

Facilitating Cohesion in Stormwater Maintenance

*A Single Asset, an Entire State, and
Everything in Between*

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ATM
A Geosyntec Company



Fred Noble, PE, State NPDES Administrator



RES, formerly E Sciences

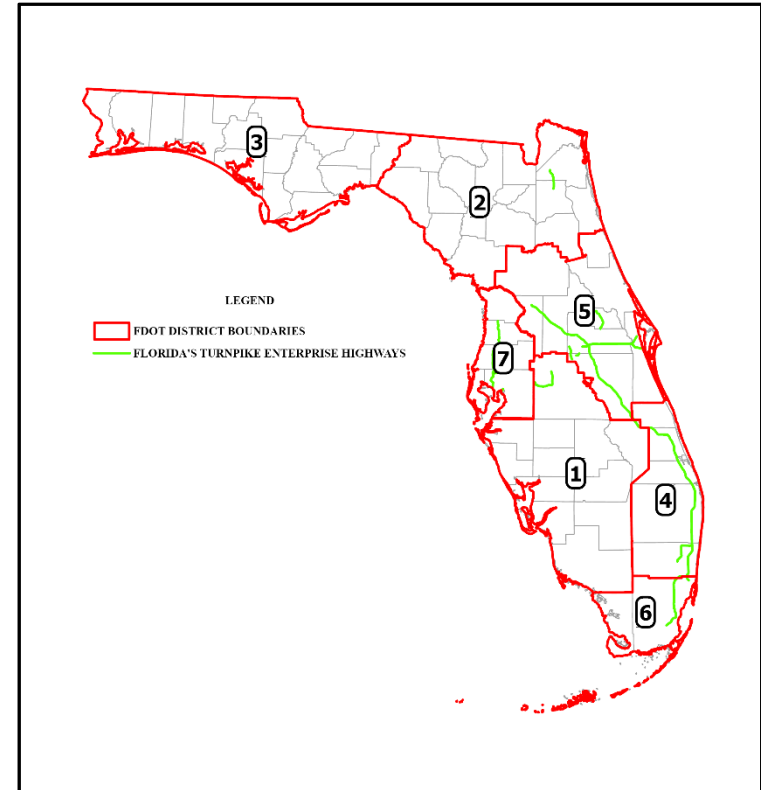


- Introduction to FDOT's MS4 Program
- SSWMP
 - Statewide Stormwater Management Plan
- SAMS
 - Stormwater Asset Management System
- SWAM
 - Maintenance Guide for Stormwater Assets
- Summary

National Pollutant Discharge Elimination System (NPDES)

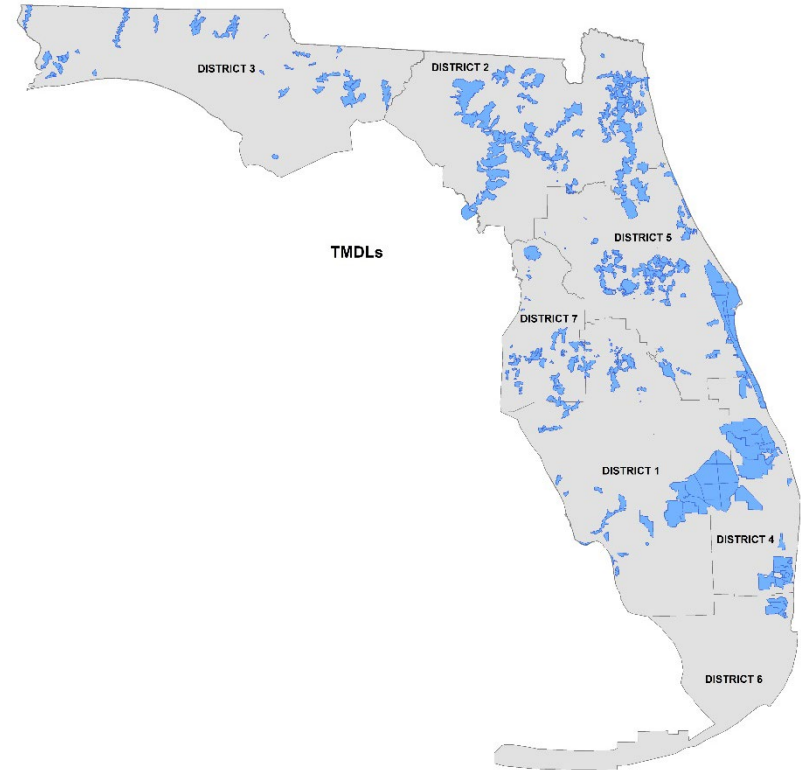
- ***MS4 Permits***
- ***Construction Generic Permits (CGP)***
- Multi-Sector Generic Permits (MSGP)
- Industrial Wastewater

- De-centralized
 - Seven Districts and the Florida Turnpike Enterprise (TPE)
 - Central Office provides guidance and support to Districts and TPE
- About 90 percent of maintenance effort outsourced



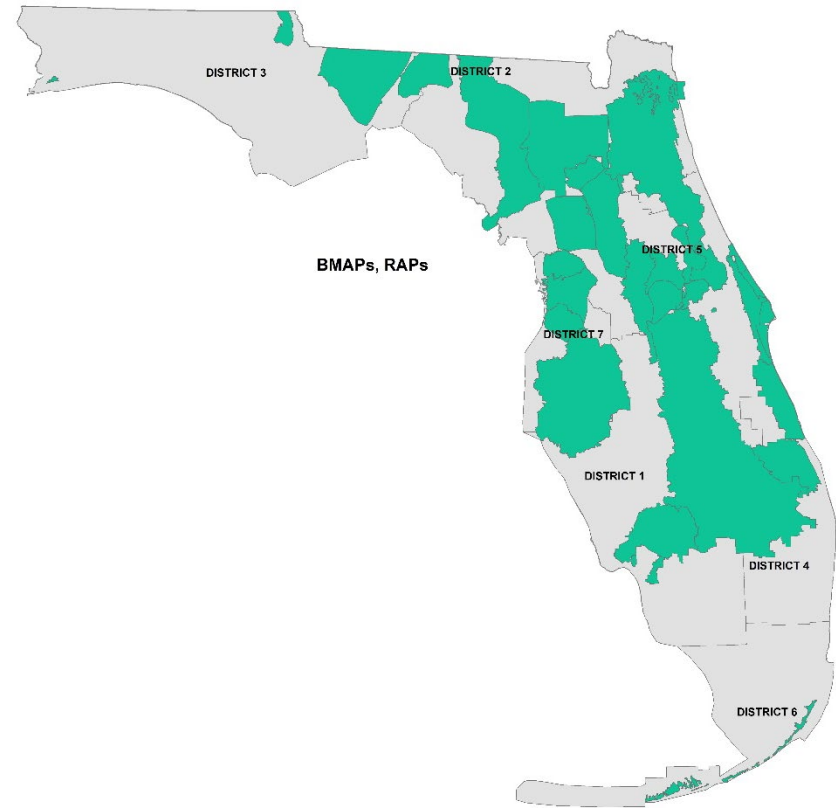
FDOT Statewide MS4 Program

- 15 Phase I MS4 permits in 15 counties (co-permittee with county as lead)
- 13 Phase II permits in 30 counties
- Facilities include 12,670 total miles of roadway, including 9,840 miles of “regulated” roadway
- Stakeholder in over 400 TMDLs/580 impairments, 33 BMAPs, and 4 reasonable assurance plans



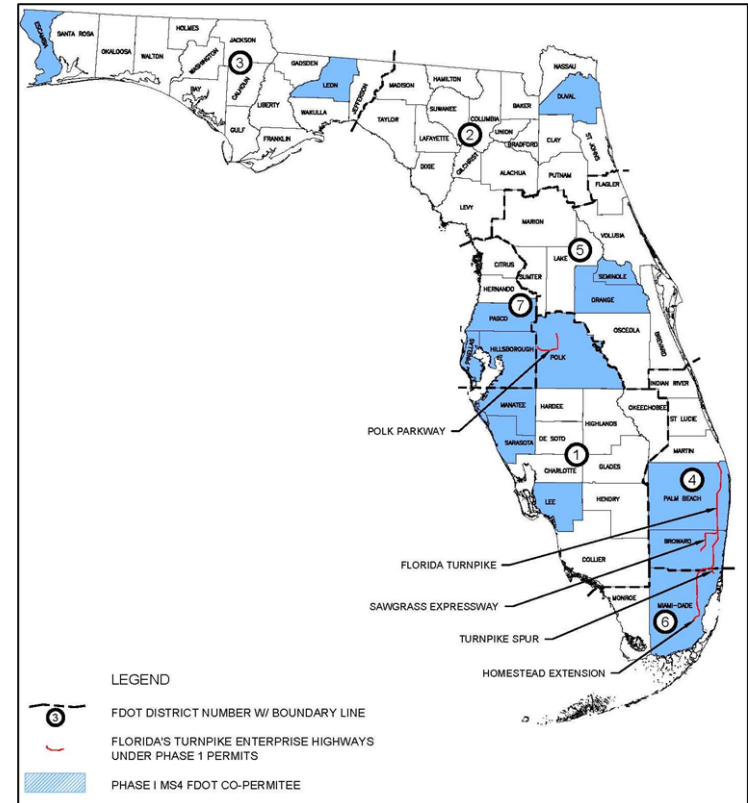
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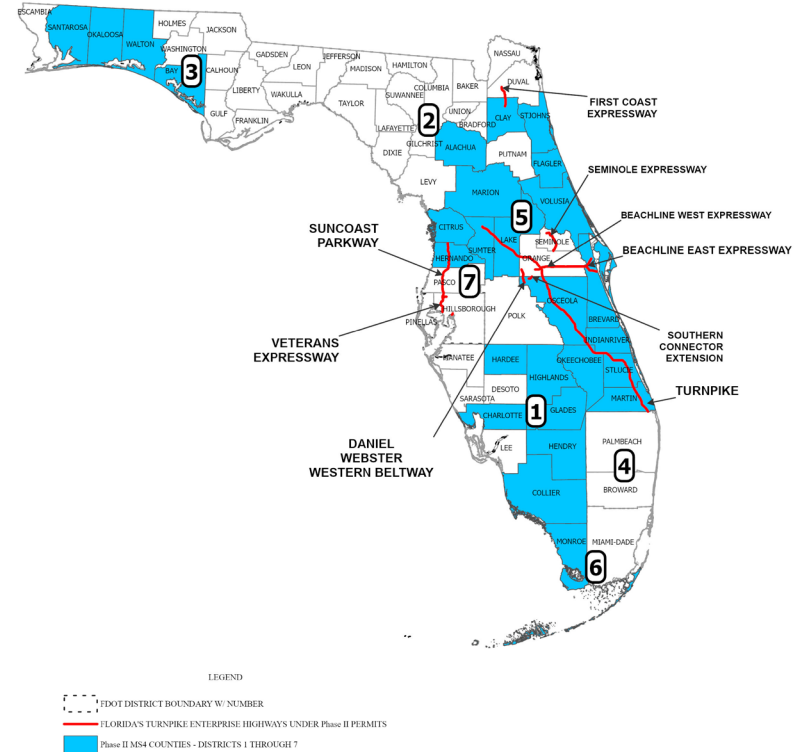
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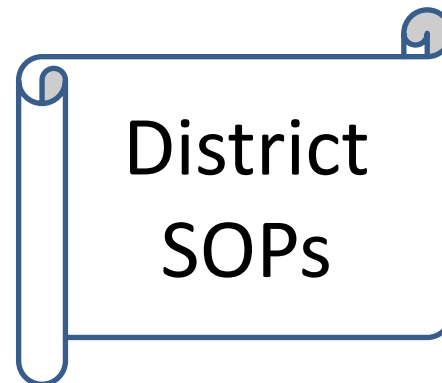
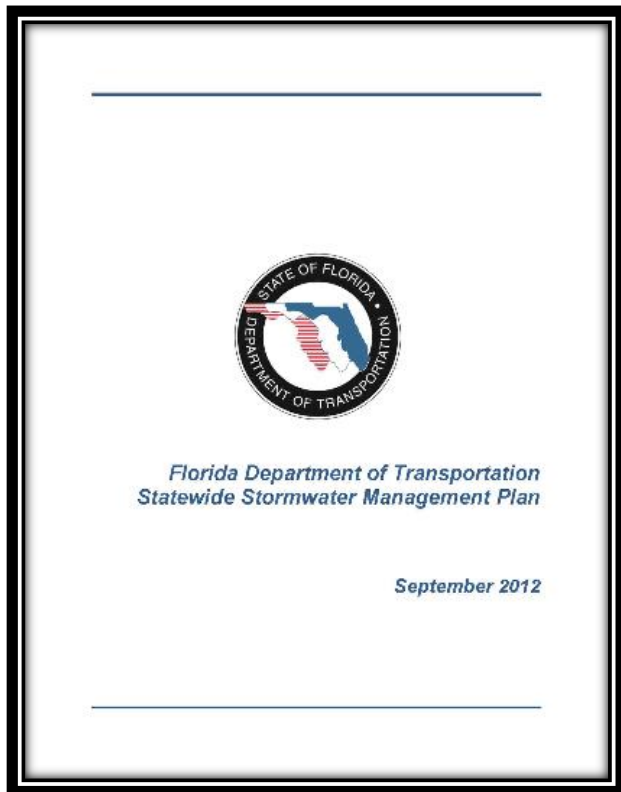


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Statewide Stormwater Management Plan

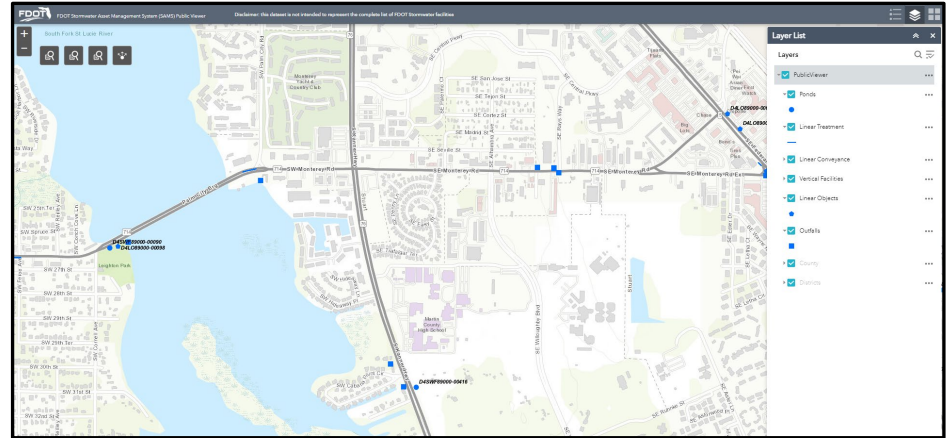


Statewide Stormwater Management Plan

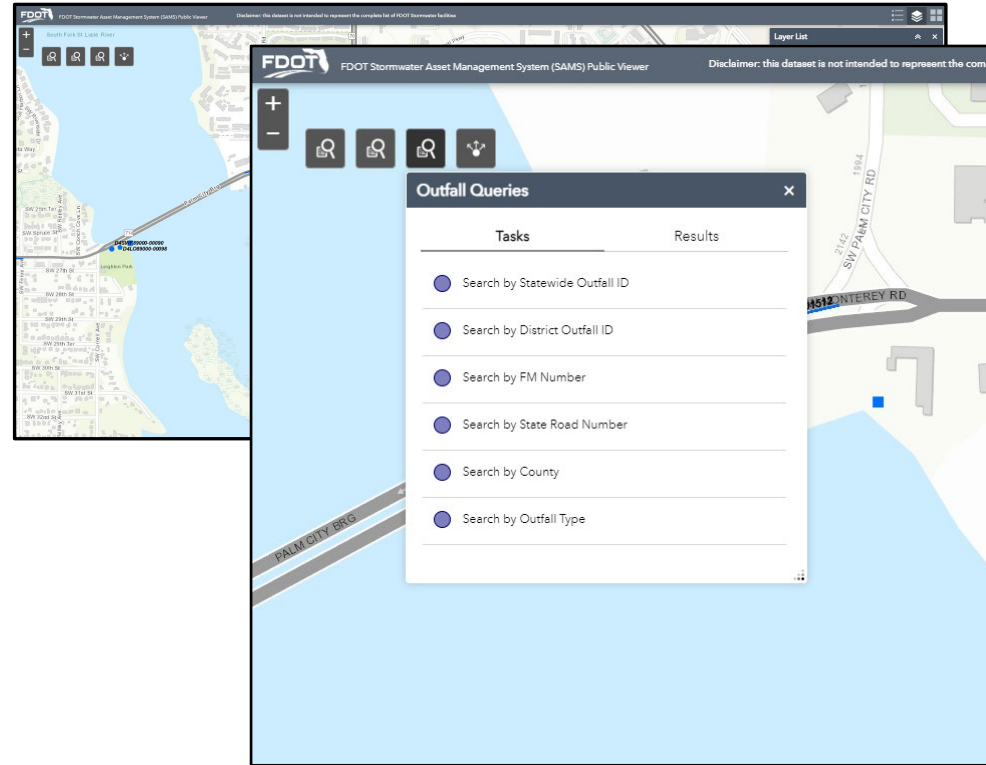
- Describes activities, methods, and procedures to reduce the discharge of pollutants from FDOT MS4s
- 2012 SSWMP developed to ensure compliance with requirements of Phase I MS4 permits, but SSWMP practices are implemented statewide
- District SOPs supplement SSWMP with specifics for program implementation
- Currently being updated to include requirements of Phase II permits and Cycle 5 Phase I permits



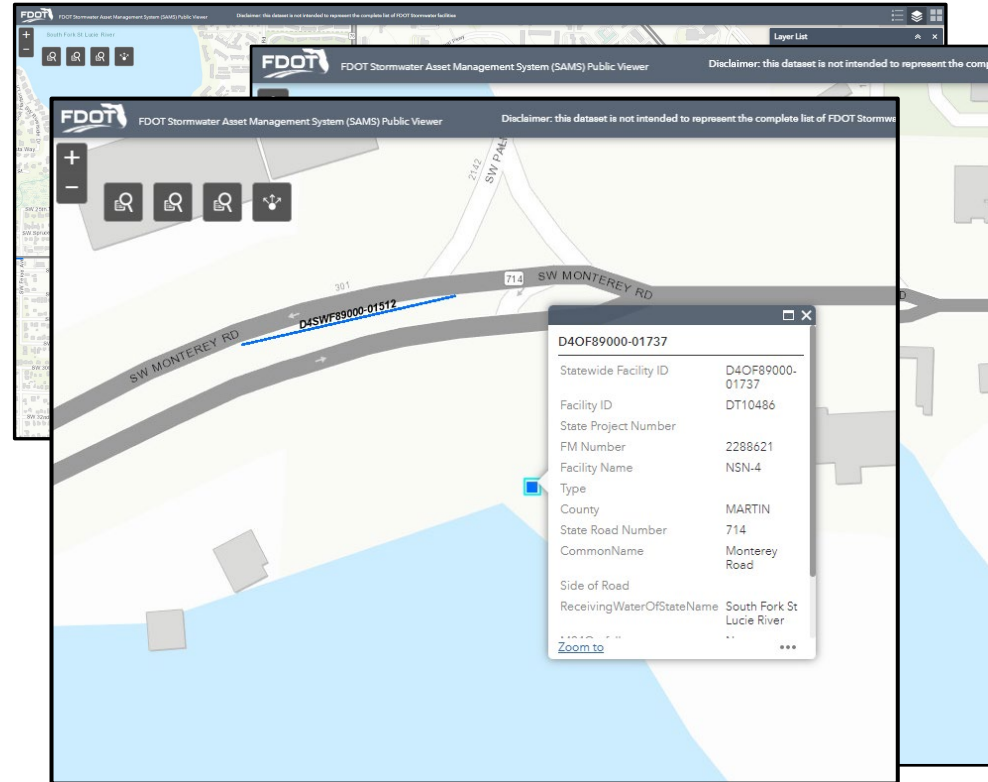
- Developed under FDOT E-Maintenance Initiative
 - ESRI ArcGIS Online Tools
- Applications and Components
 - Editor (Desktop)
 - Inspection (Phone/Tablet)
 - QA/QC (Desktop)
 - Viewer and Reporting (Desktop)
 - Public Viewer and Training Videos (E-maintenance website)



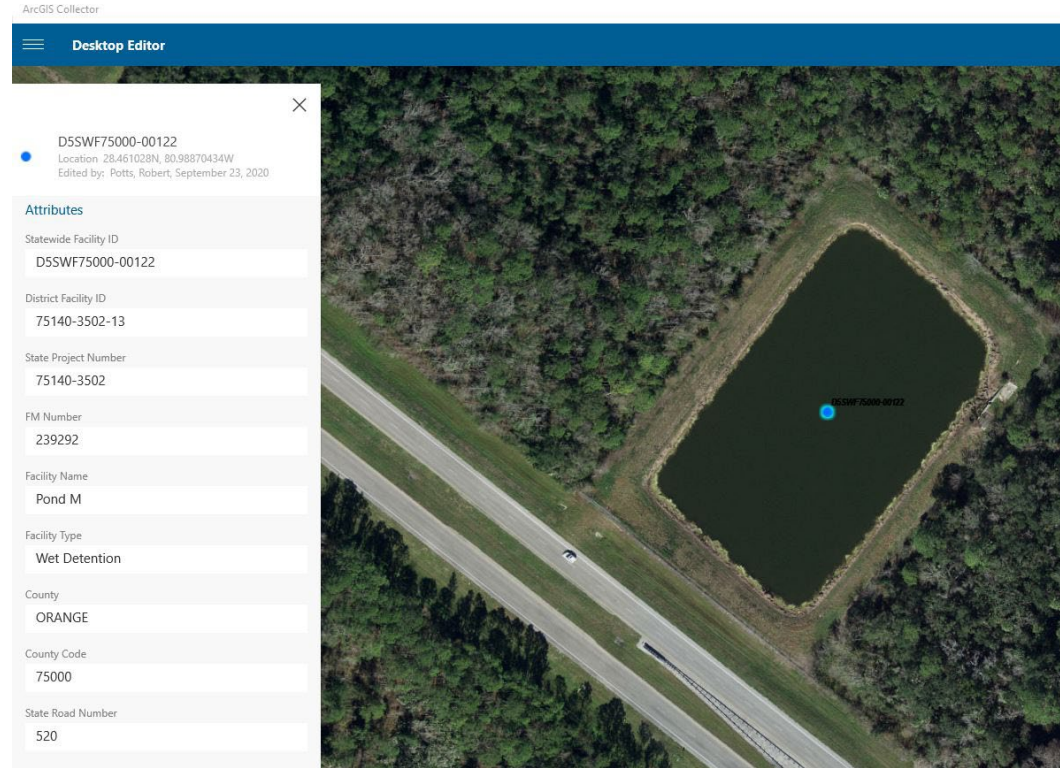
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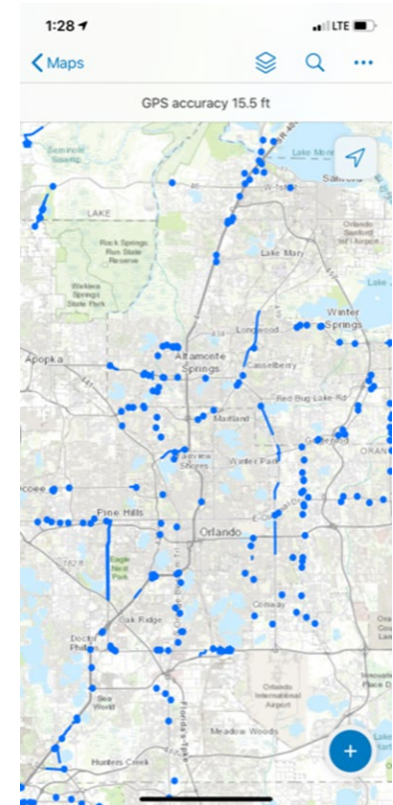
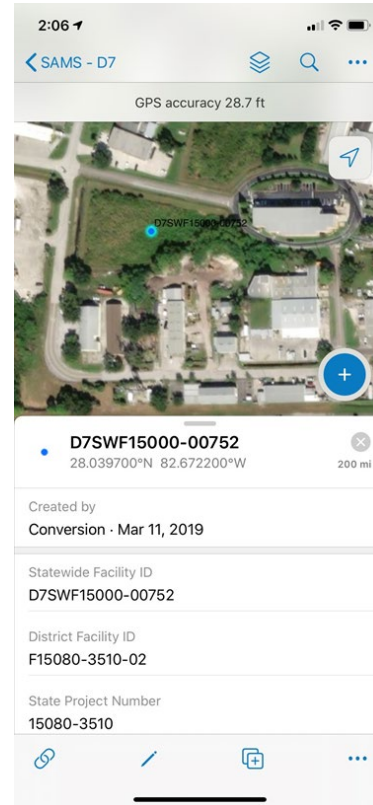
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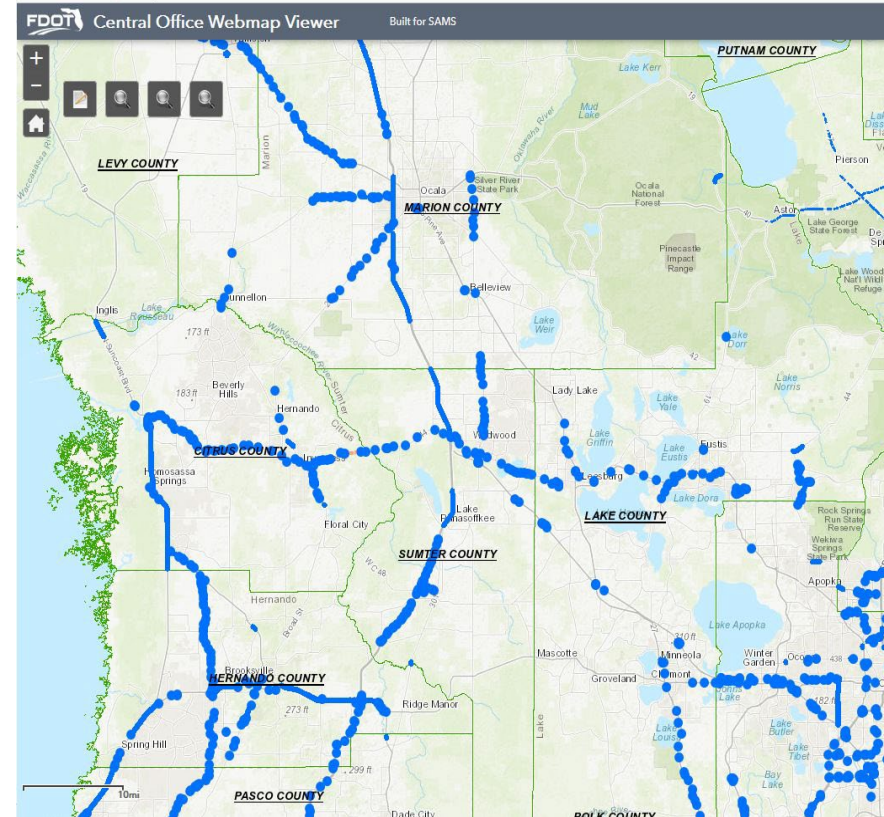
- Editor Tool (Desktop)
 - Add new facility
 - Edit facility attribute data
 - Link as-built design plans
 - Limited personnel authorized for this application



- Inspection Tool (Tablet/Smartphone)
 - Perform compliance inspections
 - Generate maintenance needs reports
 - Tablet/phone data entry onsite
 - Real-time data uploads from field to database



- Viewer and Reporting Tool (Desktop)
 - Visualize stormwater data
 - Central portal for reporting
 - Users cannot create or edit data
 - Unlimited access
 - Available to asset maintenance contractors as directed by Districts
 - Develops pre-populated reports
 - Data dashboard
 - Summary reports



Project Benefits

- 30% reduction in inspection costs
- Standardized facility inspection and MS4 annual reporting
- Easy access to data and reports to support Districts during FDEP audits
- Significantly increased access to stormwater data for FDOT staff
- Direct access to information on maintenance needs for AM contractors

STORMWATER FACILITY INSPECTION REPORT

FDOT District Three



Inspection Date:	9/23/2021	Statewide Facility ID:	D3SWF55000-00001
Primary Inspector Name:	Craig Eudell	District Facility ID:	2225901-15
Secondary Inspector Name:		FM Number:	222590
Date Last Precipitation:	9/22/2021	County:	LEON
Quantity Last Precipitation:	0.40000000	State Road Number:	6
Permit Agency:	NWFWMD	Facility Type:	Dry Retention
ERP Permit Number:		Facility Name:	SMF F-7
FDEP MS4 Permit Number:	FLS000033	Maintenance Yard:	
State Project Number:	55320	Side of Road:	Left

INSPECTION FINDINGS

Parameter:	Result:	Comments:
Aesthetics Condition	Fair	Please include Pond SMF F-7 in the next mowing cycle.
Hydraulic Recovery Condition	Good	The hydrologic fluctuations appear normal.
Vegetation Condition	Good	The vegetative cover is in good condition and well maintained.
Structural Condition	Good	Structures are in good condition.
Erosion Condition	Good	No erosion present at the time of inspection.
Water Condition	Not Applicable	No water present at the time of inspection.
Suspected IDDE	No	N/A
Public Safety Hazard	No	N/A

INSPECTION SUMMARY

Parameter:	Result:
Overall Facility Rating	Good
Maintenance Required	No
Inspection Result	Performing as designed and permitted
Inspection Notes / Comments:	
No maintenance items identified during this inspection.	

4:21 PM Tue Feb 22

SAMS D3 Editors

D3 Desktop Editor

GPS accuracy 131.2 ft - required 30 ft

OF_55000_070
30.454975°N 84.342410°W 90 mi

pondinspectionguidance.pdf

Inspection Review Needed
Yes

Maintenance Review Needed
No

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DBSP3

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RELATED

Outfall Inspections

Edit

Copy

Collect Here

Directions

Add to My Places

Collector 4:19 PM Tue Feb 22

Your location

30.43080828500821, -84.9948109183384

2 hr 49

2 d

12 hr

2 hr 49 min

2 hr 47 min

2 hr 47 min

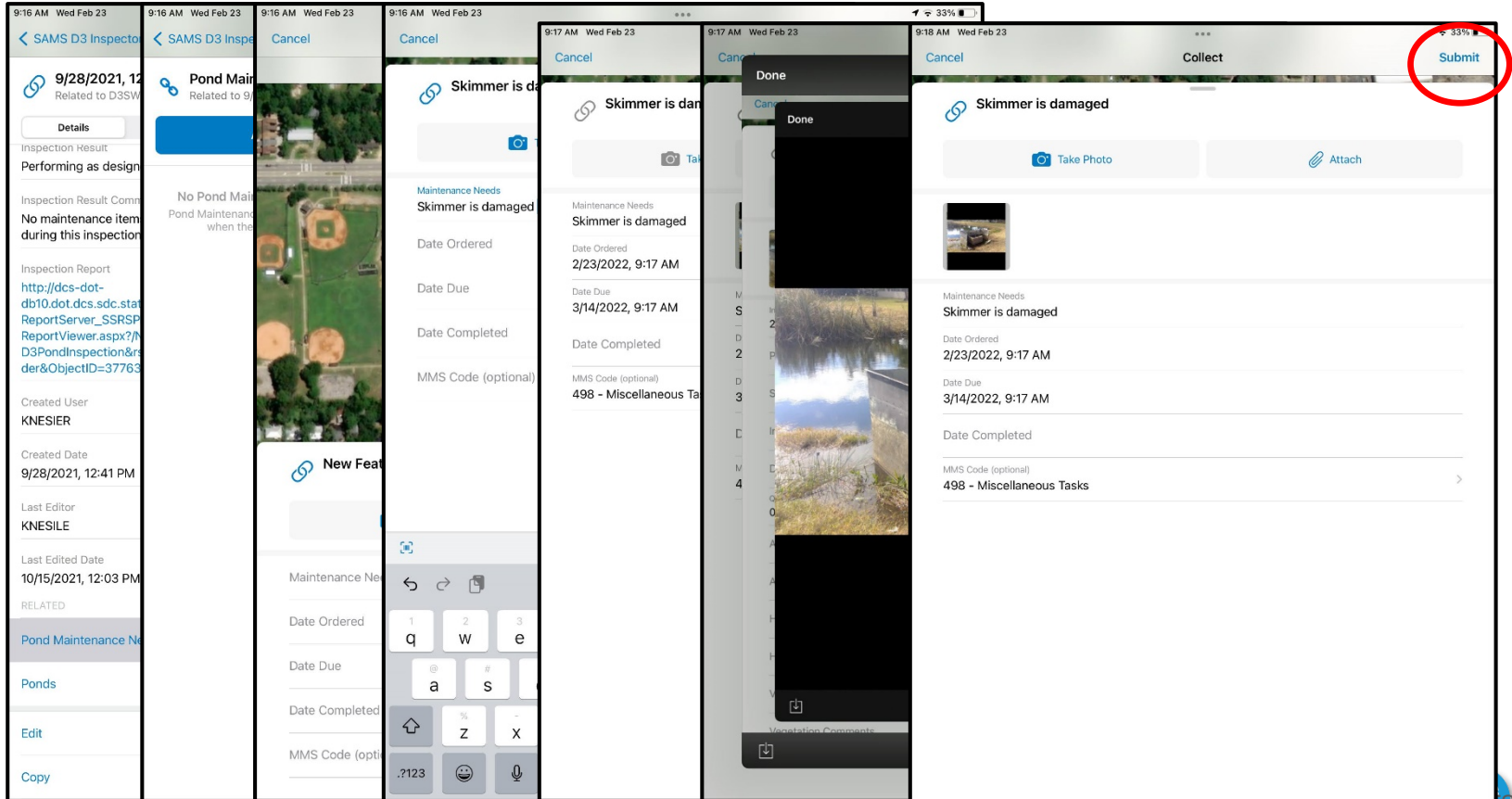
2 hr 49 min (140 mi)

Most fuel-efficient

Best route now due to traffic conditions

Steps Start Pin







District 5 Inspections Due in next 12 months

196 Facility Inspections are due by 4/28/2020

County	Facility ID	FM Number	State Road	Facility Type	Last Inspection Date	Last Inspection Result	Next Inspection Due
BREVARD	D5SWF70000-00811	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020
	D5SWF70000-00795	237421	507	Wet Detention	1/17/2018	Performing as designed and permitted	1/17/2020
	D5SWF70000-00814	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020
	D5SWF70000-00801	242266	9	Wet Detention	3/14/2018	Performing as designed and permitted	3/14/2020
	D5SWF70000-00802	242266	9	Wet Detention	3/14/2018	Performing as designed and permitted	3/14/2020
	D5SWF70000-00809	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020
	D5SWF70000-00815	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020
	D5SWF70000-00235	404601	528	Dry Retention	3/5/2018	Performing as designed and permitted	3/5/2020
	D5SWF70000-00232	237421	507	Dry Retention	1/17/2018	Performing as designed and permitted	1/17/2020
	D5SWF70000-00841	237466	520	Wet Detention	4/18/2018	Performing as designed and permitted	4/18/2020
	D5SWF70000-00842	237466	520	Wet Detention	4/18/2018	Performing as designed and permitted	4/18/2020
	D5SWF70000-00816	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020
	D5SWF70000-00236	404601	528	Dry Retention	3/5/2018	Performing as designed and permitted	3/5/2020
	D5SWF70000-00803	242266	9	Wet Detention	3/14/2018	Performing as designed and permitted	3/14/2020
	D5SWF70000-00810	413072	9	Wet Detention	3/20/2018	Performing as designed and permitted	3/20/2020

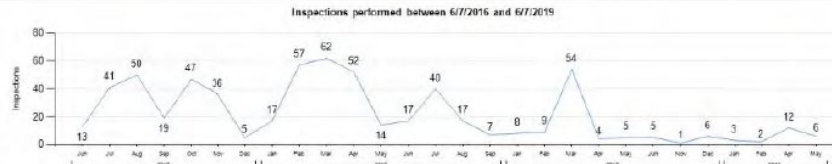
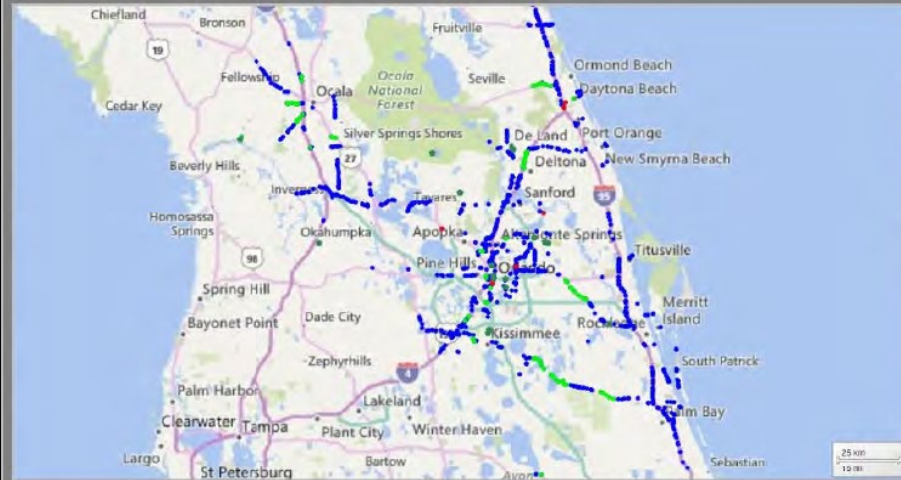


District 5 Inspections Due in next 12 months

196 Facility Inspections a

County	Facility ID	FM Number	State Road	Facility Type	Last Insp Date
BREVARD	D5SWF70000-00811	413072	9	Wet Detention	3/2
	D5SWF70000-00795	237421	507	Wet Detention	1/7
	D5SWF70000-00814	413072	9	Wet Detention	3/2
	D5SWF70000-00801	242266	9	Wet Detention	3/2
	D5SWF70000-00802	242266	9	Wet Detention	3/2
	D5SWF70000-00809	413072	9	Wet Detention	3/2
	D5SWF70000-00815	413072	9	Wet Detention	3/2
	D5SWF70000-00235	404601	528	Dry Retention	3/7
	D5SWF70000-00232	237421	507	Dry Retention	1/7
	D5SWF70000-00841	237466	520	Wet Detention	4/7
	D5SWF70000-00842	237466	520	Wet Detention	4/7
	D5SWF70000-00816	413072	9	Wet Detention	3/2
	D5SWF70000-00236	404601	528	Dry Retention	3/7
	D5SWF70000-00803	242266	9	Wet Detention	3/2
	D5SWF70000-00810	413072	9	Wet Detention	3/2

District 5 SAMS Data Dashboard



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last inspection result not performing as designed

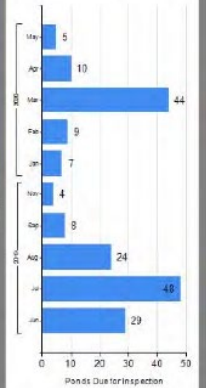
188

inspections due between 07/2016 and 06/2020

7

ponds with data that needs review

Inspection due by 6/5/2020



Background

- While developing SAMS guidelines for inspecting stormwater infrastructure (ponds, swales, etc.), realized that there is no comprehensive set of standards for maintenance
- FDOT's Maintenance Rating Program (MRP) covers some aspects of maintenance, but does not have everything required
- Formed working group in March 2018 to establish minimum statewide standards for routine maintenance of FDOT's stormwater treatment and conveyance systems

Concepts and Objectives

- Statewide consistent maintenance guidelines
 - Consistent with FDOT Maintenance Rating Program (MRP)
 - Expand on MRP with new categories of rating
- Mesh with and complement SAMS
 - Ponds
 - Linear Treatment and Conveyance Systems
 - Outfalls
 - Inlets, Pipes, Catch Basins, and Grates (future)
- Manage, maintain, and update as an E-Document

Content

- Organized by asset type
- Facility descriptions and “typical” facility schematics
- Asset rating tables by asset type
- Rating summary sheets – examples of Good, Fair, and Poor conditions
- Example SAMS inspection and maintenance needs reports
- “Expandable” appendix with additional rating examples

Maintenance Guide for Stormwater Assets



Office of Maintenance

September 2022

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Facility Descriptions and Typical Schematics

4.1.2 Retention Ponds

Dry retention systems are storage areas designed to temporarily store a defined quantity of stormwater runoff, gradually recovering its storage capacity by infiltrating stormwater through the pond bottom to the surficial groundwater aquifer and evaporating water to the atmosphere (Figure 4-19). After drawdown of the stored runoff is completed, the basin does not hold any water, thus the system is dry under normal conditions.

An online dry retention system will typically have the following components:

1. An emergency overflow structure that does not include a drawdown device (i.e., orifice or weir notch) since the treatment volume should be recovered through percolation through the pond bottom (Figure 4-20 and Figure 4-21).
2. The emergency overflow structure may have a broad, usually rectangular, weir opening that is above the pond bottom elevation. This weir opening is generally referred to as the overflow weir and allows for discharge of stormwater runoff during major rainfall events. The emergency overflow structure or emergency spillway usually includes an oil and trash skimmer that helps prevent the discharge of accumulated floatables and oils.
3. A grate located at the top of the emergency overflow structure serves as the emergency outfall for a dry retention system. If an emergency overflow structure is not provided, an emergency spillway will be installed in the pond bank to provide flood protection.

The treatment volume is the quantity of stormwater runoff that is permitted to percolate through the pond bottom and into the shallow groundwater aquifer. Dry retention systems are required to drawdown the entire treatment volume within the regulatory timeframe, typically 72 hours. However, some designs may have longer recovery periods in accordance with regulatory criteria. An aerial view of a dry retention system is shown in Figure 4-22, and photos of typical dry retention systems in good condition are shown in Figure 4-23.

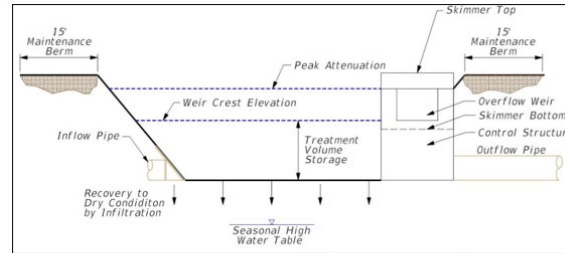


Figure 4-19. Typical Dry Retention System Schematic (Not to scale) [Return to List of Figures](#)

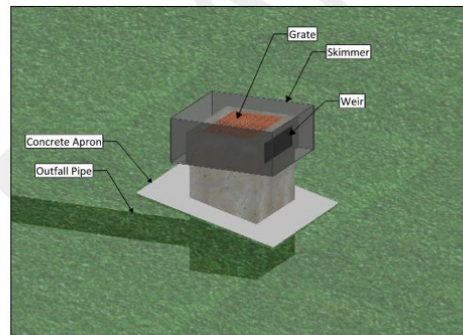


Figure 4-20. Typical Dry Retention Pond Control Structure – Isometric View (Not to scale) [Return to List of Figures](#)

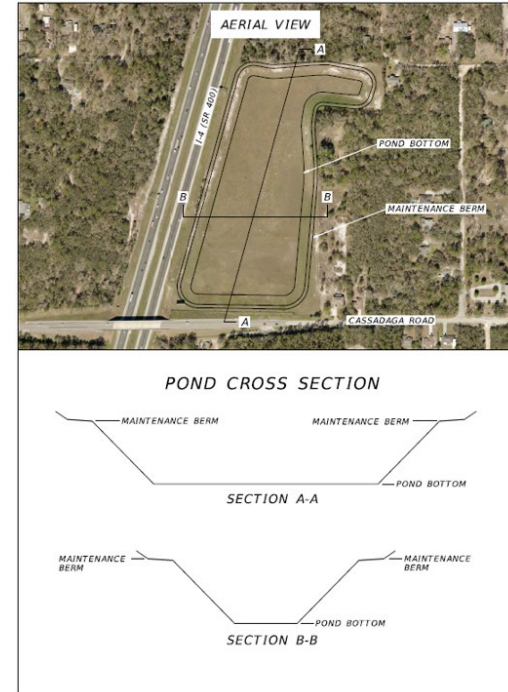
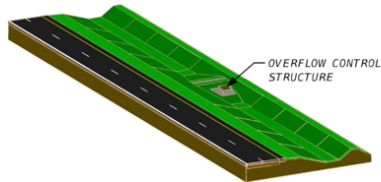


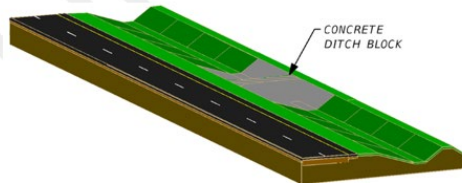
Figure 4-22. Typical Dry Retention Pond [Return to List of Figures](#)

Facility Descriptions and Typical Schematics

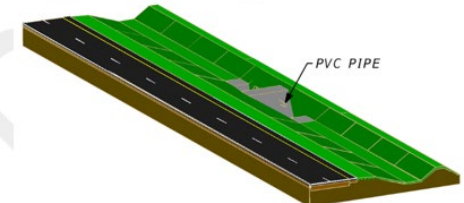
A **Treatment Swale with Control Structure, with or without Filtration** is a dry retention system with an emergency overflow control structure. The elevation of the outfall control structure determines the depth of retention and treatment volume of the swale. The dry retention area is often underlain with perforated drainage pipe that collects and conveys percolated stormwater to the control structure. Underdrain systems are intended to control the groundwater table elevation over the entire area of the treatment basin and provide for the drawdown of the treatment volume. Cleanout ports are provided for maintenance of the filtration system.



In a **Concrete Ditch Block** system, the ditch block structures are overlain by a layer of concrete. These are retention systems that are designed to hold water during typical storm conditions. During more severe storms, water may discharge over the top of the concrete berm.



A **Concrete Ditch Block with Orifice and Sump** includes a concrete berm with a pipe through the berm to slowly draw down the stormwater. Depressed areas, or sumps, at the base of the berm trap sediment to help prevent clogging of the orifice pipe. These are detention systems because they are designed to recover through slow discharge offsite and not complete onsite retention.



SWAM Erosion Condition Rating Table – Dry Detention

Dry Detention Pond without Filtration Rating Table			
Asset Component	Inspection Rating	Description of Condition	Maintenance Needs
Erosion Condition			
	Good A-25 A-26 A-27	<ul style="list-style-type: none"> ✓ Some surficial erosion with minor rills present ✓ Vegetation on slope generally intact with minimal bare areas, low erosion potential, stable slope ✓ Minimal to no undermining is apparent 	<ul style="list-style-type: none"> ✓ None
	Fair A-18 A-28	<ul style="list-style-type: none"> ✓ Minor erosion on pond slopes or berms ✓ Minor undermining around headwall, mitered end sections, or control structures, but not sufficient to cause structural failure 	<ul style="list-style-type: none"> ✓ Proactive maintenance recommended <ul style="list-style-type: none"> ○ Repair erosion ○ Repair undermining
	Poor A-29 A-35 A-36	<ul style="list-style-type: none"> ✓ Substantial erosion compromising slope and/or berm stability ✓ Large rills and gullies present along slope ✓ Large areas of vegetation on slope have become dislodged and slope is unstable ✓ Undermining of structures is evident 	<ul style="list-style-type: none"> ✓ Stabilize slopes and berm ✓ Re-establish vegetation ✓ Other maintenance as needed to correct deficiencies

SWAM – Condition Rating, Dry Pond

Good Erosion Condition

Dry Pond

A-27



Rating Summary

- Control Structures – Good
 - No visible damage
 - Free of vegetation growth
- Aesthetic Condition – Good
 - No debris or trash present
 - Side slopes are well maintained
- Erosion Condition – Good
 - No slope erosion or fills observed
- Hydraulic Recovery – Good
 - System dry, indicating the system is recovering its treatment volume
- Sedimentation – Good
 - No evidence of sedimentation problems observed
- Vegetation Condition – Good
 - Vegetation cover intact, with no bare areas
 - Pond is mowed regularly

Maintenance Needs

- None

Return to Rating Table: [Wet Detention](#) [Dry Retention](#) [Dry Detention w/o Filtration](#) [Dry Detention with Filtration](#)

Fair Erosion Condition

Dry Pond

A-18



Rating Summary

- Aesthetic Condition – Fair
 - Bare areas on side slopes and within pond
 - No debris or trash present
- Erosion Condition – Fair
 - Areas of bare soil observed within the pond and along the side slopes
- Hydraulic Recovery – Good
 - System dry, indicating the system is properly recovering
- Sedimentation – Good
 - No evidence of sedimentation problems observed.
- Vegetation Condition – Fair
 - Excessive vegetation growth observed within the pond bottom and along the side slopes

Maintenance Needs

- Re-establish turf/grass
- Mow pond area

Return to Rating Table: [Wet Detention](#) [Dry Retention](#) [Dry Detention w/o Filtration](#) [Dry Detention with Filtration](#)

Poor Erosion Condition

Dry Pond

A-35



Rating Summary

- Aesthetic Condition – Poor
 - Side slopes not well maintained
- Erosion Condition – Poor
 - Substantial erosion present
 - Large gullies present along slope
 - Slope stability compromised
- Hydraulic Recovery – Good
 - System dry, indicating the system is recovering its treatment volume
- Sedimentation – Fair
 - Sedimentation to pond bottom from slope erosion
- Vegetation Condition – Poor
 - Vegetative cover poor, with bare areas present

Maintenance Needs

- Regrade and fill areas where slope erosion is present
- Re-establish turf/grass
- Remove accumulated sediment build up from pond bottom

Return to Rating Table: [Wet Detention](#) [Dry Retention](#) [Dry Detention w/o Filtration](#) [Dry Detention with Filtration](#)

SWAM Hydraulic Recovery Condition Rating Table – Exfiltration Systems

Hydraulic Recovery Condition			
Overall Recovery	<p>Good</p> <p>C-1 C-2</p>	<ul style="list-style-type: none"> ✓ System appears to recover its treatment volume within the regulatory timeframe ✓ No sediment, trash, debris accumulation preventing flow ✓ No blockage of exfiltration pipe 	<ul style="list-style-type: none"> ✓ None
	<p>Fair</p> <p>C-4</p>	<ul style="list-style-type: none"> ✓ System appears to be recovering more slowly than required ✓ Sediment, trash, and debris accumulation causing system to recover more slowly than required ✓ Partial blockage of skimmer or baffle device (if applicable) is slowing recovery ✓ Water at or above invert elevation of exfiltration pipe 	<ul style="list-style-type: none"> ✓ Proactive maintenance recommended <ul style="list-style-type: none"> ○ Remove sediment, trash, debris accumulation ○ Remove any observed blockage from skimmer or baffle device (if applicable)
	<p>Poor</p> <p>C-3</p>	<ul style="list-style-type: none"> ✓ System appears to not recover within the regulatory timeframe ✓ Sediment accumulation above pipe invert elevation ✓ Trash and debris accumulation above pipe invert elevation ✓ Water at or above invert elevation of exfiltration pipe 	<ul style="list-style-type: none"> ✓ Remove sediment, trash, and debris accumulation ✓ Backflush exfiltration pipe to remove sediment and debris accumulation

Good Recovery

Horizontal French Drain System

C-1



Rating Summary

- Sump – Good
 - Free of trash and debris
 - No cracks or damage
 - No sign of groundwater intrusion
- Pipes – Good
 - No cracks or obstructions
- Hydraulic Recovery – Good
 - Sump is dry, indicating proper drainage and recovery
- Sedimentation – Good
 - No sediment observed

Maintenance Needs

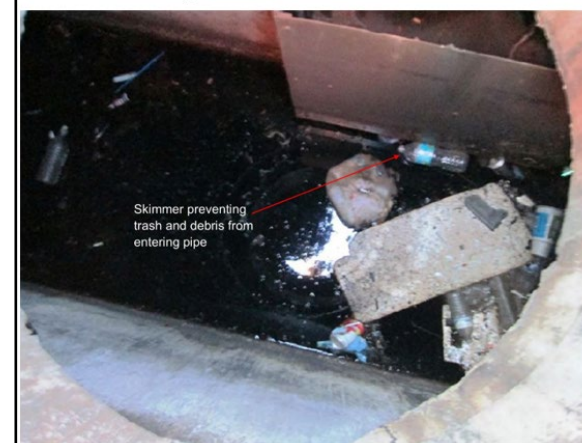
- None

[Return to Rating Table](#)

Fair Recovery

Horizontal French Drain System

C-4



Rating Summary

- Sump – Fair
 - Some trash and debris are present
 - No visible cracks or indication of groundwater intrusion
- Skimmer – Good
 - No damage to skimmer
 - Skimmer is effectively preventing trash from entering pipe
- Hydraulic Recovery – Fair
 - Partial blockage of skimmer is slowing system recovery

Maintenance Needs

- Remove trash and debris

[Return to Rating Table](#)

Poor Recovery

Horizontal French Drain System

C-3



Rating Summary

- Sump – Poor
 - Trash and debris are covering outflow pipe
- Pipes – Poor
 - Outflow pipe is 100 percent obstructed
- Hydraulic Recovery – Poor
 - Obstruction of outflow pipe is affecting system recovery

Maintenance Needs

- Remove trash and debris

[Return to Rating Table](#)

SWAM Appendix – Example SAMS Inspection and Maintenance Needs Reports

STORMWATER FACILITY INSPECTION REPORT

FDOT District Five



Inspection Date:	5/10/2022	Statewide Facility ID:	D5SWF77000-00469
Primary Inspector Name:	Craig Eudek	District Facility ID:	77040-3521-01
Secondary Inspector Name:		FM Number:	240163
Date Last Precipitation:	5/8/2022	County:	SEMINOLE
Quantity Last Precipitation:	0.22000000	State Road Number:	46
Permit Agency:	SJRWMD	Facility Type:	Wet Detention
ERP Permit Number:	40-117-95925-5	Facility Name:	Pond 1
FDEP MS4 Permit Number:	FLS000038	Maintenance Yard:	Overside Maintenance
State Project Number:	77040-3521	Side of Road:	Left

INSPECTION FINDINGS

Parameter:	Result:	Comments:
Aesthetics Condition	Good	The side slopes appear to be well maintained and mowed regularly.
Hydraulic Recovery Condition	Good	The hydrologic fluctuations appear normal.
Vegetation Condition	Good	The vegetative cover is in good condition and well maintained.
Structural Condition	Fair	Repair damaged skimmer on the control structure for Pond 1.
Erosion Condition	Good	No erosion present at the time of inspection.
Water Condition	Good	The water present was clear and odor free at the time of inspection.
Suspected HIDE	No	N/A
Public Safety Hazard	No	N/A

INSPECTION SUMMARY

Parameter:	Result:
Overall Facility Rating	Fair
Maintenance Required	Yes
Inspection Result	Not performing as designed and permitted
Inspection Notes / Comments:	
Maintenance items were identified during this inspection.	

STORMWATER FACILITY INSPECTION REPORT

PHOTO LOG



Inspection Date:	5/10/2022	State Road Number:	46
Statewide Facility ID:	D5SWF77000-00469	County:	SEMINOLE
District Facility ID:	77040-3521-01	Facility Type:	Wet Detention
FM Number:	240163	Facility Name:	Pond 1

Photo Name : 2.JPG



STORMWATER FACILITY MAINTENANCE NEED

FDOT District Five



Inspection Date:	5/10/2022 10:58:40 AM	State Road Number:	46
Statewide Facility ID:	D5SWF77000-00469	County:	SEMINOLE
District Facility ID:	77040-3521-01	Facility Type:	Wet Detention
FM Number:	240163	Facility Name:	Pond 1

MAINTENANCE NEED

Maintenance Need:	MMS Code (Not Required)	Date Ordered	Date Due	Date Completed
Repair damaged skimmer on the control structure for Pond 1.		5/10/2022	7/11/2022	Not Completed

- Before SAMS and SWAM
 - No statewide consistency in facility inspection and maintenance
 - Districts used different data inventory, inspection, and database systems
- With SAMS and SWAM
 - Consistency between Districts in facility inspection and maintenance
 - Statewide database
 - Consistent guidelines for FDOT staff and asset maintenance contractors for maintenance expectations
 - Significant cost savings
 - Expectation of improved maintenance and efficiency

Questions?