Nitrogen impact of onsite sewage treatment and disposal systems in the Wekiva Study Area

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INTRODUCTION

Wekiva Parkway and Protection Act

The act was signed into law on June 29, 2004. It authorizes the building of the Wekiva Parkway and provides protection to the Wekiva River system. The Wekiva River Basin Commission was established consisting of many local and state government representatives. The act required coordination of land use and water supply to protect the Wekiva River.

Health of the Wekiva River

The Wekiva River is designated an Outstanding Florida Water, a State Canoe Trail, and has recently been added to the federal Wild and Scenic Rivers program. The majority of flow to river comes from Wekiwa Springs and Rock Springs. The Wekiva River and its contributing springs are sensitive to excess nitrogen. Nitrogen reduction goals have been set to protect the springs and the river

What does wastewater have to do with building the Wekiva Parkway?

Good roads encourage development, more development results in more onsite systems. The proposed routes go through an area with a sensitive *Karst* environment. The river and groundwater in the area are interconnected and sensitive to nitrogen pollution. Conventional septic systems work well at removing pathogens, but do not do much to reduce nitrogen.

2006 Legislative Mandate

In May of 2006 the Department of Health was tasked to quantify onsite system nitrogen contribution to groundwater, assess relative importance of onsite systems in comparison to other sources, and recommend cost-effective solutions. The Bureau's Research Review and Advisory Committee was tasked with oversight of this study. The deadline for this study was June 30, 2007.

Wekiva Study Area contains over 55,000 onsite systems

APPROACH

Field Work: What does one system contribute to the groundwater?

The provider was Ellis & Associates, Inc. They performed detailed field sampling of three onsite systems in Wekiva Study Area to determine how much nitrogen comes out of the septic tank and how much makes it to the groundwater. Samples were analyzed under the drainfield at the top of the water table. The effluent plume was also identified in the groundwater as it moves away from the source.

Some of the conclusions were:

- Effluent in septic tanks mainly fell within the expected range
- Definite nitrogen plumes were identified, conductivity was a good tracer
- Mass loading input of nitrogen to the drainfield was higher than expected in two out of three sites
- About ½ to ¾ of the nitrogen input was loaded to shallow groundwater

What categories are important to look at to determine loading from onsite wastewater systems to the groundwater?

The provider was Otis Environmental Consultants, LLC. Two performance boundaries were examined: what comes out of the tank (input) and what enters the water table (load). The flow and concentration were estimated for the load to the water table by looking at the drainage class, depth to water, and organic content in soil

Some of the conclusions were:

- Nitrogen must be converted into nitrate first (aeration) before denitrification (with food source, without air) can occur
  - Two foot separation is maintained from the bottom of the drainfield to the water table
- Conditions where denitrification is most likely:
  - Water table no deeper than 3.5-feet below grade to allow for maximum contact with air
  - Soils with high organic content
- Estimated nitrogen removal potential based on water table, organic content and texture
- Cannot totally rely on soils to nitrify/denitrify
- Estimated nitrogen removal potential in soils found in the Wekiva Study Area ranged between 0-100% with an average of 33%

Field work summary of apparent mass loading estimates

	TN Input from Septic Tank to Drainfield (lbs/person/year)	Percent Apparent Nitrification / Denitrification	Mass Loading TN to shallow aquifer (lbs/person/year)
Literature Values	7.7	10-50%	3.8-6.9
Seminole Co. Site	14.19	32%	9.65
Lake Co. Site	14.74	52%	7.07
Orange Co. Site	7.33	23-46%	3.95-5.64

Nitrogen inputs to the Wekiva Study Area

Source	Method of Calculation
Fertilizer	Recommended application rates on pervious land area
Livestock waste	Literature values for feedlots and pasture land
Atmospheric deposition	Urban literature values for Orlando area for wet deposition, and 30% of total for dry deposition
Centralized wastewater facility effluents	Review of FDEP system permit records in Wekiva Study Area, including nitrogen in reuse water, using the actual discharge by the concentration
Onsite system effluents	Number of systems (55,000) x average number of persons in household (2.6) x average input of nitrogen per person per day (7.7 lbs)=20 pounds/system

What amount of nitrogen do onsite systems contribute as a whole to the groundwater relative to other sources?

The provider was Dr. Linda Young with the University of Florida who coordinated with the Department of Environmental Protection's provider to determine the input from other sources. Through the utilization of GIS, the number of septic systems were located and counted in each soil map unit. This allowed determination of the input (release to the environment) of nitrogen. The estimated nitrogen removal potential in each soil map unit was applied to each system to estimate the total nitrogen loading to groundwater from septic systems for the Wekiva Study Area.

Some of the conclusions were:

- Estimate 71% of inputs are fertilizer
- Estimate 6% of inputs are onsite systems
- Load estimates for all sources may be refined by DEP

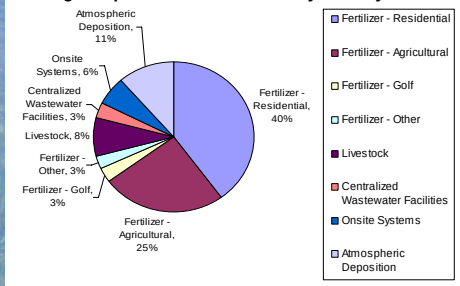
Determination of Significance

No criteria was provided by the legislature to determine significance. The Department looked at two approaches:

- Is the contribution significant as compared to other sources?
- Is the contribution significant to reach springs protection levels?

The US EPA's proposed total maximum daily loads (TMDL), has set goals of up to 95% reduction in nitrogen output for springs contributing to the Wekiva River. The St. Johns River Water Management District's proposed pollutant load reduction goals (PLRG) of up to 85% reduction in nitrogen output for springs contributing to the Wekiva River. Nitrogen impacts overall are significant. All contributing sources will need to do something to meet these goals.

Nitrogen inputs to the Wekiva Study Area by source



CONCLUSIONS / RECOMMENDATIONS

All nitrogen contributors must work together to reduce inputs. Onsite systems are not the major source of nitrogen input, but are similar to livestock and centralized wastewater. There is no consensus on how much nitrogen is loaded from all sources to the groundwater. DOH realizes, based on the nitrogen reduction goals, that onsite systems do have an impact on the nitrogen input to groundwater and recommends several strategies:

- Nitrogen discharge fee for all sources to fund cost-effective projects
- Establish a maintenance program. Either:
  - US EPA Model 4: utility collects fee to provide maintenance, repairs, upgrades, sewer connection
  - All systems have an operating permit, and be inspected and pumped every 5-years. Portion of fee to fund grant program for low-income home-owners.
- Eliminate grandfathering provisions for minimum lot sizes and surface water setbacks
- All existing systems requiring repair or modification be upgraded to new system requirements for separation to water table and surface water setbacks
- New systems add nitrogen. Nitrogen removing systems will help reduce this. All new systems should be performance based with nitrogen reduction to a level of 10 mg/L.
- Inventory all onsite systems to help locate areas with older systems closer to the water table and assess the overall impact
- Prohibit land spreading of septage
- Consider the economic feasibility of sewering high density areas

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FOR FURTHER INFORMATION

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http://www.doh.state.fl.us/ENVIRONMENT/ostds/research/research.htm