



Overview of the Status and Trend Monitoring Networks

Division of Environmental
Assessment and Restoration
March 26, 2024



Presentation Outline

- Overview of Division Monitoring and the Water Quality Monitoring Program
- Watershed Monitoring Section Background
- Descriptions of Status and Trend Monitoring Networks
- Uses of Status and Trends Monitoring Data and Online Resources



Why Do We Sample Water?



Federal Legislation

to “Protect physical, chemical, and biological integrity” –

- Clean Water Act sections 303(d) & 305(b)
 - Produce 303 (d) 305 (b) (Integrated) report to EPA on findings every 2 years

Florida Legislation:

- Florida Statutes Chapters 376 and 403, authorize Florida DEP to monitor water quality through state programs
- Florida Administrative Code Chapter 62-302 & 62-303, to assess whether Florida waters meet water quality standards for designated uses



Division of Environmental Assessment and Restoration (DEAR) WQ Monitoring

- Programs Having Monitoring Efforts
 - Water Quality Monitoring Program
 - *Alicia Hogue*
 - Water Quality Evaluation & TMDL Program
 - *Kevin ODonnell*
 - Water Quality Restoration Program
 - *Moirra Homann*



DEAR

Monitoring Needs

- **Site-specific Monitoring of Individual Waterbodies**
 - Water Quality Evaluation & TMDL Program
 - Strategic Monitoring used for determination of impairment
- **Basin Management Action Plans (BMAPs) and Restoration Focus Areas (RFAs)**
 - Water Quality Restoration Program
 - Monitoring condition of watersheds containing impaired waters
- **Statewide, Regionwide, & Watershed Assessments**
 - Water Quality Monitoring Program
 - Status and Trend Monitoring for statewide & region wide condition.



FDEP Water Quality Monitoring Program

Administrative Structure

- Watershed Monitoring Section
 - Responsible for Status and Trend Monitoring Network Design and Implementation
- North Sampling Operations – *Mike King*
(DEP NWF, TLH, and NE offices)
- South Sampling Operations – *Sarah Meyer*
(DEP Cen, SW, SE, and SO offices)



Watershed Monitoring Section

- **Section Administration** – *Jay Silvanima*
- **Quality Assurance** – *Rachael Dragon*
- **Project Managers**
 - *Tom Seal*: Contracted sampling done by the NFWFMD, SJRWMD, and Alachua County
 - *Meghan Maly*: Northwest, Northeast, and Tallahassee ROCs*
 - *Lana Neff*: Central, South, Southeast, and Southwest ROCs and the SFWMD under MOU.
- **Data Management and Analysis**
 - *Stephanie Sunderman-Barnes*: Oversight / QA QC
 - *Thomas Adams and Vacant*: Data Management
 - *Rick Copeland & Vacant*: Data Analysis

* DEP Regional Operation Centers (ROCs)



Status and Trend Monitoring Teams

- DEP
 - Regional Operations Center Staff located in in Pensacola, Tallahassee, Jacksonville, Orlando, Tampa, Fort Myers, & Fort Pierce
- External Partners
 - NFWFMD, SJRWMD, SFWMD & Alachua County



The Foundation for Scientific Sampling is Solid Quality Assurance

Need to be sure we all are following the same protocols!

- Sampling protocols taught for S&T network.
- Required to attend course and pass exam, 5-year renewal policy.
- Q/A Officer oversees training and follows up with field audits throughout the state.



Overview of Status and Trends Monitoring Networks

- Both Focus on Statewide/Region-wide Assessment
- Status Monitoring Network Goals
 - Characterize statewide and region-wide water resource conditions
 - Infer percentage of each resource that meets standards for designated use (surface & groundwater) with known confidence
- Trend Monitoring Network Goals
 - Provide estimates of change in water quality at set stations over time
 - Determine correlations with Status Network monitoring results in the same region
 - Estimate basin-wide surface water pollutant loadings



Status Monitoring Network

➤ Sample Survey Designs

- Consists of a random set of water samples selected from a target population. It is used to infer the characteristics of the target population via a subset of the target population.
- Status target populations are the seven water resources as defined in the WMS Monitoring Design Document

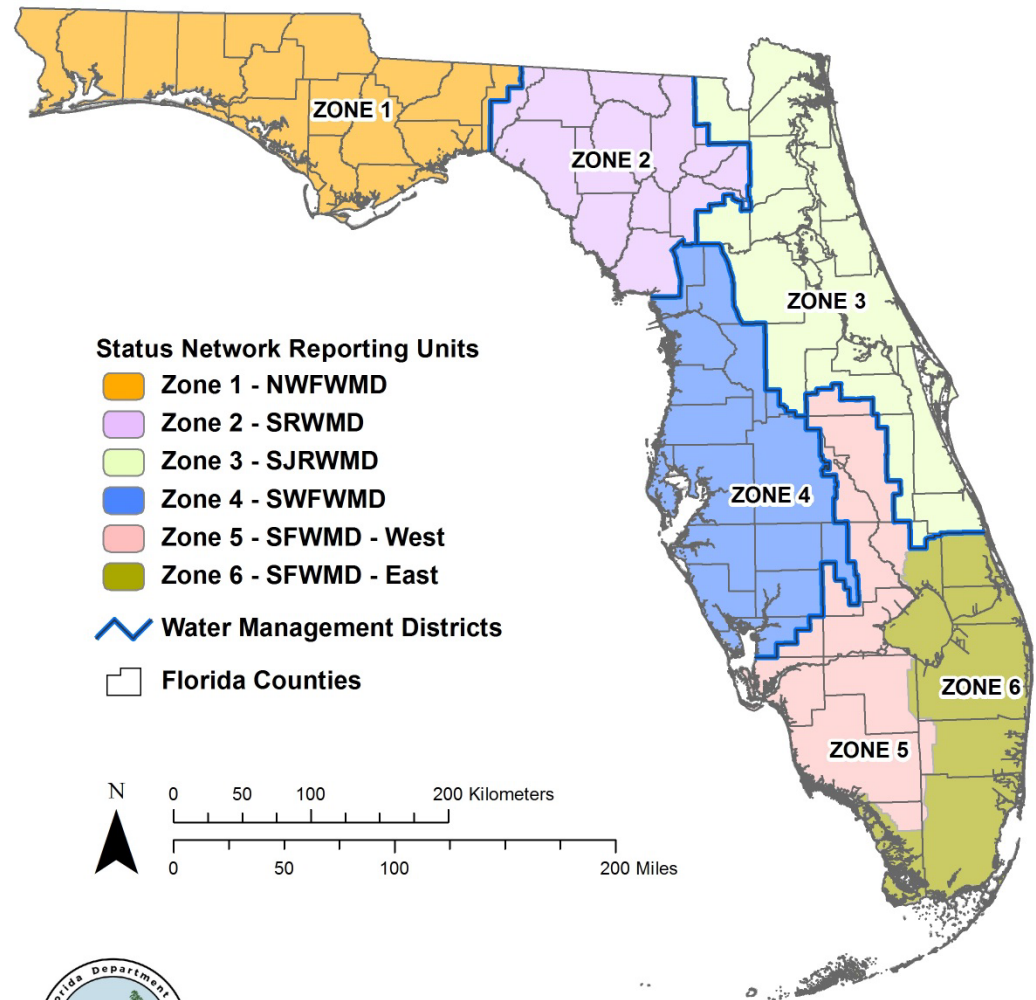
http://publicfiles.dep.state.fl.us/dear/DEARweb/WMS/Reports_Docs_SOPs/Design_Docs/WMS-MonitoringDesignDocument.pdf



Status Network Design

- 6 zones
- 7 resources
- 90 sites sampled for each surface water resource, with the exception of canals, per year (15 per zone)
- 60 sites sampled for canals per year (15 each for zones 3, 4, 5, and 6)
- 120 wells sampled for each groundwater resources per year (20 per zone)

Watershed Monitoring Reporting Units



Created August 24, 2015 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)-245-8433.



Status Monitoring Network

Surface Water Design

- Coverages of flowing waters and lakes are maintained in a geodatabase.
- Random site selections are made from each of the five surface water resources
- Annually 15 primary selections + 135 alternate selections are made per zone



Status Monitoring Network

Groundwater Design

- List frame of confined and unconfined wells is maintained with input from the WMDs, USGS, county/local governmental agencies and FDEP programs.
- Random well selections are made from the list frame for confined and unconfined aquifer sampling annually.
- Annually 20 primary selections + 180 alternate selections are made per zone.



Status Network Site Selection Types

<u>Resource Type</u>	<u>Site Selection Methodology</u>
Confined & Unconfined Aquifers	Selected by well
Rivers, Streams and Canals	Selected by line work segments
Small Lakes ≥ 4 and < 10 hectares	Selected as centroid of single lake
Large Lakes ≥ 10 hectares	Selected by polygons of lake area – can have multiple stations in one lake



Status Network Design Requirements

- Reconnaissance procedures given in recon manual.
- Sampling procedures provided in sampling manual and are based on DEP SOPs.
- Follow sample order – except first 15 (SW) or 20 (GW) selections
- Recon and collect samples from sites that meet definition of resource

Reconnaissance Manual found at

http://publicfiles.dep.state.fl.us/dear/DEARweb/WMS/Reports_Docs_SOPs/Standard%20Operating%20Procedures/Status%20Network%20Recon%20Manual/WMS-ReconManual.pdf



Water Quality Indicators

2022 Sampling Manual pp 128 & 131

➤ **Surface Waters**

- **Core indicators:** field and physical measurements, major ions, metals, nutrients, and bacteria
- **Resource specific indicators:** 1) habitat assessments for rivers and streams, 2) lake vegetative index and sediment analyses for lakes

➤ **Groundwaters**

- **Core indicators:** field and physical measurements, major ions, metals, nutrients, and bacteria



Water Quality Indicators

2022 Sampling Manual pp 128 & 131

- **Periodically incorporate analytes associated with DEP initiatives**
 - In the past have sampled for pesticides, wastewater tracers, additional trace metals, radiometrics, and volatile organic compounds. These may be resource specific.
- **2024 calendar year Status Monitoring**
 - Algal toxins in all Status surface water resources.

Are Alligators an Exclusion?



Characterizing and tracking excluded sites is a challenging part of reconnaissance that carries over into data analysis. We have developed an in-house reconnaissance tracking tool to alleviate the problems of tracking information from the field – GWIS Database Utilities.

Exclusion Criteria found in 2022 Sampling Manual pp 135-136.



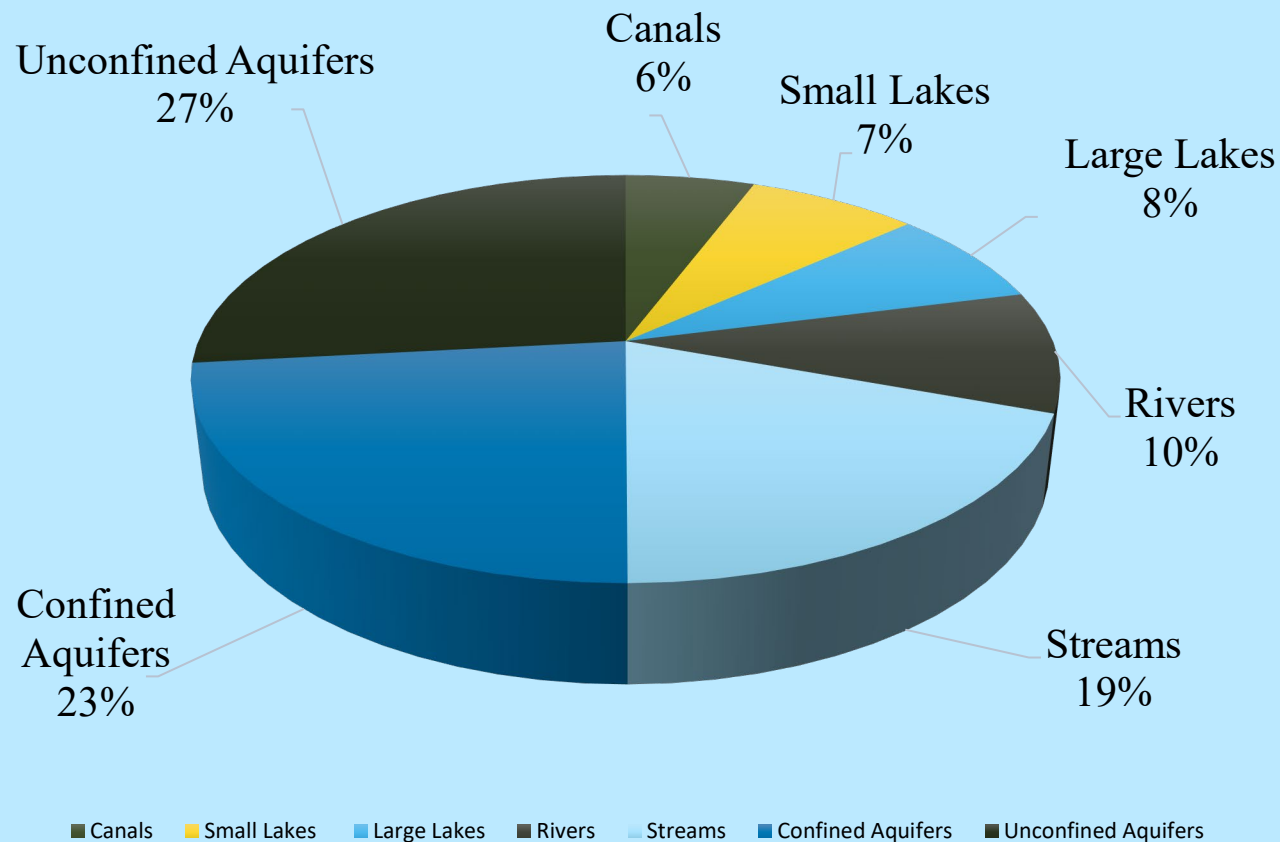
2020 – 2022 Site Evaluations

Water Resource	Resource Size - Number in Population	Resource size - Length (miles)	Resource size - Area (acres)	Sites Assessed	Sites Sampled	(%) Sampled	(%) Dry	(%) Inaccessible	(%) Wrong Resource
Large Lakes	1,684	N/A	934,109	323	268	83	3	13	1
Small Lakes	1,574	N/A	24,796	320	182	57	4	34	5
Rivers	N/A	2,616	N/A	405	263	65	7	27	1
Streams	N/A	15,065	N/A	815	203	25	8	61	6
Canals	N/A	2,370	N/A	242	180	74	4	22	0
Unconfined Aquifers	22,581	N/A	N/A	1126	343	30	1	67	2
Confined Aquifers	15,424	N/A	N/A	984	349	35	0	62	3



2020 – 2022 Site Evaluations

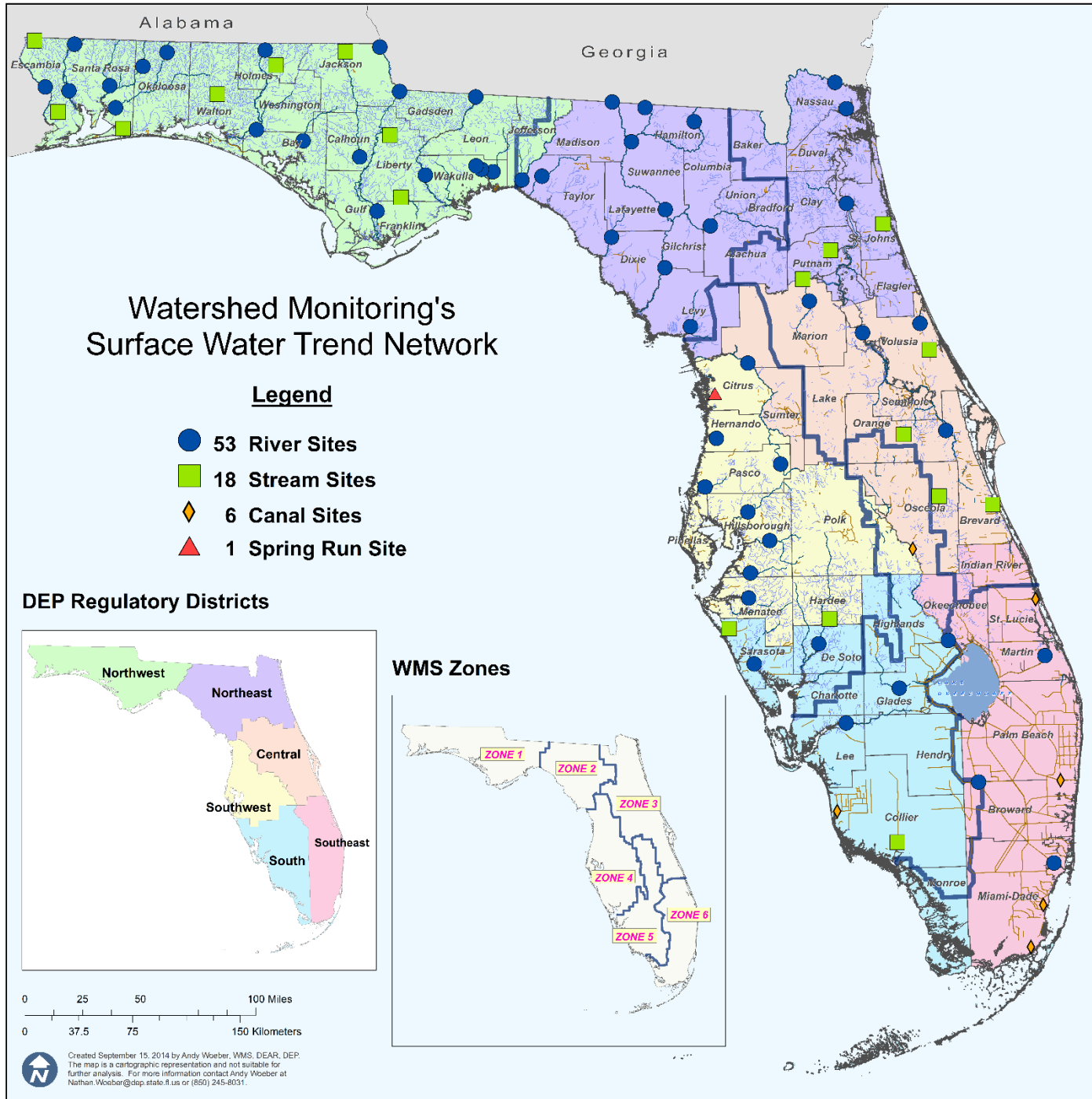
Percentage of All Sites Assessed





Surface Water Trend Network

78 surface water fixed stations sampled on a monthly basis





Surface Water Trend Indicators

2022 Sampling Manual p 131

➤ **Measurements Collected at Sites:**

- Standard suite of physical and chemical measurements on a monthly basis
- Metals suite annually in April
- Bioassessments (HA, SCI, RPS, LVS) attempted to be performed twice a year (at least 4 months apart) for sites deemed appropriate for the SCI. Refer to Page 140 figure 2 of your Sampling Manual
- Additional analytes at specific sites include, metals, wastewater tracers, and pesticides.



Groundwater

51 Trend Stations

Confined aquifers
sampled 4X year for
in situ
measurements and
WQ sample
collection

Unconfined aquifers
12X year for *in situ*
measurements, 4X
year for WQ sample
collection





Groundwater Trend Indicators

2022 Sampling Manual p 131

- **Measurements Collected at Sites:**
 - On site measurements monthly at unconfined aquifer wells, quarterly at confined aquifer wells.
 - Standard suite of lab analytes quarterly.
 - Metals during October quarterly sampling.



Uses of Status and Trend Data

- Submit annual groundwater and surface water ‘performance’ reports to Florida Legislature.
- Report for Clean Water Act Section 305 (b).
- Supply data for the determination of Impairment.
- Create Statewide and Region-wide (Zone) Reports for the public and other members of the Department.
- Support for DEP and other FL WQ monitoring programs. <https://floridadep.gov/dear/water-quality-assessment/content/reports-documents-sops-and-links>



2024 Integrated Report

**Statewide percentage of 2020-2022 streams
meeting threshold values for indicators
calculated using probabilistic monitoring design**

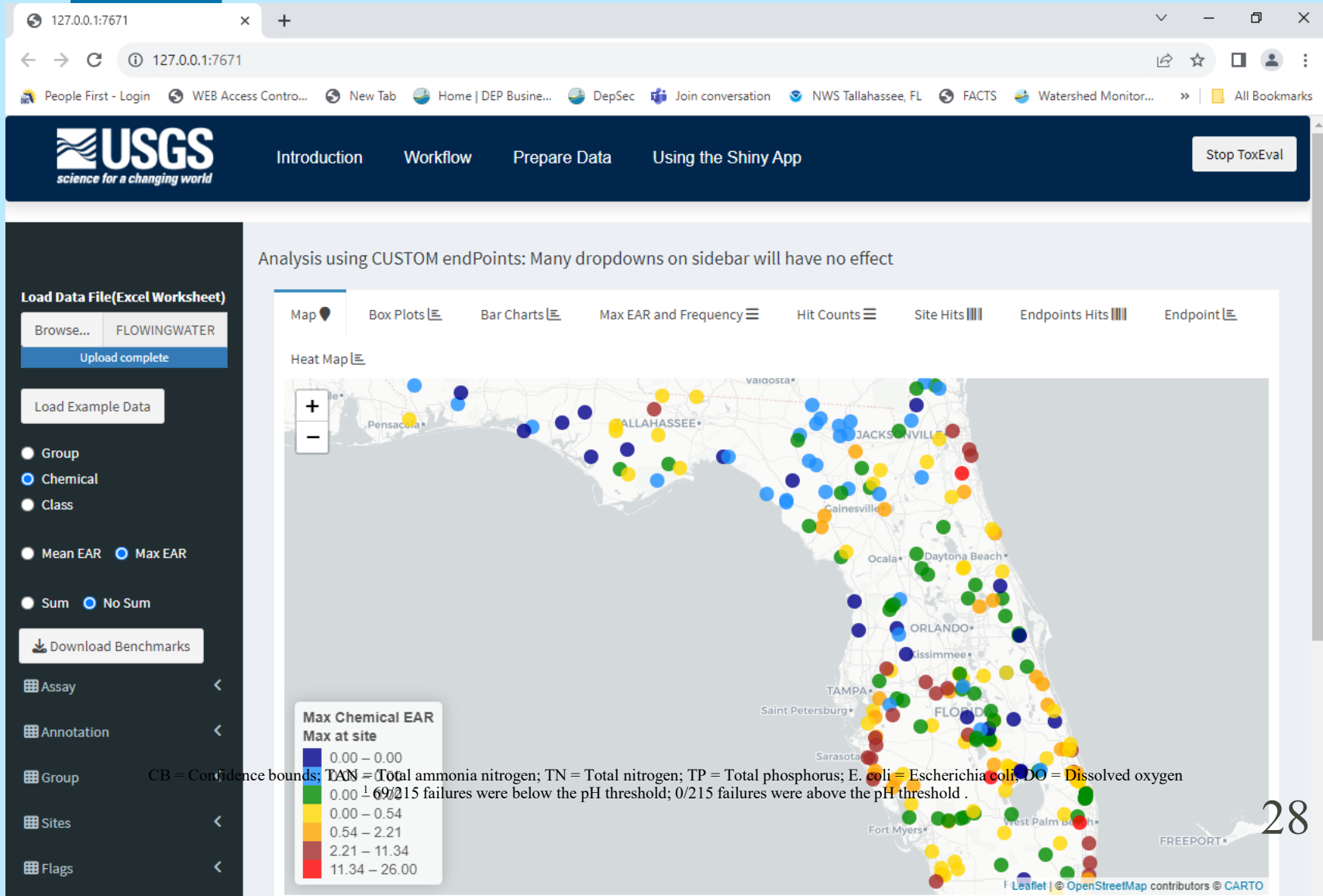
Analyte	Target Population (miles)	Number of Samples	% Meeting Threshold	Meeting Threshold 95% CB	Assessment Period
TAN	15066	203	100	100	2020-2022
TN	15066	193	71.1	64.0-78.2	2020-2022
TP	15066	194	78.7	73.0-84.4	2020-2022
Chlorophyll a	15066	203	95.7	92.9-98.6	2020-2022
E. coli bacteria	15066	202	68.9	61.6-76.2	2020-2022
DO	15066	203	76.1	69.3-82.8	2020-2022
pH¹	15066	203	52.3	45.1-59.5	2020-2022
HA	15066	190	86.9	82.0-91.9	2020-2022

CB = Confidence bounds; TAN = Total ammonia nitrogen; TN = Total nitrogen; TP = Total phosphorus;
E. coli = Escherichia coli; DO = Dissolved oxygen; HA = Habitat Assessment

¹ 69/215 failures were below the pH threshold; 0/215 failures were above the pH threshold .

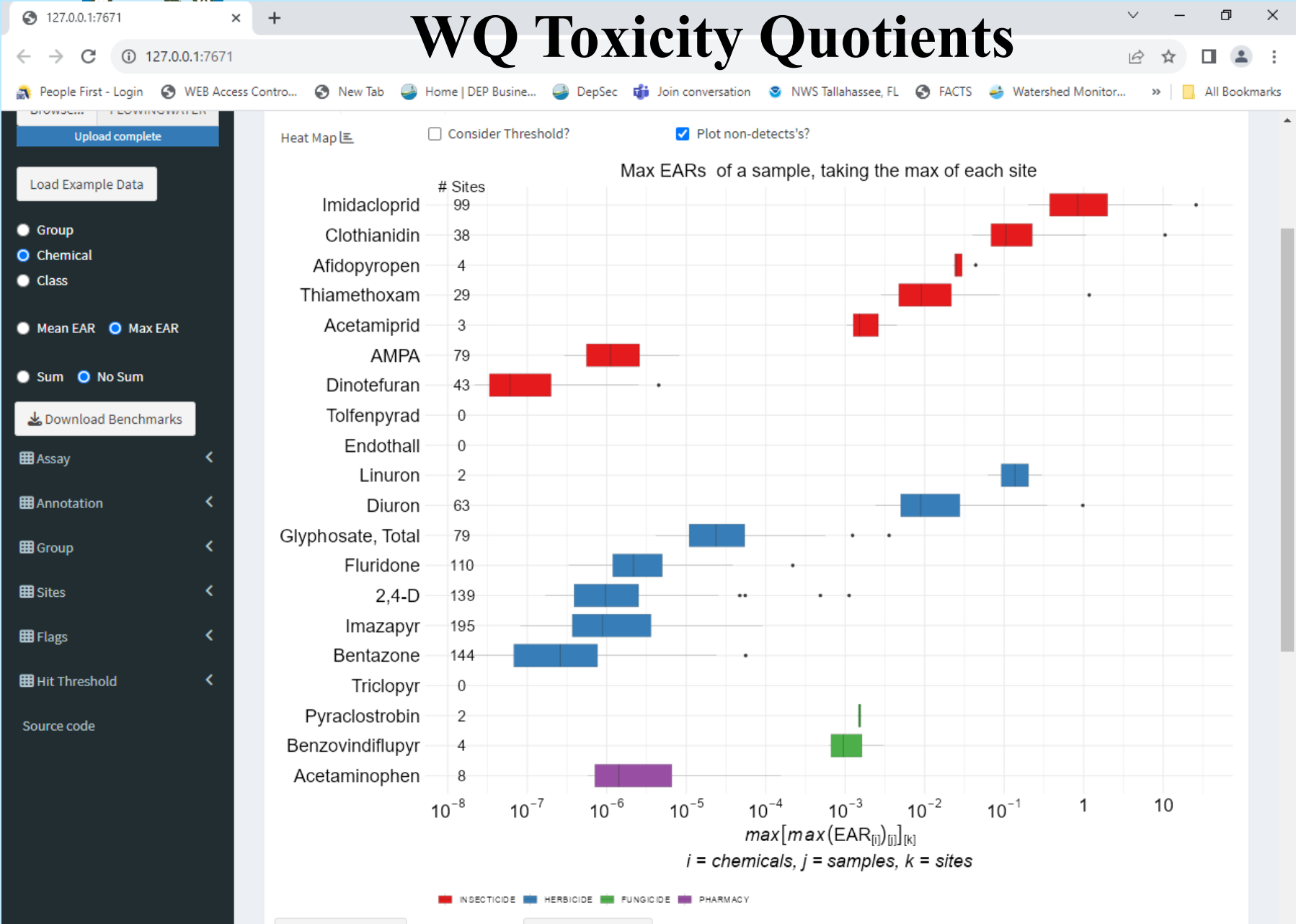


2022 Status Flowing Waters WQ Toxicity Quotients



2022 Status Flowing Waters

WQ Toxicity Quotients





Florida Department of Environmental Protection, Division of Environmental Assessment

The SN uses a probabilistic sampling design, where water sampling locations are chosen in a random and unbiased manner.

At the basin-wide scale, examine relationships between pesticide concentration and various land use and demographic variables.

WATER RESOURCES MONITORED

Lakes are non-tidal natural bodies of permanent standing water ≥ 1 m deep (at deepest location) with ≥ 1000 m² of open water. Artificially created waterbodies and agricultural private impoundments are not included.

(Small Lake area ≥ 4 ha and ≤ 10 ha; Large Lake area ≥ 10 ha)

Flowing water (Rivers, Streams & Canals) are linear waterbodies with perennial flow defined as waters of the state (Chapters 373 & 403 Florida Statutes).

Unconfined Aquifers are unconfined portions of Florida's aquifers that have potential for supplying potable water or affecting the quality of currently potable water.

Herbicide / Fungicide	Detection Frequency (%)	Min (ng/L)	Max (ng/L)
Atrazine	72.0	0.24 (I)	230
2,4-D	53.0	0.88 (I)	120
Metolachlor	52.8	0.25 (I)	98
Hexaconone	47.7	0.35 (I)	3800
Flutrazon	47.0	0.80 (I)	190

Insecticide	Detection Frequency (%)	Min (ng/L)	Max (ng/L)
Imidacloprid	38.1	0.81 (I)	43
Fipronil Sulfone	24.4	0.15 (I)	41
Chlorpyrifos Ethyl	15.5	0.10 (I)	2
Fipronil Sulfide	15.3	0.14 (I)	14
Fipronil	8.5	0.26 (I)	26

* Value greater than or equal to method detection limit (MDL) and less than practical quantitation limit (PQL).

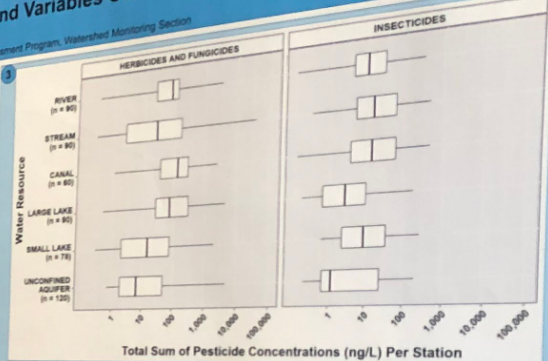


Figure 1. Statewide Summary of Total Pesticide Concentration

- Herbicides and fungicides were detected in 84% of the Status Network stations sampled from 2015-2017, while insecticides were detected in 51% of those stations.
- None of the pesticide detections were from the 2015-2017 period.

- Two midacidopH detections exceeded human health-based benchmarks. The USEPA acute pesticide registration benchmark for aquatic invertebrates (385 ng/L) and an additional 111 detections (from all water resources) were above the chronic benchmark for aquatic invertebrates (10 ng/L) (USEPA 2017). For all water resources sampled, the median total concentration of herbicides and fungicides detected per station was greater than the median total concentration of insecticides detected per station. Canals had the greatest median total herbicide & fungicide concentration, followed by Rivers and Large Lakes. Streams had the lowest median total concentration.

RESULTS AND DISCUSSION - BASIN-WIDE SCALE

- Basins were the greatest median insecticide concentrations were correlated with herbicide and fungicide concentration had a moderate positive correlation with percent commercial agricultural, urban and transportation land use ($Rho = 0.444, p = 0.018$). Median total insecticide concentration had a moderate positive correlation with percent commercial agricultural, urban and transportation land use ($Rho = 0.412, p = 0.030$). Median total insecticide concentration had a moderate positive correlation with percent commercial agricultural, urban and transportation land use ($Rho = 0.412, p = 0.030$).

Environmental Protection Agency. (2017). Aquatic life assessments for registered pesticides. <https://www.epa.gov/pesticide-registration/aquatic-life-assessments>

the benchmarks and ecological risk
Accessed 23 May 2018.

[illegible]

Figure 2. Nationwide Summary of Total Concentration of Pesticide Groups

Panel (a) displays the nationwide summary of pesticide concentrations (log scale) for 28 drainage basins, categorized by the number of agricultural, urban, and non-agricultural land use types (1 to 5). The x-axis represents the log10 concentration (ng/L) ranging from 0 to 5. The y-axis represents the log10 population size (1 to 1000). The legend indicates the number of land use types: 1 (blue), 2 (orange), 3 (green), 4 (red), and 5 (purple). Panel (b) displays the nationwide summary of pesticide concentrations (log scale) for 28 drainage basins, categorized by the number of agricultural, urban, and non-agricultural land use types (1 to 5). The x-axis represents the log10 concentration (ng/L) ranging from 0 to 5. The y-axis represents the log10 population size (1 to 1000). The legend indicates the number of land use types: 1 (blue), 2 (orange), 3 (green), 4 (red), and 5 (purple).

...with data showing the combined ...
...each basin. Data are sorted by median total

James.silvanima@dep.state.fl.us
850-245-8507