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

Approved Minutes of the Meeting held at Sylvan Lake Park, Sanford, FL
February 6, 2007
Approved by RRAC on April 10, 2007

In attendance:

- **Committee Membership and Alternates**: Sam Averett (alternate, Septic Tank Industry); David C. Carter (member, Home Building Industry); Paul E. Davis (member, DOH-Environmental Health); John Glenn (member, Environmental Interest Group); John Heber (member, Citizen); Bill Melton (alternate, Citizen); Jim Rashley (alternate, DOH-Environmental Health); John Schert (member, State University System); Clay Tappan (member, Professional Engineer); Pam Tucker (member, Real Estate Profession); and Scott Womble (member, Septic Tank Industry)
- **Not represented**: Restaurant Industry
- **Visitors**: Damann Anderson (Hazen & Sawyer); George Bartuska (Barnes Ferland and Associates, Inc.); Shelley Beville (The Nature Conservancy); Dominic Buhot (Greens Environmental Services); John Byrd (Aide to Orange County Commissioner Brummer); Ni-Bin Chang (University of Central Florida); Doug Everson (Plastic Tubing Inc.); Chris Ferraro (Florida Department of Environmental Protection); John Higgins (Markham Woods Association); Justin Hubbard (Infiltrator Systems Inc.); Tony Matthews (Seminole County); Mark Mechling (Ellis & Associates); Len Moore (Moore Marketing, Inc.); Dick Otis (Otis Environmental Consultants, LLC); Harley Pattee (Septic Tanks); Patti Sanzone (Florida Department of Environmental Protection); Kevin Sherman (Quanics); Meghan Whidden (DOH - Seminole County Environmental Health); Walter Wood (Lake County)
- **Department of Health (DOH), Bureau of Onsite Sewage Programs**: Paul Booher; Bart Harriss; Eberhard Roeder; 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 November 30, 2006:**
    a. **Motion was made by John Schert and seconded by John Heber for the RRAC to approve the 11/30/2006 meeting minutes. No changes were proposed. All are in favor with none opposed, and the motion passed.**
3. **Wekiva Onsite Nitrogen Contribution Study:**
    a. Discussion on latest developments, summary of progress as of the last RRAC meeting, and decisions made during the current meeting:
        i. **Task 1** (Field Work, $200,000): Mark Mechling with Ellis & Associates, Inc. presented on the status of the field work portion of the Wekiva project. Contract agreement between DMS, DOH, and Ellis &

Associates effective date of January 2, 2007. Quality Assurance Project Plan (QAPP) was finalized January 29, 2007. Seminole County site selected, sampling done between January 15th – February 6th. Mark Mechling went over the site selection review criteria. They started with Seminole County and focused on several houses along Markham Woods Road. The houses were in various Wekiva Aquiver Vulnerability Area (WAVA) protection zones. What he discovered is that the location of the drainfield on the property became one of the most critical criteria for selection so that the plumes can be detected. He gave an example of how if there are two properties with drainfields in close proximity to each other, that would not be an ideal situation as it would be difficult to differentiate between the two drainfields. Also if the drainfield is along the property boundary and the groundwater flow goes to neighboring properties, this would not be a good candidate site. He kept in contact with the Department of Health to help narrow down the sites to one. The groundwater samples were submitted each day to an analytical laboratory. These results have started to come back in but he does not have any results to share as it has not gone through the Quality Assurance / Quality Control process with Ellis & Associates. The draft report on the first site will be due March 23, 2007 and then DOH and other interested parties can review and make comments which will be incorporated into the final report. Sites 2 and 3 will have a draft report due in April with a final report due in May. No final site selection in either Orange or Lake County has occurred yet. Orange County site selection has narrowed down to several addresses which DOH has reviewed and ranked. At this point he is proposing to start drilling for site 2 in mid February. Lake County site selection has been narrowed to four subdivisions: Cross-Tie Ranch Phase 2, Wolfbranch Estates, Rollingwood, and Valley Hill Farms. The Lake County selected subdivisions are on private wells due to it being difficult to find a 1 acre lot on public water where the groundwater is reachable with the probe. Pam Tucker asks how they are determining whether fertilizer use is excessive. Mr. Mechling states that it is done through an interview with the homeowner. For the Seminole County site, for example, the homeowners take care of the lawn themselves and use a minimum amount of fertilizer. One of the tests performed on the site is for nitrogen isotopes which may help reveal whether the nitrogen is from fertilizer use. John Schert asks at what depth he expects to see ammonia change to nitrate. Mark Mechling states that there is a depth and vertical component and that this is variable among different sites. Pam Tucker states that she was out at the site during the testing and she was impressed at the amount of effort they took to reduce cross-contamination potentials (i.e. rubber gloves, cleaning the probes, using fresh tubing, etc.) Mark Mechling states that they are

using conductivity to locate the plume and that this is working out very well. The background nitrates for the field parameters are almost done and he is still waiting to see how they turn out for the drainfield. John Byrd asks whether Orange and Lake Counties will be done simultaneously or sequentially. Mr. Mechling indicates that the plan for now is to do them sequentially with the final site being completed in mid-March. John Schert asks how the homeowners feel about what Ellis & Associates is doing. Mark Mechling states that if they are familiar with the Wekiva issues then they are willing volunteers. One of the most difficult parts is convincing people to let them come onto their yards. The equipment they use causes minimal impacts to the landscaping. First they put in the piezometers, which remain onsite throughout the sampling to measure the groundwater depths and direction. John Higgins asks whether the results of the studies will be shared as the results are received, or will it wait until all three sites are complete. David Carter states that this is public information, and if RRAC has it the public has it. RRAC is meeting regularly and the information is being sent via email as soon as staff has it to allow for time to review prior to the meeting. John Higgins asks whether the report to RRAC will be from Ellis & Associates, or from the department. Elke Ursin states that the report will be from Ellis & Associates. Mr. Higgins asks whether the department will review and make comments and David Carter states that it is normal procedure for staff to make comments. John Byrd asks if the raw data will be available as an attachment to the report. Mark Mechling states that he does not plan on submitting any raw data at this point. All of the raw data will be available as an appendix on the March 23rd report and a presentation will be made to RRAC in April on this report. Pam Tucker points out that there is a TRAP meeting on May 17th but the final report is not due until May 30th. John Byrd states that the TRAP is not required to approve the Wekiva report, the report is to be from RRAC to the legislature. John Schert made a suggestion that whatever RRAC receives from the department can also be put on the DOH website. Elke Ursin states that the DOH Wekiva website is to be updated, and she will discuss to see if this can be done. Pam Tucker states that a short update is all the public needs. John Schert states that there are a lot of people interested in this study, so more detailed information would be appropriate. John Byrd states that it would be great if the information could be put on the website. Paul Davis is concerned that the draft report material may be taken out of context. He suggests not having the executive summaries and conclusions published prior to the RRAC reviewing and approving. David Carter asks whether there are any technical problems with doing this and Elke Ursin states that she will need to make sure this is allowable but that this is public

information and a request for the information can be made. David Carter states that the information should be made as public as practical, but that the word “draft” should be clearly printed on any documents.

ii. **Task 2** (Categorization and quantification of nitrogen loading, $25,000): Dr. Richard Otis with Otis Environmental Consultants presented on the progress. His task is to determine the amount of nitrogen contribution from an onsite system before it reaches the groundwater, but he is concerned with what is reaching the springs. He has reviewed much of the literature related to this task and has found that different studies have employed a wide range of methods and measurements, with few as comprehensive as the sampling done in Task 1. He is concerned that by looking at the literature he may be overestimating what is actually occurring. He discussed the transformation of nitrogen from organic nitrogen coming into the septic tank, then changes to ammonia, and then it goes aerobic and changes to nitrate. To denitrify, this nitrate needs to go anoxic to change to nitrogen gas which is released into the air. He discusses some methods to denitrify: the single sludge system, and the two sludge system. He states that the denitrification capacity of the environment is huge. He suggests looking at the soil organic content as an indicator of the potential for nitrogen removal. The concept that Dr. Otis describes is that organic content in the soil will help to denitrify nitrates coming from the source. He expects to find a broad range of numbers relating to the various organic content amounts found in different soil types. The soil survey has some organic matter figures, but this is only looking at the upper horizon. Most other sources for organic matter numbers are taken above the elevation of the drainfield. There is more uncertainty below the drainfield. Paul Booher asks whether the organic content degrades after the effluent goes through it. Dr. Otis states that it should continue, but if the vegetation has been stripped then it may not be replenished. He states that he is putting this information together into a searchable database. One way he suggests to determine the nitrogen removal is to look at the organic content, but that there are many other factors as well such as type of system, how it’s operated, the soils, the depth to the water table, etc. He states that a broad range of numbers showing the contribution of nitrogen is to be expected. Paul Booher states that proper credit needs to be given to the amount of nitrogen reduction taking place in the vadose zone. Dr. Otis agrees with this but adds that credit needs to be given to the amount of nitrogen removed in the groundwater as there is additional organic material in the groundwater. Damann Anderson suggests taking soil samples along with the field work being done in Task 1 and measure for organic carbon to supplement the

other data being collected. He suggests doing 4-5 samples per site at the same depth as the probe and measure the amount of carbon in the soil at different depths. He states that what this will show is whether there is a relationship between organic carbon and nitrogen. RRAC directs staff to look further into this if this can be done within the time and budget restraints of the project. John Heber asks whether the method of sewage disposal (gravity vs. low pressure dosing) will be looked at. Dr. Otis states that this will be difficult. David Carter states that historically the direction has been to improve hydraulics, and that well drained soils are better for septic systems. He also states that currently the requirements are to take out some of the severely limited soils to increase the hydraulic loading potential, but by doing this some of the benefits of having the organic content in the soil are removed. He states that maybe it is not all about hydraulics any more. Dr. Otis agrees with this assessment. He stated that effluent disposal from onsite systems is a public health issue. The whole idea was to avoid contact with the effluent and keep it underground. Now we are beginning to care more about some of these other issues such as nutrient contributions. Kevin Sherman states that there was a study done in the Indian River Lagoon looking at plume movement, and it was found that there was a great deal of denitrification at the interface between groundwater and surface water. Walter Wood with Lake County states that there are many areas in the Wekiva Study Area that have karst features, are not located near the river, and where there is limited organic content in the soil. Dr. Otis states that his job ends at the water table, but he feels that it is important to look beyond this to get a good grasp on what is actually being denitrified. Dr. Otis states that onsite systems have an advantage over wastewater treatment plants as they distribute the effluent over a larger area. There is a much better chance of contact with organic matter. Proper management and clustering of systems is needed for onsite systems to increase treatment efficiency. Management is a good reduction approach but it is hard to measure the results.

iii. **Task 3** (Assessment of the contribution of OWTS relative to other sources, $25,000): Dr. Linda J. Young with the Department of Statistics at the University of Florida presented her progress to date. She met with DOH staff to discuss the project. She showed several tables that counted septic systems by their location (Seasonal High Water Table, Drainage Characteristics, WAVA Protection Zone, etc.) As her work interfaces with Task 2, she suggested to present a range of nitrogen contributions for each category with a corresponding uncertainty value, and will not just have one final number. RRAC agreed to have her present a range of values. She made contact with the contractor

performing the work for DEP who will wait to release their numbers and their report that is due by the next legislative session.

iv. **Task 4** (Cost-effective solutions): Eberhard Roeder presented the results thus far. He has reviewed information from DOH's permitting database to determine what a typical system is. Cost information has been solicited from each of the counties for a typical system at various treatment levels. An outline has been drafted showing various strategies. RRAC decided for staff to continue their work on this in-house and report back on progress during the next meeting.

4. Discussion on Disassembling Lysimeter Stations

a. Elke Ursin sent an email to two contacts at the University of South Florida. Elke Ursin and Paul Booher visited the lysimeter station and it is in need of some repair but is still very impressive. Damann Anderson suggests using the space to test some of the hypothesis discussed earlier.

5. Updates on other projects

a. Ongoing projects

i. Florida Alternative Disposal Systems Assessment
- Working with Kevin Sherman with On Site Management Consultants Inc.
- Contract has been drafted and is in DOH Contract Management office for routing of final signatures
- Encumbrances have been approved for FY 06-07

ii. Florida Passive Nitrogen Removal Study
- Negotiations have been completed between FDOH and Applied Environmental Technology Inc.
- Award was posted with no protests
- Encumbrances have been approved for FY 06-07
- Contract in process of being written

iii. Taylor County Source Tracking Study
- September 2006 report submitted (in packets)
- RRAC to send comments to Elke Ursin or Eberhard Roeder and they will be forwarded to the provider to incorporate into the final report.
- Paul Davis commented that the results did not appear to be very conclusive, showing slightly better water quality in the septic areas, and worse water quality in the sewered areas.

iv. Monroe County PBTS Performance Assessment
- Lab vendor selected
- Contract has been routed through Monroe County and has been sent to the lab vendor for final signatures. Once the contract has been executed then the work can begin.

v. Manatee Springs, Phase II

- Quarterly reporting to EPA done.

vi. Remote Sensing of Optical Brighteners Study
- At point where the decision needs to be made whether to move forward with the aerial portion of the contract
- Meeting with DOH, EPA, and DEP on February 1st to discuss options
- Decision to amend EPA and DOH scope of work to further refine the flow-through-flourometer method (characterize temporal variability, define optimum deployment times), continue characterizing the excitation-emission matrix

vii. Glass Cullet Assessment
- Report from DOH lab to be completed in very near future

viii. Columbia County Well Testing Project
- CHD and Bureau of Water Programs fund testing of drinking water wells in similar situation as Magnolia II along the river. Sampling began 9/18 for pathogen indicators and nitrate.
- OSTDS plans to fund one additional event including analysis for TKN and TP (when available from DOH-labs), and TKN and TP part during high flow conditions

b. Projects coming up

i. 319 Project on Performance and Management of Advanced Onsite Systems

- A draft application was sent to DEP for review and comment. Currently working on fleshing out the scope with DEP. This will be a general assessment on how the systems work and how they should be managed. The Keys Study would be DOH's match. A random sample of systems throughout the state will be surveyed to find out what is working and what is not working.

6. Public Comment

a. None

7. Closing Comments, Next Meeting, and Adjournment

a. A tentative date of April 10, 2007 was set, with the meeting beginning at 9:30 at Sylvan Lake Park in Sanford if it is available. David Carter states that he had requested that staff schedule legal council for the next meeting to discuss the Sunshine Law. He states that any item that could be voted on cannot be discussed among RRAC members outside of the meeting. The public needs to hear all deliberations between RRAC members. Meeting adjourned at 1:30 pm.

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

Tuesday February 6, 2007
9:30 am - 2 pm

Sylvan Lake Park
845 Lake Markham Road
Sanford, FL 32771

Agenda:

- Introductions
- Review Minutes of Meeting 11/30/06
- Wekiva Onsite Nitrogen Contribution Study status reports Tasks 1 - 4
- Updates on other projects
- Public Comment
- Closing Comments, Next Meeting, and Adjournment

Introductions
&
Housekeeping

- Travel reimbursement forms (signatures for Travel forms)

Review Minutes of Meeting 11/30/06

- 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
  - Task 2: Categorization and Quantification of Nitrogen Loading from Onsite Wastewater Treatment System Types
  - 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
  - Task 4: Recommend a range of possible cost-effective OWTS nitrogen reduction strategies if significant

Wekiva Onsite Nitrogen Contribution Study

- Task 1: Selected Ellis and Associates, Inc. as the provider
- Task 2: Selected Otis Environmental Consultants, LLC as the provider
- Task 3: Selected Linda Young with University of Florida as the provider
- Task 4: To be handled by staff for time being

Wekiva Onsite Nitrogen Contribution Study Task 1

- Contract agreement effective date of January 2, 2007
- QAPP final January 29, 2007
- Seminole County site selected, sampling done between January 15 – February 1
- Presentation by Mark Mechling with Ellis & Associates

Wekiva Site Selection

- Seminole selected
- Orange in progress, narrowed down potential addresses
- Lake narrowed down to subdivisions (see next slide)

Wekiva Study Lake County Potential Subdivision Locations

Name	Age of Subdivision	Number of Lots	Average Lot Size	Density	WAVA Zone	County	Soil Types	Water Supply	Homeowners Association Information	Approx. Depth to Surficial Aquifer
Cross-Tie Ranch Phase 2	1995	39	2 acres	0.5 houses/acre	East 1/2 Secondary, West 1/2 Tertiary	Lake	Candler	Well	Cross-Tie Ranch Homeowners Association 2180 W SR 434 Ste 5000 Longwood FL	West 1/2 = 20 - 30, East 1/2 <20
Wolfbranch Estates	1983	46	2.7 acres	0.37 houses/acre	mostly secondary, some primary	Lake	Tavares, Candler, Arents, Orlando	Well	Wolfbranch Estates Homeowners Association PO Box 876 Sorrento FL 32776	most 0 - 20, some of all other depths too
Rollingwood	1984	42	5 acres	0.2 houses/acre	secondary	Lake	Myakka, Candler, Tavares	Well	No	most <0, some 0 - 20, and a little 20 - 30 and >30
Valley Hill Farms	1986	23	3.8 acres	0.26 houses/acre	1/2 primary, 1/2 secondary	Lake	Candler, Tavares, small Arents	Well	Valley Hill Farms Homeowners Association 34621 Valley Hill Ln. Eustis FL 32736	most <0, some 0 - 20

Wekiva Onsite Nitrogen Contribution Study Task 2

- Presentation by Richard Otis with Otis Environmental Consultants, LLC

Wekiva Onsite Nitrogen Contribution Study Task 3

- Presentation by Linda Young with the University of Florida

Task 4
cost effective strategies

Update 2/6/07

Status

- Reviewed information from permitting database
  - Typical system
- Solicit cost information for typical system for various treatment levels
- Drafted outline along structure
  - Status
  - strategies

Strategy Elements

Strategies

- Recordkeeping, Inventory
- Planning
- Performance
- Financial Assistance and Funding
- Training and Certification
- Site Evaluation
- Design
- Construction
- Operation and Maintenance
- Inspection and Monitoring, Reporting
- Corrective Action
- Public Education and Participation

Recordkeeping, Inventory

- Status
  - Wekiva Study Area coverage of improved properties without sewer (October 2004)
  - OSTDS Permitting Records central database and county datasets (~1997-2006)

Permit Records

average design flow (gpd)	County repairs	WSA repair	County new	WSA new
Lake	321	316	361	363
Orange	327	313	471	420
Seminole	361	370	455	533

Typical System

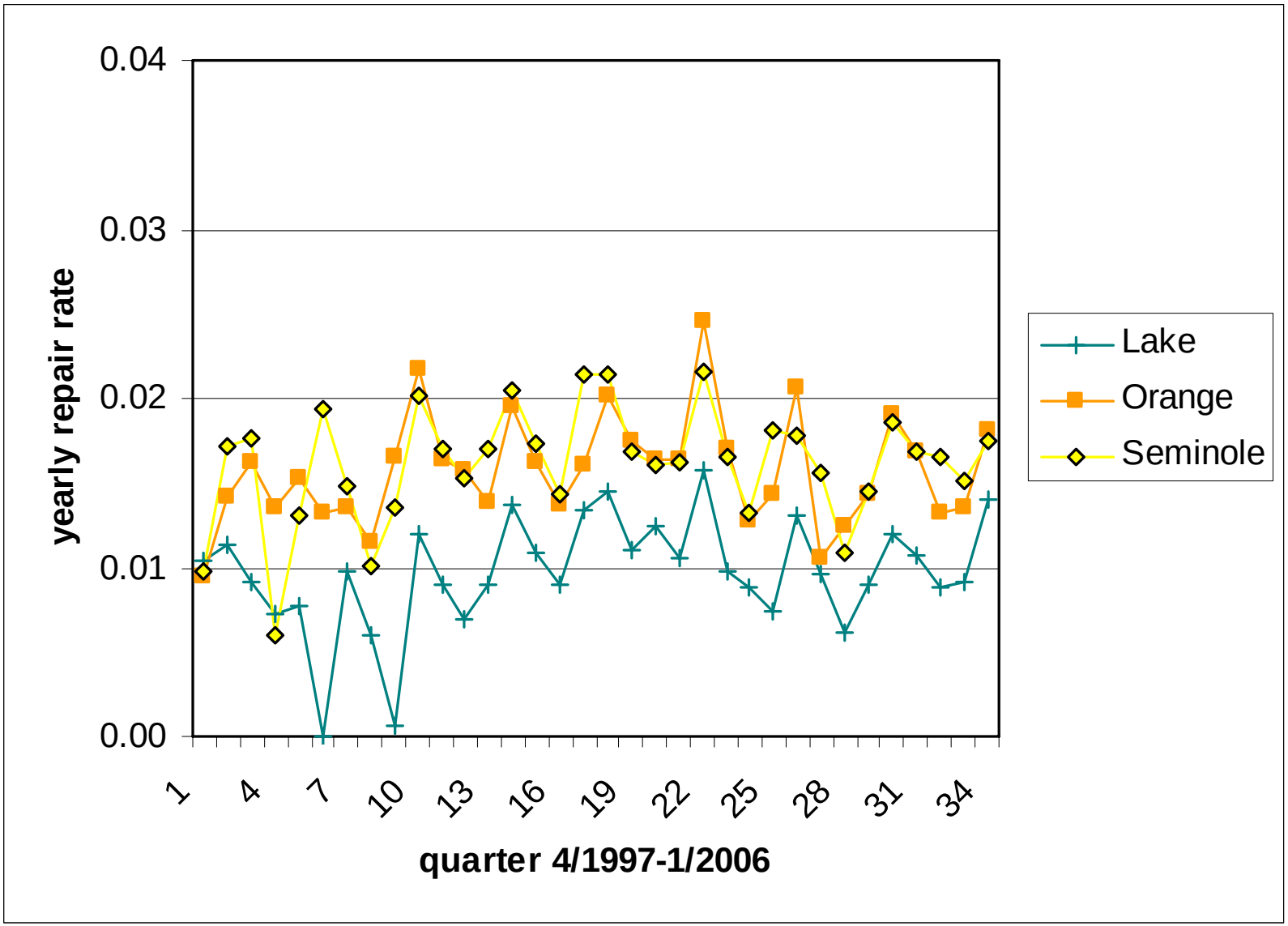
Percent of issued permits that are "typical systems"	300 gpd Repairs county	300 gpd repairs WSA	400 gpd new county	400 gpd new WSA
Lake	58	55	34	37
Orange	53	61	34	36
Seminole	50	50	31	21

Record Keeping/Inventory

- Strategies
  - Status quo
  - Slowly increase coverage of permitting database by incorporating old systems via inspection program
  - Inventory all systems to appropriate level of detail

Planning

- Status
  - Onsite: Management Level 1 (homeowner)
  - Central Sewer: Management Level 5 (utility)


0.04
0.03
0.02
0.01
0.00
yearly repair rate
1
4
7
10
13
16
19
22
25
28
31
34
quarter 4/1997-1/2006
Lake
Orange
Seminole

- Strategies
  - Status quo: Rely on repairs/modifications/new systems
  - Provide incentives
  - Target priority areas for upgrade
  - Transition to higher management levels

Performance

- Status
  - Predominantly conventional systems
  - Advanced systems tend to be larger than typical systems
- Strategies
  - Status quo
  - N-reduction per system or per lot

Other Strategy Elements

- Financial Assistance and Funding
- Training and Certification
- Site Evaluation
- Design
- Construction
- Operation and Maintenance
- Inspection and Monitoring, Reporting
- Corrective Action
- Public Education and Participation

A Comparison with Approaches for other sources

- Agriculture
- Central Wastewater
- Fertilizer use
- Stormwater

Discussion on Disassembling Lysimeter Stations

Updates on current projects

Florida Alternative Disposal Systems Assessment

- Contract drafted and is in DOH Contract Management office for routing for final signatures

Florida Passive Nitrogen Removal Study

- Negotiations have been completed between FDOH and Applied Environmental Technology Inc.
- Encumbrances have been approved for FY 06-07
- Contract in process of being written

Taylor County Source Tracking Study

- September 2006 report submitted (in packets)

Monroe County PBTS Performance Assessment

- Lab vendor selected
- Contract in process of being written and routed through Monroe County Health Department

Manatee Springs, Phase II

Remote Sensing of Optical Brighteners Study

- At point where the decision needs to be made whether to move forward with the aerial portion of the contract
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Glass Cullet Assessment

- Report to be completed in very near future

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- CHD and Bureau of Water Programs fund testing of drinking water wells in similar situation as Magnolia II along the river. Sampling began 9/18 for pathogen indicators and nitrate.
- OSTDS plans to fund one additional event including analysis for TKN and TP (when available from DOH-labs), and TKN and TP part during high flow conditions

Projects coming up

319 Project on Performance and Management of Advanced Onsite Systems

- Draft application sent to DEP for review and comment

Public Comment

Closing Comments, Next Meeting, and Adjournment

Florida Department of Health

Research Review and Advisory Committee Meeting Summary

Meeting on February 6, 2007 at Sylvan Lake Park, Sanford

- **RRAC Members/Alternates Present**: Sam Averett, David Carter, Paul Davis, John Glenn, John Heber, Bill Melton, Jim Rashley, John Schert, Clay Tappan, Pam Tucker, and Scott Womble. Eight out of nine groups were present, representing a quorum.
- **Review of Previous Meeting Minutes**: No comments or corrections on the November 30, 2006 meeting minutes. The minutes were approved as written.
- **Wekiva Onsite Nitrogen Contribution Study**:
    1. Summary of progress as of the last RRAC meeting and decisions made during the current meeting:
        - **Task 1** (Field Work, $200,000): Mark Mechling with Ellis & Associates, Inc. presented on the status of the field work portion of the Wekiva project. Contract agreement effective date of January 2, 2007. Quality Assurance Project Plan (QAPP) final January 29, 2007. Seminole County site selected, sampling done between January 15'th – February 6'th. Orange County site selection has narrowed down to several addresses which DOH has reviewed and ranked. At this point he is proposing to start drilling for site 2 in mid February. Lake County site selection has been narrowed to four subdivisions: Cross-Tie Ranch Phase 2, Wolfbranch Estates, Rollingwood, and Valley Hill Farms. Mr. Mechling stated that he did not have any results to share at this point as they have not completed their quality assurance. The draft report is due in March, another report for sites 2 & 3 will be due in April, and the final report is due in May.
        - **Task 2** (Categorization and quantification of nitrogen loading, $25,000): Dr. Richard Otis with Otis Environmental Consultants presented on the progress. He has reviewed much of the literature relating to this task and has found that different studies have employed a wide range of methods and measurements, with few as comprehensive as the sampling done in Task 1. He suggests looking at the soil organic content as an indicator of the potential for nitrogen removal. He expects to find a broad range of numbers relating to the various organic content found in different soil types. Damann Anderson suggests taking soil samples along with the field work being done in Task 1 and measure for organic carbon to

supplement the other data being collected. RRAC directs staff to look further into this if this can be done within the time and budget restraints of the project.

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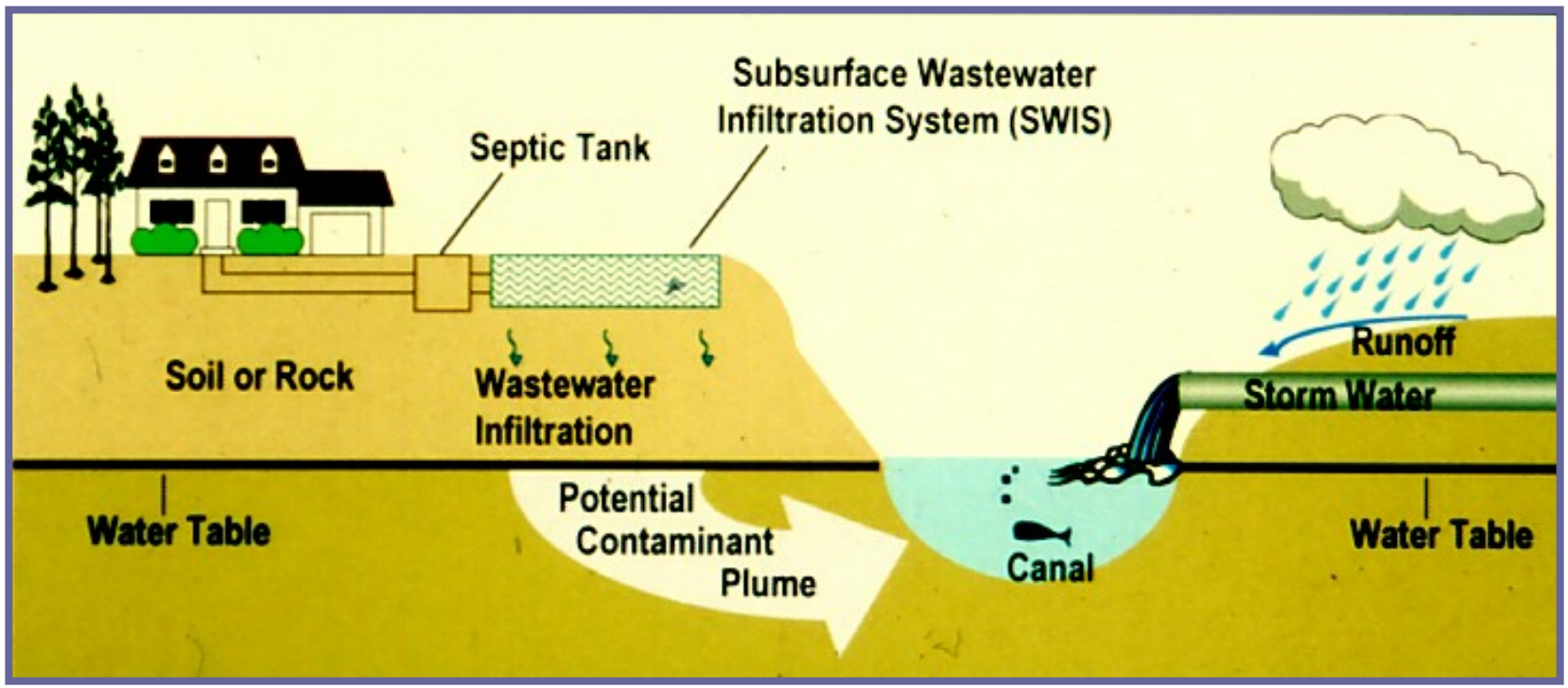
- **Updates on other projects**: Several other projects that are proposed or ongoing were discussed.
- **Next Meeting**: A tentative date of April 10, 2007 was set, with the meeting beginning at 9:30 at Sylvan Lake Park in Sanford.

Wekiva Onsite Nitrogen Contribution Study

Task 2: Categorization and Quantification of Nitrogen Loading

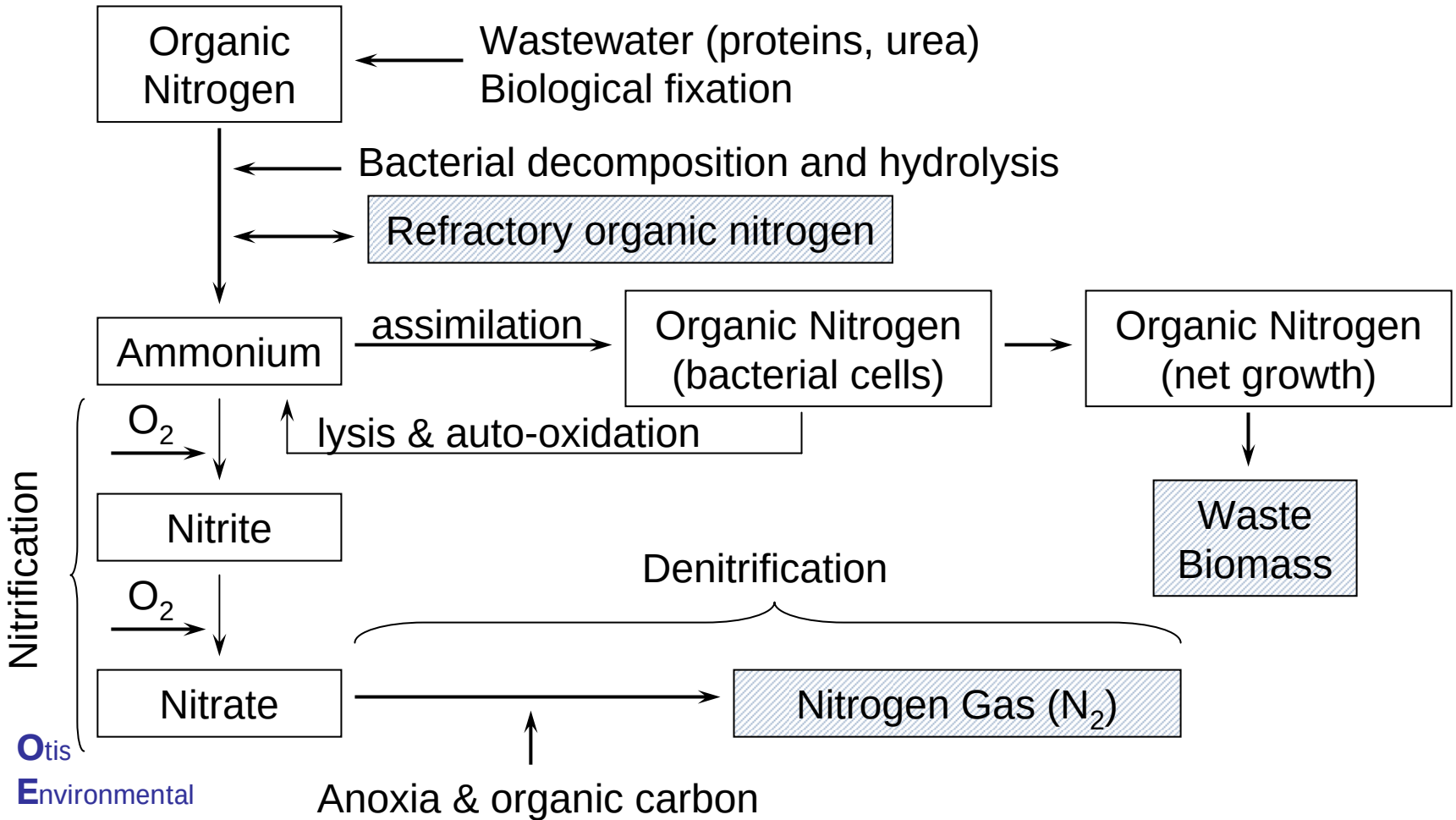
Otis
Environmental
Consultants, LLC

Near Shore Waters Nutrient Sources



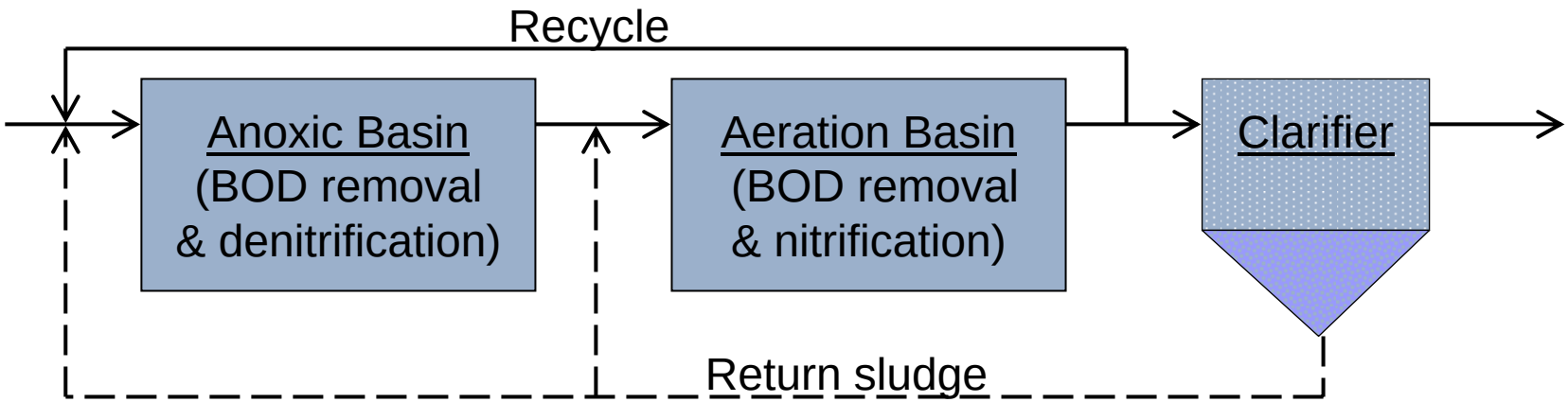
Otis
Environmental
Consultants, LLC

Biological Transformations of Nitrogen



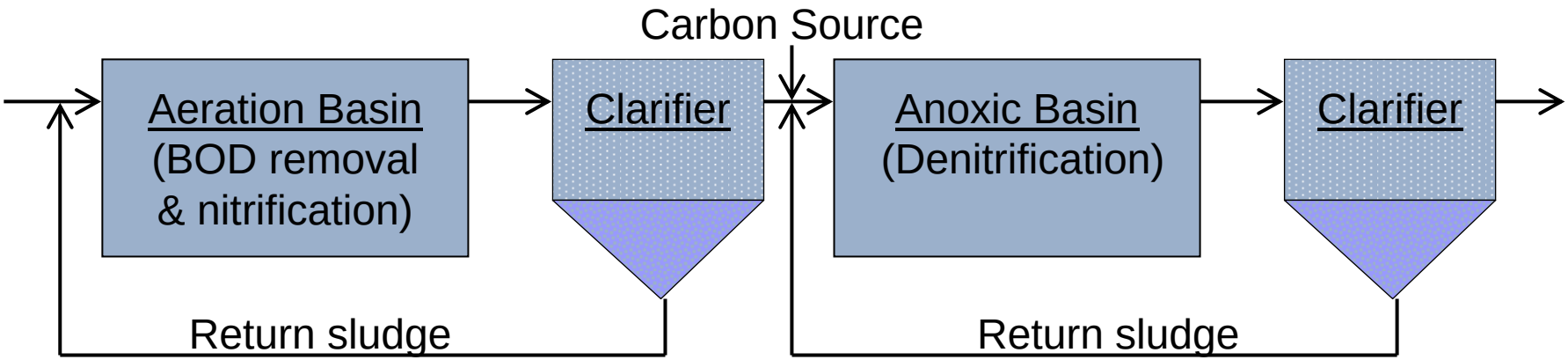
Otis Environmental Consultants, LLC

Single Sludge System



- Septic tank provides anoxic conditions
- Influent BOD provides carbon source
- Capable of achieving 8-15 mg/L TN effluent concentrations
- Typical systems:
  - Recirculating media filters with recycle
  - Activated sludge & FAS with recycle
  - Flood dosing/drying of infiltration system

Two Sludge System



- Two sludge systems can consistently produce effluents with < 5mg/L TN as compared to 8 to 15 mg/L in single sludge systems
- Alkalinity is not recovered in two sludge systems
- Subsurface wastewater infiltration system acts as a two sludge system

Soil Survey Reports

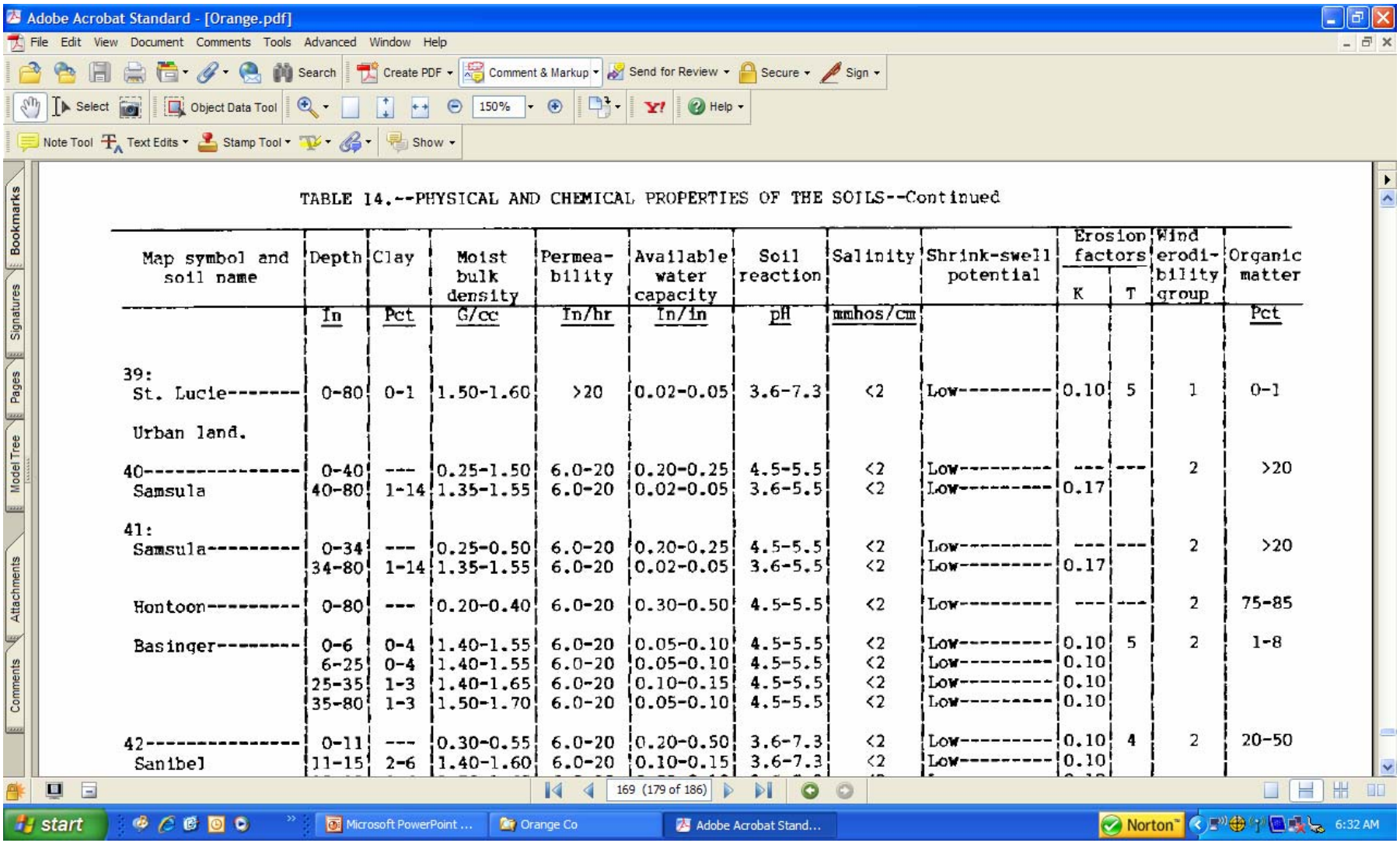
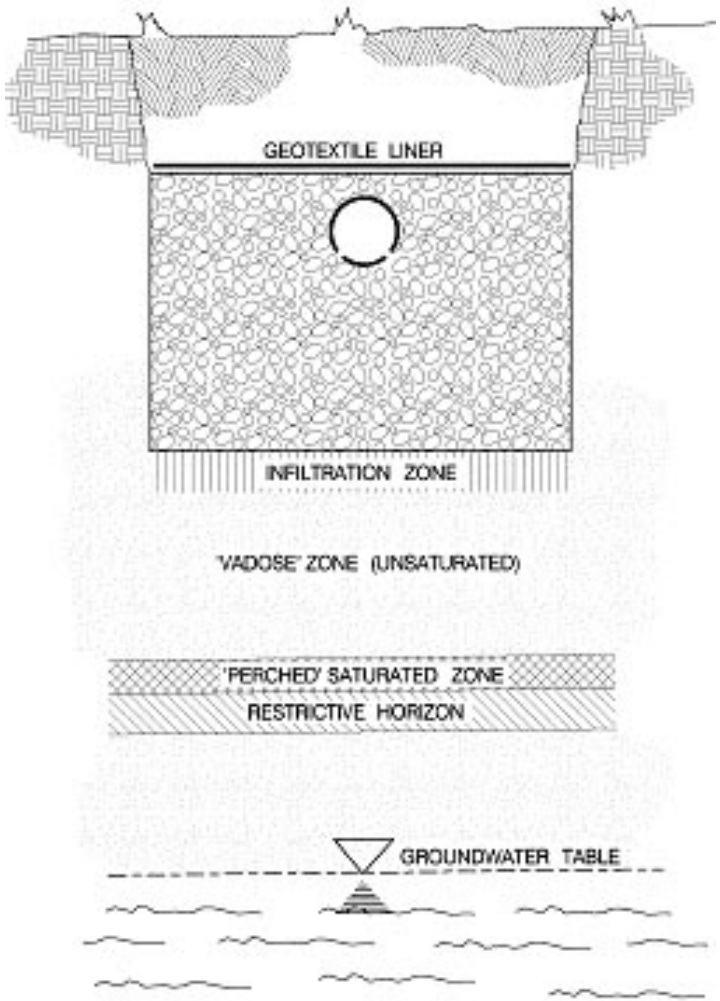


TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

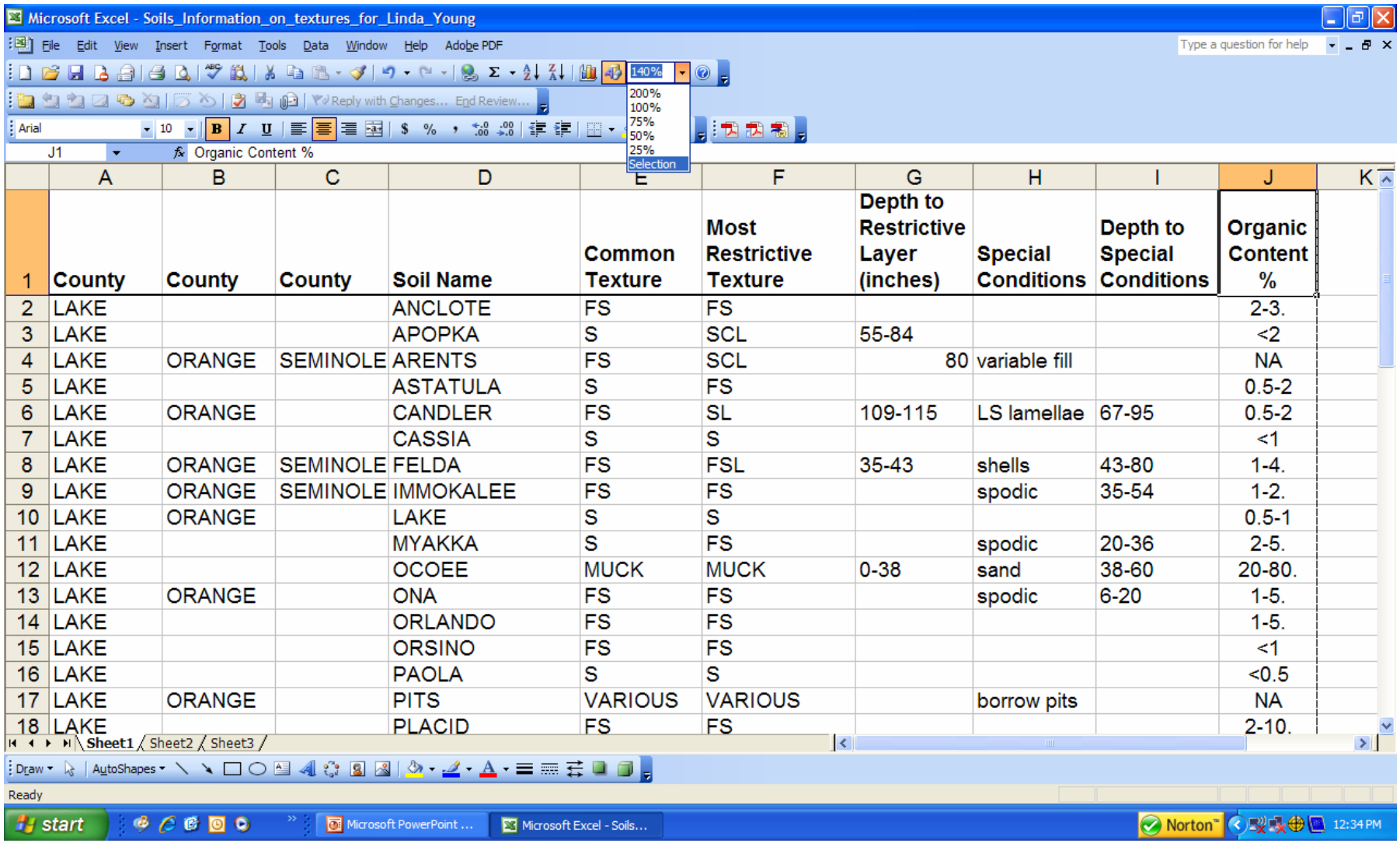
Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
39:												
St. Lucie-------	0-80	0-1	1.50-1.60	>20	0.02-0.05	3.6-7.3	<2	Low---------	0.10	5	1	0-1
Urban land.												
40----------	0-40	---	0.25-1.50	6.0-20	0.20-0.25	4.5-5.5	<2	Low---------	---	---	2	>20
Samsula	40-80	1-14	1.35-1.55	6.0-20	0.02-0.05	3.6-5.5	<2	Low---------	0.17			
41:												
Samsula---------	0-34	---	0.25-0.50	6.0-20	0.20-0.25	4.5-5.5	<2	Low---------	---	---	2	>20
	34-80	1-14	1.35-1.55	6.0-20	0.02-0.05	3.6-5.5	<2	Low---------	0.17			
Hontoon---------	0-80	---	0.20-0.40	6.0-20	0.30-0.50	4.5-5.5	<2	Low---------	---	---	2	75-85
Basinger--------	0-6	0-4	1.40-1.55	6.0-20	0.05-0.10	4.5-5.5	<2	Low---------	0.10	5	2	1-8
	6-25	0-4	1.40-1.55	6.0-20	0.05-0.10	4.5-5.5	<2	Low---------	0.10			
	25-35	1-3	1.40-1.65	6.0-20	0.10-0.15	4.5-5.5	<2	Low---------	0.10			
	35-80	1-3	1.50-1.70	6.0-20	0.05-0.10	4.5-5.5	<2	Low---------	0.10			
42----------	0-11	---	0.30-0.55	6.0-20	0.20-0.50	3.6-7.3	<2	Low---------	0.10	4	2	20-50
Sanibel	11-15	2-6	1.40-1.60	6.0-20	0.10-0.15	3.6-7.3	<2	Low---------	0.10			

N Removal Below a Infiltration System



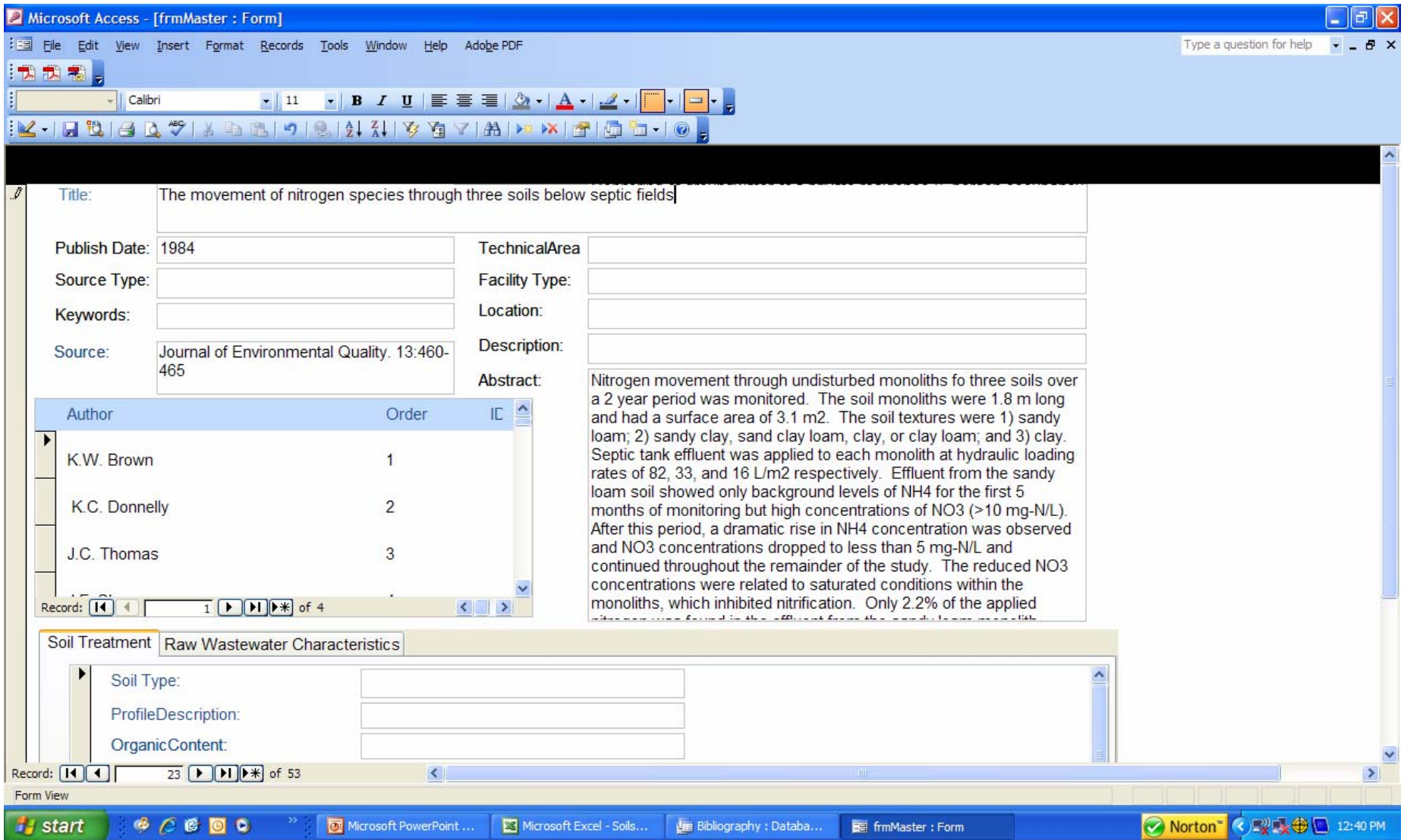
Otis
Environmental
Consultants, LLC

Soil Characteristics

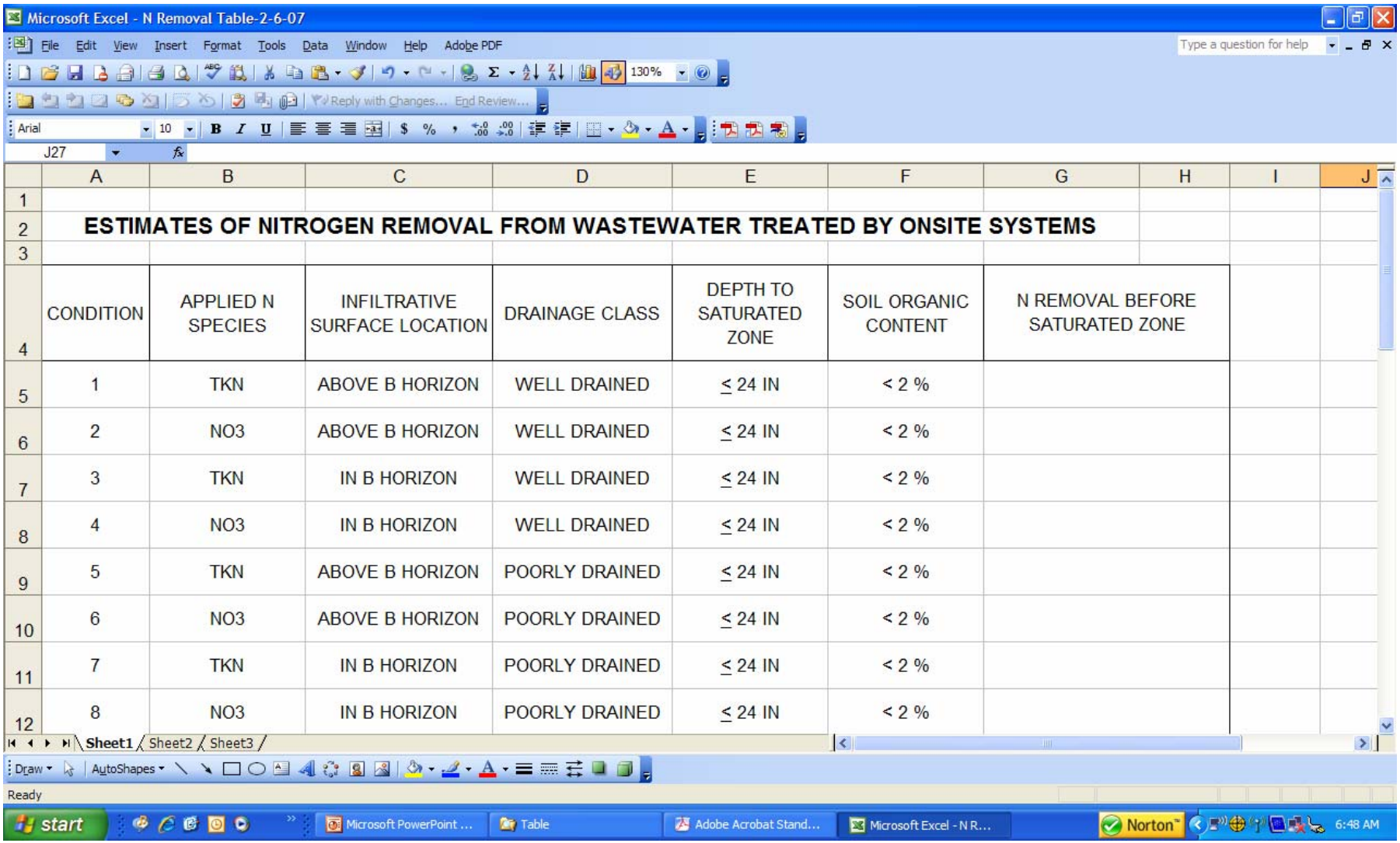


	A	B	C	D	E	F	G	H	I	J	K
1	County	County	County	Soil Name	Common Texture	Most Restrictive Texture	Depth to Restrictive Layer (inches)	Special Conditions	Depth to Special Conditions	Organic Content %	
2	LAKE			ANCLOTE	FS	FS				2-3.	
3	LAKE			APOPKA	S	SCL	55-84			<2	
4	LAKE	ORANGE	SEMINOLE	ARENTS	FS	SCL	80	variable fill		NA	
5	LAKE			ASTATULA	S	FS				0.5-2	
6	LAKE	ORANGE		CANDLER	FS	SL	109-115	LS lamellae	67-95	0.5-2	
7	LAKE			CASSIA	S	S				<1	
8	LAKE	ORANGE	SEMINOLE	FELDA	FS	FSL	35-43	shells	43-80	1-4.	
9	LAKE	ORANGE	SEMINOLE	IMMOKALEE	FS	FS		spodic	35-54	1-2.	
10	LAKE	ORANGE		LAKE	S	S				0.5-1	
11	LAKE			MYAKKA	S	FS		spodic	20-36	2-5.	
12	LAKE			OCOEE	MUCK	MUCK	0-38	sand	38-60	20-80.	
13	LAKE	ORANGE		ONA	FS	FS		spodic	6-20	1-5.	
14	LAKE			ORLANDO	FS	FS				1-5.	
15	LAKE			ORSINO	FS	FS				<1	
16	LAKE			PAOLA	S	S				<0.5	
17	LAKE	ORANGE		PITS	VARIOUS	VARIOUS		borrow pits		NA	
18	LAKE			PLACID	FS	FS				2-10.	

Bibliographic Database



Nitrogen Removal Estimation Table



ESTIMATES OF NITROGEN REMOVAL FROM WASTEWATER TREATED BY ONSITE SYSTEMS

CONDITION	APPLIED N SPECIES	INFILTRATIVE SURFACE LOCATION	DRAINAGE CLASS	DEPTH TO SATURATED ZONE	SOIL ORGANIC CONTENT	N REMOVAL BEFORE SATURATED ZONE
1	TKN	ABOVE B HORIZON	WELL DRAINED	≤ 24 IN	< 2 %	
2	NO3	ABOVE B HORIZON	WELL DRAINED	≤ 24 IN	< 2 %	
3	TKN	IN B HORIZON	WELL DRAINED	≤ 24 IN	< 2 %	
4	NO3	IN B HORIZON	WELL DRAINED	≤ 24 IN	< 2 %	
5	TKN	ABOVE B HORIZON	POORLY DRAINED	≤ 24 IN	< 2 %	
6	NO3	ABOVE B HORIZON	POORLY DRAINED	≤ 24 IN	< 2 %	
7	TKN	IN B HORIZON	POORLY DRAINED	≤ 24 IN	< 2 %	
8	NO3	IN B HORIZON	POORLY DRAINED	≤ 24 IN	< 2 %	

Initial Report on Task 3

Linda J. Young
University of Florida

Table of WAVA Protection Zone by County				
WAVA Protection Zone	**County**			
Frequency **Percent** **Row Pct** **Col Pct**	**LAKE**	**ORANGE**	**SEMINOLE**	**Total**
1 (Primary)	1378 2.49 7.73 14.96	7212 13.01 40.44 21.87	9246 16.68 51.84 69.90	17836 32.19
2 (Secondary)	6708 12.10 20.28 72.80	23377 42.18 70.68 70.89	2990 5.40 9.04 22.60	33075 59.68
3 (Tertiary)	1128 2.04 25.03 12.24	2386 4.31 52.95 7.24	992 1.79 22.02 7.50	4506 8.13
Total	9214 16.63	32975 59.50	13228 23.87	55417 100.00

Table of Municipalities by County				
Septic System Lies Within a Municipality?	**County**			
Frequency **Percent** **Row Pct** **Col Pct**	**LAKE**	**ORANGE**	**SEMINOLE**	**Total**
No	6519 11.76 13.73 70.75	30636 55.28 64.52 92.91	10329 18.64 21.75 78.08	47484 85.6
Yes	2695 4.86 33.97 29.25	2339 4.22 29.48 7.09	2899 5.23 36.54 21.92	7933 14.32
Total	9214 16.63	32975 59.50	13228 23.87	55417 100.00

Table of Average Water Table Depth by County				
Average Water Table Depth	**County**			
Frequency **Percent** **Row Pct** **Col Pct**	**LAKE**	**ORANGE**	**SEMINOLE**	**Total**
No more than 1 foot	456 0.82 6.22 4.95	5433 9.80 74.10 16.48	1443 2.60 19.68 10.91	7332 13.23
More than 1 but no more than 2 feet	0 0.00 0.00 0.00	222 0.40 2.75 0.67	7848 14.16 97.25 59.33	8070 14.56
More than 2 but no more than 3.5 feet	425 0.77 17.70 4.61	1349 2.43 56.18 4.09	627 1.13 26.11 4.74	2401 4.33
At least 3.5 but less than 6 feet	736 1.33 6.98 7.99	9146 16.50 86.77 27.74	658 1.19 6.24 4.97	10540 19.02
At least 6 feet	7597 13.71 28.06 82.45	16825 30.36 62.14 51.02	2652 4.79 9.80 20.05	27074 48.86
Total	9214 16.63	32975 59.50	13228 23.87	55417 100.00

Table of Drainage by County				
Drainage	**County**			
Frequency/Percent Row Pct/Col Pct	**LAKE**	**ORANGE**	**SEMINOLE**	**Total**
Excessively	7346 15.66 27.40 79.87	16813 35.85 62.71 51.62	2652 5.66 9.89 51.71	26811 57.17
Well	246 0.52 100.00 2.67	0 0.00 0.00 0.00	0 0.00 0.00 0.00	246 0.52
Moderately Well	909 1.94 7.94 9.88	9553 20.37 83.47 29.33	983 2.10 8.59 19.17	11445 24.41
Somewhat Poorly	252 0.54 5.12 2.74	3937 8.40 79.97 12.09	734 1.57 14.91 14.31	4923 10.50
Poorly	375 0.80 17.86 4.08	1428 3.05 68.00 4.38	297 0.63 14.14 5.79	2100 4.48
Very Poorly	69 0.15 5.03 0.75	839 1.79 61.20 2.58	463 0.99 33.77 9.03	1371 2.92
Total	9197 19.61	32570 69.45	5129 10.94	46896 100.00
Frequency Missing = 8521				

Table of Protection Zone by Municipalities			
WAVA Protection Zone	Septic System Lies Within a Municipality?		
Frequency Percent Row Pct Col Pct	No	Yes	Total
1	14691 26.51 82.37 30.94	3145 5.68 17.63 39.64	17836 32.19
2	28513 51.45 86.21 60.05	4562 8.23 13.79 57.51	33075 59.68
3	4280 7.72 94.98 9.01	226 0.41 5.02 2.85	4506 8.13
Total	47484 85.68	7933 14.32	55417 100.00

Table of Average Water Table Depth by Municipalities			
Average Water Table Depth	Septic System Lies Within a Municipality?		
Frequency Percent Row Pct Col Pct	No	Yes	Total
No more than 1 foot	6714 12.12 91.57 14.14	618 1.12 8.43 7.79	7332 13.23
More than 1 but no more than 2 feet	5833 10.53 72.28 12.28	2237 4.04 27.72 28.20	8070 14.56
More than 2 feet but no more than 3.5 feet	2134 3.85 88.88 4.49	267 0.48 11.12 3.37	2401 4.33
More than 3.5 feet but less than 6 feet	9067 16.36 86.02 19.09	1473 2.66 13.98 18.57	10540 19.02
At least 6 feet	23736 42.83 87.67 49.99	3338 6.02 12.33 42.08	27074 48.86
Total	47484 85.68	7933 14.32	55417 100.00

Table of Drainage by Municipalities			
Drainage	**Septic System Lies Within a Municipality?**		
Frequency/Percent/Row Pct/Col Pct	**No**	**Yes**	**Total**
Excessively	23506 50.12 87.67 56.97	3305 7.05 12.33 58.65	26811 57.17
Well	215 0.46 87.40 0.52	31 0.07 12.60 0.55	246 0.52
Moderately Well	9913 21.14 86.61 24.03	1532 3.27 13.39 27.19	11445 24.41
Somewhat Poorly	4429 9.44 89.97 10.73	494 1.05 10.03 8.77	4923 10.50
Poorly	1901 4.05 90.52 4.61	199 0.42 9.48 3.53	2100 4.48
Very Poorly	1297 2.77 94.60 3.14	74 0.16 5.40 1.31	1371 2.92
Total	41261 87.98	5635 12.02	46896 100.00
Frequency Missing = 8521			

Table of WAVA Protection Zone by Average Water Table Depth						
WAVA Protection Zone	**Average Water Table Depth**					
Frequency **Percent** **Row Pct** **Col Pct**	**≤ 1 foot**	**> 1 but ≤ 2 feet**	**> 2 but ≤ 3.5 feet**	**> 3.5 but < 6 feet**	**≥ 6 feet**	**Total**
1	1309 2.36 7.34 17.85	6539 11.80 36.66 81.03	910 1.64 5.10 37.90	1864 3.36 10.45 17.69	7214 13.02 40.45 26.65	17836 32.19
2	4914 8.87 14.86 67.02	1461 2.64 4.42 18.10	1303 2.35 3.94 54.27	7663 13.83 23.17 72.70	17734 32.00 53.62 65.50	33075 59.68
3	1109 2.00 24.61 15.13	70 0.13 1.55 0.87	188 0.34 4.17 7.83	1013 1.83 22.48 9.61	2126 3.84 47.18 7.85	4506 8.13
Total	7332 13.23	8070 14.56	2401 4.33	10540 19.02	27074 48.86	55417 100.00

Table of WAVA Protection Zone by Drainage							
WAVA Protection Zone	**Drainage**						
Frequency Percent Row Pct Col Pct	**Excessively**	**Well**	**Moderately Well**	**Somewhat Poorly**	**Poorly**	**Very Poorly**	**Total**
1	7183 15.32 65.09 26.79	23 0.05 0.21 9.35	2507 5.35 22.72 21.90	413 0.88 3.74 8.39	239 0.51 2.17 11.38	671 1.43 6.08 48.94	11036 23.53
2	17506 37.33 55.66 65.29	219 0.47 0.70 89.02	7917 16.88 25.17 69.17	3988 8.50 12.68 81.01	1344 2.87 4.27 64.00	479 1.02 1.52 34.94	31453 67.07
3	2122 4.52 48.15 7.91	4 0.01 0.09 1.63	1021 2.18 23.17 8.92	522 1.11 11.84 10.60	517 1.10 11.73 24.62	221 0.47 5.01 16.12	4407 9.40
Total	26811 57.17	246 0.52	11445 24.41	4923 10.50	2100 4.48	1371 2.92	46896 100.00
Frequency Missing = 8521							