposed improvements in this basin				N/A	
B1	Ramp B	4.27	1.37	2.90	0.60	0.36	0.60	No	Dry Detention[2]	0.45	0.46	30	575	Yes	
B2	Ramp B	2.24	0.92	1.32	0.27	0.19	0.27	No	Dry Detention[2]	0.21	0.37	15	500	Yes	
B3	Ramp B	There are no proposed improvements in this basin								There are no proposed improvements in this basin				N/A	
C1	Ramp C	3.07	1.03	2.04	0.43	0.26	0.43	No	Dry Detention[2]	0.32	0.32	30	400	Yes	
C2	Ramp C	2.26	0.48	1.78	0.37	0.19	0.37	No	Dry Detention[2]	0.28	0.30	18	650	Yes	
C3	Ramp C	4.68	1.24	3.44	0.72	0.39	0.72	No	Dry Detention[2]	0.54	0.56	12	1,700	Yes	
C4	Ramp C	4.16	1.83	2.33	0.49	0.35	0.49	No	Dry Detention[2]	0.36	0.72	20	1,450	Yes	
D1	Ramp D	4.56	1.01	3.55	0.74	0.38	0.74	No	Dry Detention[2]	0.55	0.25	30	320	No	3
D2	Ramp D	1.15	0.24	0.91	0.19	0.10	0.19	No	Dry Detention[2]	0.14	0.06	8	220	No	3
D3	Ramp D	There are no proposed improvements in this basin								There are no proposed improvements in this basin				N/A	
Total		32.11	10.91	21.20						3.31	4.34			Yes	

WORK SHEET



Volume = 34.5 sq.ft.

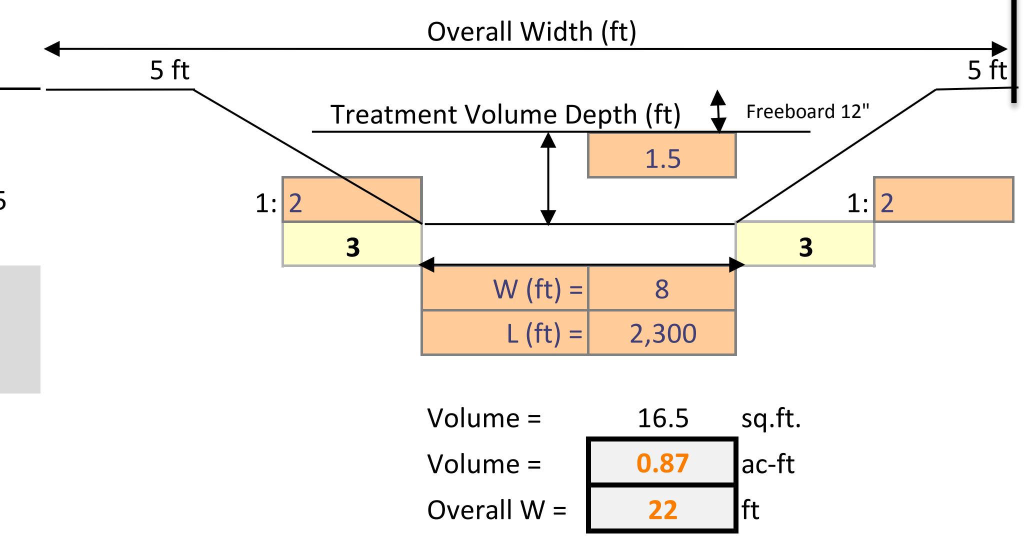
Volume = 0.25 ac-ft
Overall W = 52 ft

Notes:
1. The areas were determined using Microstation Area Tool with TOPORD and DSGNRD files.
2. The proposed BMP is Dry Detention. The minimum treatment volume is based on 75% of wet detention calculation.
3. Use compensative treatment approach. Overtreat within basin D1 and obtain SFWMD concurrence during design phase. OR reconstruct MSE wall along I-95 to provide more volume.
4. The project is permitted and existing infields/swales already provide water quality. Therefore, estimate ALL the POST impervious area for each sub-basin to determine TV req'd

TREATMENT VOLUME REQUIRED -- FLYOVER (FO) CONCEPT ALTERNATIVE

Basin Area Name	Roadway ID	Total Basin Area (acres)	Pervious Area (acres)	Impervious Area to be treated[1] (acres)	2.5" x Impervious area (Wet Detention)[6] (ac-ft)	1" x Basin area (Wet Detention)[4] (ac-ft)	Greater of 1" or 2.5" (Wet Detention)[4] (ac-ft)	Is Basin Discharging to an OFW?	Proposed type of treatment (ac-ft)	Treatment Volume Required[2] (ac-ft)	Available Volume (Roadside Swales or Infields) (ac-ft)	Avg. Bottom Width Pond (ft)	Length Pond (ft)	Treat Vol Satisfied?	See Note
A1	Ramp A	2.56	1.57	0.99	0.21	0.21	0.21	No	Dry Detention[2]	0.16	0.99	30	800	Yes	
A2	Ramp A	3.58	0.95	2.63	0.55	0.30	0.55	No	Dry Detention[2]	0.41	0.43	30	350	Yes	
A3	Ramp A	4.65	0.52	4.13	0.86	0.39	0.86	No	Dry Detention[2]	0.65	0.39	4	1,600	No	5
A4	Ramp A	6.14	1.32	4.82	1.00	0.51	1.00	No	Dry Detention[2]	0.75	0.87	8	1900	Yes	
B1	Ramp B	4.7	1.29	3.41	0.71	0.39	0.71	No	Dry Detention[2]	0.53	0.58	20	650	Yes	
B2	Ramp B	1.93	1.13	0.80	0.17	0.16	0.17	No	Dry Detention[2]	0.13	0.56	20	630	Yes	
B3	Ramp B	There are no proposed improvements in this basin								There are no proposed improvements in this basin				N/A	
C1	Ramp C	3.35	0.96	2.39	0.50	0.28	0.50	No	Dry Detention[2]	0.37	0.38	20	420	Yes	
C2	Ramp C	1.92	0.82	1.10	0.23	0.16	0.23	No	Dry Detention[2]	0.17	0.72	20	800	Yes	
C3	Ramp C	4.68	1.25	3.43	0.71	0.39	0.71	No	Dry Detention[2]	0.54	0.68	10	1,800	Yes	
C4	Ramp C	6.2	2.35	3.85	0.80	0.52	0.80	No	Dry Detention2	0.60	1.66	20	2,100	Yes	
D1	Ramp D	4.98	1.14	3.84	0.80	0.42	0.80	No	Dry Detention[2]	0.60	0.63	30	510	Yes	
D2	Ramp D	1.15	0.44	0.71	0.15	0.10	0.15	No	Dry Detention[2]	0.11	0.16	12	260	Yes	
D3	Ramp D	There are no proposed improvements in this basin								There are no proposed improvements in this basin				N/A	
Total		45.84	13.74	32.10						5.02	8.05			Yes	

WORK SHEET



Notes:
1. The areas were determined using Microstation Area Tool with TOPORD and DSGNRD files.
2. The proposed BMP is Dry Detention. The minimum treatment volume is based on 75% of wet detention calculation.
3. Runoff from the EB to NB flyover is captured and conveyed to the interchange infields beginning at STA 32+00.
4. Runoff from the WB to SB flyover is captured and conveyed to the interchange infields beginning at STA 41+00.
5. Use compensative treatment approach. Overtreat within basin A1 and C1 and obtain SFWMD concurrence during design phase.
6. The project is permitted and existing infields/swales already provide water quality. Therefore, estimate ALL the POST impervious area for each sub-basin to determine TV req'd

WATERSHED CHARACTERISTICS V 8.4

GO TO STORMWATER TREATMENT ANALYSIS

Blue Numbers =	Input data
Red Numbers =	Calculated

HELP - LAND USES/EMC

SELECT CATCHMENT CONFIGURATION 5/10/2017

CLICK ON CELL BELOW TO SELECT CONFIGURATION

A - Single Catchment

VIEW CATCHMENT CONFIGURATION

GO TO GENERAL SITE INFORMATION PAGE

For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of concentration at a one inch/hour rain

VIEW AVERAGE ANNUAL RUNOFF "C" Factor

VIEW EMC & FLUCCS

GO TO GIS LANDUSE DATA

Delay [hrs]

max delay = 15 hrs,

CATCHMENT NO.1 NAME: Northlake Blvd. Pond

	CLICK ON CELL BELOW TO SELECT
Pre-development land use: with default EMCs	Highway: TN=1.520 TP=0.200
	CLICK ON CELL BELOW TO SELECT
Post-development land use: with default EMCs	Highway: TN=1.520 TP=0.200

Total pre-development catchment area:		AC
Total post-development catchment or for BMP analysis:	18.40	AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:	92.30	
Post-development DCIA percentage:	85.00	%
Estimated BMPArea (No loading from this area)	0.00	AC

OVERWRITE DEFAULT CONCENTRATIONS USING:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):	68.225	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**	127.892	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	16.828	kg/year

CATCHMENT NO.2 NAME:

	CLICK ON CELL BELOW TO SELECT
Pre-development land use: with default EMCs	
	CLICK ON CELL BELOW TO SELECT
Post-development land use: with default EMCs	

Total pre-development catchment area:		AC
Total post-development catchment or BMP analysis area:		AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:		
Post-development DCIA percentage:		%
Estimated BMPArea (No loading from this area)		AC

OVERWRITE DEFAULT CONCENTRATIONS:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

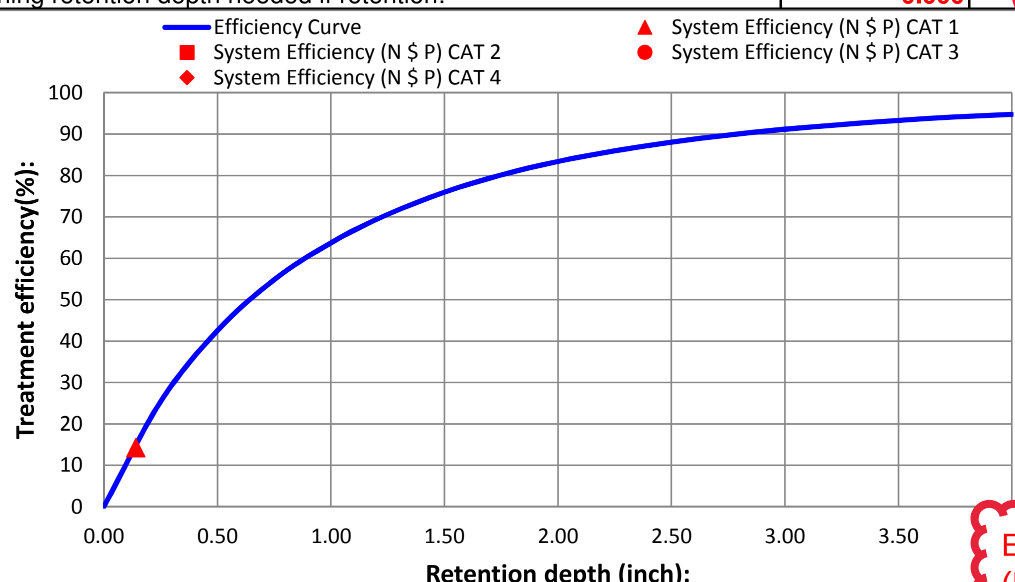
Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):		ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**		kg/year
Post-development Annual Mass Loading - **Phosphorus:**		kg/year

EXFILTRATION TRENCH: 5/10/2017 V 8.4

EXFILTRATION TRENCH SERVING:	I-95 at Northlake Blvd.				
Note: There are loadings from this BMP area above the trench.	Northlake Blvd. Pc	Catchment 2	Catchment 3	Catchment 4	
Contributing catchment area:	18.400	0.000	0.000	0.000	ac
Required treatment efficiency (**Nitrogen**):	TBD				%
Required treatment efficiency (**Phosphorus**):	TBD				%
Required retention for the entire catchment to meet required efficiency:	0.000	0.000	0.000	0.000	in
Required water quality retention volume:	0.000	0.000	0.000	0.000	ac-ft

This is an underground system, thus there is no surface area loading reduction for the area of exfiltration

Provided retention depth(0.1-3.99 inches):	0.140				in
Provided treatment efficiency (**Nitrogen**):	14.212	0.000	0.000	0.000	%
Provided treatment efficiency (**Phosphorus**):	14.212	0.000	0.000	0.000	%
Remaining treatment efficiency needed (**Nitrogen)**:					%
Remaining treatment efficiency needed (**Phosphorus)**:					%
Remaining retention depth needed if retention:	0.000	0.000	0.000	0.000	in



NOTE FOR TREATMENT EFFICIENCY GRAPH:

The purpose of this graph is to help illustrate the treatment efficiency of the retention system as the function of retention depth. The graph illustrates that there is a point of diminished return as the retention depth is substantially increased. Therefore, to provide the most economical BMP treatment system, other alternatives such as "treatment trains" and compensatory treatment should be considered.

Existing Efficiency
(Exfiltration trench)
14.2% TN
14.2% TP

EXFILTRATION STORAGE CALCULATOR:	V 8.4

Blue Numbers =	Input data
Red Numbers =	Calculated or Carryover

GO BACK TO SINGLE EXFILTRATION TRENCH

CLEAR INPUT FOR THE CALCULATOR

PIPE INPUT:

Pipe span:	24.00	in
Pipe rise:	24.00	in
Total pipe length:	1230.00	ft
Volume in pipe(s):	3,864.2	cf

TRENCH INPUT:

Trench length =	1230.0	ft
Trench width =	5.0	ft
Trench depth =	5.0	ft
Aggregate void ratio =	0.20	

REQUIRED STORAGE VOLUME:

if serving the entire watershed

0.000	ac-ft	0	cf

if part of the watershed (treatment train)

0.215	ac-ft	9351	cf

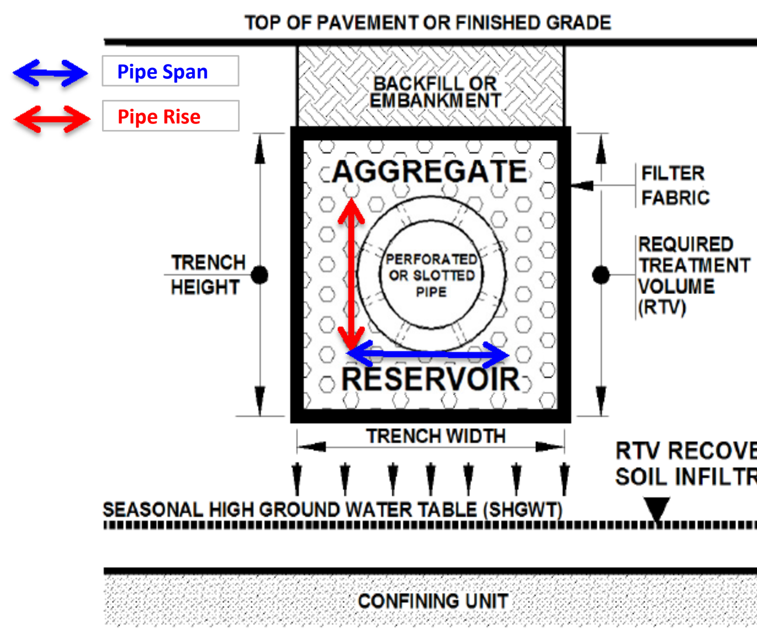
PROVIDED STORAGE VOLUME:

0.212	ac-ft	9,241	cf

ERROR MESSAGE WINDOW FOR EXFILTRATION STORAGE

THE PROVIDED EXFILTRATION TRENCH VOLUME IS GREATER THAN THE REQUIRED TREATMENT VOLUME

THE PROVIDED EXFILTRATION TRENCH DIMENSIONS ARE ADEQUATE



TYPICAL "DRY" EXFILTRATION TRENCH X-SECTION

Source of Graphic: draft **STORMWATER QUALITY APPLICANT'S HANDBOOK** dated March 2010, by the Department of Environmental Protection, available at: http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater, March 2010

WATERSHED CHARACTERISTICS V 8.4

GO TO STORMWATER TREATMENT ANALYSIS

Blue Numbers =	Input data
Red Numbers =	Calculated

HELP - LAND USES/EMC

SELECT CATCHMENT CONFIGURATION

5/10/2017

CLICK ON CELL BELOW TO SELECT CONFIGURATION

A - Single Catchment

VIEW CATCHMENT CONFIGURATION

GO TO GENERAL SITE INFORMATION PAGE

For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of concentration at a one inch/hour rain

Delay [hrs]

max delay = 15 hrs,

VIEW AVERAGE ANNUAL RUNOFF "C" Factor

VIEW EMC & FLUCCS

GO TO GIS LANDUSE DATA

CATCHMENT NO.1 NAME: Northlake Blvd. Pond

Pre-development land use: with default EMCs	CLICK ON CELL BELOW TO SELECT: Highway: TN=1.520 TP=0.200	
Post-development land use: with default EMCs	CLICK ON CELL BELOW TO SELECT: Highway: TN=1.520 TP=0.200	
Total pre-development catchment area:		AC
Total post-development catchment or for BMP analysis:	18.80	AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:	95.80	
Post-development DCIA percentage:	100.00	%
Estimated BMPArea (No loading from this area)	2.39	AC

OVERWRITE DEFAULT CONCENTRATIONS USING:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):	66.296	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**	124.276	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	16.352	kg/year

CATCHMENT NO.2 NAME:

Pre-development land use: with default EMCs	CLICK ON CELL BELOW TO SELECT	
Post-development land use: with default EMCs	CLICK ON CELL BELOW TO SELECT	
Total pre-development catchment area:		AC
Total post-development catchment or BMP analysis area:		AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:		
Post-development DCIA percentage:		%
Estimated BMPArea (No loading from this area)		AC

OVERWRITE DEFAULT CONCENTRATIONS:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

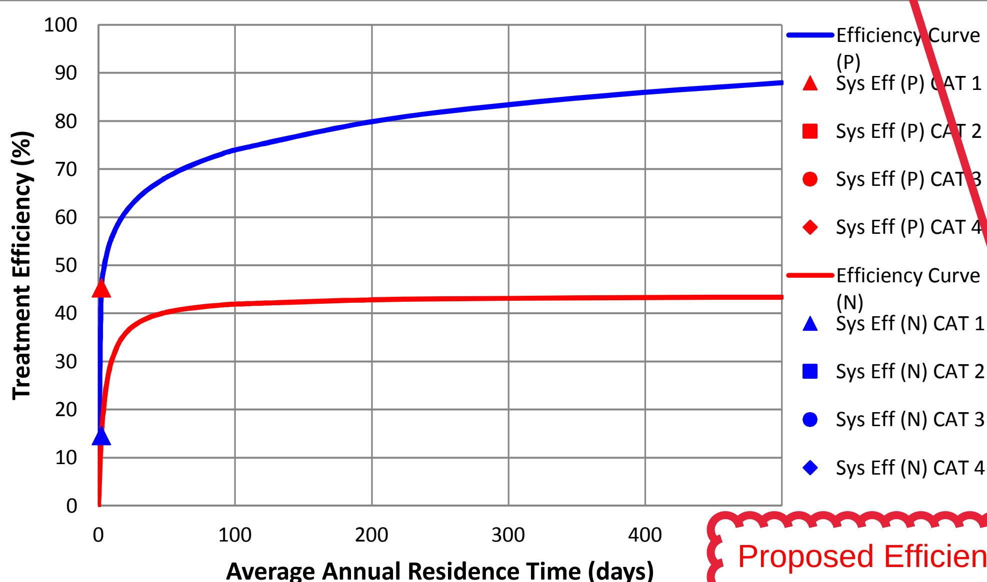
Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):		ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**		kg/year
Post-development Annual Mass Loading - **Phosphorus:**		kg/year

WET DETENTION/ MANAGED AQUATIC PLANTS:					5/10/2017 V 8.4
Also called: FLOATING ISLANDS and includes a wet detention pond:					I-95 at Northlake Blvd.
	Northlake Blvd. P	Catchment 2	Catchment 3	Catchment 4	
Total pre-development catchment area:	0.000	0.000	0.000	0.000	ac
Total post-development catchment area:	16.410	0.000	0.000	0.000	ac
Average annual residence time (between 1 and 500 days)	2.19				days
Littoral Zone or other improvements used?*	NO				
Littoral Zone or other improvement efficiency credit:					%
Floating Wetland or Mats used in the design:	NO				
Floating Wetland or Mats credit:					%
Total **Nitrogen** removal required:	TBD	TBD	TBD	TBD	%
Total **Phosphorus** removal required:	TBD	TBD	TBD	TBD	%
Total **Nitrogen** removal efficiency:	14.583	0.000	0.000	0.000	%
Total **Phosphorous** removal efficiency:	45.256	0.000	0.000	0.000	%
Is the wet detention sufficient:	NO				
Average annual runoff volume:	66.296				ac-ft/yr

* pond coverage must follow Regulatory Requirements

Wet Detention Pond Characteristic:

Minimum Pond Permanent Pool Volume:	0.398				ac-ft



NOTE FOR TREATMENT EFFICIENCY GRAPH:

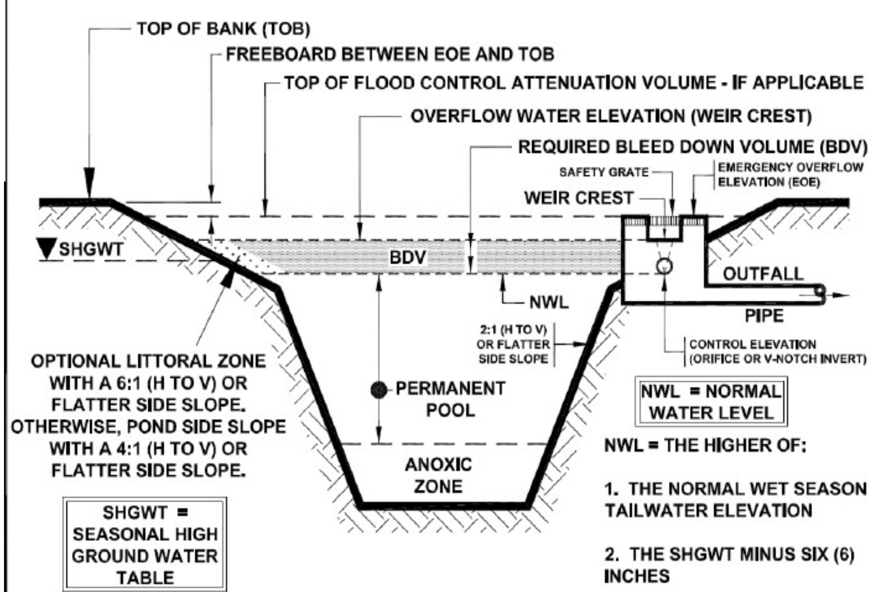
The purpose of the treatment efficiency graphs is to help illustrate the treatment efficiency of the wet detention system as the function of average annual residence time (and permanent pool volume). The graph illustrates that there is a point of diminished return as the permanent pool volume is substantially increased. Therefore, to provide the most economical BMP treatment system, other alternatives such as "treatment trains" and compensatory treatment should be

Proposed Efficiency (Wet Detention Pond)
14.5% TN
45.2% TP
Both TN and TP are greater than existing removal efficiencies and demonstrate a net improvement.

Blue Numbers =	Input data
Red Numbers =	Calculated or Carryover

GO TO STORMWATER TREATMENT ANALYSIS

REQUIRED REMAINING TREATMENT EFFICIENCIES OF TREATMENT SYSTEM IN SERIES WITH FLOATING ISLANDS WITH WET DETENTION. USE FOR SIZING OF TREATMENT SYSTEM IN SERIES WITH FLOATING ISLANDS WITH WET DETENTION.



TYPICAL X-SECTION OF A WET DETENTION SYSTEM

Source of Graphic: draft **STORMWATER QUALITY APPLICANT'S HANDBOOK** dated March 2010, by the Department of Environmental Protection, available at: http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater, March 2010

What is the retention depth provided by the existing exfiltration trench?

Trench Length	1,230	ft
Provided Storage Volume	0.212	ac-ft
Project Area	18.43	ac
Provided Retention Depth	**0.14**	**in**

What is the estimated discharge from pond?

Assume 3" orifice bleeder

Head[1]	0.5	ft
X sectional area of orifice	0.7854	sqft
Flow through orifice	**3.0**	**cfs**

What is depth of pond?	10	ft
What is surface water area?	1.3	ac
Estimate of permanent pool volume?	**566,280**	**cuft**
What is average annual residence time?	**2.19**	**days**

min. depth of pond, surface water area and residence time to achieve a net improvement in TN and TP removal eff.

Notes:
1. Need 0.36ft TV depth over 1.3 acre pond (water surface area) to satisfy treatment volume required. Therefore the 0.5 ft Head estimate is reasonable.

Appendix D

Attenuation Volume Calculation Pond Size Estimates

Project Description	Determine treatment volume required for Modified Concept Area B1 and B2 (Associated with Ramp B)		
STEP 1	Determine the Receiving Water Body	EPB 6A Canal	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	N/A	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	6.23 acres	B1 and B2 areas
STEP 6	What is the amount of pervious area	2.25 acres	B1 and B2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	0.83 acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.62 acre-ft	

Project Description Determine attenuation volume required for Modified Concept Area B1 and B2 (Associated with Ramp B)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.27	98	
Pervious *	2.96	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	6.23	87	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 63.9%

	Area (ac.)	CN	
Roadway Pvmt	3.98	98	
Pervious *	2.25	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	6.23	89	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	1.55	1.19
Runoff Depth (Q) inches =	14.48	14.85
Runoff Volume (ac-ft) =	7.52	7.71

Volume Difference = 0.19 ac-ft

The estimated attenuation volume is the volume difference 0.19 ac-ft
8368.3 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area B1 and B2 (Associated with Ramp B).				
STEP 1	**Identify system type and available Height of volume**				
	Modify existing dry detention pond.				
	Max stage, A	12.00	feet (estimated shldr or ground elev)		
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)		
	Freeboard requirment is, C	1.00	feet		
	Height of available volume is	1.00	feet (A-B-C)		
STEP 2	**The total peak storage volume required is**				
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume				
	$Volume_{PEAK}$ =	35457	cu.ft.		
STEP 3	**Use the formula for a rectangular box to determine the water surface**				
	area of a pond with vertical sides				
	Volume =	$L_{RECT}\ W_{RECT}\ H$			
	Assume L/W = 2				
	L_{RECT} =	266	feet		
	W_{RECT} =	133	feet		
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**				
	Side slope adj for 4 (H) : 1 (V)	4	feet	z factor	4
	Length at top of slope, L_{TOP} =	270	feet		
	Width at top of slope, W_{TOP} =	137	feet		
STEP 5	**The Water Surface at Peak Design Stage**				
	$Area_{WATER\ SURFACE}$	0.9	acres		

Project Description	Determine the R/W area needed for Modified Concept Area B1 and B2 (Associated with Ramp B).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	270	feet	
	W_{TOP} =	137	feet	
	Length	L_{TOP} + 2(Berm width) =	280	feet
	Width	W_{TOP} + 2(Berm width) =	147	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.9	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.1	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.73	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for Modified Concept Area B3 and B4 (Associated with Ramp B)		
STEP 1	Determine the Receiving Water Body	EPB 6A Canal	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	N/A	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	7.21 acres	B3 and B4 areas
STEP 6	What is the amount of pervious area	4.21 acres	B3 and B4 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.63 acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.47 acre-ft	

Project Description Determine attenuation volume required for Modified Concept Area B3 and B4 (Associated with Ramp B)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	4.52	98	
Pervious *	2.69	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.21	89	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 72.9%

	Area (ac.)	CN	
Roadway Pvmt	5.25	98	
Pervious *	1.96	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.21	91	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	1.23	0.93
Runoff Depth (Q) inches =	14.81	15.14
Runoff Volume (ac-ft) =	8.90	9.09

Volume Difference = 0.19 ac-ft

The estimated attenuation volume is the volume difference 0.19 ac-ft
8404.2 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area B3 and B4 (Associated with Ramp B).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	12.00	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	1.00	feet (A-B-C)

STEP 2 **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 28855 cu.ft.

STEP 3 **Use the formula for a rectangular box to determine the water surface area of a pond with vertical sides**

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 240 feet

W_{RECT} = 120 feet

STEP 4 **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	4	feet	z factor	4
Length at top of slope, L_{TOP} =	244	feet		
Width at top of slope, W_{TOP} =	124	feet		

STEP 5 **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$ 0.7 acres

Project Description	Determine the R/W area needed for Modified Concept Area B3 and B4 (Associated with Ramp B).		
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**		
	Berm Width =	5	feet
STEP 2	**Add the maintenance berms to the water surface dimensions.**		
	L_{TOP} =	244	feet
	W_{TOP} =	124	feet
	Length: L_{TOP} + 2(Berm width) =	254	feet
	Width: W_{TOP} + 2(Berm width) =	134	feet
STEP 3	**Determine Pond Right of Way Requirments**		
	$Area_{PRELIM}$: Length x Width =	0.8	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**		
	Percent Inc.	20%	
	$Area_{Required}$: Length x Width x %Inc. =	0.9	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.		
	$Area_{available}$	1.9	acres
	Is $Area_{available}$ greater than $Area_{required}$?	Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for Modified Concept Area C1 and C2 (Associated with Ramp C)		
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	Yes	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	4.99 acres	NE interchange quad.
STEP 6	What is the amount of pervious area	2.00 acres	NE interchange quad.
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.62 acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.47 acre-ft	

Project Description Determine attenuation volume required for Modified Concept Area C1 and C2 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.36	98	
Pervious *	2.63	74	
Offsite Runoff	2.54	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.53	57	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 39.7%

	Area (ac.)	CN	
Roadway Pvmt	2.99	98	
Pervious *	2.00	74	
Offsite Area	2.54	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.53	59	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	7.68	7.07
Runoff Depth (Q) inches =	9.62	10.00
Runoff Volume (ac-ft) =	6.04	6.28

Volume Difference = 0.24 ac-ft

The estimated attenuation volume is the volume difference 0.24 ac-ft

10300 cu.ft.

The 100 year - 24 hour rainfall depth is used for evaluating alternative drainage schemes (Ref. 2017 Drainage Design Guide Section 9.4.2.1)

Project Description	Determine the water surface area for Modified Concept Area C1 and C2 (Associated with Ramp C).

STEP 1

Identify system type and available Height of volume

Modify existing dry detention pond.

Max stage, A	11.90	feet (estimated shldr or ground elev)
Bottom stage, B	10.00	feet (estimated pond bottom elev.)
Freeboard requirment is, C	1.00	feet
Height of available volume is	0.90	feet (A-B-C)

STEP 2

The total peak storage volume required is

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 30650 cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface

area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} =	261	feet
W_{RECT} =	130	feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	3.6	feet	z factor	4
Length at top of slope, L_{TOP} =	265	feet		
Width at top of slope, W_{TOP} =	134	feet		

STEP 5

The Water Surface at Peak Design Stage

$Area_{WATER\ SURFACE}$ 0.8 acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7

Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Modified Concept Area C1 and C2 (Associated with Ramp C).		
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**		
	Berm Width =	5	feet
STEP 2	**Add the maintenance berms to the water surface dimensions.**		
	L_{TOP} =	265	feet
	W_{TOP} =	134	feet
	Length L_{TOP} + 2(Berm width) =	275	feet
	Width W_{TOP} + 2(Berm width) =	144	feet
STEP 3	**Determine Pond Right of Way Requirments**		
	$Area_{PRELIM}$ Length x Width =	0.9	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**		
	Percent Inc.	20%	
	$Area_{Required}$ Length x Width x %Inc. =	1.1	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.		
	Area $_{available}$	1.27	acres
	Is $Area_{available}$ greater than $Area_{required}$?	Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.		

Project Description	Determine treatment volume required for Modified Concept Area C3 (Associated with Ramp C)			
STEP 1	Determine the Receiving Water Body	Earman Canal		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =	ft	input area directly	
	Width =	ft	input area directly	
	Area =	4.68 acres	C3 area	not treating offsite areas
STEP 6	What is the amount of pervious area	1.08 acres	C3 area	
STEP 9	Determine Volume for (2.5") x Imperv Area	0.75 acre-ft		
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in		
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.56 acre-ft		

Project Description Determine attenuation volume required for Modified Concept Area C3 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.07	98	
Pervious *	2.61	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**7.07**	**56**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 50.9%

	Area (ac.)	CN	
Roadway Pvmt	3.60	98	
Pervious *	1.08	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**7.07**	**61**	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**7.85**	**6.34**
Runoff Depth (Q) inches =	**9.52**	**10.48**
Runoff Volume (ac-ft) =	**5.61**	**6.18**

Volume Difference = **0.57** ac-ft

The estimated attenuation volume is the volume difference **0.57** **ac-ft**
24728 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area C3 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.40	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	49230	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface** area of a pond with vertical sides		
	Volume =	$L_{RECT}\ W_{RECT}\ H$	
	Assume L/W = 2		
	L_{RECT} =	265	feet
	W_{RECT} =	133	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	2.8	feet z factor 2
	Length at top of slope, L_{TOP} =	268	feet
	Width at top of slope, W_{TOP} =	135	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	0.8	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	**Yes, OK**	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for Modified Concept Area C3 (Associated with Ramp C).

STEP 1 **Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**

Berm Width = 5 feet

STEP 2 **Add the maintenance berms to the water surface dimensions.**

L_{TOP} =		268	feet
W_{TOP} =		135	feet
Length	L_{TOP} + 2(Berm width) =	278	feet
Width	W_{TOP} + 2(Berm width) =	145	feet

STEP 3 **Determine Pond Right of Way Requirments**

$Area_{PRELIM}$ Length x Width = 0.9 acres

STEP 4 **Increase the pond area estimate by 10 - 20% to account for assumptions**

Percent Inc. 20%

$Area_{Required}$ Length x Width x %Inc. = 1.11 acres

STEP 5 What available area within infield/right of way can be used for stormwater management.

$Area_{available}$ 1.09 acres

Is $Area_{available}$ greater than $Area_{required}$? No, Need offsite pond.

STEP 6 Add remarks as needed. Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall. Still close. Reducing assumed berm width and the Percent used for unknowns would make this work. Designer will route storm to confirm. No pond required.

Project Description	Determine treatment volume required for Modified Concept Area C4 (Associated with Ramp C)				
STEP 1	Determine the Receiving Water Body	Earman Canal			
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW			
STEP 3	Determine if the Water Body is Impaired	N/A			
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.			
STEP 5	Determine Design Project Area				
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.			
	Length =		ft	input area directly	
	Width =		ft	input area directly	
	Area =	4.16	acres	C4 area	not treating offsite areas
STEP 6	What is the amount of pervious area	1.43	acres	C4 area	
STEP 9	Determine Volume for (2.5") x Imperv Area	0.57	acre-ft		
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in		
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.43	acre-ft		

Project Description Determine attenuation volume required for Modified Concept Area C4 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	1.55	98	
Pervious *	2.61	74	
Offsite Runoff	2.85	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.01	49	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 38.9%

	Area (ac.)	CN	
Roadway Pvmt	2.73	98	
Pervious *	1.43	74	
Offsite Runoff	2.85	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.01	53	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	10.32	8.78
Runoff Depth (Q) inches =	8.17	8.99
Runoff Volume (ac-ft) =	4.77	5.25

Volume Difference = 0.48 ac-ft

The estimated attenuation volume is the volume difference 0.48 ac-ft

20695 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area C4 (Associated with Ramp C).				
STEP 1	**Identify system type and available Height of volume**				
	Modify existing dry detention pond.				
	Max stage, A	11.90	feet (estimated shldr or ground elev)		
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)		
	Freeboard requirment is, C	0.50	feet		
	Height of available volume is	1.40	feet (A-B-C)		
STEP 2	**The total peak storage volume required is**				
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume				
	$Volume_{PEAK}$ =	39276	cu.ft.		
STEP 3	**Use the formula for a rectangular box to determine the water surface**				
	area of a pond with vertical sides				
	Volume =	$L_{RECT}\ W_{RECT}\ H$			
	Assume L/W = 2				
	L_{RECT} =	237	feet		
	W_{RECT} =	118	feet		
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**				
	Side slope adj for 4 (H) : 1 (V)	5.6	feet	z factor	4
	Length at top of slope, L_{TOP} =	242	feet		
	Width at top of slope, W_{TOP} =	124	feet		
STEP 5	**The Water Surface at Peak Design Stage**				
	$Area_{WATER\ SURFACE}$	0.7	acres		
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**				
	What is the SHWT elevation at the pond location?	0	feet		
	What is the distance between pond and gutter low point?	0	feet		
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent		
	What is the estimated energy loss in the pipe	0.00	feet		
	What is the estimated HGL elevation at the low point	0.0	feet		
	What is the estimated low point elevation at the gutter	0.0	feet		
	What is location of low point?	At Station			
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet		
	What is the estimated hydraulic gradient clearance	0.0	feet		
	Is the estimated HGL clearance greater than standard?	Yes, OK			
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.			

Project Description	Determine the R/W area needed for Modified Concept Area C4 (Associated with Ramp C).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	242	feet	
	W_{TOP} =	124	feet	
	Length	L_{TOP} + 2(Berm width) =	252	feet
	Width	W_{TOP} + 2(Berm width) =	134	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.8	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.9	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	$Area_{\ available}$	1.42	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for Modified Concept Area D1 and D2 (Associated with Ramp D)

STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	Yes	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	5.71 acres	NW interchange quad. not treating offsite areas
STEP 6	What is the amount of pervious area	1.98 acres	NW interchange quad.
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.78 acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.58 acre-ft	

Project Description Determine attenuation volume required for Modified Concept Area D1 and D2 (Associated with Ramp D)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.52	98	
Pervious *	2.19	74	
Offsite Runoff	0.49	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	6.20	82	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 60.2%

	Area (ac.)	CN	
Roadway Pvmt	3.73	98	
Pervious *	1.98	74	
Offsite Runoff	0.49	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	6.20	83	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	2.23	2.11
Runoff Depth (Q) inches =	13.80	13.92
Runoff Volume (ac-ft) =	7.13	7.19

Volume Difference = 0.06 ac-ft

The estimated attenuation volume is the volume difference 0.06 ac-ft

2627.3 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area D1 and D2 (Associated with Ramp D).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	13.00	feet (estimated shldr or ground elev)
	Bottom stage, B	11.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.50	feet (A-B-C)

STEP 2 **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 28015 cu.ft.

STEP 3 **Use the formula for a rectangular box to determine the water surface area of a pond with vertical sides**

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 193 feet

W_{RECT} = 97 feet

STEP 4 **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	6	feet	z factor	4
Length at top of slope, L_{TOP} =	199	feet		
Width at top of slope, W_{TOP} =	103	feet		

STEP 5 **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$ 0.5 acres

STEP 6 **Check low point along gutter with estimated hydraulic gradient slope**

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7 Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Modified Concept Area D1 and D2 (Associated with Ramp D).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	199	feet	
	W_{TOP} =	103	feet	
	Length	L_{TOP} + 2(Berm width) =	209	feet
	Width	W_{TOP} + 2(Berm width) =	113	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.5	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.6	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	0.87	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall.		

Project Description	Determine treatment volume required for Modified Concept Area D3 (Associated with Ramp D)		
STEP 1	Determine the Receiving Water Body	Earman Canal	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	Yes	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	5.28 acres	D3 Area not treating for offsite are
STEP 6	What is the amount of pervious area	1.15 acres	D3 Area
STEP 9	Determine Volume for (2.5") x Imperv Area	0.86 acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.65 acre-ft	

Calculated By: R. Olivier Date:2/22/2017
Checked By:________ Date:________

Project Description Determine attenuation volume required for Modified Concept Area D3 (Associated with Ramp D)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.96	98	
Pervious *	2.32	74	
Offsite Runoff	2.66	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.94	58	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 52.0%

	Area (ac.)	CN	
Roadway Pvmt	4.13	98	
Pervious *	1.15	74	
Offsite Runoff	2.66	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.94	62	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	7.20	6.21
Runoff Depth (Q) inches =	9.92	10.57
Runoff Volume (ac-ft) =	6.57	6.99

Volume Difference = 0.43 ac-ft

The estimated attenuation volume is the volume difference 0.43 ac-ft
18633 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area D3 (Associated with Ramp D).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	12.00	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.50	feet (A-B-C)

STEP 2

The total peak storage volume required is

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 46743 cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 250 feet

W_{RECT} = 125 feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	6	feet	z factor	4
Length at top of slope, L_{TOP} =	256	feet		
Width at top of slope, W_{TOP} =	131	feet		

STEP 5

The Water Surface at Peak Design Stage

$Area_{WATER\ SURFACE}$ 0.8 acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7

Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Modified Concept Area D3 (Associated with Ramp D).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	256	feet	
	W_{TOP} =	131	feet	
	Length	L_{TOP} + 2(Berm width) =	266	feet
	Width	W_{TOP} + 2(Berm width) =	141	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.9	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.0	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	$Area_{available}$	1.14	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall.		

Project Description	Determine treatment volume required for Modified Concept Area D4 (Associated with Ramp D)	
STEP 1	Determine the Receiving Water Body	Earman Canal
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	Yes
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.
	Length =	ft — input area directly
	Width =	ft — input area directly
	Area =	1.06 acres — D4 Area not treating for offsite are
STEP 6	What is the amount of pervious area	0.21 acres — D4 Area
STEP 9	Determine Volume for (2.5") x Imperv Area	0.18 acre-ft
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.13 acre-ft

Project Description	Determine attenuation volume required for Modified Concept Area D4 (Associated with Ramp D)

STEP 1

Pre-developed Area & Curve Number

	Area (ac.)	CN	
Roadway Pvmt	0.65	98	
Pervious *	0.42	74	
Offsite Runoff	0.38	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**1.45**	**65**	

* Pervious areas determined using Mircostation CAD software.

STEP 2

Post-developed Area and Curve Number

Percent Impervious = 49.7%

	Area (ac.)	CN	
Roadway Pvmt	0.72	98	
Pervious *	0.34	74	
Offsite Runoff	0.39	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**1.45**	**66**	

STEP 3

Calculate the difference in runoff volume between the pre and post conditions
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**5.30**	**5.15**
Runoff Depth (Q) inches =	**11.22**	**11.33**
Runoff Volume (ac-ft) =	**1.36**	**1.37**

Volume Difference = **0.01** ac-ft

The estimated attenuation volume is the volume difference 0.01 ac-ft

585.11 cu.ft.

Project Description	Determine the water surface area for Modified Concept Area D4 (Associated with Ramp D).				
STEP 1	**Identify system type and available Height of volume**				
	Modify existing dry detention pond.				
	Max stage, A	12.00	feet (estimated shldr or ground elev)		
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)		
	Freeboard requirment is, C	0.50	feet		
	Height of available volume is	1.50	feet (A-B-C)		
STEP 2	**The total peak storage volume required is**				
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume				
	$Volume_{PEAK}$ =	6370	cu.ft.		
STEP 3	**Use the formula for a rectangular box to determine the water surface**				
	area of a pond with vertical sides				
	Volume =	L_{RECT} W_{RECT} H			
	Assume L/W = 2				
	L_{RECT} =	92	feet		
	W_{RECT} =	46	feet		
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**				
	Side slope adj for 4 (H) : 1 (V)	6	feet	z factor	4
	Length at top of slope, L_{TOP} =	98	feet		
	Width at top of slope, W_{TOP} =	52	feet		
STEP 5	**The Water Surface at Peak Design Stage**				
	$Area_{WATER\ SURFACE}$	0.1	acres		
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**				
	What is the SHWT elevation at the pond location?	0	feet		
	What is the distance between pond and gutter low point?	0	feet		
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent		
	What is the estimated energy loss in the pipe	0.00	feet		
	What is the estimated HGL elevation at the low point	0.0	feet		
	What is the estimated low point elevation at the gutter	0.0	feet		
	What is location of low point?	At Station			
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet		
	What is the estimated hydraulic gradient clearance	0.0	feet		
	Is the estimated HGL clearance greater than standard?	**Yes, OK**			
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.			

Project Description	Determine the R/W area needed for Modified Concept Area D4 (Associated with Ramp D).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	98	feet	
	W_{TOP} =	52	feet	
	Length	L_{TOP} + 2(Berm width) =	108	feet
	Width	W_{TOP} + 2(Berm width) =	62	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.2	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.18	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	0.21	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall.		

Project Description	Determine treatment volume required for Modified Concept (Northlake Boulevard)			
STEP 1	Determine the Receiving Water Body	C-17		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Northlake Boulevard. Widening from 6-lane to 8-lane divided, urban typical section. NOT Reconstruction. Only widening. Provide water quality of additional impervious area.		
	Length =		ft	
	Width =		ft	
	Area =		acres	Total Area
STEP 6	Amount of additional impervious area	1.01	acres	Northlake Blvd
STEP 7	Determine Volume for (1.0") x Project Area	n/a	acre-ft	
STEP 9	Determine Volume for (2.5") x Imperv Area	0.21	acre-ft	
STEP 10	Which volume is greater 1" or 2.5" amount	0.21	acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-ft	
STEP 12	Determine Treatment Volume Required Assume wet Detention system	0.210	acre-ft	
STEP 13	Is there existing water quality provided by Permit that should be included?	Yes, within existing exfiltration trench		
	Volume of existing treatment volume is:	0.30	acre-ft	**
STEP 14	What is total treatment volume required?	**0.510**	**acre-ft**	
		22233.75	cu.ft.	

** Note: Assumes FD would not function after road is widened and treatement lost in FD would be provided in the proposed pond.

Project Description Determine attenuation volume required for Modified Concept (Northlake Boulevard)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN		
Roadway Pvmt	13.96	98	Exist Road Area	15.96 acres
Road Pervious *	2.00	74		
Offsite Runoff	0	0	Assume offsite runoff is attenuated offsite	
Proposed Pond Area	2.39	74	parcel is open space	2.39 acres
Total	**18.4**	**92.3**		

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

	Area (ac.)	CN		
			Percent Impervious =	78.2%
Roadway Pvmt	14.68	98	Prop Road Area	16.39 acres
Road Pervious *	1.71	74		
Offsite Runoff	0	0	Assume offsite runoff is attenuated offsite	
Proposed Pond Area	2.39	98	Prop Pond Area	2.39 acres
Total	**18.8**	**95.8**		

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**0.84**	**0.44**
Runoff Depth (Q) inches =	**15.23**	**15.69**
Runoff Volume (ac-ft) =	**23.30**	**24.55**

Volume Difference = **1.25** ac-ft

The estimated attenuation volume is the volume difference 1.254 ac-ft

54633 cu.ft.

Project Description	Determine the water surface area for Modified Concept (Northlake Boulevard)		
STEP 1	**Identify system type and available Height of volume**		
	Assume wet detention pond.		
	Max stage, A	11.25	feet (est. peak atten. vol. allowed based on HGL)
	Bottom stage, B	9.00	feet (estimated begin water surface elev., SHWT)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	**1.25**	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	**76867**	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface** area of a pond with vertical sides		
	Volume = $L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2		
	L_{RECT} =	**351**	feet
	W_{RECT} =	**175**	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	**5**	feet z factor 4
	Length at top of slope, L_{TOP} =	**356**	feet
	Width at top of slope, W_{TOP} =	**180**	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	**1.5**	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	9	feet
	What is the distance between pond and gutter low point?	3,100	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.05	percent
	What is the estimated energy loss in the pipe	**1.55**	feet
	What is the estimated HGL elevation at the low point	**10.55**	feet
	What is the estimated low point elevation at the gutter	12.8	feet
	What is location of low point?	Along Northlake Blvd at Station 16+00	
	What is the standard hydraulic gradient clearance, use 1 ft.	1.0	feet
	What is the estimated hydraulic gradient clearance	**2.25**	feet
	Is the estimated HGL clearance greater than standard?	**Yes, OK**	
STEP 7	Add remarks as needed.	Revise H value in STEP 1 to reflect available height to stack peak attenuation volume. H ends up being 1.25 ft	

Project Description	Determine the R/W area needed for Modified Concept (Northlake Boulevard)

STEP 1 **Determine the maintenance berm width**

Berm Width = 20 feet

STEP 2 **Add the maintenance berms to the water surface dimensions.**

L_{TOP} =	356	feet	
W_{TOP} =	180	feet	
Length	L_{TOP} + 2(Berm width) =	396	feet
Width	W_{TOP} + 2(Berm width) =	220	feet

STEP 3 **Determine Pond Right of Way Requirments**

$Area_{PRELIM}$ Length x Width = 2.0 acres

STEP 4 **Increase the pond area estimate by 10 - 20% to account for assumptions**

Percent Inc. 10%

$Area_{Required}$ Length x Width x %Inc. = 2.20 acres

STEP 5 What available area within infield/right of way can be used for stormwater management.

$Area_{available}$ 0 acres

Is $Area_{available}$ greater than $Area_{required}$? **No, Need offsite pond.**

STEP 6 Add remarks as needed.

Need 2.2 acre pond. Freeboard requirement is 1.0 ft. SHWT elevation and hydraulic gradient in storm drain from the pond to lowest EOP elevation along roadway influences pond size.

Project Description	Determine treatment volume required for DDI Concept Area A1 and A2 (Associated with Ramp A)	
STEP 1	Determine the Receiving Water Body	EPB 6A Canal
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	N/A
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.

Length =		ft	input area directly
Width =		ft	input area directly
Area =	5.72	acres	A1 and A2 areas

STEP 6	What is the amount of pervious area	2.79	acres	A1 and A2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.61**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.46	acre-ft	

Calculated By: R. Olivier Date: 2/22/2017
Checked By:________ Date:________

Project Description Determine attenuation volume required for DDI Concept Area A1 and A2 (Associated with Ramp A)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.76	98	
Pervious *	2.96	74	
Offsite Runoff	0.00	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	5.72	86	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 51.2%

	Area (ac.)	CN	
Roadway Pvmt	2.93	98	
Pervious *	2.79	74	
Offsite Runoff	0.00	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	5.72	86	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	1.69	1.59
Runoff Depth (Q) inches =	14.34	14.44
Runoff Volume (ac-ft) =	6.83	6.88

Volume Difference = 0.05 ac-ft

The estimated attenuation volume is the volume difference **0.05 ac-ft**
2094 cu.ft.

Project Description	Determine the water surface area for Modified DDI Area A1 and A2 (Associated with Ramp A).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	12.00	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	**1.50**	feet (A-B-C)

STEP 2

The total peak storage volume required is

Volume_{PEAK} = Treatment Volume + Est. Peak Attenuation Volume

Volume_{PEAK} =	**22036**	cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface
area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} =	**171**	feet
W_{RECT} =	**86**	feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	**6**	feet	z factor	4
Length at top of slope, L_{TOP} =	**177**	feet		
Width at top of slope, W_{TOP} =	**92**	feet		

STEP 5

The Water Surface at Peak Design Stage

$\text{Area}_{WATER\ SURFACE}$	**0.4**	acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	**0.00**	feet
What is the estimated HGL elevation at the low point	**0.0**	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	**0.0**	feet
Is the estimated HGL clearance greater than standard?	**Yes, OK**	

STEP 7

Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for DDI Concept Area A1 and A2 (Associated with Ramp A).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	177	feet	
	W_{TOP} =	92	feet	
	Length	L_{TOP} + 2(Berm width) =	187	feet
	Width	W_{TOP} + 2(Berm width) =	102	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.4	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.5	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.62	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.			

Project Description	Determine treatment volume required for DDI Concept Area B1 and B2 (Associated with Ramp B)		
STEP 1	Determine the Receiving Water Body	EPB 6A Canal	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	N/A	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	6.51 acres	B1 and B2 areas
STEP 6	What is the amount of pervious area	1.81 acres	B1 and B2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	0.98 acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.73 acre-ft 31967.6 cu.ft.	

The 100 year - 24 hour rainfall depth is used for evaluating alternative drainage schemes (Ref. 2017 Drainage Design Guide Section 9.4.2.1)

Project Description Determine attenuation volume required for DDI Concept Area B1 and B2 (Associated with Ramp B)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.83	98	
Pervious *	3.67	74	
Offsite Runoff	0.00	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	6.51	84	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 72.2%

	Area (ac.)	CN	
Roadway Pvmt	4.70	98	
Pervious *	1.81	74	
Offsite Runoff	0.00	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	6.51	91	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	1.84	0.95
Runoff Depth (Q) inches =	14.18	15.11
Runoff Volume (ac-ft) =	7.69	8.19

Volume Difference = 0.51 ac-ft

The estimated attenuation volume is the volume difference **0.51** **ac-ft**

22002 cu.ft.

Project Description	Determine the water surface area for Modified DDI Area B1 and B2 (Associated with Ramp B).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	12.00	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.50	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	53970	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface**		
	area of a pond with vertical sides		
	Volume =	$L_{RECT}\ W_{RECT}\ H$	
	Assume L/W = 2		
	L_{RECT} =	268	feet
	W_{RECT} =	134	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	6	feet z factor 4
	Length at top of slope, L_{TOP} =	274	feet
	Width at top of slope, W_{TOP} =	140	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	0.9	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	Yes, OK	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for DDI Concept Area B1 and B2 (Associated with Ramp B).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	274	feet	
	W_{TOP} =	140	feet	
	Length	L_{TOP} + 2(Berm width) =	284	feet
	Width	W_{TOP} + 2(Berm width) =	150	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	1.0	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.2	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.11	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		No, Need offsite pond.	
STEP 6	Add remarks as needed.	Construct retaining wall along R/W line and paved shoulder for more volume. And need to reduce freeboard req. from 1.0' to 0.5'. Doing these two items would not be provide enough volume, but it's close. So recommend either lower the pond bottom approximately 0.20 ft or adjusting the bleeder invert up approx. 0.20 ft or a combination of both to provide the required volume. Reconstructing the MSE along I-95 would not be required if this approach is used and would not be preferred due to cost.		

Project Description	Determine treatment volume required for DDI Concept Area C1 and C2 (Associated with Ramp C)			
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	N/A		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	5.33	acres	C1 and C2 areas (POST) not treating offsite areas
STEP 6	What is the amount of pervious area	1.51	acres	C1 and C2 areas (POST)
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.80**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.60	acre-ft	

Project Description Determine attenuation volume required for DDI Concept Area C1 and C2 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.24	98	
Pervious *	3.09	74	
Offsite Runoff	2.54	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**7.87**	**81**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 48.5%

	Area (ac.)	CN	
Roadway Pvmt	3.82	98	
Pervious *	1.51	74	
Offsite Runoff	2.54	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**7.87**	**86**	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**2.37**	**1.68**
Runoff Depth (Q) inches =	**13.66**	**14.35**
Runoff Volume (ac-ft) =	**8.96**	**9.41**

Volume Difference = **0.45** ac-ft

The estimated attenuation volume is the volume difference 0.45 ac-ft

19554 cu.ft.

The 100 year - 24 hour rainfall depth is used for evaluating alternative drainage schemes (Ref. 2017 Drainage Design Guide Section 9.4.2.1)

Project Description	Determine the water surface area for Modified DDI Area C1 and C2 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.40	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	45553	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface**		
	area of a pond with vertical sides		
	Volume = $L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2		
	L_{RECT} =	255	feet
	W_{RECT} =	128	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	5.6	feet; z factor 4
	Length at top of slope, L_{TOP} =	261	feet
	Width at top of slope, W_{TOP} =	133	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	0.8	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	Yes, OK	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for DDI Concept Area C1 and C2 (Associated with Ramp C).		
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**		
	Berm Width =	5	feet
STEP 2	**Add the maintenance berms to the water surface dimensions.**		
	L_{TOP} =	261	feet
	W_{TOP} =	133	feet
	Length: L_{TOP} + 2(Berm width) =	271	feet
	Width: W_{TOP} + 2(Berm width) =	143	feet
STEP 3	**Determine Pond Right of Way Requirments**		
	$Area_{PRELIM}$: Length x Width =	0.9	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**		
	Percent Inc.	20%	
	$Area_{Required}$: Length x Width x %Inc. =	1.07	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.		
	$Area_{available}$	0.79	acres
	Is $Area_{available}$ greater than $Area_{required}$?	No, Need offsite pond.	
STEP 6	Add remarks as needed.	If offsite pond adj to Ramp 'B' is proposed, consider using it. Otherwise lower pond by 0.50 ft and reduce freeboard req. from 1.0' to 0.5'. This will also require construction of retaining wall along R/W line and paved shoulder. Otherwise if lowering infields is not acceptable will need to reconstruct MSE wall along I-95 to provide additional volume between STA 1848+60 to 1855+00. This is not preferred due to constructibililty issues. Doing this in conjunction with retaining walls along shldr and R/W with 0.50ft freeboard would be needed to provide required volume for Ramp C quadrant. Reccommend offsite pond in lieu of costly MSE recont.	

Project Description	Determine treatment volume required for DDI Concept Area C3 (Associated with Ramp C)			
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =	ft		input area directly
	Width =	ft		input area directly
	Area =	4.68	acres	C3 area not treating offsite areas
STEP 6	What is the amount of pervious area	1.24	acres	C3 area
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.72**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.54	acre-ft	

Project Description	Determine attenuation volume required for DDI Concept Area C3 (Associated with Ramp C)

STEP 1

Pre-developed Area & Curve Number

	Area (ac.)	CN	
Roadway Pvmt	2.08	98	
Pervious *	2.60	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**7.07**	**81**	

* Pervious areas determined using Mircostation CAD software.

STEP 2

Post-developed Area and Curve Number

Percent Impervious = 48.7%

	Area (ac.)	CN	
Roadway Pvmt	3.44	98	
Pervious *	1.24	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**7.07**	**86**	

STEP 3

Calculate the difference in runoff volume between the pre and post conditions
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**2.34**	**1.67**
Runoff Depth (Q) inches =	**13.70**	**14.35**
Runoff Volume (ac-ft) =	**8.07**	**8.46**

Volume Difference = **0.39** ac-ft

The estimated attenuation volume is the volume difference **0.39 ac-ft**
16789 cu.ft.

Project Description	Determine the water surface area for DDI Area C3 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.40	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	40203	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface** area of a pond with vertical sides		
	Volume =	$L_{RECT}\ W_{RECT}\ H$	
	Assume L/W = 2		
	L_{RECT} =	240	feet
	W_{RECT} =	120	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	5.6	feet; z factor 4
	Length at top of slope, L_{TOP} =	245	feet
	Width at top of slope, W_{TOP} =	125	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	0.7	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	Yes, OK	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for the DDI Concept Area C3 (Associated with Ramp C).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	245	feet	
	W_{TOP} =	125	feet	
	Length	L_{TOP} + 2(Berm width) =	255	feet
	Width	W_{TOP} + 2(Berm width) =	135	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.8	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.0	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.24	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall.		

Project Description	Determine treatment volume required for DDI Concept Area C4 (Associated with Ramp C)			
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	N/A		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	4.16	acres	C3 and C4 areas
STEP 6	What is the amount of pervious area	1.83	acres	C3 and C4 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.49**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.36	acre-ft	

Project Description	Determine attenuation volume required for DDI Concept Area C4 (Associated with Ramp C)

STEP 1

Pre-developed Area & Curve Number

	Area (ac.)	CN	
Roadway Pvmt	1.56	98	
Pervious *	2.60	74	
Offsite Runoff	2.85	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.01	79	

* Pervious areas determined using Mircostation CAD software.

STEP 2

Post-developed Area and Curve Number

	Area (ac.)	CN	
Roadway Pvmt	2.33	98	
Pervious *	1.83	74	
Offsite Runoff	2.85	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.01	82	

Percent Impervious = 33.2%

STEP 3

Calculate the difference in runoff volume between the pre and post conditions
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	2.60	2.20
Runoff Depth (Q) inches =	13.45	13.83
Runoff Volume (ac-ft) =	7.86	8.08

Volume Difference = 0.22 ac-ft

The estimated attenuation volume is the volume difference 0.22 ac-ft

9769.6 cu.ft.

Project Description	Determine the water surface area for DDI Area C4 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.40	feet (A-B-C)

STEP 2 **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ =	25628	cu.ft.

STEP 3 **Use the formula for a rectangular box to determine the water surface area of a pond with vertical sides**

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} =	191	feet
W_{RECT} =	96	feet

STEP 4 **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	5.6	feet	z factor	4
Length at top of slope, L_{TOP} =	197	feet		
Width at top of slope, W_{TOP} =	101	feet		

STEP 5 **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$	0.5	acres

STEP 6 **Check low point along gutter with estimated hydraulic gradient slope**

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7 Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for the DDI Concept Area C4 (Associated with Ramp C).		
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**		
	Berm Width =	5	feet
STEP 2	**Add the maintenance berms to the water surface dimensions.**		
	L_{TOP} =	197	feet
	W_{TOP} =	101	feet
	Length — L_{TOP} + 2(Berm width) =	207	feet
	Width — W_{TOP} + 2(Berm width) =	111	feet
STEP 3	**Determine Pond Right of Way Requirments**		
	$Area_{PRELIM}$ — Length x Width =	0.5	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**		
	Percent Inc.	20%	
	$Area_{Required}$ — Length x Width x %Inc. =	0.6	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.		
	$Area_{available}$	1.83	acres
	Is $Area_{available}$ greater than $Area_{required}$?	Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for DDI Concept Area D1 and D2 (Associated with Ramp D)

STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	N/A
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	

Describe Project Area: Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.

Length =		ft	input area directly
Width =		ft	input area directly
Area =	5.71	acres	D1 and D2 areas

STEP 6	What is the amount of pervious area	1.25	acres	D1 and D2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.93**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.70	acre-ft	

Project Description Determine attenuation volume required for DDI Concept Area D1 and D2 (Associated with Ramp D)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.53	98	
Pervious *	2.18	74	
Offsite Runoff	0.48	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	6.19	88	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 72.1%

	Area (ac.)	CN	
Roadway Pvmt	4.47	98	
Pervious *	1.25	74	
Offsite Runoff	0.48	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	6.19	91	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	1.40	0.95
Runoff Depth (Q) inches =	14.63	15.11
Runoff Volume (ac-ft) =	7.55	7.80

Volume Difference = 0.25 ac-ft

The estimated attenuation volume is the volume difference **0.25 ac-ft**

10850 cu.ft.

The 100 year - 24 hour rainfall depth is used for evaluating alternative drainage schemes (Ref. 2017 Drainage Design Guide Section 9.4.2.1)

Project Description	Determine the water surface area for Modified DDI Area D1 and D2 (Associated with Ramp D).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	13.00	feet (estimated shldr or ground elev)
	Bottom stage, B	11.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.50	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	41240	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface**		
	area of a pond with vertical sides		
	Volume = $L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2		
	L_{RECT} =	234	feet
	W_{RECT} =	117	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	1.5	feet z factor 1
	Length at top of slope, L_{TOP} =	236	feet
	Width at top of slope, W_{TOP} =	119	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	0.6	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	Yes, OK	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Calculated By: R. Olivier Date:2/22/2017
Checked By:________ Date:________

Project Description	Determine the R/W area needed for DDI Concept Area D1 and D2 (Associated with Ramp D).

STEP 1 **Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**

Berm Width = 5 feet

STEP 2 **Add the maintenance berms to the water surface dimensions.**

L_{TOP} = **236** feet

W_{TOP} = **119** feet

Length L_{TOP} + 2(Berm width) = **246** feet

Width W_{TOP} + 2(Berm width) = **129** feet

STEP 3 **Determine Pond Right of Way Requirments**

$Area_{PRELIM}$ Length x Width = **0.7** acres

STEP 4 **Increase the pond area estimate by 10 - 20% to account for assumptions**

Percent Inc. 20%

$Area_{Required}$ Length x Width x %Inc. = **0.9** acres

STEP 5 What available area within infield/right of way can be used for stormwater management.

$Area_{available}$ 0.39 acres

Is $Area_{available}$ greater than $Area_{required}$? **No, Need offsite pond.**

STEP 6 Add remarks as needed.

Construct retaining wall along R/W line and paved shoulder for more volume. And need to reduce freeboard req. from 1.0' to 0.5'. Plus will need to provide more volume within the infield. I.E. reconstruct MSE wall along I-95 to provide additional volume between STA 1848+60 to 1854+00, but that would have constructibility issues. If all three of these ideas are implemented the volume required would still be short by 0.20 acres. Using DDI ramp terminal island is not big enough. Therefore, recommend an offsite pond area.

Project Description	Determine treatment volume required for DDI Concept (For Northlake Blvd., assume total reconstruction)		
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	Yes	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Northlake Blvd. is an Urban arterial Highly developed on both sides of road Existing 6 lane divided, sod median. Proposed 8 lane divided, sod median	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	20.94 acres	Northlake Blvd
STEP 6	What is the amount of pervious area	3.30 acres	Northlake Blvd
STEP 7	Determine Volume for (1.0") x Project Area	1.75 acre-ft	
STEP 9	Determine Volume for (2.5") x Imperv Area	3.68 acre-ft	
STEP 10	Which volume is greater 1" or 2.5" amount	3.68 acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-ft	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	2.76 acre-ft	

Project Description Determine attenuation volume required for DDI Concept
(For Northlake Blvd., assume total reconstruction)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	16.54	98	
Pervious *	1.89	74	
Offsite Runoff	0.00	74	Assume offsite runoff is attenuated offsite
Proposed Pond Area	0.0	85	Pond is onsite
Total	18.43	96	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 86.6%

	Area (ac.)	CN	
Roadway Pvmt	18.13	98	
Pervious *	2.81	74	
Offsite Runoff	0.00	74	Assume offsite runoff is attenuated offsite
Proposed Pond Area	0.00	98	Pond is onsite
Total	20.94	95	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	0.47	0.55
Runoff Depth (Q) inches =	15.65	15.56
Runoff Volume (ac-ft) =	24.04	27.15

Volume Difference = 3.11 ac-ft

The estimated attenuation volume is the volume difference 3.11 ac-ft
135353 cu.ft.

The 100 year - 24 hour rainfall depth is used for evaluating alternative drainage schemes
(Ref. 2017 Drainage Design Guide Section 9.4.2.1)

Project Description	Determine the water surface area for Modified DDI (For Northlake Blvd., assume total reconstruction)

STEP 1 — **Identify system type and available Height of volume**

Assume wet detention pond.

Ground Elev, A	13.00	feet
SHWT Elev, B	9.00	feet
Freeboard requirment is, C	1.00	feet
Height of available volume is	**3.00**	feet (A-B-C)

STEP 2 — **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = **255416** cu.ft.

STEP 3 — **Use the formula for a rectangular box to determine the water surface** area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = **413** feet

W_{RECT} = **206** feet

STEP 4 — **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	**12**	feet	z factor	4
Length at top of slope, L_{TOP} =	**425**	feet		
Width at top of slope, W_{TOP} =	**218**	feet		

STEP 5 — **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$ **2.1** acres

STEP 6 — **Check low point along gutter with estimated hydraulic gradient slope**

What is the SHWT elevation at the pond location?	9	feet
What is the distance between pond and gutter low point?	1,475	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.05	percent
What is the estimated energy loss in the pipe	**0.74**	feet
What is the estimated HGL elevation at the low point	**9.7**	feet
What is the estimated low point elevation at the gutter	10.2	feet
What is location of low point?	Along Northlake Blvd at Station 53+00	
What is the standard hydraulic gradient clearance, use 1 ft.	1.0	feet
What is the estimated hydraulic gradient clearance	**0.5**	feet
Is the estimated HGL clearance greater than standard?	**No, Berm pond or raise road**	

STEP 7 — Add remarks as needed.

Design pond berm for offsite pond(s) at least 0.5 ft higher than exist ground as needed to provide volume required.

Project Description	Determine the R/W area needed for DDI Concept (For Northlake Blvd., assume total reconstruction)			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	20	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	425	feet	
	W_{TOP} =	218	feet	
	Length	L_{TOP} + 2(Berm width) =	465	feet
	Width	W_{TOP} + 2(Berm width) =	258	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	2.8	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	3.3	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.27 acres	THIS IS POTENTIAL AVAILABLE AREA IN DDI MEDIANS.	
	Is $Area_{available}$ greater than $Area_{required}$?		No, Need offsite pond.	
STEP 6	Add remarks as needed.	Need 3.3 acre pond. Using the DDI median infields to reduce R/W needs is possible. The available area witin the 3 major infields is approximately 1.3 acres. This would reduce the offsite needs to 2.0 acres. This assumes the dry detention TOB would begin 5-ft behind back of curb and have side slopes of 1:4. This also assumes not major utility impacts, the sidewalk would wiggle thru/around the median ponds and both the City and County buys in to the idea.		

Project Description	Determine treatment volume required for Fly Over Concept Area A1 and A2 (Associated with Ramp A)			
STEP 1	Determine the Receiving Water Body	EPB 6A Canal		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	6.14	acres	A1 and A2 areas
STEP 6	What is the amount of pervious area	2.52	acres	A1 and A2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.75**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.57	acre-ft	

Project Description	Determine attenuation volume required for Fly Over Concept Area A1 and A2 (Associated with Ramp A)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.18	98	
Pervious *	2.96	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**6.14**	**86**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 59.0%

	Area (ac.)	CN	
Roadway Pvmt	3.62	98	
Pervious *	2.52	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**6.14**	**88**	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**1.57**	**1.34**
Runoff Depth (Q) inches =	**14.46**	**14.69**
Runoff Volume (ac-ft) =	**7.40**	**7.52**

Volume Difference = **0.12** ac-ft

The estimated attenuation volume is the volume difference	**0.12**	**ac-ft**
	5221.7	cu.ft.

Project Description	Determine the water surface area for Fly Over Area A1 and A2 (Associated with Ramp A).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	12.00	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	1.00	feet (A-B-C)

STEP 2

The total peak storage volume required is

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 29860 cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface
area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 244 feet

W_{RECT} = 122 feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	4	feet	z factor 4
Length at top of slope, L_{TOP} =	248	feet	
Width at top of slope, W_{TOP} =	126	feet	

STEP 5

The Water Surface at Peak Design Stage

$Area_{WATER\ SURFACE}$ 0.7 acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7

Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Fly Over Concept Area A1 and A2 (Associated with Ramp A).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	248	feet	
	W_{TOP} =	126	feet	
	Length	L_{TOP} + 2(Berm width) =	258	feet
	Width	W_{TOP} + 2(Berm width) =	136	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.8	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.0	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	$Area_{\text{available}}$	2.14	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for Fly Over Concept Area A3 (Associated with Ramp A)	
STEP 1	Determine the Receiving Water Body	EPB 6A Canal
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	Yes
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.

	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	4.65	acres	A3 area
STEP 6 — What is the amount of pervious area		0.52	acres	A3 area
STEP 9 — Determine Volume for (2.5") x Imperv Area		**0.86**	**acre-ft**	
STEP 11 — Determine Treatment Volume Required for discharging to an OFW		N/A	acre-in	
STEP 12 — Determine Treatment Volume Required using a Dry Detention system (75% of Wet)		0.65	acre-ft	

Project Description	Determine attenuation volume required for Fly Over Concept Area A3 (Associated with Ramp A)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.56	98	
Pervious *	1.09	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**4.65**	**92**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	4.13	98	
Pervious *	0.52	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**4.65**	**95**	

Percent Impervious = 88.8%

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**0.83**	**0.49**
Runoff Depth (Q) inches =	**15.25**	**15.62**
Runoff Volume (ac-ft) =	**5.91**	**6.05**

Volume Difference = **0.15** ac-ft

The estimated attenuation volume is the volume difference	**0.15**	**ac-ft**
	6331.3	cu.ft.

Project Description	Determine the water surface area for Fly Over Area A3 (Associated with Ramp A).				
STEP 1	**Identify system type and available Height of volume**				
	Modify existing dry detention pond.				
	Max stage, A	12.00	feet (estimated shldr or ground elev)		
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)		
	Freeboard requirment is, C	0.50	feet		
	Height of available volume is	**1.50**	feet (A-B-C)		
STEP 2	**The total peak storage volume required is**				
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume				
	$Volume_{PEAK}$ =	**34441**	cu.ft.		
STEP 3	**Use the formula for a rectangular box to determine the water surface**				
	area of a pond with vertical sides				
	Volume =	$L_{RECT}\, W_{RECT}\, H$			
	Assume L/W = 2				
	L_{RECT} =	**214**	feet		
	W_{RECT} =	**107**	feet		
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**				
	Side slope adj for 4 (H) : 1 (V)	**6**	feet	z factor	4
	Length at top of slope, L_{TOP} =	**220**	feet		
	Width at top of slope, W_{TOP} =	**113**	feet		
STEP 5	**The Water Surface at Peak Design Stage**				
	$Area_{WATER\ SURFACE}$	**0.6**	acres		
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**				
	What is the SHWT elevation at the pond location?			0	feet
	What is the distance between pond and gutter low point?			0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%			0.1	percent
	What is the estimated energy loss in the pipe			**0.00**	feet
	What is the estimated HGL elevation at the low point			**0.0**	feet
	What is the estimated low point elevation at the gutter			0.0	feet
	What is location of low point?	At Station			
	What is the standard hydraulic gradient clearance, use 1 ft.			0.0	feet
	What is the estimated hydraulic gradient clearance			**0.0**	feet
	Is the estimated HGL clearance greater than standard?			**Yes, OK**	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.			

Project Description	Determine the R/W area needed for Fly Over Concept Area A3 (Associated with Ramp A).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	220	feet	
	W_{TOP} =	113	feet	
	Length	L_{TOP} + 2(Berm width) =	230	feet
	Width	W_{TOP} + 2(Berm width) =	123	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.7	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.78	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	0.46	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		No, Need offsite pond.	

Calculated By: R. Olivier Date:2/22/2017
Checked By:________ Date:________

Project Description	Determine treatment volume required for Fly Over Concept Area A4 (Associated with Ramp A)	
STEP 1	Determine the Receiving Water Body	EPB 6A Canal
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	Yes
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.
	Length =	ft — input area directly
	Width =	ft — input area directly
	Area =	6.14 acres — A4 area not treating offsite areas
STEP 6	What is the amount of pervious area	1.32 acres — A4 area
STEP 9	Determine Volume for (2.5") x Imperv Area	1.00 acre-ft
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-in
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.75 acre-ft

Project Description	Determine attenuation volume required for Fly Over Concept Area A4 (Associated with Ramp A)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	4.50	98	
Pervious *	1.64	74	
Offsite Runoff	2.02	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	8.16	69	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 59.1%

	Area (ac.)	CN	
Roadway Pvmt	4.82	98	
Pervious *	1.32	74	
Offsite Runoff	2.02	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	8.16	70	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	4.51	4.31
Runoff Depth (Q) inches =	11.81	11.97
Runoff Volume (ac-ft) =	8.03	8.14

Volume Difference = 0.11 ac-ft

The estimated attenuation volume is the volume difference 0.11 ac-ft

4590.5 cu.ft.

Project Description	Determine the water surface area for Fly Over Area A4 (Associated with Ramp A).			
STEP 1	**Identify system type and available Height of volume**			
	Modify existing dry detention pond.			
	Max stage, A	12.00	feet (estimated shldr or ground elev)	
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)	
	Freeboard requirment is, C	1.00	feet	
	Height of available volume is	1.00	feet (A-B-C)	
STEP 2	**The total peak storage volume required is**			
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume			
	$Volume_{PEAK}$ =	37397	cu.ft.	
STEP 3	**Use the formula for a rectangular box to determine the water surface**			
	area of a pond with vertical sides			
	Volume =	$L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2			
	L_{RECT} =	273	feet	
	W_{RECT} =	137	feet	
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**			
	Side slope adj for 4 (H) : 1 (V)	4	feet	z factor 4
	Length at top of slope, L_{TOP} =	277	feet	
	Width at top of slope, W_{TOP} =	141	feet	
STEP 5	**The Water Surface at Peak Design Stage**			
	$Area_{WATER\ SURFACE}$	0.9	acres	
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**			
	What is the SHWT elevation at the pond location?	0	feet	
	What is the distance between pond and gutter low point?	0	feet	
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent	
	What is the estimated energy loss in the pipe	0.00	feet	
	What is the estimated HGL elevation at the low point	0.0	feet	
	What is the estimated low point elevation at the gutter	0.0	feet	
	What is location of low point?	At Station		
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet	
	What is the estimated hydraulic gradient clearance	0.0	feet	
	Is the estimated HGL clearance greater than standard?	Yes, OK		
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.		

Project Description	Determine the R/W area needed for Fly Over Concept Area A4 (Associated with Ramp A).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	277	feet	
	W_{TOP} =	141	feet	
	Length	L_{TOP} + 2(Berm width) =	287	feet
	Width	W_{TOP} + 2(Berm width) =	151	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	1.0	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.19	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.32	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	

Project Description	Determine treatment volume required for Fly Over Concept Area B1 and B2 (Associated with Ramp B)			
STEP 1	Determine the Receiving Water Body	EPB 6A Canal		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	6.63	acres	B1 and B2 areas
STEP 6	What is the amount of pervious area	2.42	acres	B1 and B2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.88**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.66	acre-ft	

Project Description Determine attenuation volume required for Fly Over Concept Area B1 and B2 (Associated with Ramp B)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	3.67	98	
Pervious *	2.96	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	**6.63**	**87**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 63.5%

	Area (ac.)	CN	
Roadway Pvmt	4.21	98	
Pervious *	2.42	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	**6.63**	**89**	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**1.46**	**1.21**
Runoff Depth (Q) inches =	**14.57**	**14.84**
Runoff Volume (ac-ft) =	**8.05**	**8.20**

Volume Difference = **0.15** ac-ft

The estimated attenuation volume is the volume difference 0.15 ac-ft
6345.2 cu.ft.

Project Description	Determine the water surface area for Fly Over Area B1 and B2 (Associated with Ramp B).

STEP 1 **Identify system type and available Height of volume**

Modify existing dry detention pond.

Max stage, A	12.00	feet (estimated shldr or ground elev)
Bottom stage, B	10.00	feet (estimated pond bottom elev.)
Freeboard requirment is, C	0.50	feet
Height of available volume is	1.50	feet (A-B-C)

STEP 2 **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 34999 cu.ft.

STEP 3 **Use the formula for a rectangular box to determine the water surface**

area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 216 feet

W_{RECT} = 108 feet

STEP 4 **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	6	feet	z factor	4
Length at top of slope, L_{TOP} =	222	feet		
Width at top of slope, W_{TOP} =	114	feet		

STEP 5 **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$ 0.6 acres

STEP 6 **Check low point along gutter with estimated hydraulic gradient slope**

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	0.00	feet
What is the estimated HGL elevation at the low point	0.0	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	0.0	feet
Is the estimated HGL clearance greater than standard?	Yes, OK	

STEP 7 Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Fly Over Concept Area B1 and B2 (Associated with Ramp B).

STEP 1 **Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**

Berm Width = 5 feet

STEP 2 **Add the maintenance berms to the water surface dimensions.**

L_{TOP} = 222 feet

W_{TOP} = 114 feet

Length L_{TOP} + 2(Berm width) = 232 feet

Width W_{TOP} + 2(Berm width) = 124 feet

STEP 3 **Determine Pond Right of Way Requirments**

$Area_{PRELIM}$ Length x Width = 0.7 acres

STEP 4 **Increase the pond area estimate by 10 - 20% to account for assumptions**

Percent Inc. 20%

$Area_{Required}$ Length x Width x %Inc. = 0.8 acres

STEP 5 What available area within infield/right of way can be used for stormwater management.

$Area_{available}$ 1.87 acres

Is $Area_{available}$ greater than $Area_{required}$? Yes, stormwater can be managed within FDOT R/W.

STEP 6 Add remarks as needed.

Project Description	Determine treatment volume required for Fly Over Concept Area C1 and C2 (Associated with Ramp C)	
STEP 1	Determine the Receiving Water Body	C-17 via Northlake Blvd system
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	Yes
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.

	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	5.27	acres	C1 and C2 areas not treating offsite areas
STEP 6	What is the amount of pervious area	1.78	acres	C1 and C2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.73**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.55	acre-ft	

Project Description Determine attenuation volume required for Fly Over Concept Area C1 and C2 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.63	98	
Pervious *	2.64	74	
Offsite Runoff	2.54	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.81	58	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 44.7%

	Area (ac.)	CN	
Roadway Pvmt	3.49	98	
Pervious *	1.78	74	
Offsite Runoff	2.54	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.81	61	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	7.24	6.49
Runoff Depth (Q) inches =	9.90	10.38
Runoff Volume (ac-ft) =	6.44	6.76

Volume Difference = 0.32 ac-ft

The estimated attenuation volume is the volume difference 0.32 ac-ft
13785 cu.ft.

Project Description	Determine the water surface area for Fly Over Area C1 and C2 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	0.90	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	37539	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface**		
	area of a pond with vertical sides		
	Volume = $L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2		
	L_{RECT} =	289	feet
	W_{RECT} =	144	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	3.6	feet; z factor: 4
	Length at top of slope, L_{TOP} =	292	feet
	Width at top of slope, W_{TOP} =	148	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	1.0	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	Yes, OK	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for Fly Over Concept Area C1 and C2 (Associated with Ramp C).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	292	feet	
	W_{TOP} =	148	feet	
	Length	L_{TOP} + 2(Berm width) =	302	feet
	Width	W_{TOP} + 2(Berm width) =	158	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	1.1	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	1.3	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	1.42	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.			

Project Description	Determine treatment volume required for Fly Over Concept Area C3 (Associated with Ramp C)			
STEP 1	Determine the Receiving Water Body	C-17 via Earman River Canal		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	4.68	acres	C3 area not treating offsite areas
STEP 6	What is the amount of pervious area	1.25	acres	C3 area
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.71**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.54	acre-ft	

Project Description	Determine attenuation volume required for Fly Over Concept Area C3 (Associated with Ramp C)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	2.08	98	
Pervious *	2.60	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	7.07	56	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 48.5%

	Area (ac.)	CN	
Roadway Pvmt	3.43	98	
Pervious *	1.25	74	
Offsite Runoff	2.39	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	7.07	61	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	7.84	6.49
Runoff Depth (Q) inches =	9.53	10.38
Runoff Volume (ac-ft) =	5.61	6.11

Volume Difference = 0.50 ac-ft

The estimated attenuation volume is the volume difference 0.50 ac-ft
21859 cu.ft.

Project Description	Determine the water surface area for Fly Over Area C3 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	0.90	feet (A-B-C)
STEP 2	**The total peak storage volume required is**		
	$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume		
	$Volume_{PEAK}$ =	45204	cu.ft.
STEP 3	**Use the formula for a rectangular box to determine the water surface** area of a pond with vertical sides		
	Volume = $L_{RECT}\ W_{RECT}\ H$		
	Assume L/W = 2		
	L_{RECT} =	317	feet
	W_{RECT} =	158	feet
STEP 4	**Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**		
	Side slope adj for 4 (H) : 1 (V)	3.6	feet — z factor 4
	Length at top of slope, L_{TOP} =	321	feet
	Width at top of slope, W_{TOP} =	162	feet
STEP 5	**The Water Surface at Peak Design Stage**		
	$Area_{WATER\ SURFACE}$	1.2	acres
STEP 6	**Check low point along gutter with estimated hydraulic gradient slope**		
	What is the SHWT elevation at the pond location?	0	feet
	What is the distance between pond and gutter low point?	0	feet
	What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
	What is the estimated energy loss in the pipe	0.00	feet
	What is the estimated HGL elevation at the low point	0.0	feet
	What is the estimated low point elevation at the gutter	0.0	feet
	What is location of low point?	At Station	
	What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
	What is the estimated hydraulic gradient clearance	0.0	feet
	Is the estimated HGL clearance greater than standard?	**Yes, OK**	
STEP 7	Add remarks as needed.	HGL check is N/A, since there is no pipe system.	

Project Description	Determine the R/W area needed for Fly Over Concept Area C3 (Associated with Ramp C).		
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**		
	Berm Width =	5	feet
STEP 2	**Add the maintenance berms to the water surface dimensions.**		
	L_{TOP} =	321	feet
	W_{TOP} =	162	feet
	Length	L_{TOP} + 2(Berm width) =	331 feet
	Width	W_{TOP} + 2(Berm width) =	172 feet
STEP 3	**Determine Pond Right of Way Requirments**		
	$Area_{PRELIM}$	Length x Width =	1.3 acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**		
	Percent Inc.	20%	
	$Area_{Required}$	Length x Width x %Inc. =	1.6 acres
STEP 5	What available area within infield/right of way can be used for stormwater management.		
	$Area_{available}$	1.25	acres
	Is $Area_{available}$ greater than $Area_{required}$?		No, Need offsite pond.
STEP 6	Add remarks as needed.	Need 0.35 acre pond	

Project Description	Determine treatment volume required for Fly Over Concept Area C4 (Associated with Ramp C)	
STEP 1	Determine the Receiving Water Body	C-17 via Earman River Canal
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW
STEP 3	Determine if the Water Body is Impaired	Yes
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.
STEP 5	Determine Design Project Area	

Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
Length =		ft	input area directly
Width =		ft	input area directly
Area =	6.20	acres	C3 and C4 areas

STEP 6	What is the amount of pervious area	2.35	acres	C3 and C4 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.80**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.60	acre-ft	

Project Description Determine attenuation volume required for Fly Over Concept Area C4 (Associated with Ramp C)

STEP 1

Pre-developed Area & Curve Number

	Area (ac.)	CN	
Roadway Pvmt	3.60	98	
Pervious *	2.60	74	
Offsite Runoff	3.94	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	10.14	54	

* Pervious areas determined using Mircostation CAD software.

STEP 2

Post-developed Area and Curve Number

Percent Impervious = 38.0%

	Area (ac.)	CN	
Roadway Pvmt	3.85	98	
Pervious *	2.35	74	
Offsite Runoff	3.94	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	10.14	54	

STEP 3

Calculate the difference in runoff volume between the pre and post conditions
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	8.60	8.40
Runoff Depth (Q) inches =	9.09	9.20
Runoff Volume (ac-ft) =	7.68	7.77

Volume Difference = 0.10 ac-ft

The estimated attenuation volume is the volume difference 0.10 ac-ft

4223.9 cu.ft.

Project Description	Determine the water surface area for Fly Over Area C4 (Associated with Ramp C).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	11.90	feet (estimated shldr or ground elev)
	Bottom stage, B	10.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	1.40	feet (A-B-C)

STEP 2 **The total peak storage volume required is**

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 30428 cu.ft.

STEP 3 **Use the formula for a rectangular box to determine the water surface area of a pond with vertical sides**

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 208 feet

W_{RECT} = 104 feet

STEP 4 **Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension**

Side slope adj for 4 (H) : 1 (V)	5.6	feet	z factor	4
Length at top of slope, L_{TOP} =	214	feet		
Width at top of slope, W_{TOP} =	110	feet		

STEP 5 **The Water Surface at Peak Design Stage**

$Area_{WATER\ SURFACE}$ 0.5 acres

Project Description	Determine the R/W area needed for Fly Over Concept Area C4 (Associated with Ramp C).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	214	feet	
	W_{TOP} =	110	feet	
	Length	L_{TOP} + 2(Berm width) =	224	feet
	Width	W_{TOP} + 2(Berm width) =	120	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.6	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.7	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	$Area_{available}$	2.35	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	Recommend using a freeboard of 0.5 ft for areas located between sound barrier wall and MSE wall.		

Project Description	Determine treatment volume required for Fly Over Concept Area D1 and D2 (Associated with Ramp D)			
STEP 1	Determine the Receiving Water Body	C-17 Canal via Northlake system		
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW		
STEP 3	Determine if the Water Body is Impaired	Yes		
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.		
STEP 5	Determine Design Project Area			
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.		
	Length =		ft	input area directly
	Width =		ft	input area directly
	Area =	6.13	acres	D1 and D2 areas not treating offsite areas
STEP 6	What is the amount of pervious area	1.58	acres	D1 and D2 areas
STEP 9	Determine Volume for (2.5") x Imperv Area	**0.95**	**acre-ft**	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A	acre-in	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.71	acre-ft	

Project Description Determine attenuation volume required for Fly Over Concept Area D1 and D2 (Associated with Ramp D)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	4.07	98	
Pervious *	2.06	74	
Offsite Runoff	0.49	74	
Proposed Pond Area	0.0	85	Pond is onsite
Total	6.62	83	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 68.7%

	Area (ac.)	CN	
Roadway Pvmt	4.55	98	
Pervious *	1.58	74	
Offsite Runoff	0.49	74	
Proposed Pond Area	0.00	98	Pond is onsite
Total	6.62	85	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions** for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the 100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	2.01	1.76
Runoff Depth (Q) inches =	14.02	14.26
Runoff Volume (ac-ft) =	7.73	7.87

Volume Difference = 0.14 ac-ft

The estimated attenuation volume is the volume difference 0.14 ac-ft

5883.8 cu.ft.

Project Description	Determine the water surface area for Fly Over Area D1 and D2 (Associated with Ramp D).		
STEP 1	**Identify system type and available Height of volume**		
	Modify existing dry detention pond.		
	Max stage, A	13.00	feet (estimated shldr or ground elev)
	Bottom stage, B	11.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	0.50	feet
	Height of available volume is	**1.50**	feet (A-B-C)

STEP 2

The total peak storage volume required is

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = **36852** cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface
area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = **222** feet

W_{RECT} = **111** feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	**6** feet	z factor	4
Length at top of slope, L_{TOP} =	**228** feet		
Width at top of slope, W_{TOP} =	**117** feet		

STEP 5

The Water Surface at Peak Design Stage

$Area_{WATER\ SURFACE}$ **0.6** acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	0	feet
What is the distance between pond and gutter low point?	0	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.1	percent
What is the estimated energy loss in the pipe	**0.00**	feet
What is the estimated HGL elevation at the low point	**0.0**	feet
What is the estimated low point elevation at the gutter	0.0	feet
What is location of low point?	At Station	
What is the standard hydraulic gradient clearance, use 1 ft.	0.0	feet
What is the estimated hydraulic gradient clearance	**0.0**	feet
Is the estimated HGL clearance greater than standard?	**Yes, OK**	

STEP 7

Add remarks as needed. HGL check is N/A, since there is no pipe system.

Project Description	Determine the R/W area needed for Fly Over Concept Area D1 and D2 (Associated with Ramp D).			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	5	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	228	feet	
	W_{TOP} =	117	feet	
	Length	L_{TOP} + 2(Berm width) =	238	feet
	Width	W_{TOP} + 2(Berm width) =	127	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	0.7	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	0.83	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	$Area_{available}$	0.86	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		Yes, stormwater can be managed within FDOT R/W.	
STEP 6	Add remarks as needed.	This is close...consider adding a bit more area for pond that is needed for Northlake Boulevard.		

Project Description	Determine treatment volume required for Modified Concept (Northlake Boulevard)		
STEP 1	Determine the Receiving Water Body	C-17	
STEP 2	Determine if the Water Body is an Outstanding Florida Water	Not OFW	
STEP 3	Determine if the Water Body is Impaired	Yes	
STEP 4	Determine Water Quality Criteria	1. Required treatment volume is 2.5" x % Impervious for Wet Detention. 2. Provide 150% of required treatment volume. (If an OFW) 3. If retention or dry detention used, provide 50% - 75% respectively of the above amount.	
STEP 5	Determine Design Project Area		
	Describe Project Area	Interchange infields and roadside linear ponds located between retaining walls and sound barrier walls along I-95.	
	Length =	ft	input area directly
	Width =	ft	input area directly
	Area =	3.23 acres	Northlake Blvd
STEP 6	What is the amount of pervious area	3.30 acres	Northlake Blvd
STEP 7	Determine Volume for (1.0") x Project Area	0.27 acre-ft	
STEP 9	Determine Volume for (2.5") x Imperv Area	-0.01 acre-ft	
STEP 10	Which volume is greater 1" or 2.5" amount	0.27 acre-ft	
STEP 11	Determine Treatment Volume Required for discharging to an OFW	N/A acre-ft	
STEP 12	Determine Treatment Volume Required using a Dry Detention system (75% of Wet)	0.20 acre-ft 8793.675 cu.ft.	

Project Description	Determine attenuation volume required for Modified Concept (Northlake Boulevard)

STEP 1 **Pre-developed Area & Curve Number**

	Area (ac.)	CN	
Roadway Pvmt	16.54	98	
Pervious *	1.89	74	
Offsite Runoff	0.00	74	Assume offsite runoff is attenuated offsite
Proposed Pond Area	0.0	85	Pond is onsite
Total	**18.43**	**96**	

* Pervious areas determined using Mircostation CAD software.

STEP 2 **Post-developed Area and Curve Number**

Percent Impervious = 91.7%

	Area (ac.)	CN	
Roadway Pvmt	22.50	98	
Pervious *	2.03	74	
Offsite Runoff	0.00	74	Assume offsite runoff is attenuated offsite
Proposed Pond Area	0.00	98	Pond is onsite
Total	**24.53**	**96**	

STEP 3 **Calculate the difference in runoff volume between the pre and post conditions**
for the 100 year - 24 hour storm using the NRCS equation for runoff.

From the NOAA website the precipitation data for the
100 year - 24 hour volume for WPB is 16.2 inches

$Q = (P-0.2S)^2 / (P + 0.8S)$ where: $S = (1000 / CN) - 10$

	Pre	Post
Potential Abstraction (S) =	**0.47**	**0.42**
Runoff Depth (Q) inches =	**15.65**	**15.71**
Runoff Volume (ac-ft) =	**24.04**	**32.12**

Volume Difference = **8.08** ac-ft

The estimated attenuation volume is the volume difference 8.08 ac-ft

351891 cu.ft.

Project Description	Determine the water surface area for Modified Concept (Northlake Boulevard)		
STEP 1	**Identify system type and available Height of volume**		
	Assume wet detention pond.		
	Max stage, A	13.00	feet (estimated shldr or ground elev)
	Bottom stage, B	9.00	feet (estimated pond bottom elev.)
	Freeboard requirment is, C	1.00	feet
	Height of available volume is	3.00	feet (A-B-C)

STEP 2

The total peak storage volume required is

$Volume_{PEAK}$ = Treatment Volume + Est. Peak Attenuation Volume

$Volume_{PEAK}$ = 360685 cu.ft.

STEP 3

Use the formula for a rectangular box to determine the water surface
area of a pond with vertical sides

Volume = $L_{RECT}\ W_{RECT}\ H$

Assume L/W = 2

L_{RECT} = 490 feet

W_{RECT} = 245 feet

STEP 4

Increase these dimensions to account for sloped sides by adding 2 x (0.5 x H x side slope) to each dimension

Side slope adj for 4 (H) : 1 (V)	12	feet	z factor 4
Length at top of slope, L_{TOP} =	502	feet	
Width at top of slope, W_{TOP} =	257	feet	

STEP 5

The Water Surface at Peak Design Stage

$Area_{WATER\ SURFACE}$ 3.0 acres

STEP 6

Check low point along gutter with estimated hydraulic gradient slope

What is the SHWT elevation at the pond location?	9	feet
What is the distance between pond and gutter low point?	1,475	feet
What is the estimated hydraulic gradient slope, use 0.05 to 0.1%	0.05	percent
What is the estimated energy loss in the pipe	0.74	feet
What is the estimated HGL elevation at the low point	9.7	feet
What is the estimated low point elevation at the gutter	10.2	feet
What is location of low point?	Along Northlake Blvd at Station 53+00	
What is the standard hydraulic gradient clearance, use 1 ft.	1.0	feet
What is the estimated hydraulic gradient clearance	0.5	feet
Is the estimated HGL clearance greater than standard?	**No, Berm pond or raise road**	

STEP 7

Add remarks as needed. Design pond berm for offsite pond(s) at least 0.5 ft higher than exist ground as needed to provide volume required.

Project Description	Determine the R/W area needed for Modified Concept (Northlake Boulevard)			
STEP 1	**Determine the maintenance berm width (adjacent to MSE wall, 20-ft typ not required)**			
	Berm Width =	20	feet	
STEP 2	**Add the maintenance berms to the water surface dimensions.**			
	L_{TOP} =	502	feet	
	W_{TOP} =	257	feet	
	Length	L_{TOP} + 2(Berm width) =	542	feet
	Width	W_{TOP} + 2(Berm width) =	297	feet
STEP 3	**Determine Pond Right of Way Requirments**			
	$Area_{PRELIM}$	Length x Width =	3.7	acres
STEP 4	**Increase the pond area estimate by 10 - 20% to account for assumptions**			
	Percent Inc.	20%		
	$Area_{Required}$	Length x Width x %Inc. =	4.4	acres
STEP 5	What available area within infield/right of way can be used for stormwater management.			
	Area $_{available}$	0	acres	
	Is $Area_{available}$ greater than $Area_{required}$?		No, Need offsite pond.	
STEP 6	Add remarks as needed.	Need 4.4 acre pond. Freeboard requirement is 1.0 ft.		

HY-8 Culvert Analysis Report

Project Notes

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

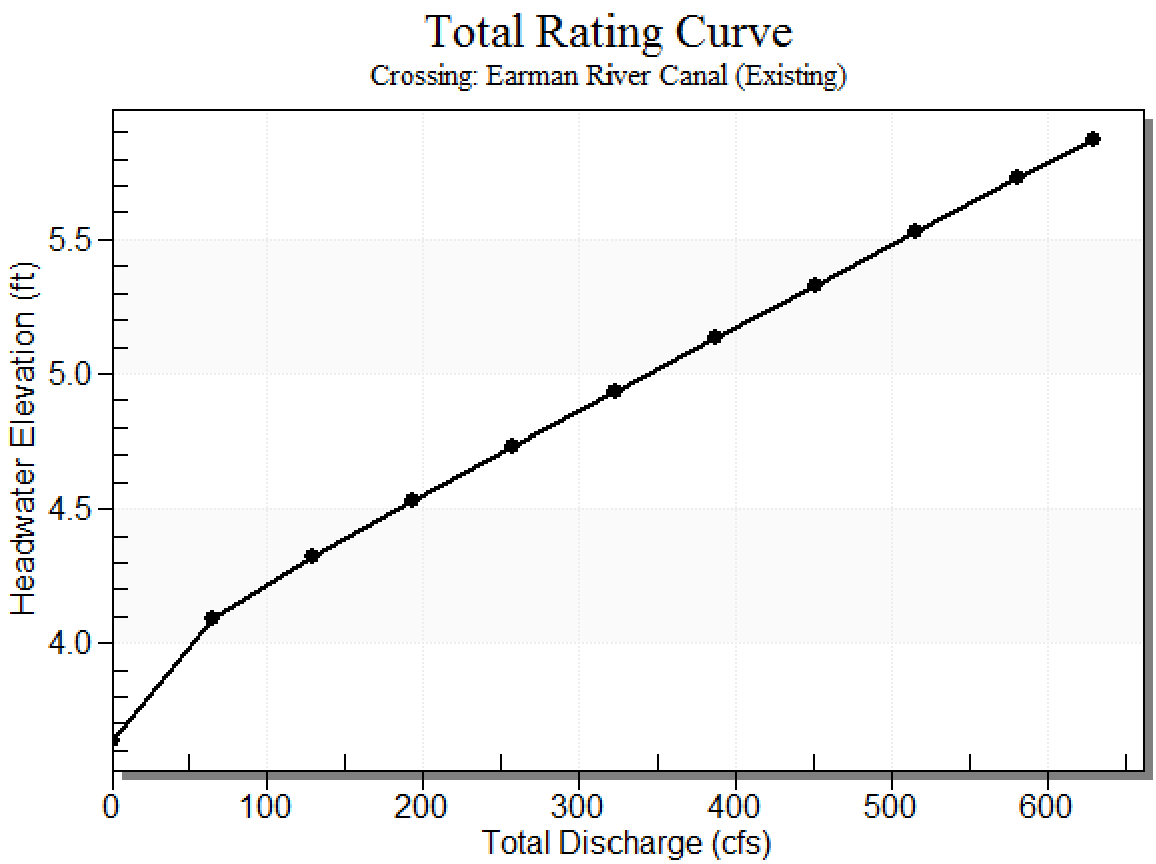
Crossing Notes: Earman River Canal

Table 1 - Summary of Culvert Flows at Crossing: Earman River Canal (Existing)

Headwater Elevation (ft)	Total Discharge (cfs)	Earman River (triple 10' x 12') Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3.64	0.00	0.00	0.00	1
4.09	64.50	64.50	0.00	1
4.32	129.00	129.00	0.00	1
4.53	193.50	193.50	0.00	1
4.73	258.00	258.00	0.00	1
4.93	322.50	322.50	0.00	1
5.13	387.00	387.00	0.00	1
5.33	451.50	451.50	0.00	1
5.53	516.00	516.00	0.00	1
5.73	580.50	580.50	0.00	1
5.88	629.64	629.64	0.00	1
15.00	3862.74	3862.74	0.00	Overtopping

Existing
HW Elev.
5.88 ft

Rating Curve Plot for Crossing: Earman River Canal (Existing)



Culvert Notes: Earman River (triple 10' x 12')

Table 2 - Culvert Summary Table: Earman River (triple 10' x 12')

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	3.64	0.000	2.540	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
64.50	64.50	4.09	1.208	2.994	3-M2t	4.712	0.525	2.980	0.439	0.721	7.464
129.00	129.00	4.32	1.554	3.223	3-M2t	8.036	0.833	3.171	0.630	1.356	9.660
193.50	193.50	4.53	1.900	3.432	3-M2t	12.000	1.091	3.323	0.782	1.941	11.194
258.00	258.00	4.73	2.276	3.634	3-M2t	12.000	1.322	3.455	0.914	2.489	12.405
322.50	322.50	4.93	2.652	3.833	3-M2t	12.000	1.534	3.574	1.033	3.008	13.417
387.00	387.00	5.13	2.996	4.031	3-M2t	12.000	1.733	3.682	1.141	3.503	14.294
451.50	451.50	5.33	3.317	4.230	3-M2t	12.000	1.920	3.783	1.242	3.978	15.071
516.00	516.00	5.53	3.617	4.429	3-M2t	12.000	2.099	3.877	1.336	4.436	15.771
580.50	580.50	5.73	3.902	4.629	3-M2t	12.000	2.270	3.967	1.426	4.878	16.409
629.64	629.64	5.88	4.111	4.776	3-M2t	12.000	2.397	4.032	1.491	5.206	16.861

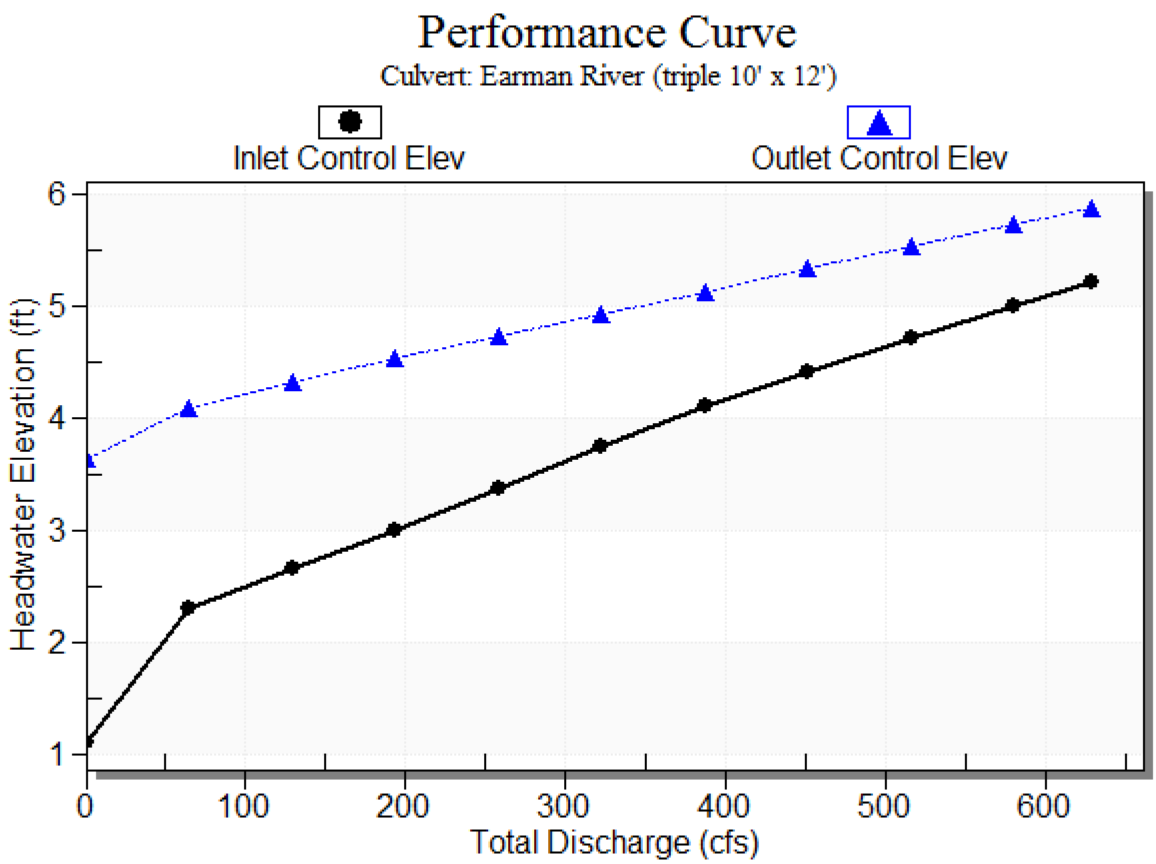
****

Inlet Elevation (invert): 1.10 ft,   Outlet Elevation (invert): 1.10 ft

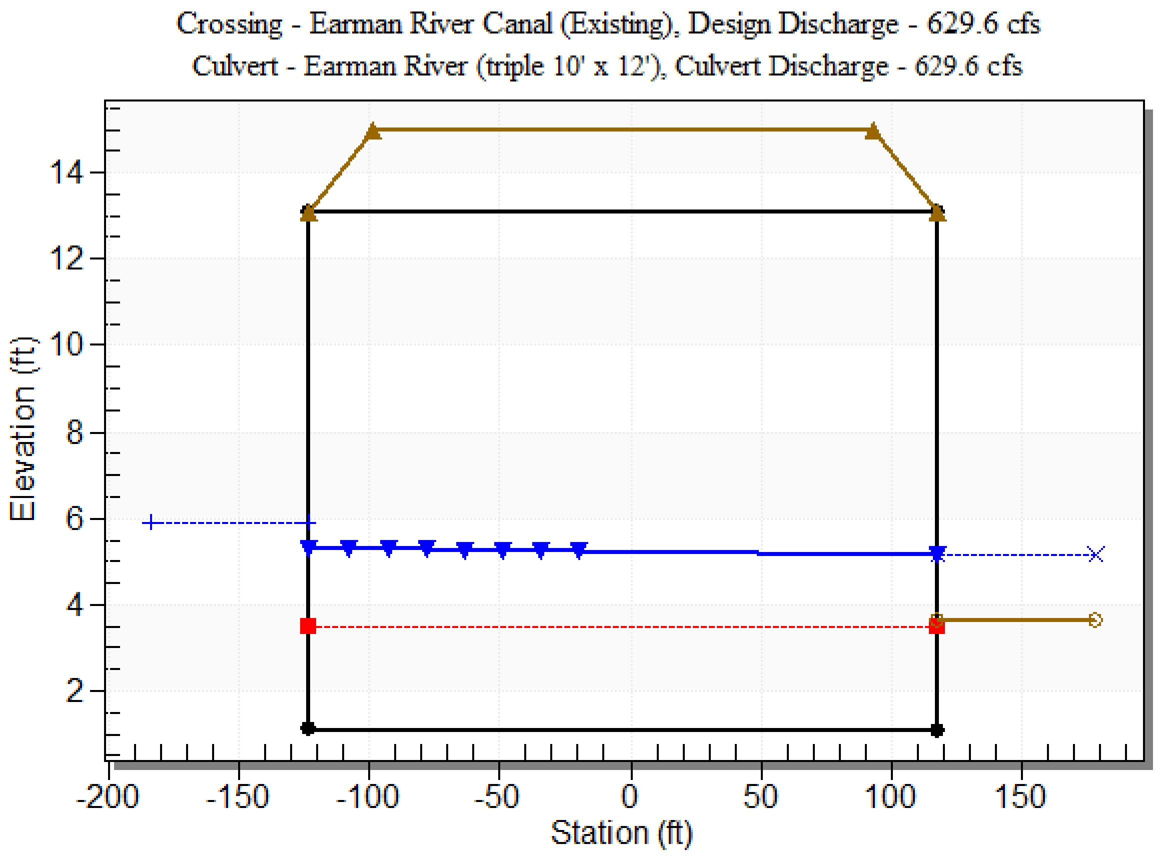
Culvert Length: 241.38 ft,   Culvert Slope: 0.0000

****

Culvert Performance Curve Plot: Earman River (triple 10' x 12')



Water Surface Profile Plot for Culvert: Earman River (triple 10' x 12')



Site Data - Earman River (triple 10' x 12')

Site Data Option: Culvert Invert Data

Inlet Station: -123.38 ft

Inlet Elevation: 1.10 ft

Outlet Station: 118.00 ft

Outlet Elevation: 1.10 ft

Number of Barrels: 3

Culvert Data Summary - Earman River (triple 10' x 12')

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 12.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90º) Headwall

Inlet Depression: NONE

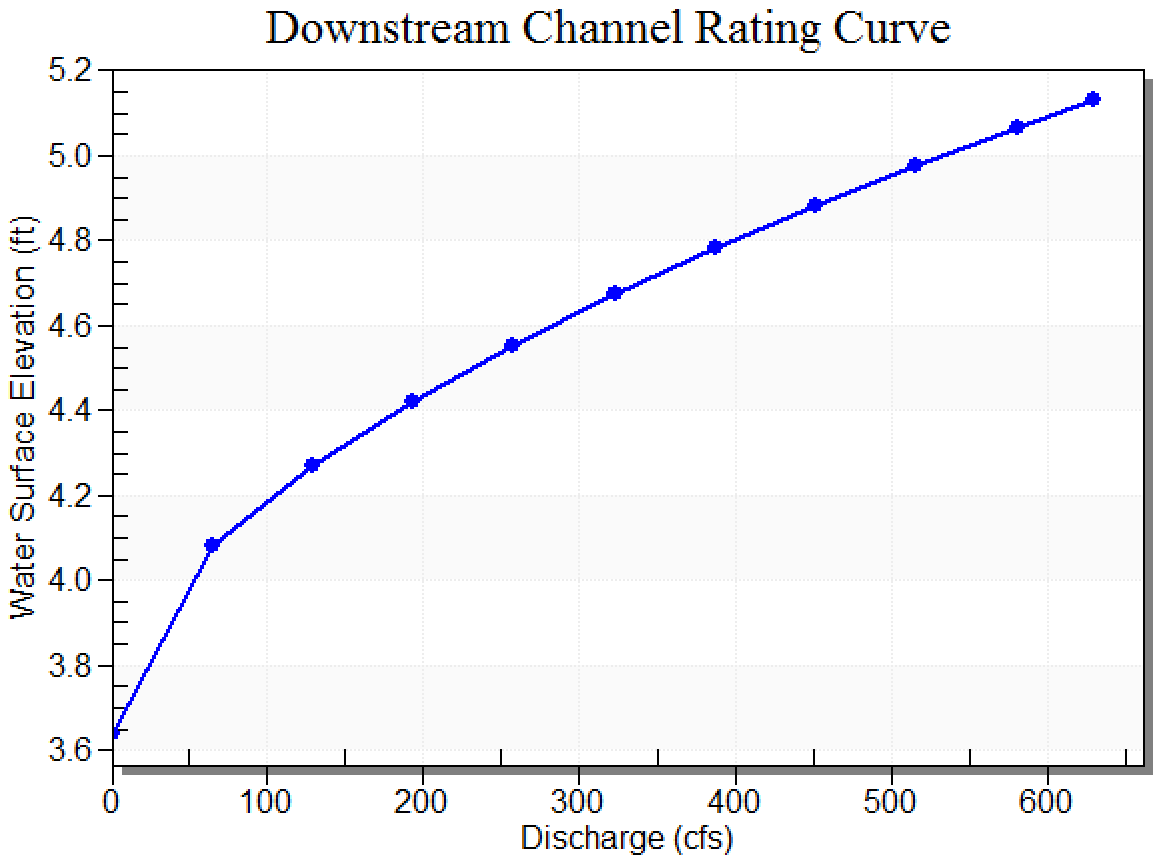
Table 3 - Downstream Channel Rating Curve (Crossing: Earman River Canal

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	3.64	0.00	0.00	0.00	0.00
64.50	4.08	0.44	7.46	0.27	2.20
129.00	4.27	0.63	9.66	0.39	2.34
193.50	4.42	0.78	11.19	0.49	2.43
258.00	4.55	0.91	12.40	0.57	2.49
322.50	4.67	1.03	13.42	0.64	2.54
387.00	4.78	1.14	14.29	0.71	2.58
451.50	4.88	1.24	15.07	0.77	2.61
516.00	4.98	1.34	15.77	0.83	2.64
580.50	5.07	1.43	16.41	0.89	2.67
629.64	5.13	1.49	16.86	0.93	2.68

Tailwater Channel Data - Earman River Canal (Existing)

Tailwater Channel Option: Irregular Channel

Tailwater Rating Curve Plot for Crossing: Earman River Canal (Existing)



Roadway Data for Crossing: Earman River Canal (Existing)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 15.00 ft

Roadway Surface: Paved

Roadway Top Width: 192.00 ft

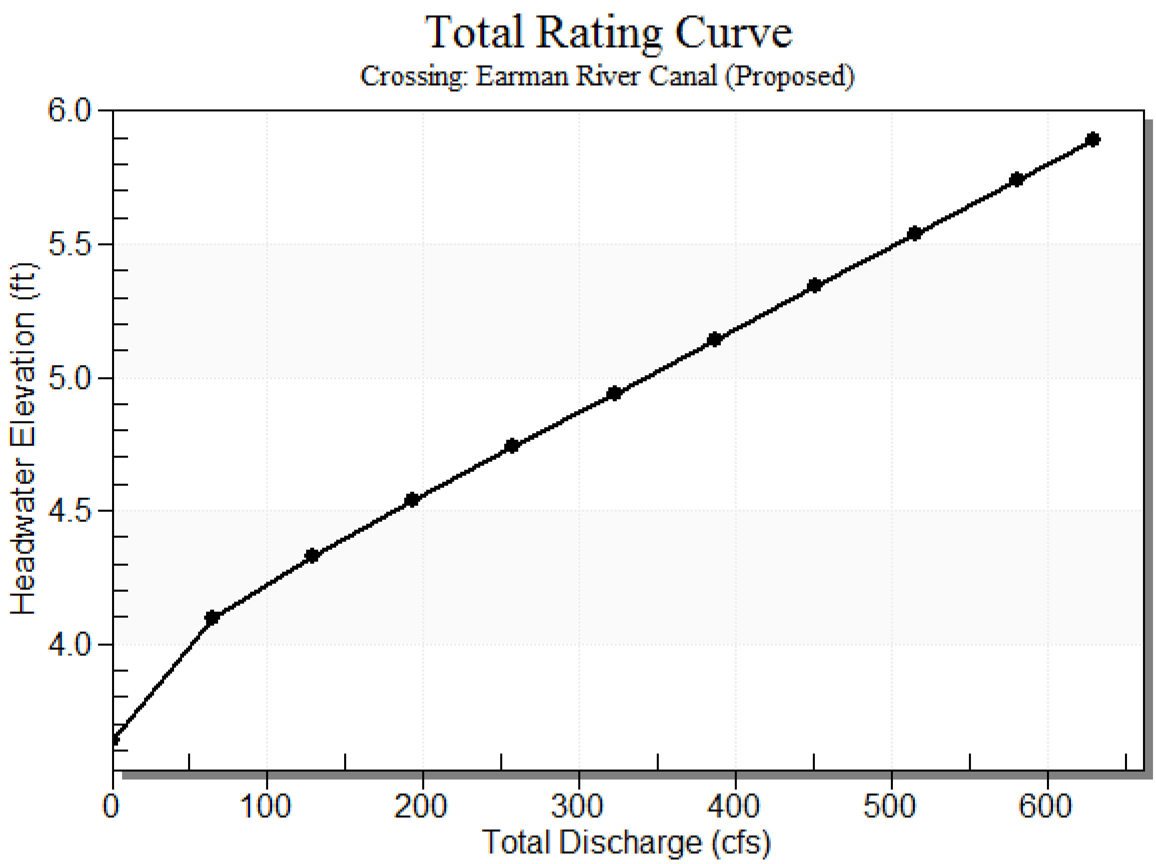
Crossing Notes: Earman River Canal (Proposed)

Table 4 - Summary of Culvert Flows at Crossing: Earman River Canal (Proposed)

Headwater Elevation (ft)	Total Discharge (cfs)	Earman River (triple 10' x 12') Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3.64	0.00	0.00	0.00	1
4.09	64.50	64.50	0.00	1
4.33	129.00	129.00	0.00	1
4.53	193.50	193.50	0.00	1
4.74	258.00	258.00	0.00	1
4.94	322.50	322.50	0.00	1
5.14	387.00	387.00	0.00	1
5.34	451.50	451.50	0.00	1
5.54	516.00	516.00	0.00	1
5.74	580.50	580.50	0.00	1
5.89	629.64	629.64	0.00	1
15.00	3850.88	3850.88	0.00	Overtopping

Proposed
HW Elev.
5.89 ft

Rating Curve Plot for Crossing: Earman River Canal (Proposed)



Culvert Notes: Earman River (triple 10' x 12')

Table 5 - Culvert Summary Table: Earman River (triple 10' x 12')

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	3.64	0.000	2.540	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
64.50	64.50	4.09	1.208	2.994	3-M2t	4.902	0.525	2.980	0.439	0.721	7.464
129.00	129.00	4.33	1.554	3.225	3-M2t	8.386	0.833	3.171	0.630	1.356	9.660
193.50	193.50	4.53	1.900	3.435	3-M2t	12.000	1.091	3.323	0.782	1.941	11.194
258.00	258.00	4.74	2.276	3.637	3-M2t	12.000	1.322	3.455	0.914	2.489	12.405
322.50	322.50	4.94	2.652	3.839	3-M2t	12.000	1.534	3.574	1.033	3.008	13.417
387.00	387.00	5.14	2.996	4.038	3-M2t	12.000	1.733	3.682	1.141	3.503	14.294
451.50	451.50	5.34	3.317	4.239	3-M2t	12.000	1.920	3.783	1.242	3.978	15.071
516.00	516.00	5.54	3.617	4.439	3-M2t	12.000	2.099	3.877	1.336	4.436	15.771
580.50	580.50	5.74	3.902	4.640	3-M2t	12.000	2.270	3.967	1.426	4.878	16.409
629.64	629.64	5.89	4.111	4.794	3-M2t	12.000	2.397	4.032	1.491	5.206	16.861

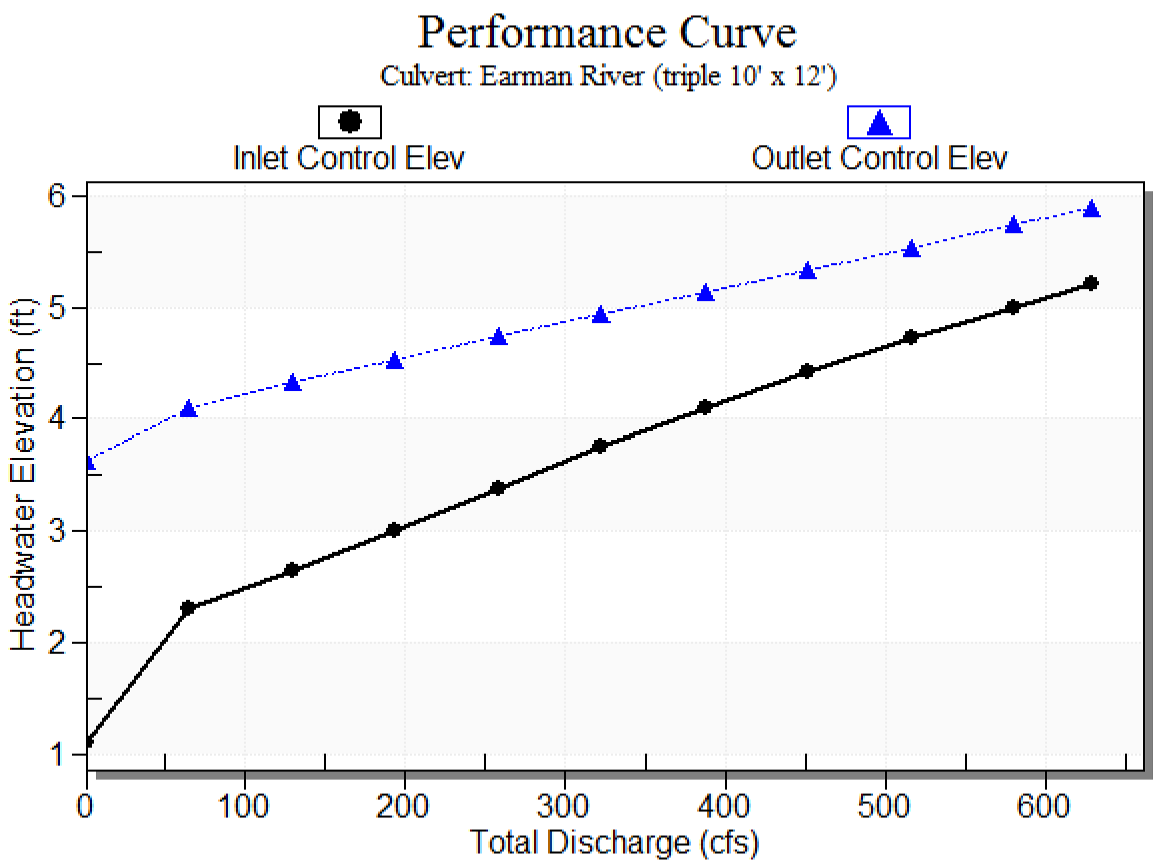
****

Inlet Elevation (invert): 1.10 ft,   Outlet Elevation (invert): 1.10 ft

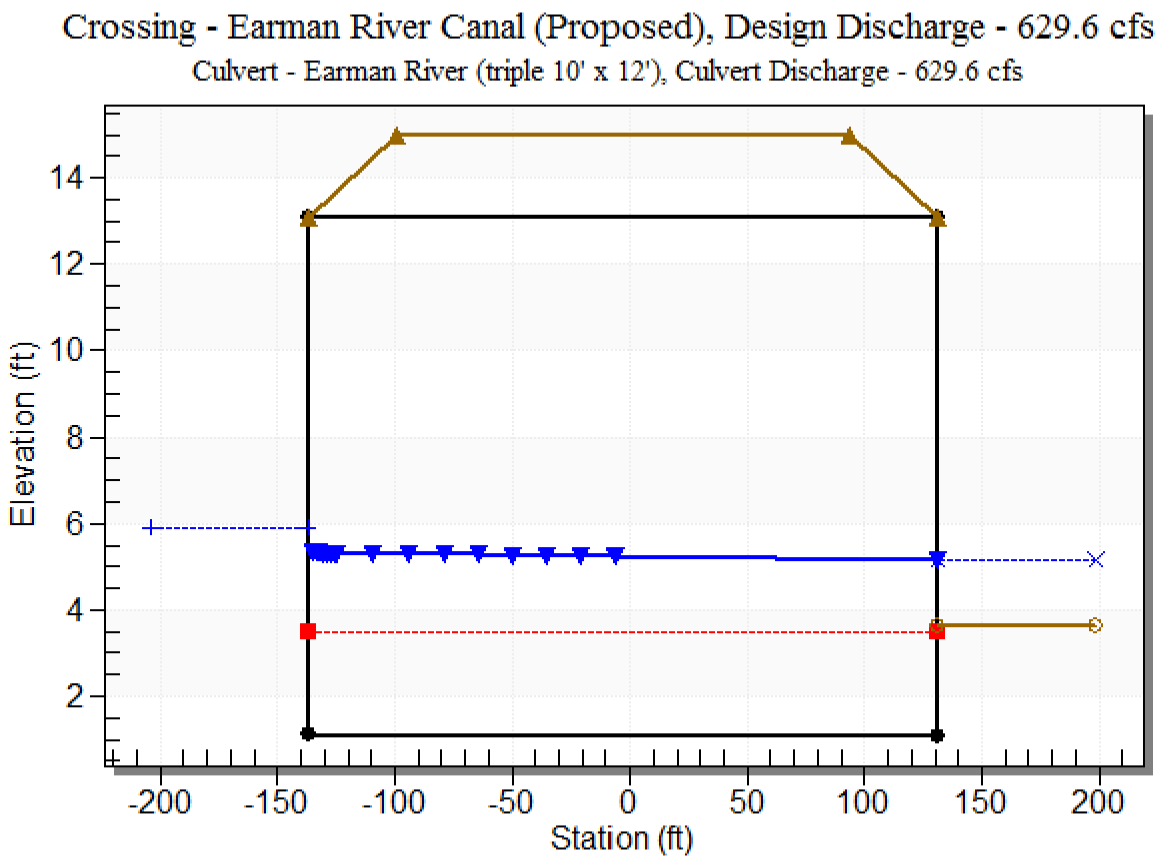
Culvert Length: 268.38 ft,   Culvert Slope: 0.0000

****

Culvert Performance Curve Plot: Earman River (triple 10' x 12')



Water Surface Profile Plot for Culvert: Earman River (triple 10' x 12')



Site Data - Earman River (triple 10' x 12')

Site Data Option: Culvert Invert Data

Inlet Station: -136.88 ft

Inlet Elevation: 1.10 ft

Outlet Station: 131.50 ft

Outlet Elevation: 1.10 ft

Number of Barrels: 3

Culvert Data Summary - Earman River (triple 10' x 12')

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 12.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90º) Headwall

Inlet Depression: NONE

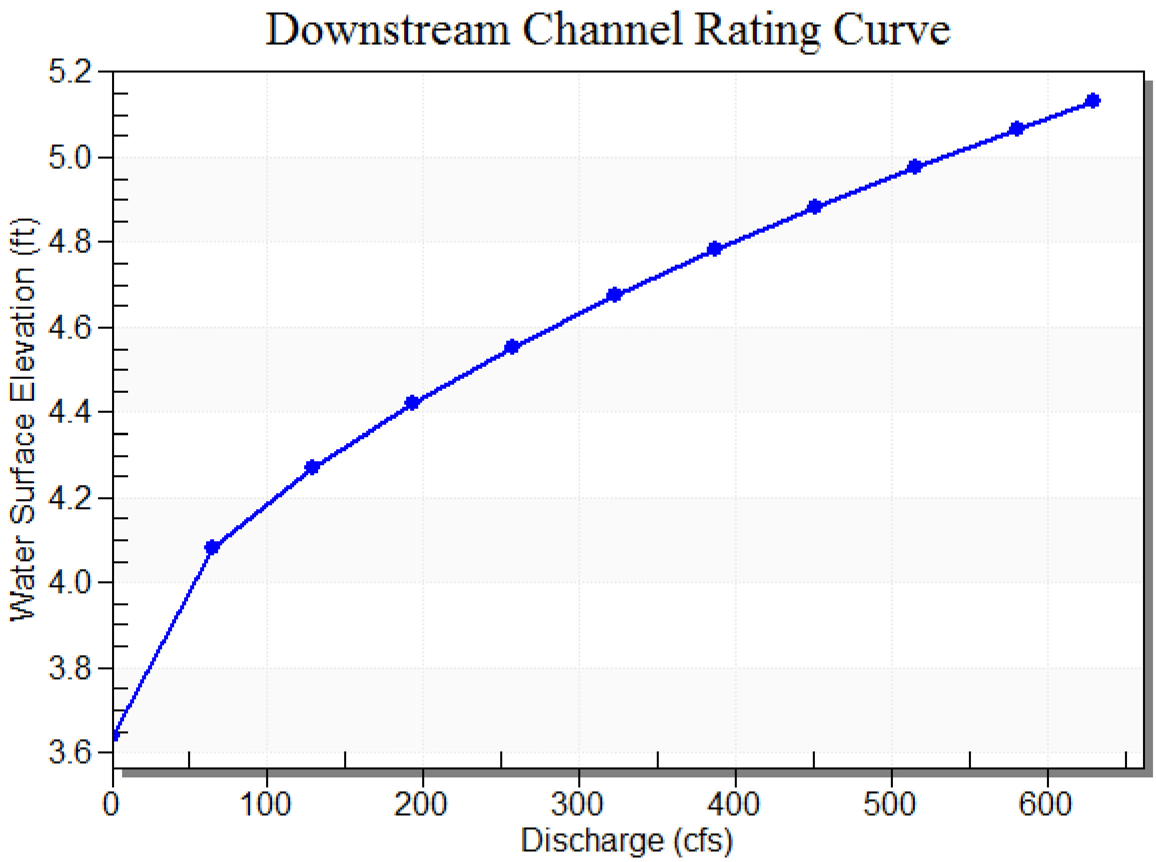
Table 6 - Downstream Channel Rating Curve (Crossing: Earman River Canal

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	3.64	0.00	0.00	0.00	0.00
64.50	4.08	0.44	7.46	0.27	2.20
129.00	4.27	0.63	9.66	0.39	2.34
193.50	4.42	0.78	11.19	0.49	2.43
258.00	4.55	0.91	12.40	0.57	2.49
322.50	4.67	1.03	13.42	0.64	2.54
387.00	4.78	1.14	14.29	0.71	2.58
451.50	4.88	1.24	15.07	0.77	2.61
516.00	4.98	1.34	15.77	0.83	2.64
580.50	5.07	1.43	16.41	0.89	2.67
629.64	5.13	1.49	16.86	0.93	2.68

Tailwater Channel Data - Earman River Canal (Proposed)

Tailwater Channel Option: Irregular Channel

Tailwater Rating Curve Plot for Crossing: Earman River Canal (Proposed)



Roadway Data for Crossing: Earman River Canal (Proposed)

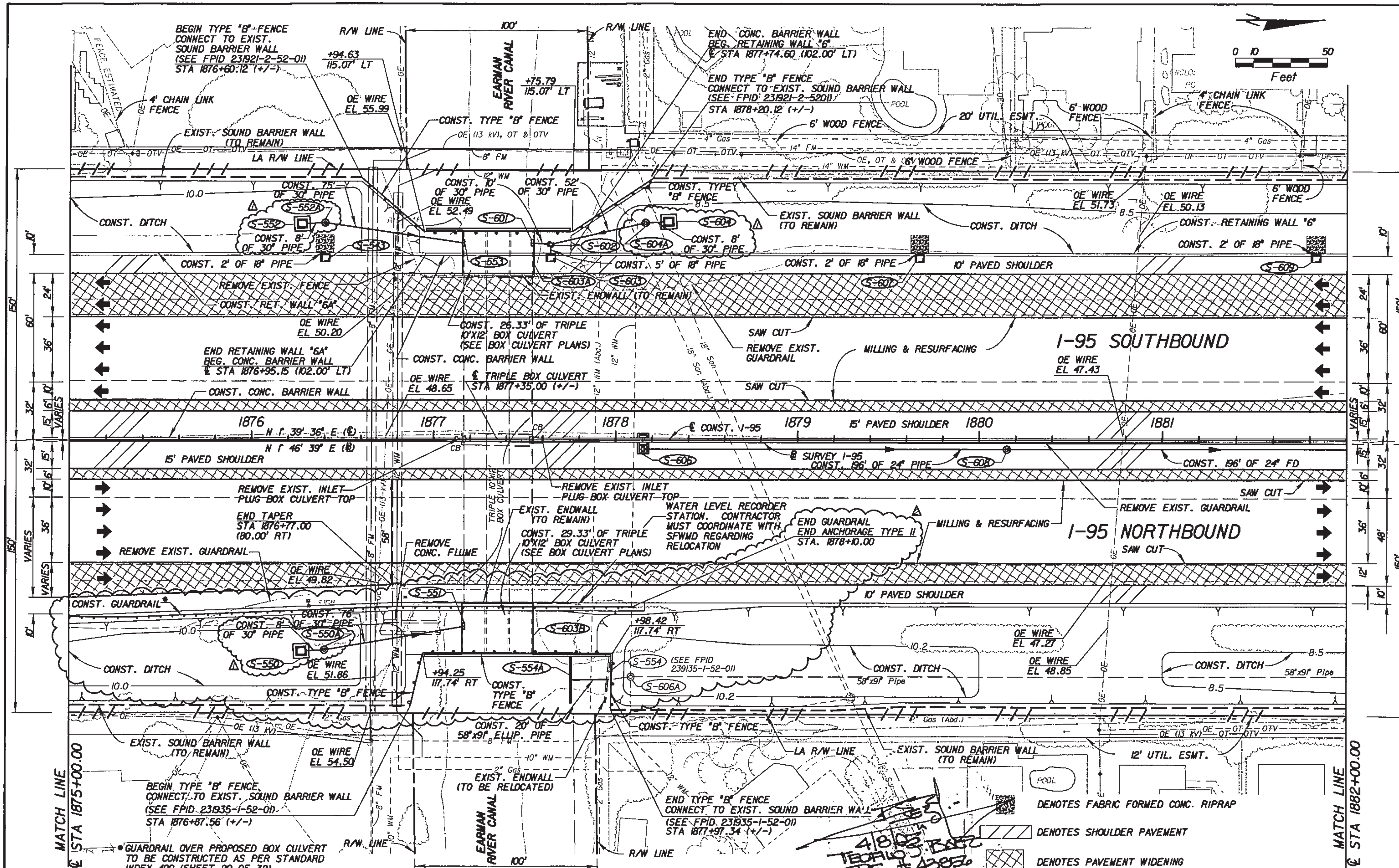
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 15.00 ft

Roadway Surface: Paved

Roadway Top Width: 192.00 ft



REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
02-19-04	TB	S-550A, S-552A, AND S-604A ADDED. STATION LOCATIONS FOR S-550, S-552, AND S-604 REVISED.			
04-08-05	TB	GUARDRAIL CONSTRUCTION ELEMENTS AND TEXT LABELS ADDED.			

URS

URS Corporation Southern
7650 Corporate Center Drive
Suite 400
Miami, FL 33126-1220
Tel: (305) 262-7466
P.E. Lic. No. EB 00000002

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

PLAN - SR 9

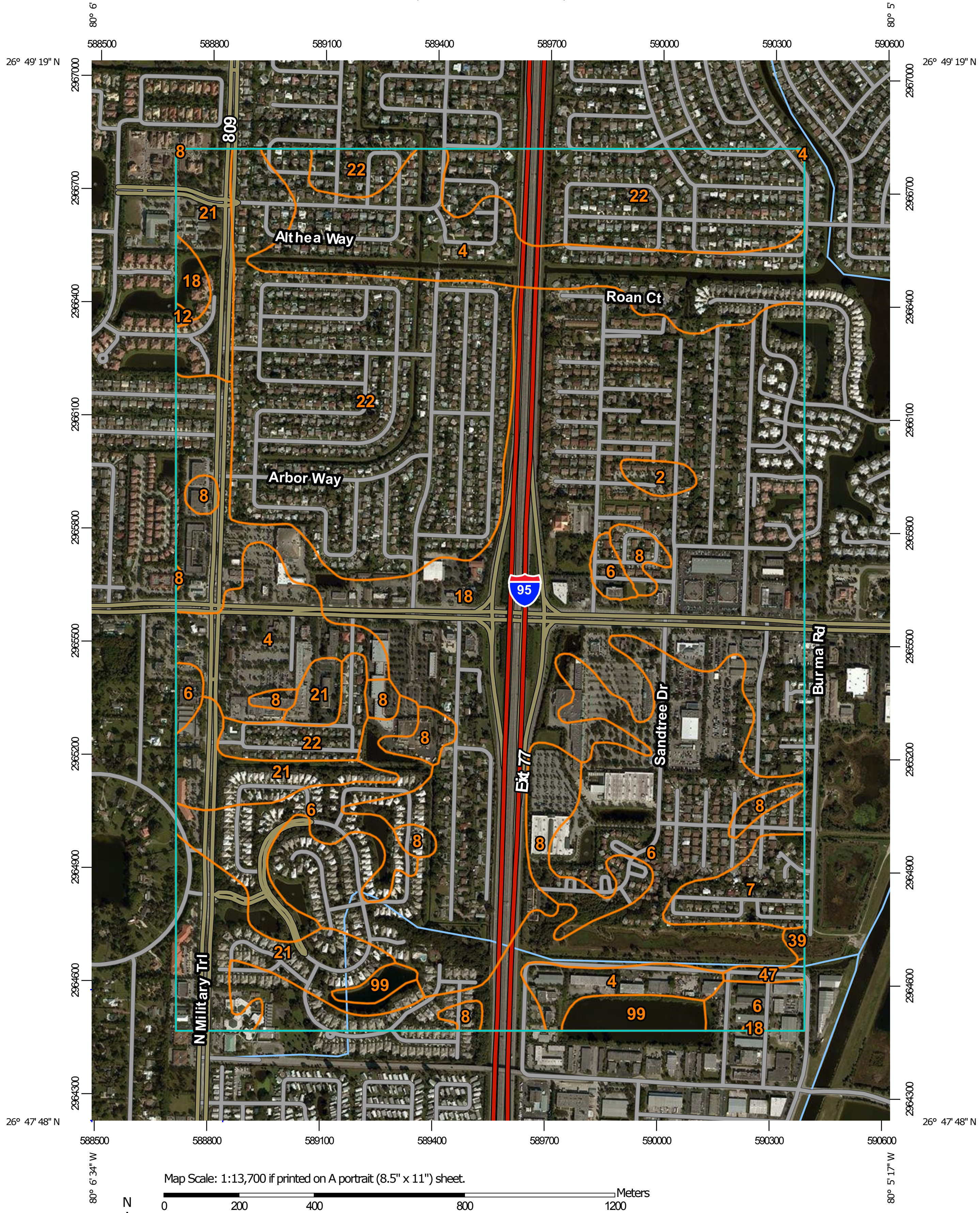
SHEET NO.
94

4/11/2005 8:38:22 AM g:\Trans\Dsg\I95DBF\231921\roadway\planrd6.dgn

Appendix E

Soil Maps

Soil Map—Palm Beach County Area, Florida
(I-95 at Northlake Blvd.)



Map Scale: 1:13,700 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

N

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Palm Beach County Area, Florida
Survey Area Data: Version 12, Sep 14, 2016

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

Date(s) aerial images were photographed: Nov 13, 2014—Dec 11, 2014

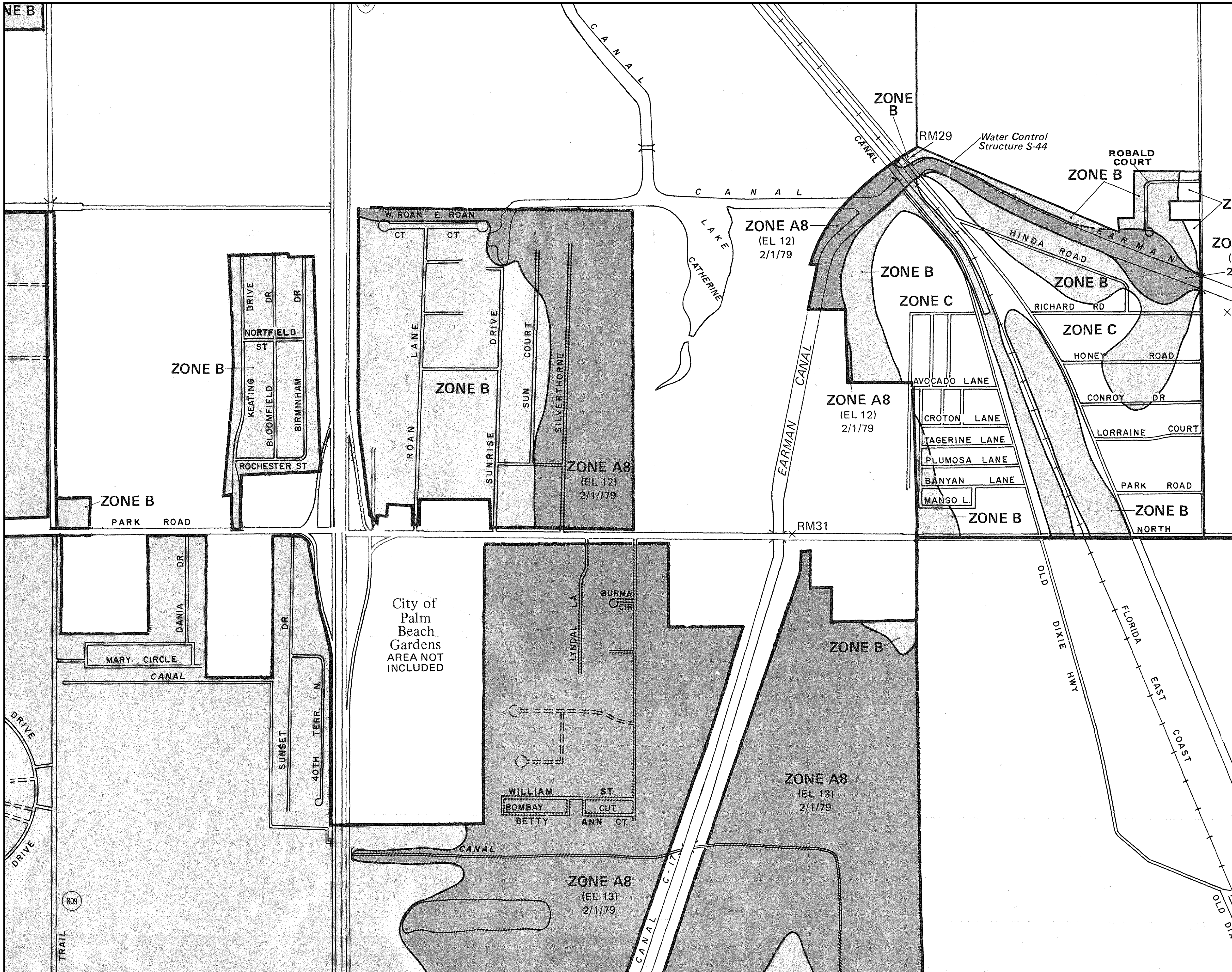
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Palm Beach County Area, Florida (FL611)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2	Anclote fine sand	3.6	0.4%
4	Arents-Urban land complex, 0 to 5 percent slopes	113.8	11.7%
6	Basinger fine sand, 0 to 2 percent slopes	156.1	16.1%
7	Basinger-Urban land complex	15.3	1.6%
8	Basinger and Myakka sands, depressional	35.7	3.7%
12	Chobee fine sandy loam	0.4	0.0%
18	Immokalee fine sand, 0 to 2 percent slopes	338.1	34.8%
21	Myakka fine sand, 0 to 2 percent slopes	74.6	7.7%
22	Myakka-Urban land complex	220.6	22.7%
39	Sanibel muck	0.9	0.1%
47	Udorthents, 2 to 35 percent slopes	2.1	0.2%
99	Water	11.2	1.2%
Totals for Area of Interest		**972.4**	**100.0%**

Appendix F

FIRM Maps



KEY TO MAP

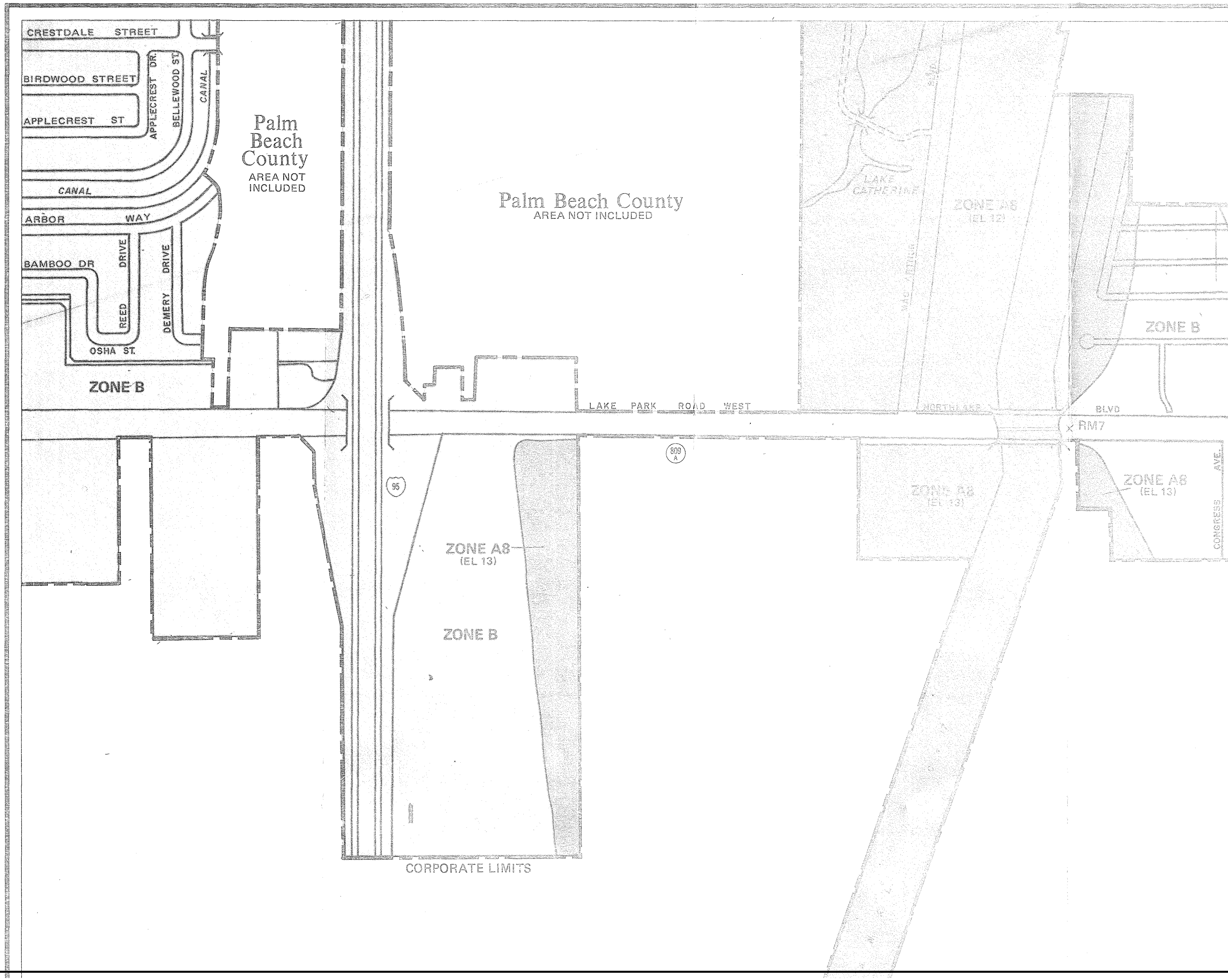
500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE A1 DATE / ZONE A5 DATE
Zone Designations* With Date of Identification e.g., 12/2/74	
100-Year Flood Boundary	
500-Year Flood Boundary	ZONE B
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER



N

APPROXIMATE SCALE

600 0 600 FEET

KEY TO MAP

500-Year Flood Boundary — ZONE B

100-Year Flood Boundary — ZONE A1 DATE

Zone Designations* With Date of Identification e.g., 12/2/74 — ZONE A5 DATE

100-Year Flood Boundary

500-Year Flood Boundary — ZONE B

Base Flood Elevation Line With Elevation In Feet** — 513

Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)

Elevation Reference Mark — RM7×

River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

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AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1 A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

Appendix G

Correspondence Permits Excerpts

Meeting 2 started at 9:20 AM: 435803-1-22-02

Attendees:

Name	Organization	Email Address
Carlos de Rojas	SFWMD	cderojas@sfwmd.gov
Caroline Hanes	SFWMD	chanes@sfwmd.gov
Renaud Olivier	Stanley Consultants	OlivierRenaud@stanleygroup.com
Courtney Arena	Stanley Consultants	ArenaCourtney@stanleygroup.com
Linda Ferreira	Stanley Consultants	FerreiraLinda@stanleygroup.com
Jamie Wilson	Stanley Consultants	WilsonJamie@stanleygroup.com
Bill Evans	Stanley Consultants	EvansBill@stanleygroup.com
Scott Thurman	FDOT Design	Scott.Thurman@dot.state.fl.us
Roberto Betancourt	FDOT Drainage	Roberto.Betancourt@dot.state.fl.us
Fernando Ascanio	FDOT PLEMO	Fernando.Ascanio@dot.state.fl.us
Hui Shi	FDOT Drainage	Hui.Shi@dot.state.fl.us
Justin Freedman	E Sciences, Incorporated	jfreedman@esciencesinc.com

District: Four
FPID/FM Number: 435803-1-22-02
FDOT Project Manager: Scott Thurman
Consultant/Company Name: Stanley Consultants, Inc.
SR/Local Name: SR-9/I-95
Project Limits: SR-9/I-95 at Northlake Boulevard interchange in Palm Beach County. I-95 limits extend 1/2 mile north and 1/2 mile south of Northlake Boulevard. The project also includes improvements along Northlake Boulevard between Military Trail and Sunset Drive.
General Scope: PD&E Study. Develop alternatives to improve overall traffic operations at the existing interchange.
Requested Attendees: SFWMD Environmental Resources and Surface Water Management staff, USACE staff.

- Bill Evans provided a verbal project overview and provided meeting attendees with a hard copy map of the project's likely preferred alternative:
  - The PD&E Project involves examination of three build alternatives for interchange improvement (to meet traffic needs in 2040).
    - Alternative 1 –current conventional interchange with ramp improvements.
    - Alternative 2 – diverging diamond interchange (DDI), depicted on hand out (**see attached figure**).
    - Alternative 3 – dual lane fly over (east bound to northbound movement over I-95, and westbound to southbound over I-95).
  - All alternatives add lane along Northlake Boulevard in east-west direction to make eight lanes between Military Trail and Sunset Drive.
  - Project team currently leaning towards Alternative 2.
  - Estimated schedule:
    - PD&E documents to be prepared over next couple months.
    - Public hearing – September/October 2017.
    - Complete project in December.

- Courtney Arena discussed project environmental issues:
  - The intersection is generally urbanized.
  - The project is within USFWS Consultation Area for scrub jay, but no habitat for this species is present.
  - The project is within a wood stork Core Foraging Area (CFA), though no foraging habitat is present for this species within the project limits.
  - Minor impacts to a canal (extension of C-17 Canal) are anticipated in association with culvert extension for road widening (would be "other surface water" impacts). Courtney added that this section of the canal is actively maintained, and that no protected resources were observed.
  - Cypress trees are present along the canal bank (**see attached photos**). However, one design alternative may require acquisition of a portion of a pond adjacent to the canal – this alternative may result in cypress tree impacts. Caroline Hanes commented that the cypress trees appear to have been planted, and impacts to the trees would not be considered wetland impacts.
- Carlos de Rojas added that if the canal is part of SFWMD ROW, then the project team will need to coordinate with SFWMD ROW staff.
- Mr. Olivier stated that costs associated with partial acquisition of the pond will be included in FDOT's overall "Cost(s) to Cure" calculations.
- Mr. Olivier provided additional project description details:
  - Northlake Boulevard is a six-lane divide urban section at present, and is proposed to be widened to eight lanes.
  - Northlake Boulevard is a north-south dividing line for drainage.
  - The I-95 bridge over Northlake Boulevard will need to be reconstructed.
  - Alternatives 1 and 3 may require acquisition of a parcel off the northwest corner of the intersection. Ms. Arena added that this parcel appears to consist of disturbed uplands (i.e. Brazilian pepper).
  - Preferred Alternative 2 provides more pervious area than other alternatives.
  - The proposed ramps will be triple-lefts and triple-rights (for all design alternatives).
  - There is an existing ERP along I-95. Water quality is currently being provided in dry detention areas within the interchange infields and I-95 mainline roadside swales. In addition there is exfiltration trench in the median which provides water quality. The proposed water quality approach is to provide treatment volume that is being provided today +2.5 inches over the additional impervious areas.
  - There is an existing ERP that covers Northlake Blvd. from Sunrise Drive to Sandtree Drive. Water quality is currently being provided in approximately 1200 feet of exfiltration trench. The proposed water quality approach for Northlake Blvd. is to provide treatment volume based on the greater of one inch over the project area or 2.5 inches over the impervious area.
  - The project discharge point is the C-17 Canal. It is not an OFW. However it is a water body identified on the statewide comprehensive verified list and currently impaired for nutrients.
  - Post development peak stages proposed to be below pre-development peak stages.

- Mr. Olivier stated that purpose of PD&E study is to identify agency concerns and provide cost effective design that addresses all concerns. Mr. Olivier added that the purpose of drainage report is to identify the potential need for off-site ponds (i.e. outside ROW).
- Mr. de Rojas stated that drainage design should accommodate either 2.5 inches of rainfall over all impervious areas or one inch of rainfall over the entire project area (pervious and impervious surfaces), whichever volume is greater.
- Mr. de Rojas stated that since the C-17 Canal is listed as “impaired for nutrients”, a pre vs post pollutant loading analysis will be required, and an additional 50% treatment may be also be required.

Meeting 2 ended at 9:50 AM.

SR 9/I-95 at Northlake Boulevard

FM 435803-1-22-02

Name (please print)	Affiliation	Email Address
Fernando Ascanio	FDOT	fernando.ascanio@dot.state.fl.us
ROBERTO BETANCOURT	FDOT DRAINAGE	ROBERTO.BETANCOURT@DOT.STATE.FL.US
Hui Shi	FDOT Drainage	Hui.Shi@dot.state.fl.us
RENAUD OLIVIER	STANLEY CONSULTANTS	olivierrenaud@stanleygroup.com
Courtney Arena	Stanley Consultants	arenacourtney@stanleygroup.com
Linda Ferreira	Stanley Consultants	FerreiraLinda@stanleygroup.com
JAMIE WILSON	Stanley Consultants	~~JAMIE WILSON~~ wilsonjamie@stanleygroup.com
BILL EVANS	" "	EVANSBill@StanleyGroup.com
Scott Thurman	FDOT DESIGN	Scott.Thurman@DOT.STATE.FL.US
Carlos deRojas	SFWMD	cderojas@sfwmd.gov
Carolina Hanes	SFWMD	chanes@sfwmd.gov
[illegible]	ESciences	jfreedman@escienceinc.com

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
3301 Gun Club Road, West Palm Beach, Florida 33406 • (561) 686-8800 • FL WATS 1-800-432-2045 • TDD (561) 697-2574
Mailing Address: P.O. Box 24680, West Palm Beach, FL 33416-4680 • www.sfwmd.gov

CON 24-06

Environmental Resource Regulation
Application No.: 021010-8

December 11, 2002

FLORIDA DEPARTMENT OF TRANSPORTATION
3400 W COMMERCIAL BLVD
FORT LAUDERDALE, FL 33309

Dear Permittee:

SUBJECT: PERMIT NO.: 50-03527-S
Project : SR9 (I-95) WIDENING NORTH OF BLUE HERON BOULEVARD TO PGA
Location: Palm Beach County, S12/T42S/R42E
S17/T42S/R43E

District staff has reviewed the information submitted October 10, 2002, for revisions to the retaining walls along the outside of the I-95 roadway corridor, modification of the profiles of Ramps A, B, and C, and the installation of exfiltration trench along Ramps A and B as shown on the plans signed and sealed by Juan C. Garcia, P.E. of URS Corporation on November 9, 2002. These plans are incorporated by reference and are included in the permit file.

Based on that information, District staff has determined that the proposed activities are in compliance with the original surface water management Permit and appropriate provisions of FAC Rule 40E-4.331(2)(b). Therefore, these changes have been recorded in our files.

Please understand that your permit remains subject to the Standard Limiting Conditions and all other Special Conditions not modified and as originally issued.

Should you have any questions concerning this matter, please contact this office.

Sincerely,

Hugo A. Carter, P.E.
Sr Supv Engineer
Palm Beach Service Center

HC/hc

5/8/03

ORIGINAL SUBMITTAL
OCT 10 2002
WPB

021010-8

ATTACHMENT C

WATER QUALITY SUMMARY TABLE
(One Original and Four Copies)

WATER QUALITY SUMMARY (AS ORIGINALLY DESIGNED)

1	S-206	FRENCH DRAIN	0.80	0.80	0.00	100.00	0.00	0.1667	0.1250	0.1667	0.5760	345.60
1	S-209	FRENCH DRAIN	0.59	0.59	0.00	100.00	0.00	0.1229	0.0922	0.1229	0.3276	266.52
1	S-250	DRY DET.	1.41	0.97	0.44	68.79	0.00	0.2021	0.1516	0.1516	0.1220	80.49
1	S-251	DRY DET.	1.40	0.98	0.42	70.00	0.00	0.2042	0.1531	0.1531	0.1154	75.36
1	S-252	DRY DET.	7.76	4.38	3.38	56.44	0.00	0.9125	0.6844	0.6844	0.6800	99.36
1	S-253	DRY DET.	9.26	5.29	3.97	57.13	0.00	1.1021	0.8266	0.8266	0.7900	95.58
1	S-305	FRENCH DRAIN	2.08	2.08	0.00	100.00	0.00	0.4333	0.3250	0.4333	0.6153	141.99
1	S-452	DRY DET.	5.59	3.93	1.66	70.30	0.00	0.8188	0.6141	0.6141	0.6100	99.34
2	S-524A	FRENCH DRAIN	1.09	1.09	0.00	100.00	0.00	0.2271	0.1703	0.2271	0.1805	79.49
2	S-541A	FRENCH DRAIN	1.97	1.97	0.00	100.00	0.00	0.4104	0.3078	0.4104	0.5003	121.90
2	S-550	DRY DET.	6.64	3.87	2.77	58.28	0.00	0.8063	0.6047	0.6047	0.6000	99.22
2	S-552	DRY DET.	6.07	3.95	2.12	65.07	0.00	0.8229	0.6172	0.6172	0.6200	100.46
2	S-604	DRY DET.	5.82	3.85	1.97	66.15	0.00	0.8021	0.6016	0.6016	0.6100	101.40
2	S-610A	DRY DET.	6.13	3.28	2.85	53.51	0.00	0.6833	0.5125	0.5125	0.5200	101.46
2	S-620	FRENCH DRAIN	3.16	3.16	0.00	100.00	0.00	0.6583	0.4938	0.6583	0.9634	146.34
2	N/A	N/A	0.29	0.29	0.00	100.00	0.00	0.0604	0.0453	0.0453	0.0000	0.00
3	S-728A	FRENCH DRAIN	2.32	2.32	0.00	100.00	0.00	0.4833	0.3625	0.4833	0.6480	134.07
3	S-735A	DRY DET.	5.77	3.33	2.44	57.71	0.00	0.6938	0.5203	0.5203	0.4300	82.64
3	S-760	DRY DET.	5.34	3.45	1.89	64.61	0.00	0.7188	0.5391	0.5391	0.5400	100.17
3	S-764	DRY DET.	3.08	2.36	0.72	76.62	0.00	0.4917	0.3688	0.3688	0.2400	65.08
4	S-614A	FRENCH DRAIN	2.41	2.41	0.00	100.00	0.00	0.5021	0.3766	0.5021	[illegible]	308.14
4	S-3004	DRY DET.	12.50	8.60	3.90	68.80	0.00	1.7917	1.3438	1.3438	1.2600	93.77
5	S-849	DRY DET.	2.56	1.27	1.29	49.61	0.00	0.2646	0.1984	0.1984	[illegible]	0.00
5	S-850	DRY DET.	7.06	2.76	4.30	39.09	0.00	0.5883	0.4413	0.4413	0.4300	97.45
5	S-853	DRY DET.	1.50	0.59	0.91	39.33	0.00	0.1250	0.0938	0.0938	0.0900	[illegible]
NORTHLAKE	S-1009	DRY DET.	5.00	3.50	1.50	70.00	0.00	0.7292	0.5469	0.5469	0.5500	100.57
NORTHLAKE	S-1014A	DRY DET.	2.27	0.73	1.54	32.16	0.00	0.1892	0.1419	0.1419	0.1200	[illegible]
TOTALS:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

WATER QUALITY SUMMARY (WITH PROPOSED WALL MODIFICATIONS)

BASIN NO.	CONTROL STRUCTURE NUMBER	TYPE OF WATER QUALITY TREATMENT	TOTAL AREA (AC)	[illegible] (AC)	[illegible] (AC)	[illegible]	[illegible] (AC)	[illegible] (AC-FT)	[illegible] (AC-FT)	[illegible] VOLUME (AC-FT)	[illegible] (AC-FT)	[illegible] TREATMENT PROVIDED
1	S-206	FRENCH DRAIN	0.80	0.80	0.00	100.00	0.00	0.1667	0.1250	0.1667	0.5760	345.60
1	S-209	FRENCH DRAIN	0.59	0.59	0.00	100.00	0.00	0.1229	0.0922	0.1229	0.3276	266.52
1	S-250	DRY DET.	1.41	0.97	0.44	68.79	0.00	0.2021	0.1516	0.1516	0.1184	78.12
1	S-251	DRY DET.	1.40	0.98	0.42	70.00	0.00	0.2042	0.1531	0.1531	0.1561	101.94
1	S-252	DRY DET.	5.95	2.57	3.38	43.19	0.00	0.5354	0.4016	0.4016	0.4368	108.78
1	S-253	DRY DET.	7.87	3.90	3.97	49.56	0.00	0.8125	0.6094	0.6094	0.6629	108.78
1	S-305	FRENCH DRAIN	2.08	2.08	0.00	100.00	0.00	0.4333	0.3250	0.4333	0.6153	141.99
1	S-452	DRY DET.	5.59	3.93	1.66	70.30	0.00	0.8188	0.6141	0.6141	0.5857	95.38
1	RAMP A	FRENCH DRAIN	1.39	1.39	0.00	100.00	0.00	0.2896	0.2172	0.2896	0.3152	108.85
1	RAMP B	FRENCH DRAIN	1.81	1.81	0.00	100.00	0.00	0.3771	0.2828	0.3771	0.3322	88.10
2	S-524A	FRENCH DRAIN	1.09	1.09	0.00	100.00	0.00	0.2271	0.1703	0.2271	0.1805	79.49
2	S-541A	FRENCH DRAIN	1.97	1.97	0.00	100.00	0.00	0.4104	0.3078	0.4104	0.5003	121.90
2	S-550	DRY DET.	6.64	3.87	2.77	58.28	0.00	0.8063	0.6047	0.6047	0.8521	140.92
2	S-552	DRY DET.	8.57	3.95	4.62	46.09	0.00	0.8229	0.6172	0.6172	0.7163	116.06
2	S-604	DRY DET.	5.82	3.85	1.97	66.15	0.00	0.8021	0.6016	0.6016	0.5523	91.81
2	S-610A	DRY DET.	6.13	3.28	2.85	53.51	0.00	0.6833	0.5125	0.5125	0.3525	68.78
2	S-620	FRENCH DRAIN	3.16	3.16	[illegible]	100.00	0.00	0.6583	0.4938	0.6583	0.9634	146.34
2	N/A	N/A	0.29	0.29	0.00	100.00	0.00	0.0604	0.0453	0.0453	0.0000	0.00
3	S-728A	FRENCH DRAIN	2.32	2.32	0.00	100.00	0.00	0.4833	0.3625	0.4833	0.6480	134.07
3	S-735A	DRY DET.	5.77	3.33	2.44	57.71	0.00	0.6938	0.5203	0.5203	0.2506	48.16
3	S-760	DRY DET.	5.34	3.45	1.89	64.61	0.00	0.7188	0.5391	0.5391	0.3286	60.96
3	S-764	DRY DET.	3.08	2.36	0.72	76.62	0.00	0.4917	0.3688	0.3688	0.0641	17.38
4	S-614A	FRENCH DRAIN	2.41	2.41	0.00	100.00	0.00	0.5021	0.3766	0.5021	1.5471	308.14
4	S-3004	DRY DET.	12.50	8.60	3.90	68.80	0.00	1.7917	1.3438	1.3438	1.1353	84.49
5	S-849	DRY DET.	2.92	1.27	1.65	43.49	0.00	0.2648	0.1984	0.1984	0.0612	30.84
5	S-850	DRY DET.	7.06	2.76	4.30	39.09	0.00	0.5883	0.4413	0.4413	0.4259	96.52
5	S-853	DRY DET.	1.50	0.59	0.91	39.33	0.00	0.1250	0.0938	0.0938	0.0498	53.12
NORTHLAKE	S-1009	DRY DET.	5.00	3.50	1.50	70.00	0.00	0.7292	0.5469	0.5469	0.3486	63.74
NORTHLAKE	S-1014A	DRY DET.	2.27	0.73	1.54	32.16	0.00	0.1892	0.1419	0.1419	0.1519	107.07
TOTALS:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

URS CORP.
5805 N.W. 11th ST.
MIAMI, FL. 33126
(305) 262-7466
LIC. #EB 00000002

JUAN C. GARCIA
P.E. # 46597

10/9/02

South Florida Water Management District
3301 Gun Club Road, West Palm Beach, Florida 33406 • (407) 686-8800 • FL WATS 1-800-432-2045

CON 24-06

Regulation Department
Application No.: 950320-7

FINAL APPROVED

SEP 15 1995

WPB

September 15, 1995

Florida Department of Transportation
3400 West Commercial Boulevard
Ft Lauderdale, FL 33309

Dear Permittee:

SUBJECT: Notice of Intent to Construct Works
General Permit and
Stormwater Discharge Certification No.: 50-03527-S
Permittee: FLORIDA DEPARTMENT OF TRANSPORTATION
Project: I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD
Location: PALM BEACH COUNTY, S19,30,24,25/T42S/R43,42E

This letter is to notify you of the District's agency action concerning your Notice of Intent to Construct Works. This action is taken pursuant to Rule 40E-1.606 and Chapter 40E-40, Florida Administrative Code.

Based on the information provided, District rules have been adhered to and a General Permit and Stormwater Discharge Certification is in effect for this project subject to:

1. Not receiving a filed request for a Chapter 120, Florida Statutes, administrative hearing,

2. the attached 19 Standard Limiting Conditions,

3. 6 Special Conditions, and

4. 29 Exhibit(s).

Should you object to these Conditions, please refer to the attached "Notice of Rights" which addresses the procedures to be followed if you desire a public hearing or other review of the proposed agency action. Please contact this office if you have any questions concerning this matter. If we do not hear from you in accordance with the "Notice of Rights", we will assume that you concur with the District's action.

Mailing Address: P.O. Box 24680, West Palm Beach, FL 33416-4680

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a "Notice of Rights" has been mailed to the addressee (and the persons listed in the attached distribution list) no later than 5:00 p.m. this 15th day of September, 1995, in accordance with Section 120.60(3), Florida Statutes.

Sincerely,

Kenneth S. Todd, Jr.

Kenneth S. Todd, Jr., P.E.
Supv Prof - Civil Engineer
West Palm Beach Service Center

KT/la/ld

CERTIFIED MAIL NO. Z 028 127 804
Enclosures

I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD

PERMIT SUMMARY SHEET

APPLICATION NUMBER: 950320-7

LOCATION: PALM BEACH COUNTY, S19,30,24,25/T42S/R43,42E

OWNER: FLORIDA DEPARTMENT OF TRANSPORTATION

ENGINEER: FLORIDA DEPARTMENT OF TRANSPORTATION

PROJECT AREA: 72.7 ACRES DRAINAGE AREA: 72.7 ACRES

PROJECT USE: HIGHWAY

FACILITIES:

1. EXISTING: This proposed project consists of improvements to Interstate 95 (State Road 9) between Blue Heron and Northlake Boulevards in Palm Beach County (refer to Exhibit No. 1). Presently, I-95 from Blue Heron to Northlake has no formal surface water management (swm) system to provide attenuation or water quality treatment. Runoff from the existing right-of-way sheetflows to roadside and median swales and to Northern Palm Beach County Improvement District's (NPBCID) EPB-6, EPB-6A and EPB-7 Canals. Ultimately, runoff from this section of I-95 is directed to the Intracoastal Waterway via the C-17 Canal. Soils consist primarily of Basinger fine sand and Immokalee sand with an average permeability of 5.0 ft/day (boring data in file). The wet season water table was estimated to be at elevation 10.0' NGVD.

2. PROPOSED: Proposed is a General Permit for the Construction and Operation of a swm system to serve proposed improvements to Interstate 95. Improvements proposed include: auxiliary lanes, paved shoulders, milling, resurfacing and drainage improvements. The project was divided into ten drainage basins for the purposes of swm design (refer to Exhibit Nos. 2 thru 5).

   Basin E-1 is 6.89 acres in size (2.13 acres impervious) and begins at Station 1755 + 00 and ends at Station 1765 + 00 Rt. Existing swales will be utilized to direct runoff from this basin to the adjacent basin (Basin E-2) where the required water quality treatment will be provided prior to gravity discharge off-site.

   Basin E-2 is 10.0 acres in size (6.19 acres impervious) and begins at Station 1765 + 00 and ends at Station 1794 + 00 Rt. Storage and water quality treatment for this basin, as well as Basin E-1, will be provided within a 0.94 acre dry detention area prior to gravity discharge off-site. The control structure for this basin (Structure S-22 shown on Exhibit Nos. 10 & 16) is proposed to consist of 1-6.0' wide sharp crested weir with a crest at elevation

Exhibit 28A

12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD. Runoff is directed into NPBWCD's system on the west side of I-95 via an existing 10' by 8' box culvert, which is proposed to be extened to account for the Ultimate Design Section.

Basin E-3 is 8.26 acres in size (4.35 acres impervious) and begins at Station 1794 + 00 and ends at Station 1818 + 00 Rt. Storage and water quality treatment for this basin will be provided within a 0.76 acre dry detention prior to gravity discharge off-site. The control structure (Structure S-32 shown on Exhibit Nos. 12 & 16) for this basin is proposed to consist of 1-5.0' wide sharp crested weir with a crest at elevation 12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD. Runoff is directed into NPBCID's system on the west side of I-95 via an existing 9' by 6' box culvert, which is proposed to be extended to account for the Ultimate Design Section.

Basin E-4 is 8.49 acres in size (4.35 acres impervious) and begins at Station 1818 + 00 and ends at Station 1836 + 00 Rt. In addition this basin serves Ramp A (Station 1836 + 00 to Station 1846 + 00), which is proposed to be widened and reconstructed. Storage and water quality treatment for this basin will be provided within a 0.46 acre dry detention area prior to gravity discharge off-site. The control structure serving this basin (Structure S-34 shown on Exhibit Nos. 12 & 16) is proposed to consist of 1-5.0' wide sharp crested weir with a crest at elevation 12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD. Runoff is directed into NPBCID's system on the west side of I-95 via the same box culvert serving Basin E-3.

Basin E-5 is 2.98 acres in size (1.07 acres impervious) and begins at Station 1841 + 00 and ends at Station 1846 + 00 Rt. Storage and water quality treatment for this basin is provided in the adjacent basin (Basin E-4) prior to gravity discharge off-site.

Basin W-1 is 6.98 acres in size (2.39 acres impervious) and begins at Station 1755 + 00 and ends at Station 1765 + 00 Lt. Storage and water quality treatment for this basin will be provided within the adjacent basin (Basin W-2) prior to gravity discharge off-site. Basin W-1 includes Ramp C (refer to Exhibit No. 8), which is proposed for widening and reconstruction.

Basin W-2 is 10.2 acres in size (6.91 acres impervious) and begins at Station 1765 + 00 and ends at Station 1794 + 50 Lt. Storage and water quality treatment for this basin, as well as Basin W-1, is provided within a 0.88 acre dry detention area prior to gravity discharge off-site. The control structure serving this basin (Structure S-19 shown on Exhibit Nos. 10 & 16) is proposed to consist of 1-6.0' wide sharp crested weir with a crest at elevation 12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD discharging to NPBWCD's system.

Basin W-3 is 8.26 acres in size (5.34 acres impervious) and begins at Station 1794 + 50 and ends at Station 1818 + 50 Lt. Storage and water quality treatment for this basin is provided within a 0.79 acre dry detention area prior to gravity discharge off-site. The control structure serving this basin (Structure S-27 shown on Exhibit Nos. 12 & 16) is proposed to consist of 1-5.0' wide sharp crested weir with a crest at elevation 12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD discharging to NPBCID's system.

Basin W-4 is 8.32 acres in size (4.6 acres impervious) and begins at Station 1818 + 50 and ends at Station 1836 + 00 Lt. In addition, this basin serves Ramp D (Station 1836 + 00 to Station 1846 + 00 Lt). Storage and water quality treatment for this basin is proposed to be provided within a 0.59 acre dry detention area prior to gravity discharge off-site. The control structure serving this basin (Structure S-29 shown on Exhibit Nos. 12 & 16) is proposed to consist of 1-5.0' wide sharp crested weir with a crest at elevation 12.5' NGVD and a 20 degree V-Notch bleeder with an invert at elevation 11.0' NGVD discharging to NPBCID's system.

Basin W-5 is 2.41 acres in size (1.19 acres impervious) and begins at Station 1841 + 00 and ends at Station 1846 + 00 Lt. Storage and water quality treatment for this basin is provided within the adjacent basin (Basin W-4) prior to gravity discharge off-site.

The applicant has provided the necessary calculations taking into account the Ultimate Design Section (refer to Exhibit No. 6). Hence, drainage improvements will be constructed for the Ultimate Section with this application. In the future, when Construction and Operation is requested for the Ultimate facilities, the drainage improvements will already be in place.

PROJECT LEVEL:

DRAINAGE BASIN: C-17

RECEIVING BODY: C-17 VIA NPBCID SYSTEM

BASIN DESIGN FREQUENCY: 25 YR-3 DAY STORM

Exhibit 21C

I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD

PERMIT SUMMARY SHEET

WATER QUALITY:

Water quality treatment in excess of 2.5 inches times the percentage of impervious area will be provided within dry detention areas prior to gravity discharge off-site. The water quality for Basins E-1, E-5, W-1 and W-5 will be provided in adjacent basins, as described in the PROPOSED section, prior to gravity discharge off-site.

Basin	Method	Vol Req'd. (ac-ft)	Vol Prov'd (ac-ft)
BASIN E-2	.94 acres DRY DETENTION	1.00	2.00
BASIN E-3	.76 acres DRY DETENTION	.80	1.57
BASIN E-4	.46 acres DRY DETENTION	.68	.94
BASIN W-2	.88 acres DRY DETENTION	1.10	1.80
BASIN W-3	.79 acres DRY DETENTION	.84	1.64
BASIN W-4	.59 acres DRY DETENTION	.72	1.21

DISCHARGE RATE:

The applicant has provided the necessary information/calculations to demonstrate that the water quality treatment will be provided in excess of what is required by District criteria. However, the limited amount of right-of-way available along this corridor and the need to protect the road subgrade resulted in a minor increase in the design discharge rate from the pre-development condition. Basins E-1, E-5, W-1 and W-5 discharge into adjacent basins for storage and water quality treatment. The discharge rates for these basins (shown below) were estimated utilizing hydrographs for pre-development and post-development conditions.

Basin	Allow Disch (cfs)	Method of Determination	Design Disch (cfs)	Design Stage (ft, NGVD)
BASIN E-1	15	PRE VS. POST	17	n/a
BASIN E-2	25	PRE VS. POST	20	13.4
BASIN E-3	20	PRE VS. POST	17	13.4
BASIN E-4	20	PRE VS. POST	25	13.7
BASIN E-5	7	PRE VS. POST	7	n/a
BASIN W-1	15	PRE VS. POST	17	n/a
BASIN W-2	22	PRE VS. POST	25	13.58
BASIN W-3	20	PRE VS. POST	17	13.4
BASIN W-4	20	PRE VS. POST	21	13.59
BASIN W-5	5	PRE VS. POST	6	n/a

Exhibit 28D

I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD

PERMIT SUMMARY SHEET

ENVIRONMENTAL ASSESSMENT:

PROJECT SITE DESCRIPTION

The project site is highway right-of-way and disturbed canal crossings. Vegetation within project site is limited to disturbed-site plant species such as Brazilian pepper, Australian pine and other exotic and nuisance plant species.

EXISTING ON SITE UPLAND COMMUNITIES:

ID NO	TOTAL ACREAGE	BIOLOGICAL CONDITION	COMMUNITY TYPE	COMMUNITY ACREAGE
U-1	77.09	N/A	ROADS AND HIGHWAYS	77.09
U-2	1.00	N/A	CANALS AND LOCKS	1.00

TOTAL ON SITE UPLAND ACREAGE: 78.09

ENDANGERED, THREATENED & SPECIES OF SPECIAL CONCERN SUMMARY:

The project site does not contain preferred habitat for endangered, threatened, or species of special concern. No endangered/threatened or species of special concern were observed on site, and potential for impacts to wetland dependent endangered/threatened or species of special concern is considered minimal. This permit does not relieve the applicant from complying with all applicable rules and any other agencies' requirements if in the future, endangered/threatened or species of special concern are discovered on the site.

ENVIRONMENTAL SUMMARY

The project site is highway right-of-way and disturbed canal crossings. Adverse impacts to wetlands are not anticipated as a result of the proposed construction.

Exhibit 28E

I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD

PERMIT SUMMARY SHEET

APPLICABLE LAND USE:

In the following land use breakdown, the "WTRM ACREAGE" includes the dry detention areas serving each basin.

	TOTAL PROJECT	PREVIOUSLY PERMITTED	THIS PHASE	
TOTAL ACRES	72.70		72.70	acres
WTRM ACREAGE	4.42		4.42	acres
PAVEMENT	39.29		39.29	acres
PERVIOUS	28.99		28.99	acres

COMMENTS:

1. The Army Corps of Engineers (ACOE) issued a Nationwide Permit on January 9, 1995 (Permit No. 199406577).

Exhibit 28F

STAFF REPORT DISTRIBUTION LIST

PROJECT: I-95 AUXILIARY LANES FROM BLUE HERON BLVD TO NORTHLAKE BLVD
APPLICATION NUMBER: 950320-7

INTERNAL DISTRIBUTION
Reviewer:
X Loris C. Asmussen, E.I.
X Stacy Myers
X Kenneth S. Todd, Jr., P.E.
X Robert M. Brown
X B. Colavecchio - REG
M. Cruz - REG
M. Elsner - UDP
J. Giddings - LDP
J. Golden - REG
F. Lund - UDP
R. Mireau - OMD
R. Robbins - NRM
D. Thatcher - CPR
W. Van Voorhess - GPA
L. Wagner - LDP
X P. Walker - GPA
X K. Wallace - REG
A. Waterhouse - REG
Director, Big Cypress Basin
X Area Engineer
Day File
X Enforcement
X Environmental PPC Reviewer
X Field Representative
Office of Counsel
X Permit File

DEPT. OF ENVIRONMENTAL PROTECTION
X West Palm Beach

EXTERNAL DISTRIBUTION

X Applicant:
FLORIDA DEPARTMENT OF TRANSPORTATION

X Applicant's Consultant:
FLORIDA DEPARTMENT OF TRANSPORTATION

X Engineer, County of:
PALM BEACH

X Engineer, City of:
WEST PALM BEACH

X Local Drainage District:
NORTHERN PBC IMPROVEMENT DIST.

COUNTY
X Palm Beach -Building Division
-Environmental Res Mgmt.
-Health Dept.
-Land Development Div.
-School Brd., Growth Mgt.

BUILDING AND ZONING

OTHER
David Sinclair
Div of Recreation and Park - District 7
F.G.F.W.F.C.
Mr. Ed Dailey, President
Port St. Lucie Planning Division
S.W.F.R.P.C. - Glenn Heath
Sierra Club - Central Florida Group

EXHIBIT 29

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
ENVIRONMENTAL RESOURCE
STANDARD GENERAL PERMIT NO. 50-04686-P

Form #0941
08/95

DATE ISSUED: October 4, 2000

PERMITTEE: PALM BEACH COUNTY
160 AUSTRALIAN AVENUE
P.O. BOX 21229
WEST PALM BEACH, FL 33416

PROJECT DESCRIPTION: A SURFACE WATER MANAGEMENT SYSTEM SERVING 12.55 ACRES OF HIGHWAY DEVELOPMENT KNOWN AS NORTHLAKE BLVD., I-95 TO SANDTREE.

PROJECT LOCATION: PALM BEACH COUNTY, SEC 13,24 TWP 42S RGE 42E
SEC 18,19 TWP 42S RGE 43E

PERMIT DURATION: Five years from the date issued to complete construction of the surface water management system as authorized herein. See attached Rule 40E-4.321, Florida Administrative Code.

This is to notify you of the District's agency action concerning Notice of Intent for Permit Application No. 980123-9, dated January 23, 1998. This action is taken pursuant to Rule 40E-1.603 and Chapter 40E-40 , Florida Administrative Code (F.A.C.).

Based on the information provided, District rules have been adhered to and an Environmental Resource General Permit is in effect for this project subject to:

1. Not receiving a filed request for a Chapter 120, Florida Statutes, administrative hearing,
2. the attached General Conditions,
3. the attached 9 Special Conditions, and
4. the attached 10 Exhibit(s).

Should you object to these conditions, please refer to the attached "Notice of Rights" which addresses the procedures to be followed if you desire a public hearing or other review of the proposed agency action. Please contact this office if you have any questions concerning this matter. If we do not hear from you in accordance with the "Notice of Rights," we will assume that you concur with the District's action.

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a "Notice of Rights" has been mailed to the Permittee (and the persons listed in the attached distribution list) no later than 5:00 p.m. on this 4th day of October, 2000, in accordance with Section 120.60(3), Florida Statutes.

BY: [signature]
Anthony M. Waterhouse, P.E.
Director - Surface Water Management
Palm Beach Service Center

GIS
10/2000
LM

Certified Mail No.7000 0600 0027 7198 2472

Enclosures

PROJECT: NORTHLAKE BLVD I-95 TO SANDTREE

PERMIT SUMMARY SHEET

APPLICATION NUMBER: 980123-9
LOCATION: PALM BEACH COUNTY, S13,24/T42S/R42E
S18,19/T42S/R43E

OWNER: PALM BEACH COUNTY

ENGINEER: LAWSON NOBLE & WEBB

PROJECT AREA: 12.55 ACRES DRAINAGE AREA: 12.55 ACRES

PROJECT USE: HIGHWAY

FACILITIES:

1. EXISTING: This segment of Northlake Boulevard, from just west of I-95 to Sandtree Drive is existing as a six-lane, curb and gutter section with associated turn lanes and sidewalks (please refer to Exhibit 1). The project presently discharges to the C-17 Canal with no provisions for water quality treatment or storm attenuation.

2. PROPOSED: Authorization for construction and operation has been requested for a surface water management (SWM) system serving 12.55 acres of Highway development known as Northlake Boulevard. The project includes milling and resurfacing an existing .50-mile section of Northlake Boulevard from just west of I-95 to Sandtree Boulevard. Proposed construction also includes shoulder paving, turn lane/ramp improvements and additional sidewalks. The net increase in impervious area for the project is .46 acres. Runoff from the site will be collected by a series of inlets and culverts and directed to several lengths of exfiltration trench for water quality treatment. Ultimately, the SWM system will overflow to the C-17 Canal.

PROJECT LEVEL:

DRAINAGE BASIN: C-17

RECEIVING BODY: C-17 CANAL THROUGH EXISTING ROAD DRAINAGE SYSTEM

Exhibit 9A

APPLICATION NUMBER: 980123-9
LOCATION: PALM BEACH COUNTY, S13,24/T42S/R42E

WATER QUALITY:

As shown in the table below, water quality treatment is provided in excess of 2.5 inches over the new impervious area, resulting in a net improvement in water quality for the 12.55-acre basin (please refer to Special Condition No. 9).

Basin	Method	Vol Req'd. (ac-ft)	Vol Prov'd (ac-ft)
I 95 TO SANDTREE	1230 LF EXFILTRATION TRENCH	.30	.30

ENVIRONMENTAL ASSESSMENT:

PROJECT SITE DESCRIPTION:

The project site consists of Northlake Boulevard and associated right-of-way from I-95 to Sandtree Drive east of I-95. Northlake Boulevard is major east/west corridor in Northern Palm Beach County. The right-of-way for this road consists of turn lanes, road shoulders and grassed slopes. There are no wetlands within this right-of-way or any portion of this project.

ENDANGERED, THREATENED & SPECIES OF SPECIAL CONCERN SUMMARY:

The project site does not contain preferred habitat for wetland-dependent endangered/threatened species or species of special concern. No wetland-dependent endangered/threatened species or species of special concern were observed on site, and submitted information indicates that potential use of the site by such species is minimal. This permit does not relieve the applicant from complying with all applicable rules and any other agencies' requirements if in the future, endangered/threatened species or species of special concern are discovered on the site.

Exhibit 9B

APPLICATION NUMBER: 980123-9
LOCATION: PALM BEACH COUNTY, S13,24/T42S/R42E

ENVIRONMENTAL SUMMARY:

The proposed activities have been evaluated for potential secondary and cumulative impacts and to determine if the project is contrary to the public interest. Based upon the proposed project design, the District has determined that the project will not cause adverse secondary or cumulative impacts to the water resources and is not contrary to the public interest.

APPLICABLE LAND USE:

The column listed as TOTAL PROJECT reflects the existing land use breakdown for the section of Northlake Boulevard included with this application.

	TOTAL PROJECT	PREVIOUSLY PERMITTED	THIS PHASE	
TOTAL ACRES	12.55		12.55	acres
PAVEMENT	9.50		10.00	acres
PERVIOUS	3.05		2.55	acres

COMMENTS:

1 . Water Quality Structures: Please refer to Exhibit 2 of this staff report for the dimensions and elevations of the eight (8) control structures which serve to retain the water quality volume in the proposed exfiltration trench.

2 . Discharge Rate: The proposed project includes improvements for a section of Northlake Boulevard, from I-95 to Sandtree Boulevard. The net increase in impervious area is .46 acres. The applicant's engineer has provided calculations which demonstrate that the post-development discharge does not exceed that of the pre-development rate.

Exhibit 9c

APPLICATION NUMBER: 980123-9
LOCATION: PALM BEACH COUNTY. S13.24/T42S/R42E

DEPARTMENT APPROVAL:

NATURAL RESOURCE MANAGEMENT

Donald L. Medellin
Anita R. Bain

DATE: 10/2/2000

SURFACE WATER MANAGEMENT

Maria Clemente
Maria C. Clemente. P.E.

DATE: 10/2/2000

Exhibit 9D

LNW

Lawson, Noble & Webb, Inc.
ENGINEERS • PLANNERS • SURVEYORS

September 3, 1999

ADDL/REVISED SUBMITTAL

SEP 07 1999

South Florida Water Management District
Surface Water Management Division
3301 Gun Club Road
West Palm Beach, Florida 33406

Attn: Ms. Maria Clemente, P.E.

Re: **NORTHLAKE BOULEVARD** (I-95 to SANDTREE/SUNRISE DR)
Application No. 980123-9
PBC Proj. No. 97103 LNW Proj. No. A205

Dear Ms. Clemente:

In response to your comments letter dated February 20, 1998 (copy attached), we would like to offer the following:

Please note that significant revisions were made to the lane alignments and storm drainage system shown on the previously submitted Plans therefor, we have resubmitted revised sets of Plans <u>and Calculations</u> with this response. Also, Plans have been added for the widening of the I-95 Northbound Exit Ramp (Ramp "A").

1. Runoff from the road R/W is directed by surface sheet/gutter flow into an existing storm sewer system consisting of a series of inlet/manhole structures and pipes that flow east and connect directly into the SFWMD C-17 Canal. The C-17 Canal is located approximately 2,540' east of the end of this Project. A sketch of the existing storm sewer system located east of the Project is enclosed with this submittal.

2. The proposed SWMS will be operated and maintained by Palm Beach County. A letter confirming their acceptance of this responsibility will be forwarded to you under a separate transmittal.

3. The approximate "wet season" water table elevations are indicated in the Exfiltration Trench Calculations included with this submittal. These elevations vary throughout the length of the Project from a high of 10.5 at the west end to a low of 8.4 at the east end which results in an average elevation of 9.3. These elevations were established from the hydraulic conductivity tests performed by Nodarse & Assoc. (see attached copy). Although I was not personally involved in this Project when these tests were performed, the date on the report is 10/27/97 which would indicate that the tests were not

G:\DATA\200-299\a205\DOCS\A205 sfwmd response1.doc performed during the "dry season", and should make the test results indicative of "wet season" conditions.

A review of SFWMD Permit No. 50-01482-S issued for the Home Depot Shopping Center located in the southeast corner of Northlake Blvd and I-95 indicated that the Control Elevation for the SWMS serving this 32.2 acre site is elev. 8.50. This site has a wet detention pond located immediately adjacent to the south R/W line of Northlake Blvd. at the I-95 interchange and would therefor be one of the primary influences on the ground water elevations occurring throughout the length of the Project. The SFWMD C-17 Canal provides legal positive outfall for the Home Depot SWMS. Since the soil borings performed indicate groundwater elevations that are above the maintained water surface elevations of adjacent property, we feel that the elevations used for the design of the Project are appropriate and represent the "best available data".

4. As stated at the beginning of this letter, the Project has been redesigned and the drainage system revised to eliminate dry retention areas and utilize exfiltration trenches for water quality treatment. In accordance with the current requirements for "Public Highway Projects", the proposed SWMS provides water quality treatment volume for the first 2.5" of runoff from the new impervious areas only ("net gain" in impervious area). The proposed exfiltration trenches have been located throughout the Project in areas that could accommodate this construction. There are several areas throughout the Project where existing conditions (i.e. existing storm lines, existing underground utilities, 10' separation from existing water mains, or space constraints) would prohibit the construction of exfiltration trenches. Compensating volume has been provided in the areas of the Project connected to exfiltration trenches so that the total water quality volume is equal to that required for the "net gain" in impervious area.

5. The entire drainage system has been revised and the dry retention areas have been eliminated. The new drainage system incorporates exfiltration trenches for water quality treatment and control elevations have been set which should not cause ponding of water on the roadway pavement during the design storm event (FDOT Zone 10 - 3 year frequency).

6. Peak discharge from the Project will increase as a result of the net increase in impervious area. However, we feel it will be a minor increase due to the relatively minor amount of additional impervious area over the total area served by the existing storm sewer system. In addition, the proposed exfiltration trenches will provide some water quantity discharge attenuation.

   It has been our experience with similar minor public highway (intersection improvement) projects that water quantity attenuation has not been a design requirement for a District permit. We are not aware of a reliable method of performing a Pre-vs-Post stage-storage-discharge flood routing of a system without significant storage volumes and/or an in-line control structure. We would be open to any guidance staff could provide in this area.

7. Retention/detention areas and their associated control structures have been eliminated from the Project.

8. We have designed the stormwater management aspects of this Project to be consistent with that of similar "intersection improvement" public highway projects which have been permitted by SFWMD. The proposed SWMS provides water quality treatment volume for the first 2.5" of runoff from the "net gain" in impervious area. Additional water quality treatment volume could be provided, however the additional cost would not be within the realm of the funds budgeted by Palm Beach County for this Project.

If you have any questions or require additional information, please contact me at (561) 684-6686, ext. 253 or via e-mail at tmichuda@lnw-inc.com.

Sincerely,

Anthony Michuda, P.E.
Project Manager

Cc: Charlie Rich, PE – Palm Beach County Engineering

Enclosures

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Drainage Report

SR 9 (I-95)

From North of Blue Heron Boulevard
To South of PGA Boulevard
Palm Beach County

Financial Project ID 231921-1-52-01

December 2001

PREPARED BY:

David Boyer

David M. Boyer, P.E.
Florida P.E. No. 43226
Kimley-Horn and Associates, Inc.
12/21/01

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INTRODUCTION AND PROJECT DESCRIPTION

This project represents the continuation of the HOV lane additions to SR 9 (I-95) currently under design in Palm Beach County. This project includes widening approximately 3.4 miles of the existing six lane interstate facility to a ten-lane section from north of Blue Heron Boulevard to south of PGA Boulevard as shown in Figure 1. The existing six-lane section will be milled and resurfaced along with widening to accommodate a HOV lane and an additional general-purpose lane in each direction. Auxiliary lanes will also be added along portions of the mainline between the existing interchanges.

All of the proposed improvements lie within the existing right of way of SR 9 (I-95). The construction will include modifications to the mainline and the mainline ramp terminals as well as modifications to the sidestreets and the sidestreet ramp terminals at Northlake Boulevard and PGA Boulevard.

Within the project limits there are two interchanges with sidestreets crossing under SR 9 (I-95), Northlake Boulevard and PGA Boulevard. The interchange with Blue Heron Boulevard lies immediately south of the beginning project limits. There are two underpasses with Holly Drive and Burns Road passing under SR 9 (I-95).

Each of the mainline bridges over Northlake Boulevard, Holly Drive and Burns Road will be replaced in order to accommodate the widened typical sections on these sidestreets and to increase the vertical clearances to 16'6" as required by the FDOT Plans Preparation Manual (PPM). This will dictate the need to reconstruct much of the mainline roadway pavement in order to provide a raised profile with adequate sight distances.

EXISTING DRAINAGE

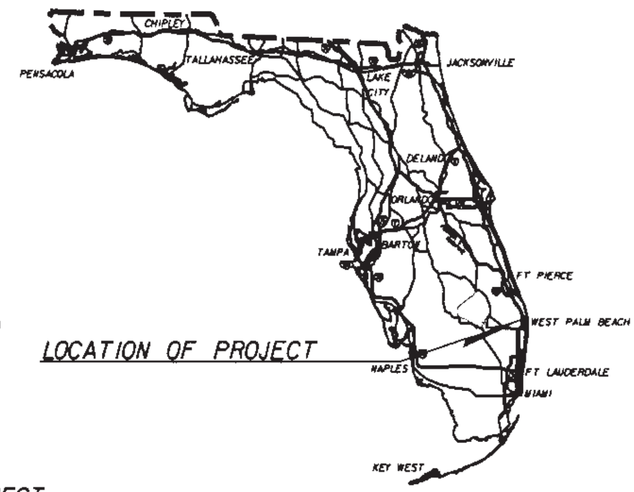
The project is located within South Florida Water Management District (SFWMD) C-17 Canal Basin. Within this portion of the basin, surface flow is generally west to east to the C-17 Canal. The canal flows north then east eventually discharging to the Intracoastal Waterway. The area west of this corridor drains via cross drains within the EPB-6A, Earman River Canal and Thompson River Canals. Another lateral canal exists within the east right-of-way between the Earman River Canal and to just south of Holly Drive and from just north of Holly Drive to the Thompson Canal. The major drainage basins associated with this project are shown in Figure 2.

There is an ongoing study by SFWMD and Northern Palm Beach County Improvement District (NPBCID) that will review the design water levels for the C-17 Canal. Preliminary results are available at Mock Roos and Associates, Inc.. The data collection results were published in November 2000. Excerpts from the November 2000 publication are presented in Appendix B. The basin modeling has been performed and results for stage and flow at the box culvert crossings are presented in Appendix.

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

CONTRACT PLANS

FINANCIAL PROJECT ID 231921-1-52-01
(FEDERAL FUNDS)
PALM BEACH COUNTY
STATE ROAD NO. 9 (I-95)
FROM NORTH OF BLUE HERON BOULEVARD TO SOUTH OF PGA BOULEVARD



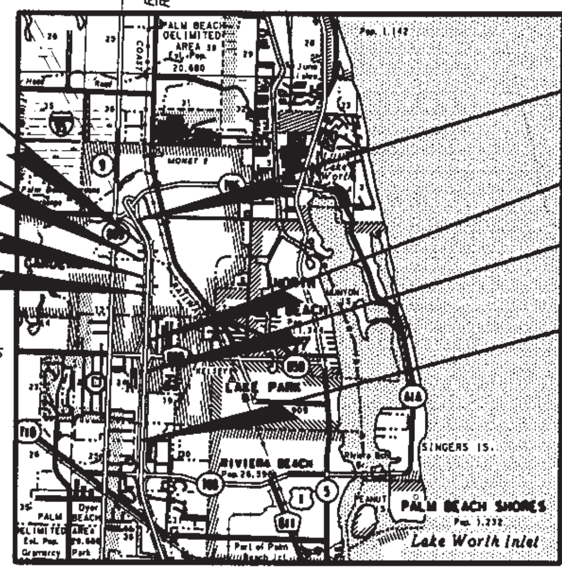
LOCATION OF PROJECT

END BRIDGE
℄ STA 1927+45.04

BEGIN BRIDGE
℄ STA 1926+24.95

END BRIDGE
℄ STA 1900+62.90

BEGIN BRIDGE
℄ STA 1899+44.90



END PROJECT
℄ STA 1950+00.00

END BRIDGE
℄ STA 1847+92.44

BEGIN BRIDGE
℄ STA 1846+21.44

BEGIN PROJECT
℄ STA 1785+00.00

N
0 1 2
Miles

LENGTH OF PROJECT		
	LINEAR FEET	MILES
ROADWAY	15,083.39	2.856
BRIDGES	444.02	0.084
NET LENGTH OF PROJECT	15,527.41	2.940
EXCEPTIONS	0	0
GROSS LENGTH OF PROJECT	15,527.41	2.940

FDOT PROJECT MANAGER: JOHN THOMPSON, P.E.

Kimley-Horn and Associates, Inc.

FIGURE 1 LOCATION MAP

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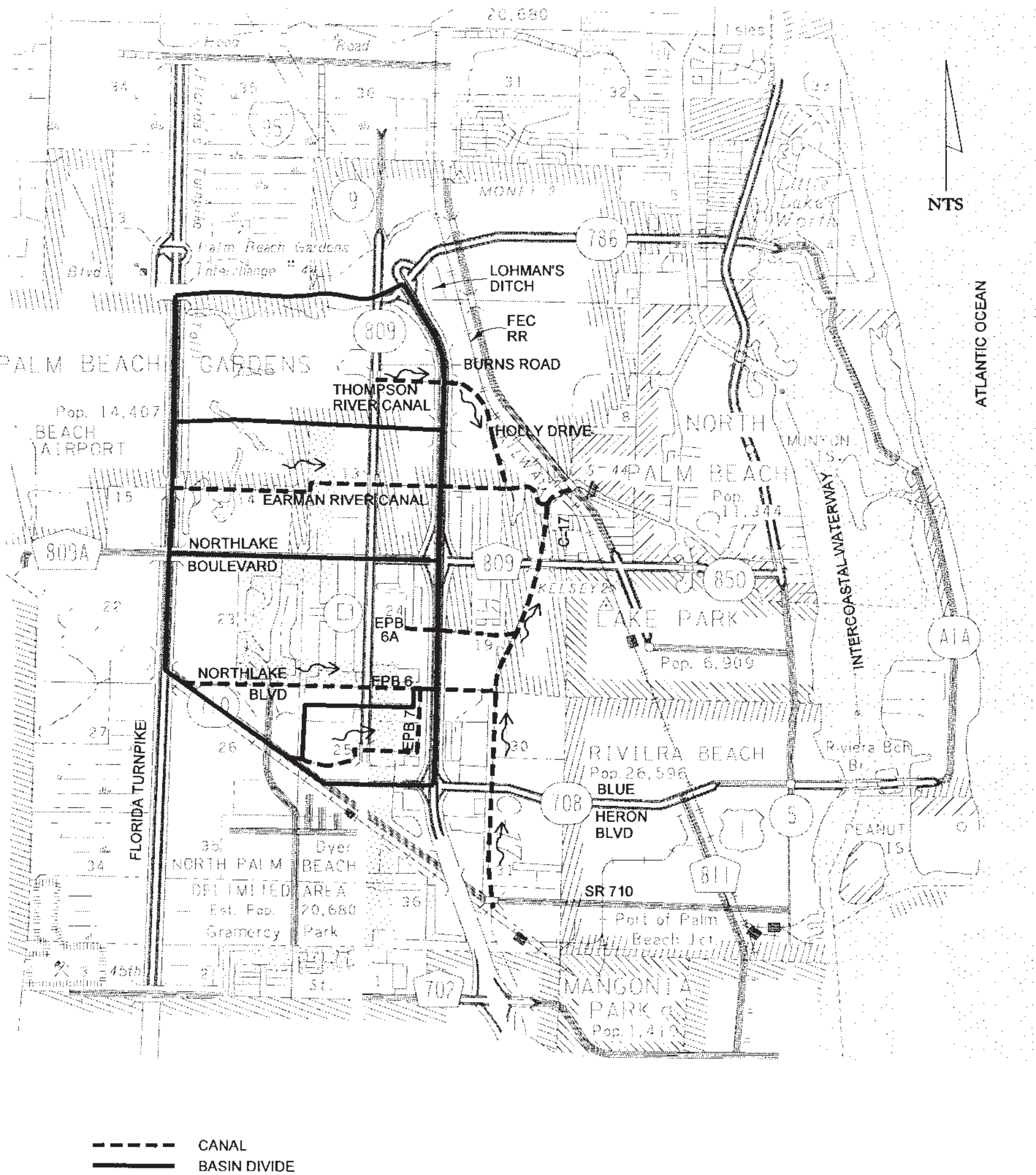


/2001 10:07:59 AM\04000512\Drainage\figure2.dgn

FIGURE 2 MAJOR BASIN DIVIDES

This project is hydraulically divided into two areas separated by Northlake Boulevard. This break is also documented by a Surface Water Management (SWM) permit (50-03527-S) that SFWMD issued for SR 9 (I-95) between Blue Heron Boulevard and Northlake Boulevard. A copy of the permit is included in Appendix D. The permit was for the construction and operation of a SWM system to accomodate improvements to SR 9 (I-95), which included auxiliary lanes, paved shoulders, resurfacing and drainage improvements. The permit was issued in 1995 and included water quality treatment and flow attenuation for the "ultimate" roadway section that includes the HOV lanes this project will construct. The "ultimate" has since changed and will be discussed in the Proposed Drainage Concepts Section.

According to the permit, within the section of SR 9 (I-95) between Blue Heron Boulevard and Northlake Boulevard, the soils consist primarily of Basinger fine sand and Immokalee sand with an average permeability of 5.0 ft/day (boring data in file). The wet season water table was estimated to be at elevation 8.5' NAVD (10.0' NGVD).

From Northlake Boulevard, north to PGA Boulevard, the roadway drains to the median and to roadside swales where it is directed to either the Earman River Canal or Thompson River Canal. Offsite flows from adjacent neighborhoods in the vicinity of Holly Drive drain to the east parallel canal between Earman River Canal and Holly Drive and between Holly Drive and the Thompson Canal.

Prior to this project, FDOT was planning to construct a noise wall along the east side of I-95 between Northlake Boulevard and the Thompson Canal. Sections of the noise wall are separated from the northbound roadway by the canal that exists within the right-of-way between the Earman River Canal and the Thompson River Canal. In order to construct the noise wall, the canal will be filled in and piped, as requested by the City of Palm Beach Gardens for maintenance reasons. The new culvert was permitted by SFWMD on June 19, 2001, under permit number 50-04765-P. A copy of the permit is included in Appendix D. The final grade of the dry swale to be graded above the proposed culvert will be set one foot above the average wet season water table, at 5.25' NAVD (6.75' NGVD) as determined by FDOT. An equivalent 60" pipe culvert will be constructed to replace the canal south of Holly Drive and an equivalent 72" pipe culvert will be constructed north of Holly Drive. Existing offsite flows that discharge to the canal will be connected to the proposed culverts. Due to the governor's economic initiative, the noise wall project will be constructed concurrently with this I-95 project.

DRAINAGE DESIGN CRITERIA

The proposed drainage design follows the drainage/permitting criteria as outlined by the Florida Department of Transportation (FDOT), South Florida Water Management District (SFWMD), Northern Palm Beach County Improvement District (NPBCID), City of Palm Beach Gardens (PBG), and Palm Beach County (PBC). Each jurisdiction's criteria was reviewed and the most restrictive will be utilized in the design.

The following drainage criteria and assumptions will be used in the development of the drainage design:

Design Frequency (Mainline):

For storm sewer (Mainline)..........10-year recurrence interval rainfall event for Zone 10

For storm sewer (Sidestreets)..........3-year recurrence interval rainfall event for Zone 10

For cross drains...........50-year recurrence interval

Hydrological Analysis:.......Rational Method (Storm System Tabulation)
SCS Method (Cross Drain Analysis, Pre vs. Post discharge analysis)

Minimum Velocity:

Storm System	2.5 Ft/s	Based on physical pipe slope When the pipe is flowing full (where pipes are above the water table).

Pipe Materials:

Will be based on Soils Analysis – see Optional Materials section.

Manning's "n" Coefficient (Storm System)

Pipe	0.012	(All pipes)

Design Tailwater:

Stormwater Sewer System	Canal Control Elevation
Cross Drains	Canal Design High Elevation
Tidal Waters	Mean High Tide

Storm System Freeboard:

Minimum 1.0 ft between gutter flowline and hydraulic grade for an urban system, 0.0 ft between inlet grate and hydraulic grade for ditch bottom inlets.

Pipe Size and Length:

Trunk Line	18" diameter (minimum) for new pipe and 24" (maximum) for French Drains

Max Pipe Lengths between Structures (unless otherwise approved):

18" pipe ....300 ft
24" to 36" pipe....................400 ft
42" and up ....500 ft
French Drains ....300 ft

SFWMD Treatment Volume:

- 1" of runoff from roadway right-of-way area
- 2.5" times the new impervious area

Dry Detention Volume = 0.75 times wet detention volume
Dry Retention Volume = 0.50 times wet detention volume

Time of Concentration:

The minimum time of concentration of 10 minutes to the first inlet will be used. Other time of concentration calculations will follow SCS TR55 Methods.

Discharge Criteria:

The C-17 Canal basin has a discharge limit of 62.7 cfs per square mile for the 25 year, 3 day storm event per SFWMD. However, SFWMD allows FDOT to design post development flows to match exiting flows within existing right-of-way. Since no right-of-way aquisition is proposed for the HOV project, this project's post development flows will be designed to match pre-development project flows.

Allowable Spread:

For projects with design speeds greater than 50 mph and for sections having full shoulders 6 feet or greater, or a parking lane, spread resulting from a rainfall intensity of 4.0 inches per hour shall not encroach on the travel lanes.

PROPOSED DRAINAGE

Generally, I-95 drains to several crossing canals within the C-17 Basin without any water quality treatment or attenuation. One exception already receiving treatment is the first basin located south of the Northlake Boulevard interchange. The proposed drainage system calls for the treatment of 2.5 inches of runoff from all of the impervious area. Two methods of treatment are used.

In the median areas where grades are flat, exfiltration trenches are proposed. Weirs in the median drainage structures retain runoff in the trenches before discharging to the outside ditches. The exfiltration trenches are sized to accommodate the water treatment volume of the median areas flowing to the trenches. That volume is 2.5 inches over the impervious areas and the SFWMD formula from Vol. IV accounts for the 50% credit for retention systems. Where the median is on a steep grade, the median runoff was piped directly to the outside ditches for treatment there.

The north and southbound lanes of I-95 and those median areas directly discharging to the outside obtain the water quality treatment in the proposed roadside ditches. The ditches are dry treatment areas and weirs are placed to detain 2.5 inches of runoff from the impervious area with the 25% credit for dry detention.

An ICPR model was used to route the 25-year, 3-day storm through both the existing system and the proposed system and the roadside ditches and weirs were sized to attenuate the proposed discharge to a level at or below the existing discharge. The only exception to running a pre-project model was basin 1 described below.

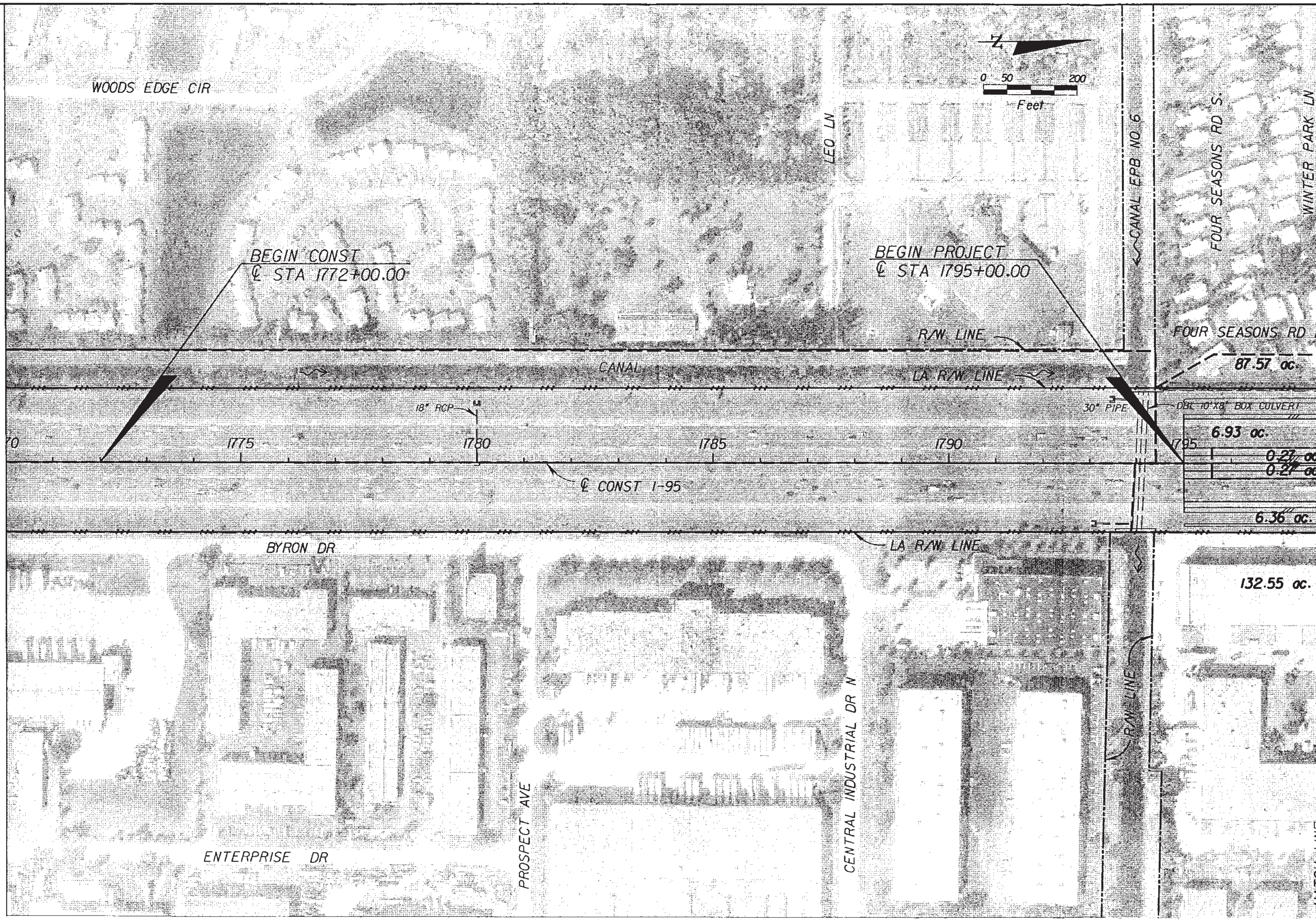
An aerial view of the project is presented as Figure 3. This figure shows the drainage areas for the median drainage system and offsite flows.

BASIN DESCRIPTION

Basin 1

Beginning at the southern terminus of the project (just north of EPB-6 Canal) and ending at Northlake Boulevard, Basin 1 discharges to the EPB-6A Canal. This portion of I-95 was recently permitted in 1995 (SFWMD Permit # 50-03527-S). The 1995 permitted discharge was used as the pre-development flow for this I-95 project.

One change was made to the drainage area in the Northlake Blvd interchange. Currently, the two infield areas south of Northlake Boulevard and the northbound and southbound lanes of I-95 adjacent to the infields, drain to the Northlake Boulevard drainage system. Since this project includes minor widening of Northlake Boulevard in the vicinity of I-95 and utilities present major conflict to the construction of exfiltration trenches under Northlake Boulevard, the above described portion of I-95 was taken south to the EPB-6A Canal. By doing this, water quality treatment could be provided in proposed I-95 ditches and, even with the additional area from the south half of the Northlake interchange, the



REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

Kimley-Horn and Associates, Inc.
4431 Embarcadero Drive
West Palm Beach, Florida 33407
(561) 845-0665
License No. 696

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

FIGURE 3
DRAINAGE MAP

SHEET NO.

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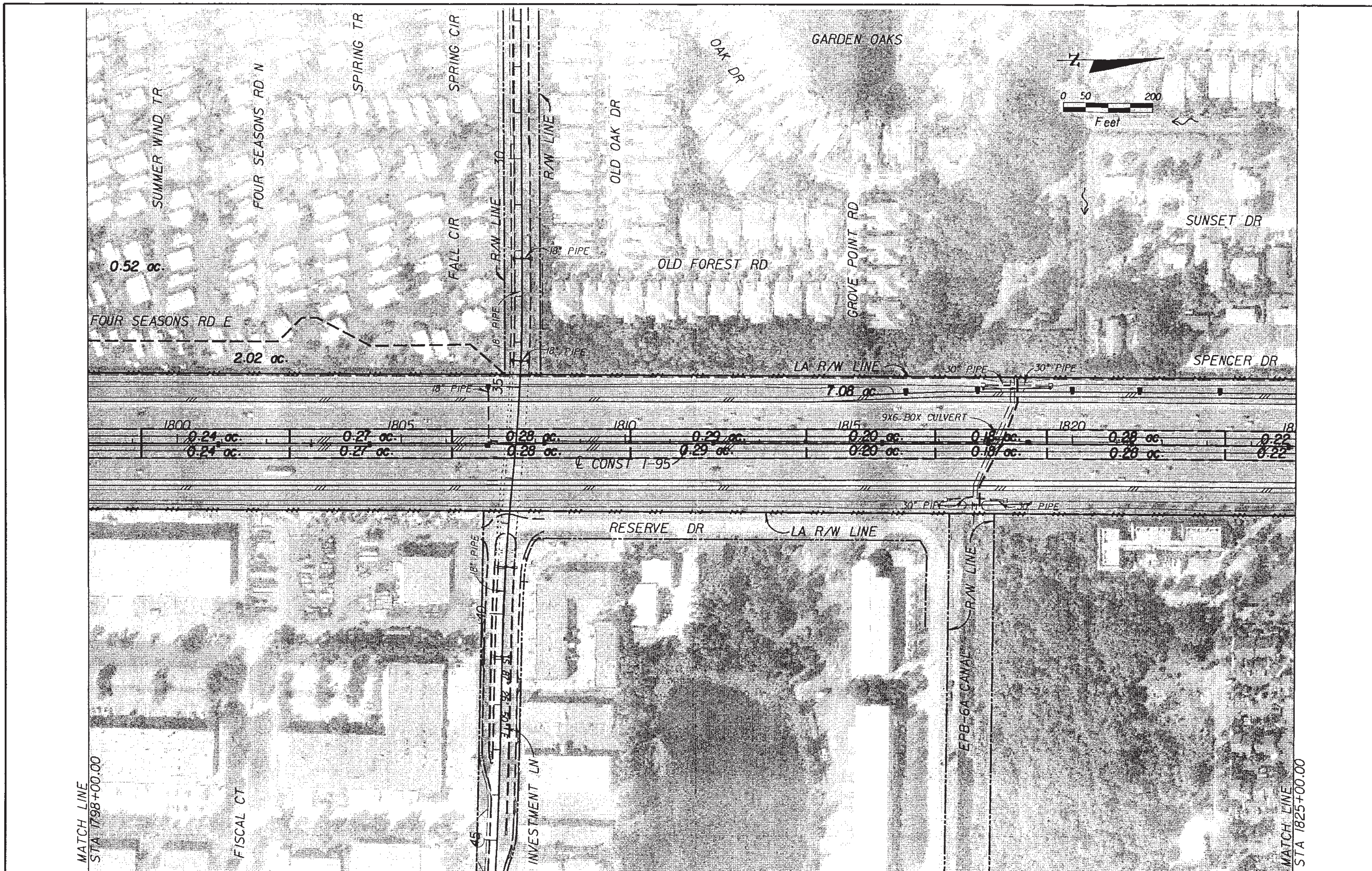

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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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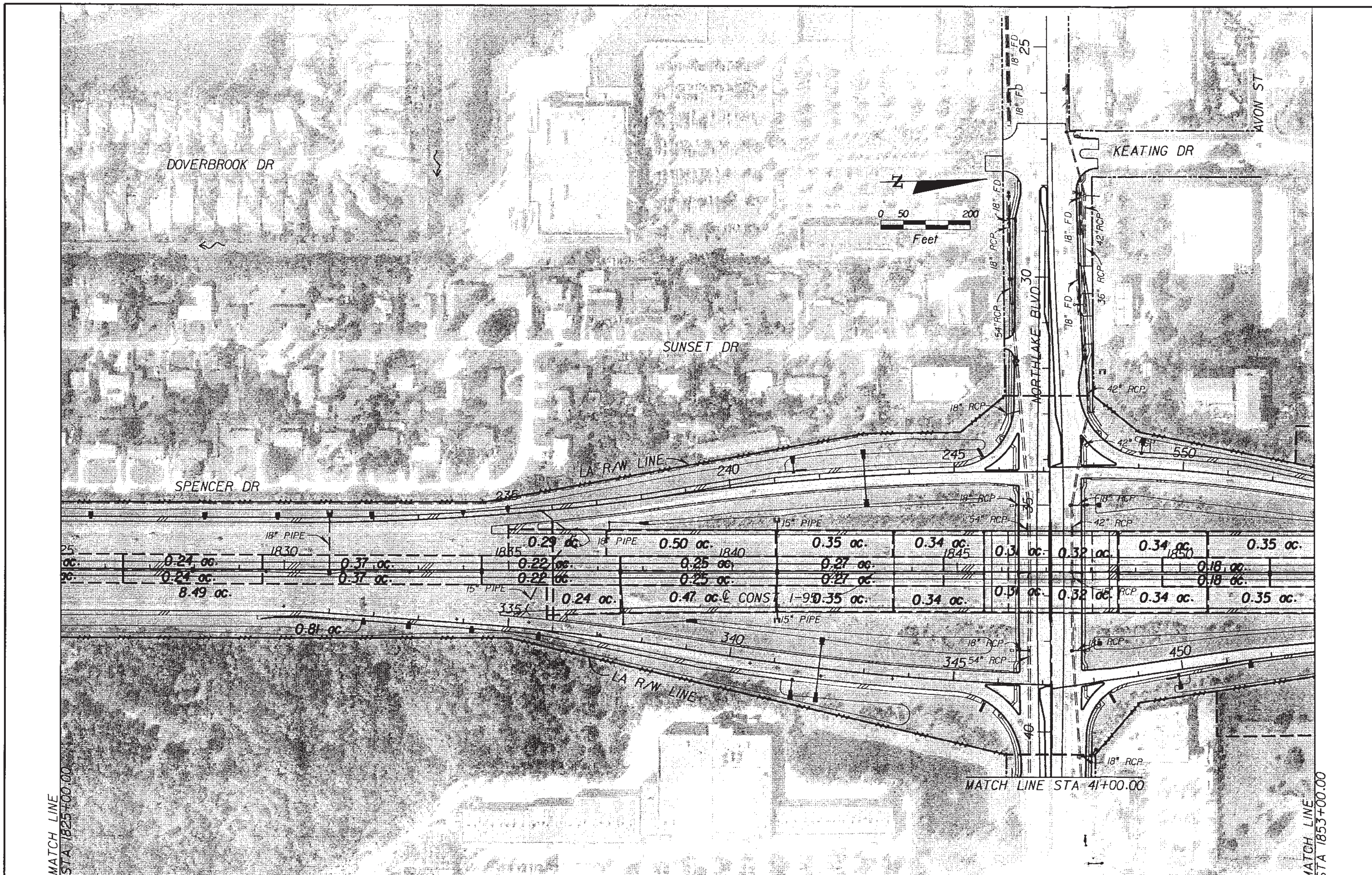
FIGURE 3
DRAINAGE MAP

SHEET NO.



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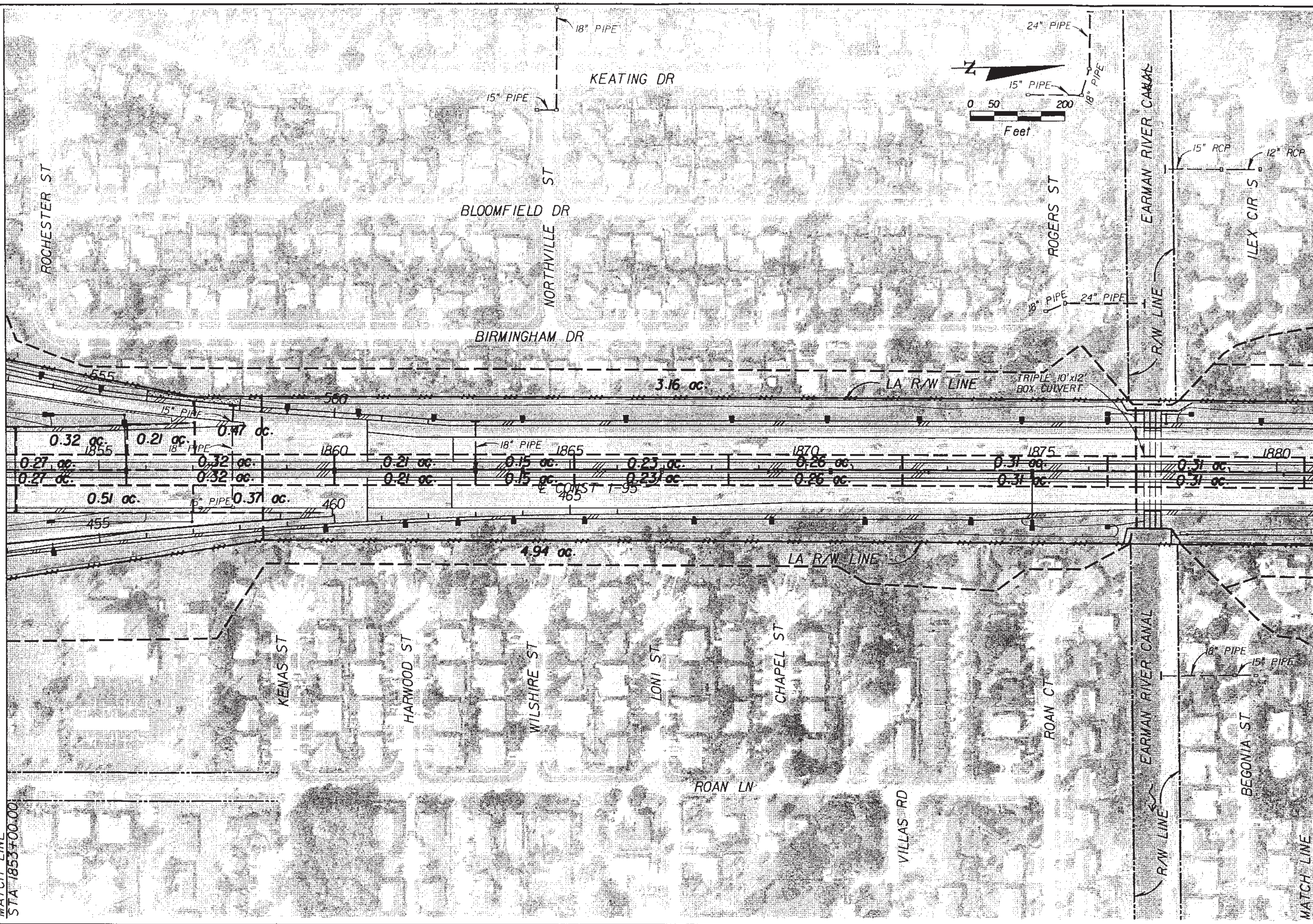
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231929-1-52-01

FIGURE 3
DRAINAGE MAP

SHEET NO.



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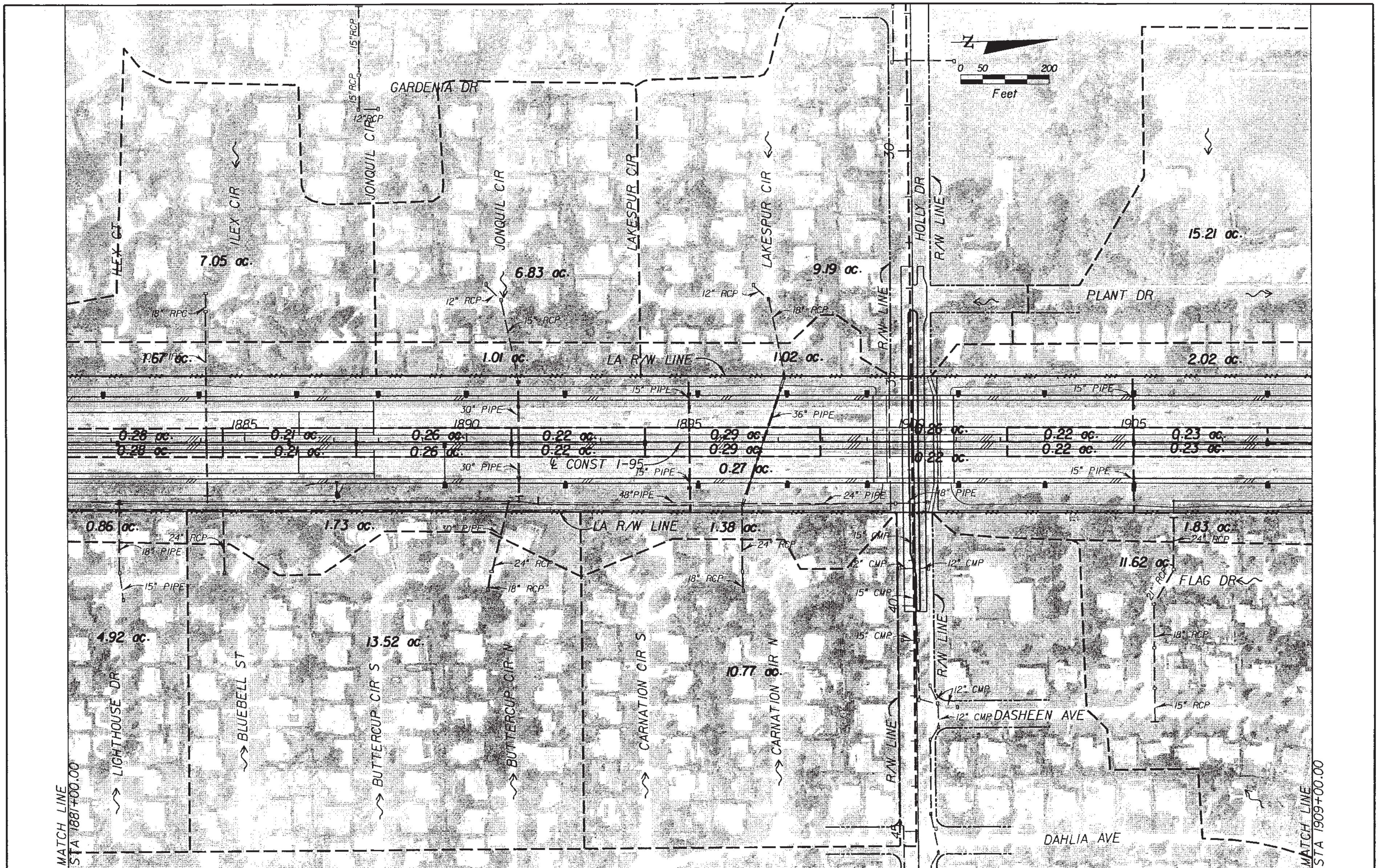
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

FIGURE 3
DRAINAGE MAP

SHEET NO.



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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

FIGURE 3
DRAINAGE MAP

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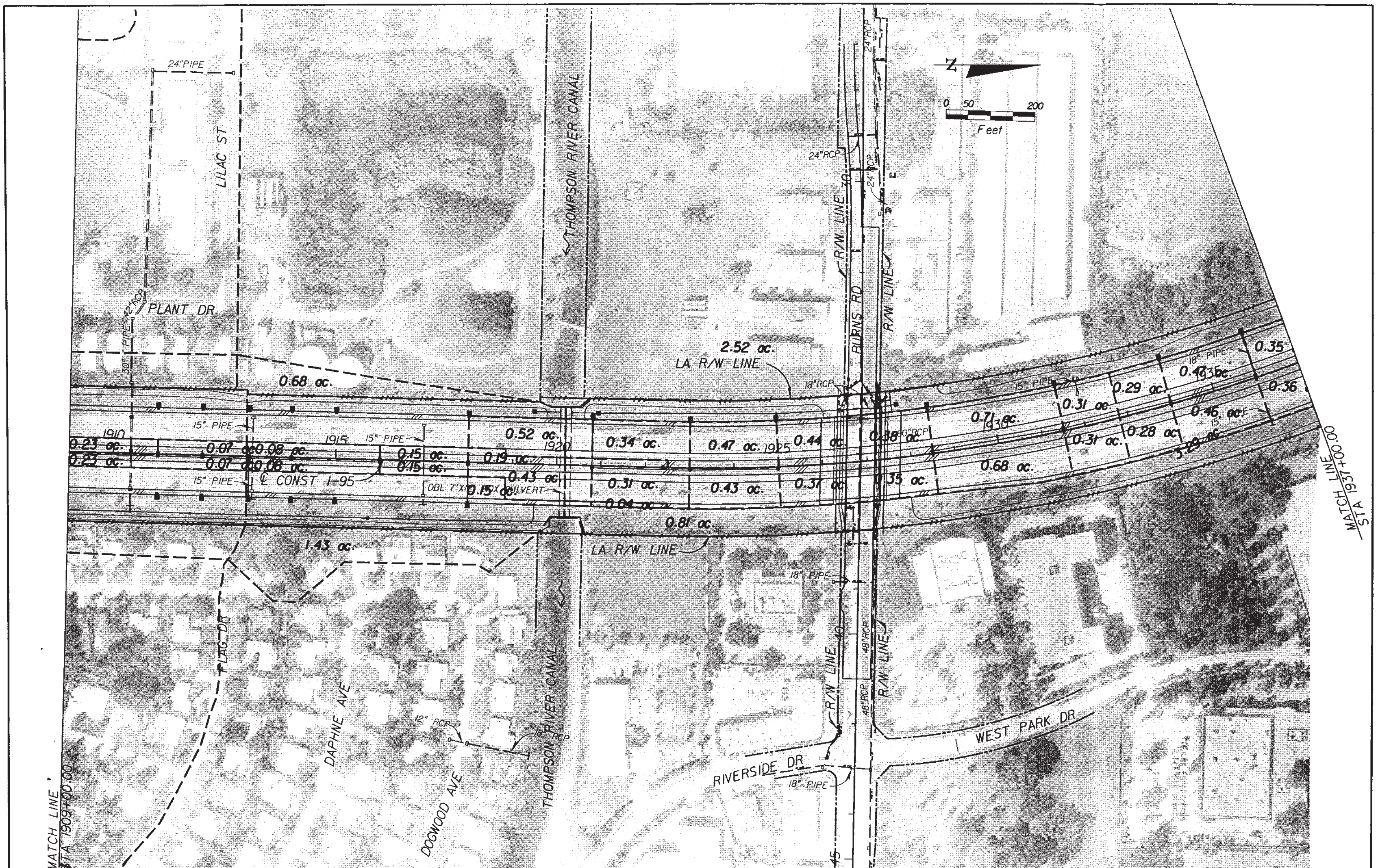

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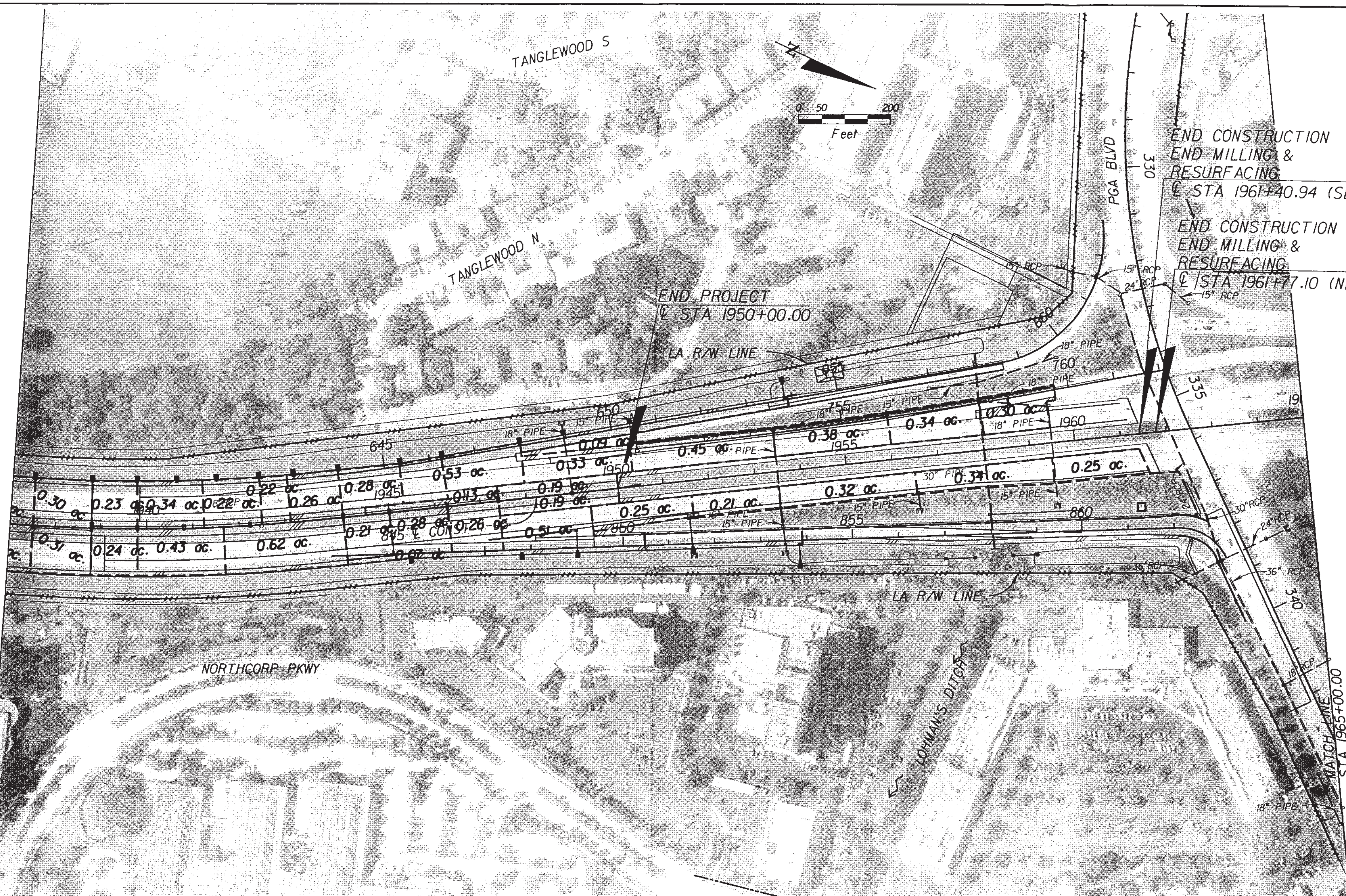
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

FIGURE 3
DRAINAGE MAP

SHEET NO.



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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9	PALM BEACH	231921-1-52-01

FIGURE 3
DRAINAGE MAP

SHEET NO.

permitted discharge to the EPB-6A canal was met.

Basin 2
Beginning at Northlake Boulevard and ending at the Holly Drive overpass, Basin 2 discharges to Earman River Canal. Currently the west side of I-95 and the east side south of the Earman River Canal drain directly to the canal in roadside ditches. The east side of I-95 north of the Earman River Canal has what is essentially an extension of the canal running north to Holly Dr. within the FDOT R/W. Under a separate permit (SFWMD Permit #50-04765-P), there are plans to fill this spur canal and pipe the water to the Earman River Canal. That work will be made a part of this project and that permit will be modified accordingly.

Basin 3
Beginning at Holly Drive and ending at Burns Road, Basin 3 discharges freely to the Thompson River Canal. The City of Palm Beach Gardens has requested the approximately 15 acres north of Burns Road be included in the post-project discharges to the Thompson River Canal. However, before that change was made, models were run of both the existing and proposed discharges from the area between Holly Dr. and Burns Road and the post-project discharges were less than the pre-project discharges to the Thompson River Canal.

Basin 4
Beginning at Burns Road and ending at the exit/entrance ramps for the PGA Boulevard interchange, Basin 4 currently discharges to a 60" outfall pipe constructed by FDOT with the original construction of I-95. This discharges historically to the FEC ditch along Alternate A-1-A. This is the area that the City of Palm Beach Gardens has requested be changed to discharge to the Thompson River Canal. A model was run to determine the existing discharges to the Burns Road outfall and a model was run with Basin 4 combined with Basin 3, both discharging to the Thompson River Canal. The sum of the pre-project discharges to both the Thompson River Canal and the Burns Road outfall exceed the post-project discharge from the combined Basins #3 and #4 to the Thompson River Canal.

Basin 5
This basin consists of the south half of the PGA interchange including entrance and exit ramps and the northbound and southbound mainline lanes within the interchange but excluding the median that is included in Basin 4. Basin 5 discharges to a drainage ditch (Lohman's Ditch) located a few hundred feet south of PGA Boulevard that flows east to the FEC ditch.

Please refer to Figure 2 for location of the referenced canals.

Sidestreets

Three side streets are directly affected by this I-95 project. The first street is Northlake Boulevard. The existing drainage on Northlake Boulevard is proposed to be relocated to accommodate widening associated with the new I-95 bridge over Northlake Boulevard. Gravity walls are also proposed to protect existing catch basins behind the proposed sidewalk. No changes are proposed to the existing mainline drainage system, or to the existing exfiltratation trench system.

The next side street is Holly Drive. The only drainage changes proposed for Holly drive is to adjust the final grade of existing structures immediately east of I-95. The last side street is Burns Road. The existing drainage will be augmented to accommodate the widening of Burns Road under the new I-95 bridge. At the request of the City of Palm Beach Gardens, we are piping the I-95 runoff, which currently discharges to Burns Road, south to the Thompson River Canal. The existing drainage system west of I-95 will be connected to the east of I-95 with a new 42"/48" pipe system. The west system currently connects to the east system via a 60" pipe which was the original I-95 outfall. The 60" pipe has to be removed to accommodate the widening of Burns Road and to maintain appropriate pipe cover. The existing 60" pipe is currently located under the bridge abutment.

CROSS DRAINS

Existing cross drains will be extended at the Earman River Canal and Thompson River Canal. These existing cross drains are triple 10-foot by 12-foot box culverts at the Earman River Canal crossing and double 7-foot by 12-foot at the Thompson River Canal crossing. The cross drains associated with Canals EPB-6 and EPB-6A were recently extended under the Blue Heron Boulevard to Northlake Boulevard Project. Two 30 inch and one 36 inch cross drains south of Holly Drive will be connected to the new equivalent 60 inch pipe within the east roadside swale. North of Holly Drive, one 30 inch cross drain will be connected to the new equivalent 72 inch pipe that will be installed within the east roadside swale. All cross drains will be analyzed to ensure that they meet design criteria with the increased length.

OUTFALLS

The proposed outfalls include the three major canals that traverse the project, EPB-6A Canal, Earman River Canal and Thompson River Canal as shown in Figure 2. Additional outfalls are located at the PGA interchange and at Northlake Boulevard. The design limits the proposed discharge to the existing discharge flow rate. There is no offsite storage for this project. Outfall structure numbers, basin numbers, contributing areas and discharge points are listed in Table 1. A control structure tabulation is presented in Table 2.

SPREAD CALCULATIONS

Spread calculations were performed to ensure proper spacing of the inlets. FDOT spread criteria require that spread resulting from a rainfall intensity of 4.0 inches per hour shall not encroach on the travel lane. Spread calculations are included in Appendix A.

A spread analysis was also used to space barrier wall inlets for a rainfall of 7.63 inches/per hour (10 year rainfall for a time of concentration of 10 minutes). The spread was used to limit the amount of bypass runoff. This was to ensure that barrier inlets at Sag locations would not be overwhelmed. The spread was generally held to 7 feet or less based on the 218 index pavement warp. A similar rational was used for the median barrier inlets on the bridge approaches. Calculations are included in Appendix A.

STORM SEWER DESIGN

The storm sewer system was designed for the 10-year, 24-hour storm using the Automated Storm Sewer Analysis and Design (ASAD) version. Minor losses were ignored; therefore the hydraulic gradient was kept at least 1.0 feet below the top of grate. The storm sewer tabulations are included in Appendix A.

DESIGN TAILWATER

Tailwater conditions for the canals were obtained from the C-17 Canal basin study being performed by Mock Roos and Associates.

Storm Sewer tailwater conditions defaulted to the outfall pipe crown elevation, unless the outfall connected directly to a canal influenced culvert. The tailwater elevation was then checked against the french drain weir elevation. In all cases the head over the weir controlled the french drain system and was not influenced by tailwater conditions. Then the tailwater based on the C-17 study was used. Calculations are provided in Appendix A.

OPTIONAL CULVERT MATERIALS

Table 1
Florida Department of Transportation District 4
I-95 HOV, Phase IV, Palm Beach County
Outfall Data

Control Structure Number	Structure Station	Side/ Location	Contributing Area (Ac)	Receiving Water
S-250	1817+00	RT	6.19	EPB-6A Canal
S-251	1818+00	LT	6.41	EPB-6A Canal
S-252	1819+00	RT	7.76	EPB-6A Canal
S-253	1819+50	LT	7.22	EPB-6A Canal
S-550	1876+40	RT	6.64	Earman River Canal
S-552	1876+40	LT	6.07	Earman River Canal
S-604	1878+00	LT	5.82	Earman River Canal
S-610A	1882+15	RT	6.64	Earman River Canal
S-735A	1915+75	RT	6.38	Thompson River Canal
S-760	1919+47.62	LT	5.34	Thompson River Canal
S-764	1920+92.38	LT	2.23	Thompson River Canal
S-850	857+00	RAMP F, RT	2.56	Lohman's Ditch
S-853	859+00	RAMP F, RT	1.50	Lohman's Ditch
S-1009	35+00	NORTHLAKE, LT	5.00	Northlake Drainage System
S-1014A	38+05	NORTHLAKE, LT	2.27	Northlake Drainage System
S-3004	34+88.50	BURNS, LT	12.50	Thompson River Canal
Total Area			**90.53**	

Table 2
Florida Department of Transportation District 4
I-95 HOV, Phase IV, Palm Beach County
Outfall Data

Control Structure Number	Structure Station	Side/ Location	Grate Elevation	Weir Elevation	Weir Length	Orifice Elevation	Orifice Size	Receiving Water
S-250	1817+00	RT	11.7	10.81	3'-8"	9.0	3"	EPB-6A Canal
S-251	1818+00	LT	12.25	10.96	3'-8"	9.0	3"	EPB-6A Canal
S-252	1819+00	RT	11.69	10.5	7'-4"	9.0	3"	EPB-6A Canal
S-253	1819+50	LT	11.76	10.64	7'-4"	9.0	3"	EPB-6A Canal
S-550	1876+40	RT	11.56	10.6	7'-4"	9.0	3"	Earman River Canal
S-552	1876+40	LT	11.37	10.6	7'-4"	9.0	3"	Earman River Canal
S-604	1878+00	LT	11.02	9.11	3'-8"	7.5	3"	Earman River Canal
S-610A	1882+15	RT	11	8.81	7'-4"	7.5	3"	Earman River Canal
S-735A	1915+75	RT	10.51	9.19	7'-4"	8.0	3"	Thompson River Canal
S-760	1919+47.62	LT	10.5	9.49	7'-4"	8.0	3"	Thompson River Canal
S-764	1920+92.38	LT	10.5	9.46	7'-4"	8.0	3"	Thompson River Canal
S-850	857+00	RAMP F, RT	10.52	9.69	7'-4"	8.5	3"	Lohman's Ditch
S-853	859+00	RAMP F, RT	10.5	9.7	3'-8"	8.5	3"	Lohman's Ditch
S-1009	35+00	NORTHLAKE, LT	14.15	12.8	3'-8"	10.0	3"	Northlake Drainage System
S-1014A	38+05	NORTHLAKE, LT	14.42	11.8	3'-8"	10.0	3"	Northlake Drainage System
S-3004	34+88.50	BURNS, LT	10.86	9.87	7'-4"	8.3	3"	Thompson River Canal

An Optional Culvert Material analysis was performed in accordance with FDOT criteria and the calculations are shown in Appendix A. Class III concrete pipe was used as the basis for the storm sewer analysis. Generally, 16-gauge aluminum can be used throughtout the project as an optional material. Slotted 16-gauge aluminum can be used for the french drain alternative. The deep pipe connecting structures S-6 to S-651 must be Class IV concrete or 12- gauge aluminum due to the depth of the pipe.

Appendix H

Palm Beach County Thoroughfare Road Design Procedures Excerpts

PALM BEACH COUNTY

THOROUGHFARE ROAD

DESIGN PROCEDURES

George T. Webb

APPROVED BY
GEORGE T. WEBB, P.E.
COUNTY ENGINEER

FEBRUARY 2006

APPENDIX B

DRAINAGE DESIGN GUIDELINES

All Thoroughfare Road Drainage Design shall comply with the Florida Department of Transportation Drainage Manual (latest Edition) and the following guidelines:

The values and methodology presented in these guidelines and supplemental references are Palm Beach County Standards. Deviations from these guidelines shall be documented within the required Drainage Design Computation Book at each instance of deviation, and must receive written authorization from Palm Beach County.

A Drainage Design Computation Book shall be prepared and one (1) signed and sealed by the Professional Engineer in responsible charge, shall be submitted to Palm Beach County. The Drainage Design Computation Book shall include all calculations necessary to support the information required by Palm Beach County and permitting agencies.

Design and construction of all drainage systems shall be for the ultimate roadway requirements.

The drainage design shall address historical flow as obstructed or displaced by the roadway construction.

The drainage design shall include flood routing computations for the 25 year, 3 day storm event. Pipes shall be sized for the 3 year, 1 day storm event, using the Rational Method and the Florida Department of Transportation Zone 10 Rainfall Intensity Duration Frequency Curve, resulting in the hydraulic gradient being at least 1' below the top of the grate with all control elements in place i.e. weirs, orifices, etc. The profile grade line shall be set for the 25 year, 3 day storm peak stage (storm water pond or canal whichever is higher), accommodating at least one through lane in each direction for the roadway being built above this elevation.

SUPPLEMENTAL REFERENCES

Florida Department of Transportation Drainage Manual (Latest Version).
Florida Department of Transportation Roadway and Traffic Design Standards (Latest Version).
Florida Department of Transportation Plans Preparation Manual (Latest Version).
South Florida Water Management District Manual Volume IV.

Appendix I

Pond Siting Alternative Analysis Matrix, Exhibits and Notes

MEETING AGENDA & NOTES

SR 9 / I-95 PD&E Study

At Northlake Boulevard Interchange

FM# 435803-1-22-02 & ETDM # 14182

Stanley Consultants INC.

Date: March 30, 2017 **Place:** FDOT 2nd Floor Conf. Room West

Project: SR 9/ I-95 at Northlake Blvd.
FM 435803-1-22-02

Notes By: Renaud Olivier, Linda Ferreira, Bill Evans

Purpose: Pond Siting Kick-Off Meeting
(Meeting 1 of 3)

ITEMS TO BE DISCUSSED:

1. Verification of Pond Design Guidelines and Criteria	7.
2. Identify Potential Pond Sites	8.
3. Identify Potential Joint Use Pond Sites	9.
4. Assign Impact Analysis to Team Members	10.
5. Next Meeting	11.
6.	12.

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If no objections, questions, additions, or comments are received within 5 working days from issuance of the meeting notes, we will assume that our understandings are correct. We are proceeding based on the contents of these meeting notes.

Attendees: See Attached Attendee List

The following items were discussed using the Potential Pond Site Map held March 30, 2017 at 2:30pm. See attached for the map.

1. Renaud discussed the Pond Design Guidelines and Criteria
    a. Alternative 1
    b. I-95 –
        i. All proposed ramp improvements can be managed within FDOT R/W.
    c. Northlake Blvd. –
        i. Arterial widening (6L to 8L).
        ii. R/W acquisition required for roadway widening.
        iii. Need for offsite pond.
    d. The permitting agency is SFWMD. Discharge to C-17 (an impaired water body).
    e. Water Quality (treatment for additional impervious area)
    f. Water Quantity (Post discharge not to exceed Pre discharge)
    g. Demonstrate a net improvement in removal of Total Phosphorus and Total Nitrogen

    Renaud stated there is a scenario where an offsite pond may not be needed for the project. Three items would need to be addressed for this scenario to occur. 1) SFWMD will need to waive the nutrient loading analysis requirement stated in 1.g. above. 2) The existing storm drain system pipe size is large enough to manage the additional runoff from the roadway widening so there is no flooding of the roadway. 3) Meeting stormwater quality rules will still need to be met. To do this exfiltration trench can be used. Finding room within the road right of way to construct the required length of exfiltration trench to meet water quality standards will need to occur. This could be a challenge considering underground utilities.

2. The team discussed and identied Potential Pond Sites
    Open discussion with exhibits occurred during the meeting to select pond sites to meet the needs for the

project and minimize impacts. The team identified 3 pond sites for further evaluation. These are

a. ID No. A. The team decided to further evaluate this site and reshape the site to not encroach within the adjacent parcel to the west (ABC Fine Liquors and Spirits, Nutrition Smart) and also utilize the residential parcels to the north that are impacted due to the proposed I-95 Ramp D widening alignment. This approach eliminates parking lot impacts and reduces business damages. The hotel parcel (Inn of America) would be a whole take with no business damages. It was noted during the meeting there is an outdoor advertising sign on the hotel parcel that will need to be accounted for. This potential pond site would occur on four residential parcels and one business parcel (Inn of America). The total area available for drainage would be 2.30 acres.

b. ID No. B. The team decided to further evaluate this site and reshape the site so multiple parcels are not required. This potential pond site occurs on one parcel. This site is currently an undeveloped parcel that is for sell. The total area for drainage would be 2.39 acres.

c. ID No. F. The team decided to further evaluate this site and reshape the site to not encroach on the McDonalds parcel which was proposed on the Potential Pond Site Map to consider the re-alignment of Sunrise Drive. This potential pond site would occur on two parcels. One developed business (Edwin Watts) and an adjacent undeveloped parcel. The total area for drainage would be 2.2 acres. This would leave a 35'R/W to accommodate the "alley" that connects Roan Lane with Sunrise Drive.

d. The remaining potential pond sites discussed were eliminated from further evaluation for various reasons as follows:

    1. Parcel C – eliminated due to adjacent high risk contamination site.
    2. Parcel D – eliminated due to high business impacts.
    3. Parcel E – eliminated since it would compromise access along Sunset Drive.
    4. Parcel G – eliminated due to high business impacts.

3. Renaud discussed potential Joint Use Pond sites identified during the Study as follows.
    a. 300 feet east of Military Trail, south side of Northlake Boulevard. (Small Dry Detention Pond)
        i. Serves commercial.
        ii. Too small. (reason for not further evaluating).
    b. 1,000 feet east of Military Trail, north side of Northlake Boulevard. (Wet Detention Pond)
        i. Serves commercial.
        ii. Discharges through residential neighborhood to canal system.
        iii. Potential to provide additional treatment.
        iv. Located upstream of project (reason for not further evaluating).
        v. Requires drainage easement (reason for not further evaluating).
    c. SE quadrant of interchange (Wet Detention Pond)
        i. Serves commercial.
        ii. Discharges through commercial and residential to canal system.
        iii. Potential to provide additional treatment.
        iv. Would require expanding pond, but would have business impacts (reason for not further evaluating).
        v. History of drainage complaints from residence. (reason for not further evaluating).

4. Assigned Impact Analysis to Team Members
    a. STEP 3 of Pond Siting Procedure was given to each team member in preparation for next meeting.

5. Open Discussion
   Action items include: 1) Send Tony the pond parcel sizes. 2) Send the pond siting matrix to the team before the next meeting. 3) Send Sean the R/W map exhibit.
   The next meeting (Meeting 2 of 3) is scheduled for April 6, 2017 at 2:30 pm.

6. The meeting adjourned at 4:30.

Meeting Attendance Sheet

SR-9/ I-95 at Northlake Interchange PD&E Study

Palm Beach County

FM 435803-1-22-02 & ETDM 14182

Date: March 30, 2017 **Meeting Purpose:** Pond Siting Kick-Off Meeting (Meeting #1)

Meeting Location: D4- 2nd Floor Conference Room West

ATTENDEES:

Initial as Attending	Name	Organization/Discipline	Phone	E-Mail
SMT	Scott Thurman	FDOT Project Manager	954.777.4135	Scott.Thurman@dot.state.fl.us
WRE	Evans, Bill	Stanley Consultants Project Manager	Direct 561.584.8708 Cell: 561.352.5662	EvansBill@StanleyGroup.com
RR	Ruben Rodriguez	FDOT Drainage	954.777.4661	Ruben.Rodriguez@dot.state.fl.us
MEM	Mary Milford	FDOT Environmental Management	954.777.4471	mary.milford@dot.state.fl.us
DW	Donnie Webster	FDOT Right of Way	954-777-4235	donald.webster@dot.state.fl.us
	John Olson	FDOT Roadway/Consultant Management		
		FDOT Maintenance		
		FDOT Construction		
	~~Richard Sherman~~	FDOT Legal		
LF	Linda Ferreira	Stanley Consultants Project Engineer	561.689.8744	FerreiraLinda@stanleygroup.com
RO	Renaud Olivier	Stanley Consultants Drainage Lead	561.584.8739	olivierrenaud@stanleygroup.com
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TC	Tony Conde	FDOT ROW	954 777-4241	tony.conde@[illegible]
JTL.	JAMES T. LEWIS JR	FDOT PALM BCH OPS.	561 370-1215	JAMES.LEWIS@DOT.STATE.FL.US

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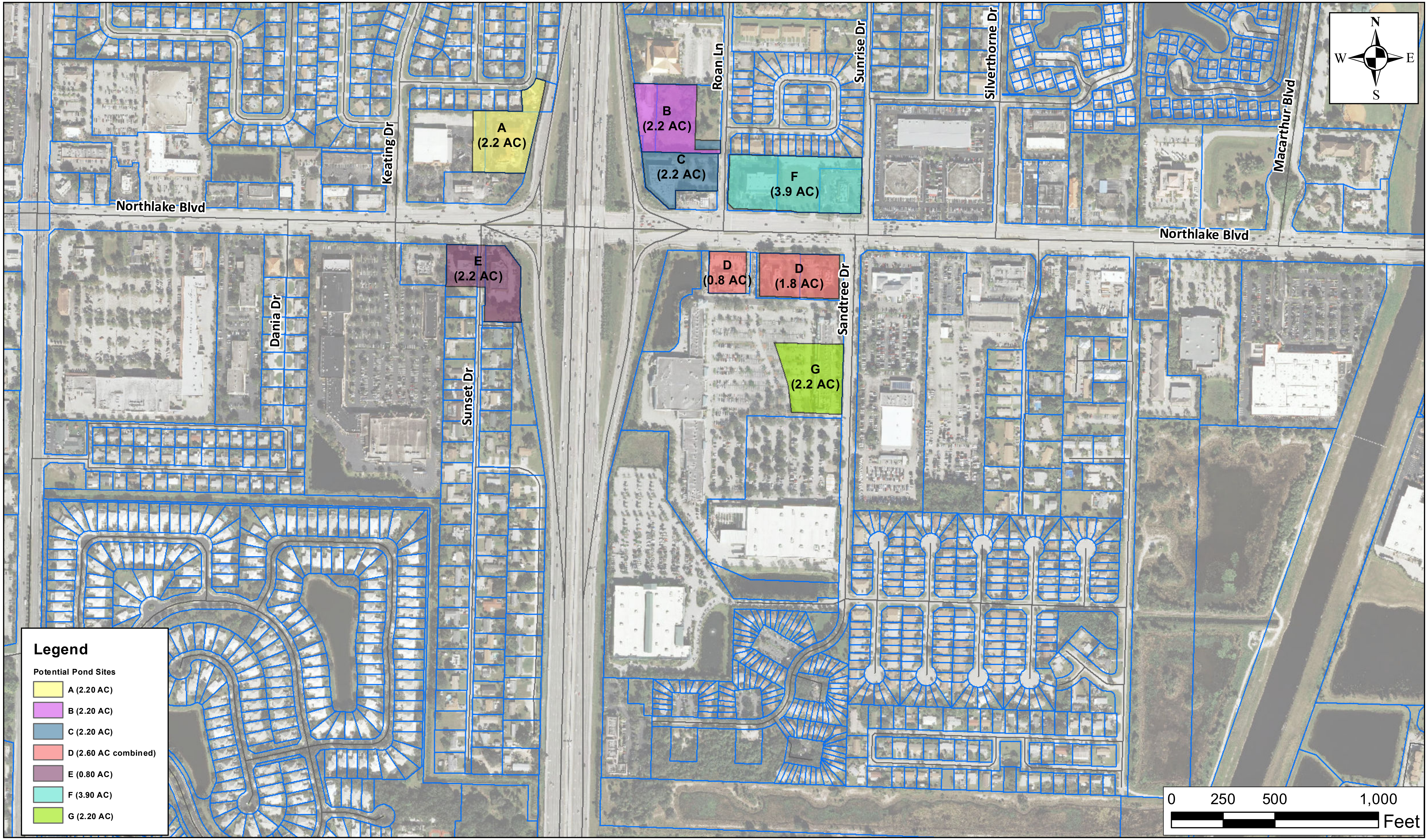
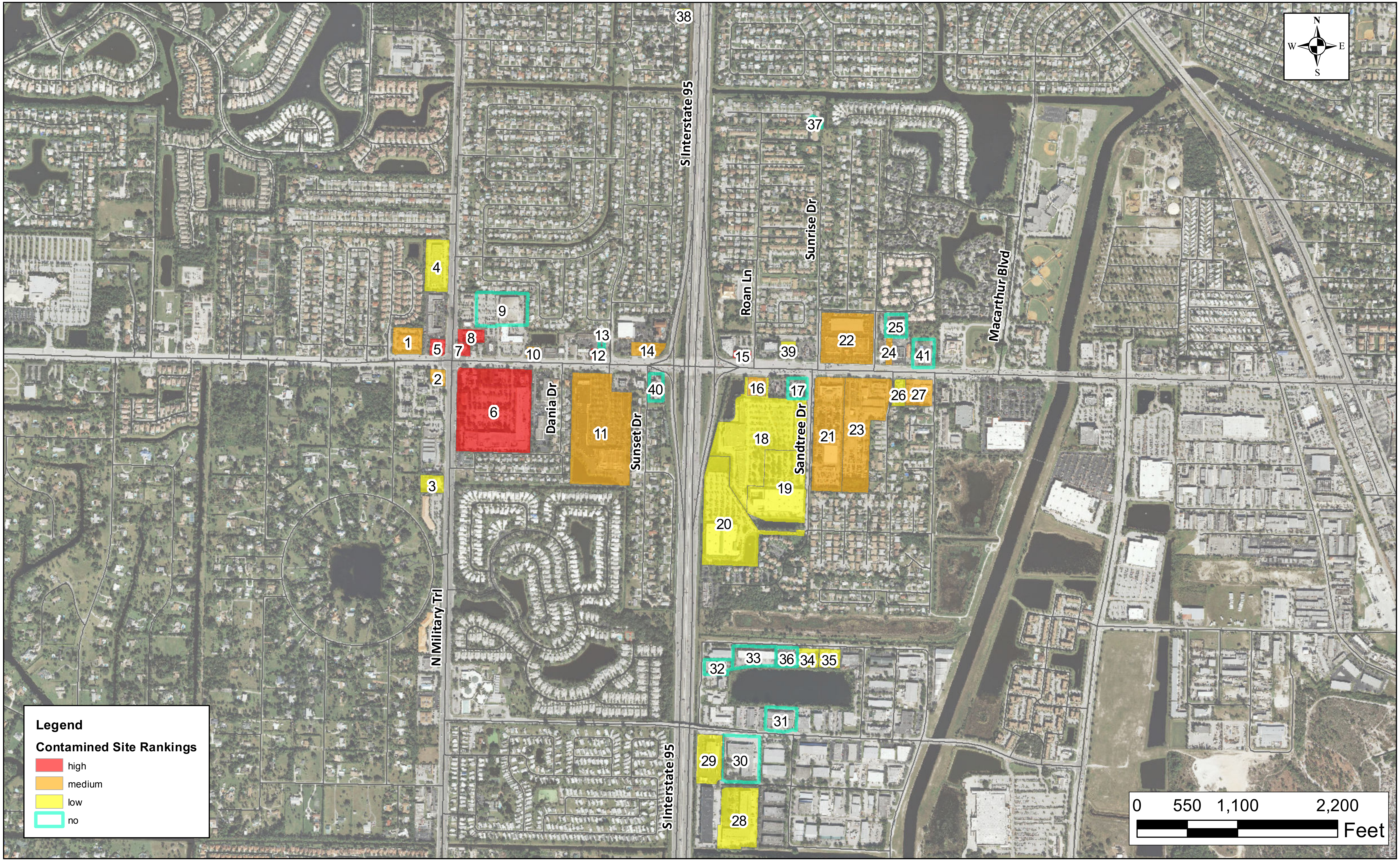


SR 9 / I-95 at Northlake Boulevard Interchange
Project Development and Environment (PD&E) Study

<u>Potential Pond Site Map</u>

FM Number: 435803-1-22-02
ETDM: 14182



SR 9 / I-95 at Northlake Boulevard Interchange
Project Development and Environment (PD&E) Study

Contamination Potential Map

FM Number: 435803-1-22-02
ETDM: 14182

MEETING AGENDA & NOTES

SR 9 / I-95 PD&E Study

At Northlake Boulevard Interchange

FM# 435803-1-22-02 & ETDM # 14182

Date: April 20, 2017 **Place:** FDOT D4-DO2 Everglades Conference Room

Project: SR 9/ I-95 at Northlake Blvd.
FM 435803-1-22-02

Notes By: Renaud Olivier

Purpose: Final Ranking & Report Review Pond Siting Meeting (Meeting 3 of 3)

ITEMS TO BE DISCUSSED:

1. Recap pond siting process	7.
2. Finalize alternative screening for the three potential pond sites	8.
3. Next steps	9.
4.	10.
5.	11.
6.	12.

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If no objections, questions, additions, or comments are received within 5 working days from issuance of the meeting notes, we will assume that our understandings are correct. We are proceeding based on the contents of these meeting notes.

Attendees: See Attached Attendee List

Meeting #3 of 3 was held today. The meeting began at 2:00 pm. Renaud presented a recap of meeting #1 and meeting #2. The following items were discussed during these two meetings following the FDOT D4 pond siting procedures.

1. Recap pond siting process

   a. Kick off meeting items discussed in Meeting #1 included:
      - i. Discussed pond design guidelines and criteria
      - ii. Evaluated seven potential pond sites
      - iii. Selected three potential pond sites to further evaluate (Pond A, Pond B and Pond F)
      - iv. Revised the limits of the three potential pond sites:
        1. minimize impacts to adjacent properties
        2. utilize parcels impacted for roadway alignment purposes
        3. minimize amount of parcels impacted
      - v. Discussed potential joint use pond sites
      - vi. Assigned impact analysis to team members to evaluate the three potential pond sites

   b. Potential pond site screening discussed in Meeting #2 included:
      - i. Pond siting matrix used to evaluate the potential pond sites to determine preferred site
        1. Criteria factors used in the pond siting matrix for evaluation purposes
        2. Team discussion with discipline expertise was used to evaluate each factor
        3. Each potential pond site was ranked accordingly

The team reviewed the weighting of factors and scoring of each pond site that was completed during Meeting #2. The team decided to increase item 17 listed on the pond site matrix (Public Opinion) from a weight of 5 to a weight of 6 to help capture the public's concern (documented during the December 8, 2016 Alternatives Public Workshop) of potential local business and residential impacts.   ACTION ITEM: The pond siting matrix will be revised accordingly and included in the Drainage/Pond Siting Report.

Final ranking of the pond sites were summarized. The Pond B site resulted in the lowest most desired alternative, as scored in the pond siting matrix, as such, Pond B is the desired pond site alternative.

ACTION ITEM: Add the name of the roadway alternative (Alternative 1) to the pond siting matrix.

ACTION ITEM: There is a possibility that all stormwater needs along Northlake Boulevard can be managed without a pond. This was discussed in Meeting #1 and the conditions for this possibility will be included in the Drainage/Pond Siting Report.

The next steps in the pond siting process were discussed. The Drainage/Pond Siting Report will be completed. R/W estimates have been completed and as noted is confidential information, not for public disclosure. The design phase of the project is scheduled to be advertised in the spring of 2018. Advance acquisition of parcels has not been decided upon and is to be determined. A hand-off meeting between the PD&E team and the design team can be considered as needed.

The meeting adjourned at approximately 3:30 pm.

Meeting Attendance Sheet

SR-9/ I-95 at Northlake Interchange PD&E Study

Palm Beach County

FM 435803-1-22-02 & ETDM 14182

Date: April 20, 2017 **Meeting Purpose:** Final Ranking & Report Review Pond Siting Meeting (Meeting #3)

Meeting Location: D4- DO2 Everglades

ATTENDEES:

Initial as Attending	Name	Organization/Discipline	Phone	E-Mail
SM	Scott Thurman	FDOT Project Manager	954.777.4135	Scott.Thurman@dot.state.fl.us
WTE	Evans, Bill	Stanley Consultants Project Manager	Direct 561.584.8708 Cell: 561.352.5662	EvansBill@StanleyGroup.com
	Ruben Rodriguez	FDOT Drainage	954.777.4661	Ruben.Rodriguez@dot.state.fl.us
MEM	Mary Milford	FDOT Environmental Management	954.777.7741	Mary.Milford@dot.state.fl.us
DW	Donnie Webster	FDOT Right of Way	954.777.4235	Donald.Webster@dot.state.fl.us
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	Sean Wydner	FDOT Legal	954.777.4510	Sean.Wynder@dot.state.fl.us
	Renaud Olivier	Stanley Consultants Drainage Lead	561.584.8739	olivierrenaud@stanleygroup.com
	Linda Ferreira	Stanley Consultants Project Engineer	561.689.8744	FerreiraLinda@stanleygroup.com

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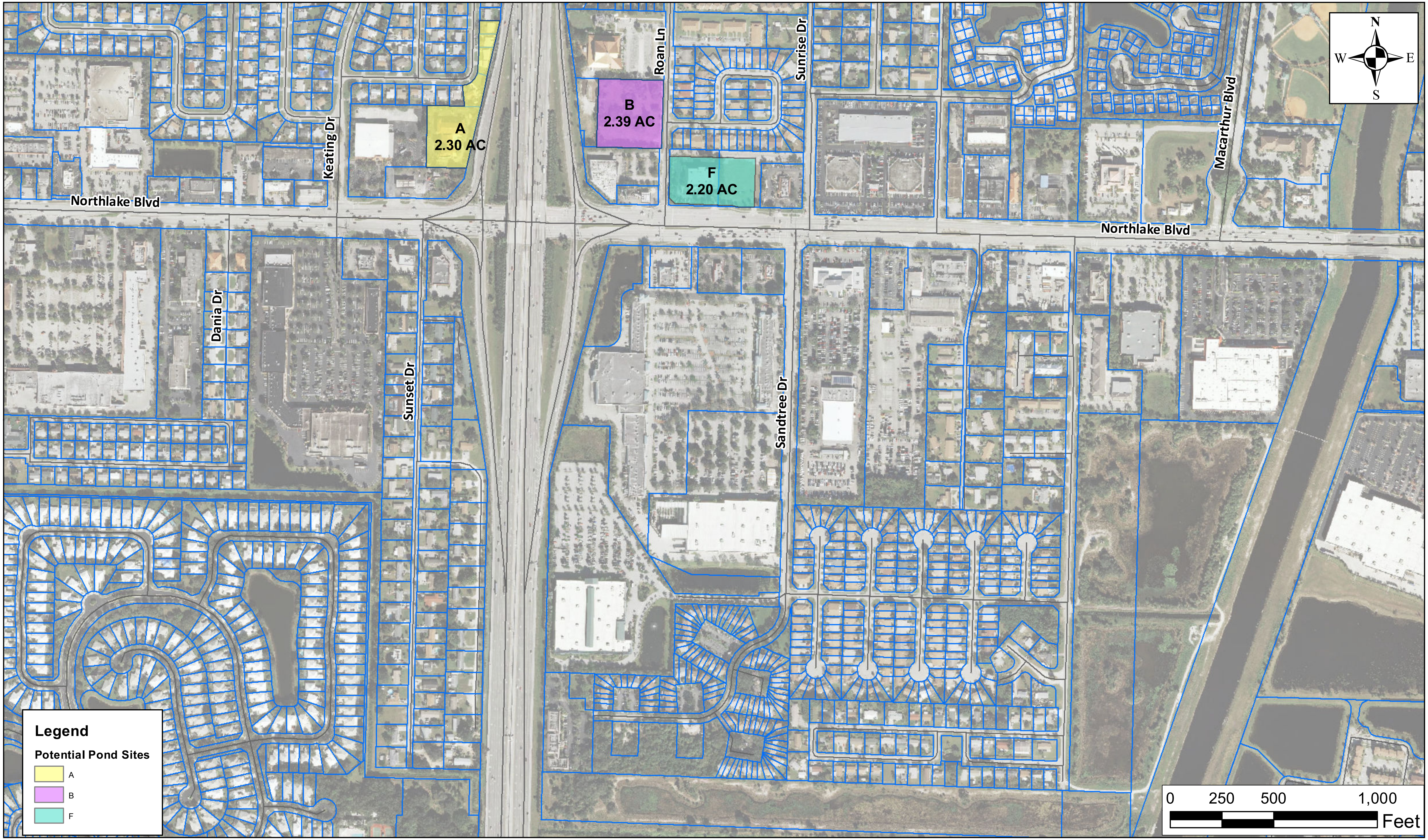
Pond Siting Matrix - Alternative 1 (Modified Concept)

	Weight of Factor	Factor	Score	Weighted Score	Notes	Score	Weighted Score	Notes	Score	Weighted Score	Notes
	1-10		1-10			1-10			1-10		
		Alternative Number	A			B			F		
		Brief Description of Alternative	2.2 Acres at NW quadrant Comm/Resid. Parcels. Utilizes hotel property and residental properties. Residentail properties are impacted by roadway Alternative 1.			2.2 acres at NE quadrant undeveloped parcel.			2.2 acres between Roan Ln & Sunrise Dr.. Utilizes retail golf store and vacant parcels. Frontage of golf store is impacted by all roadway alternatives.		
		Parcel Number									
		Parcel Size (Acres)	# Acres		2.30	# Acres		2.39	# Acres		2.20
1	4	Zoning (Right of Way)	5	20	hotel portion is commercial and plus 4 residential homes. Jurisdiction of both City of Palm Beach Gardens (hotel) and Palm Beach County (residential).	2	8	same zoning as site F. Jurisdiction of Palm Beach County.	8	32	same zoning as site B, but it is more promident and is on frontage of highway. Jurisdiction of the City of Palm Beach Gardens
2	3	Land Use	5	15	mixed land use	2	6	vacant - no current land use	8	24	leaves an uneconomic remainder
3	8	Right of Way Costs	8	64	porpotional to ROW cost estimate. Business and residential relocations.	4	32	porpotional to ROW cost estimate. No relocations.	9	72	porpotional to ROW cost estimate. Business relocation.
4	8	Drainage Considerations	6	48	site is further up stream than B or F. Pipe flow from east back west to pond then east again to outfall. Irregular shape	4	32	Connection requires restoration on Roan Lane	2	16	hydraulically, closer, adjacent to the road, no easement or separate connection to roadway required.
5		Flood Zone FEMA		0			0			0	
6	7	Contamination and Hazardous Materials	6	42	adjacent to medium risk site	8	56	close to highly contaminated site	9	63	downstream of a highly contaminated site
7	5	Utilities	3	15	potential underground service utilities, power overhead	5	25	vacant parcel likely no utilites on site. Drainage connection likley to impact underground utilities on Roan lane. May need a drainage easement agreement for Roan Lane.	4	20	underground utilities located on northside of Northlake including Seacoast easement on frontage of parcels.
8	1	Threatened and Endangered Species and Associated Costs	1	1	no mitigation needed	1	1	no mitigation needed	1	1	no mitigation needed
9		Noise		0			0			0	
10		Wetlands and Protected Uplands and Associated Costs		0	none anticipated.		0	none anticipated.		0	none anticipated.
11		Cultural Resources Involvement and Associated Costs		0	none anticipated.		0	none anticipated.		0	none anticipated.
12		Section 4(f)		0	none anticipated.		0	none anticipated.		0	none anticipated.
13		Public Wellfield		0	not applicable due to distance from the study area, not within the well field protection zone		0	not applicable due to distance from the study area, not within the well field protection zone		0	not applicable due to distance from the study area, not within the well field protection zone
14	6	Construction	6	36	access via Rochester St. and Birmingham Dr. is through residential neighborhood.	4	24	roadway restoration costs and piping to pond is required.	2	12	access is easy due to being on frontage. No additional cost due to site location.
15	4	Maintenance	3	12	all have access, same maintenance for each site	3	12	all have access, same maintenance for each site	3	12	all have access, same maintenance for each site
16	3	Aesthetics	5	15	could have requirements from the residences and local government to look more like a park then a pond	4	12	will need a fence due to school being located on adjacent parcel.	6	18	local government may want more landscape due to being on a frontage road. City could require specific landscaping, may need a berm or fencing at sidewalk and back street.
17	6	Public Opinion and Adjacent Residency Concerns	5	30	local residents might not like pond	2	12	already vacant	7	42	municipalities might not like pond on frontage of roadway. Loss of existing tax base.
18		Other		0			0			0	
		Score	298			220			312		
		Ranking	2			1			3		

Comments: Scores are given from 1 to 10. Less points means a better or more desired alternative.



SR 9 / I-95 at Northlake Boulevard Interchange
Project Development and Environment (PD&E) Study

Potential Pond Site Map (Meeting #2)

FM Number: 435803-1-22-02
ETDM: 14182

MEETING AGENDA & NOTES

SR 9 / I-95 PD&E Study

At Northlake Boulevard Interchange

FM# 435803-1-22-02 & ETDM # 14182

Stanley Consultants INC.

Date: April 6, 2017 **Place:** FDOT 2nd Floor Conf. Room

Project: SR 9/ I-95 at Northlake Blvd.
FM 435803-1-22-02

Notes By: Linda Ferreira, PE

Purpose: Pond Siting 2nd Meeting
(Meeting 2 of 3)

ITEMS TO BE DISCUSSED:

1. Verification of Pond Design Guidelines and Criteria	7.
2. Review 3 Potential Pond Sites	8.
3. Screen Pond Site Alternatives	9.
4. Conclude Scores	10.
5. Next Meeting	11.
6.	12.

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If no objections, questions, additions, or comments are received within 5 working days from issuance of the meeting notes, we will assume that our understandings are correct. We are proceeding based on the contents of these meeting notes.

Attendees: See Attached Attendee List

1. Verification of Pond Design Guidelines and Criteria – reviewed at the beginning of the meeting.

2. Review of 3 Potential Pond Sites

   Open discussion with exhibits. Review 3 pond sites identified in previous meeting.

   New pond siting exhibits were distributed to the team members.

   a. Pond A - The limits of Pond A have been revised to reflect the comments from Pond Siting Meeting #1. The new proposed site for Pond A consists of one commercial parcel and 4 residential parcels. This revision was made due to 4 of the residential parcels potentially needing to be acquired for the roadway improvements for the Modified Concept Alternative.

   b. Pond B - The limits of Pond B have been revised to reflect the comments from Pond Siting Meeting #1. The revised site is now incorporated within one existing vacant parcel on the west side of Roan Lane north of Northlake Blvd.

   c. Pond F - The limits of Pond F have been revised to reflect the comments from Pond Siting Meeting #1. The revised site is comprised of two parcels; one commercial parcel currently occupied by Edwin Watts Golf and one vacant parcel. The site is located on the north-east corner of Northlake Blvd and Roan Lane

3. Pond Site Alternatives Screening

   a. Assign weights to evaluation factors:

      Following the procedure in the District 4 Pond Siting Design Guidelines, weights were first assigned to the evaluation criteria factors. A rating scale from 1 to 10 was utilized with 10 given to factors that were determined to have high importance and 1 given to factors with lesser importance.

Right of Way Costs and Drainage Considerations were given the highest amount of weighted points with 8, Contamination and Hazardous Materials was given a weight of 7, Construction a 6, Utilities and Public Opinion and Adjacent Residency Concerns both received a 5, Zoning (Right of Way) and Maintenance a weight of 4, Land Use and Aesthetics received 3 and Threatened and Endangered Species and Associated Costs was given a weight of one.

Criteria factors that were determined to have the same significance to all three pond sites or were not applicable were not given a weight and were eliminated from the evaluation matrix scoring. Those factors include Flood Zone FEMA (no flood zones exist within the study area), Noise (N/A), Wetlands and Protected Uplands and Associated Costs (N/A), Section 4(f) (N/A), Public Wellfield (not applicable as the well fields are located far to the north of the study area) and other.

b. Score the 3 pond sites – lowest score equals higher ranking

- Zoning (Right of Way) – Pond F and Pond B have the same zoning but pond F is more prominent due to it being located on highway frontage, therefore Pond B was scored lower than Pond F and Pond A had mixed zoning and was scored in the middle.
- Land use – Due to Pond B current being vacant it was scored the lowest, Pond F would leave an uneconomic remainder giving it the highest score between the three ponds.
- Right of Way Costs – Pond F would have the highest ROW cost with Pond A closely behind. Pond B would have the lowest ROW cost and was scored the lowest.
- Drainage Considerations – Pond A is located further upstream and would have an irregular shape not making it idea for a pond given drainage considerations. Pond B would require extra piping for storm drain water to reach it. Pond F is hydraulically closer and adjacent to Northlake Blvd awarding it the lowest score in this factor category.
- Contamination and Hazardous Materials – Pond A is adjacent to a site rated with a median risk rating. Pond B is close to a high rated risk site and so is Pond F. Pond F is down gradient of the groundwater flow from the high risk contaminated site giving it the highest score.
- Utilities – There can be expected existing underground utilities located on Pond Site A to service the hotel and overhead utilities. Pond A was scored the lowest out of the three ponds in this factor. Pond B currently has no existing utilities but would require a 25-foot easement along Roan lane in order to have the runoff reach the pond. Underground utilities are located on Pond 4 for a local water utility company giving Pond F the highest score.
- Threatened and Endangered Species and Associated Costs – all three pond sites were scored the same as all three have minimal impact to threatened or endangered species. The area is mostly impervious concrete and asphalt.
- Construction – Pond A was giving the highest score due to construction access needing to be through the north of the site through a residential area. Pond B will need additional piping down Roan Lane and would need more construction area to get the pipes from the roadway to the pond. Pond F received the lowest score due to easy construction access and its location on the frontage of the highway.
- Maintenance – All site received the same score for maintenance.
- Aesthetics – The site for Pond A could have requirements from the residence and local government to look more like a park then a pond. Pond B would require a fence but would probably require minimal beatification. Pond C received the highest score due to it being on the frontage of Northlake Blvd and the city could require specific landscaping, the site would also require a berm or fencing.

- Public Opinion and Adjacent Residency Concerns – Pond A received a medium rating due to residence possibly not favoring a pond in this location. Pond B is currently vacant and receive the lowest score. Pond F was scored the highest due to it being on the frontage of Northlake Blvd and municipalities not favoring the use of valuable frontage road as a pond and not commercial property.

4. Conclude scores

   The pond site with the lowest ranking and chosen as the preferred pond site was Pond B with a score of 218. Pond A came in second with a score of 293 and Pond F received a score of 305.

5. Next Meeting/Adjourn

Meeting Attendance Sheet

SR-9/ I-95 at Northlake Interchange PD&E Study

Palm Beach County

FM 435803-1-22-02 & ETDM 14182

Date: April 6, 2017 **Meeting Purpose:** Pond Siting Kick-Off Meeting (Meeting #2)

Meeting Location: D4- 2nd Floor Conference Room West

ATTENDEES:

Initial as Attending	Name	Organization/Discipline	Phone	E-Mail
SMT	Scott Thurman	FDOT Project Manager	954.777.4135	Scott.Thurman@dot.state.fl.us
WE	Evans, Bill	Stanley Consultants Project Manager	Direct 561.584.8708 Cell: 561.352.5662	EvansBill@StanleyGroup.com
[illegible]	Ruben Rodriguez	FDOT Drainage	954.777.4661	Ruben.Rodriguez@dot.state.fl.us
MEM	Mary Milford	FDOT Environmental Management	954.777.7741	mary.milford@dot.state.fl.us
DW	Donnie Webster	FDOT Right of Way	954 777 4235	donald.webster@dot.state.fl.us
	John Olson	FDOT Roadway/Consultant Management		
		FDOT Maintenance		
[illegible]	JIM LEWIS	FDOT Construction	561 662-1216	JAMES.LEWIS@DOT.STATE.US.FL.
	Richard Sherman	FDOT Legal		
LF	Linda Ferreira	Stanley Consultants Project Engineer	561.689.8744	FerreiraLinda@stanleygroup.com
	Renaud Olivier	Stanley Consultants Drainage Lead	561.584.8739	olivierrenaud@stanleygroup.com
	Tony Conde	FDOT ROW	954-777-4247	tony.conde@dot.state.fl.us
	JIM			
LCM	Launice Mayes	FDOT Legal	954 777-4509	launice.mayes@dot.state.fl.us
[illegible]	Sean Wydner	FDOT legal	9/777-4510	sean.wydner@dot.state.fl.us

Stanley Consultants INC

Pond Siting Matrix

	Weight of Factor	Factor	Score	Weighted Score	Notes	Score	Weighted Score	Notes	Score	Weighted Score	Notes
	1-10		1-10			1-10			1-10		
		Alternative Number	A			B			F		
		Brief Description of Alternative	2.2 Acres at NW quadrant Comm/Resid. Parcels. Utilizes hotel property and residental properties. Residentail properties are impacted by roadway Alternative 1.			2.2 acres at NE quadrant undeveloped parcel.			2.2 acres between Roan Ln & Sunrise Dr.. Utilizes retail golf store and vacant parcels. Frontage of golf store is impacted by all roadway alternatives.		
		Parcel Number									
		Parcel Size (Acres)	# Acres		2.30	# Acres		2.39	# Acres		2.20
1	4	Zoning (Right of Way)	5	20	hotel portion is commercial and plus 4 residential homes. Jurisdiction of both City of Palm Beach Gardens (hotel) and Palm Beach County (residential).	2	8	same zoning as site F. Jurisdiction of Palm Beach County.	8	32	same zoning as site F, but it is more promident and is on frontage of highway. Jurisdiction of the City of Palm Beach Gardens
2	3	Land Use	5	15	mixed land use	2	6	vacant - no current land use	8	24	leaves an uneconomic remainder
3	8	Right of Way Costs	8	64	porpotional to ROW cost estimate. Business and residential relocations.	4	32	porpotional to ROW cost estimate. No relocations.	9	72	porpotional to ROW cost estimate. Business relocation.
4	8	Drainage Considerations	6	48	site is further up stream than B or C. Pipe flow from east back west to pond then east again to outfall. Irregular shape	4	32	Connection requires restoration on Roan Lane	2	16	hydraulicly, closer, adjacent to the road, no easement or separate connection to roadway required.
5		Flood Zone FEMA		0			0			0	
6	7	Contamination and Hazardous Materials	6	42	adjacent to medium risk site	8	56	close to highly contaminated site	9	63	downstream of a highly contaminated site
7	5	Utilities	3	15	potential underground service utilities, power overhead	5	25	vacant parcel likely no utilites on site. Drainage connection likley to impact underground utilities on Roan lane. May need a drainage easement agreement for Roan Lane.	4	20	underground utilities located on northside of Northlake including Seacoast easement on frontage of parcels.
8	1	Threatened and Endangered Species and Associated Costs	1	1	no mitigation needed	1	1	no mitigation needed	1	1	no mitigation needed
9		Noise		0			0			0	
10		Wetlands and Protected Uplands and Associated Costs		0	none anticipated.		0	none anticipated.		0	none anticipated.
11		Cultural Resources Involvement and Associated Costs		0	none anticipated.		0	none anticipated.		0	none anticipated.
12		Section 4(f)		0	none anticipated.		0	none anticipated.		0	none anticipated.
13		Public Wellfield		0	not applicable due to distance from the study area, not within the well field protection zone		0	not applicable due to distance from the study area, not within the well field protection zone		0	not applicable due to distance from the study area, not within the well field protection zone
14	6	Construction	6	36	access via Rochester St. and Birmingham Dr. is through residential neighborhood.	4	24	roadway restoration costs and piping to pond is required.	2	12	access is easy due to being on frontage. No additional cost due to site location.
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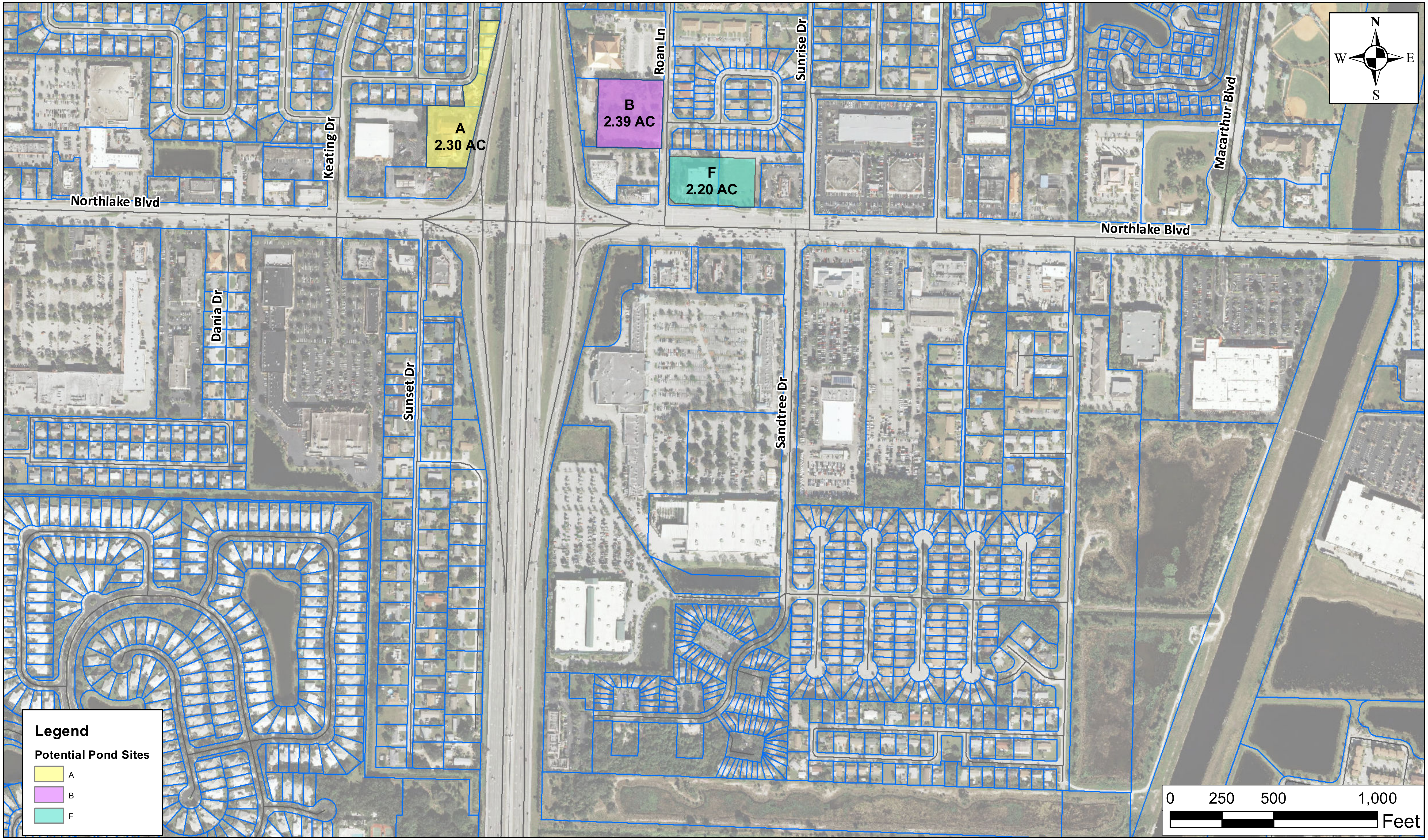
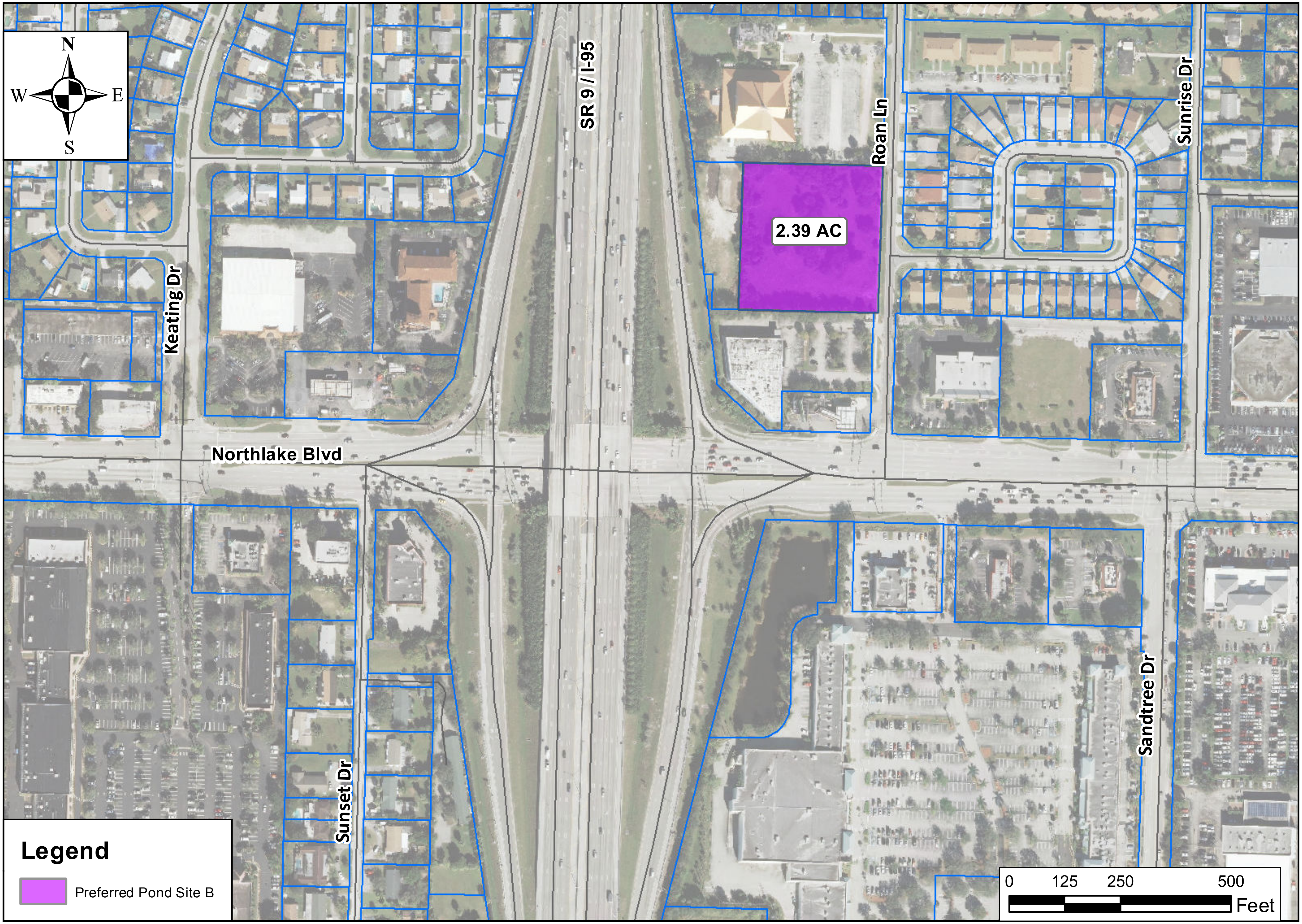


SR 9 / I-95 at Northlake Boulevard Interchange
Project Development and Environment (PD&E) Study

Potential Pond Site Map (Meeting #3)

FM Number: 435803-1-22-02
ETDM: 14182



SR 9 / I-95 at Northlake Boulevard Interchange
Project Development and Environment (PD&E) Study

Preferred Pond Site Map

FM Number: 435803-1-22-02
ETDM: 14182