

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
The Homosassa and Chassahowitzka Springs Groups

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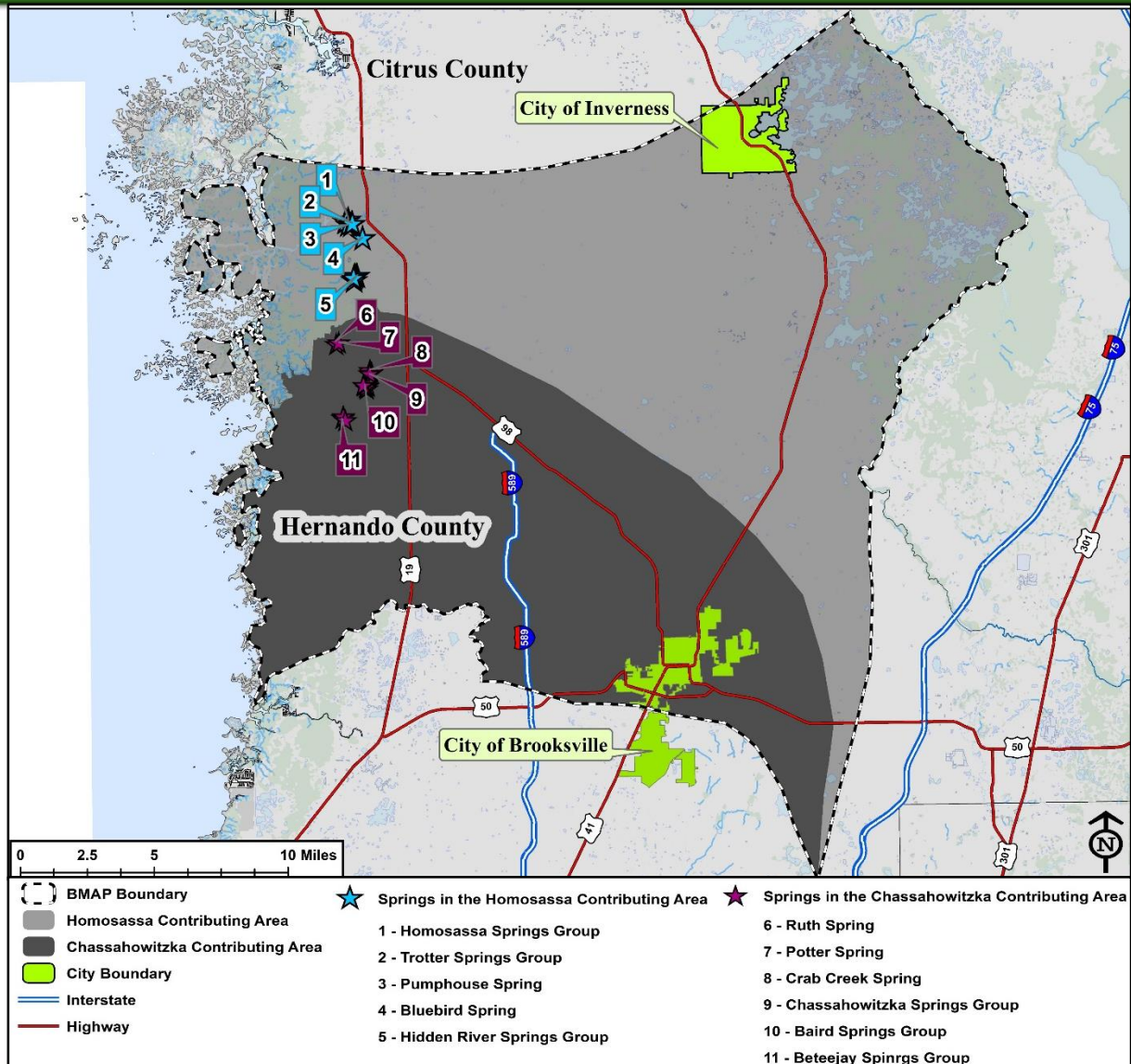
Nitrogen Source Inventory and Loading Tool

- Estimate N loading to ground water with BMAP areas
- Identify sources for which reductions in N loading could achieve restoration of impaired waters
- Customize for individual spring basins
- Inventories have been completed for Wakulla, Silver, Rainbow, Kings Bay, Weeki Wachee, Volusia Blue, Jackson Blue Springs BMAP areas





BMAP Boundary





Estimating Nitrogen Loads to Ground Water

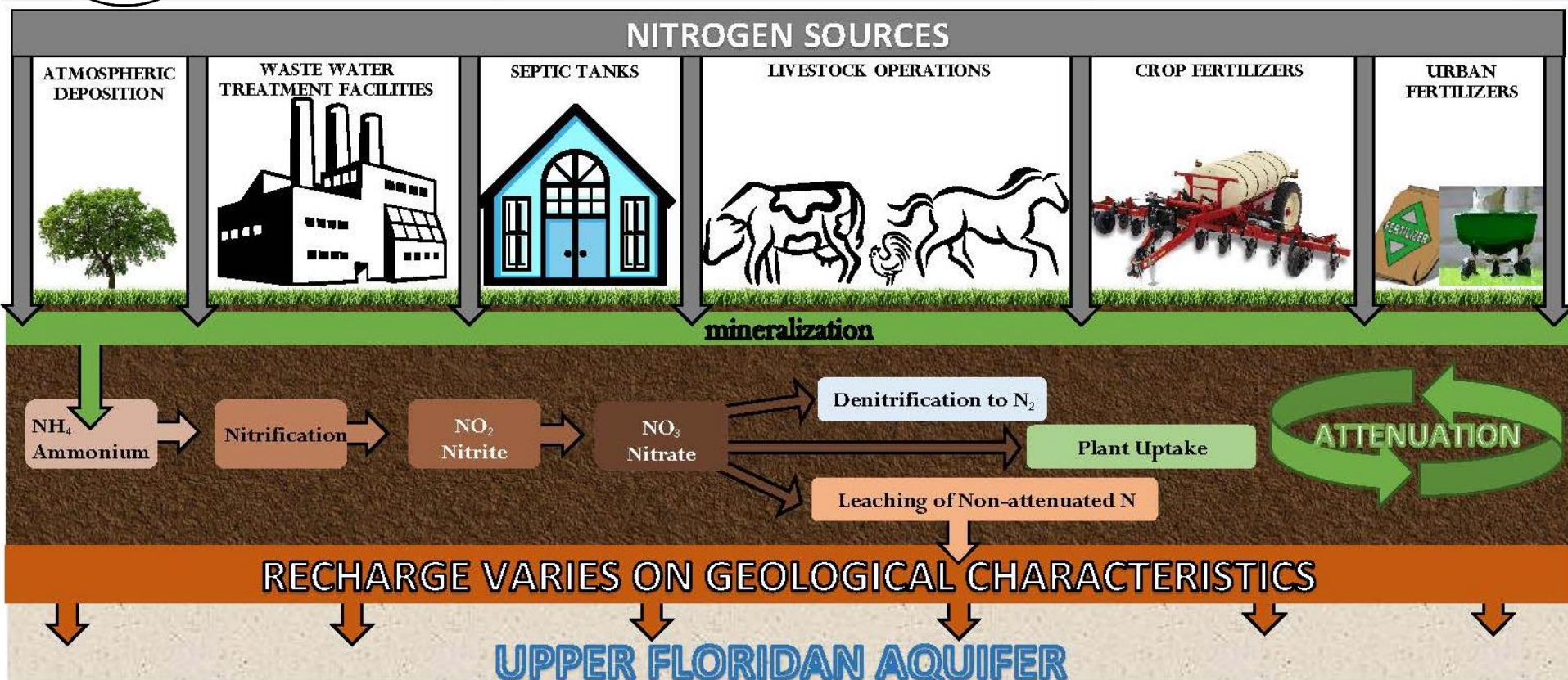
Steps:

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 ground water to estimate nitrogen loads to ground water.
4. Fine-tune estimates after getting feedback from stakeholders.





Nitrogen Cycle and Nitrogen Attenuation

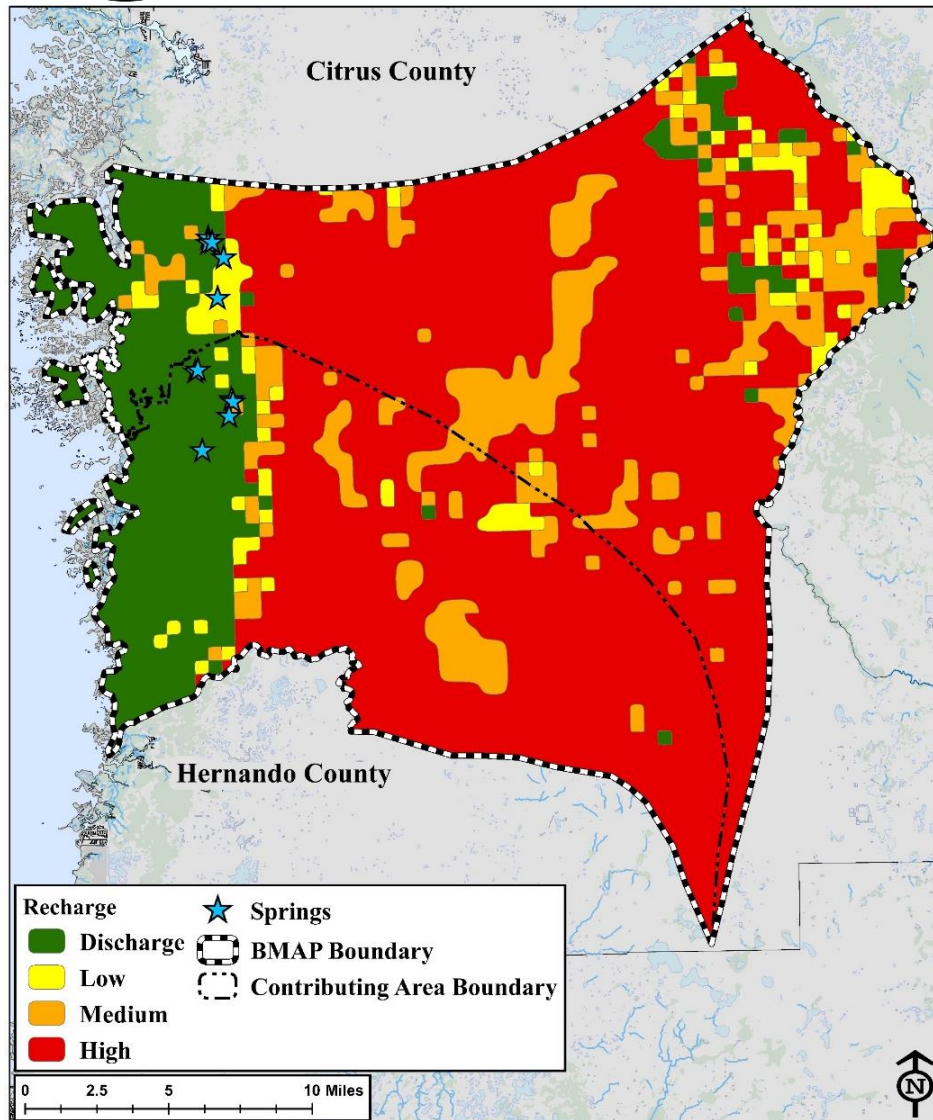


Processes that control the transformation of N in soils and the subsurface.

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



Ground Water Recharge Areas

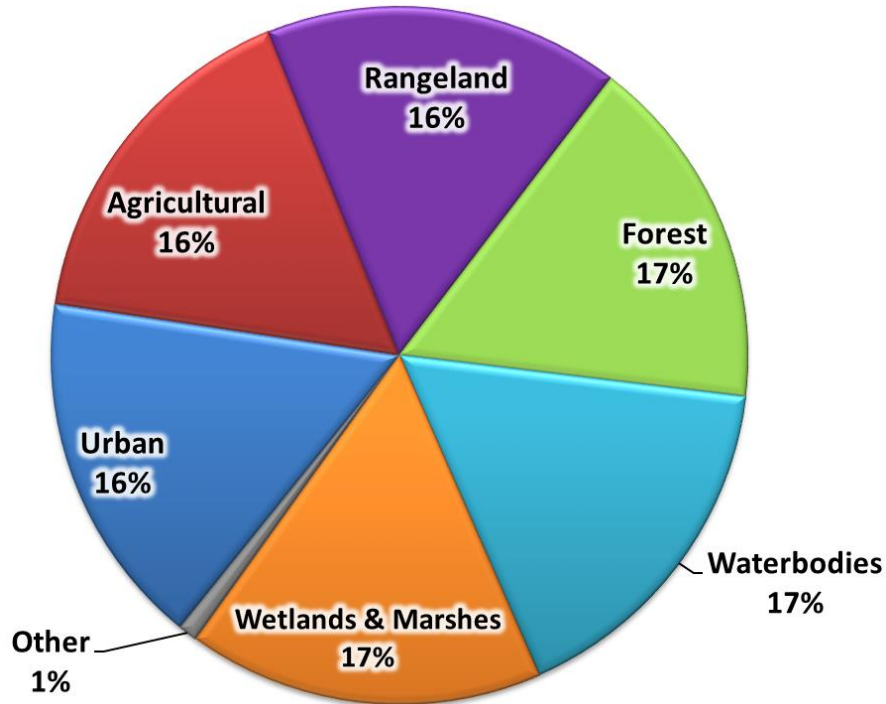


- ◇ Quantify the rate of recharge to the UFA within the Homosassa and Chassahowitzka contributing areas
 - ◇ High Recharge: >10 in/yr
 - ◇ Medium Recharge: 3-10 in/yr
 - ◇ Low Recharge: 0-3 in/yr
- ◇ Rates are weighted to estimate loading potential for each source category

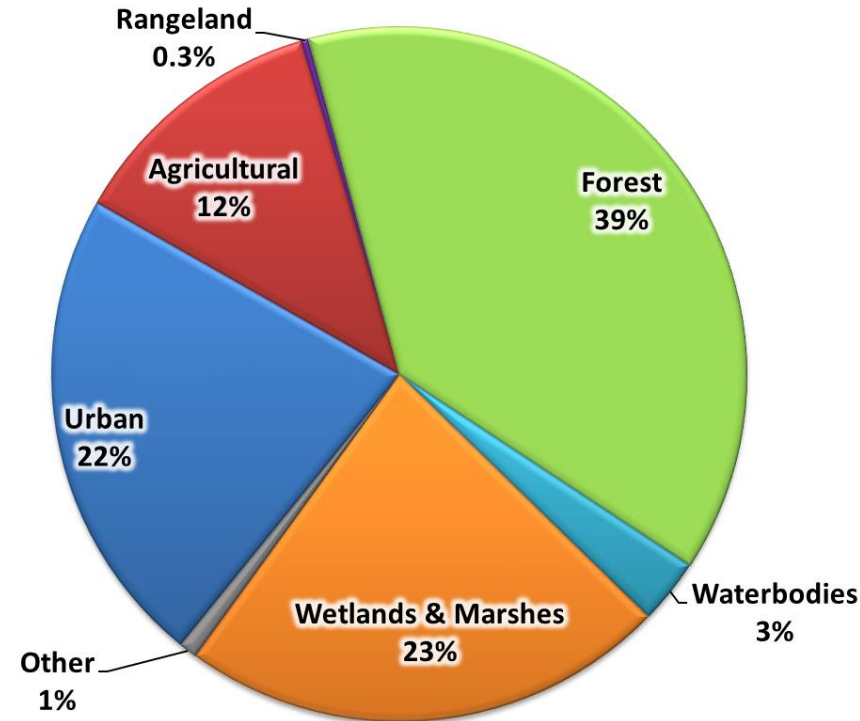


Land Use

Chassahowitzka



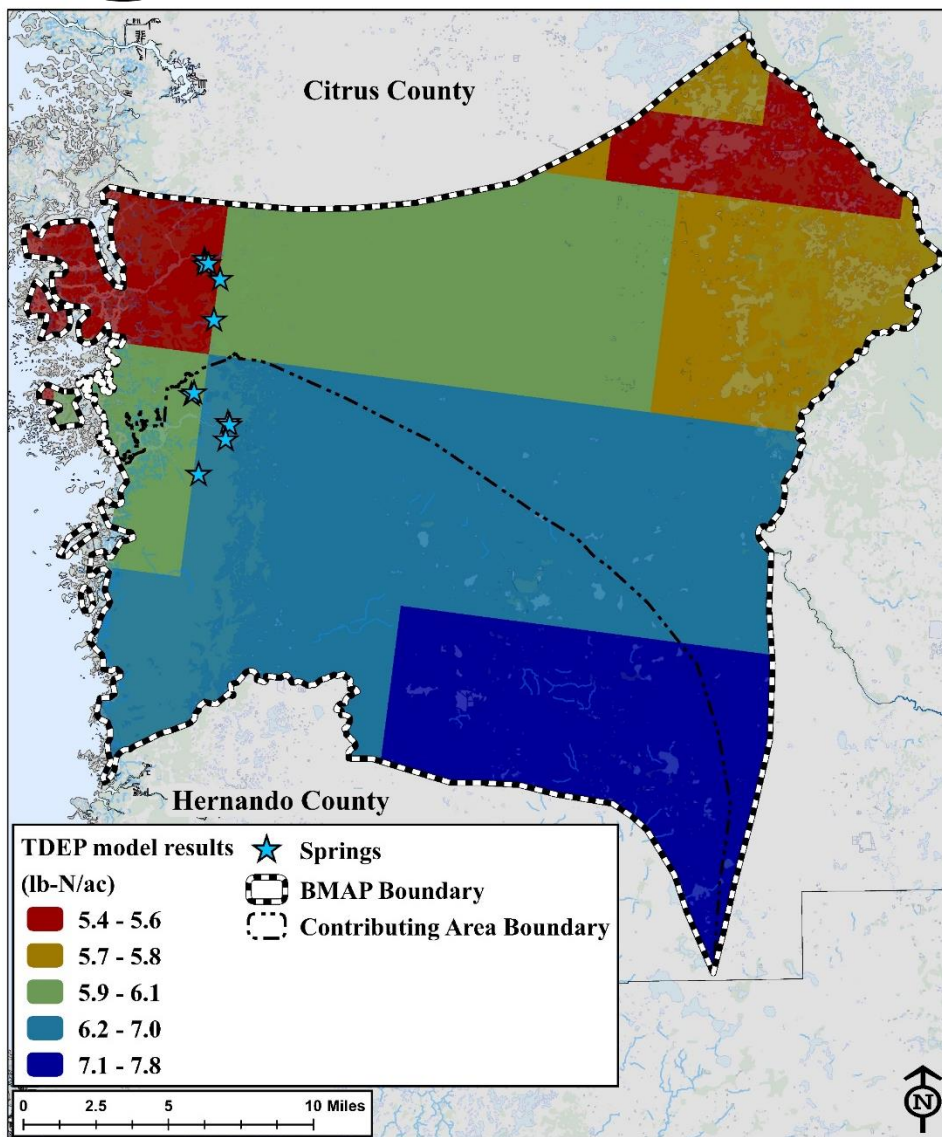
Homosassa



- ◊ Majority of N inputs occur within agricultural and urban land areas
- ◊ These represent 34% of the land use within the Homosassa Contributing Area and 32% of the land use in the Chassahowitzka Contributing Area



Atmospheric Deposition



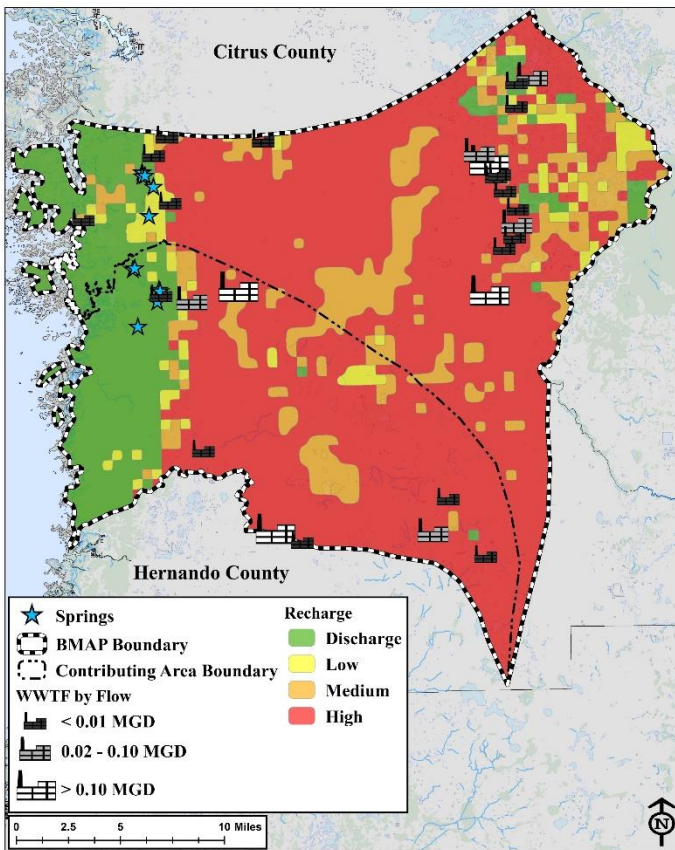
- ◇ TDEP model
 - ◇ U.S. EPA method to estimate spatially continuous atmospheric deposition
 - ◇ Nationwide total deposition model for N and S
 - ◇ Estimated deposition based on monitoring stations and modeled atmospheric concentrations
 - ◇ Model year is an average from 2011 to 2013
 - ◇ Average TN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

Recharge Area	Homosassa Input to Land Surface (lb-N/yr)	Chass Input to Land Surface (lb-N/yr)
Low	60,456	29,677
Medium	206,304	93,240
High	802,581	626,520



Wastewater Treatment Facilities

- ◇ 18 permitted facilities in the Homosassa CA
 - ◇ 2 with discharge ≥ 0.1 MGD
- ◇ 9 permitted facilities in the Chassahowitzka CA



Treatment Type	Recharge Area	Homosassa Input to Land Surface (lb-N/yr)	Chassahowitzka Input to Land Surface (lb-N/yr)
RIB	Medium	150	20
Sprayfield		-	1,351
Reuse		215	-
RIB	High	4,245	11,659
Sprayfield		3,662	5,452
Reuse		6,128	-

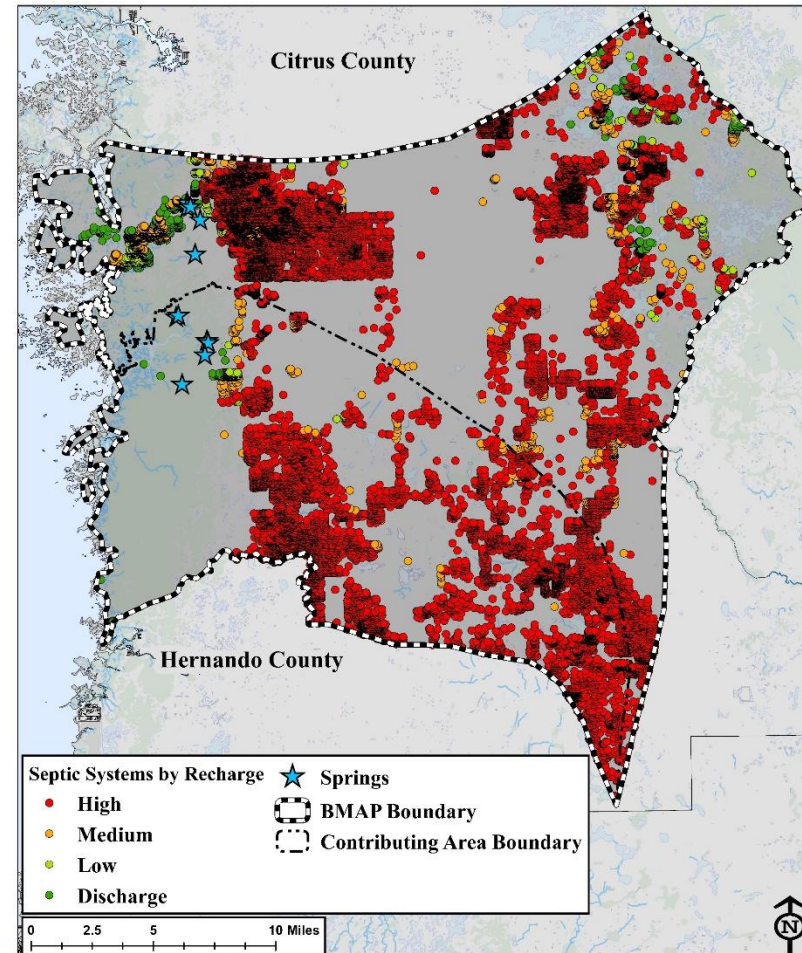
- ◇ TN effluent concentrations as reported to DEP
- ◇ NO_3 used to project TN data, if necessary
- ◇ Effluent data separated based on treatment type
 - ◇ RIBs, Absorption Fields
 - ◇ Sprayfields
 - ◇ Reuse



Septic Systems

- ◇ DOH model relies on tax parcel data and sewer service areas
- ◇ Accuracy of this data was verified using an aerial analysis
- ◇ Calculate # of people relying on septic tanks
 - ◇ Hernando County = 2.08 people per household
 - ◇ Citrus County = 1.95 people per household
- ◇ Average annual input to septic tank = 9.012 lb-N/person (US EPA)

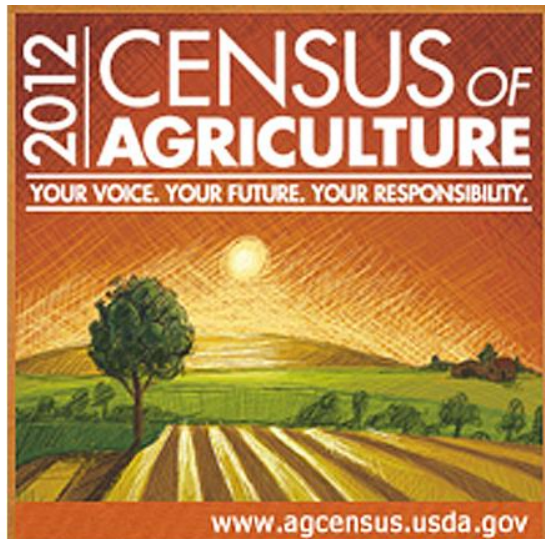
Recharge Area	Homosassa Input to Land Surface (lb-N/yr)	Chassahowitzka Input to Land Surface (lb-N/yr)
Low	4,523	1,171
Medium	19,515	2,613
High	202,246	128,101





Nitrogen Input: Livestock Waste

- ◇ Literature review provided information on
 - ◇ Common livestock animals in Florida
 - ◇ Animal waste factors
- ◇ 2012 Census of Agriculture (CoA)
 - ◇ US Dept of Agriculture
 - ◇ Every 5 years
 - ◇ # of livestock (categorized by animal)
 - ◇ Full county data ONLY



Animal	Daily Waste Factor (lb-N/day)
Beef Cattle	0.337
Dairy Cow	0.977
Broiler Chickens	0.159
Goats	0.035
Hogs	0.190
Sheep	0.198
Turkey	0.006
Horses	.273



Land use Percentages: Livestock

♦ Pastures

- ♦ Improved
- ♦ Unimproved
- ♦ Woodland

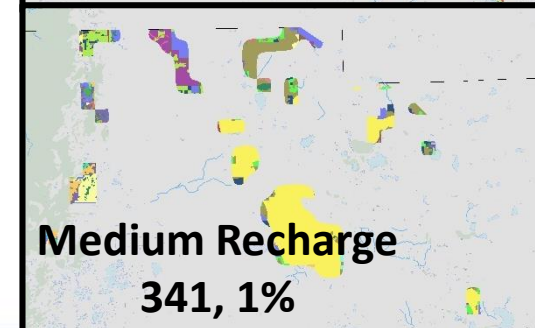
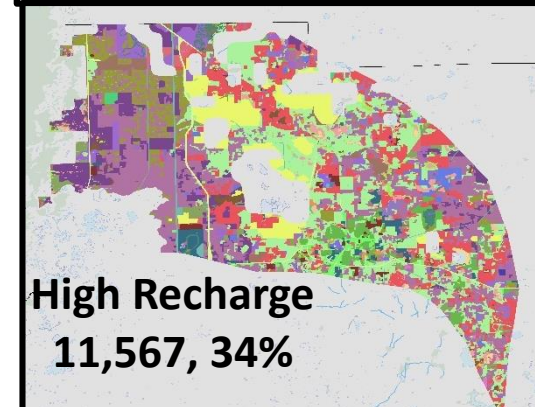
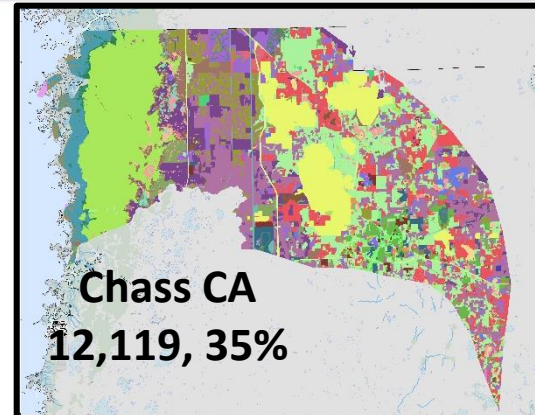
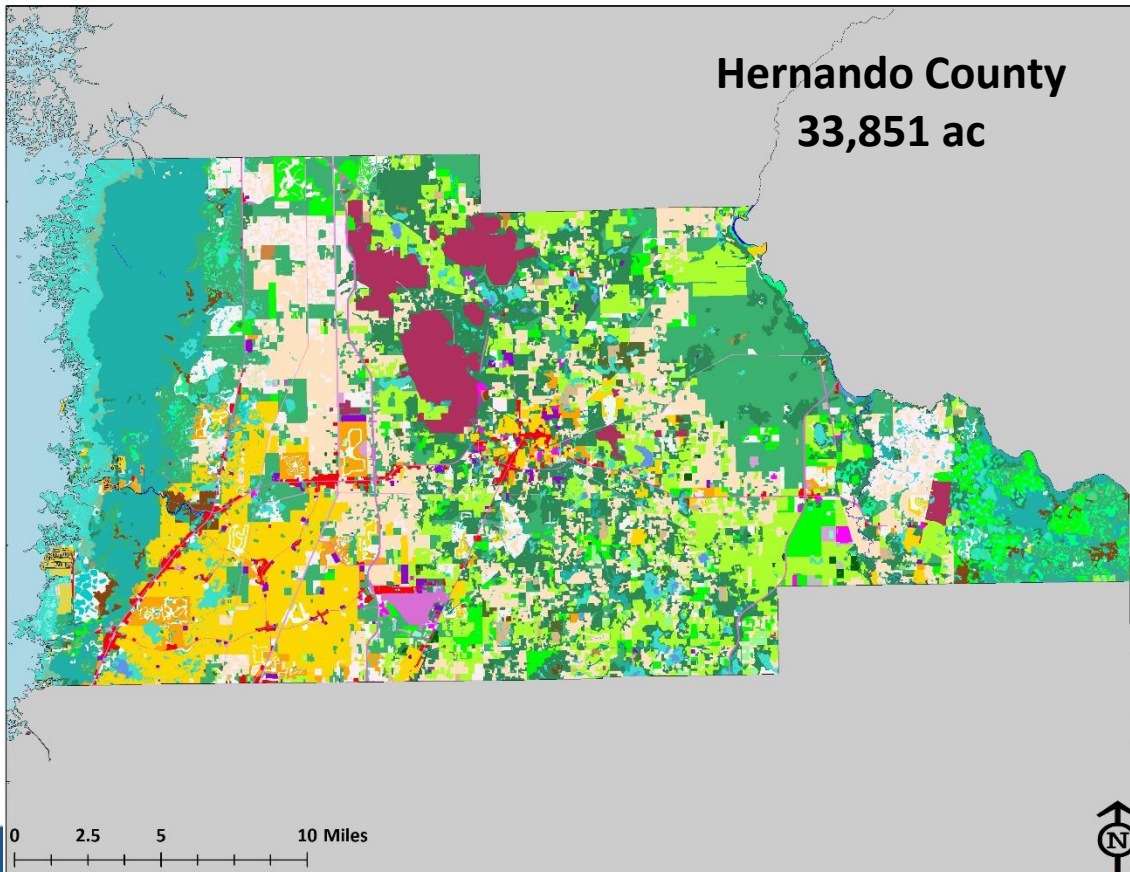
♦ Feeding

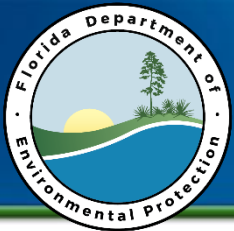
Operations

- ♦ Cattle
- ♦ Poultry
- ♦ Dairies

♦ Specialty Farms

- ♦ Horse Farms





Livestock Waste

Animal	Estimated CA population, Homosassa	Estimated CA population, Chass
Beef Cattle*	3,428	2,206
Dairy Cows	675	-
Horses	995	758
Broiler Chickens	287	200
Layer Chickens	1,044	41
Goats	687	284
Hogs	165	120
Sheep	212	118
Turkey	16	1

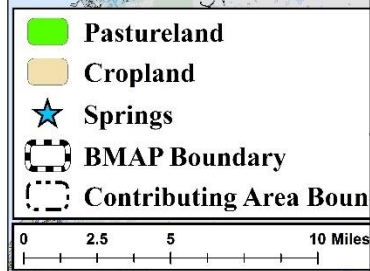
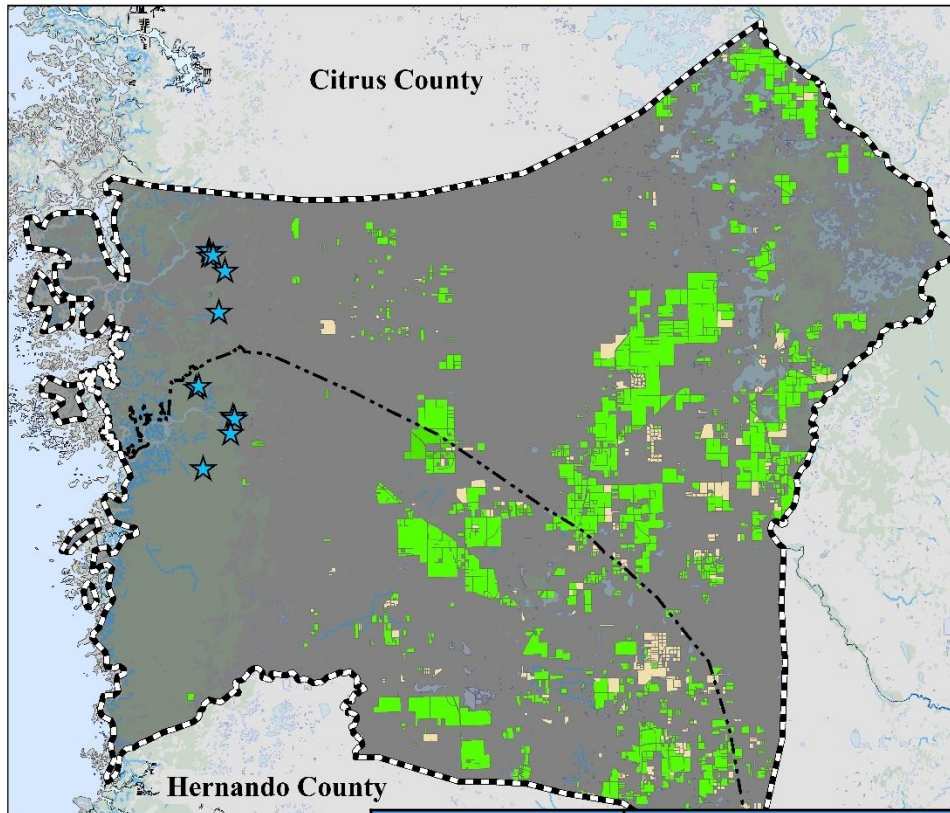
*Beef Cattle population estimated based on a stocking rate vetted by local agricultural producers of 8 ac per cow



Recharge Area	Homosassa Input to Land Surface (lb-N)	Chass Input to Land Surface (lb-N)
Low	9,783	4,877
Medium	48,503	19,687
High	711,457	441,974



Farm Fertilizers



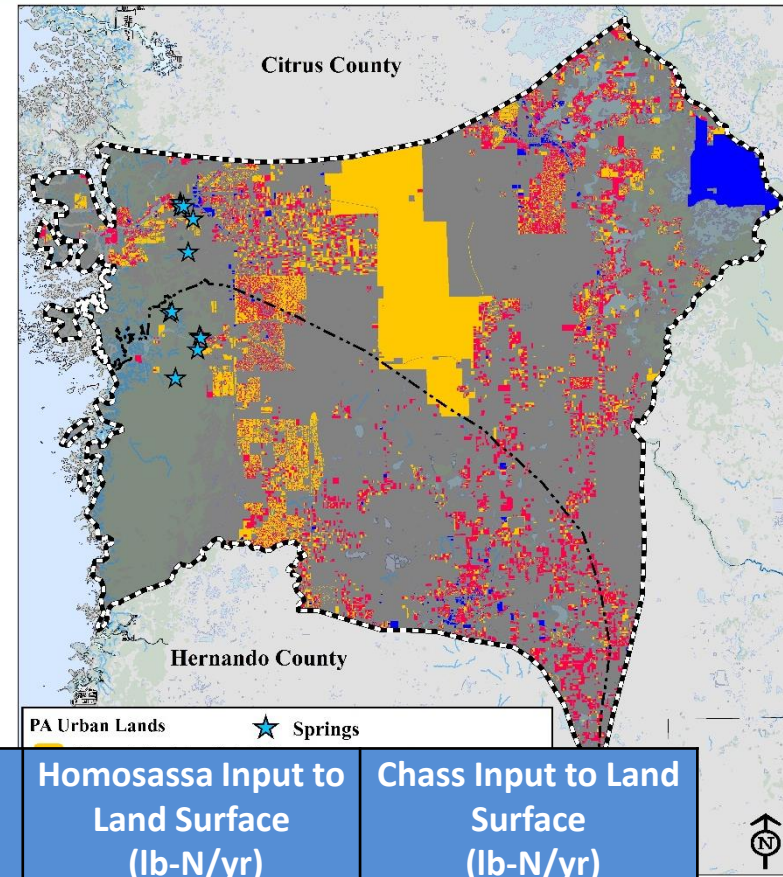
Recharge Area	Homosassa Input to Land Surface (lb-N/yr)	Chassahowitzka Input to Land Surface (lb-N/yr)
Low	12,542	3,111
Medium	65,109	14,708
High	561,567	496,158

- Property appraiser land use data was compiled
- Each county was evaluated individually
- Land areas for specific crops were estimated
- Application rates based on IFAS recommendations and farmer feedback
 - 17-60 lb-N/ac: Pastures
 - 10 lb-N/ac: Hay, Watermelons, Berries
 - 10 lb-N/ac: Ornamentals
 - 50 lb-N/ac: Orchards

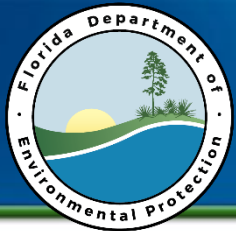


Urban Turfgrass Fertilizers

- ◊ Acreage likely to receive fertilizer estimated from PA data and property values
- ◊ Annual Application Rates based on SWFWMD study
 - ◊ 68% fertilized by owners
 - ◊ 15% @ 0.5 lb-N/1000 sq ft
 - ◊ 59% @ 0.8 lb-N/1000 sq ft
 - ◊ 27% @ 1 lb-N/1000 sq ft
 - ◊ 2.98 times year
 - ◊ 32% fertilized by lawn service
 - ◊ 0.5 lb-N/1000 sq ft
 - ◊ 2 times a year
- ◊ Impervious surfaces estimate based on zoning laws

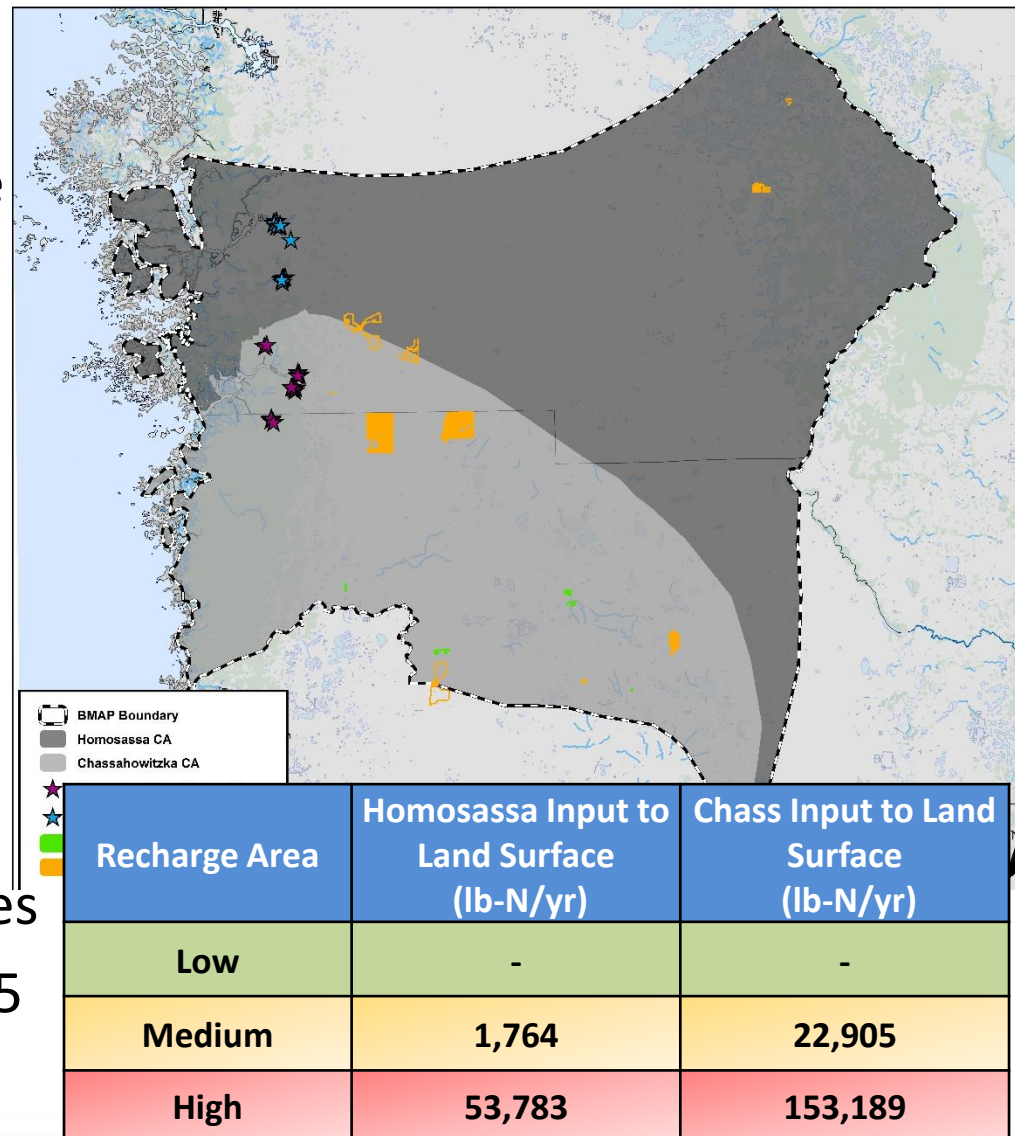


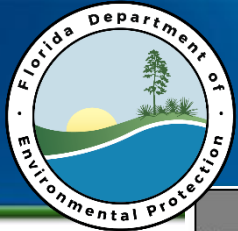
Recharge Area	Homosassa Input to Land Surface (lb-N/yr)	Chass Input to Land Surface (lb-N/yr)
Low	81,845	536
Medium	108,460	12,304
High	440,417	267,920



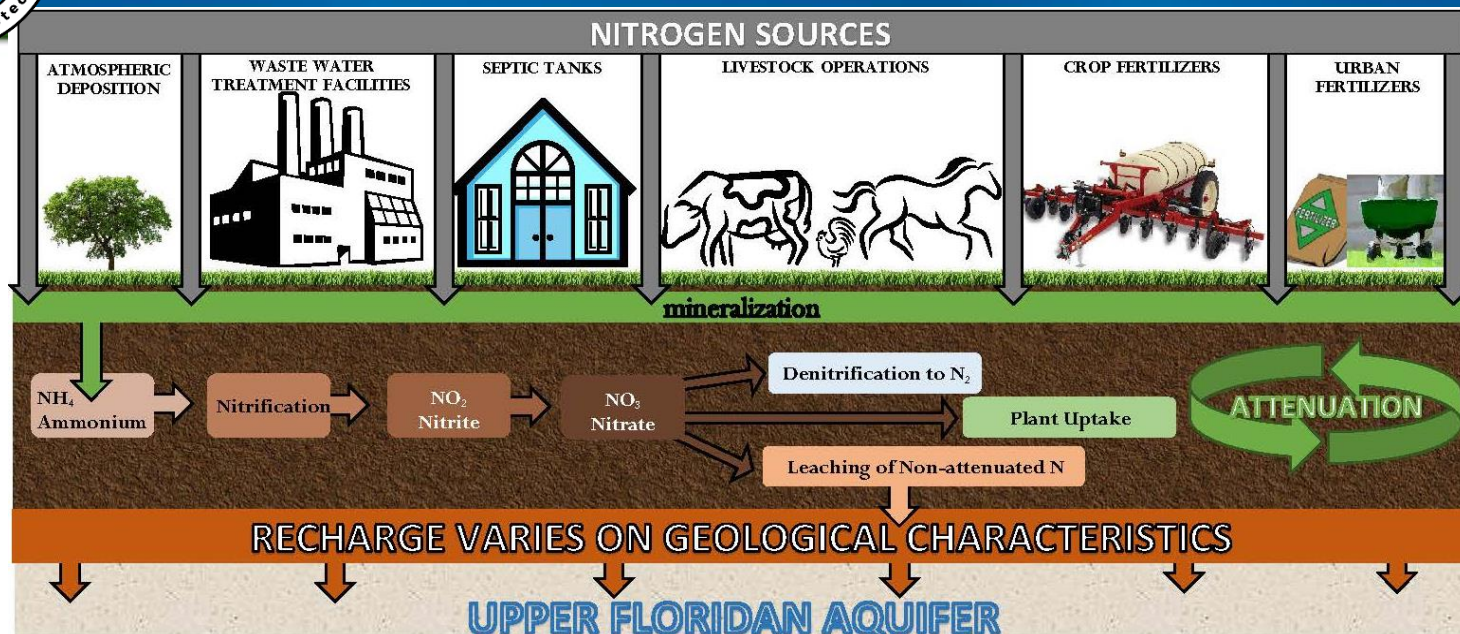
Sports Turfgrass Fertilizers

- ◇ Sports fields
 - ◇ Acreage estimates from aerial analysis of PA landuse data
 - ◇ Application rates based on lawn service company 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

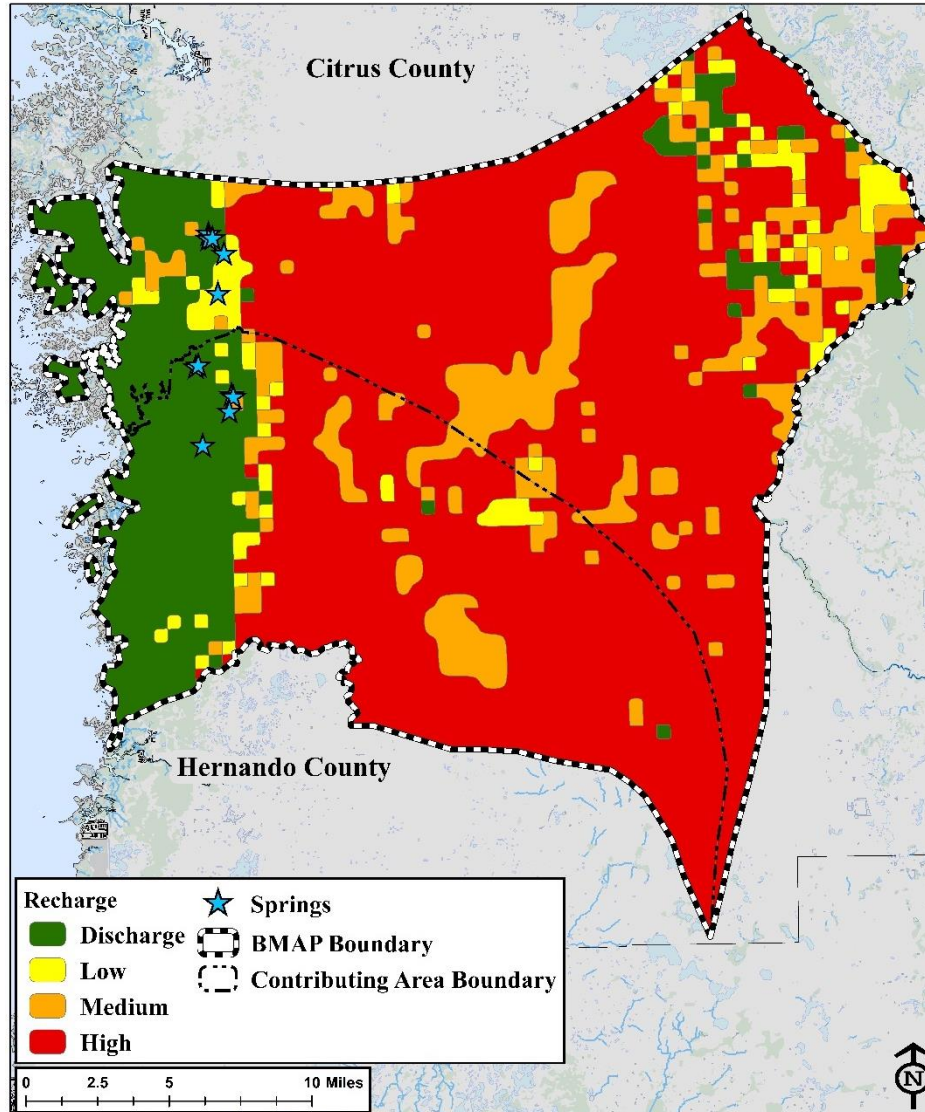


- ◇ Represent the percentage of N removed and therefore not available for leaching to groundwater
- ◇ Based on factors used in similar past studies and found in relevant literature

Loading Category	N Attenuation Factor	N Leaching
Atmospheric Deposition	90%	10%
Septic Systems	50%	50%
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%

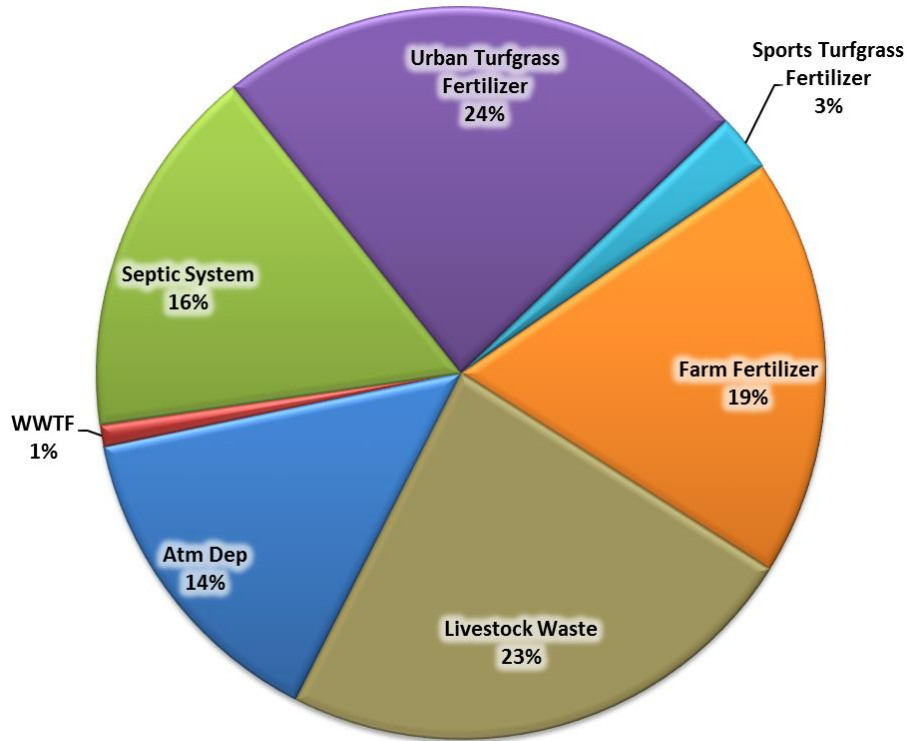
50%

90%



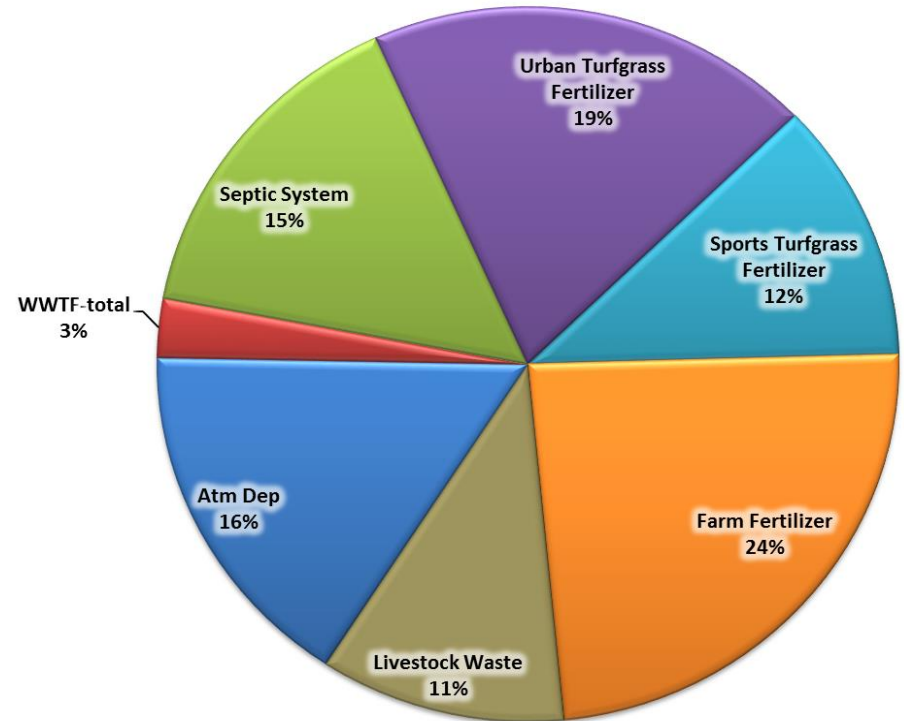
Estimated Annual Average Loading to Ground Water

Homosassa



582,174 lb-N/yr

Chassahowitzka

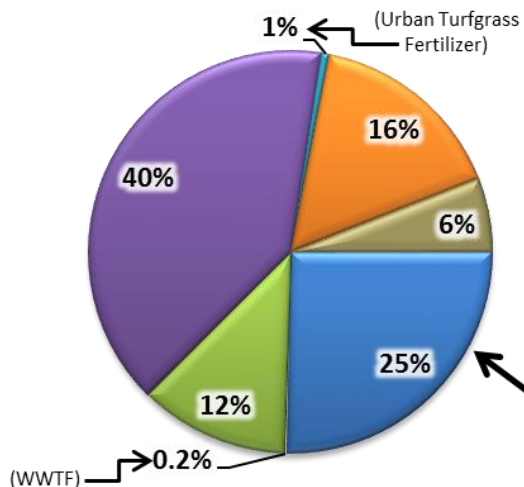


380,462 lb-N/yr

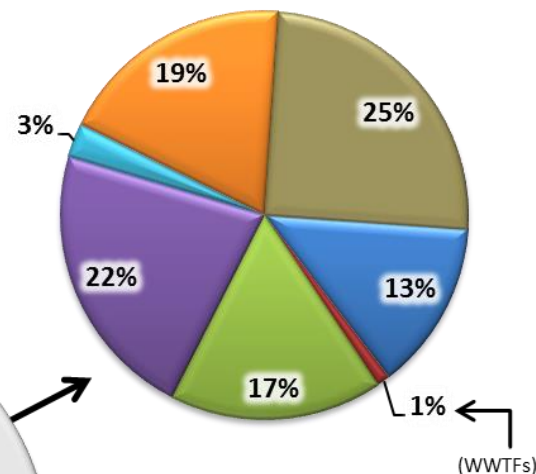


Estimated Annual Average Loading to Ground Water, Homosassa

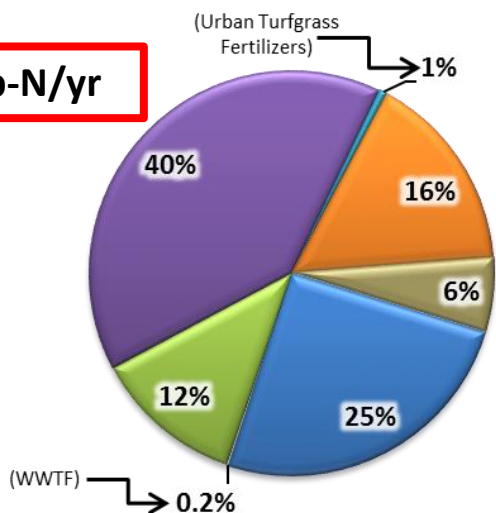
3,651 lb-N/yr



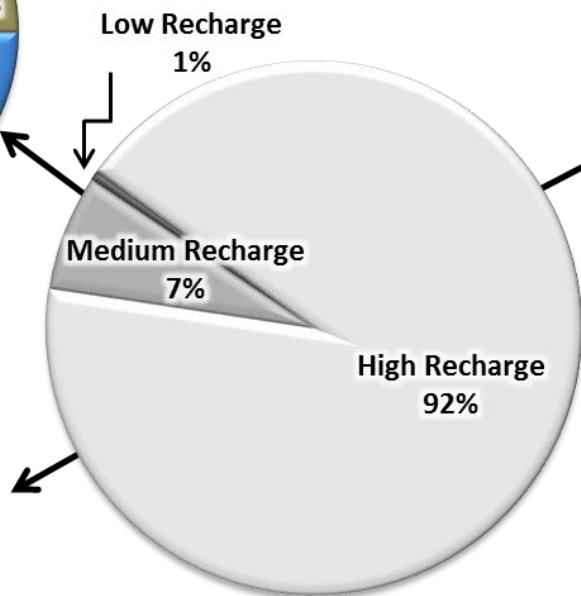
537,777 lb-N/yr



40,747 lb-N/yr



582,174 lb-N/yr

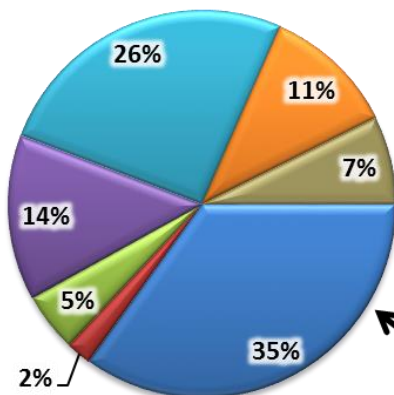


- Atm Dep
- WWTF
- Septic System
- Urban Turfgrass Fertilizer
- Sports Turfgrass Fertilizer
- Farm Fertilizer
- Livestock Waste

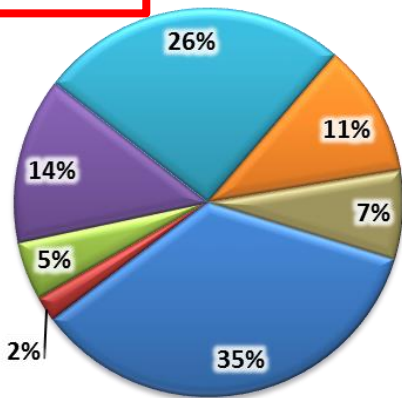


Estimated Annual Average Loading to Ground Water, Chassahowitzka

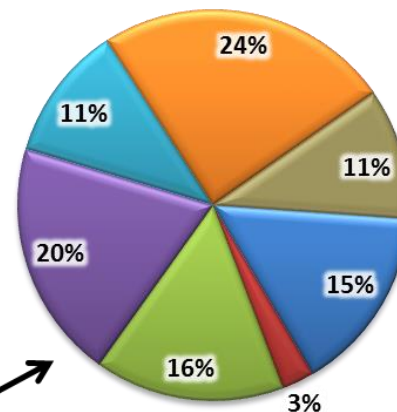
482 lb-N/yr



13,329 lb-N/yr



366,651 lb-N/yr



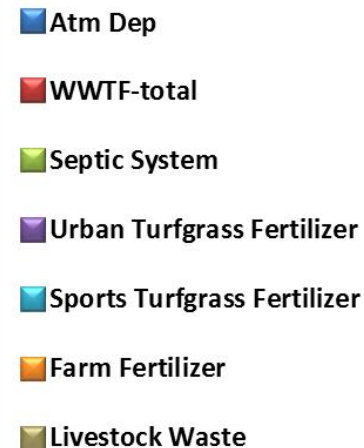
Low Recharge

0.1%

Medium Recharge

4%

High Recharge
96%



380,462 lb-N/yr



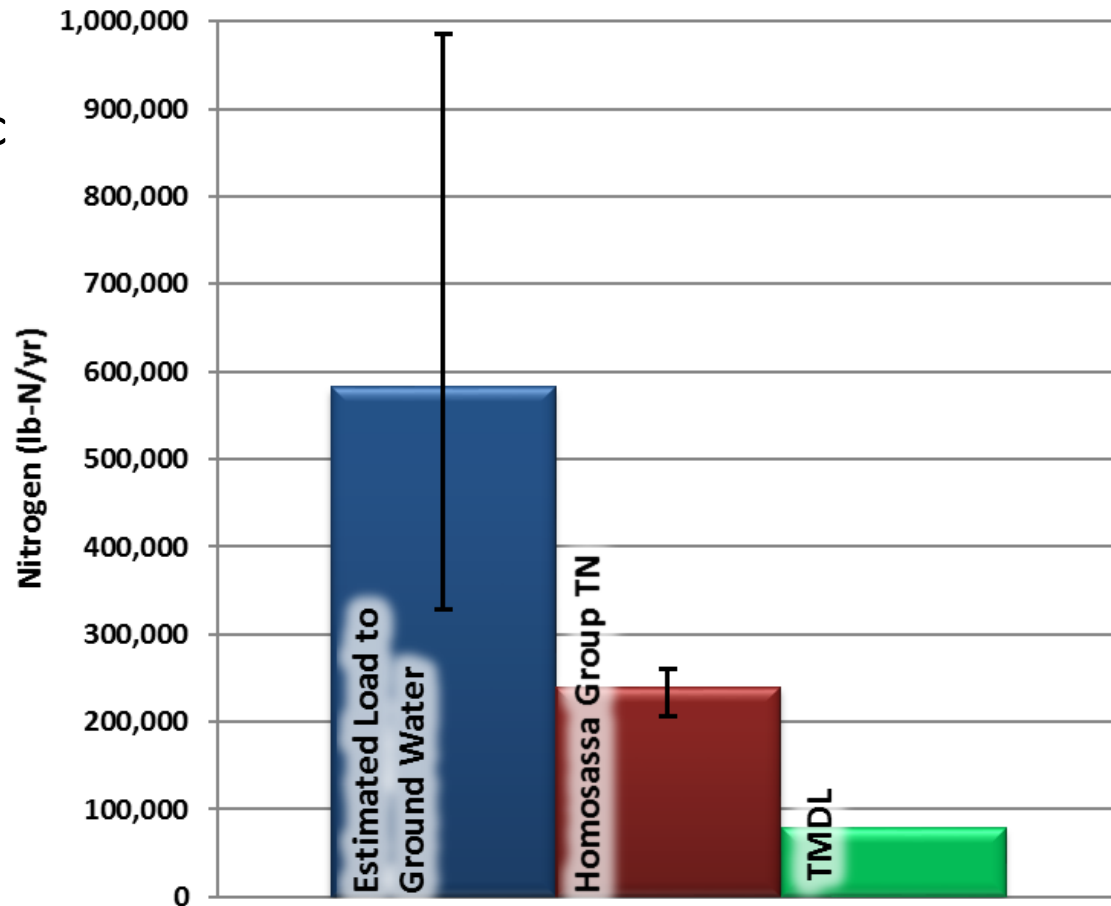
Homosassa Springs Group Discharge of Nitrogen

◇ Current

- ◇ Discharge = $172.59 \text{ ft}^3/\text{sec}$
- ◇ TN = 0.79 mg/L
- ◇ Load = $582,174 \text{ lb-N/yr}$

◇ TMDL

- ◇ Using current discharge
- ◇ TN = 0.23 mg/L
- ◇ Load = $78,048 \text{ lb-N/yr}$





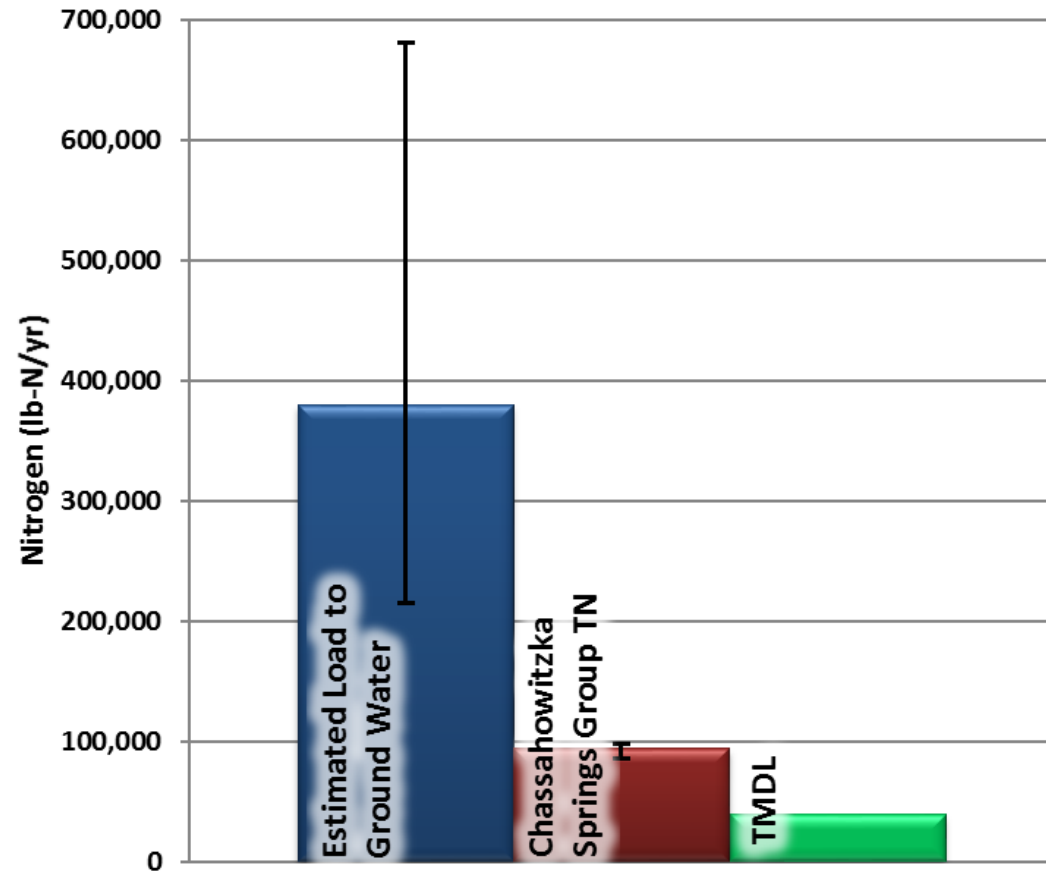
Chassahowitzka Springs Group Discharge of Nitrogen

◇ Current

- ◇ Discharge = 85.48 ft³/sec
- ◇ TN = 0.49 mg/L
- ◇ Load = 380,462 lb-N/yr

◇ TMDL

- ◇ Using current discharge
- ◇ TN = 0.23 mg/L
- ◇ Load = 38,654 lb-N/yr





QUESTIONS??



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