Unintended Consequences of the 2008 Fertilizer Ord. in Lee County

Ernesto Lasso de la Vega

Pond Watch Coordinator

PondWatch

Lee County Hyacinth Control District

HYACINTH CONTROL DISTRICT

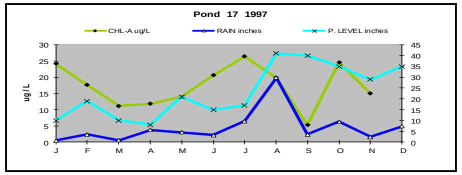
LEE COUNTY

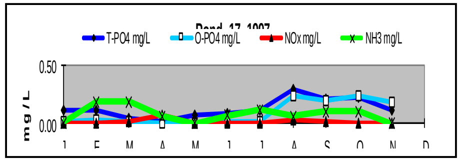
28 Years

PondWatch

Lee County Hyacinth Control District

Hyacinth Control District Lee County





http://www.chnep.wateratlas.usf.edu/new/

Pond Watch Program

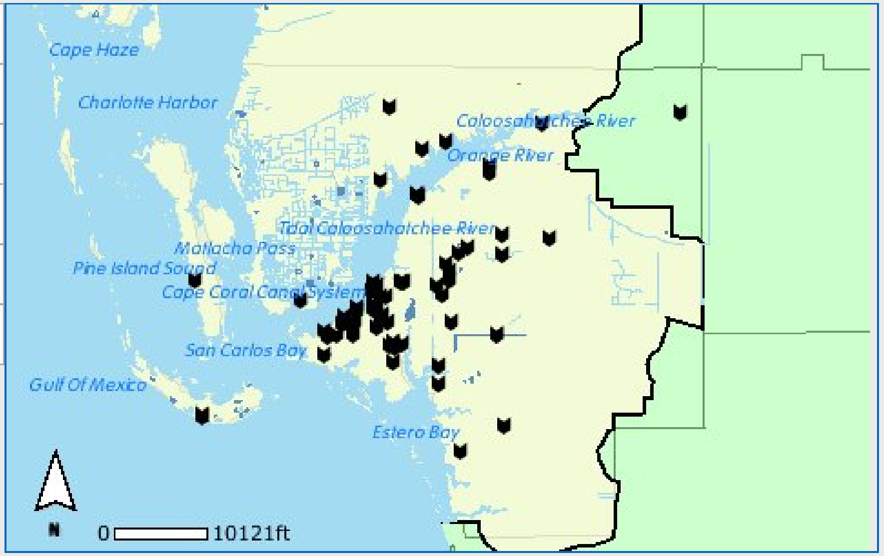
A program of the Lee County Hyacinth Control District

Pond Watch is a citizen volunteer monitoring program established by the Lee County Hyacinth Control District to educate citizens about pond management in stormwater ponds. Homeowners will receive an analysis of the pond and surroundings that relate to conditions that trigger aquatic weed and algae problems. The focus of the program is to identify and manage the source of the nutrient problem and not just the problem itself.

There is no charge for this service, however, the volunteer is expected to bring a water sample from their pond to the District facility every month in order to participate in the program and to understand how using best management practices can improve water quality and reduce excessive weed and algae growth. LCHCD staff provide the sampling containers and instructions on how to take the sample.

Most ponds and lakes in Lee County are artificially created to help control the quality and quantity of the stormwater associated with the pond watershed. As such it is important to determine their pollutant removal efficiency. Stormwater ponds collect pollutants and debris by detaining and slowing the discharge of stormwater to public water bodies. Pond aeration is often a management practice we recommend to address nutrient and low oxygen problems, especially in relatively deep ponds.

Map | Aerials | Water Resources Search

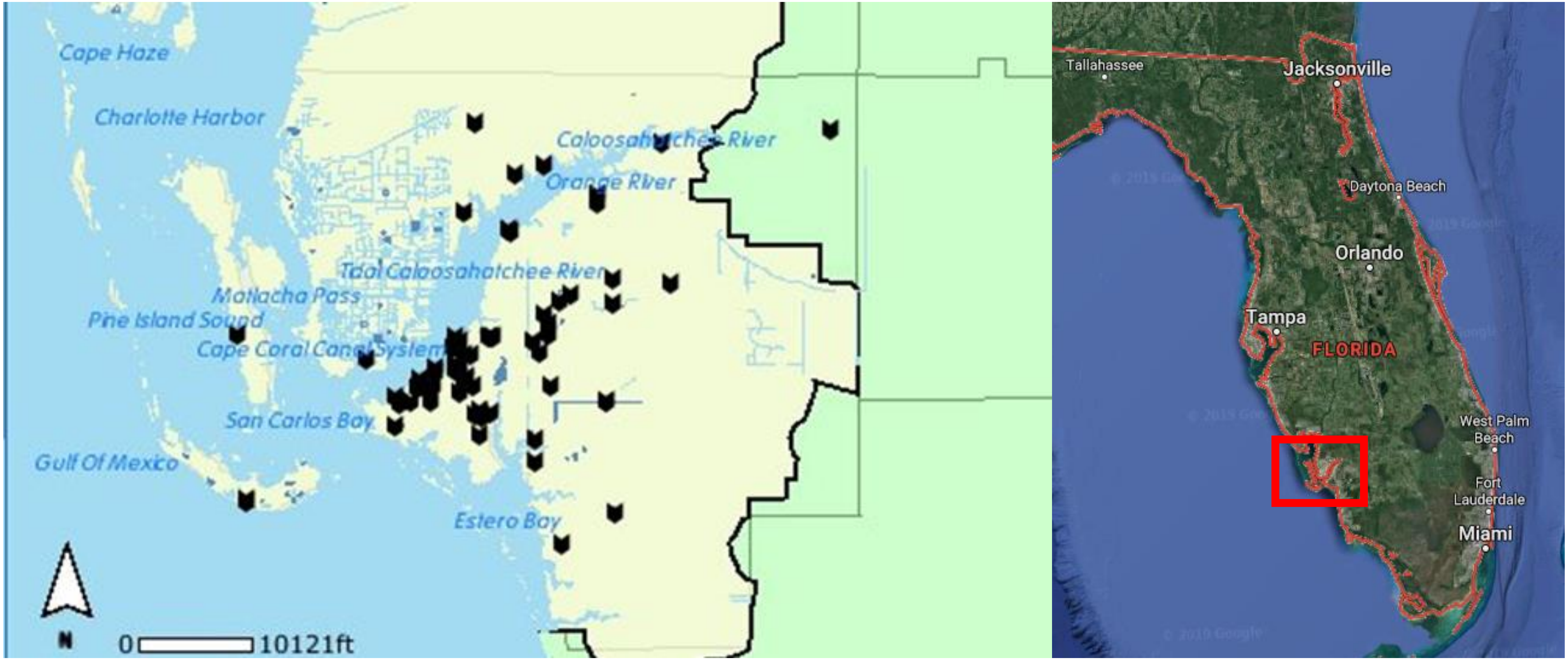


Map Legend

Pond Watch Sample Sites

Select from one of the **67** Pond Watch sampling sites below to view water quality information.

- Airport Canal, 70.1
- Airport Canal, 70.2
- Avalon Preserve, 61
- Beach Walk, 82
- Bill Rose Pond, 40



Cape Haze
Charlotte Harbor
Caloosahatchee River
Orange River
Tidal Caloosahatchee River
Matlacha Pass
Pine Island Sound
Cape Coral Canal System
San Carlos Bay
Gulf Of Mexico
Estero Bay
N
0
10121ft
Tallahassee
Jacksonville
Daytona Beach
Orlando
Tampa
FLORIDA
West Palm Beach
Fort Lauderdale
Miami


MAC

Biological Sciences

Analysis of nutrients and chlorophyll relative to the 2008 fertilizer ordinance in Lee County, Florida

Ernesto Lasso de la Vega[(1)] and Jim Ryan[(2)]

[(1)]Pond Watch Program, Lee County Hyacinth Control District, 15191 Homestead Road, Lehigh Acres, Florida 33971
[(2)]Pond Watch Volunteer, Peppertree Point Association, 2400 Sundial Court, Fort Myers, Florida 33908

Abstract Research and qualitative observations suggest that a major contributor to algae growth in stormwater ponds is the nitrogen (N) and phosphorus (P) contained in fertilizers that enter the ponds via runoff from lawns and impervious surfaces. In May 2008, the Lee County Board of Commissioners enacted a fertilizer ordinance with the objective of lessening discharge of nutrients to stormwater ponds. It prohibits applying fertilizers containing N and P during the four wet summer months (June through September). The Pond Watch Program is a citizen volunteer monitoring program that helps understand and manage community ponds. This study examines Pond Watch data to compare N, P and chlorophyll *a* levels in similar urban stormwater ponds during the wet months of 2004 through 2008 (prior to the fertilizer ordinance enforcement) compared to 2009 through 2013 (after enactment). The results showed a statistically significant difference in the reduction of levels between pre- and post-ordinance in total phosphorus and chlorophyll *a*. This was not the case for total nitrogen. The study suggests that the fertilizer ordinance may have had a positive effect on the reduction of nutrient concentrations in some stormwater ponds, which may contribute reducing the abundance of planktonic algae.

Keywords Chlorophyll, fertilizer ordinance, nutrients, Pond Watch, volunteer monitoring

Introduction

During the summer months in southwest Florida, stormwater ponds exhibit from time to time frequent algae blooms (Greening et al. 2014). Crane and Xian (2006) reported that a major contributor to these algae blooms was the increased amount of nitrogen (N) and phosphorus (P) by anthropogenic activities associated with urban sprawl. N and P contained in fertilizer may enter stormwater ponds from lawns and landscapes, runoff from impervious surfaces and water that percolates through predominantly sandy soils. Ultimately, these waters containing excess nutrients may enter natural water bodies and coastal waters (FDEP 2009).

In 2008, Lee County Board of Commissioners enacted a fertilizer ordinance (Lee County Ordinance 08-08) (Lee County Florida 2008) after technical recommendations from the South West Florida Regional Planning Council and several non-governmental organizations (SWFRPC 2007). These laws became mandatory during the wet months of 2009. Among many of the

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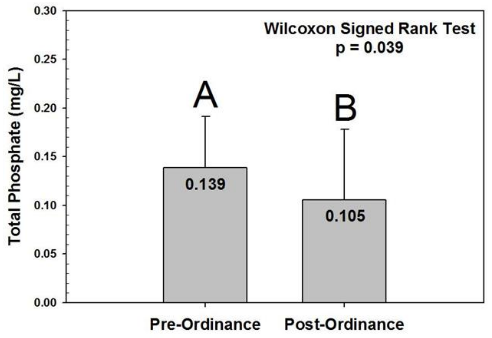
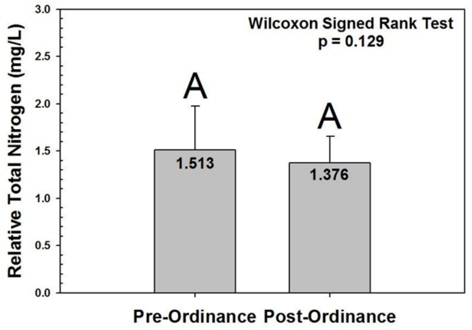
Analysis of Phosphorus, Nitrogen and Chlorophyll a in Storm Water Ponds Relative to the 2008 Fertilizer Ordinance

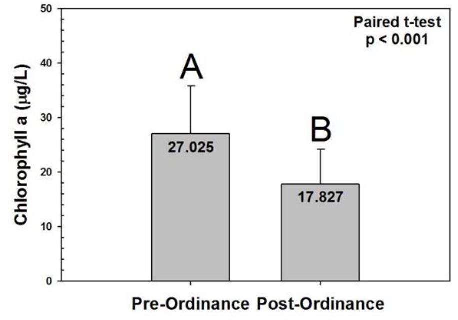
Phosphorus



Nitrogen



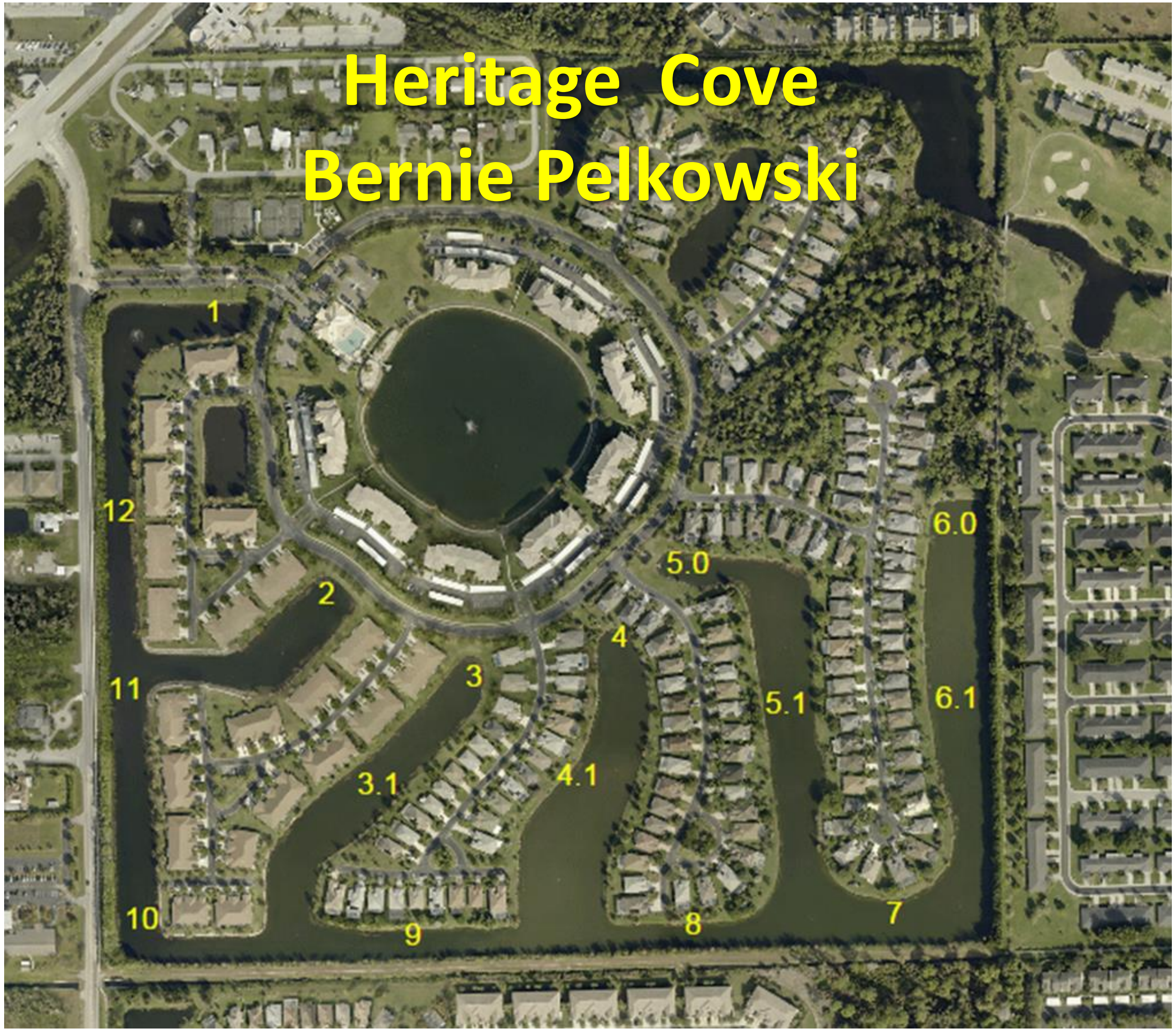
Chlorophyll a

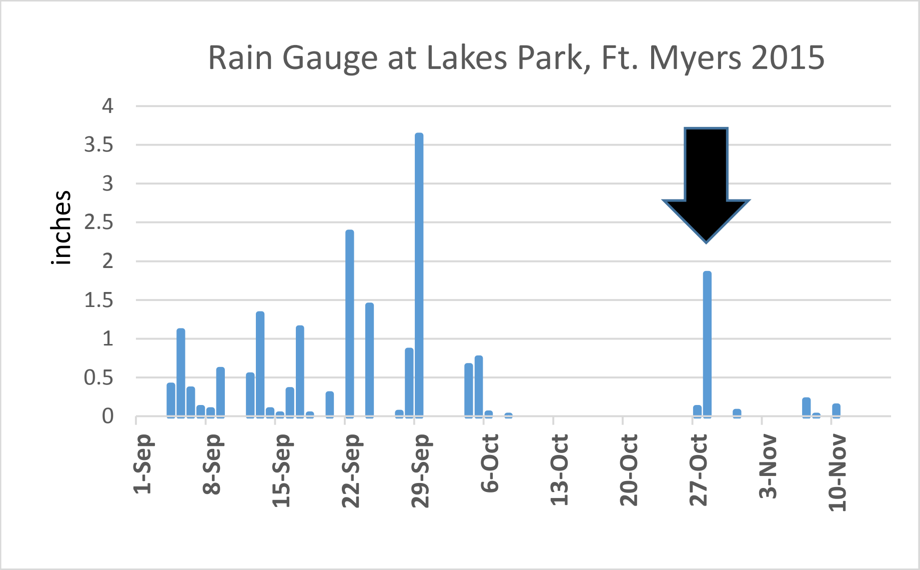


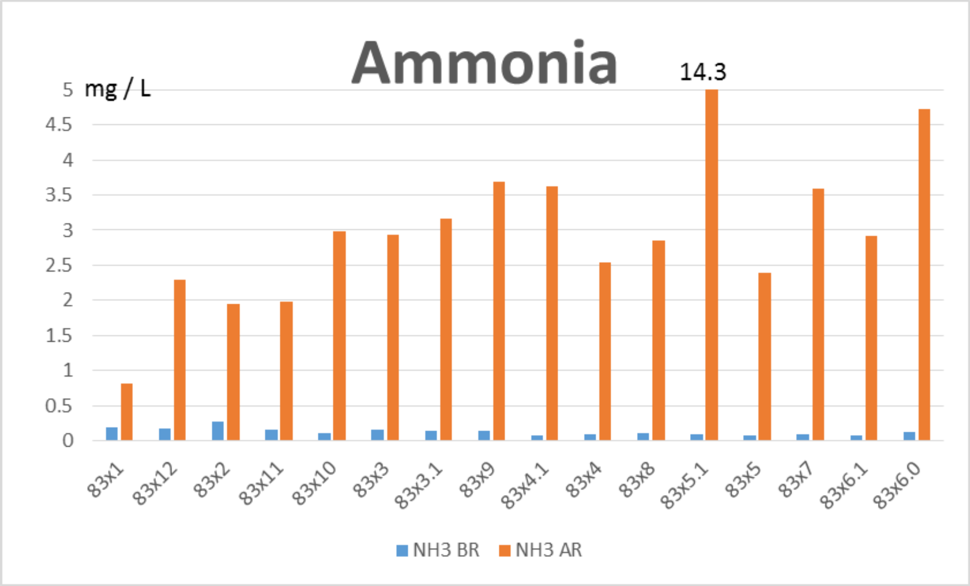
Summary of the Change in Parameter as Relates to the Fertilizer Ordinance per Pond

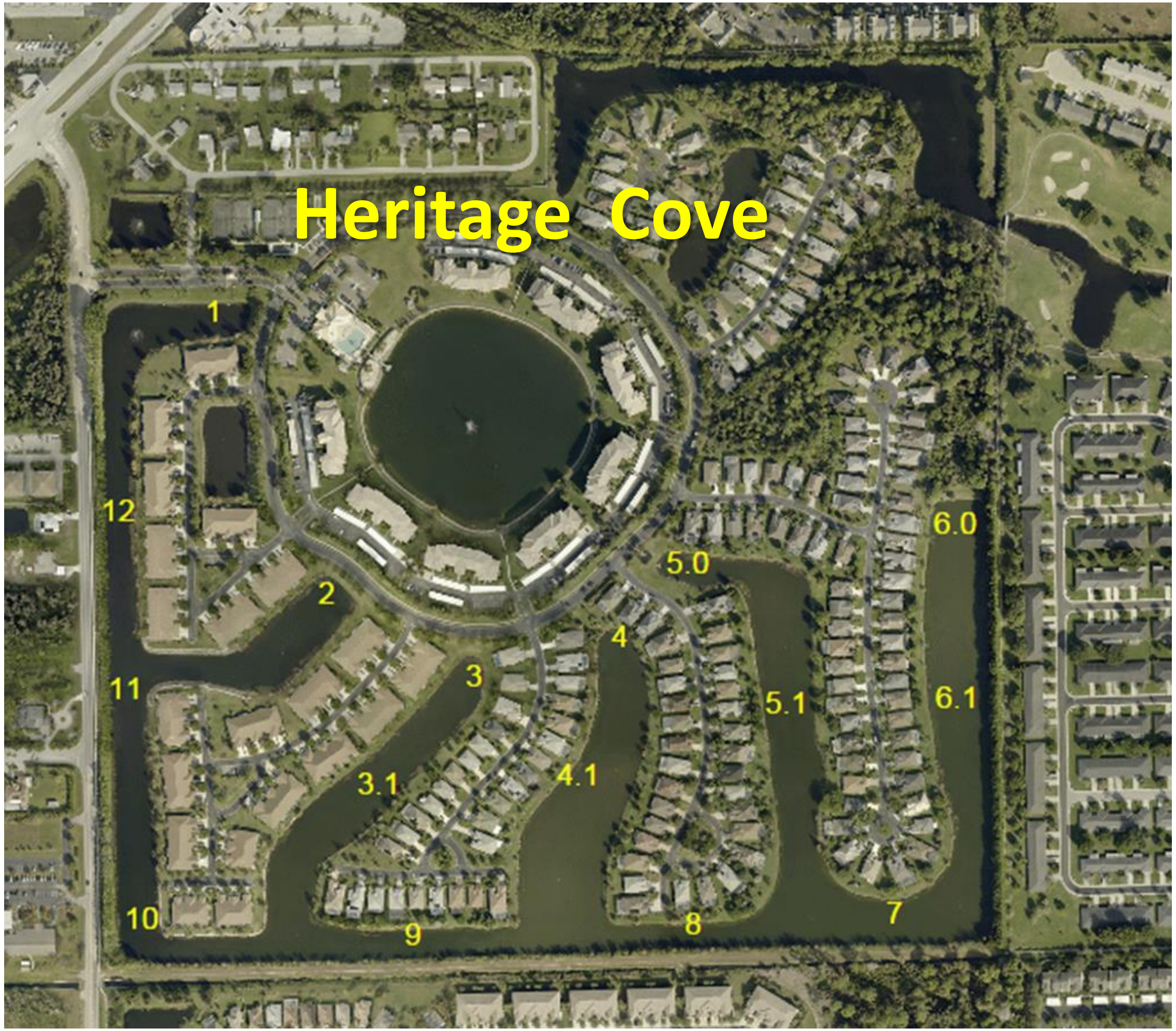
Pond	Location	TP	Rel. TN	Chl *a*
1	Stone Bridge	**Decrease**	No Change	**Decrease**
4	Peppertree Point	**Decrease**	Decrease	Decrease
14	South Point S.	Increase	Decrease	Decrease
35	Corkscrew W.	Decrease	Increase	Decrease
37	Wellington	**Decrease**	Decrease	Decrease
42	Wyldewood L.	Decrease	Increase	Decrease
47	South Wind	Decrease	Decrease	**Decrease**
54	Candlewood L.	**Decrease**	**Decrease**	**Decrease**
57	Calosa Creek	Decrease	Decrease	Decrease

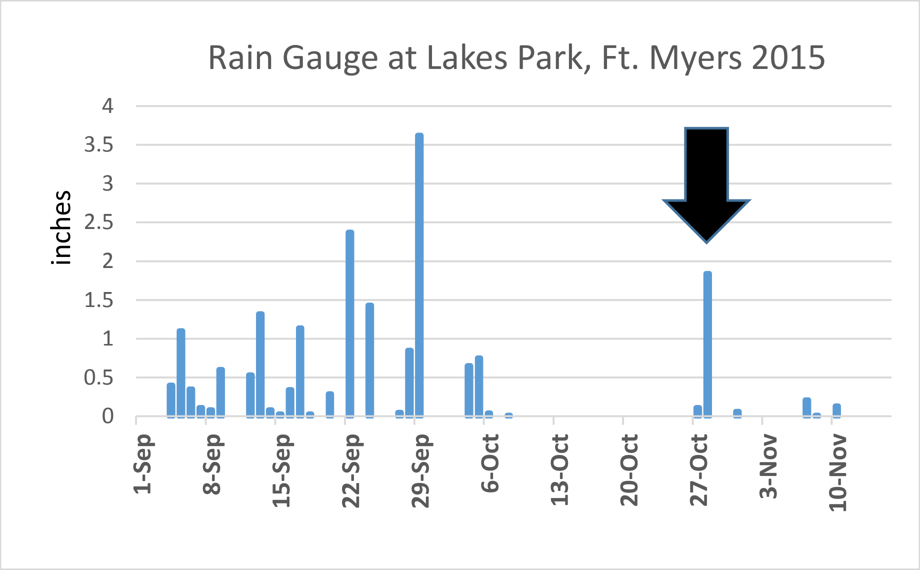
Significant Reduction
No Significant Reduction
Increase

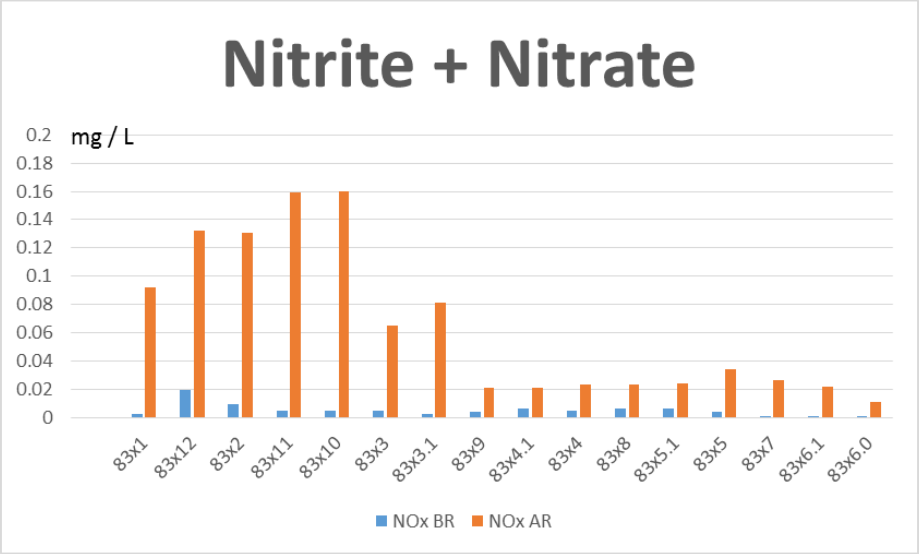

Heritage Cove
Bernie Pelkowski
1
2
3
3.1
4
4.1
5.0
5.1
6.0
6.1
7
8
9
10
11
12

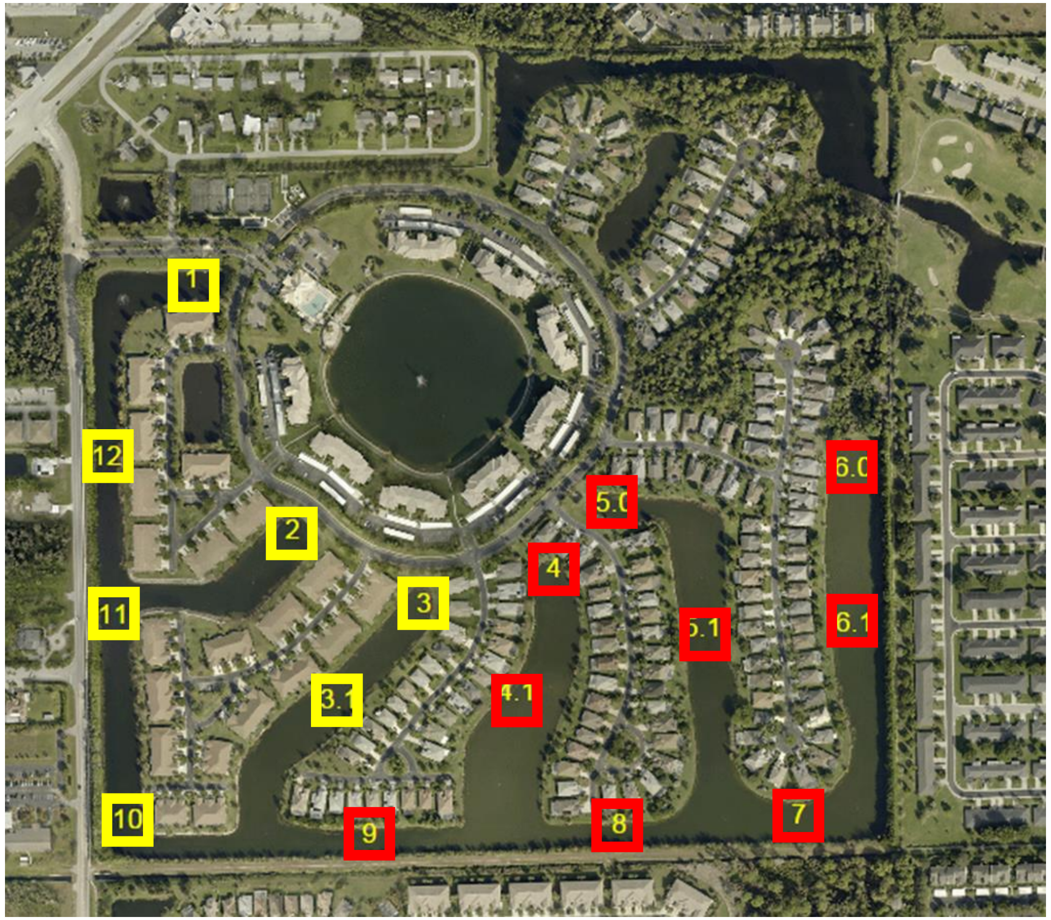

Rain Gauge at Lakes Park, Ft. Myers 2015
inches
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct
27-Oct
3-Nov
10-Nov

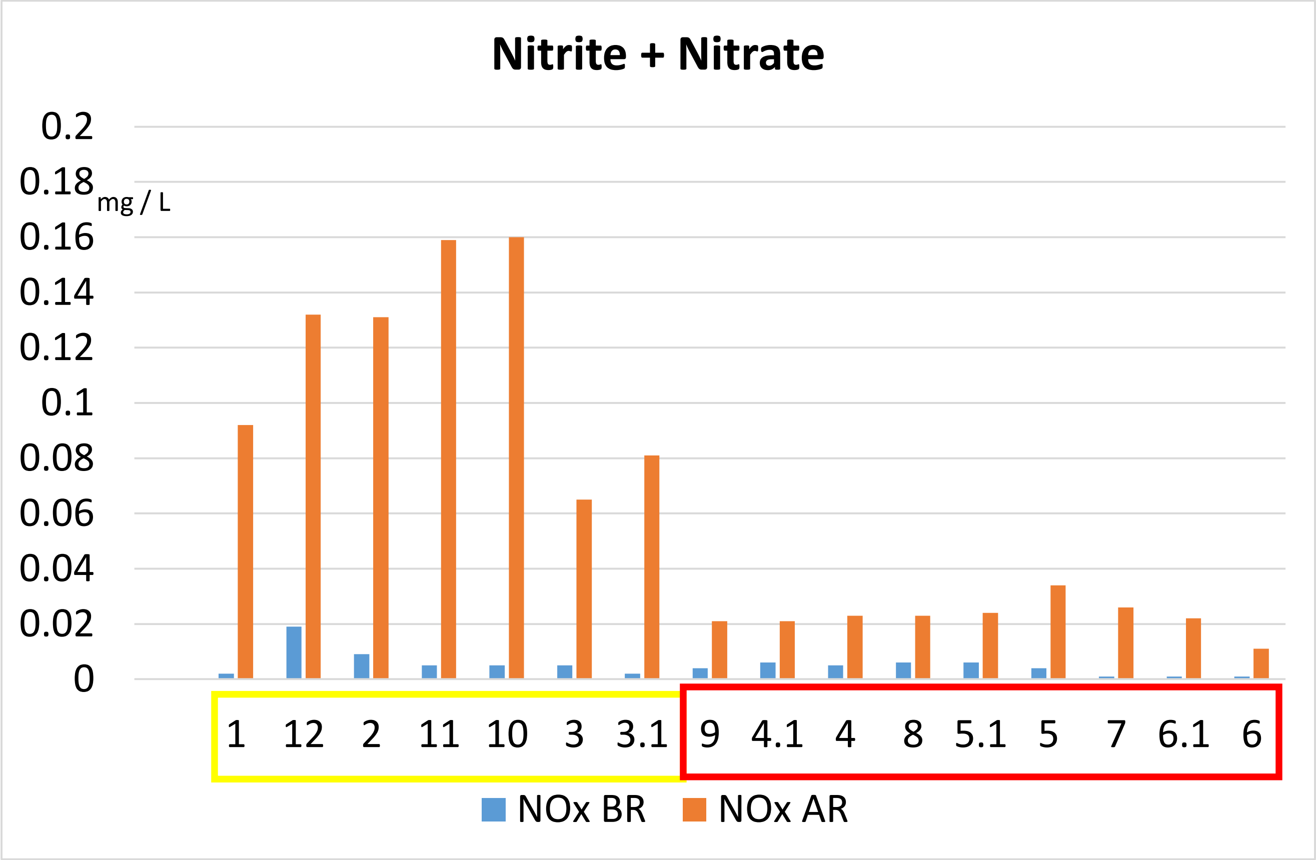

Ammonia
14.3
5 mg / L
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
83x1
83x12
83x2
83x11
83x10
83x3
83x3.1
83x9
83x4.1
83x4
83x8
83x5.1
83x5
83x7
83x6.1
83x6.0
NH3 BR
NH3 AR

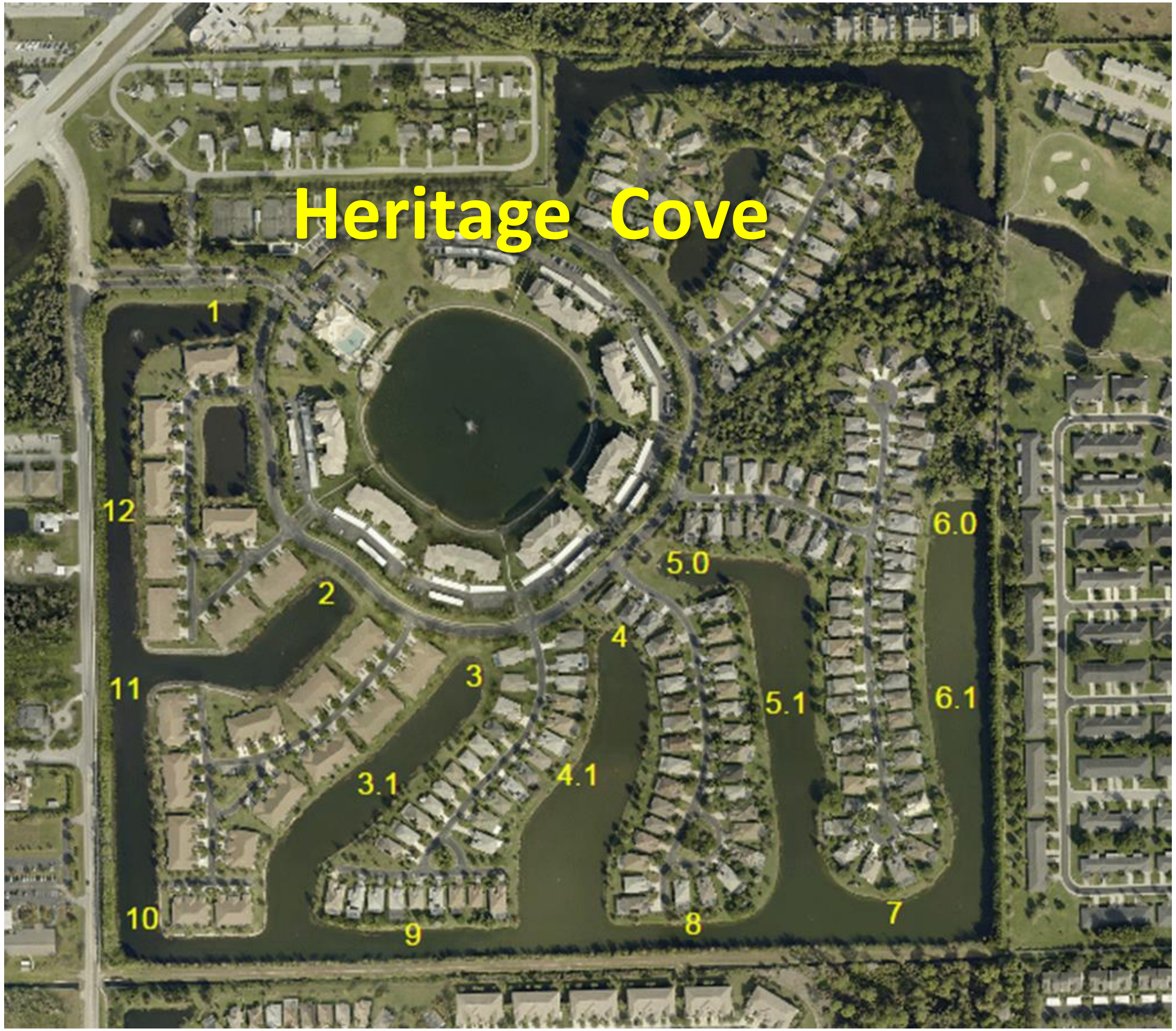

Heritage Cove
1
2
3
3.1
4
4.1
5.0
5.1
6.0
6.1
7
8
9
10
11
12

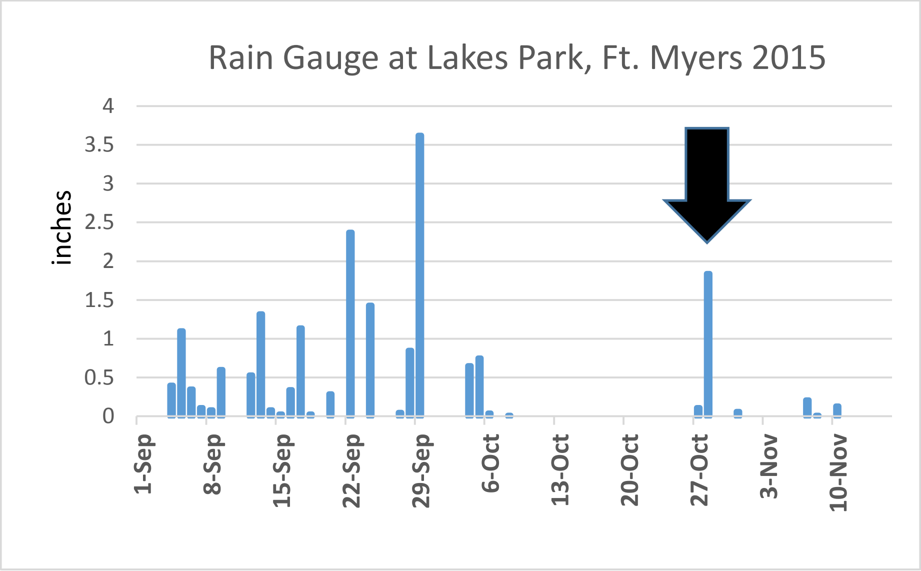

Rain Gauge at Lakes Park, Ft. Myers 2015
inches
0
0.5
1
1.5
2
2.5
3
3.5
4
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct
27-Oct
3-Nov
10-Nov

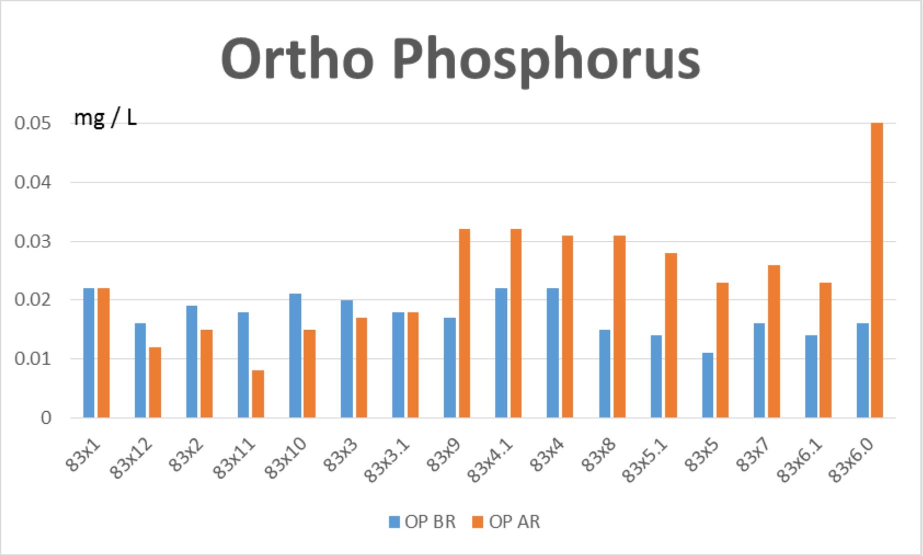

Nitrite + Nitrate
mg / L
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
83x1
83x12
83x2
83x11
83x10
83x3
83x3.1
83x9
83x4.1
83x4
83x8
83x5.1
83x5
83x7
83x6.1
83x6.0
NOx BR
NOx AR


1
12
2
3
11
3.1
10
9
4.1
4
8
5.0
5.1
6.0
6.1
7

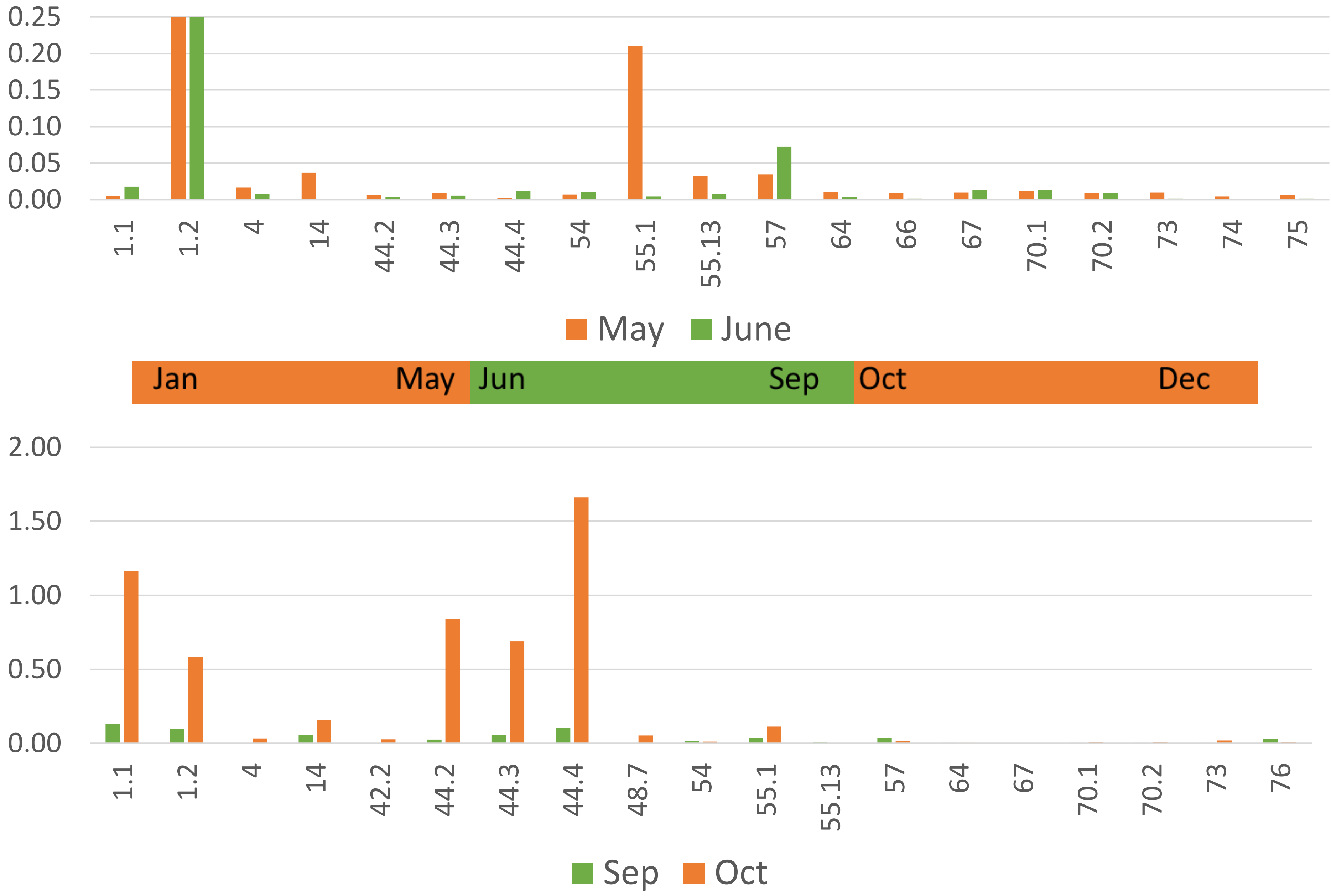

Nitrite + Nitrate
mg / L
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1
12
2
11
10
3
3.1
9
4.1
4
8
5.1
5
7
6.1
6
NOx BR
NOx AR


Heritage Cove
1
2
3
3.1
4
4.1
5.0
5.1
6.0
6.1
7
8
9
10
11
12

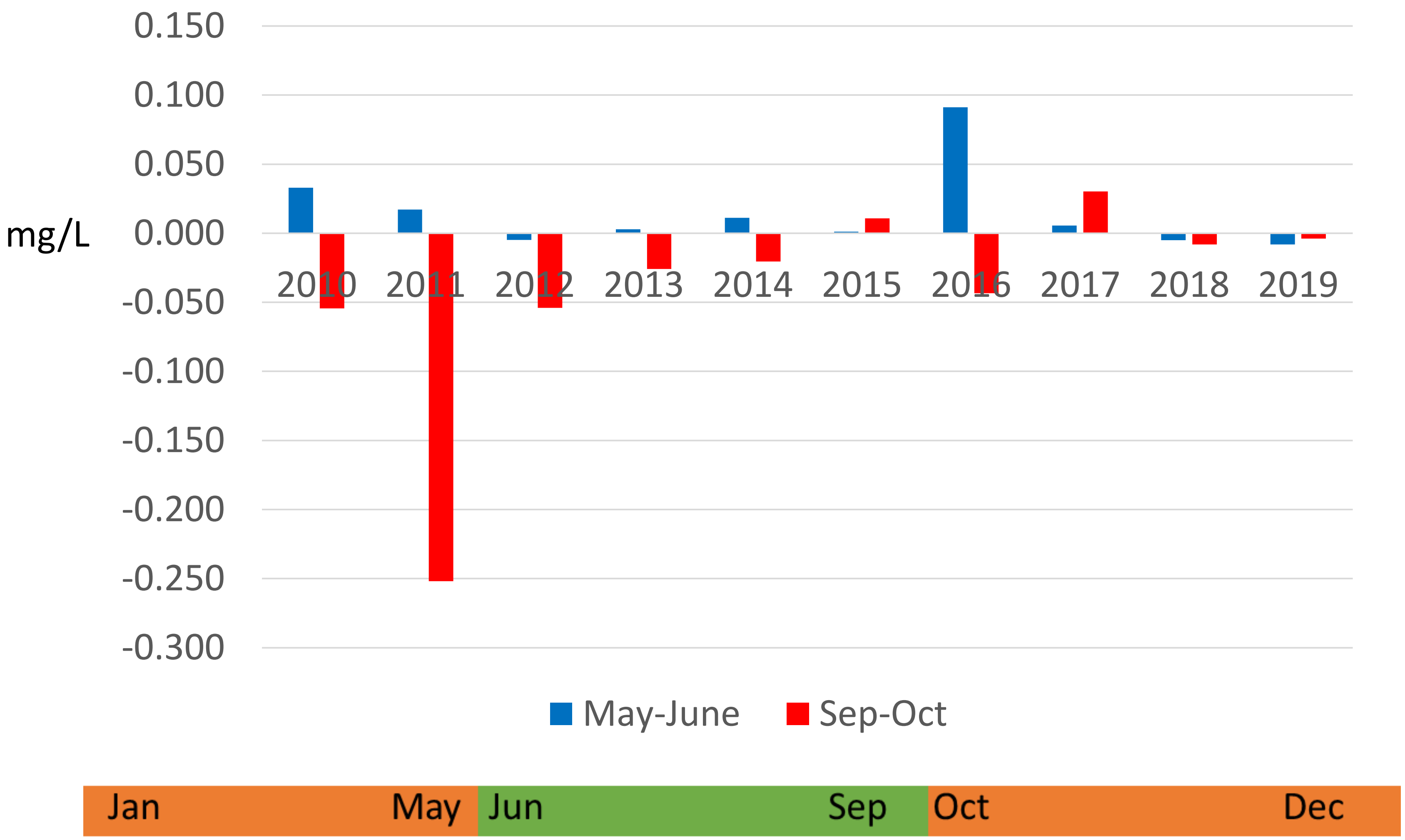

Rain Gauge at Lakes Park, Ft. Myers 2015
inches
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct
27-Oct
3-Nov
10-Nov

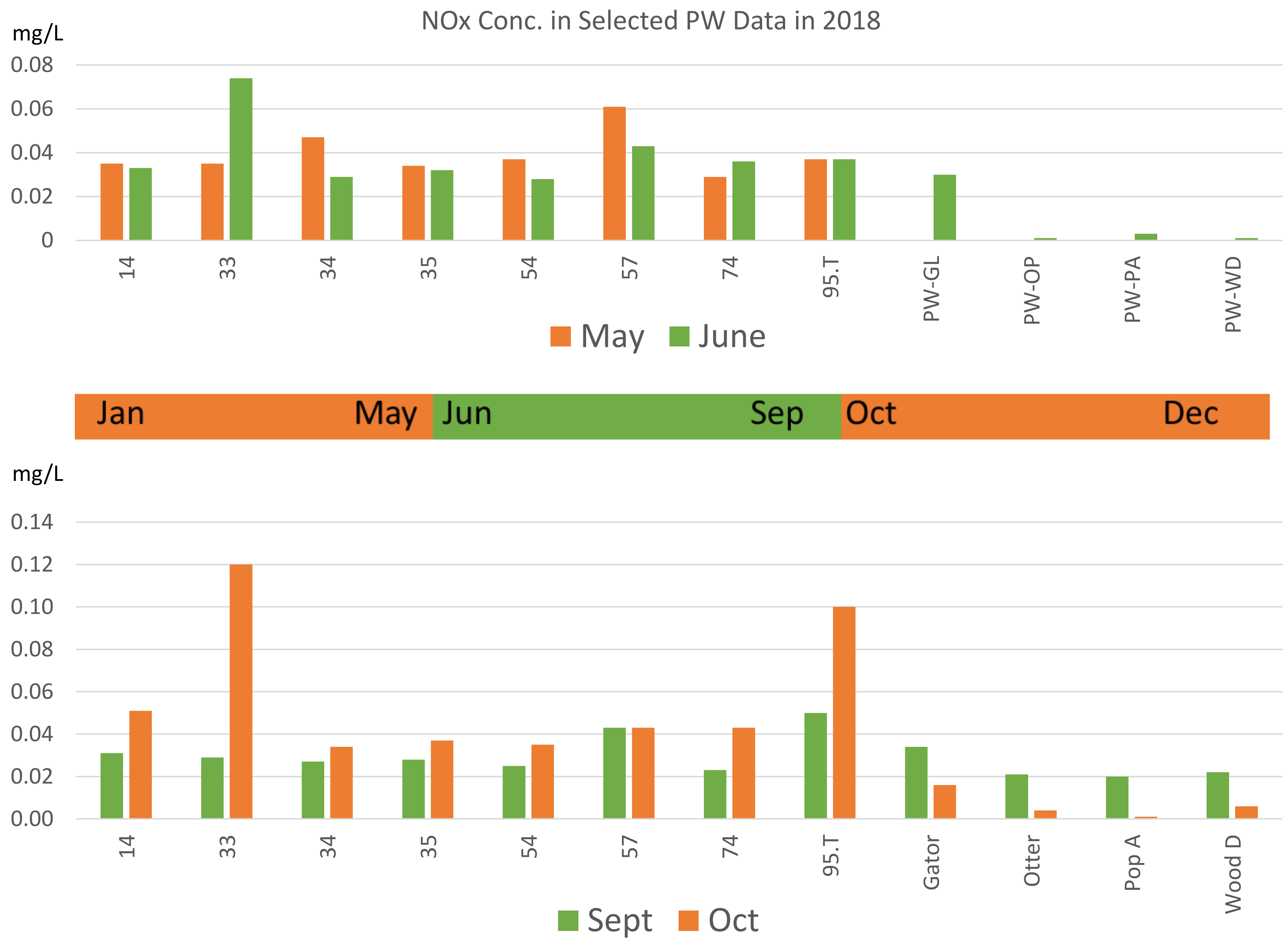

Ortho Phosphorus
mg / L
0.05
0.04
0.03
0.02
0.01
0
83x1
83x12
83x2
83x11
83x10
83x3
83x3.1
83x9
83x4.1
83x4
83x8
83x5.1
83x5
83x7
83x6.1
83x6.0
OP BR
OP AR

NOx Concentration of PW data in 2011



Average NOx substraction of Pond Watch Data
Δ (May-June) and Δ (Sep-Oct)




NOx Conc. in Selected PW Data in 2018
mg/L
0.08
0.06
0.04
0.02
0
14
33
34
35
54
57
74
95.T
PW-GL
PW-OP
PW-PA
PW-WD
May
June
Jan
May
Jun
Sep
Oct
Dec
mg/L
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
14
33
34
35
54
57
74
95.T
Gator
Otter
Pop A
Wood D
Sept
Oct

Isotope Analysis of Nitrogen and Oxygen

$\delta_{15}N = {}_{15}N:{}_{14}N$

$\delta_{18}O = {}_{18}O:{}_{16}O$

$$R = \frac{\text{(number of nitrogen molecules with atomic weight of 15)}}{\text{(number of nitrogen molecules with atomic weight of 14)}}$$

$$\delta^{15}N = [(R_{\text{sample}} / R_{\text{standard}}) - 1] \times 1000$$

Nitrate (NO_3) in water samples was analyzed by bacterial conversion of nitrate to nitrous oxide (N_2O) and subsequent measurement on a continuous flow isotope ratio mass spectrometer (Sigman et al. 2001; Casciotti et al. 2002; Coplen et al. 2004; Revesz and Casciotti 2005).

"Inorganic" artificial fertilizer = < 0 ‰
Waste water treatment = +10 ‰
Beef and dairy operations= +14 ‰
Atmospheric deposition = 0 ‰

Contents lists available at ScienceDirect

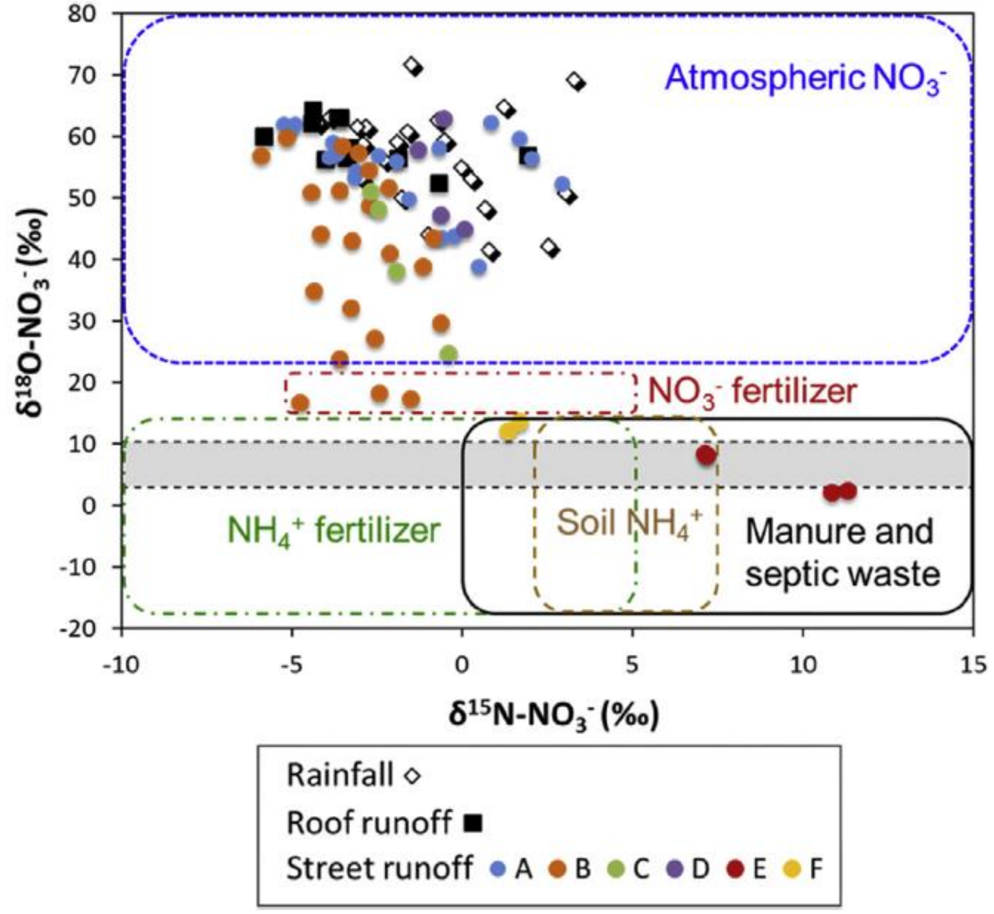
Water Research

journal homepage: www.elsevier.com/locate/watres

Sources and mechanisms of nitrate and orthophosphate transport in urban stormwater runoff from residential catchments

Yun-Ya Yang, Gurpal S. Toor*

Soil and Water Quality Laboratory, Gulf Coast Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, 14625 CR 672, Wimauma, FL 33598, USA

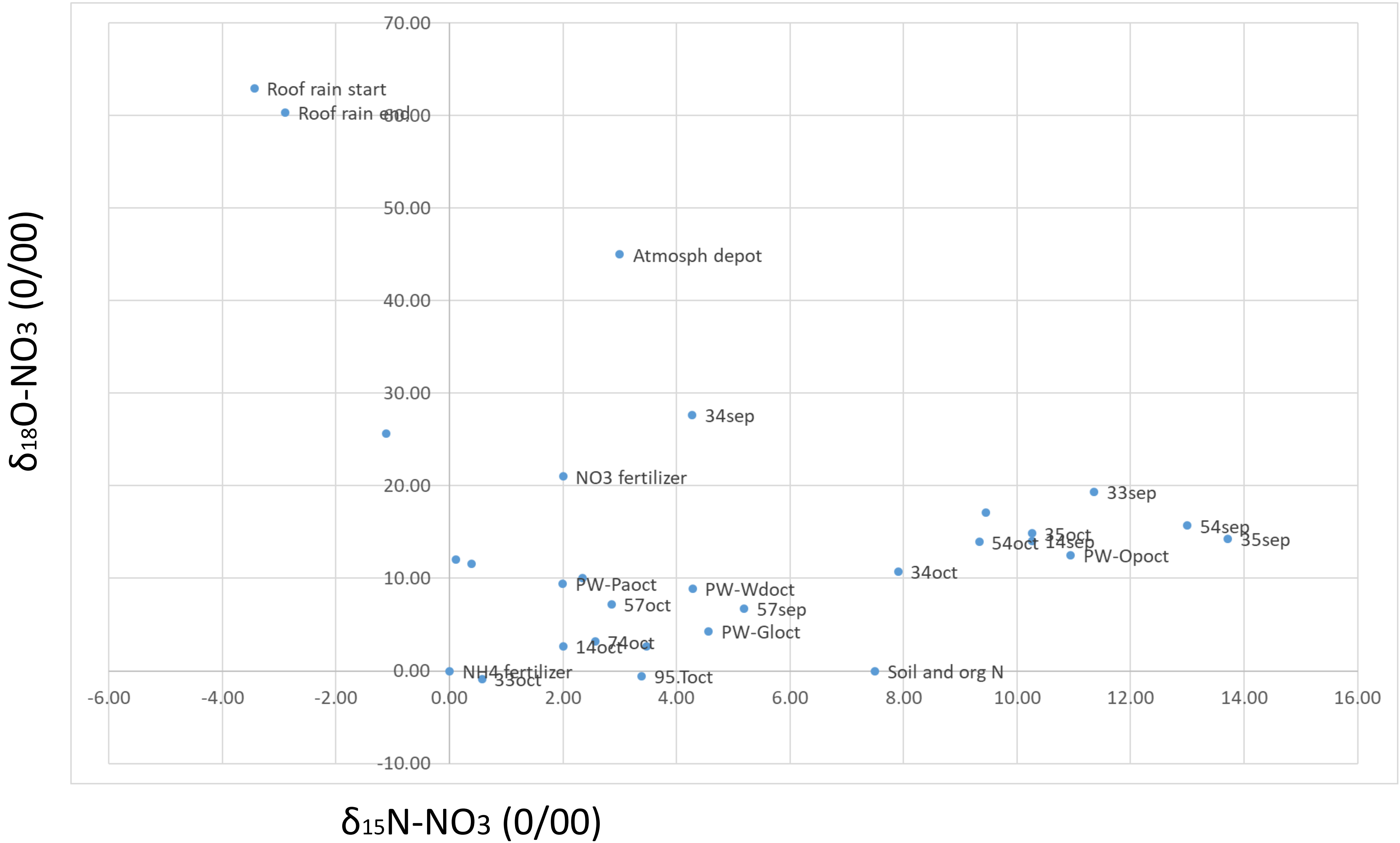


Isotope Analysis of Nitrogen and Oxygen

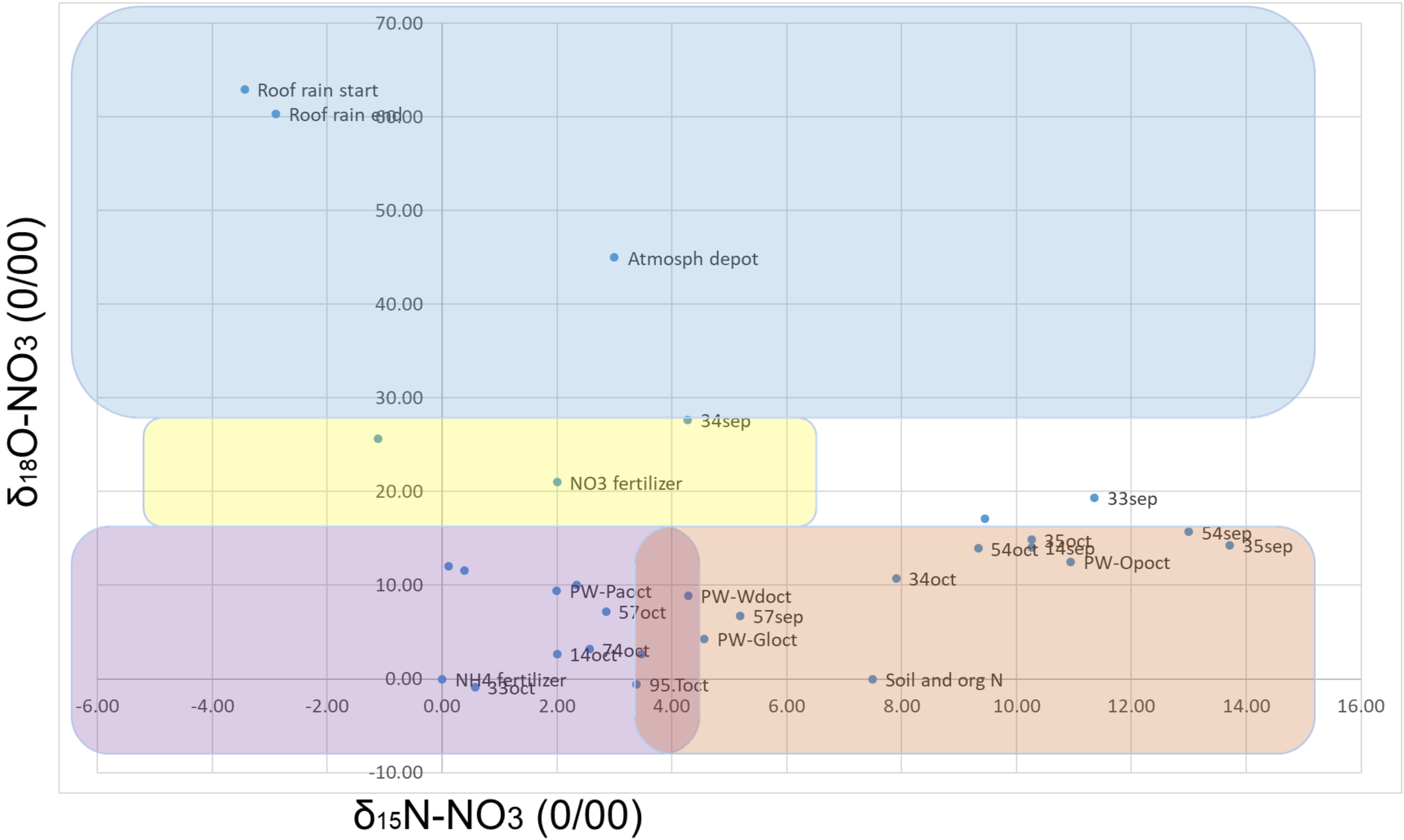
R = (number of nitrogen molecules with atomic weight of 15) / (number of nitrogen molecules with atomic weight of 14)

$$\delta^{15}N = [(R_{\text{sample}} / R_{\text{standard}}) - 1] \times 1000$$

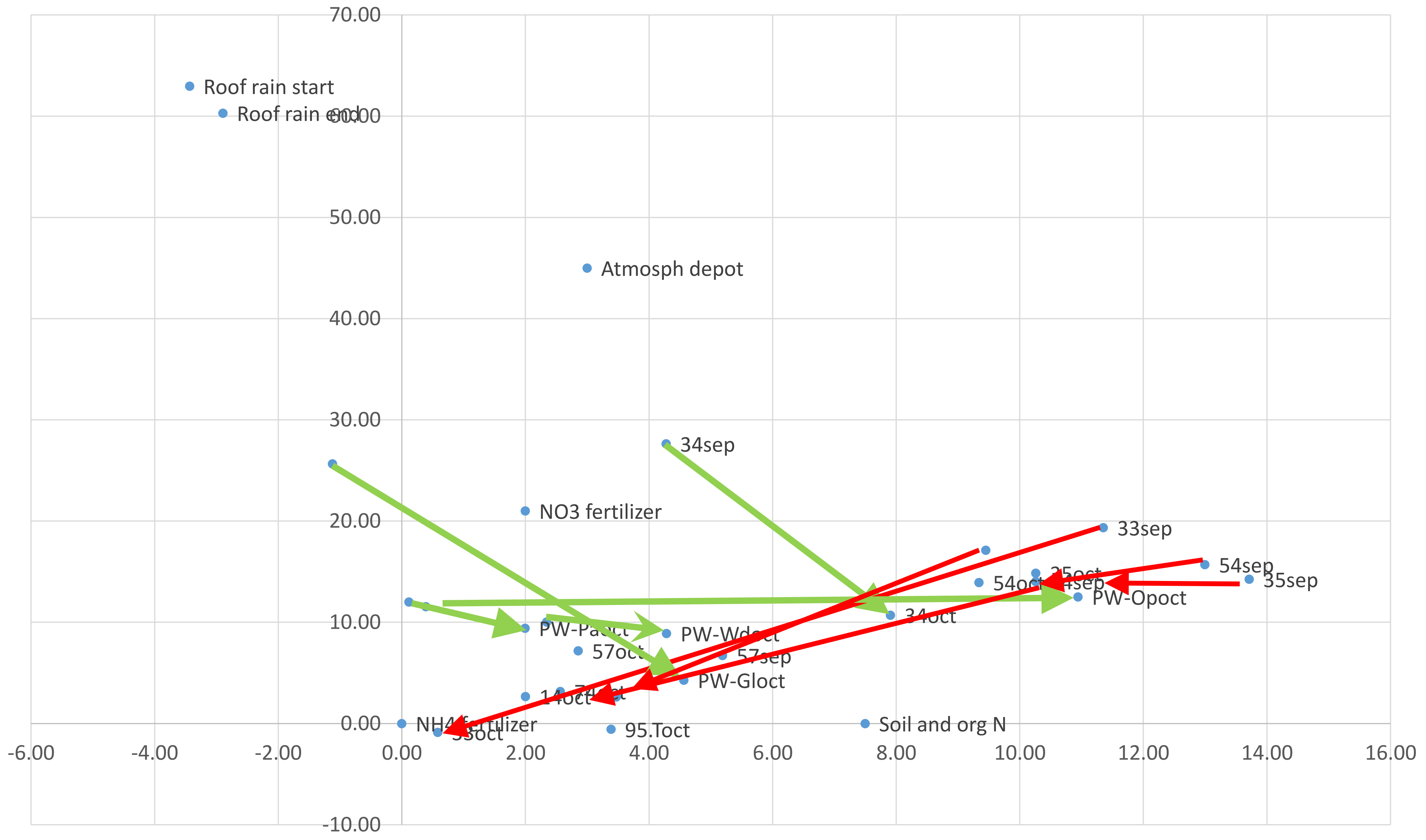
"Inorganic" artificial fertilizer = < 0 ‰
Waste water treatment = +10 ‰
Beef and dairy operations= +14 ‰
Atmospheric deposition = 0 ‰



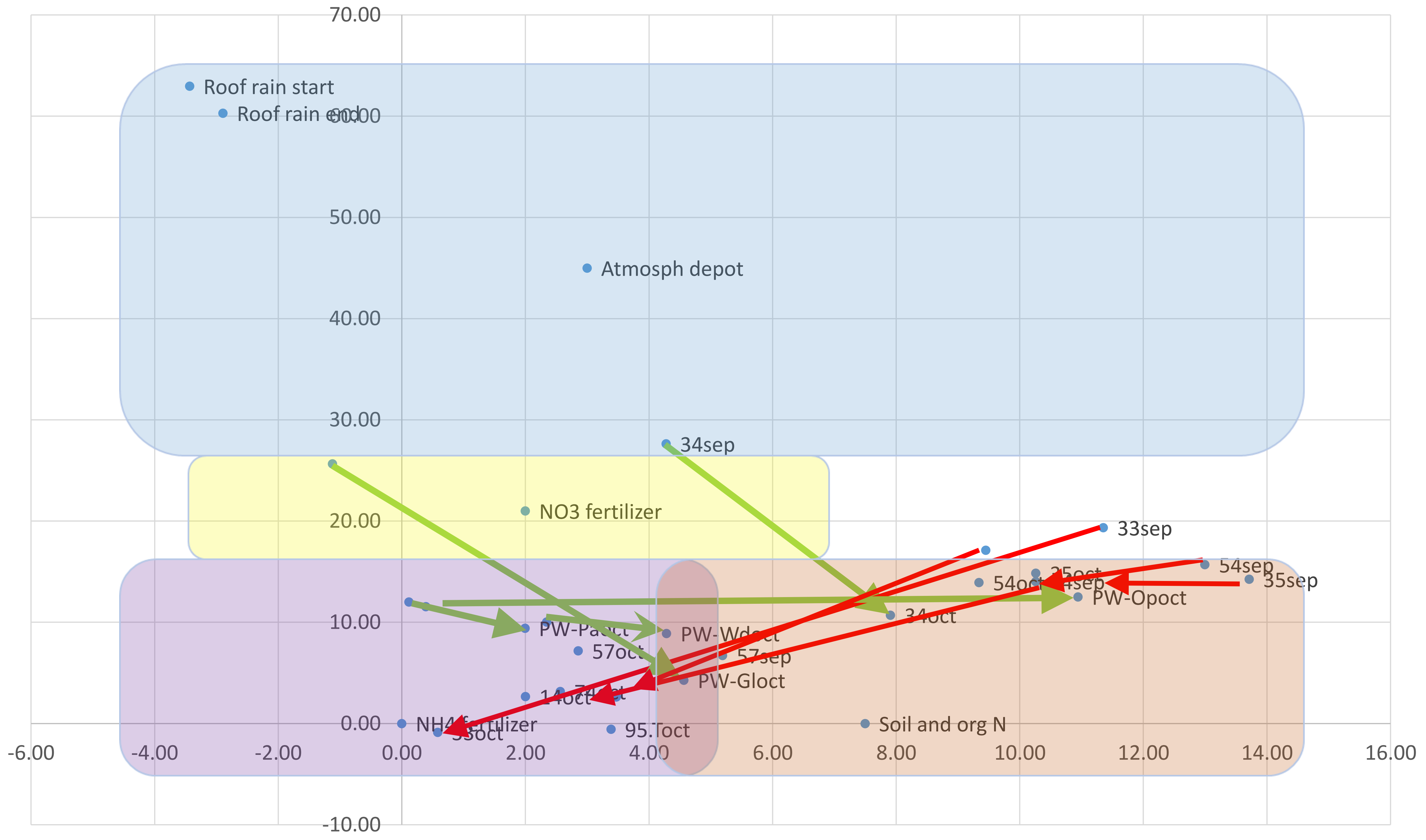
Roof rain start
Roof rain end
Atmosph depot
34sep
NO3 fertilizer
33sep
54sep
35oct
54oct
14sep
35sep
PW-Opoct
34oct
PW-Paoct
PW-Wdoct
57oct
57sep
PW-Gloct
74oct
14oct
NH4 fertilizer
33oct
95.Toct
Soil and org N
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
δ18O-NO3 (0/00)
δ15N-NO3 (0/00)



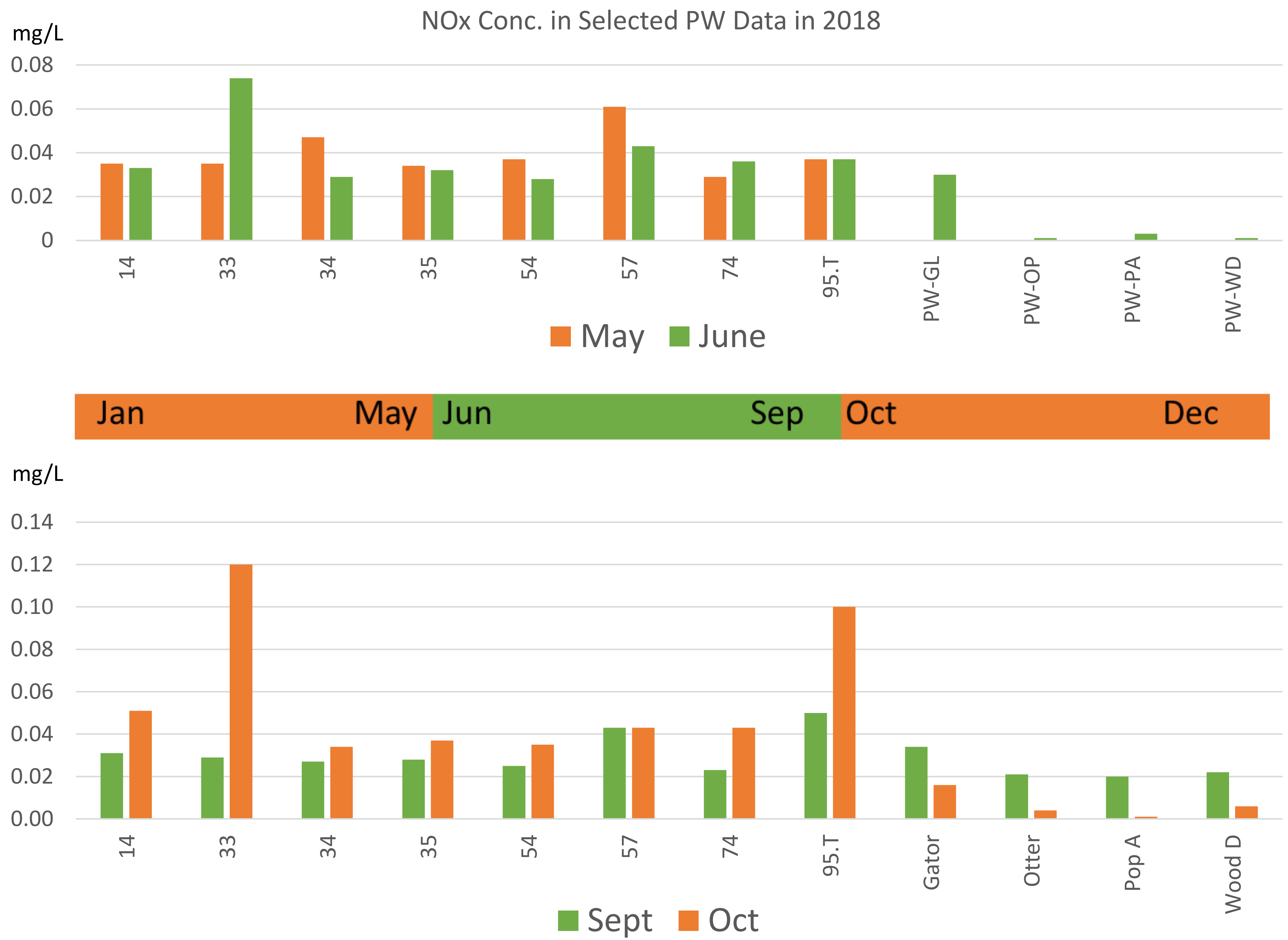
Roof rain start
Roof rain end
Atmosph depot
34sep
NO3 fertilizer
33sep
54sep
35oct
35sep
54oct
14sep
PW-Opoct
34oct
PW-Pacct
PW-Wdoct
57oct
57sep
PW-Gloct
14oct
74oct
NH4 fertilizer
33oct
95.Toct
Soil and org N
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
δ18O-NO3 (0/00)
δ15N-NO3 (0/00)

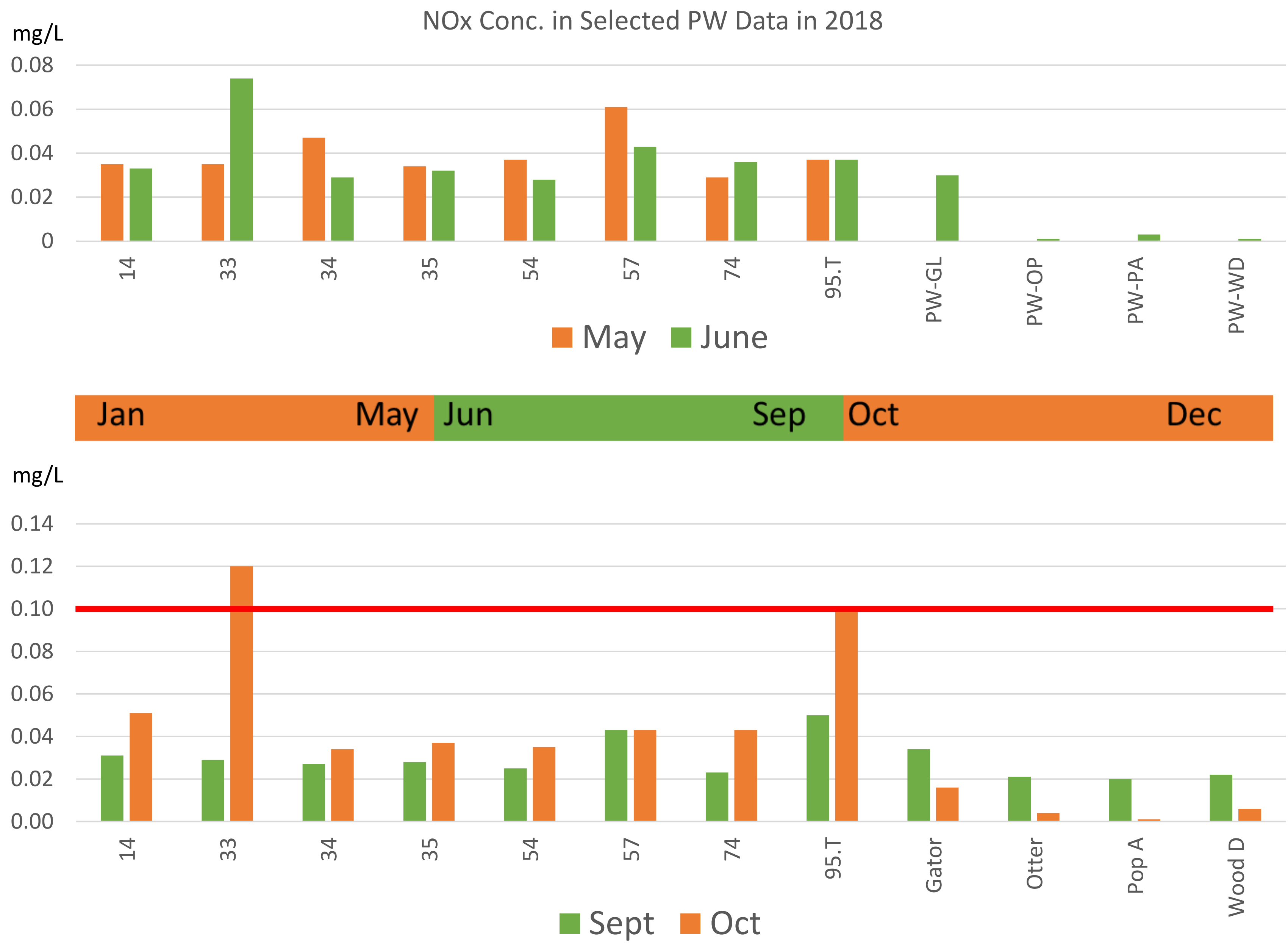


Roof rain start
Roof rain end
Atmosph depot
34sep
NO3 fertilizer
33sep
54sep
35sep
PW-Opoct
34oct
PW-Wdoct
57oct
57sep
PW-Gloct
14oct
NH4 fertilizer
95.Toct
Soil and org N
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00



70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
Roof rain start
Roof rain end
Atmosph depot
34sep
NO3 fertilizer
33sep
54sep
35sep
35oct
54oct
PW-Opoct
34oct
PW-Paoct
PW-Wdoct
57oct
57sep
PW-Gloct
14oct
NH4 fertilizer
95.7oct
Soil and org N


NOx Conc. in Selected PW Data in 2018
mg/L
0.08
0.06
0.04
0.02
0
14
33
34
35
54
57
74
95.T
PW-GL
PW-OP
PW-PA
PW-WD
May
June
Jan
May
Jun
Sep
Oct
Dec
mg/L
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
14
33
34
35
54
57
74
95.T
Gator
Otter
Pop A
Wood D
Sept
Oct


NOx Conc. in Selected PW Data in 2018
mg/L
0.08
0.06
0.04
0.02
0
14
33
34
35
54
57
74
95.T
PW-GL
PW-OP
PW-PA
PW-WD
May
June
Jan
May
Jun
Sep
Oct
Dec
mg/L
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
14
33
34
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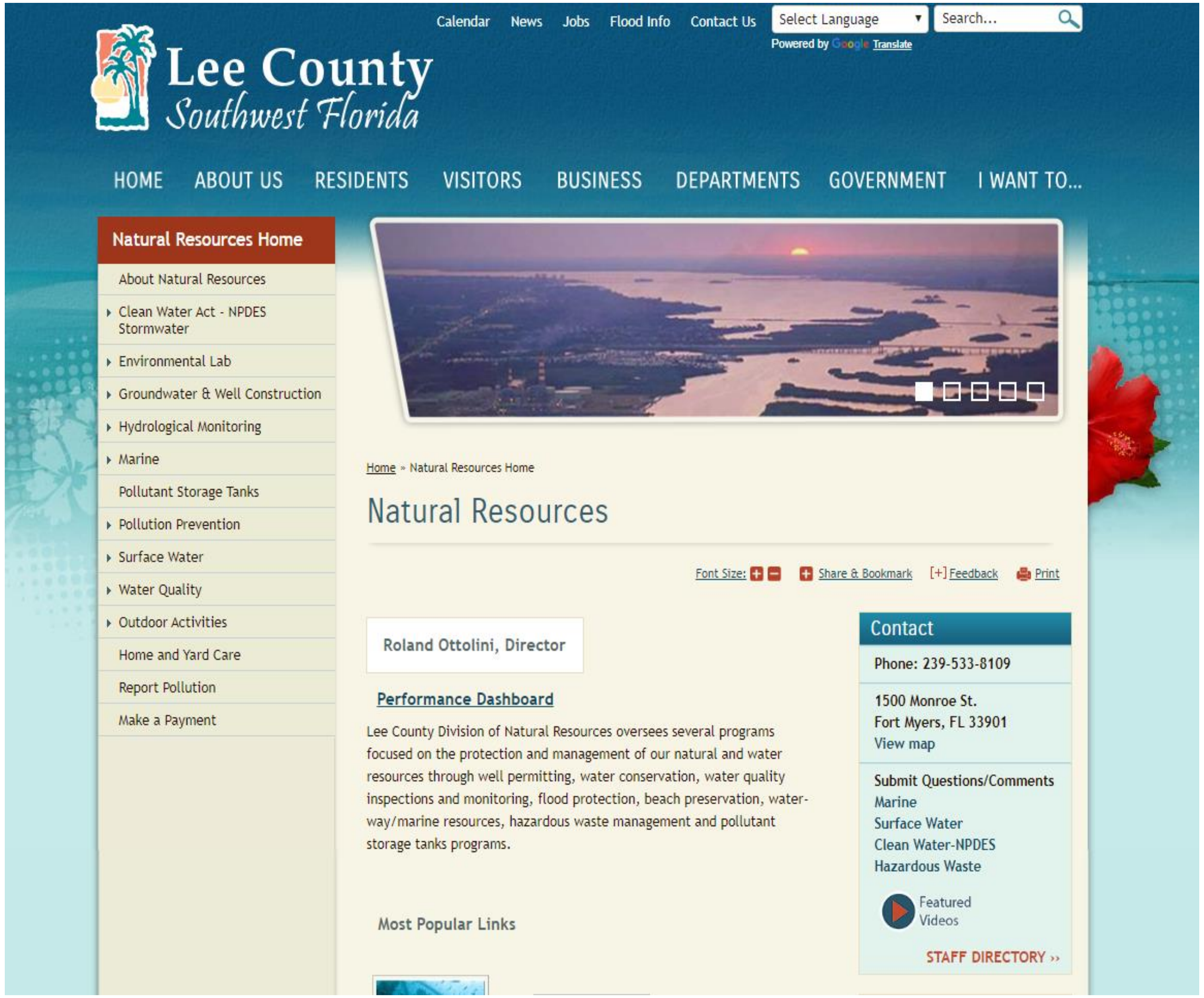
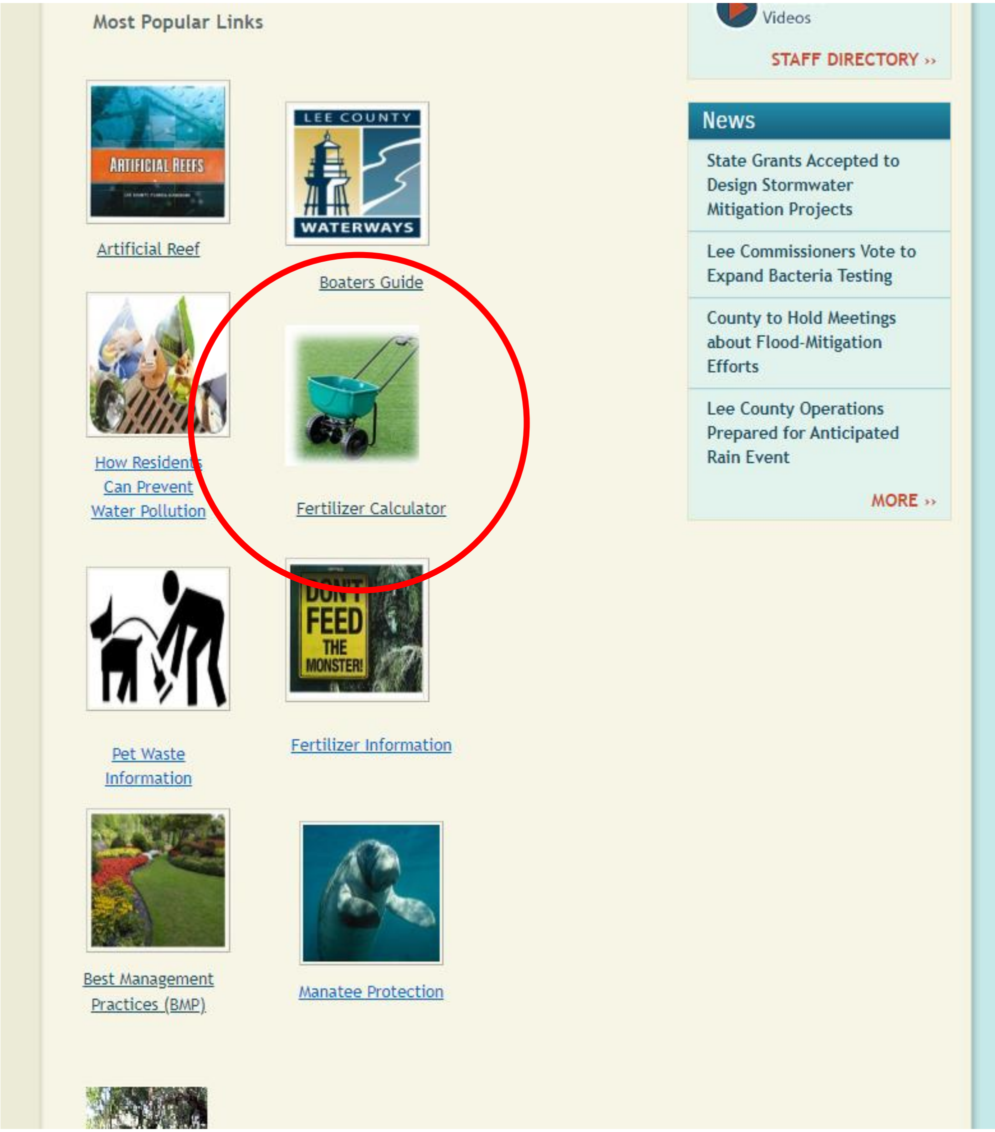
54
57
74
95.T
Gator
Otter
Pop A
Wood D
Sept
Oct





https://www.leegov.com/naturalresources

Lee County Fertilizer Calculator

Use this calculator to determine the amount of fertilizer that can be applied in Lee County, Florida per ordinance 08-08

fertilize smart

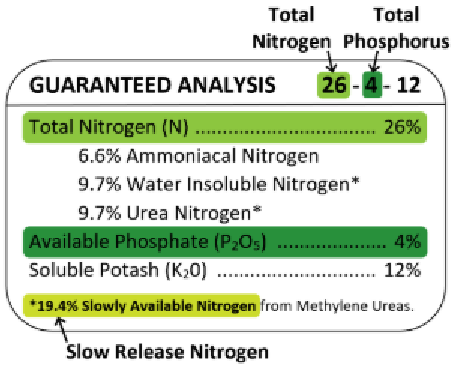
Next

Page 1 of 5

Lee County Fertilizer Calculator

Step 1. Enter Fertilizer Information

This can be found on the Guaranteed Analysis label on the fertilizer bag:



Total Nitrogen (%)

Total Phosphorus (%)

Slow Release Nitrogen (%)

Fertilizer applied in Lee County must contain *50% or more* slow release nitrogen:

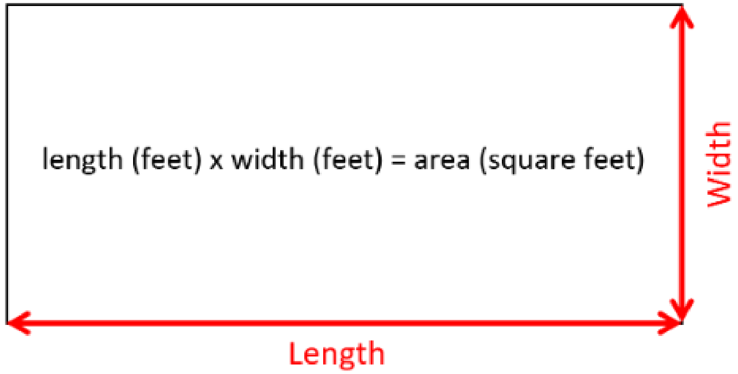
Enter nitrogen values to determine if your fertilizer meets this requirement

Back Next Page 2 of 5

Lee County Fertilizer Calculator

Step 2. Determine the Size of the Area to be Fertilized

Measure the length and width of your area in feet then multiply the two numbers to determine the area in square feet:



Or click here to measure the area on a map

Area to Fertilize in Square Feet

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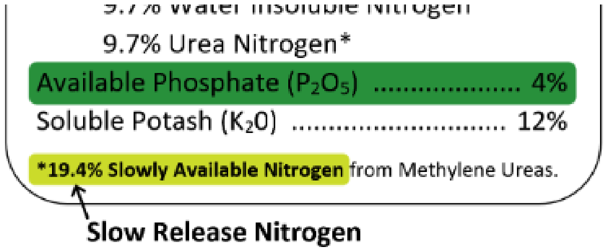
Powered by Survey123 for ArcGIS


fertilize smart
Find address or place
Measurement
Sq Feet (US)
Measurement Result
1,004.3 Sq Feet (US)
Clear
Brengle Ave
20ft
POWERED BY esri



Total Nitrogen (%)

20

Total Phosphorus (%)

0

Slow Release Nitrogen (%)

30

Fertilizer applied in Lee County must contain *50% or more* slow release nitrogen:

This fertilizer contains **150% slow release nitrogen** and **may be applied within Lee County**

Lee County Fertilizer Calculator

Step 3. Apply Fertilizer at a Rate Allowed by Lee County and State Regulations

Maximum Amount Allowed *per Application* for 1000 Square Feet:

5 pounds per application

Maximum Amount Allowed *per Year* for 1000 Square Feet:

20 pounds per year

Reminder:

Do not apply fertilizer containing nitrogen and/or phosphorus during the rainy season (June 1 to September 30). Rain water already contains nitrogen that will keep your lawn alive and fed, so don't worry, sit back and let nature do the job for you!

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Lee County Fertilizer Calculator

Do you have any questions? (optional)

Name*

Phone Number

Email*

Question or Comment*

500

Note:

Information entered on previous pages will be submitted as well

Back Submit

In Summary

- Nitrates concentrations have been found to be higher before and <u>after</u> the “Fertilizer Black Out Period” in Lee County

- Isotope Ratio Analysis has identified nitrogen associated with fertilizers, atmospheric and organic sources discharged into storm water ponds

- Education to Home Owner Associations and specific evaluations per community will help identify problems and provide solutions