Modeling Nutrient and Biological Sources within Hendry and Mullock Creek Basins:

Identifying Areas of Concern and Recommending BMPs to Mitigate Effects

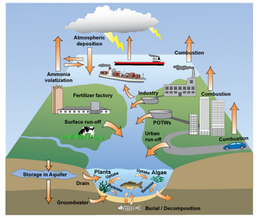
Background

Regulations

- **Federal Clean Water Act - Section 303(d)**
  - Required States, Territories, and authorized Tribes to develop lists of impaired waters
- **Florida Watershed Restoration Act – Section 62-403**
  - Identify impaired surface waters (1999)
  - Science-based methodology (2001)
- **Total Maximum Daily Load (TMDL) must be developed and implemented for impaired waters**

  TMDL = $\sum$ WLA + $\sum$ LA
  where:
  $\sum$ WLA = point sources (i.e. WWTP, NPDES)
  $\sum$ LA = nonpoint sources (i.e. stormwater runoff, atmospheric deposition)
  - **Reduce pollutants**
  - **Clean up the water body.**

Nutrient Cycle in the Basins



Pollution Loading Models based on land use:

- Watershed Management Model (WMM) (CDM, 1998)
- Generalized Watershed Loading Function (GWLF) model (Haith, 1992)
- USGS Regression Method (USGS, 1988)
- Desktop Model: Spreadsheet Calculation (HSA, 2008)

Parameters & Florida State Impairment Criteria

- **No Numeric Nutrient criteria for Florida**
  - *October 2010: Lakes, Stream*
  - *October 2011: Estuaries, Coastal*
- **Chlorophyll *a***
  - *20 µg/L (Chapter 62-303 FAC)*
- **Dissolved Oxygen (DO)**
  - *5 mg/L (Chapter 62-302 FAC)*
- **Fecal Coliforms** *(Chapter 62-302 FAC)*
  - *> 800 colonies/100mL (daily)*
  - *> 400 colonies/100 ml (10% samples)*
  - *> 200 colonies/100ml (monthly)*

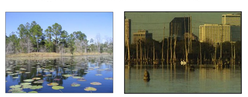
Objectives or Scope of Work

- **Conduct a "desktop" inventory of potential loading sources of nutrient and fecal coliforms to land use categories in Hendry and Mullock Creek basins;**
- **Develop a "desktop model " to estimate nutrient and fecal input/loading to both basins;**
- **Recommend additional data and/or analysis needed to identify/confirm loadings to the Hendry / Mullock Creek basins**

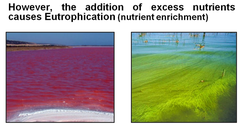
Nutrients

Nitrogen (N): nitrate, nitrite, ammonia, org-N
Phosphorus (P): phosphate, org-P

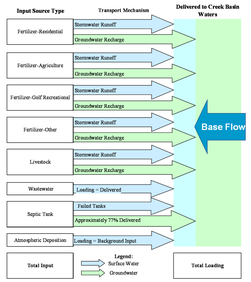
- **Essential to aquatic life:**
  Oligotrophication (nutrient depletion)



- **However, the addition of excess nutrients causes Eutrophication** (nutrient enrichment)



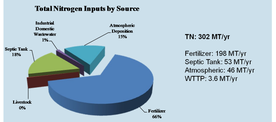
Conceptual Model of Nutrient Inputs & Loadings

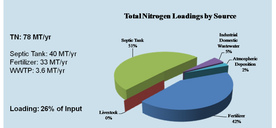


Hendry Creek Basin

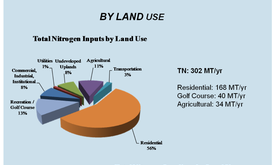
Nitrogen

BY SOURCE



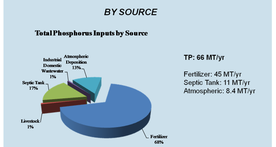


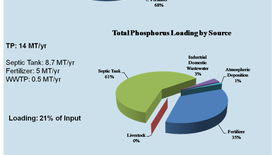
BY LAND USE



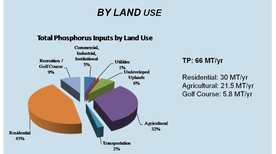
Phosphorus

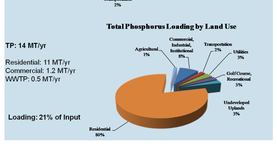
BY SOURCE



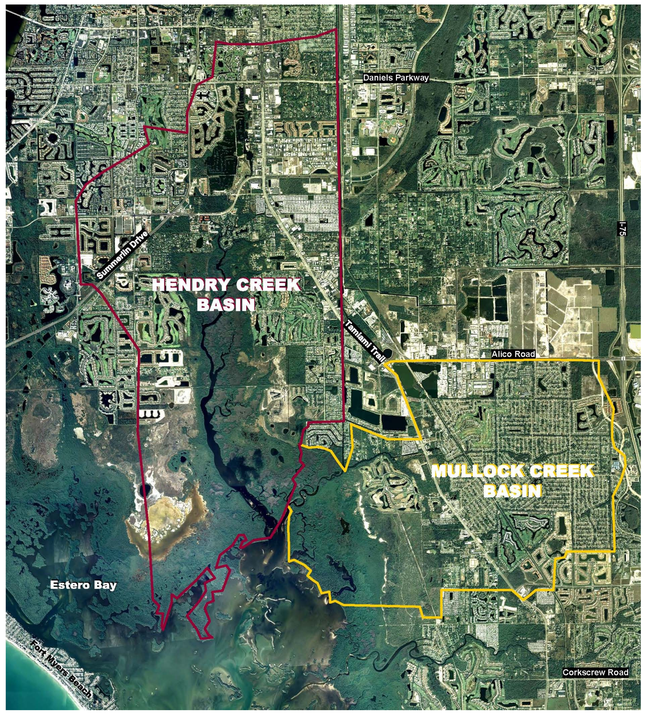


BY LAND USE

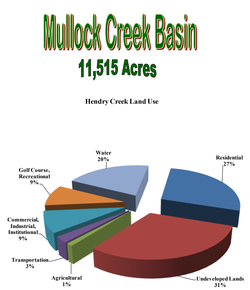


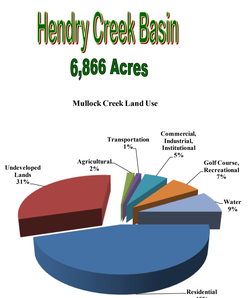


Study Area



LAND USE
Source – Lee County GIS Department

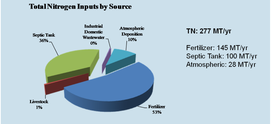


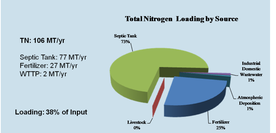


Mullock Creek Basin

Nitrogen

BY SOURCE





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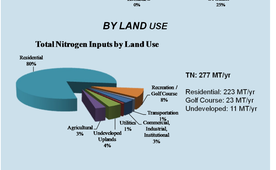
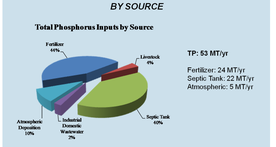
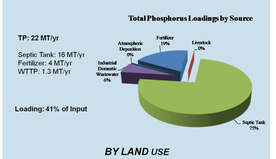


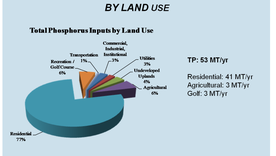
Phosphorus

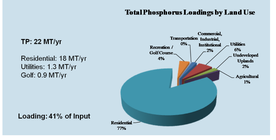
BY SOURCE





BY LAND USE





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Fecal Coliform Input

HENDRY CREEK FECAL COLIFORM ESTIMATE

Sources	Input (Colonies/yr)	Reference
Fiesta Village WWTP	1.8E+10	Actual Data
Forest Utilities WWTP	3.9E+09	Actual Data
Failing Septic Tanks	1.1E+14	FDOH
Dogs	2.8E+15	AVMA Pet Ownership
Cats	3.8E+08	AVMA Pet Ownership
Birds	1.2E+12	Gull - Alderisio & Deluca, (1999) and First Dawn Roost Count in Lakes Park by Mr. Robert Repenning

MULLOCK CREEK FECAL COLIFORM ESTIMATE

Sources		Input (Colonies/yr)	Reference
Waste Water Plants	Three Oaks	2.5E+11	Actual Data
	San Carlos Park	2.8E+09	Actual Data
	Granada Lakes RV	8.9E+07	Actual Data
	Cypress Bend RV	1.4E+09	Actual Data
	Wood Smoke	4.3E+08	Actual Data
	Fort Myers Campground	1.2E+08	Actual Data
	Shady Acres Mobile Homes	1.1E+07	Actual Data
	Shady Acres Trailer Park	2.9E+08	Actual Data
Failing Septic Tanks		2.0E+14	FDOH
Dogs		2.8E+15	AVMA Pet Ownership
Cats		3.8E+08	AVMA Pet Ownership

Conclusions

Conclusions & Uncertainties

- **Nutrients** – For both the Hendry and Mullock Creek basins the greatest nitrogen and phosphorus loads were due to
  - Septic tanks by source
  - Residential areas by land use
- **Fecal Coliform** – Septic tank systems and dogs are the major fecal coliform contributions to both Hendry and Mullock Creek basins
  - The actual loadings are not available without field testing to trace down the sources
- **Uncertainties** – Based on best available data (BAD), need calibration/verification using more available actual data

With the completion of the "Desktop Model":

- Under EPA review
- Focus on "ground truthing"
- "Shovels hit the ground"
- Application
  - Predict the loading changes by using varying parameters (*i.e.*, land use change)
  - For other basin studies
  - Used for TMDL assessments
  - Used for best management practices (BMPs)