Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Wekiva River, Rock Springs Run, and Little Wekiva Canal Basin Management Action Plan (BMAP)

Moira R. Homann

May 11, 2017



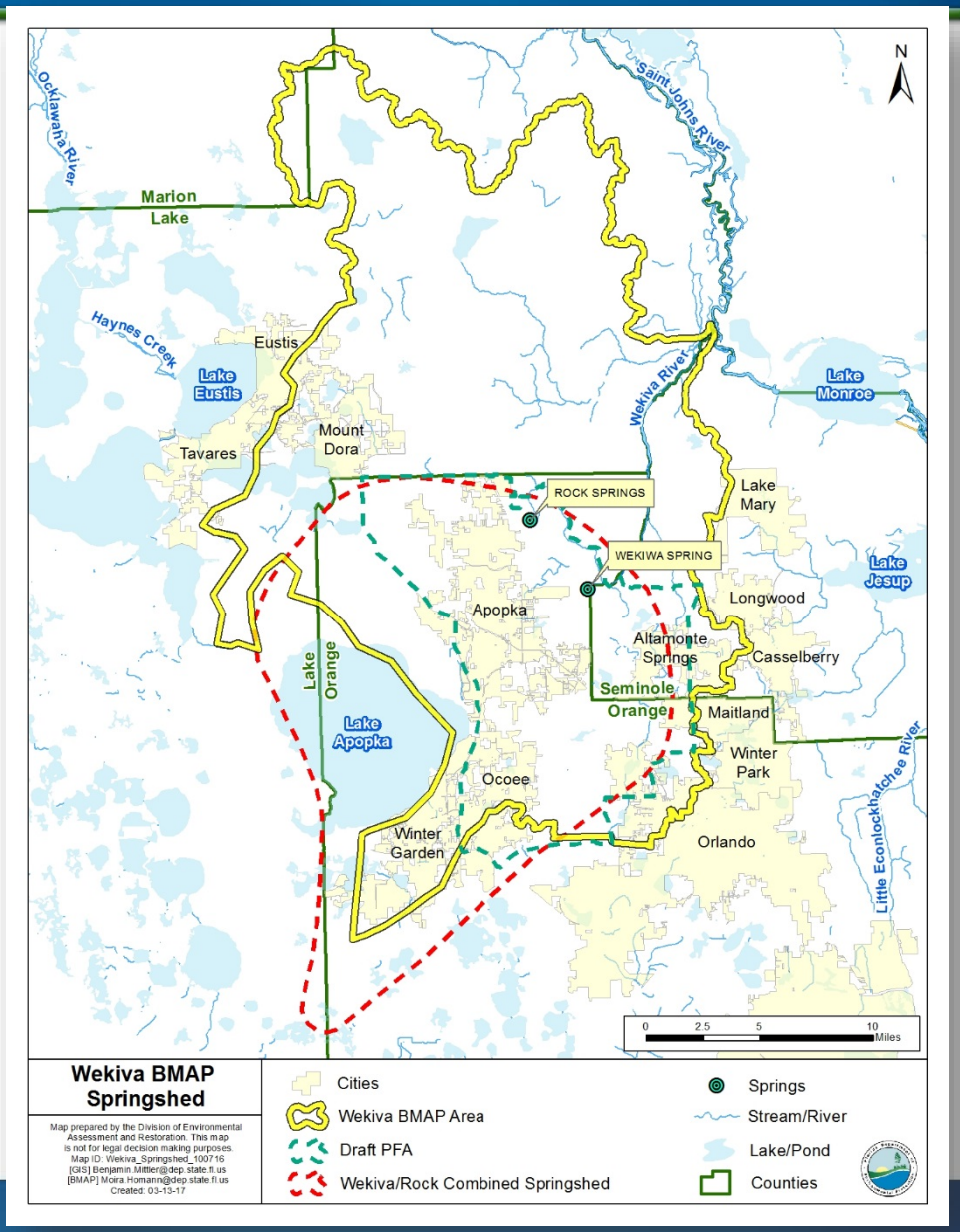


Agenda

1. Welcome and Opening Remarks.
2. Recap Items.
   a. Committee update.
   b. Other items.
3. New Items/Discussion.
   a. Update on Septic Tank Studies – *Rick Hicks*.
   b. Nitrogen Source Inventory Methodology and Status – *Celeste Lyon*.
4. Public Comments.
5. Adjourn.

Recap Items

1. Advisory Committee Update
   - Orange Co. Utilities resigned participation on the committee – will be represented by Orange County Environmental Protection Division and Health Department.
2. Priority Focus Area has been finalized (see map).
   - Final report is available here.
3. Teleconference to discuss a coordinated OSTDS education campaign – June 26, 27, or 28?
4. R. Mattson (SJRWMD) Water Quality in the Wekiva River System Current Status and Selected Trends 2012 presentation available here.
5. Annual report will be posted for comments and review.
   - Please send comments by May 31, 2017.
   - Provide any specific corrections using "track changes," if possible.
6. Florida Springs and Aquifer Protection Act reminders (following slides).

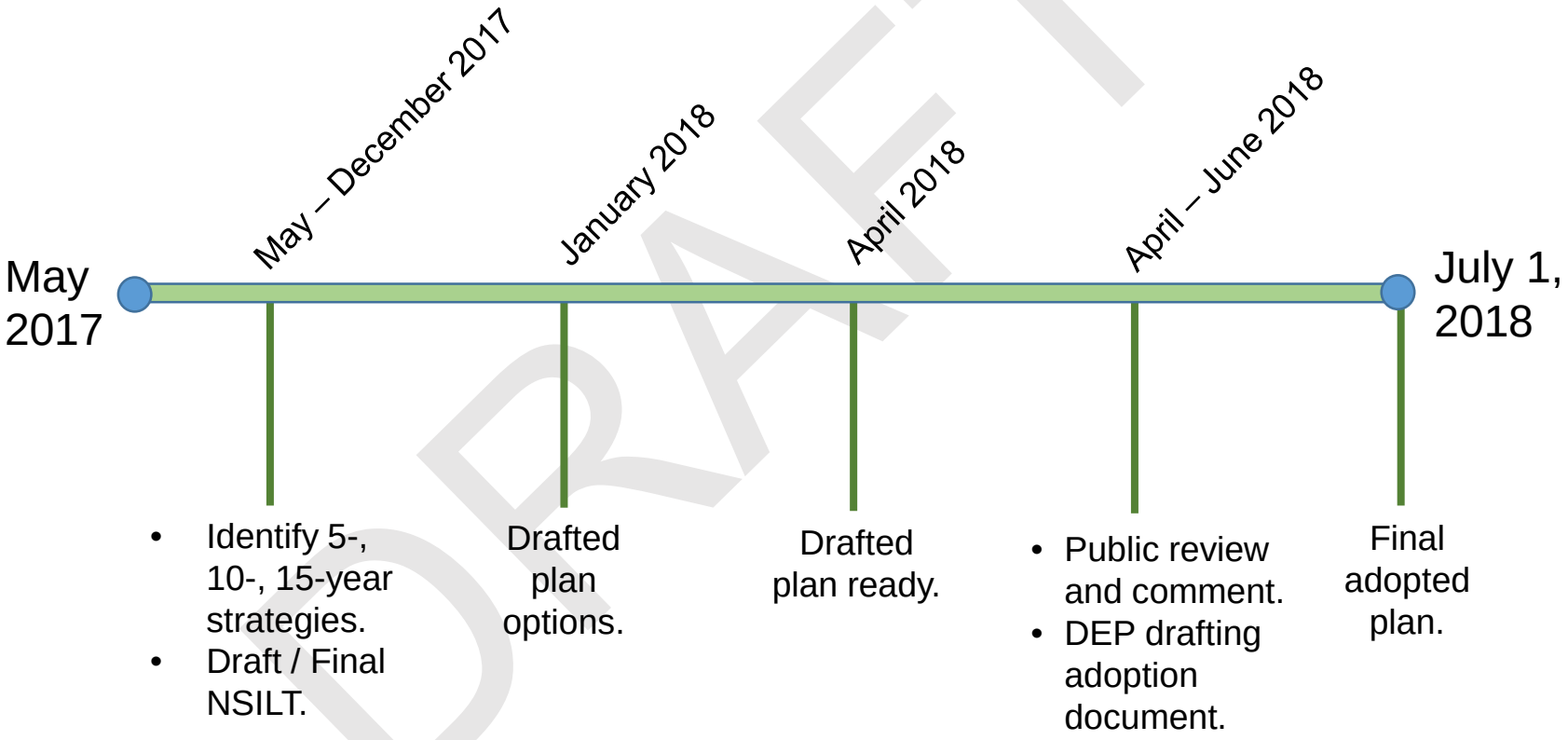


Florida Springs and Aquifer Protection Act

Florida Springs and Aquifer Protection Act

- Requires 5-, 10-, 15-, and 20-year goals to achieve TMDLs for each source identified in Nitrogen Source Inventory and Loading Tool (NSILT).
- Revise or adopt new BMAPs to include source specific goals as well as OSTDS Remediation Plan by **July 1, 2018**.
- Delineate priority focus areas (PFA[s]).

DRAFT
Timeline BMAP Revision and Adoption



Florida Department of Environmental Protection

Update on Wekiva Septic Tank Study

Rick Hicks
May 11, 2017





Study Objectives

The results of study helps us better understand:

- Attenuation and leaching of nitrogen from existing septic systems into the soil and groundwater.
- Other sources of nitrogen in residential areas.
- Conditions that may influence nitrogen attenuation local to this area.

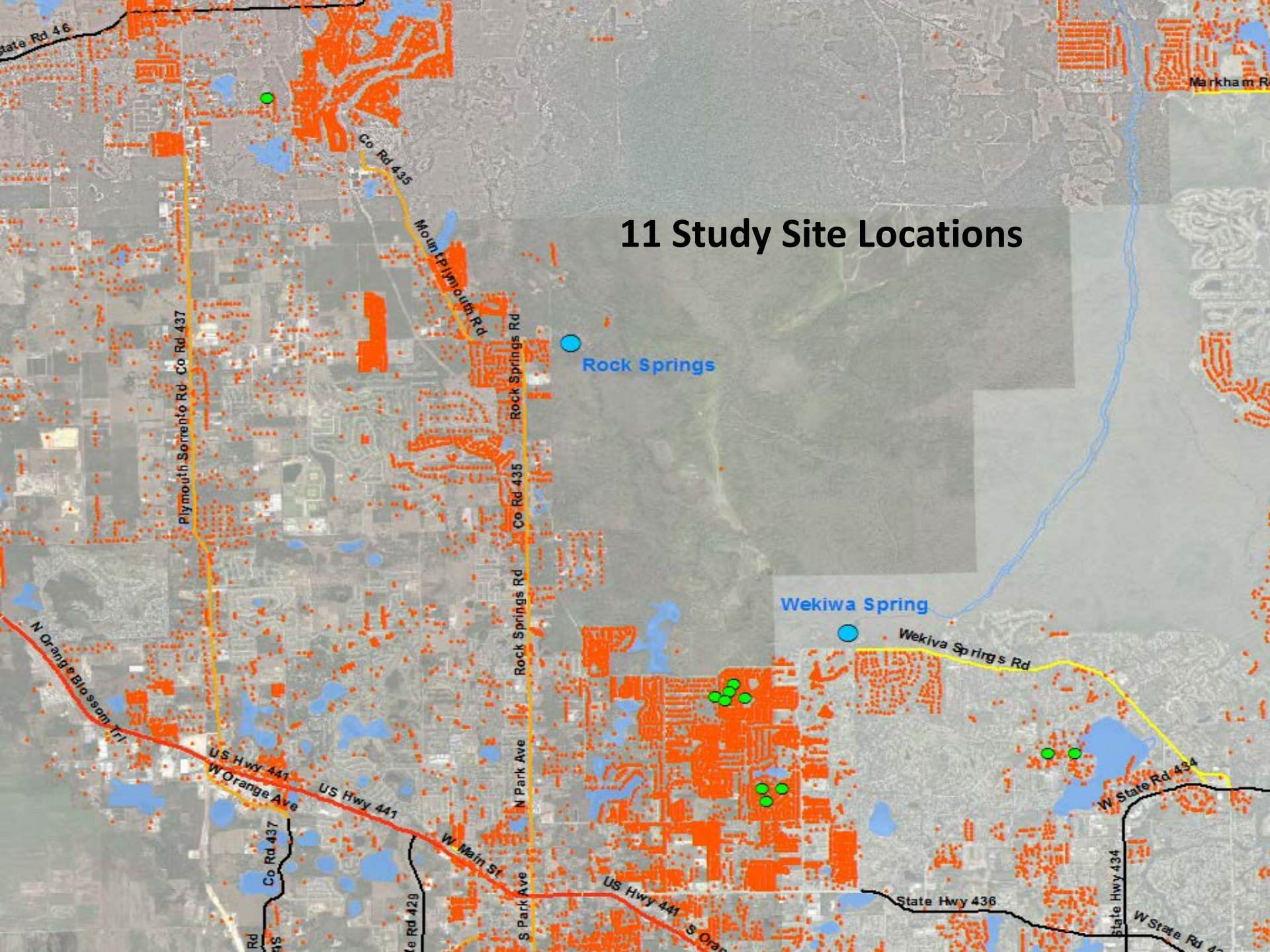
Chronology

Chronology of Activities

Date	Activity
December 2014	Study plan development and coordination with CPR
December 2014	SF6 injection, Rock Springs well
March 2015	Meeting with homeowners to discuss project and initial site visits
April-June 2015	Solicit septic tank contractor services
June 2015	Site inspections with contractor, select 12 study sites
July-August 2015	Install lysimeters at sites, install risers, initial sampling
September 2015	SF6 injection, Wekiwa Spring well
October 2015	Begin bi-monthly sampling
February 2016	Meeting with homeowners, interim findings
February 2016	Remove lysimeters Site H
February 2016	Install deep lysimeters at sites A, B, E,F, G,
March 2016	Pump septic tanks at 4 sites (A, B, E,G)
June 2016	Deep borings at A, J, K, Install monitoring wells at J,K
July 2016	Install deeper lysimeters at sites B and E
October 2016	Finish monitoring program
January 2017	Remove lysimeters from sites
April 2017	**Report findings**

Information on Study Sites

Site ID	City	No. residents	Drainfield repair/replacement history	Maintenance info	Fertilizer use	Soil
A	Sorrento	2	infiltrators (original)	pumped regularly	yes, self applied	Candler fine sand
B	Apopka	3	infiltrators (2009)	pumped in 2013	yes, self applied	Candler fine sand
C	Apopka	3	infiltrators (2010)	septic tank pumped in 2013	yes, self applied	Candler fine sand
D	Apopka	2	pipe in gravel (original)	not pumped out lately	yes, commercial service	Candler fine sand
E	Apopka	2	pipe in gravel (1989)	not pumped	yard mostly mulched beds	Candler fine sand
F	Apopka	4	infiltrators (2010)	pumped in 2014	not lately	Candler fine sand
G	Apopka	3	pipe in gravel (original)	pumped in 2014	yard mostly mulched beds	Candler fine sand
H	Apopka	2	pipe in gravel (original)	not pumped	yes, commercial service	Candler fine sand
I	Longwood	1-2	infiltrators (1989)	pumped in 2015	yes, commercial service	Urban land
J	Longwood	2	mounded pipe in gravel bed	pumped regularly	yes, commercial service	Urban land
K	Apopka	2	pipe in gravel (original)	pumped in 2015	yard mostly mulched beds	Candler fine sand


11 Study Site Locations
Rock Springs
Wekiwa Spring
Wekiva Springs Rd
Co Rd 435
Mount Plymouth Rd
Rock Springs Rd
Plymouth Sorrento Rd
Co Rd 437
N Orange Blossom Trl
US Hwy 441
W Orange Ave
W Main St
N Park Ave
S Park Ave
State Hwy 436
W State Rd 434
State Hwy 434

Scope

- Lysimeters to monitor soil pore water below drainfields and at background locations.
- Riser installation and effluent monitoring.
- Monitoring wells at some locations.
- Collect data on water use to estimate loading.

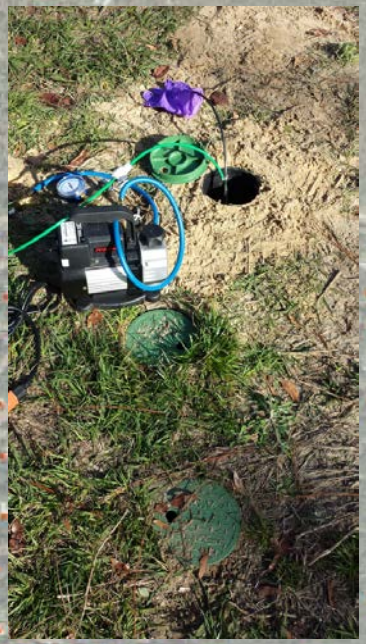
Other Activities

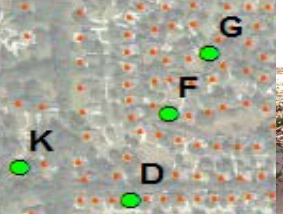
- Evaluate changes in septic tank treatment after pumping.
  - By selectively sampling septic tank effluent, pre- and post-pumping, we hope to help provide some actual data on the potential benefit of tank pumping.
- Construct experimental alternative nitrogen reducing drainfield system(s).
  - Bold and Gold® or other similar reactive media.
  - Passive low-cost construction.
  - Wekiwa Springs State Park location.
  - Orchard Drive location.
- Use data for modeling purposes, e.g., “STUMOD.”

Nutrient Levels in Soil Pore Water

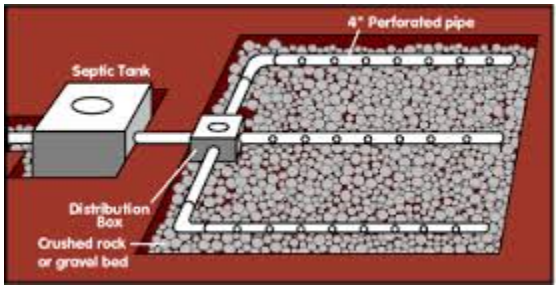
Site	Lysimeters Installed	Total Depth (ft below land surface)	Location
A	AL1S-AL4S	5	Drainfield
	AL5S	5	Background
	AL2D	10	Drainfield adjacent to AL2S
B	BL1S-BL4S	5	Drainfield
	BL5S	5	Background
	BL3D	10	Drainfield, adjacent to BL3S
	BL3E	15	Drainfield, adjacent to BL3S
C	CL1S-CL3S	5	Drainfield
	CL4S	5	Background
D	DL1S-DL2S	5	Drainfield
	DL3S	5	Background
E	EL1S-EL3S	5	Drainfield
	EL4S	5	Background
F	FL1S-FL3S	5	Drainfield
	FL4S	5	Background
	FL2D	10	Drainfield, adjacent to FL2S
G	GL1S-GL2S	5	Drainfield
	GL3S	5	Background
	GL1D	10	Drainfield, adjacent to GL1S
	GL1E	15	Drainfield, adjacent to GL1S
H	HL1S-HL2S	5	Drainfield
	HL3S	5	Background
I	IL1S-IL3S	5	Drainfield
	IL4S	5	Background
J	JL1S-JL3S	5	Drainfield
	JL4S	5	Background
K	KL1S-KL4S	5	Drainfield
	KL5S	5	Background

Lysimeter Installation





Types of Drainfields in Study



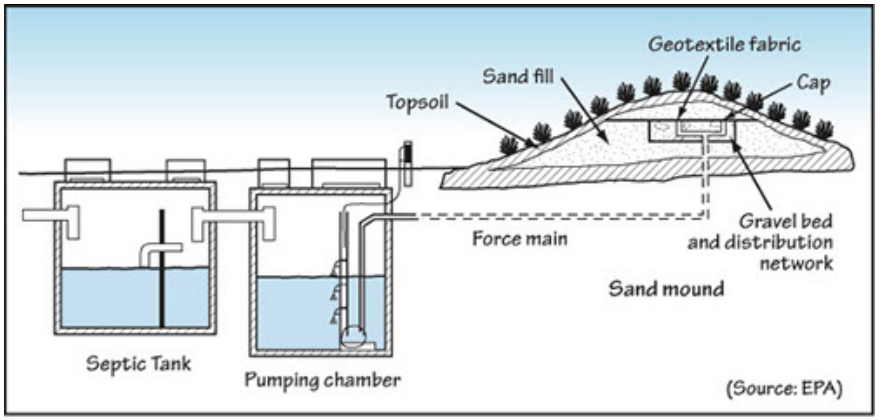


Figure 4 - Schematic of a Sand Mound System

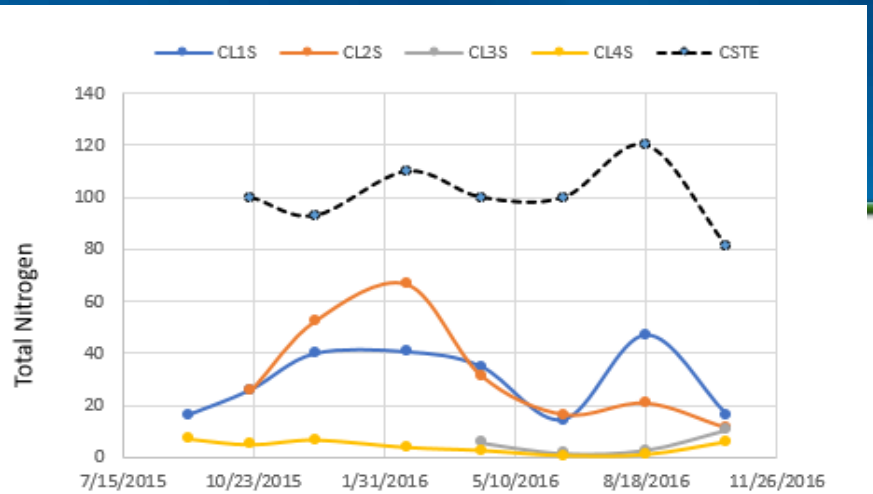
Septic Tank Effluent Sampling

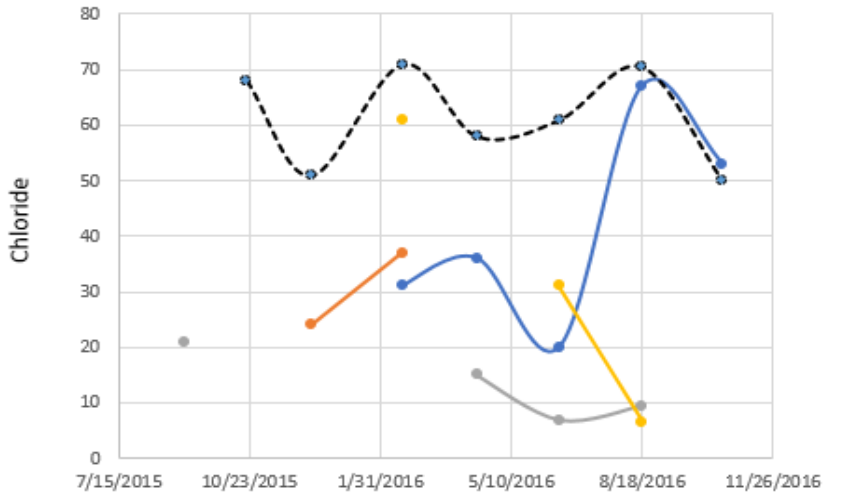
Septic tank effluent samples collected bimonthly at 8 sites (units are in mg/L):

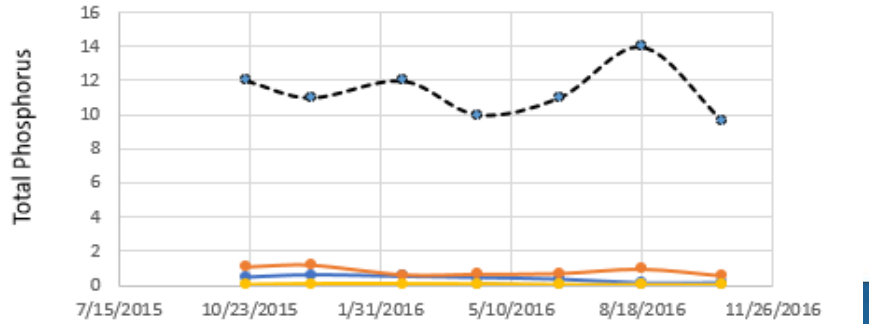
Site	Average Total Nitrogen	Average Chloride	TN/Chloride Ratio	Average Total Phosphorus
A	61	32	1.91	7.8
B	93	43	2.16	9.3
C	101	63	1.60	12
E	57	47	1.21	6.8
F	57	45	1.27	6.8
G	75	42	1.79	7.5
I	140	87	1.61	16
J	93	74	1.26	9.3
All Sites	**85**	**54**	**1.57**	**9.4**

Units are mg/L


Septic Tank
L3S
L1S
L4S
L2S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Wekiva Septic Study
Site: C
Feet
0 5 10 20 30
Map prepared 4/12/2017 by the Division of Environmental Assessment and Restoration. This map is not for legal decision making purposes. For more information or copies, contact David.Huggins@dep.state.fl.us
L = Lysimeter
S = Shallow
D = Deep
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


CL1S
CL2S
CL3S
CL4S
CSTE
Total Nitrogen
140
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Chloride
80
70
60
50
40
30
20
10
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Total Phosphorus
16
14
12
10
8
6
4
2
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


L1S
L2S
L1D
Septic Tank
L3S
L4S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Wekiva Septic Study
Site: E
Feet
0 5 10 20 30
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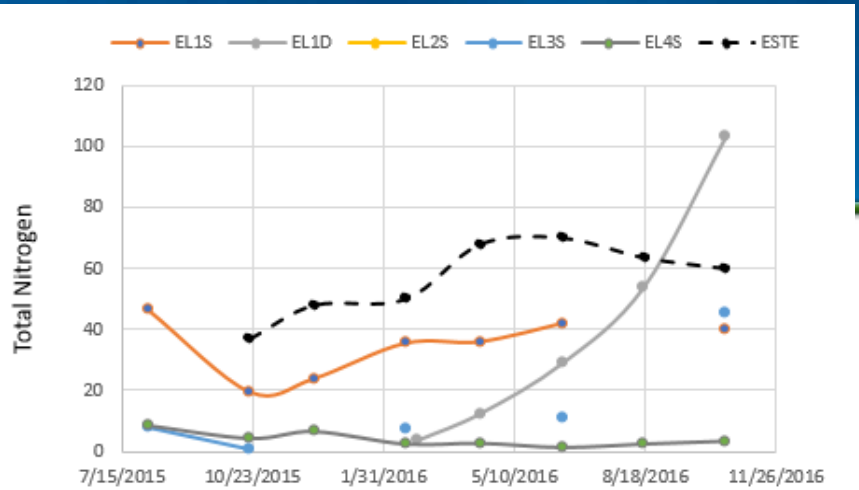
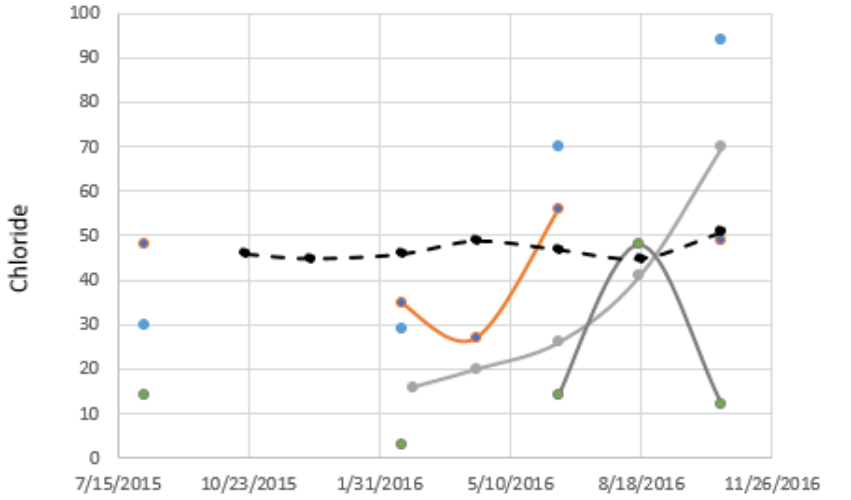
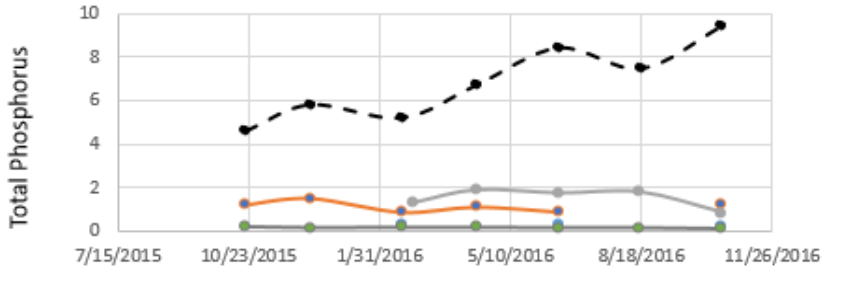
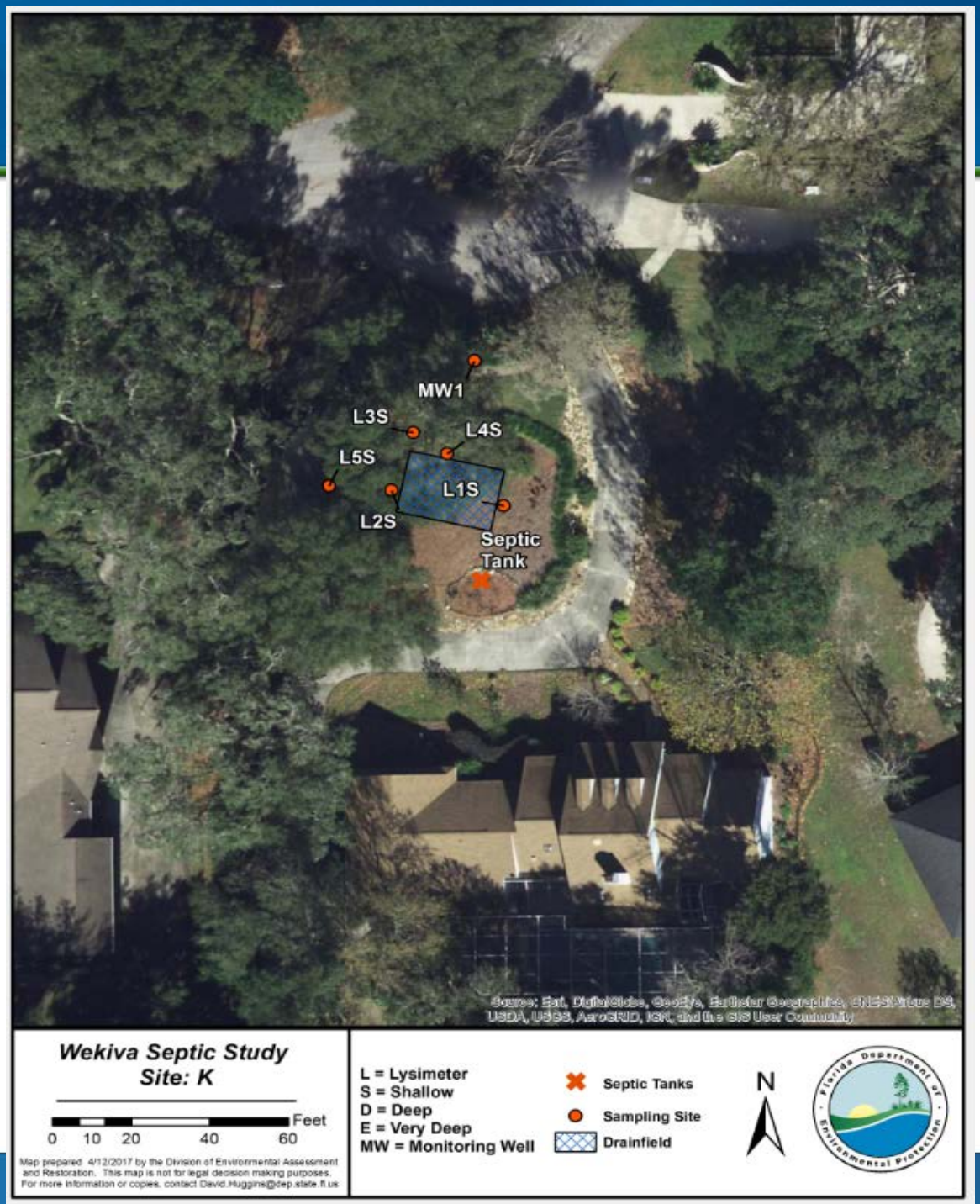
D = Deep
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


EL1S
EL1D
EL2S
EL3S
EL4S
ESTE
Total Nitrogen
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Chloride
100
90
80
70
60
50
40
30
20
10
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Total Phosphorus
10
8
6
4
2
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


MW1
L3S
L4S
L5S
L1S
L2S
Septic Tank
Wekiva Septic Study
Site: K
0 10 20 40 60 Feet
Map prepared 4/12/2017 by the Division of Environmental Assessment and Restoration. This map is not for legal decision making purposes. For more information or copies, contact David.Huggins@dep.state.fl.us
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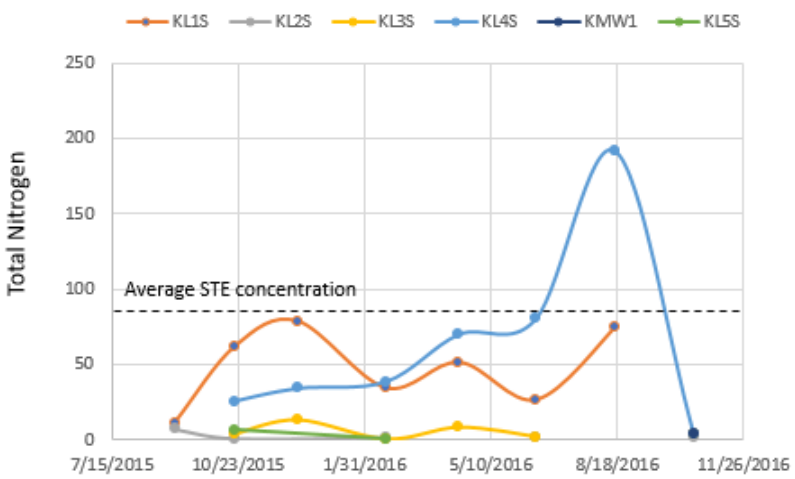
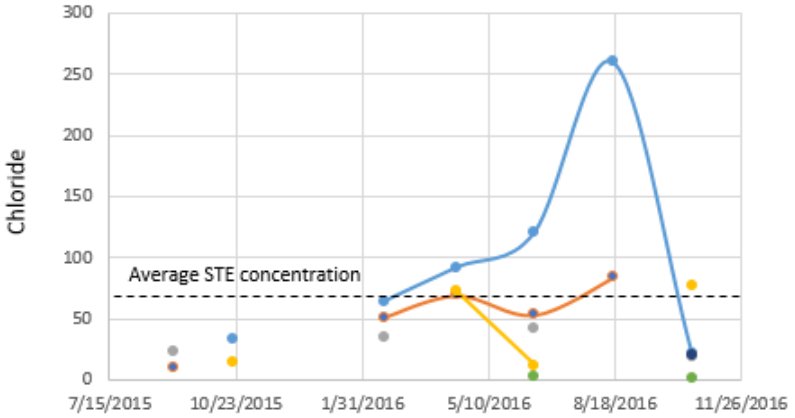
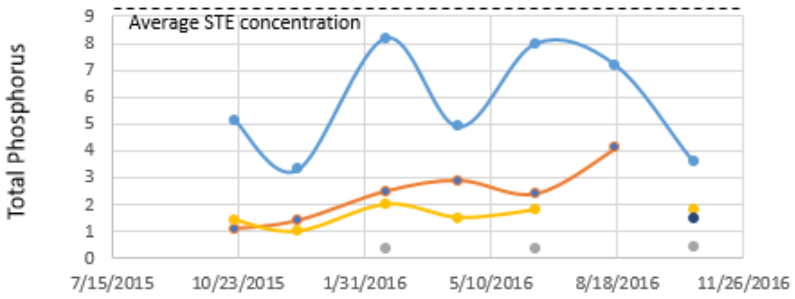
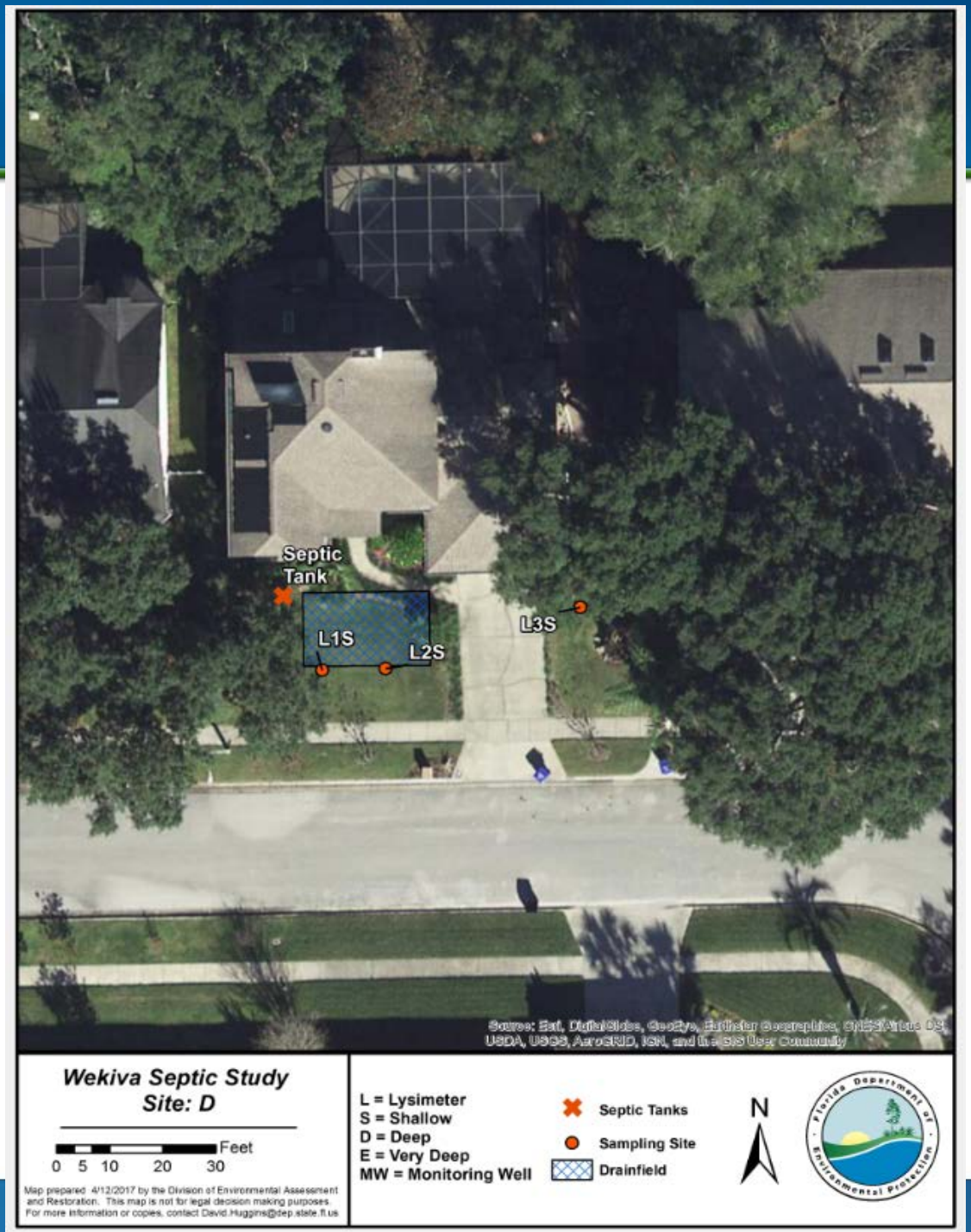
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


KL1S
KL2S
KL3S
KL4S
KMW1
KL5S
Total Nitrogen
250
200
150
100
50
0
Average STE concentration
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Chloride
300
250
200
150
100
50
0
Average STE concentration
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Total Phosphorus
9
8
7
6
5
4
3
2
1
0
Average STE concentration
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Septic Tank
L1S
L2S
L3S
Wekiva Septic Study
Site: D
Feet
0 5 10 20 30
Map prepared 4/12/2017 by the Division of Environmental Assessment and Restoration. This map is not for legal decision making purposes. For more information or copies, contact David.Huggins@dep.state.fl.us
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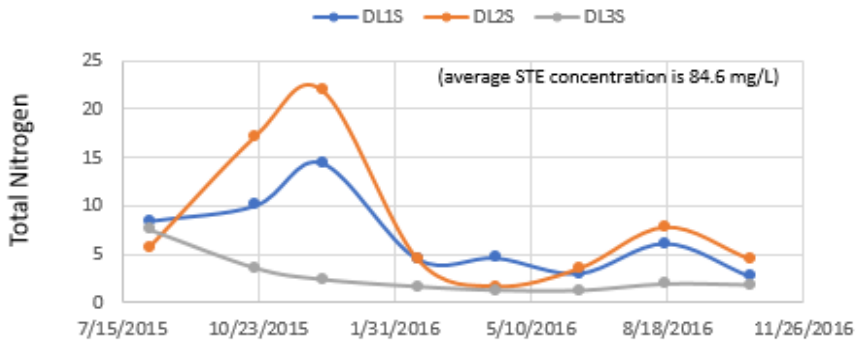
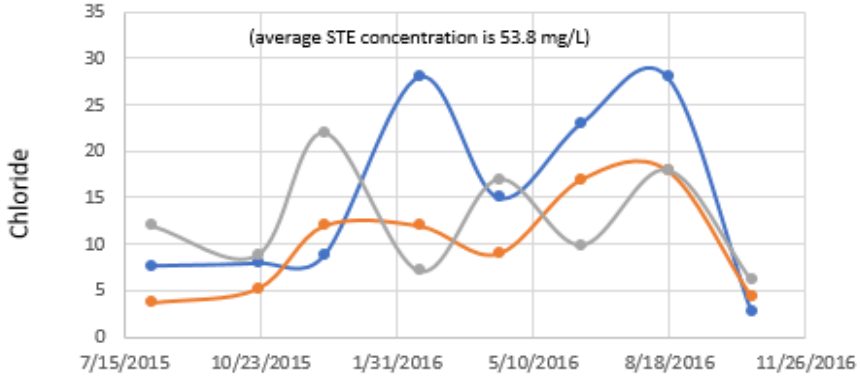
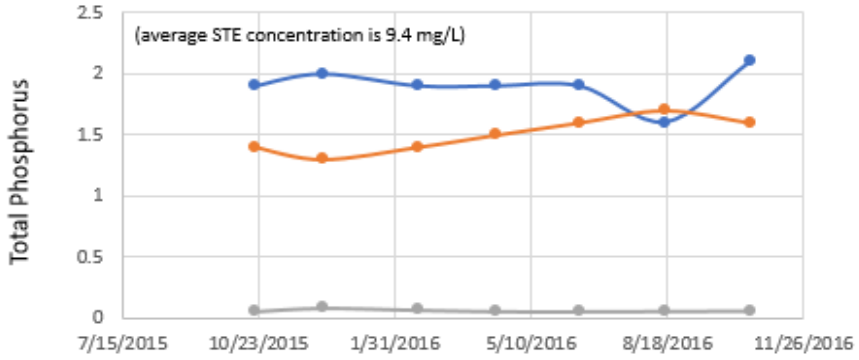
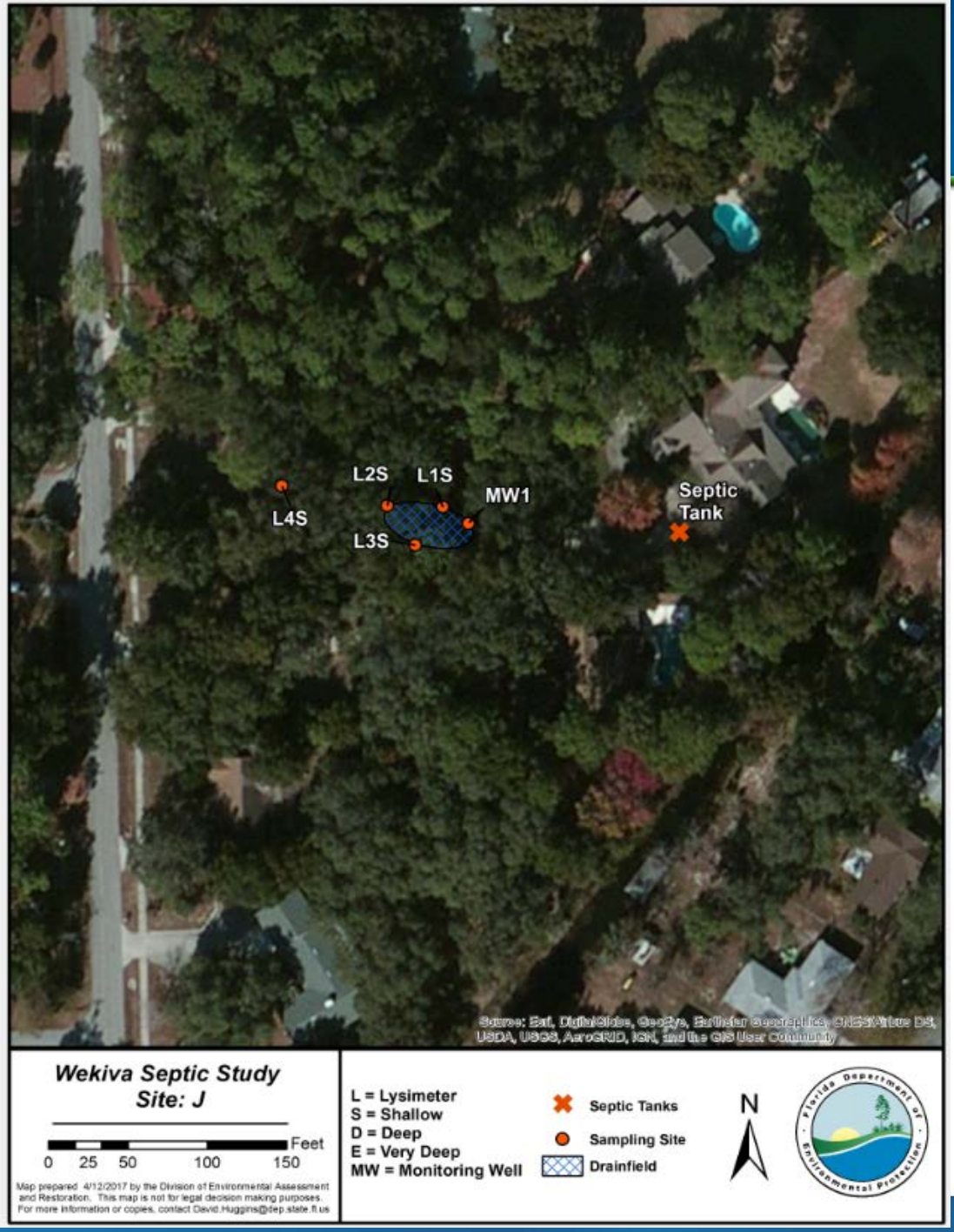
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


DL1S
DL2S
DL3S
Total Nitrogen
(average STE concentration is 84.6 mg/L)
25
20
15
10
5
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Chloride
(average STE concentration is 53.8 mg/L)
35
30
25
20
15
10
5
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


Total Phosphorus
(average STE concentration is 9.4 mg/L)
2.5
2
1.5
1
0.5
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


L2S
L1S
MW1
L4S
L3S
Septic Tank
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Wekiva Septic Study
Site: J
Feet
0 25 50 100 150
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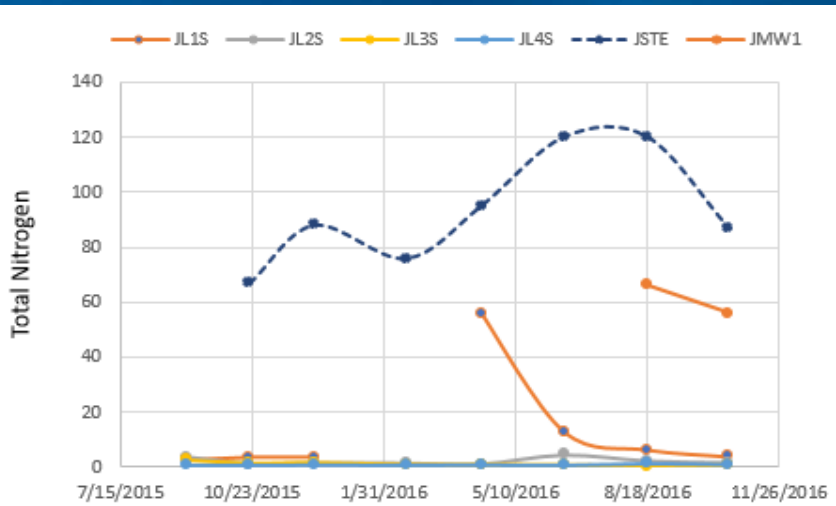
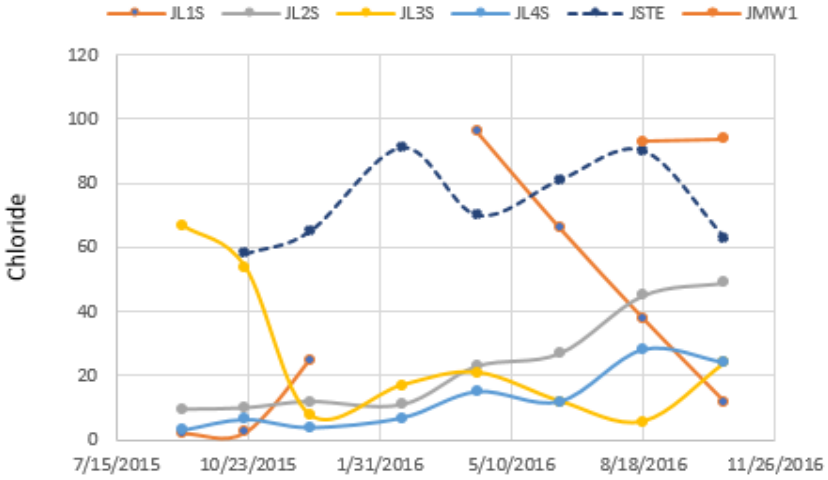
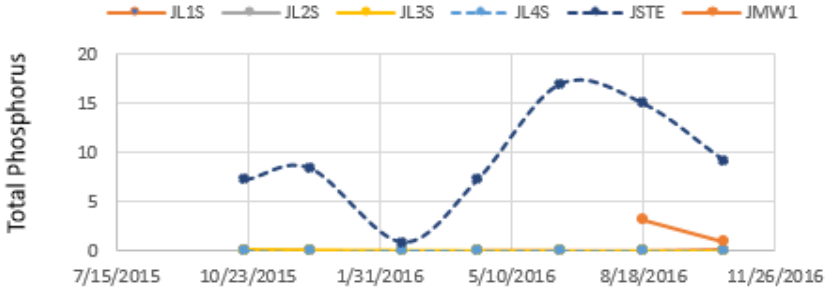
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


JL1S
JL2S
JL3S
JL4S
JSTE
JMW1
Total Nitrogen
140
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


JL1S
JL2S
JL3S
JL4S
JSTE
JMW1
Chloride
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


JL1S
JL2S
JL3S
JL4S
JSTE
JMW1
Total Phosphorus
20
15
10
5
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


L5S
L1S
L3S
Septic
Tank
L4S
L2S
L2D
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Wekiva Septic Study
Site: A
Feet
0 5 10 20 30
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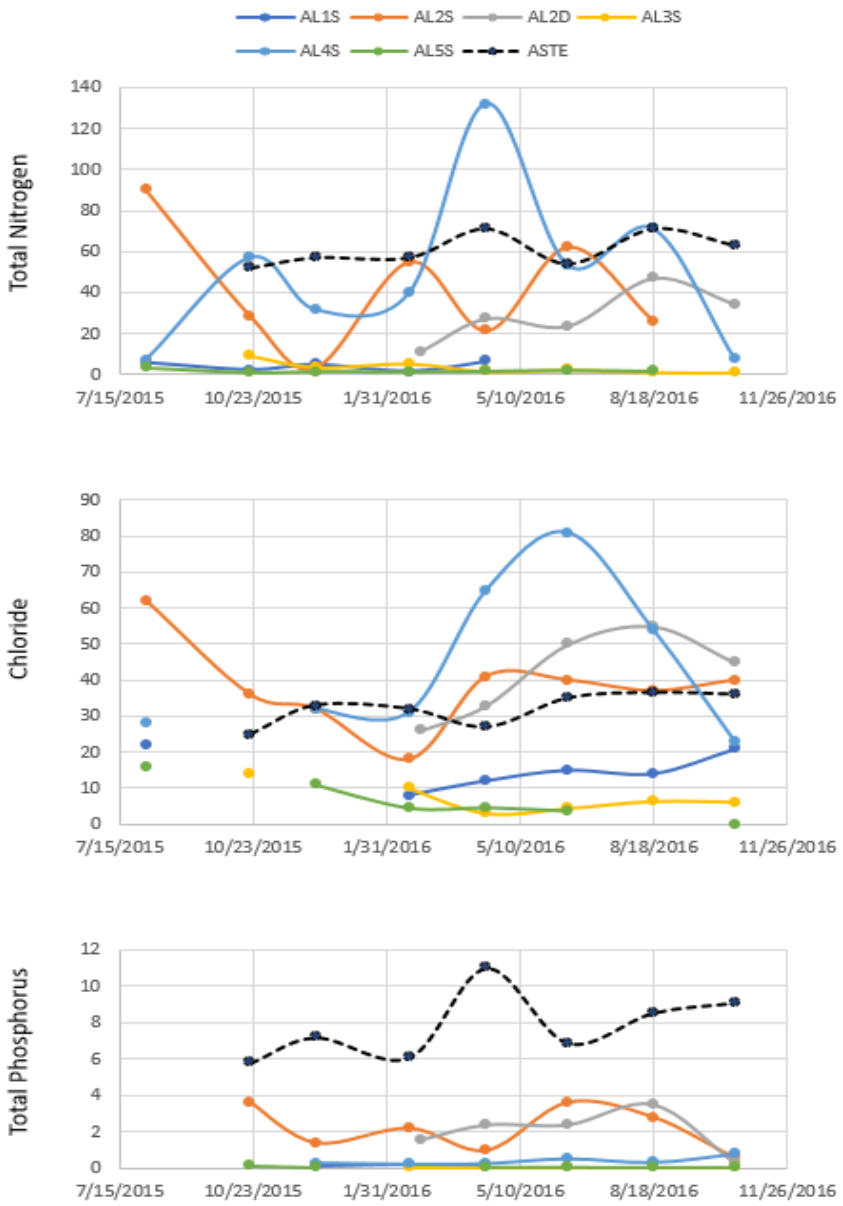
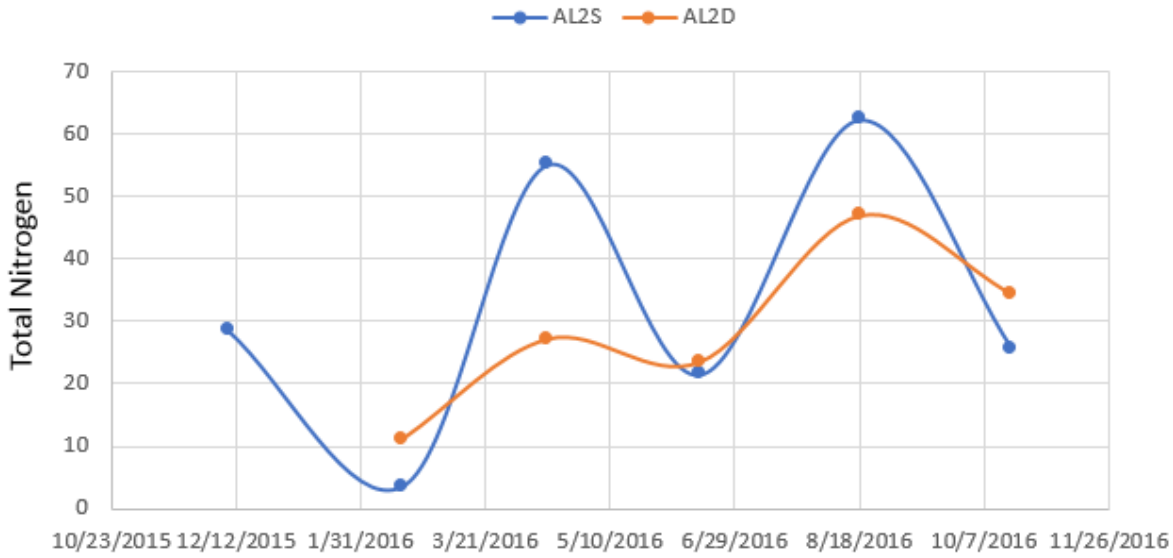
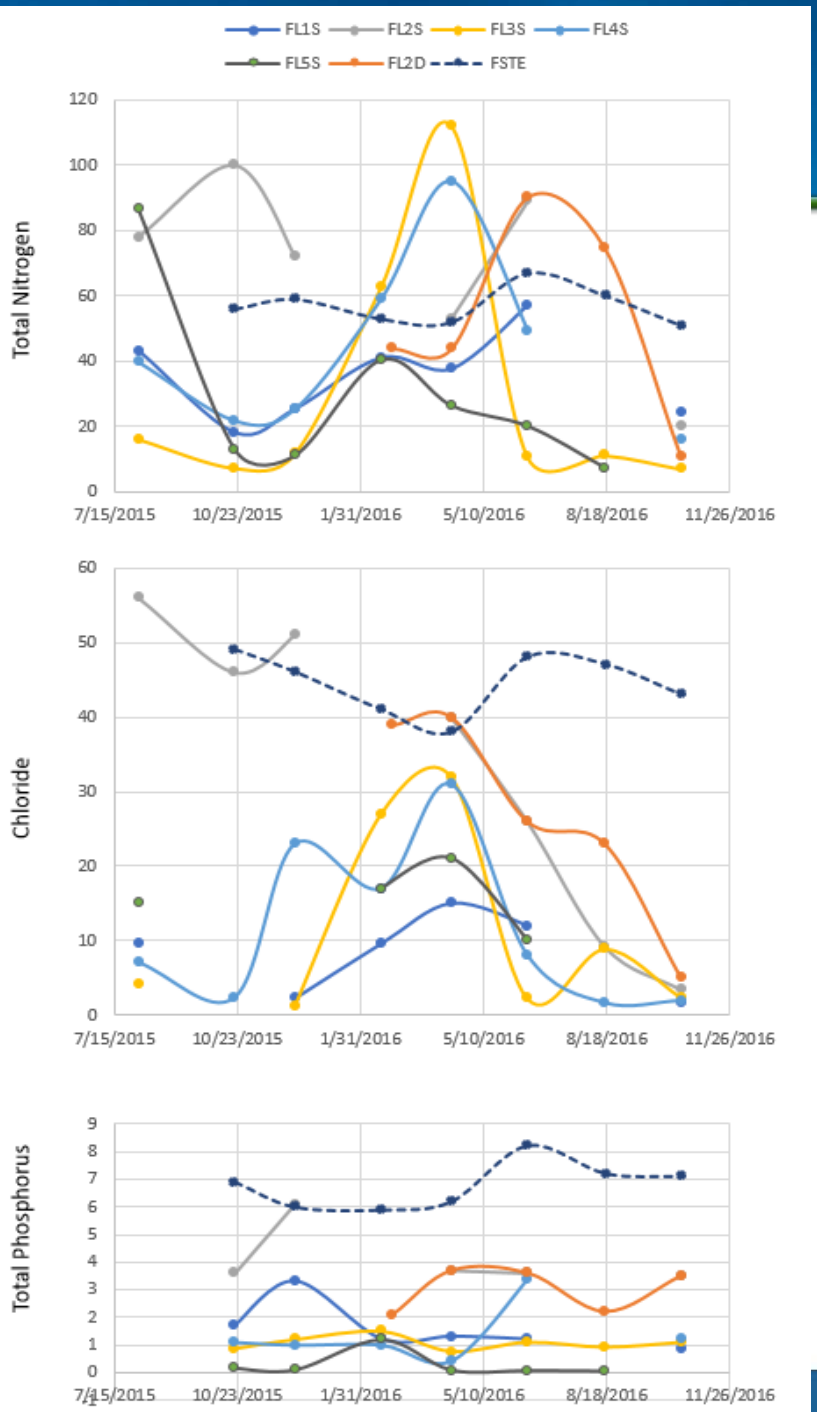
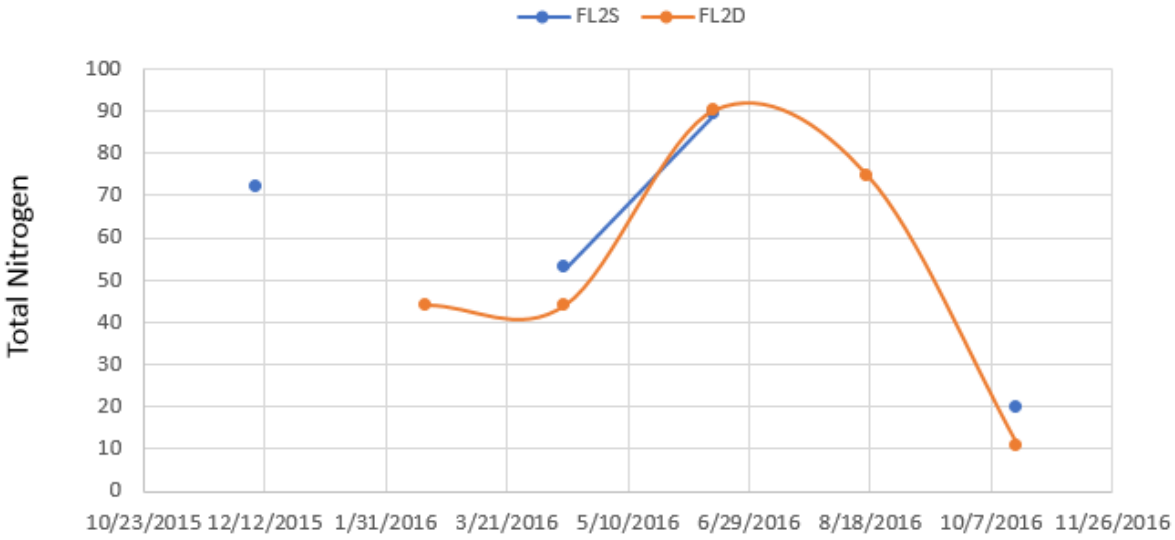
Septic Tanks
Sampling Site
Drainfield
N


AL1S
AL2S
AL2D
AL3S
AL4S
AL5S
ASTE
Total Nitrogen
140
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016
Chloride
90
80
70
60
50
40
30
20
10
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016
Total Phosphorus
12
10
8
6
4
2
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


AL2S
AL2D
Total Nitrogen
70
60
50
40
30
20
10
0
10/23/2015
12/12/2015
1/31/2016
3/21/2016
5/10/2016
6/29/2016
8/18/2016
10/7/2016
11/26/2016


L5S
L2D
L1S
Septic
Tank
L2S
L3S
L4S
Wekiva Septic Study
Site: F
Feet
0 5 10 20 30
Map prepared 4/12/2017 by the Division of Environmental Assessment and Restoration. This map is not for legal decision making purposes. For more information or copies, contact David.Huggins@dep.state.fl.us
L = Lysimeter
S = Shallow
D = Deep
E = Very Deep
MW = Monitoring Well
Septic Tanks
Sampling Site
Drainfield
N


FL1S
FL2S
FL3S
FL4S
FL5S
FL2D
FSTE
Total Nitrogen
120
100
80
60
40
20
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016
Chloride
60
50
40
30
20
10
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016
Total Phosphorus
9
8
7
6
5
4
3
2
1
0
7/15/2015
10/23/2015
1/31/2016
5/10/2016
8/18/2016
11/26/2016


FL2S
FL2D
Total Nitrogen
100
90
80
70
60
50
40
30
20
10
0
10/23/2015
12/12/2015
1/31/2016
3/21/2016
5/10/2016
6/29/2016
8/18/2016
10/7/2016
11/26/2016

Summary Findings for Lysimeter Samples

Site	Max TN	Min TN	Avg TN	Max Chloride	Min Chloride	Avg Chloride	Max TP	Min TP	Avg TP
A	132	0.96	37	81	0.04	26	3.6	0.034	0.89
B	254	1.5	49	180	1.6	33	3.6	0.008	0.32
C	67	0.83	19	67	6.5	30	1.2	0.033	0.38
D	22	1.3	6.0	28	2.7	13	2.1	0.053	1.2
E	103	0.74	22	94	2.9	37	1.9	0.11	0.77
F	112	7	42	56	1.3	18	6.1	0.047	1.8
G	152	2.2	49	2600	5.8	234	7.9	0.04	1.8
H	10	1.5	6.3	92	1.9	24	0.12	0.021	0.07
I	69	0.6	8.5	120	3.9	21	2.3	0.048	0.80
J	56	0.56	4.0	96	2.2	24	0.12	0.015	0.038
K	192	0.43	31	260	1.3	55	8.2	0.32	3.0

(units are in mg/L)

Information About Drainfield-Related N Attenuation

Results from some of the sites where TN was mostly from drainfields during some portion of the monitoring period are summarized below.

- At Site E, 39 % of nitrogen was reduced with 10 % due to dilution.
- At Site G, 42 to 46 % of nitrogen was reduced in shallow and deep lysimeters with no dilution.
- At Site J where there is a shallow water table, 35 % of the nitrogen was reduced in a shallow well with no dilution.
- At Site K, 44 % of nitrogen was reduced with no dilution.

Using data from multiple sites, it appears that attenuation of N by means other than dilution is about 40 % (based on assumed TN/Cl relationship).

Soil Attenuation Modeling

Soil Science Society of America

SSSA Onsite Wastewater Conference
April 7-8, 2014

The Florida Onsite Sewage Nitrogen Reduction Strategies (FOSNRS) Project

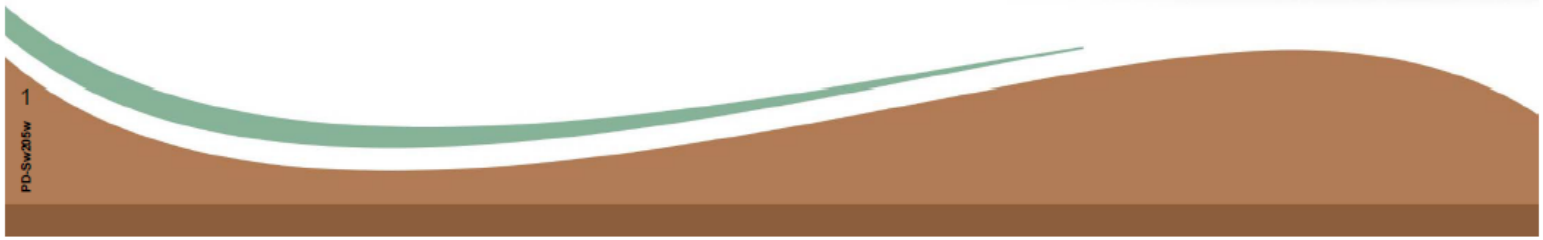
FOSNRS 6: STUMOD-FL - A Tool for Predicting Fate and Transport of Nitrogen in Soil Treatment Units in Florida

April 7, 2014

Mengistu Geza[1], Kathryn S Lowe[1], Cliff Tonsberg[1], John McCray[1] and Eberhard Roeder[2]

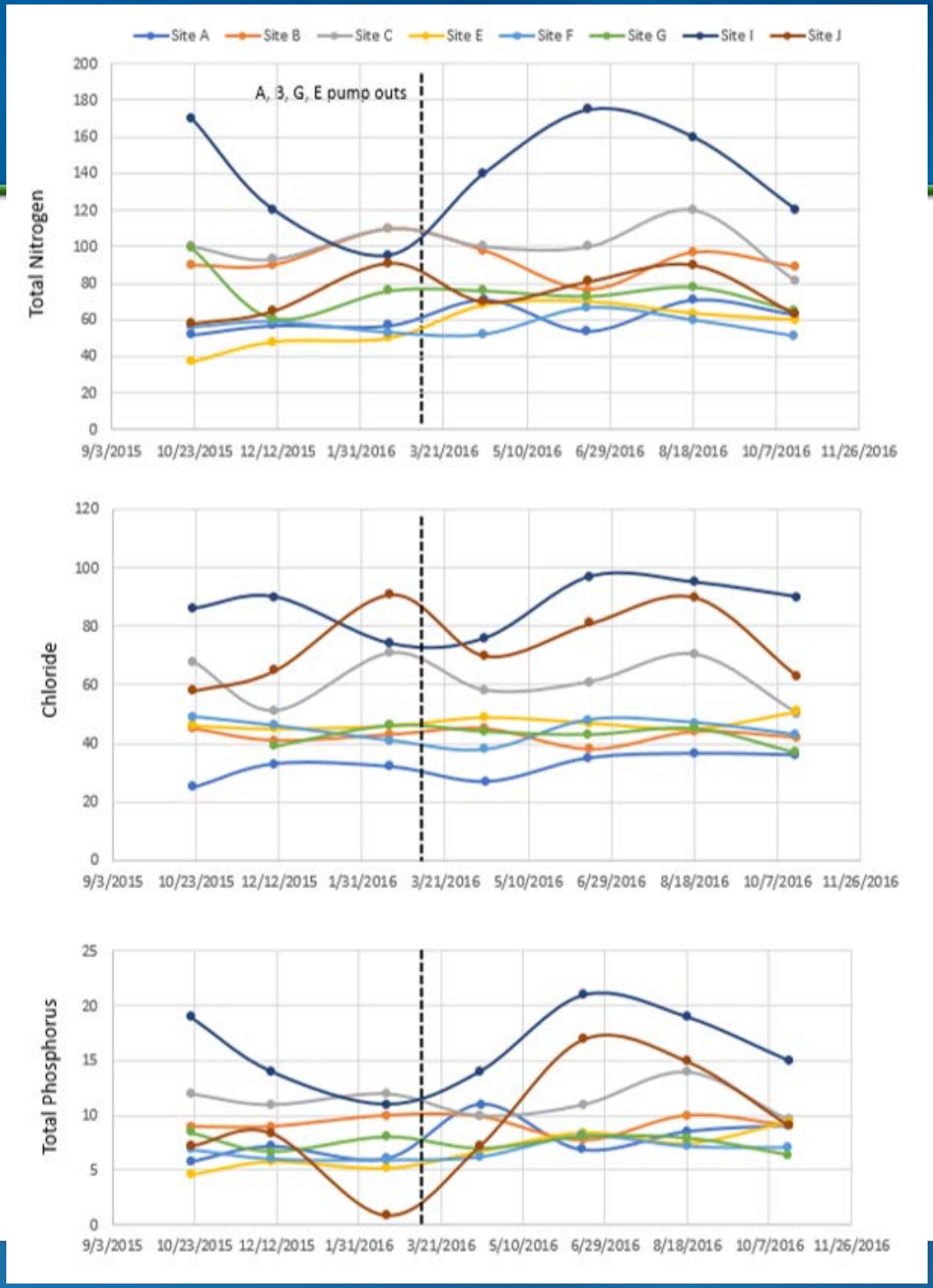
[1]Civil and Environmental Engineering, Colorado School of Mines, Golden, CO

[2]Division of Disease Control and Health Protection Bureau of Environmental Health, Florida Department of Health, Tallahassee, FL



Septic Tank Effluent and Influence of Pumping

- Midway through the study, 4 septic tanks were pumped. Others left as control.
- Septic tanks at sites A, B, E and G were pumped in March 2016, between February and April monitoring events.


Site A
Site B
Site C
Site E
Site F
Site G
Site I
Site J
A, 3, G, E pump outs
Total Nitrogen
Chloride
Total Phosphorus
9/3/2015
10/23/2015
12/12/2015
1/31/2016
3/21/2016
5/10/2016
6/29/2016
8/18/2016
10/7/2016
11/26/2016

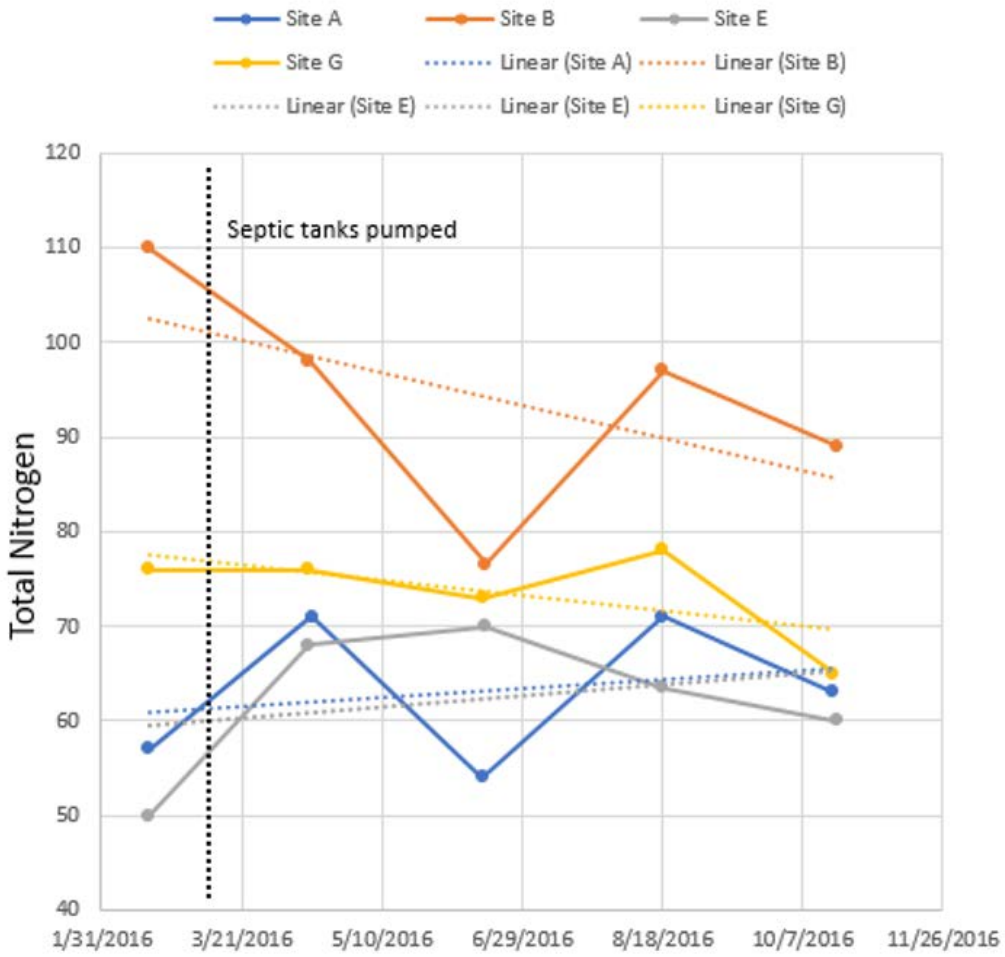
General Statistics for All Sites

Site	TN Before	TN After	% Chg	Chloride Before	Chloride After	% Chg	TP Before	TP After	% Chg
A[1]	55	65	+18	30	34	+13	6	9	+5
B[1]	97	90	-7	43	42	-2	9	9	0
C	101	100	-1	63	60	-5	12	11	-8
E[1]	45	65	+44	46	48	+4	5	8	+60
F	56	65	+18	45	48	+7	6	8	+33
G[1]	79	73	-8	43	42	-2	8	7	-13
I	128	149	+16	83	90	+8	15	17	+13
J	77	106	+38	71	76	+7	5	12	+140

Notes: [1]- septic tank pumped in March 2016. Other sites are controls.

(units are in mg/L)

TN Trends After Pumping



Alternative Drainfield Research

Construction Summary: Assessment of the Nitrogen Removal and Viability of a Reactive Layer with Liner under a Conventional Septic System Drainfield

Division of Environmental Assessment and Restoration

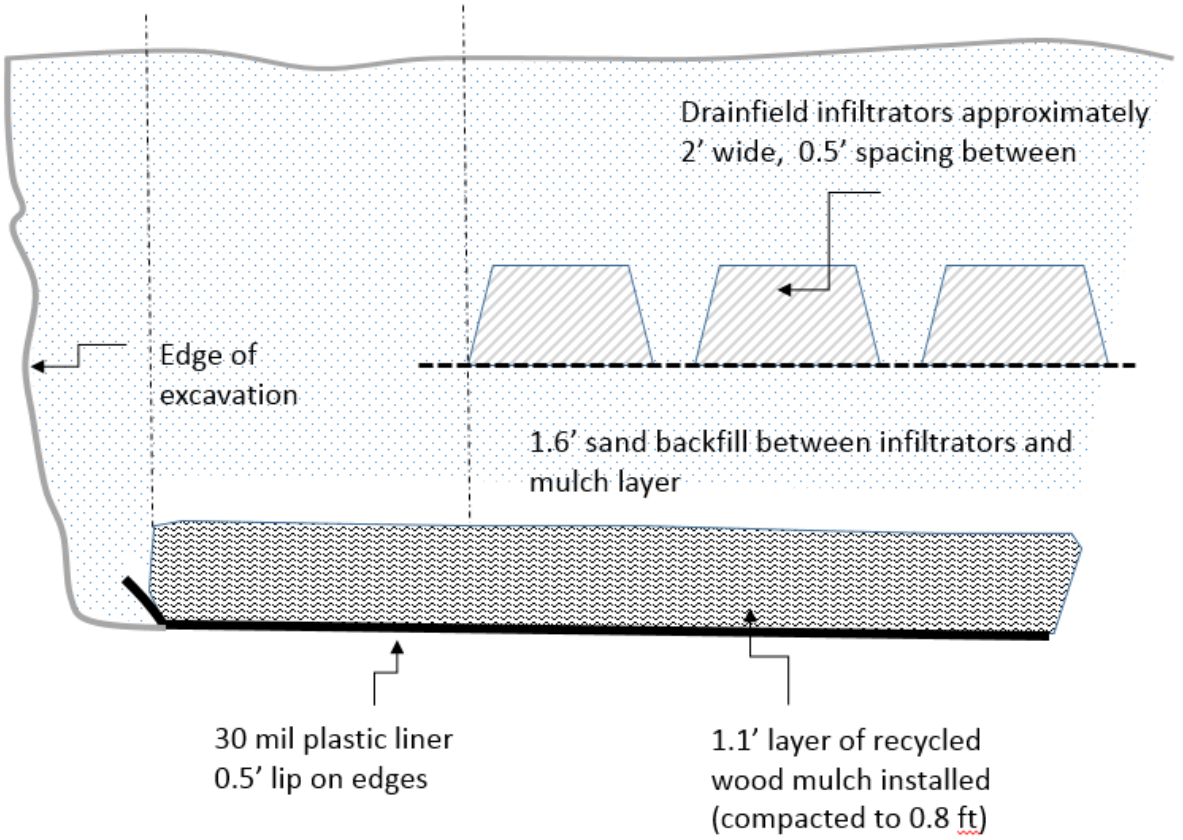
Florida Department of Environmental Protection

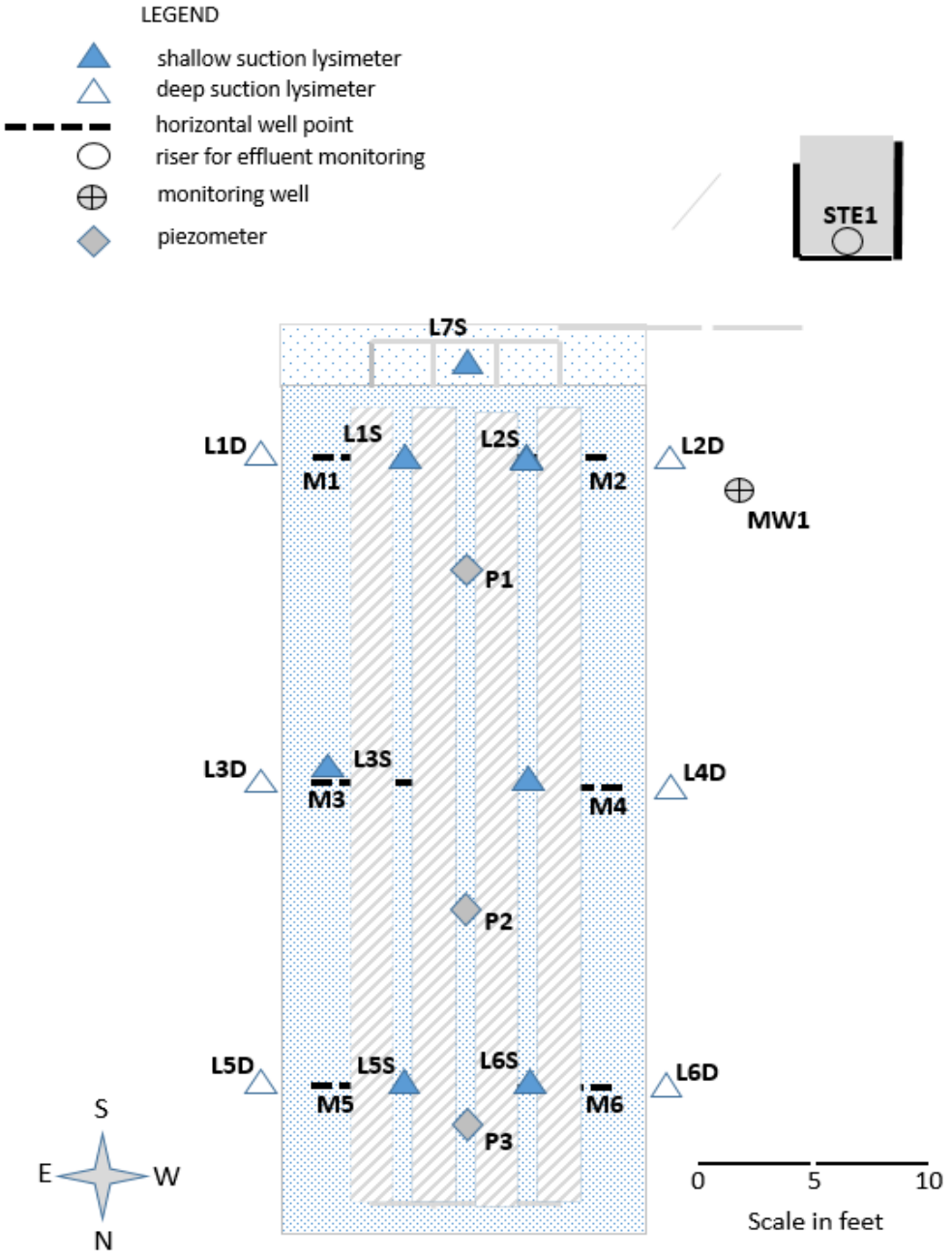
August 2016

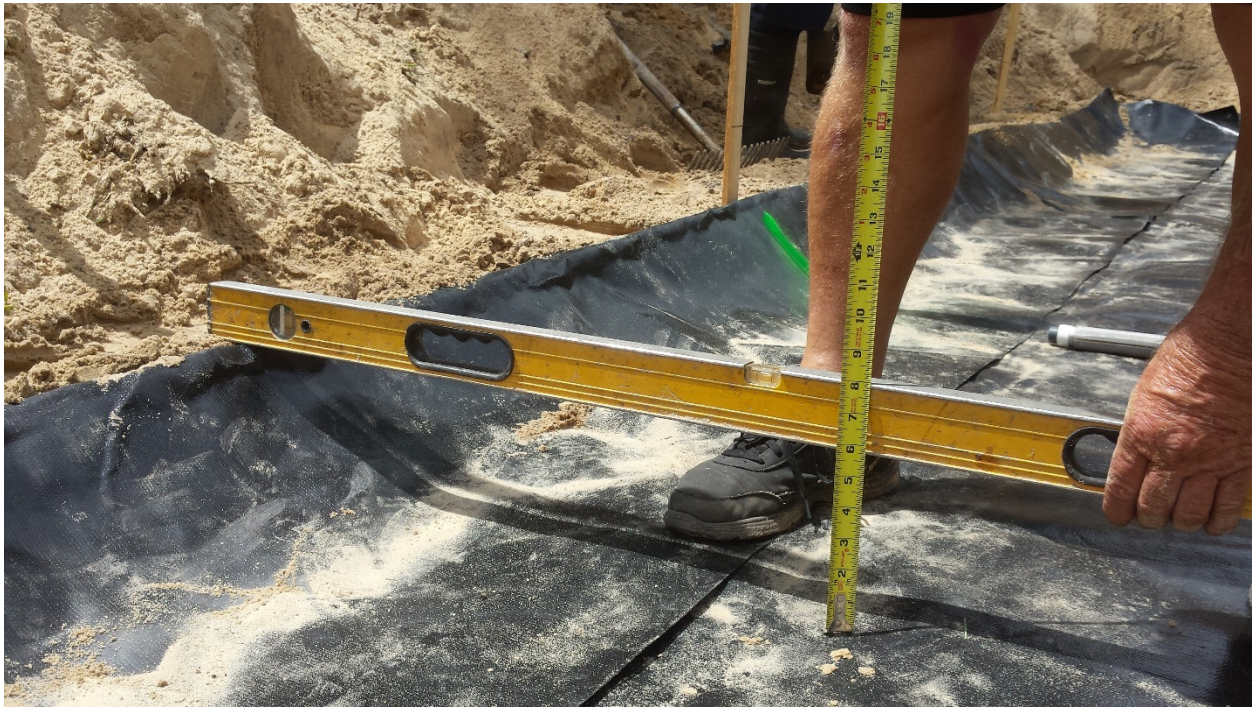
2600 Blair Stone Road, MS 3575
Tallahassee, Florida 32399-2400
www.dep.state.fl.us


Power line
Driveway
Experimental drainfield
Pre-existing drainfields
Septic tank
Water well
0
12.5
25
50 Feet

Wood mulch and liner extend
3-5’ beyond edge of drainfield

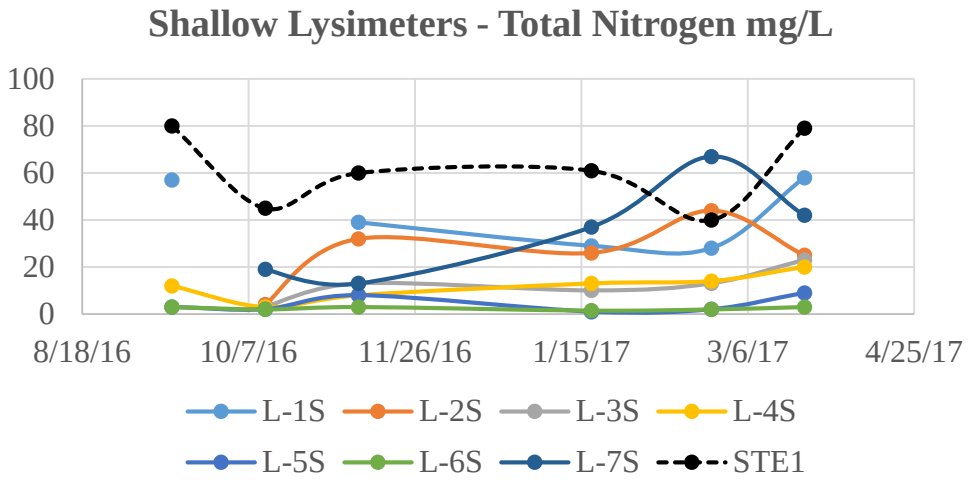


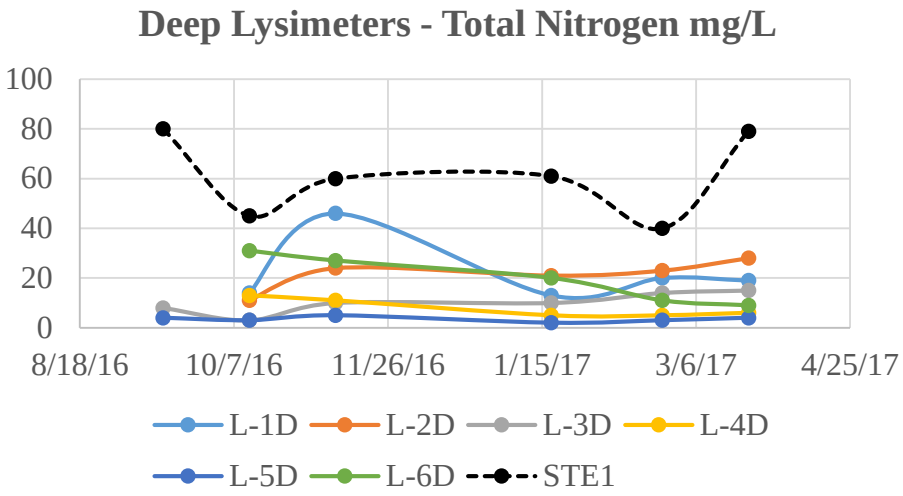

LEGEND
shallow suction lysimeter
deep suction lysimeter
horizontal well point
riser for effluent monitoring
monitoring well
piezometer
STE1
L7S
L1D
L1S
M1
L2S
M2
L2D
MW1
P1
L3D
L3S
M3
L4D
M4
P2
L5D
L5S
M5
L6S
M6
L6D
P3
S
E
W
N
0
5
10
Scale in feet




CASE

TN Results Through March 2017





Deep lysimeter average 65-77 % lower than STE.

Next Steps

- Complete modeling of soil attenuation (May 2017).
- Produce draft report (May 2017).
- Finalize report (June 2017).
- Continue monitoring at experimental site.

Questions?

Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Estimated Nitrogen Loading to the Upper Floridan Aquifer:

Nitrogen Source Inventory and Loading Tool for Wekiwa and Rock Springs

Celeste Lyon

Groundwater Management Section

May 11, 2017

Celeste.Lyon@dep.state.fl.us

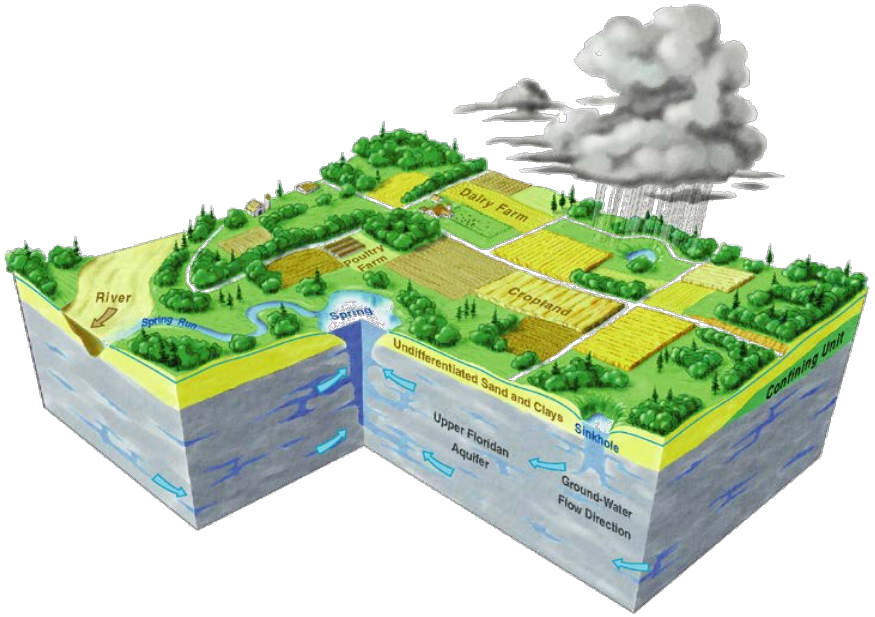
Richard.W.Hicks@dep.state.fl.us

Nitrogen Inventories

- The Florida Springs and Aquifer Protection Act of 2016 requires DEP to develop nitrogen inventories for the contributing areas of all Outstanding Florida Springs that are impaired
- The information developed from the nitrogen inventory for the Wekiwa-Rock combined springshed will be used to provide nitrogen load estimates for sources in the springshed (by source category)

Nitrate-Impaired Spring Waters

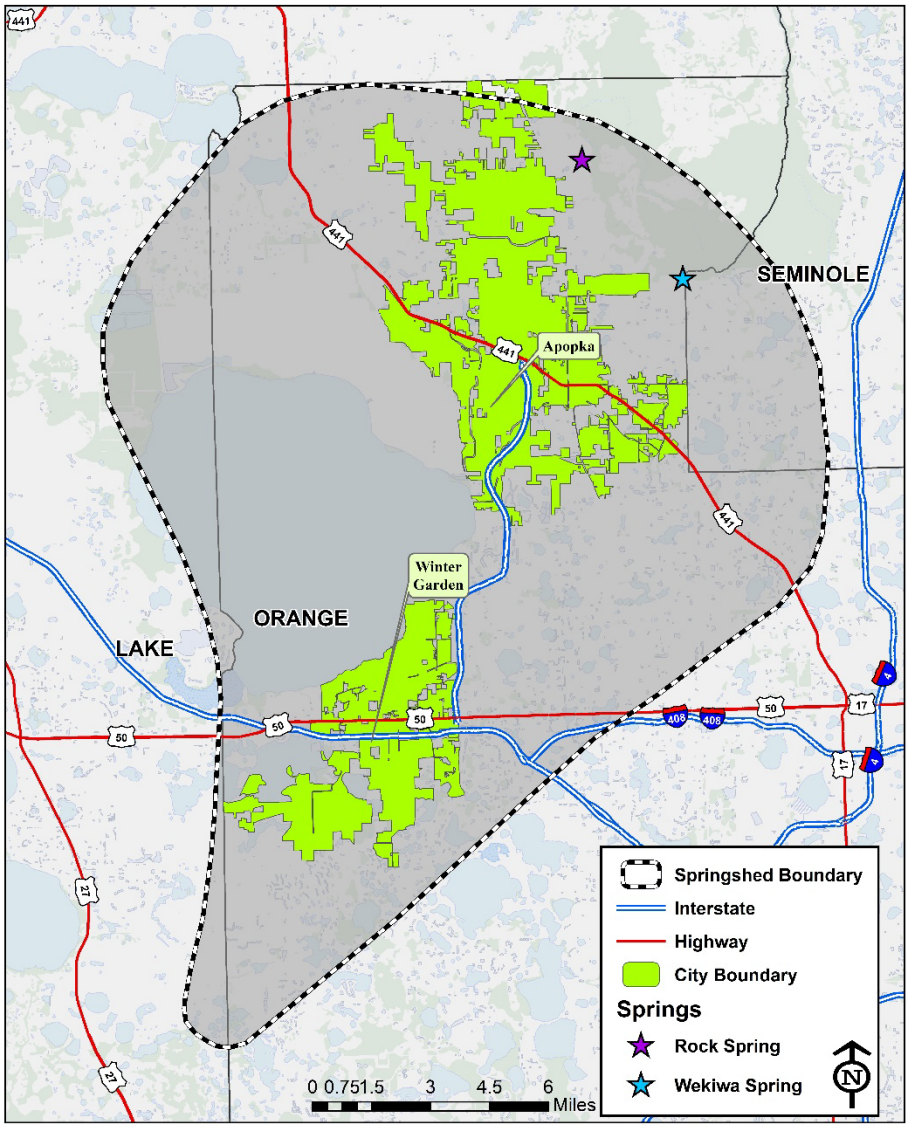
- The water quality in several Outstanding Florida Springs, including Wekiwa and Rock Springs, is impaired due to elevated nitrate concentrations
- Many sources contribute nitrogen in each springshed:
  - atmospheric deposition
  - urban turfgrass fertilizers
  - septic tanks
  - land application of wastewater
  - livestock manure
  - farm fertilizers



Nitrogen Source Inventory and Loading Tool

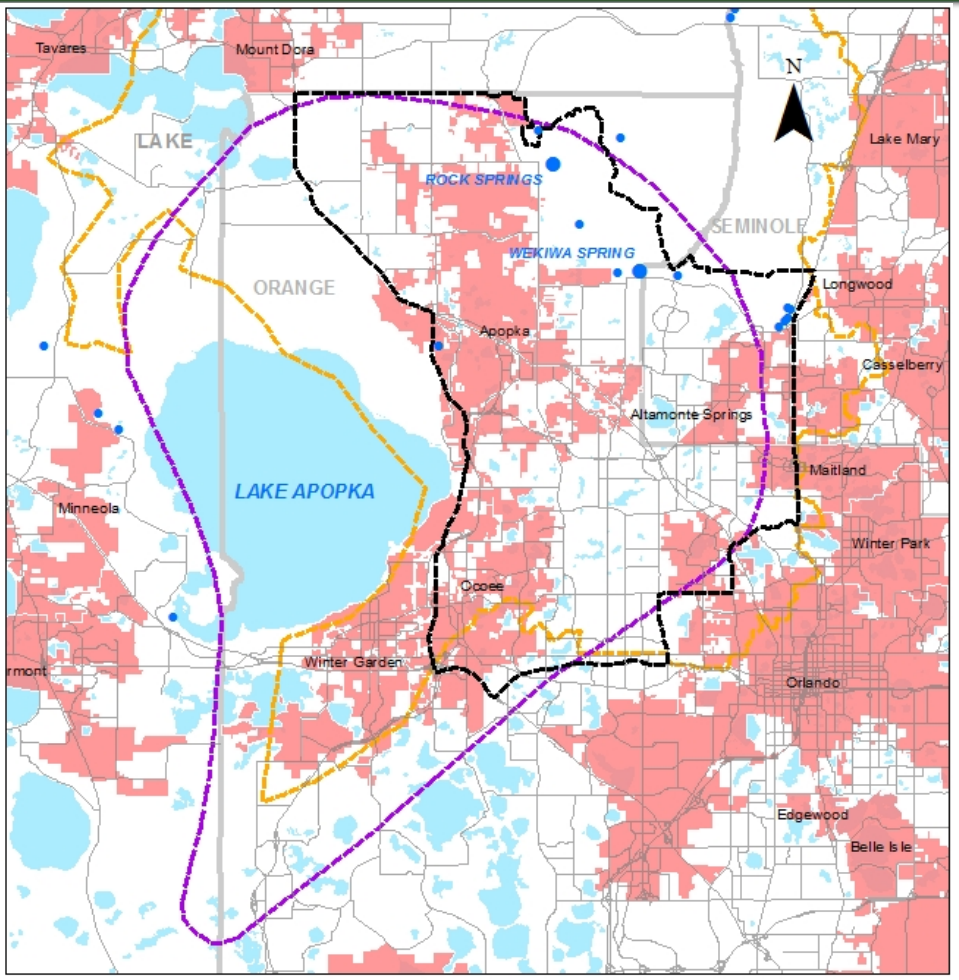
- Estimate N loading to groundwater with BMAP areas
- Identify sources for which reductions in N loading could achieve restoration of impaired waters
- We customize the inventory for each spring basin or BMAP area to account for hydrogeologic and land use differences
- Inventories have been completed for Wakulla, Jackson Blue, Volusia Blue, Silver, Rainbow, the Springs Coast Springs, and springs in the Suwannee Basin

Combined Wekiwa-Rock Springshed Area



This map was prepared on 05/03/17 by FDEP Groundwater Management Section. For display purposes only. For more information: C.Lyon (850) 245-8652

Wekiwa-Rock Area

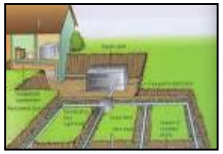


Estimating Nitrogen Loads to Groundwater

Steps:

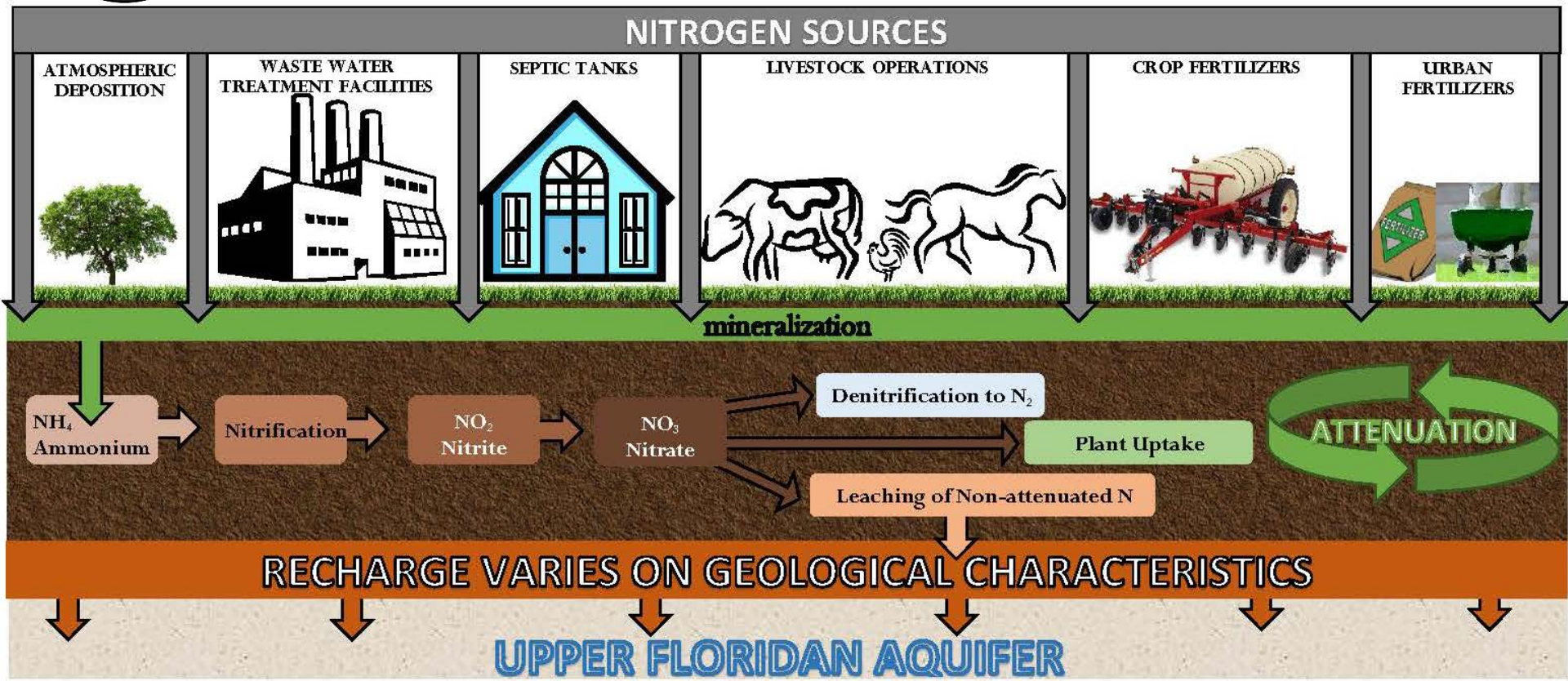
1. Estimate the inputs of nitrogen to the land surface from the source inventory information (best available and most current).
2. Apply attenuation factors based on the various environmental processes that could transform the various forms of nitrogen in the subsurface (such as denitrification, nitrification of ammonia, uptake by plants, mineralization of organic nitrogen).
3. Apply areal weighting factors that are based on the rate of recharge to groundwater to estimate nitrogen loads to groundwater.
4. Fine-tune estimates after getting feedback from stakeholders.







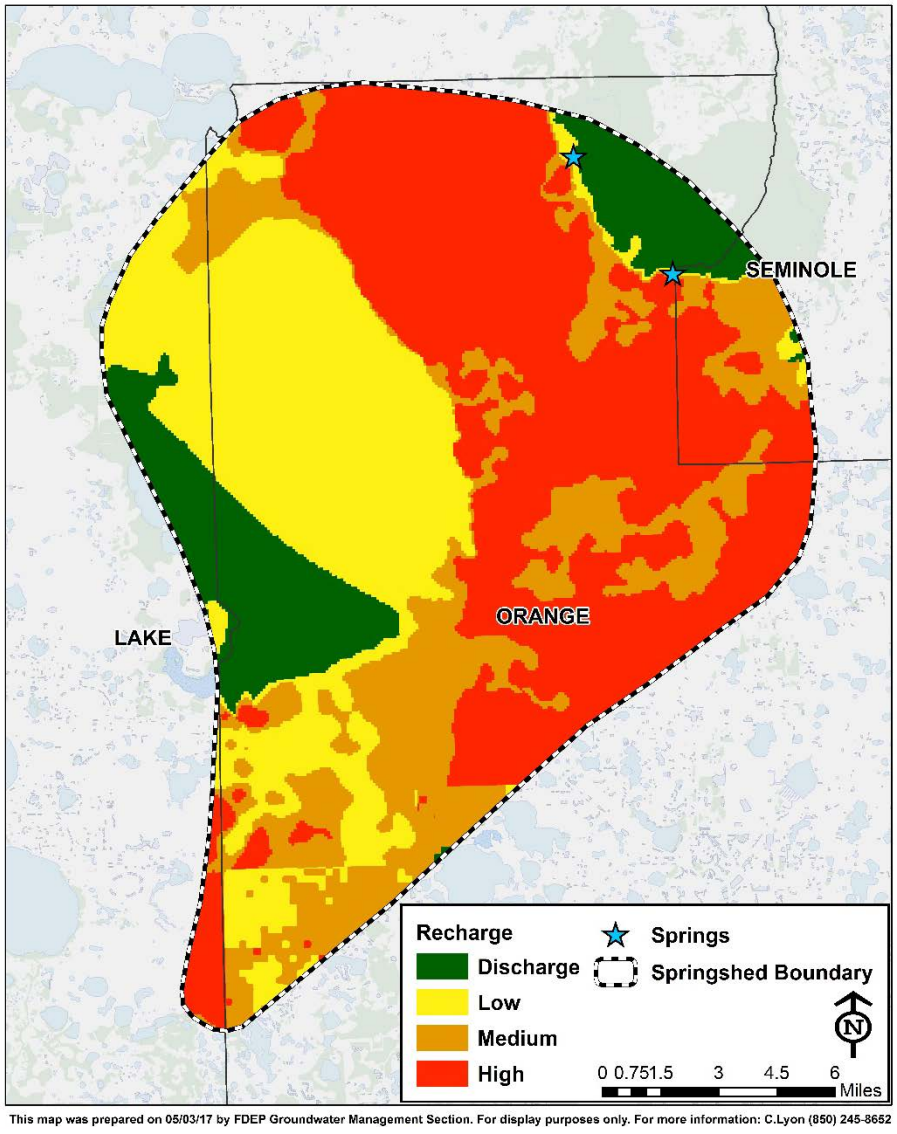

Nitrogen Cycle and Nitrogen Attenuation



Processes that control the transformation of N in soils and the subsurface.

The wide ranges reflect variable soil conditions, fertilizer material, livestock, crop types, etc.,
ALL AFFECT LEACHING OF N TO GROUNDWATER

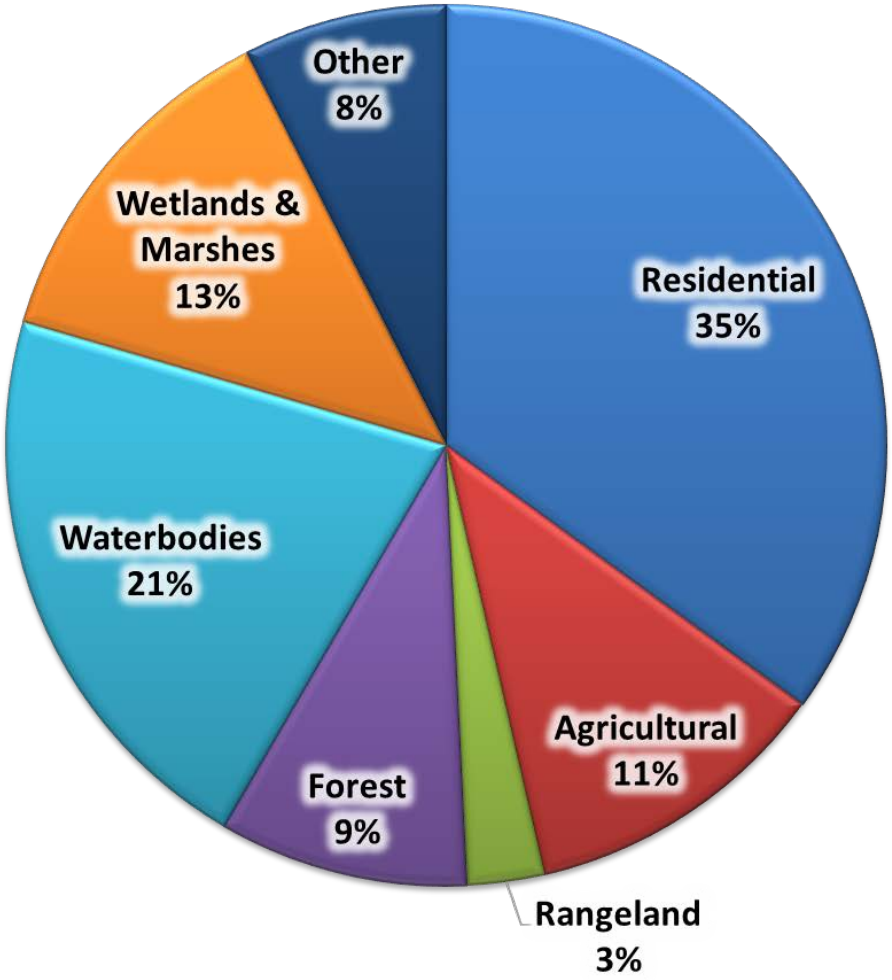
Groundwater Recharge Areas



This map was prepared on 05/03/17 by FDEP Groundwater Management Section. For display purposes only. For more information: C.Lyon (850) 245-8652

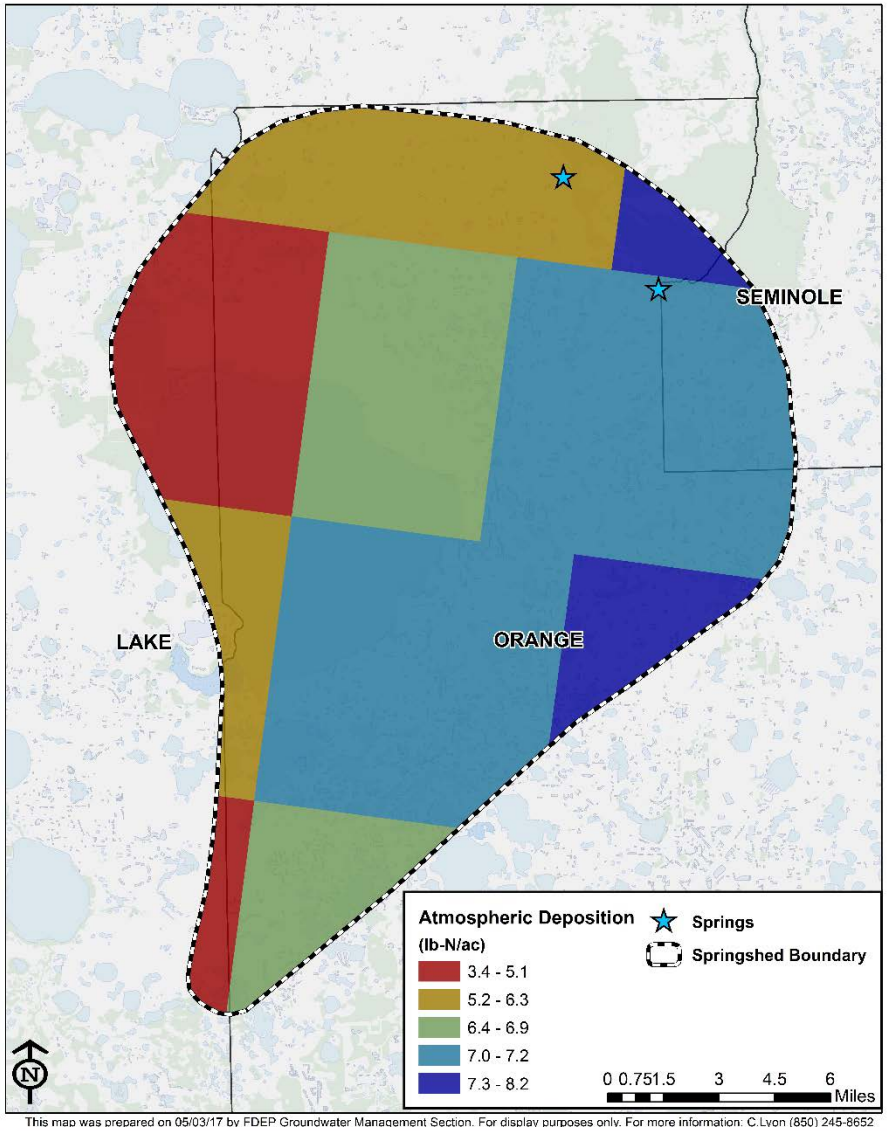
- Inputs to land and loads to groundwater are calculated by recharge region within the springshed
- SJRWMD (2015) mapped areas of relative recharge to the UFA based on geological properties
  - High Recharge: >10 in/yr
  - Medium Recharge: 3-10 in/yr
  - Low Recharge: 0-3 in/yr
- A weighting factor is assigned to recharge category to account for additional attenuation:
  - High, 0.9
  - Medium, 0.5
  - Low, 0.1

Land Use in the Springshed



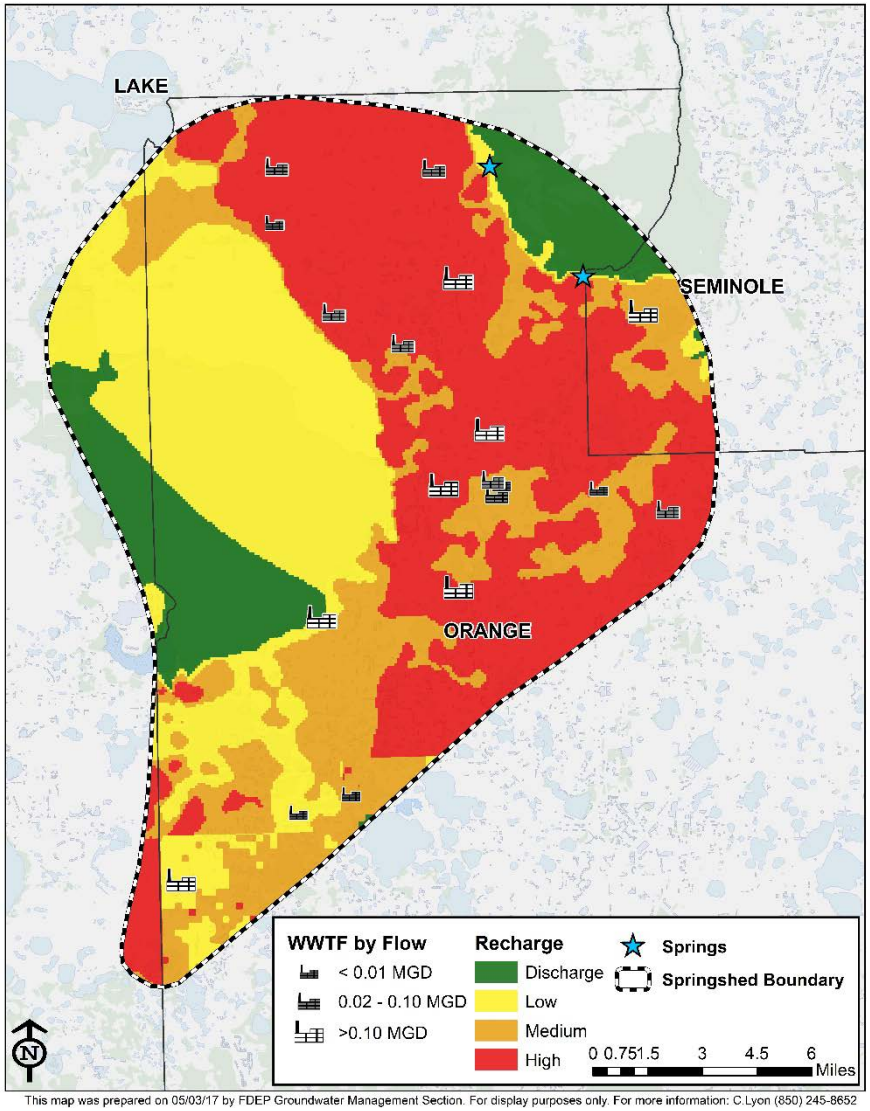
- Majority of N inputs occur within agricultural and urban land areas
- These categories represent 46% of the land use within the springshed

Nitrogen Input: Atmospheric Deposition



- TDEP model
  - U.S. EPA method to estimate spatially continuous atmospheric deposition
  - Nationwide total deposition model for N and S
  - Estimated deposition based on monitoring stations and modeled atmospheric concentrations
  - Model year is an average from 2011 to 2013
  - Average TN deposition
    - Range 5.4-7.8 lb-N/ac/yr

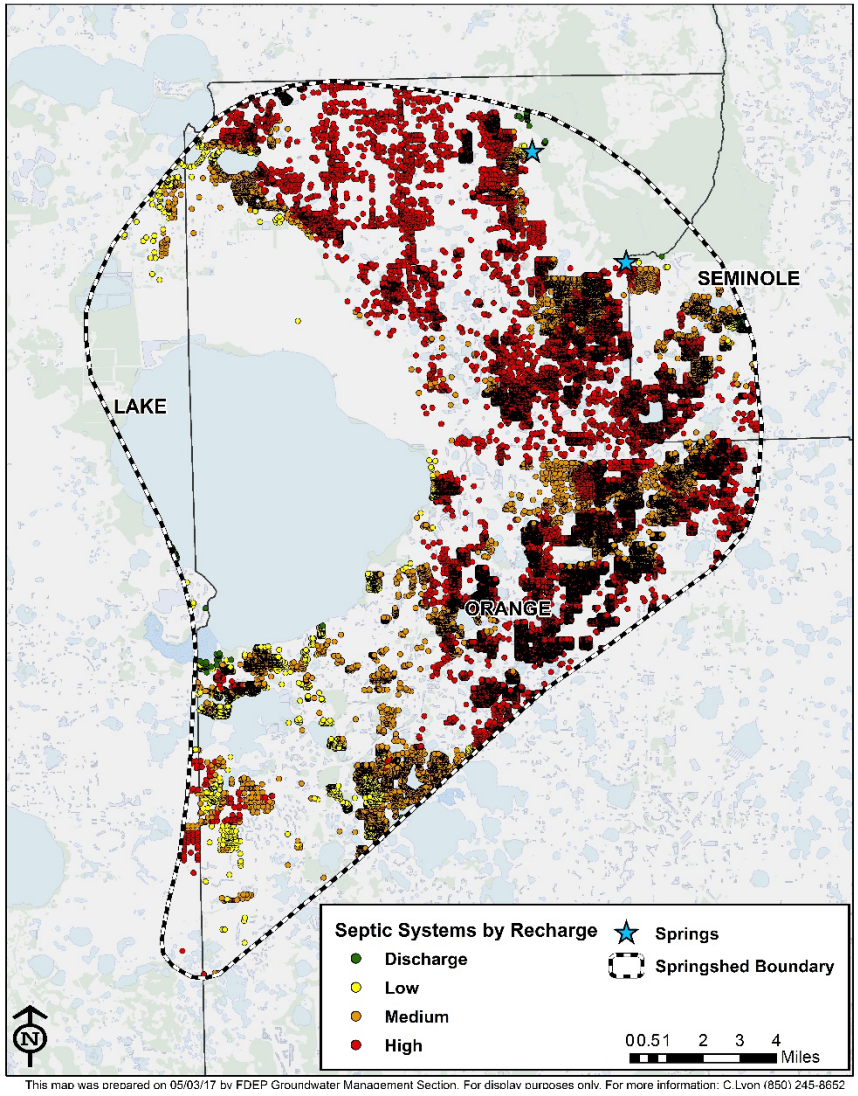
Nitrogen Input: Domestic Wastewater



- Inventory includes domestic WWTF application sites in the springshed
- TN effluent concentrations as reported to DEP
- NO_3 used to project TN data, if necessary
- Effluent data separated based on treatment type
  - RIBs, Absorption Fields
  - Sprayfields
  - Reclaimed Water Application
- 19 permitted facilities apply wastewater in the springshed
  - 7 with discharge ≥0.1 MGD

Nitrogen Input: Septic Systems (OSTDS)

- Septic count taken from DOH's Florida Water Management Inventory (FLWMI)
- Accuracy of this data was verified using an aerial analysis
- Calculate # of people relying on septic tanks
  - Lake County = 2.03 people per household
  - Seminole County =2.05 people per household
  - Orange County =2.15 people per household
  - Average annual input to septic tank = 9.012 lb-N/person (US EPA)



Nitrogen Input: Livestock Waste

Literature review provided information on common livestock animals in Florida

- Animal waste factors

2012 Census of Agriculture (CoA)

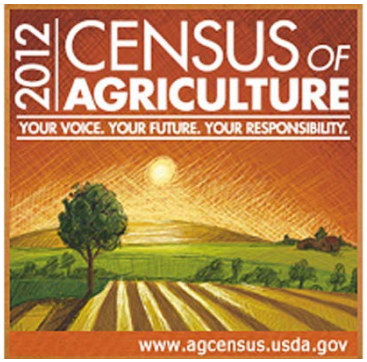
- # of livestock (categorized by animal)
- Full county data ONLY

2016 USDA Survey

- # of beef cattle

Use County-level land use information to estimate livestock population within the springshed

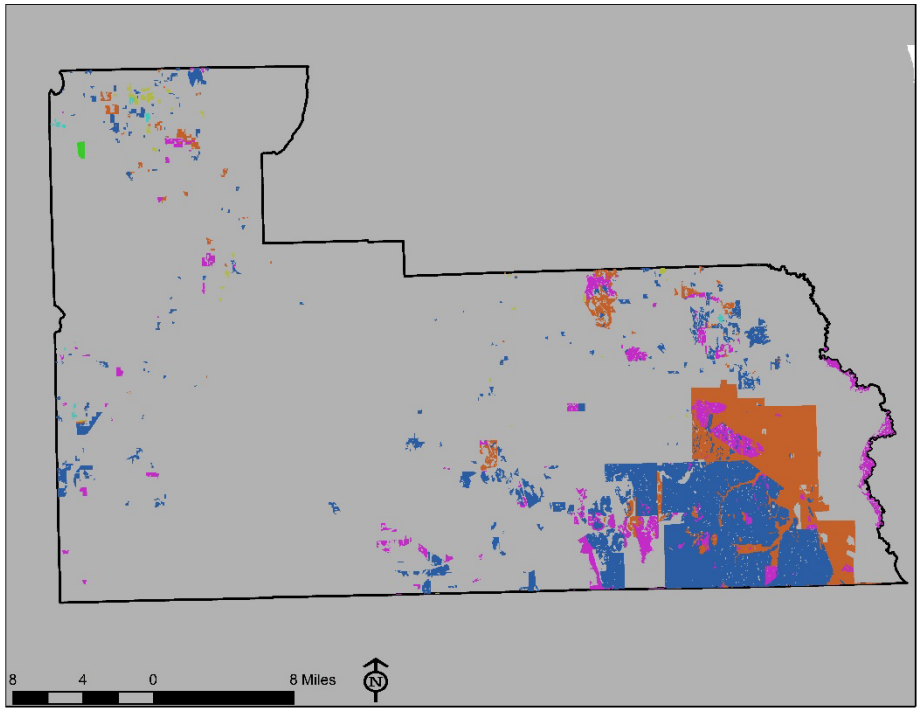
Land Use Description
Cattle Feeding Operations*
Feeding Operations*
Horse Farms
Improved Pastures*
Poultry Feeding Operations
Range Land, Herbaceous (Dry Prairie)*
Specialty Farms
Unimproved Pastures*

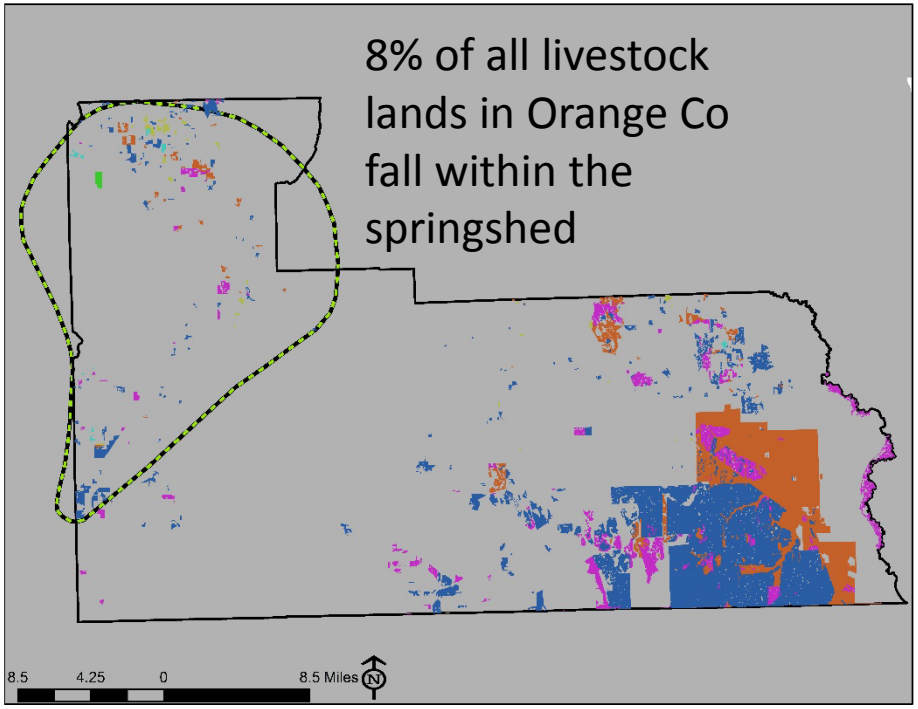


Livestock	Waste Factor (lb-N/day)
Beef Cows	0.337
Other Beef Cattle	0.31
Chicken, broilers	0.002
Chicken, layers	0.003
Calves	0.068
Equine	0.273
Goats	0.035
Hogs	0.19
Sheep	0.198
Turkeys	0.006

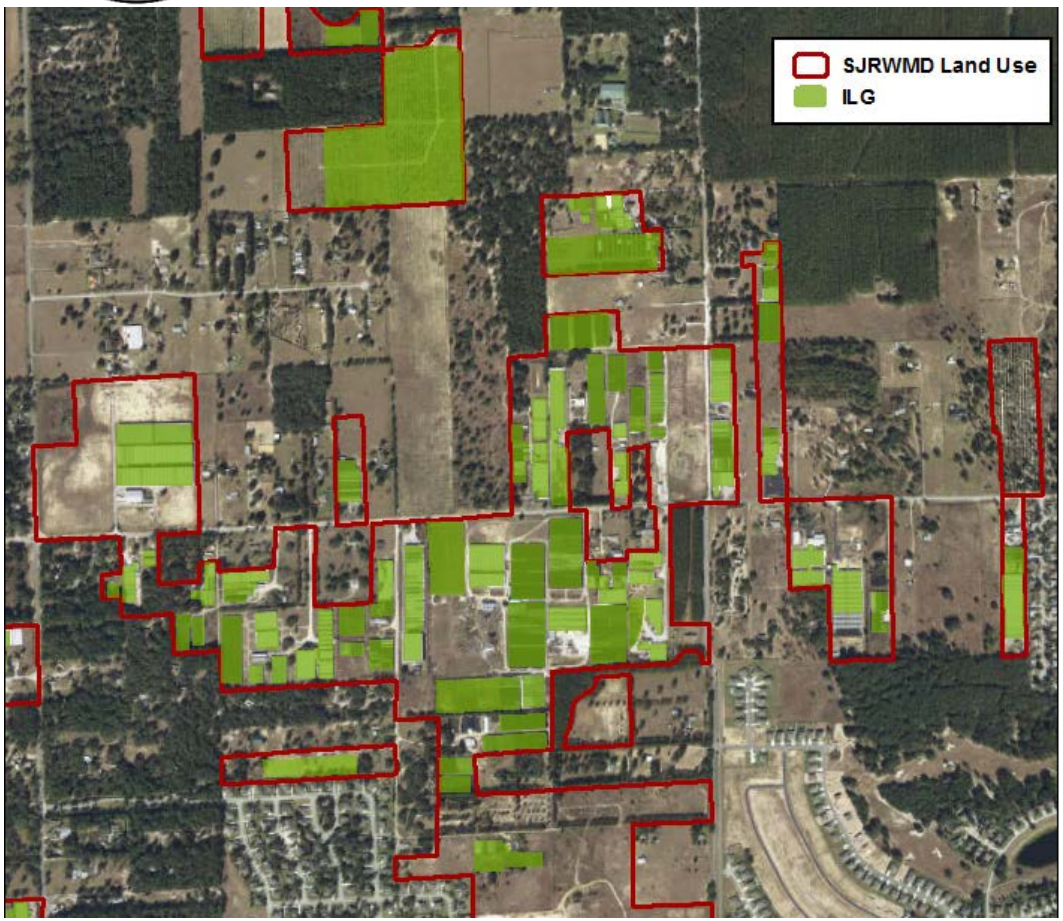
USDA

Land use Percentages: Livestock





Combination of Three Agricultural Land Use Tools to Estimate Crop Type and Acreage to Calculate Nitrogen Input



Irrigated lands and crop type based on FSAID irrigated lands geodatabase (ILG).

Outside of ILG, agriculture areas based on WMD land use and Property Appraiser Data.

Crop fertilizer application rates were applied to the acreages identified within springsheds based on crop type.

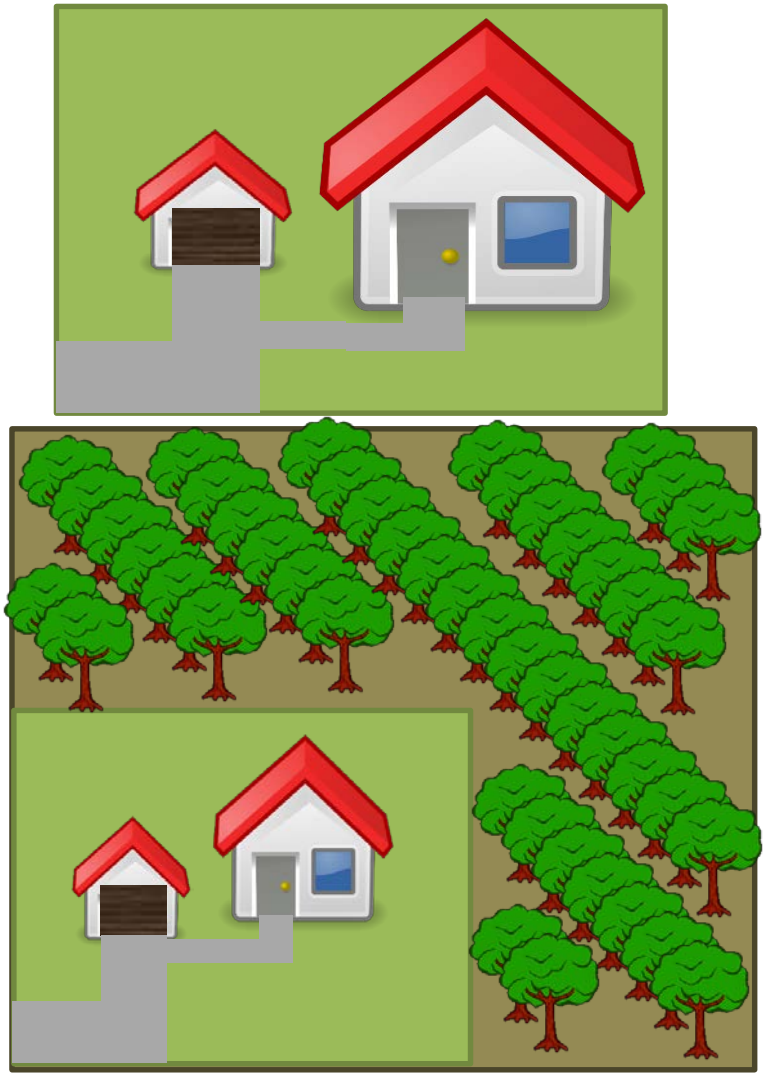
Application rates based on UF-IFAS recommended rates as well as producer feedback.

Working with FDACS to verify coverage of nursery operations and citrus groves

Working with nursery industry to help understand nitrogen fertilizer use

Nitrogen Input: Urban Turfgrass Fertilizers

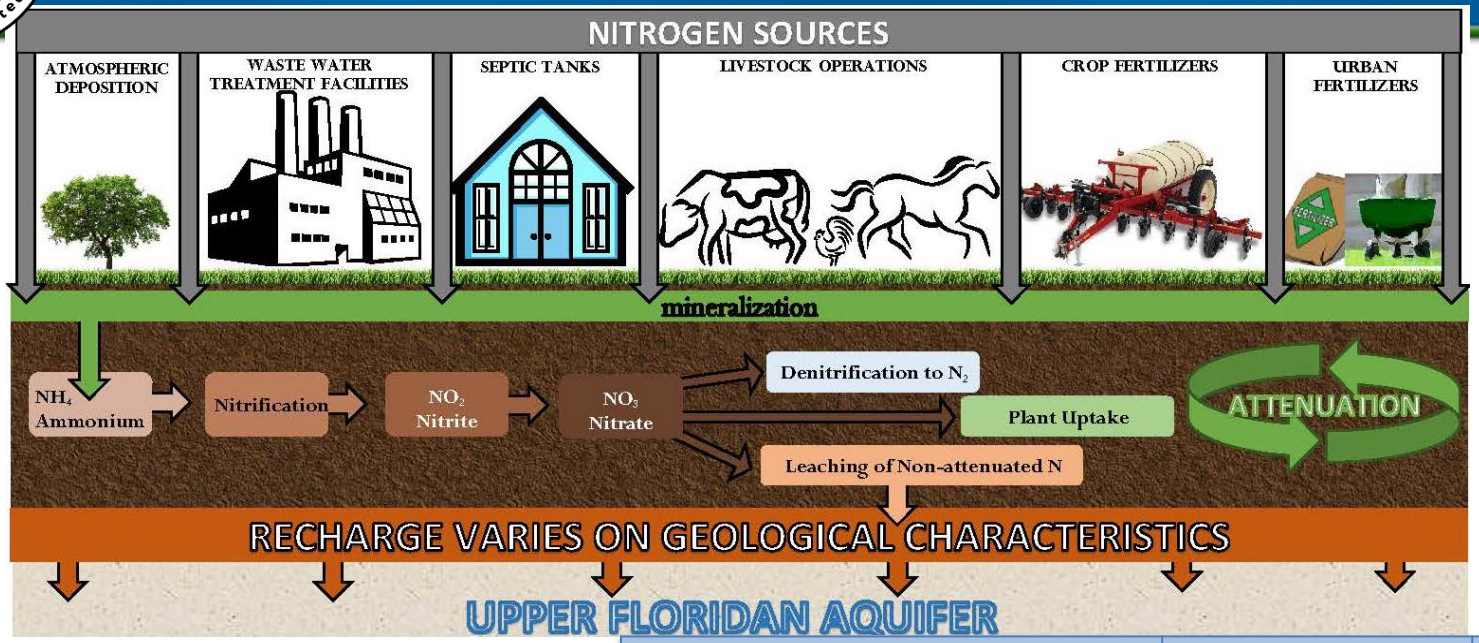
- Acreage likely to receive fertilizer estimated from PA data and property values
  - Residential
  - Non-residential
- Maximum fertilizable acreage was capped at 1 acre
- Property values used to assess probability of fertilization
- Annual Application Rates based on 2009 study by UCF in the Wekiva area
  - 51% fertilized by owners
    - 2.88 times year
  - 33% fertilized by lawn service
    - 4.76 times a year
  - 16% non-fertilized



Sports Turfgrass Fertilizers

- Sports fields
  - Acreage estimates from aerial analysis of PA landuse data
  - Application rates based on commercial turf maintenance estimates
- Golf Courses
  - Acreage estimated through PA landuse data
  - Application rates based on data provided by golf courses
  - Annual application rate = 4.5 lb-N/1,000 sq ft

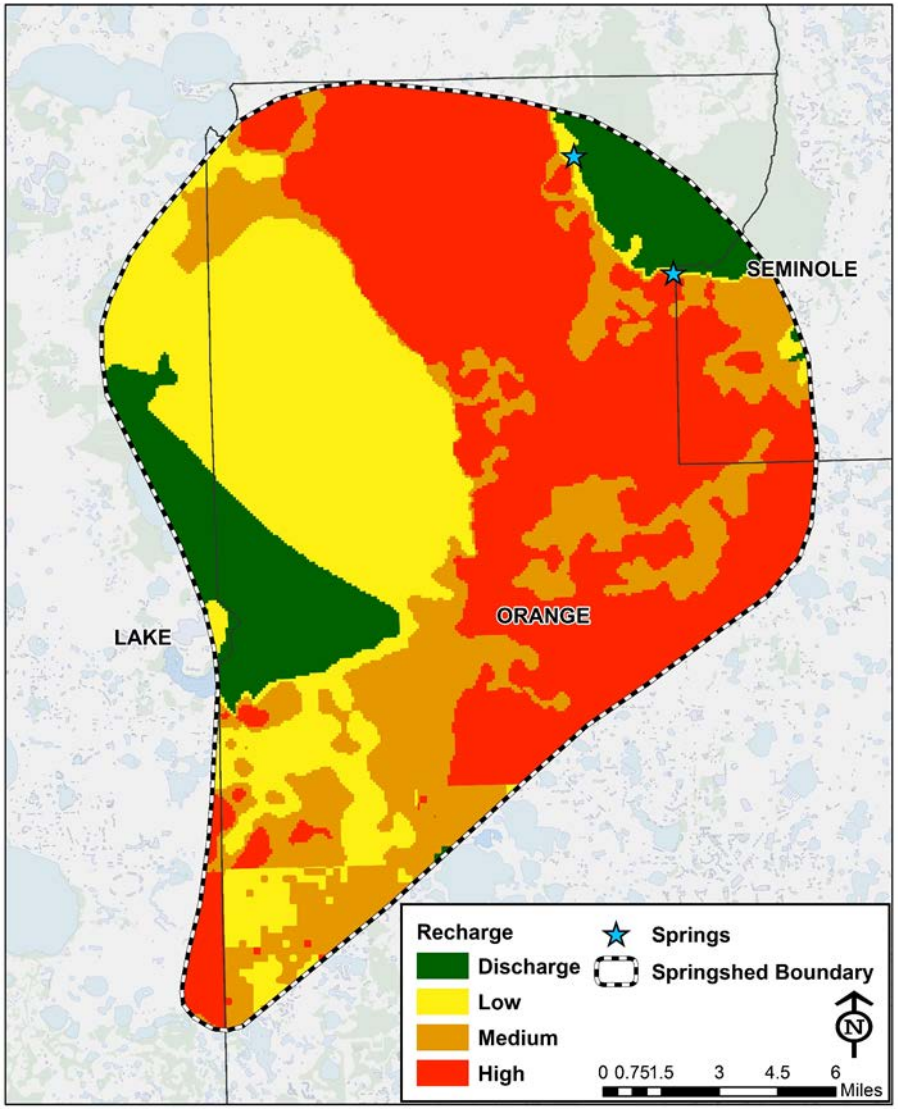
Biochemical Attenuation Factors



- Represent the percentage of N removed and therefore not available for leaching to groundwater
- Based on factors used in similar past studies and found in relevant literature
- Septic tank attenuation TBD

Loading Category	N Attenuation Factor	N Leaching
Atmospheric Deposition	90%	10%
Septic Systems*	TBD%*	TBD%*
WWTF-RIB	25%	75%
WWTF-Sprayfield	60%	40%
WWTF-Reuse	75%	25%
Urban Turfgrass Fertilizers	70%	30%
Sports Turfgrass Fertilizers	70%	30%
Farm Fertilizers	80%	20%
Livestock	90%	10%

Hydrogeological Attenuation Factors Based on Recharge to UFA



- Recharge factors are used to estimate the percentage of the non-attenuated nitrogen expected to reach the aquifer in a year

10%

50%

90%

Next Steps

- Complete inventory for agricultural source inputs
- Complete modeling effort to help refine attenuation factors for septic tank effluent
- Develop draft inventory for stakeholder review and comment
- Revise and refine NSILT results
- NSILT results and information on nitrate loads from the springs will be used for estimating nitrogen reductions needed

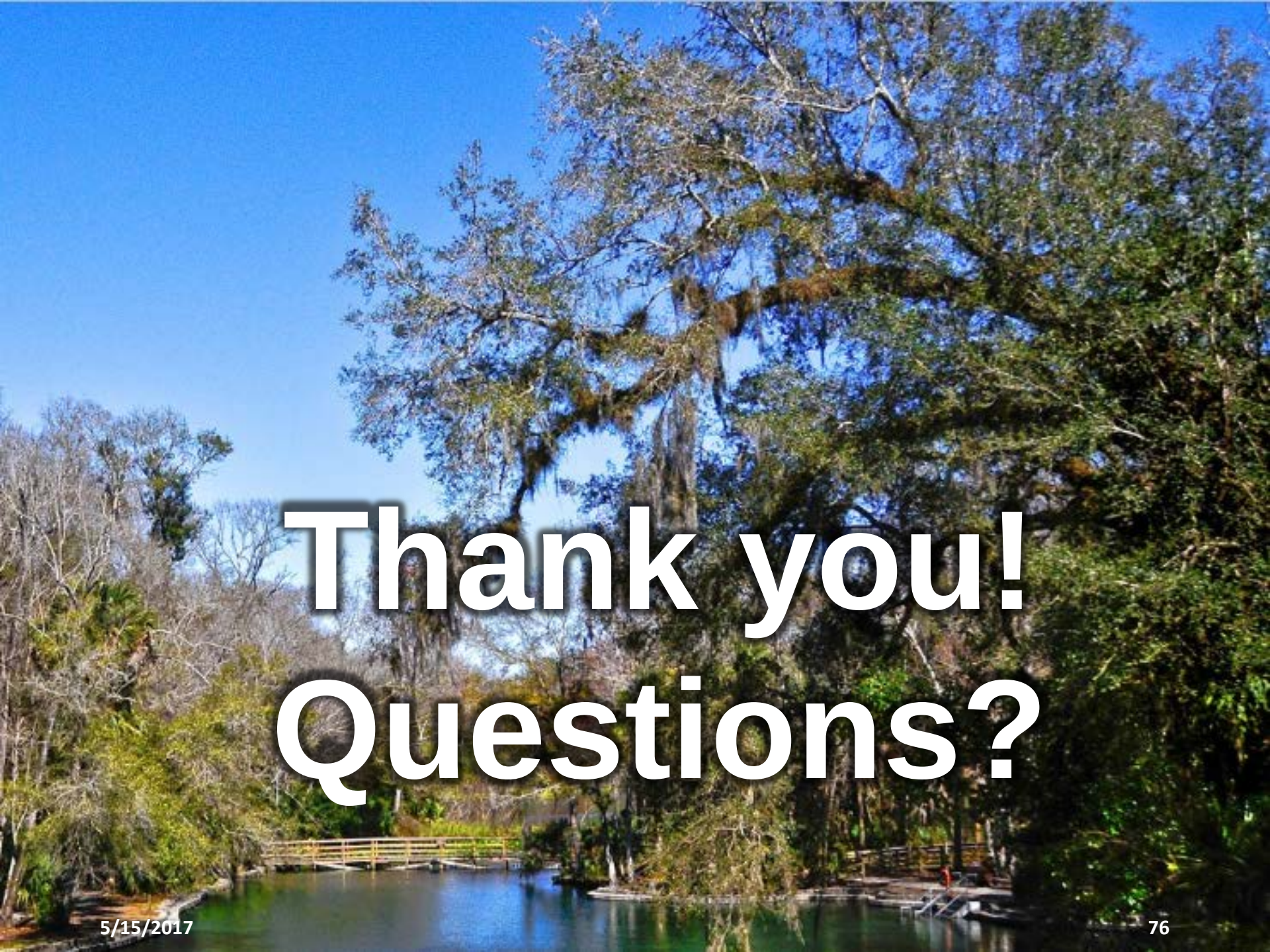
QUESTIONS??

Division of Environmental Assessment and Restoration
Groundwater Management Section

Celeste.Lyon@dep.state.fl.us

Wrap Up

- Action Items.
  - Annual report comments by **May 31, 2017**.
  - Next meeting, July/August time frame.
- Other comments/announcements.


Thank you!
Questions?

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