

Florida Department of Environmental Protection



Division of Environmental Assessment
and Restoration

Preliminary Estimates for Nitrogen Loading to the Upper Floridan Aquifer: Nitrogen Source Inventory and Loading Tool for King's Bay/Crystal River BMAP Boundary

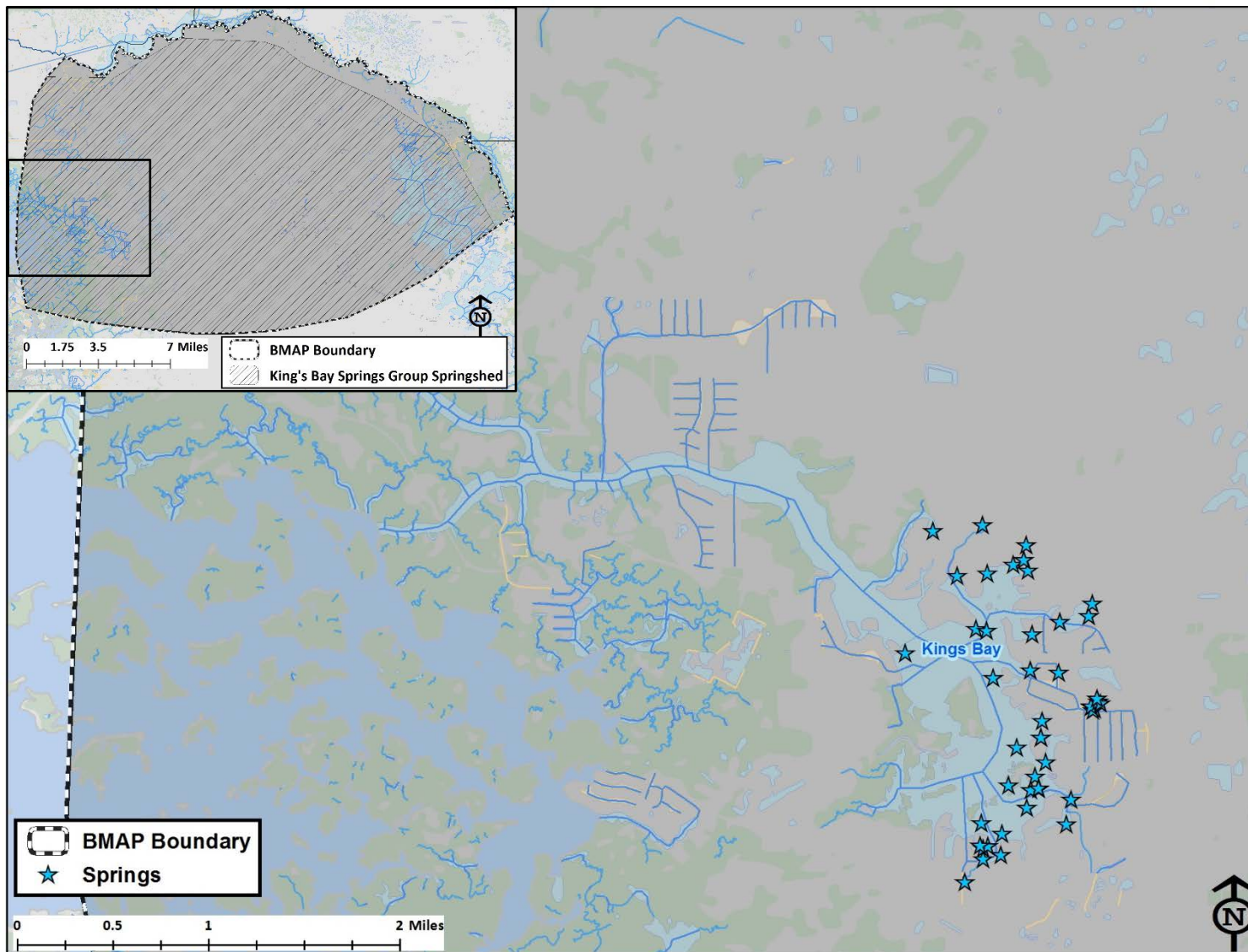
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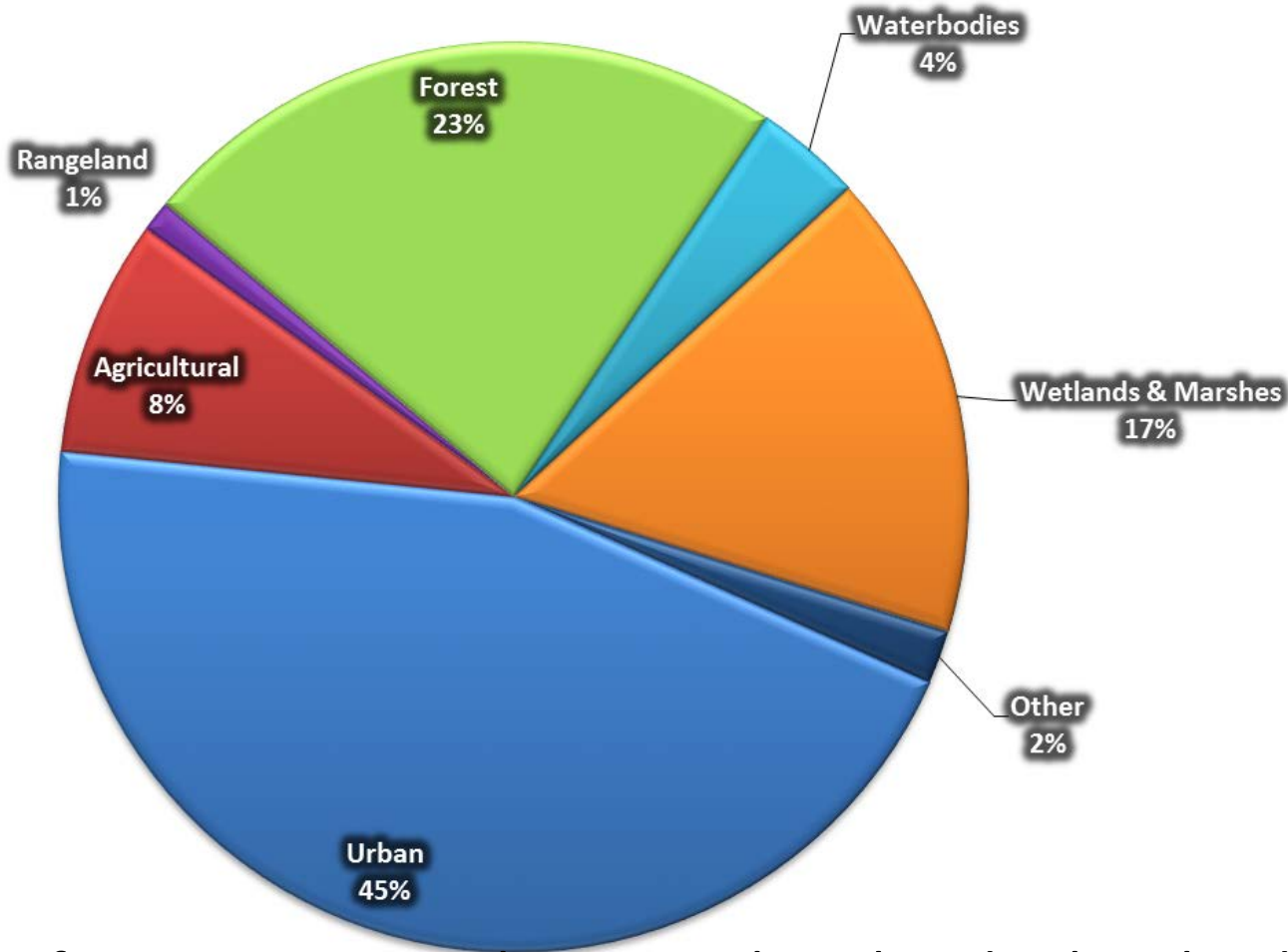
King's Bay/Crystal River BMAP Area



BMAP area is based on the King's Bay springs group springshed

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King's Bay Land Use



- ♦ Majority of inputs occur within agricultural and urban landscapes
- ♦ Nitrogen sources are concentrated in 53% of the BMAP land use

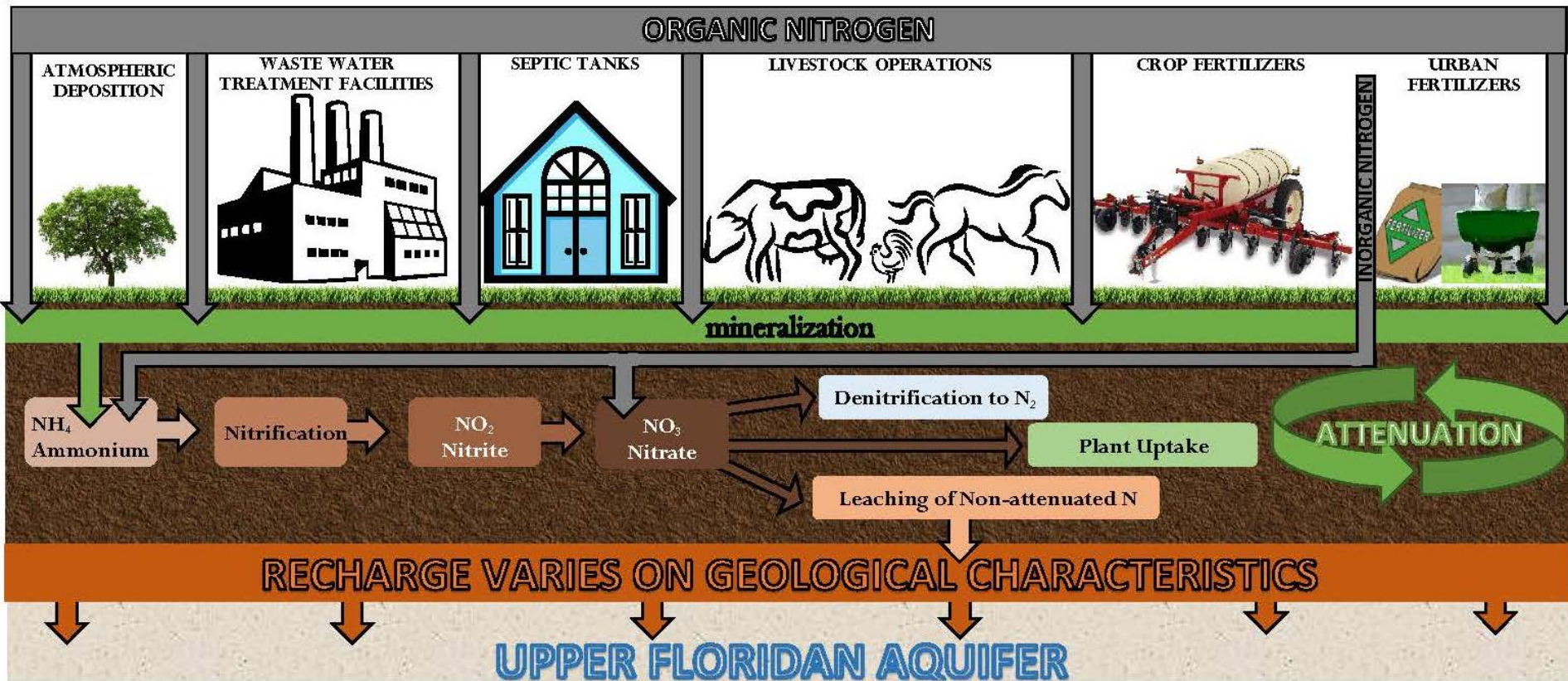
Estimating Nitrogen Loads to Ground Water

Process:

1. Estimate the inputs of nitrogen to the land surface from the source inventory information **(best available)**.
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 vegetation, mineralization of organic nitrogen).
3. Apply an areal weighting factor that is based on the rate of recharge to ground water to get nitrogen loads to ground water.
4. Account for proximity of N source to spring. 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

Recharge to Ground Water

- ◇ Quantify the degree of subsurface flow within the BMAP boundary
 - ◇ High Recharge: >12 in/yr
 - ◇ Medium Recharge: 4-12 in/yr
- ◇ Rates are weighted to estimate loading potential for each source category

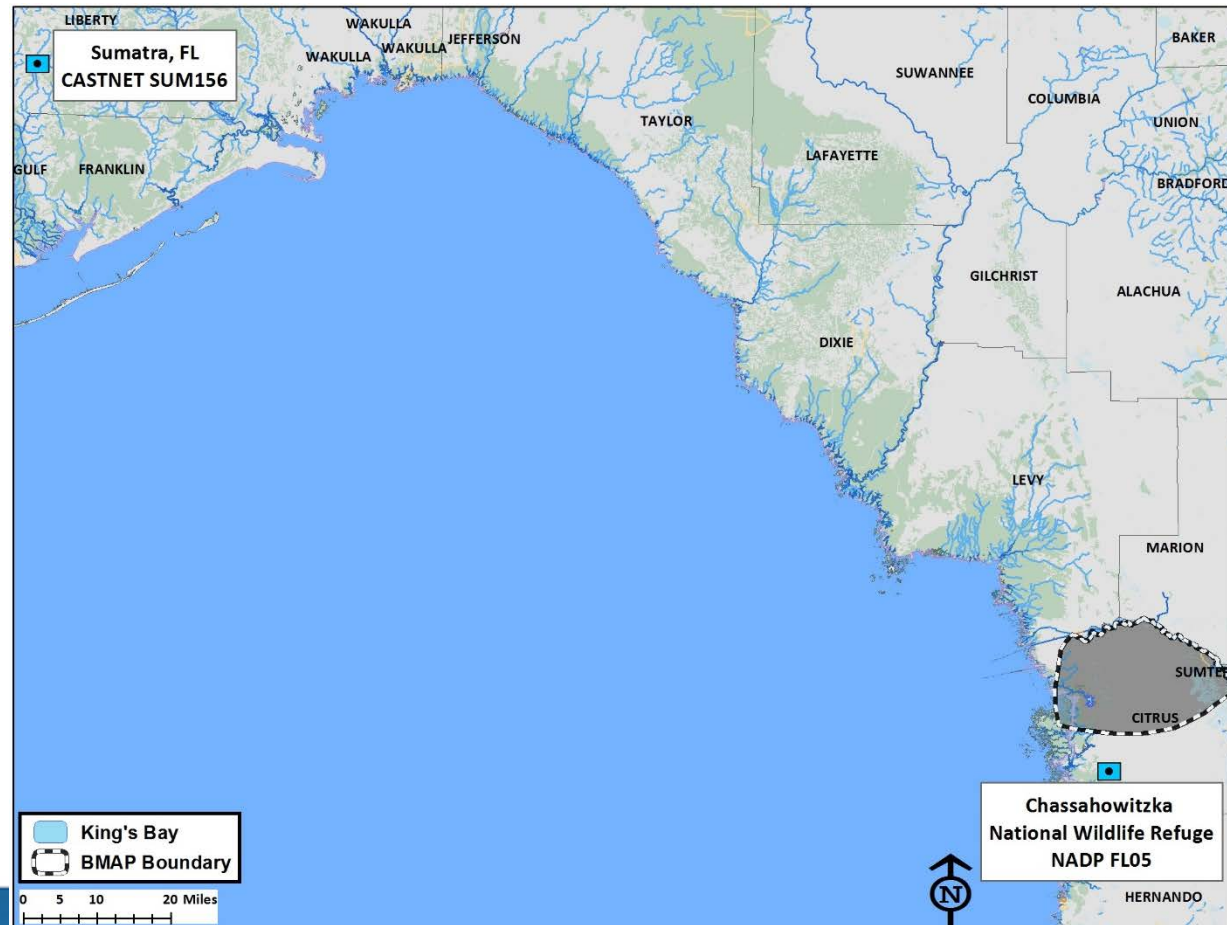


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Atmospheric Deposition

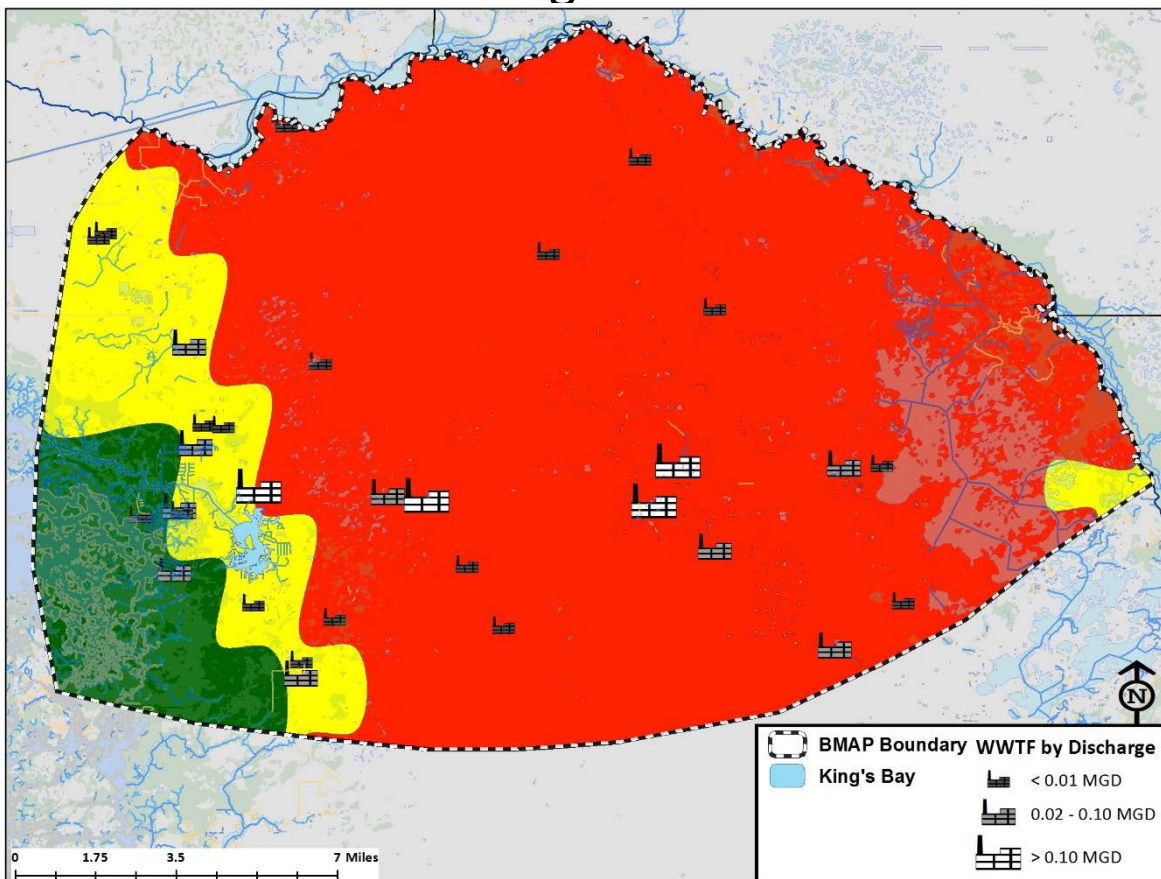
- ◇ National Atmospheric Deposition Program (NADP)
 - ◇ Wet deposition
 - ◇ Chassahowitzka National Wildlife Refuge(FL05)
- ◇ Clean Air Status and Trend Network (CASTNET)
 - ◇ Dry deposition
 - ◇ Sumatra, FL (SUM156)
- ◇ Annual Average TN deposition
 - ◇ 2002-2005, 2007, 2010-2011
 - ◇ 3.11 lb-N/ac





Wastewater Treatment Facilities

- ◇ 31 permitted facilities
 - ◇ 4 with discharge ≥ 0.1 MGD
 - ◇ 9 with discharge < 0.1 & ≥ 0.01 MGD
 - ◇ 18 with discharge < 0.01 MGD
- ◇ TN effluent concentrations as reported in DMR
 - ◇ NO3 used to project TN data, if necessary
 - ◇ 8.97 mg/L TN used if no data available
 - ◇ 50% design capacity if no flow data available



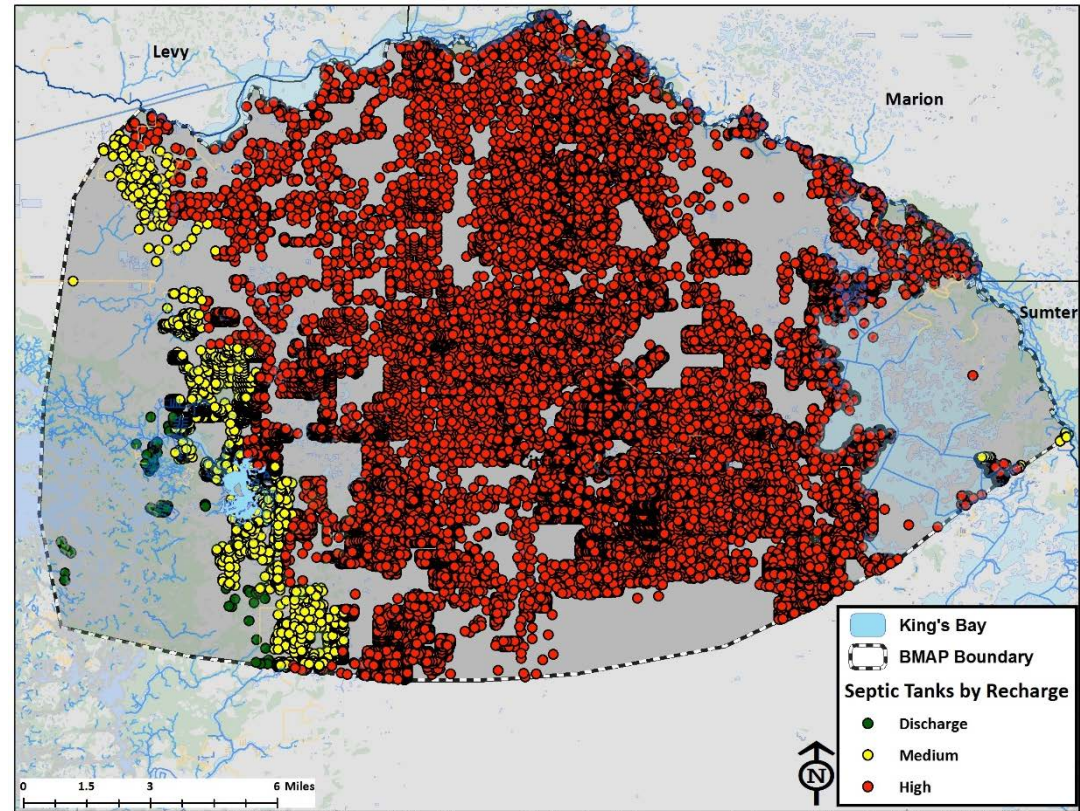
Recharge Area	Input to Land Surface (lb-N)
Medium	2,760
High	33,753

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Septic Tanks

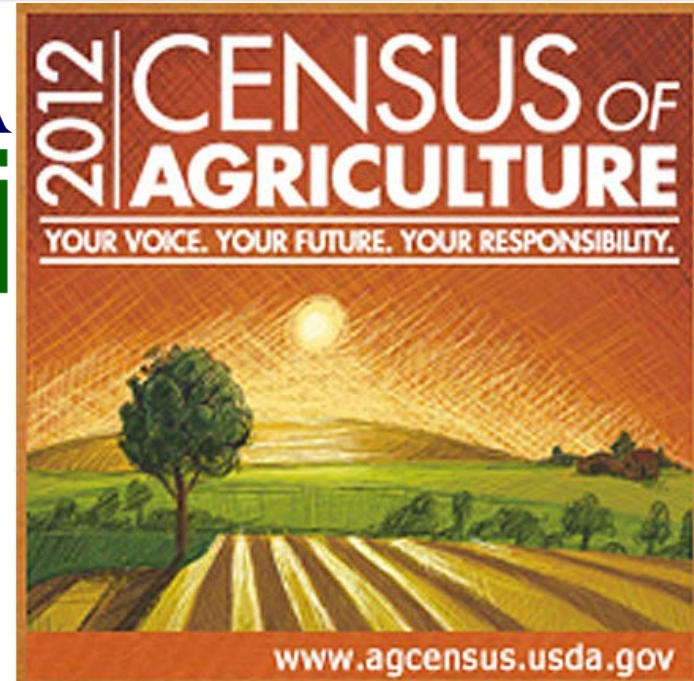
- ◇ DOH model relying on tax parcel data and sewer service areas
- ◇ Calculate # of people relying on septic tanks from 2010 Census
 - ◇ 2.23 people per household in Citrus County
 - ◇ 41,504 tanks in BMAP boundary
- ◇ Average annual input to septic tank = 9.92 lb-N/person (FDOH)

Recharge Area	Input to Land Surface (lb-N)
Medium	76,268
High	836,865





Livestock Populations



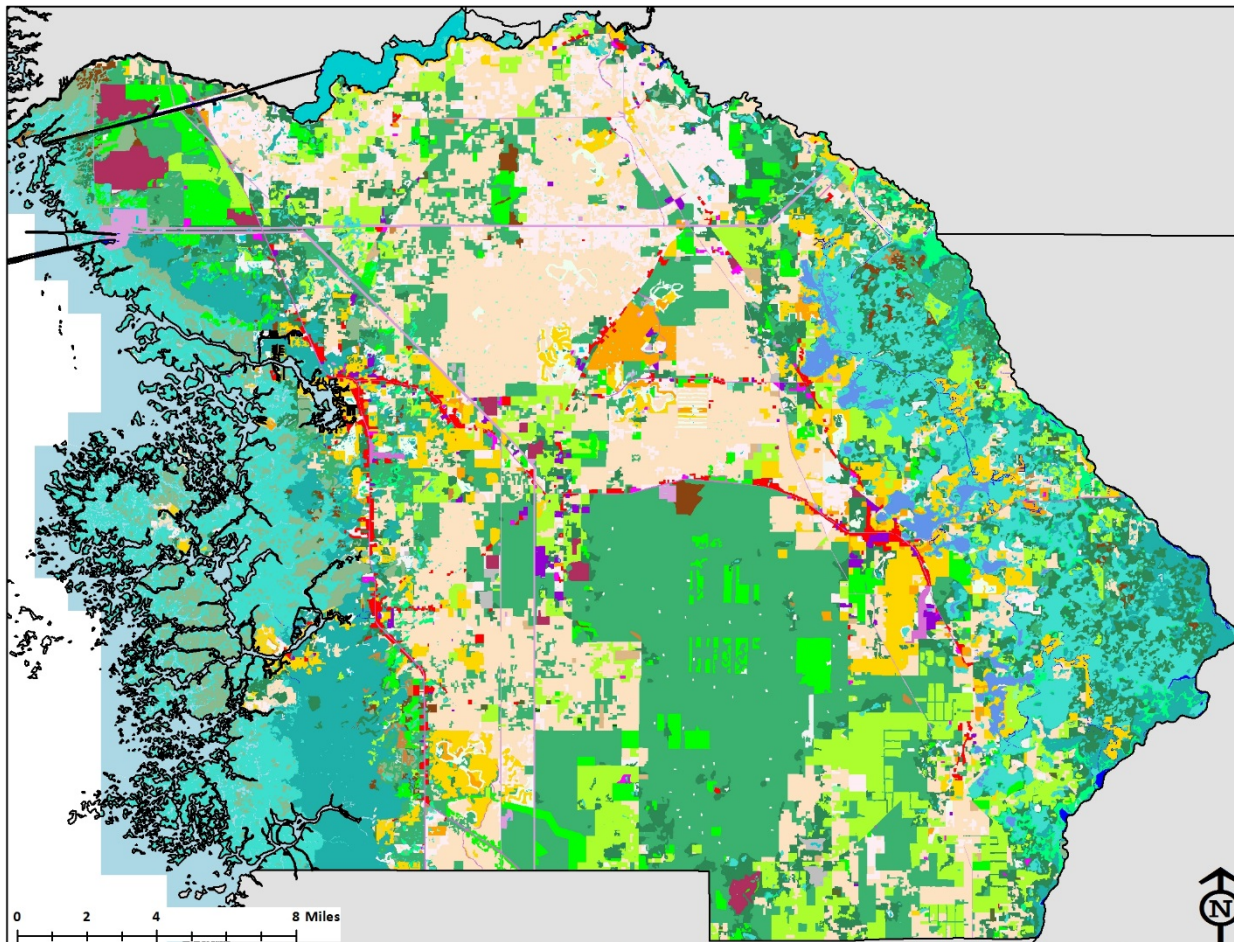
- ◇ Census of Agriculture
 - ◇ Dept of Agriculture
 - ◇ Every 5 years
 - ◇ # of livestock (categorized by animal)
 - ◇ Full county data ONLY
- ◇ Livestock waste factors (lb-N/animal/day)

- ◇ Cow: 0.337
- ◇ Calf: 0.068
- ◇ Horse: 0.273
- ◇ Goats: 0.035
- ◇ Hogs: 0.190

- ◇ Sheep: 0.198
- ◇ Turkey: 0.006
- ◇ Broiler Chickens: 0.159
- ◇ Layer Chickens: 0.003

Land use Percentages: Livestock

- ◇ Pastures
 - ◇ Improved
 - ◇ Unimproved
 - ◇ Woodland
- ◇ Feeding Operations
 - ◇ Cattle
 - ◇ Poultry
 - ◇ Dairies
- ◇ Specialty Farms
 - ◇ Horse Farms

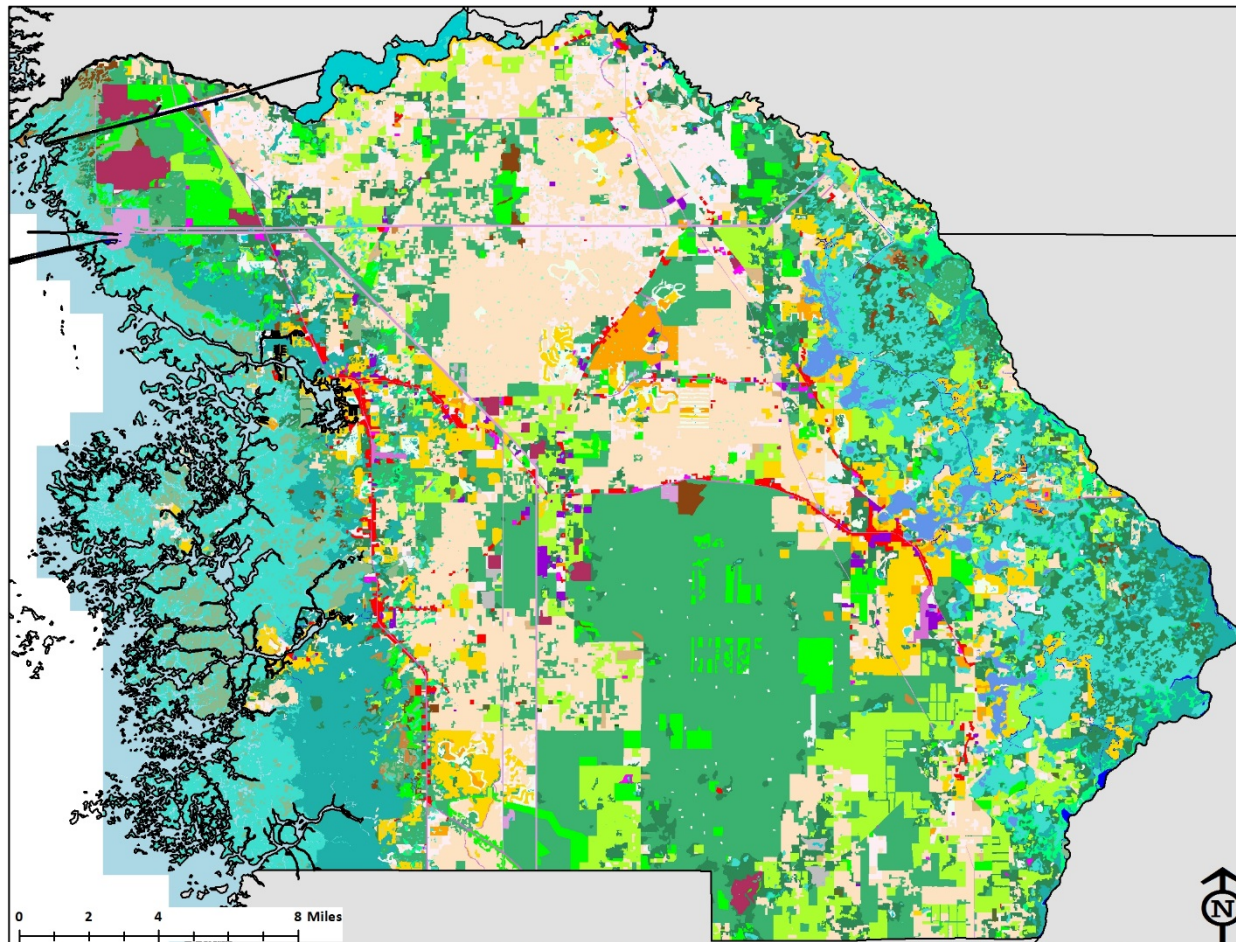


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Land use Percentages: Livestock

- ◇ EXAMPLE:
Citrus County
livestock lands
- ◇ Citrus County-
28,860 ac

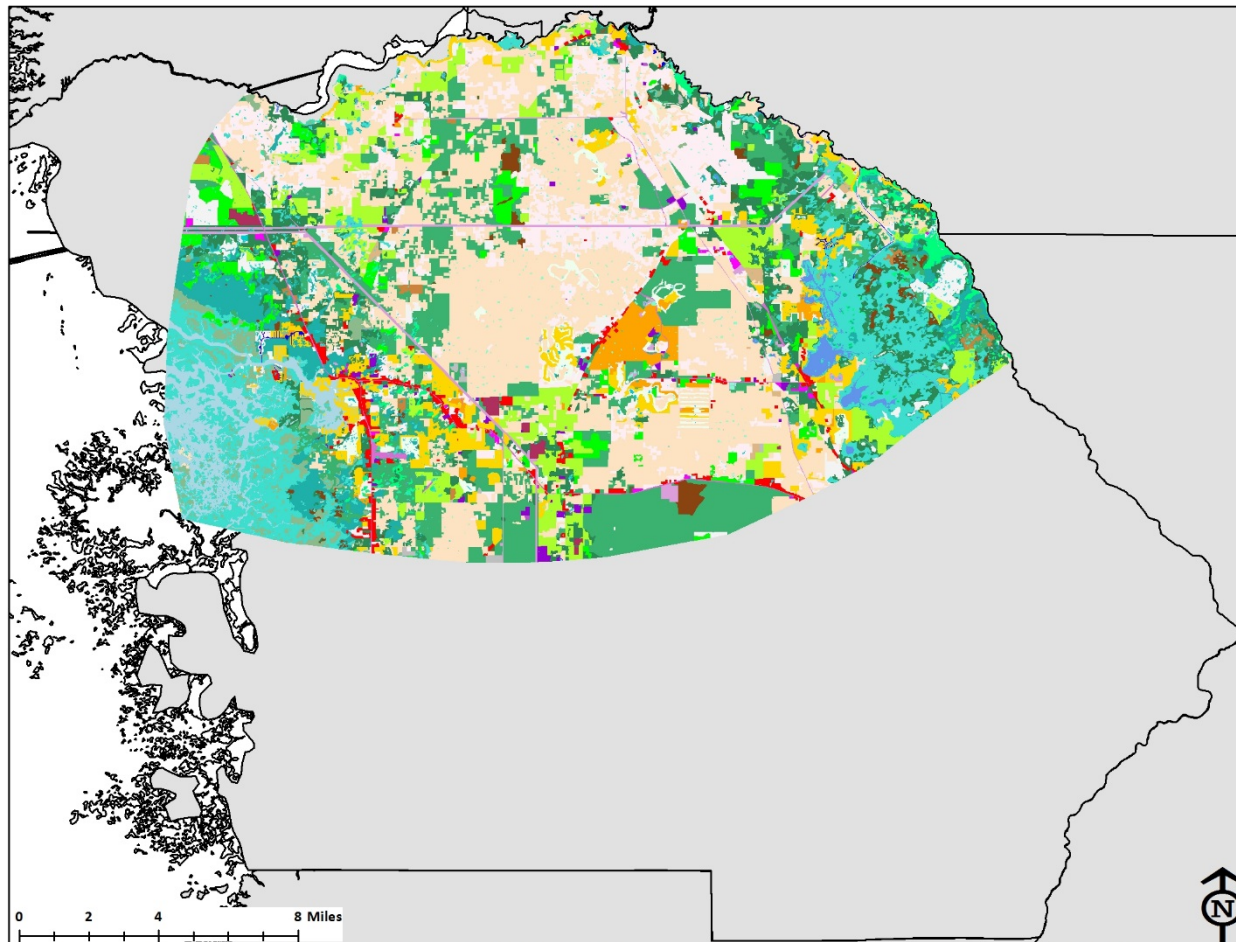


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Land use Percentages: Livestock

- ◇ EXAMPLE:
Citrus County
livestock lands
- ◇ Citrus County-
28,860 ac
- ◇ BMAP Area-
10,790, 37%



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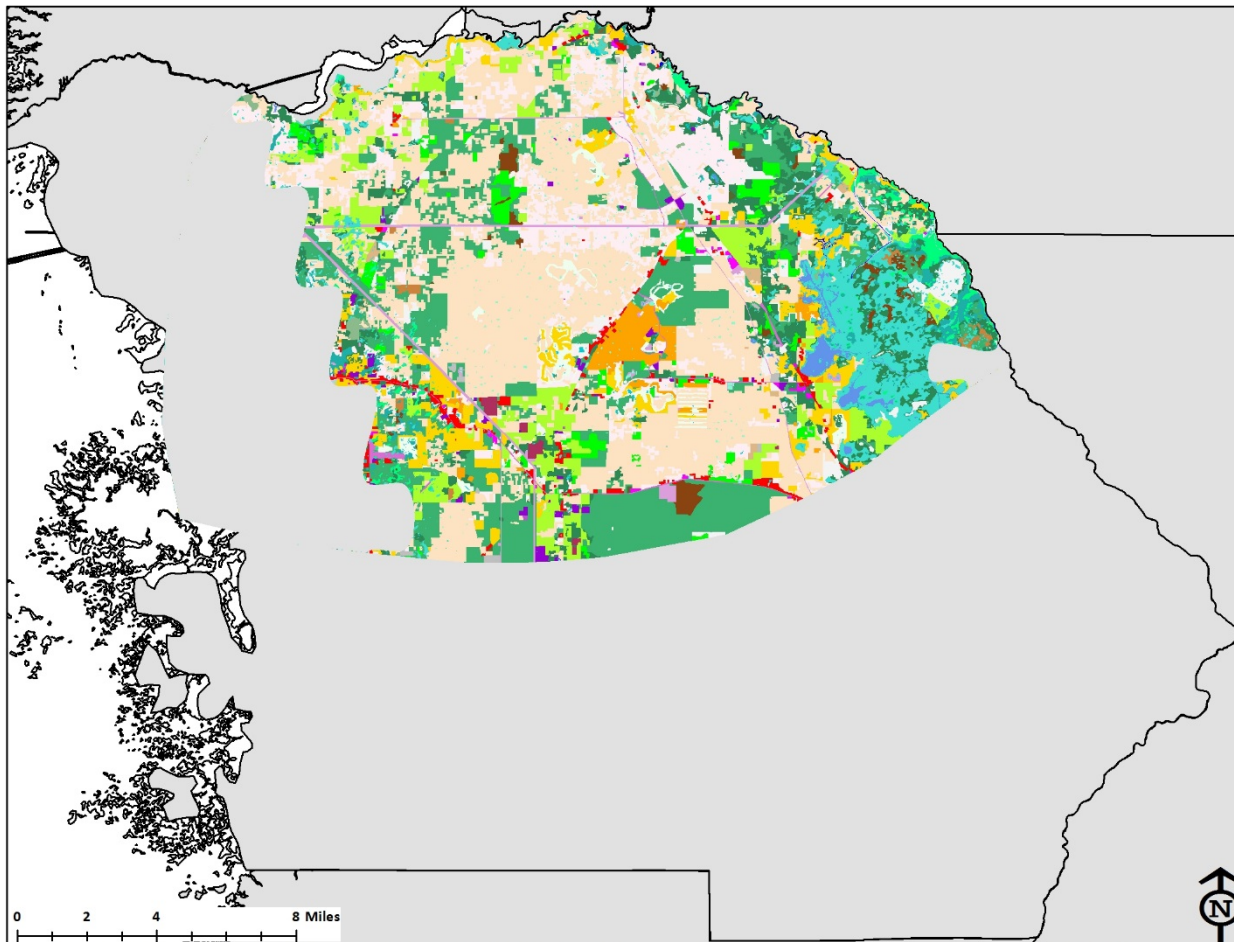


Land use Percentages: Livestock

◇ EXAMPLE:

Citrus County
livestock lands

- ◇ Citrus County-
28,860 ac
- ◇ BMAP Area-
10,790, 37%
- ◇ **High Recharge-**
9,330 ac, 32%



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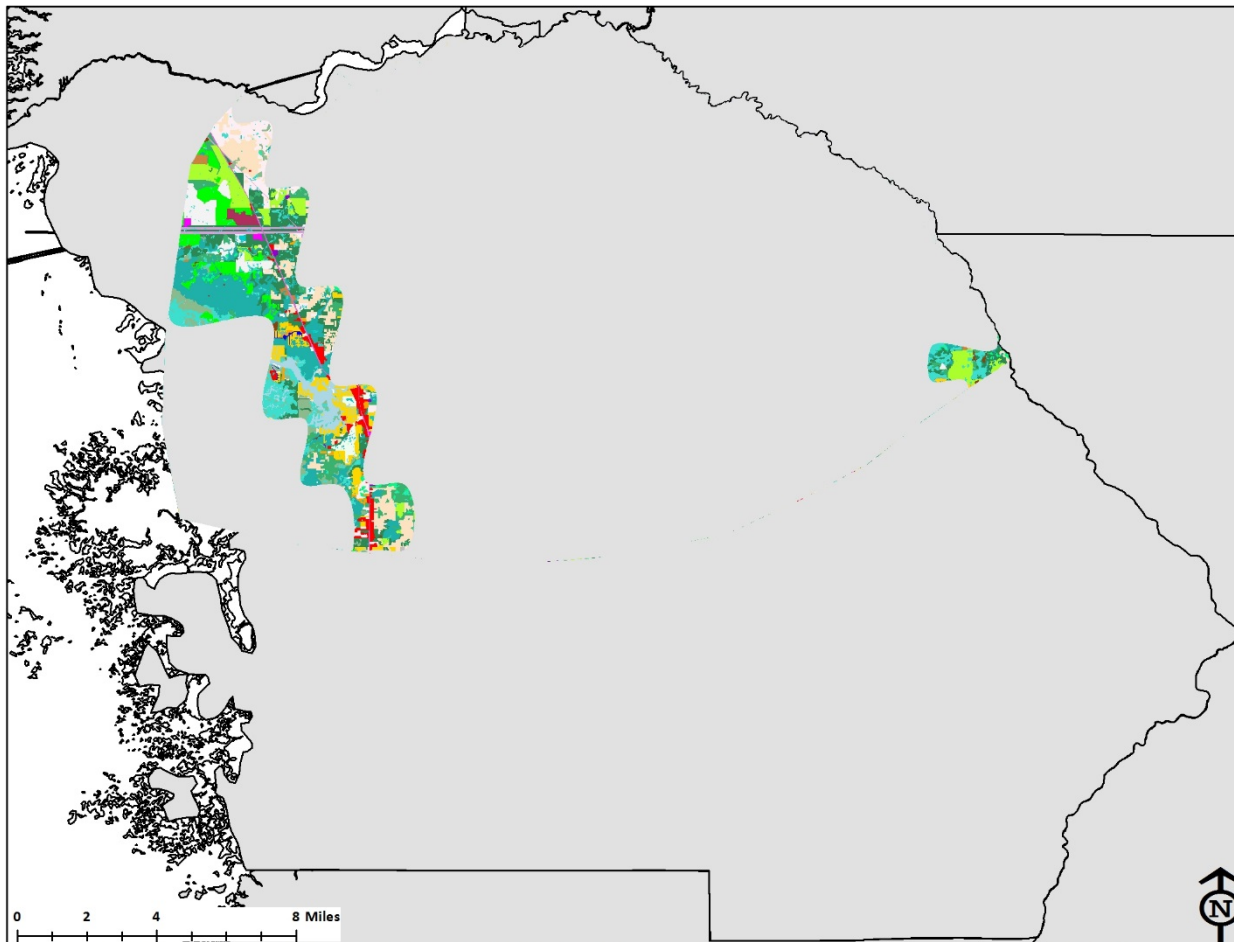


Land use Percentages: Livestock

◇ EXAMPLE:

Citrus County
livestock lands

- ◇ Citrus County-
28,860 ac
- ◇ BMAP Area-
10,790, 37%
- ◇ **High Recharge-**
9,330 ac, 32%
- ◇ **Medium Recharge-**
1,460 ac, 5%



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Livestock Waste

◇ BMAP populations estimated with land use percentages

- ◇ 2,201 Cattle
- ◇ 874 Calves
- ◇ 433 Horses
- ◇ 130 broiler chickens
- ◇ 664 layer chickens
- ◇ 338 goats
- ◇ 73 hogs
- ◇ 104 sheep
- ◇ 10 turkey

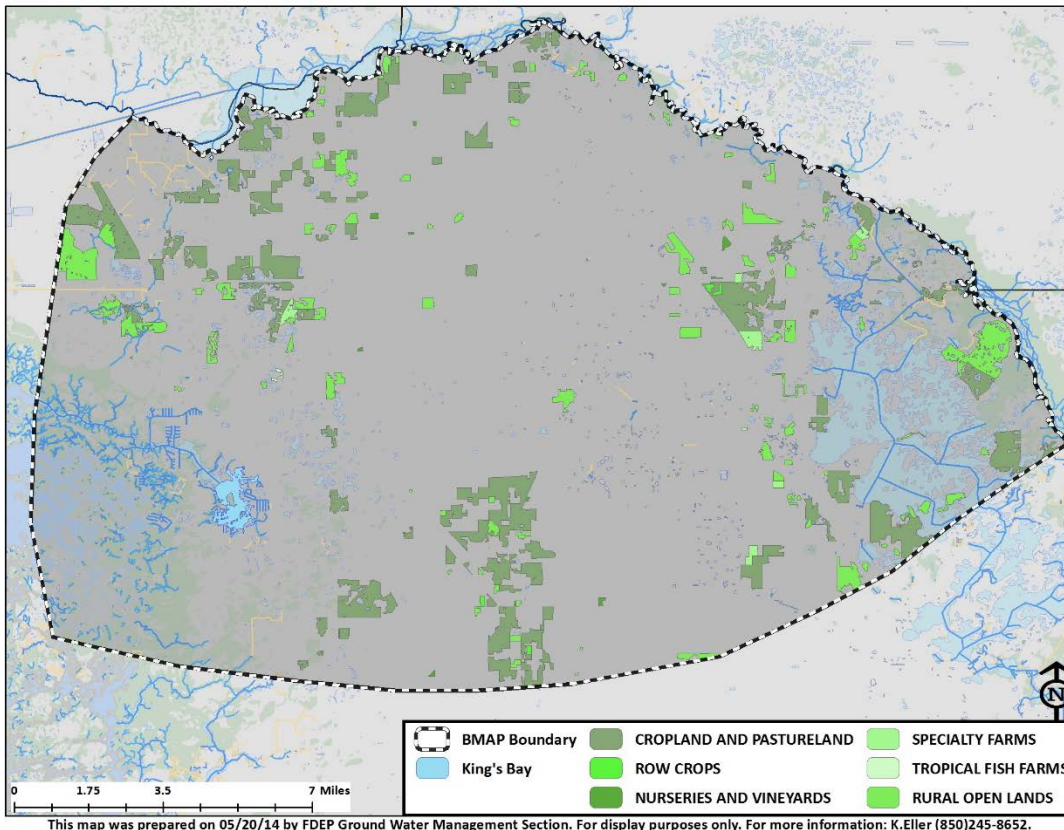
◇ Daily waste factors applied



Recharge Area	Input to Land Surface (lb-N)
Medium	48,821
High	312,039



Farm Fertilizers



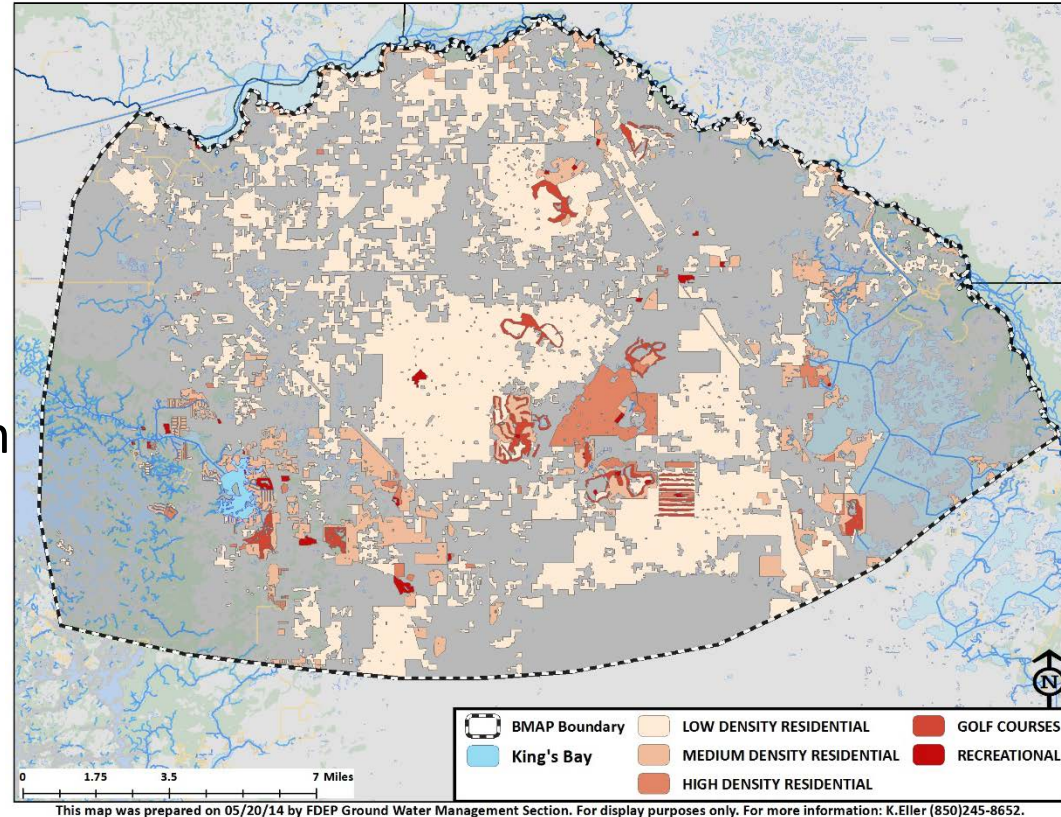
- ◇ Property appraised land use data was compiled
- ◇ Each county was evaluated individually
- ◇ Land areas for specific crops were estimated
- ◇ Application rates based on IFAS recommendations and farmer feedback
 - ◇ 25 lb-N/ac: Pastures
 - ◇ 80 lb-N/ac: Ornamentals
 - ◇ 110 lb-N/ac: Hay
 - ◇ 150 lb-N/ac: Orchards

Recharge Area	Input to Land Surface (lb-N)
Medium	50,379
High	321,132

Urban Fertilizers

♦ FL Dept of Ag Fertilizer Sales Data

- ♦ Annual data
- ♦ Total Fertilizer Sold
- ♦ Total N in Fertilizer Sold
- ♦ Total Fertilizer for Non-Farm Applications
- ♦ Full County data ONLY appropriated by land use percentages

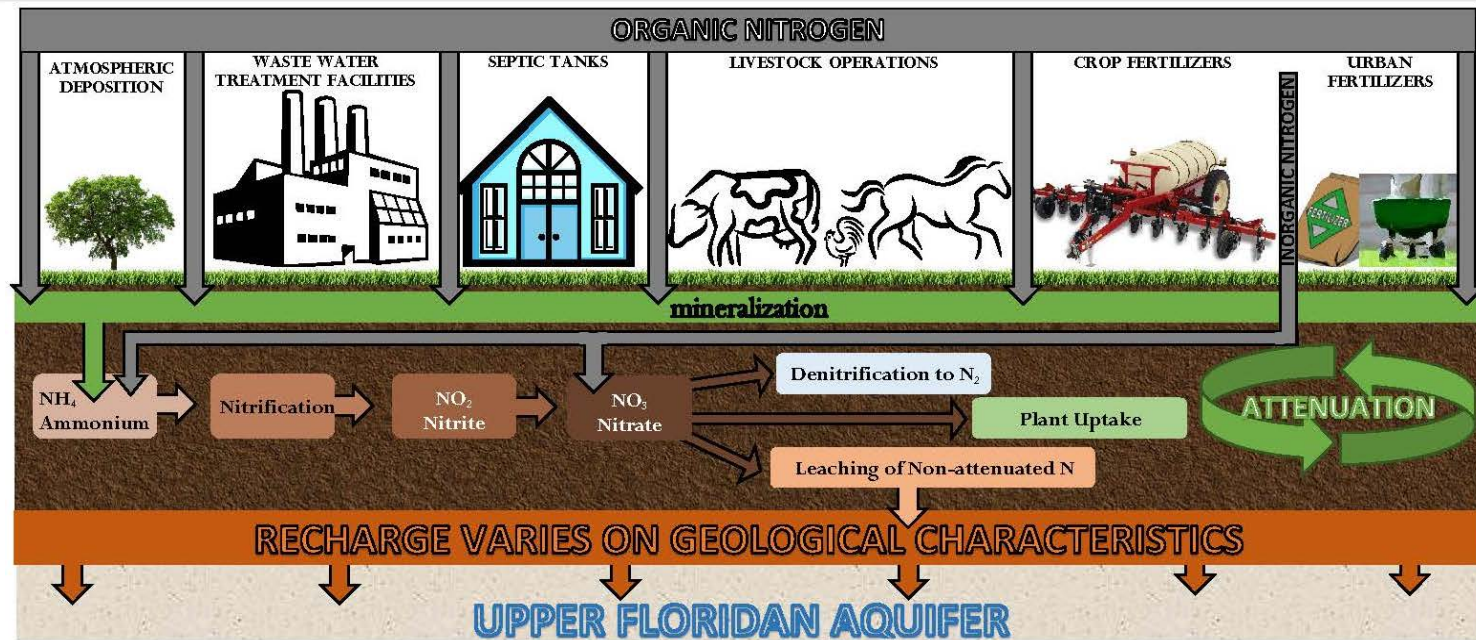


♦ Golf Course Exception

- ♦ 150 lb-N/ac application rate
- ♦ 72% of course is fertilized

Recharge Area	Input to Land Surface (lb-N)	
	Urban Fertilizers	Golf Courses
Medium	15,079	21,360
High	237,396	323,603

Environmental Attenuation Factors (EAFs)

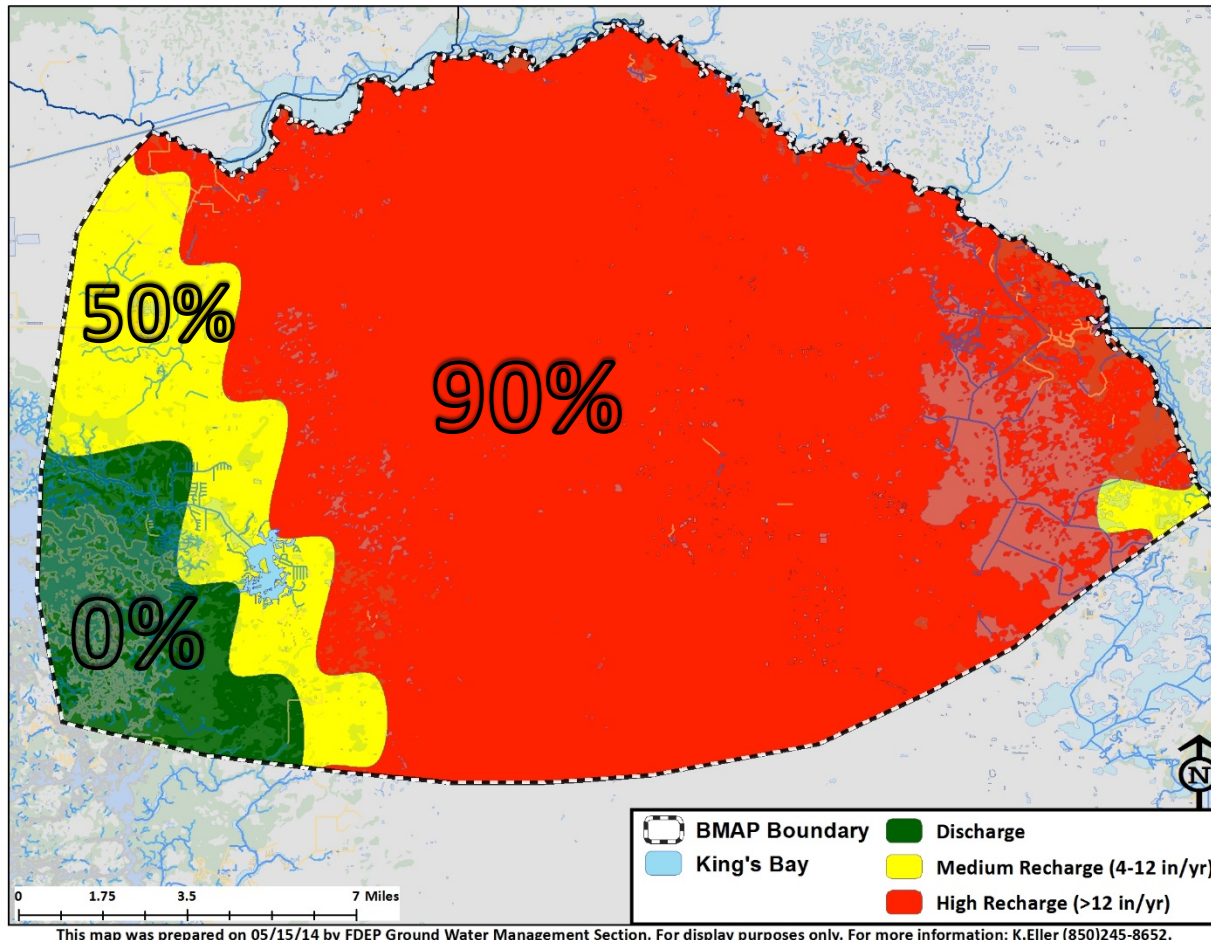


- ♦ EAFs represent the percentage of N removed and therefore not available for leaching to groundwater
- ♦ Based on factors used in similar past studies and found in relevant literature

Loading Category	Attenuation Factor
Atmospheric Deposition	90%
Wastewater Treatment Facilities	60%
Septic Tanks	40%
Urban Fertilizers	80%
Golf Courses	80%
Farm Fertilizers	80%
Livestock	90%

Recharge Factors

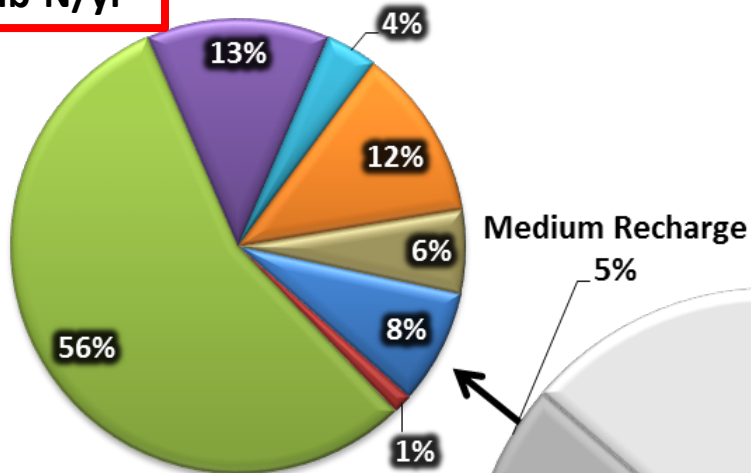
- Recharge factors are used to estimate the percentage of the non-attenuated nitrogen expected to reach the aquifer



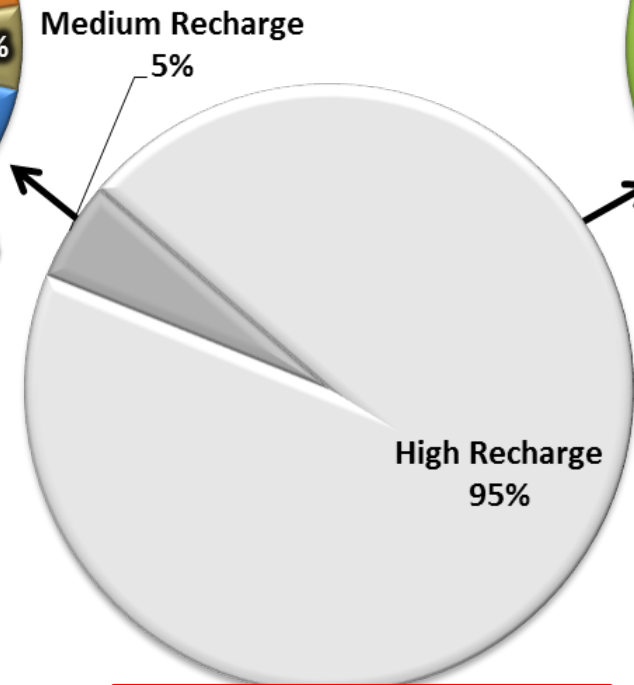
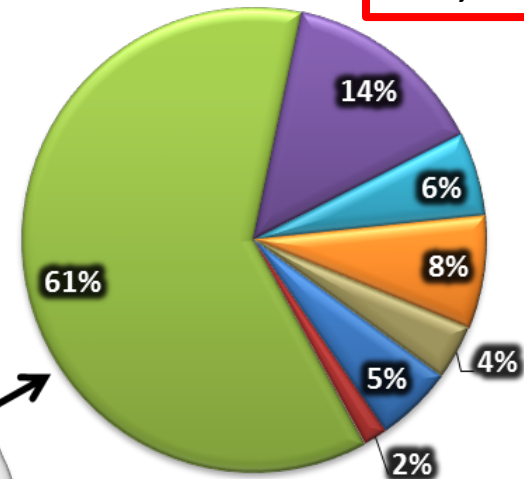


Annual Average Loading to Ground Water

41,126 lb-N/yr



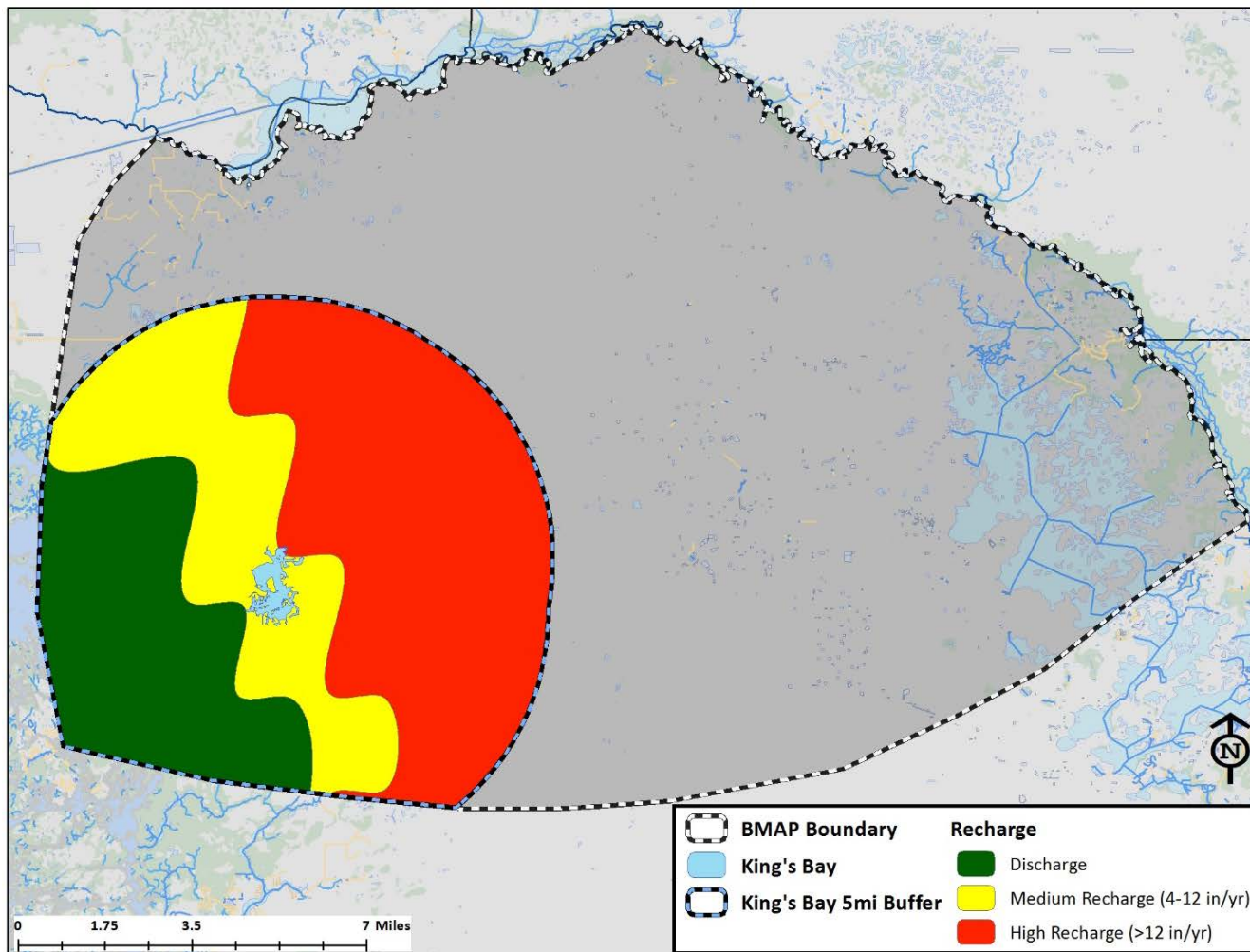
737,093 lb-N/yr



778,218 lb-N/yr

- Atmospheric Deposition
- WWTF
- Septic Tanks
- Golf Courses
- Fertilizer, Urban
- Fertilizer, Farm
- Livestock

Proximity to Spring Vents: 5 mile buffer



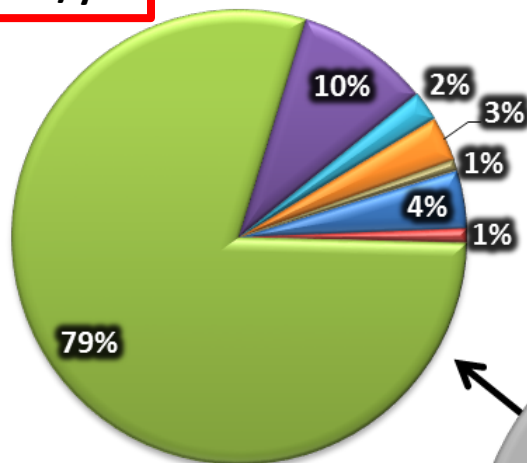
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- Close proximity to the spring vents leads to shorter travel times
- BMAP boundary contains 178,758 ac
- 5 mile buffer contains 56,232 ac or 31%
- Dominated by urban land use practices

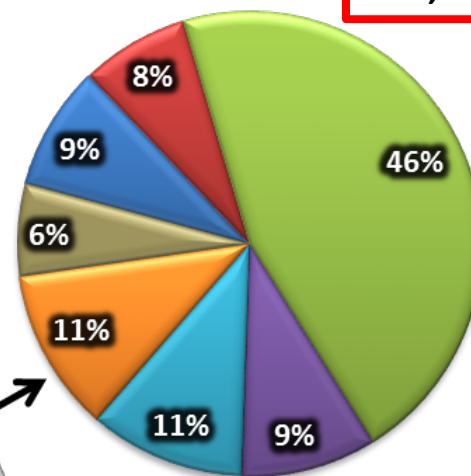


Annual Average Loading to Ground Water

56,661 lb-N/yr



84,254 lb-N/yr



Medium Recharge
40%

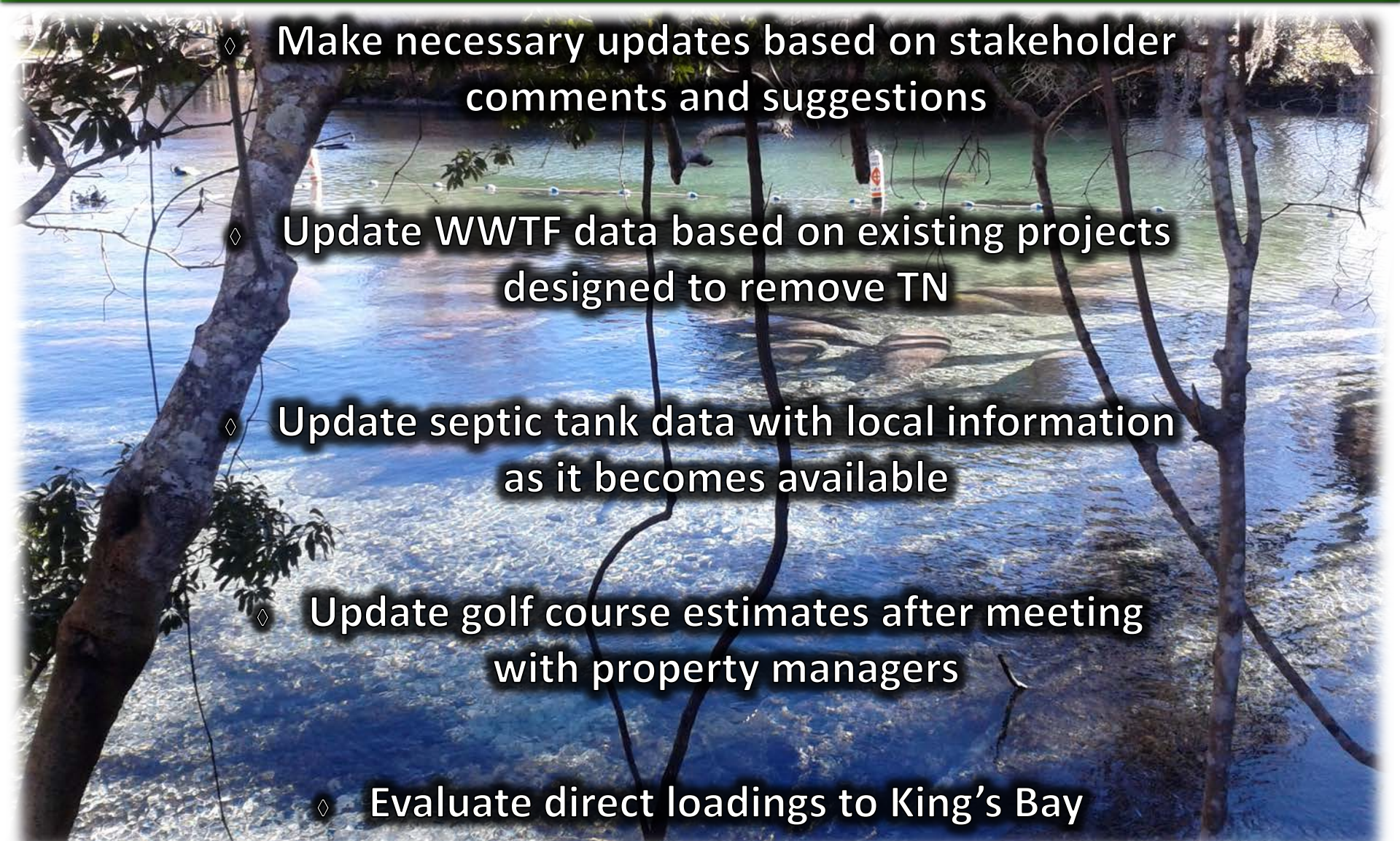
High Recharge
60%

140,915 lb-N/yr

18% of BMAP load



Next Steps

- 
- A scenic photograph of a river or bay with several trees in the foreground. A small boat is visible in the distance on the water.
- ◇ Make necessary updates based on stakeholder comments and suggestions
 - ◇ Update WWTF data based on existing projects designed to remove TN
 - ◇ Update septic tank data with local information as it becomes available
 - ◇ Update golf course estimates after meeting with property managers
 - ◇ Evaluate direct loadings to King's Bay



QUESTIONS??



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