Results of a Decade of Monitoring Groundwater Nitrogen Concentrations in Florida's Santa Fe Basin

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AquiferWatch "Team"

- **Rick Copeland**
  ◦ AquiferWatch
- **Gary Maddox**
  ◦ Apalachee Minerals Inc.
- **Hailey Hall**
  ◦ AquiferWatch / Is Your Water Well

RC and GM: Worked with FDEP Extensively

FDEP: Florida Department of Environmental Protection

"**Monitoring to Answer Questions**"

- AW – a 501(c)(3) nonprofit organization

- AW – Cooperates with FL LAKEWATCH, a lake volunteer monitoring organization (Univ. of FL.)

AW and Volunteer GW Monitoring

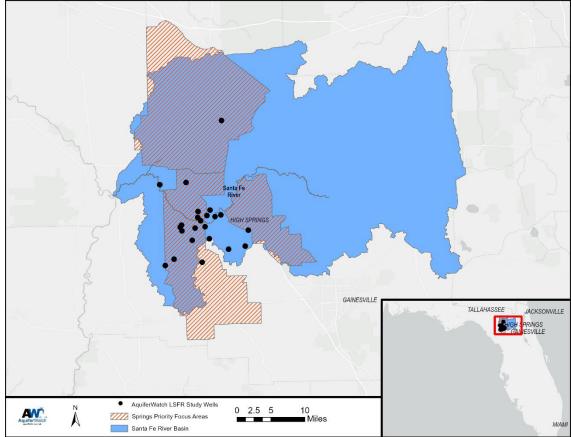- Governmental entities lack funding for sufficient monitoring

- Volunteers produce additional data that can be used to evaluate the conditions of Florida's water resources including GW

Nitrate (NO3+NO2 as N)
Elevated in GW for several decades
(Florida Springs Task Force, 2000)

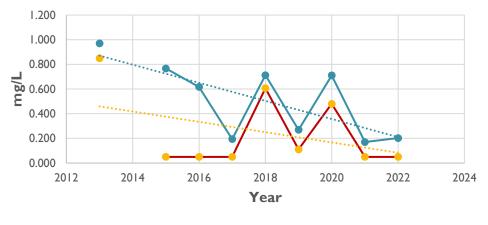## (Lower) Santa Fe Basin GW Monitoring

Santa Fe Basin Project

- AW monitors private drinking water wells.

- Samples from the unconfined Upper Floridan aquifer (UFA)

- 2014 and 2015

- 2016, No funds

- AW/LW re-initiated 2017
  - AW: collects samples
  - LW : conducts laboratory analyses (Total Nitrogen (**TN**))

Nitrate (abbreviated **NO3**) is analyte of interest

TN is a surrogate for NO3.

Based on 200 FDEP samples, **[NO3 varies from 0.30 to 0.95 (TN)]**

30 UFA GW Samples from Santa Fe Basin Private Drinking Water Wells (Source : FDEP)
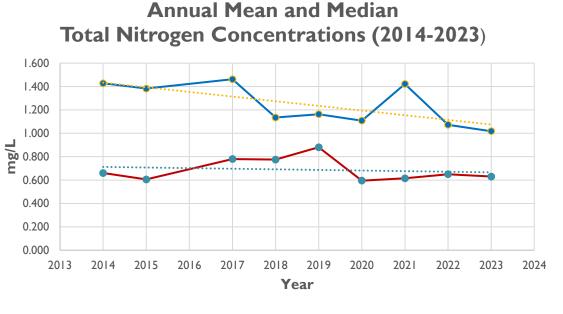## (Ave NO3/TN = 0.40)

TN & NO3 Medians (2013-2022)

Data / Visual Analysis

◦ At a minimum, need 10 years of data; have **9** (Insufficient data for Trend Analysis)

◦ One way to present data is by visualizing annual means and medians

◦ Means are more susceptible to outliers than medians

◦ Prefer to use annual medians
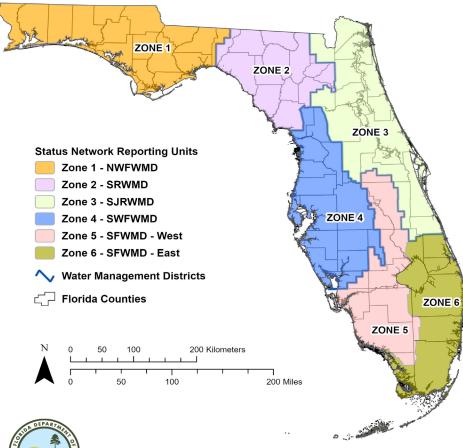 - But not always

23 "AW" Wells; Santa Fe Basin
(Private Drinking Water Wells)

Annual Mean and Median
Total Nitrogen Concentrations (2014-2023)

FDEP – GW Monitoring Network Regions (1991-2024)

Watershed Monitoring Reporting Units

Status Network Reporting Units

- Zone 1 - NWFWMD
- Zone 2 - SRWMD
- Zone 3 - SJRWMD
- Zone 4 - SWFWMD
- Zone 5 - SFWMD - West
- Zone 6 - SFWMD - East

Water Management Districts

Florida Counties

ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
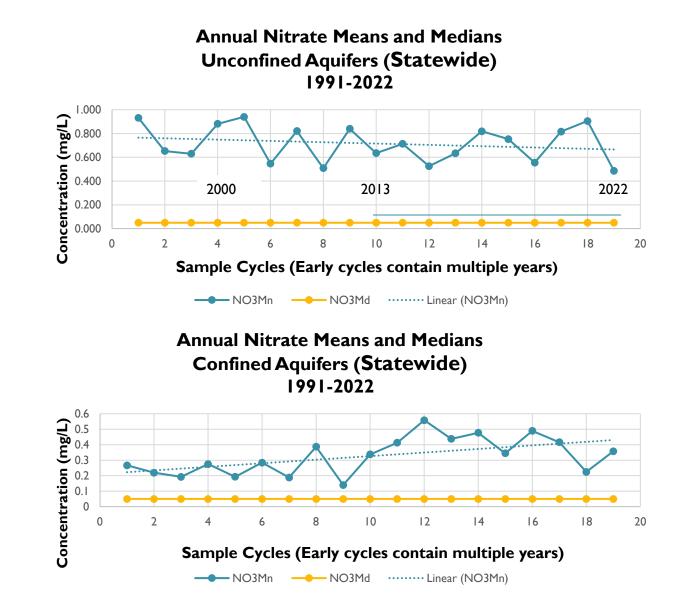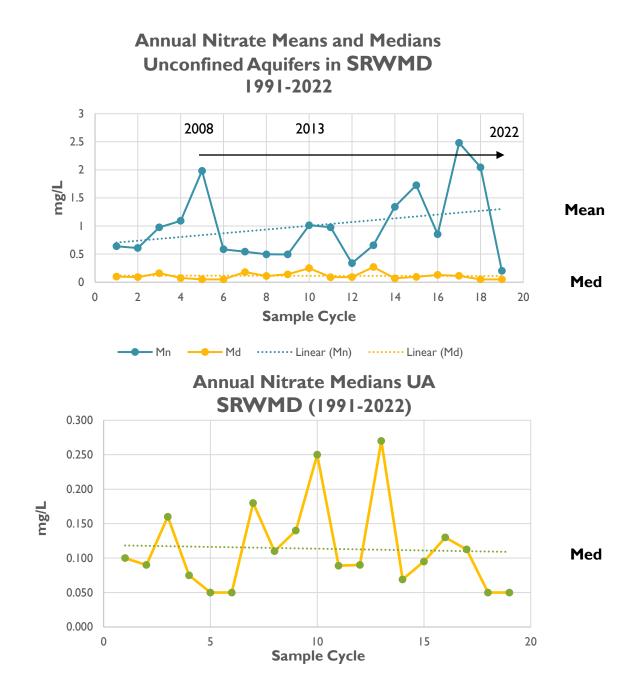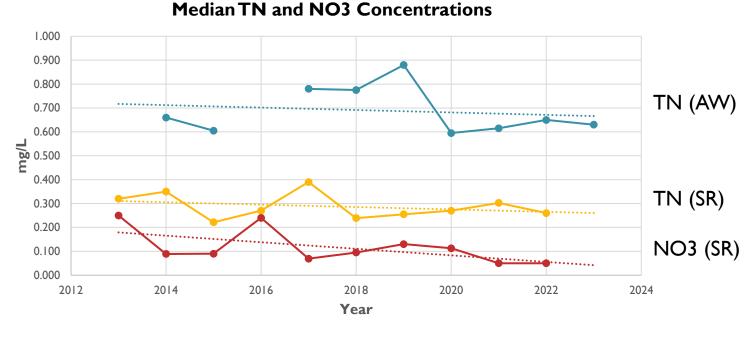ZONE 6

Created August 9, 2021 by Florida Department of Environmental Protection staff in the Division of Environmental Assessment and Restoration, Watershed Monitoring Section. This map is a representation of ground conditions and is not intended for further analysis. For more information contact (850)-245-8080.

FDEP Monitors Unconfined Aquifers (UA) and Confined Aquifers (CA)

Annual Nitrate Means and Medians
Unconfined Aquifers (Statewide)
1991-2022

Annual Nitrate Means and Medians
Confined Aquifers (Statewide)
1991-2022

Annual Nitrate Means and Medians
Unconfined Aquifers in SRWMD
1991-2022

Annual Nitrate Medians UA
SRWMD (1991-2022)

TN and NO3 Changes (2013-2023) SRWMD and AW

Median TN and NO3 Concentrations

Interpretation of Graphs

- **Insufficient Evidence of Trend**

- Increasing Trends
    - "Bad" News
- Decreasing Trends
    - "Good" News
- **Insufficient Evidence:**
    - "**Not Bad News, but could be better**"

- Visually, FDEP & AW data; slowly decreasing?

If Concentrations are Decreasing, Selected Plausible Drivers

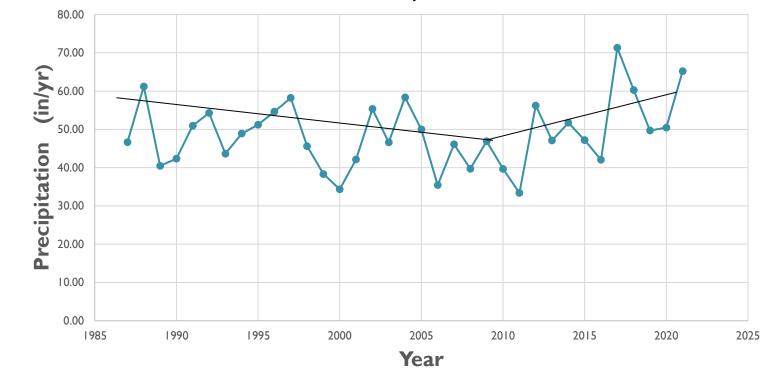(Modified from Upchurch, 1992; Upchurch et al. , 2019)

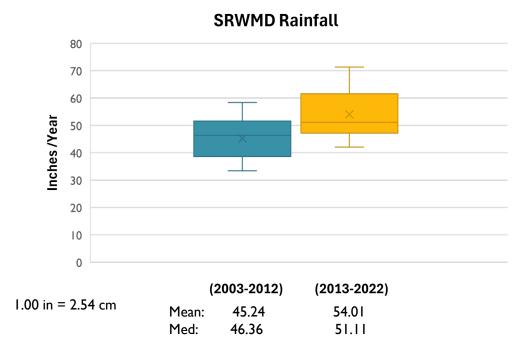| NO3 + NO2 as N |
| --- |
| **Decreasing Trends** |
| 1.   Dec. in N loading to GW |
| 2.   Inc. in low-N recharge water; Dilution/dispersion in aquifer |
| **Comments** |
| A.   Currently, N-loading data is insufficient for time-series evaluations |
| B.   Recharge data is scarce. However, in the long term, recharge follows rainfall and precipitation data are available. |

Annual Precipitation Gainesville, FL

FL. Climate Center, 2023

Comparison of Two Periods of SRWMD Rainfall

SRWMD Rainfall

Inches /Year

1.00 in = 2.54 cm

	(2003-2012)	(2013-2022)
Mean:	45.24	54.01
Med:	46.36	51.11

Data from FL. Climate Center, 2023l

Summary

- AW: Monitors TN in unconfined UFA in Santa Fe Basin (<u>2014-2023</u>)

- TN used as surrogate for NO3

   No Trend (but slowly decreasing)

- FDEP Network: NO3 (<u>2013-2022</u>) in SRWMD

- No Trend (but slowly decreassing)

- AW's "Signal" resembles FDEP's

Summary

- If NO3 concentrations are decreasing
- Plausible drivers
  - Decrease in N-Loading
  - Increase in recharge, and dilution in aquifer

- Insufficient time-series N-Loading data
- During past decade, rainfall/recharge ⬆
  - Probably causing dilution of NO3 in GW

- Both could be currently active drivers

- **Questions?**

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