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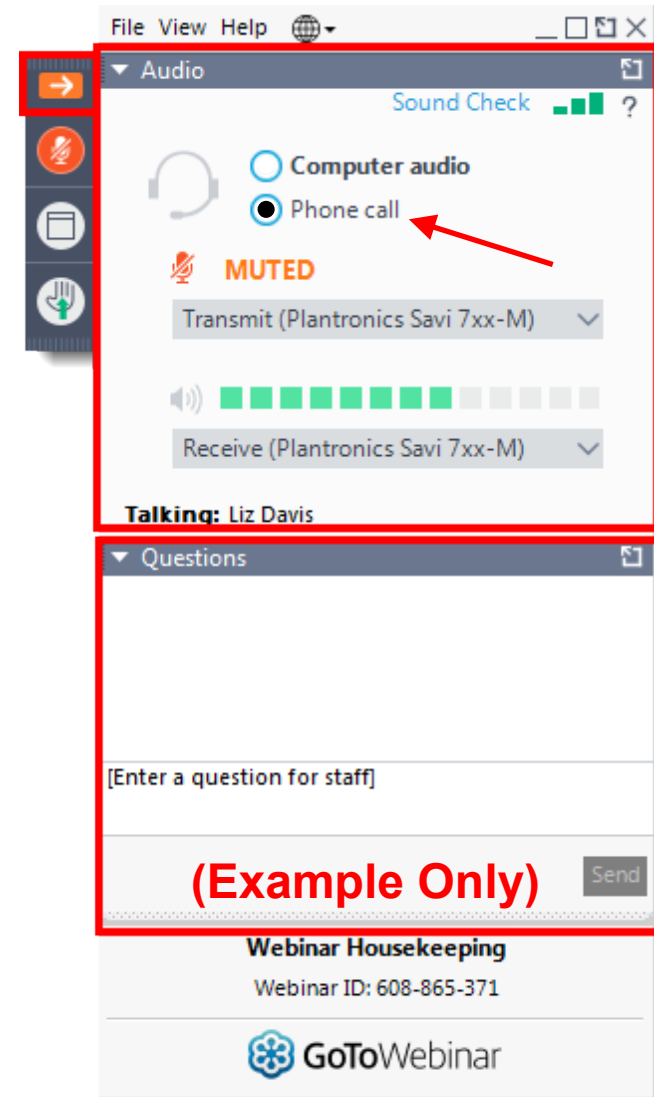
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Note: Today's presentation is being recorded and will be provided on the FTP after the webinar.





UPPER WAKULLA RIVER AND WAKULLA SPRING BASIN MANAGEMENT ACTION PLAN UPDATES

Sam Hankinson, Professional Geologist II
Lauren Campbell, Environmental Administrator
Water Quality Restoration Program
Florida Department of Environmental Protection
GoTo Webinar | April 9, 2024



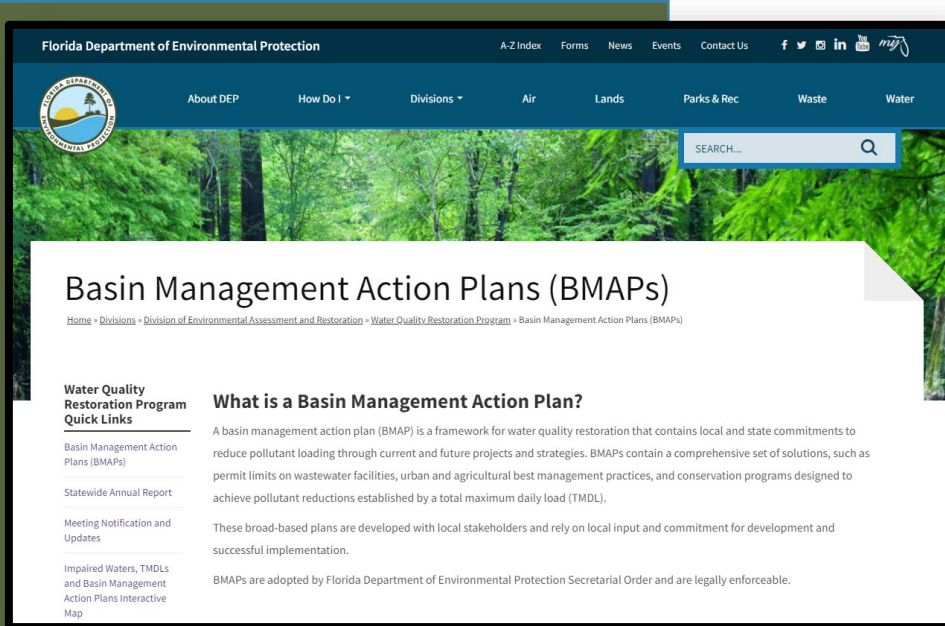
AGENDA

- Basin Management Action Plan (BMAP) Overview.
- Nitrogen Source Inventory Loading Tool (NSILT).
 - Updates.
 - Draft Results.
- Spring Vent Load Analysis.
- Next Steps - BMAP Updates.
 - Draft Allocation Approach.
 - Milestones.





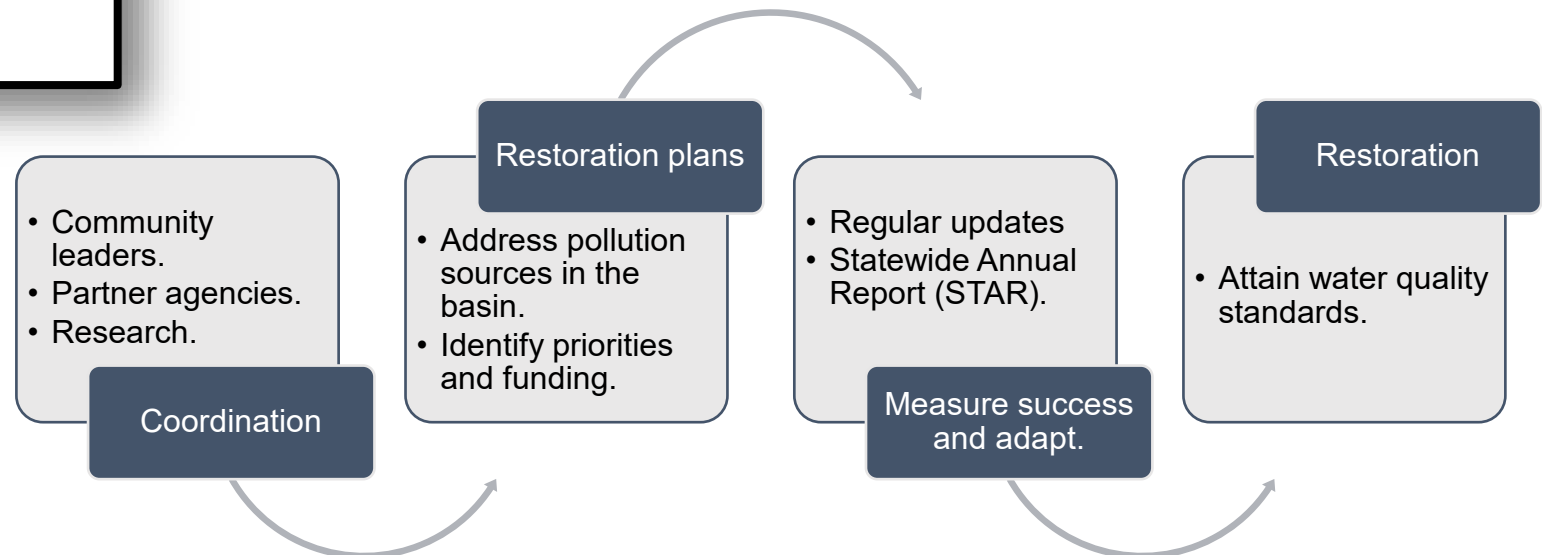
BASIN MANAGEMENT ACTION PLANS (BMAPs)



One of DEP's methods for **restoring water quality** in an impaired waterbody.

Basin Management Action Plans (BMAPs) are:

- Developed with stakeholder input.
- Adopted by DEP Secretarial Order.
- Enforceable.
- Implemented through a phased approach.
- Reported on annually.
- Updated regularly.





KEY BMAP COMPONENTS

- Total Maximum Daily Loads (TMDLs) being addressed.
- Area addressed by the restoration plan.
- Identify sources.
- Phased implementation approach.
- Milestones.
- Projects and management strategies.
- Future growth impacts.

Projects to meet the TMDL:

- Implementation timeline.
- Commitment to projects.
- Expected water quality improvement from projects and management strategies.

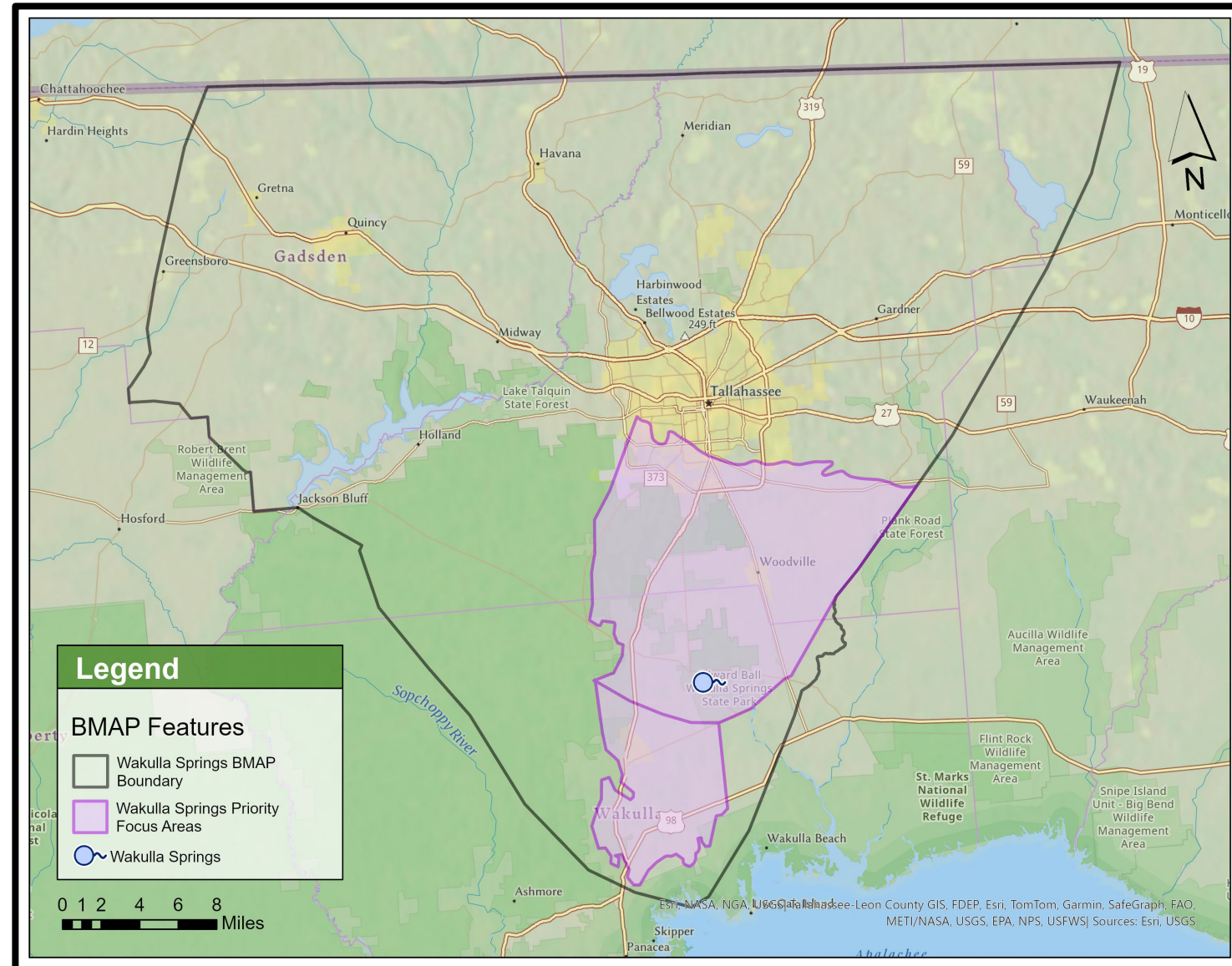
Process to assess progress toward achieving the TMDL:

- Monitoring plan.
- Project reporting.
- Periodic follow-up meetings.
- Water quality analyses.



WAKULLA SPRING BMAP

- Approximately 848,445 acres/1,325 square miles.
- Two Priority Focus Areas (PFAs).
- TMDL is 0.35 mg/L of nitrate, as a monthly (arithmetic) mean.





CLEAN WATERWAYS ACT: TIMELINE

June 12, 2023

Final Order signed by the Secretary.



July 12, 2023

Deadline for written explanation of potential exemption to be submitted to the department.



Feb. 1, 2024

Deadline for submitting draft Onsite Sewage Treatment and Disposal System (OSTDS) remediation and/or wastewater treatment plans for the department's review.



Aug. 1, 2024

Deadline for submitting complete OSTDS remediation and/or wastewater treatment plans to the department.

The nutrient BMAPs included in the Final Order require these plans.



HB 1379: ENVIRONMENTAL PROTECTION

Increased protection for Outstanding Florida Springs (OFS).

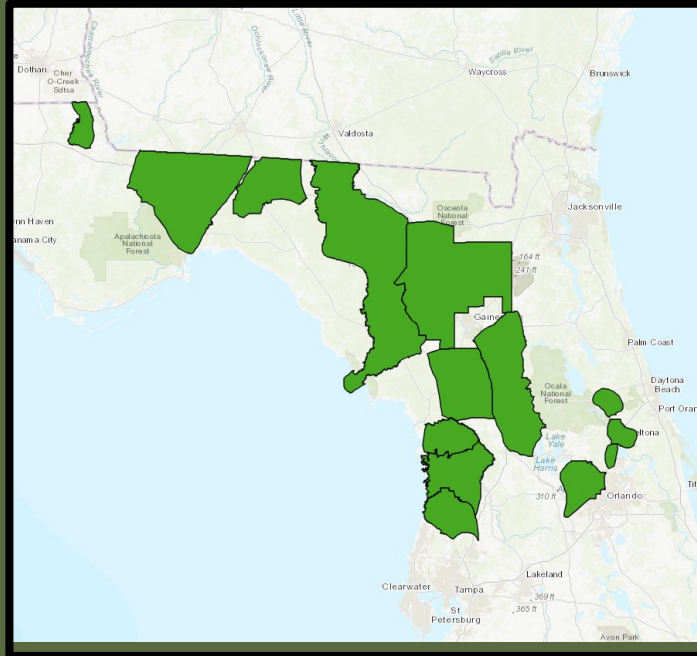
Strengthens Water Quality Protections and BMAPs.

HB1379

Improves Local Government Long-Term Comprehensive Planning.

Expands Funding Opportunities to Address Water Quality Impairments.

Expanded prohibitions in OFS to entire BMAP area. (373.811, Florida Statutes [F.S.])



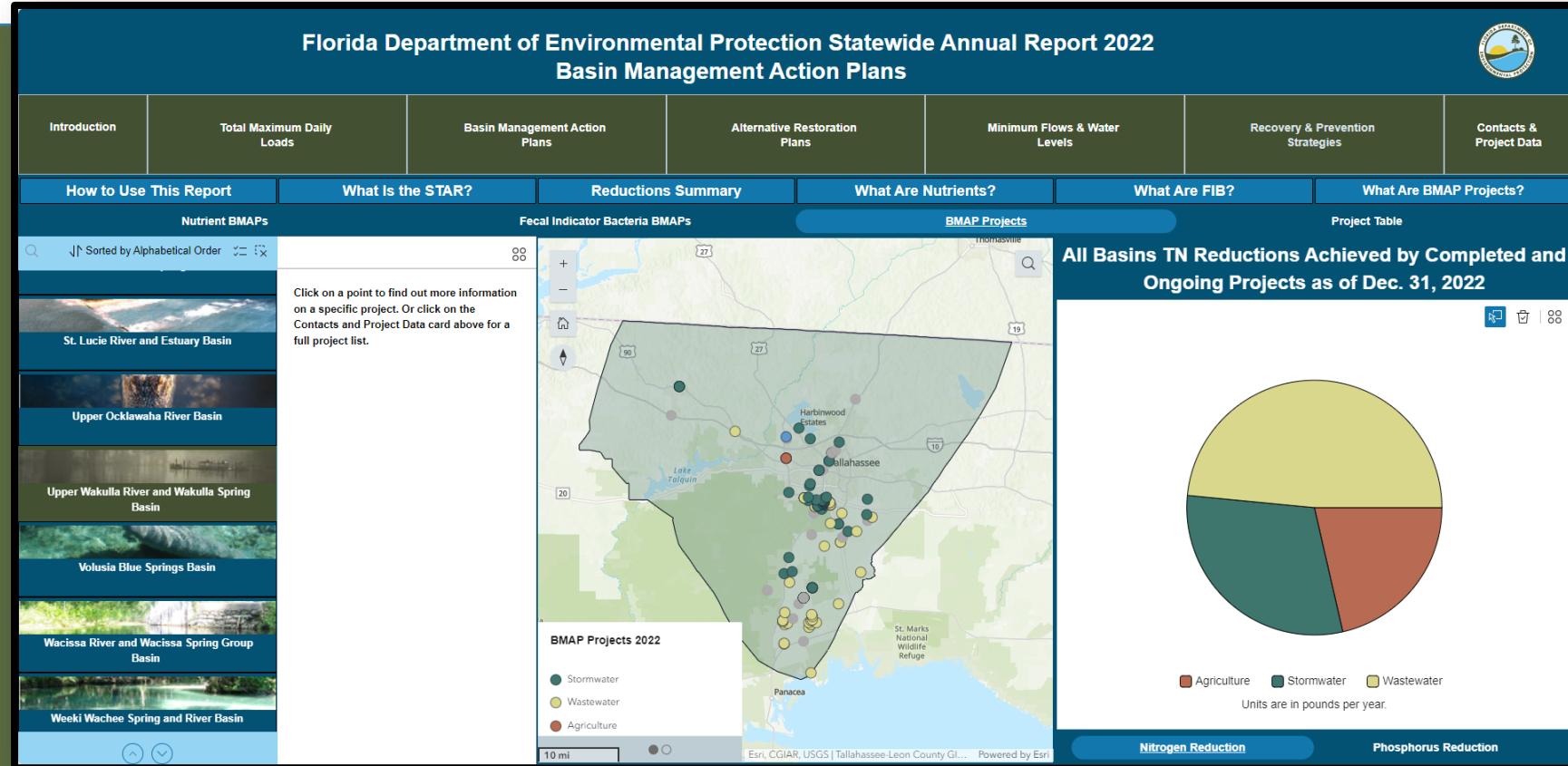
- New conventional OSTDS where sewer is available.
- New domestic wastewater disposal facilities with permitted capacities of 100,000 gallons per day or more, unless they meet Advanced Wastewater Treatment (AWT) standards.
- New HAZMAT disposal facilities.
- Land application of Class A or B biosolids not in accordance with a DEP-approved nutrient management plan.
- New agricultural operations not implementing Best Management Practices (BMPs), measures necessary to achieve pollution reduction levels or groundwater monitoring plans.



STATEWIDE ANNUAL REPORT (STAR) PROJECT REPORTING

What is the STAR?

- Summarizes accomplishments in the BMAPs statewide.
- Reports on restoration projects and management strategies.
- Published July 1 of each year.
- Currently in the process of project updates and verification for STAR 2023.





PRELIMINARY STAR RESULTS FOR 2023

WAKULLA SPRING BMAP

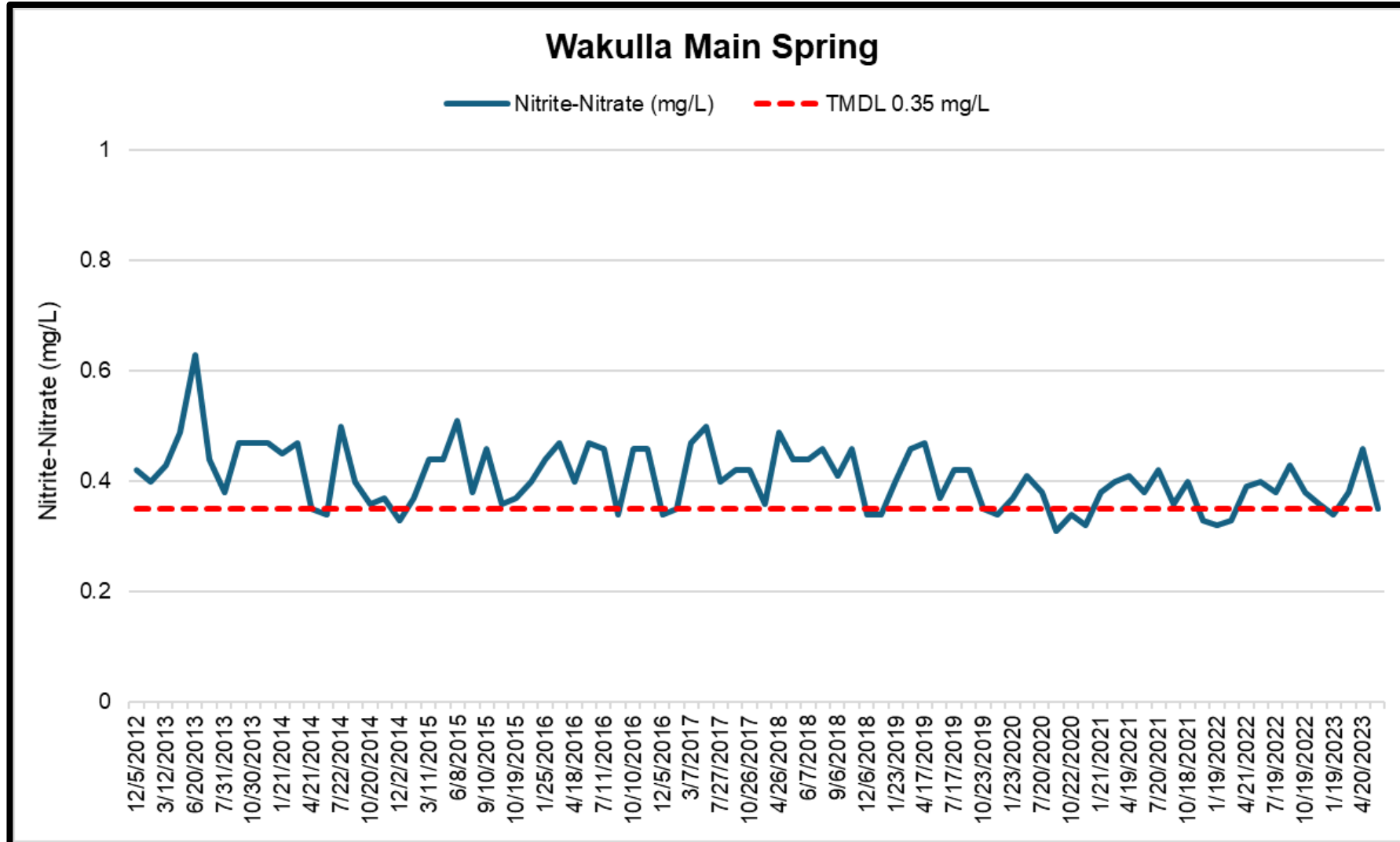
Project Status	Count of Projects
Planned	17
Ongoing	60
Underway	30
Completed	48
Total	155

As of Dec. 31, 2023, verified projects in the Wakulla Spring BMAP have reduced **22,835 lbs./yr.** of total nitrogen (TN).



WATER QUALITY DATA

WAKULLA MAIN SPRING NITRATE DATA

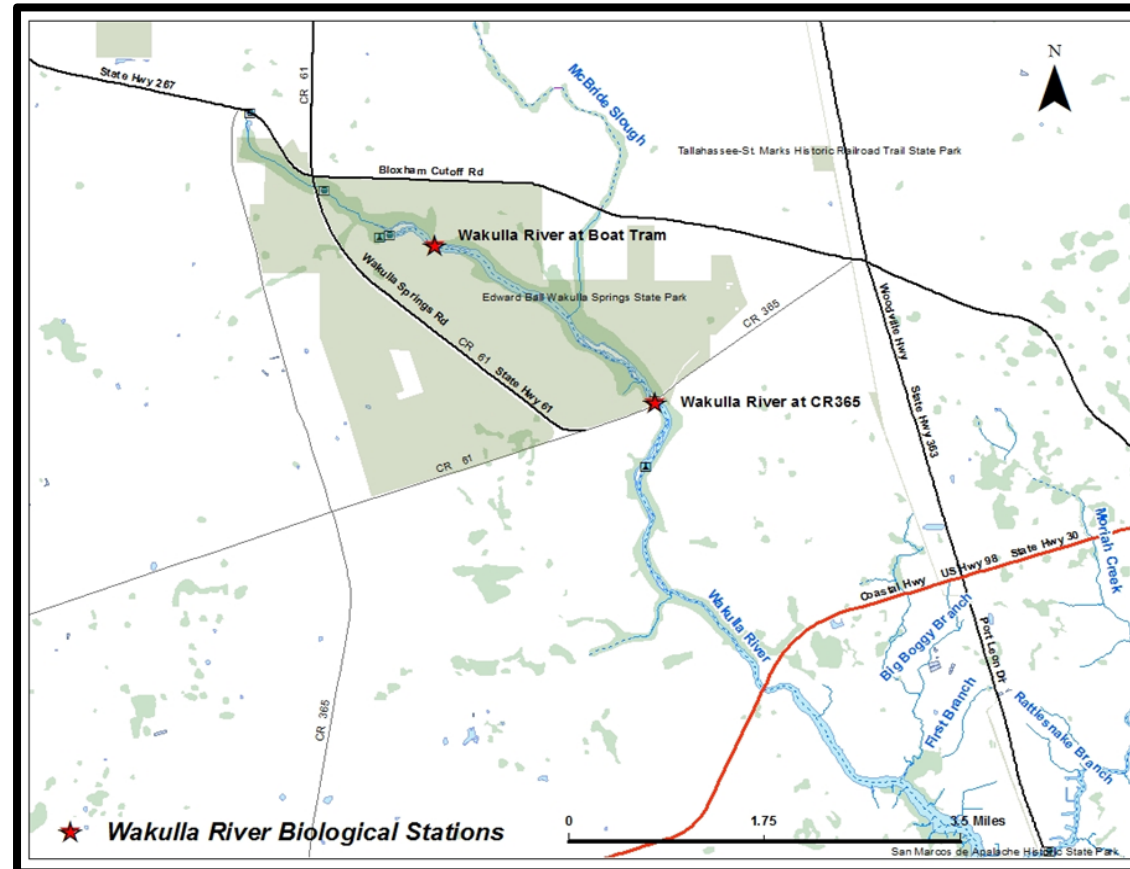




WAKULLA SPRING DATA

BIOLOGICAL DATA

- Beginning in October 2013, the department, in collaboration with the Northwest Florida Water Management District (NFWFWD), collected quarterly water chemistry and biological samples at two locations (CR365 and Boat Tram Site) in the Wakulla River to monitor and measure the effects of current and future nutrient reductions on the biological communities in the Wakulla River.

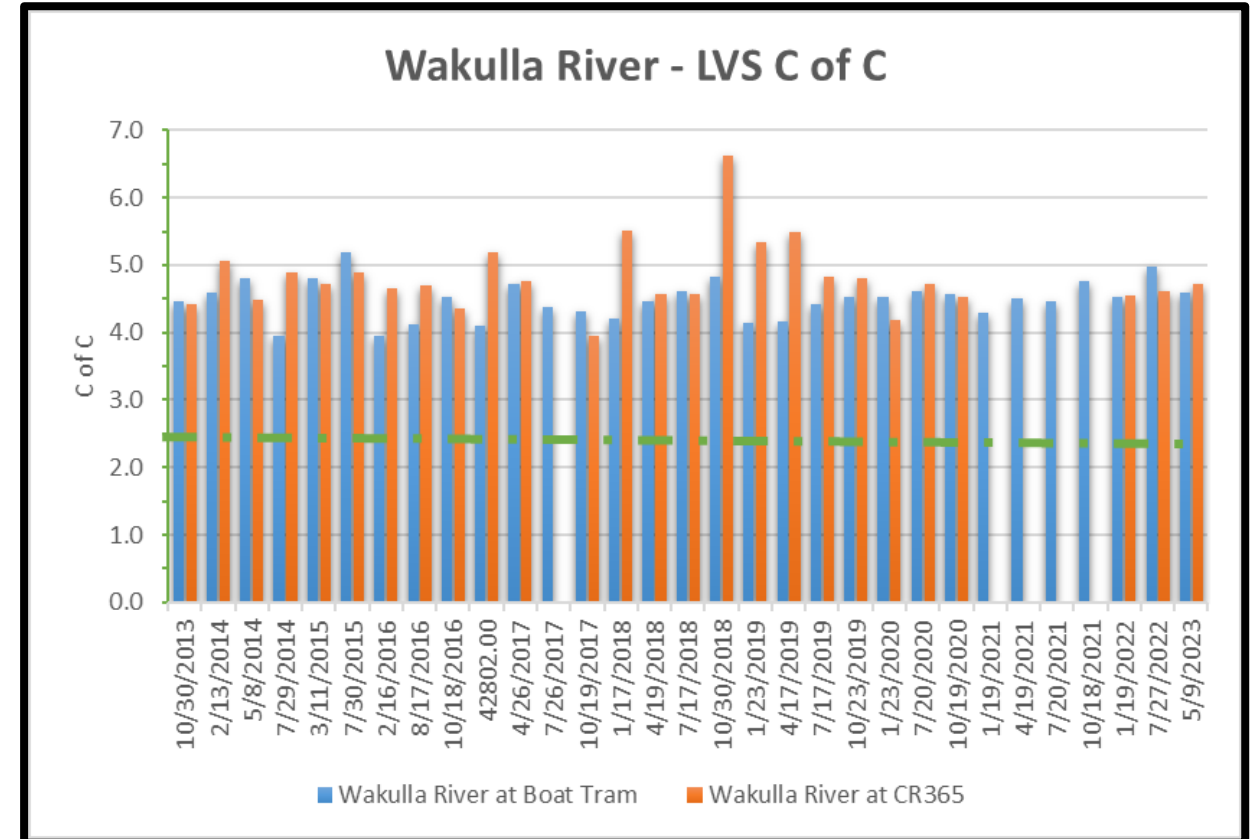
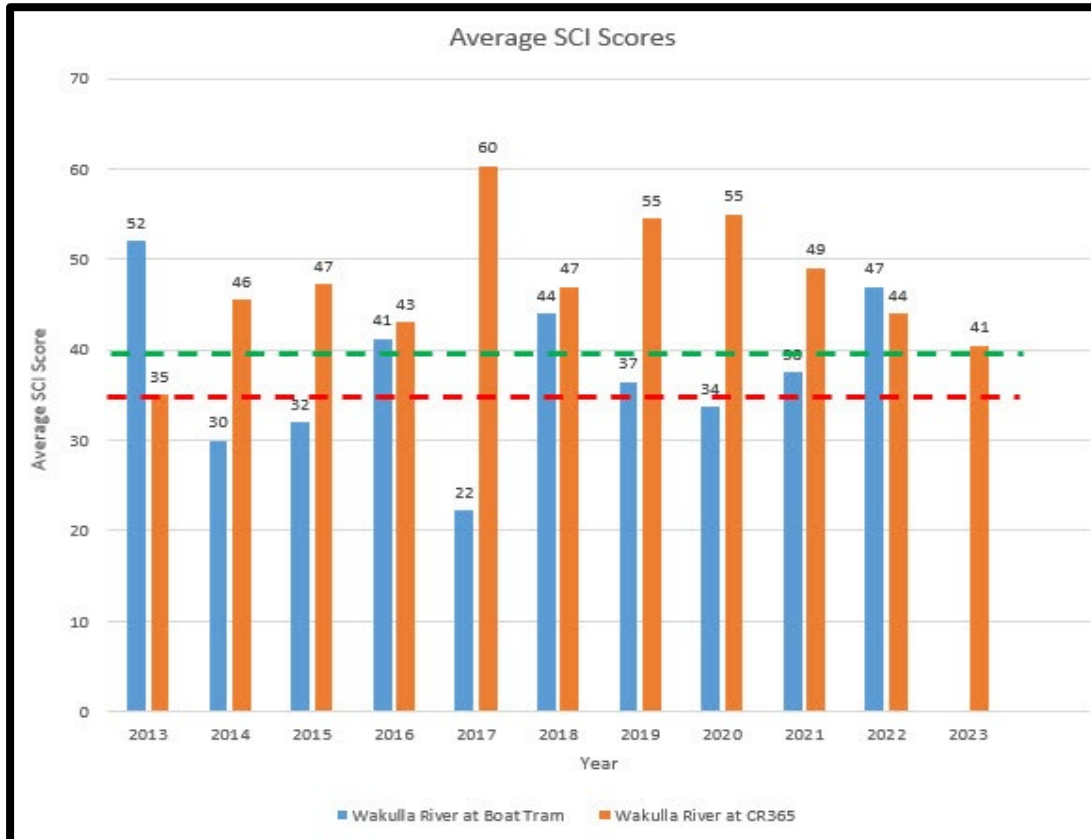




WAKULLA SPRING DATA

BIOLOGICAL DATA

- The overall average Stream Condition Index (SCI) score remains at 42, passing the average minimum impairment threshold of 40.
- The Linear Vegetation Survey (LVS) average score is 4.5 which is greater than or equal to 2.5, the threshold for balanced flora. The LVS metrics meet the evidentiary thresholds.

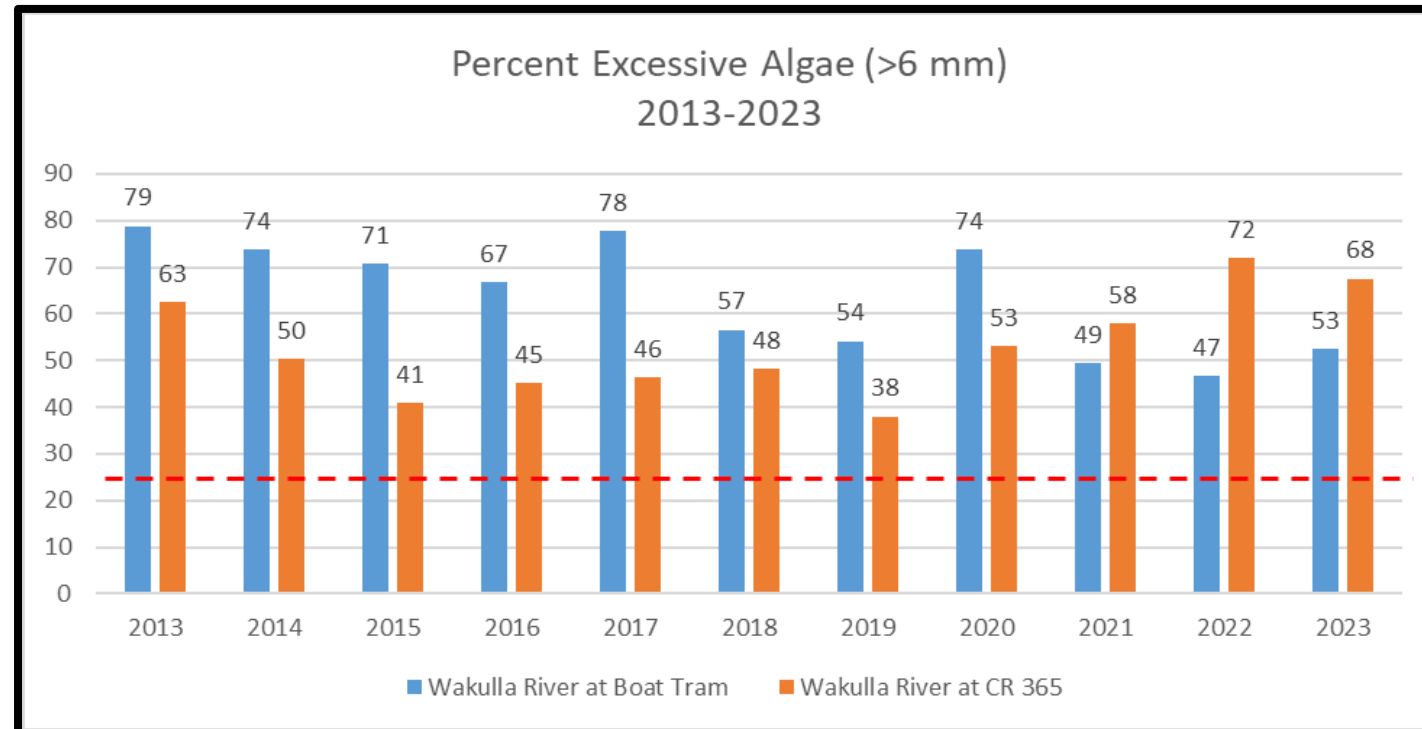




WAKULLA SPRING DATA

BIOLOGICAL DATA

- The Rapid Periphyton Survey (RPS) indicates an imbalance in the floral community based on the abundance of excessive algal growth.
- No years indicate an imbalance in floral communities based on chlorophyll *a*. If a stream exhibits annual geometric mean (AGM) chlorophyll *a* concentrations below the 90th percentile values (3.2-3.5 µg/L) observed at minimally disturbed and healthy sites, that chlorophyll *a* concentration shows no imbalance of flora.





DATA UPLOAD

WATERSHED INFORMATION NETWORK (WIN)

- Through both the Watershed Information Network (WIN) and Florida STORET (STOrage and RETrieval) data repositories, DEP implements Florida statutory requirements, DEP rule requirements and Environmental Protection Agency (EPA) funding requirements for management of environmental (non-regulatory) data for the state.
- Data from WIN are used by DEP for standards development, Impaired Waters Rule (IWR) assessments, TMDL development, Reasonable Assurance Plans, Alternative Restoration Plans, **BMAP development and assessment** and for providing data as required to EPA and to the public.
- WIN data can be retrieved through the WIN Reports and Extracts menu at: <https://prodenv.dep.state.fl.us/DearWin/>.
- Data providers to WIN and STORET include Division of Environmental Assessment and Restoration (DEAR) and other DEP entities, water management districts, cities, counties, other state agencies, universities, private and volunteer organizations.
- If your entity is collecting ambient water quality data, please upload it to WIN.



WIN COORDINATORS

WIN Coordinator	DEP District Area or Role	Phone	Email
Justin Nelson	Northeast, Northwest, Southeast	850-245-8510	Justin.M.Nelson@FloridaDEP.gov
Casey Marston	South, Southwest	850-245-8049	Casey.Marston@FloridaDEP.gov
Lisa Schwenning	SPA (STORET Public Access), WQX (U.S. EPA Water Quality Exchange)	850-245-8509	Lisa.Schwenning@floridaDEP.gov
Jason Storrs	Central, Statewide	850-245-8467	Jason.Storrs@FloridaDEP.gov



RESOURCES

BMAP WEBSITE AND STORYMAP

Basin Management Action Plans

[Home](#) » [Divisions](#) » [Division of Environmental Assessment and Restoration](#) » [Water Quality Restoration Program](#) » Basin

Water Quality Restoration Program Quick Links

[Basin Management Action Plans \(BMAPs\)](#)

[Statewide Annual Report](#)

[Water Quality Grant Opportunities 2023-24](#)

[BMAP Public Meetings](#)

[Impaired Waters, TMDLs and Basin Management Action Plans Interactive Map](#)

[Tools and Guidance for](#)

What is a Basin Management Action Plan

A basin management action plan (BMAP) is a framework for water quality management that reduces pollutant loading through current and future projects and standards, permit limits on wastewater facilities, urban and agricultural best management practices, and other measures to achieve pollutant reductions established by a total maximum daily load. BMAPs are developed by stakeholders and rely on local input and commitment for development and implementation. BMAPs are required by Department of Environmental Protection Secretarial Order and are

Water Quality Protection Grant

DEP has launched an [online grant portal](#) to provide eligible entities with information about grant programs. Eligible entities include local governments, academic institutions, and non-profit organizations. The [application portal](#) opened July 5, 2023. Closing dates for individual grant programs are posted on the portal. Applicants are encouraged to



Florida Springs Basin Management Action Plans (BMAPs)

Welcome to the Florida Springs Basin Management Action Plan (BMAP) StoryMap

The springs BMAPs are developed with specific provisions for the protection and restoration of the state's Outstanding Florida Springs. This story map focuses on the springs-related BMAPs; for more details about other BMAPs or more information about the BMAP program in general, visit <https://floridadep.gov/bmaps>.

* The story map will display differently depending on the screen size and resolution being used. Story map best viewed in Chrome or Firefox.

Overview



1 (COPY) Nitrogen Source Inventory and Loading Tool...



2 (COPY) Statutes & Bills



3 (COPY) Crystal River - Kings Bay BMAP Story Map



4 (COPY) DeLeon Spring BMAP Story Map



5 (COPY) Gemini Springs BMAP Story Map



6 (COPY) Homosassa and Chassahowitzka Springs Group



7 (COPY) Jackson Blue and Merritts Mill Pond BMAP Story Map



8 (COPY) Santa Fe River BMAP Story Map



9 (COPY) Silver Springs, Upper Silver Springs, and Rainbow Springs





BMAP UPDATES

ADOPTED BY JULY 1, 2025

- Nitrogen Source Inventory Loading Tool (NSILT) updates.
 - Spring vent load analyses.
 - Entity allocation development.
 - Future growth.
 - Establish five-year milestones for project implementation.
 - Incorporate additional projects.
 - Incorporate Clean Waterways Act (SB 712) requirements.
 - Incorporate HB 1379 requirements.
 - Incorporate regional projects.
- Water quality data evaluation:
 - Evaluation of the monitoring network (spring vent and groundwater).
 - Water quality trend analyses.
 - Evaluate further OSTDS provisions.
 - Evaluate AWT or other more stringent effluent limits.
 - Update the BMAP documents.





NSILT UPDATES

- NSILT Process.
- Methodology review for sources:
 - Atmospheric deposition.
 - Wastewater treatment facilities.
 - OSTDS.
 - Urban turfgrass fertilizer.
 - Sports turfgrass fertilizer.
 - Farm fertilizer.
 - Livestock waste.
 - Biosolids (no sites in Wakulla BMAP).
- Draft results.





NSILT GENERAL PROCESS SUMMARY

Estimate loading to land surface for each source category.

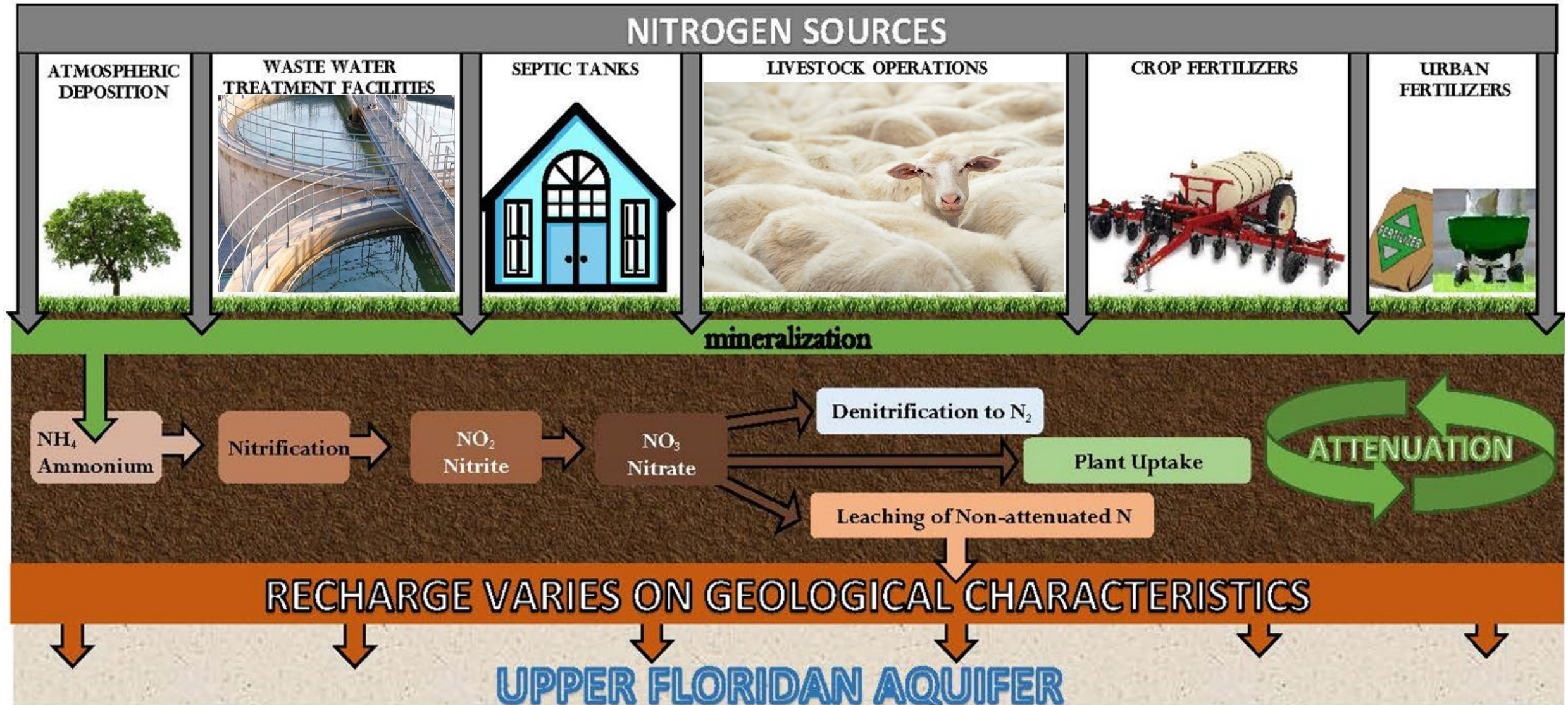
Apply a source specific, literature derived biochemical attenuation factor to surface loading estimate.

Apply a location specific recharge factor to surface loading estimate.

LOADING TO GROUNDWATER.

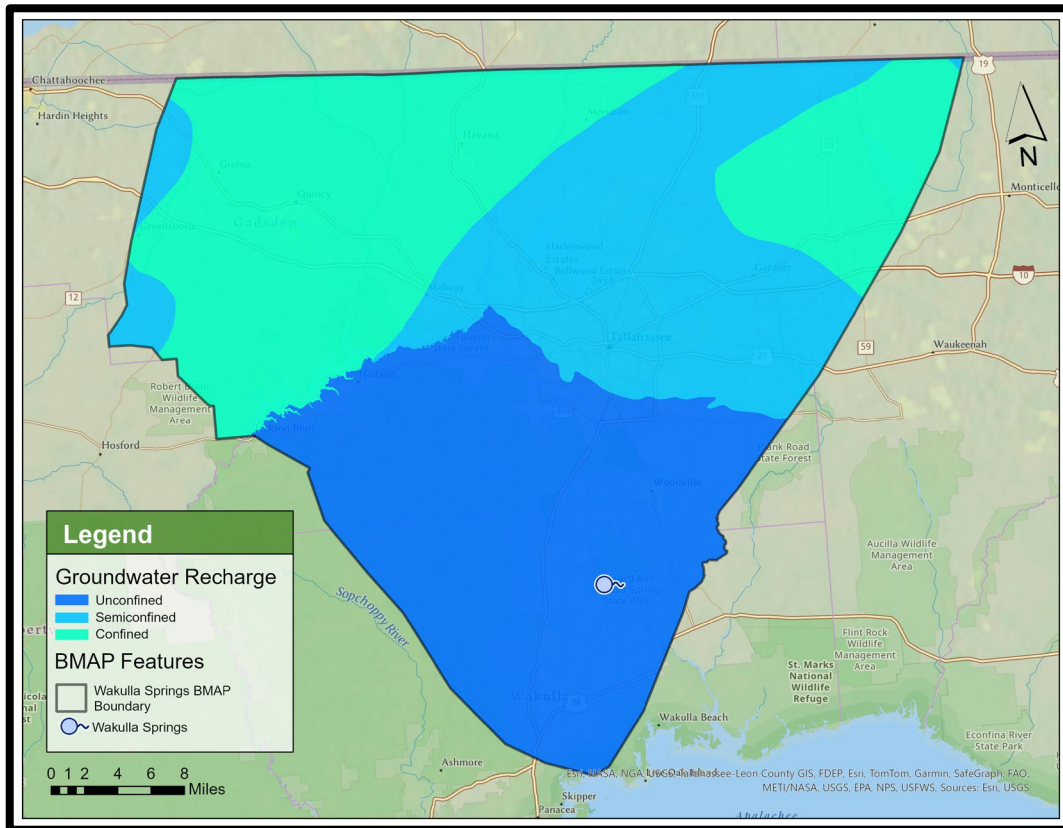


NITROGEN CYCLE AND ATTENUATION





RECHARGE TO GROUNDWATER



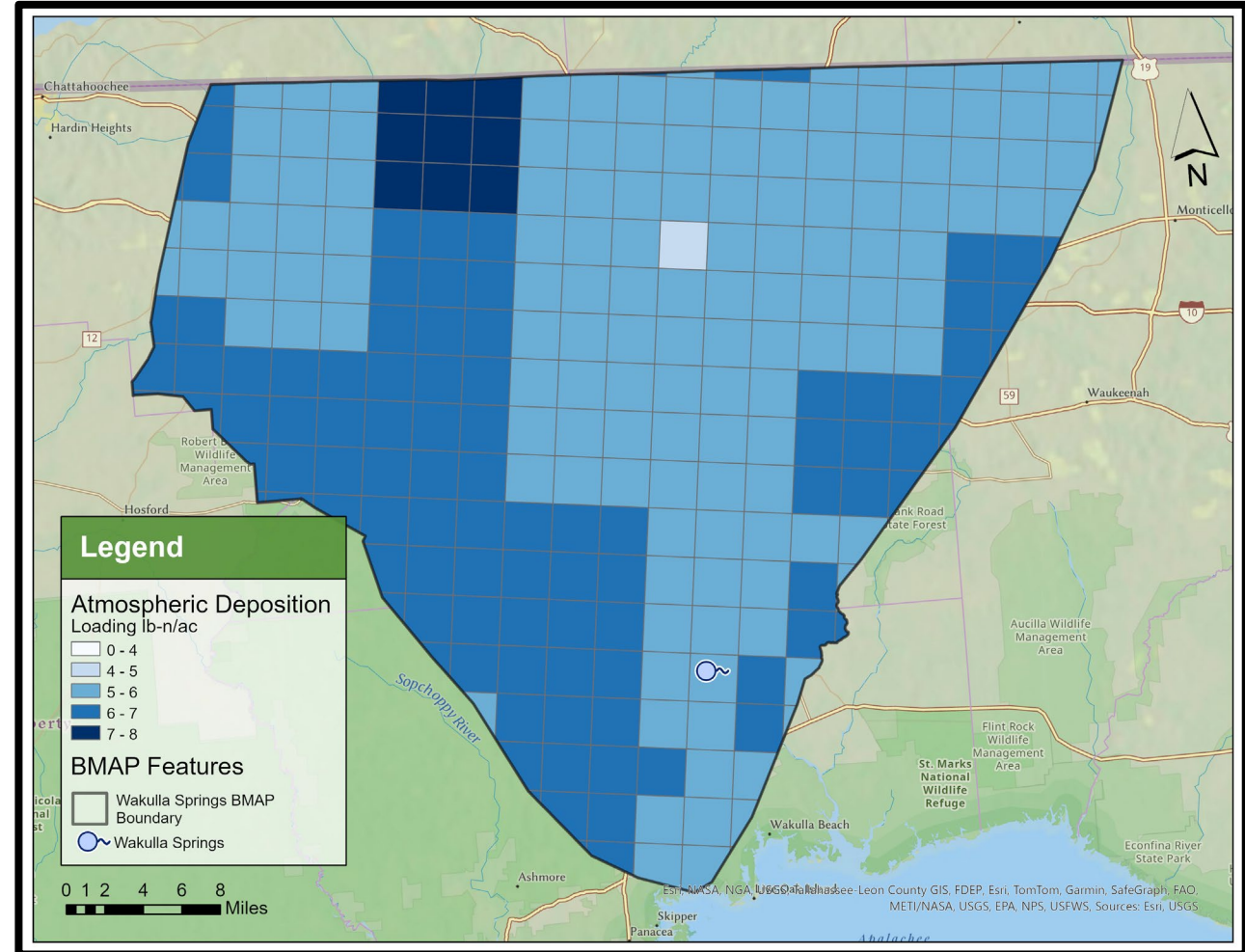
- The Wakulla Spring BMAP is divided into three recharge categories based on the confinement of the Floridan aquifer.
- In unconfined areas, it is estimated that between 9 and 20 inches of water will recharge to the Floridan aquifer annually.
- In semiconfined areas it is estimated that between 3 and 8 inches of water will recharge the aquifer annually.
- In confined areas it is estimated that 0 to 2 inches of water will recharge the Floridan aquifer annually.
- Due to the variability in the quantity of water recharging the Floridan aquifer, various recharge rates are applied.
- Delineation of unconfined, semiconfined, and confined areas and associated recharge rates are consistent with the previous NSILT report.

Recharge to Groundwater	
Category	Rate
Unconfined	90%
Semiconfined	40%
Confined	10%



ATMOSPHERIC DEPOSITION (AD)

- Atmospheric deposition of nitrogen was estimated using a nationwide model developed by the Total Deposition Science Committee and U.S. Environmental Protection Agency (EPA) called the Total Deposition (TDEP) model.
- AD estimates from 2019 and 2020 were averaged to estimate annual loading in the Wakulla Spring BMAP.
- An estimated 5,030,310 pounds of nitrogen from AD are loaded annually at the land surface within the Wakulla Spring BMAP.
- An estimated 232,007 pounds of nitrogen are loaded to the Floridan aquifer annually from AD after attenuation and recharge have been considered.
- Methodology is consistent with previous NSILT.

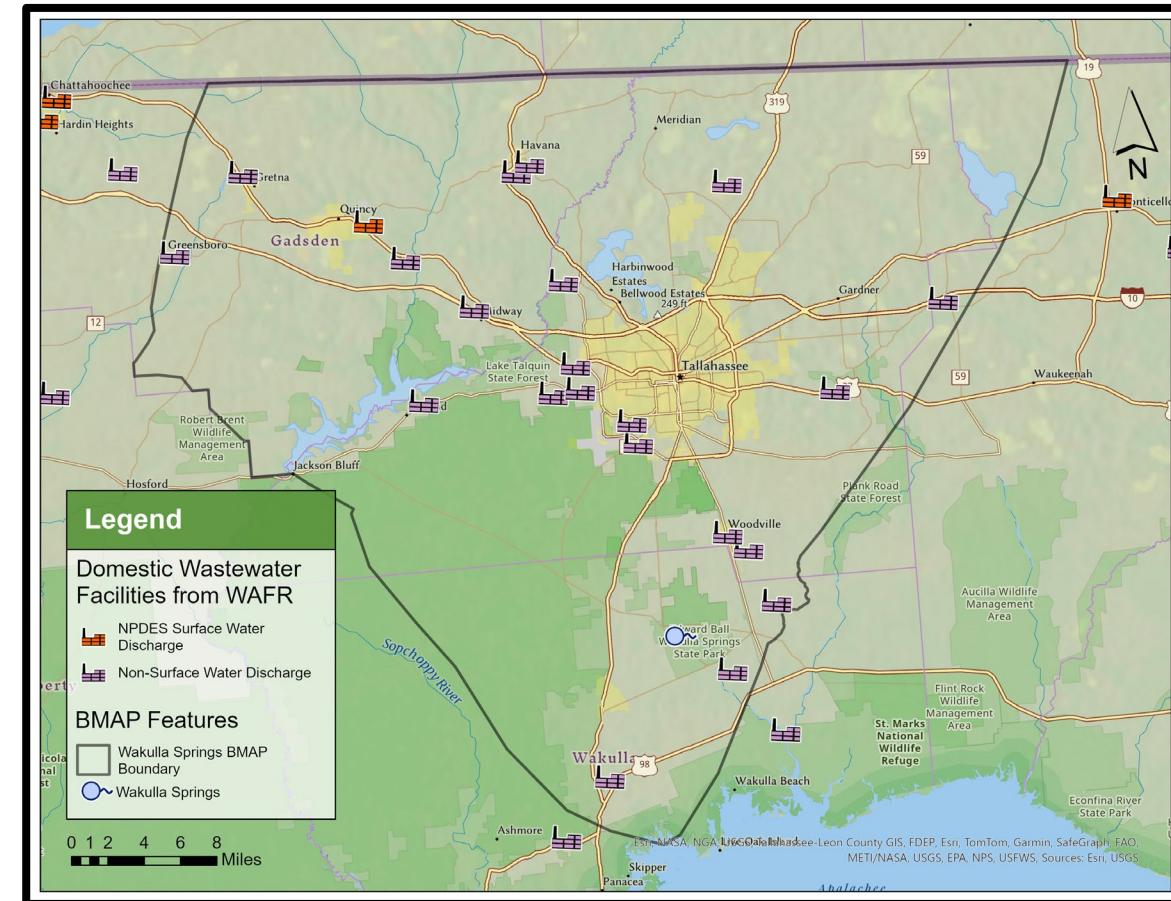




WASTEWATER TREATMENT FACILITIES

- Wastewater Facility Regulation (WAFR) information was reviewed to determine the location of all Wastewater Treatment Facilities (WWTFs), as well as their effluent application or disposal sites.
- Discharge Monitoring Report (DMR) data collected by WAFR from 2019 to 2021 were reviewed to determine effluent discharge volume and total nitrogen (TN) concentration for each disposal stream.
- Effluent disposal sites evaluated include reuse, Rapid Infiltration Basins (RIB), sprayfield, absorption field or wetland. Each method has its own estimated attenuation factor.

Wastewater Treatment Effluent Attenuation				
Reuse	RIB	Sprayfield	Absorption Field	Wetland
75%	25%	60%	50%	85%





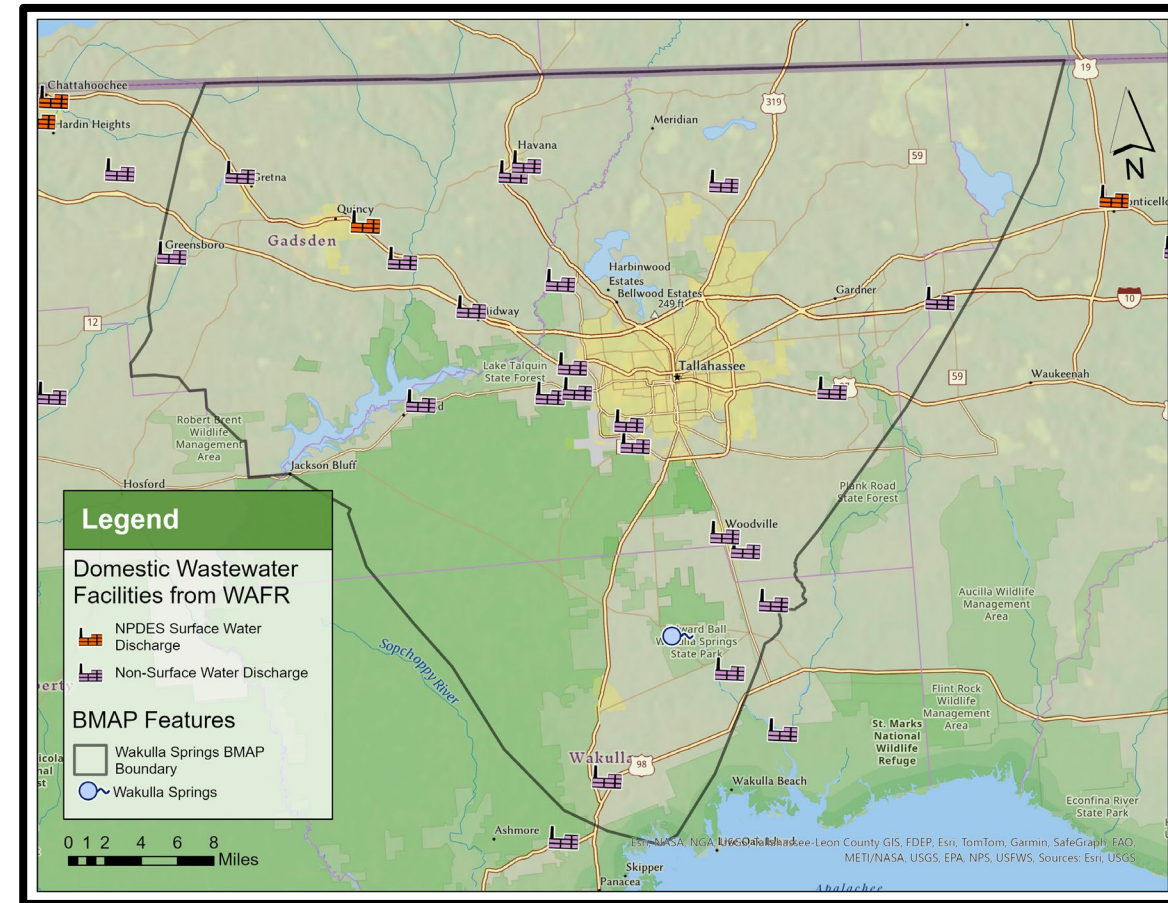
WASTEWATER TREATMENT FACILITIES

Wakulla Spring BMAP Waste Water Treatment Facility Loading to Land Surface Summary					
County	Facility ID	Facility Name	Disposal Type	Recharge Type at Disposal Site	Total Nitrogen Load (lbs/yr)
Gadsden	FLA010074	Greensboro Elementary School WWTP	Absorption Field	Low	49
Gadsden	FLA010079	Rentz MHP WWTP	Absorption Field	Low	198
Gadsden	FLA010085	Havana Middle School WWTP	RIB	Low	69
Jefferson	FLA010134	Capital City Plaza WWTP	RIB	Low	37
Leon	FLA010136	Woodville Elementary School WWTP	Absorption Field	High	27
Leon	FLA010137	Disc Village WWTP	RIB	High	66
Leon	FLA010138	Fort Braden Elementary School WWTP	Absorption Field	High	92
Leon	FLA010139	T P Smith Water Reclamation Facility	Reuse (golf, residential, etc.)	High	52,659
Leon	FLA010139	T P Smith Water Reclamation Facility	Reuse (golf, residential, etc.)	Medium	247
Leon	FLA010139	T P Smith Water Reclamation Facility	Reuse (golf, residential, etc.)	High	1,382
Leon	FLA010139	T P Smith Water Reclamation Facility	Reuse (golf, residential, etc.)	Medium	543
Leon	FLA010148	Lake Bradford Estates MHP WWTP	Absorption Field	High	531
Leon	FLA010151	Grand Village Mobile Home Park WWTP	RIB	High	413
Leon	FLA010152	Western Estates MHP WWTP	Absorption Field	High	106
Leon	FLA010159	Meadows - At - Woodrun WWTF	RIB	Medium	650
Leon	FLA010167	Sandstone Ranch WWTF	RIB	High	502
Leon	FLA010171	Lake Jackson WWTP	RIB	Medium	9,915
Leon	FLA010173	Killearn Lakes WWTP	Sprayfield	Medium	12,664
Leon	FLA010173	Killearn Lakes WWTP	RIB	Medium	527
Wakulla	FLA010229	Wakulla Middle School WWTP	Absorption Field	High	94
Wakulla	FLA010241	River Plantation Estates WWTP	RIB	High	246
Wakulla	FLA016544	Winco Utilities, Inc WWTP	Sprayfield	High	3,923
Gadsden	FLA100765	Havana WWTF	Sprayfield	Low	3,392
Gadsden	FLA100781	Gretna, City of - WWTP	Reuse (golf, residential, etc.)	Low	1,550
Gadsden	FLA187941	Gadsden East WWTF	RIB	Low	2,491



WASTEWATER TREATMENT FACILITIES

- An estimated 92,373 pounds of nitrogen are applied to the land surface from all WWTFs and all disposal methods.
- Within the Wakulla Spring BMAP, use of reclaimed water on golf courses or public access is the predominant effluent disposal method (61%), followed by sprayfields (21.6%), RIBs (16.1%) and absorption fields (1.2%).
- After recharge and attenuation factors are applied, it is estimated that 20,597 pounds of nitrogen are loaded to the Floridan aquifer from WWTFs.

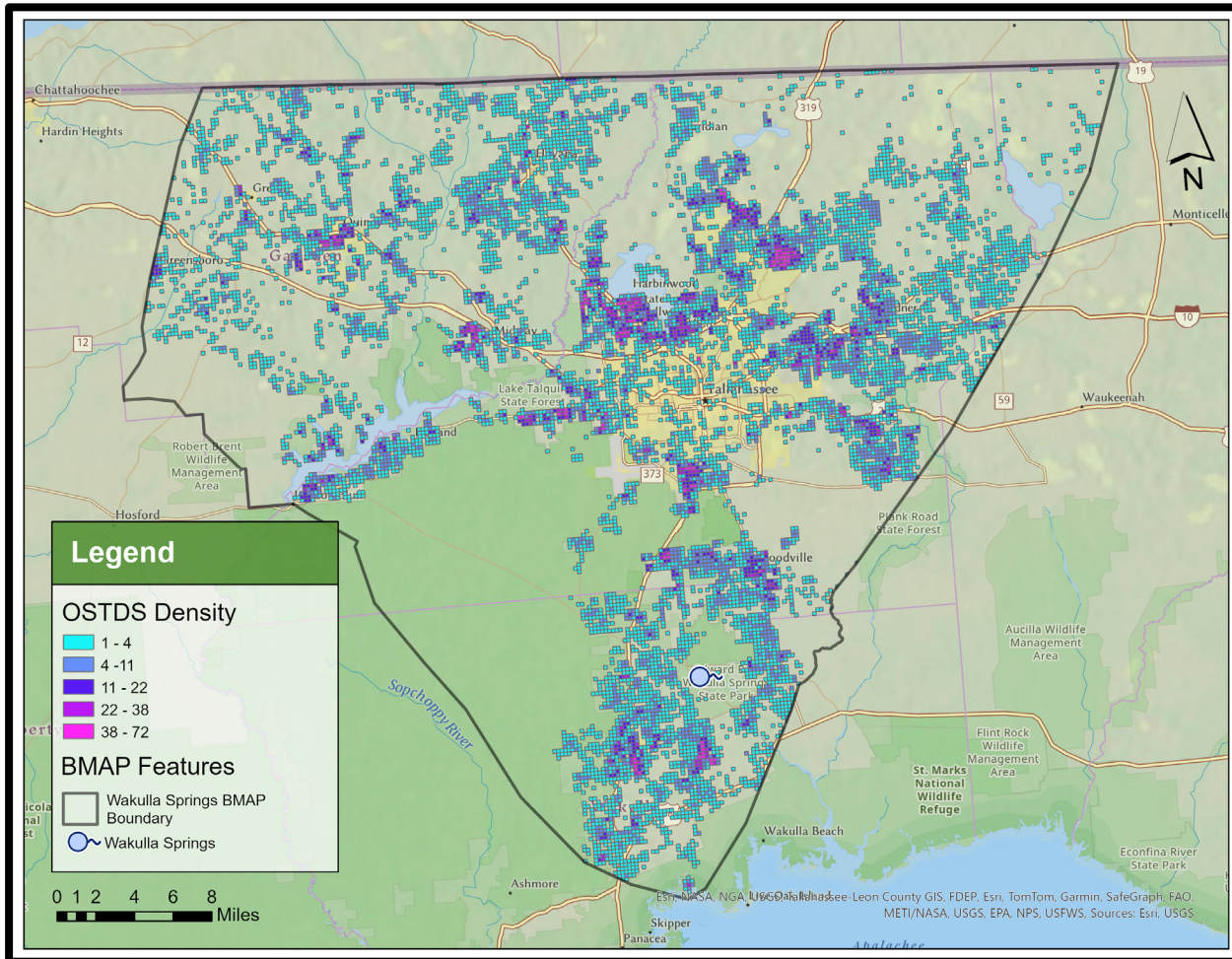




- Florida Water Management Inventory (FLWMI) data was used to estimate the number of OSTDS within the Wakulla Spring BMAP (updated in 2021).
- Parcels identified as "known septic", "likely septic" and "somewhat likely septic" were considered to have one septic system per parcel.
- 2020 U.S. Census data was used to estimate the average persons per household (pph) by county.
- Estimated loading of 10 lb.-N/year per person (Armstrong, 2015).
- Estimated load per tank is based on multiplying the average pph by the estimated loading per person.
- Credited enhanced nutrient reducing OSTDS with a 50% reduction in TN loading from the existing condition.
- Loading from OSTDS is estimated to attenuate at 30%.



ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS



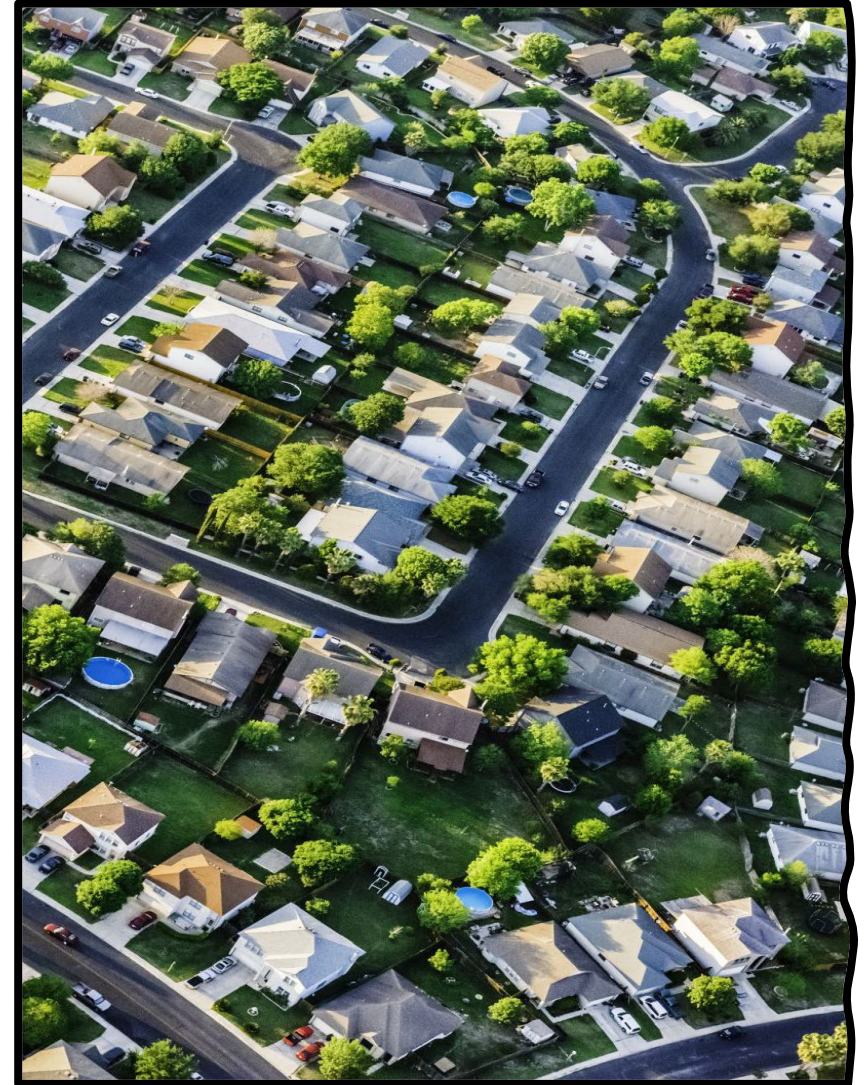
*Density is per 300-meter by 300-meter grid cells.

- An estimated 49,593 OSTDS are within the Wakulla Spring BMAP.
- There are 423 enhanced nutrient reducing OSTDS within the BMAP.
- An estimated 1,196,788 pounds of nitrogen are loaded to drainfields annually from OSTDS within the Wakulla Spring BMAP.
- An estimated 413,225 pounds of nitrogen are loaded to groundwater annually after recharge and attenuation factors are applied.



URBAN TURFGRASS FERTILIZER

- Urban Turfgrass Fertilizer (UTF) loading was evaluated separately for single family residential, non-single family residential and sports turfgrass.
- Sports turfgrass loading includes the application of fertilizers to both sports fields and golf courses.
- Loading from urban turfgrass fertilizers are estimated to attenuate at 70%.



Microsoft Stock Image, 2023



URBAN TURFGRASS FERTILIZER

SINGLE FAMILY RESIDENTIAL

- 2021 Florida Department of Revenue Cadastral information was used to determine size and value of single-family residential parcels.
- Assumed 27.8% of parcel as impervious area (Tilley & Slonecker, 2006).
- Assumed 0.5 acres maximum for fertilized area for single family residential parcels greater than 0.5 acres in the Wakulla Spring BMAP.
- Assumed likelihood to fertilize rate is based on home value. Three tiers of home value considered.
- Fertilizer application rates are informed by local survey information and the Green Industries Best Management Practice (GIBMP) manual.

Lawn Care Source	
Service	19.00%
Self	16.00%
None	65.00%

Self Application Rates	Percent of Self Lawn Care Source	Application Rate (lbs/N/ac/application)	Number of Applications
BMP	20.00%	26.136	1.880
Low	75.00%	30.490	1.880
High	5.00%	43.560	1.880



URBAN TURFGRASS FERTILIZER

NON-SINGLE FAMILY RESIDENTIAL

- Water management district land use/land cover data was used to estimate non-single family residential UTF application acreage estimates. Land use data year is dependent on the water management district with all data updated between 2019 and 2022.
- Fourteen land cover codes were assumed to be likely to receive fertilizer.
- Impervious area was estimated using a United States Geological Survey (USGS) study (Tilley & Slonecker, 2006). Percent impervious area was dependent on the land use category.
- The area of pervious surface expected to receive fertilizer was evaluated by local land cover data. The percentage of pervious area evaluated to be bare ground or grass surface was applied to the estimated pervious areas of the 14 land cover codes to then estimate the area expected to receive fertilization.

WMD Land Cover Code	Percent Impervious	Percent of Pervious area Receiving Fertilizer
1220: Medium Density, Mobile Home Units	32.6%	17.7%
1230: Medium Density, Mixed Units (Fixed and Mobile Home Units)	32.6%	15.4%
1320: High Density, Mobile Home Units	44.4%	20.7%
1330: Multiple Dwelling Units, Low Rise	44.4%	27.8%
1340: High Density, Multiple Dwelling Units, High Rise (Four Stories or More)	44.4%	32.8%
1400: Commercial and Services	72.2%	31.3%
1411: Shopping Centers	72.2%	31.3%
1480: Cemeteries	8.3%	42.2%
1700: Institutional	34.4%	43.3%
1720: Religious	39.9%	37.7%
1740: Medical and Health Care	72.2%	33.8%
1750: Governmental	35.4%	41.0%
1850: Parks and Zoos	12.5%	44.9%
1860: Community Recreational Facilities	12.5%	59.8%



URBAN TURFGRASS FERTILIZER

- Estimated fertilizer application rates for non-single family residential fertilized areas were based on an evaluation of the GIBMP Manual. It is estimated that fertilizer is applied at a rate of 2.5 lb-N/1,000 ft² to fertilized turfgrass in the region.
- In total, it is estimated that 416,384 lb-N/year are applied to single family residential areas, and 239,419 lb-N/year are applied to non-single family residential areas within the Wakulla Spring BMAP.
- With attenuation and recharge factors considered, it is estimated that 55,298 lb-N/year is loaded to groundwater from single family residential sources, and 32,957 lb-N/year is loaded to groundwater from non-single family residential sources, for a total of 88,255 lb-N/year loaded to groundwater for UTF.

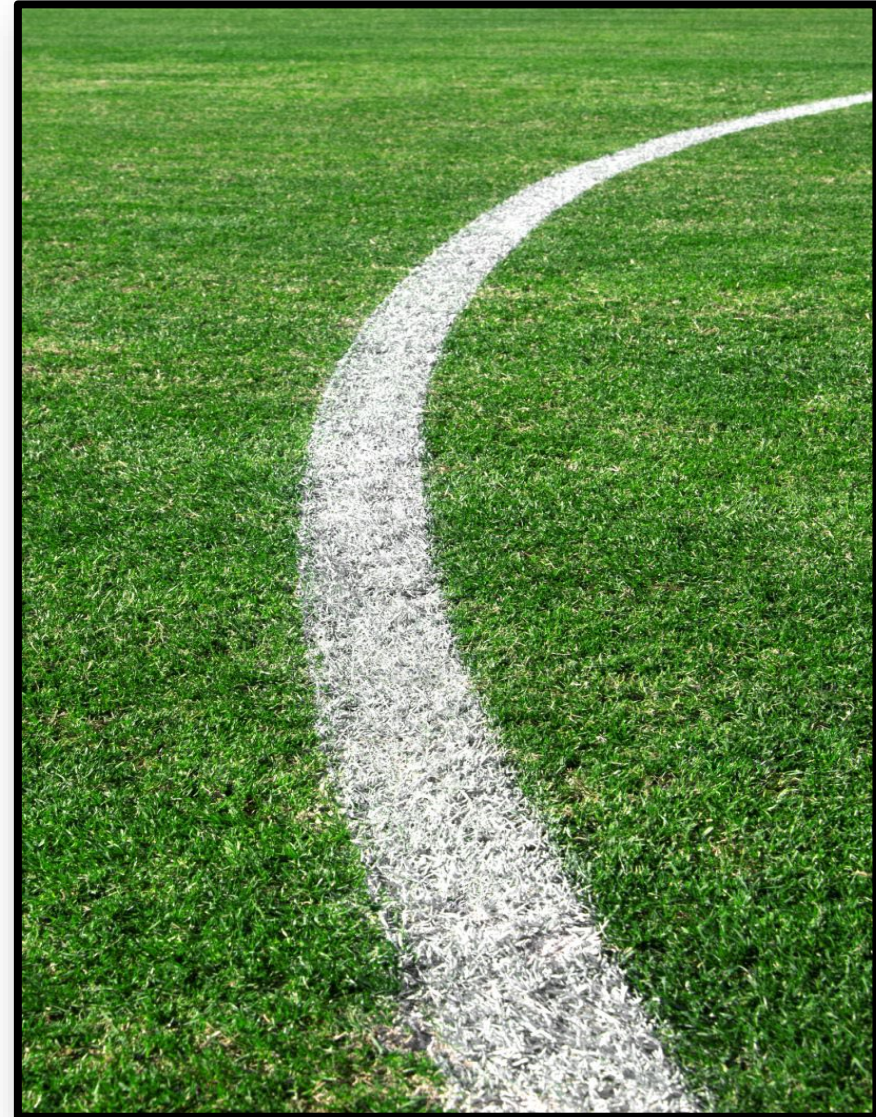


SPORTS TURFGRASS FERTILIZER

Sports Turfgrass Fertilizer (STF) is a combination of golf course and other sports turfgrass areas:

- BMAP area was evaluated to identify active golf courses.
- Previous NSILT estimates of non-golf STF areas were used in this evaluation to estimate loading from this source.
- Fertilizer application rates and area from the previous NSILT were used to estimate current nutrient loading for STF where information was available.

Wakulla Spring	Acres of Sports Turfgrass				Loading (lb-N/year)			
	High	Medium	Low	Discharge	High	Medium	Low	Discharge
Leon	76	183.59	2.22	0	3292	7997	97	0
Wakulla	32	0	0	0	1398	0	0	0
Gadsden	0	2.36	24.25	0	0	103	1056	0



Microsoft Stock Image, 2023

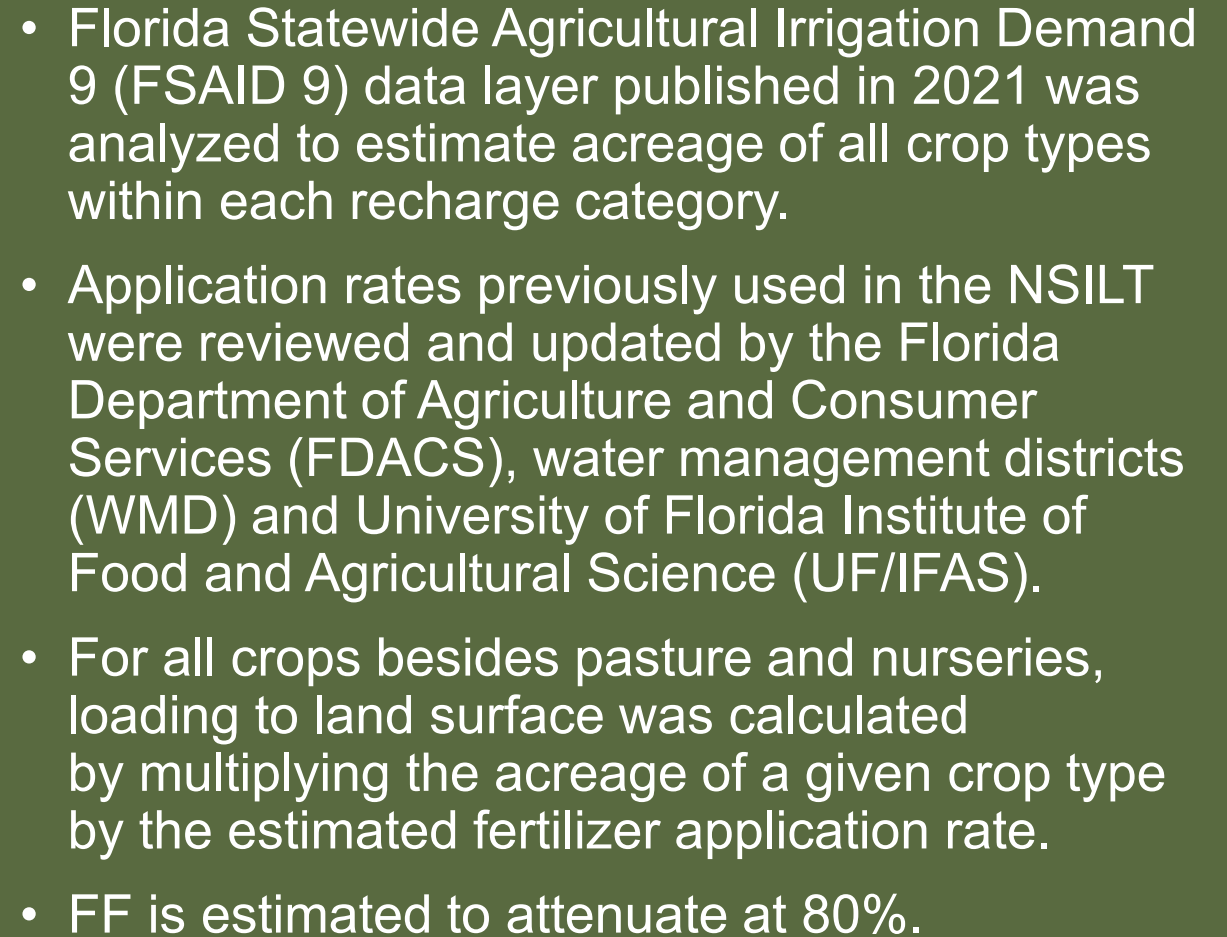


SPORTS TURFGRASS FERTILIZER

Leon		Land Area (Ac)				N Input (lb-N/yr)			
Golf Course	Regional Rate or Site Specific	High	Medium	Low	Discharge	High	Medium	Low	Discharge
Seminole	Regional	124	206			11,883	19,741	0	0
Southwood	Regional		277			0	26,545	0	0
Summerbrooke	Regional		171			0	16,387		
Capital City	Regional		189			0	18,112		
Jack Gaiher	Specific	119				1,787	0	0	0
Killearn	Regional		269			0	25,779	0	0
Golden Eagle	Regional		171			0	16,387	0	0
Hilaman	Specific		122			0	3,895	0	0
Wakulla		Land Area (Ac)				N Input (lb-N/yr)			
Golf Course	Regional Rate or Site Specific	High	Medium	Low	Discharge	High	Medium	Low	Discharge
Wildwood	Regional	163				15,621	0	0	0
Gadsden		Land Area (Ac)				N Input (lb-N/yr)			
Golf Course	Regional Rate or Site Specific	High	Medium	Low	Discharge	High	Medium	Low	Discharge
Havana	Regional			92		0	0	8,817	0
Quincy	Specific			195			0	3,719	0

- Golf courses operating within the Wakulla Spring BMAP were reviewed. Acreage for operating courses were consistent with the previous NSILT evaluation.
- Golf course application rates were updated based on a study of regional golf course practices published by HortTechnology (Shaddox, et al., 2023).
- It is estimated that 168,673 lb-N/year is applied to the land surface at golf courses.
- When attenuation and recharge are considered, it is estimated that 25,779 lb-N/year is loaded to groundwater from golf courses.

Golf Course Study Rates		
Application Rate	95.832	lb-N/ac
% fertilized	100%	





FARM FERTILIZER

Nursery Crops	Fertilizer Application Rate (lb-N/acre)	Effective Application Rate (lb-N/acre)
Asparagus Fern	90	21.6
Aspidistra	90	21.6
Container Nursery	150	36
Coontie Fern	90	21.6
Fern	90	21.6
Field Nursery	90	21.6
Leatherleaf	90	21.6
Liriope	90	21.6
Nurseries and Vineyards	90	21.6
Nursery	90	21.6
Ornamentals	90	21.6
Pittosporum	90	21.6
Timber Nursery	50	12
Tree Nurseries	90	21.6

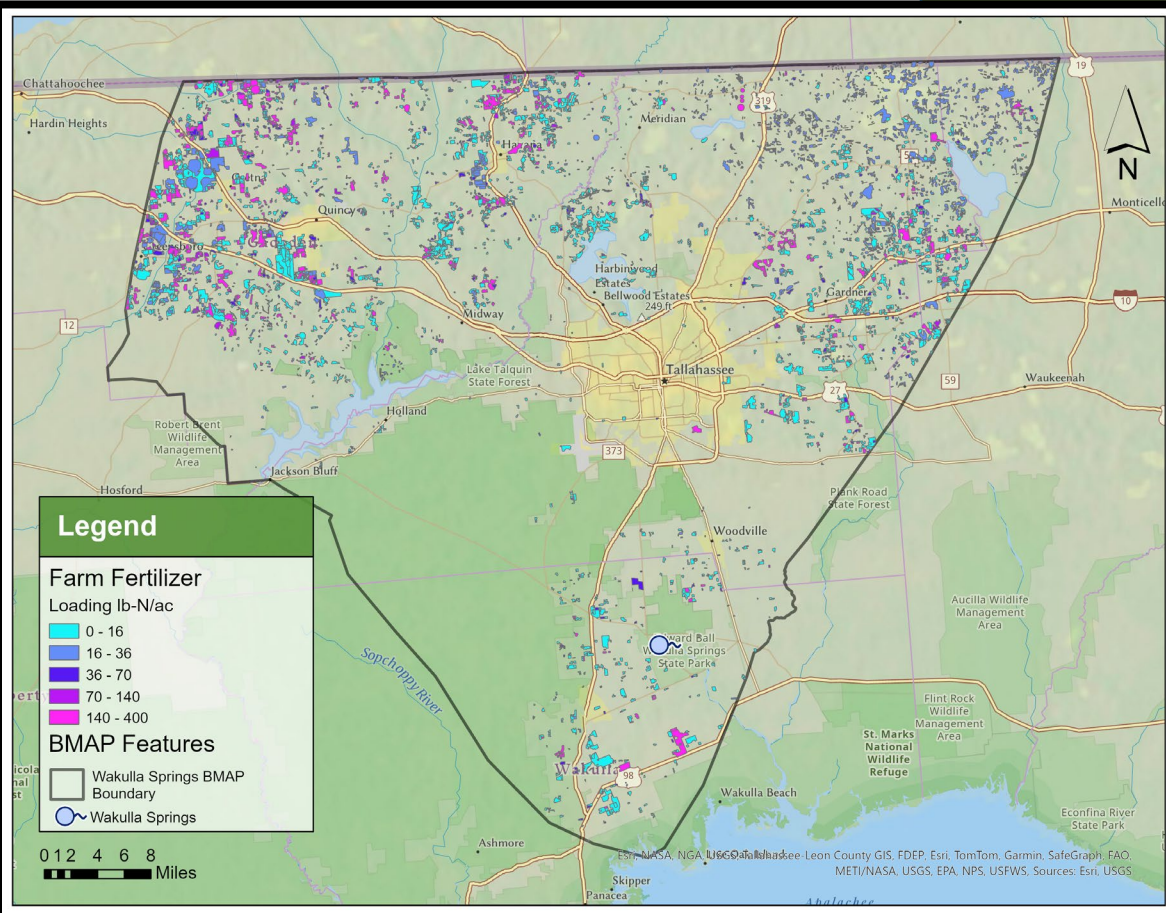
Crop	Fertilizer Application Rate (lb-N/acre)	Effective Application Rate (lb-N/acre)
Grass Pasture	80	16
Horse Farms	50	10
Improved Pastures	50	10
Pasture	50	10

- For nurseries that use containers:
 - A reduction of 20% of the FSAID 9 land area was made to account for plant spacing.
 - A reduction of 70% of loading was estimated to account for fertilizer being applied to containers that hold the nutrients longer.
- Adjustment to fertilizer application rates for pastureland that utilize field rotation.
 - Fertilizer was estimated to be applied to 20% of pasturelands annually.



FARM FERTILIZER

- In total, it is estimated that 2,909,724 pounds of nitrogen are applied to the land surface from FF within the Wakulla Spring BMAP.
- When recharge and attenuation are applied, it is estimated that 136,907 pounds of nitrogen are loaded to the Floridan aquifer annually from FF.





FARM FERTILIZER

Crop	Fertilizer Application Rate (lb-N/ac)	Acres in BMAP
Improved Pastures	50	13,084
Hay	180	8,638
Wildlife Strip Crops	30	7,775
Peanuts	20	3,703
Grass Pasture	80	2,918
Cropland Pastureland	50	2,909
Cotton	110	1,156
Horse Farms	50	812
Sod	200	717
Container Nursery	150	707

- The most common crop types by acreage within the Wakulla Spring BMAP are improved pastures, hay and wildlife strip crops.
- When the fertilizer application rates and the adjustments for pasture and nursery crops are considered, hay is the crop with the highest estimated nitrogen loading to land surface within the BMAP.
- When attenuation and recharge factors are applied, hay is estimated to be the crop contributing the greatest load to groundwater within the basin.

Crop	Fertilizer Application Rate (lb-N/ac)	Loading to Land Surface (lb-N/year)
Hay	180	1,554,793
Wildlife Strip Crops	30	233,244
Cropland Pastureland	50	145,466
Sod	200	143,358
Improved Pastures	50	130,837
Cotton	110	127,153
Corn (non-irrigated)	180	96,394
Field Corn	240	76,856
Peanuts	20	74,060
Vegetables	150	47,559

Crop	Fertilizer Application Rate (lb-N/acre)	Loading to Groundwater (lb-N/year)
Hay	180	78,625
Wildlife Strip Crops	30	10,051
Improved Pastures	50	9,052
Cropland Pastureland	50	8,291
Sod	200	4,819
Cotton	110	3,996
Grass Pasture	80	3,081
Corn (irrigated)	240	2,858
Corn(non-irrigated)	180	2,634
Peanuts	20	2,627



LIVESTOCK WASTE

- Livestock populations were estimated using 2017 U.S. Department of Agriculture (USDA) census of agriculture data. USDA population estimates are provided by county.
- FSAID 9 land use was used to evaluate the proportion of livestock land within the BMAP and adjust USDA livestock population estimates.
- Waste factors were multiplied by the estimated animal population to calculate livestock waste loading.
- Loading from Livestock Waste (LW) is estimated to attenuate at 90%.
- Dairy loading was considered separately from LW; however, it was determined that there were no dairy operations within the Wakulla BMAP area.

Livestock Type	Waste Factor (lb-N/day)
Beef Cattle	0.337
"Other" Cattle	0.31
Calves	0.068
Dairy Cows	0.977
Donkeys	0.1
Horses	0.273
Chicken, Broilers	0.002
Chicken, Layers	0.003
Goats	0.035
Hogs	0.19
Sheep	0.198
Turkeys	0.006



LIVESTOCK WASTE

Livestock Type	Estimated Livestock Population				
	Gadsden	Jefferson	Leon	Wakulla	Total
Beef Cattle	2,550	7,560	1,050	550	11,710
"Other" Cattle	83	3,360	608	425	4,475
Calves	1,418	5,880	893	525	8,715
Donkeys	170	172	80	49	471
Horses	463	1,046	717	218	2,444
Chicken, Broilers	13	16	47	231	307
Chicken, Layers	0	1,952	1,182	3,088	6,222
Goats	628	793	1,171	115	2,707
Hogs	157	156	256	32	601
Sheep	351	336	36	56	779
Turkeys	0	35	0	68	103

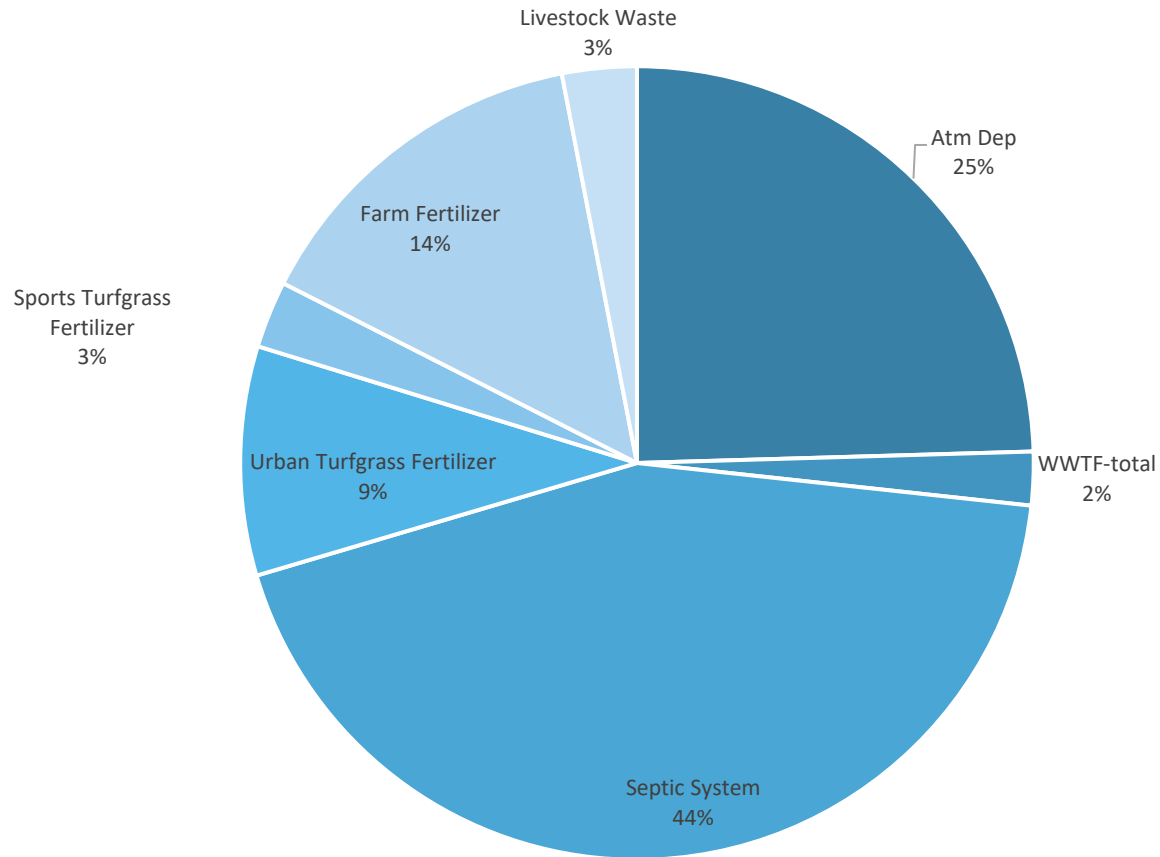
Livestock Type	Loading to Land Surface (lb-N/year)	Loading to Groundwater (lb-N/year)
Beef Cattle	501,907	13,586
"Other" Cattle	137,100	6,416
Calves	35,460	1,120
Donkeys	10,094	309
Horses	134,849	4,666
Chicken, Broilers	190	15
Chicken, Layers	4,363	312
Goats	23,474	705
Hogs	29,370	888
Sheep	29,105	694
Turkeys	135	12

- An estimated 906,047 pounds of nitrogen are deposited on the land surface from LW within the Wakulla Spring BMAP.
- When recharge and attenuation are applied, an estimated 28,722 pounds of nitrogen are loaded to groundwater from LW.



DRAFT NSILT LOADING

Wakulla Spring (2023)



Wakulla Springs BMAP Area	
Source	Annual Loading (lb-N/year)
Atmospheric Deposition	232,007
Wastewater Treatment Facilities	20,597
OSTDS	413,225
Urban Turfgrass Fertilizer	88,255
Sports Turfgrass Fertilizer	25,799
Farm Fertilizer	136,907
Livestock Waste	28,722
Total	945,512



BMAP UPDATES

SPRING VENT LOAD ANALYSIS

Calculated the current loading using the most recent 10 years of nitrate and discharge data.

Calculated the percent reduction using the TMDL and current loading.

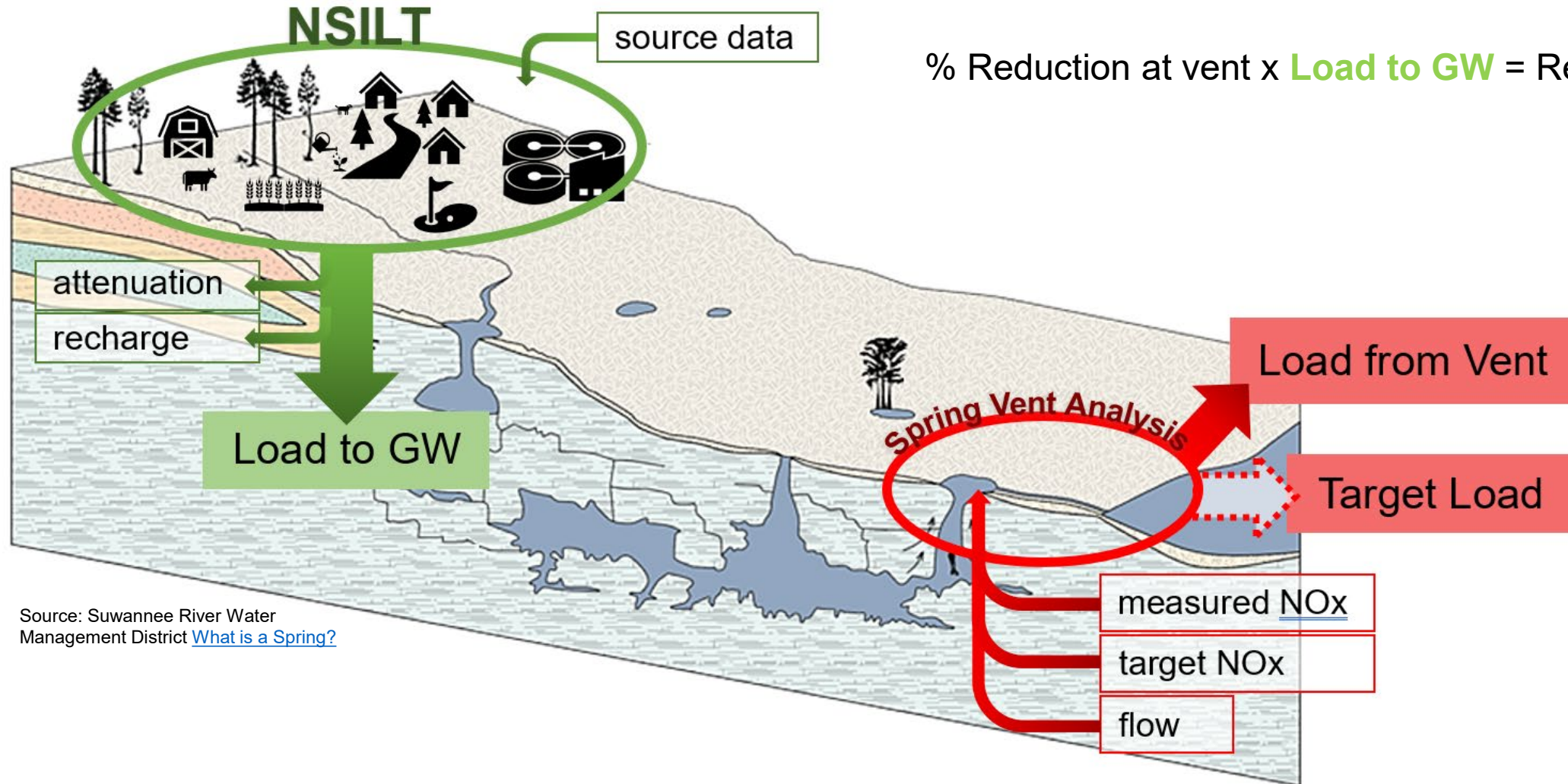
Applied the spring vent percent reduction to the updated NSILT loading.

Estimate the total reduction needed to meet the TMDL.



BMAP UPDATES

SPRING VENT LOAD ANALYSIS



Source: Suwannee River Water Management District [What is a Spring?](#)

Load from Vent – **Target Load** = Reduction Goal
(at vent)

% Reduction at vent x **Load to GW** = Required Reductions
(from sources)



BMAP UPDATES

DRAFT SPRING VENT LOAD ANALYSIS

Description	DRAFT Nitrogen Loads (lb-N/yr)	Notes Regarding Data Used
Total Load at Spring Vent	627,101	Upper 95% confidence interval - nitrate data from 2014 to 2022 and flow data from 2012 to 2022 (0.41 mg/L and 784 cubic feet per second (CFS)).
TMDL Load	539,806	TMDL target is 0.35 mg/L and using the same flow data from 2012 to 2022.
Required Reduction	87,295	Total Required Reduction of 14% is needed to meet the TMDL at the spring vent.



BMAP UPDATES

ALLOCATION AND REDUCTION APPROACH

- The percent reduction calculated from the spring vent analysis is applied to the estimated NSILT load to determine the overall required reduction needed in the basin.
- Each source will be evaluated for a reduction strategy.
- Responsible entities will receive an allocation based on the combined necessary reductions estimated by source for their area based on the NSILT loading.



BMAP UPDATES

ALLOCATION AND REDUCTION APPROACH

OSTDS

- Reduction strategy based on BMAP OSTDS requirements in Appendix D.

WWTF

- Reduction strategy based on BMAP effluent requirements in the BMAP document.

Agriculture

- Reduction strategy based on:
 - BMP enrollment using a 15% reduction applied to FF load to groundwater.
 - BMP enrollment using a 10% reduction applied to LW and dairies.
 - Any remaining agricultural reductions will be allocated to agricultural cooperative elements, which could include regional projects and cost-share practices.

AD

- Anticipated reductions to be addressed by reductions from other sources.



BMAP UPDATES

ALLOCATION AND REDUCTION APPROACH

UTF

- Apply the 14% reduction to the total UTF load to groundwater and allocate to the applicable local governments.

STF

- Apply the 14% reduction to the STF load to groundwater and allocate to the applicable governments.

Golf Courses

- Reduction based on requirement of all golf courses to submit information on their implementation of BMPs and a Nutrient Management Plan (NMP) to address their loading.



BMAP UPDATES

FUTURE GROWTH

Domestic Wastewater Projections:

- Use wastewater to estimate future growth projections.
- Start with population growth for each county from Bureau of Economic and Business Research (BEBR)
 - 2040 Medium Growth Projections.
- Proportion growth for each entity based on land area.
- Distinguish the future population expected to be served by sewer versus those with OSTDS based on the most recent FLWMI for each BMAP county.
- Use per person calculations to estimate future loads from WWTF and OSTDS.

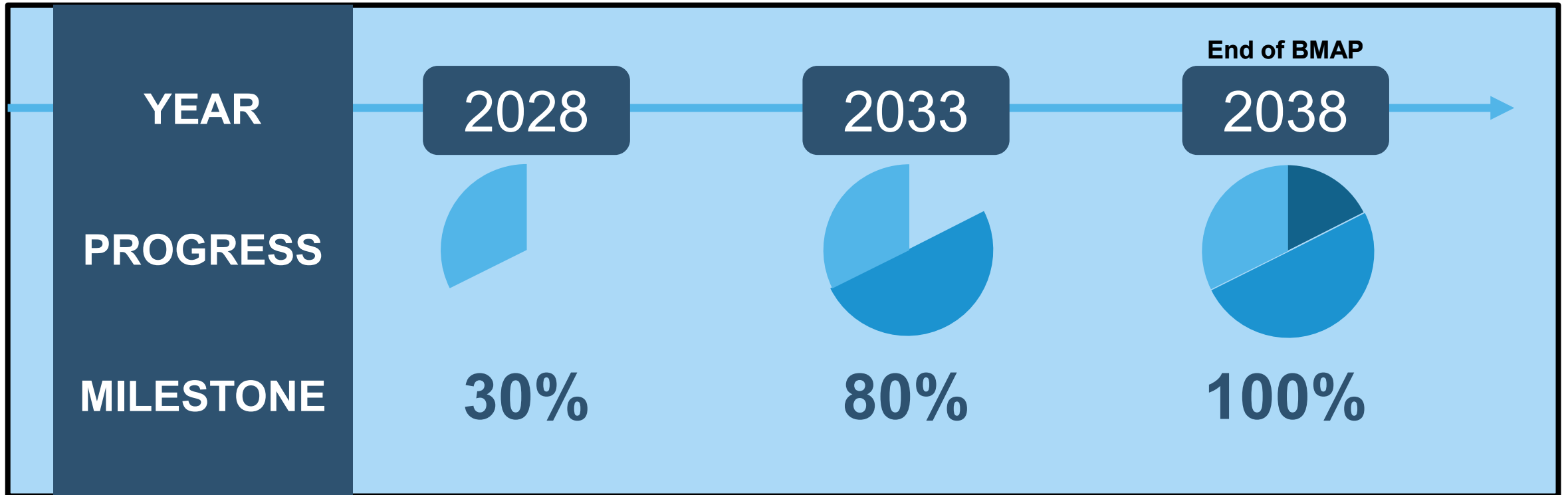
Agriculture Projections:

- Exploring different tools to estimate future changes in agricultural acreage in the BMAPs to estimate changes in agricultural loading.



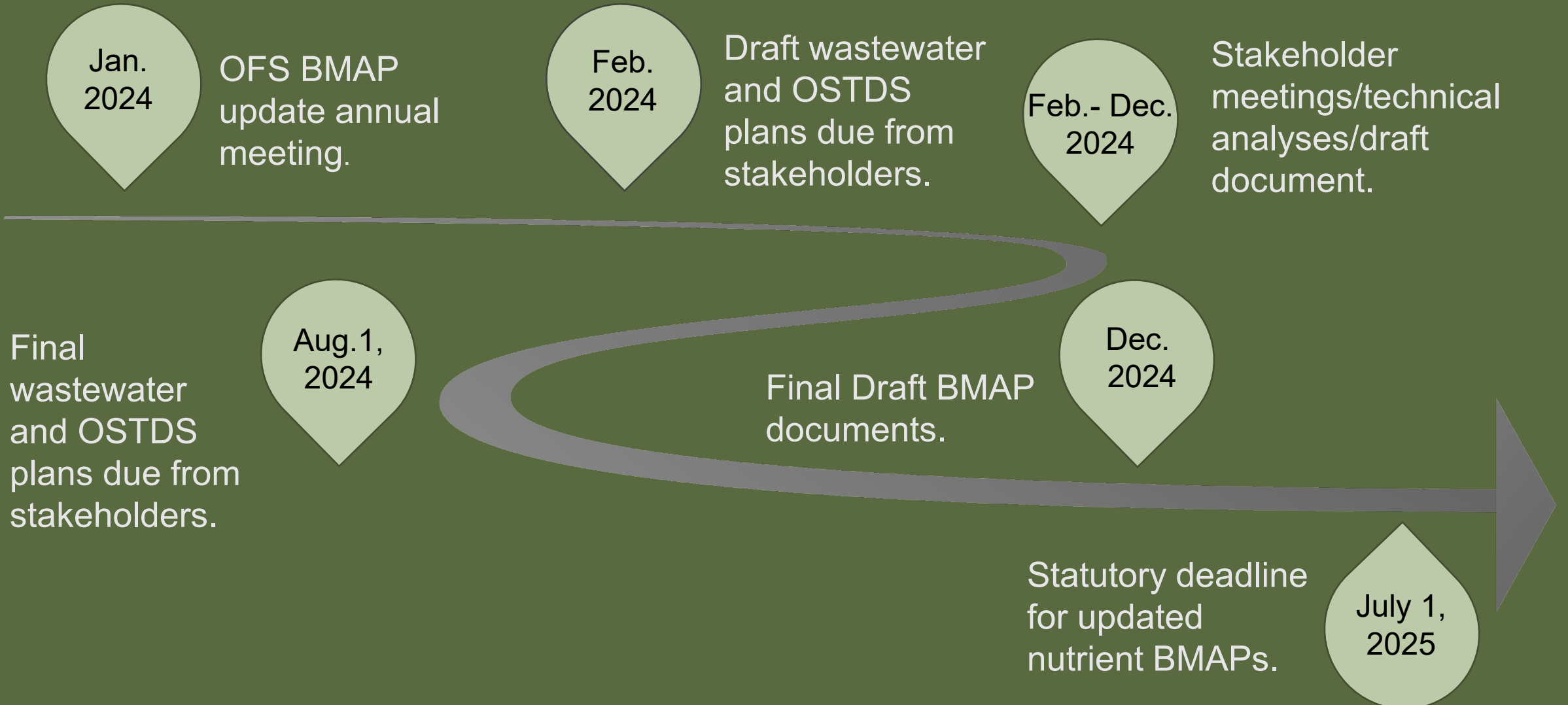
BMAP UPDATES

5-, 10- AND 15-YEAR MILESTONES/REDUCTION SCHEDULE





SPRINGS BMAP UPDATES TIMELINE





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THANK YOU

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