

Research Review and Advisory Committee for the Bureau of Onsite Sewage Programs

Approved Minutes of the Meeting held at Sylvan Lake Park, Sanford, FL

June 12, 2007

Approved by RRAC on October 18, 2007

In attendance:

- **Committee Membership and Alternates:** Sam Averett (alternate, Septic Tank Industry); David C. Carter (Chairman, member, Home Building Industry); John Glenn (member, Environmental Interest Group); Stan Keely (alternate, Professional Engineer); Bill Melton (member, Consumer); Jim Rashley (alternate, DOH-Environmental Health); Patti Sanzone (alternate, Environmental Interest Group); John Schert (member, State University System); Pam Tucker (member, Real Estate Profession); and Ellen Vause (alternate, Septic Tank Industry)
 - **Not represented:** Restaurant Industry
 - **Visitors:** Damann Anderson (Hazen & Sawyer); Rick Baird (Orange County Environmental Protection Department); Quentin Beitel (Markham Woods Association); Alic Berkley (Office of Representative Bryan Nelson); Dominic Buhot (Greens Environmental Services); John Byrd (Aide to Orange County Commissioner Brummer); Bill Carson (Florida Onsite Wastewater Association); John Cochrane (Seminole County Environmental Health Department); Stewart Dawson (Mack Concrete); Kim Dove (Seminole County Environmental Health Department); Frankie Elliott (Orlando Regional Realtor Association); Doug Everson (Plastic Tubing Inc.); Sarah Hardy (Office of Senator Lee Constantine); Roland Harris (Citizen); Henry Hicks (Florida Water Environment Association Utility Council); Justin Hubbard (Infiltrator Systems); Chazz Huston (Citizen, WI Financial); Tony Matthews (Seminole County); Mark Mechling (Ellis & Associates); Steve Meints (Averett Septic); Russ Melling (Lake County Environmental Health Department); Dick Otis (Otis Environmental Consultants, LLC); Harley Pattee (World Wide Water Recycling Inc.); Chris Rowe (Plastic Tubing Inc.); Nicholas Rupnow (Citizen, WI Financial); Gary Smith (Orange County Environmental Health Department); Britt Watson (Averett Septic Tank); Linda Young (University of Florida)
 - **Department of Health (DOH), Bureau of Onsite Sewage Programs:** Paul Booher; Bart Harriss; Mark Hooks; Dr. Eberhard Roeder; and Elke Ursin
1. **Introductions:** Eight out of nine groups were present, representing a quorum. Chairman David Carter calls the meeting to order at 9:40 am.
 2. **Review Minutes of Meeting February 6, 2007:**
 - a. **Motion was made by John Schert and seconded by Bill Melton for the RRAC to approve the May 8, 2007 meeting minutes. No changes were proposed. All are in favor with none opposed, and the motion passed.**
 3. **Wekiva Onsite Nitrogen Contribution Study:**
 - a. Elke Ursin presents a brief overview of the tasks. The department was assigned to look at the nitrogen loading from onsite systems in the Wekiva Study Area. The project was split into four tasks to accomplish this assignment. The first task was to do Wekiva specific field work and to take groundwater samples underneath the drainfield and in the wastewater plume to find the contribution from onsite systems. The second task was to determine the input estimate for onsite systems, and what different

categories are important to determine loading estimates from onsite systems. The third task was to take the input and loading estimates by category and apply Wekiva specific GIS information to determine a total input and loading for onsite systems and then compare that with DEP's estimates for other sources to determine an overall significance. The fourth task was to determine some cost-effective solutions if the overall impact was significant.

- b. Summary of progress as of the last RRAC meeting and decisions made during the current meeting for the DOH study:
 - i. **Task 1** (Field Work, \$200,000): Elke Ursin stated that RRAC reviewed a draft report from Ellis & Associates at the May RRAC meeting. The final report for this task came in on June 1, 2007 and was forwarded to the RRAC committee for review. This final report incorporated comments from DOH and comments from RRAC. One of the main differences between the draft and the final report is that the mass loading calculations are included in the final report. Mark Mechling with Ellis & Associates, Inc. presented the final report on the results of the field work portion of the Wekiva study. Mark Mechling outlined how the mass loading of nitrogen to the surficial aquifer was calculated for each system. His estimates for nitrogen removal by nitrification / denitrification at the three sample sites were between 23% to 52%. Mark Mechling stated that the three sites should not be viewed as average or typical. The total nitrogen from the septic tanks were at the high end of the EPA established range. They developed a table showing estimated total nitrogen loading to the groundwater for a low, moderate, and high effluent load. These estimates were based on three sites, and the Wekiva Study Area has over 55,000 sites, so any total estimates of loading based on these numbers should be viewed cautiously. Pam Tucker states that she does not know whether this field work addresses significance of loading to the groundwater, the aquifer, or the springshed. Mark Mechling states that they were tasked to look at how much nitrogen makes it from a septic tank to the groundwater. They looked at three systems, which does not address all of the 55,000 systems. One of the recommendations he made was to use the study that they performed in conjunction with other studies being done at the same time, and that has been done in the draft final report submitted by DOH. He recommends looking beyond the results of this task and gather further information on the 55,000 systems. He recommends further study to determine whether the EPA baseline is accurate in the Wekiva Study Area. He also recommended that smaller lot subdivisions should be studied to see the potential cumulative impact of onsite systems. Mr. Beitel states that it appears as if there were too few study sites and recommends additional study before significance is determined. Mark Mechling states that this study provides a step beyond anything previously in the Wekiva Study Area. It is expensive to look at numerous sites. One question still remaining is what happens when you have lots of onsite systems together and whether the numbers generated in this task give an adequate estimate of total nitrogen loading down gradient. Denitrification rates calculated in this task are similar to rates previously published in other studies, and are on the high end of the range. Mr. Beitel states that the homeowners in his association are getting excited, in a negative way, about being forced to do something when the reason may or may not have been proven. Mr. Hicks states that the report indicates an estimate of 18 pounds of nitrogen per year per system, which is

lower than previous studies. He asks whether any consideration has been made to the abnormal drought situation that the area is in. Mark Mechling states that more information over more time would be better, but he is confident in the loading estimates that they determined for the three sites because it is based on real data. He does caution again in using the estimates and extrapolating to all the other 55,000 sites. Damann Anderson states that they did a good job identifying the plume, and the calculations show removal of nitrogen, but asks what would happen in the shallow aquifer. Mark Mechling states that it would be beneficial to look downgradient at many sites and does not know if he has enough information to make the determination on what happens in the shallow aquifer. Damann Anderson states that he expects that denitrification will continue in the aquifer. John Byrd states that the report shows nitrogen at background levels in a short distance, and Damann Anderson states that the majority of that is dilution. The mass of nitrogen is important, not dilution. Dilution only hides what is there, the nitrogen is still there. Damann Anderson states that in the late 1980's, early 1990's he looked at subdivisions and there was no evidence of down gradient cumulative plumes from four Florida subdivisions. Mark Mechling states that a follow-up study to see the cumulative impacts could be to install permanent wells at varying depths around a dense subdivision and observe over a year minimum. Stan Keely asks Mark Mechling to highlight the differences between the sites and the EPA results and Mark Mechling states that generally they were in the range, and the nitrogen concentrations of the septic effluent were in the upper range. Damann Anderson states that nitrogen concentration in wastewater has been increasing over the years because of water conserving fixtures. Bill Melton states that it is important to note that none of the three sites were outside the expected parameters. David Carter states that Mark Mechling's recommendation of looking at a subdivision is very similar to what Damann Anderson suggested back in June of last year. Dr. Eberhard Roeder states that the concern is that there is enough mixing underneath the drainfield to find the plumes. Mark Mechling thanks everyone and appreciates the opportunity to work on a project that so many people feel so strongly about.

- ii. **Task 2** (Categorization and quantification of nitrogen loading, \$25,000): Elke Ursin gives a quick update on what has happened since the last meeting. Dr. Richard Otis with Otis Environmental Consultants LLC, presents the final report on the results of this task. The purpose of this task was to estimate the amount of nitrogen coming from onsite sewage treatment and disposal systems in the Wekiva Study Area (WSA) and going to the groundwater. The scope was limited to estimating what makes it to the water table, including the capillary fringe, but not including what is going on in the aquifer. He reviewed literature to get to how much nitrogen is removed. The literature was focused more on different technologies, but not on the soils. The data does not look at characteristics in the soil profile that are providing conditions that are conducive to denitrification. Some of the literature data ranged from 0 – 80%, and his struggle was trying to determine which number to use. Most of the data was on concentrations, with no flow information. To get to mass loading you need concentration and volume. There are a lot of unknowns. He worked with two models for wastewater treatment: the single sludge model, and the two sludge model. He produced a table outlining the percentage of nitrogen reduction in

various soil types found in the Wekiva Study Area. This number was based on the drainage class, the amount of organic content in the soil, where the estimated seasonal high water table was, the soil texture and mineralogy, the fluctuation in the water table, the influent nitrogen species (either total Kjeldahl nitrogen or nitrate), and the type of infiltration system (mounded, in-ground, etc.) Dr. Otis states that the numbers generated in Task 1 are not included in the numbers in Task 2 because the Task 1 numbers included what was going on in the groundwater and the Task 2 numbers only reflect up to the groundwater. He stated that his estimates are conservatively low, and that the fate of nitrogen in the groundwater is not included. Ellen Vause asks what the difference is between gravity systems and dosed systems and Dr. Otis states that there is more nitrogen removal in dosed systems due to the wetting and drying conditions. Dr. Otis states that the trend is moving from public health to a water quality approach. The current rules are written from a public health approach. David Carter asks if there were two systems with the same nitrogen loading and one has a standard drainfield size and the other was spread it over twice the area, would you expect to see nitrogen reduction to be twice as much. Dr. Otis states that that could be, that there is a better chance of getting the organic matter. David Carter states that low pressure dosed systems appear to be a low cost alternative. Dr. Roeder asks whether a well drained soil does much for denitrification and Dr. Otis states that the carbon source is replenished all the time as roots cycle every two days. John Byrd asks whether Task 2 is part of the determination of loading and Dr. Otis states that it is. The percentages he came up with for the different soil types were applied to the actual number of systems in each soil type in Task 3. David Carter states that from a public health perspective the wastewater should go down in the groundwater so limiting soils are removed. Dr. Otis states that the way systems are designed today are not designed to remove nitrogen. There needs to be a balance between public health and water quality. Ellen Vause states that it is a balance. The hydraulics allow for a small footprint on a small lot. Florida has one of the smallest drainfield footprints in the country. Instead, she recommends looking at all options: i.e. if you need a small footprint then you need a PBTS, if you have a larger size lot then put in a larger drainfield. Dr. Otis states that when dealing with water quality, each individual system is different. He stated that removing nitrogen to 12 – 15mg/L is easy, but 10mg/L is much more difficult to achieve. He looked at Linda's report which took the Task 2 information in the MACTEC report and thinks something is wrong with the conversion from input to load. John Byrd asks how can we move forward with this report to the governor. Dr. Otis states that the data needs to be comparing apples to apples and now it is comparing apples to oranges. Dr. Otis states that DOH is working on their own and DEP is working on their own. He would like everyone to get together and describe the entire "creature". The Task 4 report will require cooperation from everyone involved and that is hard. We need to look at the value of what we're doing, how do we put a dollar figure on good clean groundwater. Traditionally it is putting in the cheapest system, ignoring the value of good treatment. John Schert states that the work done in this report is cutting edge. He thinks the department should think about how to educate on putting in better systems. Ellen Vause asks for clarification on how much more benefit there is between 10 mg/L of nitrogen vs. 15 mg/L. Mark

Hooks explains that the 10 mg/L refers to the testing result under controlled conditions. Dr. Roeder states that according to research he did for Task 4 shows that systems that claim to get 10 mg/L are not any less cost effective than those that get 15 mg/L. There will be variations in strength, toxicity, flow volume, etc. in the field that might influence reaching 10 mg/L. Dr. Otis stresses the importance of maintenance on PBTS. Mr. Beitel states the Markham Woods Association supports conservation issues, but he has a problem with there being a lot of science but no facts. Dr. Otis states that it is very difficult to prove a null hypothesis. If nothing is found does it mean that nothing is there? Sam Averett states that every research project has assumptions. Dr. Otis states that if further studies are done then we need to come up with a good hypothesis and test it. Damann Anderson states that one thing that we could all agree on and move forward with are the input numbers. They are easier to collect, they are more finite, there is no questionable nature of what happens in the environment, and we know the sources. He suggests source load reduction goals. He states that scientists can study this groundwater issue for many years and not reach a consensus. He states that he likes the framework established by Dr. Roeder in Task 4. He would like to see a task force between all agencies to come up with a solution.

- iii. **Task 3** (Assessment of the contribution of OWTS relative to other sources, \$25,000): Dr. Linda Young with the University of Florida presented the final report on the results of this task. The report follows the process used in the DEP report but looks at the Wekiva Study Area as opposed to the Wekiva Basin. She put together the Task 2 work and the DEP work to come to some conclusions on loading to the groundwater. There is diversity in the land uses in the Wekiva Study Area. There are over 55,000 septic systems in the area as well as numerous centralized wastewater facilities. There are two wastewater facilities that lie just outside the boundary of the Wekiva Study Area and there was discussion on whether to include them in the calculations or not. One of the facilities, Conserve II, generates more nitrates than all the rest of the facilities put together. The percentage of the contribution from wastewater treatment facilities goes from 6% to 13% if this contribution is fully included. Stan Keely stated that this facility handles wastewater from areas both inside and outside of the WSA and the Wekiva Basin. He cautions not to use the total numbers in the calculations; this is a distribution center which distributes to areas both inside and outside of the WSA. She presented pie charts for both scenarios (100% of two boundary systems included, or 0% of two boundary systems included). The inputs that were considered were fertilizer use, livestock wastes, atmospheric deposition, centralized wastewater facilities, and onsite systems. She took the methodology used by MACTEC and applied it to the Wekiva Study Area. A major part of her effort was scaling it down properly to the study area. Onsite systems were calculated to be 6% of the inputs. There was a discussion on some of the assumptions made in the DEP report and how these assumptions may not be accurate. She explains that the DEP study used nitrate numbers for the majority of the estimates, but used total nitrogen for onsite systems. She made the analogy that the onsite system slice of the pie is an orange in the midst of a basket of apples. David Carter asked how this affects the answer. Dr. Otis stated that if the pie chart for the inputs were to only look at nitrates then the onsite contribution would be zero

because the effluent comes out of the tank as ammonia. He stated that if the wastewater treatment plants are denitrifying they may only be discharging nitrates, but if they are not denitrifying then they are not accounting for all the nitrogen. Damann Anderson stated that most of the wastewater treatment plants are not denitrifying yet, but that they will be required to in the future. Mr. Anderson stated that the wastewater input and loading numbers are grossly underestimated at this point. There are 265,000 people served by sewer in the WSA, and only 160,000 served by onsite systems. If you only look at inputs the sewer should be considerably greater than the onsite but the numbers in the MACTEC report do not show that. This is because they did not look at the total nitrogen numbers from the facilities. Dr. Young stated that although MACTEC stated that nitrate numbers were being considered, if you look carefully through the report they mangle it a lot and may have used total nitrogen numbers and nitrate numbers. Dr. Young stated that she consistently tried to state nitrates throughout her report. Damann Anderson stated that they only used the nitric portion of atmospheric deposition and that's probably less than half the actual amount if the results are similar to Tampa. Dr. Young stated that MACTEC used one monitor for rural and one monitor for urban and used it throughout. Damann Anderson stated that this area is not rural. Dr. Young stated that she is trying to be clear of some of the assumptions that went into the work that she did because the analysis is only as good as the assumptions used. Pam Tucker asked why the MACTEC numbers were used and Dr. Young stated that that is what her task was. Pam Tucker asked if DOH was tasked to use the DEP numbers and Patti Sanzone responded by asking where else these numbers would come from. Dr. Young stated that she was tasked to work with the DEP numbers, that this is the best available data at this point in time. Dr. Young stated that the funding and the timeline were not sufficient enough to do anything other than to use the MACTEC numbers. John Byrd stated that there is still \$200,000 for DEP to use to verify the numbers in the MACTEC report. David Carter stated that Dr. Young was trying to make the RRAC aware of the inconsistencies and limitations of what it was that she had to work with. Pam Tucker stated that Dr. Otis has his limitations and Dr. Young has her limitations, so coming up with any determination of significance is tough at this point. Dr. Young stated that often decisions have to be made on the best available information, and this is the best available information. There can be discussions on how to tweak these numbers, but she does not know of anything that can be used to replace this information. Damann Anderson stated that the pie chart can be corrected fairly easily, because the numbers are there for the inputs. It's the loading that is difficult to estimate. MACTEC used recharge rates to estimate the loading. There was a small portion of the WSA that had no recharge information and most of it was water. For the land portions she took the weighted average of the residential recharge rates and applied it to these areas. Damann Anderson asked whether it is the recharge rate to the surficial or the Floridan aquifer and there was a discussion on this. Ellen Vause asked whether the loadings include the 10-15% that is removed in the septic tank, and Dr. Otis stated that it does. Quentin Beitel asked whether the type of system is taken into consideration, and Dr. Young stated that this information is not available for all 55,000 systems. Dr. Otis stated that the system types are incorporated into his

numbers as it relates to whether it is a subsurface, filled, or mounded system. Damann Anderson stated that there is an agreed amount of what comes out of the tank and then depended on the soil type to determine what other reductions take place. She presented a series of pie-charts showing the low, mid, and high range of loading based on the task 2 estimates. The estimates for the contribution by onsite systems to groundwater loading ranged between 25% and 31%. Damann Anderson stated that the problem with the pie charts is the way the fertilizer loading was calculated versus how the onsite system loading was calculated. The fertilizer loading has gone way down and is inconsistent with how the other numbers were calculated. There was a question from the audience whether the land application from septage was included in the calculations and the county health department representatives stated that there are no land application sites in the WSA. Pam Tucker stated that the MACTEC report would need to be fine-tuned a bit to make this report more accurate. Dr. Roeder stated that there is information available supporting the estimates used by MACTEC for the fertilizer reduction estimates. David Carter asked if Dr. Young is given an updated MACTEC report how difficult would it be to update these numbers, and Dr. Young stated that it is possible but may take some time to do but that better numbers are certainly worth the effort. David Carter stated that he is wrestling with whether there is a number that he can feel confident in at this point. Bill Melton asked how can there be a percentage that they are comfortable with if the measurements are using different parameters. Dr. Young stated that this is a limitation described in her report. Damann Anderson stated that overall input to load reduction ranges between 10% to 23%, but the field work found a starting point reduction at 23% and went up from there. Dr. Roeder stated that what was input into the drainfield was more in the field work, so it actually comes to a wash. Dr. Young stated that she did not incorporate the field work into her numbers unless it impacted Dr. Otis' numbers. There were only three out of 55,000 sites sampled and in two soil types. Bill Melton asked what assumptions were made by MACTEC to justify fertilizer reductions from input to loading and Dr. Young stated that they assumed the nitrogen that is applied is used. Damann Anderson then stated that unless the crop is harvested it does not go away. He stated that if the same methodology is used for onsite systems the loading would be 29 metric tons per year (as opposed to over 350 metric tons per year estimated in Dr. Young's report). Quentin Beitel stated that he would prefer to see fertilizer as one slice of the pie, rather than broken out, because as it is now it visually lessens the impact of its proportion of the pie.

- iv. **Discussion on Draft DOH Final Report:** The RRAC had concerns regarding the final conclusions and recommendations presented in the DOH draft report. Patti Sanzone asked whether anyone sat in on DEP's planning meeting regarding phase II of their task, and John Byrd stated they had one meeting but the scope of work had not been drafted for public review as of yet and that they will meet again in the near future to develop this scope. The SJRWMD presentation on the phase I work was made at the RRAC, TRAP, and Wekiva River Basin Commission meetings. David Carter asked whether DOH staff or Damann Anderson had received any response to Mr. Anderson's letter to DEP regarding the phase I report. The letter is posted on the DOH website. DOH staff and Damann Anderson both indicated that they have not had a response

but that the phase I report will most likely not be rewritten, instead it will be verified in phase II. Mark Hooks stated that some of the issues raised about the MACTEC report will probably not be addressed until the phase II report comes out. Patti Sanzone asked if DEP will take one to three years to do phase II then does DEP expect DOH to wait to act until this has been completed, and Mark Hooks stated that he cannot speak for DEP and does not know. John Byrd stated that there is a DOH draft report that stated that onsite systems are a significant contributor, and he would like to know when RRAC determines whether that is in fact the case. He stated that if DOH is going to meet the June 30th deadline, which DEP is not going to meet, how can significance be determined. David Carter stated that John Byrd's point was whether the committee should come to a decision of significance, and if it does not then should RRAC proceed with discussions on Task 4. Ellen Vause would like to address the executive summary because if RRAC does not agree with the executive summary, and RRAC needs to make a statement independent of the summary, than it would certainly play into how Task 4 is addressed. John Byrd stated that Task 4 doesn't happen if significance is not determined. Dr. Roeder stated that Task 4 is a range of cost-effective strategies if contributions are significant and can be included either way, the question would be on whether they would be implemented or not. John Byrd sees this differently and the statutory language was read. There was a discussion on who determines significance. The DOH draft report stated that the contributions are significant. Dr. Roeder stated that the department can state that it is significant and then it is up to the legislature to agree or disagree with this statement. David Carter stated that in his opinion the legislature wants RRAC to weigh in on whether it is significant or not, the department can have their own separate decision. Pam Tucker stated that at the last RRAC meeting she had requested an outline of the final report. Mark Hooks stated that the department will consider RRAC's comments. Elke Ursin stated that there is an internal review process in DOH that required a draft be routed to the secretary by Friday June 8th. Mark Hooks stated that any policy recommendations as a result of this will require review from TRAP and the variance committee. Ellen Vause stated that in order for her to decide whether onsite systems play a significant part of the impact, she would want some qualifications on the data used to get to the final decision. She cannot state that she is certain of anything right now because there are questions on MACTEC's assumptions. She stated that the information from MACTEC gathered and used as part of the RRAC's task has faults in it and no conclusions can be made at this time. John Byrd stated that these are separate studies, the MACTEC report should not be a part of this process, and that DEP does not consider the MACTEC report as a final determination. Damann Anderson stated that there is no other way to compare onsite contributions to other sources without looking at the MACTEC report. Mr. Anderson stated that if you are going to evaluate significance you cannot base it on the loading. The loadings are not comparative the way they have been calculated. He stated that with some minor adjustments to the input numbers, a determination of significance can be made on the inputs. He also stated that there is still the question of what the definition of significance is. There can be consensus on the inputs, but not on the loadings because there are too many unknown questions and too many discrepancies in the data. Bill

Melton asked whether the inputs were calculated the same, and Mr. Anderson stated that with some minor corrections that can be fixed. The wastewater treatment facilities need to have total nitrogen applied to them, the atmospheric deposition number is only looking at nitrate in a rural setting instead of total nitrogen in an urban setting, and reuse water should be added into the wastewater. Dr. Young stated that the reuse numbers were not included in the MACTEC report as the assumption was made if you have reuse water you do not use fertilizers. John Glenn stated that he had difficulty relating total sales in an area to the input into that same area, and Damann Anderson stated that MACTEC did not use sales information. David Carter stated that the fertilizer input was based on an assumption of an application of a certain amount of fertilizer per acre of residential land. Pam Tucker stated that there is not time to change all the reports and reevaluate all the testing that has been done, but there is time to review the report that is going to the governor. She stated that the assumptions are generally consistent with MACTEC, the methodology is inconsistent, there is mangled information on nitrates vs. nitrogen, rural vs. urban. She stated that the department's report is based on conclusions in ill-matched reports. She stated that MACTEC and Damann Anderson have both stated that the reports are based on assumptions and she understood that studies would not be concluded on assumptions. She stated that she went through the entire report and has several comments that she will not go into at this point, but she does not think that RRAC can endorse this report as it is written. She would like to make a motion that RRAC does not support the report, it needs to be changed, amended, modified, etc. and Sam Averett seconded the motion for consideration and discussion purposes. David Carter asked whether RRAC wants to spend the remainder of the meeting going through the report. Stan Keely stated that RRAC can provide input but that the department will submit the report if they want to submit it. Mark Hooks stated that the report has to be submitted whether it is endorsed by RRAC or not, the department is required to submit. The timelines have not been conducive to get the report boiled down to one final conclusion. David Carter asked if the department could see any circumstance where the department would write a report that stated that the results were inconclusive, and Mark Hooks asked whether the budget language specifically asked for a conclusion. Patti Sanzone pointed out that DEP was also given similar budget language. David Carter stated that one can give a two line report that stated the results are inconclusive. Mark Hooks stated that that is true but is not certain that was one of the options outlined in the budget language. David Carter stated that he does not know how anyone as a scientist and a public health official can tell somebody that something is right, wrong, significant, or insignificant if you have not come to that conclusion. Patti Sanzone was concerned that the first line of the conclusions stated that there is an answer when RRAC is finding out that there is no answer at this time. Mark Hooks stated that there is data and the department recognizes that the data is not ideal and Patti Sanzone stated that she does not read that in the first sentence of the conclusions. Mark Hooks stated that the report does outline where the data came from, that the conclusion was based on this data, and that a conclusion can only be made on the data that is available at the time of the decision. Patti Sanzone stated that RRAC does not know what they need to know in order to make a judgment on

what needs to be implemented. David Carter stated that this is a 50 to 100 million dollar program, and real people are going to have to pay this money. He is okay telling people that they need to spend this money if there is a real problem and this will help solve the problem, but he is not at that point yet. In reading the report he felt that the tone was more conclusive rather than inconclusive. David Carter was under the impression that the department would be handing in a status report. Mark Hooks stated that there is a deadline that needs to be met; a report has to be issued. This does not mean that this is the last say in everything. He stated that there is time between now and the next TRAP meeting in August for RRAC to make comments. Pam Tucker stated that the legislature will most likely not review the report until next March. Mark Hooks stated that there is nothing that prohibits the report from being amended. Damann Anderson does not understand how the department can move forward with a report worded in this way and there is no evidence to support the language in the executive summary. Pam Tucker reads part of the legislative mandate, and points out that the report shall assess whether onsite systems are a significant contributor, and at this point the data is inconclusive. Mark Hooks stated that the department understands the limitations on the data on which the language is based. Bill Melton stated that there are parts of the draft that he agrees with. He stated that if nothing is done, and development continues in this area, that loading is just going to become greater. Some of the recommendations need to be addressed now or the loading will continue to increase. David Carter asked why the department would want to go forward with inconclusive results. Damann Anderson stated that there are a lot of good ideas in the report, but there are many misperceptions that will be maintained once the report comes out. David Carter stated that RRAC and the department got the task, the consultants did the work, and now the results are not gelling. He would like to see RRAC come forward with a solid recommendation that makes sense. The department can put rules forward, but they can be challenged. He stated that you are not really improving the environment unless you come forward with a solid report. Paul Booher stated that he would like to expand on this. There is a new DOH secretary and this is an assignment given to her office and she would appreciate if she did not miss the date. John Byrd pointed out that this task was given to her by Governor Bush. The department has reservations about this and there are three things on the input side that Damann Anderson had suggested that could be correctable within the next two weeks. Then the report could be submitted, with Dr. Roeder's Task 4 report with the first sentence reading: "This appendix of the 2007 Wekiva Study Report suggests a range of strategies that can be employed as a part of a comprehensive onsite sewage treatment and disposal system management program to reduce their particular nitrogen contributions and generally their environmental impact in the Wekiva Study Area, **in the event that onsite sewage treatment and disposal systems are found to be significant relative to other sources.**" Paul Booher continues, stating that the report can say that we did this because we did not have the time, we do not know whether it is significant, and we do not know who is going to determine whether it is significant. John Byrd stated that what he understands Paul Booher is saying is that the department will say they do not know whether it is significant or not, but if it is here is what we propose. Paul Booher stated that if this statement is

added the report, and the introduction is amended to reflect that this report is inconclusive because it is not verified by phase II of the DEP task, then the deadline can be met. When the department receives a copy of the phase II DEP report the department will do the verification and finalize the report. Damann Anderson stated that he thinks this is a good idea if the loadings are left out. John Glenn stated that significance is a range, and the report can state that it is significant to an extent we have not quite determined. David Carter stated that if onsite systems were a big part of the problem then many things would need to be done, but if they are a small part of the problem then a few minor things can be done to make them work better. His reaction to decisions on cost-effective solutions may differ depending on how much of a problem onsite systems are determined to be. He stated that the committee can come to the conclusion that they are satisfied with the inputs, but not satisfied with the loadings which are the key part to determining significance, and not list the numbers as if they are absolute and finite. Quentin Beitel stated that significance is a relative term. As compared to fertilizer, onsite systems are not significant. He recommended to put a definition of significance in the report. He stated that the quality of the report is very good, but he wants to see a quality truthful product. He assured everyone that his association will follow-up on this. Paul Booher suggested that RRAC review the report, make modifications to the input calculations, and withhold the loading part for DEP's phase II. John Byrd stated that the DEP spokesperson stated that they might have the project done in approximately a year and it might be done in time for the next legislative session. Paul Booher stated that this information gathered today goes back to Gerald Briggs and he is the one that makes the final decision. Paul Booher stated that he understands the concerns with the loading pie-chart going out, and suggests withholding that until the DEP phase II information comes in. Stan Keely suggested that RRAC clearly tell the secretary the issues and problems they find regarding the report, RRAC cannot control what the department does. He does not think that the onsite numbers have increased as much as some of the other sources over the last 30-years. David Carter suggested that RRAC develop a list of conclusions. Pam Tucker stated she had an issue with the recommendations, if working with presumptuous conclusions, how do you come up with specific strategies. John Byrd suggested Pam Tucker's earlier motion be amended as Paul Booher stated before moving on to the Task 4 discussion. Pam Tucker restated what Paul Booher stated earlier: Remove the loadings at this time to reevaluate once DEP's phase II is completed, concentrating on the contributions from inputs as updated by Damann Anderson's suggestions. Paul Booher stated also to include Dr. Roeder's report with the modification to the statement he mentioned earlier. John Byrd stated that the determination of significance should be withheld until the DEP phase II information has been received. Dr. Roeder stated that this essentially means that we would not commit to not doing anything for a long time. Pam Tucker withdrew her first motion that RRAC does not endorse the report as it is written now. Pam Tucker makes a new motion in the spirit of what Paul Booher stated. Dr. Young stated that she does not have the information on the total nitrogen numbers from wastewater treatment facilities and there was a discussion that those numbers will be obtained. Dr. Young asked whether she would do anything to the fertilizer

numbers if she adds reuse back to wastewater and the consensus was that she would not need to do anything because reuse was not added to the fertilizer numbers. Dr. Young asked how she was to calculate the atmospheric deposition numbers and Damann Anderson stated that there is much information about the Tampa Bay airshed he could get her. There was a discussion about whether this is an urban or a rural or a mixed airshed, and Damann Anderson stated that it was an urban airshed. There was a discussion about how the total nitrogen numbers would be calculated for the wastewater treatment plants that do not have any information, and it was agreed that for those where there is information the average "blow-up" factor from nitrate to total nitrogen would be applied to those with no information. Stan Keely stated that there is a significant difference in air models in different parts of the state. He recommended that numbers should be obtained for central Florida, and that the coastal numbers will most likely be different than inland numbers. David Carter pointed out that it is better to use urban coastal numbers rather than rural coastal numbers which are the numbers that MACTEC used. Sam Averett pointed out the significant difference in the original pie chart in the DOH report submitted in 2004 for atmospheric deposition: going from 49% to 2%, and Mark Hooks explained that the 2004 report used the Wakulla Springs area which is more rural than the WSA. David Carter stated that the loading numbers should be eliminated from the report because of the inconsistencies in the way the numbers are calculated and portrayed in the MACTEC report. John Byrd stated that the department can submit Task 4 as they see fit, but that implementation of anything in that report shall be contingent on the determination of significance which will come after DEP's phase II. It was made clear that Paul Booher's references to altering the statement regarding the recommendations was in the Task 4 report and not in the 18-page DOH draft report that everyone else was looking at. Paul Booher stated that there were concerns about Task 4 being included in the report if significance has not been decided on and his suggestion is to include it with the caveat that he mentioned earlier. In the case that onsite systems are determined to be significant after the DEP phase II, then the recommendations are there for review. Dr. Roeder asked whether we need to wait for DEP's phase II before continuing or can we use any new information that may develop. Jim Rashley stated that we need to be in agreement with DEP. If new information is uncovered RRAC can review it and make a decision at that time. **Motion by Pam Tucker and seconded by John Glenn to amend the report to use the inputs as presented in Linda Young's report with adjustments for atmospheric deposition to use urban information instead of rural and adding ammonia to make it total nitrogen, to add reclaimed/reuse water to the estimates for wastewater treatment plants, and to use total nitrogen numbers for wastewater treatment plants. Linda Young's report shall be modified to reflect these changes. There shall be no conclusions on loading until the second phase of the DEP report has been completed. The loadings shall be removed from the DOH report and the Appendix.** The motion passed unanimously.

The RRAC and the public request that the final DOH report be available for review by posting the report on the website and emailing the report to the distribution list.

- v. **Task 4** (Cost-effective solutions): Dr. Roeder has drafted a report. There was a discussion on whether this task should be included before there was a conclusion by RRAC that onsite systems are a significant source of loading to the groundwater. Pam Tucker asked whether the Task 4 report will be changed in response to the motion voted on by the RRAC committee to remove the loading numbers from the report. Dr. Roeder stated he can update his report as Paul Booher had suggested. John Byrd stated that if the determination of significance will be withheld until the DEP phase II report is done, then Task 4 can remain in the report but would not be implemented until the determination has been made. David Carter stated that he is uncomfortable with requiring performance based treatment systems (PBTS) on a large scale. It is better to be simple. He asked staff whether it would be better to propose some other strategies that are not as complicated and maintenance intensive. Dr. Roeder stated that if we want to get to nitrogen reduction, adding new systems will increase the contribution. If new systems meet higher requirements, then there is a decrease in the increase of the rate of loading. If sewer could be made available, then there can be a comparison between nitrogen reduction vs. connecting to sewer to make the best decisions on where to install new infrastructure. The question then is how to do the nitrogen reduction. The code has a performance boundary that can be met in several different ways. Dr. Roeder stated that the Seminole County site showed that you cannot only rely on the soil. This is why pretreatment is a strategy. He surveyed installers in the WSA and found that there are two steps in increasing performance levels: an ATU and 10 or 20 mg/L effluent levels with a PBTS. The expensive step is to go to an ATU and then going to a PBTS is not that much more expensive, has similar operation and maintenance, and yields better reductions in nitrogen. David Carter asked whether the costs include maintenance and Sam Averett stated that the more systems there are the cheaper it is to maintain them, and that the costs to install would also go down. Dr. Roeder stated that we could keep the homeowner to maintenance entity structure that currently exists or go to a utility program where there is one utility that oversees everything. A utility would be a cheaper alternative. Paul Booher mentioned Dr. Otis' comment that 12 to 15 mg/L is a passive system and is much more expensive to reach 10 mg/L. Dr. Otis explained that a passive system could include a pump, and that some of the more passive systems are the fixed film systems such as recirculation filters. Paul Booher stated that based on Dr. Otis' comments, 15 mg/L may be more cost effective, but Dr. Roeder's determination based on specific WSA information showed that there was not much of a difference in costs. David Carter asked how different the big picture would look if effluent is brought from 70 mg/L to 15 mg/L vs. 70 mg/L to 10 mg/L. Sam Averett stated that if the restriction is raised to 15 mg/L the market opens up for many more manufacturers. David Carter stated that if there was \$5 million, for example, would it be better to spend that on 500 new PBTS or do 1000 system upgrades to those in the groundwater. Dr. Roeder pointed out that in the Seminole County site there was the separation to the water table but it still was not getting the nitrogen out. Dr. Otis suggested empowering the people and giving them choices. In his experience it is not the same cost to get from 15 mg/L to 10 mg/L. There are many things in the report that it looks like the department would like to do regardless of the results, like

upgrading existing systems. He would suggest that instead of the Task 4 report to have a list of things that DOH would like to implement regardless of the results, and the rest will be on hold until the final determination on significance can be made. Damann Anderson agreed this is a good idea. The report can recommend such things as getting rid of digouts and bringing repair systems up to code, but hold off on the ultimate fix until you know the significance. David Carter stated that the PBTS systems are a riskier expenditure of money. The other things are known to work. Damann Anderson stated that many of these recommendations need to be done anyway. Ellen Vause stated that the department is defining what needs to be done but would like this statement to be put into the report: The department intends to work with the TRAP and RRAC to help develop these recommendations to reduce the inputs. Instead of listing all these recommendations, just state that the department will work with TRAP to develop rule changes to reduce impacts. There was agreement among RRAC and the audience that there are several good ideas presented in the report that would be of benefit throughout the state, and should be considered for implementation. Sam Averett stated that reducing or eliminating digouts will save the homeowner money and will improve the quality of the effluent. Dr. Roeder asked whether there is data to support that this will work and Damann Anderson stated they will work if the drainfield is sized big enough. Sam Averett stated there is nothing in the code that identifies a spodic as a severely limited soil and Mark Hooks stated that it is an organic soil which is defined in the code as a severely limited soil. David Carter asked the RRAC whether they would want to review the recommendations in more detail while waiting for the updated DEP numbers and Pam Tucker stated that she would rather take the entire recommendations section out because the determination of significance has not been made. Paul Booher stated that along with Dr. Otis and Damann Anderson's comments, Task 4 would remain in the report with a statement that these are some things that should be done regardless of the determination of significance and preface some of the other recommendations with if it is determined to be significant we recommend these other things. Ellen Vause asked if the draft is going to be changed, would the recommendations still be listed in the executive summary. Paul Booher explains again that Gerald Briggs is the one who makes the final decision. David Carter stated that everyone needs to understand that all RRAC can do is give a list of recommendations. Ellen Vause asked whether there will be a section of RRAC recommendations if the final report comes out to be significantly different from what was discussed during this meeting; David Carter stated that the motions made as part of this meeting need to be included in the final report. Pam Tucker makes a motion that RRAC does not endorse the conclusions or recommendations of the department report at this time due to outstanding questions that persist over the loading data for sources and the premature nature of the conclusions and recommendations. Ellen Vause stated that she was recommending that the recommendations from RRAC be included in the report to the governor. Pam Tucker modified her original **motion for the department to list the committee recommendations voted on during the meeting in a separate section of the report.** John Glenn seconded the motion. Doug Everson stated that the objective of the study was to determine

whether onsite systems are a significant source and that this was to be determined by the RRAC. He would interject that the motion should encompass whether RRAC has reached a decision as to whether the objective has been met. If the objective has not been met than it should be on record. David Carter thought that was taken care of in the first motion. Pam Tucker stated that they were holding off on significance. Pam Tucker asked whether the department is in agreement with allowing the RRAC comments to be included in the report and Dr. Roeder, Mark Hooks, and Elke Ursin did not think that would be a problem and that Gerald Briggs had indicated that when the TRAP meeting was canceled the TRAP comments would come from Chairman Harper directly to the legislators. There was no further discussion, all were in favor and the motion passed. David Carter stated that there are two options on how to proceed with the recommendations: to include the entire list as is or split the list into two parts: common sense issues to implement now, and more involved recommendations that are only triggered by a finding of significance. Ellen Vause stated there are several good things to address in the report. The report could state that out of these studies things were found that could be corrected and if it is found to be significant then move to the next step. From the executive summary Ellen Vause stated that some of the recommendations she is in favor of are to have all systems inspected and pumped every five years, inspections during real estate transactions, and upgrade repair/modifications to new system standards. Bill Melton stated he has an issue with upgrading repairs to new standards because older homes are built to elevations that make new system standards difficult or impossible to meet. Damann Anderson stated that in that situation a pump would be installed which would increase the nitrogen removal. Bill Melton stated that a three-foot mound in the front yard changes the appearance of the whole piece of property and can reduce the value of the home. Jim Rashley stated that on smaller lots there is also a sacrifice on drainfield size to accommodate shoulders and slopes. Ellen Vause stated that there are many systems being repaired today with the 6-inch separation that have the room to be able to meet a higher separation. Bill Melton stated that this is an issue for the TRAP. Damann Anderson stated that the department should take advantage of this opportunity to say: while we cannot determine significance at this point we realize that onsite systems do have an impact on nitrogen and here are some things we can do immediately to help solve the problem. John Byrd stated that now there is the appearance of being halfway in and halfway out, and feels that until there is a determination of significance to hold off on Task 4. Dr. Roeder stated that significance still has not been defined, but his impression is that there is a cost-effectiveness component to it. If the cost is expensive then it better be really really significant, but if it's cheap it can be a little bit significant. David Carter asked whether RRAC wants to put in a list of strategies now or not. Several members stated that they would rather wait until significance is determined. Pam Tucker stated that she has a problem with the real estate point of sale inspections. Sam Averett makes a motion that nothing be done with Task 4 and Pam Tucker seconded. Bill Melton stated that he is not uncomfortable with adding a caveat stating that Task 4 has been addressed if loading is significant. David Carter paraphrased what Bill Melton stated: the department has evaluated the strategies however a finding of significance is not being made at

this time so no strategies are being put forward at this time. Ellen Vause interpreted what Bill Melton stated as the department recognizes if nitrogen contributions are determined to be significant the following strategies are recommended. This lets the legislature know that Task 4 has been completed. John Byrd stated that the department can come to the legislative session and say that there are some great proposals that came out of this process and here's what the department thinks should be done. John Glenn suggested modifying the motion to state that RRAC has made no determination on strategies at this time. This leaves the opportunity in the future to go back to some things. Sam Averett amended the motion to read: **the RRAC committee recommends no action be taken on Task 4 at this time** and Pam Tucker was in agreement with the change. Damann Anderson asked whether this would mean the Task 4 report would be taken out, and that decision would be up to Gerald Briggs. There was no more discussion, all were in favor and the motion passed.

- vi. **Summary of RRAC Motions:** The committee made the following motions:
 1. Motion by Pam Tucker and seconded by John Glenn to amend the report to use the inputs as presented in Dr. Young's report with adjustments for atmospheric deposition to use urban information instead of rural and adding ammonia to make it total nitrogen, to add reclaimed/reuse water to the estimates for wastewater treatment plants, and to use total nitrogen numbers for wastewater treatment plants. Dr. Young's report shall be modified to reflect these changes. There shall be no conclusions on loading until the second phase of the DEP report has been completed. The loadings shall be removed from the DOH report and the Appendix. The motion passed unanimously.
 2. Motion by Pam Tucker and seconded by John Glenn for the DOH draft report to include the list of RRAC recommendations voted on during this meeting. The motion passed unanimously.
 3. Motion by Sam Averett and seconded by Pam Tucker that the RRAC recommends that no action be taken on Task 4 at this time. Task 4 was to determine cost-effective solutions if contributions of nitrogen are found to be significant. The motion passed unanimously.

4. Public Comment

- a. The public was allowed to comment throughout the meeting and their comments are included throughout the minutes.

5. Closing Comments, Next Meeting, and Adjournment

- a. John Glenn stated that there is nothing stopping the RRAC from taking some of the recommendations made in the report and supporting them. David Carter clarifies that all the motions were made unanimously, and recommended that the minutes reflect that. Ellen Vause stated that the department has worked very hard on this project and does not discount the amount of time and effort that went into doing this. There were some very good things that can be used with this report to upgrade the industry and make sure the environment is protected. John Glenn and David Carter both stated that they were pleased with staffs cooperation and hard work. John Byrd asked whether the final report would be available for RRAC to review before it is sent to the

legislature. David Carter stated that the report can be emailed and/or posted to the website but there is no more time for another meeting. RRAC can submit comments about the report at any time to the department. The RRAC has almost been meeting monthly for this project when they are only required to meet twice a year. The membership can be polled to call a meeting. Sam Averett would like to discuss the Keys study. David Carter would like to have a financial accounting of the department's budget and a list of priorities for the next meeting. John Glenn made a comment about Florida running out of water and there needs to be more support for waterless and self-composting toilets. Ellen Vause stated that Florida needs to stop dumping wastewater into streams and oceans. We need to allow it to filter down to the aquifer through the soil.

- b. No date was set for the next meeting. Anticipated to be some time in September at a location to be determined. The meeting adjourned at 3:40 pm.



Department of Health
Bureau of Onsite Sewage Programs
Research Review and Advisory Committee

Tuesday June 12, 2007
9:30 am - 5 pm

Sylvan Lake Park
845 Lake Markham Road
Sanford, FL 32771



Agenda:

- Introductions
- Review Minutes of Meeting 05/08/07
- Wekiva Onsite Nitrogen Contribution Study
 - Task 1 - 4 Presentations and Discussions
 - Discussion on DOH Draft Report
- Public Comment
- Closing Comments, Next Meeting, and Adjournment



Introductions & Housekeeping

-
- Travel reimbursement forms



Review Minutes of Meeting 05/08/07

- See draft minutes



Wekiva Onsite Nitrogen Contribution Study

Overview of Tasks

- Task 1: Field Study to identify and quantify nitrogen loading at a few sample OWTS in the Wekiva Study Area (Ellis and Associates, Inc.)
- Task 2: Categorization and Quantification of Nitrogen Loading from Onsite Wastewater Treatment System Types (Otis Environmental Consultants, LLC)
- Task 3: Assessment if OWTS are a significant source of nitrogen to the underlying groundwater relative to other sources; in particular enumeration and aggregation of OWTS loading (University of Florida)
- Task 4: Recommend a range of possible cost-effective OWTS nitrogen reduction strategies if significant (Staff)



Wekiva Onsite Nitrogen Contribution Study Task 1

- Final report submitted to DOH on June 1, 2007



Wekiva Onsite Nitrogen Contribution Study Task 1

- Presentation by Mark Mechling with Ellis & Associates



Wekiva Onsite Nitrogen Contribution Study

Task 2

- Final report submitted to DOH on June 2, 2007



Wekiva Onsite Nitrogen Contribution Study Task 2

- Presentation by Dr. Richard Otis, Otis Environmental Consultants, LLC



Wekiva Onsite Nitrogen Contribution Study Task 3

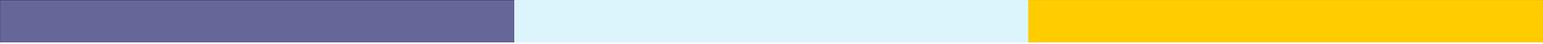
- Final report submitted to DOH on June 4, 2007



Wekiva Onsite Nitrogen Contribution Study

Task 3

- Presentation by Dr. Linda Young,
University of Florida



Wekiva Onsite Nitrogen Contribution Study Task 4

Range of Cost Effective Strategies

Draft report completed on June 7, 2007



A range of cost-effective strategies

Outline of the task report

E. Roeder 06/12/07



Strategies

- Funding
- Recordkeeping, Inventory
- Planning
- Performance Requirements
- Assuring Performance



Funding/Financial Assistance

- Integrate nitrogen reduction into the economics of onsite wastewater treatment
 - Utilize existing programs to set overall goals (Pollution Load Reduction Goal, Total Maximum Daily Load)
 - Source trading / cost transfer
 - Competitive grant program for lower cost nitrogen reduction entities.
 - Funded by a yearly nitrogen discharge fee.



- Cost sharing or insurance for upgrading wastewater infrastructure
 - For existing establishments
 - Either upgrading existing system or connecting to sewer
 - Priorities to existing systems not meeting code
 - Range in intensity from only require repair upgrades to upgrading all systems in 10-years
 - Management entity necessary to organize this
- Minimize new loads of nitrogen
 - For new establishments
 - Require nitrogen reducing treatment for new permits
 - Can be paid through construction loans



■ Performance evaluation

- Watershed scale (for further study)
- Individual scale (sanitary nuisance inspections, existing system evaluations, operating permit inspections)
 - Require evaluation when property is sold
 - Periodic inspection
 - Sampling program

■ Inventory of all OSTDS data

- Necessary to implement strategies
- Either done through the property appraiser / DOH or through a utility



Recordkeeping / Inventory

- Create current inventory of OSTDS, integrate GIS information (e.g. location, parcel, permitting data), inventory systems with no current permitting records
- Maintain inventory by tracking additions and subtractions, periodical checks



Planning

- Build on existing assessments of vulnerability (WAVA, PLRG report, TMDL report)
- Integrate land use, wastewater management, and aquifer vulnerability
- Be aware of limitations if DOH requires increase performance, but not require management (stay even)



- Establish performance standards
- New development management alternatives
 - Development planning stage provides the most flexibility to provide cost-effective nitrogen reduction (one system per lot, clustered systems, connection to central sewer)
- Designate priority areas for upgrades to existing onsite systems and management



Performance

- Re-evaluate loading per system
(incorporation of Wekiva Study Field data)
- Evaluate technology for nitrogen removal
(source separation, increased treatment)
- Establish performance standards for
concentration and load reduction
- Evaluate cost-effectiveness for a range of
nitrogen removal performance
requirements



- Density reduction
- Establish performance standards that encourage improvement
- NEW: Require setback distance from karst features



Ensuring Performance

- Training
- Site Evaluation
- Design and Construction
 - Certification of systems by
 - Engineer
 - Manufacturer
 - installer
 - Performance-based or design-based
- Operation and Maintenance
 - At least current levels



- Inspection and Monitoring, Reporting
 - Knowledge is costly
 - Combine sampling with qualitative assessment of functioning
 - All systems every visit
 - All systems initially, no sampling required if functioning
 - Random (stratified) sampling
 - Only qualitative assessments (need to know predictive value)



Wekiva Onsite Nitrogen Contribution Study

Discussion on DOH Draft Report

Draft report completed on June 8, 2007



DOH Recommendations

- Pretreatment discharge limit of 10 mg/L TN for new systems, systems being modified, and for existing systems in the WSA
- Prohibit removal of severely limited soils in the WSA
- Prohibit land spreading of septage and grease trap waste in WSA (dispose at wastewater treatment plants)
- State and local planning agencies evaluate economic feasibility of sewerage vs. nutrient removal upgrades to existing systems (existing systems in WAVA primary and secondary protection zones do not need to upgrade to 10 mg/L TN limit if sewer will be available by 2013)
- Upgrade existing systems to new system standards. Phased through existing system repair and modification permitting process. Inspect and upgrade systems in conjunction with real estate transactions.



DOH Recommendations (cont.)

- Establish a maintenance program. Either:
 - EPA model 4 program to establish a responsible maintenance entity. Wastewater utilities or local governments would be authorized to collect a fee from all developed properties in their service area. Fee to be used for maintenance, repairs, mandated upgrades, or connection to sewer. Must contract with licensed septic tank contractors, licensed plumbers, or licensed wastewater treatment plant operators to do the inspection and maintenance services. Minimum five-year inspection/pumping requirement.
 - Require all OSTDS to be inspected and pumped every 5-years by licensed septic contractor and reported to DOH with filing fee. Part of fee will be used to fund and administer a grant program to assist lower-income property owners with any additional costs associated with the repair or upgrade of the system to meet the requirements listed above.



Public Comment



Closing Comments, Next Meeting, and Adjournment

Important dates:

TRAP meeting: to be determined

Wekiva Commission Meeting: end Sept. or beginning Oct. 2007

Final Wekiva report due: 6/30/07

Florida Department of Health

Research Review and Advisory Committee Meeting Summary

Meeting on June 12, 2007 at Sylvan Lake Park, Sanford

- **RRAC Members/Alternates Present:** Sam Averett, David Carter, John Glenn, Stan Keely, Bill Melton, Jim Rashley, Patti Sanzone, John Schert, Pam Tucker, and Ellen Vause. Eight out of nine groups were present, representing a quorum.
- **Review of Previous Meeting Minutes:** No comments or corrections on the May 8, 2007 meeting minutes. The minutes were approved as written.
- **Wekiva Onsite Nitrogen Contribution Study:**
 - Summary of progress as of the last RRAC meeting and decisions made during the current meeting for the DOH study (all reports can be found on the DOH website <http://www.doh.state.fl.us/ENVIRONMENT/ostds/wekiva/task.htm>):
 - **Task 1** (Field Work, \$200,000): Mark Mechling with Ellis & Associates, Inc. presented the final report on the results of the field work portion of the Wekiva study. Mark Mechling outlined how the mass loading of nitrogen to the surficial aquifer was calculated for each system. His estimates for nitrogen removal by nitrification / denitrification at the three sample sites were between 23% to 52%.
 - **Task 2** (Categorization and quantification of nitrogen loading, \$25,000): Dr. Richard Otis with Otis Environmental Consultants LLC, presented the final report on the results of this task. The purpose of this task was to estimate the amount of nitrogen coming from onsite sewage treatment and disposal systems in the Wekiva Study Area and going to the groundwater. He produced a table outlining the percentage of nitrogen reduction in various soil types found in the Wekiva Study Area. This number was based on the drainage class, the amount of organic content in the soil, where the estimated seasonal high water table was, the soil texture and mineralogy, the fluctuation in the water table, the influent nitrogen species (either total Kjeldahl nitrogen or nitrate), and the type of infiltration system (mounded, in-ground, etc.) He stated that his estimates are conservatively low, and that the fate of nitrogen in the groundwater is not included.
 - **Task 3** (Assessment of the contribution of OWTS relative to other sources, \$25,000): Dr. Linda Young with the University of Florida presented the final report on the results of this task. The report follows the process used in the DEP report but looks at the Wekiva Study Area as opposed to the Wekiva Basin. She explains that the DEP study used **nitrate** numbers for the majority of the estimates, but used **total nitrogen** for onsite systems. There was a discussion on some of the assumptions made in the DEP report and how these assumptions may not be accurate. Dr. Young stated that she was tasked to work with the DEP numbers, that this is the best available data at this point in time. The input of total nitrogen to the environment from onsite systems was around 6%. She presented a series of pie-charts showing the low, mid, and high range of loading based on the task 2 estimates. The estimates for the

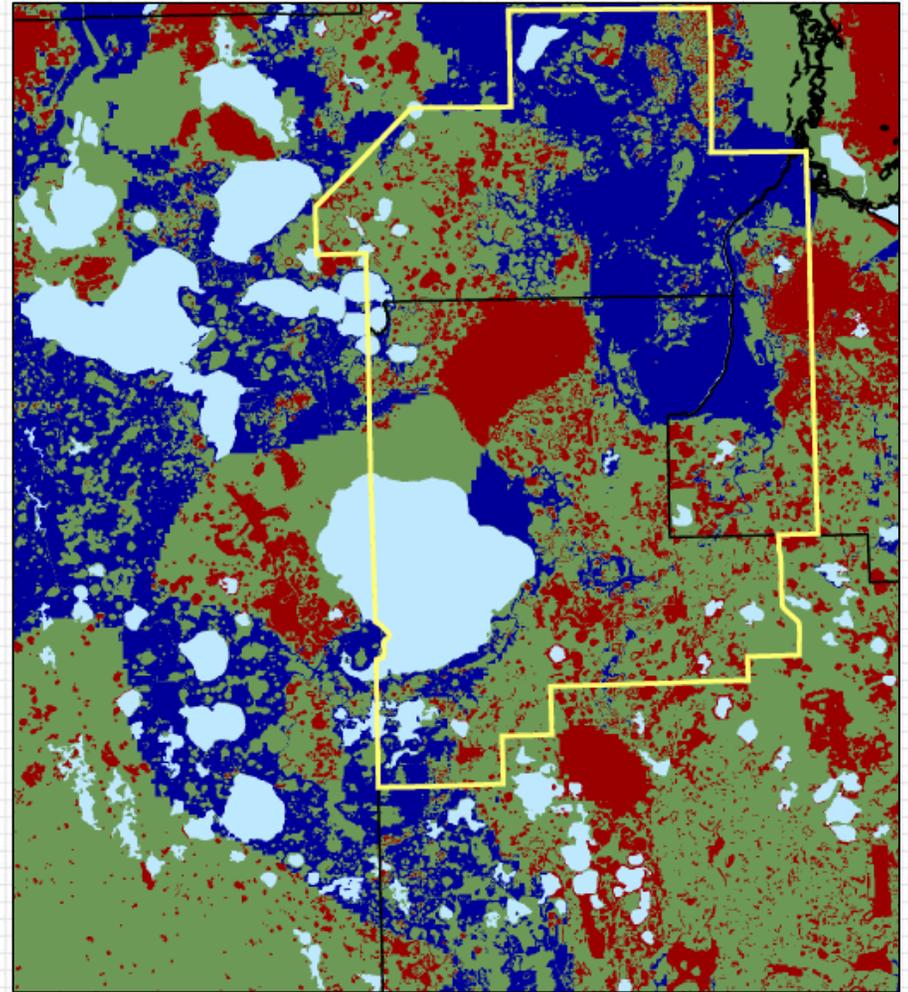
contribution by onsite systems to groundwater loading ranged between 25% and 31%.

- **Task 4** (Cost-effective solutions): Dr. Eberhard Roeder has drafted a report. There was a discussion on whether this task should be included before a conclusion by RRAC that onsite systems are a significant source of loading to the groundwater. The discussion on this task was limited. There was agreement among RRAC and the audience that there are several good ideas presented in the report that would be of benefit throughout the state, and should be considered for implementation.
- **DOH Draft Report:** The RRAC had concerns regarding the final conclusions and recommendations presented in the DOH draft report. Dr. Young stated that she was limited by the accuracy of the data from the DEP report. There was a discussion between the RRAC members and the audience on how to proceed with RRAC's recommendations. In order for RRAC to make the decision on significance they have to feel comfortable with the quality of the data used to make that decision. At this point the RRAC had too many questions regarding the accuracy of DEP's report to use it as a basis for their final decision. DEP is in the planning stages for a phase two study to verify the estimates made in the report, and RRAC would like to have this information prior to finalizing their decision on significance. Damann Anderson states that there can be consensus on the input numbers, with some slight modifications. DOH staff stated that the report must be sent by the due date. David Carter stated that the recommendations require real money from real people and does not think that the data supports the conclusions at this point. Bill Melton stated that if nothing is done than the loading continues to increase. The committee made several motions:
 - Motion by Pam Tucker and seconded by John Glenn to amend the report to use the inputs as presented in Linda Young's report with adjustments for atmospheric deposition to use the Tampa Bay airshed information, to add reclaimed/reuse water to the estimates for wastewater treatment plants, and to use total nitrogen numbers for wastewater treatment plants. Linda Young's report shall be modified to reflect these changes. There shall be no conclusions on loading until the second phase of the DEP report has been completed. The loadings shall be removed from the DOH draft report and the Appendix. The motion passed unanimously.
 - Motion by Pam Tucker and seconded by John Glenn for the DOH draft report to include the list of RRAC recommendations voted on during this meeting. The motion passed unanimously.
 - Motion by Sam Averett and seconded by Pam Tucker that the RRAC recommends that no action be taken on task 4. Task 4 was to determine cost-effective solutions if contributions of nitrogen are found to be significant. The motion passed unanimously.

The RRAC and the public request that the final DOH report be available for review by posting the report on the website and emailing the report to the distribution list.

Next Meeting: No date was set for the next meeting. Anticipated to be some time in September at a location to be determined.

Multiple Nitrogen
Loading Assessments
from Onsite Waste
Treatment and Disposal
Systems Within the
Wekiva River Basin
Wekiva Study Area, Florida
May 2007



**Wekiva study area and Wekiva Aquifer
Vulnerability Zones**

Source: Cichon et al, 2005

CONCLUSIONS

- During January through May 2007, Ellis & Associates (E&A) performed an assessment on three properties within the Wekiva Study Area.
- Criteria for selection of properties to be investigated were prepared by DOH with input from the Research Review and Advisory Committee (RRAC).



CONCLUSIONS

Summary of apparent mass loading estimates

	TN Load from Septic Tank to Drainfield (lbs/person/year)	Percent Apparent Nitrification / Denitrification	Mass Loading TN to shallow aquifer (lbs/person/year)
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



CONCLUSIONS

- It should be noted that the mass loading results should not be considered as “average” or “typical” since both the Seminole and Lake County sites had septic tank effluent loading from nitrogen to the drainfield at the upper end of the expected range.



CONCLUSIONS

Potential mass loading scenarios for the Wekiva Study Area

	TN Concentration to drainfield (mg/L) ¹	Estimated TN Load from Septic Tank to Drainfield (lb/person/year) ²	Apparent Percent Nitrification / Denitrification (%) ³	Estimated Mass Loading TN to Shallow Aquifer (lb/person/year)
High Effluent Load	75	15.68	23-52	7.52 – 12.07
Moderate Effluent Load	50	10.45	23-52	5.01 – 8.04
Low Effluent Load	26	5.43	23-52	2.61 – 4.15

¹ Based on EPA, 2007, Table 3-7

² Based on EPA, 2007, 259.7 liters/person/day, Table 3-1

³ see Table 14



RECOMMENDATIONS

- Nitrogen loading to the land surface, groundwater and surface water comes from a number of sources in addition to onsite wastewater treatment systems, such as
 - atmospheric deposition;
 - burning of fossil fuels;
 - natural and chemical fertilizers used in agriculture and landscaping;
 - municipal wastewater treatment facilities;
 - animal waste from commercial livestock operations.



RECOMMENDATIONS

- A number of other studies are recently or soon to be completed which address loading from these other sources.
- In our opinion, the results of these other studies should be used in conjunction with the results of this assessment in order to establish practical means of reducing nitrogen loading to the Wekiva Study Area in a manner that addresses all nitrogen loading sources.



RECOMMENDATIONS

- E&A recommends that before the mass loading rates presented in this report are used to extrapolate mass loading concentrations being applied by all OWTS in the WSA, further analysis of
 - septic tank effluent concentrations,
 - residential water usage, and
 - number of residentsat an appropriate number of additional sites within the Wekiva Study Area be carried out to provide better statistical certainty.



RECOMMENDATIONS

- These studies were conducted at properties of relatively large lot size to allow distinguishing on-site plumes from neighboring plumes.
- A study that investigates nitrogen concentrations downgradient of more densely constructed developments (i.e., subdivisions or developments with smaller lot sizes and a higher density of OWTS) is an appropriate next step to determine whether the mass loading estimates reported here are representative in terms of current and expected development in the Wekiva Study Area.



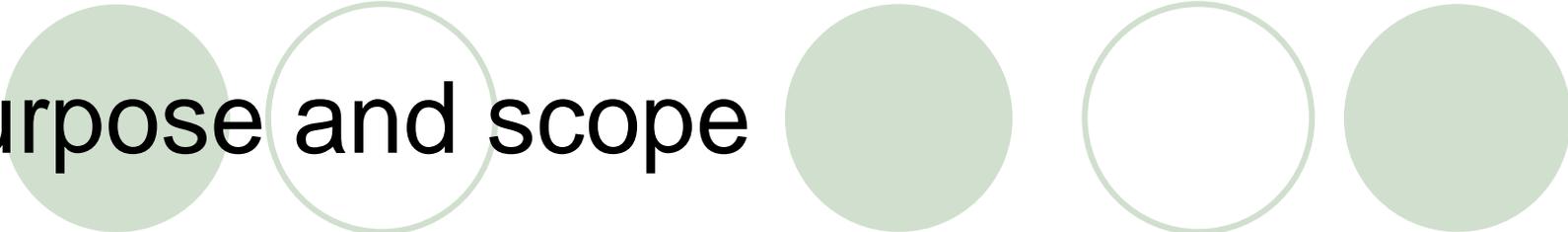
Wekiva Onsite Nitrogen Contribution Study

Task 2: Categorization and Quantification of Nitrogen Loading

Research Review and Advisory Committee Meeting

June 12, 2007

Purpose and scope



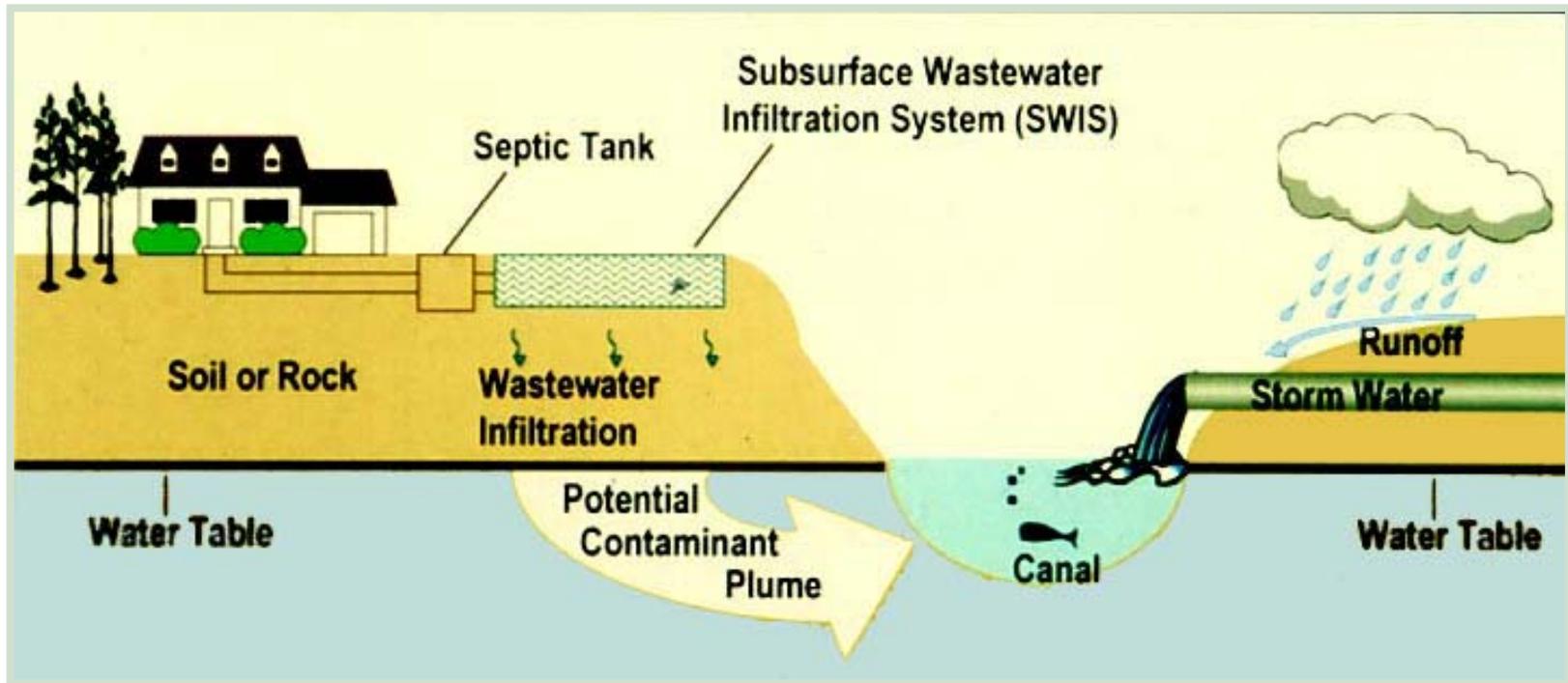
● Purpose

- Estimate nitrogen loadings to groundwater from OWTS in the WSA
- Use to determine share of total nitrogen loading attributable to OWST

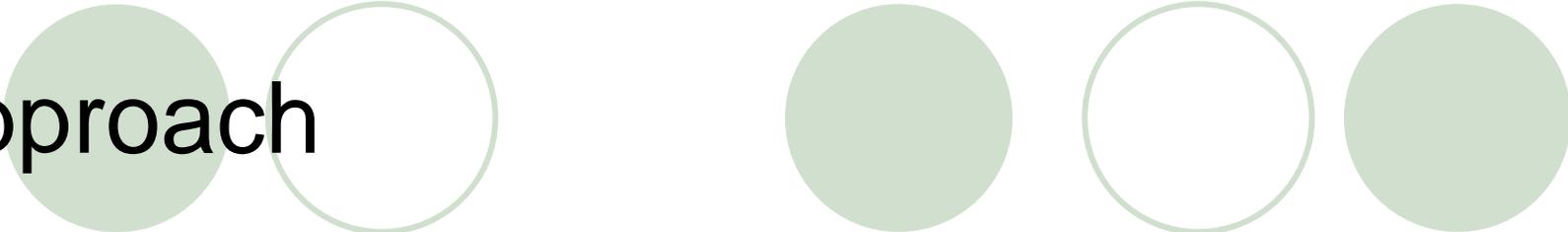
● Scope

- Estimate nitrogen removal only through the OWTS to the water table.
- Off lot removal estimates not included

Project scope limits



Approach



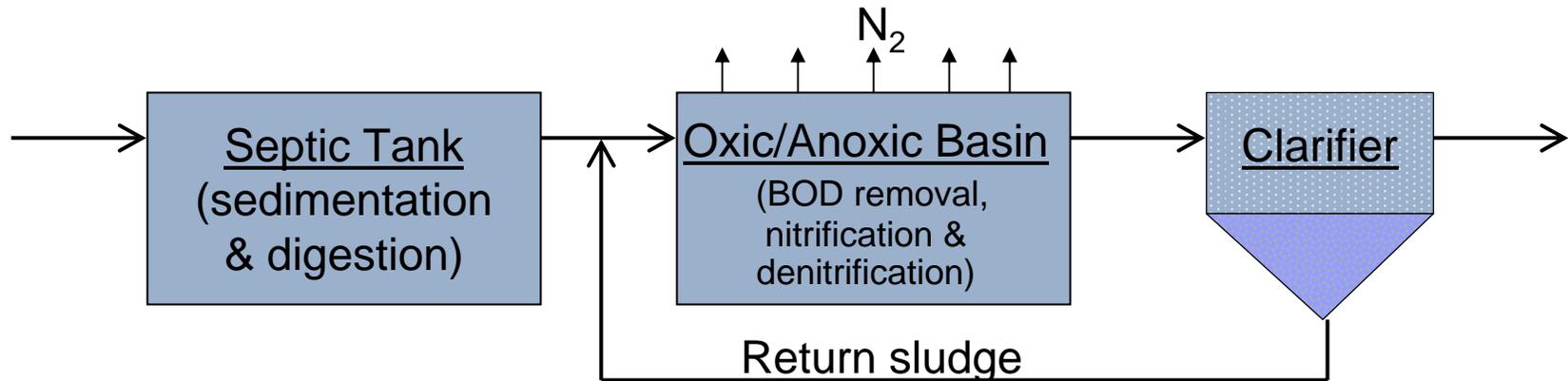
- Original intent was to review literature for data from operating systems
 - Focus on technology and not soil characteristics
 - Literature data varied from 0 to >80% removal for same system but critical soil characteristics not reported
 - Most data reported concentrations without accurate flow data
 - Effects of dispersion, dilution, spatial variability in soil characteristics, wastewater application rates, uncertainty whether upstream and downstream monitoring stations are in the same flow path, and others create significant uncertainties with the data.

Revised approach



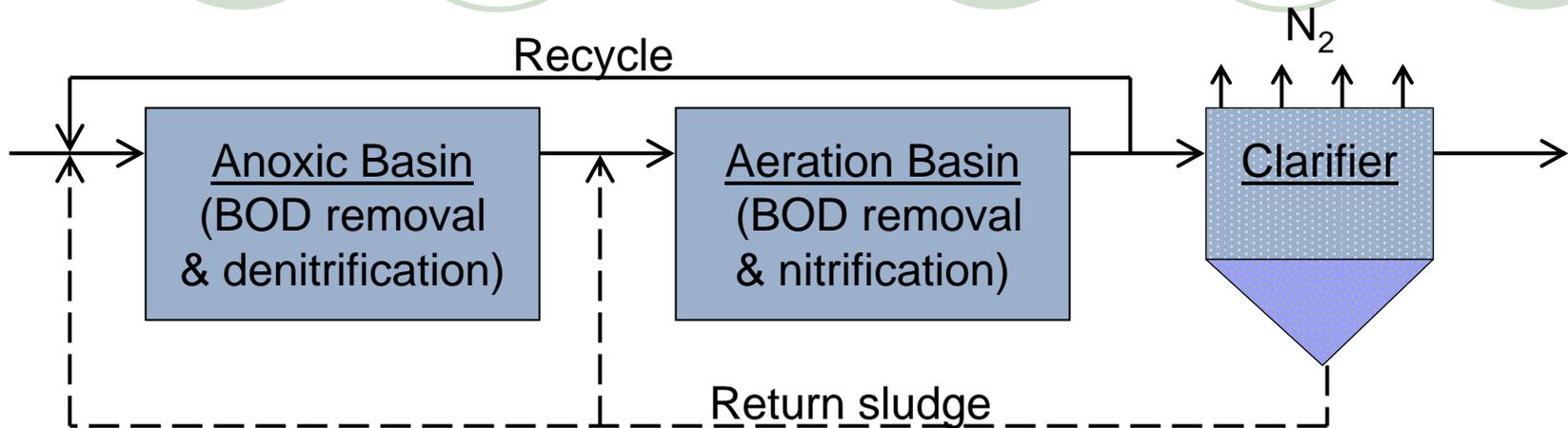
- Developed a model based on influent characteristics and necessary soil conditions for N removal
- Two models
 - Two sludge system
 - Simultaneous and/or single sludge system

Simultaneous Denitrification



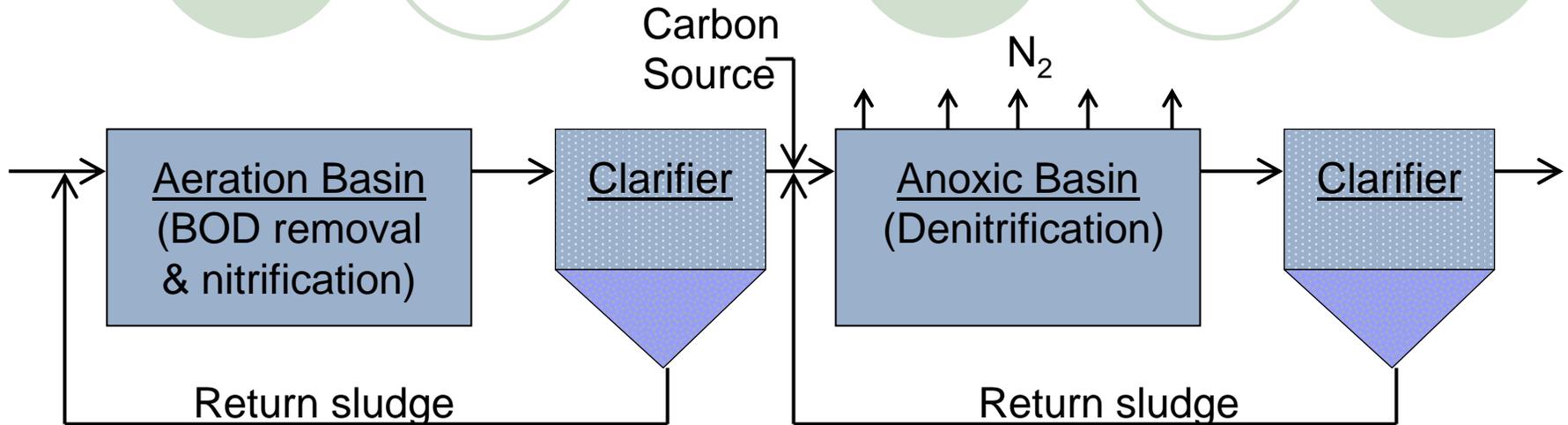
- Alternating oxic and anoxic conditions
- BOD remaining provides carbon source
- Ammonium must be retained during anoxic period
- Capable of achieving 8-15 mg/L TN effluent concentrations

Single Sludge System



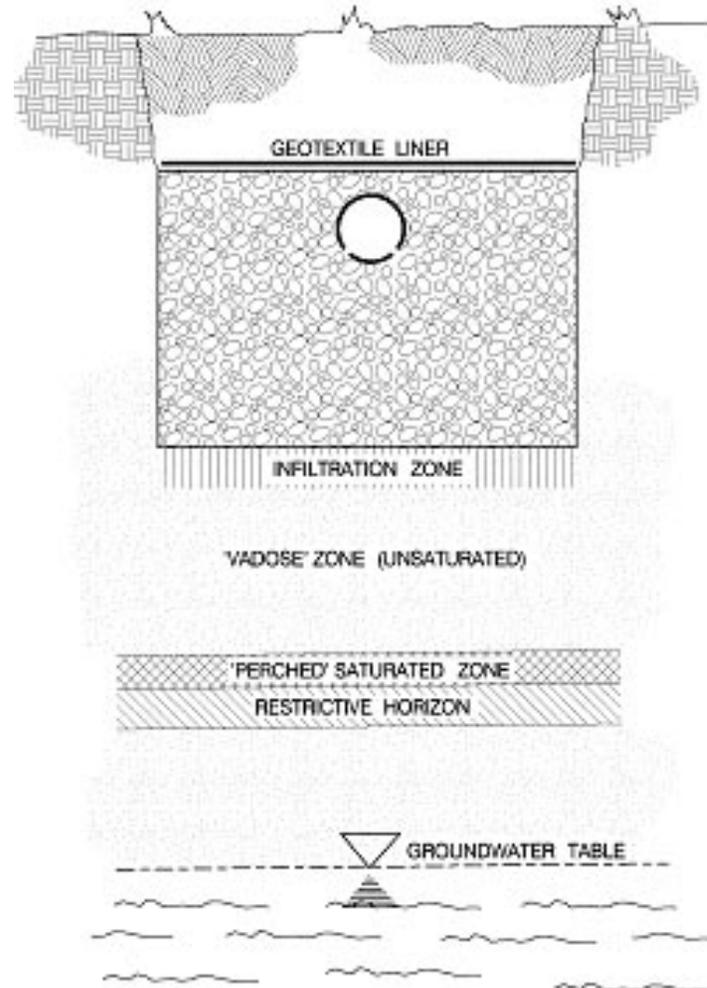
- Septic tank provides anoxic conditions
- Influent BOD provides carbon source
- Capable of achieving 8-15 mg/L TN effluent concentrations

Two sludge system



- Anoxic conditions and a carbon source must be provided in the soil profile or groundwater
- Alkalinity is not recovered in two sludge systems
- Two sludge systems can consistently produce effluents with $< 5\text{mg/L TN}$ as compared to 8 to 15 mg/L in single sludge systems

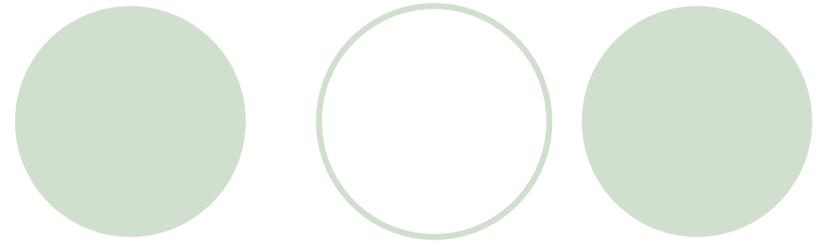
N removal below an infiltration system



Necessary conditions for denitrification

- Nitrified substrate
- Source of organic carbon
- Anoxic or anaerobic conditions
- Adequate residence time for biochemical reactions to occur

Soil Groupings



- Drainage class

- Excessively, Somewhat excessively, and Well
- Moderately well
- Somewhat poorly, Poorly, & Very poorly

- Water table depth

- < 3.5 ft
- > 3.5 ft

- Organic matter content

- < 1%
- > 1%

Other factors considered

- Soil texture and mineralogy
- Fluctuation of water table
- Influent nitrogen species
 - TKN
 - Nitrate
- Type of infiltration system
 - In-ground
 - At-grade
 - Mound

Soil characteristics descriptions

Drainage Class	Water Table Class	Organic Matter Content Class	Soil Name	Soil Series Benchmark Profile Description								
				Location of Benchmark Description	Drainage and Permeability	Depth (cm)	Horizon	Texture Class	Saturated Hydraulic Conductivity	Organic C %	Organic Matter	
P	1	2	MYAKKA FINE SAND	Citrus	Poor; rapid in A horizons, moderate	0-10	A1	FS	14.1	3.01	5.1892	
			Sandy, siliceous, hyperthermic	Citrus	Poor; rapid in A horizons, moderate	10-25	A2	FS	34.5	1.25	2.15	
			Aeric Haplaquods	Citrus	Poor; rapid in A horizons, moderate	25-68	E	FS	12	0.09	0.1551	
				Citrus	Poor; rapid in A horizons, moderate	68-107	Bh1	FS	0.5	2.55	4.396	
				Citrus	Poor; rapid in A horizons, moderate	107-140	Bh2	FS	4.5	1.43	2.4653	
				Citrus	Poor; rapid in A horizons, moderate	140-170	Bw	FS	1.9	0.89	1.5343	
				Citrus	Poor; rapid in A horizons, moderate	170-203	B'h	FS	1.4	0.74	1.2757	
			P	1	2	MYAKKA FINE SAND	Polk	Poor; rapid in the A and E horizons	0-18	Ap	FS	38.8
	Polk	Poor; rapid in the A and E horizons				18-64	E	FS	28	0.1	0.172	
	Polk	Poor; rapid in the A and E horizons				64-76	Bh1	FS	12.8	1.94	3.3445	
	Polk	Poor; rapid in the A and E horizons				76-91	Bh2	FS	9	0.91	1.5688	
	Polk	Poor; rapid in the A and E horizons				91-150	C	FS	11.2	0.32	0.5516	
	Polk	Poor; rapid in the A and E horizons				150-203	C	FS	9.5	0.41	0.7068	
P	1	2	NITTAW		Frequently flooded							
			Fine, montmorillonitic, hyperthermic Typic Argiaquolls									
P	1	2	OCOOE MUCK									
P	1	2	OKEELANTA MUCK									
			Sandy or sandy-skeletal, siliceous, euic, hyperthermic Terric									
P	1	2	ONA FINE SAND	Polk	Poor; moderate	0-10	Ap	FS	5.6	4.3	7.413	
			Sandy, Siliceous, hyperthermic	Polk	Poor; moderate	10-25	A	FS	4.3	1.5	2.58	
			Typic Haplaquods	Polk	Poor; moderate	25-48	Bh	FS	10.7	1.05	1.810	
				Polk	Poor; moderate	48-61	BE	FS	6.7	0.47	0.8102	
				Polk	Poor; moderate	61-67	E	FS	11.2	0.22	0.3792	
				Polk	Poor; moderate	67-127	E	FS	6.8	0.14	0.2413	
				Polk	Poor; moderate	127-190	Bh1	FS	2.3	0.36	0.6206	
				Polk	Poor; moderate	190-203	Bh2	FS	blank	0.37	0.6378	
P	1	2	PLACID FINE SAND	Lake	Wet							
P	1	2	POMPANO FINE SAND	Orange/Semir	Wet							
			Siliceous, hyperthermic Typic Psammaquents									
P	1	2	SAMSULA MUCK	Polk	Very poor; rapid	0-18	OA1	blank	18.4	47.86	82.5106	
			Sandy or sandy-skeletal,	Polk	Very poor; rapid	18-68	OA2	blank	19.1	57.56	99.2334	
			siliceous, dysic, hyperthermic Terric	Polk	Very poor; rapid	68-79	OA3	blank	13.2	54.06	93.1994	
				Polk	Very poor; rapid	79-132	C1	S	11.5	0.75	1.29	
				Polk	Very poor; rapid	132-203	C1	S	blank	0.3	0.517	
P	1	2	SANIBEL FINE SAND	Orange	Wet							
			Sandy, siliceous, hyperthermic Histic Humaquepts									
P	1	2	SEFFNER	Orange/Semir	Wet							
			Sandy, siliceous, hyperthermic Quartzipsammentic Haplumbrepts									

Soil characteristics descriptions

Soil Name	Location of Soil Series in Study Area			Restrictive Horizons					Depth to Water Table (feet)			Organic Matter (%)	
	Seminole County	Lake County	Orange County	Dominate Texture	Most Restrictive Horizon Texture	Depth to Restrictive Horizon (inches)	Special Condition	Depth to Special Condition (inches)	Seminole County	Lake County	Orange County	Seminole County	Lake County
MYAKKA FINE SAND Sandy, siliceous, hyperthermic Aeric Haplaquods		X		S	FS		SPODIC	20-36	0-1	0-10		2-5	<3.5> to 6" <0.5> to 20" <15> to 36" <0.5> below
MYAKKA FINE SAND		X		S	FS		SPODIC	20-36	0-1	0-10		2-5	<3.5> to 6" <0.5> to 20" <15> to 36" <0.5> below
NITTAW Fine, montmorillonitic, hyperthermic Typic Argiaquolls	X			SC	MUCK	0-7	C 15-52", FS rest		(+2)-1			20-90	
OCOOE MUCK		X		MUCK	MUCK	0-38	SAND	30-60		0			<75> to 38"
OKEELANTA MUCK Sandy or sandy-skeletal, siliceous, euic, hyperthermic Terric			X	FS	MUCK	0-31			0-1		(+1)-0	60-85	
ONA FINE SAND Sandy, Siliceous, hyperthermic Typic Haplaquods		X	X	FS	FS		SPODIC	20-Jun		0-10	0-1		<3.5> to 18" <0.5> below
PLACID FINE SAND		X		FS	FS				0-10				<15> to 18"
POMPANO FINE SAND Siliceous, hyperthermic Typic Psammaquents	X	X	X	FS	FS		SPODIC	42-54	2-3.5	30-40	2-3.5	<1	<3.5> in spodic
SAMSULA MUCK Sandy or sandy-skeletal, siliceous, dysic, hyperthermic Terric			X	FS	SAPRIC	9-36			(+2)-0		(+2)-1	>20	
SANIBEL FINE SAND Sandy, siliceous, hyperthermic Histic Humaquepts			X	FS	SAPRIC	0-9			(+2)-0		(+1)-1	20-50	
SEFFNER Sandy, siliceous, hyperthermic Quartzipsammentic Haplumbrepts	X	X	X	FS	FS				1.5-3.5		1.5-3.5	2	

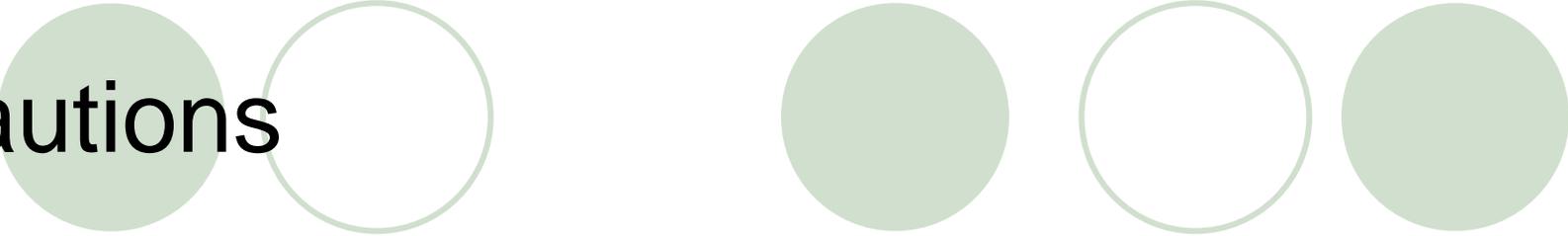
Estimated denitrification potentials

Drainage Class	Water Table Class 1=<3.5 ft 2=>3.5 ft	Organic Matter Class 1=<1.0% 2=>1.0%	Soil Series Taxonomy	Soil Series Description	NRCS "Suitability" Rating for Onsite Treatment	Applied Nitrogen	Estimated TN Removal Potential	Comments	Code Allowed Sys
[REDACTED]	2	1	ARCHBOLD SAND Hyperthermic, uncoated Typic Quartzipsamments	Deep, well drained, very rapidly permeable sandy soils that formed in marine or eolian deposits. Seasonally high water table (June-November) at 42-60" but 60-80" the remainder of the year.	Moderate: wetness	TKN/NO ₃	5-15%	Very low organic content Low moisture content (aerobic)	In-ground traditional system slight amounts of fill added
	2	1	ORSINO FINE SAND Hyperthermic, uncoated Spodic Quartzipsamments	Very deep, moderately well drained, very rapidly permeable soils that formed in thick beds of sandy marine or eolian deposits. Water table at 50-60" deep. Spodic horizon at 25".	Severe: wetness	TKN/NO ₃	5-15%	Very low organic content Low moisture content (aerobic)	In-ground traditional system slight amounts of fill added Orsino is likely will have soil "digout" and sand replacer
	2	2	FLORAHOME SAND Siliceous, hyperthermic Humic Psammentic Dystrudepts	Deep, moderately well drained, dark surfaced, rapidly permeable soils that formed in sandy marine and eolian deposits. Water table depth at 48-72" for 4-6 months each year receding to >72 in dry periods.	Moderate: wetness	TKN/NO ₃	10-20%	Low organic content Low moisture content (aerobic) Fluctuating water table	In-ground traditional system
	2	2	MILLHOPPER SAND Loamy, siliceous, semiactive, hyperthermic Grossarenic Paleudults	Very deep, moderately well drained, moderately permeable soils that formed in thick beds of sandy and loamy marine sediments. Water table depth is 48-60" for 1-4 months and 60-72" for 2-4 months most years.	Moderate: wetness	TKN/NO ₃	10-20%	Low organic content Low moisture content (aerobic) Fluctuating water table	
	2	2	TAVARES FINE SAND Hyperthermic, uncoated Typic Quartzipsamments	Very deep, moderately well drained, rapidly permeable soils that formed in sand marine or eolian deposits. Zones of saturation at depths of 40-80".	Moderate: wetness	TKN/NO ₃	5-15%	Low organic content Low moisture content (aerobic)	
[REDACTED]	1	1	ADAMSVILLE FINE SAND Hyperthermic, uncoated Aquic Quartzipsamments	Very deep, somewhat poorly drained, rapidly permeable soils that formed in thick sandy marine sediments. Water table is at 20-40" for 2-6 months of most years and 10-20" for up to two weeks in some years. It is within 60" for more than 9 months in most years.	Severe: wetness poor filter	TKN NO ₃	5-15% 15-30%	Very low organic content below 4" Rapid permeability Fluctuating water table with aquic regime (anoxic)	Filed or Mound systems
	1	1	CASSIA FINE SAND Sandy, siliceous, hyperthermic Oxyaquic Alorthods	Very deep, somewhat poorly drained, moderately rapid permeable soils formed in sandy materials. Water table is at 18-42" for about 6 months during most years and will drop to >42" during the driest season.	Severe: wetness	TKN NO ₃	10-20% 5-25%	Fine sand with shallow water table High organic content in spodic horizon at 2-3 ft. Fluctuating water table	Soil "digout" and Mound systems
	1	1	POMELLO FINE SAND Sandy, siliceous, hyperthermic Oxyaquic Alorthods	Very deep, moderately well to somewhat poorly drained soils, which are sandy to depths of >80" that formed in sandy marine sediments. Seasonally high water table is at depths of about 24-42" for 1-4 months during most years.	Severe: ponding poor filter	TKN NO ₃	10-40% 10-50%	Freely draining Shallow, fluctuating water table at 2-3 ft Spodic horizon high in organic	Soil "digout" and Mound systems or very high Mounds without "digouts".
	1	1	ZOLFO FINE SAND Sandy, siliceous, hyperthermic Oxyaquic Alorthods	Very deep, somewhat poorly drained soils that formed in thick beds of sandy marine deposits. Water table is at depths of 24-40" for 2-6 months of the year and up to 10-24" deep for short periods. It is within 60" for more than 9 months most years.	Severe: wetness poor filter	TKN NO ₃	5-25% 15-35%	Fine sand with shallow water table (2-3.5ft) Spodic horizon at 5-8 ft Fluctuating water table	Mound systems without "digouts"

Considerations in using table

- Estimates are meant to be conservatively low
 - Heterogeneity of soils
 - Differences in system designs, operation, and use
- Fate of nitrogen in groundwater not included
 - Literature indicates significant denitrification in groundwater, which is complete in a few feet based on US and international studies
- Distributed treatment maximizes the use of the environment's assimilative capacity

Cautions



- Costs on nitrogen removal

- Michigan

- “Advanced Treatment System”

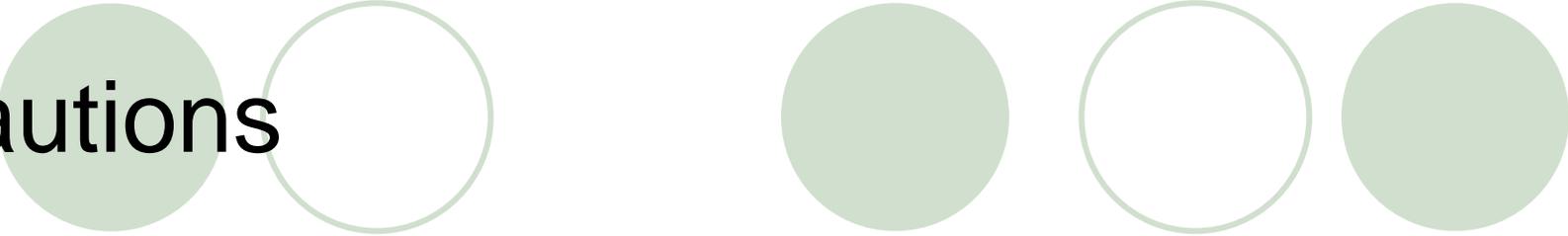
- Capital cost \$18,500
 - Annual O&M \$300/yr
 - 20 yr Present Worth \$71,000

- Minnesota

- 10,000 gpd cluster system (30 homes) to meet 10 mg/L TN

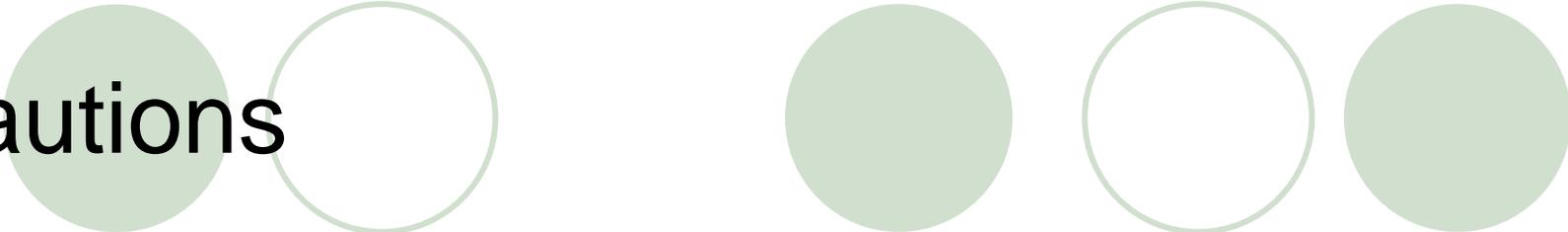
- Capital cost to remove N to 20mg/L = \$127,000 (2.5 lbs/day removed)
 - Additional capital cost to remove N from 20 to 10 mg/L = \$102,000 (additional 0.83lbs removed)

Cautions



- Ensure data is well vetted and used appropriately
 - Example: Nitrates versus Total Nitrogen
 - MACTEC study – Only looked at nitrates?
 - Relative source contributions versus relative mass in groundwater?
 - Fertilizer: Source - 78%; GW - 54%
 - Onsites: Source - 6%; GW – 31%

Cautions



- Test data

- Comparison of 3rd Party test data to field

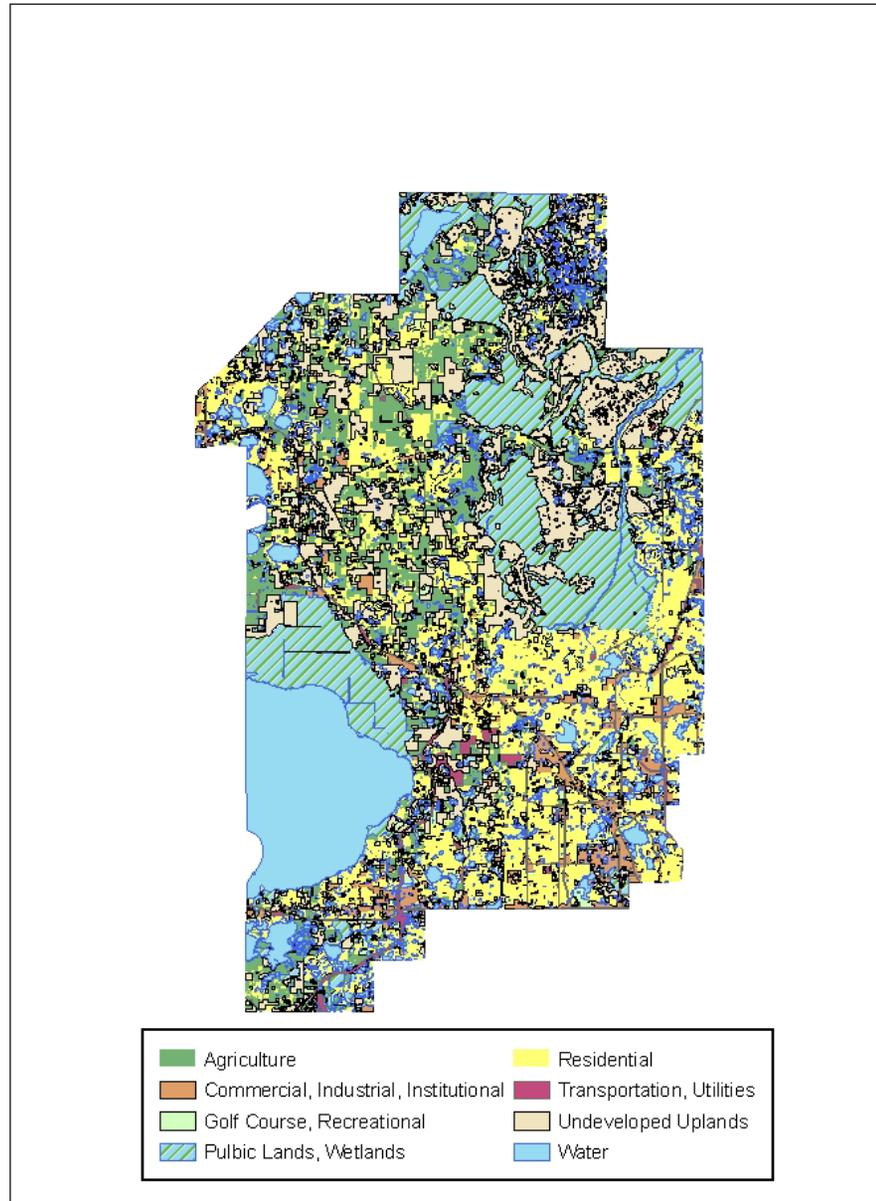
- National Decentralized Water Resources Capacity Development Project

- Test systems always out performed actual systems
- Actual systems had high variability
- Found actual system performance can not be predicted from test data

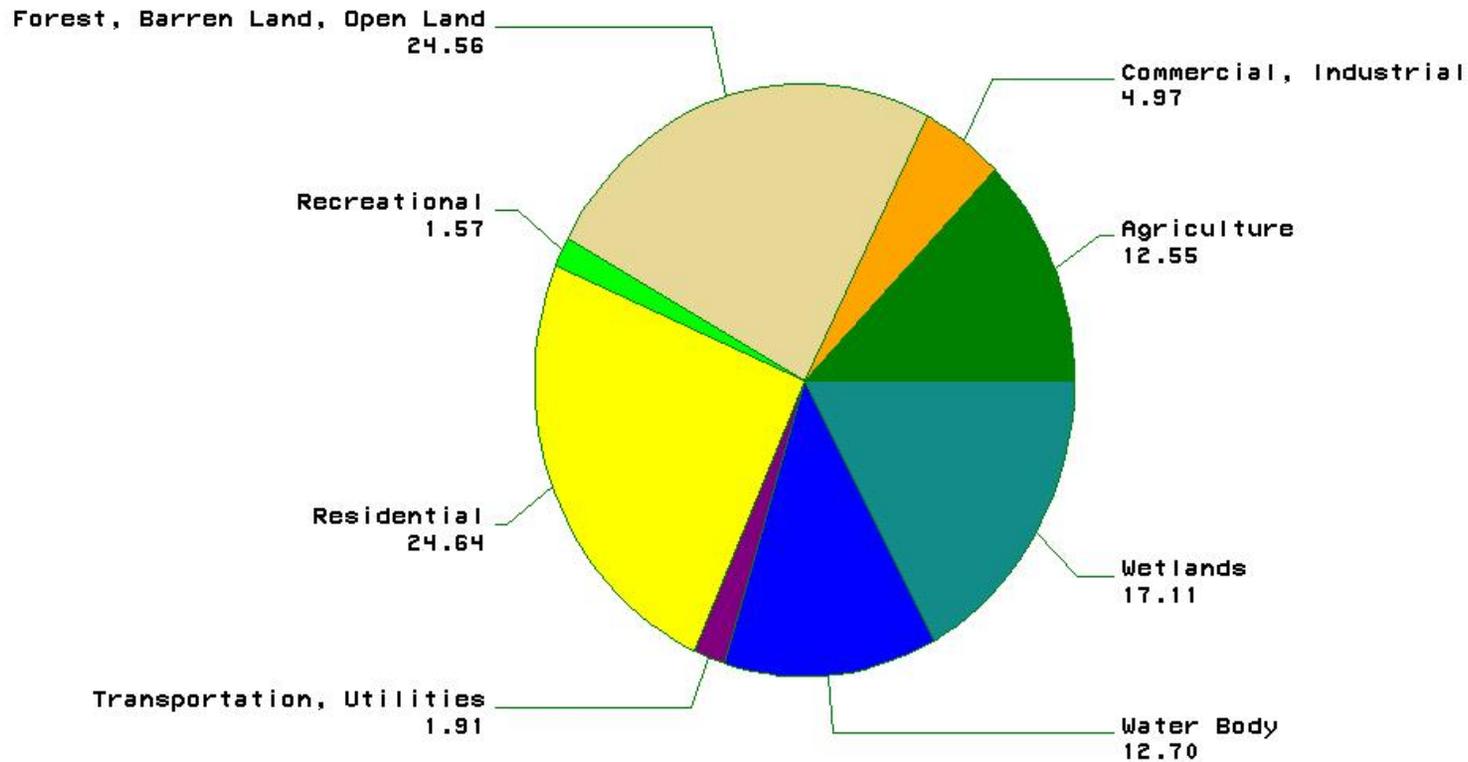
Final Report on Task 3

Linda J. Young, Ph.D.
Department of Statistics
University of Florida

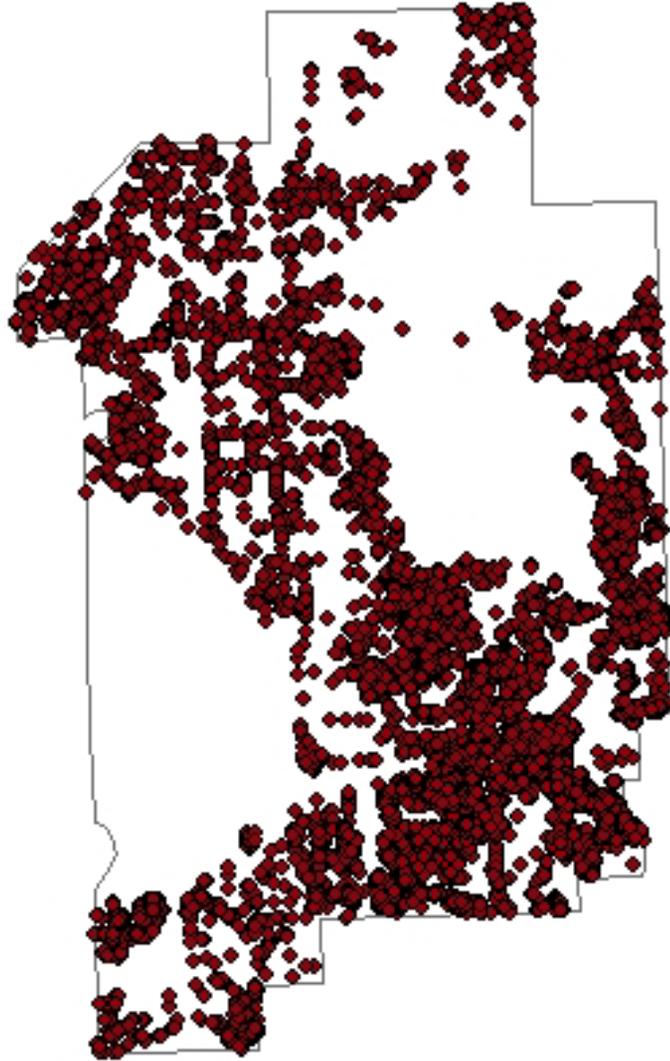
Land Uses in the Wekiva Study Area



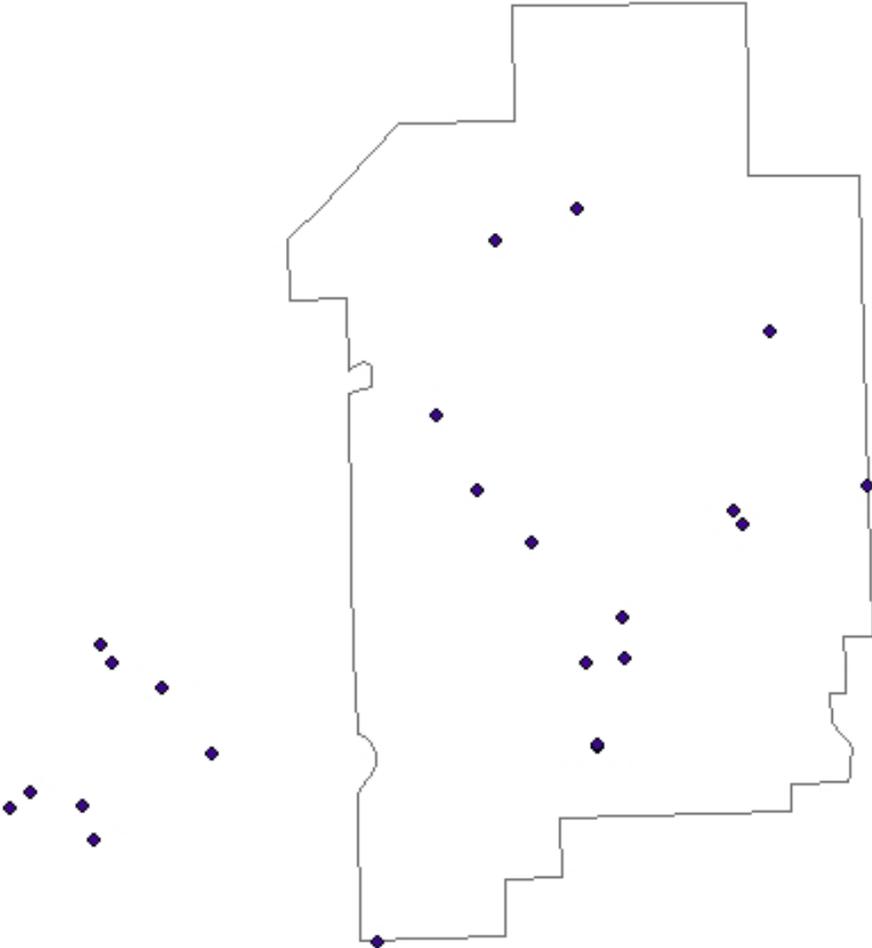
Land Uses in Wekiva Study Area by Proportions



Location of Septic Systems in WSA



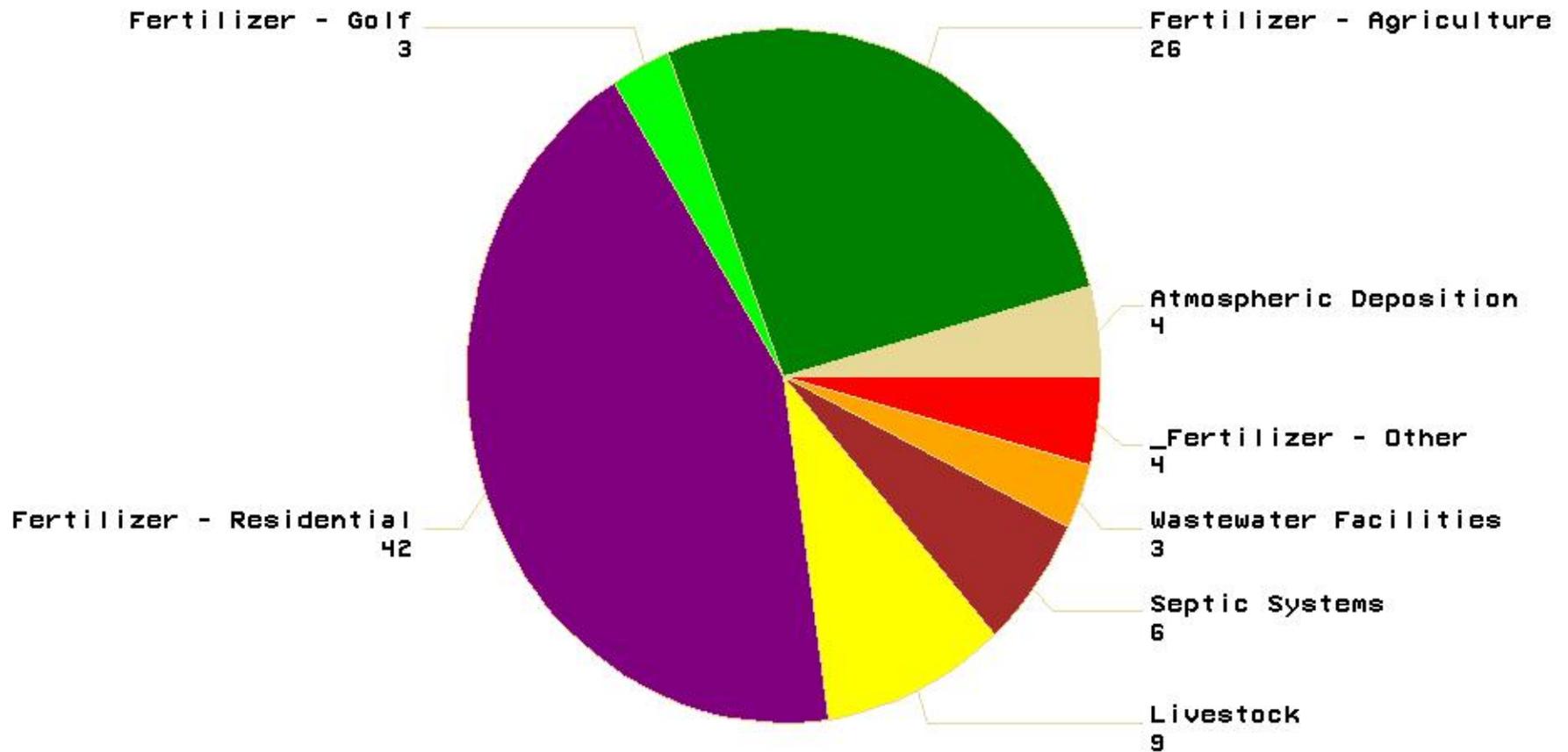
Location of Centralized Wastewater Facilities



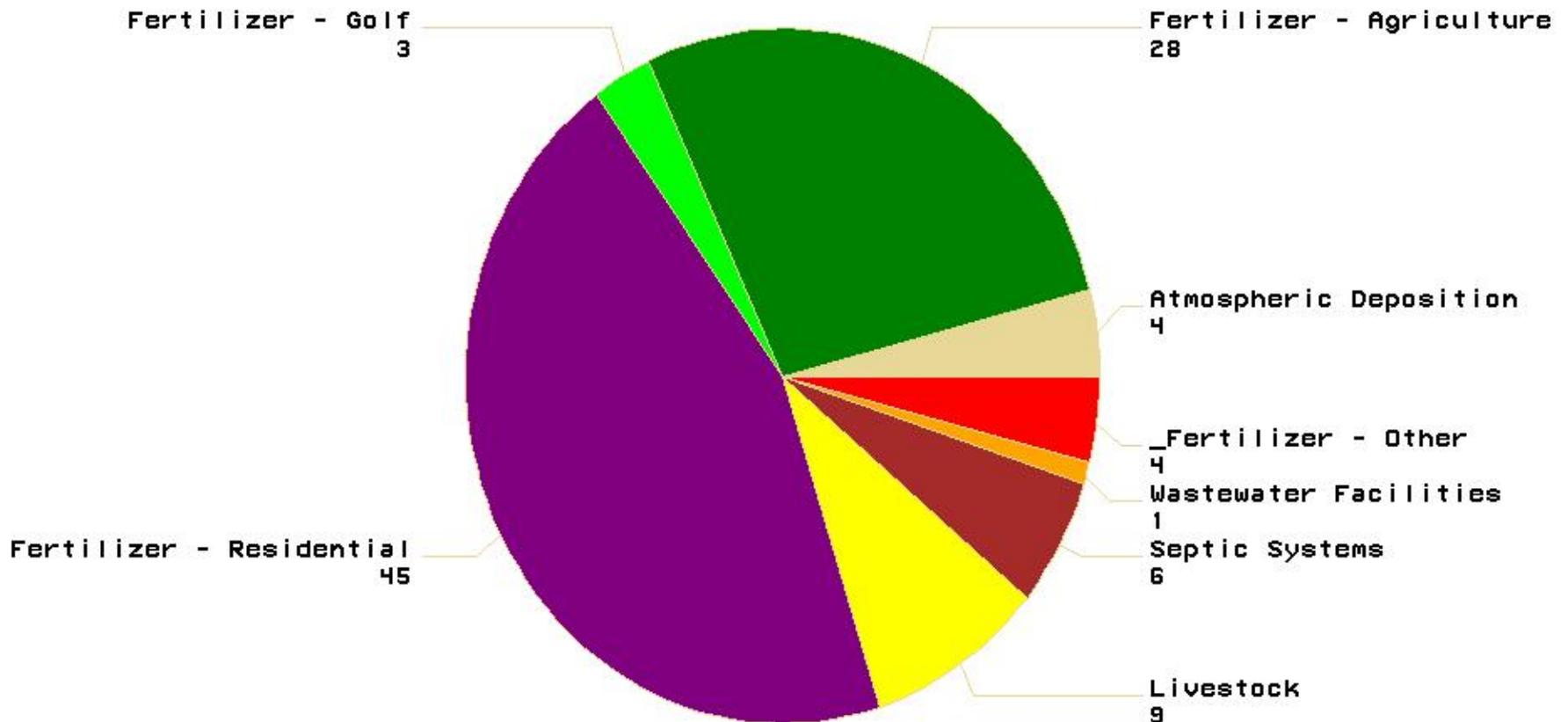
Inputs to the WSA

- Fertilizer Use
- Livestock Waste
- Atmospheric Deposition
- Centralized Wastewater Facility Effluents
- Septic System Discharge

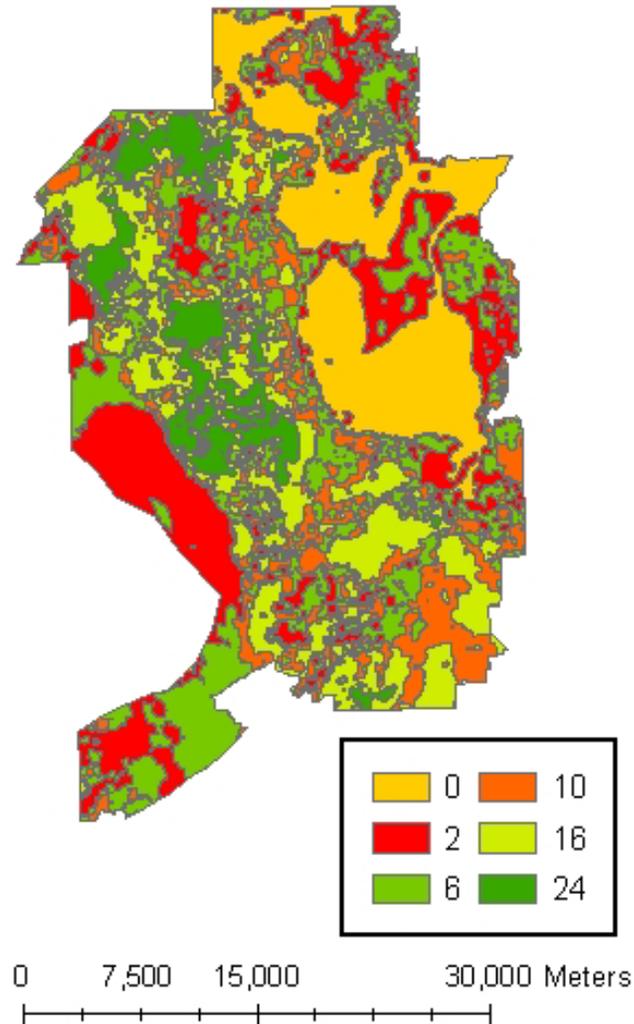
Inputs by Source to WSA, Including Boundary Wastewater Facilities



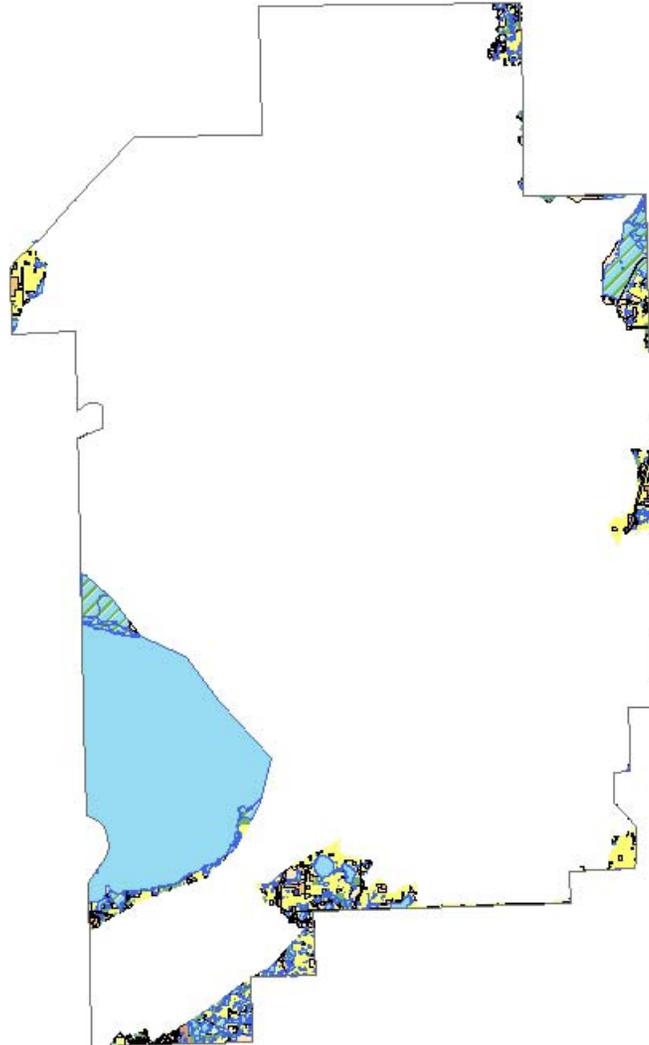
Inputs by Source to WSA, Excluding Boundary Wastewater Facilities



Recharge Rates Within WSA



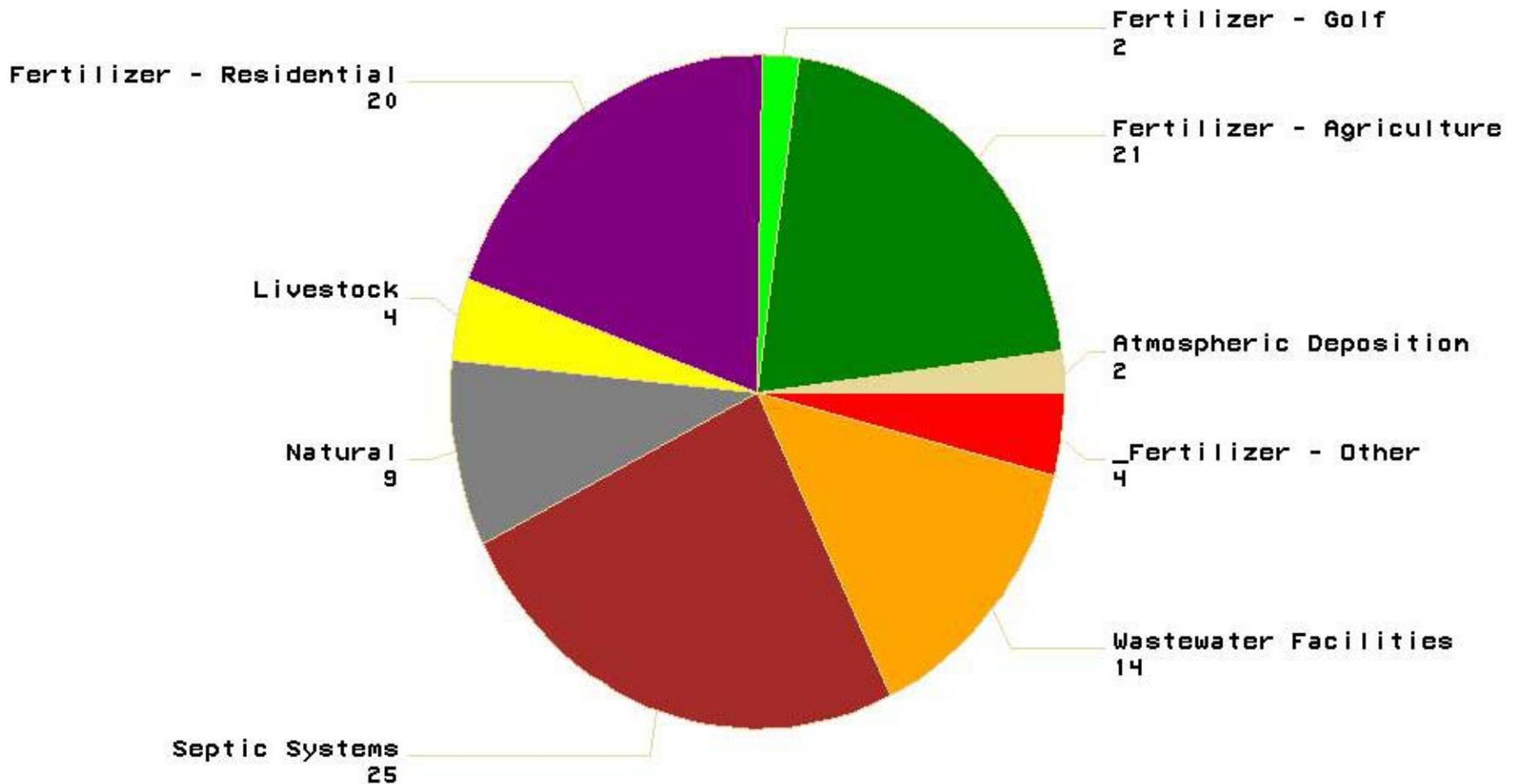
Areas Within WSA With No Recharge Information



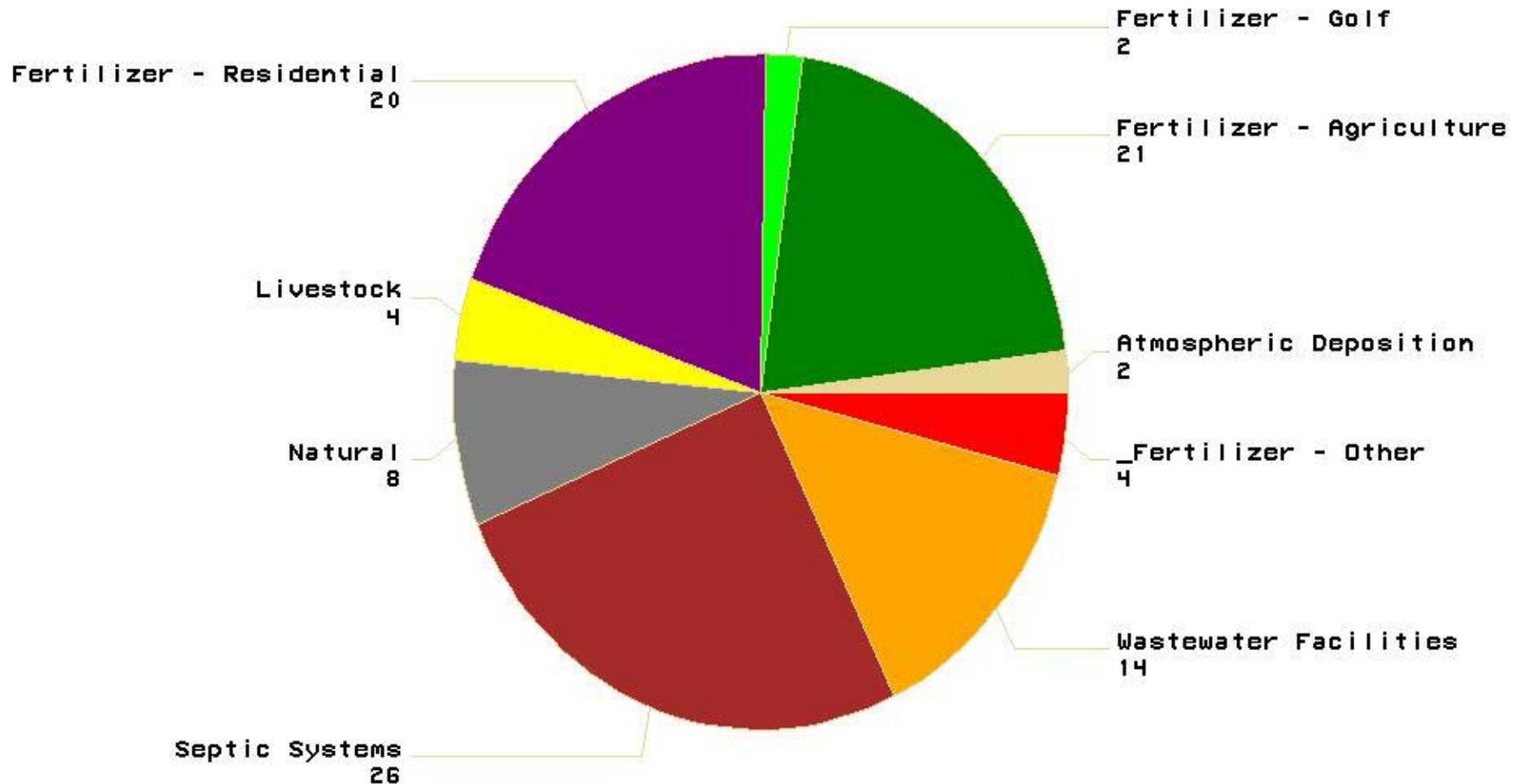
Loadings to the WSA

- Septic Systems
- Centralized Wastewater Facilities
- Natural Sources
- Groundwater Recharge, by Land Use
- Storm Water, by Land Use

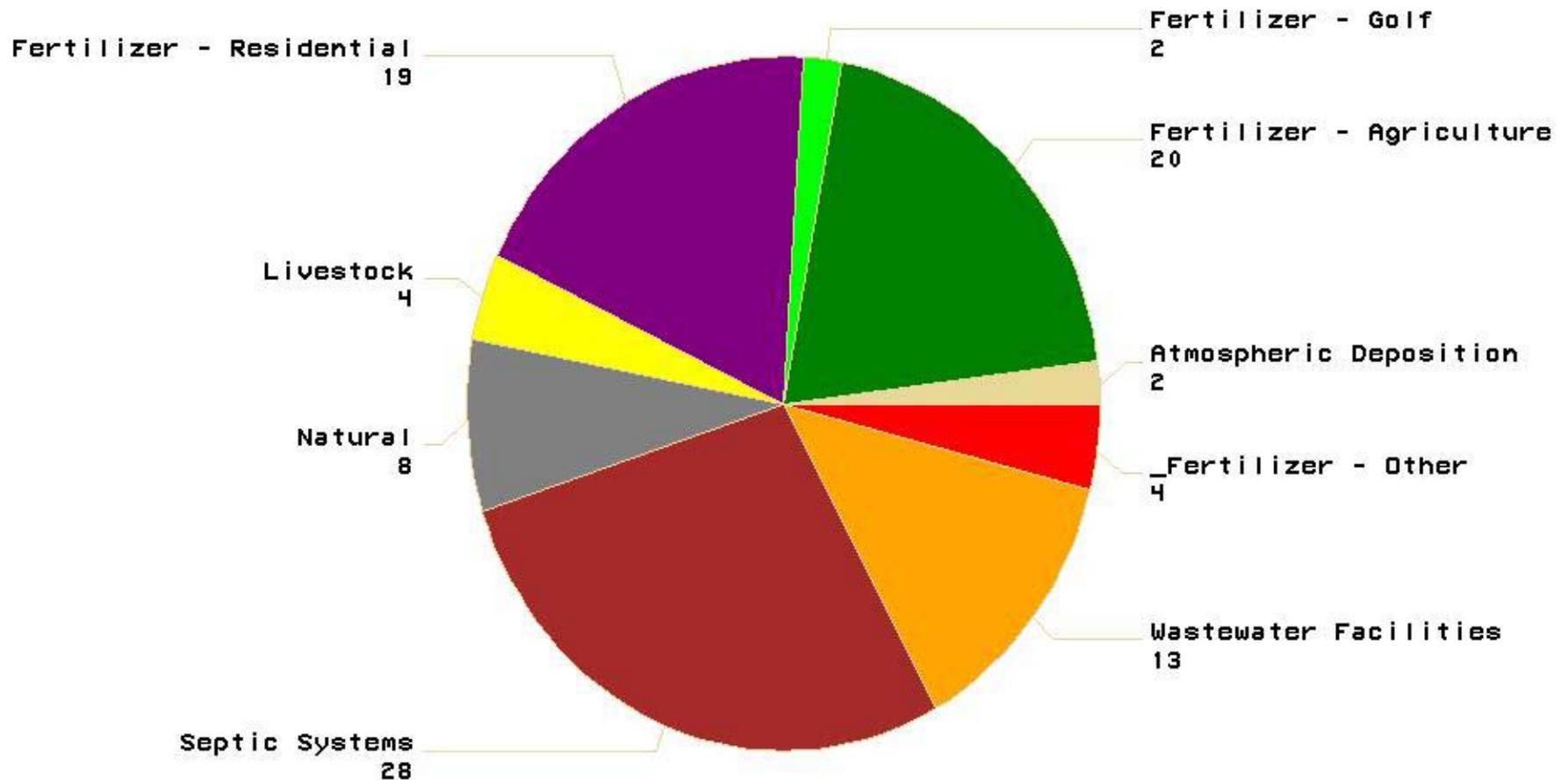
Loadings to WSA by Source, Including Boundary Wastewater Facilities and Using Low Estimates for Septic Systems



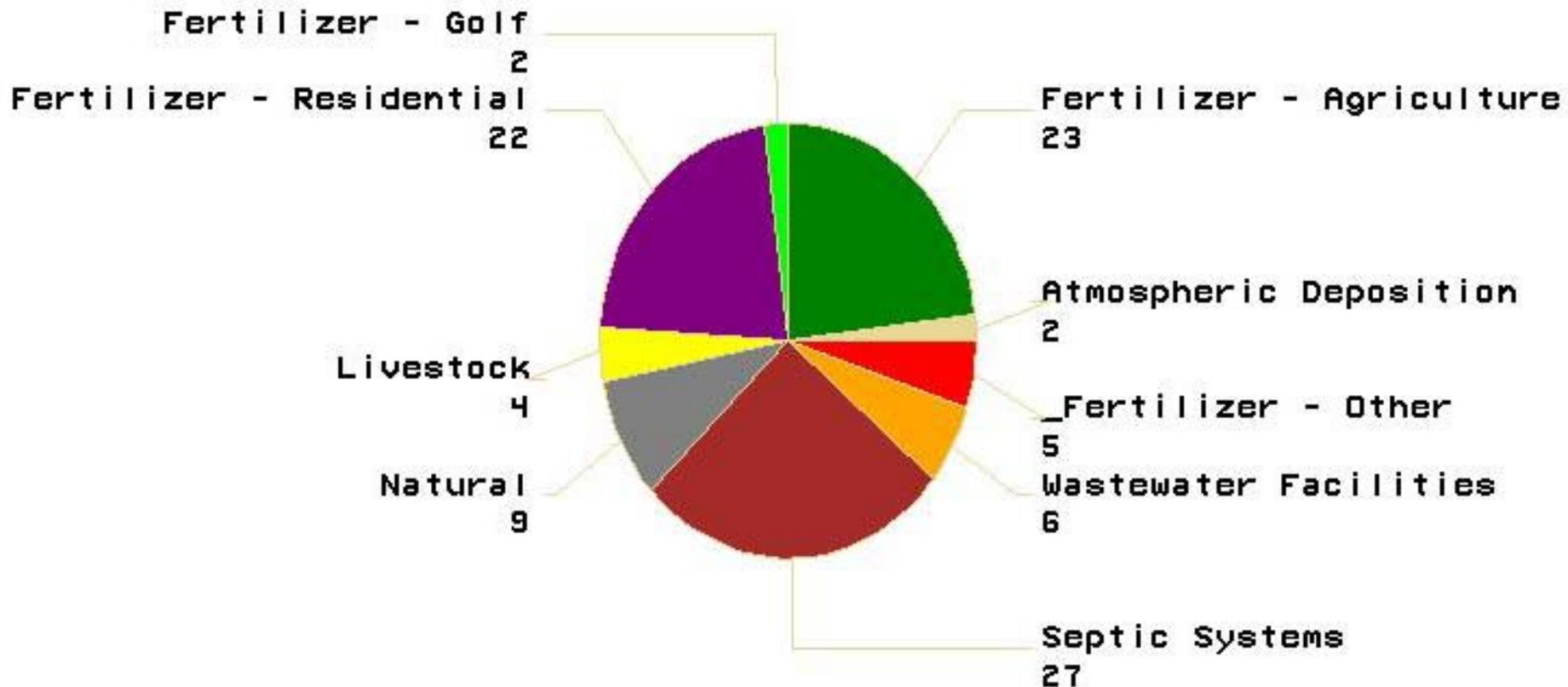
Loadings to WSA by Source, Including Boundary Wastewater Facilities and Using Median Estimates for Septic Systems



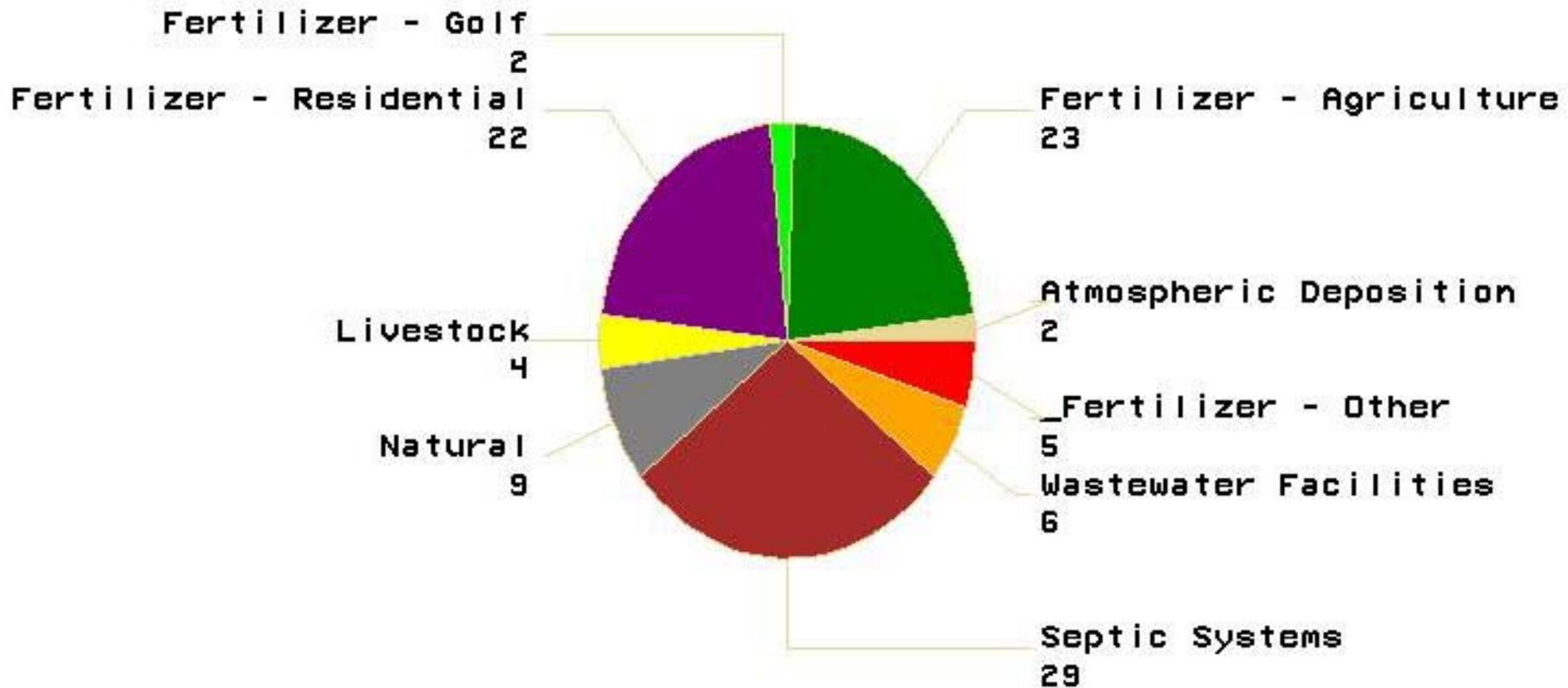
Loadings to WSA by Source, Including Boundary Wastewater Facilities and Using High Estimates for Septic Systems



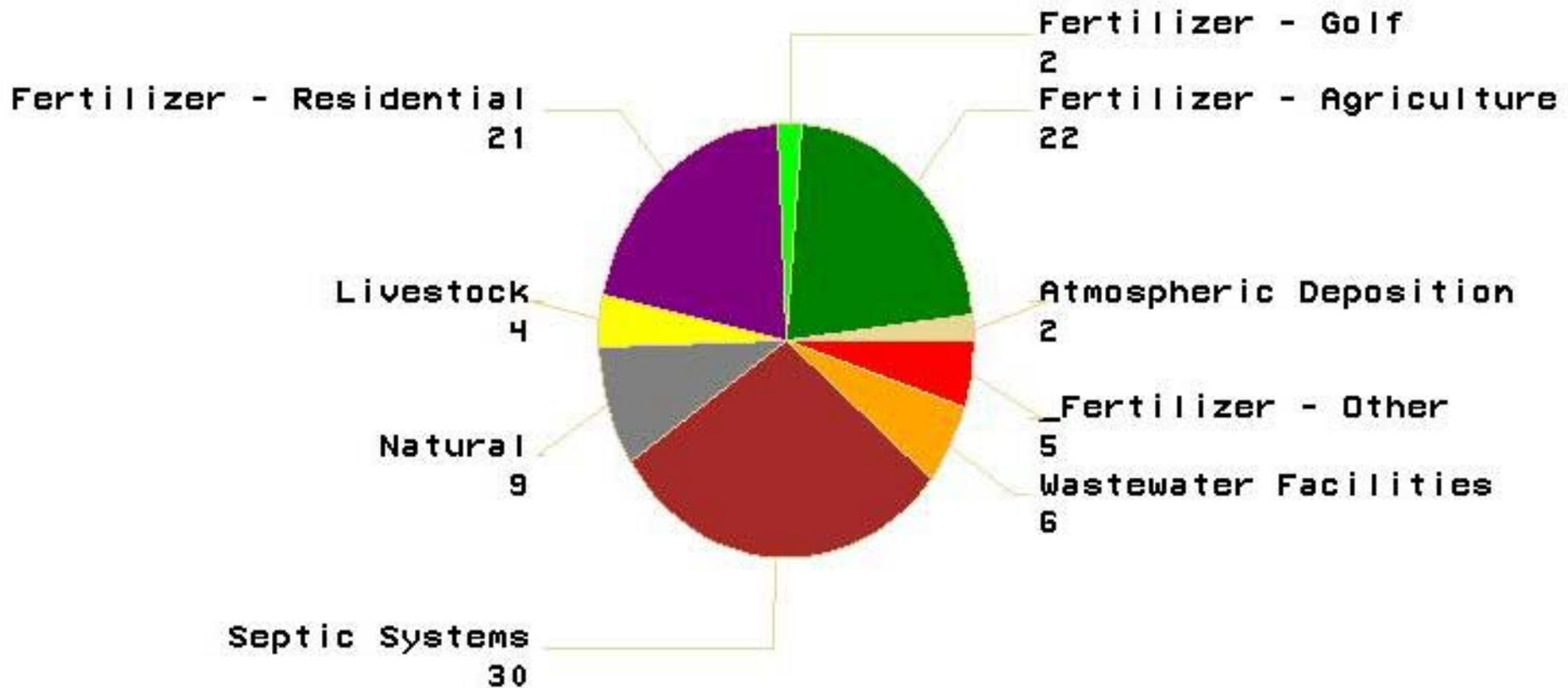
Loadings to WSA by Source, Excluding Boundary Wastewater Facilities and Using Low Estimates for Septic Systems



Loadings to WSA by Source, Excluding Boundary Wastewater Facilities and Using Median Estimates for Septic Systems



Loadings to WSA by Source, Excluding Boundary Wastewater Facilities and Using High Estimates for Septic Systems



Loadings to WSA by Source, Including Boundary Wastewater Facilities and Using Median Estimates for Septic Systems

