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.

4.3 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 to 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

The largest domestic WWTF treat 96% of the effluent of all domestic WWTF in Florida.[16] This is only 367 WWTF out of 2157 (17%). This means that capturing information from the largest 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. In all, to date, we have over 2 million mapped sewer parcels.

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

Total WWTF				
Response	N WWTF	MGD	% N WWTF	%MGD
Data Received	1002	2097	46%	81%
No Response	1155	500		
Total	2157	2598		
Municipalities	N WWTF	MGD	% N WWTF	%MGD
Data Received	1889	1301	88%	50%
No Response	268	1296		
Total	2157	2598		
Capacity Class	N Large	%MGD	N Small	%MGD
	≥ 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

[16] Florida Department of Environmental Protection, General Facts and Statistics about Wastewater in Florida. http://www.dep.state.fl.us/water/wastewater/facts.htm

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).

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

We used the over 2.6 million parcels with known wastewater treatment as the basis for modeling the characteristics of sewer vs. OSTDS parcels. The statistical analysis methodology utilized is a logistic regression. The treatment method consists of either sewer or OSTDS, hence is binary, and the logistic form of a regression is appropriate. The model is, essentially, a mathematical description of the "correlation" of parcel characteristics with their known form of wastewater treatment. The model produces a probability of a parcel having an OSTDS, ranging from 0 (no OSTDS) to 1 (OSTD present). The parameters of the model for parcels with known treatment and the characteristics of the parcels with unknown treatment are used to compute the probability that an unknown parcel has an OSTDS on it. The closer that probability is to 1, the more likely the parcel has an OSTDS, 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. These classification criteria can be varied to suit the conditions of the model and to provide a measure of reliability of the modeling out comes.

The following steps were taken to build the 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**:** A 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 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 OSTD 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 is provided in Table 4-6.

4.4 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 are 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 OSTD 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 at to obtains 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 of 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 results 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 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. Baker, Bradford and Wakulla have both enough parcels and an 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 WWFT 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 OSTD 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 subdivision, 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 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 parcel 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 government or authority sewer providers. The sewered parcels are usually more common in the named communities, but these service areas 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 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, 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 insufficient response 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 largest 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, county-wide sewer provider. An independent assessment of the number of OSTDS in Duval has been carried out by the water and sewer authority 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 that 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 as 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 little 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.