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

DATE AND TIME: **July 1, 2009 at 10 am**

PLACE: Gulf Coast Research and Education Center
14625 County Road 672
Wimauma, FL 33598
813-634-0000

To attend via Conference Call: 1-888-808-6959
Conference Code: 1454070#

This meeting is open to the public

AGENDA: FINAL 6/29/2009 Elke Ursin

1. Introductions and Housekeeping
2. Review Minutes of Meeting May 27, 2009 and May 28, 2009
3. Discussion on the Florida Nitrogen Reduction Strategies Study
4. Lunch
5. Brief Updates on Ongoing and Future Projects
6. Other Business
7. Public Comment
8. Closing Comments, Next Meeting, and Adjournment

OPTIONAL tour of Gulf Coast Research and Education Center to be held after the meeting.

Attachment I for Florida Onsite Sewage Nitrogen Reduction Strategies Study: Technology Evaluation, Characterization of Environmental Fate and Transport, and an Assessment of Costs

A. SERVICES TO BE PROVIDED

1. Definition of Terms

a) Contract Terms

1. Department – Florida Department of Health
2. FAC – Florida Administrative Code
3. FDOH – Florida Department of Health or the department
4. IT – Information Technology - DOH division responsible for approving and setting DOH standards for computer hardware, off-the shelf software, and approving customized applications
5. QAPP – Quality Assurance Project Plan
6. RRAC – Research Review and Advisory Committee, a committee with the Florida Department of Health, Division of Environmental Health, that develops priorities for research in onsite sewage, reviews and ranks research proposals, reviews and comments on project reports, and accepts as complete final reports
7. State - The State of Florida and legally authorized employees, agents, contractors, or vendors acting on behalf of the aforementioned for the purpose of conducting State business
8. TRAP – Technical Review and Advisory Panel, a panel with the Florida Department of Health, Division of Environmental Health, that assists the department with rule adoption

b) Program Specific Terms

1. ATU – Aerobic treatment unit, a treatment receptacle that utilizes air to further treat wastewater prior to discharge into a drainfield

2. CBOD5- The carbonaceous biochemical oxygen demand over a 5-day period (mg/L) determined by EPA 405.1 or SM5210 B

3. Conventional drainfield material – Gravel as specified in 64E-6.014(5) FAC

4. Conventional System – Standard septic tank and drainfield to treat wastewater on site that does not perform advanced treatment

5. Enterococci – bacteria indicating fecal contamination determined by EPA 1600 or SM 9230 C

6. Fecal Coliform – fecal bacteria that form blue colonies after incubation on M-FC medium (SM 9222D)

7. Florida onsite sewage nitrogen reduction strategies study – study that is subject of this contract

8. H_2S – Hydrogen sulfide concentration in a water sample

9. Media – Material that effluent from a septic tank or pretreatment device passes through prior to reaching the groundwater. This may include soil, saw dust, zeolites, tire crumbs, vegetative removal, sulfur, spodosols, or other media

10. memo – in the context of task D, a report that describes the methods and results of work on a subtask, including electronic copies of input, output and model files as applicable

11. OSTDS – Onsite Sewage Treatment and Disposal Systems

12. PAC – Project Advisory Committee. Committee made up of renowned experts in the field to provide input, review, and technical advice to the project team to ensure scientifically valid results, efficient experimental designs, and defensible testing conditions

13. Passive – A type of onsite sewage treatment and disposal system that excludes the use of aerator pumps and includes no more than one effluent dosing pump with mechanical and moving parts and uses a reactive media to assist in nitrogen removal

14. PNRS -Passive Nitrogen Removal Study – study completed for DOH under contract CORY6 in 2007 and 2008, now referred to as phase I (PNRS I). A second phase of this study (PNRS II) is part of the scope

15. PBTS – Performance Based Treatment System, a type of OSTDS that has been designed to meet specific performance criteria for certain wastewater constituents

16. Reactive media – Media that reacts with wastewater to reduce nitrogen concentrations

17. SO_4 – Sulfate concentration in a water sample

18. TN - Total Nitrogen concentration in a water sample (mg/L), determined as sum of nitrate/nitrite (EPA 353.2), total Kjeldahl nitrogen (EPA 351.2)

19. Total Coliform - Number of coliforms per sample determined by method SM 9222B

20. TP - Total Phosphorus concentration in a water sample (mg/L) determined by method EPA 365.1 or 365.3

21. TSS - Total Suspended Solids concentration in a water sample (mg/L) determined by method EPA 160.2

22. Wekiva Study Area – Area delineated by the Wekiva Parkway and Protection Act of 2004 (http://www.dca.state.fl.us/fdcp/DCP/wekiva/wekivaact/study%20area%20map.pdf)

2. General Description

a) General statement: The provider will conduct a study to examine nitrogen reduction strategies for onsite sewage treatment and disposal systems in the State of Florida.

b) Authority: The Bureau of Onsite Sewage Programs operates under Section 381.0065 et seq. of the Florida Statutes. 381.0065(3)(c) directs the department to "develop a comprehensive program to ensure that onsite sewage treatment and disposal systems … are sized, designed, constructed, installed, … operated, and maintained … to prevent groundwater contamination and surface water contamination".

Laws of Florida, 2008-152, includes Specific Appropriation 1682 that directs: "$1 million from the Water Protection and Sustainability Program Trust Fund shall be transferred to the Department of Health to further develop cost-effective nitrogen reduction strategies. The Department of Health shall contract, by request for proposal, for Phase I of an anticipated 3-year project to develop passive strategies for nitrogen reduction that complement use of conventional OSTDS. The project shall be controlled by the Department of Health's research review and advisory committee and shall include the following components: 1) comprehensive review of existing or ongoing studies on passive technologies; 2) field-testing of nitrogen reducing technologies at actual home sites for comparison of conventional, passive technologies and performance-based treatment systems to determine nitrogen reduction performance; 3) documentation of all capital, energy and life-cycle costs of various technologies for nitrogen reduction; 4) evaluation of nitrogen reduction provided by soils and the shallow groundwater below and down gradient of various systems; and 5) development of a simple model for predicting nitrogen fate and transport from onsite wastewater systems. A progress report shall be presented to the Executive Office of the Governor, the President of the Senate and the Speaker of the House of Representatives on February 1, 2009, including recommendations for funding additional phases of the study."

c) Scope of Service: The provider shall perform technology evaluations; field work and monitoring of OSTDS and groundwater; analysis and evaluation of data, and modeling. The provider shall also reach conclusions and provide recommendations.

In particular, the provider shall perform tasks in furtherance of the following scope:

1) Perform a comprehensive review of existing or ongoing studies on passive technologies;

2) Perform field-testing of nitrogen reducing technologies at actual home sites for comparison of conventional, passive technologies, and performance-based treatment systems to determine nitrogen reduction performance;
3) Provide documentation of all capital, energy, and life-cycle costs of various technologies for nitrogen reduction;
4) Perform an evaluation of nitrogen reduction provided by soils and the shallow groundwater below and down gradient of various systems;
5) Develop a simple model for predicting nitrogen fate and transport from onsite wastewater systems

Deliverables will be reviewed by the Florida Department of Health and its Research Review and Advisory Committee. The provider shall prepare deliverables using software and hardware applications that are consistent with department standards (currently Microsoft software, PC-compatible hardware).

d) Major Program Goals: The goals of the Florida Onsite Sewage Nitrogen Reduction Strategies Study are to develop passive strategies for nitrogen reduction that complement the use of conventional onsite sewage treatment and disposal systems, to systematically evaluate the field performance and associated costs of such OSTDS nitrogen reduction strategies in comparison to conventional and existing technologies and to assess and model the environmental fate and transport of nitrogen discharged to the environment. Nitrogen loading is important to the mission of the Bureau of Onsite Sewage Programs: “Protecting the public health and environment through a comprehensive onsite sewage program”.

B. MANNER OF SERVICE PROVISION

1. Service Tasks

a) Task List

This section describes the tasks, subtasks and deliverables associated with the Florida Onsite Sewage Nitrogen Reduction Strategies project. Following the task and deliverable descriptions is a table (Table I) summarizing the estimated cost components by deliverable and year.

Some tasks are identified to occur in years after the first year. Funding for these tasks is not available at the time of execution of this document and is uncertain. Details of the tasks identified for subsequent years, including deliverables and prices, will be determined in an amendment to this contract before work on these tasks begins.

Task A: Technology Evaluation for Field Testing: Review, Prioritization, and Development

The provider will:

- Perform literature review to evaluate nitrogen reduction technologies
- Develop technology classification scheme
- Formulate criteria for ranking of nitrogen reducing technologies
- Rank and prioritize nitrogen reduction technologies for field testing

- Conduct technology ranking workshop with RRAC
- Prepare innovative systems application
- Conduct Technology Development in Passive Nitrogen Removal Study II

Sub-tasks and Deliverables

1. **Literature Review (draft)**
   The literature review of nitrogen reducing technologies completed as part of the Passive Nitrogen Removal Study commissioned by FDOH in 2007 will be updated with information which has emerged since the original study. The scope of the review will be expanded from the Passive Nitrogen Removal Study to include source separation, active systems, modifications to conventional onsite treatment systems, including modified soil treatment units, in addition to passive systems. The provider shall produce a searchable literature reference database, compatible with Endnote X or other department approved software format. The literature reference database shall not infringe on any copyrights. The provider shall also produce a technology database, in tabular or other department approved format, that will facilitate establishment of categories for summary and comparison, assessment of individual citations within the context of organizational categories, and analysis of trends and differences among systems. The categories shall include items such as treatment classification, media type, wastewater source, treatment configuration, documented effectiveness, documented and theoretical longevity, cost, nutrient recovery, and effect of water chemistry. The provider shall summarize the updated literature review in a report.

   Deliverables: Draft updated literature reference database; draft updated technology database; draft updated literature review report.

2. **Literature Review (final)**
   The department will gather comments on the draft documents of sub-task A1 from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables for the literature review within one month of receiving comments.

   Deliverables: Updated literature reference database; updated technology database; updated literature review report.

3. **Classification of Technologies (draft)**
   The provider will develop a scheme to classify and group identified nitrogen reduction technologies and practices to summarize the literature and facilitate comparisons between similar technologies. Four classifications are envisioned: waste stream alteration (such as blackwater systems, and urine separation); conventional OSTDS alteration (such as dosed vs. gravity systems, operational strategies, installation depth); passive nitrogen removal (OSTDS systems using no more than one pump and excluding aerators); active nitrogen removal (mechanical systems utilizing more than one pump or aerators). The preliminary classification scheme will be presented to the RRAC at a workshop, which will provide a forum for full vetting and discussion.

   Deliverable: Draft classification scheme of technologies report.

4. Technology Ranking Criteria (draft)

The provider will develop evaluation criteria to rank technologies and practices to determine which best meet the goals of the project and shall have priority for further development or field evaluation. Criteria will build on and may lead to revisions to the categories developed in the literature review and include characterizations of nitrogen removal effectiveness, maturity of technology including status in Florida, costs (energy, maintenance, monitoring, replacement of parts and media), critical knowledge gaps, likelihood of success, need to field test, and the feasibility of obtaining data from existing installations in Florida. The provider will evaluate the technologies classified in sub-task A3 relative to each criterion. The provider will propose draft sets of weights to characterize the relative importance of each criterion for a) work during the initial funding period; b) work during future funding periods. The provider will prepare a working document, such as a calculation table, that shows the ranking of technologies given the evaluations relative to the criteria and the relative weights of each criterion. The provider will summarize criteria and weights in a report.

Deliverables: Draft summary of criteria and proposed weights for short-term and long-term testing, working document for obtaining technology ranks from evaluations to criteria and criteria weights.

5. Priority List for Testing (draft)

The provider will propose additional criteria to consider in establishing priorities for testing from the top ranked technologies and practices. Such criteria may address representation of several technology classifications (sub-task A3), similarity of technologies or several maturity levels in the study. The purpose of prioritization is to select the more promising technologies that may not have sufficient prior testing or that may be differently configured to improve performance, and to avoid duplicating testing where substantial experience already exists. The provider will also list technologies to be considered for sub task A10 and A11 (innovative system application assistance).

Deliverable: Draft summary of additional criteria; Draft priority list for testing.

6. Technology Classification, Ranking and Prioritization Workshop

The provider will present the preliminary technology classification, rankings and priority lists developed in sub-task A3, A4 and A5 to the RRAC at a public workshop, which will provide a forum for full vetting and discussion of evaluation criteria and their assigned weights. This one day roundtable workshop with the Research Review and Advisory Committee (RRAC) will present the results and recommendations contained in the draft reports of technology classification, ranking and prioritization. The provider will facilitate RRAC's development of guidance on modifications to the draft classification, ranking and prioritization. Unless this guidance results in a need for further information collection by the provider, RRAC will provide comments on the priority lists for the initial and future funding periods. The comments and concerns of the RRAC will be documented and incorporated into the three final reports.

Deliverable: Public RRAC-Workshop, Summary of the workshop.

7. Classification of Technologies (final)

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the final classification scheme.

Deliverable: Final report.

8. Technology Ranking Criteria (final)

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the final technology ranking scheme.

Deliverable: Final report.

9. Priority List for Testing (final)

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the draft priority list.

Deliverable: Final report.

10. Innovative Systems Application Report (draft)

Based on the technology evaluation in sub-task A5, the provider will identify emerging and innovative technologies that have not matured or are not currently permitted by FDOH but rank high for consideration for testing. For up to five technologies, the provider will complete or assist the manufacturer if appropriate, in completing an innovative system application for acceptance by FDOH, for which field testing of Task B will be part of the proposed innovative system monitoring protocol.

Deliverable: Innovative system application (per technology, up to five).

11. Innovative Systems Application Report (final)

The provider will respond or assist the manufacturer in responding to any requests for additional information by the department in regard to the innovative system applications.

Deliverable: Additional information resulting in an innovative permit by the department (per technology if additional information is requested by the department, up to five).

12. Identification of Test Facility Sites (per agreement)

The provider will identify and evaluate potential sites for their suitability for establishing test centers. Among these potential sites will be the Gulf Coast Research and Education Center and the University of South Florida (USF) Lysimeter Station. Test facility site evaluations will include the feasibility of multiple treatment technology testing as well as the ability to monitor non-commingled subsurface plumes and the assessment of subsurface nitrogen fate and transport. Salient issues include space availability, site access, wastewater source of sufficient quantity and availability, subsurface hydrology, power supply, and security. The provider will establish agreements with the respective property owners for establishing and operating test centers on their land, and for ownership and continued use after project is completed.

Deliverable: Test Facility Site Agreement(s).

13. Passive Nitrogen Removal Study II Quality Assurance Project Plan (draft)

The provider will develop a draft QAPP that documents the objectives, experimental design, system operation, analytical methods, and sampling frequencies to be used in PNRS II. The objectives are to 1) directly address denitrification, which the provider proposes as the highest priority onsite nitrogen removal knowledge gap; 2) expand the

performance envelope for the innovative unsaturated filter media filters demonstrated in the PNRS I; 3) delineate TN removal capability of PNRS I media using pre-denitrification; 4) establish test systems that are close to full scale; 5) enable critical testing of a large number of systems to be completed within the first project year; 5) produce key data which can then be used directly for design of denitrification filters for subsequent full scale testing at home sites; 6) develop data for preliminary life cycle cost analysis and resource needs.

The experimental design is expected to consist of a battery of passive nitrogen removal treatment systems fabricated to evaluate salient design features of passive nitrogen removal systems including filter media, media stratification, surface loading rates, filter length, geometry, and aspect ratios, and unsaturated filter recycle for pre-denitrification and alkalinity recovery. The test configuration is anticipated to consist of a common wastewater feedstream, a suite of vertical unsaturated filters supplied by a common septic tank effluent (STE) feedstream, mixing of the unsaturated filter effluents to provide a common influent to the denitrification filters, a suite of horizontal saturated filters using lignocellulosic and sulfur reactive media and liquid carbon dosing as well as other system designs, and a means of final effluent disposal. The draft QAPP will address additives issues per Florida Administrative Code (FAC) Chapter 64E-6. The draft QAPP will propose where the test facility will be located and operated to determine nitrogen removal performance and optimize design variables.

Deliverable: Draft QAPP.

14. Recommendation for Process Forward

Based on the details agreed upon in the draft QAPP, the provider will develop a recommendation whether or not to proceed with the remainder of Task A as outlined below, or recommend an amendment to this contract, and present a revised cost estimate. This will include a recommendation on whether the USF Lysimeter Station should be renovated and utilized as a test facility for this project. Both the provider and FDOH shall reach a written agreement prior to moving forward with the remaining parts of Task A.

Deliverable: Meeting summary and recommended scope and budget revisions.

15. PNRS II Quality Assurance Project Plan (final)

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final QAPP to be approved by FDOH.

16. PNRS II Specification Reports

The provider will prepare procurement and assembly reports that document design and fabrication of the test systems, procurement of treatment system construction materials as well as the media for the filters, site preparation, instrumentation, and operational testing of the PNRS II systems.

Deliverables: Specification reports and as-built diagrams of the treatment systems tested as part of PNRS II.

17. Test Facility Design (50%)

The provider will design the test facility. Test facility 50% design submittal will include preliminary layout sketches and design concepts and criteria. Provisions for supporting the installation and operation of in-tank treatment systems or unsaturated groundwater monitoring systems, including supply of power, individual energy monitoring for each treatment system or treatment system sub-components, a common wastewater source at controllable flowrates, provision for effluent routing to soil treatment units, sampling collection and monitoring appurtenances, and staging of field analytical work and sampling will be included. If the USF Lysimeter Facility is recommended as a test facility, the renovations of the facility necessary for its continued use will be included in the design documents. The 50% design documents will be submitted to FDOH for review and comment. The department will provide comments within two weeks of receipt.

Deliverable: 50% design documents.

18. Test Facility Design (100%)

The provider and the department will agree on the design concepts based on review of the 50% design submittal. The provider will prepare a test facility 100% design submittal based on these concepts. The 100% design submittal will include all design details and technical specifications necessary to estimate construction cost. These documents will be submitted to FDOH for review and comment. The department will provide comments within two weeks of receipt.

Deliverable: 100% design documents.

19. Test Facility Design (Final)

In preparing the test facility final design submittal, the provider will include final revisions based on the review of the 100% design submittal. This will result in a set of signed and sealed contract documents suitable for obtaining competitive bids for facility construction.

Deliverable: Signed and sealed contract documents.

20. Test Facility construction bid acceptance

Provider will solicit bids, respond to bidder requests for information and prepare any necessary addenda. The provider will review bids for construction for completeness and conformance with contract documents. The provider will review qualified bids select a contractor for facility construction and contract with a contractor if the bid is within the amount allocated for construction in subtask A21-24 of this attachment or its amendments. If bids are above the allocated amount, the provider will notify the department immediately, justify why the costs are higher, and will not execute a sub-contract in excess of the current allotted funds prior to an approved amendment of the contract between the department and the provider. The provider will propose a contract amendment to increase funds or test facility design changes to decrease costs.

Deliverable: Contract with construction contractor.

21. Test Facility Construction (shop drawing review by provider)

The construction contractor will provide shop drawings that will be reviewed by the provider as necessary for conformance with the design concept and contract requirements.

Deliverable: Completed review of each shop drawing by provider as submitted to contractor.

22. Test Facility Construction (construction)

Provider will monitor facility construction as needed to monitor progress and conformance with design documents. This task will include the construction cost of the facility based on the accepted bid and any addenda. For budgeting purpose,, the provider and the department have assumed an arbitrary construction cost value in this scope and budget.

Deliverable: Construction Progress Report.

23. Test Facility Construction (substantial completion)

Provider will conduct one substantial completion site inspection to determine if the project is substantially complete. The inspection will result in the preparation of a punch list to be delivered to the contractor in writing for final completion.

Deliverable: Construction punch list.

24. Test Facility Construction (accept construction)

The provider will conduct one final inspection for the project to determine if the work has been completed in accordance with the contract documents and the punch list. Subsequent to this final inspection, the provider will recommend in writing final payment to the contractor and will make final payment to the subcontractor. The provider shall give written notice to FDOH that the work is complete. As-built drawings will then be developed by the provider for the facility.

Deliverable: As-built drawings of the test facility.

25. Sample Event Reports

The provider will provide sample event reports verifying operation of the test systems, flowrate monitoring, field parameter results, and chain of custody forms that document sample collection and delivery to the analytical laboratory. The number of events shall be determined in the QAPP and is subject to available funding.

Deliverables: Sampling event report.

26. Data Summary Reports

The provider will provide data reports that verify completion of analyses by an analytical laboratory and that include compiled data from field and analytical laboratory analyses in electronic and paper form.

Deliverables: Data Summary Reports (per event).

27. PNRS II Report (draft)

The provider will prepare a PNRS II report that includes PNRS II objectives, experimental methods, results, discussion, conclusions and recommendations. For each nitrogen reduction technology a technical description will be prepared that includes name, supplier, operating principles, salient physical description, flow sequence, pertinent design details, manufacturer or designer claims of treatment goals, and operating recommendations. The draft report will be provided to the department for comments from the department and other interested parties prior to submitting a final report.

Deliverable: Draft report.

28. PNRS II Report (final)

The department will gather comments on the draft report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final report.

29. Task A Final Report (draft)

The provider will submit a final report will summarize the results of the technology classification, ranking and prioritization efforts in Task A and provide recommendations for funding additional phases of the project. If warranted, this report will also recommend a revised priority list for testing of future systems.

Deliverable: Draft report.

30. Task A Final Report (final)

The department will gather comments on the draft report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final report.

Task B Field Testing of Technologies and Cost Documentation

The objectives of Task B are:

- Indentify home sites and establish use agreements
- Establish vendor agreements
- Quality Assurance Project Plan
- Design and construct test facilities
- Install field systems at test facilities and home sites
- Operate and monitor field systems
- Compile results in report format
- Provide technical description of nitrogen removal technologies
- Acceptance of systems by homeowners
- Conduct Life Cycle Cost Analyses

- Final Report for Task B

Sub-tasks and Deliverables

1. **Identification of Home Sites (per homeowner agreement)**
   The provider will identify individual homeowner sites for their suitability for establishing technologies for field evaluation. Criteria considered in the suitability will include homeowner willingness, site access, number of residents and continuousness of occupancy, power supply, security, location, adequate space, access for monitoring and maintenance, participation in previous or concurrent studies, and pre-existing treatment technologies. The provider will survey the homeowners and/or system users on use characteristics. Agreements will be established between homeowners and the provider for establishing and monitoring treatment systems. Written homeowner agreements will specify expected energy costs and the arrangements in regards to responsibility for application for permits, modifications, operation, maintenance, monitoring, inspections, removal or leaving the system in place at study termination. If a homeowner site will also be used for fate and transport studies (Task C), then access will be needed for monitoring equipment in the downgradient direction and lack of interference with other systems must be ascertained. Up to ten (10) homesites at various locations in Florida (e.g. Wekiva Study Area, Wakulla and south Florida) will be identified for testing under this task.

   Deliverable: Written agreements between homeowner and provider, completed homeowner survey.

2. **Vendor Agreement Report (per vendor agreement)**
   The provider will contact technology vendors to explain the testing project, to identify specifics of the technology offering and special considerations, to delineate to the vendor the arrangements by which testing will be conducted, to identify specific models to be tested, and to obtain a price quotation for purchase or ascertain vendor interest in donating a system. Vendors will agree to specifications that vendors will not be allowed to physically modify or manipulate equipment once installed. Any exceptions to this default policy will be fully documented. Up to 8 vendors will be identified for testing under this task.

   Deliverable: Written agreements between vendor and provider. .

3. **Quality Assurance Project Plan for Field Testing (draft)**
   A QAPP will be developed to document the objectives, specific systems for testing, and technology configurations that will be tested, operation of the systems, sampling and monitoring methodology and frequency, analytical parameters and methods, and data and document management. The monitoring program will develop performance data sets for total treatment systems and also for intermediate points such as aerobic treatment unit effluent or mixed aerobic effluent with STE and pre-denitrification. Monitoring of intermediate locations will provide data sets for separate evaluation of loading and performance for individual treatment components. The anticipated monitoring program will begin six weeks after startup and approximately 8 sample events per system will be conducted. Monitoring points will include septic tank effluent (STE), aerobic effluent (if applicable), and denitrification filter effluent (if applicable). Anticipated parameters for influent STE include TSS, cBOD5, TKN, NH4+, and NOx, as well as temperature, pH, alkalinity, dissolved oxygen and oxidation reduction potential.

Stage 1 and Stage 2 effluents will be monitored for the same parameters, with less frequent analyses for TSS and cBOD5. Lower frequency monitoring will be conducted as necessary for a number of parameters: total phosphorus, PO4, and fecal coliform in STE, aerobic and denitrification effluents, SO4 and H_2S in sulfur denitrification filter influent and effluent, and cBOD5 in lignocellulosic filter effluents.

The provider will develop a data management and storage template for cataloging and assessing performance data from disparate treatment systems and technology combinations and influent wastewater characteristics.

The selection of systems for testing will follow the recommendations developed in Task A. The provider will consider the use of and the addition of components to existing systems.

The exact sequencing of installations over the multi-year project will be established in the QAPP based on the priority list developed in Task A and refinements through the study.

Deliverable: A draft QAPP within three months of notice to proceed.

4. Recommendation for Process Forward (per meeting)

Based on the details agreed upon in the final QAPP, the provider will develop a revised cost estimate and recommendation as to the number of systems included in the initial and future funding phases and whether or not to proceed with the remainder of Task B as outlined below, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task B.

Deliverable: Meeting summary and recommended scope and budget revisions.

5. Quality Assurance Project Plan (final)

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final QAPP accepted by FDOH.

6. Field Systems Installation Report (per system)

The provider will submit existing system evaluations performed by individuals authorized by the department to perform such work, modifications, or new system permits as appropriate for the respective home sites and shall ensure proper permitting through the department for such permits. The provider will be, or will hire, an engineer of record for innovative or performance-based treatment system applications and identify the maintenance entity for each system. The provider will be responsible for individual field test systems to be purchased or fabricated and installed at individual homeowner sites. Field system installation will include providing all materials and assembly needed to produce a fully functional and working treatment system, including initial test evaluation and installation report. If necessary an existing system evaluation will be conducted per FAC Chapter 64E-6. The provider will ensure that operating permits and maintenance entity contracts for the system exist, as required by FDOH. The provider will address the event if one or several of the homeowners seek to withdraw from the program by

assisting with installing a replacement onsite wastewater system or fund system repair or maintenance.

Deliverable: Copy of final system permit including operating permit if necessary; detailed installation report, construction costs.

7. Field Systems Monitoring Report (per event)

Subject to details specified in the QAPP, the provider, in cooperation with the homeowner and the maintenance entity, will operate field technologies for a base period of up to 24 months and monitored for at least the following parameters: temperature, pH, alkalinity, DO, ORP, TKN, NH_3, NO_x, TSS, C-BOD_5. Additional parameters will be monitored less frequently for other parameters of interest (COD, TP, PO_4, fecal coliform, total enterococci, and SO_4 and H_2S for systems with sulfur-based denitrification).

The provider will submit deliverables after each monitoring event for the systems installed in Task B6, which will also include results for flowrate or treated volume, electricity and/or media use, field parameter results, chain of custody forms for samples delivered to analytical laboratory, analytical laboratory reports, and compiled results.

Deliverables: Monitoring reports in tabular form.

8. Field Systems Operation, Maintenance, and Repairs Report (per system)

The provider, in cooperation with the homeowner, maintenance entity, and county health department, will maintain copies of records of repairs, maintenance actions, inspection results and system observations. The provider will develop a report form for each entity and a summary report for each treatment system. Records will include date, description of repair and pertinent factors, and repair cost.

Deliverable: Report form for each system, summary report of observations.

9. Technical Description of Nitrogen Reduction Technology Report

The provider will develop a technical description for each nitrogen reduction technology studied, including information such as if the technology is vendor supplied or custom design, trade name, model number, unit specifications, purported operating principals, description of process flows and hydraulics, physical features including tanks, fixed film media, pumps, aerators, and other appurtenances, addition of chemicals or other materials, performance claims, observations, operational experience and measured performance during the study. The report will include a brief description of nitrogen removal processes and factsheets for each nitrogen removal system studied.

Deliverable: Draft and final nitrogen reduction technology report.

10. Acceptance of System by Owner Report (per system)

At the conclusion of system monitoring, a homeowner acceptance document will be provided that transfers complete ownership and operational responsibility of the system to the homeowner. In the event the homeowner does not desire to keep the study systems, the funds from Task B6 will be utilized to restore the system to its original condition.

Deliverable: Acceptance of System by Owner Report.

11. Life Cycle Cost Analysis draft (template and user guidelines)

The provider will develop a Life Cycle Cost Analysis (LCCA) template, with the PNRS I LCCA as a starting point and will summarize the features of the template in a user guidelines document. Costs will be expressed in a variety of ways, such as uniform annual cost, cost effectiveness of nitrogen removal, marginal cost effectiveness of additional treatment components etc. The analysis will include equipment, material and installation costs for treatment systems, recurrent costs for energy, maintenance, repair, permitting and monitoring, and replacement of materials such as reactive media or electron donor supply for denitrification. Materials costs include the purchase cost and delivery cost of vendor systems, or costs to purchase and prepare materials and media for custom designed systems. Use of a common LCCA template will enable all nitrogen removal technologies to be evaluated on an equivalent basis, and will be useful for future systems that are not evaluated within this project. In developing the template, the provider will illustrate its use with existing data, such as developed as part of Task A, the Keys Onsite Wastewater Nutrient Reduction Systems study or the information obtained from homeowners surveyed during this task.

Deliverable: Draft LCCA template and user guidelines.

12. Life Cycle Cost Analysis final (template and user guidelines)

The department will gather comments on the draft LCCA from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final LCCA template and user guidelines.

13. Life Cycle Cost Analysis Report (per system)

Based on the LCCA Template, the provider will conduct an LCCA analysis for each nitrogen reduction technology evaluted during field testing using actual purchase prices, installation cost estimates, and operational costs records.

Deliverable: LCCA Report (per system tested) including cost analysis.

14. Task B Final Report (draft)

The provider will develop a final report that will summarize the results of the Task B evaluations of treatment technologies, including an aggregation of technology reports and LCCA completed over the course of the study. The report will provide summary recommendations for deploying the tested technologies to meet the objectives of the Florida Onsite Nitrogen Removal Strategy. The report will include the data on which it is based, in tabular form.

Deliverable: Draft Task B Final Report.

15. Task B Final Report (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Task B Final Report.

Task C. Evaluation of Nitrogen Reduction Provided by Soils and Shallow Groundwater

The objectives of Task C are:

- Critical characterization of nitrogen reduction in Florida soils and groundwater
- Develop Quality Assurance Project Plan
- Establish a controlled test facility
- Indentify home sites and make use agreements
- Instrument field systems at test facility and home sites
- Operate and monitor field systems
- Compile data in report format
- Close-out of home sites and controlled test facility
- Provide Final Report for Task C

Sub-tasks and Deliverables

1. **Literature Review (draft)**
   The provider will review available literature to assess the current status of knowledge related to nitrogen fate and transport in saturated and unsaturated soils. Literature from other fields (e.g. agriculture, agronomy, hydrogeology, soil science, environmental science, ecology, biosystems engineering) will be reviewed for its application to OSTDS in Florida. Particular focus will be placed on studies that have measured and documented denitrification rates in soil and groundwater. This review will expand on the literature review on denitrification in soil performed for the department's Wekiva study and a complementary literature review, recently completed by the Colorado School of Mines. Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

   Deliverable: Draft literature review and updated reference database.

2. **Literature Review (final)**
   The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

   Deliverable: Final report and updated reference database.

3. **Quality Assurance Project Plan for field and test center sites (draft)**
   The provider will develop a QAPP to document Task C objectives and the monitoring framework for field sites. Information gained during the literature review conducted as part of Task D will be incorporated, as appropriate, into the monitoring framework to ensure data required for model inputs will be collected. The monitoring framework will encompass the "Observational Approach" to allow information obtained in the field and during other tasks (e.g., Task D2, D7, D10, etc.) to be utilized to direct subsequent monitoring. The QAPP will describe the number and type of homeowner systems to be monitored, sample frequency and duration, analytical parameters and methods, data handling and management, and document control.

It is anticipated that each site will be monitored to delineate the OSTDS effluent quality, hydraulic and nitrogen loading rates to the soil, and potential groundwater impacts. Flow meters will be installed as needed to determine actual soil loading rates. Shallow piezometers will be installed within the soil treatment unit and downgradient of the system to evaluate nitrogen fate and transport. Tracer tests using a conservative tracer will be conducted to determine connectivity of the OSTDS-vadose zone-groundwater system as well as evaluate subsurface travel times. Water quality analyses will be conducted on all field samples and will include temperature, total nitrogen, ammonium nitrogen, nitrate-nitrogen, and chloride. Less frequent analyses will be conducted on samples as necessary and will include pH, alkalinity, cBOD5, total phosphorus, anions, cations, fecal coliform, and E. coli. Should a total nitrogen plume be identified from an OSTDS, additional piezometers may be installed to enable further hydrogeologic characterization affecting fate and transport (i.e., groundwater velocity, hydraulic gradient) and assessment of nitrogen concentrations over time. This field monitoring framework will enable evaluation of the current nitrogen reduction in soil and groundwater and provide input to parameter selection for Task D. Results will also enable validation and verification of simple models developed and refined as described in Task D.

It is anticipated that at least two subsurface monitoring sites will be established at each of three dispersed locations in Florida to provide geographical variety. Example candidate locations are the Wakulla area (north Florida), the Wekiva area (central Florida), and a south Florida site to be determined. It is anticipated that four monitoring events will be conducted at each site. Sites will be selected and monitored to encompass a range of conditions affecting nitrogen mass loading to the environment and the resulting groundwater concentrations. Site selection will be leveraged, to the extent possible, with Task B to enable complete evaluation of the onsite system from STE through nitrogen treatment units and including soils. The key conditions of importance will be the hydraulic loading rate of effluent to the soil, and the effluent quality discharged to the soil.

It is anticipated that a test center will also be established in this task to provide performance evaluations of multiple wastewater treatment systems; systems that will provide a broad range of nitrogen removal capabilities. The subsequent application of treated effluent to soil treatment and dispersal units will result in separate, non-commingled plumes which can be used for monitoring of nitrogen fate and transport in the subsurface. Subsurface monitoring will be used to develop data sets for nitrogen fate and transport for parallel systems receiving widely varying nitrogen concentrations. Subsurface sites at the test center will be monitored for a variety of parameters at different frequencies, including pH, alkalinity, DO, ORP, TKN, NH_3, NO_x, C-BOD_5, TP, PO_4, fecal coliform, and total enterococci. Duration and frequency of monitoring at each of the sites will be specified in the QAPP.

Deliverables: Draft QAPP for field sites and test center.

4. Recommendation for Process Forward

Based on the details agreed upon in the draft QAPP, the provider will develop a revised cost estimate and a recommendation whether or not to proceed with the remainder of Task C as outlined below, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task C.

Deliverable: Meeting summary and recommended scope and budget revisions.

5. **Quality Assurance Project Plan (final)**
   The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

   Deliverable: Final QAPP acceptable to FDOH.

6. **Home Site Selection (per homeowner agreement)**
   Candidate homeowner sites will be identified by the provider for subsurface monitoring activities. FDOH permit information will be gathered by the provider as available on candidate sites, and a system inspection and evaluation conducted on selected sites. Monitoring at the sites will be used to assess the current level of nitrogen reduction obtained by Florida soils, to assess groundwater impacts due to conventional and nitrogen removal systems, and to provide data for parameter estimation, and verification and validation of models developed in Task D. Sites will be monitored by the provider to encompass a range of conditions affecting nitrogen mass loading to the environment and the resulting groundwater concentrations. Specifically, key conditions of importance will be the hydraulic loading regime (e.g., trench vs. drip), the rate of effluent discharged to the soil, the effluent quality (e.g. BOD, nitrogen) discharged to the soil, and the density of OSTDS. Factors considered during site selection include homeowner amenability, site access, occupancy, system age, type of system and daily household flow. While numerous subtleties exist between individual OSTDS, monitoring a range of these key conditions and factors will enable comparison of sites.

   Agreements will be established with homeowners by the provider for establishing monitoring systems. It is anticipated that up to eight (8) homeowner sites will be identified for potential inclusion in the study. Task B7 will establish which of these will be included for monitoring.

   Deliverable: Homeowner agreement.

7. **Instrumentation of Home Sites Report (per site)**
   The QAPP will document the objectives, monitoring framework, sample frequency and duration and analytical methods to be used at the home sites. Instrumentation of the sites, in accordance with the QAPP, will include providing all materials and assembly needed to establish the monitoring framework at each home site, and will be performed by the provider. An installation report will be provided by the provider for each of up to six (6) individual home sites describing the monitoring system.

   Deliverable: Installation report.

8. **Monitoring Report (per sampling event, per site)**
   The monitoring framework will be described in the QAPP including number of sampling points at each site, sampling frequency and duration, and analytical parameters. Monitoring reports, based on the QAPP framework, will be provided that describe site conditions and interim sample results (i.e., compiled data from field and analytical laboratory analyses).

Deliverable: Monitoring report.

9. Draft Site Summary and Close-out Report (each site)

The provider will summarize the observations for each site, including site conditions, onsite system characteristics and soil and ground water concentrations and conditions found.

At the conclusion of home site monitoring, the provider will submit homeowner acceptance documents to the department that either ownership and responsibility of monitoring points will be transferred to the homeowner (e.g., piezometers) or all monitoring points will be removed by the provider and the site shall be returned to its original configuration.

A report will be provided to the department to document close-out of each home site. The draft close-out reports will be submitted to FDOH for review and comment.

Deliverable: Draft Site Close-out report.

10. Final Site Close-Out Report (per site)

Comments will be provided by the department within two weeks of receipt and the provider will prepare a final close-out report.

Deliverable: Final site close-out report acceptable to FDOH.

11. Test Facility Design (50%)

The Gulf Coast Research & Education Center of the University of Florida (or other location) will be evaluated by the provider for suitability for establishing a controlled test site for side-by-side evaluation of multiple soil treatment unit regimes and the resulting nitrogen groundwater fate and transport. This task will be leveraged with tasks B and D.

The provider will design the test facility. The Test facility 50% design submittal will include preliminary layout sketches and design concepts and criteria. Provisions for supporting installation, operation, and monitoring of treatment systems and groundwater plumes, including controllable dosing flowrates, effluent quality, soil hydraulic loading rates, and staging for field efforts. The monitoring framework will support evaluation of time and spatial variations of soil treatment and groundwater plume configurations (e.g. groundwater flow velocity, concentrations, etc.). Provisions will be made for supporting the installation and operation of in-tank treatment systems or unsaturated groundwater monitoring systems, including supply of power, individual energy monitoring for each treatment system or treatment system sub-components, a common wastewater source at controllable flowrates, provision for effluent routing to soil treatment units, sampling collection and monitoring appurtenances, and staging of field analytical work and sampling will be included.

The 50% design documents will be submitted to FDOH for review and comment. Comments will be provided by the department within two weeks of receipt.

Deliverable: 50% design documents.

12. Test Facility Design (100%)

The provider and the department will agree on the concepts based on review of the 50% design submittal. The provider will prepare the test facility 100% design submittal based on these concepts. The 100% design submittal will include all design details and technical specifications necessary to estimate construction cost. These documents will be submitted to FDOH for review and comment. Comments will be provided by the department within two weeks of receipt.

Deliverable: 100% design documents.

13. Test Facility Design (Final)

In preparing the test facility final design submittal, the provider will include final revisions based on the review of the 100% design submittal. This will result in a set of signed and sealed contract documents suitable for obtaining competitive bids for facility construction.

Deliverable: Signed and sealed contract documents.

14. Test Facility construction bid acceptance

Provider will solicit bids, respond to bidder requests for information and prepare any necessary addenda. Bids for construction will be reviewed for completeness by the provider and conformance with contract documents. Qualified bids will be reviewed by the provider and a contractor will be selected by the provider for facility construction. The provider will contract with a contractor if the bid is within the amount budgeted in this attachment or its amendments.

If bids are above the allocated amount, the provider will notify the department immediately, justify why the costs are higher, and will not execute a sub-contract in excess of the current allotted funds prior to an approved amendment of the contract between the department and the provider. The provider will propose a contract amendment to increase funds or test facility design changes to decrease costs.

Deliverable: Contract with construction contractor.

15. Test Facility Construction (shop drawing review)

The construction contractor will provide shop drawings that will be reviewed by the provider as necessary for conformance with the design concept and contract requirements.

Deliverable: Completed review of each shop drawing by provider as submitted to contractor.

16. Test Facility Construction (construction)

Provider will monitor facility construction as needed to monitor progress and conformance with design documents. This task budget will include the construction cost of the facility based on the accepted bid and any addenda. For budgeting purposes, the provider and the department have assumed an arbitrary construction cost value in this scope and budget.

Deliverable: Construction Progress Report.

17. Test Facility Construction (substantial completion)

Provider will conduct one substantial completion site inspection to determine if the project is substantially complete. The inspection will result in the preparation of a punch list to be delivered to the contractor in writing for final completion.

Deliverable: Construction punch list.

18. Test Facility Construction (accept construction)

The provider will conduct one final inspection for the project to determine if the work has been completed in accordance with the contract documents and the punch list. Subsequent to this final inspection, the provider will recommend in writing final payment to the contractor and will make final payment to the subcontractor. Written notice shall be provided to FDOH that the work is complete. As-built drawings will then be developed by the provider for the facility.

Deliverable: As-built drawings of the test facility.

19. Monitoring Reports (per system sampling event)

The monitoring framework will be described in the QAPP including number of sampling points for each plume, sampling frequency and duration, and analytical parameters. Monitoring reports, based on the QAPP framework, will be provided that describe site conditions and interim sample results (i.e., compiled data from field and analytical laboratory analyses). A brief description of the monitoring progress as well as field assessment for Task D model parameter estimation, model verification and validation will also be included.

Deliverable: Monitoring report.

20. Test Facility Closeout Report

At the conclusion of controlled test site monitoring, the provider will submit an acceptance document to the department that documents transfer of ownership and complete responsibility of test site infrastructure to the owner. A report will be provided to document close-out of the site.

Deliverable: Test Facility Closeout Report.

21. Task C Final Report (draft)

The final report will summarize results of Task C activities on nitrogen reduction in Florida soil and shallow groundwater. The report will include task objectives, methods, results, discussion, conclusions and recommendations.

Deliverable: A draft report will be provided for comment prior to submittal of the final report.

22. Task C Final Report (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final report.

Task D Nitrogen Fate and Transport Modeling

The objectives of Task D are:

- Literature review on fate and transport models
- Quality Assurance Project Plan
- Space time variable aquifer model with simplied soil treatment
- Development-scale aquifer model creation and calibration
- Space time variable model with complex soil treatment
- Development-scale model with aquifer and soil treatment
- Uncertainty analysis
- Validate and refine models using data from Task C
- Develop decision making framework
- Final Report for Task D

Sub-tasks and Deliverables

1. **Literature Review of Nitrogen Fate and Transport Models (draft)**
   A literature review will be conducted to determine the current practice for modeling nitrogen fate and transport in soils and ground-water. Particular attention will be paid to data gathered from the Task C literature reviews that have relevance to model parameterization of nitrogen fate and transport. If feasible, sensitivity analysis will be conducted based on previous work for conditions relevant to Florida soil and hydrology to help direct Task C monitoring and future modeling efforts.

   Currently available models for nitrogen fate and transport will be reviewed, and the hydraulic and transport/transformation parameters for the models and estimation tools that the provider deems to be applicable, will be summarized so that a plan for fieldwork can begin to be developed at an early stage in the project. Existing available models specific to OSTDS or similar source types will be included in this review to determine the appropriate starting point for model development for this project.

   Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

   Deliverable: Draft literature review and updated reference database.

2. **Literature Review of Nitrogen Fate and Transport Models (final)**
   The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

   Deliverable: Final literature review and updated reference database.

3. **Selection of Existing Data Sets for Calibration Report**
   The provider will select data from existing sites in Florida or elsewhere to evaluate the performance of a soil and aquifer model, and will provide recommendations for future

data collection efforts for subsequent model calibration. The sites shall have information on a nitrogen plume, and data will be obtained via document review and by working with FDOH.

Deliverable: Brief memo describing calibration data sets.

4. **Quality Assurance Project Plan Nitrogen Fate and Transport Models (draft)**
A detailed QAPP will be drafted describing the sub-tasks to be completed in Task D. The overall goal will be to develop a model representing soil and shallow groundwater that is capable of predicting nitrogen concentrations at a specified location downgradient of an OSTDS source and determining nitrogen loadings/mass flux at a specified location. A simplified, user friendly modeling approach (e.g., programmed Microsoft Excel spreadsheet) will be employed that includes parameters that model the dominant soil and hydraulic factors that influence nitrogen reduction. The development of the fate and transport model will be accompanied with a parallel assessment of soil characterization at individual sites that provide data for model parameterization and calibration (Task C). The Florida soils classification system is one potential source of soil characterization data that could be used for a simple estimation of unsaturated zone transport.

The development of a model can include several steps from the concept over implementation of a mathematical model, assurance of numerical accuracy (code verification), adjustment of model parameters to best match a real world experimental data set (calibration), comparison of predictions from a calibrated model to different experimental data (model validation or verification), analysis of the effect of uncertainty in model parameter values on model results or of uncertainty and variability in data sets on calibrated parameter values (sensitivity analysis) and adjustments of the concept, mathematical, or calibrated model to better represent observations (model redesign) can be potentially a never-ending circular process as new data become available for comparison over time. The QAPP will describe how model development will proceed from the literature review, initial model development, calibration to existing data, model verification with other existing data or data gathered during this study, and model redesign to a final model product. It will also describe how the developed models and sensitivity analyses can guide data gathering efforts (in particular for task C), provide insights into nitrogen behavior in the environment, and provide a framework for decision making.

The final product of Task D is anticipated to be a simplified site scale model that predicts nitrogen concentration and mass flux at selected distances downgradient from the source loading location. Comparisons of this modeling approach with the results of non-steady state models and complex soil models will characterize the limitations of this model. The model will be a combination of a simple soil model and averaged aquifer model. The simple soil model will predict nitrogen reduction in unsaturated soil and the loading of nitrogen to the aquifer at the groundwater table surface. The simplified soil model may take the form of a simple algorithm or correlation that predicts nitrogen reduction as a function of such unsaturated soil characteristics as grain size distribution, water content and organic matter. The aquifer model will likely be time averaged and predict nitrogen concentration and attenuation with distance from the source. Input information includes the direction of groundwater flow at the average groundwater flow velocity and organic matter content. Model parameter values will be derived from calibration for Florida locations using data from Task C and suggested model parameters will be provided.

Deliverable: Draft Task D QAPP.

5. **Recommendation for Process Forward (per meeting)**
   Based on the details agreed upon in the final QAPP, the provider will develop a recommendation whether or not to proceed with the remainder of Task D as outlined below, a revised cost estimate, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task D.

   Deliverable: Meeting summary and recommended scope and budget revisions.

6. **Quality Assurance Project Plan Nitrogen Fate and Transport Models (final)**
   The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

   Deliverable: Final QAPP acceptable by FDOH.

7. **Simple Soil Model Development**
   This model will use a simple classification approach for soil treatment of nitrogen based on prior research. A soil classification model will be adapted (such as developed by D. Otis for the Wekiva study) or developed. A more detailed model for soil treatment will be developed in a subsequent task (subtask D15), however, a simple soil treatment model will allow aquifer model development to proceed much sooner, and is expected to be easier to use for many sites where detailed information for such a soil treatment model is not available.

   Deliverable: Simple Soil Model Specification memo.

8. **Non-steady state aquifer model with simple soil model**
   A non-steady state aquifer model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from a single OSTDS source, or a surface area that can be estimated as a single OSTDS source. The simple soil model from D7 will be linked to this model, and it is anticipated that aerial nitrogen input and loading will depend on factors such as pretreatment, recharge, soil conditions, and property size. Model development will be based on information gained in the literature review.

   Deliverable: Brief modeling memo and model in electronic format (e.g., Microsoft Excel spreadsheet).

9. **Aquifer model with averaged output with simple soil model**
   A model will be developed, possibly by revising the model developed in Task D8, to produce averaged output predictions for nitrogen concentration or mass flux.

   Deliverable: Brief modeling memo and model in electronic format.

10. Multiple source aquifer model

A model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from several OSTDS in a development-scale area.

Deliverable: Brief modeling memo and model in electronic format.

11. Calibrate non-steady state aquifer model to existing data sets

The models will be initially calibrated using existing data sets from Florida or other sites identified during subtask 3. The aquifer model performance will be evaluated using measures of difference between available actual field data and model results,. By comparing predictions from a calibrated model to another data set, this task may result in verification of the model. Experience during calibration or sensitivity analysis of the model will likely be useful to better understand the quality and quantity of data required to enable a rigorous calibration using data from Task C.

Deliverable: Model calibration memo.

12. Calibrate aquifer model with averaged output to existing data sets

The aquifer model will be calibrated using existing data sets based on metrics such as average concentration in the plume or mass flux crossing a boundary.

Deliverable: Model calibration memo.

13. Calibrate multi-source aquifer model to existing data sets

The aquifer model will be calibrated using existing data from a development-scale plume, based on metrics such as average concentration in the plume or mass flux crossing a boundary.

Deliverable: Model calibration memo.

14. Complex Soil Model

The complex soil model will be based on unsaturated soil transport mechanisms, and based on Florida-specific soil and climate data, but still incorporated into a simplified approach (e.g., programmed into a Microsoft Excel spreadsheet) useable by most practitioners with basic training. For example, the complex soil model may incorporate a field-capacity/mass-balance approach for water flow similar to that used by the Yucca Mountain project to estimate infiltration, which addresses the capacity of soil to store water and tracks water entering and leaving the soil. The soil treatment module would enable estimation of site-specific soil treatment in the vadose zone, and model output will be the loading at the water table to the aquifer models. Development of the complex soil treatment module will be further described in the QAPP.

Deliverable: Complex Soil Model specification memo.

15. Non-steady state aquifer model with complex soil model

The complex soil-treatment model from D14 will be interfaced with the non-steady state aquifer model. Development of the non-steady state aquifer model based on a complex soil treatment module will be further described in the QAPP.

Deliverable: Brief modeling memo and model in electronic format.

16. Aquifer model with averaged output, with complex soil model

The complex soil-treatment model will be interfaced with the averaged aquifer model. Development of the averaged aquifer model based on a complex soil treatment module will be further described in the QAPP.

Deliverable: Brief modeling memo and model in electronic format.

17. Multi-source aquifer model, with complex soil model

The complex soil-treatment model will be interfaced with the averaged aquifer model, taking into account numerous OSTDS in an area.

Deliverable: Brief modeling memo and model in electronic format.

18. Calibrate non-steady state and averaged aquifer and complex soil model to existing data sets

Aquifer model performance will be evaluated using available actual field data and rigorous calibration techniques for the integrated soil-treatment/aquifer model. By comparing predictions from a calibrated model to another data set, this task may result in verification of the model. Experience during calibration or sensitivity analysis of the model will likely be useful to better understand the quality and quantity of data required to rigorously calibrate the model (Task C).

Deliverable: Model calibration memo.

19. Calibrate multi-source aquifer model and complex soil model to existing data sets

Aquifer model performance will be evaluated using data from a development-scale plume and rigorous calibration techniques for the integrated soil treatment/aquifer model.

Deliverable: Model calibration memo.

20. Uncertainty Analysis for Non-Calibrated Models

A methodology will be developed whereby the developed models can be used for decision making even if sufficient site-specific data does not exist to calibrate the model. Probability-based ranges for model input parameters will be used to generate probable model outcomes, providing planners with the option of using the most probable model outcome in the decision making process, or the model outcome that would lead to a more conservative or liberal decision as the specific case warrants. To the extent possible (without precluding model-performance evaluation of the aquifer model in year 1), model uncertainty and sensitivity analyses will be conducted.

Deliverable: Uncertainty analysis memo.

21. Validate/Refine non-steady state aquifer model with data collection from Task C

Aquifer model performance will be evaluated using ground-water data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

22. Validate/Refine complex soil model with data collected from Task C

Soil treatment model performance will be evaluated using field data collected from Task C (soil, vadose zone, shallow water table) and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

23. Uncertainty analysis for calibrated models

The uncertainty in results produced by calibrated models (e.g., nitrogen concentration or mass flux) will be characterized based on factors such as range in calibrated parameter set values that result in similar agreement between model results and data, model-parameter correlation and bias, and the potential for different parameter combinations to achieve the same agreement between model results and data.

Deliverable: Model uncertainty analysis memo.

24. Validate/Refine non-steady state aquifer, complex soil model with Data Collected from Task C

Soil/aquifer integrated model performance will be evaluated using site-scale field data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

25. Decision-Making Framework Considering Uncertainty

A methodology will be developed based on the results of subtask 20 to describe how planners can include the uncertainty associated with both calibrated and non-calibrated models in the decision-making process.

Deliverable: Modeling decision-making memo.

26. Validate/Refine multi-source aquifer model, complex soil model with data collected from Task C

Soil/aquifer integrated model performance will be evaluated using development-scale plume field data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

27. Task D Final Report (draft)

The draft final report will be developed to summarize the results of the Task D modeling development.

Deliverable: Draft Task D Report.

28. **Task D Final Report (final)**
    The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

    Deliverable: Final Task D Report.

Task E Project Management, Coordination and Meetings

The objectives of Project management, coordination and meetings are:

- Conduct project kickoff meeting
- Prepare progress reports
- Make presentations to RRAC and TRAP
- Conduct PAC meetings

Sub-tasks and Deliverables

1. **Project Kick-Off Meeting (conference call)**
   The provider will hold a project kick-off meeting to establish contact information, routes of communication, points of contact, and administrative procedures. A list of attendees, contact information sheet and meeting minutes will be produced by the provider.

2. **PM - Project Progress Reports (per monthly report)**
   A monthly progress report will be provided that summarizes the general status of each task, progress during the reporting period, activities planned in the next reporting period, and any issues, problems or decisions with significant effect on project implementation. This task includes time for the project manager, for project team and Program Coordination, Subcontract maintenance, project financial analysis, and invoicing.

3. **RRAC Meetings (per meeting)**
   Twice a year the provider shall present project result updates to the RRAC. The department can request additional presentations to the RRAC or TRAP in writing as warranted by work progress or other requirements.

4. **Project Advisory Committee Meetings (per meeting)**
   Project Advisory Committee (PAC) meetings will be held at least once per year or more frequently as requested by the department to evaluate the strategic direction of the project, review project activities and reports, provide technical review, and make comments and recommendations on project activities. The provider will submit to the department for each review meeting a summary report that documents PAC review .

Task F. Other Services

Other subtasks, including deliverables and prices, may be defined and added to this contract by amendment. These subtasks shall be within the general scope of the original Invitation to Negotiate leading to this contract. Criteria to initiate an amendment will include: either RRAC direction or changes in funding and/or direction by the Legislature, and agreement between the department and the provider. Any amendments shall be prospective, and the provider shall not

perform the revised tasks until the amendment has been fully executed. All task amendments shall be within the scope of the original Invitation to Negotiate.

b) Task Limits

Services are limited to the contract specifications and the availability of funds.

The provider shall not perform any tasks related to the project other than those described in Section B, Manner of Service Provision, Paragraph 1(a), Task List without the express written consent of the department.

2. Staffing Requirements

a) Staffing levels

Provider will have at least one project manager and a qualified person to do field work available on staff. The provider shall maintain an adequate administrative organizational structure and support staff sufficient to discharge its contractual responsibilities. In the event the department determines that the provider's staffing levels do not conform to those promised in the proposal, it shall advise the provider in writing who shall have thirty (30) days to remedy the identified staffing deficiencies.

The provider shall replace any employee whose continued presence would be detrimental to the success of the project as determined by the department with an employee of equal or superior qualifications. The department's contract manager will exercise exclusive judgment in this matter.

b) Professional Qualifications

Qualifications shall include evidence of either work experience or training in sampling of water quality.

c) Staffing Changes

If such staff ceases to be available, provider may substitute staff with equivalent qualifications, provided that the substitute shall be trained on the project by the provider, and the department is given two weeks notice of such a change and the provider's plan for the transition.

d) Subcontractors

Subcontractors may be used by the provider; their role shall be described in the associated QAPP documents.

3. Service Location and Equipment

a) Service Location

Field work shall be performed in the State of Florida. Analytical work and data analysis shall be performed in the field, at the laboratory, or office locations as chosen by the provider, and subject to the associated QAPP documents.

b) Service Delivery Location

Services listed under Section B, Manner of Service Provision, Paragraph 1(a), Task List will be delivered at the following location:

Department of Health, Division of Environmental Health
Bureau of Onsite Sewage Programs
4052 Bald Cypress Way, Bin #A-08
Tallahassee, Florida 32399-1713

c) Change in Location

Upon any change in location, provider shall report to the department within two weeks of such a change and the provider's plan for the transition. All changes in location must be approved by the department.

d) Equipment

The provider and its subcontractors will be responsible for supplying, at its own expense, either directly or indirectly, all equipment necessary to perform, conduct, and complete the contract including, but not limited to, computers, telephones, copiers, fax machines, sampling equipment, supplies and maintenance, as well as needed office supplies. Liability for the use of equipment shall be exclusively the domain of the provider. See the provisions in the standard contract for liability.

4. Deliverables

a) Service Unit

See Section B, Manner of Service Provision, Paragraph 1(a), Task List for list of deliverables and the associated tasks.

b) Reports

The provider shall provide an expenditure report for the project together with the final invoice. The expenditure report shall include date, amount, recipient, and category of expenditures.

c) Records and Documentation

Copies of deliverables shall be kept at the provider's office in electronic and paper format. Field records shall be kept at the provider's office in the format they were obtained. See the provisions of the standard contract for length of record keeping.

5. Performance Specifications

a) Outcomes and Outputs

Outcomes shall be measured in service tasks as specified in Section B, Manner of Service Provision, Paragraph 1(a), Task List. The deliverables will be evaluated for accuracy and percentage completed.

b) Monitoring and Evaluation Methodology

The department shall monitor performance of the provider by review of the deliverables and by attending at least one of the sampling events to observe if sampling procedures outlined in the QAPP are followed. Any observed shortcomings shall be noted to and resolved by the provider.

6. Provider responsibility

All unique activities that the provider is responsible for are outlined in this contract under section B, Manner of Service Provision, Paragraph 1(a), Task List.

7. Department responsibility

The department has final authority over approving quality acceptability of service deliverables. The department reserves the right to renegotiate or terminate this contract if the performance standards are not satisfactorily met.

The department shall facilitate review of QAPP, other deliverables, and reports.

Department staff shall also perform one contract monitoring evaluation to demonstrate that the terms of the contract are met.

C. METHOD OF PAYMENT

1. Payment Clause.

This is a fixed price (unit cost) contract. The department shall pay the provider, upon satisfactory completion of the services outlined in the Attachment I of this contract in accordance with the terms of this contract for a total dollar amount not to exceed $4,999,999.00, subject to the availability of funds. There shall be no equipment budget. The purchase of any equipment is the responsibility of the provider as are any cost overruns.

Fixed Price Presentation

Deliverables, listed in Section B, Manner of Service Provision, Paragraph 1(a), Task List., developed during completion of the tasks described in Section B, Manner of Service Provision, Paragraph 1(a), Task List shall be paid according to the schedule on the following pages:

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			No. of Deliverables								Total Cost								
TASK NO.	Task	Per Deliverable Subtotal	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Total
A	Task A: Technology Selection & Prioritization	$608,999	3	2	7	7	1	2	37	4	$18,247	$17,958	$101,040	$86,742	$2,884	$14,384	$314,854	$52,892	$608,999
A.1	A.1 Draft Literature Review Report	$13,796			1						$0	$0	$13,796	$0	$0	$0	$0	$0	$13,796
A.2	A.2 Final Literature Review Report	$6,092				1					$0	$0	$0	$6,092	$0	$0	$0	$0	$6,092
A.3	A.3 Draft Classification of Technologies Report	$12,831			1						$0	$0	$12,831	$0	$0	$0	$0	$0	$12,831
A.4	A.4 Draft Technology Ranking Criteria Report	$10,096			1						$0	$0	$10,096	$0	$0	$0	$0	$0	$10,096
A.5	A.5 Draft Priority List for Testing Report	$14,859			1						$0	$0	$14,859	$0	$0	$0	$0	$0	$14,859
A.6	A.6 Technology Classification, Ranking and Prioritization Workshop	$18,243				1					$0	$0	$0	$18,243	$0	$0	$0	$0	$18,243
A.7	A.7 Final Classification of Technologies Report	$5,044				1					$0	$0	$0	$5,044	$0	$0	$0	$0	$5,044
A.8	A.8 Final Technology Ranking Criteria Report	$7,944				1					$0	$0	$0	$7,944	$0	$0	$0	$0	$7,944
A.9	A.9 Final Priority List for Testing Report	$7,787				1					$0	$0	$0	$7,787	$0	$0	$0	$0	$7,787
A.10	A.10 Draft Innovative Systems Applications Report (per technology, up to five)	$7,192						2	3		$0	$0	$0	$0	$0	$14,384	$21,575	$0	$35,959
A.11	A.11 Final Innovative Systems Applications Report (per technology, up to five)	$8,344							5		$0	$0	$0	$0	$0	$0	$41,720	$0	$41,720
A.12	A.12 Identification of Test Facility Sites (per agreement)	$2,538	2								$5,077	$0	$0	$0	$0	$0	$0	$0	$5,077
A.13	A.13 Draft QAPP PNRS II	$13,171	1								$13,171	$0	$0	$0	$0	$0	$0	$0	$13,171
A.14	A.14 Recommendation for Process Forward (per meeting)	$6,237		1							$0	$6,237	$0	$0	$0	$0	$0	$0	$6,237
A.15	A.15 Final QAPP PNRS II	$4,496			1						$0	$0	$4,496	$0	$0	$0	$0	$0	$4,496
A.16	A.16 PNRS Specification Reports	$28,762			1	1					$0	$0	$28,762	$28,762	$0	$0	$0	$0	$57,524
A.17	A.17 Test Facility Design 50%	$11,721		1							$0	$11,721	$0	$0	$0	$0	$0	$0	$11,721
A.18	A.18 Test Facility Design 100%	$16,201			1						$0	$0	$16,201	$0	$0	$0	$0	$0	$16,201
A.19	A.19 Test Facility Design Final	$12,871				1					$0	$0	$0	$12,871	$0	$0	$0	$0	$12,871
A.20	A.20 Test Facility Accept Bid	$2,884					1				$0	$0	$0	$0	$2,884	$0	$0	$0	$2,884
A.21	A.21 Test Facility Shop Drawing Review (per dwg)	$898							10		$0	$0	$0	$0	$0	$0	$8,980	$0	$8,980
A.22	A.22 Test Facility Construction	$56,857							1		$0	$0	$0	$0	$0	$0	$56,857	$0	$56,857
A.23	A.23 Test Facility Construction Substantial Completion	$2,884							1		$0	$0	$0	$0	$0	$0	$2,884	$0	$2,884
A.24	A.24 Test Facility Accept Construction	$2,884							1		$0	$0	$0	$0	$0	$0	$2,884	$0	$2,884
A.25	A.25 Sample Event Reports (per event)	$20,126							8		$0	$0	$0	$0	$0	$0	$161,008	$0	$161,008
A.26	A.26 Data Summary Report (per event)	$2,368							8		$0	$0	$0	$0	$0	$0	$18,946	$0	$18,946
A.27	A.27 Draft PNRS II Report	$22,110								1	$0	$0	$0	$0	$0	$0	$0	$22,110	$22,110
A.28	A.28 Final PNRS II Report	$12,054								1	$0	$0	$0	$0	$0	$0	$0	$12,054	$12,054
A.29	A.29 Draft Task A Final Report	$12,384								1	$0	$0	$0	$0	$0	$0	$0	$12,384	$12,384
A.30	A.30 Task A Final Report	$6,343								1	$0	$0	$0	$0	$0	$0	$0	$6,343	$6,343
B	Task B: Field Testing of Technologies	$973,147	0	0	3	6	6	7	15	33	$0	$0	$9,415	$17,021	$43,444	$39,906	$499,670	$363,692	$973,147
B.1	B.1 Identification of Home Sites (per homeowner agreement)	$3,138			3	3	2	2			$0	$0	$9,415	$9,415	$6,277	$6,277	$0	$0	$31,383
B.2	B.2 Vendor Agreement Report (per vendor agreement)	$2,535				3	3	2			$0	$0	$0	$7,606	$7,606	$5,071	$0	$0	$20,282
B.3	B.3 Draft QAPP for Field Testing	$29,562					1				$0	$0	$0	$0	$29,562	$0	$0	$0	$29,562
B.4	B.4 Recommendation for Process Forward (per meeting)	$6,237						1			$0	$0	$0	$0	$0	$6,237	$0	$0	$6,237
B.5	B.5 Final QAPP Field Testing	$10,414						1			$0	$0	$0	$0	$0	$10,414	$0	$0	$10,414
B.6	B.6 Field Systems Installation Report (per system)	$43,057							8		$0	$0	$0	$0	$0	$0	$344,452	$0	$344,452
B.7	B.7 Field Systems Monitoring Report (per event)	$24,599							6	6	$0	$0	$0	$0	$0	$0	$147,594	$147,594	$295,188
B.8	B.8 Field Systems Operation, Maintenance and Repairs Report (per system)	$7,050								8	$0	$0	$0	$0	$0	$0	$0	$56,398	$56,398
B.9	B.9 Technical Description of Nitrogen Reduction Technology Report	$14,801								1	$0	$0	$0	$0	$0	$0	$0	$14,801	$14,801
B.10	B.10 Acceptance of System by Owner Report (per system)	$3,758								8	$0	$0	$0	$0	$0	$0	$0	$30,066	$30,066
B.11	B.11 LCCA Template Report (draft template and user guidelines)	$11,908						1			$0	$0	$0	$0	$0	$11,908	$0	$0	$11,908
B.12	B.12 LCCA Template Report (final template and user guidelines)	$7,624							1		$0	$0	$0	$0	$0	$0	$7,624	$0	$7,624
B.13	B.13 LCCA Report (per system)	$4,576								8	$0	$0	$0	$0	$0	$0	$0	$36,611	$36,611

TASK NO.	Task	Per Deliverable Subtotal	No. of Deliverables								Total Cost								
			Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Total
B.14	B.14 Draft Task B Final Report	$51,435								1	$0	$0	$0	$0	$0	$0	$0	$51,435	$51,435
B.15	B.15 Task B Final Report	$26,788								1	$0	$0	$0	$0	$0	$0	$0	$26,788	$26,788
C	Task C: Evaluation of Nitrogen Reduction by Soils & Shallow GW	$1,921,383	0	2	4	4	6	3	38	43	$0	$14,601	$64,841	$27,408	$119,505	$95,815	$728,995	$870,219	$1,921,383
C.1	C.1 Draft Literature Review on Nitrogen Reduction in Soil Report	$11,300			1						$0	$0	$11,300	$0	$0	$0	$0	$0	$11,300
C.2	C.2 Final Literature Review on Nitrogen Reduction in Soil Report	$6,900				1					$0	$0	$0	$6,900	$0	$0	$0	$0	$6,900
C.3	C.3 Draft QAPP Evaluation of N Reduction by Soils & Shallow GW	$38,940			1						$0	$0	$38,940	$0	$0	$0	$0	$0	$38,940
C.4	C.4 Recommendation for Process Forward (per meeting)	$5,907				1					$0	$0	$0	$5,907	$0	$0	$0	$0	$5,907
C.5	C.5 Final QAPP Evaluation of N Reduction by Soils & Shallow GW	$9,190					1				$0	$0	$0	$0	$9,190	$0	$0	$0	$9,190
C.6	C.6 Home Site Selection (per homeowner agreement)	$7,301		2	2	2	2				$0	$14,601	$14,601	$14,601	$14,601	$0	$0	$0	$58,404
C.7	C.7 Instrumentation of Home Sites Report (per site)	$34,622					2	2	2		$0	$0	$0	$0	$69,244	$69,244	$69,244	$0	$207,732
C.8	C.8 Monitoring Report (per sampling event, per site)	$28,017							12	12	$0	$0	$0	$0	$0	$0	$336,200	$336,200	$672,400
C.9	C.9 Draft Site Summary and Close-Out Report (per site)	$13,686								6	$0	$0	$0	$0	$0	$0	$0	$82,114	$82,114
C.10	C.10 Final Site Close-Out Report (per site)	$4,489								6	$0	$0	$0	$0	$0	$0	$0	$26,936	$26,936
C.11	C.11 Test Facility Design 50%	$26,471					1				$0	$0	$0	$0	$26,471	$0	$0	$0	$26,471
C.12	C.12 Test Facility Design 100%	$26,571						1			$0	$0	$0	$0	$0	$26,571	$0	$0	$26,571
C.13	C.13 Test Facility Design Final	$21,207							1		$0	$0	$0	$0	$0	$0	$21,207	$0	$21,207
C.14	C.14 Test Facility Accept Bid	$8,464							1		$0	$0	$0	$0	$0	$0	$8,464	$0	$8,464
C.15	C.15 Test Facility Shop Drawing Review (per dwg)	$3,288							15		$0	$0	$0	$0	$0	$0	$49,320	$0	$49,320
C.16	C.16 Test Facility Construction	$132,229							1		$0	$0	$0	$0	$0	$0	$132,229	$0	$132,229
C.17	C.17 Test Facility Construction Substantial Completion	$23,681							1		$0	$0	$0	$0	$0	$0	$23,681	$0	$23,681
C.18	C.18 Test Facility Accept Construction	$11,523							1		$0	$0	$0	$0	$0	$0	$11,523	$0	$11,523
C.19	C.19 Monitoring Report (per system sampling event)	$19,282							4	16	$0	$0	$0	$0	$0	$0	$77,128	$308,514	$385,642
C.20	C.20 Test Facility Close-Out Report	$14,921								1	$0	$0	$0	$0	$0	$0	$0	$14,921	$14,921
C.21	C.21 Draft Task C Final Report	$69,891								1	$0	$0	$0	$0	$0	$0	$0	$69,891	$69,891
C.22	C.22 Task C Final Report	$31,644								1	$0	$0	$0	$0	$0	$0	$0	$31,644	$31,644
D	Task D: Nitrogen Fate and Transport Models	$784,606	0	1	2	2	2	2	8	11	$0	$15,533	$47,279	$11,545	$19,921	$37,061	$239,278	$413,989	$784,606
D.1	D.1 Draft Literature Review on Nitrogen Fate & Transport Model Report	$15,533		1							$0	$15,533	$0	$0	$0	$0	$0	$0	$15,533
D.2	D.2 Final Literature Review on Nitrogen Fate & Transport Model Report	$5,211				1					$0	$0	$0	$5,211	$0	$0	$0	$0	$5,211
D.3	D.3 Selection of Existing Data Set for Calibration Report	$15,092			1						$0	$0	$15,092	$0	$0	$0	$0	$0	$15,092
D.4	D.4 Draft QAPP N Fate and Transport Models	$32,187			1						$0	$0	$32,187	$0	$0	$0	$0	$0	$32,187
D.5	D.5 Recommendation for Process Forward (per meeting)	$6,334				1					$0	$0	$0	$6,334	$0	$0	$0	$0	$6,334
D.6	D.6 Final QAPP N Fate and Transport Models	$15,657					1				$0	$0	$0	$0	$15,657	$0	$0	$0	$15,657
D.7	D.7 Simple Soil Model Development	$4,263					1				$0	$0	$0	$0	$4,263	$0	$0	$0	$4,263
D.8	D.8 Non-Steady State Aquifer Model, Simple Soil Model	$17,053						1			$0	$0	$0	$0	$0	$17,053	$0	$0	$17,053
D.9	D.9 Aquifer Model with Averaged Output, Simple Soil Model	$20,008						1			$0	$0	$0	$0	$0	$20,008	$0	$0	$20,008
D.10	D.10 Multi-Source Aquifer Model	$22,835							1		$0	$0	$0	$0	$0	$0	$22,835	$0	$22,835
D.11	D.11 Calibrate Non-Steady State Aquifer Model to Existing Data Sets	$34,034							1		$0	$0	$0	$0	$0	$0	$34,034	$0	$34,034
D.12	D.12 Calibrate Aquifer Model with Averaged Output to Existing Data Sets	$11,635							1		$0	$0	$0	$0	$0	$0	$11,635	$0	$11,635
D.13	D.13 Calibrate Multi-Source Aquifer Model to Existing Data Sets	$22,835							1		$0	$0	$0	$0	$0	$0	$22,835	$0	$22,835
D.14	D.14 Complex Soil Model Development	$63,937							1		$0	$0	$0	$0	$0	$0	$63,937	$0	$63,937
D.15	D.15 Non-Steady State Aquifer Model, Complex Soil Model	$27,401							1		$0	$0	$0	$0	$0	$0	$27,401	$0	$27,401
D.16	D.16 Aquifer Model with Averaged Output, Complex Soil Model	$12,943							1		$0	$0	$0	$0	$0	$0	$12,943	$0	$12,943
D.17	D.17 Multi-Source Aquifer Model, Complex Soil Model	$12,943								1	$0	$0	$0	$0	$0	$0	$0	$12,943	$12,943
D.18	D.18 Calibrate Non-Steady State Aquifer Model, Complex Soil Model to Existing Data Sets	$16,481								1	$0	$0	$0	$0	$0	$0	$0	$16,481	$16,481

			No. of Deliverables								Total Cost								
TASK NO.	Task	Per Deliverable Subtotal	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	YR 2	YR 3	Total
D.19	D.19 Calibrate Multi-Source Aquifer Model, Complex Soil Model to Existing Data Sets	$16,481								1	$0	$0	$0	$0	$0	$0	$0	$16,481	$16,481
D.20	D.20 Uncertainty Analysis for Non-Calibrated Models	$43,659							1		$0	$0	$0	$0	$0	$0	$43,659	$0	$43,659
D.21	D.21 Validate/Refine Non-Steady State Aquifer Model with Data Collection from Task C	$65,925								1	$0	$0	$0	$0	$0	$0	$0	$65,925	$65,925
D.22	D.22 Validate/Refine Complex Soil Model with Data Collected from Task C	$65,053								1	$0	$0	$0	$0	$0	$0	$0	$65,053	$65,053
D.23	D.23 Uncertainty Analysis for Calibrated Models	$33,128								1	$0	$0	$0	$0	$0	$0	$0	$33,128	$33,128
D.24	D.24 Validate/Refine Non-Steady State Aquifer, Complex Soil Model with Data Collected from Task C	$66,257								1	$0	$0	$0	$0	$0	$0	$0	$66,257	$66,257
D.25	D.25 Decision-Making Framework Considering Uncertainty	$44,753								1	$0	$0	$0	$0	$0	$0	$0	$44,753	$44,753
D.26	D.26 Validate Refine Multi-Source Aquifer Model, Complex Soil Model with Data Collected from Task C	$65,385								1	$0	$0	$0	$0	$0	$0	$0	$65,385	$65,385
D.27	D.27 Draft Task D Final Report	$18,160								1	$0	$0	$0	$0	$0	$0	$0	$18,160	$18,160
D.28	D.28 Task D Final Report	$9,424								1	$0	$0	$0	$0	$0	$0	$0	$9,424	$9,424
E	Task E: Project Management, Coordination, and Meetings	$711,864	2	1	1	1	2	2	15	45	$17,022	$9,298	$9,298	$9,298	$21,030	$28,589	$154,332	$462,996	$711,864
E.1	E.1 Project Kick-Off Meeting (conference call)	$7,724	1						0	0	$7,724	$0	$0	$0	$0	$0	$0	$0	$7,724
E.2	E.2 PM-Project Progress Reports (per monthly report)	$9,298	1	1	1	1	1	1	12	36	$9,298	$9,298	$9,298	$9,298	$9,298	$9,298	$111,576	$334,728	$502,092
E.3	E.3 RRAC Meetings (per meeting)	$11,732					1		2	6	$0	$0	$0	$0	$11,732	$0	$23,465	$70,394	$105,590
E.4	E.4 PAC Meetings (per meeting)	$19,291						1	1	3	$0	$0	$0	$0	$0	$19,291	$19,291	$57,874	$96,457
F	Task F: Other																		
		TOTAL COST ESTIMATE																	
	PROJECT TOTALS	**$4,999,999**									$35,269	$57,390	$231,872	$152,013	$206,785	$215,754	$1,937,128	$2,163,787	$4,999,999
	PROJECT YEARLY TOTALS															**$899,083**	**$1,937,128**	**$2,163,787**	**$4,999,999**

2. Invoice Requirements.

The provider shall submit an invoice to the contract manager at the address listed in the department's standard contract on a monthly basis using the form of Attachment III within 30 days following the end of the period for which payment is being requested. Payment shall be authorized only for service tasks on the invoice that are in accord with the above list and other terms and conditions of this contract. Documentation of completion of service tasks shall be submitted to the contract manager prior to, or with the invoice. Partially completed tasks may be invoiced and paid based on the percentage of the service task completed.

D. SPECIAL PROVISIONS

1. Contract Renewal

Upon mutual agreement, the department and the provider may renew the contract, in whole or in part, for a period that may not exceed 3 years or the term of the contract, whichever period is longer. Any renewal shall specify the renewal price, as set forth in the solicitation response. The renewal must be in writing and signed by both parties, and is contingent upon satisfactory performance evaluations and subject to availability of funds. The total cost for the contract under the first renewal will not exceed $4,999,999.00 and the second renewal will not exceed $4,999,999.00.

2. Documentation

Provider is required to maintain separate accounting of revenues and expenditures of funds under this contract and each CSFA or CFDA number identified on Exhibit I attached hereto in accordance with generally accepted accounting practices and procedures. Expenditures which support Provider activities not solely authorized under this contract must be allocated in accordance with applicable laws, rules and regulations, and the allocation methodology must be documented and supported by competent evidence. Provider must maintain sufficient documentation of all expenditures incurred (e.g. invoices, canceled checks, payroll detail, bank statements, etc.) under this contract which evidences that expenditures are:

1. allowable under the contract and applicable laws, rules and regulations;
2. reasonable; and
3. necessary in order for Provider to fulfill its obligations under this contract.

The aforementioned documentation is subject to review by the Department and/or the State Chief Financial Officer and Provider will timely comply with any requests for documentation.

This is the end of text.

SECTION 3 - HUMAN SERVICES

468	AID TO LOCAL GOVERNMENTS		
	CONTRIBUTION TO COUNTY HEALTH UNITS		
	FROM GENERAL REVENUE FUND	3,278,293	
	FROM ADMINISTRATIVE TRUST FUND . . .		1,417,426
	FROM GRANTS AND DONATIONS TRUST FUND		1,204,571
469	OPERATING CAPITAL OUTLAY		
	FROM ADMINISTRATIVE TRUST FUND . . .		15,000
	FROM FEDERAL GRANTS TRUST FUND . . .		46,698
	FROM RADIATION PROTECTION TRUST FUND		56,997
470	SPECIAL CATEGORIES		
	ACQUISITION OF MOTOR VEHICLES		
	FROM ADMINISTRATIVE TRUST FUND . . .		80,000
	FROM RADIATION PROTECTION TRUST FUND		130,856
471	SPECIAL CATEGORIES		
	CONTRACTED SERVICES		
	FROM GENERAL REVENUE FUND	189,084	
	FROM ADMINISTRATIVE TRUST FUND . . .		340,000
	FROM FEDERAL GRANTS TRUST FUND . . .		348,235
	FROM GRANTS AND DONATIONS TRUST FUND		671,203
	FROM RADIATION PROTECTION TRUST FUND		150,000

From the funds in Specific Appropriation 471, $540,000 from the Grants and Donations Trust Fund is provided to the department to continue and complete the study authorized in Specific Appropriation 1682 of chapater 2008-152, Laws of Florida. The report shall include recommendations on passive strategies for nitrogen reduction that complement use of conventional onsite wastewater treatment systems. The department shall submit an interim study and report on February 1, 2010, and a final study and report on May 1, 2010, to the Governor, the President of the Senate, and the Speaker of the House of Representatives prior to proceeding with any nitrogen reduction activities.

472	SPECIAL CATEGORIES		
	GRANTS AND AIDS - CONTRACTED SERVICES		
	FROM GENERAL REVENUE FUND	86,399	
	FROM FEDERAL GRANTS TRUST FUND . . .		750,000
473	SPECIAL CATEGORIES		
	RISK MANAGEMENT INSURANCE		
	FROM GENERAL REVENUE FUND	67,993	
	FROM RADIATION PROTECTION TRUST FUND		14,575
474	SPECIAL CATEGORIES		
	TRANSFER TO DEPARTMENT OF MANAGEMENT SERVICES - HUMAN RESOURCES SERVICES PURCHASED PER STATEWIDE CONTRACT		
	FROM GENERAL REVENUE FUND	12,630	
	FROM ADMINISTRATIVE TRUST FUND . . .		25,242
	FROM FEDERAL GRANTS TRUST FUND . . .		9,712
	FROM GRANTS AND DONATIONS TRUST FUND		1,382
	FROM RADIATION PROTECTION TRUST FUND		40,522
475	SPECIAL CATEGORIES		
	STATE UNDERGROUND PETROLEUM ENVIRONMENTAL RESPONSE (SUPER) ACT REIMBURSEMENT		
	FROM ADMINISTRATIVE TRUST FUND . . .		534,775
TOTAL:	ENVIRONMENTAL HEALTH SERVICES		
	FROM GENERAL REVENUE FUND	5,825,883	
	FROM TRUST FUNDS		21,321,969
	TOTAL POSITIONS	218.50	
	TOTAL ALL FUNDS		27,147,852

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FLORIDA DEPARTMENT OF HEALTH

FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATEGIES (FOSNRS) STUDY

RRAC Meeting Presentation
July 1, 2009

SCHOOL OF MINES 1874 COLORADO

AET
Applied Environmental Technology

OTIS ENVIRONMENTAL CONSULTANTS

1

Agenda

- Proposed Year 1 Scope and Schedule Revisions
- PNRS II
- Next Steps
- Tour of the GCREC Facility

Scope – Task A

Task	Current Year 1	Proposed Year 1
A.1 Draft Lit Review	1	1
A.2 Final Lit Review	1	1
A.3 Draft Classification of Tech	1	1
A.4 Draft Tech Ranking Criteria	1	1
A.5 Draft Priority List for Testing	1	1
A.6 Tech Classification, Ranking & Prioritization Workshop	1	1
A.7 Final Classification of Tech	1	1
A.8 Final Tech Ranking Criteria	1	1
A.9 Final Priority List for Testing	1	1
A.10 Draft Innovative Systems Application	2	
A.12 Identification of Test Facility Sites	2	1.8
A.13 Draft QAPP PNRS II	1	1
A.14 Recommendation for Process Forward	1	1
A.15 Final QAPP PNRS II	1	1
A.16 PNRS Specification Reports	2	2
A.17 Test Facility Design 50%	1	1
A.18 Test Facility Design 100%	1	1
A.19 Test Facility Design Final	1	
A.20 Test Facility Accept Bid	1	
A.25 Sample Event Reports		3
A.26 Data Summary Report		3

Scope – Task B

Task	Current Year 1	Proposed Year 1
B.1 Identification of Home Site	10	
B.2 Vendor Agreement Report	8	
B.3 Draft QAPP for Field Testing	1	
B.4 Recommendation for Process Forward	1	
B.5 Final QAPP for Field Testing	1	
B.11 LCAA Template Report	1	

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Scope – Task C

Task	Current Year 1	Proposed Year 1
C.1 Draft Literature Review on N Reduction in Soil	1	1
C.2 Final Literature Review on N Reduction in Soil	1	1
C.3 Draft QAPP Evaluation of N Reduction by Soils & Shallow GW	1	1
C.4 Recommendation for Process Forward	1	1
C.5 Final QAPP Evaluation of N Reduction by Soils & Shallow GW	1	1
C.6 Home Site Selection	8	
C.7 Instrumentation of Home Sites	4	1 (GCREC)
C.11 Test Facility Design 50%	1	1
C.12 Test Facility Design 100%	1	1
C.13 Test Facility Design Final		1
C.14 Test Facility Accept Bid		1
C.15 Test Facility Shop Drawing Review		4
C.16 Test Facility Construction		1
C.17 Test Facility Construction Substantial Completion		1
C.18 Test Facility Accept Construction		1
C.19 Monitoring Report		3

Scope – Tasks D & E

Task	Current Year 1	Proposed Year 1
D.1 Draft Lit Review on N Fate & Transport Model	1	1
D.2 Final Lit Review on N Fate & Transport Model	1	1
D.3 Selection of Existing Data Set for Calibration	1	1
D.4 Draft QAPP N Fate & Transport Models	1	1
D.5 Recommendation for Process Forward	1	1
D.6 Final QAPP N Fate & Transport Models	1	1
D.7 Simple Soil Model Development	1	
D.8 Non-Steady State Aquifer Model, Simple Soil Model	1	
D.9 Aquifer Model with Averaged Output, Simple Soil Model	1	
E.1 Project Kick-Off Meeting	1	1
E.2 PM – Project Progress Reports	6	5
E.3 RRAC Meetings	1	1
E.4 PAC Meetings	1	1

Schedule – Task A

Task	June 2009	Jul 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	March 2010	April 2010	May 2010	June 2010
A.1 Draft Lit Review	1												
A.2 Final Lit Review	1												
A.3 Draft Classification of Tech	1												
A.4 Draft Tech Ranking Criteria	1												
A.5 Draft Priority List for Testing	1												
A.6 Tech Classification, Ranking & Prioritization Workshop	1												
A.7 Final Classification of Tech		1											
A.8 Final Tech Ranking Criteria			1										
A.9 Final Priority List for Testing				1									
A.12 Iden. of Test Facility Sites	1.8												
A.13 Draft QAPP PNRS II	1												
A.14 Rec. for Process Forward		1											
A.15 Final QAPP PNRS II			1										
A.16 PNRS Specification Reports				1	1								
A.17 Test Facility Design 50%		1											
A.18 Test Facility Design 100%			1										
A.25 Sample Event Reports								1		1		1	
A.26 Data Summary Report									1		1		1

Schedule – Task C

Task	June 2009	Jul 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	March 2010	April 2010	May 2010	June 2010
C.1 Draft Literature Review	1												
C.2 Final Literature Review		1											
C.3 Draft QAPP			1										
C.4 Rec. for Process Forward			1										
C.5 Final QAPP				1									
C.7 Instrumentation of Home Sites					1								
C.11 Test Facility Design 50%	1												
C.12 Test Facility Design 100%			1										
C.13 Test Facility Design Final				1									
C.14 Test Facility Accept Bid					1								
C.15 Test Fac Shop Dwg Review						4							
C.16 Test Facility Construction						1							
C.17 Test Facility Construction Substantial Completion							1						
C.18 Test Facility Accept Construction							1						
C.19 Monitoring Report								1		1		1	

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Schedule – Tasks D & E

Task	June 2009	Jul 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	March 2010	April 2010	May 2010	June 2010
D.1 Draft Lit Review on N Fate & Transport Model	1												
D.2 Final Lit Review on N Fate & Transport Model			1										
D.3 Selection of Existing Data Set for Calibration	1												
D.4 Draft QAPP N Fate & Transport Models					1								
D.5 Recommendation for Process Forward								1					
D.6 Final QAPP N Fate & Transport Models											1		
E.1 Project Kick-Off Meeting	1												
E.2 PM – Project Progress Reports	5			0.5				0.5					
E.3 RRAC Meetings		1											
E.4 PAC Meetings						1							

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PNRS II Workplan Overview

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Passive Nitrogen Removal Study II

Objectives

- Follow up to PNRS I
- Develop detailed performance data for passive biofiltration
- Produce scalable design data from pilot scale biofilters

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PNRS I – AWARD WINNING!

Dr. Daniel Smith accepts E3 Award from AAEE President Dr. Deborah Reinhart of UCF

American Academy of Environmental Engineers:

Excellence in Environmental Engineering (E3) Award in Applied Research and Practice

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Passive Nitrogen Removal Study II

Significant Features

- Couple first stage recycle (mixed biomass) to denitrification (separate stage biomass)
- Unsaturated filter: 2 layer stratification design with 2 media depths
- Evaluate lignocellulosic and sulfur based denitrification biofilters
- Reactive media in in-ground systems

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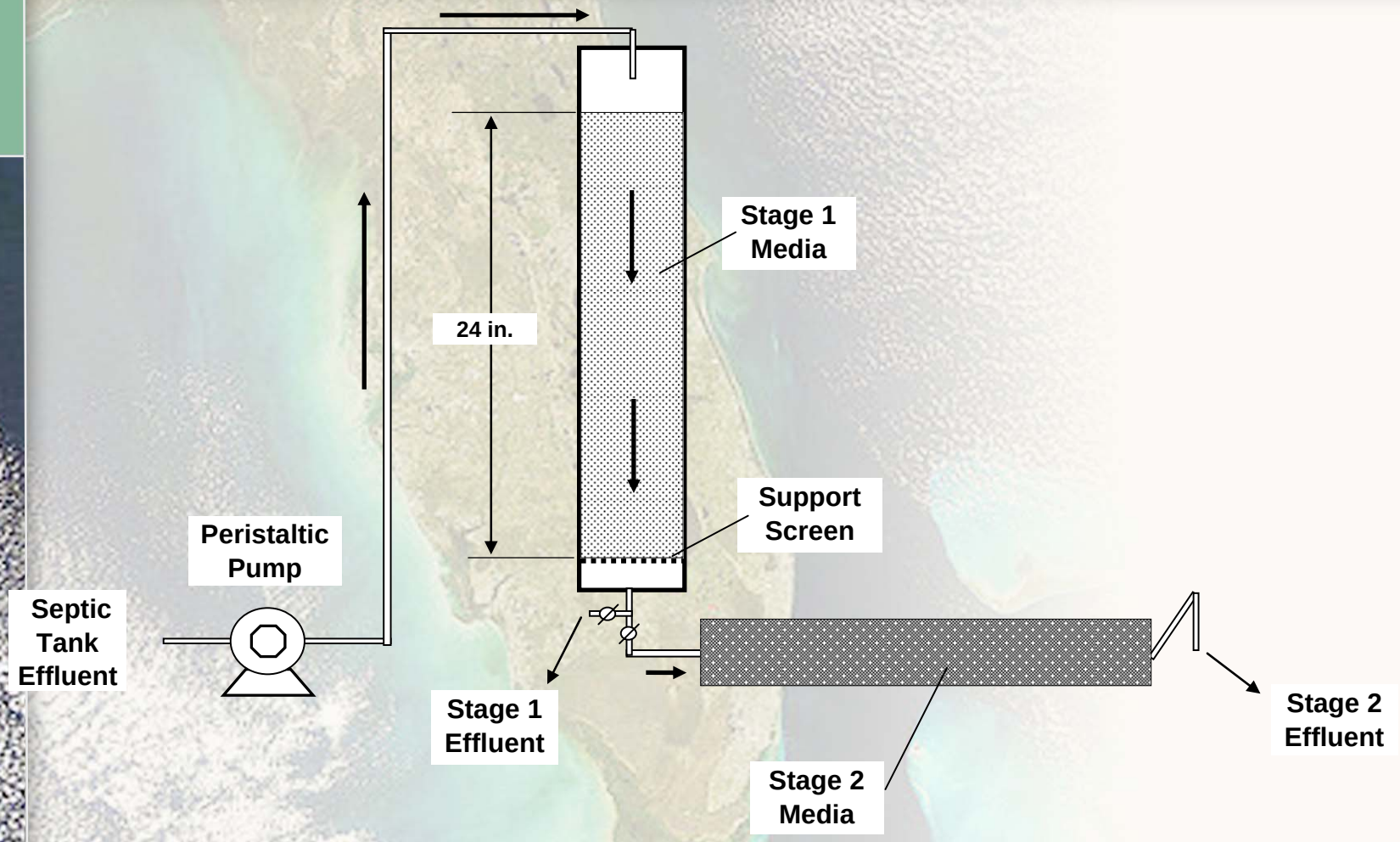
Passive Nitrogen Removal Study II

Approach

- Establish test site at Gulf Coast Education and Research Center (IFAS)
- In-vessel and in-situ pilot systems
- Operate on septic tank effluent for 12 months
- Nitrification and denitrification biofilters

Passive Two Stage Biofiltration PNRS I



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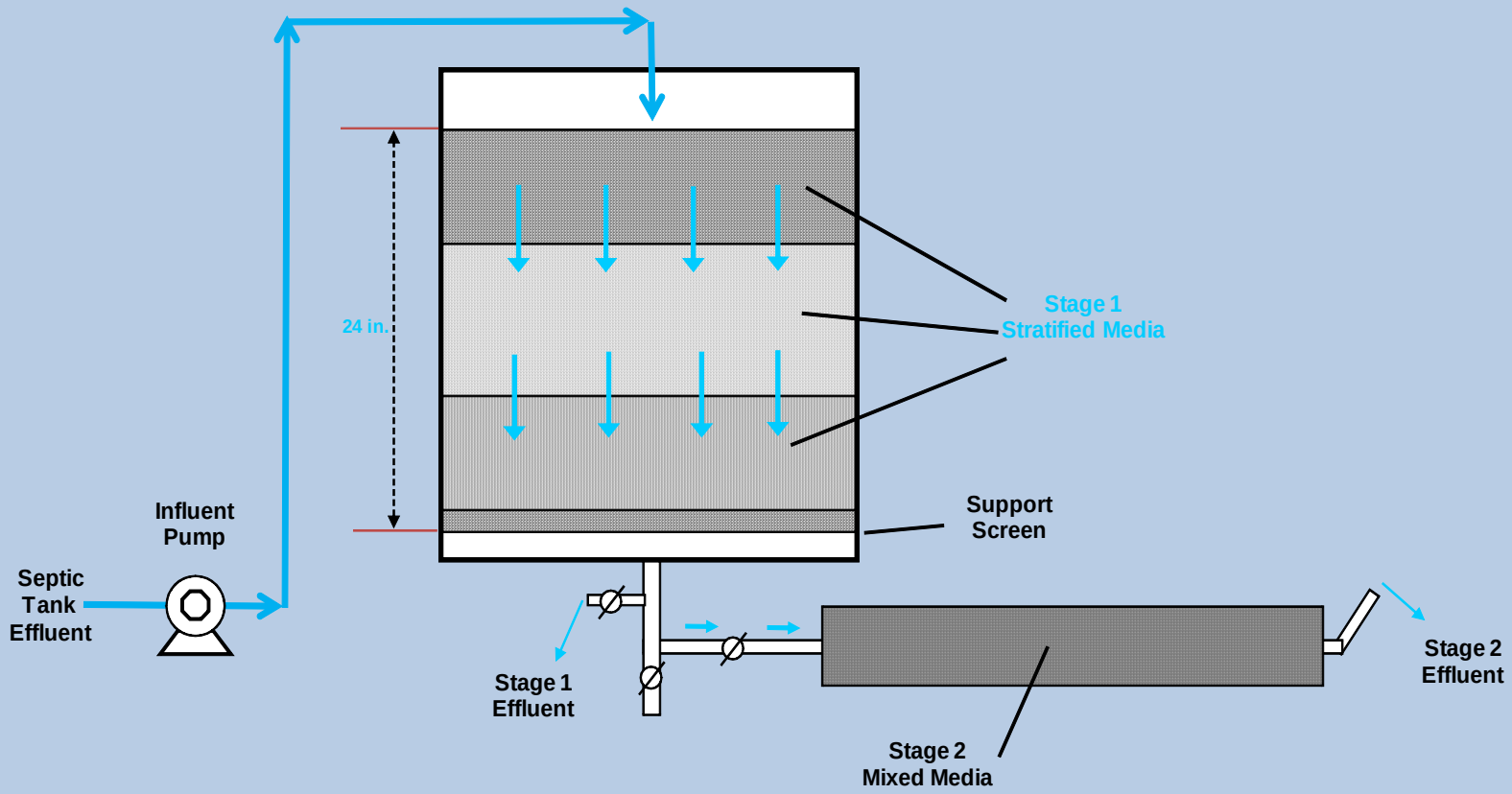
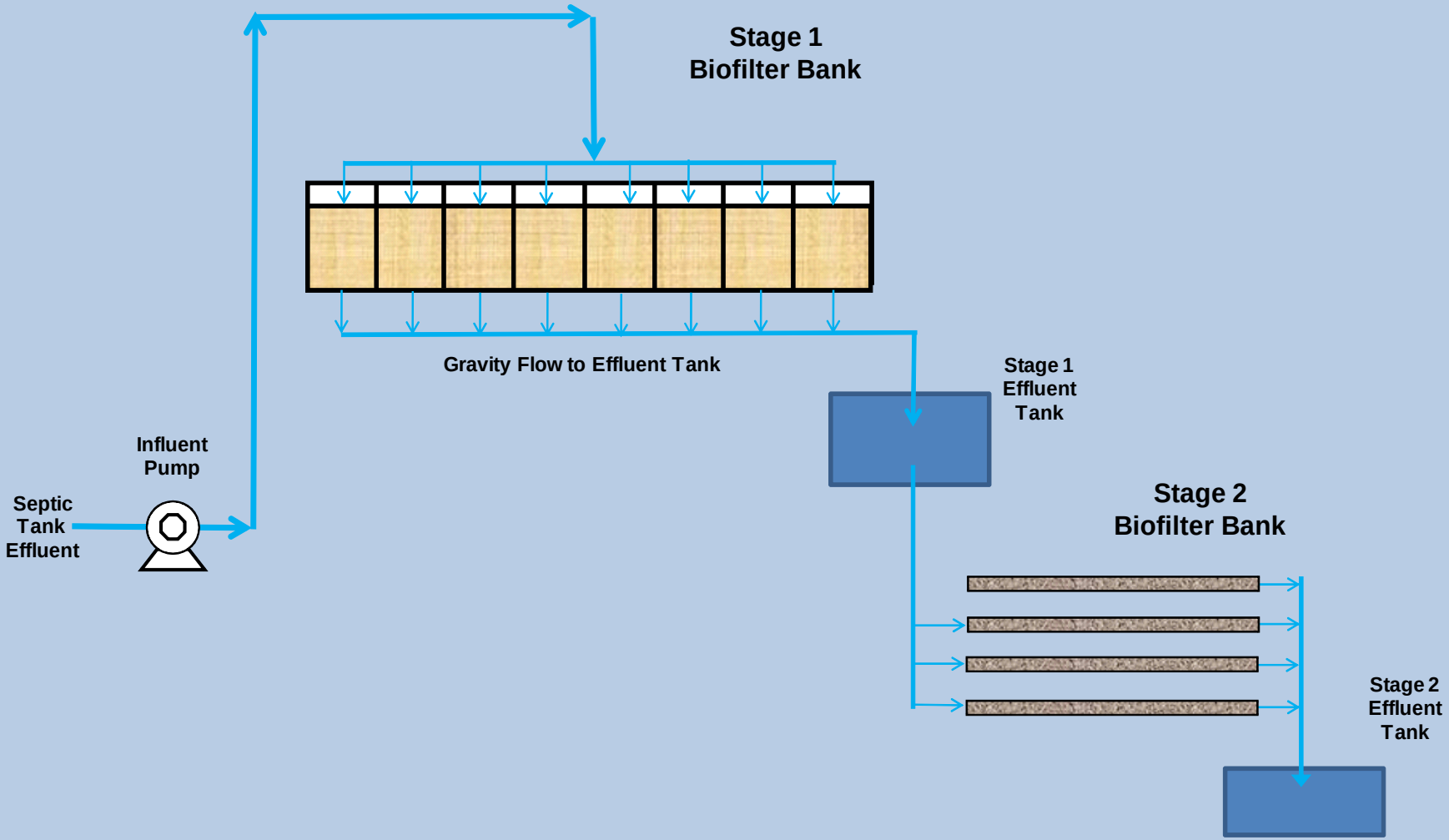
Passive Nitrogen Removal Study II

Pilot Two Stage Biofiltration



Passive Nitrogen Removal Study II



Stage 1 Media (nitrification)

Zeo-Pure clinoptilolite

Expanded polystyrene

Expanded clay

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Stage 2 Media (denitrification)

Lignocellulosics

Elemental sulfur

Expanded clay

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Passive Nitrogen Removal Study II

Two-Stage Biofiltration Pilot Units

- Horizontal configuration
- 10 unsaturated (Stage 1) biofilters

  expanded clay (4), clinoptilolite (4), polys (2)

  single pass (5), recycle (5)

  15 in. depth (4), 30 in. depth (6)
- 9 denitrification biofilters

  lignocellulosic (5), sulfur (3), glycerol (1)

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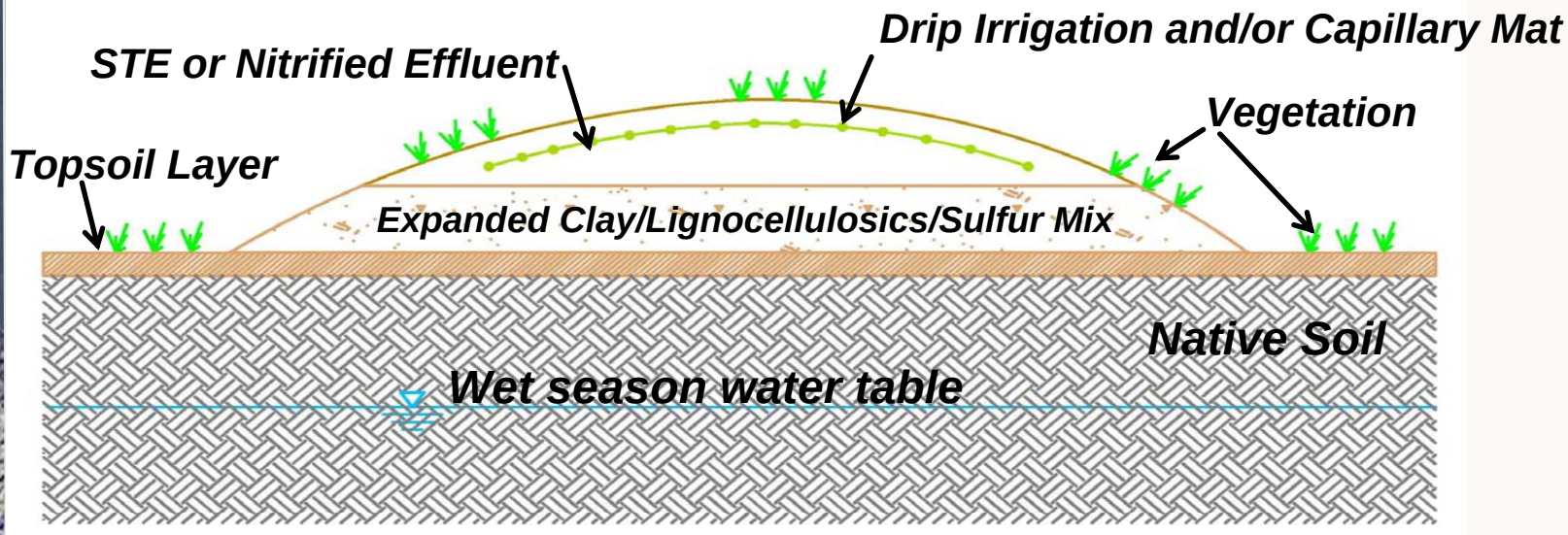
Passive Nitrogen Removal Study II

In-Ground Engineered Media



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Passive Nitrogen Removal Study II

In-Ground Engineered Media

- 12 - 24 in. unsaturated mixed media above natural soil horizon
- Media: expanded clay/lignocellulosic/sulfur
- Plan area loading rate: ~0.50 gal/ft^2-day
- Dosing: 24 dose/day

  STE : subsurface drip tubing

  Nitrified effluent: SD w capillary seepage matt

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Passive Nitrogen Removal Study II

Application of Technologies

	Passive Two Stage Biofiltration	In-Situ Biofiltration	Passive Denitrifcation
New or replacement systems	X	X	
Retrofit to existing conventional system	X	X	
Addition to existing aerobic treatment system		X	X

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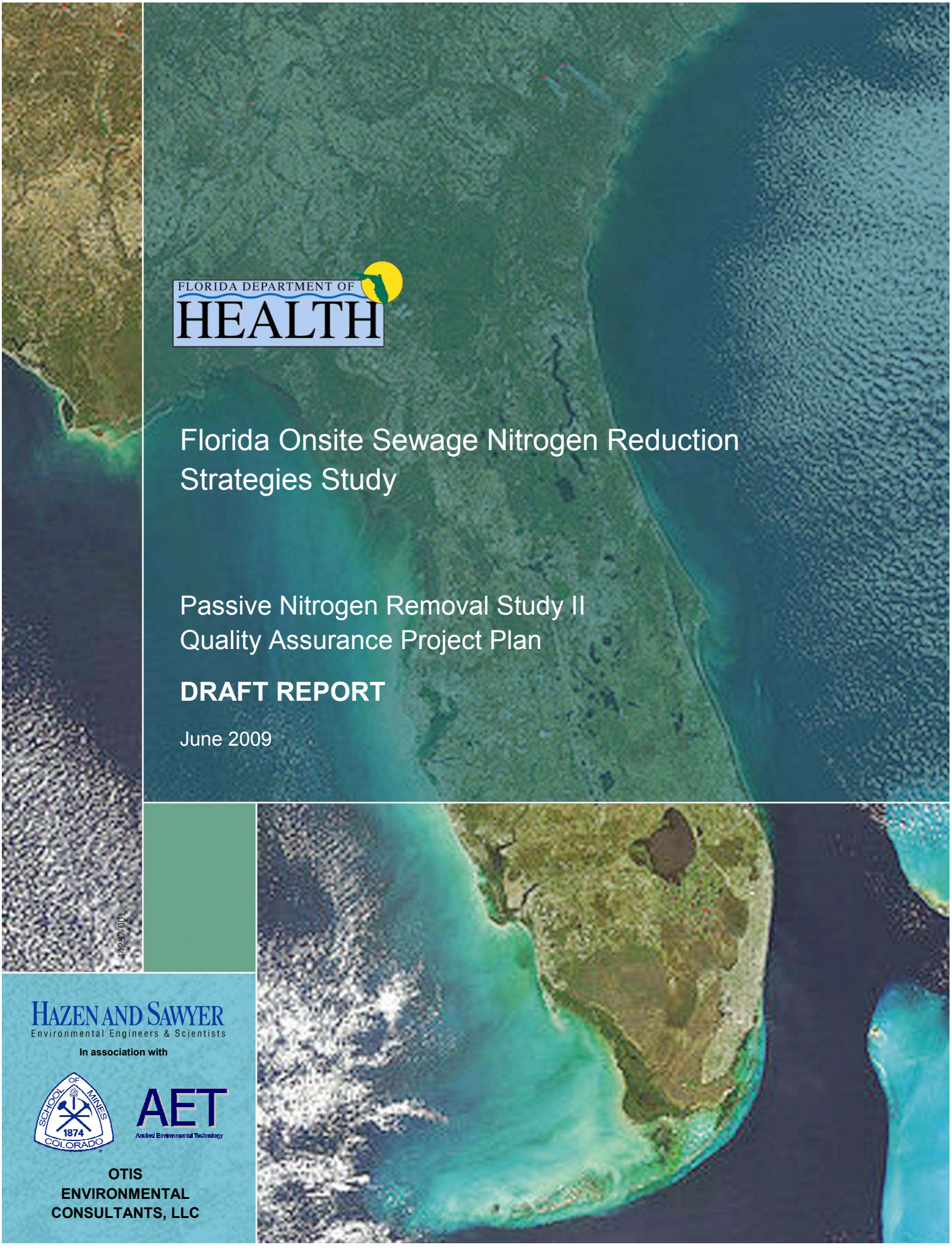
FOSNRS Study – Next Steps

- Complete contract amendment for Year 1 with FDoH
- Complete subconsultant contract amendments
- Continue on test facility design and remaining year 1 tasks



FLORIDA DEPARTMENT OF HEALTH

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Passive Nitrogen Removal Study II Quality Assurance Project Plan

DRAFT REPORT

June 2009

4423.001

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In association with

SCHOOL OF MINES 1874 COLORADO

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Applied Environmental Technology

OTIS ENVIRONMENTAL CONSULTANTS, LLC

Florida Onsite Sewage Nitrogen Reduction Strategies Study

DRAFT REPORT
Passive Nitrogen Removal Study II
Quality Assurance Project Plan

Prepared for:

Florida Department of Health
Division of Environmental Health
Bureau of Onsite Sewage Programs
4042 Bald Cypress Way Bin #A-08
Tallahassee, FL 32399-1713

FDOH Contract CORCL

June 2009

Prepared by:

HAZEN AND SAWYER
Environmental Engineers & Scientists

In Association With:

AET
Applied Environmental Technology

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Section 1.0
Project Organization and Management

The Florida Department of Health has contracted to continue the study of passive nitrogen removal (PNRS II) under Task A of the Florida Onsite Sewage Nitrogen Reduction Strategies Study (FOSNRS). PNRS II is a follow up to the previous experimental evaluations of passive nitrogen removal technologies conducted under Contract CORY (Passive Nitrogen Removal Study I). The Passive Nitrogen Removal Study II (PNRS II) will be conducted by Hazen and Sawyer and Applied Environmental Technology, who will perform overall project management, establish and conduct the pilot studies, and who will deliver samples for water quality analyses to an approved analytical laboratory. The contractors will review and interpret the resulting data, adjust the pilot testing program as warranted, and generate a summary report and recommendations. Prudent project management will help minimize changes, ensure project continuity, and avoid delays in the project schedule. This type of project is highly specialized, requiring unusual equipment and services. Therefore it is crucial that adequate project management be used to ensure the success of the project.

Section 2
Problem Definition and Background

A. Project Background

The Florida Department of Health (FDOH) has provided funding to evaluate methods that can be used to enhance nitrogen removal in onsite wastewater systems in a passive and cost effective manner. The Florida Onsite Sewage Nitrogen Reduction Strategies Study (FOSNRS) Task A.13 entails formulating a pilot testing plan to evaluate candidate technologies that can be used to remove nitrogen from septic tank effluent with more passive systems. The purpose of the Passive Nitrogen Removal Study II is to extend and expand into field pilot testing the previous experimental studies of the two-stage biofiltration process that were conducted in PNRS I. PNRS II will perform field testing of candidate media and passive nitrogen reduction treatment systems. The results of PNRS II may be used to develop and implement subsequent evaluations of full-scale systems that will be conducted under Task B of this project.

The *Florida Passive Nitrogen Removal Study Literature Review and Database* proposed the development of a two stage biofilter system for passive removal of total nitrogen from septic tank effluent (Smith et al., 2008). The two stage system consisted of an initial unsaturated media biofilter for ammonification and nitrification, followed in series by a saturated anoxic denitrification biofilter. The system would be deployed between the septic tank and the soil treatment unit (drainfield) or soil dispersal system of new or existing facilities. Nitrogen in septic tank effluent would be substantially removed before wastewater was directed to the soil for treatment or dispersal. Results from the previous experimental studies conducted in PNRS I provided the proof of concept of the two-stage passive nitrogen reduction system.

To perform PNRS II testing, it is desired to conduct studies in a manner that more closely resembles the functioning of actual onsite systems. Actual candidate media should be used, placed in appropriate depths and distribution. Continuous and dosed biofilter operation is preferable, where microbial populations will establish their metabolic activities and perform desired biochemical transformations in response to conditions similar to an operating system. The use of actual septic tank effluent (STE) as feed source is deemed preferable to use of a synthetic analog STE. This Quality Assurance Project Plan (QAPP) describes the methods and procedures that will be used to conduct the passive nitrogen removal evaluations.

B. Candidate Study Sites

Two candidate sites have been identified and arrangements are being sought for their use. The acceptability of the sites must be established, and a single site will be chosen for the study. The chosen site must have a source of actual septic tank effluent or primary effluent, a power supply to pump STE to test biofilters, and power for operation of equipment. Both site locations are isolated from public access and would cause minimal disruption to any activity, and each site has reasonable security. Both sites are in Hillsborough County, Florida, and are identified below.

1. University of Florida Gulf Coast Research and Educational Center (GCREC)

2. University of South Florida Lysimeter Research Facility

Section 3
Project Description

A. Project Purpose

To evaluate candidate media and treatment processes for development of more passive nitrogen removal systems for onsite wastewater treatment.

B. Project Objectives

The objective is to establish pilot passive nitrogen removal systems to evaluate the effectiveness of various media and two-stage biofilter designs in removing total nitrogen from septic tank effluent. The pilot test systems will consist of various configurations of in-tank biofilters and passive in-situ systems. In-tank systems will primarily employ variants of the two-stage biofiltration concepts elucidated in PNRS I. In-situ technology evaluation will include a drip irrigation system for effluent dosing, with emitters located in shallow root zones.

In the two-stage biofilter process, a first stage unsaturated biofilter is followed in series by a second stage biofilter operated in a water saturated mode. Septic tank effluent will be applied to the top of the first stage media, resulting in a downward percolation of wastewater over and through the media biofilter bed. The unsaturated pore spaces in the first stage media will allow air to reach microorganisms attached to the media surfaces, enabling aerobic biochemical reactions to occur. The significant target reactions are aerobic heterotrophic oxidation (by microorganisms that oxidize organic material and reduce biochemical oxygen demand), hydrolysis and ammonification (releasing ammonia), and nitrification (biochemical conversion of ammonia to nitrate and nitrite). Of particular interest are the organic and ammonia nitrogen concentrations in first stage effluent, as well as nitrate and nitrite.

Effluent from the bottom of the first stage biofilter is passed through a saturated anoxic biofilter that contains a reactive media that supplies electron donor for denitrification (reduction of nitrate and nitrite to N_2 gas). The biofiltration systems will be operated over a twelve month period and monitored for nitrogen species and other water quality parameters. Of particular interest are the concentrations of ammonia in first stage effluent and nitrate, nitrite and total nitrogen in the second stage effluent.

The interaction of media with applied wastewater governs the treatment process. Key features affecting nitrogen removal performance include:

1. The effects of hydraulic and nitrogen loading rates, on average daily and per dose basis, on first stage effluent nitrogen concentrations.

2. The effects of first stage media on effluent nitrogen levels.

3. Alkalinity consumption in the first stage and its possible effects on nitrification.

4. The effects of hydraulic and nitrogen loading rates, on average daily basis, on second stage effluent nitrogen concentrations.

5. The effects of second stage media on effluent nitrogen levels.

6. Second stage effluent total nitrogen concentrations and speciation into organic, ammonia, and oxidized nitrogen forms.

7. Alkalinity consumption or restoration in the second stage and its possible effects on denitrification.

8. Use of first stage recycle.

C. Project Tasks and Timeline

Project tasks and preliminary timeline are shown in Table 3.1. The start dates and tasks are contingent upon Recommendations for Process Forward (FOSNRS Task A.14) and may be altered based on the results of Task A.14. The task descriptions provide a template by which the project team will conduct the PNRS II project. The nature of technology demonstration projects will necessitate system and testing modifications during the course of the study. It is important to recognize that operational adaptation is a central feature of pilot testing and process optimization. A typical example is a modification in operation as a result of assessment of performance data, where a higher loading rate is applied to a well functioning system to evaluate performance over a wider loading envelope. The QAPP established initial loading rates for PNRS II systems that may be adjusted as the study progresses, based on ongoing results and the professional judgment of the project team. A degree of discretion must be afforded to the project team to make modifications as warranted. Additionally, longer term operation of successful on-site treatment systems may be warranted. All substantive modifications will be fully communicated to FDOH.

Table 3.1
Project Tasks and Timeline

Task/Activity	Start	Projected Completion
Task 1 PNRS II Infrastructure Design	Week 1	Week 4
Task 2 Procurement of materials and media	Week 4	Week 8
Task 3 Construction of test facility and pilot systems	Week 6	Week 10
Task 4 Operation and monitoring of pilot systems	Week 12	Week 64
Task 5 Preparation of draft report	Week 68	Week 74
Task 6 Preparation of final report	Week 76	Week 80

Task 1: PNRS II Infrastructure Design

A final testing site will be established based on the acceptability of wastewater sources, use of the site for other FOSNRS work elements in Tasks B and C, and establishing site use arrangements. Once test facility infrastructure is designed (Tasks A.17 through A.19), the design of PNRS II infrastructure can begin and will be integrated into the test facility design. The design documents will define the needed materials and construction of the PNRS II testing component.

Task 2: Procurement of Materials and Media

Candidate media for evaluation in Stage 1 (unsaturated) biofilters and Stage 2 (saturated) biofilters are listed in Table 3.2, with physical properties and their sources. Included are media with high water retention and porosity, and the clinoptilolite additionally provides ion exchange capacity. Media will be procured from vendors for use (Table 3.2). Stage 1 media includes expanded clay and clinoptilolite. These have greater than 45% porosity and high water retention. The clinoptilolites have cation exchange capacities of 1.5 to 1.8 meq/g, and will act to retain ammonia ions for enhanced ammonia removal under non-steady flows and higher loading rates. Livlite is an expanded clay with high water retention characteristics. Expanded polystyrene is a very lightweight material that should be quite suitable as a low cost Stage 1 biofilter media.

The Stage 2 electron donor media are elemental sulfur, which will result in an autotrophic denitrification process in the anoxic biofilter; lignocellulosic materials, such as woodchips, which support heterotrophic denitrification, and glycerol, a readily available carbon source for heterotrophic denitrification. Crushed oyster shell and sodium sesquicarbonate will be used as alkalinity sources in sulfur-based denitrification biofilters, as autotrophic sulfur-based denitrification will consume alkalinity. Expanded shale may be in-

cluded as a Stage 2 option for its anion exchange capacity to enhance nitrate removal performance.

Table 3.2
Biofilter Media

Material	Bulk density, lb/ft^3	Particle Size Range	Supplier
Zeo-Pure AMZ 8/20 Clinoptilolite	55	0.8 – 2.3 mm	Ash Meadows, Armagose, NV
Livlite (expanded clay)	41	3 to 5 mm	Big River, Alpharetta, GA
Expanded Polystyrene	0.34 – 1.5	2.2 – 3.6 mm	JSP
Elemental sulfur	77	2 – 4 mm	Georgia Sulfur, Valdosta, GA
Oyster shell	82	3 – 15 mm	Misc. Locations, FL
Sodium Sesquicarbonate T-50	69	1 – 3 mm	Solvay
Lignocellulosic material (woodchips, sawdust)	20 – 28	1 to 5 mm	Robbins Products, Tarrytown, FL
Glycerol	79	-	Greenhunter Energy
ACT-MS ESF-450 Utelite (expanded shale)	54	0.4 – 4.5 mm	ES Filter, Ogden, UT

Task 3: Construction of Test Facility and Pilot Systems

A test facility will be constructed that will provide a source of primary effluent (i.e. septic tank effluent) to the PNRS II systems, as well as dosing regimes, sampling ports, and effluent collection. Design of the test facility will be conducted under FOSNRS Tasks A.17 through A.19. Two types of testing systems will be constructed:

A. Vertical/Horizontal Two-Stage Biological Filtration

B. In-Situ Vegetation/Media Simulators

A. Vertical/Horizontal Two-Stage Biological Filtration

The two-stage biofilters consist of a vertical unsaturated biofilter followed by horizontal saturated denitrification biofilter (Figure 3-1). Primary effluent (i.e. septic tank effluent) is dosed to the upper surface of the Stage 1 biofilter, trickles through the unsaturated media, and then flows by gravity through the saturated denitrification filter. In PNRS II pilot testing, multiple Stage 1 biofilters will be operated in parallel on the same primary effluent, and multiple Stage 2 biofilters will be operated in parallel on the same common Stage 1 effluent.

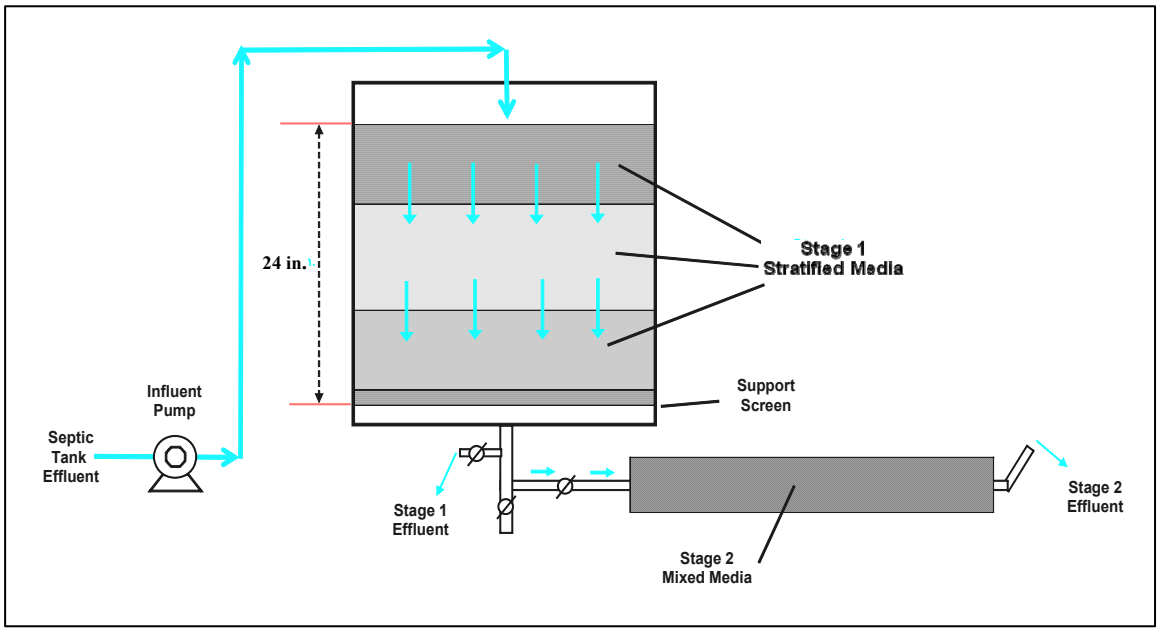


Figure 3-1 Schematic of Vertical/Horizontal Two-Stage Biofiltration

Configuration of the Stage 1 unsaturated biofilters is shown in Table 3.3. Three biofilter media will be examined in PNRS II pilot studies: expanded clay and clinoptilolite, both of which were evaluated in PNRS I, and expanded polystyrene, a readily available low cost and light weight material. Design of the expanded clay and clinoptilolite pilot biofilters was guided by the results of PNRS I. Expanded clay and clinoptilolite biofilters will each be evaluated in 2^2, or 4 units. The 2^2 test matrix consists of two media depths (15 and 30 inch) and single pass and recycle operation (Table 3.3). All expanded clay and clinoptilolite biofilters will employ a two layer stratified design for particle size (Table 3.4). Expanded polystyrene biofilters will be evaluated in a 2^1 test matrix consisting single pass and recycle operation (Table 3.3). All pilot Stage 1 biofilters will be dosed at a 30 minute interval (48 dose/day), the dosing regime that was employed successfully in PNRS I.

The initial hydraulic loading rate to Stage 1 biofilters will be 3 gallon/ft^2-day. It is expected that this loading rate will be progressively increased as performance data is gathered over the course of the study. The PNRS II pilot studies will include recycle systems to delineate total nitrogen removal by pre-denitrification, and the use of two media size stratification and different media depths than were applied in PNRS I. These factors have direct technological and cost savings implications.

Stratification of media based on particle size is based on the expected progression of biochemical reactions within the biofilter. The processes in the upper coarse media layer include adsorption of wastewater particulates and colloids, hydrolysis and release of soluble organics, aerobic utilization of soluble organics, and biomass synthesis. In the upper layer, the biochemical processing of organic matter between doses must keep pace with the newly applied wastewater constituents from each dose. The greatest accumulation of organic and inorganic mass will occur in the upper layer, and the use of larger particle size media will provide greater space for accumulation of solids. Stratified media should enhance the potential for long term operation while maintaining treatment efficiency. The use of finer particle sizes in the lower media depths will provide greater surface area for microbial attachment and physical filtration, the later which could improve removal of pathogens and other wastewater constituents. The coarser sized particles in the upper layer will also filter out larger particulates and protect the underlying finer media. The two layer media size stratification (Table 3.4) is a simplification of the 3 layer design employed in PNRS I; the two layer design will simplify construction and reduce costs.

Table 3.3
Stage 1 Vertical Unsaturated Biofilter Configuration and Initial Operation

Unsaturated Biofilters (Stage 1)					
No.	**Media**	**Biofilter**	**Media Depth, Inches**	**Flow Regime**	**Recycle Ratio α**
1	Expanded Clay	UNSAT-EC-1	15	Single Pass	-
2		UNSAT-EC-2		Recycle	3
3		UNSAT-EC-3	30	Single Pass	-
4		UNSAT-EC-4		Recycle	3
5	Clinoptilolite	UNSAT-CL-1	15	Single Pass	-
6		UNSAT-CL-21		Recycle	3
7		UNSAT-CL-3	30	Single Pass	-
8		UNSAT-CL-4		Recycle	3
9	Polystyrene	UNSAT-PS-1	30 (NS)	Single Pass	-
10		UNSAT-PS-2		Recycle	3

EC: expanded clay, CL: clinoptilolite, PS: polystyrene, α: recycle flowrate/forward flowrate, NS: non-stratified

Specification of pilot hydraulic loading rates was guided by the results of PNRS I. Unsaturated expanded clay and clinoptilolite biofilters both exhibited exceptional performance at 3 gallon/ft^2-day. The PNRS I results suggest that the potential of these media was not fully utilized. The PNRS II pilot study will delineate treatment performance under real world conditions at the PNRS I loading rate of 3 gallon/ft^2-day and at higher loading rates. Higher loading rates translate into a smaller footprint for Stage 2 biofilters and significantly lower construction costs.

Table 3.4
Stage 1 Vertical Unsaturated
Biofilter Media Depth and Stratification

Total media depth, inch	Layer	Media layer depth, inch	Particle diameter, mm
15	Upper	5	1.5 – 2.5
	Lower	10	0.3 – 0.6
30	Upper	10	1.5 – 2.5
	Lower	20	0.3 – 0.6

The Stage 1 biofilters will be supplied with septic tank effluent with a timed dosing of once per one half hour (48 doses/day), as was employed in PNRS I. A centrally located dosing system will be used to distribute primary effluent over the surface of the media of each Stage 1 biofilter. Water will percolate downward through the Stage 1 media, through the support screen, and into a line that conveys biofilter effluent to the common Stage 1 effluent collection chamber. The water elevation in the line below the Stage 1 biofilter will provide hydraulic head for passive movement of water to the common collection chamber. A valve and sample port (with another valve) will be located in the line below the Stage 1 biofilter. In normal biofilter operation, the sample port valve will be closed and the valve leading to the effluent collection chamber will be open. The design of the biofilter system will minimize internal volumes within the connecting piping. At 48 doses per day and 3 gallon/ft^2-day, a single dose will add a volume that is approximately 6% of the water retained within the Stage 1 biofilter bed (Smith et al., 2008).

Configuration of the Stage 2 saturated denitrification biofilters is shown in Table 3.5. The Stage 2 biofilters will be constructed with unstratified mixed media containing elemental sulfur, crushed oyster shell, sodium sesquicarbonate, lignocellulosic materials, and expanded clay (Table 3.5). The use of elemental sulfur with oyster shell was successfully demonstrated in PNRS I. Sodium sesquicarbonate will provide a non-calcium containing alkalinity supply which will reduce the potential for supersaturation of calcium carbonate. The potential use of lignocellulosic materials as a source of organics in denitrification filters was reviewed in the PNRS I literature review. Expanded clay was also evaluated

as microbial attachment medium in PNRS I. Glycerol is a low cost fermentable substrate which serves as a denitrification electron donor.

Stage 2 biofilters will employ non-stratified mixed media of 1 to 2 mm particle size. A preliminary configuration of Stage 2 biofilters is as 6 inch diameter columns of 72 inch length; detailed design will be conducted in Tasks A.15 through A.17. Sample ports will be provided at 1/3 and 2/3 of total biofilter length, which will enable four point longitudinal profiling of nitrogen species and other water quality parameters.

A schematic of the two stage biofiltration pilot apparatus is shown in Figure 3-2. Like PNRS I, the pilot PNRS II biofilter systems will be configured for simplicity of operation, minimal moving parts, and passive gravity flow where possible. The two stage biofilter systems will likely be constructed as above ground Stage 1 filter vessels with gravity flow to the common Stage 1 effluent collection tank, with gravity or pumped flow to the horizontal Stage 2 filters (Figure 3-2). The same primary effluent (i.e. septic tank effluent) will be supplied to the surface of each of the Stage 1 vertical biofilters, which will be placed above ground to allow effluent to flow by gravity to a common Stage 1 effluent tank (Figure 3-2). Flow from the common Stage 1 effluent tank will be directed to the Stage 2 filters with individual control to each Stage 2 filter with pumps and/or valves. The system design will provide independent control of the flowrate to each Stage 2 filter. Stage 2 biofilters will be maintained in saturated mode by the Stage 2 overflow elevation. Stage 2 effluent will be collected via gravity into a Stage 2 collection tank, for management or disposal. Details of design and fabrication of pilot biofilter systems will be addressed in Tasks A.15 through A.17.

Monitoring sample points are septic tank effluent, Stage 1 effluents, the common Stage 2 influent, and Stage 2 effluents (Table A.1). For each monitoring point, separate samples will be collected for field analyses and for laboratory analyses. Field analyses will be performed immediately upon sample collection. Samples for laboratory analyses will be collected by directing samples directly into sample collection containers that are located within iced coolers and that contain any required sample preservatives. Influent and effluent samples will not have contact with any intermediate sample devices. Effluent samples will be maintained in iced coolers and transported to the lab within 24 hours of collection.

Table 3.5
Stage 2 Saturated Denitrification Biofilter
Configuration and Initial Operation

No.	Electron Donor	Biofilter	Media Composition (by volume)	Flowrate gpd	Surface Loading Rate, gal/day-ft^2	Water residence time at 1/3 of length (hour)	Water residence time 2/3 of length (hour)	Water residence time at 100% (hour)
1	Elemental sulfur	DENIT-SU-1	80% SU 20% OS	5	25.5	5.6	11.3	16.9
2		DENIT-SU-2		10	51.0	2.8	5.6	8.5
3		DENIT-SU-3		15	76.4	1.9	3.8	5.6
4		DENIT-SU-4	80% SU 20% NS	5	25.5	5.6	11.3	16.9
5		DENIT-SU-5		10	51.0	2.8	5.6	8.5
6		DENIT-SU-6		15	76.4	1.9	3.8	5.6
7	Lignocellulosic	DENIT-LS-1	60% LS 40% EC	5	25.5	5.6	11.3	16.9
8		DENIT-LS-2		10	51.0	2.8	5.6	8.5
9		DENIT-LS-3		15	76.4	1.9	3.8	5.6
10		DENIT-LS-4	35% LS 65% EC	5	25.5	5.6	11.3	16.9
11		DENIT-LS-5		10	51.0	2.8	5.6	8.5
12		DENIT-LS-6		15	76.4	1.9	3.8	5.6
13	Glycerol	DENIT-GL-1	100% EC	5	25.5	5.6	11.3	16.9
14		DENIT-GL-2		10	51.0	2.8	5.6	8.5
15		DENIT-GL-3		15	76.4	1.9	3.8	5.6

SU: elemental sulfur, LS: lignocellulosic, GL: glycerol, OS: oyster shell, NS: sodium sesquicarbonate, EC: expanded clay

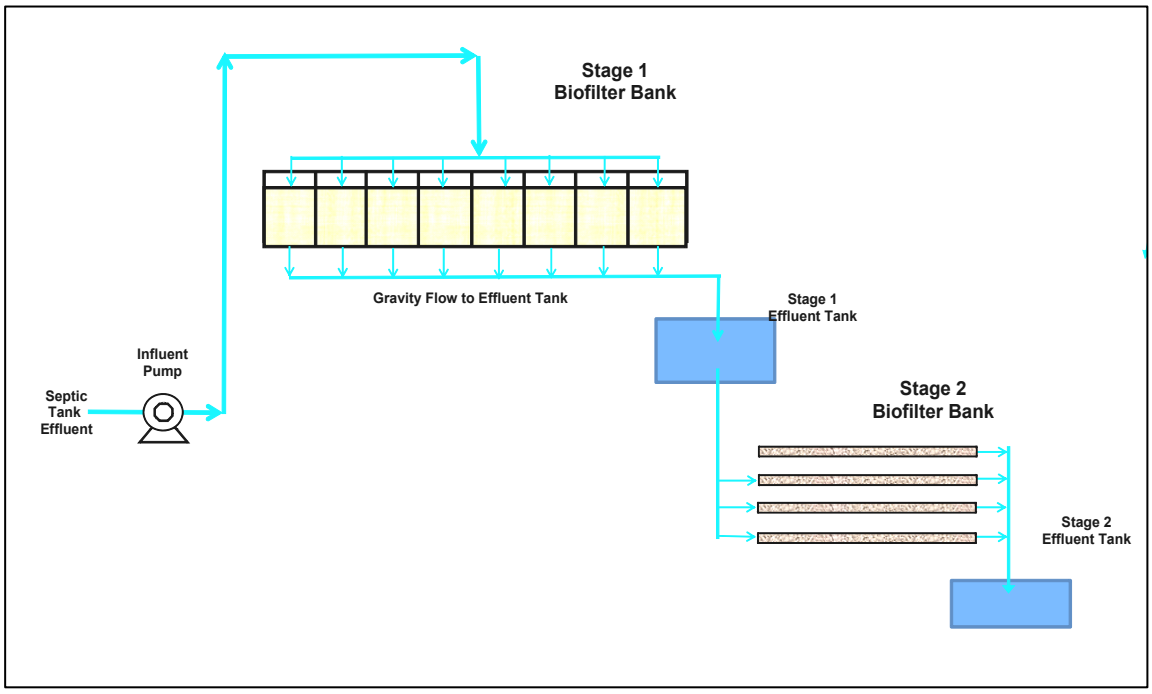


Figure 3-2 Schematic of Pilot Two-Stage Vertical/Horizontal Biofilter Systems

B. In-Situ Vegetative/Media Simulators

In-situ testing will be conducted by the application of primary effluent (i.e. septic tank effluent) and nitrified effluent to in-situ vegetative/media treatment systems. Effluent will be applied using subsurface drip irrigation (STE) or using an innovative capillary seepage matt that has been developed for irrigation of agricultural plants by scientists at the University of Florida Gulf Coast Research and Educational Center (GCREC). A schematic of in-situ simulators is shown in Figure 3-3. Other than the pumping of effluent by subsurface irrigation, the in-situ simulators are completely passive systems.

In INSITU-1, primary effluent (i.e. septic tank effluent) will be applied by subsurface drip irrigation to a near surface location, such that STE will interact with the active root zone of plantings, trickle downward through a 12 in. zone of unsaturated media, and then pass through an underlying zone of natural undisturbed soil (Figure 3-3). The 12 in. unsaturated media zone will consist of an upper layer of expanded clay of 1-2 mm, while the lower media layer will be a mixed media of 0.5 to 1 mm particle size of expanded clay, lignocellulosic material, and elemental sulfur (Table 3.3). The rationale for media size stratification was previously applied in PNRS I. The large size media in the upper

layer assimilate particulates and microbial growth, while finer size media at lower depths provide physical filtration and high surface area for biochemical reaction.

In INSITU-2, primary effluent will first be nitrified through an external in-tank biofiltration process. Nitrified effluent will be applied to a near surface location using drip irrigation over a capillary seepage matt such that nitrified effluent will interact with the active root zone of plantings, trickle downward through a 12 in. zone of unsaturated media, and then pass through an underlying zone of natural undisturbed soil (Figure 3-3). The 12 in. unsaturated media zone will consist of a single layer of 1-2 mm media consisting of expanded clay, lignocellulosic material, and elemental sulfur (Table 3.3).

An innovative feature of the in-situ simulator design is the use of mixed media in unsaturated mode that contains both a high water retention media (expanded clay) and heterotrophic and autotrophic electron donor (Table 3.6). The innovative media mix will provide three electron donor source options for denitrification: wastewater organics, lignocellulosics, and elemental sulfur. The use of solid electron donor media in an unsaturated operational mode will facilitate both aerobic processes (i.e. nitrification) and denitrification in saturated microsites with low redox potential. In a sense, this design will provide an electron donor boost to the simultaneous nitrification/denitrification process that occurs in unsaturated filters with inert media supports.

The goal of this testing is to quantify nitrogen reduction in systems where STE or nitrified effluent is applied with subsurface drip emitter tubing or capillary matt to shallow locations within the subsurface which contain plant root zones, unsaturated media, and electron donor media for enhanced denitrification. Timed dosing to shallow application points in the subsurface could be capable of affecting nitrogen reduction. This potential for in-situ treatment systems, including plant-assisted nitrogen transformations, has not been examined in Florida with innovative systems of this type but is of potentially high significance.

The 2^1 test matrix is shown in Table 3.6. The test matrix consists of subsurface drip irrigation emitter dosing of primary effluent (i.e. septic tank effluent) or nitrified effluent into the root zone of St. Augustine grass, 12 inch of unsaturated media to provide nitrification and denitrification. The in-situ simulators will receive an average hydraulic application rate of 0.50 gallon/ft^2-day on an aerial basis applied at 24 doses/day. Drip emitters will be placed at 12 inch spacings.

Issues that may affect nitrogen reduction are average daily hydraulic application rate, horizontal emitter spacing, doses per day, volume per dose, and the depth at which the bottom of emitter tubes is placed. Emitter tubing is available with spacings of as little as

12 in., which are preferred to typical 24 in. emitter spacings and will be used in this study. The lower emitter spacing results in lower effluent volume per dose at each emitter that are spread more uniformly over the plan area of the dosing zone, thereby increasing the effectiveness of utilization of the total plan area of the receiving surface. Hydraulic application rate affects volume per dose for any given dosing schedule, as interrelated to dosing frequency. As the average daily hydraulic application rate increases, the vegetative/media system will be increasingly challenged to assimilate nitrogen in the applied STE and limit downward nitrogen migration. The depth of emitters and the relationship of emitted effluent to surface vegetation root zones is an ostensibly significant factor affecting total nitrogen reduction. A dosing event can lead to water saturation in a temporally and spatially limited zone that creates oxygen limited conditions that favor denitrification. After saturated conditions end, microenvironments with limited DO can persist and provide continued denitrification. When bulk pore spaces are filled with air, conditions can favor nitrification. Plant roots can exude organic carbon and provide an electron donor rich region. The combination of the supply of organic carbon and reduced nitrogen in the applied STE, the varying saturation and oxygen levels resulting from the dosing regime, and the characteristics of the plant root zone can affect sequential nitrification and denitrification reactions. Downward advective transport of organic carbon and nitrate can create a biologically active denitrification zone of some vertical extent. The interaction of all of these factors will determine the extent to which total nitrogen reduction can be affected by drip application of STE into plant/media systems and the significance of plant processes on overall nitrogen reduction. Detailed design of in-situ simulators will be conducted in Tasks A.15 through A.17.

For all PNRS II pilot units, system shakedown will proceed following fabrication and set up. System integrity and hydraulics will be fully evaluated with clean water. Basic features of system integrity and hydraulic conveyance will be examined, including system leaks, gravity flow conveyance where applicable, operation of pumps and valves, and sample access functionality. Media will be pre-screened where needed, washed at least three times to remove fines, and placed to appropriate depths in the biofilters. Denitrification biofilters will be initially filled with a clean water source which will be displaced upon commencement of operation. Operation on wastewater will proceed and flow monitoring will be commenced.

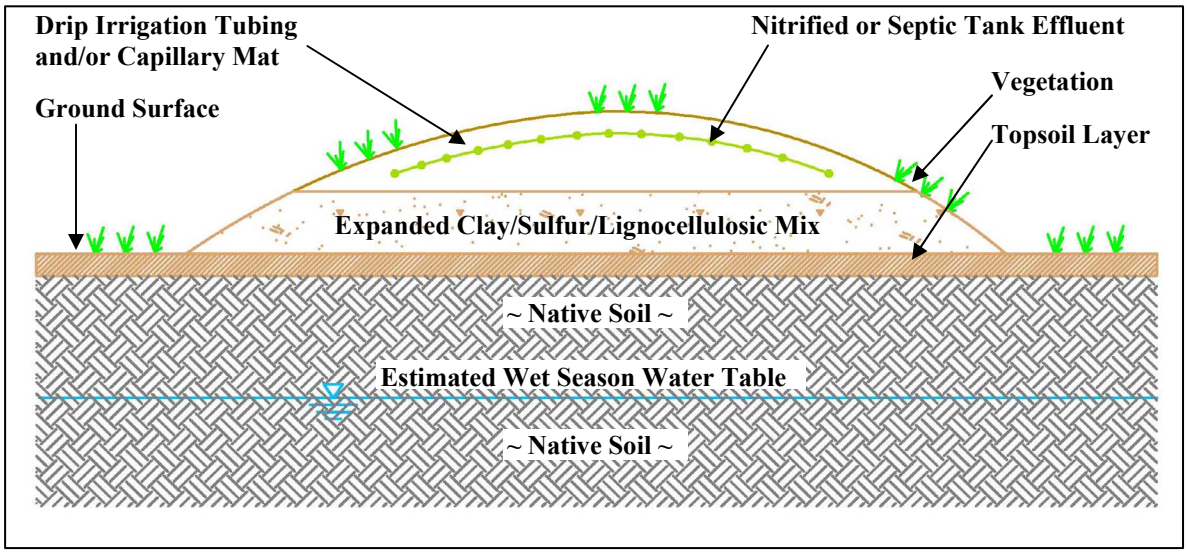


Figure 3-3 Cross-Section Schematic of In-Situ Vegetative Denite - Media Treatment System

Table 3.6
In-Situ Vegetation/Media Simulator Configuration and Operation

No.	In-Situ Simulator	Influent	Flow Application	Unsaturated Media	Saturated Media	Hydraulic Loading Rate, Plan Area Basis, gallon/ft^2-day	Dosing Regime
1	INSITU-1	Primary effluent	Subsurface Drip Irrigation Tubing	5 in. 1-2 mm 100% EC 7 in. 0.5-1 mm 40% EC 30% LS 30% SU	Native soil	0.50	24/day
2	INSITU-2	Nitrified effluent	Drip Irrigation Tubing over Capillary Seepage Matt	12 in. 0.5-1 mm 40% EC 30% LS 30% SU			

SU: elemental sulfur LS: lignocellulosic EC: expanded clay

Task 4: Operation and Monitoring of Pilot Systems

The biofilter systems will be operated over a twelve month period during which eight monitoring events will be conducted. The analytical template is shown in Table 3.7. A detailed analytical description is included in Appendix A. As outlined in Table A.1, there are 23 sampling points and a monitoring analyses structure that employs three analytical

tiers. Tier 1 analytes include field and laboratory parameters that will be monitored at each sample point (up to 23) and at each sample event. Potential monitoring points are STE (1), Stage 1 effluents (10), Stage 2 influent (1), horizontal Stage 2 effluents (9), and in-situ soil/vegetative simulator effluents (2). Tier 1 analytes include field parameters (temperature, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP); the nitrogen series (laboratory parameters) of total kjeldahl nitrogen (TKN), ammonia (NH_3), and oxidized nitrogen (NO_x); five day carbonaceous biochemical oxygen demand (C-BOD_5) and total suspended solids (TSS). Tier 2 analytes are supporting parameters that will be monitored at much reduced frequency at all sample points. Tier 3 parameters will be conducted only on sulfur-based denitrification biofilter sample points. (Table 3.7).

Table 3.7
Analyses Template

Analysis Tier	Number of events	Sample points	Analytes	Total number of analyses
1	8	23 (all)	Temperature	184
			pH	184
			DO	184
			ORP	184
			Alkalinity	184
			TKN	184
			NH_3-N	184
			(NO_3+NO_2)-N	184
			C-BOD_5	184
			TSS	184
2	1 - 4	23 (all)	COD	50
			Total phosphorus	29
3	4 - 8	5 (sulfur systems)	Sulfate	40
			H_2S	16

Task 5: Preparation of Draft Report

A draft report will be prepared describing pilot testing methods and procedures, results of the research, discussion and conclusions, and all monitoring data. The draft report will be submitted to FDOH for review and comment.

Task 6: Preparation of Final Report

A final report will be prepared based on comments from reviewers of the draft report.

Section 4
Quality Objectives and Criteria

The objective of this monitoring program is to evaluate media for passive nitrogen removal from septic tank effluent. The following summarizes the work to be performed:

- Two stage biofilters, redial flow denitrification biofilters and passive in-situ systems will be constructed and operated on primary effluent over a twelve month period.
- The flowrates to each biofilter system provide a range of hydraulic loading rates.
- First stage recycle will be employed to evaluate pre-denitrification.
- Monitoring will be conducted for septic tank effluent, effluent from the Stage 1 (unsaturated) biofilters and effluent from the Stage 2 (saturated) biofilters.
- Field parameters will be monitored at the site. Sample will be collected and transported to the laboratory for analysis of nitrogen species, sulfate and other wet chemistry parameters.
- Operation or configuration of the biofilters will be modified based on analysis of results and adaptive management.
- In-situ soil/vegetative evaluations will be conducted using subsurface drip irrigation technology with emitters located in root zone and monitoring to develop nitrogen concentrations and vertical nitrogen flux.

The monitoring data will be used to calculate:

1. average concentrations and standard deviations of water parameters in septic tank effluent, Stage 1 effluent and Stage 2 effluents;
2. percent removal nitrogen and nitrogen species in Stage 1 biofilters, Stage 2 biofilters and two stage biofilter systems;

3. changes to dissolved oxygen, pH, oxidation reduction potential and alkalinity through biofiltration treatment stages; and

4. average applied hydraulic loading rate, applied loading rates of total nitrogen and nitrogen species.

5. Vertical nitrogen flux in in-situ soil/vegetative systems.

A. Precision and Accuracy

Precision describes the reproducibility of results. Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy will be evaluated through the analysis of surrogate spikes, Laboratory Control Samples (LCS), Laboratory Control Sample Duplicates (LCSD), matrix spike samples (MS/MSD) and laboratory internal blind audit samples. Precision and accuracy information is tracked by the laboratory, with acceptable ranges updated periodically. In addition, NELAC requirements include the analysis of proficiency test samples to evaluate precision and accuracy. Analytical methods, precision and accuracy, method detection limits and practical quantification limits are shown in Table 4.1.

Table 4.1
Aqueous Methodology, Precision and Accuracy, Detection Limits

Analyte	Method	Precision, %	Accuracy, %	MDL, ppm	PQL, ppm
Temperature					
pH	SM4500H+B	20	NA	0.1 pH units	0.1 pH units
DO					
ORP					
Turbidity	180.1	20	90-110	0.2 NTU	0.2 NTU
Alkalinity	SM2320 B	20	90-110	5.0	5.0
C-BOD_5	SM5210 B	20	85-115	2.0	2.0
COD	410.4	20	90-110	12.09452	25
TOC	SM5310 B	20	90-110	0.14778	1.0
TSS	SM2540 D	20	90-110	5.0	5.0
TKN	351.2	20	90-110	0.07121	0.5
NH_3-N	350.1	20	90-110	0.02	0.05
(NO_3+NO_2)-N	353.2	20	90-110	0.02541	0.05
Sulfate	300.0	20	90-110	0.05523	0.5
H_2S	SM4500S-E	20	80-120	1.0	1.0
Fecal coliforms	SM9222 B	20	NA	1.0	1.0
Total coliforms	SM9222 B	20	NA	1.0	1.0
Escherichia coli	SM9222 B	20	NA	1.0	1.0

MDL = method detection limit

PQL = practical quantitation limit

B. Representativeness

Representativeness refers to the relationship of a sample taken from a site to be analyzed to the remainder of the sample matrix at the site. The samples will be taken directly from the influents and effluent of the biofilters and will provide representativeness.

C. Comparability

The use of NELAC approved procedures and consistent approved methodologies ensure the comparability of data sets generated by different laboratories.

D. Completeness

Completeness is defined as a measure of the extent to which the data fulfill the data quality objectives of the project. The completeness of the data will be determined during the data validation and verification process.

Section 5
Documentation and Records

All documentation archives will be kept for a minimum of 5 years after the date of project completion as outlined in Table 5.1. Reports and deliverables will be submitted in Word or Excel format.

Table 5.1
Documentation and Records Storage

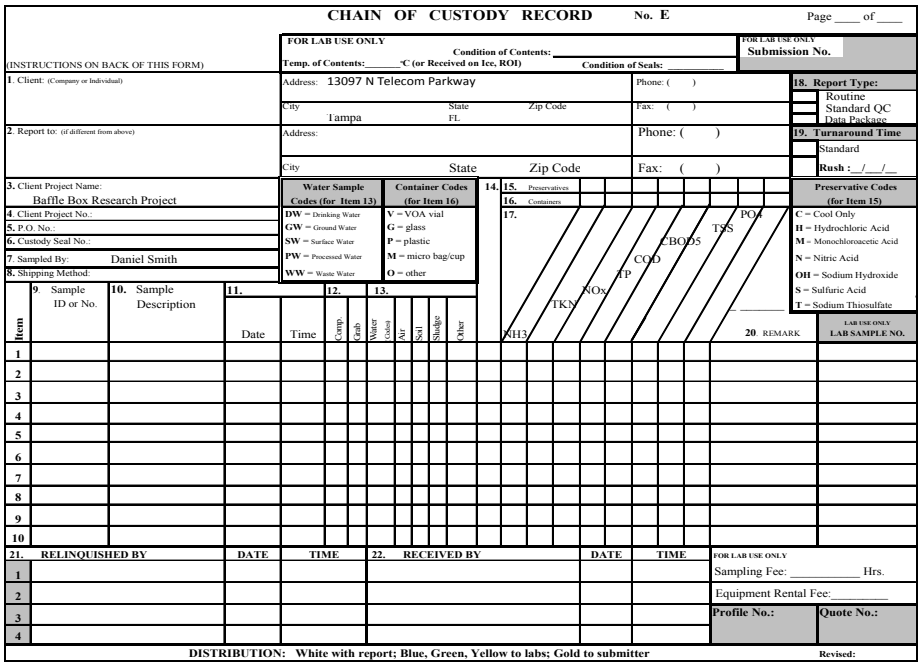
Document/Record	Location	Retention Time	Format
QAPP and revisions	Hazen and Sawyer, AET	5 years after project completion	Paper, electronic
Field notes	Hazen and Sawyer	5 years after project completion	Paper
Chain of custody	Hazen and Sawyer, Lab	5 years after project completion	Paper
Laboratory QA manual	Lab	5 years after project completion	Paper, electronic
Laboratory SOPs	Lab	5 years after project completion	Paper, electronic
Laboratory data reports	Hazen and Sawyer, Lab	5 years after project completion	Paper, electronic
Laboratory equipment maintenance logs	Lab	5 years after project completion	Paper
Laboratory calibration records	Lab	5 years after project completion	Paper, electronic

A. Field Documentation

1. Field Notes
   Field notes will be documented and maintained by field staff.

2. Field Parameters
   Field staff will record specific sample point, date and time of sample collection, parameter name, result and units

3. Sample Collection, Preservation and Transport
   Chain of custody forms and sample tags attached to sample bottles will be supplied by the laboratory. Figure 5-1 depicts a typical chain of custody form. Legal or evidentiary chain of custody as defined in the NELAC standards will be executed.



CHAIN OF CUSTODY RECORD No. E Page ____ of ____

(INSTRUCTIONS ON BACK OF THIS FORM)

FOR LAB USE ONLY
Temp. of Contents:_____°C (or Received on Ice, ROI)
Condition of Contents: _____
Condition of Seals: _____

FOR LAB USE ONLY
Submission No.

1. Client: (Company or Individual)
Address: 13097 N Telecom Parkway
City Tampa State FL Zip Code
Phone: ( )
Fax: ( )

18. Report Type:
Routine
Standard QC
Data Package

2. Report to: (if different from above)
Address:
City State Zip Code
Phone: ( )
Fax: ( )

19. Turnaround Time
Standard
Rush : __/__/__

3. Client Project Name: Baffle Box Research Project
4. Client Project No.:
5. P.O. No.:
6. Custody Seal No.:
7. Sampled By: Daniel Smith
8. Shipping Method:

Water Sample Codes (for Item 13)	Container Codes (for Item 16)
DW = Drinking Water	V = VOA vial
GW = Ground Water	G = glass
SW = Surface Water	P = plastic
PW = Processed Water	M = micro bag/cup
WW = Waste Water	O = other

14. 15. Preservatives
16. Containers
17. TKN NOx NH3 TP COD CBOD5 TSS PO4

Preservative Codes (for Item 15)
C = Cool Only
H = Hydrochloric Acid
M = Monochloroacetic Acid
N = Nitric Acid
OH = Sodium Hydroxide
S = Sulfuric Acid
T = Sodium Thiosulfate

Item	9. Sample ID or No.	10. Sample Description	11. Date	11. Time	12. Comp.	12. Grab	13. Water (Codes)	13. Air	13. Soil	13. Sludge	13. Other	20. REMARK	LAB USE ONLY LAB SAMPLE NO.
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

	21. RELINQUISHED BY	DATE	TIME	22. RECEIVED BY	DATE	TIME
1						
2						
3						
4						

FOR LAB USE ONLY
Sampling Fee: _____ Hrs.
Equipment Rental Fee:_____
Profile No.: Quote No.:

DISTRIBUTION: White with report; Blue, Green, Yellow to labs; Gold to submitter
Revised:

Figure 5-1 Typical Chain of Custody Form

B. Laboratory Documentation and Reporting

Laboratory deliverables will be submitted in Word or Excel format. Laboratory reports will be issued in accordance with NELAC requirements. Certificates from vendors will be retained, whether from a laboratory or commercial vendor. Records of the lot numbers of reagents and other cleaning supplies, with the inclusive dates for use, will be recorded. Pre-cleaned container packing slips, lot numbers of shipments, and certification statements provided by the vendor will be retained by laboratories. All local, state and federal requirements pertaining to waste storage and disposal will be followed.

C. Archival of Electronically Stored Data

Analytical reports generated will be retained by Hazen and Sawyer and the laboratories performing the analyses.

Section 6
Sampling Process Methodology

A. Site Location

The project will be conducted at one of the sites in Hillsborough County listed in Section 2B.

B. Monitoring and Sampling Frequency and Duration

The biofilter systems will be monitored eight times over a twelve month period.

C. Number of Samples and Matrices

All sampling will be aqueous samples. On each monitoring date, samples will be collected for septic tank effluent, the effluents from Stage 1 biofilters, and the effluents from Stage 2 biofilters. Field analysis will be performed upon sample collection. Aqueous samples for laboratory analysis will be collected in sample containers prepared by the laboratories, maintained in an iced cooler during collection and transport, and transported to the laboratory. Samples will arrive at laboratories within twenty four hours after the completion of collection activities, or as needed for shorter sample hold times. Field analysis will be performed on the same date and for the sample locations taken for aqueous laboratory samples. Samples for field analyses will be collected in separate containers from laboratory samples. Stage 1 and 2 field parameter analyses will be measured in-situ by placing probes directly into collected samples or directly into effluent pipes. Shipping coolers will be supplied and decontaminated by the laboratories. Sample preservation and holding times are provided in Table 6.1. The laboratories will follow all local, state and federal requirements pertaining to waste storage and disposal. No equipment except the sample container will be used to collect the samples, and the sampling equipment will be certified clean by the laboratory providing the equipment. A field blank will be collected for TKN, NH_3 and NO_3+NO_2 for a minimum of 5% of samples collected over the life of the project using distilled water supplied by the laboratories. As a part of its QC, laboratories will perform sample duplicates for a minimum of 5% of samples. Laboratory QC will also include matrix spikes, percent recovery on QC standards, and method blanks.

Table 6.1
Aqueous Matrix Containers, Preservation and Holding Times

Analyte	Method	Minimum Sample Volume	Holding Time	Container Type	Sample Preservation	Preservative Dosage
Physical and Inorganic Parameters						
Alkalinity as CaCO3	310.1/SM2320B	100 mL	14 days	250 mL	4° C	n/a
Ammonia	350.1	25 mL	28 days	250 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
BOD / cBOD	SM5210B/405.1	1 L	48 hours	1 L Plastic	4° C	n/a
Chloride	300	50 mL	28 days	250 mL	4° C	n/a
COD	410.4	50 mL	28 days	250 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
Hydrogen Sulfide	376.1	500 mL	7 days	500 mL Plastic	Zinc Acetate / NaOH	.1 / .5 gm/ 500 mL
Nitrate/Nitrite-N (NO_X)	SM4500	50 mL	28 days	250 mL	1:1 H_2SO_4 / 4 ° C	l mL/ 250 mL
Nitrate-N	SM4500	50 mL	48 hours	250 mL	4° C	n/a
Nitrite-N	SM4500	50 mL	48 hours	250 mL	4° C	n/a
Organic Nitrogen (calculation)	350.1/351.2	100 mL	28 days	500 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
Ortho Phosphorus	365.4/9056/300.0	25 mL	48 hours	250 mL	4° C	n/a
pH	SM4500HB	50 mL	24 hours	250 mL	4° C	n/a
Sulfate	300	10 mL	28 days	250 mL	4° C	n/a
Sulfide	376.1/9030/9034	500 mL	7 days	500 ml	NaOH + Zn Acetate	1 mL/ 500 mL
TKN	351.2	100 mL	28 days	250 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
Total Nitrogen (calculation)	300.0/351.2	100 mL	28 days	250 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
Total Organic Carbon (TOC)	415.1/SM5310B	25 mL	28 days	125 mL Plastic	HCl to pH < 2 / 4 ° C	.5 mL/ 125 mL
Total Phosphorus	365.2/365.4	50 mL	28 days	250 mL	1:1 H_2SO_4 to pH < 2	1 mL/ 250 mL
Total Suspended Solids	160.2	300 mL	7 days	1 L Plastic	4° C	n/a
Turbidity	180.1	30 mL	48 hours	125 mL Plastic	4° C	n/a

Table 6.1
Aqueous Matrix Containers, Preservation and Holding Times

Analyte	Method	Minimum Sample Volume	Holding Time	Container Type	Sample Preservation	Preservative Dosage
Microbiological Parameters						
Total Coliform (MMO-Mug)	SM9223	100 mL	30 hours	Micro-cup	4° C	n/a
Total Coliform (MF)	SM9222	100 mL	6 hours	Micro-cup	4° C	n/a
Fecal Coliform (MF)	SM9222	100 mL	6 hours	Micro-cup	4° C	n/a
Standard Plate Count	SM9222	100 mL	8 hours (DW)	Micro-cup	4° C	n/a
Standard Plate Count	SM9222	100 mL	6 hours (WW)	Micro-cup	4° C	n/a
Fecal Coliform (MPN)	SM9221	100 g.	24 hours	Micro-cup	4° C	n/a

Short hold times

Minimum volume does not include sample volume needed to perform required quality control parameters

D. Inspection/Acceptance of Supplies and Consumables

1. Sample Containers

To be provided by the laboratory prior to each sampling event.

2. Sample Coolers

To be provided by the laboratory prior to each sampling event.

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Section 7
Data Review, Verification and Validation

A. Data Verification

Data verification is the process for evaluating the completeness, correctness, and conformance of the data set against the methodology. This evaluation is integral to the final report.

B. Data Validation

Data validation is an analyte and sample specific process that determines the quality of the data set relative to the end use. Any data deemed to be unusable for the stated objectives will be identified as such in the final report.

Appendix A
Analytical Schedule

Table A.1
Estimated Number of Analyses at each
Monitoring Point for each Sampling Event

Sample point	Influent (STE)	Vertical Stage 1 effluent	Stage 2 influent	Horizontal sulfur Stage 2 effluent	Horizontal non-sulfur Stage 2 effluent	In-situ vegetative/ media simulator sulfur	In-situ vegetative/ media simulator non-sulfur
No. of sample points	**1**	**10**	**1**	**3**	**6**	**1**	**1**
Analyses	**No. of Sample Events**						
Temp	8	8	8	8	8	8	8
pH	8	8	8	8	8	8	8
DO	8	8	8	8	8	8	8
ORP	8	8	8	8	8	8	8
Alkalinity	8	8	8	8	8	8	8
TKN	8	8	8	8	8	8	8
NH_3	8	8	8	8	8	8	8
NO_x	8	8	8	8	8	8	8
C-BOD_5	8	8	8	8	8	8	8
TSS	8	8	8	8	8	8	8
COD	4	2	4	2	2	2	2
Total P	4	1	4	1	1	1	1
SO_4	0	0	8	8	0	8	0
H_2S	0	0	0	4	0	4	0

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Table A.2
Estimated Total Number of Analyses
at each Monitoring Point over PNRS II Study.

	Influent (STE)	Vertical Stage 1 effluent	Stage 2 influent	Horizontal sulfur Stage 2 effluent	Horizontal non-sulfur Stage 2 effluent	In-situ vegetative/ media simulator sulfur	In-situ vegetative/ media simulator non-sulfur	
	1	10	1	3	6	1	1	
Analyses	**No. of Samples**							**Total Samples**
Temp	8	80	8	24	48	8	8	184
pH	8	80	8	24	48	8	8	184
DO	8	80	8	24	48	8	8	184
ORP	8	80	8	24	48	8	8	184
Alkalinity	8	80	8	24	48	8	8	184
TKN	8	80	8	24	48	8	8	184
NH_3	8	80	8	24	48	8	8	184
NO_x	8	80	8	24	48	8	8	184
C-BOD_5	8	80	8	24	48	8	8	184
TSS	8	80	8	24	48	8	8	184
COD	4	20	4	6	12	2	2	50
Total P	4	10	4	3	6	1	1	29
SO_4	0	0	8	24	0	8	0	40
H_2S	0	0	0	12	0	4	0	16

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Table A.3
Estimated Number of Analyses to be
Conducted for each Sample Event for all Systems

	Number of samples								
	Sample event								
Analyses	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Sum**
Temp	23	23	23	23	23	23	23	23	184
pH	23	23	23	23	23	23	23	23	184
DO	23	23	23	23	23	23	23	23	184
ORP	23	23	23	23	23	23	23	23	184
Alkalinity	23	23	23	23	23	23	23	23	184
TKN	23	23	23	23	23	23	23	23	184
NH_3	23	23	23	23	23	23	23	23	184
NO_x	23	23	23	23	23	23	23	23	184
C-BOD_5	23	23	23	23	23	23	23	23	184
TSS	23	23	23	23	23	23	23	23	184
COD	23	0	23	0	2	0	2	0	50
Total P	23	0	2	0	2	0	2	0	29
SO_4	5	5	5	5	5	5	5	5	40
H_2S	4	0	4	0	4	0	4	0	16

References

References

Smith, D., R. Otis, and M. Flint (2008) Florida Passive Nitrogen Removal Study Final Report. Submitted to the Florida Department of Health, Tallahassee, Florida, June 26, 2008.

Smith, D. (2008) Florida Passive Nitrogen Removal Study Additional Monitoring. Submitted to the Florida Department of Health, Tallahassee, Florida, November 4, 2008.

FLORIDA DEPARTMENT OF HEALTH
ONSITE NITROGEN REDUCTION STRATEGIES STUDY

PROGRESS REPORT NO. 4
(MAY, 2009)

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task A – Technology Evaluation for Field Testing: Review, Prioritization, and Development				
Task A.1, Draft Literature Review Report	Task Complete	Draft literature review report submitted on May 19, 2009.	None	N/A
Task A.2, Final Literature Review Report	Not started	No activity	N/A	N/A
Task A.3, Draft Classification of Technologies Report	Task Complete	Draft Classification, Ranking and Prioritization report submitted on May 19, 2009.	None	N/A
Task A.4, Draft Technology Ranking Criteria Report	Task Complete	Draft Classification, Ranking and Prioritization report submitted on May 19, 2009.	None	N/A
Task A.5, Draft Priority List for Testing Report	Underway	Continued development of draft technology list and ranking database.	N/A	N/A
Task A.6, Technology Classification, Ranking and Prioritization Workshop	Task Complete	Workshop presentation materials were developed. Workshop was conducted on May 28, 2009.	None	N/A
Task A.7, Final Classification of Technologies Report	Not started	No activity	N/A	N/A
Task A.8, Final Technology Ranking Criteria Report	Not started	No activity	N/A	N/A

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task A.9, Final Priority List for Testing Report	Not started	No activity	N/A	N/A
Task A.10, Draft Innovative Systems Applications Reports	Not started	No activity	N/A	N/A
Task A.12, Identification of Test Facility Sites:	Underway	*USF Lysimeter Station* – A general assessment of lysimeter station rehabilitation needs has been determined. *UF Gulf Coast Research and Education Center* – We have a preliminary agreement to participate, and will finalize arrangements with GCREC after RRAC approves recommendation to proceed with GCREC as a test facility site based on preliminary soil and GW assessment. A summary of the site conditions and recommendations was sent to Elke and distributed May 19, 2009. On May 28, 2009 the RRAC voted to use the GCREC facility site as the only test facility site.	Lysimeter station rehabilitation costs alone are likely to be in excess of $60,000, which exceed the total construction budget for the Task A test facility. .	We are recommending consolidating our activities to one test facility. We recommended to conduct all test facility activities at this site
Task A.13, Draft QAPP PNRS II	Underway	Draft QAPP undergoing internal review and revision. This QAPP is somewhat dependent on test facility site for finalization.	Behind schedule on draft QAPP, anticipate completion in early June	Will attempt to shorten timeframe on final QAPP so that Final deadline is met.
Task A.14, Recommendation for Process Forward Meeting	Not started	No activity	N/A	N/A
Task A.15, Final QAPP PNRS II	Not started	No activity	N/A	N/A
Task A.16, PNRS Specification Reports	Not started	No activity	N/A	N/A

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task A.17, Test Facility Design 50%	Not started	No activity	N/A	N/A
Task A.18, Test Facility Design 100%	Not started	No activity	N/A	N/A
Task A.19, Test Facility Design Final	Not started	No activity	N/A	N/A
Task A.20, Test Facility Accept Bid	Not started	No activity	N/A	N/A
Task B – Field Testing of Technologies and Cost Documentation				
Task B.1, Identification of Home Sites	Underway	Continued discussions with homeowners groups. Several home sites in Manasota Key were visited to perform preliminary evaluation of sites with homeowners interested in the project.	None	N/A
Task B.2, Vendor Agreement Reports	Not started	No activity	N/A	N/A
Task B.3, Draft QAPP for Field Testing	Underway	Continued discussions of field testing work plan	None	N/A
Task B.4, Recommendation for Process Forward Meeting	Not started	No activity	None	N/A
Task B.5, Final QAPP Field Testing	Not started	No activity	N/A	N/A
Task B.11, LCCA Template Report	Not started	No activity	N/A	N/A

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task C – Evaluation of Nitrogen Reduction Provided by Soils and Shallow Groundwater				
Task C.1, Draft Literature Review on Nitrogen Reduction in Soils & Shallow GW Report	Underway	Completed assimilation of literature sources. Draft near completion	Anticipated submittal by June 30, 2009.	N/A
Task C.2, Final Literature Review on Nitrogen Reduction in Soils & Shallow GW Report	Not started	No activity	N/A	N/A
Task C.3, Draft QAPP Evaluation of Nitrogen Reduction Provided by Soils & Shallow GW	Underway	Continued discussions of Task C work plan	Behind schedule, requesting 1 month extension to deadline	Will attempt to keep Final QAPP deadline by shortening Final QAPP prep.
Task C.4, Recommendation for Process Forward Meeting	Not started	No activity	N/A	N/A
Task C.5, Final QAPP Evaluation of Nitrogen Reduction Provided by Soils & Shallow GW	Not Started	No activity	N/A	N/A
Task C.6, Home Site Selection	Underway	Continued discussions with homeowners groups	None	N/A
Task C.7, Instrumentation of Home Sites Report	Not started	No activity	N/A	N/A
Task C.11, Test Facility Design 50%	Not started	No activity	N/A	N/A
Task C.12, Test Facility Design 100%	Not started	No activity	N/A	N/A

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task D – Nitrogen Fate and Transport Modeling				
Task D.1, Draft Literature Review on Nitrogen Fate & Transport Model Report	Underway	Completed assimilation of literature sources. Draft near completion.	Anticipated submittal by June 30, 2009.	Will attempt to keep final lit. review deadline by shortening final lit. review prep.
Task D.2, Final Literature Review on Nitrogen Fate & Transport Model Report	Not started	No activity	N/A	N/A
Task D.3, Selection of Existing Data Set for Calibration Report	Underway	Continued data collection and review	None	N/A
Task D.4, Draft QAPP N Fate and Transport Modeling	Underway	Continued work on modeling work plan	None	N/A
Task D.5, Recommendation for Process Forward	Not started	No activity	N/A	N/A
Task D.6, Final QAPP N Fate and Transport Modeling	Not started	No activity	N/A	N/A
Task D.7, Simple Soil Model Development	Not started	No activity	N/A	N/A
Task D.8, Non-Steady State Aquifer Model, Simple Soil Model	Not started	No activity	N/A	N/A
Task D.9, Aquifer Model with Averaged Output, Simple Soil Model	Not started	No activity	N/A	N/A

Task	Task Status	Activity this Period	Technical, Schedule, or Budget Problems Encountered	Recommended Methods to Resolve Problems
Task E – Project Management, Coordination and Meetings				
Task E.1, Project Kick-off Meeting	Task Complete	No activity	None	N/A
Task E.2, PM-Project Progress Report	Progress Report 1, 2, 3 - Complete	The May 2009 progress report (this report) was completed June 2, 2009.	None	N/A
Task E.3, RRAC Meeting	Not started	No activity	N/A	N/A
Task E.4, PAC Meeting	Not started	No activity	N/A	N/A

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

Minutes of the Meeting held at the Gulf Coast Research and Education Center, Wimauma, FL
July 1, 2009
Approved by RRAC September 10, 2009

In attendance:

- **Committee Membership and Alternates**:
  - In person: Sam Averett (alternate, Septic Tank Industry); David Carter (chairman, member, Home Building Industry); Anthony Gaudio (member, Septic Tank Industry); Mike McInarnay (alternate, Septic Tank Industry); Jim Peters (alternate, Professional Engineer), Eanix Poole (alternate, Consumer); Patti Sanzone (member, Environmental Interest Group); John Schert (member, State University System)
  - Via teleconference: Bill Melton (member, Consumer); Vincent Seibold (alternate, Local Government); and Pam Tucker (member, Real Estate Profession)
- **Not represented**: DOH-Environmental Health and Restaurant Industry
- **Visitors**:
  - In person: Damann Anderson (Hazen and Sawyer); Blaine Carter (Carter Engineering); Ivy Cormier (Hillsborough County DOH); Mike Dreyer (Hillsborough County DOH); Josefin Edeback (Hazen and Sawyer); Don Orr (ADS/Sludge Hammer); Craig Stanley (University of Florida IFAS); Gurpal Toor (University of Florida IFAS)
  - Via teleconference: Quentin (Bob) Beitel (Markham Woods Association); John Byrd (Orange County Government Mayor & Board of County Commissioners); Chris Ferraro (Florida Department of Environmental Protection); Jack Hannahs (Markham Woods Association); Pio Lombardo (Lombardo Associates); Debra Roberts (Florida Department of Health)
- **Department of Health (DOH), Bureau of Onsite Sewage Programs**:
  - Paul Booher; Eberhard Roeder; and Elke Ursin

1. **Introductions:** Eight out of ten groups were present, representing a quorum. Chairman Carter called the meeting to order at 10:07 a.m. Introductions were made and some housekeeping issues were discussed.

2. **Review of Previous Meeting Minutes**:

   Motion by Eanix Poole and seconded by Jim Peters to approve the minutes as submitted. All were in favor with none opposed and the motion passed unanimously.

3. **Updates on projects**

   a. **Florida Onsite Sewage Nitrogen Reduction Strategies Study** – The 2009 budget language was discussed. The language authorizes the department to spend $540,000 of the funds appropriated in the 2008-2009 budget and directs the department to continue the study and submit an interim report by February 1, 2010 and a final report by May 1, 2010. While there is every possibility of additional funding to continue the study, the department and the provider should prioritize the tasks that should get done this year that will provide the most information and benefits. At this point Damann Anderson with Hazen and Sawyer presented on their proposed revision to the scope

and schedule. He mentioned that there are many reports that are coming out soon that will be distributed out to the RRAC. At the last meeting it was decided to utilize the Gulf Coast Research and Education Center to use as the test facility. The new budget language does not appropriate any additional funds, so the proposed reorganized scope and schedule makes the best use of the time and money that is available for this project. He went over the proposed Year 1 scope and schedule revisions, the PNRS II design, next steps for this project, and a tour of the facility if the weather permits. Pio Lombardo asked why the test facility design was expedited over the testing at the home sites, and that it appeared that the selection of the technologies has been made prior to the ranking. Damann Anderson stated that there are two components to their approach: initial development of the technologies and actual testing at home sites. The Invitation to Negotiate advertised with the Department of Health was open to allow for any type of proposal and the Passive Nitrogen Removal Systems Phase II (PNRS II) project was the highest ranked RRAC priority. Much of the groundwater transport and modeling work will be developed at the test facility so that the model can be calibrated and tested at a controlled setting and then moved out to testing at home sites. There was a discussion on the University of Central Florida (UCF) work currently going on looking at passive nitrogen removal technologies. Damann Anderson stated that their work is complimentary to this study, that there are no intentions of duplicating their work with this study, and as the results come in from UCF they will be looked at along with the results coming from this study. Anthony Gaudio had several objections to the proposed revised scope. He wanted to see more of a focus on testing existing systems. He outlined several objectives that he would like to see achieved with this study, and would like some of the resources devoted to investigating some of these issues. One objective was to look at nitrogen fate and transport, and he sees that some of that will be done at the test facility. Also, he would like to see a comparison of nitrogen reduction to drip irrigation as well as a comparison of advanced treatment vs. standard systems, and Damann Anderson stated that that will partly be done in the PNRS II and will also be partly done in the Task C groundwater testing. Another objective is to test a variety of vegetation over the drip and Damann Anderson stated that there are too many variables with this and they are not planning on doing this now but could possibly look at this in the future. Finally, Anthony Gaudio stated that another concern he has is the amount of sodium and sulfate released from the PNRS II media.

> **Jim Peters made a motion, seconded by Patti Sanzone, to amend the contract to reflect the scope and schedule as discussed and presented by the consultants. All except for one were in favor with Anthony Gaudio casting the dissenting vote, and the motion passed.**

The draft Quality Assurance Project Plan (QAPP) was submitted for the Passive Nitrogen Removal Study Phase II and the QAPP was discussed in detail during the meeting. The objectives are to perform a follow-up to PNRS I, develop detailed performance data for passive biofiltration, and produce scalable design data from the pilot scale biofilters. Dr. Daniel Smith accepted an award from the American Academy of Environmental Engineers for Excellence in Environmental Engineering in Applied Research and Practice. The basic approach for Phase II of this study is to establish a test site at the Gulf Coast Education and Research Center, use in-vessel and in-situ pilot systems, operate on septic tank effluent for 12-months, and test various

nitrification and denitrification biofilters. Pam Tucker asked whether the effluent from the dormitory will be comparable to home sites and Damann Anderson stated that the number of people affects the flow but does not necessarily affect the nitrogen levels in the wastewater. A sample of the effluent was taken prior to finalizing the selection of the facility and it appears to be representative. The individual testing units will be scaled down to an appropriate size so that the amount of effluent is proportionate to be comparable with a standard system. Phase I of this study was at a lab scale, and this next pilot stage is a necessary step prior to going to full scale, to help define the design criteria. Anthony Gaudio asked whether the recycling will be done around the stage 1 or the stage 2 effluent, and Damann Anderson stated that it will be the stage 1 effluent moved back into the top of stage 1. Specifically they will look at the difference between no recycling and a 3:1 recycle rate (one goes to stage 2 and three get recycled). Anthony Gaudio stated that by adding the recycling it could add an additional pump which would no longer make this a passive system per the definition. Damann Anderson stated that this has not been designed yet, but it could still meet the definition of passive. The test facility set-up itself may not be technically passive because they are trying to test several different scenarios at once, but the final design could very well end up passive. The two-stage biofiltration pilot units will have a horizontal configuration with 10 unsaturated (stage 1) biofilters and 9 denitrification biofilters (stage 2). The stage 1 variables are the media (expanded clay, clinoptilolite, and polystyrene), whether it's single pass or recycled, and the depth of the media (either 15-inches or 30-inches). The stage 2 variables are the media (either lignocellulosic, sulfur, or glycerol). Eberhard Roeder stated that there may be issues with compliance with the additive rule for the sulfur and glycerol. The University of Central Florida (UCF) test facility had to route all their wastewater back to sewer because there was no data on how what they were testing related to the additive rules. Next Damann Anderson went of the in-ground engineered media portion of this study. This could be a system that could be added to an existing septic tank by simply adding this type of drainfield. Full strength septic tank effluent or nitrified effluent could be added to a drainfield constructed with either drip irrigation or a capillary seepage mat. The capillary seepage mat is used in the agricultural industry for improving the efficiency of irrigation, and consists of a porous mat that would lie under the drip lines to hold the water for a longer period of time and spread it out so that plants can better use it. Another addition to this system would be a mix of expanded clay/lignocellulosic/sulfur just above the topsoil in a mound, which could go anoxic. Anthony Gaudio mentioned that this mix will be compressed and used up over time and Damann Anderson stated that they will monitor this as long as there is funding but that having the expanded clay there will keep the structure so that it does not compress. Anthony Gaudio also mentioned that with mounded systems the confining layer is generally removed to allow the effluent to drain downward rather than pooling over the confining layer and blowing out of the sides of the mound, and that this design has several confining layers which could be an issue. Damann Anderson stated that this is experimental and that the loading rate will be fairly low. Eberhard Roeder suggested making a column for stage one including the proposed mix that will be used in this in-ground test and Damann Anderson indicated that that could be looked at. Eberhard Roeder also asked whether this in-ground test could be done with low-pressure dosing as well. Eberhard Roeder also stated that there might be an issue with having a confining layer so close to the water table and this is coming more from a permitting standpoint as the current rule does not allow coarse sand within 48-inches

of the groundwater table. Sam Averett asked how deep the drip will be below grade, and Damann Anderson stated he would like to see it as shallow as possible by just laying the sod over the drip line. Damann Anderson listed the different application of technologies for the passive two stage biofiltration, the in-situ biofiltration, and passive denitrification and which could be used for new or replacement systems, retrofitting of existing conventional systems, and additions to existing aerobic treatment systems.

The next steps for this project are to complete the contract amendment, complete subconsultant contract amendments, and to continue work on the test facility design and remaining tasks. Anthony Gaudio asked whether the agreement with the Gulf Coast Research and Education Center (GCREC) will be between Hazen and Sawyer or with DOH and Elke Ursin stated that the memorandum of understanding should be between DOH and GCREC with Hazen and Sawyer as an authorized agent but that GCREC will be a subcontractor under Hazen and Sawyer for the purposes of this project. Anthony Gaudio wants to make sure the contract/agreement is clear as to who has possession of the equipment after this study is done so that it can be used in future projects. Comments on the QAPP draft are due on Monday July 13th and should be sent to Elke Ursin for her to compile and send to the provider.

b. **Town of Suwannee Study** – The Quality Assurance Project Plan (QAPP) was approved by all parties on May 18, 2009. Weekly sampling continues until mid-July. A decision was made to provide source tracking for three sites (two sites with high Enterococci and one background site) for four sampling events and to remove phosphorus sampling from all sites. The source tracking will allow for a determination to be made on whether the source of the Enterococci is from a human or non-human source.

John Schert made a motion, seconded by Anthony Gaudio, to authorize staff to spend approximately $1,600 and commended staff for taking this initiative. All were in favor and the motion passed.

At the last meeting the RRAC agreed to utilize research funds to renew this contract and have sampling done during December/January of 2009-2010. Staff is working on getting the contract renewed.

c. **Manatee Springs, Performance of Onsite Systems Phase II Karst Study** – The modifications to the systems have been completed and final approved by the County Health Department. A background sampling event has been completed. An intensive 4-day performance sampling event has been completed. A draft final report has been submitted for review by the RRAC, DOH, and other interested parties. The project is to be completed in July. Elke Ursin proposed the option of adding an additional sampling event during a non-flood time in approximately six-eight weeks.

John Schert made a motion, seconded by Patti Sanzone, to authorize staff to extend this project to add one additional sampling event. All were in favor and the motion passed.

d. **Monroe County Performance Based Treatment System Performance Assessment** – Quality control of existing data is ongoing. The phase III sampling has been completed and lab results should be submitted soon. The department is

discussing the option of paying a portion of the salary for the employee who did the sampling to train the new employee that has been hired to do the statewide sampling.

e. **319 Project on Performance and Management of Advanced Onsite Systems** – For the database task, data has been gathered from the state database, any county specific databases, and from Carmody. The data fields and database structure have been discussed and sketched. The Florida State University Survey Research Laboratory was selected to perform the user-group perceptions survey task, and they are currently in the process of developing the surveys with the homeowner and regulator surveys nearing completion. Once the surveys are final they will be sent to the committee. Debra Roberts has been hired to assist with this project, and her background was discussed. One of the next steps for this project is to develop a Quality Assurance Project Plan for the sampling based on the Keys Sampling Plan.

f. **Inventory Study** – The final report has been submitted and the contract has now ended. The RRAC voted at the May 27th meeting to continue this project. Initial internal discussions have begun on how to do this and were presented to the RRAC. One option would be to work with the Department's Environmental Health Database (EHD) people to see if hiring a programmer to integrate the inventory database into the EHD. Another idea is to automate a process to update the Inventory with Department of Revenue information as that is updated every year. Bill Melton mentioned that there are definite holes in the data pointing out that some cities that are on sewer are listed as septic on the maps. Elke Ursin responded by saying that if the utility provider did not respond to the request for information from EarthSteps, then that information was not available for them to create accurate maps. This is another one of the proposed next steps: to resend requests out to the DEP regulated Wastewater Treatment Plants for current information. David Carter stated there needs to be strongly worded legislative language to make these Wastewater Treatment Plants respond to these information requests. Eanix Poole asked of what value this inventory is, and Elke Ursin stated that it very valuable and is a good first step to a management program. Anthony Gaudio stated that there is more value on a county level rather than an aggregate basis. Another option for a next step for this project is to see if County Health Departments might be interested in receiving a grant to update their specific county information in whatever method they propose. Different options will be scoped out and presented to the RRAC at a future meeting.

4. **Other Business** – David Carter recommended staff to contact Dr. Wanielista with the University of Central Florida to let him know that DOH and RRAC are interested in what they are doing.
5. **Public Comment** - The public was allowed to comment throughout the meeting.
6. **Next Meeting** – The next meeting will be scheduled for the beginning of September. The meeting location has not been determined, but the option of having a live meeting via teleconference and/or via the computer was discussed and staff will research this further. The focus of the next meeting will be to hear a presentation on the Town of Suwannee Study, discuss progress on the Nitrogen Reduction Strategies Study, as well as discuss current and proposed research projects.

The meeting adjourned at 4:25 p.m.

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

Wednesday July 1, 2009

10 am – 3 pm

Agenda:

1. Introductions and Housekeeping
2. Review Minutes of Meetings on May 27 & 28, 2009
3. Discussion on the Florida Nitrogen Reduction Strategies Study
4. Brief Updates on Ongoing and Future Projects
5. Other Business
6. Public Comment
7. Closing Comments, Next Meeting, and Adjournment

Introductions & Housekeeping

- Travel forms
- Roll call
- Identification of audience

Review Minutes of Meeting May 27 & 28, 2009

- See draft minutes

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Purpose: Develop passive strategies for nitrogen reduction that complement use of conventional onsite sewage treatment and disposal systems, and further develop cost-effective nitrogen reduction strategies

Progress:

- Draft QAPP submitted for Passive Nitrogen Removal Study Phase II

2009 Budget Language

"From the funds in Specific Appropriation 471, **$540,000** from the Grants and Donations Trust Fund is provided to the department to **continue and complete the study** authorized in Specific Appropriation 1682 of chapter 2008-152, Laws of Florida. The report shall include **recommendations on passive strategies for nitrogen reduction that complement use of conventional onsite wastewater treatment systems**. The department shall submit an **interim study and report on February 1, 2010**, and a **final study and report on May 1, 2010**, to the Governor, the President of the Senate, and the Speaker of the House of Representatives prior to proceeding with any nitrogen reduction activities."

2008 Budget Language

$1 million from the Water Protection and Sustainability Program Trust Fund shall be transferred to the Department of Health to **further develop cost-effective nitrogen reduction strategies**. The Department of Health shall contract, by request for proposal, for Phase I of an anticipated 3-year project to **develop passive strategies for nitrogen reduction that complement use of conventional onsite wastewater treatment systems**. The project shall be controlled by the Department of Health's research review and advisory committee and shall include the following components:

1) comprehensive review of existing or ongoing studies on passive technologies;

2) field-testing of nitrogen reducing technologies at actual home sites for comparison of conventional, passive technologies and performance-based treatment systems to determine nitrogen reduction performance;

3) documentation of all capital, energy and life-cycle costs of various technologies for nitrogen reduction;

4) evaluation of nitrogen reduction provided by soils and the shallow groundwater below and down gradient of various systems; and

5) development of a simple model for predicting nitrogen fate and transport from onsite wastewater systems.

A progress report shall be presented to the Executive Office of the Governor, the President of the Senate and the Speaker of the House of Representatives on February 1, 2009, including recommendations for funding additional phases of the study.

Florida Onsite Sewage Nitrogen Reduction Strategies Study

- While there is every possibility of additional funding to continue the study, we should prioritize the tasks we want to get done this year that will provide the most information and benefits

Hazen and Sawyer Presentation of:

Options for Prioritization of Tasks

and

Discussion on Passive Nitrogen Removal Study Phase II

Ongoing projects

Statewide Inventory of Onsite Sewage Treatment and Disposal Systems in Florida Study

Purpose: To provide a comprehensive inventory of the 2.5 million systems in the state

Progress:

- Final report has been submitted
- Contract has now ended
- RRAC voted the continuation of this project as a priority at the May 27th meeting
- Initial internal discussions have begun on process forward

Town of Suwannee Study

Purpose: Test the difference in water quality after central sewer has been installed in an area previously served by onsite sewage systems

Progress:

- Quality Assurance Project Plan (QAPP) approved by DEP on May 18th
- Weekly sampling continues until mid-July
- Decision to provide source tracking for three sites (two sites with high *Enterococci* and one background) for 4 sampling events and remove Phosphorus sampling from all sites

Manatee Springs, Performance of Onsite Systems Phase II Karst Study

Purpose: Test the difference in water quality after nutrient reducing systems are installed in a Karst area

Progress:

- Modifications of systems have been completed and final approved by the County Health Department
- Background sampling event completed
- Performance sampling event completed
- Draft final report submitted
- Project to be completed in July
- Discuss option to add an additional sampling event during non-flood conditions

Monroe County PBTS Assessment: Next Phase of Sampling in the Keys

Purpose: Evaluate effectiveness of Performance Based Treatment Systems in the Keys

Progress:

- Quality control of existing data ongoing
- Phase III sampling completed, waiting for lab results
- Discussing option of paying for employee who did sampling to train new employee hired to do statewide sampling

319 Project on Performance and Management of Advanced Onsite Systems

Purpose: Assess water quality protection by advanced onsite sewage treatment and disposal systems throughout the State of Florida

Progress:

- Database of advanced systems:
  - Data has been gathered from the state database, any county specific databases, and from Carmody
  - Data fields and database structure have been discussed and sketched
- Survey of user groups perceptions task:
  - Provider is Florida State University Survey Research Laboratory
  - Development of surveys is ongoing with draft homeowner and regulator surveys nearing completion
- Debra Roberts has been hired to assist with this project. Debra is a graduate of Florida A&M University with a major in Biology and minor in Chemistry, and she has worked in several diverse arenas such as Quality Assurance Supervisor, Chemist, and QA environmental laboratory technician
- Next steps: Development of Quality Assurance Project Plan for sampling (based off of Keys Sampling Plan)

Upcoming projects

Other Business

Public Comment

Next Meeting

Upcoming meeting topics:
Suwannee Draft Report

Proposed dates for next meeting:

- Week of August 31st?
- Other suggestions?

Closing Comments and Adjournment

Florida Department of Health (FDOH)

Research Review and Advisory Committee (RRAC) Meeting Summary

Meeting on July 1, 2009

Gulf Coast Research and Education Center, Wimauma, FL

- **RRAC Members/Alternates Present**:
  - In person: Sam Averett, David Carter, Anthony Gaudio, Mike McInarnay, Jim Peters, Eanix Poole, Patti Sanzone, and John Schert
  - Via teleconference: Bill Melton, Vince Seibold, and Pam Tucker

  Eight out of ten groups were present, representing a quorum

- **Review of Previous Meeting Minutes**: The minutes were approved as submitted.

- **Updates on projects:**

  - **Nitrogen Reduction Strategies Study**: The 2009 budget language was discussed. The language authorizes the department to spend $540,000 of the funds appropriated in the 2008-2009 budget and directs the department to continue the study and submit an interim report by February 1, 2010 and a final report by May 1, 2010. While there is every possibility of additional funding to continue the study, the department and the provider should prioritize the tasks that should get done this year that will provide the most information and benefits. At this point Damann Anderson with Hazen and Sawyer presented on their proposed revision to the scope and schedule. The RRAC approved a motion to amend the contract to reflect the scope and schedule as discussed and presented by the consultants. The draft Quality Assurance Project Plan (QAPP) was submitted for the Passive Nitrogen Removal Study Phase II and the QAPP was discussed in detail during the meeting. The basic approach is to establish a test site at the Gulf Coast Education and Research Center, use in-vessel and in-situ pilot systems, operate on septic tank effluent for 12-months, and test various nitrification and denitrification biofilters. The next steps for this project are to complete the contract amendment, complete subconsultant contract amendments, and to continue work on the test facility design and remaining tasks.

  - **Town of Suwannee Study**: The Quality Assurance Project Plan (QAPP) was approved by all parties on May 18, 2009. Weekly sampling continues until mid-July. A decision was made to provide source tracking for three sites (two sites with high Enterococci and one background site) for four sampling events and to remove phosphorus sampling from all sites. The RRAC approved a motion to authorize staff to spend additional funds to help pay for this source tracking, and commended staff for taking this initiative.

  - **Manatee Springs, Performance of Onsite Systems Phase II Karst Study**: The modifications to the systems have been completed and final approved by the County Health Department. A background sampling event has been completed. An intensive 4-day performance sampling event has been completed. A draft final report has been submitted for review by the RRAC, DOH, and other interested parties. The project is to be completed in July. The RRAC approved a

motion to authorize staff to extend this project to add one additional sampling event.

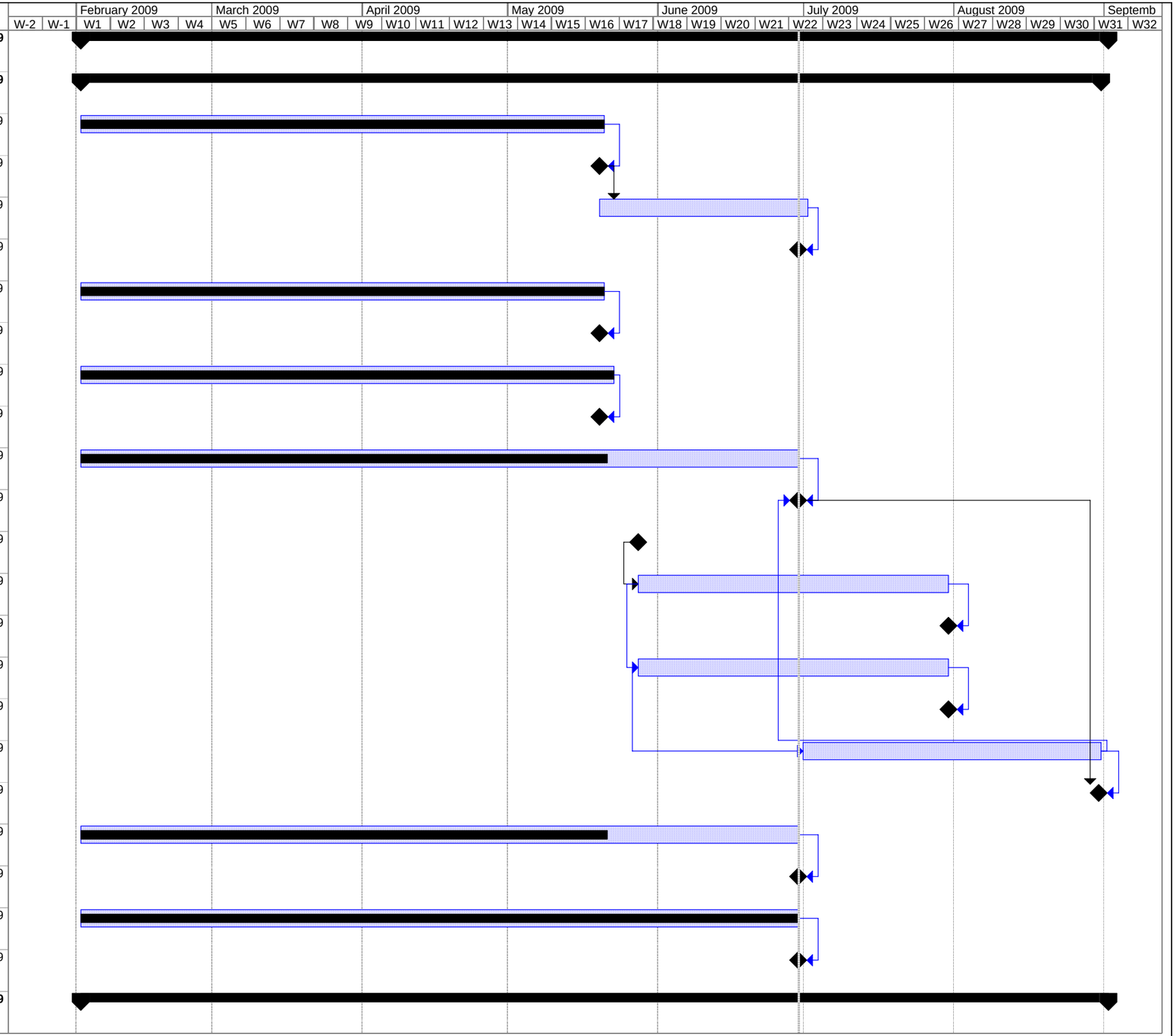
- **Monroe County Performance Based Treatment System Performance Assessment**: Quality control of existing data is ongoing. The phase III sampling has been completed and lab results should be submitted soon. The department is discussing the option of paying the salary for the employee who did the sampling to train the new employee that has been hired to do the statewide sampling.

- **319 Project on Performance and Management of Advanced Onsite Systems**: For the database task, data has been gathered from the state database, any county specific databases, and from Carmody. The data fields and database structure have been discussed and sketched. The Florida State University Survey Research Laboratory was selected to perform the user-group perceptions survey task, and they are currently in the process of developing the surveys with the homeowner and regulator surveys nearing completion. Debra Roberts has been hired to assist with this project, and her background was discussed. Some of the next steps for this project is to develop a Quality Assurance Project Plan for the sampling based on the Keys Sampling Plan.

- **Statewide Inventory of Onsite Sewage Treatment and Disposal Systems in Florida Study**: The final report has been submitted and the contract has now ended. The RRAC voted at the May 27th meeting to continue this project. Initial internal discussions have begun on how to do this and were presented to the RRAC. Different options will be scoped out and presented to the RRAC at a future meeting.

- **Other Business**: None
- **Public Comment**: The public were allowed to comment throughout the meeting.
- **Next Meeting**: The next meeting will be scheduled for the beginning of September. The meeting location has not been determined, but the option of having a live meeting via teleconference and/or via the computer was discussed and staff will research this further. The focus of the next meeting will be to hear a presentation on the Town of Suwannee Study, discuss progress on the Nitrogen Reduction Strategies Study, as well as discuss current and proposed research projects.

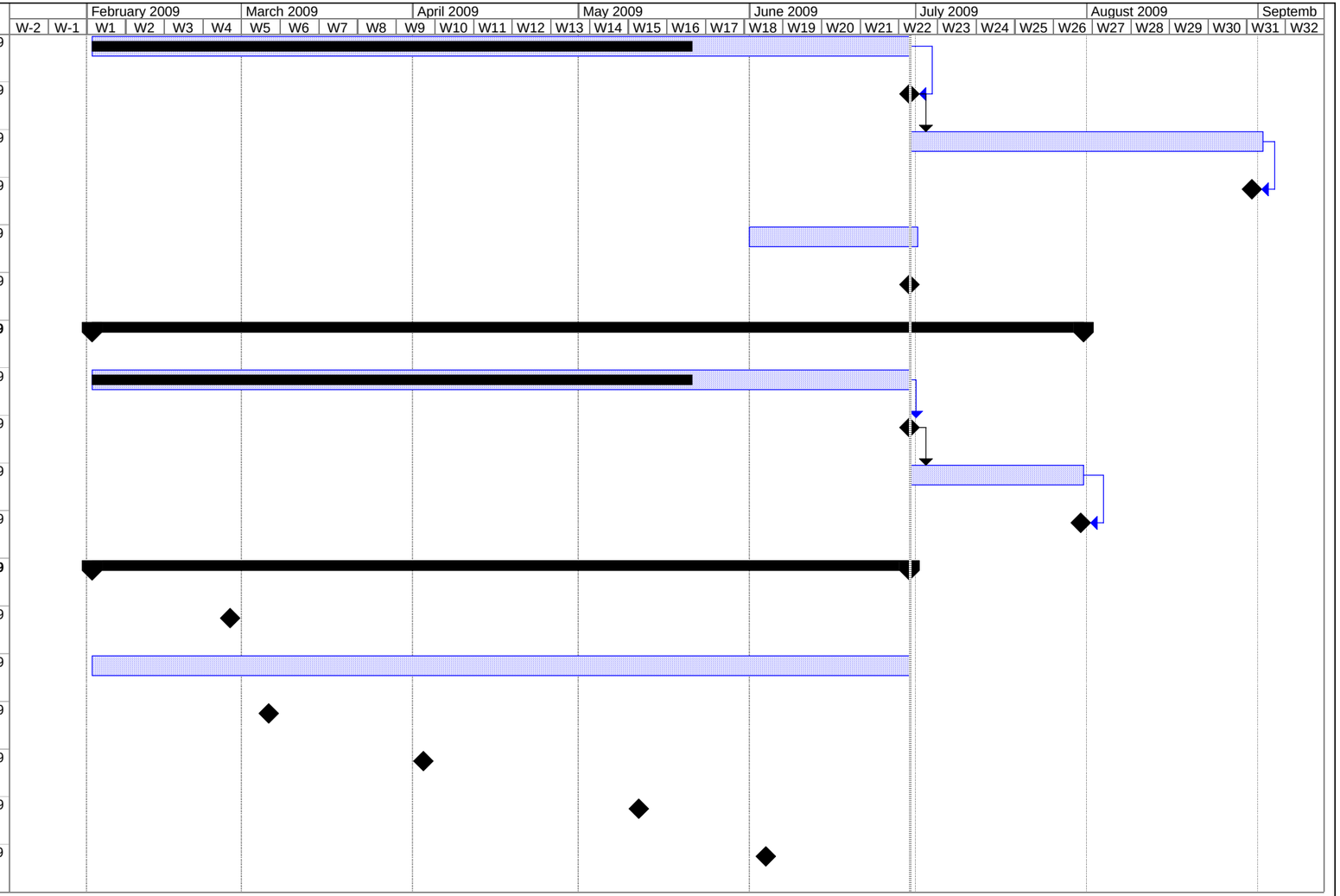
ID	Task Name	Duration	Start	Finish
1	**Nitrogen Reduction Strategies Study**	**30 wks**	**Mon 2/2/09**	**Tue 9/1/09**
2	**Task A: Technology Selection & Prioritization**	**29.7 wks**	**Mon 2/2/09**	**Mon 8/31/09**
3	A.1 Draft Lit Review Report	15.6 wks	Mon 2/2/09	Wed 5/20/09
4	Draft Lit Review Report Delivered	0 wks	Wed 5/20/09	Wed 5/20/09
5	A.2 Final Lit Review Report	6 wks	Wed 5/20/09	Wed 7/1/09
6	Final Lit Review Report Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
7	A.3 Draft Classification	15.6 wks	Mon 2/2/09	Wed 5/20/09
8	Draft Classification of Tech Report Delivered	0 wks	Wed 5/20/09	Wed 5/20/09
9	A.4 Draft Tech Ranking Criteria Report	16 wks	Mon 2/2/09	Fri 5/22/09
10	Draft Tech Ranking Criteria Report Delivered	0 wks	Wed 5/20/09	Wed 5/20/09
11	A.5 Draft Priority List for Testing Report	21 wks	Mon 2/2/09	Mon 6/29/09
12	Draft Priority List for Testing Report Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
13	A.6 Tech. Classification, Ranking & Prioritization Workshop	0 wks	Thu 5/28/09	Thu 5/28/09
14	A.7 Final Classification of Tech. Report	9 wks	Thu 5/28/09	Thu 7/30/09
15	Final Classification of Tech. Report Delivered	0 wks	Fri 7/31/09	Fri 7/31/09
16	A.8 Final Technology Ranking Criteria Report	9 wks	Thu 5/28/09	Thu 7/30/09
17	Final Technology Ranking Criteria Report Delivered	0 wks	Fri 7/31/09	Fri 7/31/09
18	A.9 Final Priority List for Testing Report	8.5 wks	Wed 7/1/09	Mon 8/31/09
19	Final Priority List for Testing Report Delivered	0 wks	Mon 8/31/09	Mon 8/31/09
20	A.12 Identification of Test Facility Sites	21 wks	Mon 2/2/09	Mon 6/29/09
21	Identification of Test Facility Site Agreement 1	0 wks	Tue 6/30/09	Tue 6/30/09
22	A.13 Draft QAPP PNRS II	21 wks	Mon 2/2/09	Mon 6/29/09
23	Draft QAPP PNRS II Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
24	**Task C: Evaluation of N Reduction by Soils & Shallow GW**	**30 wks**	**Mon 2/2/09**	**Tue 9/1/09**



Project: Schedule rev
Date: Tue 6/30/09

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks | Group By Summary
Progress | Summary | Rolled Up Milestone | Split | Project Summary | Deadline

ID	Task Name	Duration	Start	Finish
25	C.1 Draft Lit Review on N Reduction in Soil Report	21 wks	Mon 2/2/09	Mon 6/29/09
26	Draft Lit Review Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
27	C.2 Final Lit Review on N Reduction in Soil Report	9 wks	Tue 6/30/09	Tue 9/1/09
28	Final Lit Review Delivered	0 wks	Mon 8/31/09	Mon 8/31/09
29	C.11 Test Facility Design 50%	4.5 wks	Mon 6/1/09	Wed 7/1/09
30	Test Facility Design 50% Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
31	**Task D: Nitrogen Fate & Transport Models**	**25.5 wks**	**Mon 2/2/09**	**Fri 7/31/09**
32	D.1 Draft Lit Review on N Fate & Transport Model Report	21 wks	Mon 2/2/09	Mon 6/29/09
33	Draft Lit Review Report Delivered	0 wks	Tue 6/30/09	Tue 6/30/09
34	D.2 Final Literature Review on Nitrogen Fate & Transport M	4.5 wks	Tue 6/30/09	Fri 7/31/09
35	Final Lit Review Delivered	0 wks	Fri 7/31/09	Fri 7/31/09
36	**Task E: Project Management, Coordination & Meetings**	**21 wks**	**Mon 2/2/09**	**Mon 6/29/09**
37	E.1 Project Kick-Off Meeting (conference call)	0 wks	Fri 2/27/09	Fri 2/27/09
38	E.2 PM-Project Progress Reports (per monthly report)	21 wks	Mon 2/2/09	Mon 6/29/09
39	Progress Report 1 Delivered	0 wks	Fri 3/6/09	Fri 3/6/09
40	Progress Report 2 Delivered	0 wks	Fri 4/3/09	Fri 4/3/09
41	Progress Report 3 Delivered	0 wks	Tue 5/12/09	Tue 5/12/09
42	Progress Report 4 Delivered	0 wks	Wed 6/3/09	Wed 6/3/09



Project: Schedule rev
Date: Tue 6/30/09

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks | Group By Summary
Progress | Summary | Rolled Up Milestone | Split | Project Summary | Deadline

Statewide Inventory of Onsite Sewage Treatment and Disposal Systems in Florida

State of Florida
Department of Health
Division of Environmental Health
Bureau of Onsite Sewage Programs

Prepared by:

EarthSTEPS, LLC and GlobalMind
Tallahassee, Florida

Preliminary Submittal: June 29, 2009

The Florida Statewide Inventory of Onsite Sewage Treatment and Disposal Systems (OSTDS)

Final Report
June 29, 2009

Pamela Hall, Ph.D., EarthSTEPS

Stephen J. Clancy, GlobalMind

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List of Tables

Executive Summary

EarthSTEPS and GlobalMind of Tallahassee, Florida are pleased to provide the Florida Department of Health (FDOH), Division of Environmental Health (EHD), and the Bureau of Onsite Sewage Programs this Executive Report describing the Statewide Inventory of Onsite Sewage Treatment and Disposal Systems (OSTDS) in Florida. It serves as a brief overview of our project approach, methodology, resources, scope, and findings. Detailed information regarding each project task with accompanying tables and maps is found in the complete report.

To accomplish the inventory process, a database was constructed to facilitate the collection and storage of data on existing OSTDS. This enabled the FDOH and County Environmental Health Directors a means to provide information on the number and location of OSTDS in every county in Florida.

Information collected through this effort serves as the baseline for all aspects of OSTDS management. It provides explicit OSTDS information and models for those charged with comprehensive planning and the growth management of urban infrastructure so that natural resources and human health can be protected and sustained.

Findings:

1. The project database utilized the Department of Revenue 2008 tax roll and Geographic Information Systems (GIS) information of nearly 9 million parcels. The development status of each parcel was determined using fields from the Florida Department of Revenue (DOR) data and resulted in 6,608,050 improved parcels.

2. Our team contacted all 2000 FDEP domestic wastewater treatment facilities (WWTF) and subsequently obtained data on the location of sewered parcels from approximately half of them. We accepted information in any electronic format that could be provided by the WWTF owners or managers. The results represent about 80% of the total permitted capacity of all WWTF. We identified 2,056,129 sewered parcels. Some vacant parcels were included in this accounting.

3. Using the permit data from the Environmental Health Database and from all other county permit databases that we located, we identified 564,026 parcels known to have an OSTDS. In addition from older and local county databases we identified 85,731 OSTDS parcels. This totals to 649,757 parcels known to have OSTDS. Some vacant parcels are included in this accounting.

4. We garnered other useful information on OSTDS using the linked permits from the EHDB and locally identified county databases. All of the information, including the source of identifiers, was collected into a documented, relational database. The database includes fields computed in subsequent analyses.

5. The result of this data collection was approximately 4 million improved parcels for which no wastewater treatment method was known. In order to assign a treatment method to these parcels we developed a logistic regression model based on the over 2.5 million parcels with known wastewater treatment. The model descriptors were: characteristics of the parcels themselves (lot size, year built, etc.), characteristics of their nearest neighbor parcels (mean lot size, proportion with OSTDS) and the proportion of OSTDS for the category of land use, taxing authority and lot size category to which the parcel belonged.

6. We computed models for each county individually using parcels with known wastewater methods. We determined the most statistically reliable combinations of descriptors for the prediction of the location of known OSTDS using three main indicators: the strength of the statistical significance (Z score) of each descriptor in combination with others, the highest proportion of parcels correctly classified to their known wastewater treatment method, and the smallest proportion of parcels known to have OSTDS incorrectly classified as sewered.

7. The parameters of the models of parcels with known wastewater treatment methods were then used to compute the probability of OSTDSs on all of the improved parcels for which independent information of wastewater method was not available. This was done for each county individually. A parcel was classified as having an OSTDS if the probability from the model was ≥ 0.5 (50%). The total number of OSTDS for each county was computed as the sum of those classified by estimation and the known. Using different probability levels for parcel classification provided a range of predicted number of OSTDS. A higher estimate was computed using a probability of 0.25 and a lower estimate was computed using a probability of 0.75. The range of values, from high to low, was expressed as a percentage of the midpoint is order to more readily compare model reliability among the counties.

8. This Statewide Inventory estimates that there are 3,496,120 parcels with OSTDS in Florida (range: 3,317,152 to 3,652,276) of which 49,988 are currently (temporaily) vacant (2.06% of the total number of vacant parcels in Florida). The estimated range of total parcels with OSTDS is 9.6% of the midpoint. There are 3,446,132 improved parcels with OSTDS. There are estimated to be 3,129,708 sewered parcels. Using these estimates, 52% of the improved parcels and 39% of all parcels (vacant and improved) are using OSTDS as a wastewater treatment method. The estimates for each county and the reliability of these estimates are discussed.

9. Two maps are provided for each county showing 1) the location of known sewer, known OSTDS and improved parcels that require an estimation of wastewater method and 2) known and estimated sewer, known and estimated OSTDS and any remaining improved undesignated parcels for which an estimate could not be done.

10. A brief review of other locales within the United States and in Florida that have also estimated the number and location of OSTDS is provided. A survey of all 67

County Environmental Health Directors was done to ascertain their state of knowledge of the number and location of OSTDS in their county. As a result, a detailed methodology for proceeding with an inventory and recommendations about how to maintain an inventory is also provided. We provide recommendations for further enhancement of the Statewide Inventory Database and refinements to the modeling and estimation process.

11. In summary, the efforts of EarthSTEPS and GlobalMind results in a database that provides: 1) an inventory consisting of the number and location of existing OSTDS; 2) statistically based qualification of the OSTDS inventory; 3) a foundation for the investigation of regional and local impacts of existing systems to identify where mitigation is needed; 4) a framework for the appropriate location of future development using OSTDS for the protection of public health; and recommendation for maintaining and updating information resulting for current contract tasks.

1.0 Introduction and Description of Report Contents

This report makes up a portion of the Statewide Inventory of Onsite Sewage Treatment and Disposal Systems (OSTDS) in Florida as defined by the Florida Department of Health (FDOH), Division of Environmental Health (EHD), and the Bureau of Onsite Sewage Programs. The Statewide Inventory Database has been provided separately to the FDOH Bureau of Onsite Sewage Programs. This report was prepared by EarthSTEPS, LLC and GlobalMind of Tallahassee, Florida.

Chapter 2 describes several salient experiences from regions, states and communities in the United States. These entities have concluded the environmental impact from OSTDS to be serious enough to warrant the implementation of more effective management methods. This section includes examples in Florida.

Chapter 3 is a discussion of the results of a questionnaire that was distributed to every County Environmental Health Director (CEHD) to ascertain the current state of knowledge regarding the number and location of OSTDS in each Florida county and to learn of any estimates and inventories that had been done. Brief descriptions of estimations of OSTDS done for Wekiva and Wakulla spring sheds are also included.

Chapter 4 describes the Statewide Inventory including the database contents and methods that were used to create it and modeling methodology and results. Modeling was used to provide a probability of the existence of an OSTDS on developed parcels for which we did not obtain information from other sources such as the Florida Department of Environmental Protection (FDEP) permitted wastewater treatment facilities (WWTF), CEHD databases or EHDB. The estimated total number of OSTDS and comparison of this number to other estimations is provided in the final part of Section 4.

Chapter 5 contains the steps to take to perform an inventory which were derived from the survey and extensive conversations with Florida CEHD and staff from equivalent agencies in other states. A summary of the current state of knowledge of the number and location of OSTDS in relationship to the results from the Statewide Inventory modeling and the CEHD survey is provided for all counties.

Chapter 6 contains recommendations for management of an inventory and maintaining its integrity.

Chapter 7 provides recommendations for refinement of the database and areas of future study.

The Appendices contain table and figures with legends that are not directly incorporated in the text and information related to database structure and content.

A DVD with the questionnaire and responses from CEHD and a copy of this report, pdf versions of the county maps and electronic versions of this report are also provided.

2.0 The Inventory of OSTDS: Experiences from around the United States

In 1997, the U.S. Environmental Protection Agency publicly recognized "onsite systems …as potentially viable, low-cost, long-term, decentralized approaches to wastewater treatment if they are planned, designed, installed, operated, and maintained properly."

Approximately 25 percent of the U.S. population and one third of all new development utilize onsite systems for wastewater treatment[1]. These systems were once thought to provide temporary treatment solutions, placeholders until sanitary sewage treatment infrastructure was built. OSTDS are becoming an increasingly important form of wastewater treatment in part due the rapid development that has occurred more quickly than urban infrastructure can be constructed. Development located far from existing urban infrastructure is also dependent on OSTDS. While the provision of centralized sewer service has never been an option for many rural and exurban areas, the costs of centralized sewer service, even for large, dense communities, have grown tremendously[1]. It has also been recognized that centralized sewer systems may not always provide the highest level of treatment, spills can impair nearby water resources and treatment systems can become significant point-source polluters. It is now evident that onsite systems *can* provide a permanent and effective wastewater treatment that adequately protects public health and surface and ground water quality. As the EPA states, OSTDS are effective if they are properly designed, sited, constructed, operated and maintained.

When OSTDS are not properly sited or maintained, operational and functional failures occur. The U.S. Census (2000) reports that 10 percent of onsite systems fail[1]. The most commonly reported failure is an operational failure, when a toilet fails to flush, the pipes back up or the drain field becomes soggy and begins to emit an unpleasant odor. Functional failure, when the OSTDS does not provide sufficient treatment of effluent to remove pathogens, probably occurs more often, but is not reported or repaired until it creates a clear public nuisance or great inconvenience to the property owners. Failure rates are difficult to determine, but recently in Florida, counties with inspection programs have reported rates from 8% to 11% per year[5].

While functional OSTDS can protect human health, the most commonly used technology and installation practices are not designed to provide high rates of denitrification of effluent. Individual site conditions largely dictate the capacity of drainfields to provide denitrification and therefore generalizations about nitrogen removal rates are hard to provide. Anderson (2006)[2] provided a summary of the literature, citing values from only 10% or up to 50% removal rates. A recent in situ study from the Woodville Karst Plain also reported highly variable denitrification rates with about 50% or less removal[3].

Therefore, even OSTDS that appear to be functioning and operational and in compliance with permitting standards can contribute to nitrogen pollution of water resources. There is increasing evidence in a number of coastal and bay environments

that the cumulative effect of onsite systems contributes substantially to pollutants in these ecosystems, particularly to nutrient pollutants.

These problems occur throughout the United States. According to U.S. Census data, new development is even more apt to be built with onsite wastewater treatment than existing development[1]. This means that the areas with the most intense population growth may become the areas contributing the most to the increasing environmental impact from OSTDS.

Many jurisdictions recognize the pollution impacts that OSTDS can create when they are poorly sited, with inappropriate design and installation, and lacking in proper maintenance regimes. Policies have been adopted throughout the country for the purpose of creating better oversight and technological requirements for onsite systems. Most have been ineffective so far because:

- compliance is usually voluntary, and
- compliance is left to the homeowner, who often does not know where the septic system is located, and
- location of the OSTDS and contact information for property owners is unknown to authorities who could inform and assist owners in meeting their responsibilities.

Current estimates indicate that 2.6 million OSTDS[4] are in use throughout Florida, serving approximately 31% of the population. More than half of Florida's OSTDS are over 30 years old and were installed under standards less stringent than those currently applied[5]. As pollution increases, some locales are mandating that new development and major repairs install performance based technologies and comply with operation and maintenance requirements. Unfortunately, these actions have resulted in active management of less than one percent of Florida septic systems, a situation typical of most states.

Examples of the typical reporting conditions are related below. In the latter cases, public education has reached a sufficient level to force a change in permitting practices and technological improvements. Experience shows that once the public becomes aware, conditions begin to change. Hopefully, through public education and increased awareness levels, decreases in the pollutant levels of surface, coastal and aquifer waters will result.

2.1 Northeast United States - Chesapeake Bay

The Chesapeake Bay is the largest estuary in the United States. The Chesapeake Bay watershed stretches across more than 64,000 square miles, encompassing parts of six states — Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia and the District of Columbia. Over 25 years ago, in December 1983, the first Chesapeake Bay Agreement was signed, committing state and federal agencies to cooperate on improving the health of the Bay. The Chesapeake Bay Program was established[6].

Additional agreements in 1987 and 2000 set more specific cleanup goals. One of the most heralded aspects of this program was the inclusion of a large public education and outreach program intended to spark financial investment in water pollution prevention and voluntary changes in individual behavior. Unfortunately, the political complexities of the region and failure to motivate property owners to voluntary make costly upgrades to what often appeared to be working septic systems, have brought little progress in establishing OSTDS management programs and the creation of OSTDS inventories that would accompany them.

Maryland established a fund intended to finance sewage treatment plant upgrades, replacement of failing septic systems and payments to farmers to plant cover crops and other nutrient control actions. In 2005, Maryland instituted a "flush tax" on sewer bills and septic systems to generate funding for the Chesapeake and Atlantic Coastal Bays Restoration Fund. The tax on sewer amounted to an additional $2.50 a month and about $30 a year for OSTDS. To date over $60 million has been collected, a substantial portion of which is already in use to upgrade and replace OSTDS with performance based systems.

A statewide implementation of the septic tank fee did not take place until 2006. There are approximately 420,000 OSTDS in Maryland, yet no statewide OSTDS inventory was compiled. It has been difficult to thoroughly identify properties on which OSTDS are located in order to provide a fair and complete billing process. Some counties had databases of OSTDS but most have few electronic records. Databases had to be created from scratch, using various databases such as property appraiser and realtor data. In many cases, parcels were visited in order to determine if an OSTDS was in use[7].

2.2 Washington State - Puget Sound

The coastal waters of the Puget Sound of Washington State have been plagued with pollution from a wide variety of sources for many years. There are twelve counties and many more municipal jurisdictions tasked with regulating runoff and discharge into the Sound and its tributaries. OSTDS were identified as a probable source of non-point source pollution, especially those within the adjacent watersheds flowing directly into the Sound. In July 2005, the State Board of Health added a new requirement for regulation of OSTDS by local health officers intended to lower the environmental impact of this wastewater treatment type. The Board required local health officers to develop management plans for OSTDS located in environmentally sensitive areas. By designating a Marine Recovery Area (MRA), local health officers were given the authority to implement a strategy to create an OSTDS management program in the area. By July 1, 2007, they were required to identify MRAs in their jurisdiction. By July 1, 2012 they are required to have developed an inventory that allows them to:

- find failing systems and ensure that system owners make necessary repairs and
- locate "unknown" systems and ensure that they are inspected, functioning properly or serviced if necessary.

To ensure that the management plans are implemented, the Washington State Department of Health and the local health jurisdiction will enter into a contract that includes state oversight and assistance to implement the strategy.

Starting in December, 2008 each local jurisdiction is required to provide the following to Washington State DOH:

- The status of on-site strategies.
- The status of OSTDS location, identification, and inclusion within electronic data systems, including estimates of remaining OSTDS within MRAs that have not been identified or included within electronic data systems.
- The progress made and ability of local health jurisdictions to identify OSTDS within MRAs and to ensure that failing systems are repaired and that all systems are operated and maintained in compliance with Board of Health standards.
- Regulatory, statutory, and financial barriers to implementation.
- Recommendations to successfully implement the plan.

The State also provided legislation that specifically required local health officers to inventory existing OSTDS, to identify their location, to require the inspection and repair of failing systems and to develop an electronic data system capable of maintaining the OSTDS inventory sufficiently for compliance with their regulatory responsibility. The public and relevant agencies have a right to access this information. The Washington State DOH created a Web site that provides information on the local OSTDS management plans and their status[8]. The document On-site Management Plan Guidance provides a description of OSTDS inventory and database components[9].

The On-site Management Plan Guidance includes a brief description of the current database conditions in the jurisdictions of Puget Sound with guiding questions that must be addressed to create and maintain an inventory. The document explains how to maintain, access, and disseminate estimates of the number of OSTDS and their location using the inventory.

The legislation defines three types of OSTDS designations for the inventories in regards to the degree to which information about their location and condition is known. This standardized terminology is explicit as to what is meant by an "inventory" of OSTDS. The degree of certainty for the existence of an OSTDS is clearly defined as follows (OSS is the abbreviation used in the documents for OSTDS):

> **Unknown OSS (this is a new definition from 3SHB 1458)**
> "Unknown system means an on-site sewage disposal system (or OSS per WAC 246- 272A) that was installed without the knowledge or approval of the local health jurisdiction, including those that were installed before such approval was required."

Known OSS (interpretation from 3SHB 1458)

"Known system means an OSS that was installed with the knowledge or approval of the local health jurisdiction. Known OSS include conforming and nonconforming systems."

Chapter 246-272A WAC: "Conforming system" means any on-site sewage system or component meeting any of the following criteria:

a) In full compliance with new construction requirements under this chapter; or
b) Approved, installed and operating in accordance with requirements of previous editions of this chapter; or
c) Permitted by the waiver process under WAC 246-272A-0420 that assures public health protection by higher treatment performance or other methods.

Assumed OSS (for the purposes of inventorying OSS)

"An assumed OSS has no records but through GIS analysis an OSS can be assumed to exist on a parcel."

The "Assumed" category, which falls between the Known and the Unknown, applies to cases where no permitting records exist but some form of data indicates an OSS is likely to be present. Some assumed OSS designations are generated through more robust methodology than others. For example, a parcel outside a sewer district boundary with some assessed improved value might be assumed to have an OSS and therefore is assigned an Assumed OSS designation. A parcel data set might include a Land Use code that indicates the parcel has an inhabited structure. An Assumed OSS designation on this parcel would be more reliable than the former example. An Assumed OSS is more valuable than an Unknown OSS for the purpose of mapping and analysis, though this type of data is not necessarily reliable. This definition is intended to distinguish between records for which identified OSS are known to exist and records that are generated from a process which may be prone to error. Maps created showing Assumed OSS should indicate where OSS are calculated.

This is a very useful distinction and can, with some modification, be applied to OSTDS in Florida. The "known" OSTDS are clearly defined as those with permits that can be located. In Florida, this would include permits that are electronically stored in the EHDB and for which a paper permit is on file. The "assumed" OSTDS category is assigned to parcels likely to have an OSTDS, based on characteristics of land use, building age and the wastewater methods of the lots surrounding them and some indication of compliance with existing regulations. These are often referred to as "legacy" systems. The "unknown" label, in Florida, would be an illegal system.

The degree of completion and implementation of inventories and management plans is highly variable among the counties and for different MRAs. To date, about 17 MRAs have been designated. These cover a very limited portion of the Puget Sound drainage basin and it is unclear whether all of the most environmentally critical areas are included. Three counties have yet to accomplish this initial step. The databases of

OSTDS records that do exist were begun as recently as the late 1990s and progress on entering paper records and providing updating processes has been slow. For a detailed list, see *http://www.doh.wa.gov/ehp/ts/WW/lom/LMPCompare.pdf*.

2.3 Wisconsin - Mandated OSTDS Management Plans

In August 2008, Wisconsin adopted legislation that requires all counties to inventory OSTDS within three years and to implement and enforce a comprehensive maintenance program for all systems within five years. This is the first statewide mandate for such a program to be implemented in the U.S.

Currently the responsibility for management lies with property owners, but county health departments must identify whom and what parcels will be obligated to comply. An inventory is required, but conditions and results are only mentioned briefly, and no process is prescribed. The only mention is that, at a minimum, the parcel location and use of the Property Appraiser's identification system are required, but no site visits for verification are mandated. The management program will require site visits and it is anticipated that, over time, verification of existing systems will result. Funding for this program is expected to be generated by fees paid by property owners. There is no evidence that a statewide inventory is planned, which would provide assistance, a means of support, and standardization of local efforts to implement the new maintenance programs.

In Wood County, Wisconsin, regulations adopted nearly 20 years ago required that property owners communicate with the wastewater treatment authority. Slowly, through much public education on the part of county administration, the public came to accept that onsite system management is needed in order to protect human health and surface waters[10]. A Responsible Management Entity (RME), run by the Wood County Planning and Zoning office was established nine years ago and an inventory of OSTDS initiated. The RME is a simple implementation. The property owner signs an affidavit at the time of purchase, which obligates him to provide inspection results on his septic tank every three years and have the tank pumped if necessary. To date, 12,500 OSTDS have been identified and permitted within the RME. The compliance rate has been at 90% for the past three years, which is the maximum achievable given that properties are bought, sold and subdivided. It has taken six years for the inventory to be "complete". Duane Greuel, the zoning administrator, operates the RME and offers the following advice.

- Implement enforcement incrementally and educate the public, contractors and government staff every step of the way.
- Identify the proper and documented management of OSTDS as a property enhancement and establish the expectation that the OSTDS be in good condition upon sale of the property.
- Constantly update and search for inconsistencies in the database and seek field verification during each inspection. Design a database that will inform the

inspector about inconsistencies that need investigation.

- Avoid becoming caught up in the objective of having a "perfect" inventory before starting up the RME. Define the responsibilities of the RME and begin.

2.4 Florida - Regional and County

Charlotte Harbor National Estuary Program and other County Initiatives

The Charlotte Harbor National Estuary Program is a large, multi-discipline program involving citizens, elected officials, federal, state and local resource managers and commercial and recreational resource users[11]. The program is designed to provide protection and restoration of the greater Charlotte Harbor estuarine system from Venice in Sarasota County to Bonita Springs in Lee County to Winter Haven in Polk County. A 20-year plan, known as the Comprehensive Conservation and Management Plan (CCMP) was approved in 2001 and includes diverse resource management concerns such as fish and wildlife habitat loss, water quality degradation and water flow[12]. The Management Plan continues to evolve.

Among the many projects accomplished under this program was a research and monitoring effort designed to assess the potential water quality impacts of septic systems. For this study, estimations of OSTDS numbers and locations were developed using the U.S. Census data without reliance on county health department records. This was sufficient to demonstrate the potential for a substantial contribution from OSTDS to the quality of surface and aquifer waters. However, a management plan could not rely on an estimate of this type for an initial database.

While the CCMP was in development, Charlotte County adopted a Comprehensive Plan element requiring the establishment and immediate implementation of a countywide septic system management program, to be initiated by the year 2000. The estimate of the number of OSTDS used to justify plan implementation was not a sufficient foundation for establishing the program. However, in 2007 Charlotte County did mandate an inspection program and began its implementation[5]. The CEHD started by entering all of the paper permit records since 1972 into the EHDB (either directly or migrated from CENTRAX). Then, through the use of property appraiser's tax records, developed parcels were identified, parcels provided wastewater treatment by FDEP permitted WWTF were subtracted and the remainder is presumed to have OSTDS. Parcels from this list were matched against the EHDB records. All parcels that did not have a permit on record are to be visited in the next five years to ascertain if an OSTDS does exist on site and to bring it into the EHDB. The County Health Department inspectors and registered private sector businesses perform inspections. The cost of a site inspection has been approximately $115 and is covered by local fees. The CEHD expects to complete this effort within five years.

Escambia County implemented a program in 1999 that mandates a point of sale inspection. However, the mandate is limited to designated environmentally sensitive areas. Property owner notification is handled by the private sector including realty and title companies. The inspection provides information to the property owner, identifies

malfunctioning systems, and may result in repairs. This process benefits both seller and buyer as the condition of a critical component of home ownership is verified as functional. The program costs the County approximately $84 per inspection and is funded by a fee. Information collected about the location and condition of the OSTDS is maintained by the CEHD. According to answers to the survey, the CEHD is likely to enter any OSTDS without a permit into the EHDB. The CEHD has not created an inventory of OSTDS in Escambia County, but the county does track FDEP permitted WWTF (Escambia County Utility Authority) customer records on an annual basis.

Santa Rosa County requires mandatory inspections every five years but this mandate is limited to designated environmentally sensitive areas. Property owner notification is handled by the real estate industry and a CEHD inspector or a licensed private professional performs inspections. As in Escambia County, an inspection provides the property owner with a location, description, capacity and condition of the OSTDS. Inspections may initiate repair requirements in order to comply with current regulations. The Santa Rosa program costs about $215 per inspection, a cost that is partially covered by an inspection fee. The remainder, presumably, is taken from general County revenues.

Franklin and Monroe Counties have a number of OSTDS that require operating and maintenance permits, but mandatory inspections of all systems are not required. Wakulla County has recently implemented a requirement for nitrogen reducing systems and these will require operating and maintenance programs.

The Southwest Florida Regional Planning Council, whose jurisdiction includes Charlotte Harbor, has recently adopted a recommendation that, by 2012, all counties and municipalities within the jurisdiction adopt a comprehensive management plan for wastewater treatments systems, including onsite systems.

SECTION 6: RECOMMENDATIONS RELATING TO DEVELOPING INTEGRATED, COMPREHENSIVE MANAGEMENT PLANS FOR ONSITE/DECENTRALIZED AND CENTRALIZED TREATMENT SYSTEMS

A. Local governments will ensure the development of integrated, comprehensive management plans for planning and managing all wastewater treatment systems, including onsite/decentralized and centralized systems for the communities within their jurisdiction by no later than 2012. Communities contiguous with or otherwise impacting those water bodies listed as verified impaired by the Florida Department of Environmental Protection will receive prioritization in this process. Local governments will ensure community residents and other citizens are involved in the creation of the management plans.

2.5 Conclusions

The role of inventories in OSTDS permitting, management, assessment of environmental impacts and protection of human health

OSTDS are an important component of wastewater management systems. However, because these are decentralized "systems", maintaining utility and effectiveness is much more complicated than with centralized sewage treatment systems. When they collectively fail to perform as designed or cannot reduce nutrient loading to surface and groundwater, they can become serious health hazards. The degree of success or failure cannot be ascertained without adequate documentation of location and condition of many individual systems.

The EPA describes five forms of OSTDS management, starting with basic homeowner responsibility and expanding to full control of the onsite system by a responsible management entity. This is a hierarchical system with increasing oversight and public sector responsibility. However, components of the higher-level models can be incorporated into lower-level models to accommodate specific local needs or capacities. It is also possible to have more than one management system active in the same jurisdiction. These management systems can also be implemented in conjunction with centralized wastewater management systems.

1. *Management Model 1* - "Homeowner Awareness". An **inventory** of all systems and permitting for installation.
2. *Management Model 2* - "Maintenance Contracts". An **inventory** of all systems and a service contract tracking system.
3. *Management Model 3* - "Operating Permits". An **inventory** of all systems and a tracking system for operating permit and compliance monitoring.
4. *Management Model 4* - "Responsible Management Entity (RME) Operation and Maintenance". An **inventory** of all systems and a tracking system for operating permit and compliance monitoring. The operating permit is issued to the RME instead of the property owner.
5. *Management Model 5* - "RME Ownership". An **inventory** of all systems and a tracking system for operating permit and compliance monitoring. The program elements and activities for treatment systems are owned, operated and maintained by the RME.

Effective management models can be specifically customized to meet local, state and regional needs. However, at the base of every model is the need of an inventory. It is impossible to manage effectively that which cannot be located nor is known to exist. Florida appears to be the first state to create a statewide inventory of substantial reliability and completeness, especially in advance of a statewide mandated OSTDS management program. When completed, this Statewide Inventory will provide a

determination of the wastewater treatment type for every parcel in the state. Some portion will be known "sewer" or "septic" based on independent information from FDEP permitted WWTF or existing DOH and CEHD permit databases. Another portion of developed parcels with be assigned the label "sewer" or "septic" based on the results of a model that takes into account the characteristics of each parcel and the community attributes. This will provide Florida CEHDs with a list of "known" OSTDS and a list of "probable OSTDS". With these lists they can prioritize any further refinement needed to protect human health and to assess the impact of OSTDS on environmental health conditions. In addition, should there be a state mandate to establish OSTDS management programs, the CEHDs and the DOH will have provided the basis of all EPA management models: an inventory of OSTDS.

3.0 Survey of Environmental Health Directors:

3.1 Survey Questions and Responses

The survey was designed to ascertain the quality and extent of permit records and the degree to which these records aided CEHDs in reliably estimating the number and location of OSTDS in their county. To ensure that the survey would accomplish the intended objectives, the questions and arrays of possible answers were selected after discussions with DOH staff, RRAC members and several CEHDs. The survey consisted of ten sections, each designed to address a different component of County OSTDS permit records. The survey was made available on a web site and was expected to take less than an hour to complete. All sixty-seven CEHDs completed the survey by March 13, 2009. They were generous with the useful comments and with their time in follow up conversations. Below is a brief description of these sections and the question numbers associated with them. The survey questions and the full responses of the CEHDs are provided on the included DVD.

Abbreviations used:

EHDB	Environmental Heath Database (in this table)
DB	Database
WWT	Wastewater Treatment
WWTF	Wastewater Treatment Facility
FDEP	Florida Department of Environmental Protection
OSTDS	Onsite Sewage Treatment and Disposal Systems

Section	Question #	Label	Topic
1	1 - 3	Respondents	Respondent contact information
2	4 - 12	EHDB	Scope of permit records in EHDB
3	13 - 19	CENTRAX	Scope of permit records in CENTRAX
4	20 - 27	OtherDB	Scope of permit records in other databases
5	28 - 34	PaperRecords	Scope of paper permit records
6	35 - 39	OtherWWT	Contact with FDEP WWTF, State and Federal
7	40 - 44	OSTDSCounts	The number of OSTDS
8	45 - 71	Estimates	Details of estimations planned or completed
9	72 - 100	Inventories	Details of inventories planned or completed
10	101 - 102	FinalComments	General and final comments

3.2 Summary of Survey Responses

Electronic Records

As software and hardware became available, counties began to create databases of the environmental health information, including OSTDS. The adoption of electronic forms of information varied tremendously from county to county with the larger, better-funded and more sophisticated counties being first. These “legacy” electronic databases ran the gamut from simple spreadsheets or databases (e.g. Excel, Dbase and Access) to

more complex systems that were shared among a group of counties (**DVD 3-1: Survey Questions 20 – 27**). There was at least one consortium of 12 counties that shared a system called CPHUIMS. In the mid 1980's the DOH made a database program available that kept track of community facilities for which the DOH had some regulatory oversight. This was called the Onsite Sewage Disposal System (OSDS) database. Some counties used it but it appears from the CEHD survey, the majority did not. Therefore, there was a patchwork of locally controlled databases with a number of counties working predominantly with paper records and paper reporting systems.

The need of an electronic form of record keeping, the capacity to share this information easily and having a centralized electronic location for records became more pressing as the state grew and the complexity of information the DOH was responsible for increased. In the early 1990's William Reinhold developed a data management system for many of the responsibilities of County Environmental Health Departments. It was called the Comprehensive Environmental Health Tracking System, CENTRAX. He and Gerald Briggs collaborated in adapting CENTRAX to build upon the functions of OSDS so that tracking of OSTDS permits was included in this comprehensive system. CENTRAX was also made available, with training to each of the counties and by the late 1990s was the required form of electronic record keeping. CENTRAX included on site data storage and a monthly transfer of information to the DOH statewide database. It was also capable of being used to analyze and summarize permit information. According to the CEHD survey, the CENTRAX system was adopted and used by all counties by 2000, except Columbia.

Over time web based access has become more desirable, GIS information more available and so has the importance of being able to protect human health and welfare in the face of natural disasters and other catastrophic occurrences. The DOH developed the current Environmental Health Database (EHDB) to address these needs and to handle more sophisticated information and more flexible data access. All counties contribute current OSTDS permit data to EHDB and most were very successful in migrating information from their CENTRAX databases and even from other older databases. However, some counties also keep a parallel system locally, though most appear to have stopped entering new permit information into these. The local databases appear to serve the purpose of access to permit information not available on EHDB or simply because of greater local expertise and familiarity with these local systems.

It is clear from survey responses that a wide range exists in the use of data management technology among Florida counties (Table 3-1, Appendix). A few counties began employing electronic databases in the 1980s or earlier, recording some level of permit information on spreadsheets. The Department of Health assisted by providing standardized database software and content at various times over the last two decades. By 2000, most counties had established electronic permit databases that were regularly referenced and maintained. The most recent statewide effort is the EHDB system, which all sixty-seven counties now use and to which they have migrated at least their most recent electronic records.

However, the EHDB database does not contain the entire wealth of permit information available. Thirty-seven counties report some form of electronic database that is

independent of EHDB and contain additional permits. However, most of the electronic information for these permits is limited.

Table 3-2 summarizes the use of electronic databases, including EHDB by counties. The columns indicate the number of counties that have databases in an electronic format that could include EHDB or another local systems and those that only use the EHDB as their electronic database. The first column indicates a range of years which include the earliest permits that are stored in an electronic form. For instance, 7 counties have permits from as far back as the 70s in electronic form. But most (31) have electronic records dating back to between 1995 and 2000.

Most are legacy databases, though two are newly created through OSTDS inventories completed by the county (Alachua) and a centralized sewer and water authority (Duval). More than half the legacy databases contain permit records dating back 20 years. A number of counties use these databases regularly. Sarasota and Columbia Counties have maintained databases with permits from the 1970's. Nine counties have legacy CPHIUMS databases that should contain records from the 1980's: Bradford, Dixie, Gilchrist, Hamilton, Lafayette, Levy, Putman, Suwannee, and Union. These nine do not currently appear to be in use, and some did contain useful information for the Statewide Inventory.

Table 3-2: Number of Counties with databases
that include permit records within the given range of years.

Earliest Permit Date in Database	All Electronic Database Records	Only EHDB Records
before 1970	1	1
1970 < 1980	7	0
1980 to 1990	11	0
1990 to 1995	9	4
1995 to 2000	31	38
2000 to 2005	2	5
since 2005	2	15
no information	4	4

Most counties report the continued use of paper records, mostly for older records but in some cases for all references to permits. A few counties include permits from these records to derive annual estimates of existing OSTDS.

However, paper permit records are more commonly accessed to answer daily inquiries from the public regarding individual parcels. Nine counties, including Brevard, Columbia, Duval, Highlands, Hillsborough, Nassau, Okaloosa, Putnam, and Sarasota, have, or will shortly have, all paper records in a searchable electronic format. Such databases greatly reduce staff time spent responding to pubic records requests. Not all counties with searchable permits have incorporated this information into the EHDB database. In some cases we were able to extract basic information about permit date and location from these files.

The Statewide Inventory project actively sought any "legacy" databases and most counties with any electronic information sent it to us immediately. A detailed description of the contents of the databases and paper records for each county as reported by CEHDs in response to the survey is contained on the report DVD. However, we were unable to obtain data from the local Columbia database.

Though County databases contain permit data, this does not directly translate to definitive numbers and location of parcels with OSTDS. There were over 250,000 records in all of these legacy databases. Unfortunately this only translated into about 70,000 records with linked addresses. Nonetheless, this was an addition to the identified OSTDS parcel list.

Identifying Sewered Parcels

There are nearly 9 million mapped parcels in Florida, of which approximately 6.5 million are developed. In order to discern which developed parcels may have OSTDS, identification of those properties, which are served by FDEP permitted sewer systems, is critical. There are over 2,000 active WWTF in Florida. About 20% of these facilities account for 96% of the total effluent treated by all WWTF. This service accounts for approximately 64% of Florida's population and therefore includes a large number of parcels.

The number and size of FDEP WWTF varies greatly among counties (Table 3-3, Appendix). The capacity of the CEHD to know the location of the OSTDS in each given county and to permit these appropriately is heavily dependent upon timely and accurate communication from the WWTFs regarding changes in service provision.

Many WWTF are small and provide service to only a few parcels or homes. Examples would include Recreational Vehicle Parks or condominium complexes. Once the sites served by these WWTF are identified, it is unlikely that service will change or expand over time. They are more likely to eventually be incorporated into large municipal centralized sewer systems. This will not affect the permitting of OSTDS.

Many public WWTF, including those run by designated authorities such as JEA of Jacksonville, alter service areas over time. Municipalities often extend sewer lines to new development even before providing service to all of their existing area, and less often, retrofit older neighborhoods. State law (Chapter 381.0065 (2) F.S.) requires that all parcels abandon OSTDS and hook up to sewer lines within a year of their installation

and that the installer of new sewer lines inform property owners of the sewer extension shortly after it is fully available. However, this does not appear to occur as regularly as the law anticipated. In older neighborhoods, use of OSTDS will continue until a system failure prompts the property owner to seek relief. At that point, owners are required and do, hook up to the existing sewer lines. In the meantime, identification of these parcels becomes difficult as they appear to be subsumed in a centralized sewer service area. Customer billing data can identify them, though some properties pay a "ready to serve" fee even if they do not receive centralized sewer services. Not all WWTF billing agencies do distinguish such differences in service.

In order for the CEHD to maintain knowledge of where OSTDS are located and can be permitted for use, it is important that changes in centralized sewer service areas are regularly communicated to them in a direct and consistent fashion. The regulatory tool is the abandonment permit which is required to be sought when sewer extension and hook up occurs (64E-6.011 F.A.C). Some service providers seek these permits, have regulatory capacity to issue them in large numbers to cover an expansion, or simply inform the CEHD of streets that have been connected. However, despite the regulatory requirements, communication between these service providers and the CEHDs is sometimes inadequate. This creates uncertainty in data regarding the number and location of OSTDS within the jurisdiction.

The survey asked CEHDs to describe their communication with the FDEP permitted sewer service providers in their jurisdiction. Tables 3-4 and 3-5 provide a synopsis of these responses.

Less than half of the CEHDs have documentation of the FDEP WWTF sewer service areas in their counties. Over half (58%) are not notified about service expansion or hook ups of older residences within service areas, regardless of regulatory requirements. Over half (56%) fail to regularly issue abandonment permits when a parcel previously served by an OSTDS is hooked up to the centralized sewer line (Table 3-6). Even when permits are issued, a method for associating the property with the initial OSTDS permit on the parcel is often lacking because locating the original construction or a subsequent repair or modification permit for that OSTDS cannot be done. This is due to a variety of reasons including that records are only available on paper and searching for them is time consuming, original permits often have inadequate locational information to match with the abandonment permit and relatively few counties have put their older permits in the EHDB which does provide a routine for reconciling an abandonment permit with other permits for the same OSTDS.

It appears that there is little regular communication and that much of the communication that does exist relies upon the relationship between county and WWTF staff. This may be effective much of the time, but does not guarantee consistent, dependable patterns of communication concerning a major element of providing wastewater treatment.

Table 3-4: Number of County Environmental Health Departments with documentation of FDEP WWTF service areas. (Forms of documentation include maps, list of jurisdictions, parcels, etc. and vary among WWTF.)

Documentation	# of Counties	Percent of Total Counties
Sufficient	13	19%
Some information	12	18%
No information	42	63%

Table 3-5: Number of County Environmental Health Departments that are notified by FDEP permitted sewer providers about changes in service areas. (Forms of notification include providing abandonment permits, reports, etc. and vary among counties).

Notification	# of Counties	Percent of Total Counties
Annually	1	1%
When changes occur	27	42%
Sometimes when changes occur	9	13%
No notification	30	45%

Table 3-6: Number of County Environmental Health Departments for which Abandonment permits are issued when FDEP permitted sewer service is first provided to a parcel with an OSTDS and which are sufficiently reconciled to existing OSTDS permits as determined by the CEHD.

Abandonment Permits Issued	# of Counties	Percent of Total Counties
Always	12	18%
Sometimes	17	25%
Not Usually	12	18%
Not Sure	5	7%
Not Issued	21	31%

EHD survey responses and their comments, to questions #35 to #39 regarding communication with FDEP permitted sewer providers can be found on the DVD.

Distinguishing between Estimations and Inventories

The survey used in this project distinguished between an estimation and an inventory of the number and location of OSTDS. However, the distinction made in the survey instructions was not well understood by the CEHDs, perhaps because it was poorly communicated but also because they relied on a continuum of the degree to which the accounting of the number and location parcels with known wastewater treatment methods has been accomplished.

The absolutely complete inventory is a list of locations, latitude and longitude coordinates, for each and every OSTDS in a county and can only be accomplished by going to each parcel and determining if any OSTDS exists onsite, including more than one installation. However, since this can take years to accomplish, even in small jurisdictions, new construction and abandonments continue, the number and location are constantly in flux.

On the other hand, estimation can be a very gross approximation, based on record counts and assumptions that these records reflect current conditions on parcels. The DOH estimates the number of OSTDS each year by reporting the total number of new construction permits for each county, with a base number in 1970 that was derived from the US Census and assumptions of the number of persons per household. Abandonment permits are not even subtracted from this since abandonments are also issued for replacements of OSTDS.

Another consideration is that this project will also include some degree of estimation. The response to our request for parcel information from all FDEP WWTF is voluntary so this project cannot control the quantity or the quality of the data on sewered parcels. The OSTDS parcel information is derived as described above and will also incompletely identify existing OSTDS. Our intention was to statistically estimate the wastewater treatment method for as few parcels as possible and to use as robust and reliable a model as could be created from the parcels with known treatments. The more parcels for which wastewater treatment can be independently identified the closer the results of this project are to an inventory than to an estimation.

At the county level, an inventory is more easily understood to be the result of actual visits to parcels and verification of the location and number of OSTDS on each site. Making an estimate of which parcels should be visited begins such an inventory. This estimation is effectively, the number and list of parcels for which wastewater treatment methods are unknown. The length of this list is dependent on the amount of permit data that is available electronically and with valid addresses and the amount of information that is obtained from WWTF. This is essentially the constraint on the difference between an estimate and an inventory that this project is confined by.

However, the CEHDs will not, in most cases, have the GIS or statistical expertise to assign a probability of there being an OSTDS on a given parcel, which this project has supplied. This final step moves the Statewide Inventory to a more complete and reliable accounting of the number and location of OSTDS. It can also be used by the CEHDs that have the staff for on site visits, to prioritize which parcels in the list of "unknown wastewater treatment" to visit first.

The more important distinction to be drawn is to provide a clear methodology for the assignment of wastewater treatment to every parcel so that the results can be reproduced and generalized. The degree of reliability is ultimately captured in the number of parcels for which wastewater method must be estimated and a metric of the quality of the assignment. With this information in hand, appropriate conclusions can be drawn for any given use of this information whether it is for the initiation of an inspection program, environmental impact assessment or coordination with comprehensive and infrastructure planning.

Estimations and Inventories Done by Counties

Twenty-two counties have made or are planning to make estimates of the number of OSTDS within their jurisdictions. These estimates range from detailed preparation in anticipation of implementing a countywide inspection based management program (Alachua and Charlotte) to a simple summation of the various types of permits in existing electronic databases. Table 3-7 contains information on these counties, including a brief description of methods and motivations. Counties with electronic databases that include many years of permit records (Columbia, Sarasota, Monroe) can provide valid estimates by simply utilizing their permit databases. However, if a GIS map of a parcel is lacking, active permits must then be compared with the Property Appraiser parcel ID in order to accumulate sound data on the OSTDS location. Sarasota

explicitly states that estimates are merely the sum of permits in all electronic databases minus abandonment permits.

Some counties appear to have relied on a variety of resources, including the Property Appraiser's database, GIS maps of sewer lines from FDEP permitted sewer service providers and their own records, yet remain able to provide only approximate figures. This reflects the extensive amount of expertise that is required to reconcile information gleaned from many sources. Other counties reported performing the task of estimation in hours or days. It remains unclear how rigorously listed data sources were utilized or verified in these cases. Most likely these are the results of queries run on existing electronic permit databases to count records.

CEHD survey responses to questions #40 to #100 regarding estimations and inventories of OSTDS can be found on the DVD. A more detailed description of rigorous and data intensive estimates are provided in Chapter 3.4.

Conclusions

The Statewide Inventory Database includes the integration of all sources of permitting records we could locate including the EHDB and 13 databases supplied directly by the County Environmental Health Departments. The inventory is a geographical based database and therefore, only permits that were successfully linked to the DOR GIS database could be used. This resulted in over 300,000 parcels identified as having OSTDS for wastewater treatment.

Clearly, there are sixty-seven different states of knowledge of the number and location of OSTDS. The counties differ in

1. how successfully they have been able to convert paper records into accessible electronic formats,

2. how well they communicate with FDEP permitted sewer service providers on a regular basis,

3. how completely parcel lists are compared with the Property Appraiser data, and

4. whether existing information has been integrated into a geographical information system or other spatial display.

We would like to thank the sixty-seven CEHDs and their staffs for providing suggestions on the design of the survey, as well as useful and interesting responses. The CEHDs were forthcoming with their opinions, providing great detail on methods of tracking OSTDS permitting in their jurisdictions.

3.3 Description of Inventories and Estimates

The following are brief descriptions of some of the estimations of the number and in some cases, the location of OSTDS that have been done in Florida, either for entire counties or for spring sheds. Though often referred to as inventories, strictly defined as discussed above, most described here include estimation.

Two counties, Alachua and Charlotte, have performed the first important step of clearly defining parcels for which forms of wastewater treatment are accurately determined and which are unknown. Charlotte has begun a 5-year program of inspecting parcels in environmentally sensitive areas to determine the number, location and condition of all existing OSTDS. They created a list of parcels based on the Property Appraiser's tax roll, removed undeveloped parcels, removed parcels identified with wastewater treatment provided by a FDEP WWTF as determined by the data collection efforts of the Charlotte County Environmental Health Department.

Alachua has also recently completed a first step toward an inventory and also now has a defined list of parcels for which the wastewater treatment method is not known. Methods for determining what form of treatment actually exists on these parcels are currently being devised. Both Charlotte and Alachua Counties have created datasets, and intend to develop updating systems and to integrate with the EHDB database.

In 1996, Monroe County, in response to a state mandate for the protection of coastal waters in the Florida Keys created a database consisting only of those parcels where treatment types were unknown. Staff has endeavored since that time to accurately determine types of existing treatment on these parcels.

In Duval County, the Water and Sewer Expansion Authority (WSEA) is compiling a parcel-based inventory of wastewater treatment types. The information source for this inventory is limited to data on FDEP permitted sewer service provision from the Jacksonville Electrical Authority (JEA).

Thirteen other Florida counties have completed some form of estimation. None use particularly rigorous methods, but these methods may prove quite accurate for counties that have kept good electronic permitting records for a long period of time. None of these counties appears to have established a method for assessing the accuracy of their estimate or maintaining the information in a database. Most view the estimate as a single time point to be repeated as needed. The Sarasota County process is presented here in detail as an example of the most typical form of estimation which is often referred to as an inventory. Data sources are limited to the permit database, with outside sources such as the Property Appraiser's database and service addresses from FDEP Wastewater Treatment Facility (WWTF) contact database referenced to some extent.

The Wekiva Springshed Study provides an example of estimations that were specifically undertaken to assess the environmental impact of the number and location of OSTDS. The Wekiva Springshed covers several counties and many different jurisdictions. Study methods offer an interesting description as to how estimation can

be used to provide sufficiently accurate numbers and locations for the purposes of an environmental impact assessment. However, this method would only comprise an initial and incomplete step in the creation of an inventory for the purposes of establishing a management regime for OSTDS.

An estimate was also performed for the Wakulla Springs basin, using different assumptions and databases than were used in Wekiva. The same end was accomplished - a sufficiently realistic estimate of the number and location of OSTDS to determine their contribution to the degradation of the springs. However, this estimate is insufficient for establishing and operating an inspection and management program, although it offers a good first step.

Both springshed estimates created the impetus for a more thorough statewide inventory of OSTDS to ascertain the number and parcel location of each, and to develop a process of maintaining an accurate inventory of wastewater treatment types. The Statewide Inventory should clearly be the product of the successful use of estimating the number and location of OSTDS.

Alachua County

Alachua County obtained a grant to perform an inventory of OSTDS throughout the county. The Alachua staff followed these steps to produce the inventory:

1. Accessed the Property Appraiser's tax roll to identify all parcels that are improved and therefore would require some form of wastewater treatment.
2. Identified all parcels that are served by FDEP permitted sewer service provider.
3. Incorporated all paper permits and the County Environmental Health Databases, including CENTRAX and EHDB, including 19,000 records from before 1988.
4. Reconciled these three sources of information: tax rolls, utilities and County OSTDS databases.

The difficulties encountered included:

1. Distinguishing land use categories that did not require wastewater treatment facilities presented a challenge, such as accurately identifying parking lots and warehouses without bathrooms. This required significant ground-truthing.
2. Alachua provided a parcel listing to the municipalities within the county and requested that they indicate the wastewater treatment type for each parcel. Most instead provided a list of customer site addresses not always distinguishing between customers with water *and* centralized sewer service versus water alone. This required much more time using GIS and mapping software.
3. Reconciling abandonment permits with initial construction permits could not be completed because FDEP permitted sewer service provider did not consistently provide parcel information for new sewer hook ups. Also, permits did not always contain sufficient information on the location of the parcels.

We have performed the reconciliation of three data sources: EHDB database, FDEP permitted sewer service provider customer information, and Property Appraiser data,

and linked parcel addresses to the DOR GIS data. Alachua has just about 100,000 parcels of which 80,000 are improved. There are 29,636 parcels known to have OSTDS and 43,582 parcels that have been identified as being sewered. This leaves 7,099 parcels that have not been assigned wastewater treatment, about 7% of the total.

The database field names are not yet finalized, but to date the following have been used for all parcels:

- Tax parcel ID
- Owner Name
- Address (multiple lines)
- Date
- Identification of wastewater treatment type (septic, sewer, not needed, unknown)
- Identification of water source (water main, private well)

Anthony Dennis, the Alachua CEHD, intends to devise a method to annually update the inventory with the tax roll and reconcile all forms of OSTDS permits, including abandonment permits and FDEP permitted sewer expansions.

Charlotte County

In 1997, Charlotte County adopted a Comprehensive Plan that included the establishment of a septic system management program to serve the entire county. In 2007, a locally mandated inspection program was implemented, which requires 5-year inspections in geographically designated and environmentally sensitive areas. The CEHD handles the tracking and property owner inspection notification process and inspections are performed by both the CEHD inspectors and private sector companies (Registered Septic Tank Contractors, State Licensed Plumbers and Private Certified Environmental Health Professionals).

Charlotte County occupies the enviable position of having complete permit records dating back to 1973 already entered into EHDB. Even though some paper records were lost during Hurricane Charlie, the information was already contained in an electronic database. However, their OSTDS database is not directly used for the inventory. Instead a list of parcels that should have some form of wastewater treatment has been created. The following steps were taken to create this list:

1. Property Appraiser tax roll was accessed to identify all parcels that are developed and would require some form of wastewater treatment.
2. All parcels served by FDEP permitted sewer service providers were identified.
3. Abandonment OSTDS permits were reconciled with FDEP permitted sewer service provider customer listings.

These three sources of information were reconciled, and no problems in the use of methodology were reported. There are twenty-seven FDEP permitted WWTF and

eleven cities and towns, but communication between them and the CEHD appears to be thorough and reliable.
The inspection program will be guided by this list and prioritized by geographically delineated ecologically sensitive areas. As the process proceeds, the OSTDS that are already in the EHDB database will be noted. New OSTDS or updated information on existing systems will be added to EHDB as the information becomes available and all permits issued as the inspection programs proceeds will be entered. As these systems are found under the requirements of onsite inspection, the location, potential age, components and functional condition will most likely be recorded. By the end of the 5-year period, Charlotte County should have a robust inventory and database.

Monroe County

In 1996, as a part of the Cesspool Identification and Elimination Program (CIEP), Monroe County identified 23,000 parcels with OSTDS, including cesspits. These parcels were identified as follows:

1. Property Appraiser tax roll was accessed to identify all developed parcels that would require some form of wastewater treatment.
2. All paper permits were entered into a database. Paper permits prior to 1972 had been lost (see story below).
3. Contractor records were entered when available.
4. Information about parcels served by existing FDEP permitted sewer service provider was entered.

The compiled data indicated that for 7,200 (31%) parcels there was sufficient evidence from the tax rolls that the parcel was develed and wastewater treatment would be necessary, but evidence of a permit from DOH or FDEP was lacking. A database (CIEP DB) of these 7,200 records was created, which contained the following fields:

- Tax parcel ID
- name : presumably owner or possibly only resident
- address (2 lines)
- city
- zip
- year built for structure
- legal address (3 lines)
- unknown : logical value T or F

The field "unknown" was set to "T" for all records in 1996, indicating that the parcel could not be assigned a wastewater treatment method. Since that date, the wastewater treatment type on approximately 2,200 parcels has been identified and the unknown designation changed to "F". Most of these have been identified since 1996 through the permitting process.

Monroe County has an electronic database that consists of permits from 1985 to 2004, but these are not contained in a single database. The EHDB database contains permits

from 2005 to present. There is an "urban legend" that all records prior to 1972 were "tossed over a bridge" during a move of department material. It is not clear where the records from 1972 to 1985 reside, if they still exist.
Monroe encountered the following difficulties while creating the CIEP:

1. After the list of parcels lacking sufficient information on wastewater facilities was compiled, 16,000 requests for information were sent to private property owners.
2. There are 218 FDEP permitted WWTF that are small, permitted for 0.1 MGD or less.
3. The CIEP resulted in a list of "unknown" parcels. No database of "known" parcels was created nor maintained.

The requests created consternation among the public ("almost caused an insurrection"). Residents should be informed as to why an inventory and/or management system is sought and what their roles might be *before* asking questions about the wastewater treatment on their properties. This clearly constitutes a lesson learned for creating an inventory and management systems of OSTDS.

Distinguishing the parcels that are served by FDEP permitted WWT sewer service facilities can be difficult. Cooperation from owners of these facilities is also needed in order to have a robust inventory of OSTDS. The CIEP in Monroe County only lists parcels with indeterminate assignment of wastewater treatment type. The permits in the EHDB date from 2005. While the CEHD believes that between these two, the total number of OSTDS is well determined, it appears that there is no parcel database of existing known OSTDS locations. All Monroe County's database files including records in the EHDB database, the CIEP data and the older records that were used, in part, to generate the CIEP will be included in the Statewide Inventory. This should yield a database of known OSTDS parcels.

Duval County

The Water and Sewer Expansion Authority (WSEA) of the City of Jacksonville has been conducting an inventory of parcel wastewater treatment service for about two years. The purpose for this inventory is to identify locations that would be appropriate for the expansion of sewer services. Mr. Danny Turner is heading this project. He has based the inventory on:

1. Parcel tax roll and identification of developed properties
2. Location of sewer mains and laterals for large utilities
3. Known location of OSTDS in areas served by FDEP permitted sewer lines

It appears that no OSTDS permit database was used even though all permits from 1993 to the present are available in electronic format for Duval County. Duval has twenty-six FDEP permitted WWTF, sixteen of which are large facilities serving large areas of the counties. The Statewide Inventory has acquired information from these large WWTF permittees as well as from some smaller permittees including the federal

facilities and is using the data available in the EHDB.

Sarasota County

Sarasota County appears to have the most complete electronic record database. They report that all paper records are electronically available and that the pertinent information in them has been entered into a database. The EHDB database appears to contain only records from 2006 to the present, but a local database exists that contains records back to 1972. Sarasota estimates the cumulative number of OSTDS each year by simply adding up the permits in the EHDB and their local database minus abandonment permits. This appears to be the safe process as used by the DOH. Sarasota does not appear to have a method for reliably accessing information regarding abandonments due to the sewer line expansion, but abandonments are linked to the OSTDS, which was initially permitted. This estimate is probably highly accurate given the longevity of record keeping, but the list of OSTDS parcels has never been compared with the tax rolls and the parcels provided sewer service by FDEP permitted WWTF in the county.

Wekiva

Wekiva Study Area / Wekiva Aquifer Vulnerability Assessment

During the assessment of the source of nutrient pollution levels in the Wekiva Study Area, more than one estimate of the number and location of OSTDS was undertaken. A different method of estimation was used for Seminole, Orange and Lake, the three counties in the Wekiva Study Area[13].

One of the estimates for Seminole was done using existing county data sources but did not use the County Health Department data. They identified all parcels with sewer lines adjacent or within 50 feet and were vacant. The remaining parcels were presumed to be on septic tanks. This was done only for the Wekiva Study Area and the Wekiva Protection Area as it intersected with Seminole County.

In Orange County data was obtained from the utility companies for the cities within the study area. They provided the number of residences on water and sewer and the number on water. Residences that only received water service used OSTDS for wastewater treatment. The residences that were on well and OSTDS were not provided[14].

In Lake County, wastewater treatment providers were contacted and the parcels that they served were identified. Then information from the property appraiser's database was used to further elucidate which of these parcels used OSTDS due to their development status.

An estimation for the Wekiva Basin by the St. John's Water Management District and the FDEP was done[15]. They combined data from the FDOH for the Wekiva Study Area (WSA) with an extrapolation for the rest of the area in the Wekiva Basin that was not also in the WSA. The WSA data was based on the 1990 US census, FDOH permit files,

information about sewered areas. The DOR tax parcel data was used to estimate the density of OSTDS per acre for different land uses in the WSA. These values were used to estimate the number of OSTDS the remaining area of the Wekiva Basin using the land uses found there.

The many approaches to the Wekiva Basin/WSA estimations demonstrates that there is no generally agreed upon way to determine the number and location of OSTDS when there is not an existing inventory. It will be possible to make estimations for any area that can be defined with GIS software within Florida with the Statewide Inventory.

Wakulla Springs

Wakulla Springs Studies / Aquifer Vulnerability Assessment

The number and location of OSTDS in Wakulla and Leon Counties was estimated in order to assess their importance as a source of nutrient pollution to Wakulla Springs[16]. The U.S. Census and FDOH records were used to obtain estimates of the number of people using OSTDS in 1990. These values were extrapolated to the 2000 U.S. Census. The spatial distribution of OSTDS was based on:

1. Leon County Tax roll parcel database; developed properties are defined as improvements valued at $400 or greater.
2. City of Tallahassee sewer billing/site addresses with all parcels inside the city limits designated as lacking OSTDS.
3. Removal of subdivisions in Leon County believed to be served by FDEP WWTF operated by Talquin Utilities.
4. Use of Wakulla County plat maps to identify improved parcels.
5. Removal of parcels known to receive sewer service from FDEP permitted WWTF within Wakulla County.

Talquin Utilities would not provide parcel lists for any of the subdivisions for which it provides sewer service, so the location of its service area had to be estimated largely based on the local experience of the Leon and Wakulla County CEHDs. For the Statewide Inventory, Talquin would only provide a list of subdivision names. (We have used the Property Appraiser's database to identify the parcels in these subdivisions for the Statewide Inventory, however, there are likely to be individual parcels at the edges of these subdivisions that Talquin has also extended sewer service to that we are unable to distinguish.)

Determined in this manner, as of 1999, the total number of OSTDS in Leon County was 24,304 and 6,513 in Wakulla County. These numbers are substantially lower than those estimated by the Leon County CEHD.

Since this estimation both Leon and Wakulla Counties have taken steps intended to reduce the nitrogen contribution to the springs from OSTDS. Leon County is embarking on a more rigorous estimation to accompany its adopted Primary Springshed Protection Zone.

Conclusions

These examples indicate a growing interest and need to know the number and location of OSTDS in counties and environmentally sensitive areas with boundaries that include multiple jurisdictions. The Statewide Inventory will provide a base line for each county and because of the standardization of data collection, data quality validation, and estimation; it will also provide the same for extra-jurisdictional regions as well.

4.0 Statewide Inventory Data Collection and Estimation

The purpose of this portion of the report is to provide an overview of the information utilized in the inventory as well as general procedures. These elements are crucial to the successful modeling of the number and location of OSTDS. We will discuss our sources of information, methodology for data compilation, limitations and ideas for refinement of the inventory database.

Also, we will begin to document, county by county, the roadblocks to seamless integration and steps taken to maximize proper assigning of wastewater methods. Since we are working with literally hundreds of different datasets, many required a unique approach to the way they were integrated and eventually used in the inventory. It is important to understand the relationships between the different data into order to accurately and efficiently compile them into the system.

Lastly, we will present the current state of the database and maps showing the known and estimated locations of OSTDS.

4.1 Sources of Information - Description and Acquisition

Geographic and Ownership Information

The parcel ownership information was obtained from the Florida Department of Revenue (DOR). Each county Property Appraiser is required to submit their geographic information system (GIS) parcel layer and accompanying tax roll to the DOR annually. Until recently, the DOR was not obligated to share the compiled information. However, nearly two years ago, a mandate from the Governor required the Department to make the information available for download. DOR has established a data definition with required fields and formats that the counties follow. These requirements for normalized formats make statewide compilation a less daunting task than acquiring the information from each of the 67 counties - usually in 67 different formats.

Following the certification of their tax rolls on November 1", each County submits their data to DOR. We obtained the current parcel and ownership information for the 2008 tax roll. The process for developing a seamless statewide cadastral fabric, and the basis for our inventory, began with loading the parcel shapefile for each of the counties into SQL Server through ArcSDE. Since the GIS and tax roll are provided separately, a join was established between the tax identification numbers in order to assign attributes to the parcels.

In addition to ownership and location, the DOR tax roll also provides DOR standardize coding for the land use, parcel size and improvement condition as well as county determined grouping variables such as tax authority and neighborhood codes.

Over several years, the DOR has developed a data format and structure that, generally, each county conforms to well. However, there are instances where the information is incorrect, invalid or useless. During this project, when those instances were discovered, we worked to remedy the situation. Examples of re-examination of data include:

- City of Tampa/Hillsborough County: Nearly half of the parcels were missing tax identification numbers in the GIS. This is the primary field for linking the GIS to the tax roll. New data was acquired from the county in order to have a complete data set.
- Sumter County: The County was partially mapped when it was submitted to the Department in November. Since then, the remainder of the county had been completed. Therefore, we ordered/purchased the new GIS and tax roll information from the county – increasing the mapped parcels by nearly 50,000.
- Multiple instances of altered or reformatted tax identification numbers by counties. Specific examples are outlined in the State of the Data (Appendix).

The accuracy and validation of the DOR data is well managed by the Department with few exceptions. Therefore, it is a very reliable data set.

Sewer Customers: FDEP permitted WWTF

The first step of the Statewide Inventory project was to obtain information regarding the number and location of parcels for which wastewater treatment can be identified through independent means. The more parcels that can be assigned a wastewater treatment type through independent data sources, the less estimation will be required. Also, the more identified parcels, the more parcels that can be used to develop models and the more reliable these models will be for estimating wastewater treatment methods.

The FDEP regulates and permits the construction and operation of WWTF in the State. They provide, via their website, a list of those facilities as well as general information - including contact, location and capacity. From the available list, we compiled a relational database, filtering out common contacts. We performed a mail merge from the parsed list and sent letters to each of the contacts for the permitted facilities. The letters requested serviced addresses for each of their facilities. We provided a number of options for delivery, including mail, FTP website and email.

The response to this mailing was immediate and continues. So far, we have handled more than 2,000 emails and many hundreds of phone calls addressing questions about what information we were seeking and often providing detailed help on how to obtain the information we requested through the billing or customer service departments of the WWTF permittees. Most were very willing to help with our endeavor, while some choose not to participate.

The responses contributed massive amounts of data in a variety of formats and of highly varying quality. After incorporating this material into our contact database, in April we initiated a second round of phone and email contacts aimed at the large and publicly owned (municipalities and counties) WWTF for which no information had

been submitted at the time. In addition, municipalities and billing agents, who represent wholesale customers to the largest WWTF, were contacted. This included wholesale customers of Broward County, St. Petersburg, Fort Lauderdale, a consortium in central Brevard, and the East Central Regional WWTFs. Data continues to arrive, especially from the larger sewer service providers. This round of requests was more personalized and required substantial follow up. But the result was a substantial increase in the number of known sewage parcels.

In our initial letter to the individual wastewater treatment facilities, we requested specific information for their response. Although, the method of response varied based upon individuals' abilities and size, the general information was the same – service addresses. From the addresses, we utilized various methods for linking and assessing the accuracy of the link to the tax roll. Since we were comparing text fields, it was crucial that they matched identically. Therefore, we took an iterative approach to narrowing down unmatched records and resolving them, sometimes individually. It was a labor-intensive process but crucial to the successful inventory of serviced parcels. Since we rarely were able to match 100% of records, our modeling also determines and estimates for sewered parcels as well. We believe this accounts for the unmatched records quite well.

County Environmental Health Department OSTDS Records

The two primary sources for septic tank information are the Department of Health Environmental Health Database (EHDB) and databases locally retained by the individual County Health Departments (CHD). Following meetings with DOH, we were provided applicable subsets of the EHDB. We utilized the Property ID (tax identification number) and address fields to link to individual tax parcels. A brief narrative for the process involved by county is provided in this report.

We also contacted each CEHD directly requesting information and access to any database that they stored, retained or actively used in the county offices. To do this, we created a contact table of County Environmental Health Directors using information from DOH, which we updated by phone for several of the CEHD. From the database table, we performed a mail merge to create letters for each contact. A number of CEHD provided databases in a large variety of forms and conditions. The Alachua County office provided us with records remaining from their CPHIUMS 12 county consortium. We were unable to obtain the database of records from 1972 to 1999 for Columbia County, but we did obtain records from 2000 onward via the EHDB.

We were able to acquire a select number of databases with septic information from the CEHD's. But due to the age of the information, incomplete data entry and proprietary nature of the some of the databases, extraction of information proved difficult. We salvaged what we could and added the location information of these permits to the Statewide Inventory.

In addition, Alachua and Charlotte counties provided us with substantially complete inventory information. Alachua provided two files. One was a list of parcels with information on the provided wastewater treatment from DEP permitted WWTF. The

other was a list of parcels known to have OSTDS. This second list was obtained through their own records primarily through data entry of paper permit records. We have joined these files to the DOR parcel database for Alachua County and have relied upon this excellent database for Alachua's portion of the Statewide Inventory.

The Charlotte County Environmental Health Director provided us a list of 50,000 parcels, which represented his work of separating undeveloped parcels, and parcels that were provided wastewater treatment by a DEP permitted WWTF from the DOR tax rolls. Unfortunately we did not receive any other information about the possible OSTDS on these parcels. We used this as Charlotte County's portion of the Statewide Inventory.

As stated, many CEHDs reached into their electronic "vaults" and sought to help us identify as many known OSTDS as possible in each of their domains.

Primarily, we were interested in the "tblAddresses" table of the EHDB for linking to the tax roll. We utilized the various address fields and the property identification field (propertyid). Since these are all manually entered fields, they were quite inconsistent in some counties. We reviewed, county-by-county, the information entered in these fields and how they would be utilized to link to the corresponding tax parcel. We quickly determined that there were certainly "highs and lows" to the quality of entered information. We have summarized our methods for each county and our achieved results using those methods in the State of the Data (Appendix).

With respect to the individual county databases, we designed the septic table to allow for a broad range of information given the age and uncertain shape of the individual databases. Therefore, many of the data types for the septic fields are varchar – which allows for a range of values. We have compiled notes regarding each supplied database in the State of the Data (Appendix).

4.2 Data Validation and Quality Control

Department of Revenue – Tax Information

There was no data validation performed with respect to the tax roll information received from the Department of Revenue (DOR). The Department has developed a data delivery format and data definition that all counties are required to conform to before publishing for distribution on their website. We have utilized the DOR information for approximately 5 years and have found that beyond the formatting of the tax identification numbers, the information is very reliable.

Information regarding the reformatting of the tax identification numbers to build successful links to EHDB and CHD records can be found in the State of the Data portion of the report. We've summarized by county what routines were performed to complete the process.

The quality control we performed on the DOR data dealt with the linking of the GIS and "flat file" tax roll information. Each county submits a flat file tax roll in a predefined, comma delimited, text file format. We imported each of these tables into SQL Server using a batch import and manually linked each county using the tax identification number in the tax roll and the same in the parcel shapefile (which is loaded individually into SQL Server through ArcSDE). We performed queries to identify records not joined or where data was null. Through manual inspection and a very good familiarity with individual counties, we identified areas where data was not joined and took additional steps to link. In some cases, we went directly to the individual property appraisers to get complete and correct information.

It is our professional opinion that the combined parcel and tax roll information is a reliable source for statewide analysis of ownership and parcel information. We have utilized this methodology for several years for other clients with similar success.

County Health Department Databases

We had a two step process of data validation for CHD Legacy Information: table design and staging. First, due to the nature of the information we were gathering from CHD's our goal was to capture as much information as possible per requirements in for the Statewide Inventory project. We allowed for many of the fields to be text to capture what was submitted absent formatting or completeness. Since we were interacting with data upwards of 30 years old, we entered what was submitted.

Second, we utilized Microsoft Access as a staging ground for review of submitted information. Of the counties that submitted information, the vast majority provided Microsoft Excel spreadsheets or DBASE (dbf) files. Our staff would import those files into Access, review the data entered (as there was no conforming field names or similar structure in almost all cases), and then append to the septic table based upon review. In the State of the Data portion of our report, we identify what was provided by the CHD's and our successes. There by no means was complete information in any case. We captured everything possible that would lead us to believe a parcel was serviced by a legacy system.

The quality control we performed involved cursory review of the information submitted in the staging portion of the process. Since many counties submitted incomplete, partial or unusable information, our review in many cases was limited to identification of common fields for linking. We reviewed the site addresses, parcel identification numbers and other common fields to determine conformance to our database design. Our staff often calculated fields from a combination of fields to develop usable addresses or tax identification numbers.

Our assessment of the information submitted by county is provided in the State of the Data portion of our report. It is our opinion that the CHD information in vastly incomplete. However, we do find that those that successfully link to the parcels, provide a clear indication of the existence of an OSTDS. However, we would not rely on the legacy data to provide accurate measures of capacity or other indicators of usage and discharge.

Environmental Health Database

We performed no validation or quality control measures on the Environmental Health Database provided by DOH staff. All indications from staff identified the EHDB as the "gold standard" of OSTDS permits. We did however modify the tblAddresses table to include a physical address field to perform links. A series of queries were written to iteratively update the physical address field from the following: Street Number, Street Name, Suffix, Pre Direction and Post Direction.

Statements regarding the success rate for identifying links between the EHDB and the parcels table are included in the State of the Data portion of our report. Our quality control for preparing the links involved a very manual process of review – both addresses and tax identification numbers. All of which are summarized in our report.

Other Datasets – Serviced Parcels & DEP Permitted Facilities

The tables designed to store the DEP Permitted Facilities and contacts information were done so as to capture all of the information that was provided via the DEP website. Therefore, the validation occurs at the table design phase. Since we knew what all the data looked like and was comprised of, we designed the table around it and captured all of the necessary information without loss. There are no measures of accuracy. The information provided by DEP is captured and presented in two relational tables. The only way to determine what DEP provide is accurate is to pull the permit applications and verify that they were entered properly. This was not part of the scope.

The serviced parcels table was designed in order to capture the information requested of the DEP permitted facilities. Validation occurred during the staging phase. We utilized Microsoft Access and ArcGIS to review information submitted by the respondents. Our staff used database queries and geoprocessing to successfully link records. These linked records were appended to the database and the parcels were updated to specify the facility they were serviced by. Our assessment is that this is a highly reliable method for identifying serviced parcels. The Contacts table identifies information received and what problems, if any, were encountered.

4.3 General Procedure for Inventory

The methods for compiling the information are as varied as the number of respondents. We will generalize how sewer and septic parcels were identified as well as pitfalls and recommendations.

Wastewater Treatment Facility Responses

Verbal Responses - Phone Calls
Many of the respondents were "single parcel" facilities - a WWTF servicing one tax parcel (Recreational Vehicle Park, Condominium or School). Typically, these individuals provided a site address, tax identification number or general location. We

utilized the provided information accompanied with Property Appraiser websites, Department of State (DOS) Sunbiz website (corporate filings) and the Statewide GIS compiled from the DOR data to identify the property. We manually entered the property into the database and inventoried receipt from the respondent. Although it is a very manual process, it was necessary to compile for as complete an inventory as possible.

Serviced Customers List

Larger facilities provided their customer lists in various formats. We received responses that included a couple hundred pages of hard-copy print outs, Microsoft Excel spreadsheets, Adobe Acrobat PDF and text files. The facilities typically provided site addresses only as they do not track tax identification numbers for their customers. Those facilities that did provide tax identification numbers were usually County Public Works or Sewer Departments. Using Microsoft Access as a staging database, we imported the provided files and performed various queries to link the records to corresponding parcels.

Serviced Parcels GIS

There were a few facilities, which provided GIS information to fulfill our request. The two primary submittals were the actual parcels serviced or service boundaries. From the information provided, we performed an intersection with our statewide parcel framework to extract out corresponding records in our database. This provided the most reliable and easiest method for compiling serviced parcels.

Other Methods

We received a number of submittals, which did not conform to the methods listed. These included latitude and longitude coordinates of Department of Transportation Interstate Highway Rest Stops (not typically included in parcel mapping since they are rights of way), AutoCAD drawings of entire infrastructure (water and sewer lines, laterals, lift stations, etc.) and hand drawn maps. Our staff included these submittals and extracted serviced parcels through various methods.

Direct Assignment of Serviced Parcels

Lastly, we reviewed permitted facilities by size and name to determine where we could assign parcels as being served by a facility. These properties were typically small capacity, single owner parcels where the owner name matched the facility. We reviewed aerial photography, general internet searches and DOS Sunbiz to identify these properties. Examples of these properties include recreational vehicle parks, campgrounds, hotels, restaurants and schools.

Table 4.1 provides a description of the types of responses and the number of parcels they represent, from which we received information. The permitted capacity in million gallons per day (MGD) of effluent treatment was uses as a metric for assessing the proportion of the total number of sewered parcels in Florida.

Table 4-1: Types of Responses an Inventory States of FDEP Permitted WWTFs

Contact Status	Total Number WWTF	Total Capacity (MGD)
Completed	760	1,487.30
Assigned	4	1.65
Partial submittals	7	119.60
Does not serve parcels	3	80.95
Awaiting information	45	72.72
Inventoried only	76	156.86
Issue with submittal	16	4.71
Unmapped	7	0.67
Negative response	19	0.52
Total	937	1,924.99

- Completed are facilities where serviced parcels have been inventoried.
- Assigned parcels are those that we identified as being serviced by a facility.
- Partial submittals are facilities that are known to serve both individual customers and other facilities and for which we only have received partial customer lists. Some of the largest municipal and regional WWTF are included here. We have successfully contacted some of their wholesale customers.
- Does not serve parcels includes facilities that receive effluent from other facilities.
- Awaiting information are those contacts that have called or emailed our staff to state they would supply information but the information has not been received.
- Inventoried only are facilities for which we have received information but not have not yet inventoried it. These have been received recently or may be submittals that are abnormal.
- Issue with submittal includes facilities that have provided files in an unknown format.
- Unmapped include those facilities which lie within unmapped portions of counties.
- Negative response are those facilities which declined to participate usually stating privacy or a simple unwillingness to provide information.

Septic Tank Identification

Perhaps the most challenging aspect of this project is the identification of parcels with septic tanks. The information contained within the EHDB, County Databases and DOR data are all vastly different. We utilized tax parcel identification numbers and addresses to link parcels. When linking two different text fields in databases, they need to be identical to create a join between sources. Therefore, we have to look at each county separately and review both sources for commonality. The process is very time consuming and we will address specific examples here.

Miami-Dade County
After review, it was determined that the EHDB contained tax identification numbers with both dashes and spaces, where as the DOR data contained neither. The DOR and

EHDB tax identification number was updated to normalize the number with dashes at predefined intervals that were consistent to published values on the Property Appraiser website. After completing this, more of the records were successfully joined. A secondary method of linking parcels is to utilize the physical address. The abbreviation for Terrace in the EHDB is "Ter." While the County DOR information uses "Terr." Although it is a minor detail, it prohibited nearly 1,200 records from joining properly.

Sumter County
First, it must be mentioned that in November, the GIS for Sumter County was incomplete as the Property Appraiser was still in the process of mapping. Therefore, we acquired the completed mapping in March to use in the inventory. The new parcel information contained 40,000 additional parcels. The EHDB does not contain an accurate tax identification number. Most of the records have the Section, Township and Range, which is not used by the property appraiser. Therefore, it is useless for the purposes of this project. Also, of the over 7,000 permits in the database, nearly 1,300 of them have an address denoted as "Legacy" and nearly 1,800 do not have house numbers {many of these are PO Boxes). It is not likely that all of the parcels with septic tanks represented in the EHDB will be linked to corresponding tax parcels.

Remaining Counties
A brief narrative for all counties will be provided in the final report. It is important to understand what conflicts occur in each county in order to better understand how to move forward in the future.

4.4 Identifying the Wastewater Treatment Method for Parcels

The quality of the estimation of the total number of OSTDS for this Statewide Inventory is dependent upon:

- How well parcels can be identified as developed.
- How many parcels can be assigned a wastewater treatment using independent information from which a model can be built.
- The degree of statistically identifiable differences between parcels that are sewered versus those using OSTDS to treat wastewater.

Determining Improvement Status of Parcels

The DOR tax roll provides a variety of fields that can be used to determine if a parcel is vacant or developed (improved). Vacant parcels do not need to be assigned a wastewater treatment method. For the purposes of this inventory, if we identified the wastewater treatment of a parcel, whether it was vacant or improved, we retained that information. But only the improved parcels required estimation of the form of wastewater treatment they had.

We were liberal in our definition of improved so that we would not miss a possible location of an OSTDS. An improved parcel was identified as one with:

- Vacant/Improvement DOR Code = Improved
- Number of buildings DOR field > 0
- Year improved was not missing, a value of 1900 or more

Identifying Wastewater Treatment for Parcels

About 96% of the domestic effluent is treated by 17% of the WWTF (367 facilities out of 2157).[17] This means that capturing information from the largest facilities is most important for obtaining a large number of parcels, but the remaining WWTF may represent highly scattered service areas in a "sea" of OSTDS parcels. Both of these classes of WWTF are crucial to a robust estimate of statewide number of OSTDS.

We were extremely successful in obtaining sewered parcel information. In all we obtained parcels from WWTF that represent 82% of the domestic sewage treatment in the State of Florida. In addition we successfully obtained parcel lists from 75% of the largest WWTF in Florida and 45% of the smaller facilities. There are over 2 million mapped sewer parcels in the Statewide Inventory database.

Table 4-2**:** Summary of responses from FDEP permitted WWTF

Total WWTF				
Response	# WWTF	MGD	% # WWTF	%MGD
Data Received	1002	2097	46%	81%
No Response	1155	500		
Total	2157	2598		
Municipalities	# WWTF	MGD	% # WWTF	%MGD
Data Received	1889	1301	88%	50%
No Response	268	1296		
Total	2157	2598		
Permitting Capacity	# Large	% MGD	# Small	%MGD
Million Gallons / Day	≥ 0.5 MGD		< 0.5 MGD	
Data Received	239	82%	763	43%
No Response	128	18%	1027	57%
Total	367	2509	1790	89%

The values in Table 4-2 differ slightly from those in Table 4-1. We often received a single data file that contained information from more than one WWTF. However, for the purposes of recording the receipt of files, each response was attributed to only one WWTF at the time of receipt and processing. Later it became evident that we were receiving data from more than one facility in many cases. Table 4-2 reflects this summation of the data. We received sufficient information to identify 2,056,129 sewered parcels (Table 4-4).

As discussed above, identifying the parcel location that a given OSTDS permit refers to turned out to be the most daunting task. The EHDB has just over 900,000 permits of which 84% are active (Table 4-5). These parcels did not all link to addresses and some

parcels had more than one permit link to them. In the end, there were 564,026 parcels for which there is at least one EHDB permit. This is 63% of the total EHDB permits.

In addition, from local CEHD databases that preceded the EHDB, we were able to identify 85,731 more parcels with permit evidence of an OSTDS. Unfortunately we were unable to obtain the large OSTDS permit databases for Columbia and Sarasota counties. According to the Columbia County EHD, their database has records back to 1973 and it is under active use. We were unable to obtained access to the database due to proprietary software access issues. We have not been able to assess how well the addresses of this database would link to the DOR GIS information.

We have identified a total of 649,757 parcels known to have OSTDS (Table 4-5). These are the permits that were successfully linked to parcel locations. Many more permits exist but could not be linked to parcel locations because of insufficient addressing information.

In both cases of sewer or OSTDS parcel identification; some of these parcels are designated as vacant by our criteria of improved. There could be many reasons for this from simple inconsistent information in the DOR tax roll record for a given parcel, parcels on which a home burned down, was moved (mobile homes), etc. There were 114,985 vacant parcels with independently identified wastewater treatment methods. When needed, we distinguish between known sewered and OSTDS parcels that are improved versus our entire count of all parcels with a designated wastewater treatment.

Estimation of Wastewater Treatment for Parcels

Building a logistic regression model to estimate the probability for OSTDS

There is a great deal of diversity in growth patterns and growth management regulation and implementation among Florida counties. There are also a wide range of the number, distribution and treatment capacities of WWTF among counties. In addition, not all of the WWTF provided data for this analysis. We did have over 2.6 million parcels with known wastewater treatment to use as the basis for modeling the characteristics of sewer vs. OSTDS parcels, but the number of parcels with known wastewater treatment also varied among the counties. In order to estimate the probability of OSTDS for parcels with unknown wastewater treatment, two forms of analyses were considered, an explicitly spatial analysis, kriging and logistic regression.

Spatial analyses are appropriate to use when there is evidence of strong spatial correlations in the data. For instance, wastewater treatment is highly spatially correlated when the wastewater treatment of a parcel is more correlated with the wastewater treatment of parcels geographically near by than it is with parcels that are located further away and if other characteristics of the parcel that are not geographically related, were not important factors in determining the wastewater treatment.

Kriging, is a form of spatial analysis. It is an interpolation method that uses the strength of spatial correlations to estimate a value for a point based on the value of nearby points. The reliability of kriging models can be assessed with measures of variance and standard errors.

Logistic regression is a form of regression that assumes that independent factors are important determinants in the characteristic of a point and that spatial correlation among points is minimal. For instance landuse, acreage, year of development, tax authority, etc. may be more important in determining the wastewater treatment of a parcel than whether the parcels near by have OSDTS or sewer. Continuous and categorical variables, such as acreage and tax authority, respectively, can be used in a logistic regression. In addition, if spatial correlation exists, but not for all important factors, the spatially correlated factors can be used in logistic regression within certain limits (e.g. neighborhood characteristics). Care must be taken however, as the results from a logistic regression that is predominantly based on very highly spatially correlated values can lead to erroneous interpretation.

Wastewater treatment forms could be spatially correlated because sewer is often provided within municipal boundaries, rural areas are often exclusively on OSTDS. However, there are a number of other factors than geographical location that affect whether a parcel has sewer service or OSTDS. First, many FDEP WWTF provide sewer to scattered developments or to subdivisions that may be contiguous but in a region where there are also a substantial number of OSTDS. This can include municipalities in which older residences are still using OSTDS though newer residences on the same street are using the available sewer lines, as well are very large authorities for which service provision has not expanded in an orderly fashion. Second, there are a number of counties with many, even over 100, small WWTF that serve a few or single parcels, such as a mobile home park or a condominium where surrounding parcels are using OSTDS with substantially lower development intensity and different land uses. This means that there are many characteristics that are also important in determining the wastewater treatment which are not strongly spatially correlated, such as land use, density, acreage, year developed (built), tax authority, etc. Third, some of the important characteristics are categorical in nature and cannot be ordered. An example is the tax authority, which is a coded value indicating a legislatively determined tax standard that may reflect services provided, not a contiguous geographical area. The tax authorities in a county cannot be arranged in an order, they are simply a named location or a coded number. Fourth, a number of WWTF did not provide any information and in many instances, the collected data was very spotty. This results in a few parcels of known wastewater treatment determining the condition of many thousands of others in their vicinity.

In order to directly assess the importance of spatial correlation, the degree of spatial correlation was explored for a few counties using a nearest neighbor analysis. This analysis estimates the value on a parcel based on the values of only a small defined set of nearest neighbors instead of using the spatial correlations of all parcels as kriging does. We used a "neighborhood" of five parcels. A number of characteristics that could be important to the form of wastewater treatment were computed for the five nearest neighboring parcels of each parcel with known wastewater treatment. These included parcel acreage, landuse, tax authority and wastewater treatment, if known. The degree of similarity between the neighbors and the target parcel was compared using regressions analyses. There was relatively little spatial correlation among neighbors that could not also be described by the logistic regression. In addition, the logistic

regression can be very rapidly calculated and the measures of model reliability more easily explained to others.

Using a spatial analysis, as this point in the inventory project, did not provide substantially more accurate prediction nor clarity in interpretation. Therefore, the logistic regression was chosen for this analysis.

The logistic model produces a probability of a parcel having an OSTDS, ranging from 0 (no OSTDS) to 1 (OSTDS present). The closer that probability is to 1, the more likely the parcel has an OSTDS and the more similar it is to parcels that do have OSTDSs. The probability is a continuous value but it can be used to classify the parcel's wastewater treatment method. If the probability was ≥ 0.5, then the parcel was classified as having an OSTDS. For any value less than this, the parcel was classified as being sewered. The classification criteria can be varied to suit the conditions of the model and to provide a measure of reliability of the modeling outcomes.

The following steps were taken to build the logistic models:

1. Develop a set of variables describing parcel characteristics that would likely affect the wastewater treatment method present, such as the size of the parcel, its location in a city or unincorporated portion of a county.

2. Use these characteristics to fit parameters of a logistic regression to parcels for which the wastewater method has been determined independently of the modeling process.

3. Accept as useful a model that:
    - has as few interpretable descriptors as possible,
    - fulfills a recognized statistical significance criteria,
    - has a high value of correct classifications of parcels with known wastewater treatment methods, and
    - has a low value of OSTDS parcels incorrectly classified as sewered.

4. Apply the model to parcels with unknown wastewater treatment methods and assign a wastewater method to each using a low, median and high probability.

5. Compare the total number of estimated and known OSTDS parcels with other estimations such as the DOH annual cumulative estimate, estimates provided by the County Environmental Health Directors in the survey (part of this study) and a simple computation of the number of developed parcels – the number of parcels known to use sewer service for wastewater treatment.

Step 1:

Three types of characteristics were designated for each parcel,

- characteristics of the parcel itself,
- characteristics of its' nearest neighbors,
- parcels that belong to the same categories.

A characteristic of the parcel itself includes information available from the DOR tax rolls. The variables used were:

- parcel size (acres),
- number of buildings,
- size of buildings (total square feet) and
- year the structure was built.

The second set of variables was computed by identifying the five nearest neighboring parcels (using coordinates of the parcel centroids) and then computing their characteristics. The assumption these variables is that parcels located near each other will have similar wastewater treatment methods. We computed

- the percent of neighbors with identified OSTDS,
- percent of neighbors that were developed,
- the sum of the distance for all neighbors,
- the number of neighbors with the same taxing authority, land use and wastewater treatment method as the target parcel.

The third set of variables, also taken from the DOR tax rolls, describes political characteristics of parcels. We also divided parcels into size classes, using very fine categories for parcels under 1 acre and grosser categories up to greater than 5 acres. For these we computed the proportion of parcels with known OSTDS for each level of these categories. The categories used were

- tax authority,
- land use,
- neighborhood codes, and
- acreage size classes.

Step 2:

Logistic regression models were run using these variables only for parcels with wastewater treatment methods that had been determined independently, e.g. by FDEP WWTF permittees or county OSTDS databases.

The models were simplified by excluding variables that offered no additional statistical significance (measured by individual parameter Z scores and the change in the AIC criterion).

Models were also assessed as to how well they classified the wastewater treatment method on the parcel. Two measures of successful classification were 1) a high percentage of correct classifications, including both sewer and OSTDS, and 2) a low

percentage of known OSTDS misclassified as being served by sewer. An example is provided below.

As an example, for Baker County, a model was used that incorporated the following descriptors: percentage of septic tanks in taxing authorities, percentage of septic tanks in land use classes, percentage of septic tanks in acreage size classes and the year the structure on the parcel was built. A total of 2,844 parcels with known wastewater treatment methods and values for all the descriptor variables were used to compute model parameters. These parameters were then used to compute the probability of an OSTDS for each parcel with the following results.

Table 4-3**:** An example of assessing the quality of prediction of a given model for the data used to compute the parameters of the model.

	Known		
Predicted	Sewer	OSTDS	Margin Total
Sewer	1498	8	1506
OSTDS	5	1333	1338
Margin Total	1503	1341	2844

Percent correctly classified = (1498 + 1333) / 2844 = 99.5%
Percent OSTDS incorrectly classified = 8 / 1341 = 0.6%

Step 3:

The model exhibiting the best balance of the fewest significant variables, the lowest Akaike Information Criteria (AIC) and the best percentage of correct classifications and the lowest error rate of classifying OSTDS, was selected to estimate the parcels for which the wastewater method had not be determined independently.

Software was written using the open source R statistical programming platform. All code is available upon request. The detailed results of each model for each county are provided in the appendix. They are summarized in Table 4-7.

Step 4:

The selected model was used to compute the probability of an OSTDS for each parcel. The designation of a wastewater treatment method was both the classification by the probability and an assignment of an attributed used to make maps.

1. Undeveloped parcels = 0, no OSTDS
2. Developed parcels known to have sewer service = 0, “sewer”
3. Developed parcels know to have OSTDS = 1, “septic”
4. Developed parcels with probability < 0.5, = 0, “estimated sewer”
5. Developed parcels with probability ≥ 0.5 = 1, “estimated septic”

6. Developed parcels for which a probability could not be computed, probability = NULL, "not estimated".

The probability itself is the measure of reliability of the assignment of any given parcel to OSTDS or sewer. High values, near 1, mean that assigning the parcel to an OSTDS form of wastewater treatment is highly likely to be accurate. Parcels with low values, near 0, are assigned to the sewer category because there is a low probability that it has an OSTDS but since it is improved, the only alternative wastewater treatment is sewer.

We devised an overall measure of reliability for estimation for each county by changing the threshold of OSTDS vs. sewer designation. If the threshold is increased above the probability of 0.5 then it is less likely that a parcel will have an OSTDS and the total number of estimated OSTDS will be lower. If the threshold is decreased to less than 0.5, then it is more likely that a parcel will be designated as OSTDS and the number of estimated OSTDS parcels will increase. We used the higher probability threshold of 0.75 for a more conservative estimate of the number of OSTDS and the lower probability threshold of 0.25 for a more liberal estimate of the number of OSTDS in a county.

Step 5:

We compared the estimate of the total number of OSTDS from our models, including the range of estimates provide by a sliding probability threshold, to other available estimates.

The DOH annually reports the total number of OSTDS permits and has maintained a table of this data for decades. The cumulative number of OSTDS reflects a base value estimated from the 1970 Census and the total number of new construction permits issued each year. Abandonments are not subtracted from the permit counts as it is not always true that abandonment means no further use of OSTDS on the site. However, abandonment permits are not usually compared to other permits for a given OSTDS so it would be difficult to know from "where" to subtract them.

Most of the CEHDs provided estimates in response to a question in the survey they did for the Statewide Inventory. These estimates have a wide variety of histories. Some represent at least a year of work identifying parcels and inputting paper records. Others were done explicitly for this project's questionnaire and therefore, are a synopsis of the number of electronically stored permits. Still others were, freely admitted, educated guesses, based on in-house discussions and years of experience working in the county.

The third estimate provided is simply the subtraction of the number of known sewered parcels, as identified in this Inventory, from the total number of developed parcels in a given county. When all or nearly all of the WWTF have provided reliable data, this can offer a very sound initial estimate. Charlotte County has used this approach and is embarking on a 5-year plan to locate the OSTDS on all developed parcels that are not sewered according to the Charlotte County WWTF.

A summary table of improved parcels, known and estimated OSTDS and sewered parcels are provided in Table 4-6.

4.5 The Total Number of OSTDS in Florida

There are 6,608,050 improved parcels in Florida. This study produced an estimate of 3,446,132 improved parcels with OSTDS and 3,129,708 improved parcels provided wastewater treatment by FDEP WWTFs. Using these estimates, 52% of all improved parcels in Florida use an OSTDS for wastewater treatment (Table 4-7).

In addition there are 50,850 undeveloped parcels that are indicated by independent means to have an OSTDS and 64,135 vacant sewered parcels. This brings the final total OSTDS to 3,496,120. There were 32,210 parcels for which there was insufficient information to estimate wastewater treatment using the modeling technique described herein.

A range of the number of OSTDS was calculated for each county using a different threshold probability to classify parcel as having an OSTDS (Table 4-8). These values were calculated including the vacant parcels with independent designation of OSTDS. The values reported in the previous paragraph, were calculated using a probability of 0.5 as the threshold. Using 0.25, allowing more parcels to be designated as OSTDS, raises the estimate for OSTDS to 3,652,276. Using 0.75, allowing fewer parcels to be designated as OSTDS, lowers the estimate to 3,317,152. Even though the reliability of the county level estimate varies a lot (discussed below), at the statewide level, the range is only 9.6% of the total number of OSTDS for the entire state.

Model Results: County Maps of Sewer and OSTDS parcels

Two maps are provided for each county. The first shows all improved parcels and those that have been identified through independent means as sewered (FDEP WWTF information) and containing an OSTDS (EHDB and other databases when applicable). Known sewered parcels are in bright red. Known OSTDS are in bright blue. These include some parcels that are undeveloped, but we show all the information we gleaned from the data collection portion of this project. The yellow parcels are improved but for no information on wastewater treatment was found. Vacant parcels are not shown.

The second map shows again, all of the known sewered and OSTDS parcels. These known parcels were used to develop models to predict where sewer and OSTDS would be for parcels without designated wastewater treatment. The estimation of the type of wastewater treatment for the remaining improved parcels is shown as light blue for estimated sewer parcels and pink for estimated OSTDS parcels. Parcels for which there was insufficient information to apply the current models are retained in yellow – improved but not yet estimated. The lack of information is most often due to missing or inconsistent field values in the DOR tax roll database.

The visualization of the results of the data collection and modeling make it immediately obvious how easily this information can be layered on any other geographic form of information, such as spring sheds, zones of potential storm surge, and comprehensive plan land use maps. The differentiation between known and estimated allows evaluation of the reliability of any count of OSTDS in a given area. The FDEP WWTF service areas are also apparent.

In addition, the identification of known and estimated parcels, along with the database and associated information will immediately provide the CEHDs with a capacity to prioritize any local need for better permitting or management information.

Model Results: Data Quality of County Estimates

The quality and quantity of sewer and OSTDS parcel information is the most critical to creating a robust model which can be used with confidence to estimate the number and location of all OSTDS in each county. If very little information is collected, there is no mathematics that will provide a robust model. The collection of FDEP WWTF parcel data was inconsistent among the counties. We did not have any authority to require either response to our request, a timely response or one that provided useful data. In addition, the large number of permits in the EHDB, resulted in a large variation in the successful linkage of permits to parcel addresses. The best solution to low levels of response is to target data collection and spend time developing sufficient personal contacts and assistance to the remaining large municipal and private WWTF so as to obtain information from them.

In addition, when either sewer or OSTDS parcel identification rates far exceeds the other, this will bias models resulting in the too frequent assignment of the most common wastewater method to estimated parcels. This problem can be addressed with more refined models using a Bayesian form of analysis that provides a methodology to weight the final probabilities based on an expectation that either sewer or OSTDS is a very dominant form of wastewater treatment in the county.

In the end, despite some low levels of response, we did obtain sufficient information to designate over 2.6 million parcels with known wastewater treatment method.

Model Results Reliability: Types of Counties

The counties have very different histories of growth and infrastructure development. This is evident in the number of parcels, their size distributions, the proportion that are improved, the number of WWTF and the size of the areas to which they provide service. The size, distribution and number (abundance) of WWTF will define the degree to which sewer and OSTDS is clustered, clearly separated or interspersed. Counties with similar numbers of large (>= 0.5 MGD permitted capacity) and small (<0.5 MGD permitted capacity) will share, for the most part, scales of dispersion and clustering.

We created six different groups of counties, reflecting the differences described above. The designations are not exact. These six groups represent general features of counties that dictate, to an extent, the type of variables that will be important in estimating the number of OSTDS parcels that are not identified. The current Statewide Inventory modeling method was to use a standard model form on all counties. Though different variables were selected for each county, the net result is the understanding that the types and numbers of WWTF largely dictate the type of decision tree and modeling that should be used to enhance the estimation of OSTDS in a county. As the quality of estimate can be improved for each county, so will the statewide estimate become more reliable.

The six groups are simply labeled as Group A though F. The characteristics of these groups and the quality of the models that were computed for each county is described in Table 4-8**.**

A. **Counties with very few WWTF and with a low number of parcels: Rural Counties**. OSTDS are most dominant form of wastewater treatment in these counties and that is unlikely to change in the near future. These are counties with 5 or less (some 0) large WWTF and similarly 0 to 10 small ones and with less than 20,000 improved parcels**.** The dominant sewer provider(s) are often municipalities, which provide sewer in a well-defined area and sometimes have tax authority for this area. The provision of sewer within the service area can be very "spotty" with scattered older OSTDS parcels within the boundaries. These counties have few other WWTF and those that exist serve only a single subdivision, school or mobile home park, etc. Manatee falls within the designations of 5 or less WWTF of each size class, but due to its large number of parcels, nearly an order of magnitude more than the other in the group; it was moved to Group B. Examples of Group A include Baker, Dixie, Jackson and Wakulla.

   Many rural counties had extremely few independently identified sewered parcels. This is largely due to a lack of response from small municipalities or their incapacity to provide an electronic form of their sewer customer database, if they have access to it at all. Models are more reliable when there are both a large number of parcels and a nearly equal sample of the sewered and OSTDS parcels in the county. Baker, Bradford and Wakulla have both enough parcels and an near even number of parcels for OSTDS and sewer from which a reliable model can be created. These models are the most reliable in this group.

   Of the 22 counties with 100 or less identified sewer parcels most of them are rural counties in Group A. The estimates for these counties are simply unreliable due to the low number of parcels that could be used for the model. However, rural counties can have much more reliable models with the successful data collection of the few municipal WWTF located in these counties. The other very small WWTF are often recreational vehicle parks, mobile home parks, schools, etc. These can be identified through other means such as using Google-maps, SunBiz and various other forms of determining the ownership of the parcel and its' location. This is a time consuming process but would result in much better

identification of OSTDS for rural counties. Once these localized sewered areas are identified, it can be assumed that the rest of the county's parcels are all OSTDS.

B. **Small to medium sized counties with 5 or less large WWTF and with 10 to 50 small ones. Counties, generally, with small to intermediate improved parcel numbers.** These counties have relative few large WWTF, but quite a large number of small ones. Some of the large WWTF provide service to municipalities and substantial portions of the unincorporated area around their own jurisdictions. Older, "legacy" OSTDS are apt to be scattered within these established sewer areas because sewer lines were built to serve newer subdivisions, leaving older ones on OSTDS. Because of the reach of the WWTFs into the unincorporated areas, sewer service information from the substantial providers is essential for a reliable estimation. The remaining few smaller WWTF can create a sparse patchy distribution of sewer but there are only a few of them. This sort of situation may require separating out the effect of large WWTF by knowing their service areas directly and then modeling the remaining lots, looking for ways to identify the few small WWTF: large and intensely used parcels in a sea of OSTDS parcels.

The collection of sewered parcel information was very successful in Group B which has many reliable models. The range as a percentage of the midpoint, a form of confidence interval, is only 9.6% for the entire state but is exceeded by a number of county models in Group B. This is likely due to the large number of small WWTF which are scattered within areas heavily dominated by OSTDS, yet these parcels appear to share many of the characteristics of the OSTDS. The large difference in the high and low estimates means that a large number of parcels have probabilities around 0.5. This means that parcels with different wastewater treatment methods are not effectively differentiated from each other using the current models. In order to improve these models, it is likely that separately modeling residential parcels from nonresidential parcels will distinguish the many smaller WWTF.

Alachua County has already completed extensive work on identifying sewered parcels and entering all of their paper permits into a database from which they can identify parcel location. For this inventory, we put their files of known sewer and known OSTDS together and joined them with the DOR GIS database. We modeled the approximately 7,000 remaining improved but undesignated parcels. The model incorrectly classified 11.8% of the known OSTDS parcels as sewered. Given the very reliable data that this county provided, this is an indication of how scattered older OSTDS systems are within existing well sewered areas. They are very difficult to identify as the parcels have most of the same characteristics as the surrounding sewered parcels. However, the range of estimates was very narrow, only 1% of the midpoint value. This means that the probabilities that were estimated for most of the undesignated parcels were all very close to 0 for sewered or 1 for OSTDS.

C. **Small to medium sized counties with about 5 to 20 large and 5 to 20 small WWTF. The number of WWTF is, more or less, evenly divided between large and small facilities**. Counties in Group C have many of the same characteristics as Group B, but the much larger number of small WWTFs than in the previous group substantially complicates estimation of OSTDS location outside of the major municipal providers. In addition, we had relatively little success obtaining sewer information even from the few large WWTF in a number of counties. Many of the other very low values of know sewered parcels, as seen in the Rural Counties (Group A) are found here. There are some exceptions, most notably Charlotte County where the CEHD provided us with information sufficient to identify all of the sewered parcels. Still, the model incorrectly classified 15.2% of the known OSTDS parcels. This indicates how interspersed the OSTDS parcels are within the sewered districts. They appear to have buildings, most likely residences, that have the same characteristics as sewered parcels.

D. **Large counties with 5 to 20 large WWTF, often including a few large service providers that serve through out the county and in addition, many smaller WWTF.** These are some of the largest counties with large sewer providers. The sewered parcels are usually more common in the named communities, but these service areas are interspersed with older OSTDS areas. In some counties, the large WWTF may be wholesale treatment facilities. Their retail customers are small to medium sized cities that do not have their own WWTFs. Locating the service areas of these retail customers is essential for a reliable estimate. Examples include Brevard and Palm Beach which both have regionally shared WWTFs.

   Many of the models for counties in Group D were quite reliable. This is most likely due to the very large number of known sewer and OSTDS parcels, even if it is an incomplete accounting. However, bias is predominant in this group. The Bayesian method described above would improve these county estimates substantially.

   An interesting example of the complexity of having some, but not all of the sewer information and a large parcel number to estimate, occurs in Miami-Dade. For this county we were successful in obtaining the sewer records from the county water and sewer district WASD but had relatively few records of OSTDS compared to the total number of parcels in the county (Table 4-8, Group D). The ratio is about 10 to 1. However, we did not obtain a sewer parcel list from the City of Homestead. Homestead has many fewer sewer customers that the WASD, but it nonetheless represents a substantial amount of wastewater treatment capacity. The combination of having many more identified sewer parcels but not having the location of one large facility, led to an underestimation of the total number of OSTDS in Miami-Dade and to locating many of the estimated ones probably within the sewer service area of the City of Homestead (see maps for Miami-Dade in the appendix). This is clearly seen in the high proportion (65.1%) of known OSTDS that were incorrectly classified as sewered parcels by the current model. Obtaining the sewer information from Homestead and more careful modeling of residential parcels will greatly improve the

reliability of the estimation for Miami-Dade.

E. **Many small WWTF and a wide range of large WWTF.** The number of small WWTF in these counties is 100 or more (92 in Volusia). Even though these may each serve a relatively small number of parcels, they collectively can represent quite a number of parcels. They may have distinctive features relative to OSTDS parcels, representing high-density land use that is very localized. However, we received insufficient responses to begin this form of modeling. Some targeted data collection would help remedy this situation. In addition, most of these counties have at least one, or many, very large facilities.

   Obtaining sewer parcel information from all of the largest WWTF is essential in this group. Separately modeling the areas outside these large WWTF service areas and modeling residential and nonresidential land uses separately would greatly improve these estimates

F. **Counties with very few small WWTF (≤5) but quite a few large ones.** These counties are the inverse of all the others. Duval is included in this group and it has a single very large, countywide sewer provider. The water and sewer authority has carried out an independent assessment of the number of OSTDS in Duval but we have not been able, yet, to obtain this information for comparison. Broward and Pinellas estimates would be greatly improved if the low number of known OSTDS could be accounted for with Bayesian modeling.

Comparison with other Estimates

The DOH provides an estimate of the total number of OSTDS based on 1970 census values and the cumulative number of permits since then for each county (Table 4-7). In addition, most of the CEHDs provided estimates. A third estimate is simply the total number of improved parcels minus the known sewer parcels. In theory, if all known sewer parcels were identified, then all remaining improved parcels should have an OSTDS.

The comparison of these three estimates and the Statewide Inventory is based on the total number of improved parcels in the Inventory. So about 50,000 vacant parcels that have been independently identified as having an OSTDS are not included.

The Statewide Inventory estimated that there were 3,446,132 improved parcels with OSTDS. The DOH estimate is 2,661,072. The CEHD is 2,292,775 (10 counties did not provide any estimate). The large difference can be seen in the cumulative effect of much higher estimates in the Statewide Inventory than in the DOH estimate for large counties with many WWTF of which quite a number did not provide information such as Brevard, Lake, Lee, Manatee, Orange, Pasco, Polk, St. Johns, and Volusia. There are a few cases in which the Statewide Inventory provides a substantially lower estimation: Miami-Dade, Duval, Hillsborough, and Sarasota. In another set of circumstances, the Statewide Inventory produces lower estimates than DOH, but these estimates were more similar to those provided by the CEHDs. Such cases include Sarasota, Clay and

Broward. For many of the smaller counties, the DOH and Statewide Inventory estimates are quite similar. Flagler is a large exception and reflects the very limited WWTF information we were able to obtain.

5.0 How to Perform an Inventory of OSTDS

In order to adequately protect the quality of surface and groundwater in Florida, quantifying the contribution of nutrient pollution from the existing onsite wastewater treatment and dispersal systems (OSTDS) is crucial. An inventory cataloging the number and location of OSTDS is essential to this calculation.

The sixty-seven counties of Florida are in sixty-seven different states of knowledge regarding the number and location of OSTDS within the respective jurisdictions. Nineteen counties have electronic databases containing at least twenty years of permit records, and these counties are positioned to provide an accurate accounting of all permitted OSTDS countywide with relative ease. However, the remaining forty-eight counties have less than twenty years of recorded permitting data in an electronic database. In many counties, the new, repair and abandonment permits have not been reconciled nor the accuracy of address recording checked. Furthermore, some electronic databases with valuable information have not been integrated with other databases such as the EHDB or they are, apparently, no longer accessible due to a loss of knowledge as to how to use them.

Counties with incomplete or unreconciled permit information can only estimate the number of OSTDS based on census figures, summations of permit types and counts of paper records. Unfortunately, this type of estimate lacks any measure of reliability or mapping by which existing OSTDS can be located. No county has a count and a map depicting the location of all OSTDS with an explicitly provided level of confidence, although Alachua and Charlotte are close to achieving this.

An inventory cannot attempt to provide complete information on the location and condition of every single OSTDS at all times. Land uses and available infrastructure are constantly changing. A good inventory should consist of a database that includes, at a minimum, information on the location, date and type of permitting for each OSTDS, as well as a procedure for maintaining the reliability of information over time.

Given the wide-ranging state of record-keeping among Florida counties, each might begin the process by establishing what is *not* known about the number and location of OSTDS. Until the uncertainties in an inventory are identified, they are difficult to eliminate. Once a defined list is developed of parcels for which the wastewater treatment type is unknown, uncertainties can be systematically clarified.

The following five-step process can be used to create an OSTDS inventory:

1. Acquire the county Property Appraiser parcel database and digital parcel map as a reference database

2. Reconcile documented electronic sources of information about the wastewater treatment method on each parcel.
    a. Determine which parcels should have wastewater treatment due to their development status.

b. Identify parcels known to have OSTDS permits from the County Environmental Health Department.
c. Identify parcels that are served by a FDEP permitted sewer service system.

3. Evaluate whether information available on paper permits is important to the accuracy of the inventory. If so, begin the process of identifying which records and what information is important. Create an electronic form of this data and reconcile it with the reference database.
4. Periodically produce a count, list, and map of parcels with "unknown" wastewater treatment methods to assess the progress of the inventory.

5. Develop an updating process so that the inventory database does not become obsolete.

5.1 Tasks in Detail

1. **Acquire the county Property Appraiser parcel database and digital parcel map as a reference database.** The PA database contains information on location, land use and development status for each parcel. The Department of Revenue requires a standardized set of information for each parcel, and this database is updated annually through a formal process. Most counties have complete digital parcel maps, or at minimum, maps that include all but the larger rural parcels. Using the PA database, parcels can be identified by unique codes, physical site addresses, taxing jurisdiction and, at a larger scale, township, range and section. The land use and development status information is contained in fields defined by the Department of Revenue and local county uses. This creates a well defined, regulated and updatable reference database, which is stable and consistent on the statewide level.

   - Use the PA database as the reference database for the OSTDS inventory.

   - Obtain documentation from the PA for the coded values used in the database and an assessment of the reliability of county specific information.

   - All subsequent databases and information acquired should be reconciled with location information available from the PA database and the digital parcel map.

2. **Reconcile documented electronic sources of information about the wastewater treatment method on each parcel.**

   A. Determine which parcels should have some form of wastewater treatment. The development status and land use of a given parcel must be determined in order to identify which parcels should have some form of wastewater treatment. It is simpler to determine which parcels do not require wastewater treatment and then deduce that the remaining parcels should have a treatment assigned for the

inventory.

The PA database contains a number of fields that aid in determining the development status and land use of a parcel. Ideally, the values of these fields would be consistent for each parcel, but that is not always the case. Therefore, each parcel must be subjected to a series of criteria in order to establish whether it *should* have a form of wastewater treatment. Two types of parcels do not require some form of wastewater treatment:

- those parcels that are vacant, undeveloped, without improvement
- parcels that are developed but lack facilities that require wastewater treatment (parking lots, agriculture, parks, utility rights of way, waterways)

The second category is more difficult to identify with certainty. In the case of ambiguity, it is best to assume that the parcel requires wastewater treatment. Next, identify vacant parcels and determine if an existing building use requires wastewater treatment:

- Vacant or Improved Code: This field indicates whether a parcel was vacant or improved at the time of the last sale. Development or demolition since that point is not considered in the assignment of this value.
- Land Use Code/Vacant: The field has codes that differentiate among land use categories and, for most PA databases, a code for "vacant" is included. For instance, residential land uses include a code specifically for "vacant residential". There are also codes for vacant commercial and industrial land use categories.
- Evidence of a building: There are several fields that indicate whether a building is present on the parcel. These fields include the number of buildings, total living or usable area, number of residential units, year built, construction class, building tax value, homestead exemptions. These variables should be identified for each parcel, but it is prudent to determine the presence of a building on the parcel by indications from at least two of these fields.
- Land Use Code/Use: Parcels with land uses that may not require wastewater treatment facilities (parking lots, agriculture, parks, utility rights of way, waterways) require close attention in order to achieve a high degree of accuracy.

B. Identify parcels known to have OSTDS permits from the County Environmental Health Department (CEHD). The object of this step is to identify parcels, which have received some form of OSTDS permit at any point in time. The EHDB database is the first source for information that an OSTDS permit was issued for a given parcel. However, many counties have older databases whose contents

were not migrated to the EHDB or were not migrated completely (legacy databases). The contents of these databases should also be utilized. At a minimum, the type of permit (construction, modification, abandonment, etc.) and date of permit should be recorded. Parcel identification requires reconciling information about parcel location (physical address on permit), parcel ID from the property appraiser at the time of the permit, or latitude and longitude for use with electronic parcel maps. Also, the order of permits must be established for parcels with multiple permits. Abandonment permits are especially important in order to distinguish between parcels on which an OSTDS was replaced or abandoned so that a sewer connection could be made.

- Reconcile records in the EHDB database of OSTDS permits with the PA parcel database.
- Reconcile records in any legacy database of OSTDS permits with PA parcel location information.
- Establish the order of permits for parcels with multiple permits.

C. Identify parcels that are provided with FDEP permitted sewer service.

The Florida Department of Environmental Protection (FDEP) maintains a permittee contact database for all domestic WWTF. However, FDEP does not maintain information on the actual parcels served by these permittees. Each permittee must be contacted in order to identify parcels that are provided with FDEP permitted sewer service. There are over 2,000 such permits throughout Florida, ranging in size from those capable of treating effluent from many jurisdictions to ones that serve only a few homes. Ownership of these facilities may be public (federal, state, county, municipality), designated authorities or private providers.

The permittee contact list may be out of date as permits are only renewed every five years and changes in contact information are often slow to be reported. However, some FDEP regions maintain lists that are annually updated in order to handle disasters, such as hurricane evacuations.

Often the most accessible form of information is the customer-billing list. However, it is important to make sure that the site of service address is provided, not the mailing address for the bill. Many utilities provide both water and sewage treatment service. Make sure that these can be distinguished somehow.

Service area maps are not necessarily equivalent to the actual location of parcels that are using the FDEP permitted sewer services of the WWTF. It is important to distinguish not only between provision of water and of sewer service, but to identify parcels within a service area or within the service length of a sewer main, yet not connected to the sewer line.

Some of the largest WWTF provide treatment for “feeder” locations and therefore

will not be the billing agent for all sources of the effluent they treat. The feeder locations are often jurisdictions that operate sewage collection system that discharge to the large treatment facility. The WWTF should have contact and other information on the feeder locations they serve.

Contacting all of the municipalities within a county can be helpful in identifying feeder locations and those who receive FDEP permitted sewer service from another authority. The municipality may better know the extent of such a service area than the treatment provider. Communication with the municipal departments that provide building permits may offer accurate information on parcels that are connected to sewer lines after abandonment.

FDEP sewer service permittees range widely in the ability to identify the locations from which they collect effluent and to communicate this information to the County Health Department. Therefore, it is important to tailor the request for information to the capacity of the permittee to respond in order to successfully obtain information. Though a number of difficulties can arise with obtaining accurate, up-to-date information about FDEP permitted sewer service, it is an essential part of an OSTDS inventory to determine which parcels have no need for OSTDS.

- Attain list of FDEP WWTF permits : http://www.dep.state.fl.us/water/wastewater/facinfo.htm

- Contact regional FDEP office to ascertain if there is a more up-to-date list of contacts.

- Contact each permittee and request information on the parcels from which effluent is collected and treated in their WWTF.

    1. While viewing a GIS parcel map that is connected to the PA database, allow small facilities to simply identify parcels over the phone.

    2. Request a list of customer billing addresses or parcel IDs for each WWTF. Only locational information is needed therefore privacy issues should be minimal.

    3. Request from the WWTF a GIS file depicting FDEP permitted sewer system lines, including laterals that indicate individual parcel connections.

    4. Request a list of "feeder" locations from the large WWTF and up-to-date contact information for each; contact them and request addresses.

    5. Make sure that the information received is in an accessible electronic format scaled to the capacities of the Environmental Health Department. Do not accept scanned lists unless the CEHD has capacity for data entry.

6. Where possible, obtain a map of the service area. Even a hard copy map can be useful, though it is not sufficient for the inventory.

7. Contact each municipality to determine if they provide their own FDEP permitted sewer services, bill customers themselves, send their wastewater to a larger WWTF, and have maps which indicate the extent of the FDEP permitted sewer service provision.

STOP AND EVALUATE

The bulk of the work for creating an inventory of OSTDS is accomplished by completing Tasks 1 and 2. However, these tasks contain numerous moving targets. Parcels are subdivided, OSTDS permits are issued and FDEP permitted sewer services are expanded during the process of data collection for the inventory.

Build a draft parcel database and develop a color coded map to allow easy assessment of the parcels with an identified wastewater treatment type, if any. Determine at this point whether more effort should be put into accessing OSTDS legacy databases, improving methods to reconcile abandonment permits or identifying parcels with FDEP permitted sewer service.

3. **Evaluate whether information only available on paper permits is important to the accuracy of the inventory.** Entering information from paper permits can be costly and time consuming but may be essential, not only for the inventory, but also because providing copies of permits to the public is a service that consumes staff time. It may be worthwhile to scan all permits and to extract sufficient information to identify parcels with OSTDS and data on each OSTDS for future permitting needs. This process can be ongoing with priority given to the most recent permits so that the inventory and the county EHDB database can become more accurate and useful right away. Clearly, acquiring funds to process paper records will be required. The inventory can proceed without all paper records in electronic format. However, the priority to identify the parcels for which wastewater treatment type remains unclear should be tempered with a consideration of the volume of recent paper records not yet recorded in an electronic form.

4. **Produce a count, list and map of parcels with "unknown" wastewater treatment methods periodically to assess progress of the inventory.**

5. **Develop an updating process so that the inventory database does not become obsolete.** There are many issues to consider in this process:

   - Continue to use the PA database as the reference database and plan to update the OSTDS inventory at least once a year when new tax rolls are published.

   - Establish contact with FDEP WWTF permittees to encourage them to annually provide reliable information on the parcels for which they provide sewer service.

- Establish a system of reconciling all abandonment permits with parcels that have an existing OSTDS permit.

- Establish a method to identify the wastewater treatment type specifically on the "unknown" parcels.

5.2 Use of the Existing Statewide Inventory

The Statewide Inventory is being created by following steps 1 and 2 of the five-step process as outlined above. Therefore, the Statewide Inventory is intended to become a complete inventory of all parcels and provides a documented source for the assignment of wastewater treatment method for each parcel. The sources used to create the Statewide Inventory will be made available to each county including the FDEP WWTF permittees who provided information, permit databases that were successfully integrated and addresses that could not be matched to the GIS maps.

The number of parcels that a) are developed, b) have a known OSTDS present, and c) are known to receive FDEP permitted sewer service will be provided to each county. Parcels for which either OSTDS or sewer service was estimated will be tabulated for each county. In addition, a probability of the presence of OSTDS, based on the parcel's characteristics and geographical context, will be calculated for developed properties with no direct evidence of any wastewater treatment type. This table and the accompanying database will allow the CEHD to assess precisely which parcels require clarification, to prioritize where to begin improving the Statewide Inventory and what actions should be taken to do so.

The Statewide Inventory will bring all counties to a defined point of knowledge about the number and location of OSTDS in their county and the sources of supporting information. The level of knowledge will differ, but the uncertainties in all inventories will have been identified in an identical manner. Identification will be simplified, and each county can proceed with the elimination of uncertainties in their portion of the Statewide Inventory. The resources each county will require will also become apparent. Many counties will be able to determine the wastewater treatment type for most unknown parcels by contacting a WWTF that failed to provide information or by checking through specific years of paper permits through referencing the build out date of houses on those parcels. For others, data entry for large numbers of paper permits will be necessary to account for OSTDS permitting.

With the Statewide Inventory in hand, county CEHDs will be able to immediately and systematically begin to clarify the parcels with unknown wastewater treatment. Furthermore, they will know when they have completed the task as the problem will be well defined - a list of parcels. They can maintain this inventory by annually updating through Property Appraiser tax rolls, the county's permitting data, and good communication with WWTF. The counties will be ready to establish OSTDS management systems in Florida which should reduce the environmental impact from existing systems and help to improve coastal, surface and groundwater.

6.0 Best Management Practices and Recommendations

There are a number of practices that facilitate the process of creating and maintaining an OSTDS inventory. First, reliable information is essential for the inventory to be useful to the CEHD and other agencies. One of the best ways to create a reliable inventory is to have an established set of standardized processes for creation and maintenance. It is important to ensure that public and private participants in the inventory development and maintenance understand their stake in the integrity of the inventory and thus implement the standardized processes. It is also important to be aware of OSTDS efforts both within Florida and nationally so as to learn from and communicate to others creating inventories.

Below are eight recommendations, which have been developed from this project's survey results and research findings for OSTDS inventory management, best practices, and problem resolution as identified from within Florida and nationally. Specifically, our recommendations address known problems that arise in creating and maintaining an OSTDS inventory. We suggest that instituting certain changes in regulations and communication might resolve a number of potential problems.

The recommendations are divided into four categories: Creation of an Inventory, Policies for Improving and Maintaining an Inventory, Establishment of OSTDS Management System as it relates to this Statewide Inventory and finally, Recommendations for Updating and Maintaining the Inventory Database. This last sections is a more technical description of database management.

6.1 Creation of an Inventory

1. **The methods used to create and maintain an inventory are the same regardless of the goals for the inventory.**

   In most cases in Florida and throughout the U.S., the initial impetus for investigating the number and location of OSTDS is to assess the human health and environmental impacts on coastal areas, surface water, groundwater and other environmentally sensitive resources. But it is also the foundation for a number of other important functions. An actively maintained and easily accessible inventory of OSTDS is essential for:

   - Improving the permitting of OSTDS
   - Determining the contribution of OSTDS to environmental impacts
   - Establishing maintenance and operating permits for OSTDS

- Locating utility service areas where FDEP permitted sewer service is provided

- Planning for land uses and infrastructure provision

The process of creating and maintaining an inventory is the same regardless of which of these recognized needs is paramount.

2. **An inventory of OSTDS includes a list of parcels, their location and the type of wastewater treatment in use. It is not a list of OSTDS permits. The critical feature of any OSTDS inventory is to align with Property Appraiser parcel ID and to link the permits to the parcels.**

   An inventory should include a designated form of wastewater treatment, including "no treatment necessary" such as for vacant, undeveloped parcels. It is **as important** to establish if a parcel has an OSTDS as it is to be sure that it does not. It is important to track all parcels as vacant parcels may begin using OSTDS or sewer and OSTDS parcels may become sewered. Each OSTDS requires a permit, and an OSTDS is located on a parcel. It is simpler to track the number and location of OSTDS and to update this information if the record is associated with the parcel as a unit of measurement, in addition to its association with a permit. Many other databases relevant to development are also based on parcels - the Property Appraiser's tax roll, provision of sewer service, building permits and development review. Also, environmental measurements are geographically based and can be easily displayed with parcel maps of OSTDS. Creating and maintaining the quality of an OSTDS inventory should coordinate with these other sources of parcel information. Again, if the fundamental unit of the inventory database is a parcel, this task is relatively simple to accomplish because the Property Appraiser must produce an annual tax roll that accounts for all changes in parcel information. Updating the inventory with the parcel list allows the CEHD to be assured that the appropriate wastewater treatment is being permitted.

   The inventory database should interact with the permit database. The permits should contain parcel IDs as provided in the DOR tax roll and addresses sufficient to link to the DOR GIS parcel maps. The inventory database can be linked to the permit database to provide information on the number and types of permits for a given parcel. This allows a count of the actual total number of OSTDS, not only the total number of parcels with OSTDS.

   Parcels without OSTDS should remain in the inventory (for the reasons given above) but need contain only information as to their source of wastewater treatment such as a DEP WWTF identification number. The FDEP maintains a list of their WWTF permits and contact information[18]. If the permit database is well maintained, the inventory database is also easily maintained.

   This recommendation does not ignore the fact that latitude and longitudinal coordinates offer a valid means of locating, mapping, and tracking OSTDS. We,

in fact, believe that the exact position of the OSTDS on each parcel should be included as part of the permit and added whenever feasible (see suggestions below). In some cases it is the only feasible form of reporting location, such as on very large parcels (military installations, parks and recreational parcels, etc.). In addition, if the components of OSTDS are well defined, then the location of their parts as well as the number of complete systems (by function) can be provided using GPS and as part of the permit. Then this permit information can be linked to the parcel inventory database.

However, we also believe that the use of a global position data form should not be used to the exclusion of parcel information. For the foreseeable future, only parcel data exist ubiquitously with legal standing in all counties throughout the state. As such, we contend that the use of parcel information remains the most viable solution for OSTDS locations in Florida for the inventory.

6.2 Policies for Improving and Maintaining an Inventory

The next four recommendations are concerned with how to improve and maintain the Statewide Inventory. The Inventory is, even at this point, an extraordinary collection of data, database and GIS capacity. Yet its' integrity and utility can be greatly enhanced if it is well maintained.

Once parcels are connected to a centralized sewer, it is highly unlikely they will return to using OSTDS for wastewater treatment. Also, many, perhaps as much as three quarters of the FDEP WWTF are very unlikely to ever change their service areas unless it is to become subsumed into a much large facility, annual updates on their parcel service areas is unnecessary. This means that the initial data collection will suffice. The rest of the parcels in the inventory SHOULD be monitored through existing permitting and notification policies. Therefore, much of the maintenance of the Statewide Inventory is the timely, reliable and consistent of communication among the agencies and departments which regulate construction, growth management and environmental protection, about changes in the number and location of parcels and their wastewater treatment systems.

3. **Elimination of parcels with "unknown" wastewater treatment methods.**

   No inventory is ever completely accurate. The more important objective is to accurately assign a wastewater treatment method to each parcel in order to quantify the "known unknowns". Once these are identified, a process for determining the actual wastewater treatment type can be established and executed. However, this will be a long-term process for any county. Charlotte County expects the inventory verification process to take five years. Alachua County spent several months attempting to create an accurate inventory and wastewater treatment type still remains uncertain on a few thousand parcels. In jurisdictions outside Florida where OSTDS inspection and management plans are legal requirements, the inventory process has generally taken several years to

reach a 95% level of accuracy.

Elimination of "unknowns" requires some point of contact with the property owner and/or other government entities with jurisdiction over the parcel. Below are contact points and notification elements that have succeeded in reducing the number of parcels with "unknown" wastewater treatments. These also are processes that will maintain the integrity of the inventory in general.

- Require annual communication with FDEP WWTF permittees regarding the parcels to which they provide centralized sewer service (recognizing that their cooperation is crucial to achieving any such goal).
- Communicate with development review boards and building permit entities to establish a process of notification when new parcels/new buildings are created.
- Update OSTDS inventory annually through Property Appraiser tax rolls.
- Provide the wastewater treatment type on the Property Appraiser public database access.
- Require identification of parcel wastewater treatment type at the point of sale.
- Require inspections of OSTDS on parcels at the point of sale. Provide mapping of the location of the OSTDSs on the property using GPS.
- Conduct an annual review of the OSTDS inventory by direct comparison to the previous year's inventory.
- Contact owners of parcels with "unknown" status directly.
- Identify where information regarding wastewater treatment type is missing by highlighting data gaps on the Property Appraiser's database and on maps provided to the public.
- Instituting rebate and/or incentive programs for OSTDS replacements for parcels to identify potentially unknown systems.

4. **Require consistent, timely and well-documented communication between Environmental Health FDEP and the FDEP WWTF permittees regarding the provision of sewer service.**

The FDEP and FDOH are the government entities that regulate wastewater treatment in Florida. In order to manage their respective functions effectively, both departments must assure clear communication among the staff charged with implementing these regulations. It is critical that the staffing personnel be thoroughly informed about the activities of their counterparts. Unfortunately, according to the CEHDs, information on the location of FDEP permitted sewer service availability and service expansion is spotty. Changes are inconsistently

communicated by FDEP WWTF permittees to the CEHDs. Only 40% report that they are regularly notified by FDEP permitted sewer service providers about the availability FDEP permitted sewer service, and only 19% actually have documentation of service locations on hand for their own reference. This means that in many counties, either the homeowner or contractor must provide evidence of OSTDS, or staff must make individual phone calls and check with the local institutional memory.

It may also appear that knowledge of new sewer connections or the existence of OSTDS on a parcel would be communicated through plumbing permits or other construction permits. However, this does not appear to happen consistently or reliably so that the CEHD can use this as knowledge about the state of wastewater treatment on any given parcel. The circumstances under which this does happen quite effectively is when the Environmental Health Department is housed in conjunction with the building permit functions of the larger local governments.

Even though regulations for notification exist, such as through abandonment permits, the notification process is not executed consistently enough for most CEHDs to confidently report that they know which parcels are served by FDEP permitted sewer lines. Information on older OSTDS located either within sewer franchise areas or on the fringe of a rapidly developing area is often inadequately reported. Reconciliation of abandonment permits with the active permits for a parcel is often sporadic. CEHDs regularly have incomplete permit databases and/or poor permitting information, thus correlating the parcel location is difficult.

The communication between FDEP WWTF permittees and County CEHDs should, at a minimum incorporate the following requirements:

- Consistent, continuous notification when parcels are converted from OSTDS to FDEP permitted sewer service
- Capacity to reconcile abandonment permits with parcels having previously permitted OSTDS
- Notification of changes in FDEP permitted sewer service area and installation of new sewer lines
- Provision of regularly updated maps, in GIS format when possible, with **parcel identification** where FDEP permitted sewer service is provided;
- Provision of accurate maps, in GIS format where possible, delineating locations where future FDEP permitted sewer service is expected to become available within the time frame of the utility's current franchise or planning horizon

5. **Coordination with other local government agencies that control development on a parcel.**

   The number and development status of parcels changes each day. Various local government agencies are involved in the authorization and recording of the subdivision and development of parcels. The county Property Appraiser is required by law to provide a certified tax roll of all parcels each year to the Department of Revenue. This database provides a unique and stable identifier for each parcel and contains a large amount of information regarding development status. Parcels are "created" through the development review and the building permit process, altering the development status. Information about the wastewater treatment method on a parcel is an important component of assessing property values for taxation, development and sale.

   As with effective communication with the FDEP as described above, there may appear to be sufficient regulation and policies in hand. However, the permitting processes such as rezoning or subdivision do not appear to effectively communicate information about wastewater treatment decisions to the CEHD. In order to keep an OSTDS inventory up-to-date, communication among the Property Appraisers (PA), development review boards, building permit regulators and realtors is necessary or the inventory will quickly become inaccurate. The integrity of the most useful OSTDS inventory data is maintained through the following:

   - Annual updates using the Property Appraisers tax roll
   - Identification of wastewater treatment type in new subdivisions as part of the development review process
   - Verification of wastewater treatment type that is installed as part of the building permit process
   - Notification of the appropriate agency and the inventory at the point of sale of the wastewater treatment type that exists for the parcel and/or the structure being sold
   - Sharing of information from the OSTDS inventory database with the Property Appraiser so that the wastewater treatment and any associated permits are available to the public on an ongoing basis

6. **Paper records – when to add them to the inventory and / or to make them electronically available.**

   The initial creation of an OSTDS inventory does not necessarily entail the entry of all existing paper permit data into an electronic format or the scanning of all permits. The Statewide Inventory provided by this project offers the initial version of the OSTDS inventory without, to date, any direct entry of data from paper records.

However, over twenty counties have records on legacy databases that have inconsistently linked with current parcel and GIS information, but could, potentially be enhanced by the addition of information from paper records. Eight counties have scanned most records from which key information could be extracted for the purposes of the inventory. The information content and number of years of paper recording varies widely among counties. Records from legacy databases supplied to this project have been included in the Statewide Inventory and reconciled with existing records in the EHDB database. Turning the information in paper permits into an electronically accessible form requires staff time, equipment, software and funding to accomplish. However, if much of staff time is currently spent supplying routine permit information to the public, making this information available in a public electronic database, especially if it is shared with the Property Appraiser, may free up staff time and expertise for other responsibilities.

Each county should assess the sufficiency of the Statewide Inventory compared to the amount of permit information that was included and what remains available in paper form. The following considerations are recommended for records that are NOT in any form that allows electronic access:

- Records within the last twenty years should be the high priority.
- Records older than twenty years may not contain useful information because many of these OSTDS may have been issued permits for repairs, modifications or replacements since the initial installation. Some may have been abandoned.
- Records that contain clear locational information should be a high priority;
- Records that contain large format paper are more expensive to scan, are not essential to the inventory, but are essential to OSTDS management.
- Scanning paper records reduces physical storage requirements;
- Scanning records and providing them in a database accessible to the public can reduce staff time spent on routine public requests for information.
- For all scanned records, access also should be provided through the Property Appraisers database.

6.3 Establishing an OSTDS Management Systems

These last two recommendations concern the value of an inventory in establishing a management system for OSTDS. Education of the public AND government personnel, at all levels, is the key to using OSTDS as a cost effective and environmentally sound

wastewater treatment system.

7. **Establishing an OSTDS management system**

   A management system that seeks to track and maintain the functional capacity of OSTDS to treat wastewater relies upon an inventory. The management system can be instituted without a completely accurate inventory, as long as processes to eventually eliminate "unknown" parcels and to maintain the integrity of the inventory are established. In fact, a mandatory OSTDS management system, particularly one incorporating the requirement for an OSTDS operating permit, is an excellent way to quickly eliminate "unknown" parcels and to establish consistent communication among governmental and private entities involved in the sale and development of land.

   The management system can target an environmentally sensitive area as a good reason for establishing, such systems, but the **process to create and maintain the inventory is the same everywhere**, regardless of environmental conditions on a given parcel or region.

   - The Statewide Inventory provides the basis for creating a county inventory that is sufficient to establish an OSTDS management system.
   - The Statewide Inventory should be improved using the recommendations provided herein.
   - Residents must be informed of the value that having onsite wastewater treatment information as a component of development contributes to their own real estate holdings, their water resources and the local economy.

8. **Educate the public, local governmental agencies and FDEP WWTF permittees.**

   The effectiveness of any OSTDS management system is fundamentally a product of the importance placed upon it by the public and other governmental entities involved in land development. Education on the positive environmental and fiscal impact that well sited and managed OSTDS can provide is essential to public understanding of the need for OSTDS inventory and management regimes.

   Notifying property owners of parcels with unknown wastewater treatment methods is a straightforward means of obtaining up-to-date information. However, notifying thousands of property owners without a prior public discussion highlighting the value of maintaining an OSTDS inventory can potentially generate concern among the public. As Monroe County learned when over 16,000 property owners were notified as part of the Cesspool Elimination Program, requiring information without first educating people as to why this process is important can ignite a revolt. The Monroe County experience offers a valuable lesson that education must precede implementation of the

inventory process.

Part of the education process is to clearly explain the goal of making the OSTDS inventory easily available in a context that provides value to the property owner. If the OSTDS inventory is effectively connected to the Property Appraiser database, it can provide information that buyers and sellers of property can use to assess the value of buildings and land. If the inventory is available in a GIS format, the map layers of OSTDS locations can be overlaid onto all sorts of other information: springsheds, coastal pollution problems, infrastructure expansion plans, well locations, etc.

An intriguing idea encountered in the research for this project was the suggestion from a staff member of the Washington State Department of Health to generate a parcel map, color coding the parcels to indicate the degree of data and management for OSTDS. The parcels with an "unknown" status of wastewater treatment type, the status designation that the CEHDs wish to eliminate, should be indicated in RED, the most attention grabbing color. The suggested color-coding for such a parcel map is as follows:

- Undeveloped - white
- Parcels served by a FDEP permitted sewer system - blue
- OSTDS and established maintenance programs - green
- OSTDS lacking a maintenance program - yellow
- "Unknown" wastewater treatment method - red.

Such mapping can contribute invaluable visual assistance at public meetings on environmental and planning issues. Individuals will identify the color of their own parcel. Many people will not wish to be red and will offer to provide information about OSTDS on their parcels. They may be sufficiently motivated to establish a formal maintenance plan so that they can be "turned green". This was a very successful method of increasing participation in OSTDS maintenance planning in Puget Sound. Here are some suggestions culled from conversations with Florida CEHDs, environmental planners and other interested parties throughout the country:

- Require identification or inspection at point of sale, and provide the buyer with information on how the condition of the OSTDS affects property value.

- Provide easy access to parcel information about the wastewater treatment method through Property Appraiser's database and online permit access.

- Collaborate with planning agencies and environmental impact projects to provide parcel maps indicating wastewater treatment type and allow these maps to be freely used on Web sites for established entities.

- Collaborate with large FDEP sewer service providers to obtain the location of OSTDS in the context of sewer provision and infrastructure planning.

- Encourage property owners to provide information by providing color-coded maps for public meetings that show parcels in RED for which information is needed on wastewater treatment type.

6.4 Most Important Overall Policy Reccommendations

The following recommendations appear multiple times throughout the report due to their fundamental importance to the creation and maintenance of an OSTDS inventory at the county or state level. Lists can become sophisticated structures given the availability of database software. But the value of the list is a function of the quality, source, and integrity of the information input and maintenance routines. These recommendations include ways to slowly but surely eliminate parcels with "unknown" wastewater treatment methods and to communicate with the public in order to accomplish this quickly and effectively.

- Maintain the OSTDS inventory independently, key it to the Property Appraiser parcel ID and link it to the EHDB.

- Maintain the parcel component of the inventory in concert with the Property Appraiser tax roll and provide unambiguous parcel and OSTDS location information in the EHDB.

- Use the Statewide Inventory as a standardized starting point for individual county inventories. Provide the CEHDs with the capacity to utilize the Statewide Inventory for management purposes and to provide feedback as to its accuracy.

- Initiate a program to scan and produce electronic files from those paper permit records that are essential to creating an effective inventory.
- Create a consistent manner for reporting changes in wastewater treatment method on parcels due to activities of the FDEP WWTF permittees, building permit regulators and development review boards. This will provide the best way to maintain the inventory.

- Develop points of contact with parcel owners and local environmental programs where applicable during development review and at the point of sale in order to ascertain the wastewater treatment method for each parcel.

- Provide direct access to and maps of the inventory results to the Property Appraiser, planning departments, real estate agents and any forum for public education.

6.5 Technical Recommendations for Updating and Maintaining the Inventory Database

Property Records

For the past several years, we have attempted methods for updating our statewide parcel framework as DOR information becomes available. Unfortunately, we have not identified a straightforward, "push button" method for doing so. Updating requires two steps, what parcels have changed (large parcels being subdivided) and what information has changed.

Our recommendation for updating the parcel information is:

1. Create statewide parcel framework as completed in this project utilizing new 2009 DOR GIS and tax roll information.

2. Identify parcels that fall within two categories:
   a. Parcels that have attribute changes only – these are parcels where the ownership has changed and do not require updating.
   b. Parcels that have been subdivided – these are larger parcels that have been platted and developed (often going from Improved/Septic or vacant to Improved Sewer)

3. Update the attributes of Parcels in Category 1 including Parcel ID.

4. Replace the GIS boundary of the Parcels in Category 2 with the new parcels and assign new parcel id's.

5. Using the parcel centroids provided in the Geodatabase, you can easily perform a spatial join to capture the "Legacy" parcel identification number that we assigned for this project.

After updating, the "Legacy" parcel ID from this project is your link to the septic and EHDB (tblAddresses) record.

Environmental Health Database

The method for update and maintenance is much simpler for identifying new septic parcels from the EHDB. We utilized the tblAddresses as it was provided, but added three fields to allow for linking to the parcels table: county_id, parcel_id and physical_address. Newly permitted parcel records can be appended to this table from the EHDB. Utilizing the common fields between the two tables (tblAddresses.PropertyID = parcels.tax_id and tblAddresses.physical_address = parcels.physical_address1) create inner joins and update the tblAddresses.parcel_id to parcels.id. It is also important to create an inner join using county id in case addresses or tax identification numbers are not unique by county. There may be data cleanup necessary as identified in the

State of the Data portion of our report. Sample queries are below for Alachua County (County ID = 11):

Update based on Address:

```
UPDATE    tblAddresses
SET       parcel_id = parcels.id
FROM      parcels INNER JOIN
          tblAddresses ON parcels.county_id = tblAddresses.county_id
AND parcels.physical_address1 = tblAddresses.physical_address

    WHERE    (parcels.county_id = 11)
```

Update based on Tax Identification Number:

```
UPDATE    tblAddresses
SET       parcel_id = parcels.id
FROM      parcels INNER JOIN
          tblAddresses ON parcels.county_id = tblAddresses.county_id
AND parcels.tax_id = tblAddresses.PropertyID

                WHERE    (parcels.county_id = 11)
```

7.0 Refinement of the Inventory Database

There are two scales at which the Inventory Database can be refined so as to greatly extend its robustness and utility. The first is the DOH need for assessing human and health impacts and threats that extend beyond political, nonjurisdictional boundaries and are determined by geological and ecological phenomena. The second is for use by the County Environmental Health Directors (CEHD) to perform their duties.

In reviewing the survey results submitted by all 67 counties, several key issues emerged that provided invaluable insight into County needs, priorities, and operational concerns. To address these first, we found that 22 counties performed some form of estimation or inventory in order to:

- improve the permitting or management process of OSTDS,
- provide the capacity to participate in growth management and comprehensive planning within their respective counties and regionally to optimize their potential to inform and educate the public on environmental health issues thus reducing risks to public health and the environment
- assess the environmental impacts to water and other natural resources,
- respond in a timely manner to government mandates and requests, usually for one or more of the three reasons listed above.

These estimations and inventories were accomplished in different ways by each of the 22 counties. This is in part due to differences of need and intent but also because few counties have the resources to collect data and/or the expertise to create a quality controlled database and to perform the necessary statistical analysis. Most estimates merely provide an account of the number of permits for OSTDS. Unlike the Statewide Inventory provided herein, they are not reconciled with the number of improved parcels in the county that might require onsite wastewater treatment. This form of estimation may suffice as a response to a request for the number of permitted OSTDS, but it does not provide for any further use. Essentially, local efforts are designed to serve a single/limited purpose. They do not scale, nor can they be combined to address the regional, non-jurisdictional needs addressed above. Limited access to referential data, as was utilized in this statewide effort, hampers the individual ECHD's ability to efficiently model or assess data quality.

Currently, Alachua and Charlotte Counties are addressing their need for location and quantification of OSTDS. In Duval County, the Water and Sewer Authority has pursued a county level inventory. For these three counties, developing an adequate listing of sewered and septic parcels has taken a year or more.

Additional effort is indicated for these three counties to address various refinements consistent with their respective priorities. Access to the Statewide Inventory utilizes modeling, data reconciliation, and county level GIS mapping as described in detail

throughout this report. It affords each county a means to move beyond counting of permits for inventory creation. It enables each county to address management needs for planning and prioritization to improve their existing inventories.

Table 7-1: Reasons listed by CEHD for performing an estimation or inventory.

County	Improvement of Permitting or Management Process	Growth Management	Environmental Impacts	Mandate from Local, State or Federal Govt.
Total	13	9	13	8
Alachua	Y	Y	Y	
Brevard	Y			Y
Calhoun	Y			
Charlotte	Y		Y	
Columbia	Y			
Miami Dade	Y			
Duval		Y	Y	
Flagler	Y	Y	Y	
Hardee			Y	Y
Hernando				Y
Hillsborough			Y	
Leon		Y	Y	
Martin			Y	Y
Monroe		Y	Y	Y
Okaloosa	Y	Y	Y	
Orange	Y	Y	Y	
Santa Rosa				Y
Sarasota				Y
St Lucie	Y	Y	Y	
Sumter	Y	Y		
Suwannee	Y			
Wakulla	Y		Y	Y

A number of counties clearly anticipate the need to expand their countywide management plans for OSTDS to include onsite inspection, either due to an impetus at the local level or in anticipation of regional or state directives or mandates. All of the EPA management programs rely on an actual inventory, not a count of permits. The distinction of an inventory developed solely through a count of existing permits and a comprehensive inventory is described in earlier chapters. Counties have self-identified the enormity of the task and need to assess the extent to which their paper permit

records need to be added to the existing EHDB. Methods for reconciling abandonment permits and efficiently identifying where and when a parcel changes from OSTDS to sewer are needed. Therefore, CEHDs are aware that they need an inventory and a clear priorities that is cross=walked to parcel data to pinpoint areas where OSTDS "probably" exist but for which there is no easily accessible permit data. Their capacity and resources necessary to accomplish these tasks are limited; therefore few counties have made the attempt.

7.1 Data Collection and Model Refinement

Any information derived from a database is only as useful as the data itself. As discussed earlier, a robust and viable OSTDS inventory is both dynamic and flexible. Specifically, the Statewide Inventory is derived for multiple sources, each with elements driving our recommendations for refinement. One of the most important implications of this is that the data collection needs to be enhanced as soon as possible before there are substantial changes in the parcel tax rolls and sewer provision by larger utilities.

We believe that information provided herein will illuminate the need to supply additional or expanded data in future endeavors. Counties and other stakeholders, upon review of information from this report, should be able to identify any missing, incorrect, or misleading information. To ensure that refinement efforts yield the desired outcomes, we submit the following recommendations that reflect our proposed data collection and model refinement procedures.

Data Collection

1. Target those large WWTF that to date have failed to provide parcel data on their service areas. There are 130 municipal and/or large WWTF that have never responded to requests for parcel information. Approximately ten are additional retail customers of large regional WWTF. These entities were unknown through state sources and not compelled to participate. Although identified and contacted, they have not yet furnished information. Though our efforts to identify and develop a working relationship with these sources, we believe that their participation is probable and realistic. If data from these sources alone were obtained, the inventory would contain parcel information for 96% of the total effluent permitting capacity of FDEP WWTF, serving approximately 61% of the population of Florida.

   During the course of this project, researchers have found direct contact with previously nonresponsive WWTF through emails and phone calls to be effective in data gathering (this approach enabled the us to garner over 2 million parcels). Such targeted contacts with the remaining large and municipal WWTF could yield a 95% response rate and identify an additional half million sewered parcels.

2. Target small municipalities, especially in the rural counties of groups A and B. Some of these are smaller than the 0.5 MGD limit and may have difficultly providing data in an electronic format. Data entry or OCR conversion may be necessary. When these rural WWTF provide parcel lists, the identification of OSTDS will be statistically reliable due to the process of elimination. This phenomenon is unique to rural areas with highly defined WWTF service areas.

3. Identify WWTF that serve a very limited number of parcels using other resources. There are many hundreds of very small WWTF that provide wastewater treatment to a recreational vehicle park, an apartment building, a restaurant or school. In addition, the address of the WWTF, provided by the FDEP permittee contact database, is often the same address as the served parcel. This can be identified and verified by "hand", using available web based information and phone calls. This is time consuming but will allow identification of small sewered areas in what is usually a large expanse of OSTDS.

4. As we worked to identify unmatched records in the EHDB, we found when linking the EHDB permitted systems to the DOR tax roll that not all records were successfully linked. We attempted to maximize the success rate by utilizing various string queries; however there were several counties with severely deficient data. To resolve this matter, it would be advantageous to perform more manual approaches in order to yield higher match rates for these counties. Where DOR data is deficient, it may be crucial to acquire alternative data sources to supplement the tax roll - E911 addresses or other high accuracy data.

   When the above steps have been or are nearly completed, a review of the Statewide Inventory database, maps and estimation results should be performed with County Environmental Health Directors and Directors of the largest sewer service providers. This not only provides an essential review process but will also create an investment in the quality and continuance of the Statewide Inventory.

5. Provide the current synopsis of parcel wastewater treatments and maps to interested CEHDs for feedback on the assumptions and estimations made for this inventory, modeling and mapping. Provide maps in a format that can be enlarged on screen for detailed examination. A visit to each county and thorough discussion of the maps and database would greatly improve their content and utility to the CEHD.

6. Provide the current synopsis of parcel wastewater treatments and maps to the largest sewer providers for comment on the number and location of sewer and OSTDS in their service area. Many counties have very large public providers of sewer (Miami-Dade, Orange, etc.). The cooperation of these providers is essential to a successful inventory. They also often have substantial GIS and database technical capacities that can provide excellent review and possible revision of the records in their service area. A further step would be to provide

indication of the service areas of large providers in the inventory.

7. The goal of further data collection should be to greatly reduce the reliance on estimations for OSTDS inventories in Florida. The need for modeling will continue until individual counties complete programs of onsite inspection. This could take many years and in the meantime, counts and location information on OSTDS will continue to be necessary for the protection and improvement of environmental and human health.

Model Refinement

1. Some WWTF may never be forthcoming with provider data. In these cases the relationship between the permitted capacity of the WWTF and the number of parcels that the facility could potentially serve can be modeled through existing information in the database. Use this relationship and the physical location of the WWTF to estimate the parcels served by the facility. This will work well for those WWTF constructed to serve specific developments as such facilities are not apt to expand.

2. Customize models for each county by including local regulatory limits on the capacity for developments to use OSTDS for wastewater treatment. Florida has certain longstanding requirements that apply statewide. Local jurisdictions can also implement more stringent rules. Such regulations usually relate directly to land use density and intensity allowances for OSTDS. These rules can be captured in a model by a decision tree.

3. Customize models for each county by including local regulatory limits on the capacity for developments to use OSTDS for wastewater treatment. Florida has certain longstanding requirements that apply statewide. Local jurisdictions can also implement more stringent rules. Such regulations usually relate directly to land use density and intensity allowances for OSTDS. These rules can be often be captured in a model by a decision tree more accurately than in statistical models. Therefore, models can be customized to include decision trees and statistical methods as appropriate for each county.

4. Separately model residential and nonresidential land uses. In many instances, nonresidential land uses have clearly distinct characteristics if they are sewered or using OSTDS. The distinctions among residential parcels are less obvious. Separating the two groups would provide better models that account for the unique differences among counties in their pattern of provision of wastewater treatment to residences.

5. Adjust for large difference in the known number of sewer and OSTDS parcels using a form of Bayesian analysis. Bayesian analysis is a method of providing a weighting to the final result when it is known that there are actually many more OSTDS or sewer parcels in a county or that the data collected is heavily biased

towards one treatment form.

6. Even when WWTF provide parcel data, not all parcels can be linked to the GIS database. Therefore, modeling should be done even when all WWTF for a given county have supplied service area data. Municipal sewer service areas commonly have scattered OSTDS still in use. These parcels often fail to link up in OSTDS permit databases. Models tend to assume that any improved parcel within a sewered area is also sewered. These WWTF should be modeled individually by comparing the number of parcel records provided, the number linked to the GIS maps, the capacity of WWTF, the jurisdiction-specific regulations relating to the retention of OSTDS when sewer is available, and septic system use relative to land use regulations. Only a small number of WWTF in certain counties require such treatment.

This expanded data collection and model refinement will yield more reliable estimates of the number and location of OSTDS statewide. Such a product will provide each CEHD a specific listing of parcels for which OSTDS information has been estimated. They can then prioritize where to apply resources to locate OSTDS and ensure compliance with local and state regulations.

More data collection and modeling will yield significantly more reliable estimations. Reaching a higher level of data and model exploration should be possible to achieve in a twelve-month period using the above steps.

7.2 Areas of Future Study

The second scale is to provide cross-jurisdictional geographically explicit information about the number and distribution of OSTDS in relationship to other geographically displayed information. A Statewide Inventory based on county specific data collection methods and estimations that allow for direct comparison of reliability would enhance the assessment of impacts from OSTDS. As the measure of reliability of estimation is captured directly in the probability that any given parcel has an OSTDS, that reliability can be factored directly into any geographical accounting done with the Inventory Database. These probabilities can be mapped by color coding to identify areas of low or high quality information.

1. Environmental data on springsheds (as in Wakulla and Wekiva, the Ichetucknee), coastal seepage zones, areas threatened by storm surge can be overlaid onto the Inventory maps and the impact of OSTDS on these features quantified. The Wekiva Study Area and the Wakulla karst plain offer opportunities for the first comparisons because substantial work has been done in estimating the location and number of OSTDS. Through such calibration, other defined sensitive areas can be assessed for the number of OSTDS located there. For instance, the FDEP is initiating a number of Basin Management Area Plan (BMAP) for which identification of nonpoint nutrient sources for surface and aquifer waters is an initial and essential step. Assessments for flood plains

(FEMA maps) and potential storm surge areas would allow DOH and local CEHD to take preventative action to mitigate harm to human health and to initiate OSTDS removal or replacement in these high risk areas.

2. Properly sited and maintained OSTDS provide sanitary wastewater treatment, but conventional systems and drain fields may not provide adequate denitrification, potentially contributing to nonpoint source nutrient pollution. With a thorough inventory, the relative contribution of OSTDS to nutrient pollution can be more accurately assessed in a geographical manner. It would also be possible to link details of permits to parcels and improve assessments of impact based on age, performance and local siting conditions. In addition, as nitrogen reducing systems are installed, their effectiveness in reducing the nitrogen load from OSTDS can be evaluated.

3. Water quality impacts from OSTDS can affect the resources of a neighboring county. A sound inventory and estimation can identify pollution sources and provide evidence that is unbiased by the capacity of the given jurisdiction to perform an analysis.

4. Costs and benefits of infrastructure expansions could be assessed more adequately with a reliable OSTDS inventory. Comprehensive planning for future land use designations can be facilitated if the locations of existing OSTDS are identifiable and identification of where it should be used can be done. A statistically qualified inventory allows the use of OSTDS as a permanent, planned component of wastewater treatment. OSTDS can be effectively for development in areas where low density should be retained due to land use efficiencies or environmental sensitivity,

5. The capacity exists to identify the wastewater treatment method on improved parcels and also on platted and unplatted parcels currently undeveloped. With improvement in the base data (as described in Chapter 7.1) the Inventory Database can be employed to predict the location and estimate of the future number of OSTDS or sewered parcels for a given location. This would be helpful to comprehensive planning and growth management, as well as in assessing environmental impacts.

6. The inventory can be maintained in a variety of ways. The most important is the enhanced use of existing regulation for communication among the wastewater providers within a county. In addition, a third party could provide annual "checkups" of the Inventory when the new DOR tax roll is available. The existing Statewide Inventory includes an extensive contact database for greater ease of updating sewer parcel information from very large WWTFs.

7. This is the first statewide OSTDS inventory to be attempted in the US, though legislation is now emerging to accomplish this effort in other states. With the proposed improvements in the baseline data, Florida will become a leader in exploring methods for creating a database that 1) provides consistent data to establish uniformity in OSTDS management, 2) improves assessment of

environmental impacts from OSTDS nutrient loading, 3) helps in mitigating harmful effects from OSTDS on human health and welfare due to catastrophic weather, and 4) improves growth management through knowledge of the distribution of wastewater treatment methods.

7.3 Future Integration with Existing Database

Through this project, the ability to obtain information on wastewater treatment methods from a range of sources has been established. Such information can now be incorporated into a database, its quality assessed and then linked to GIS parcel information. The information can be used to model the parcels for which a wastewater treatment method has previously not been identified. This project has successfully identified 6.6 million improved parcels, 2 million sewered parcels, and nearly 650,000 parcels with OSTDS. The project has successfully developed models to estimate the wastewater treatment method on the remaining improved parcels and via those models, and provide a measure of the reliability of that estimate. The project has mapped all improved parcels, known sewer and OSTDS parcels and estimated many for each category of wastewater treatment. Much has been accomplished in six months.

Future data integration opportunities might be found from the use of data generated or maintained within other Department data stores such as those used for reportable diseases, family health, infant mortality, and even site planning for EPA brownfield redevelopment initiatives. Efforts that might well generate grant funding opportunities.

This is the first Statewide Inventory of the number and location of OSTDS in the United States. The opportunity to continue its leadership role provides the State with the potential to garner financial support from other entities with shared data needs. The Florida DOH now possesses a very important tool with which to carry out its mission of protecting public health and the environment.

8.0 References

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9.0 Appendix

9.1 Tables

Table 3-1

Years of OSTDS Permit Data for Existing Electronic Databases as reported by CEHD

Description of the years of permit records in three categories of electronic databases: EHDB, CENTRAX, and legacy databases. A legacy database is any database that has permit records from past years which has not be integrated into the database currently in use, usually EHDB. The dates are truncated to the year reported by the CEHDs. The summary is the maximum range of all databases combined but does not yet reflect whether the legacy data is or is not useful or usable. The Access column refers to whether or not the database has been provided for integration into the Statewide Inventory. These legacy databases are being actively sought as they potentially contain valuable information. This table will be updated for the final version of this report.

County	*EHD(rehost)*	*CENTRAX*	*Legacy Data Bases*	*Summaryof Electronic Records*	*Access to Legacy Database*	*Paper Records*
Alachua	some 2007 - 2009	1997 - part of 2007	all records soon	1997 - 2009	CPHIUMS provided / useful	1985 - 2009
Baker	1998 - 2009	1998 - 2001	1985 - 1998	1985 - 2009	Database not yet useful	1997 - 2009
Bay	2005 - 2009	unknown		2005 - 2009		1995 - 2009
Bradford	no info provided	no info provided	no info provided	no info provided	CPHIUMS not yet useful	1973-1985 most,1986-2009 all
Brevard	2002-2009	2002 - 2007	1992 - 2006	1992 - 2009	Database provided / useful	will be electronic
Broward	all	from start to EHD migration		insufficient info provided		not used
Calhoun	1996 - 2009	1996 - 2007		1996 - 2009	Database provided / useful	1983-2009
Charlotte	1973 - 2009	1974 - 2009		1973 - 2009	Database provided / useful	some destroyed
Citrus	1998 - 2009	1998 - 2009		1998 - 2009		1994 - 2009
Clay	1996 - 2009	1996 - 2007	1973-1996	1973 - 2009	Database not yet useful	1973-2009
Collier	1998 - 2009	1998 - 2007		1998 - 2009		(1985) 2000 - 2009
Columbia	2000 - 2009		1973-1999	1973 - 2009	Request pending to Carmody	all electronic
Miami-Dade	1999 - 2009	1999 - 2007		1999 - 2009		no info
DeSoto	2000 - 2009	2000 - 2009		2000 - 2009		1998 - 2009
Dixie	1997 - 2009	1997 - 2009	1986 - 1997	1986 - 2009	CPHIUMS not yet useful	1968 - 2009
Duval	1993 - 2009	1993 - 2007	1993 - 2001	1993 - 2009	Request pending to WSAE	all electronic
Escambia	1998 - 2009	1998 - 2007		1998 - 2009	Database provided / useful	all
Flagler	1995 - 2009	1995 - 2009		1995 - 2009	Database provided / useful	1973 - 2009
Franklin	1999 - 2009			1999 - 2009		1980 - 2009
Gadsden	1995 - 2009	1995 - 2006		1995 - 2009		1987 - 1994
Gilchrist	1997 - 2009	1997 - 2009	1986 - 1997	1986 - 2009	CPHIUMS not yet useful	1974 - 2009
Glades	1995 - 2009	1995 - 2007		1995 - 2009		1995 - 2009
Gulf	1997 - 2009	1997 - 2007		1997 - 2009		1974 - 1997
Hamilton	2006 - 2009	1998 - 2007	1983 - 1997	1983 - 2009	CPHIUMS not yet useful	no info
Hardee	1998 - 2009	1998 - 2009		1998 - 2009		1984 - 1997
Hendry	1995 - 2009	1995 - 2007		1995 - 2009		1968 - 2009
Hernando	6/1998 - 2009	6/1998 - 2009		1998 - 2009		1972 - 1998
Highlands	1994 - 2009	1994 - 2008		1994 - 2009		all electronic
Hillsborough	spotty since 1995, 1999 pretty complete	spotty since inception to 1999		1995 - 2009		all electronic
Holmes	1996 - 2009	1996 - 2007		1996 - 2009	Database not yet useful	1973 - 2009
Indian River	3/30/1998 - 2009	3/30/1998 - 10/10/2008	1973 - 1997	1973 - 2009	Database not yet useful	1978 - 1985
Jackson	1994-present	1994 - 2006	1994-1996	1994 - 2009	Database not yet supplied	1996 - 2009
Jefferson	2006 forward	1991 forward to 2006		1991 - 2006		no info
Lafayette	around 2000 - 2009	1996 - 2000		1996 - 2009	CPHIUMS not yet useful	1978 - 2009

County	*EHD(rehost)*	*CENTRAX*	*Legacy Data Bases*	*Summaryof Electronic Records*	*Access to Legacy Database*	*Paper Records*
Lake	1999 - 2009	1999 - 2009		1999 - 2009		1995 - 1999
Lee	1998 - 2009	1998 - 2007		1998 - 2009	Database provided / useful	none exist
Leon	1998 - 2009	1998 - 2006	1988 - 1998	1998 - 2009	Database provided / useful	no info
Levy	2007 - 2009	1998 - 2007	1974 TO 1998	1974 - 2009	CPHIUMS not yet useful	1970 - 2009
Liberty	2008 - 2009	1997 - 2007	1989--1997	1989 - 2009	Database not yet useful	1975 - 2009
Madison	1991 - 2009	1991 - 2006		1991 - 2009		1967 - 2009
Manatee	2007 - 2009	no centrax		2007 - 2009		1960 - 1995 (approx)
Marion	1998 - 2009	1998 - 2007	1986-1998	1998 - 2009	Database provided / useful	1967 - 2009
Martin	1998 - 2009	1998 - 2007	1994 - 1998	1994 - 2009	Database not yet useful	archieved < 1983
Monroe	2005 - 2009	2004 - 2009	1985 - 2004	1985 - 2009	Database not yet useful	1985 - 2004
Nassau	All years	1997 - 2007	Beginning of permits to centrax	1997 - 2009	Request pending	all electronic
Okaloosa	1998 - 2009	1998 - 2007		1998 - 2009		soon all electronic
Okeechobee	2006 - 2009	1996 - 2005		1996 - 2009		2001- 2009
Orange	1999 - 2009	1999 - 2008	1993 - 1998	1993 - 2009	Database not yet useful	none exist
Osceola	1998 - 2009	1998 - 2007	1986 - 1998	1986 - 2009	Database not yet useful	1986 - 2007
Palm Beach	1999 - 2009	1999 - 2008	1993 - 1998	1993 - 2009	Database provided / useful	1980 - 1993
Pasco	1998 - 2009	1998 - 2007		1998 - 2009		1976 - 2009
Pinellas	all	unknown		insufficient info provided		1972 - 2009
Polk	migrated 1998, data entry to 2007	1998-2007		1998 - 2007(?)	Database lost	(1970) 1990 - 2009
Putnam	Centrax, no dates	1999 - start of rehost	1993 - 1999	1993 - 2009	CPHIUMS not yet useful	all electronic
St. Lucie	1999 - 2007 (?)	1999 - 2007	1987 - 1998	1987 - 2009	Database not yet useful	1984 -1986
St. Johns	2007 - 2009	1994 - 2007	1986 - 1994	1986 - 2009	Database provided / useful	no info
Santa Rosa	no info provided	no info provided	no info provided	no info provided		1970 - 2009
Sarasota	2006 -2/2/2009	2005 and some 2006	1972 - 2005/6	1972 - 2009	Database not yet useful	all electronic
Seminole	1999 - 2009	1999 - 2007	no accessible	1999 - 2009	Request pending	none exist
Sumter	2008 - 2009	1995 - 2008	finals from 1950's thru 1983	1950 - 2009	Request pending	1950 - 1983
Suwannee	Back to around 1998	2000 - 2007		1998 - 2009	CPHIUMS not yet useful	1990 - 2009
Taylor	1974 (incomplete upto 2002) - 2009	1974 - 2006		1974 - 2009		1974 - 2009
Union	1998 - 2009	1998 - 2007	1986-1998	1986 - 2009	CPHIUMS provided / useful	1973 - 2009
Volusia	1999 - 2009	1999 - 2007		1999 - 2007		1989 - 1999
Wakulla	2006 - 2009			2006 - 2009		1983 - 2009
Walton	4/1998 - 2009	1998 - 2007	hard copy list of all systems permitted from 1980 - 6/2003	1998 - 2009	Database provided / useful	1985 - 2009
Washington	2006 - 2009	1998 - 2006		1998 - 2009		no info

Table 3-3

FDEP Wastewater Treatment Facilities, Number and Capacity by County

This table contains information on the wastewater treatment facilities (WWTF) in each county. WWTF supply centralized sewer services to developed parcels and thus play an important role in determining which parcels have OSTDS. The larger facilities are often public or municipal facilities, but can also be operated by private authorities. They provide the majority of the effluent treatment and hence serve the largest number of parcels. The smaller facilities are more numerous, and do not often expand. Municipalities may also provide centralized sewer services which can be operated by a public or private entity. Municipalities are also included in the columns for Public and Private WWTF. This information is important for understanding the different challenges counties face in creating and maintaining an OSTDS inventory.

- # WWTF : Number of domestic wastewater treatment facilities
- Total MGD : WWTF permitted effluent capacity in millions of gallon per day
- Municipal WWTF : Number of WWTF owned or operated for municipalities
- Public WWTF : Number of WWTF owned by a public entity
- Private WWTF : Number of WWTF owned by a private entity
- Public % of Total MGD : % of Total MGD that are permitted to Public WWTF
- Large WWTF : Number of WWTF with capacity of $\geq$ 0.5 MGD
- Large WWTF % of Total MGD : % of Total MGD permitted to Large WWTF
- Small WWTF : Number of WWTF with capacity of < 0.5 MGD
- Small WWTF % of Total MGD : % of Total MGD permitted to Small WWTF

County	# WWTF	Total MGD	Municipal WWTF	Public WWTF	Private WWTF	Public % of Total MGD	Large WWTF	Large WWTF % of Total MGD	Small WWTF	Small WWTF % of Total MGD
Florida	2,157	2,598	268	615	1,542	83%	367	97%	1,752	3%
Alachua	20	22.6754	7	8	12	85%	4	95%	16	5%
Baker	4	1.593	1	3	1	98%	1	82%	3	18%
Bay	15	29.055	6	9	6	98%	7	98%	7	2%
Bradford	5	3.453	1	3	2	99%	2	99%	3	1%
Brevard	58	65.5486	11	23	35	98%	17	98%	39	2%
Broward	16	288.065	12	14	2	98%	15	100%	1	0%
Calhoun	1	1.5	1	1	0	100%	1	100%	0	0%
Charlotte	27	9.6798	1	6	21	64%	4	79%	23	21%
Citrus	66	6.6009	3	12	54	75%	6	77%	60	23%
Clay	24	17.5678	4	20	4	98%	7	88%	17	12%
Collier	23	49.7855	3	12	11	92%	6	99%	16	1%
Columbia	22	3.6578	6	10	12	96%	1	82%	19	18%
Miami-Dade	26	359.2855	3	8	18	60%	4	100%	21	0%
De Soto	20	3.924	1	5	15	86%	2	70%	18	30%
Dixie	4	0.523	2	2	2	95%	0	0%	3	100%
Duval	26	123.9815	5	18	8	100%	16	99%	9	1%
Escambia	11	33.556	1	9	2	100%	4	98%	6	2%
Flagler	19	8.6914	3	5	14	79%	4	81%	14	19%
Franklin	9	2.738	2	3	6	84%	2	80%	7	20%
Gadsden	10	4.267	4	4	6	49%	2	66%	8	34%
Gilchrist	5	0.3775	1	3	2	65%	0	0%	5	100%
Glades	21	0.5205	0	3	18	34%	0	0%	21	100%
Gulf	7	3.805	2	4	3	97%	1	81%	5	19%
Hamilton	10	1.6139	3	4	6	94%	1	74%	8	26%
Hardee	14	2.562	3	6	8	91%	1	47%	13	53%
Hendry	15	2.7644	2	5	10	78%	1	54%	14	46%
Hernando	31	8.8305	1	10	21	95%	7	92%	24	8%
Highlands	62	6.1544	4	5	57	54%	3	57%	59	43%
Hillsborough	122	151.0296	3	19	103	98%	10	97%	112	3%
Holmes	4	1.5185	3	3	1	95%	1	92%	3	8%
Indian River	12	13.8811	1	8	4	99%	5	96%	7	4%
Jackson	8	6.84	4	6	2	68%	3	91%	5	9%
Jefferson	4	1.2825	2	2	2	3%	1	78%	3	22%
Lafayette	2	0.363	1	1	1	41%	0	0%	2	100%

County	# WWTF	Total MGD	Municipal WWTF	Public WWTF	Private WWTF	Public % of Total MGD	Large WWTF	Large WWTF % of Total MGD	Small WWTF	Small WWTF % of Total MGD
Florida	2,157	2,598	268	615	1,542	83%	367	97%	1,752	3%
Lake	115	25.5349	16	24	91	69%	11	74%	103	26%
Lee	77	75.8023	7	16	61	82%	15	95%	57	5%
Leon	12	33.7197	2	4	8	95%	4	99%	8	1%
Levy	15	1.341	4	9	6	94%	0	0%	13	100%
Liberty	2	0.45	1	2	0	100%	0	0%	2	100%
Madison	6	1.2545	2	3	3	92%	1	79%	5	21%
Manatee	9	49.8225	2	6	3	100%	5	100%	4	0%
Marion	128	25.6435	5	26	102	64%	9	78%	117	22%
Martin	36	17.1781	3	6	30	58%	7	89%	29	11%
Monroe	237	17.5885	10	21	216	68%	2	60%	228	40%
Nassau	16	6.216	3	6	10	89%	3	80%	13	20%
Okaloosa	18	39.493	3	14	4	82%	12	99%	6	1%
Okeechobee	18	2.2815	0	6	12	86%	1	70%	17	30%
Orange	53	206.8123	6	15	38	50%	11	99%	39	1%
Osceola	39	32.659	3	11	28	90%	10	95%	29	5%
Palm Beach	54	162.1439	4	11	43	96%	10	99%	44	1%
Pasco	71	61.3513	4	13	58	50%	12	96%	59	4%
Pinellas	23	275.7815	14	17	6	99%	18	100%	5	0%
Polk	156	65.2846	21	39	117	91%	22	90%	133	10%
Putnam	28	3.8471	5	13	15	93%	1	78%	26	22%
St. Johns	27	17.2787	2	13	14	84%	10	95%	17	5%
St. Lucie	32	24.6025	1	6	26	49%	7	93%	25	7%
Santa Rosa	13	17.22	4	7	6	70%	6	95%	6	5%
Sarasota	47	37.9222	4	13	34	87%	13	98%	34	2%
Seminole	24	68.0386	8	11	13	90%	11	98%	13	2%
Sumter	33	8.0687	3	3	30	25%	4	82%	29	18%
Suwannee	9	1.6475	2	2	7	83%	1	76%	8	24%
Taylor	6	1.755	1	3	3	95%	1	71%	4	29%
Union	1	0.7	1	1	0	100%	1	100%	0	0%
Volusia	106	64.8656	14	26	80	95%	13	96%	92	4%
Wakulla	6	1.248	1	3	3	54%	1	48%	5	52%
Walton	11	10.83	3	7	4	22%	5	92%	6	8%
Washington	6	1.876	2	4	2	96%	1	64%	5	36%

Table 3-7

Description of County Estimations of Number of OSTDS

Twenty-two counties that reported performing or planning to perform an inventory or estimate of OSTDS. The information presented is taken directly from the survey responses and edited only for formatting purposes. The Method and Reason columns are the items chosen as "very important" or "somewhat important". Onsite verification as a method of performing the inventory and the establishment of an RME as a reason for doing the inventory are highlighted.

County	Estimated OSTDS	Quality of Estimation	Date	How long did it take?
Alachua	30,410	96%	inventory to finish in about 3 months	14 months
Brevard	80,000	unknown	Annual estimates from 2005 - 2008	About 10 hours
Calhoun	4,680	90%	annually	no time
Charlotte	44,026	very good	estimation done, inventory in progress, 5 years to complete	1 Week
Columbia	20,000	80%	2008	4 MONTHS
Duval	approx 90,000	90% with GIS	EHD only tracks number of permits	
Flager	about 6,000	planned	started a few months ago	uncertain
Hardee	4,613	98%	annually	5 hours
Hernando	54,818	98%	done for this survey 2/5/09	one hour
Hillsborough	115,000 to 125,000	80-90%	2006-2007	1 week
Leon	38,000	95%	2009 until done	unknown
Martin	10,000 in 1994	Good	1994	SIX MONTHS
Monroe	27,024	90%	1996 Governors Executive Order	1 year
Miami-Dade	250,000	80%	Mar-09	24 hours
Okaloosa	30,000	expect 90%	start in 2010	1 year
Orange	113,000	80-85%	2006, started with Wekiva and expanded to rest of County	ongoing as area constantly growing
Santa Rosa	over 40,000	90%	July, 2000	1 month
Sarasota	43,223	90% identified	done in 2007	Not sure, I think I worked on it on and off for a month
St. Lucie	37,532	only adequate	done monthly but results are only adequate	1-2 weeks
Sumter	14,600	50% prior to 1984 98% after 1984	done every year	ongoing
Suwannee	about 6,000	planned	calculate annually, planning estimate in 2 years	2 hours per year
Wakulla	15,000	85%	quarterly (??)	1-2 days

County	Method	Reason
Alachua	Tax Roll, DEP WWTF parcels served, OSTDS DB	environmental impact, water protection, growth management
Brevard	Estimate in 1996/97 as baseline (unknown method), County DB for current annual estimates	update database
Calhoun	EHD(rehost), Centrax, County DB, paper records	improving permitting database, process
Charlotte	Tax Roll, DEP WWTF service areas, lines and laterals, reconciliation of abandonments with OSTDS permits, **onsite verification (inventory)**	improve permitting, environmental impact, water protection, **RME establishment**
Columbia	Paper records, tax rolls,	improving permitting database, process
Duval	Parcel based inventory being done by Water and Sewer Expansion Authority of City of Jacksonville. Tax Roll, DEP WWTF parcels served, known location OSTDS in sewered areas	environmental impact, water protection, growth management
Flager	Tax Roll, County DB, EHD(rehost), DB paper records, DEP WWTF parcels served, known location of OSTDS in sewered areas	improve permitting process, growth management, water protection
Hardee	Tax Roll, EHD(rehost), Centrax, DEP WWTF parcels served, service areas, location of known OSTDS in sewered areas, **onsite verification as part of permitting**	water protection, presumed DOH request
Hernando	US Census, EHD(rehost), Centrax, paper records,	presumed DOH request
Hillsborough	Tax Roll, Centrax, main and lateral sewer lines, known OSTDS in sewered areas, regulation exceptions, variances and grandfathering, census numbers	environmental impact, water protection
Leon	EHD(rehost), DEP WWTF service areas, mains and laterals, known OSTDS in sewered areas	environmental impact, growth management, water protection
Martin	EHD(rehost), Centrax, DB of paper records, DEP WWTF parcels served, main and lateral sewer lines, known location of OSTDS in sewered areas, regulation exceptions, variances and grandfathering	water protection, presumed DOH request
Monroe	Tax Roll, County DB, followed up since by repair permits and abandonments	comprehensive planning, water protection, cesspool elimination, required by legislature
Miami-Dade	EHD(rehost), jurisdiction boundaries, location of sewer mains and laterals, tax rolls and parcel development status, We determine from property appraisal that 500,000 lots exist in Dade County. Based upon water and sewer Department records about 1/2 of the lots are serviced by sewers. Therefore 250,000 lots are serviced by septic tanks.	improve permitting process
Okaloosa	EHD(rehost), Centrax, DB paper records, DEP WWTF parcels served, main and lateral sewer lines, contractor records, **onsite verification of OSTDS**	update database, environmental impact, growth management, water protection
Orange	Tax Roll, EHD(rehost), Centrax, DB of paper records, sewer mains and laterals, known location of OSTDS in sewered areas, **onsite verification**	improve permitting process, environmental impact, growth management, water protection
Santa Rosa	Tax rolls, Centrax, primary source was the total number of water connections less the total number of sewer connections yields the number of ostds.	I needed to have a number for a presentation to the board of county commisioners.
Sarasota	County DB, plus Centrax and rehost data minus abandonment permits	comprehensive planning
St. Lucie	EHD(rehost), Centrax, County DB, DEP WWTF parcels served and service area, lost track of sewer conversions in building boom	improve permitting process, environmental impact, growth management, water protection
Sumter	EHD(rehost), Centrax, County DB	improve permitting process, update database, growth management

County	Method	Reason
Suwannee	Tax roll, EHD(rehost), Centrax, DB of paper records, known location OSTDS in sewered areas, reconciliation with abandonment permits,	improve permitting process
Wakulla	only EHD(rehost)	improve permitting process, budgeting

Table 4-4

Response from FDEP Permitted Wastewater Treatment Facilities (WWTF) and the number of Sewered Parcels in Florida Counties

- # of Parcels
- # of Improved parcels
- Total number of WWTF
- Total permitting capacity in million gallons per day (MGD)
- Percent of WWTF that provided some form of data on sewer service
- Percent of total MGD the reporting WWTFs represent
- Number of sewer parcels collected by March
- Final number of known sewer parcels for the Statewide Inventory

County	# of Parcels	# of Improved	Total WWTF	Total MGD	Data Received % WWTF	Data Received % MGD	Sewer Parcels March 2009	Sewer Parcels Final
Florida	9,037,945	6,608,050	2,157	2597.9	52%	85%	360,322	2,056,129
Alachua	99,666	80,317	20	22.7	100%	100%	2,120	43,582
Baker	12,316	8,245	4	1.6	100%	100%	2	1,552
Bay	117,174	86,990	15	29.1	93%	76%	1	12,914
Bradford	14,521	10,004	5	3.5	100%	100%	14	1,425
Brevard	293,637	210,224	58	65.5	64%	99%	1,571	46,312
Broward	491,278	420,678	16	288.1	69%	72%	65,891	205,969
Calhoun	10,319	5,463	1	1.5	100%	100%	0	483
Charlotte	218,401	97,937	27	9.7	100%	100%	519	30,023
Citrus	127,838	65,700	66	6.6	38%	64%	131	134
Clay	83,504	66,656	24	17.6	83%	99%	1,521	28,128
Collier	175,775	97,498	23	49.8	52%	90%	1,070	5,407
Columbia	40,408	25,286	22	3.7	50%	96%	12	2,115
Miami-Dade	551,589	489,351	26	359.3	96%	98%	3	281,245
De Soto	19,116	11,114	20	3.9	35%	36%	6	6
Dixie	17,591	9,031	4	0.5	75%	24%	0	1
Duval	357,366	312,400	26	124.0	85%	100%	134,558	141,421
Escambia	149,188	123,033	11	33.6	91%	99%	0	55,060
Flagler	72,960	42,255	19	8.7	42%	74%	58	273
Franklin	16,040	6,784	9	2.7	78%	53%	163	164
Gadsden	26,750	17,421	10	4.3	80%	57%	580	571
Gilchrist	14,691	7,230	5	0.4	80%	91%	3	4
Glades	11,211	5,549	21	0.5	14%	5%	3	4
Gulf	16,700	8,978	7	3.8	86%	19%	2	730
Hamilton	14,491	5,613	10	1.6	70%	16%	343	344
Hardee	14,059	8,832	14	2.6	36%	19%	4	4
Hendry	35,534	13,006	15	2.8	53%	81%	12	12
Hernando	115,995	78,145	31	8.8	58%	78%	26,866	26,867
Highlands	97,890	39,863	62	6.2	35%	62%	4,847	4,897
Hillsborough	469,685	408,004	122	151.0	44%	98%	156	227,932
Holmes	15,324	8,344	4	1.5	50%	6%	1	88
Indian River	77,586	53,895	12	13.9	75%	91%	3	7,031
Jackson	39,917	18,894	8	6.8	63%	21%	5	402
Jefferson	12,685	6,392	4	1.3	75%	22%	7	7
Lafayette	6,874	2,829	2	0.4	50%	59%	3	3
Lake	223,070	151,439	115	25.5	41%	62%	649	27,948

County	# of Parcels	# of Improved	Total WWTF	Total MGD	Data Received % WWTF	Data Received % MGD	Sewer Parcels March 2009	Sewer Parcels Final
Florida	9,037,945	6,608,050	2,157	2597.9	52%	85%	360,322	2,056,129
Lee	438,587	238,982	77	75.8	49%	74%	3,889	19,495
Leon	107,254	88,913	12	33.7	92%	98%	0	50,608
Levy	48,672	20,427	15	1.3	53%	26%	5	6
Liberty	6,130	2,663	2	0.5	50%	44%	1	1
Madison	15,868	7,643	6	1.3	50%	7%	2	7
Manatee	141,093	110,933	9	49.8	44%	0.05%	2	3
Marion	267,033	149,007	128	25.6	52%	89%	2,883	2,930
Martin	77,621	71,038	36	17.2	56%	89%	37	3,570
Monroe	90,174	48,106	237	17.6	41%	17%	121	1,107
Nassau	47,541	33,221	16	6.2	44%	87%	2,566	4,688
Okaloosa	100,727	84,025	18	39.5	56%	66%	995	995
Okeechobee	33,085	16,306	18	2.3	22%	14%	301	302
Orange	367,509	312,216	53	206.8	62%	97%	11	54,890
Osceola	149,286	112,276	39	32.7	33%	73%	36	12,067
Palm Beach	436,963	392,436	54	162.1	44%	95%	13	250,004
Pasco	252,568	245,141	71	61.4	37%	80%	17	1,921
Pinellas	434,384	406,913	23	275.8	78%	100%	1	240,932
Polk	308,683	222,889	156	65.3	38%	77%	15,109	19,519
Putnam	100,851	40,689	28	3.8	50%	14%	17	419
St. Johns	161,905	96,796	27	17.3	44%	48%	12,599	12,600
St. Lucie	153,137	108,869	32	24.6	72%	62%	37,163	42,172
Santa Rosa	90,806	58,861	13	17.2	85%	99%	1,180	9,642
Sarasota	216,810	154,387	47	37.9	55%	98%	230	75,243
Seminole	170,499	146,092	24	68.0	83%	100%	41,670	66,600
Sumter	71,736	51,432	33	8.1	52%	95%	4	28,059
Suwannee	28,795	14,113	9	1.6	89%	93%	2	29
Taylor	18,841	9,950	6	1.8	83%	29%	4	4
Union	6,718	3,673	1	0.7	100%	100%	0	0
Volusia	487,658	295,259	106	64.9	49%	22%	329	1,908
Wakulla	24,870	12,708	6	1.2	83%	60%	1	2,151
Walton	78,205	38,494	11	10.8	82%	99%	6	1,193
Washington	42,787	10,192	6	1.9	67%	29%	4	6

Table 4-5

Number of OSTDS Permits in Databases and Number of Parcels with OSTDS in Florida Counties

- # of Parcels
- # of Improved parcels
- Active permits found on EHDB
- Closed permits found on EHDB
- EHD permits that were successfully linked to parcels by March. There can be more than one permit/parcel
- Final Number of unique septic parcels identified by at least one EHDB permit
- Number of permits from a legacy CEHD database (not the EHDB)
- Final Number of unique septic parcels identified by at least one CEHD database permit (not the EHDB)
- Final total number of known OSTDS parcels for the Statewide Inventory

County	# of Parcels	# of Improved	Active EHD Permits	Closed EHD Permits	Linked EHD Permits March 2009	Septic Parcels per EHDB	CHD Legacy Permits Obtained	CHD Legacy Permits Linked	Total OSTDS Known Parcels
Florida	9,037,945	6,608,050	755,674	144576	229,569	564,026	370,013	85,731	649,757
Alachua	99,666	80,317	22,128	82	6,220	9,445	33,916	20,191	29,636
Baker	12,316	8,245	1,533	1064	1	1,488	0	0	1,488
Bay	117,174	86,990	10,894	27	5,807	7,653	0	0	7,653
Bradford	14,521	10,004	3,070	4	155	1,869	84	27	1,896
Brevard	293,637	210,224	9,116	10455	2	14,195	28,485	11,240	25,435
Broward	491,278	420,678	13,132	233	5,769	8,468	0	0	8,468
Calhoun	10,319	5,463	1,637	0	16	139	486	0	139
Charlotte	218,401	97,937	4,435	14527	5,076	12,310	55,398	22,933	35,243
Citrus	127,838	65,700	24,839	762	621	17,436	0	0	17,436
Clay	83,504	66,656	15,083	46	5,146	10,519	0	0	10,519
Collier	175,775	97,498	14,827	107	5,676	6,404	0	0	6,404
Columbia	40,408	25,286	10,808	5	5,938	5,988	0	0	5,988
Miami-Dade	551,589	489,351	38,925	278	16,871	23,073	0	0	23,073
De Soto	19,116	11,114	3,693	27	2,185	2,620	0	0	2,620
Dixie	17,591	9,031	3,309	74	257	1,759	2,280	0	1,759
Duval	357,366	312,400	30,809	468	6,068	15,290	0	0	15,290
Escambia	149,188	123,033	25,922	1890	2,704	16,971	11,610	3,204	20,175
Flagler	72,960	42,255	2,716	54	4	1,737	5,593	705	2,442
Franklin	16,040	6,784	3,881	6	198	563	0	0	563
Gadsden	26,750	17,421	8,099	5	270	3,764	0	0	3,764
Gilchrist	14,691	7,230	1,895	1820	1,633	1,710	4,151	55	1,765
Glades	11,211	5,549	2,121	11	8	1,142	0	0	1,142
Gulf	16,700	8,978	3,421	46	1,156	1,797	0	0	1,797
Hamilton	14,491	5,613	1,757	14	117	776	1,554	0	776
Hardee	14,059	8,832	1,309	737	1,387	1,621	0	0	1,621
Hendry	35,534	13,006	4,132	85	72	2,404	0	0	2,404
Hernando	115,995	78,145	21,588	27	18	15,127	0	0	15,127
Highlands	97,890	39,863	12,129	149	960	7,923	0	0	7,923
Hillsborough	469,685	408,004	26,722	74	1,075	20,515	0	0	20,515
Holmes	15,324	8,344	3,233	61	44	316	0	0	316
Indian River	77,586	53,895	16,917	322	1	9,613	10,167	0	9,613
Jackson	39,917	18,894	9,437	35	90	4,206	0	0	4,206
Jefferson	12,685	6,392	3,499	0	2,000	2,165	0	0	2,165
Lafayette	6,874	2,829	1,089	13	2	587	216	0	587

County	# of Parcels	# of Improved	Active EHD Permits	Closed EHD Permits	Linked EHD Permits March 2009	Septic Parcels per EHDB	CHD Legacy Permits Obtained	CHD Legacy Permits Linked	Total OSTDS Known Parcels
Florida	9,037,945	6,608,050	755,674	144576	229,569	564,026	370,013	85,731	649,757
Lake	223,070	151,439	23,776	1583	5	20,388	0	0	20,388
Lee	438,587	238,982	10,907	52238	48,651	55,863	39,742	12,216	68,079
Leon	107,254	88,913	13,427	28	8,787	9,762	26,777	8,625	18,387
Levy	48,672	20,427	9,234	27	963	4,555	15,626	1	4,556
Liberty	6,130	2,663	1,205	0	41	44	0	0	44
Madison	15,868	7,643	4,010	45	1,635	1,757	0	0	1,757
Manatee	141,093	110,933	5,524	1603	2,020	4,965	0	0	4,965
Marion	267,033	149,007	5,585	39291	37,055	37,238	21,232	585	37,823
Martin	77,621	71,038	10,165	167	1,138	3,568	263	27	3,595
Monroe	90,174	48,106	8,067	205	221	5,988	2,306	283	6,271
Nassau	47,541	33,221	10,396	33	6,649	6,974	0	0	6,974
Okaloosa	100,727	84,025	10,235	151	5,559	7,931	0	0	7,931
Okeechobee	33,085	16,306	4,623	8	2,310	2,500	0	0	2,500
Orange	367,509	312,216	33,555	383	2,053	20,989	0	0	20,989
Osceola	149,286	112,276	8,429	1006	3	7,286	0	0	7,286
Palm Beach	436,963	392,436	22,512	179	15,527	13,433	8,186	967	14,400
Pasco	252,568	245,141	23,491	1111	530	19,130	0	0	19,130
Pinellas	434,384	406,913	3,801	15	144	2,184	0	0	2,184
Polk	308,683	222,889	35,359	104	1,136	21,553	0	0	21,553
Putnam	100,851	40,689	8,764	125	266	7,269	0	0	7,269
St. Johns	161,905	96,796	20,866	91	3,057	13,906	10,959	0	13,906
St. Lucie	153,137	108,869	1,770	8359	796	4,458	15,055	3,868	8,326
Santa Rosa	90,806	58,861	24,905	59	859	13,240	0	0	13,240
Sarasota	216,810	154,387	7,997	31	2,349	4,783	60,784	0	4,783
Seminole	170,499	146,092	12,965	75	7,041	8,514	0	0	8,514
Sumter	71,736	51,432	7,125	144	506	1,859	0	0	1,859
Suwannee	28,795	14,113	6,620	30	1	1,192	0	0	1,192
Taylor	18,841	9,950	10,892	39	18	3,017	0	0	3,017
Union	6,718	3,673	1,861	17	926	937	1,360	773	1,710
Volusia	487,658	295,259	34,501	355	159	18,131	0	0	18,131
Wakulla	24,870	12,708	2,450	2836	1,605	3,154	0	0	3,154
Walton	78,205	38,494	8,706	612	8	4,109	13,783	31	4,140
Washington	42,787	10,192	3,846	118	4	1,756	0	0	1,756

Table 4-6

Number of Known and Estimated Parcels with OSTDS or Sewer

- # of Parcels
- # of Improved parcels
- Total known sewer parcels for the Statewide Inventory
- Estimated number of sewer parcels using Inventory models
- Total number of sewer parcels, sum of known and estimated
- Total known OSTDS parcels for the Statewide Inventory
- Estimated number of OSTDS parcels using Inventory models
- Number of parcels for which wastewater treatment cannot be estimated
- Total number of OSTDS parcels, sum of known and estimated

County	# Parcels	# Improved Parcels	# Known Sewer	# Estimated Sewer	Total Sewer	# Known Septic	# Estimated Septic	# Not Estimated	Total OSTDS (number)
Florida	9,037,945	6,608,050	2,056,129	1,137,714	3,193,843	649,757	2,846,363	50,904	3,496,120
Alachua	99666	80,317	43,582	1,470	45,052	29,636	1,204	5,943	30,840
Baker	12316	8,245	1,552	507	2,059	1,488	4,759	130	6,247
Bay	117174	86,990	12,914	21,458	34,372	7,653	46,521	0	54,174
Bradford	14521	10,004	1,425	883	2,308	1,896	6,053	0	7,949
Brevard	293637	210,224	46,312	20,097	66,409	25,435	120,826	85	146,261
Broward	491278	420,678	205,969	146,653	352,622	8,468	62,061	4,808	70,529
Calhoun	10319	5,463	483	1,786	2,269	139	3,096	80	3,235
Charlotte	218401	97,937	30,023	8,909	38,932	35,243	21,325	6,931	56,568
Citrus	127838	65,700	134	34	168	17,436	49,291	0	66,727
Clay	83504	66,656	28,128	16,659	44,787	10,519	12,251	0	22,770
Collier	175775	97,498	5,407	11,774	17,181	6,404	75,130	0	81,534
Columbia	40408	25,286	2,115	22,796	24,911	5,988	15,105	0	21,093
Miami-Dade	551589	489,351	281,245	98,677	379,922	23,073	97,817	0	120,890
De Soto	19116	11,114	6	3	9	2,620	7,867	881	10,487
Dixie	17591	9,031	1	0	1	1,759	7,585	0	9,344
Duval	357366	312,400	141,421	105,800	247,221	15,290	52,828	0	68,118
Escambia	149188	123,033	55,060	29,412	84,472	20,175	20,363	0	40,538
Flagler	72960	42,255	273	1,449	1,722	2,442	36,269	0	38,711
Franklin	16040	6,784	164	874	1,038	563	5,321	0	5,884
Gadsden	26750	17,421	571	446	1,017	3,764	10,920	2,194	14,684
Gilchrist	14691	7,230	4	2	6	1,765	5,748	0	7,513
Glades	11211	5,549	4	3	7	1,142	4,506	0	5,648
Gulf	16700	8,978	730	517	1,247	1,797	6,026	368	7,823
Hamilton	14491	5,613	344	1,681	2,025	776	3,007	0	3,783
Hardee	14059	8,832	4	0	4	1,621	7,461	0	9,082
Hendry	35534	13,006	12	23	35	2,404	10,924	0	13,328
Hernando	115995	78,145	26,867	3,153	30,020	15,127	33,330	1,273	48,457
Highlands	97890	39,863	4,897	436	5,333	7,923	29,453	0	37,376
Hillsborough	469685	408,004	227,932	119,112	347,044	20,515	47,637	0	68,152
Holmes	15324	8,344	88	216	304	316	7,809	0	8,125
Indian River	77586	53,895	7,031	3,250	10,281	9,613	34,816	0	44,429
Jackson	39917	18,894	402	340	742	4,206	15,315	0	19,521
Jefferson	12685	6,392	7	0	7	2,165	4,572	0	6,737
Lafayette	6874	2,829	3	10	13	587	2,352	0	2,939
Lake	223070	151,439	27,948	19,299	47,247	20,388	86,522	0	106,910

County	# Parcels	# Improved Parcels	# Known Sewer	# Estimated Sewer	Total Sewer	# Known Septic	# Estimated Septic	# Not Estimated	Total OSTDS (number)
Florida	9,037,945	6,608,050	2,056,129	1,137,714	3,193,843	649,757	2,846,363	50,904	3,496,120
Lee	438587	238,982	19,495	5,658	25,153	68,079	155,759	0	223,838
Leon	107254	88,913	50,608	10,123	60,731	18,387	13,784	0	32,171
Levy	48672	20,427	6	12	18	4,556	16,319	0	20,875
Liberty	6130	2,663	1	0	1	44	2,621	0	2,665
Madison	15868	7,643	7	4	11	1,757	6,161	0	7,918
Manatee	141093	110,933	3	24	27	4,965	106,247	0	111,212
Marion	267033	149,007	2,930	2,990	5,920	37,823	108,783	0	146,606
Martin	77621	71,038	3,570	3,177	6,747	3,595	60,809	0	64,404
Monroe	90174	48,106	1,107	990	2,097	6,271	40,706	0	46,977
Nassau	47541	33,221	4,688	1,972	6,660	6,974	20,347	0	27,321
Okaloosa	100727	84,025	995	5,713	6,708	7,931	70,101	0	78,032
Okeechobee	33085	16,306	302	708	1,010	2,500	13,195	0	15,695
Orange	367509	312,216	54,890	42,392	97,282	20,989	196,505	0	217,494
Osceola	149286	112,276	12,067	70,274	82,341	7,286	23,419	0	30,705
Palm Beach	436963	392,436	250,004	82,000	332,004	14,400	49,149	0	63,549
Pasco	252568	245,141	1,921	2,320	4,241	19,130	221,780	0	240,910
Pinellas	434384	406,913	240,932	118,938	359,870	2,184	30,470	21,233	32,654
Polk	308683	222,889	19,519	15,023	34,542	21,553	168,585	0	190,138
Putnam	100851	40,689	419	868	1,287	7,269	32,796	0	40,065
St. Johns	161905	96,796	12,600	4,070	16,670	13,906	67,774	0	81,680
St. Lucie	153137	108,869	42,172	34,463	76,635	8,326	21,204	4,524	29,530
Santa Rosa	90806	58,861	9,642	8,302	17,944	13,240	31,184	0	44,424
Sarasota	216810	154,387	75,243	39,221	114,464	4,783	38,765	0	43,548
Seminole	170499	146,092	66,600	40,783	107,383	8,514	32,631	2,395	41,145
Sumter	71736	51,432	28,059	5,452	33,511	1,859	16,507	0	18,366
Suwannee	28795	14,113	29	4	33	1,192	13,068	0	14,260
Taylor	18841	9,950	4	0	4	3,017	7,439	0	10,456
Union	6718	3,673	0	0	0	1,710	2,202	0	3,912
Volusia	487658	295,259	1,908	1,579	3,487	18,131	274,325	59	292,456
Wakulla	24870	12,708	2,151	2,116	4,267	3,154	6,232	0	9,386
Walton	78205	38,494	1,193	805	1,998	4,140	32,937	0	37,077
Washington	42787	10,192	6	4	10	1,756	8,489	0	10,245

Table 4-7

Comparison of The Statewide Inventory estimate of the number of OSTDS with other estimates for Florida Counties

- # of Improved parcels
- Total improved parcels with sewer , sum of known and estimated
- Total improved parcels with OSTDS, sum of known and estimated
- DOH estimate of OSTDS, July 1, 2008
- CEHD estimate of OSTDS as provided from the Inventory survey
- Total improved parcels – total improved parcels with sewer

  These three values include all identified OSTDS parcels, including currently vacant ones and all estimated OSTDS parcel
- Low value estimate of OSTDS, probability threshold =0.75
- Mid value estimate of OSTDS, probability threshold = 0.50
- High value estimate of OSTDS, probability threshold = 0.25

County	# Parcels (improved)	Total Sewer (improved)	Total OSTDS (improved)	DOH Estimate	CEHD Estimate	Improved-Known Sewer	Low OSTDS (prob 0.75)	Total OSTDS (incl. vacant)	High OSDTD (prob 0.25)	Estimate Range % Total
Florida	6,608,050	3,129,708	3,446,132	2,661,072	2,292,775	3,478,342	3,317,152	3,496,120	3,652,276	9.6%
Alachua	80,317	44,718	29,656	40,432	31,000	35,599	30,633	30,840	30,937	1.0%
Baker	8,245	2,010	6,105	7,508	7,000	6,235	6,240	6,247	6,257	0.3%
Bay	86,990	33,622	53,368	35,445	30,000	53,368	52,797	54,174	69,680	31.2%
Bradford	10,004	2,281	7,723	9,995	1,500	7,723	7,864	7,949	8,002	1.7%
Brevard	210,224	65,705	144,434	89,984	80,000	144,519	129,948	146,261	149,671	13.5%
Broward	420,678	345,589	70,281	106,886	65,000	75,089	68,756	70,529	72,697	5.6%
Calhoun	5,463	2,229	3,154	5,178	NA	3,234	1,107	3,235	4,298	98.6%
Charlotte	97,937	37,924	53,082	42,078	44,026	60,013	52,524	56,568	60,632	14.3%
Citrus	65,700	145	65,555	58,914	55,000	65,555	66,721	66,727	66,729	0.0%
Clay	66,656	44,651	22,005	31,167	20,000	22,005	21,671	22,770	24,120	10.8%
Collier	97,498	16,274	81,224	44,141	44,000	81,224	81,380	81,534	86,071	5.8%
Columbia	25,286	24,887	20,399	23,877	NA	399	20,881	21,093	21,262	1.8%
Miami-Dade	489,351	369,795	119,556	212,708	250,000	119,556	109,824	120,890	134,473	20.4%
De Soto	11,114	8	10,225	10,314	15,000	11,106	10,487	10,487	10,490	0.0%
Dixie	9,031	0	9,031	7,417	15,000	9,031	9,344	9,344	9,344	0.0%
Duval	312,400	245,063	67,337	90,868	90,000	67,337	65,481	68,118	71,170	8.4%
Escambia	123,033	83,520	39,513	68,901	NA	39,513	36,970	40,538	49,974	32.1%
Flagler	42,255	1,638	38,449	5,877	6,000	40,617	38,686	38,711	38,860	0.4%
Franklin	6,784	1,005	5,779	5,281	NA	5,779	5,111	5,884	6,530	24.1%
Gadsden	17,421	977	14,250	16,617	NA	16,444	14,605	14,684	14,869	1.8%
Gilchrist	7,230	4	7,226	7,487	15,000	7,226	7,513	7,513	7,513	0.0%
Glades	5,549	7	5,542	5,057	8,500	5,542	5,647	5,648	5,648	0.0%
Gulf	8,978	1,186	7,424	6,716	5,000	7,792	7,663	7,823	7,933	3.5%
Hamilton	5,613	1,995	4,480	3,926	4,000	3,618	3,001	3,783	4,645	43.5%
Hardee	8,832	2	8,830	8,632	NA	8,830	9,085	9,082	9,085	0.0%
Hendry	13,006	30	12,976	10,099	10,600	12,976	13,317	13,328	13,344	0.2%
Hernando	78,145	29,366	47,506	54,200	54,818	48,779	47,922	48,457	49,206	2.6%
Highlands	39,863	3,146	36,717	36,063	35,000	36,717	36,825	37,376	37,528	1.9%
Hillsborough	408,004	341,007	66,997	106,542	120,000	66,997	62,374	68,152	73,783	16.7%
Holmes	8,344	293	8,051	8,898	8,332	8,051	8,084	8,125	8,126	0.5%
Indian River	53,895	10,146	43,749	36,495	36,744	43,749	44,226	44,429	45,717	3.4%
Jackson	18,894	724	18,170	17,107	20,000	18,170	19,521	19,521	19,534	0.1%
Jefferson	6,392	2	6,390	5,236	NA	6,390	6,710	6,737	6,737	0.4%
Lafayette	2,829	12	2,817	3,170	3,000	2,817	2,939	2,939	2,939	0.0%
Lake	151,439	45,295	106,144	75,482	82,500	106,144	104,455	106,910	113,983	8.9%

County	# Parcels (improved)	Total Sewer (improved)	Total OSTDS (improved)	DOH Estimate	CEHD Estimate	Improved-Known Sewer	Low OSTDS (prob 0.75)	Total OSTDS (incl. vacant)	High OSDTD (prob 0.25)	Estimate Range % Total
Florida	6,608,050	3,129,708	3,446,132	2,661,072	2,292,775	3,478,342	3,317,152	3,496,120	3,652,276	9.6%
Lee	238,982	24,449	214,533	129,575	134,100	214,533	222,265	223,838	224,152	0.8%
Leon	88,913	58,145	30,768	38,768	NA	30,768	32,025	32,171	33,912	5.9%
Levy	20,427	13	20,414	21,845	18,000	20,414	20,852	20,875	20,878	0.1%
Liberty	2,663	0	2,663	3,045	5,000	2,663	2,665	2,665	2,665	0.0%
Madison	7,643	8	7,635	7,205	4,500	7,635	7,910	7,918	7,922	0.2%
Manatee	110,933	27	110,906	36,257	12,000	110,906	111,206	111,212	111,221	0.0%
Marion	149,007	4,980	144,027	118,944	120,000	144,027	140,827	146,606	147,541	4.6%
Martin	71,038	6,695	64,343	28,002	10,000	64,343	35,748	64,404	65,413	46.1%
Monroe	48,106	2,058	46,048	25,486	23,000	46,048	46,518	46,977	47,446	2.0%
Nassau	33,221	6,451	26,770	20,776	NA	26,770	26,581	27,321	27,330	2.7%
Okaloosa	84,025	6,614	77,411	31,643	30,000	77,411	77,677	78,032	78,513	1.1%
Okeechobee	16,306	838	15,468	12,350	12,500	15,468	15,189	15,695	16,403	7.7%
Orange	312,216	95,480	216,736	105,587	113,000	216,736	205,962	217,494	233,495	12.7%
Osceola	112,276	82,054	30,222	24,583	10,000	30,222	30,138	30,705	46,545	53.4%
Palm Beach	392,436	329,576	62,860	79,960	100,000	62,860	62,367	63,549	65,838	5.5%
Pasco	245,141	4,241	240,900	70,399	40,000	240,900	233,556	240,910	241,378	3.2%
Pinellas	406,913	353,030	32,650	23,835	5,000	53,883	24,887	32,654	35,989	34.0%
Polk	222,889	33,867	189,022	117,747	150,000	189,022	159,599	190,138	199,975	21.2%
Putnam	40,689	1,273	39,416	39,508	35,000	39,416	40,045	40,065	40,080	0.1%
St. Johns	96,796	16,162	80,634	28,760	NA	80,634	77,460	81,680	82,636	6.3%
St. Lucie	108,869	75,108	29,237	43,886	37,532	33,761	28,203	29,530	35,854	25.9%
Santa Rosa	58,861	16,453	42,408	43,538	NA	42,408	39,019	44,424	48,355	21.0%
Sarasota	154,387	111,780	42,607	80,014	43,223	42,607	41,581	43,548	54,167	28.9%
Seminole	146,092	102,861	40,836	39,773	49,000	43,231	37,321	41,145	44,925	18.5%
Sumter	51,432	33,193	18,239	19,406	14,600	18,239	18,342	18,366	18,409	0.4%
Suwannee	14,113	21	14,092	17,241	6,000	14,092	13,212	14,260	14,262	7.4%
Taylor	9,950	1	9,949	8,886	5,000	9,949	10,456	10,456	10,456	0.0%
Union	3,673	0	3,673	4,465	3,300	3,673	3,912	3,912	3,912	0.0%
Volusia	295,259	3,422	291,778	98,428	100,000	291,837	291,999	292,456	292,608	0.2%
Wakulla	12,708	3,655	9,053	10,698	15,000	9,053	8,364	9,386	10,877	26.8%
Walton	38,494	1,990	36,504	21,630	20,000	36,504	30,712	37,077	37,085	17.2%
Washington	10,192	7	10,185	10,134	20,000	10,185	10,242	10,245	10,247	0.0%

Table 4-8

Grouping of Counties by Characteristics that affect Estimations and Measures of Reliability

- Number of large (MGD $\geq$ 0.5)
- Number of small WWTF (MGD < 0.5)
- Number of improved parcels
- Number of known sewer parcels
- Number of known OSTDS parcels
- Number of variables in categories of self, neighbor and group that were retained in the final model

Measures of model quality

- % of parcels with known wastewater treatments that the model correctly predicted
- % of parcels known to be OSTDS that the model predicted to be sewered
- Range from low to high estimate of OSTDS (From Table 4-7) as a percentage of the mid value estimate (standardized for comparison)
- Descriptive label of model quality

County	Large WWTF	Small WWTF	Known			Variables		Measures of Model Quality			
Group A	<= 3	<= 10	Improved Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range % of Midpoint	Reliability
Baker	1	3	8,245	1,552	1,488	1	3	99.5%	0.6%	0.3%	good
Bradford	2	3	10,004	1,425	1,896	0	4	97.4%	1.7%	1.7%	good
Calhoun	1	0	5,463	483	139	0	3	90.0%	12.5%	98.6%	low number, poor
Dixie	0	3	9,031	1	1,759	1	0	99.9%	0.0%	0.0%	low number, biased
Franklin	2	7	6,784	164	563	1	1	98.3%	1.4%	24.1%	low number, good
Gadsden	2	8	17,421	571	3,764	0	4	99.3%	0.4%	1.8%	low number, biased
Gilchrist	0	5	7,230	4	1,765	0	1	99.8%	0.1%	0.0%	low number, biased
Gulf	1	5	8,978	730	1,797	1	4	95.9%	2.5%	3.5%	biased
Hamilton	1	8	5,613	344	776	1	1	93.1%	4.9%	43.5%	low number, good
Holmes	1	3	8,344	88	316	0	2	98.5%	0.6%	0.5%	low number
Jackson	3	5	18,894	402	4,206	0	3	99.2%	0.6%	0.1%	low number, biased
Jefferson	1	3	6,392	7	2,165	0	1	99.7%	0.0%	0.4%	low number, biased
Lafayette	0	2	2,829	3	587	0	1	99.8%	0.2%	0.0%	low number, biased
Liberty	0	2	2,663	1	44	0	1	97.8%	0.0%	0.0%	low number
Madison	1	5	7,643	7	1,757	0	2	99.5%	0.1%	0.2%	low number, biased
Suwannee	1	8	14,113	29	1,192	1	1	99.7%	0.1%	7.4%	low number, biased
Taylor	1	4	9,950	4	3,017	1	0	99.9%	0.0%	0.0%	low number, biased
Union	1	0	3,673	0	1,710	1	0	100.0%	0.0%	0.0%	low number, biased
Wakulla	1	5	12,708	2,151	3,154	1	2	80.1%	16.0%	26.8%	good
Washington	1	5	10,192	6	1,756	2	0	99.7%	0.0%	0.0%	low number, biased

County	Large WWTF	Small WWTF	Known			Variables		Measures of Model Quality			
Group B	<= 5	10 <= 50	Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range, % of Midpoint	Reliability
Alachua	4	16	80,317	43,582	29,636	2	4	93.0%	11.8%	1.0%	good
Bay	7	7	86,990	12,914	7,653	2	4	98.3%	3.2%	31.2%	good
Clay	7	17	66,656	28,128	10,519	2	1	92.7%	18.9%	10.8%	good
Collier	6	16	97,498	5,407	6,404	1	2	99.7%	0.4%	5.8%	good
Escambia	4	6	123,033	55,060	20,175	3	2	79.8%	65.8%	32.1%	poor
Indian River	5	7	53,895	7,031	9,613	0	1	94.1%	8.1%	3.4%	good
Leon	4	8	88,913	50,608	18,387	1	3	99.2%	1.9%	5.9%	biased, good
Manatee	5	4	110,933	3	4,965	2	0	99.9%	0.0%	0.0%	low number, biased
St. Johns	10	17	96,796	12,600	13,906	1	3	99.1%	1.4%	6.3%	good
Santa Rosa	6	6	58,861	9,642	13,240	0	4	82.0%	18.0%	21.0%	good
Seminole	11	13	146,092	66,600	8,514	3	1	93.3%	44.1%	18.5%	biased, poor
Walton	5	6	38,494	1,193	4,140	1	3	97.6%	0.1%	17.2%	biased
Group C	4 <= 20	5 <= 20	Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range, % of Midpoint	Reliability
Charlotte	4	23	97,937	30,023	35,243	2	4	79.2%	15.2%	14.3%	good
Columbia	1	19	25,286	2,115	5,988	2	4	97.7%	0.0%	1.8%	fair
De Soto	2	18	11,114	6	2,620	0	2	99.8%	0.1%	0.0%	low number, biased
Flagler	4	14	42,255	273	2,442	2	2	99.0%	0.9%	0.4%	low number, biased
Glades	0	21	5,549	4	1,142	2	0	99.6%	0.1%	0.0%	low number, biased
Hardee	1	13	8,832	4	1,621	1	0	99.8%	0.0%	0.0%	low number, biased
Hendry	1	14	13,006	12	2,404	2	2	99.8%	0.0%	0.2%	low number, biased
Highlands	3	59	39,863	4,897	7,923	0	2	99.6%	0.4%	1.9%	good
Levy	0	13	20,427	6	4,556	2	1	99.9%	0.0%	0.1%	low number, biased
Nassau	3	13	33,221	4,688	6,974	2	2	99.1%	0.6%	2.7%	fair
Okeechobee	1	17	16,306	302	2,500	1	1	89.2%	1.9%	7.7%	biased, good
Putnam	1	26	40,689	419	7,269	1	2	99.6%	0.2%	0.1%	biased, good
Sumter	4	29	51,432	28,059	1,859	1	2	99.4%	0.6%	0.4%	biased, good

County	Large WWTF	Small WWTF	Known			Variables		Measures of Model Quality			
Group D	5 <= 20	21 <= 60	Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range, % of Midpoint	Reliability
Brevard	17	39	210,224	46,312	25,435	1	4	91.1%	10.0%	13.5%	good
Citrus	6	60	65,700	134	17,436	1	1	99.2%	0.8%	0.0%	low number, biased
Miami-Dade	4	21	489,351	281,245	23,073	2	4	94.2%	65.1%	20.4%	fair
Hernando	7	24	78,145	26,867	15,127	1	4	98.6%	0.2%	2.6%	good
Lee	15	57	238,982	19,495	68,079	2	3	99.1%	0.6%	0.8%	biased, good
Martin	7	29	71,038	3,570	3,595	2	3	97.9%	3.0%	46.1%	good
Orange	11	39	312,216	54,890	20,989	0	3	97.4%	5.0%	12.7%	good
Osceola	10	29	112,276	12,067	7,286	0	4	99.1%	0.7%	53.4%	good
Palm Beach	10	44	392,436	250,004	14,400	0	4	99.0%	14.3%	5.5%	biased, fair
Pasco	12	59	245,141	1,921	19,130	0	4	98.1%	0.3%	3.2%	biased, fair
St. Lucie	7	25	108,869	42,172	8,326	3	2	90.6%	48.9%	25.9%	poor
Sarasota	13	34	154,387	75,243	4,783	1	4	97.2%	36.9%	28.9%	biased, poor

Group E	mixed	>=90	Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range, % of Midpoint	Reliability
Hillsborough	10	112	408,004	227,932	20,515	1	3	96.3%	32.6%	16.7%	biased, poor
Lake	11	103	151,439	27,948	20,388	1	3	97.9%	29.6%	8.9%	fair
Marion	9	117	149,007	2,930	37,823	1	4	99.2%	0.3%	4.6%	biased, fair
Monroe	2	228	48,106	1,107	6,271	1	2	99.0%	0.1%	2.0%	biased, fair
Polk	22	133	222,889	19,519	21,553	1	4	99.1%	0.5%	21.2%	good
Volusia	13	92	295,259	1,908	18,131	1	4	99.7%	0.1%	0.2%	biased, fair

Group F	5 <= 20	<= 5	Parcels	Sewer	OSTDS	self	group	% Correct	% OSTDS Wrong	Range, % of Midpoint	Reliability
Broward	15	1	420,678	205,969	8,468	4	4	97.9%	47.7%	5.6%	biased, poor
Duval	16	9	312,400	141,421	15,290	1	4	97.4%	17.5%	8.4%	biased, fair
Okaloosa	12	6	84,025	995	7,931	0	4	99.9%	0.1%	1.1%	biased, fair
Pinellas	18	5	406,913	240,932	2,184	1	4	99.5%	40.5%	34.0%	biased, poor

Table 4-9

Details of Modeling Results

Variables used for each county model indicated with "Y"

- Percent of parcels in each taxing authority category with OSTDS
- Percent of parcels in each land use category with OSTDS
- Percent of parcels in each neighborhood code with OSTDS (DOR field)
- Percent of parcels in lot size class categories with OSTDS
- Year structure built (DOR field)
- Number of buildings on parcel (DOR field)
- Total square feet of structures on parcel (DOR field)
- Parcel size in acres (DOR field)
- AIC – Akaike's information criterion, a measure of the reduction in model explanatory power when adding or deleting independent variables or interaction terms
- Number of parcels (with known wastewater treatment) used in the model
- Percent of total parcels that the model correctly classified
- Percent of total OSTDS parcels that the model incorrectly classified
- Number of vacant parcels
- Number of estimated OSTDS parcels
- Number of estimated sewer parcels
- Number of parcels for which an estimation cannot be calculated
- Number of known OSTDS parcels
- Number of known sewer parcels
- Number of known sewer parcels that are not improved (vacant)
- Number of known OSTDS parcels that are not improved (vacant)
- Number of known improved OSTDS parcels
- Number of known improved sewer parcels
- Total number of OSTDS when probability threshold = 0.25
- Total number of OSTDS when probability threshold = 0.50
- Total number of OSTS when probability threshold = 0.75
- Range from high to low estimate of OSTDS as a percentage of the mid value estimate
- Total number of parcels for which a wastewater treatment was estimated
- Total number of parcels for which a wastewater treatment was known
- Total number of improved parcels with OSTDS
- Total number of improved parcels

COUNTY	perSptcTA	perSptcLUT	perSptcNBR	perSptcAcres	yrblt	Nbldg	totsqft	acres	AIC	N modeled	%Correct	%septicwrong
Florida												
Alachua	Y	Y	Y	Y	Y	Y			27,918.0	71,133	93.0%	11.8%
Baker	Y	Y		Y	Y				141.9	2,844	99.5%	0.6%
Bay	Y		Y	Y		Y	Y		1,854.6	20,528	98.3%	3.2%
Bradford	Y	Y	Y	Y					649.6	3,313	97.4%	1.7%
Brevard	Y	Y	Y	Y			Y		30,827.0	71,461	91.1%	10.0%
Broward	Y	Y		Y	Y	Y	Y	Y	34,923.0	204,073	97.9%	47.7%
Calhoun	Y	Y	Y						280.4	605	90.0%	12.5%
Charlotte	Y	Y	Y	Y		Y	Y		49,221.0	60,042	79.2%	15.2%
Citrus		Y					Y		1,372.5	17,570	99.2%	0.8%
Clay		Y		Y			Y		16,735.0	38,627	92.7%	18.9%
Collier	Y	Y					Y		404.0	11,810	99.7%	0.4%
Columbia	Y	Y	Y	Y		Y	Y		964.2	8,095	97.7%	0.02%
MiamiDade	Y	Y	Y	Y		Y	Y		101,837.0	300,874	94.2%	65.1%
DeSoto		Y	Y						26.3	2,623	99.8%	0.1%
Dixie								Y	20.0	1,760	99.9%	0.0%
Duval	Y	Y	Y	Y				Y	24,757.0	156,711	97.4%	17.5%
Escambia		Y		Y			Y	Y	71,155.0	75,716	79.8%	65.8%
Flagler			Y	Y	Y		Y		162.8	2,274	99.0%	0.9%
Franklin			Y					Y	179.5	727	98.3%	1.4%
Gadsden	Y	Y	Y	Y					224.5	4,332	99.3%	0.4%
Gilchrist		Y							37.6	1,763	99.8%	0.1%
Glades				Y		Y			45.8	1,146	99.6%	0.1%
Gulf	Y	Y	Y	Y	Y				584.8	1,999	95.9%	2.5%
Hamilton		Y						Y	691.6	1,117	93.1%	4.9%
Hardee								Y	57.8	1,625	99.8%	0.0%
Hendry	Y	Y				Y		Y	58.8	2,416	99.8%	0.04%
Hernando	Y	Y	Y	Y	Y				3,976.9	39,951	98.6%	0.2%
Highlands		Y	Y						386.6	12,778	99.6%	0.4%
Hillsborough	Y		Y	Y		Y			51,933.0	248,447	96.3%	32.6%
Holmes	Y	Y							68.0	404	98.5%	0.6%
IndianRiver	Y	Y	Y					Y	5,380.0	16,644	94.1%	8.1%
Jackson	Y	Y	Y						280.6	4,608	99.2%	0.6%
Jefferson		Y							35.7	2,158	99.7%	0.00%
Lafayette		Y							8.5	590	99.8%	0.2%
Lake	Y		Y	Y			Y		5,789.6	48,336	97.9%	29.6%

COUNTY	perSptcTA	perSptcLUT	perSptcNBR	perSptcAcres	yrblt	Nbldg	totsqft	acres	AIC	N modeled	%Correct	%septicwrong
Florida												
Lee	Y		Y	Y		Y		Y	4,831.6	87,574	99.1%	0.6%
Leon	Y	Y	Y				Y		4,773.8	68,410	99.2%	1.9%
Levy		Y					Y	Y	43.4	4,552	99.9%	0.00%
Liberty	Y								13.5	45	97.8%	0.00%
Madison		Y		Y					74.4	1,761	99.5%	0.1%
Manatee						Y		Y	44.5	4,968	99.9%	0.0%
Marion	Y	Y	Y	Y			Y		2,157.5	40,180	99.2%	0.3%
Martin	Y		Y	Y			Y	Y	891.5	7,165	97.9%	3.0%
Monroe	Y		Y				Y		568.7	7,378	99.0%	0.1%
Nassau	Y		Y				Y		821.6	11,662	99.1%	0.6%
Okaloosa	Y	Y	Y	Y					93.9	8,876	99.9%	0.1%
Okeechobee		Y						Y	1,504.1	2,802	89.2%	1.9%
Orange	Y		Y	Y					12,329.0	75,879	97.4%	5.0%
Osceola	Y	Y	Y	Y					1,243.0	19,287	99.1%	0.7%
PalmBeach	Y	Y	Y	Y					19,285.0	263,974	99.0%	14.3%
Pasco	Y	Y		Y					2,563.0	21,041	98.1%	0.3%
Pinellas	Y	Y	Y	Y		Y			7,527.4	241,127	99.5%	40.5%
Polk	Y	Y	Y	Y		Y			2,735.5	40,959.0	99.1%	0.5%
Putnam	Y	Y				Y			367.6	7,675	99.6%	0.2%
StJohns		Y	Y	Y		Y			1,367.1	26,355	99.1%	1.4%
StLucie			Y	Y	Y	Y	Y		22,511.0	48,187	90.6%	48.9%
SantaRosa	Y	Y	Y	Y					16,514.0	22,823	82.0%	18.0%
Sarasota	Y	Y	Y	Y			Y		12,253.0	79,947	97.2%	36.9%
Seminole	Y			Y	Y		Y		27,131.0	69,427	93.3%	44.1%
Sumter	Y		Y				Y		982.6	29,908	99.4%	0.6%
Suwannee				Y				Y	172.2	1,221	99.7%	0.1%
Taylor								Y	59.5	3,021	99.9%	0.00%
Union								Y	4.0	1,710	100.0%	0.0%
Volusia	Y	Y	Y	Y		Y			395.9	20,033	99.7%	0.1%
Wakulla		Y		Y			Y		4,569.0	5,302	80.1%	16.0%
Walton	Y		Y	Y			Y		744.5	5,333	97.6%	0.1%
Washington						Y		Y	77.9	1,762	99.7%	0.00%

COUNTY	NULL (vacant no WW)	EstSeptic	EstSewer	Not Estimated	Known Septic	Known Sewer	Known Vac Septic	Known Vac Sewer	Known Imp Septic	Known Imp Sewer
Florida	2,850,379	2,846,363	1,137,714	50,904	649,757	2,056,129	50,850	64,135	598,907	1,991,994
Alachua	17,831	1,204	1,470	5,943	29,636	43,582	1,184	334	28,452	43,248
Baker	3,880	4,759	507	130	1,488	1,552	142	49	1,346	1,503
Bay	28,628	46,521	21,458	0	7,653	12,914	806	750	6,847	12,164
Bradford	4,264	6,053	883	0	1,896	1,425	226	27	1,670	1,398
Brevard	80,882	120,826	20,097	85	25,435	46,312	1,827	704	23,608	45,608
Broward	63,319	62,061	146,653	4,808	8,468	205,969	248	7,033	8,220	198,936
Calhoun	4,735	3,096	1,786	80	139	483	81	40	58	443
Charlotte	115,970	21,325	8,909	6,931	35,243	30,023	3,486	1,008	31,757	29,015
Citrus	60,943	49,291	34	0	17,436	134	1,172	23	16,264	111
Clay	15,947	12,251	16,659	0	10,519	28,128	765	136	9,754	27,992
Collier	77,060	75,130	11,774	0	6,404	5,407	310	907	6,094	4,500
Columbia	14,404	15,105	22,796	0	5,988	2,115	694	24	5,294	2,091
MiamiDade	50,777	97,817	98,677	0	23,073	281,245	1,334	10,127	21,739	271,118
DeSoto	7,739	7,867	3	881	2,620	6	262	1	2,358	5
Dixie	8,246	7,585	0	0	1,759	1	313	1	1,446	0
Duval	42,027	52,828	105,800	0	15,290	141,421	781	2,158	14,509	139,263
Escambia	24,178	20,363	29,412	0	20,175	55,060	1,025	952	19,150	54,108
Flagler	30,359	36,269	1,449	0	2,442	273	262	84	2,180	189
Franklin	9,086	5,321	874	0	563	164	105	33	458	131
Gadsden	8,855	10,920	446	2,194	3,764	571	434	40	3,330	531
Gilchrist	7,172	5,748	2	0	1,765	4	287	2	1,478	2
Glades	5,556	4,506	3	0	1,142	4	106	0	1,036	4
Gulf	7,262	6,026	517	368	1,797	730	399	61	1,398	669
Hamilton	8,683	3,007	1,681	0	776	344	165	30	611	314
Hardee	4,973	7,461	0	0	1,621	4	252	2	1,369	2
Hendry	22,171	10,924	23	0	2,404	12	352	5	2,052	7
Hernando	36,245	33,330	3,153	1,273	15,127	26,867	951	654	14,176	26,213
Highlands	55,181	29,453	436	0	7,923	4,897	659	2,187	7,264	2,710
Hillsborough	54,489	47,637	119,112	0	20,515	227,932	1,155	6,037	19,360	221,895
Holmes	6,895	7,809	216	0	316	88	74	11	242	77
IndianRiver	22,876	34,816	3,250	0	9,613	7,031	680	135	8,933	6,896
Jackson	19,654	15,315	340	0	4,206	402	1,351	18	2,855	384
Jefferson	5,941	4,572	0	0	2,165	7	347	5	1,818	2

COUNTY	NULL (vacant no WW)	EstSeptic	EstSewer	Not Estimated	Known Septic	Known Sewer	Known Vac Septic	Known Vac Sewer	Known Imp Septic	Known Imp Sewer
Florida	2,850,379	2,846,363	1,137,714	50,904	649,757	2,056,129	50,850	64,135	598,907	1,991,994
Lafayette	3,922	2,352	10	0	587	3	122	1	465	2
Lake	68,913	86,522	19,299	0	20,388	27,948	766	1,952	19,622	25,996
Lee	189,596	155,759	5,658	0	68,079	19,495	9,305	704	58,774	18,791
Leon	14,352	13,784	10,123	0	18,387	50,608	1,403	2,586	16,984	48,022
Levy	27,779	16,319	12	0	4,556	6	461	5	4,095	1
Liberty	3,464	2,621	0	0	44	1	2	1	42	0
Madison	7,939	6,161	4	0	1,757	7	283	3	1,474	4
Manatee	29,854	106,247	24	0	4,965	3	306	0	4,659	3
Marion	114,507	108,783	2,990	0	37,823	2,930	2,579	940	35,244	1,990
Martin	6,470	60,809	3,177	0	3,595	3,570	61	52	3,534	3,518
Monroe	41,100	40,706	990	0	6,271	1,107	929	39	5,342	1,068
Nassau	13,560	20,347	1,972	0	6,974	4,688	551	209	6,423	4,479
Okaloosa	15,987	70,101	5,713	0	7,931	995	621	94	7,310	901
Okeechobee	16,380	13,195	708	0	2,500	302	227	172	2,273	130
Orange	52,733	196,505	42,392	0	20,989	54,890	758	1,802	20,231	53,088
Osceola	36,240	23,419	70,274	0	7,286	12,067	483	287	6,803	11,780
PalmBeach	41,410	49,149	82,000	0	14,400	250,004	689	2,428	13,711	247,576
Pasco	7,417	221,780	2,320	0	19,130	1,921	10	0	19,120	1,921
Pinellas	20,627	30,470	118,938	21,233	2,184	240,932	4	6,840	2,180	234,092
Polk	84,003	168,585	15,023	0	21,553	19,519	1,116	675	20,437	18,844
Putnam	594,999	32,796	868	0	7,269	419	649	14	6,620	405
StJohns	63,555	67,774	4,070	0	13,906	12,600	1,046	508	12,860	12,092
StLucie	42,448	21,204	34,463	4,524	8,326	42,172	293	1,527	8,033	40,645
SantaRosa	28,438	31,184	8,302	0	13,240	9,642	2,016	1,491	11,224	8,151
Sarasota	58,798	38,765	39,221	0	4,783	75,243	941	2,684	3,842	72,559
Seminole	19,576	32,631	40,783	2,395	8,514	66,600	309	4,522	8,205	62,078
Sumter	19,859	16,507	5,452	0	1,859	28,059	127	318	1,732	27,741
Suwannee	14,503	13,068	4	0	1,192	29	168	12	1,024	17
Taylor	8,381	7,439	0	0	3,017	4	507	3	2,510	1
Union	2,806	2,202	0	0	1,710	0	239	0	1,471	0
Volusia	191,656	274,325	1,579	59	18,131	1,908	678	65	17,453	1,843
Wakulla	11,217	6,232	2,116	0	3,154	2,151	333	612	2,821	1,539
Walton	39,130	32,937	805	0	4,140	1,193	573	8	3,567	1,185
Washington	32,532	8,489	4	0	1,756	6	60	3	1,696	3

COUNTY	Total OSTDS prob >=0.25	Total OSTDS prob >= 0.5	Total OSTDS prob >= 0.75	Differnce 75%-25% of Median	sum OSTDS prob >=0.5	Total Parcels Estimated WWT	Total Parcels Known WWT	Total OSTDS Improved Only	Total Improved
Florida	3,652,276	3,496,120	3,317,152	0	3,357,576	3,984,077	2,705,886	3,445,270	6,608,050
Alachua	30,937	30,840	30,633	0	30,726	2,674	73,218	29,656	80,317
Baker	6,257	6,247	6,240	0	6,211	5,266	3,040	6,105	8,245
Bay	69,680	54,174	52,797	0	52,061	67,979	20,567	53,368	86,990
Bradford	8,002	7,949	7,864	0	7,746	6,936	3,321	7,723	10,004
Brevard	149,671	146,261	129,948	0	135,812	140,923	71,747	144,434	210,224
Broward	72,697	70,529	68,756	0	66,778	208,714	214,437	70,281	420,678
Calhoun	4,298	3,235	1,107	1	2,234	4,882	622	3,154	5,463
Charlotte	60,632	56,568	52,524	0	54,338	30,234	65,266	53,082	97,937
Citrus	66,729	66,727	66,721	0	66,303	49,325	17,570	65,555	65,700
Clay	24,120	22,770	21,671	0	21,747	28,910	38,647	22,005	66,656
Collier	86,071	81,534	81,380	0	78,596	86,904	11,811	81,224	97,498
Columbia	21,262	21,093	20,881	0	20,830	37,901	8,103	20,399	25,286
MiamiDade	134,473	120,890	109,824	0	111,949	196,494	304,318	119,556	489,351
DeSoto	10,490	10,487	10,487	0	10,485	7,870	2,626	10,225	11,114
Dixie	9,344	9,344	9,344	0	9,338	7,585	1,760	9,031	9,031
Duval	71,170	68,118	65,481	0	64,959	158,628	156,711	67,337	312,400
Escambia	49,974	40,538	36,970	0	37,516	49,775	75,235	39,513	123,033
Flagler	38,860	38,711	38,686	0	38,478	37,718	2,715	38,449	42,255
Franklin	6,530	5,884	5,111	0	5,444	6,195	727	5,779	6,784
Gadsden	14,869	14,684	14,605	0	14,573	11,366	4,335	14,250	17,421
Gilchrist	7,513	7,513	7,513	0	7,505	5,750	1,769	7,226	7,230
Glades	5,648	5,648	5,647	0	5,637	4,509	1,146	5,542	5,549
Gulf	7,933	7,823	7,663	0	7,439	6,543	2,527	7,424	8,978
Hamilton	4,645	3,783	3,001	0	3,371	4,688	1,120	3,618	5,613
Hardee	9,085	9,082	9,085	0	9,065	7,461	1,625	8,830	8,832
Hendry	13,344	13,328	13,317	0	13,296	10,947	2,416	12,976	13,006
Hernando	49,206	48,457	47,922	0	47,801	36,483	41,994	47,506	78,145
Highlands	37,528	37,376	36,825	0	36,758	29,889	12,820	36,717	39,863
Hillsborough	73,783	68,152	62,374	0	64,524	166,749	248,447	66,997	408,004
Holmes	8,126	8,125	8,084	0	7,974	8,025	404	8,051	8,344
IndianRiver	45,717	44,429	44,226	0	43,407	38,066	16,644	43,749	53,895
Jackson	19,534	19,521	19,521	0	19,482	15,655	4,608	18,170	18,894
Jefferson	6,737	6,737	6,710	0	6,724	4,572	2,172	6,390	6,392

COUNTY	Total OSTDS prob >=0.25	Total OSTDS prob >= 0.5	Total OSTDS prob >= 0.75	Differnce 75%-25% of Median	sum OSTDS prob >=0.5	Total Parcels Estimated WWT	Total Parcels Known WWT	Total OSTDS Improved Only	Total Improved
Florida	3,652,276	3,496,120	3,317,152	0	3,357,576	3,984,077	2,705,886	3,445,270	6,608,050
Lafayette	2,939	2,939	2,939	0	2,939	2,362	590	2,817	2,829
Lake	113,983	106,910	104,455	0	104,858	105,821	48,336	106,144	151,439
Lee	224,152	223,838	222,265	0	221,997	161,417	87,574	214,533	238,982
Leon	33,912	32,171	32,025	0	32,001	23,907	68,995	30,768	88,913
Levy	20,878	20,875	20,852	0	20,858	16,331	4,562	20,414	20,427
Liberty	2,665	2,665	2,665	0	2,614	2,621	45	2,663	2,663
Madison	7,922	7,918	7,910	0	7,897	6,165	1,764	7,635	7,643
Manatee	111,221	111,212	111,206	0	111,155	106,271	4,968	110,906	110,933
Marion	147,541	146,606	140,827	0	143,368	111,773	40,753	144,027	149,007
Martin	65,413	64,404	35,748	0	53,359	63,986	7,165	64,343	71,038
Monroe	47,446	46,977	46,518	0	45,452	41,696	7,378	46,048	48,106
Nassau	27,330	27,321	26,581	0	26,346	22,319	11,662	26,770	33,221
Okaloosa	78,513	78,032	77,677	0	77,445	75,814	8,926	77,411	84,025
Okeechobee	16,403	15,695	15,189	0	14,870	13,903	2,802	15,468	16,306
Orange	233,495	217,494	205,962	0	201,703	238,897	75,879	216,736	312,216
Osceola	46,545	30,705	30,138	1	30,136	93,693	19,353	30,222	112,276
PalmBeach	65,838	63,549	62,367	0	62,556	131,149	264,404	62,860	392,436
Pasco	241,378	240,910	233,556	0	230,369	224,100	21,051	240,900	245,141
Pinellas	35,989	32,654	24,887	0	28,466	149,408	243,116	32,650	406,913
Polk	199,975	190,138	159,599	0	172,550	183,608	41,072	189,022	222,889
Putnam	40,080	40,065	40,045	0	39,957	33,664	7,688	39,416	40,689
StJohns	82,636	81,680	77,460	0	77,682	71,844	26,506	80,634	96,796
StLucie	35,854	29,530	28,203	0	28,811	55,667	50,498	29,237	108,869
SantaRosa	48,355	44,424	39,019	0	41,783	39,486	22,882	42,408	58,861
Sarasota	54,167	43,548	41,581	0	41,809	77,986	80,026	42,607	154,387
Seminole	44,925	41,145	37,321	0	38,941	73,414	75,114	40,836	146,092
Sumter	18,409	18,366	18,342	0	17,886	21,959	29,918	18,239	51,432
Suwannee	14,262	14,260	13,212	0	13,773	13,072	1,221	14,092	14,113
Taylor	10,456	10,456	10,456	0	10,447	7,439	3,021	9,949	9,950
Union	3,912	3,912	3,912	0	3,912	2,202	1,710	3,673	3,673
Volusia	292,608	292,456	291,999	0	291,438	275,904	20,039	291,778	295,259
Wakulla	10,877	9,386	8,364	0	8,606	8,348	5,305	9,053	12,708
Walton	37,085	37,077	30,712	0	32,268	33,742	5,333	36,504	38,494
Washington	10,247	10,245	10,242	0	10,218	8,493	1,762	10,185	10,192

9.2 Acronyms

CEHD	County Environmental Health Director
CHD	County Health Department
CENTRAX	Comprehensive Environmental Health Tracking System
EHDB	Environmental Health Database (aka Rehost)
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
GIS	Graphical Information Systems
OSTDS	Onsite Sewage Treatment and Disposal Systems
WWTF	Wastewater Treatment Facility

9.3 Database Description

Description of the tables in the Statewide Inventory Database is provided in the first 5 pages. It is followed by a pictoral layout of the database (2 pages) and then by SQL views, which are examples of how the database appears.

Table: parcels

Description:
The table contains the attributes of the tax parcel records including owner, location, size and characteristics. The wastewater method and source are included with probabilities, if assigned.

Fields:

id	long	Primary Key
tax_id	varchar(30)	County Specific Tax Identification Number
county_id	integer	Foreign Key - County ID
landuse_id	integer	Foreign Key - Links to landuse table to get description.
number_residential_units	integer	Total number of residential units on property.
square_foot	long	Square Footage of property.
total_area	long	Total Square Footage of Fixed Improvements
number_buildings	integer	Number of Buildings on Property
owner	varchar(30)	Owner of Record for Property
owner_address1	varchar(40)	Owner mailing address line 1
owner_address2	varchar(40)	Owner mailing address line 2
owner_city	varchar(40)	Owner mailing address - city
owner_state	varchar(25)	Owner mailing address - state or country
owner_zip_code	varchar(5)	Owner mailing zip code
short_legal	varchar(30)	Abbreviated Description of Property
plss_township	varchar(5)	Public Land Survey System - Township
plss_range	varchar(5)	Public Land Survey System - Range
plss_section	varchar(5)	Public Land Survey System - Section
physical_address1	varchar(40)	Physical Address of property - line 1
physical_address2	varchar(40)	Physical Address of property - line 2
physical_city	varchar(40)	Physical City of property
physical_zip_code	varchar(5)	Physical Zip Code of property
alternate_key	varchar(30)	Alternate Key for county - secondary Tax ID
state_parcel_id	varchar(30)	State specific parcel ID
improved	bit	Yes/No (1 or 0) if the parcel is considered improved

id	long	Primary Key
wastewater_method	varchar(50)	Method for wastewater disposal - septic, sewer, estimate or NA
source	varchar(50)	Source for determining wastewater method (DEP Permitted Facility, EHDB, CHD or Estimate)
septic_probability	double	Probability calculated that parcel has an active septic system 0 = known sewer parcel values > 0 and <1 = estimated probability of OSTDS 1 = known OSTDS parcel -9 = undeveloped parcels, no probability estimated -8 = no probability can be estimated, missing data
acreage	double	Mapped acreage of property
longitude	double	NAD83 Longitude of Parcel Centroid
latitude	double	NAD83 Latitude of Parcel Centroid

Table: septic

Description:
The table contains the records obtained from the County Health Department legacy databases. Information from the submitted databases are added to this table and linked to the parcels table using the parcel_id field.

Fields:

Column	Type	Description
id	long	Primary Key - Autonumber
parcel_id	long	Foreign Key links to parcels table ID field.
tax_id	varchar(30)	Tax Parcel number provided by County.
county_id	long	Foreign Key - Links to county table ID field.
contact_id	integer	Foreign Key - Links to county_contacts table ID field.
county_permit_number	varchar(50)	Permit number assigned by county
permit_type	varchar(50)	Type of permit
company_name	varchar(50)	Company name requesting permit
owner	varchar(50)	Owner of property requesting permitted septic tank
address1	varchar(50)	Address of property in permit application
address2	varchar(50)	Address line 2 of property in permit application
city	varchar(50)	City of property in permit application
zip_code	varchar(50)	Zip code of property in permit application
application_date	datetime	Date of Application
issue_date	datetime	Issue Date of Permit
install_date	datetime	Installation Date of Septic System

Column	Type	Description
subdivision	varchar(50)	Subdivision name where permitted property resides
block	varchar(50)	Subdivision Block where permitted property resides
lot	varchar(50)	Subdivision lot where permitted property resides
tank_size	varchar(50)	Size of permitted tank
drainfield_size	varchar(50)	Drainfield size of permitted tank
flow	varchar(50)	Flow rate received by permitted tank
comments	longchar	General Comments

Table: county

Description:
The table contains the name of the counties and a unique ID which is keyed to other tables.

Fields:

Column	Type	Description
id	long	Primary Key
countyname	varchar(50)	Florida County Name

Table: county_contacts

Description:
The table contains contact information for the County Health Departments as identified at: http://www.doh.state.fl.us/chdsitelist.htm.

Fields:

Column	Type	Description
id	integer	Primary Key - Links to septic table contact_id
county	varchar(50)	Name of County
county_type	varchar(10)	Rural or Non Rural
title	varchar(100)	Title for Contact/Individual
contact	varchar(50)	Contact/Individual Name
address1	varchar(50)	1st Line of Address
address2	varchar(50)	2nd Line of Address
city	varchar(50)	Mailing City for Contact
state	varchar(4)	Mailing State for Contact
zipcode	varchar(10)	Mailing Zip Code for Contact
telephone	varchar(20)	Telephone number for Contact
extension	varchar(10)	Telephone Extension for Contact
fax	varchar(20)	Fax Number for Contact

Column	Type	Description
website	varchar(100)	County Healt Department Website URL

Table: landuse

Description:
The table contains provides a lookup for the Department of Revenue land use codes. The ID from this table links to the landuse_id contained in the parcels table.

Fields:

Column	Type	Description
id	integer	Primary Key
doruc	varchar(3)	DOR Land Use Code - Character String
description	text	DOR Long Description of Land Use

Department of Revenue Land Use Code
as provided with the DOR Tax Roll 2008

Land Use Code (doruc)	Land Use Description (description)
0	Vacant Residential
1	Single Family
2	Mobile Homes
3	Multi-Family - 10 units or more
4	Condominia
5	Cooperatives
6	Retirement Homes (not eligible for exemption under section 196.192, Florida Statutes. Others shall be given an Institutional classification.)
7	Miscellaneous Residential (migrant camps, boarding homes, etc.)
8	Multi-Family - less than 10 units
9	Undefined - Resewed for Use by Department of Revenue
10	Vacant Commercial
11	Stores, one story
12	Mixed use - stor and office or store and residential or residential combination
13	Department Stores
14	Supermarkets
15	Regional Shopping Centers
16	Community Shopping Centers
17	Office buildings, non-professional service buildings, one-story
18	Office buildings, non-professional service buildings, multi-story
19	Professional Service Buildings
20	Airports (private or commercial), bus terminals, marine terminals, piers, marinas.
21	Restaurants, cafeterias

Land Use Code (doruc)	Land Use Description (description)
22	Drive-In Restaurants
23	Financial Institutions (banks, saving and loan companies, mortgage companies, credit services)
24	Insurance Company Offices
25	Repair service shops (excluding automotive), radio and TV
26	Service stations
27	auto sales, auto repair and storage, auto service shops, body and fender shops, commercial garages, farm and machinery sales and services, auto rental, marine equipment, trailers and related equipment, mobile home sales motorcycles, construction vehicle sales
28	Parking lots (commercial or patron) mobile home parks
29	Wholesale outlets, produce houses, manufacturing outlets
30	Florist, Greenhouse
31	Drive-In Theaters, open stadiums
32	Enclosed theaters, enclosed auditoriums
33	Nightclubs, cocktail lounges, bars
34	bowling alleys, skating rinks, pool halls, enclosed arenas
35	tourist attractions, permanent exhibits, other entertainment facilities, fairgrounds (privately owned)
36	Camps
37	race tracks; horse, auto or dog
38	golf courses, driving ranges
39	hotels, motels
40	vacant industrial
41	light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing printing plants
42	heavy industrial, heavy equipment manufacturing, large machine shops, foundries, steel fabricating plants, auto or aircraft plants
43	lumber yards, sawmills, planing mills
44	packing plants, fruit and vegetable, bottlers and brewers distilleries, wineries
45	canneries, fruit and vegetables, bottlers and brewers distilleries, winieries
46	other food processing, candy factories, bakeries, potato chip factories
47	mineral processing, phosphate processing, cement plants, refineries, clay plants, rock and gravel plants
48	warehousing, distribution terminals, trucking terminals, van and storage warehousing
49	open storage, new and used building supplies, junk yards, auto wrecking, fuel storage, equipment and material storage
50	improved agricultural
51	cropland soil capability Class I
52	cropland soil capability Class II
53	cropland soil capability Class III
54	Timberland - site index 90 and above
55	Timberland - site index 80 to 89
56	Timberland - site index 70 to 79
57	Timberland - site index 60 to 69

Land Use Code (doruc)	Land Use Description (description)
58	Timberland - site index 50 to 59
59	Timberland not classified by site index to Pines
60	Grazing land soil capability Class I
61	Grazing land soil capability Class II
62	Grazing land soil capability Class III
63	Grazing land soil capability Class IV
64	Grazing land soil capability Class V
65	Grazing land soil capability Class VI
66	Ochard Groves, Citrus, etc.
67	Poultry, bees, tropical fish, rabbits, etc.
68	Dairies, feed lots
69	Ornamentals, miscellaneous agricultural
70	vacant institutions
71	churches
72	private schools and colleges
73	prvately owned hospitals
74	homes for the aged
75	Orphanages, other non-profit or charitable services
76	mortuaries, cemetaries, crematoriums
77	clubs, lodges, union halls
78	Sanitariums, convalescent and rest homes
79	cultural organizations, facilities
80	undefined Government - reserved for future use
81	military
82	forest, parks, recreational arenas
83	public county schools - include all property or Board of Public Instruction
84	Colleges
85	Hospitals
86	Counties (other than public schools, colleges, hospitals) including non-municipal government
87	state, other than military, forests, parks, recreational areas, colleges, hospitals
88	federal, other than military, forests, parks, recreational areas, hospitals, colleges
89	municipal, other than parks, recreational areas, colleges, hospitals
90	leasehold interests (government owned property leased by a non-government lessee)
91	utility, gas and electricity, telephone and telegraph, locally assessed railroads, water and sewer service, pipelines, canals, radio/television communication
92	mining lands, petroleum lands or gas lands
93	subsurface rights
94	right-of-way, streets, roads, irrigation channel, ditch, etc.
95	rivers and lakes, submerged lands
96	sewage disposal, solid waste, borrow pits, drainage reservoirs, waste land, marsh, sand dunes, swamps
97	outdoor recreational or parkland, or high-water recharge subject to classified use assessment

Land Use Code (doruc)	Land Use Description (description)
98	centrally assessed
99	acreage not zoned agricultural

Table: serviced_parcels

Description:
The table contains parcels, which are serviced by DEP permitted wastewater treatment facilities – parcels on sewer systems. The parcel_id field links to the id field in the parcel table. The facility_id links to the facility_id in the DEP_permit_facilities table (this is a unique field as it is a character string, not an integer value).

Fields:

Column	Type	Description
id	long	Unique ID for Serviced Parcel
parcel_id	long	Unique ID which links to parcels.id (Table and Feature Class)
contact_id	integer	Foreign Key - Links to contacts table id field
facility_id	varchar(15)	DEP Facility ID for Facility which services parcel
tax_id	varchar(30)	Tax ID of Serviced Parcel
address1	varchar(40)	Physical Address of Serviced Parcel - Line 1
address2	varchar(40)	Physical Address of Serviced Parcel - Line 2

Table: contact

Description:
The table contains information regarding the contact made between EarthSTEPS and the contact individual with the DEP permitted facilities.

Fields:

Column	Type	Description
id	long	Unique ID of Response
DEP_facility_contacts_id	integer	Foreign Key - DEP_facility_conacts.id
contact_type	varchar(50)	Type of response received from contact - email, phone call, letter, FTP files
status	varchar(50)	Status of receipt of response and workflow (completed, inventoried, partial, etc.)
alternative_contact	varchar(50)	Secondary contact individual.
telephone	varchar(50)	Telephone number of contact and/or secondary contact
comments	longchar	General comments regarding response including issues, type of response, number of records, etc.

Table: DEP_permit_contacts

Description:
The table contains contact information for the party responsible for the DEP permitted wastewater facility. Often, it is not that individual which provides information; therefore, a secondary contact is maintained in the contact table.

Fields:

Column	Type	Description
id	long	Primary Key
related_party_name	varchar(255)	Name of responsible party for DEP Permitted Facility
company_name	varchar(255)	Name of company for DEP Permitted Facility
address1	varchar(255)	Mailing Address of Contact
address2	varchar(255)	Secondary Mailing Address Field for Contact
city	varchar(50)	Mailing City for Contact
state	varchar(5)	Mailing State for Contact
zip_code	varchar(10)	Mailing Zip Code for Contact
phone	varchar(20)	Phone Number of Contact
email	varchar(50)	Email Address of Contact

Table: DEP_permit_facilities

Description:
The table contains information on each of the permitted wastewater treatment facilities. Information is available from:
http://www.dep.state.fl.us/water/wastewater/facinfo.htm

Fields:

Column	Type	Description
id	long	Primary Key
county	varchar(50)	County where facility resides.
DEP_office	varchar(10)	DEP Regional Office with jurisdiction over facility
facility_id	varchar(15)	DEP Permitted Facility ID
facility_name	varchar(255)	Name of Facility
NPDES	byte	Yes/No - NPDES facility?
facility_type	varchar(255)	DEP Facility Type
status	varchar(20)	DEP Facility Status
address1	varchar(255)	Physical Address of Facility
address2	varchar(255)	Secondary Field for Physical Address of Facility
city	varchar(50)	City of Facility
state	varchar(5)	State of Facility

Column	Type	Description
ownership_type	varchar(20)	Ownership Type of Facility
treatment_process_summary	varchar(255)	Summarization of Treat Process
capacity	double	Capacity of Facility in Millions of Gallons per Day (MGD)
dw_class	varchar(15)	DEP Domestic Wastewater Facility Class
issue_date	datetime	Date of Issue of the DEP Permit
expiration_date	datetime	Expiration Date of the DEP Permit
doc_description	varchar(255)	Description of Permitted Application
type	varchar(20)	Type of Permitted Application
dep_permit_contacts_id	long	Foreign Key - Links back to DEP_permit_contacts

DEP Facility Codes, as provide by DEP

OFFICE (DEP office)

CD	Central District
NED	Northeast District
NWD	Northwest District
SD	South District
SDB	South District Branch
SDS	South District Satellite
SED	Southeast District
SEDA	Dade County
SEDB	Southeast District Branch
SEPB	Palm Beach County
SWD	Southwest District
SWHI	Hillsborough County
SWPM	Phosphate Management
SWSA	Sarasota County
TAL	Headquarters
TLST	Tallahassee NPDES Stormwater

FACILITY STATUS CODES (status)

STATUS	DEFINITION	DESCRIPTION
A	Active	Existing, permitted facility/site for which effluent, reclaimed water or wastewater residual discharge into the environment and/or monitoring is taking place.
I	Inactive, not monitored	Facility/Site where discharge into the environment is not taking place and which is not being monitored.

C	Closed, but monitored	Facility/site with no discharge into the environment taking place but which is being monitored.
N	Active - Permit not required	Active but not permitted (i.e. exempt, regulated by another agency).
U	Under Construction	Under construction. This status applies until the facility provides a Certification of Completion.

FACILITY TYPES CODES (facility type)

FACILITY TYPE	DESCRIPTION
AFO	Animal Feeding Operation
AGR	Agricultural
CBP	Concrete Batch GP
CFO	Concentrated Animal Feeding Operation
CGP	Construction Stormwater GP
CON	Conservation Area
DEW	Dewatering GP
DW	Domestic WWTP
ISW	Individual Stormwater
IU	Industrial User (Pretreatment)
IW	Industrial Wastewater
MCP	MS4 Co-permittee
MS2	Stormwater - MS4 Phase 2
MS4	Municipal Separate Stormwater Sewer System
MSP	Multi-Sector Stormwater GP
NEX	Stormwater No Exposure Certification
PET	Petroleum Cleanup GP (long term)
RAF	Residuals Application Facility
RES	Residuals/Septage Management Facility
REU	Reuse/Distribution System
UIC	Underground Injection Control Facility

DOMESTIC WASTEWATER FACILITY CLASS (dw_class)

DW CLASS	DESCRIPTION
5D	Subsurface Disposal System: flow >= 0.005 MGD
1A	AWT: flow >= 3 MGD
1B	AWT: 0.5 MGD <= flow < 3 MGD
1C	AWT: no flow < flow < 0.5 MGD
2A	Act Slg/Cont Stab: flow >= 5 MGD
2B	Act Slg/Cont Stab: 1 MGD <= flow <5 MGD
2C	Act Slg/Cont Stab: no flow < flow < 1 MGD

DW CLASS	DESCRIPTION
3A	Ext Air: flow >= 8 MGD
3B	Ext Air: 2 MGD <= flow < 8 MGD
3C	Ext Air: 0.025 MGD <= flow < 2 MGD
3D	Ext Air: no flow < flow < 0.025 MGD
4A	Biofilm: flow >= 10 MGD
4B	Biofilm: 3 MGD <= flow < 10 MGD
4C	Biofilm: 0.025 MGD <= flow < 3 MGD
4D	Biofilm: no flow < flow < 0.025 MGD

GIS Feature Class: parcel

Description:
The feature class contains the attributes necessary for rendering basic maps. Fields include location, size and characteristics. The wastewater method and source are included with probabilities, if assigned. Additional attributes can be linked using a join between the id field in the feature class with the id in the parcels table.

Fields:

Column	Type	Description
id	long	Primary Key
objectID	long	Required field by ArcGIS
tax_id	varchar(30)	County Specific Tax Identification Number
county_id	integer	Foreign Key - Links to county table ID field.
alternate_key	varchar(30)	Alternate Key for county - secondary Tax ID
improved	bit	Yes/No (1 or 0) if the parcel is considered improved
wastewater_method	varchar(50)	Method for wastewater disposal - septic, sewer, estimate or NA
source	varchar(50)	Source for determining wastewater method (DEP Permitted Facility, EHDB, CHD or Estimate)
septic_probability	double	Probability calculated that parcel has an active septic system
acreage	double	Mapped acreage of property
longitude	double	NAD83 Longitude of Parcel Centroid
latitude	double	NAD83 Latitude of Parcel Centroid

Table: tblAddresses

Description:
The tblAddresses table in the Environmental Health Database was modified to add fields which link to the database we developed for the inventory. This provides the ability to link to existing records and seamlessly combine information following project completion.

Fields:

Column	Type	Description
AddressID	long	Field from EHDB – unique ID.
StreetNumber	varchar(10)	Field from EHDB – street number.
StreetName	varchar(75)	Field from EHDB – street name.
Suffix	varchar(100)	Field from EHDB – street suffix.
PreDirection	varchar(100)	Field from EHDB – address pre-direction.
PostDirection	varchar(100)	Field from EHDB – address post-direction.
UnitName	varchar(100)	Field from EHDB – unit name.
UnitNumber	varchar(10)	Field from EHDB – unit number.
ZipCodeID	long	Field from EHDB – zip code identification.
GISLocationID	long	Field from EHDB – GIS location identification.
SubdivisionID	long	Field from EHDB – subdivision identification.
PropertyID	long	Field from EHDB – property identification.
Lot	varchar(100)	Field from EHDB – lot number.
Block	varchar(100)	Field from EHDB – block number.
county_id	integer	Foreign Key which links to the county table id field.
parcel_id	long	Foreign Key which links to the parcels table id field.
physical_address	varchar(255)	Physical Address - Combined multiple fields

DOH Database Tables

The following tables in the database came from a data dump from the Department of Health (DOH) on March 9, 2009:

- ctrltblSepticApplicationSubdivisions
- ctrltblZipCodes
- mtmEntityAddresses
- tblAddressGISLocation
- tblEntity
- tblInspections
- tblOSTDSOperatingPermitDetails
- tblSepticApplication
- tblSepticApplicationtblSepticFinalInspection
- tblSepticApplicationPermit

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ODSTD Database Diagram

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EHDB Subset Database Diagram

GIS Feature Class: Parcel_Features

Description:
The feature class contains the attributes necessary for rendering basic maps. Fields include location, size and characteristics. The wastewater method and source are included with probabilities, if assigned. Additional attributes can be linked using a join between the id field in the feature class with the id in the parcels table.

Fields:

Column	Type	Description
OBJECTID	Object ID	Required field by ArcGIS
Shape	Geometry	Used by ArcGIS to indicate geometry type
tax_id	Text(26)	County Specific Tax Identification Number
county_id	Long Integer	Foreign Key - Links to county table ID field.
alternate_key	Text(50)	Alternate Key for county - secondary Tax ID
id	Long Integer	Primary Key
improved	Double	Yes/No (1 or 0) if the parcel is considered improved
acreage	Double	Mapped acreage of property
longitude	Double	NAD83 Longitude of Parcel Centroid
latitude	Double	NAD83 Latitude of Parcel Centroid
septic_probability	Double	Probability calculated that parcel has an active septic system
wastewater_method	Text(20)	Method for wastewater disposal - septic, sewer, estimate or NA
source	Text(20)	Source for determining wastewater method (DEP Permitted Facility, EHDB, CHD or Estimate)
Shape_Length	Double	Feature length created by ArcGIS
Shape_Area	Double	Feature area created by ArcGIS

GIS Feature Class: ParcelCentroids

Description:
The feature class contains the parcel centroid point.
Fields:

Column	Type	Description
OBJECTID	Object ID	Required field by ArcGIS
Shape	Geometry	Used by ArcGIS to indicate geometry type
CountyID	Long Integer	Foreign Key - County ID
GID	Long Integer	Parcel ID
POINT_X	Double	Longitude
POINT_Y	Double	Latitude

GIS Feature Class: CountyBoundaries

Description:
The feature class contains the county polygons and basic county information.

Fields:

Column	Type	Description
OBJECTID	Object ID	Required field by ArcGIS
Shape	Geometry	Used by ArcGIS to indicate geometry type
AREA	Double	Reported area (not from GIS)
PERIMETER	Double	Reported perimeter (not from GIS)
NAME	Text(32)	County Name
FGDLCODE	Text(32)	County Code used by FGDL (coincides with alphabetical order)
FIPS	Text(3)	Federal Informational Processing Standard Code. Unique county code used by the Census Bureau.
Shape_Length	Double	Feature length created by ArcGIS
Shape_Area	Double	Feature area created by ArcGIS

GIS Feature Class: Transportation

Description:
The feature class contains the road center lines and basic information for map creation and display.

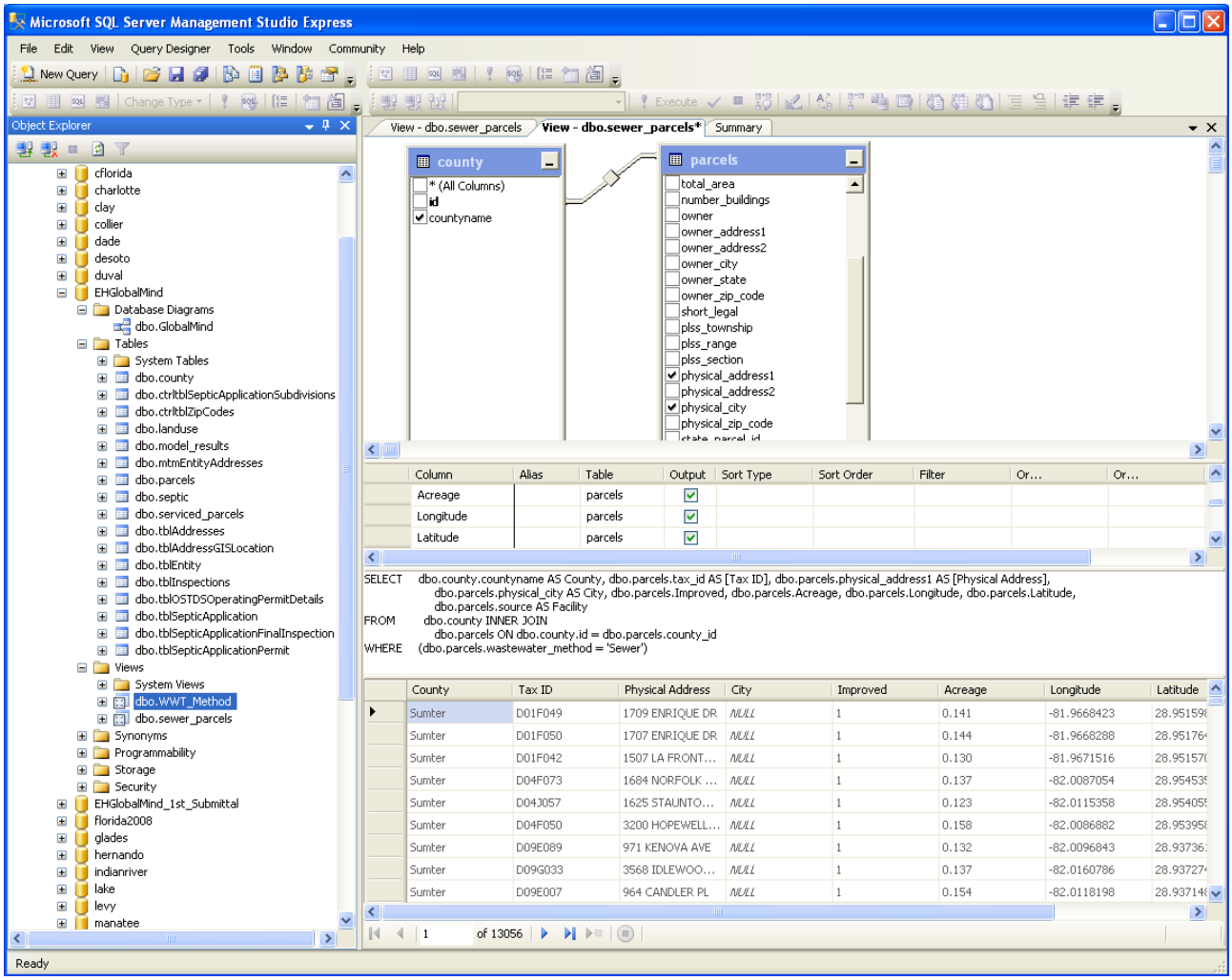
Fields:

Column	Type	Description
OBJECTID	Object ID	Required field by ArcGIS
Shape	Geometry	Used by ArcGIS to indicate geometry type
ROADWAY	Text(8)	Roadway number
LOCALNAME	Text(20)	Local Name
USROUTE	Text(8)	Lowest numerical posted US Route number
STROUTE	Text(8)	Lowest numerical posted State Road number
CLASS	Text(16)	Roadway class
DESCRIPT	Text(20)	General road description
INST_LAB	Text(3)	Interstate label
USRD_LAB	Text(3)	US Road label
STRD_LAB	Text(5)	State Road label
CNTRD_LAB	Text(4)	County Road label
LOCRD_LAB	Text(20)	Local Road label
Shape_Length	Double	Feature length created by ArcGIS

9.4 SQL Server Views

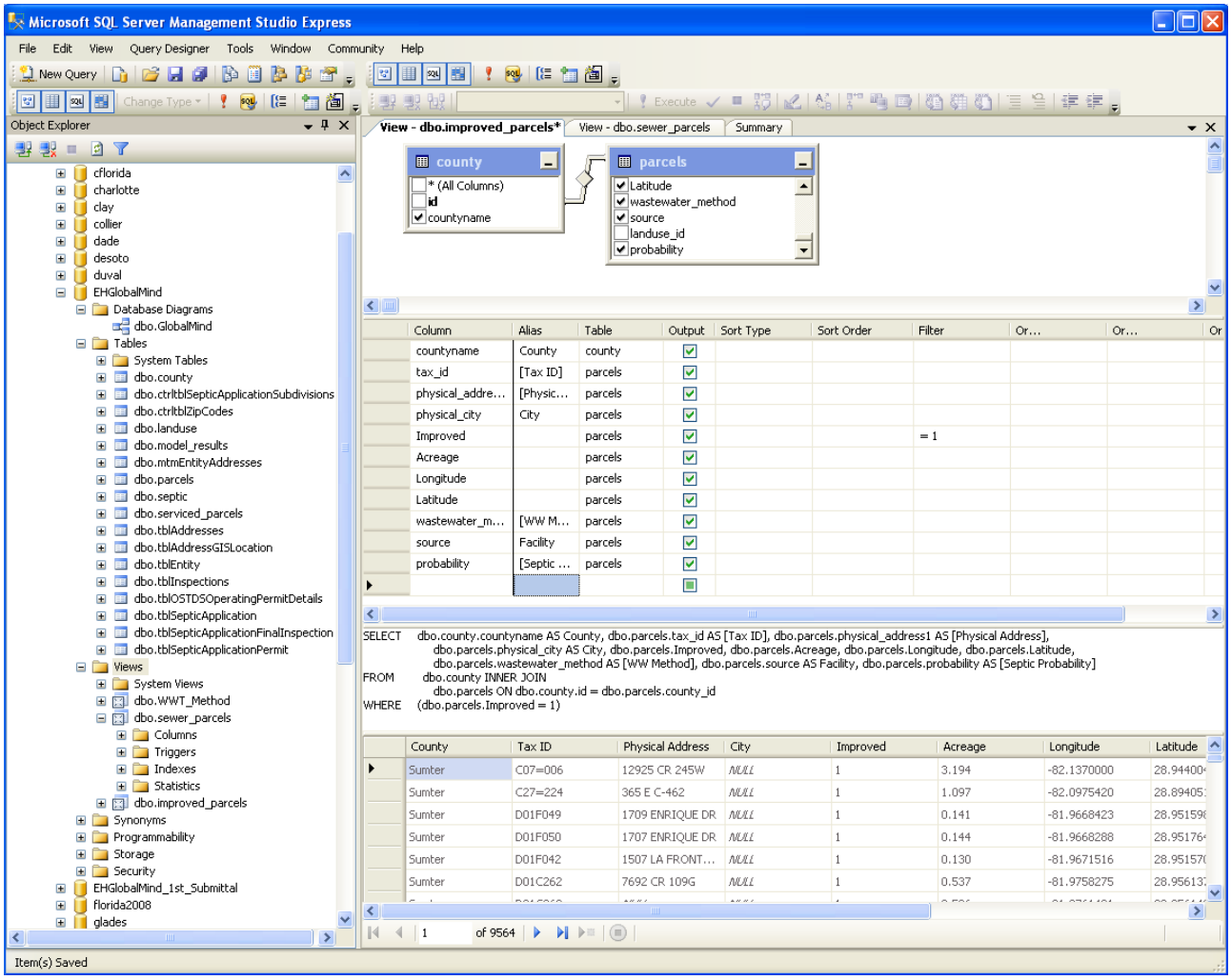
SQL Server View: sewer_parcels

Utilizing views we are able to present information from multiple tables. The process is synonymous with a select query in Microsoft Access. Below is the sewer_parcels view from the database.



SQL Server View: improved_parcels

Below is the improved_parcels view from the database.



9.5 State of the Data

This is a narrative of the condition of the EHDB and CHD Legacy databases (where obtained) for each county.

Background
The purpose of this information is to identify differences between the data maintained in the various data sets used to compile the inventory: Department of Revenue Tax Information, Environmental Health Database and Individual County Health Department lists. The notes contained herein are an attempt to explain irregularities in the information, how we overcame these obstacles and basic results.

Environmental Health Database (EHDB)

Alachua: (22,185 Address Records)
We were able to link 12,047 records using the tax identification numbers and addresses. The DOR data had spaces in the tax id where the EHDB contained dashes.

Baker: (2,595 Address Records)
We were able to link 1,744 records using the tax identification numbers and addresses. The DOR data did not have the dashes as the EHDB did.

Bay: (10,911 Address Records)
3,756 EHDB records are either blank or contain S/T/R only. Linking by tax identification numbers yielded 6,616 records. Utilizing addresses, another 2,486 records were successfully linked. The result is an 84% success rate.

Bradford: (3,071 Address Records)
The formatting of the tax id's in the EHDB are inconsistent. Many contain preceding S-T-R, often without leading zeros in one digit sections. The DOR data contains no reference to S-T-R. We were only able to link 158 records by tax id without a significant amount of manual review and entry. Utilizing addresses linked an additional 89 records. Lastly, we used a "Right" string concatenation to look at the EHDB tax id numbers absent S-T-R and were able to link 1,877 records.

Brevard: (19,569 Address Records)
The vast majority of EHDB records only contain S/T/R in the Property ID field. No records were matched using tax identification numbers. However, we were able to link 17,246 records using the addresses – a success rate of 88%.

Broward: (13,361 Address Records)
The EHDB does not have a single valid tax identification number in Broward County. However, using addresses alone, we were able to link nearly 11,000 records.

Calhoun: (1,635 Address Records)
Less than 20 records have tax id numbers that are something other than S-T-R or blank. Only 14 records linked using tax identification numbers. 663 records do not have a street number associated with the address. Therefore, only 153 records were linked by address.

Citrus: (25,598 Address Records)
There are no valid tax identification numbers in the EHDB. Those that have data are only the Section, Township and Range – which does not define a parcel. The addresses in the tax roll had leading zeros in the street number to make them a consistent length of 5 characters. We parsed the leading zeros and linked to the EHDB. Following the updates, we were able to match over 19,200 records or just over 75%.

Clay: (15,125 Address Records)
There are over 6,500 EHDB records without tax identification numbers or they are simply the S/T/R. We were able to link slightly more than 5,700 records by tax identification numbers. An additional 6,600 records were linked by address giving an 82% success rate.

Collier: (14,929 Address Records)
The tax identification numbers in the EHDB are very inconsistent. They are believed to be a combination of the S/T/R with the true tax identification number. However, many are missing the S/T/R portion making varying length id's. There are also hundreds of records that have leading dashes. Using addresses alone, we were only able to successfully match half of the records.

Columbia: (10,811 Address Records)
There are about 500 EHDB records without tax identification numbers. We were able to link over 7,000 using the tax identification numbers. A negligible number of additional records were linked using the addresses.

DeSoto: (3,720 Address Records)
About 450 EHDB records do not have tax identification numbers. Using tax id, we were able to join over 2,600 records. Linking by address provided 500 additional joins. The DOR data has the "PreDirection" after the suffix. It was altered for the purposes of the join.

Dixie: (3,377 Address Records)
Almost EHDB 600 records have null tax id or only the S-T-R. The EHDB has dashes in the tax identification number while the DOR data does not. We formatted the parcels table with the dashes as shown in the tax ID's within the EHDB. After the modifications, we were able to link 1,831 records by tax ID. There are 1,901 records without Street Numbers for the addresses which make linking by address not possible for those records. Another 129 records were linked using the addresses alone.

Duval: (31,243 Address Records)
There are approximately 19,000 records with blank or invalid tax identification numbers in the EHDB. Of the records with apparently valid id's 6,991 were linked using this method; while another 14,900 were linked using the addresses.

Escambia: (27,804 Address Records)
There are 3,405 records in the EHDB without Tax Identification numbers. The EHDB has dashes in the tax identification number while the DOR data does not. We formatted the parcels table with the dashes as shown in the tax ID's within the EHDB. After the modifications, we were able to link 21,681 records by tax ID. There are almost 500 records without street numbers. Another 4,143 were linked using addresses for a linked success rate of 93%.

Flagler: (2,769 Address Records)
The DOR data did not contain the same formatting as the EHDB tax identification numbers. DOR was updated to similar formatting. We were able to link 2,142 records using the modified tax numbers. A nominal number of additional records were linked using addresses. Many of the unmatched do not include tax identification numbers in the EHDB.

Franklin: (3,885 Address Records)
The Parcel Tax ID field within the EHDB is sparsely populated – 1,362 are not populated. Those that are populate have varying formats, lengths and completeness. Therefore, we were only able to get 33 matches. When using the addresses, we are able to match slightly greater than 800 records.

Gadsden:
DOR did not have "-" in the tax identification number. EHDB is missing preceding "0" in majority of tax identification numbers with single-digit section numbers. EHDB does not have preceding digit for jurisdiction (1-4). Utilized modified Tax ID numbers and physical addresses to link nearly 60% of addresses.

Gilchrist: (3,172 Address Records)
There are 895 records in the EHDB that do not have tax identification numbers or only have S-T-R values. We were able to link more than 1,700 records by tax id and another 200 by address. There are also 107 "Legacy" records with no information.

Glades: (2,131 Address Records)
Majority of tax id's in EHDB did not have dashes. Removed the dashes from the ones that did in order to create a join with the DOR data – also removed dashes. Using the reformatted tax identification numbers yielded over 1,100 links. Joining based on addresses yielded an additional 230 links.

Gulf: (3,467 Address Records)
There are 471 records without tax identification numbers in the EHDB. Using those that are populated and formatted correctly, we are able to match 1,240 to corresponding parcels. We were also able to match over 900 using addresses.

Hamilton: (1,766 Address Records)
390 of the records in the EHDB do not have Tax ID numbers. Many more had S-T-R preceding the correct tax identification number. Therefore, only 118 records linked automatically. Using addresses, we were able to link 23 records automatically. Using a "right" string concatenation on tax id – removing S-T-R – we were able to link another 704 Records. There are also 318 records without street numbers which makes linking by address difficult.

Hardee: (2,046 Address Records)
1,563 records were joined utilizing the tax identification numbers. Another 284 records were linked using addresses. This provided a success rate in excess of 90%.

Hendry: (4,209 Address Records)
The tax identification numbers in the EHDB are highly irregular and inconsistent. Therefore only 67 matches were found. However, using addresses, almost 2,000 records were successfully linked. After determining that there were an excessive number of addresses in the DOR data with multiple spaces between content and repairing, another 700+ records were successfully linked.

Hernando: (21,611 Address Records)
There are 14,509 records in the EHDB missing tax identification numbers. Of the ones that are not null, the vast majority contain only the Section/Township/Range and are therefore useless. Using the addresses, we were able to link 16,500 – over 75%.

Highlands: (12,276 Address Records)
The DOR data did not contain the preceding digit to the Township or Range as it should. The EHDB also used periods where there should have been dashes. Both the parcels table and EHDB records were modified to be consistent. Following the updates, 5,386 records were successfully linked. Utilizing addresses, we were able to link and additional 3,141 records.

Hillsborough: (26,789 Address Records)
The tax identification numbers in the EHDB are actually the alternate key stored by the county. This is actually better since the tax identification number is much longer and more likely to be entered improperly. The DOR tax roll does not have the period after the 6th digit, but the database was updated to reflect it. Using the Alternate Key and PropertyID, we were able to link over 18,000 records successfully. Linking by addresses yielded another 4,000 linked records – providing a link rate greater than 82%.

Holmes: (3,294 Address Records)
Most of the Tax ID's in the EHDB are invalid. They simply contain the Section, Township and Range for the property – and include "SEC", "TWN" and "RNG" in the field. Therefore, we were only able to link 40 records based on tax identification number. An additional 320 were linked using the addresses. The physical address in the tax roll for Holmes County is sparsely populated.

Indian River: (17,234 Address Records)
There are 7,369 EHDB records without tax identification numbers or only have S-T-R values. There were also inconsistencies between the DOR tax ID's and the EHDB property id's. After iterative cleaning, we were able to link 8,258 records. Using the addresses, were able to link 2,574 records. The numbered address for street names in the EHDB do not contain suffixes (24 versus 24th) as the DOR address does. This causes address not to match.

Jackson: (9,471 Address Records)
The vast majority of the tax identification numbers in the EHDB contain only the S/T/R or are blank. Therefore, only 92 records were linked utilizing this method. Using the addresses, we were able to link an additional 5,100 records. Many of the unlinked records have incomplete addresses – either missing street numbers or suffixes.

Jefferson: (3,499 Address Records)
The tax identification numbers in the EHDB are fairly consistent. Therefore, we were able to link over 2,500 records using this method. Additionally, another 200 records were linked by address. We were therefore able to obtain an 80% success rate. Many of the unlinked records have incomplete addresses – either missing street numbers or suffixes – and are lacking the property identification number.

Lafayette: (1,101 Address Records)
The DOR data did not contain the same formatting as the EHDB tax identification numbers. DOR was updated to similar formatting. We were able to link 669 records using the modified tax numbers. However the DOR data has no addresses entered. Therefore we were not able to link up additional records.

Lake: (25,357 Address Records)
There are nearly 1,700 records with missing tax identification numbers in the EHDB. The property ID in the EHDB for nearly all of the populated fields is incorrect. The values entered are a combination of the S/T/R and alternate key. First, we linked 13,400 using the addresses alone. Using a subset of the Property ID and linking to the Tax Roll Alternate Key, we were able to link and additional 9,100 records – giving us an 89% success rate.

Lee: (63,099 Address Records)
There are 8,172 records in the EHDB without Tax Identification numbers. We were able to link 46,016 records using tax identification numbers. Another 14,147 records were linked using addresses providing a 95% success rate.

Leon: (13,445 Address Records)
There are 1,731 records in the EHDB without Tax Identification numbers. We were able to link 10,231 records using tax identification numbers. Another 1,772 records were linked using addresses providing an 89% success rate.

Levy: (9,285 Address Records)
There are 1,384 records in the EHDB without Tax Identification numbers or only S-T-R. We were able to link 3,931 records using tax identification numbers. Another 1,134 records were linked using addresses.

Liberty: (1,204 Address Records)
The EHDB contains no valid tax identification numbers. Most are blank, while the remaining are STR only. 770 of the records contain no street number for the permitted septic system. We were able to link only about 50 of the remaining 400 records.

Madison: (4,053 Address Records)
2,622 records have no street number – only street name. A large number of EHDB records contained "/" instead of "-" in tax identification numbers. The formatting was updated. Joining using Tax ID's linked nearly 1,900 records while using Addresses another 200 linked.

Manatee: (7,124 Address Records)
Many of the tax identification numbers stored in the EHDB contained the "/" or "." formatting (there are also 1,758 with null values). Those characters were removed for linking to the DOR tax roll which did not include the formatting. Linking by tax ID yielded over 2,600 records. Using the address, another 3,000 records were successfully linked – many of the unlinked are numbered roads without suffixes (i.e. 17 Street versus 17th Street).

Marion: (44,873 Address Records)
There are 2,666 records in the EHDB without tax identification numbers. We were able to successfully link 40,752 records using tax id – a very substantial percentage relative to other counties. Another 2,232 records were linked by addressing yielding a 96% success rate.

Martin: (10,323 Address Records)
The EHDB is lacking more than 7,500 tax identification numbers for the properties or may only contain the S-T-R. The DOR data did not have dashes as the EHDB had. They were updated to coincide with the formatting. Also, numerous records in the EHDB have incorrect length and are missing characters. We were only able to link about 100 records by tax id. After only being able to link 1,200 records by address, we determined that there were thousands of address records in the DOR data with multiple spaces between address parts. After scrubbing the data, we were able to link another 2,700 reocrds.

Monroe: (8,263 Address Records)
The DOR data contains the preceding S-T-R information, while the EHDB does not. There are 1,423 EHDB records that do not have tax id's. Utilized string concatenation queries to join portion of DOR tax roll data to the EHDB and was able to achieve on 6,091 records. Additionally, we were able to link 1,136 records by address giving us an 87% success rate.

Nassau: (10,417 Address Records)
Majority of EHDB records have valid tax identification numbers. Over 8,000 addresses joined based on tax ID alone. 948 records do not have a street number and do not join based upon Tax ID numbers. Using addresses, we were able to link an additional 440 parcels – providing an 82% success rate.

Okaloosa: (10,384 Address Records)
820 EHDB records have NULL tax identification numbers. While another 1,366 records are either spaces or only contain STR. Over 6,100 records linked utilizing tax identification numbers. Using the address as a link, another 2,600 records were successfully joined – providing an 84% success rate.

Okeechobee: (4,628 Address Records)
153 Records have no tax Id and the address is "Legacy". Utilizing addresses, we were able to link 60%. Tax ID's in the EHDB are inconsistent with formatting and do not match the length of the DOR. We were unable to determine proper formatting between the databases.

Orange: (33,938 Address Records)
17,210 Records in the EHDB do not have valid tax identification number – either null or not enough characters. Utilizing tax identification numbers, we were able to link slightly over 400 records. However, using addresses, we matched over 24,200.

Osceola: (9,434 Address Records)
The EHDB tax ID numbers contain formatting which the DOR tax roll did not have. The database was updated with formatting. Following the update, nearly 6,700 records were linked using the formatted tax identification numbers. After finding that linking by address yielded only a negligible amount of additional records, it was determined that the DOR tax roll contained multiple spaces between the street number and street name portions of the address. When corrected, an additional 2,000 records were linked giving us a 92% success rate.

Palm Beach: (22,688 Address Records)
Only 1,224 records in the EHDB do not have a tax identification number. Using the tax id's to link records, we obtained 17,167 links. Another 3,045 records were linked using addresses which gave us an 89% success rate.

Pasco: (24,601 Address Records)
It was determined that the tax identification numbers in the DOR tax roll data were in the format of Range/Township/Section; while, the EHDB had them formatted as Section/Township/Range. We updated the DOR information to follow the EHDB convention and were able to successfully link 18,400 records. The physical addresses contained in the tax roll also contained numerous extraneous spaces. These were parsed before linking. Linking by address yielded an additional 4,000 records and giving us a 91% combined success rate.

Pinellas: (3,815 Address Records)
The formatting for the Tax ID in the EHDB, when populated, is very inconsistent along with the use of Township and Range Directions (not included in DOR information). Using tax id number only yielded 37 matches. Utilizing the addresses, resulted in an additional 2,700 matches.

Polk: (35,454 Address Records)
There are 4,119 records in the EHDB without Tax Identification numbers. Property ID formatting in the EHDB was inconsistent. We removed the dashes to provide for a link to the parcels. After reformatting, 10,133 records were successfully linked. Utilizing addresses, we were able to link and additional 13,831 records.

Putnam: (8,888 Address Records)
There are 1,132 records in the EHDB without Tax Identification numbers. The EHDB has dashes in the tax identification number while the DOR data does not. We formatted the parcels table with the dashes as shown in the tax ID's within the EHDB. After the modifications, we were able to link 7,094 records by tax ID. Another 1,022 were linked using addresses for a linked success rate of 91%.

Saint Johns: (20,948 Address Records)
Almost a quarter of the records do not have tax identification numbers. The tax id in the EHDB also contains a dash. We updated the parcels table to include similar formatting. Of those that have tax ids, we were able to link nearly all of them, 14,224 records. Another 3,993 records were linked using addresses for a success rate of 87%.

Saint Lucie: (10,119 Address Records)
There are over 9,100 records in the EHDB without tax identification number or contain incomplete information. Therefore, we were only able to link 490 records using this method. Another 2,891 records were linked utilizing the addresses. After reviewing the results, we determined that the DOR data contained multiple spaces between address parts for many records. We cleaned the data and were able to link an additional 1,957 records.

Santa Rosa: (24,953 Address Records)
There are 11,844 tax identification numbers in the EHDB that are invalid – blank, null or too short (S/T/R only). Therefore, only 7,800 records were linked using the tax identification number. We were able to join an additional 8,400 using addresses.

Sarasota: (8,014 Address Records)
There are about 2,600 tax identification numbers in the EHDB that are blank or invalid – STR only or incomplete. We were able to link 3,245 records using tax ids. While reviewing the DOR data, we identified that the county placed a dash (-) and an extra space between the street number and name. After cleaning, we were able to link another 3,373 records.

Seminole: (13,038 Address Records)
There are 3,532 tax identification numbers in the EHDB that are invalid – blank, null or too short (S/T/R only). Therefore, only 4,900 records were linked using the tax

identification number. The DOR tax roll did not contain similar formatting as the EHDB tax id's. Therefore, they were updated before the link was able to occur. Additionally, 5,400 records were linked using addresses.

Suwannee: (6,651 Address Records)
There are 1,676 records in the EHDB with blank or invalid tax identification numbers – STR only or some unidentifiable format. Using tax identification numbers, we were able to link 1,292 records. The DOR information does not have site addresses and we could not locate an readily available alternative source. It should be noted that the EHDB does not contain the leading zero in the township portion of the tax id, while the county DOR data does. We updated the parcels table to coincide. There are other inconsistencies in the EHDB tax id's as well. It would take a significant amount of work to normalize or clean.

Taylor: (10,931 Address Records)
6,327 Records have no tax Id and the address is "Legacy". DOR did not contain formatting as shown in EHDB (/ and -). Copied DOR Tax ID to formatted field and added formatting to tax_id field for join. Removed the "/' in the EHDB parcels because it was inconsistently used versus the "-". The county also separates the street number from the street name in the DOR physical address fields. They were combined for the join.

Union: (1,878 Address Records)
Nearly one-quarter of the tax identification numbers in the EHDB are incomplete or blank. Of the ones that are populated, we were able to link 1,212 records. Only 8 additional records were linked using addresses. Many of the remaining unlinked records have incomplete tax ids and missing street numbers in the address.

Volusia: (34,863 Address Records)
The EHDB contained tax identification numbers with and without formatting (dashes in ID). Therefore, the dashes were removed for consistency and for creating the link to the tax roll. There are 2,481 EHDB records without Tax ID numbers. However, after inspection the tax identification numbers in the EHDB and tax roll are not similar. We could not determine how they were modified or recreate them from other information. Using the addresses, we were able to link over 19,000 records.

Wakulla: (5,284 Address Records)
389 Records have no tax Id and the address is "Legacy". Properly formatted and consistent tax identification numbers in the EHDB are lacking – many do not include jurisdictions or include punctuation. A large number of the unmatched addresses do not include street numbers. We were able to successfully link 56% of addresses. Another 17% were linked utilizing the tax identification numbers.

Walton: (9,314 Address Records)
There are 2,839 EHDB records with missing or incomplete tax identification numbers. The DOR data did not have the dashes (formatting) that the EHDB records do. We updated the parcels table to reflect similar formatting. We were able to link 2,954 records using tax numbers. Another 2,033 records were linked using addresses.

Washington: (3,962 Address Records)
Most records do not have valid tax id's. They are just STR or blank. Created physical address field and utilized to join to the DOR data – had 50% success rate.

County Health Departments - Legacy (CHD)

Alachua:
23,403 Records were supplied in an Excel Spreadsheet. Of these records; 4,715 only have Permit # and no other information. The county also provided a list of all known sewer parcels, which we identified as being serviced by facility id "FLALACHUA."

Bay:
Data was submitted but files do not open properly. There were numerous "doc" files which are not word documents.

Bradford:
The proprietary OSDS Database was provided. There were 841 permits none of which contained tax identification numbers. Many of the addresses provided are incomplete or not valid. Therefore only 102 records were joined.

Brevard:
Provided Excel Spreadsheet containing 28,485 Permits, almost all have Tax ID numbers – with multiple spaces. We parsed all of the spaces out of the tax id numbers and the extra spaces between the address parts. Following the database clean up, we linked 27,310 records using the tax id and addresses provided.

Calhoun:
The county provided an Excel Spreadsheet of 490 permits. The address field of the permits only includes road name, no numbers or other unique information.

Charlotte:
Provided Excel Spreadsheet of Septic Tank Permits granted each year. Also provided a list of approximately 55,000+ Short Legal Numbers for septic parcels, there are no other attributes.

Clay:
Proprietary Database provided. We attempted to extract information; however we were unable to get anything from the database.

Dixie:
The county supplied an Excel Spreadsheet with 2,280 permits all having permit #'s. There are no tax identification numbers and the site addresses provided are locations, not specific addresses. No addresses were successfully linked.

Escambia:
The county provided Excel Spreadsheet of 11,610 Permits, almost all have Tax ID Numbers. Using the tax id's we were able to link over 10,000 records. Using the addresses created an additional 800 linked records.

Flagler:
The county provided an Excel Spreadsheet containing 5,593 permits; almost all have Tax ID numbers. Using the tax identification numbers to create the link, we were able to achieve 2,663 linked records. We were not able to link any records by address. Many of the records are void of addresses.

Gilchrist:
The county provided an Excel Spreadsheet consisting of 4,146 permits with permit #'s, 35% do not have addresses – none have tax identification numbers. The majority of those with address information populated are not valid addresses. They contain descriptions, locations and other non-identifying information. Therefore, we were only able to link 78 records.

Hamilton:
The county provided an Excel Spreadsheet with 1,554 permits; most of the permits have a location and not a valid address. There are no tax identification numbers for permits. There were no valid joins to the parcel table using address.

Indian River:
The county provided a proprietary database program which had numerous DBF files – amounting to 10,167 septic records. We utilized those files to get information. There were no tax id numbers and the addresses were street names. Where there are numbers, they are in parentheses at the end of the field. We could not make joins without very rigorous cleanup and database work.

Lafayette:
Supplied an Excel Spreadsheet consisting of 216 permits, all having permit numbers. Incomplete Site Address where people's names are there and no actual addresses.

Lee:
The county provided an Excel Spreadsheet of 39,742 permits where most have either a Tax ID or Address. We were able to link about 9,000 records using the tax identification numbers; while another 11,700 were linked using addresses.

Leon:
A CSV file consisting of 26,777 permits was supplied by Leon County. Permits in the mid-1980's start having Tax ID numbers, however there are permits with no Tax ID and tend not to have Street Number with Location. Using Tax ID, slightly more than 17,000 records were successfully linked. The addresses only yielded 44 additional links, likely due to the absence of street numbers for most addresses.

Levy:
An Excel Spreadsheet containing 15,626 permits was provided by Levy County. The lot addresses are sparse; those that are populated are PO boxes or Rural Route Boxes. There are no tax identification numbers either. In all, we were able to link 1 record by address.

Marion:
An Access Database was supplied and would not open using various versions. Also provided an Excel spreadsheet with 21,232 Records; Tax ID Numbers are sparse and the address provided is mailing address – Location and Subdivision are not easily locatable. We were only able to link 794 records by tax identification number.

Martin:
The county supplied an Access Database with 263 permit numbers with addresses/general locations. There were no tax identification numbers provided. We were only able to link 31 records after cleaning up punctuation and other inconsistencies in the database provided.

Monroe:
The county provided 2 Excel Spreadsheets with 2,306 permits; included permit#, subdivision and owner and real estate number (one of their tax identification numbers). There are 1,826 records without tax id numbers. Therefore, we were only able to link 404 records.

Orange:
Supplied a DBASE1.exe file (86 kb) – too small to be a program or self-extracting executable. No other information provided

Osceola:
Supplied a 297 page PDF file of CENTRAX database reports – duplicate of EHD. No archived data provided.

Palm Beach:
The county provided a Microsoft Access database of 8,186 records. We computed the tax identification numbers from multiple columns. The numbered streets in the addresses do not contain suffixes (i.e. 24 versus 24th) as the DOR data does. We were able to link 1,333 records.

Sarasota:
Supplied two databases PERMSEPN & PERMSEPR; which contains 60,784 Permit #'s along with owner, tank size and installer. There are no addresses or tax identification numbers. We cannot link records simply by using owner name or other information provided.

St. Johns:
Provided 3 Excel Spreadsheets with the same information just sorted differently. There are a total of 10,959 permits. Files only contained date, permit number, owner, lot/block and subdivision. No method for automating location.

St. Lucie:
The county provided 2 Excel Spreadsheets for the 1980's and 1990's totaling 15,055 permits. No Tax ID's provided, but most have Addresses. We were able to link slightly more than 4,400 records.

Union:
We received a spreadsheet with 1,360 records. All of the records have tax identification numbers. We were able to link 1,224 records by tax identification number.

Walton:
We received a delimited text file from the county of permits. There were no tax identification numbers and the site addresses were mainly locations – absent street numbers and usually lists a road, intersection or subdivision. Therefore, we only were able to link about 150 records.

9.6 Files provided on the DVD

1. Statewide Inventory DraftFinal.pptx (PowerPoint document)
   Presentation of Final Draft Report to the RRAC, May 27th, 2009.

2. Maps (Folder)
   Maps for each county of the known and estimated locations of OSTDS and sewer for developed parcels. There are two pdf files for each county. The maps have also been printed and presented in a bound volume.

3. Model Results (Folder)
   The output from the logistic regression analysis for estimation of OSTDS for each county. The final parameter values and assessment of the quality of the model are presented. This information is the direct output from the R programs also provided on the DVD. The counties are in alphabetical order.

4. StatewideInventory_Software.pdf (PDF document)
   Functions used to calculate estimates of OSTDS for each county. These were written in Rcode, using the R statistical platform and programming environment.

5. Survey of County EHDs (Folder)
   This folder contains the questions and responses to the Survey of EHDs. The questions are in the file SurveyQuestions.pdf. The answers are provided in two formats. The first is provided in files that are provided in topical groups in the files SurveyAnswers_*.pdf. For instance, SurveyAnswers_4to12.pdf contains the questions and responses to question 4 to 12 which all relate to the EHDB. The numbers in the file names refer to the question numbers in the survey. The second format is a spreadsheet with all responses, SurveyAnswers_all.xls).

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M E M O R A N D U M **DATE:** June 18, 2009

FOR: Elke Ursin, Florida Department of Health

FROM: Damann L. Anderson, P.E.

SUBJECT: Evaluation of Test Facility Site

Hazen and Sawyer is conducting the Florida Onsite Sewage Nitrogen Reduction Strategies (FOSNRS) Study under contract CORCL with the Florida Department of Health. Under Task A of this project, we are in the process of identifying test facility sites where multiple assessments of onsite nitrogen reduction technologies and groundwater quality can be conducted in subsequent phases of the study. Two potential sites identified in the response to the ITN were the University of South Florida Lysimeter Facility property and the University of Florida's Gulf Coast Research and Education Center (GCREC) near Wimauma, FL. Salient issues include space availability, site access, wastewater source of sufficient quantity and quality, subsurface hydrology, power supply and security.

After a preliminary assessment of the USF Lysimeter Facility, we feel that the cost of rehabilitating this facility will be beyond the budget allocated for that effort. Also, since space is limited at the USF facility and it is not conducive for groundwater quality assessments, we have concluded that it would be more cost effective to have only one test facility, where the controlled testing portion of the project could be conducted. It is our recommendation that the GCREC be selected as the test facility site. This memorandum summarizes the evaluation of the USF facility.

The USF Lysimeter Facility is located on the east side of the USF campus, west of 50th street, north of Fowler Avenue and south of Fletcher Avenue, in Tampa, Florida. In 1988, a cooperative agreement was in place between DOH's predecessor agency, the Florida Department of Health and Rehabilitative Services (HRS), and USF allowing for a lysimeter station to be established on the USF campus. The Station was used to perform experiments through contracts between HRS and selected providers until 1998. The research facility was constructed to monitor the fate of septic tank effluent pollutants in the vadose zone of fine sand soils in Florida.

For the FOSNRS study it was anticipated that the Lysimeter station could be used for pilot tests of treatment technologies and unsaturated zone work. However, since the water table is extremely deep at the site (>25 ft.) and sufficient area for plume delineation and monitoring is not

available it would not be suitable for groundwater fate and transport studies. The facility has been out of service for approximately 10-years. The facility area is identified in Figure 1.

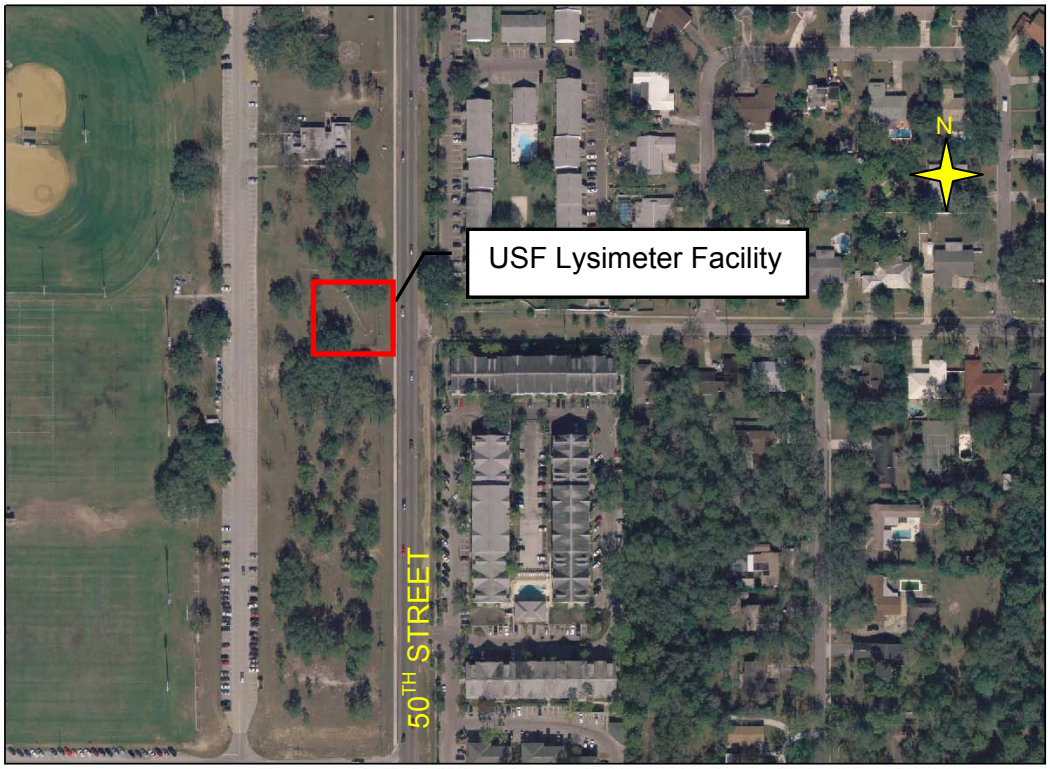

Figure 1. USF Lysimeter Facility Location

On February 9, 2009, a site evaluation was conducted to assess the required rehabilitation efforts to use the facility for the FOSNRS testing program. Two contractors were present to estimate the costs associated with the facility rehabilitation effort. The first area evaluated was the on-site groundwater well that provides water to the facility and is used to establish the artificial water tables at the site. The contractor that originally installed the well is Pope's Water Systems, Inc. Well Drilling. Paul Pope attended the site evaluation, and he determined that the pump and control panel for the well will need to be replaced. A budgetary cost estimate is provided in Table 1.

Figure 2. Water Well Pump and Controls

Next, the Lysimeter station was evaluated. The facility includes a series of drainfields and artificial water tables on each side of the facility. The contractor that originally installed the system was Bingham Onsite, Incorporated. Dewayne Bingham Sr. attended the site evaluation, and he provided cost estimates for replacement of the water table areas and drainfields. During the site visit, a representative from the campus informed the group that the original source of wastewater has been connected to the City of Tampa wastewater system. Therefore, a tap will need to be made into a pressurized force main with associated valves and controls to allow a wastewater feed to the facility. Additionally a new pipe line will need to be installed to a tank. Mr. Bingham provided a budgetary cost estimate for the replacement of the artificial water tables and the work associated with connecting to the main sewer line. Additionally the roof, instrumentation and controls, and electrical connections require replacement, and these costs were estimated by Hazen and Sawyer.

Figure 3. USF Lysimeter Station

Table 1 outlines a preliminary capital cost estimate for the rehabilitation of the USF Lysimeter station. This estimate does not include engineering design or permitting that may be required.

Table 1. Cost Estimate USF Lysimeter Station Rehabilitation	
Tap main sewer line (FM) and install pipe to septic tank	$ 8-10 K
Install 1,500 gallon concrete septic tank	$ 2-3 K
Excavate old water table area and install new liners	$ 18-20 K
On-site well pump and control panel	$ 3.5-5K
Roof replacement	$8-10 K
Electrical connections, valves, pump replacements	$8-10 K
Instrumentation and controls replacement and programming	$25-30 K
Debris removal	$ 1-2 K
Subtotal	$73.5-90 K
Contingency (25%)	$18.4-22.5 K
Estimated Total	$91.9-112.5 K

Summary

Based on the cost and time associated with rehabilitating the USF facility, it has become apparent that proceeding with construction of two test facility sites will be costly and time consuming. The current budget in the FOSNRS contract for construction of a test facility at USF does not appear to be sufficient for both the rehabilitation work and the testing facility construction. In addition, the USF Lysimeter station can only be used for pilot tests of treatment technologies and unsaturated zone work, since the water table is extremely deep at the site (>25 ft.) and sufficient area for plume delineation and monitoring is not available. Management of two facilities once operational will also be more difficult and expensive in future phases of the project.

Treatment technology pilot testing and both the saturated & unsaturated zone investigations could be performed at the GCREC. Therefore, the Project Team recommendation is to conduct all test facility work at the GCREC.

enc: Cost Estimates

c: E. Roeder
P. Booher

File 44237-000