Designing a Network to Monitor Nutrients in the Upper Floridan Aquifer, West-Central Florida

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Abstract

Several springs within the Rainbow, King's Bay, Homosassa, Chassahowitzka, Weeki Wachee and Aripeka spring-recharge basins have shown statistically significant increases in nitrate concentrations over the past twelve years. The recharge areas for many of the springs include residential and agricultural land uses, which have been shown to be the predominant source for nutrient loading to the springs. This trend has prompted the Resource Data Section at the Southwest Florida Water Management District to establish a network to monitor nutrients in ground water within these vulnerable areas. It may take 10 to 25 years for ground water from recharge areas to travel through the aquifer and discharge at the springs. Analyzing water-quality samples from Upper Floridan aquifer wells that are closer to the source of nutrient loading may be able to determine the effectiveness of implemented Best Management Practices (BMP's), track nutrients trends, determine water quality distribution throughout the study area and improve the delineation of spring-recharge basins. A well network to monitor nutrient loading in the Upper Floridan aquifer was designed using a geostatistical analysis technique called trans-Gaussian kriging. Kriging is a linear, unbiased estimator that predicts values at unmeasured locations and calculates the uncertainty in those predictions. The range that describes the spatial autocorrelation of the nitrate data across the study area was determined to be 8,200 meters. This distance was used to produce a grid design to select wells for inclusion in the network. It is anticipated that the design process will produce a monitoring network that yields the least amount of gaps and redundancy in the data, while providing accurate and defensible water-quality information.

Introduction

Background

According to Upchurch (1992), the ambient concentration for nitrate in the Floridan aquifer is non-detectable (<0.01 mg/L) across the state. Recent studies within the Southwest Florida Water Management District (SWFWMD or District) however, have shown elevated nitrate concentrations in ground water collected from Upper Floridan aquifer (UFA) wells and springs in northern portions of the SWFMWD. Between 1991 and 1995, nearly 500 Upper Floridan aquifer (UFA) wells were sampled for nutrients, nitrogen isotopes and major ions. As a result, five spring's reports (Jones and Upchurch, 1993, 1994; Jones et al., 1996, 1997 and Champion and Dewitt, 2000) were produced that delineated generalized spring-recharge basins within the northern portion of the SWFWMD. The reports identified areas with elevated nitrate and correlated this information with land use. The reports concluded that the vast majority of nitrate loading to the UFA was derived from the use of inorganic fertilizer used for crop production and turf-grass maintenance. Other sources of nitrate loading to the UFA include poultry production, livestock facilities, and septic systems, but to a lesser degree. In addition, the Resource Data Section has been collecting water-quality data, including nutrients, from approximately 50 springs throughout the District for over a decade via the Coastal Springs Nutrient Monitoring Network. These data have indicated a trend of increasing nitrate concentrations at many of these springs (Champion and Starks, 2001). Increased nitrate concentrations are potentially linked to increased plant and algal growth in spring runs.

Purpose and Scope

This report summarizes the tasks accomplished in order to design a long-term well network to monitor nutrients within the northern portion of the SWFWMD using geostatistical analysis. These tasks include: 1) delineating the study area by selecting spring-recharge basins for inclusion in the network; 2) selecting the nutrient data to be used for the geostatistical analysis; 3) performing an exploratory data analysis on the resulting dataset to determine distribution; 4) determining a network design and selecting monitoring wells via geostatistical analysis; and 5) establishing the sample frequency and a field and lab parameter list. The procedure for designing such a monitoring network is a step-by-step process. Therefore, each completed task builds on the previous one. The organization of this report reflects this process.

A long-term nutrient monitoring network would be better suited to assess the overall effectiveness of implemented Best Management Practices (BMPs) to address nutrient concerns in the UFA and springs derived from this aquifer. These BMP's include improved turf-grass and crop-fertilization practices largely achieved through education efforts, better nutrient-management practices at livestock facilities, and more efficient residential septic systems.

Wells that are within the spring-recharge basins should respond more quickly to changes in nitrate use than the springs themselves. The average residence time for ground water in the northern portions of the state is between 10 and 25 years (Katz et al., 1999). Moving the ground-water sampling points closer to the source of nutrients could reveal increases or decreases in nitrate concentrations earlier. The changes in concentration could also be tracked throughout the spring-recharge basins, perhaps giving better insight about the travel times and water-quality distribution throughout the study area.

Previous investigations on the origin of nutrients in ground water at major spring groups (Jones and Upchurch, 1993, 1994; Jones et al., 1996, 1997 and Champion and Dewitt, 2000) have used "snapshot" ground-water quality sampling to gain data on nutrient transport through the UFA for a relatively short temporal window. Generalized spring-recharge basins have been delineated using this type of water-quality analysis and potentiometric surface maps for most of the major spring systems (Jones and Upchurch, 1993, 1994; Jones et al., 1996, 1997; Champion and Dewitt, 2000 and Dewitt, 2004). A more long-term monitoring effort could improve the identification of these vulnerable areas.

The objectives of the monitoring network consist of: 1) determining the overall effectiveness of implemented BMP's and other nitrate-remediation programs to reduce organic and inorganic nitrate loading to the UFA on a local and regional scale; 2) tracking both long-term and short-term trends in nitrate concentration within the recharge basins; 3) determining distribution of water quality within the study area; and 4) improving the delineation of spring-recharge basins.

Delineation of the Study Area

In order to select which of the generalized spring-recharge basins located in the northern SWFWMD (Figure 1) should be included in the study area and monitoring network, it was necessary to determine which of them contain springs with increasing trends in nutrients. This analysis uses nutrient data collected for the Coastal Springs Nutrient Monitoring Network at the SWFWMD. Only nitrate data were used for this analysis since phosphorus and orthophosphate concentrations were at or below detection for the entire period of record for each spring. The exact form of the Wilcoxon Rank-Sum test was used to determine if there was a significant difference between spring nitrate concentrations grouped by time periods. This allowed for a comparison of nitrate concentrations through time.

The Wilcoxon Rank-Sum test (also known as the Mann-Whitney test) is a nonparametric statistical test to determine whether two groups come from the same population (same median). In this case, the test was used to determine if one group of observations tends to contain larger values than another group of observations. The exact form of the Wilcoxon Rank-Sum test is the appropriate form to use when comparing groups with sample sizes of ten or less (Helsel and Hirsch, 2002), as is the case with the springs data set. A nonparametric test was needed to analyze these data since there are outliers in the data set and the data commonly appear skewed. Unlike parametric tests, no assumptions are made as to the frequency distribution of either of the test groups.

The Wilcoxon Rank-Sum test calculates a *p*-value, which is the significance level attained by the data (Helsel and Hirsch, 2002). If the calculated *p*-value is less that 0.05, then the groups are considered to be significantly different at the 95% confidence level.

The spring's nitrate data were organized into three temporal groups that each contain four-years of data as follows:

- Temporal Group A (baseline) – January 1, 1993 – December 31, 1996
- Temporal Group B (previous) – January 1, 1997 – December 31, 2000
- Temporal Group C (current) – January 1, 2001 – December 31, 2004

Grouping the data in this way enables comparisons to be made between the past (baseline), intermediate (previous), and recent (current) groups for the available period of record. Comparisons were made between Group A (baseline) and Group C (current) and between Group B (previous) and Group C (current).

The statistical analysis for both temporal group comparisons indicated that six of the eight spring-recharge basins (Figure 2 and Tables 1 - 3) in the northern SWFWMD contain springs that have significantly increasing trends in nitrate concentrations. The spring-recharge basins with increasing nitrate trends include: King's Bay, Chassahowitzka, Homosassa, Weeki Wachee, Rainbow and Aripeka. As a result, these spring-recharge basins have been selected for inclusion in the study area (Figure 3) and ultimately the monitoring network.

Description of Study Area

Physiography and Topography

The study area includes all or part of Marion, Levy, Citrus, Sumter, Hernando, and Pasco Counties. Nine physiographic regions occur in the area: the Brooksville Ridge, Coastal Swamps, Cotton Plant Ridge, Fairfield Hills, Martel Hill, Northern Gulf Coastal Lowlands, Sumter Upland, Tsala Apoka Plain, and the Western Valley (White, 1970) (Figure 4). Soil type, drainage patterns, topography and geology were used to characterize the regions. In general, the soils that comprise the study area are well drained and have a direct connection to the underlying Floridan aquifer via karst features including sinkholes.

Topography throughout the study area varies extensively as compared to most areas in Florida (Figure 5). Karst processes have produced a terrain characterized by undulating topography and surface elevations that change abruptly. Elevations throughout the Brooksville Ridge, Sumter Upland and Fairfield Hills can exceed 275 feet (84 meters) above sea level.

Geology

The geology of the study area consists of approximately 2,000 to 2,500 feet (610 to 760 meters) of Tertiary-age limestone and dolostone overlain by siliciclastic deposits of marine, transitional, and terrestrial origin (Scott et al., 2001). The main geologic units that make up the study area are the Hawthorn Group, the Coosawhatchie Formation, the Suwannee and Ocala Limestones and the Avon Park Formation. Figure 6 (Scott et al., 2001) shows the stratigraphic units that are at or near land surface throughout the study area.

The Hawthorn Group is of Miocene age and consists predominantly of clayey sands and silty clays. The unit includes hard-rock phosphate in some areas on the eastern flank of the Brooksville Ridge. The Hawthorn Group acts as a confining unit when it is present and continuous.

The Miocene-age Coosawhatchie Formation is present in the northeastern portion of Marion County in the study area. It consists of poorly to moderately consolidated sand and clay. In general, the permeability of the formation is low and is a confining unit to the Floridan aquifer.

The Suwannee Limestone is Oligocene in age and consists of partially crystalline to crystalline limestone with a pale orange color, sand, silt and clay and is weakly cemented with calcite. The limestone is very fossiliferous and has considerable moldic porosity. The Suwannee Limestone crops out in Citrus and Hernando counties but is absent in the northern portions of the study area due to erosion (Miller, 1986).

The Ocala Limestone is Late Eocene in age and generally underlies the Suwannee Limestone except in areas where the Suwannee Limestone has been eroded away. The Ocala consists of a granular, highly fossiliferous, tan and brown limestone, or a gray and cream to white limestone. Layers of chert, when present, are usually located near the top of the unit. Uneven erosional processes have worn down the surface of the Ocala Limestone such that there is a wide variation in the elevation of the surface of the limestone. The Ocala is at the surface in much of the study area, especially to the west and east of the Brooksville Ridge.

The Avon Park Formation is the deepest formation that contains potable water in this region. It is at or near land surface in Citrus and Levy counties, but beneath the Ocala in all of the study area. The Avon Park Formation consists of highly fossiliferous limestone and dolostone with low to high porosity. In the lower portions of the formation, gypsum and anhydrite are present.

Hydrogeologic Setting

The study area is characterized by numerous sinkholes, internal drainage, and undulating topography typical of karst landscapes. The hydrogeologic units that form the hydro-stratigraphic framework in the study area include: (1) the discontinuous, siliciclastic surficial aquifer system, (2) the discontinuous, siliciclastic intermediate confining unit, and (3) the thick, predominantly carbonate UFA (Knochemus and Yobbi, 2001; Fretwell, 1985) (Table 4).

A distinct lack of rivers and streams in the study area is a result of a well-established underground drainage system made up of conduits, fractures and other karst features in the limestone. The northern portion of the SWFWMD is unique in that there is no continuous confining layer. The lack of a continuous confining unit provides for high recharge rates along the entire flow path of ground water in the UFA. Unfortunately, the rapid infiltration of water through the inert sandy soils and into the UFA increases the likelihood that contaminants such as nutrients will enter the aquifer unabated.

The predominant direction of ground-water flow in the study area is from east to west based on potentiometric-surface maps of the study area (Figure 7). Additionally, several ground-water divides can be identified on potentiometric-surface maps and by water-quality analyses. These divides have been used to delineate the generalized spring-recharge basins within the northern portions of the District (Jones and Upchurch, 1993, 1994; Jones et al., 1996, 1997; and Dewitt, 2004).

Land Use

Land use throughout the study area is predominantly rural and agricultural. Urban and residential growth has increased throughout the past few decades. Figure 8 illustrates the distribution of residential and agricultural land use throughout the study area in 1999.

Data Selection for Geostatistical Analysis

Site Selection

Nitrate data from 304 sites that included 59 springs (Table 5) and 245 wells (Table 6) within the study area were selected for the geostatistical analysis. The data were selected from the Coastal Springs Nutrient Monitoring Network, and well data collected for the Jones and Upchurch (1993, 1994) and Jones et al. (1996, 1997) spring's reports. The following criteria were used to select spring and well data for inclusion in the geostatistical analysis.

Temporal Criteria

In order to maintain temporal consistency, sites with nitrate data collected between January 1, 1991 and December 31, 1995 were selected for inclusion in the geostatistical analysis. This time interval insured that all nitrate data collected by the Resource Data section for the referenced spring's reports were included. This also served to make the dataset as synchronous as possible. Upchurch (1999) emphasized that in order for geostatistical analysis to possess the maximum reliability, it is essential for all samples to be synchronous (collected during a relatively short time interval). This serves to reduce the effect of temporal trends on the analysis. Since the dataset represents several different sampling events, sites that were sampled more than once during this time period were averaged together to produce one value per site for the entire period. This "dynamic average steady-state" method has been used for ground-water flow modeling (Anderson and Woessner, 1992) and geostatistical analysis (Bateman, 2001).

Depth Criteria for Wells

The original spring's well network in the northern District consisted of 312 dedicated monitor wells and wells used for domestic and public supply. Of the 312 wells, 245 fell within the delineated study area; approximately 40 of the 245 wells (16.3%) did not have known total depths. The spring reports (Jones and Upchurch, 1993, 1994 and Jones et al., 1996, 1997) assumed the wells to be within the potable thickness of the Upper Floridan aquifer based on water-quality analysis. The same assumption was used for this project. The remaining 205 wells have been included on the basis of total depth measurements that have been verified to be within the upper flow zone of the Floridan aquifer (Jones and Upchurch, 1993, 1994 and Jones et al., 1996, 1997).

Exploratory Data Analysis

The geostatistical analysis method used for this project assumes that the data follows a normal or Gaussian distribution. Therefore, it was necessary to perform an exploratory data analysis to determine the initial distribution of the data, correct for censored data (below-detection values), and transform the data to approximate a normal distribution.

Distribution of the Dataset

In many cases, environmental datasets are positively or right-skewed, meaning the median is considerably less than the mean (Helsel and Ryker, 2001). Although the presence of outliers in a dataset may increase skewness, they are not the only reason that datasets appear skewed. Low concentrations or numerous below-detection values can also positively skew the dataset.

The method detection limit (MDL) for an analyte is defined as the lowest concentration that is detectable by a particular laboratory method. Most laboratories report values that fall below this threshold as "below detection". Instead of reporting a concentration, a less than sign "<" and the MDL are reported. Data such as these are referred to as censored because they are not the true concentration. Censored data may pose a problem for statistical analysis since they are usually reported as one value, the MDL. In the case of the nitrate data used for this study, the MDL is 0.01 mg/L. In order to approximate a more normal (Gaussian) distribution, substitution methods may be employed for data below detection, although there is no theoretical basis for such substitutions (Helsel, 2005 and Helsel and Gilroy (personal communication), 2005). To accomplish this substitution, random values between 0.00 and 0.01 were generated using the RAND function in Microsoft™ Excel. These values were substituted back into the original data set. There were 45 sites in which nitrate was "below detection" and a randomly generated number was substituted for the reported MDL.

Figure 9A and 9B show a histogram and probability plot of the data in the original units. The dataset has a mean nitrate concentration of 0.46 mg/L and a median of 0.28 mg/L.

Transformation of the Dataset

Helsel and Ryker (2001) stress "least-square surfaces are pulled up toward the tail of a skewed distribution to a few extreme values that may occur in only one part of the study area". Therefore it is necessary to "transform the data into units that closely approximate a normal distribution (Gaussian) so that results can be interpreted as a central trend". Helsel and Ryker (2001) also point out "transformations that are not nearly normal will result in a surface that is neither a mean (expected concentration) or median (typical value), and become virtually useless in practical terms". For this reason, a power transformation in which the transformed value is approximately equal to the fourth root in the original units was used. The Minitab™14.0 software maximizes the transformation to approximate the most normal distribution possible. If *x* is a value in the original units, and *y* is the transformed value, than the following equations would represent the transformation and approximate back-transformation used for the dataset:

$$y = x^{0.24}$$

$$x = y^{4.17}$$

Geostatistical analysis of a dataset that has been transformed using a power transformation is called "trans-Gaussian kriging" (Cressie, 1993). A histogram and probability plot of the transformed dataset with a mean nitrate concentration of 0.70 and a median of 0.74 in transformed units is shown in Figure 10A and 10B.

Geostatistical Analysis

Overview of Geostatistical Concepts

Several monitoring networks have been established using geostatistical analysis. These include: Upchurch (1990, 1999), Olea (1982, 1984a,b), Bateman (2001), Boniol and Toth (1999), and Myers et al. (1982).

Generally, there is a two-phase approach to geostatistical analysis. The two steps are: 1) structural analysis, which includes graphing the semivariogram to analyze surface properties and 2) kriging.

Graphing of the semivariogram investigates spatial autocorrelation: the relationship that pairs of data points that are close together in distance should have smaller measurement differences than those that are farther apart. The semivariance (λ) is defined as the variance between subsets consisting of pairs of points at given separation distances (Upchurch, 1999). “The first step in creating the empirical semivariogram is to calculate the distance and squared differences between each pair of locations” (Johnson et al., 2001).

The distance between two locations is calculated by using the Euclidean distance (d_{ij}):

$$d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$$

Where:

x_i is the location of the i th location is the x-direction
x_j is the location of the j th location is the x-direction
y_i is the location of the i th location is the y-direction
y_i is the location of the j th location is the y-direction

The empirical semivariance is calculated by multiplying 0.5 by the square difference of a pair of measured values. Plotting the semivariance (y-axis) versus the distance between pairs of data points (x-axis) yields the empirical semivariogram (Figure 11). Theoretically, as the distance between pairs of data points increases, so does the semivariance. Plotting the semivariance for each pair of data points would quickly become unmanageable, so pairs of data points are organized into “lag bins” based on separation distance. The average semivariance for each bin is calculated and plotted on the semivariogram. The *lag spacing* and *lag distance* designate the number of bins included in the semivariogram and separation distance within each bin, respectively. For example, if the lag distance for a semivariogram is 1,500 meters, and the lag spacing is 10, then the first bin would contain the average semivariance for all pairs of data with separation distances of 0 to 1,500 meters, the second bin would include the average semivariance for all pairs of data with separation distances of 1,501 to 3,000 meters and so on. The total distance included in the semivariogram would be 15,000 meters (1,500 meters x 10). Once the semivariance of the data is plotted, it is necessary to fit a semivariogram model to the data (Upchurch, 1999).

The ESRI Geostatistical Analyst™ software is an ArcMap™ extension tool and was used for the geostatistical analysis in this report. It provides several functions to model the empirical semivariogram including Linear, Spherical, Exponential, and Gaussian. The technique is similar to the least-squares method for regression analysis where a line or a curve is fitted to the data. The model selection influences the prediction of the unknown values, and each model is designed to fit different types of phenomena more accurately. In addition, the function that is represented by the model is characterized by three variables: 1) the *range* which is the distance where the model flattens out and spatial autocorrelation ceases to exist, 2) the *sill* which is the semivariance at which the function flattens, and 3) the *nugget* or *nugget effect* which occurs where the distance between data-point pairs is too small to support spatial autocorrelation and uncertainty is greatest (Figure 11). This effect can be attributed to measurement errors or spatial sources of variation at distances smaller than the sampling interval. Most important to the design of monitoring network is the range that quantifies the separation distance in which spatial autocorrelation ends. This distance can then be used to create a well-network grid in which each chosen data point is within the "range distance" of data points in neighboring cells. In summary, graphing the semivariogram and selecting a theoretical model sets the limits and weights used in the kriging process, which is the next step in geostatistical analysis (Upchurch, 1999).

Kriging is a linear and unbiased (the average difference between the predicted and measured values should be zero) estimator that predicts values at unmeasured locations based on the theoretical model of the semivariogram given by the following equation:

$$\hat{Z}(\mathbf{s}_o) = \sum_{i=1}^{N} \lambda_i Z(\mathbf{s}_i)$$

Where:

$Z(\mathbf{s}_i)$ is the measured value at the ith location

λ_i is an unknown weight for the measured value at the ith location

$\mathbf{s}_o$ is the prediction location

$\hat{Z}$ is the predicted value at $\mathbf{s}_o$

N is the number of measured values

Kriging predicts values at unmeasured locations and calculates the uncertainty in those predictions at each measured location. Kriging uses the semivariogram theoretical model to produce weights (λ_i) that are assigned to each measured value. Higher weights are given to data that are closer together than those that are farther apart. The assigned weights are used to predict values at unmeasured locations. Kriging produces two maps: a contour map that shows the predicted distribution of the data, and a standard-errors (kriging errors) map that shows the uncertainty of the predicted values.

Geostatistical Methods

The ESRI Geostatistical Analyst™ ArcMap 8.3 extension tool was used for global trend removal; analyzing the omni-directional semivariogram; graphing the directional semivariograms; correcting for anisotropy; calculating the theoretical semivariogram, and creating the prediction and uncertainty maps.

Global Trends

A fundamental assumption for geostatistical methods is that any two locations that are a similar distance and direction from each other should have similar semivariance (Johnson et al., 2001). This is called stationarity. If a relationship exists between locations that cause this assumption to fail, then the geostatistical results may lose some of their validity. Trends across the entire range of the data (global trends) can influence the predictions in the output surface created by kriging the data. The trend-analysis tool in the software was used to determine if a trend existed within the dataset. The trend-analysis tool provides a three-dimensional view of the data (Figure 12). The locations of the data points are plotted on a coordinate *x*,*y* plane, and the value of the transformed nitrate concentration is given by the height of the stick in the *z*-direction. In the same graph, the nitrate values are also plotted on scatterplots that have an *x* and *y* orientation and a polynomial function is fitted through the scatterplots. Using this method, the nitrate data show a strong east-to-west trend represented by the red upside-down "U". The ESRI Geostatistical Analyst™ software uses a least-squares fit method for determining the best polynomial to describe the global trend. In this case, a second-order polynomial was used to illustrate the trend. This process is known as global polynomial interpolation (Johnson et al., 2001).

It is not enough to see the trend in the scatterplot and remove it; there must be a physical reason that the trend exists. If the study area is divided into three sections that include an eastern, central, and western portion, then recalling that the general direction of ground-water flow is from east to west, the reason becomes apparent. In the eastern portion of the study area land uses that would contribute loading to the Floridan aquifer are relatively scattered. In the central portion of the study area, however, residential and agricultural land uses are widespread and in some areas quite congested. Nitrate concentrations in the Floridan should be at their greatest in these areas. As ground water moves along the flow path to the western portion of the study area, dilution occurs and nitrate concentrations are somewhat diminished before they discharge at the springs. A trend such as this, that can be explained, should be removed prior to the kriging process, and then added back in prior to the final predicted results. Once the user has identified such a trend, the ESRI Geostatistical Analyst™ software performs this procedure automatically.

The Omni-Directional Semivariogram

The omni-directional semivariogram is a plot of semivariance for all pairs of data points in every direction. The omni-directional semivariogram was plotted for the nitrate data with a lag spacing of 10, lag distance of 1,175 meters, and maximum distance of 12,000 meters (Figure 13). A Gaussian theoretical model (yellow line in Figure 13) was fitted to the semivariance. In a semivariogram in which the semivariance varies little with direction, the points should be grouped together and level off when the sill has been reached. In Figure 13, several of the semivariance points appear to increase beyond the sill. This may be an indication that anisotropy (semivariance changing with direction) in the data exists. If true, the assumption of stationarity would be violated. This finding warranted further investigation with the use of directional semivariograms.

Anisotropy and Directional Semivariograms

"Anisotropy is a characteristic in a random process that shows higher autocorrelation in one direction than in another. Unlike a global trend, anisotropy may not have a known cause, so it is modeled as random error" (Johnson et al., 2001). A method that was used by Bateman (2001) was to plot semivariance in different directions with the use of directional semivariograms (Figure 14). The directional semivariograms are plotted for directions from 10 to 170 degrees referenced from the north. With the use of directional semivariograms, it can be seen that semivariance increases above the sill most drastically in the 90-, 110-, and 130-degree directions. The ESRI Geostatistical Analyst™ software calculates separate theoretical models for each direction when anisotropy is accounted for. The culmination of this process can be seen in the theoretical semivariogram (Figure 15), where each of the separate models is plotted in one semivariogram. In this way, a major range (the greatest separation distance at which the semivariance reaches the sill) and the minor range (the shortest separation distance at which the semivariance reaches the sill) can be calculated. The resulting Gaussian theoretical semivariogram has a lag distance of 1,175 meters, a minor range of 8,203 meters, a major range of 11,117 meters, sill of 0.064, and nugget of 0.024.

Kriging

Kriging is an automated process in the Geostatistical Analyst software and ultimately yields a predicted surface and calculates the uncertainty in that surface. The results of the kriging process were used to create Figure 16 that represents the predicted nitrate concentrations in transformed units for the study area and Figure 17 that illustrates the standard error (kriging error) of the kriging process, also in transformed units. It is clear in Figure 17 that uncertainty in the predicted values is greatest in areas that lack nitrate data (no wells are present).

Cross-Validation

There are several ways of estimating the validity of the theoretical model and resulting predicted surface. The ESRI Geostatistical Analyst™ software provides a cross-validation process in which each measured data point is removed one at a time, and a value for that point is predicted using the remaining points. This process yields summary statistics including: the mean prediction error, the root-mean-square (RMS) prediction error, average standard (kriging) error, mean standardized prediction error, and the RMS standardized prediction errors. The equations used for calculating these statistics can be found in Appendix B.

The following summary statistics were calculated for the transformed nitrate predictions:

Mean Prediction error:	**0.004**	**transformed units**
RMS Prediction error:	**0.23**	**transformed units**
Average Standard error:	**0.18**	**transformed units**
Mean Standardized Prediction error:	**0.012**	
RMS Standardized Prediction error:	**1.22**	

In general, the best predictive model is one in which: 1) the mean prediction error and mean standardized error are closest to zero, 2) the RMS prediction error is nearest to the average standard error, 3) and the RMS standardized prediction error is closest to one. Based on the results of the summary statistics, the chosen theoretical model does a fairly good job predicting values at unmeasured locations. However, when the average standard error is less than the RMS prediction error, and the RMS standardized prediction error is greater than one, the model slightly underestimates the variability in the predicted values. It is just as important to calculate the correct variability (uncertainty) of the predicted surface as it is for the predicted values to approximate the measured values.

There are several graphical methods of assessing the validity of the model predictions. Figure 18 provides a histogram of the kriging residuals (the difference in the measured value and the predicted value). If the predicted values are unbiased (close to the measured value), than the distribution of the residuals should follow a normal distribution with the mean near zero. The residuals in Figure 18 appear to follow a normal distribution with a mean of 0.004 in transformed units. The standard error (kriging errors) should also follow a normal distribution; however, as Figure 19 illustrates, the distribution appears skewed with a mean of 0.181 and a median of 0.178 in transformed units, and the standard deviation of the kriging errors is 0.02 also in transformed units. When the standard error is not normally distributed, it loses its rigorous significance at the 95% confidence interval but still makes sense as a nominal (or conventional) confidence interval (Chiles and Delfiner, 1999). This is likely caused by the slight underestimation of the variability revealed in the summary statistics. The standard error is created by the modeling process, but is a direct result of variability caused by the lack of measured observations within the dataset.

Network Design

Grid Design

Because the geostatistical analysis yielded a minor range of approximately 8,200 meters, and a major range of approximately 11,100 meters, a grid composed of cells with side measurements of approximately 5,000 meters and a diagonal distance of approximately 8,000 meters was created. The method for designing a grid such as this is well documented in Upchurch (1999) and Bateman (2001).

The grid was then laid over the study area. Some of the grid cells were located on the perimeter of the study area, and included only a portion of the study area. Only cells that contained at least fifty-one percent of the study area were selected for actual well assignment. A total of 121 cells were selected in this process, hence 121 wells will be selected for inclusion in the network. The selected cells are denoted by red shading in Figure 20.

Well Selection

Wells with the lowest standard error should be marked for inclusion in the network, because the standard errors are a representation of the statistical relevance of a point (Bateman, 2001). An estimate of the uncertainty at each well can be illustrated in the original units by using an appropriate back-transformation of the predicted values attained by the geostatistical analysis. Recall that the original dataset was transformed to approximate a more normal (Gaussian) distribution, and a power transformation approximately equal to the fourth root was used to accomplish this. For example, a predicted value such as 0.66 with a standard error of 0.17 in transformed units would translate into a nitrate concentration range from 0.49 to 0.83 in transformed units. This value and range would back-transform to a value of 0.18 mg/L with an error range from 0.05 mg/L to 0.49 mg/L in the original units. As the standard error in transformed units increases, the error range in the original units also increases. As a result, the reliability of a well to effectively represent nitrate concentrations relative to adjacent UFA wells decreases. Therefore, it is important to select wells that have the lowest standard errors for inclusion in the final network.

Figure 21 represents the locations of the wells and springs included in the geostatistical analysis. The coverage of wells was not spatially consistent over the entire study area, and each grid cell did not have a “kriged” well to populate it. Consequently, the well selection process for the final network was separated into two phases composed of selecting wells that were part of the geostatistical analysis and those that were not.

The first phase consisted of wells that were included in the geostatistical analysis. Each well within a grid cell was ranked by the standard error (kriging error). Wells with the lowest error for a grid cell were given a priority ranking of one, and for the next lowest error a priority ranking of two was assigned, and so on. The wells with a priority ranking of one are included in Figure 22. Using this method, 78 wells were selected for inclusion in the final network.

The second phase of the selection process involved wells that were not part of the original network. The Water Management Database (WMDB) at the SWFWMD was used to select Floridan aquifer wells that had been used by the District for various reasons including water-level monitoring. From this database, wells within each grid cell were ranked by total depth (shallower Floridan wells were ranked higher than deeper ones). Using this method, the first-priority wells within each grid cell were selected and another 24 grid cells were populated (Figure 23). Unfortunately, 19 grid cells were still unrepresented with a monitor well. Therefore, withdrawal locations for all water-use permits that fell within the 19 cells that were still lacking monitoring locations were selected from the SWFWMD Regulatory Database (RDB). From this database, using the same priority ranking method for the WMDB selection, another 16 first-priority wells were selected (Figure 24).

The final well network of first-priority wells consists of 118 wells (Figure 25). There were still three grid cells lacking a representative monitor well (Figure 26). These grid cells may have to be populated using ground reconnaissance, direct mailing to homeowners, well construction permit records, or new monitor well construction.

It is highly unlikely that each of the first-priority wells that have been chosen for inclusion in the final network will actually be sampled. There are several reasons that wells may be unsuitable for inclusion in the network. These include: the well is damaged, destroyed or abandoned; the well owner refuses cooperation; or the well cannot be accessed safely. Appendix C contains all of the well selections and priority rankings for each grid cell. Before the first sampling of the network, a reconnaissance will need to take place in which field technicians will try to contact the well owner to inquire about the status of the well and receive permission to sample. The technicians should include or exclude wells in each grid cell based on priority ranking. If the first-priority well in a grid cell is unsuitable, then the second-priority well should be investigated, and so on down the list until a suitable well can be established. This process should be carried out for each grid cell within the network. Once a suitable well for each grid cell is identified, it should be included as a permanent well in the network on a long-term basis.

Determination of Sampling Frequency

To determine the optimal sampling frequency for the monitoring network, it was necessary to explore seasonal water quality. The Kruskal-Wallis test was used to compare water quality for twelve potential monitoring wells that were sampled by Resource Data technicians within the Homosassa spring-recharge basin between October 2003 and September 2004. The dataset is not related to other well data or the Coastal Spring's Nutrient Monitoring Network data used for other analyses in this report.

Nitrate, total nitrogen, calcium, magnesium, and alkalinity concentrations for the twelve wells were used for this analysis. Because several of the wells used in the analysis are tidally influenced, it was necessary to choose analytes that were assumed to be relatively unaffected by tidal processes.

The Kruskal-Wallis test is a non-parametric statistical test that compares the equality of medians for two or more populations based on data from independent, random samples due to one factor. In this case, concentrations of water-quality analytes were grouped by season and compared. According to Helsel and Hirsh (2002), the Kruskal-Wallis test may be used to determine the general equivalence of groups of data.

The Kruskal-Wallis test calculates a *p*-value, which is the significance level attained by the data (Helsel and Hirsch, 2002). The null hypothesis of the test assumes that there is no difference between the medians of each group. If the *p*-value for the test is greater than 0.05, than the null hypothesis is not rejected and the medians are essentially the same. If the p-value is less than 0.05 than one or more of the medians is statistically different at the 95% confidence interval.

The analysis (Table 7 and Figure 27A-E) showed that the median concentration for each of the compared analytes were not statistical different over the course of one water year. Therefore, it is recommended that the final well network be sampled no more than twice per year. Collecting samples on a quarterly basis would be unnecessarily costly and time consuming. As previously mentioned, this analysis was performed for one of the spring-recharge basins. Resources were not available to sample other potential network wells within the other spring-recharge basins. It is possible that other basins may show water quality changes at different rates than the Homosassa basin; however, the land use and geology are fairly similar throughout much of the study area. The Resource Data Section may want to consider sampling a subset of wells from the final network within each of the spring-recharge basins on a quarterly basis for a period of one year, and evaluate the results using this statistical test.

Sample Parameter List

The sample parameter list for the ground-water nutrient monitoring network will include the same field parameters and laboratory analytes as the Coastal Springs Nutrient Monitoring Network (Table 8). This list includes field temperature, specific conductance, pH, and dissolved oxygen as well as nutrients, major ions, some trace metals, and dissolved solids.

Kreitler and Browning (1983) state “measuring the ratio between the nitrogen isotopes of ^{15}N and ^{14}N is an effective method of identifying sources of nitrate in an aquifer”. The Coastal Spring Nutrient Monitoring Network and Jones and Upchurch (1993, 1994) and Jones et al. (1995, 1997) UFA wells were sampled for nitrogen isotopes. This analysis has been one of the key components in identifying inorganic fertilizer as the main source of nitrate loading to the UFA. As a result, it is suggested that each well be sampled for nitrogen isotopes every four years. If there are financial constraints to consider, perhaps thirty wells per year could be sampled for nitrogen isotopes. This schedule would ensure that nitrogen isotopes are collected for each well every four years.

Several of the major springs throughout the district have been sampled for priority pollutants with little if any detections for the 231 priority pollutant analytes defined by the Florida Department of Environmental Protection (Haber, 2003). As a result, including these analytes in the parameter list is unnecessary at this time.

Network Evaluation and Refinement

A network evaluation should be performed after the first complete sampling of the network. This would entail another geostatistical analysis to confirm the findings of this study. A geostatistical analysis based on more synchronous nitrate data may show that the range distance between wells needs to be changed and wells need to be added or subtracted. Also, the Resource Data Section may want to run a geostatistical analysis on each separate spring-recharge basin. The range for each basin may be different than the range calculated for the entire study area.

It is a basic statistical principle that increased observations decrease uncertainty. Thus, additional wells added to the network would serve to decrease the uncertainty and variability in the network. If the Resource Data Section is satisfied with the analysis and variability presented in this study, than additional wells would be unnecessary.

The Resource Data Section may also want to consider including additional wells that are outside of the study area used in this report. The spring-recharge basins within the northern SWFWMD were delineated using potentiometric-surface maps and water-quality data collected using the Jones et al. (1993, 1994, 1995 and 1997) UFA wells. Perhaps a more long-term monitoring effort that included wells outside the current spring-recharge basins would assist in confirming the delineation of these vulnerable areas.

Summary and Conclusions

Over the past decade, springs in the northern portions of the SWFWMD have been identified as having elevated concentrations of nitrate. The statewide background level of nitrate in the Floridan aquifer is below detection (<0.01 mg/L) (Upchurch, 1999). Past investigations have identified residential and agricultural land uses as the predominant source for nutrient loading to the UFA. In recognition of this problem, a network to monitor nutrients in ground water has been designed with the potential to determine the effectiveness of nutrient remediation programs, track nutrient trends, determine water quality distribution throughout the study area, and improve delineation of the spring-recharge basins. To complete this task, it was necessary to: 1) delineate the study area by selecting spring-recharge basins for inclusion in the network; 2) select the nutrient data to be used for the geostatistical analysis; 3) perform an exploratory data analysis on the resulting dataset; 4) determine a network design and select monitoring wells via geostatistical analysis; and 5) establish the sample frequency and field and lab parameter lists.

To determine which spring-recharge basins to include in the monitoring network, it was necessary to determine which springs had statistically significant trends in nutrient concentrations. Nitrate data of the springs were organized into three temporal groups (baseline, previous and current), and a statistical hypothesis test was performed on the groups. The Wilcoxon Rank-Sum test showed that six spring-recharge basins within the Springs Coast region of the SWFWMD had statistically increasing nitrate concentrations for both of the temporal group comparisons. It was concluded that the network to monitor nutrients in ground water should target these areas.

In preparation for the geostatistical analysis portion of the project, 304 springs and wells with nitrate data from January 1, 1991 to December 31, 1995 were selected. For each site that was sampled more than once during this time period, the concentrations were averaged to report a single concentration. The selections were also based on depth criteria in which each site was open to the potable thickness of the UFA. In addition, an exploratory data analysis was performed on the data set. Censored data, or data reported as “below detection” were removed and replaced with randomly generated values that were between zero and the method detection limit. The nitrate dataset was shown to be positively skewed with the use of histograms and probability plots. As a result, the data was transformed using a power transformation to approximate a normal distribution, which is a necessity in geostatistical analysis.

Using the ArcMap™ Geostatistical Analyst software, a global trend in the data was removed based on land use; the omni-directional semivariogram was graphed; anisotropy was accounted for using directional semivariograms; and the resulting theoretical semivariogram with a minor range of 8,200 meters and a major range of 11,100 meters was calculated. Cross-validation of the modeling and kriging confirmed that although the predicted surface was a fairly good representation of the median, the model may have slightly underestimated the variability in those predictions. The validity of the analysis however, should not be affected.

The minor range of 8,200 meters was used to create a grid system composed of cells that were approximately 8,000 meters diagonally and 5,000 meters on each side. As a result of the spatial inconsistency of the original network, only 78 wells that were included in the geostatistical analysis were selected based on the standard error of the kriging predictions. Therefore, another 40 known UFA wells were selected for the network using other SWFWMD databases including the Water Management Database and the Regulatory Database. The selections from these databases were prioritized based on depth (shallower wells were selected over deeper wells). A total of 118 wells were selected for inclusion into the final network. Three grid cells remained unrepresented with a known monitor well.

Another statistical hypothesis test was used to determine if several potential network wells possessed seasonal variations in water quality. Seasonality in the water-quality data directly influences the sampling frequency of the monitoring network. Resource Data technicians collected water-quality samples at twelve potential network wells within the Homosassa spring-recharge basin for an entire water year. The Kruskal-Wallis test was used to determine if the median concentration for nitrate, total nitrogen, calcium, magnesium, and alkalinity differed seasonally. The test showed that median concentrations for all twelve wells were not significantly different during the course of one year. Therefore, it was recommended that the final network not be sampled more than twice per year.

The sample parameter list for the network that includes field parameters (i.e., temperature, pH, etc.) nutrients, major ions, and some trace metals is based on the current Coastal Springs Nutrient Monitoring Network parameter list. In addition, it is suggested that samples be collected for nitrogen isotope analysis on each well, at a rate of once per four years. Collecting samples for analysis of priority pollutants was deemed unnecessary based on the results of past analyses at several of the major springs with the northern SWFWMD.

It is anticipated that the design process used in this report, will produce a ground-water network that monitors nutrients and yields the least amount of gaps and redundancy in the data, while providing accurate and defensible water-quality information.

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Table 1. Wilcoxon Rank-Sum test results for Spring Nitrate Analysis (Group A versus Group C).

Station ID	Station	Spring Recharge Basin	P-Value of Wilcoxon Rank Sum Test	Significant Trend?	Direction of Trend	# of samples in Group A	Median of Group A	# of samples in Group C	Median of Group C	Median Difference	Percent Change
282611082392301	BOAT SPRING	ARIPEKA	0.004	**Yes**	**Increasing**	8	0.34	5	0.47	0.13	39.7%
284258082343001	CHASSAHOWITZKA #1 SPRING	CHASSAHOWITZKA	0.021	**Yes**	**Increasing**	10	0.46	14	0.50	0.04	8.5%
284255082343401	CHASSAHOWITZKA MAIN SPRING	CHASSAHOWITZKA	0.001	**Yes**	**Increasing**	10	0.42	15	0.48	0.06	14.5%
284302082343301	CRAB SPRING	CHASSAHOWITZKA	0.037	**Yes**	**Increasing**	5	0.45	5	0.54	0.08	18.1%
284605082345801	HIDDEN RIVER #2 SPRING	HOMOSASSA	0.000	**Yes**	**Increasing**	9	0.52	14	0.69	0.17	32.1%
284604082344701	HIDDEN RIVER HEAD SPRING	HOMOSASSA	0.000	**Yes**	**Increasing**	8	0.56	15	0.71	0.15	26.9%
284757082351701	HOMOSASSA #1 SPRING	HOMOSASSA	0.001	**Yes**	**Increasing**	9	0.42	16	0.50	0.08	17.8%
284757082351702	HOMOSASSA #2 SPRING	HOMOSASSA	0.001	**Yes**	**Increasing**	9	0.41	15	0.48	0.07	16.8%
284757082351703	HOMOSASSA #3 SPRING	HOMOSASSA	0.001	**Yes**	**Increasing**	9	0.44	14	0.52	0.09	19.5%
285339082353301	HUNTERS SPRING	KINGS BAY	0.001	**Yes**	**Increasing**	5	0.30	16	0.37	0.08	26.0%
282602082390801	MAGNOLIA SPRING	ARIPEKA	0.000	**Yes**	**Increasing**	9	0.37	15	0.50	0.12	33.3%
284758082352501	PUMPHOUSE SPRING	HOMOSASSA	0.026	**Yes**	**Increasing**	10	0.38	6	0.49	0.11	28.3%
290609082261501	RAINBOW #1 SPRING	RAINBOW	0.013	**Yes**	**Increasing**	9	1.02	14	1.21	0.19	18.8%
290609082261301	RAINBOW BRIDGE SEEP NORTH	RAINBOW	0.006	**Yes**	**Increasing**	10	0.48	4	0.80	0.32	67.1%
284357082354801	RUTH SPRING	CHASSAHOWITZKA	0.020	**Yes**	**Increasing**	5	0.42	4	0.54	0.12	28.7%
283246082370801	SALT SPRING	WEEKI WACHEE	0.006	**Yes**	**Increasing**	10	0.42	4	0.51	0.09	21.5%
285254082354101	TARPON HOLE SPRING	KINGS BAY	0.000	**Yes**	**Increasing**	9	0.16	16	0.18	0.02	15.0%
284757082352001	TROTTER MAIN SPRING	HOMOSASSA	0.000	**Yes**	**Increasing**	9	0.45	14	0.55	0.10	22.3%
283100082342501	WEEKI WACHEE MAIN SPRING	WEEKI WACHEE	0.003	**Yes**	**Increasing**	10	0.49	16	0.64	0.15	29.4%
275113082162601	BOYETTE SPRING	LITHIA BUCKHORN	0.000	Yes	Decreasing	9	15.70	18	8.07	-7.63	-48.6%
275321082180901	BUCKHORN MAIN SPRING	LITHIA BUCKHORN	0.016	Yes	Decreasing	9	2.10	15	1.88	-0.22	-10.4%
284123082353901	BETEE JAY SPRING	CHASSAHOWITZKA	0.112	No	Increasing	7	0.28	17	0.32	0.04	15.4%
284111082360201	BLUE RUN SPRING	CHASSAHOWITZKA	1.000	No	Increasing	7	0.26	4	0.26	0.00	1.4%
282607082383401	BOBHILL SPRING	ARIPEKA	0.704	No	Increasing	9	0.57	11	0.63	0.06	10.3%
290610082261401	BUBBLING SPRING	RAINBOW	0.815	No	Increasing	11	1.11	15	1.15	0.04	3.6%
285353082355501	CATFISH SPRING	KINGS BAY	0.161	No	Increasing	9	0.22	5	0.24	0.02	9.0%
285316082352101	IDIOTS DELIGHT SPRING	KINGS BAY	0.240	No	Increasing	6	0.17	4	0.19	0.02	12.8%
290534082254201	RAINBOW #6 SPRING	RAINBOW	0.097	No	Increasing	11	0.86	15	0.94	0.08	9.0%
290609082261401	RAINBOW SWAMP #3 SPRING	RAINBOW	0.626	No	Increasing	7	1.35	5	1.40	0.05	3.7%
275159082135301	LITHIA MAIN SPRING	LITHIA BUCKHORN	0.074	No	Decreasing	9	2.93	15	2.76	-0.17	-5.9%
290606082261301	RAINBOW #4 SPRING	RAINBOW	0.733	No	Decreasing	10	1.32	13	1.31	-0.01	-0.9%

Table 2. Wilcoxon Rank-Sum Test Results for Spring Nitrate Analysis (Group B versus Group C)

Station ID	Station	Spring Recharge Basin	P-Value of Wilcoxon Rank Sum Test	Significant Trend?	Direction of Trend	# of samples in Group B	Median of Group B	# of samples in Group C	Median of Group C	Median Difference	Percent Change
285238082355701	BLACK SPRING	KINGS BAY	0.018	**Yes**	**Increasing**	7	0.21	4	0.26	0.05	25.2%
282611082392301	BOAT SPRING	ARIPEKA	0.004	**Yes**	**Increasing**	10	0.37	5	0.47	0.11	29.4%
285353082355501	CATFISH SPRING	KINGS BAY	0.043	**Yes**	**Increasing**	10	0.23	5	0.24	0.01	5.4%
284258082343001	CHASSAHOWITZKA #1 SPRING	CHASSAHOWITZKA	0.017	**Yes**	**Increasing**	17	0.47	14	0.50	0.03	6.0%
284255082343401	CHASSAHOWITZKA MAIN SPRING	CHASSAHOWITZKA	0.004	**Yes**	**Increasing**	18	0.43	15	0.48	0.04	10.0%
284605082345801	HIDDEN RIVER #2 SPRING	HOMOSASSA	0.002	**Yes**	**Increasing**	16	0.62	14	0.69	0.06	10.3%
284604082344701	HIDDEN RIVER HEAD SPRING	HOMOSASSA	0.002	**Yes**	**Increasing**	18	0.64	15	0.71	0.07	10.4%
284757082351701	HOMOSASSA #1 SPRING	HOMOSASSA	0.000	**Yes**	**Increasing**	17	0.44	16	0.50	0.06	12.5%
284757082351702	HOMOSASSA #2 SPRING	HOMOSASSA	0.003	**Yes**	**Increasing**	16	0.43	15	0.48	0.05	11.6%
284757082351703	HOMOSASSA #3 SPRING	HOMOSASSA	0.001	**Yes**	**Increasing**	17	0.46	14	0.52	0.07	14.5%
285339082353301	HUNTERS SPRING	KINGS BAY	0.002	**Yes**	**Increasing**	13	0.34	16	0.37	0.03	8.0%
282602082390801	MAGNOLIA SPRING	ARIPEKA	0.002	**Yes**	**Increasing**	18	0.42	15	0.50	0.08	17.8%
290609082261501	RAINBOW #1 SPRING	RAINBOW	0.010	**Yes**	**Increasing**	17	1.04	14	1.21	0.17	16.6%
290534082254201	RAINBOW #6 SPRING	RAINBOW	0.012	**Yes**	**Increasing**	15	0.86	15	0.94	0.09	9.9%
290609082261301	RAINBOW BRIDGE SEEP NORTH	RAINBOW	0.009	**Yes**	**Increasing**	9	0.53	4	0.80	0.28	52.9%
285254082354101	TARPON HOLE SPRING	KINGS BAY	0.001	**Yes**	**Increasing**	18	0.16	16	0.18	0.02	14.3%
284757082352001	TROTTER MAIN SPRING	HOMOSASSA	0.000	**Yes**	**Increasing**	16	0.48	14	0.55	0.07	14.8%
283100082342501	WEEKI WACHEE MAIN SPRING	WEEKI WACHEE	0.002	**Yes**	**Increasing**	17	0.55	16	0.64	0.09	15.8%
275113082162601	BOYETTE SPRING	LITHIA BUCKHORN	0.000	Yes	Decreasing	35	12.90	18	8.07	-4.83	-37.4%
275321082180901	BUCKHORN MAIN SPRING	LITHIA BUCKHORN	0.002	Yes	Decreasing	17	2.15	15	1.88	-0.27	-12.6%
275159082135301	LITHIA MAIN SPRING	LITHIA BUCKHORN	0.003	Yes	Decreasing	18	3.24	15	2.76	-0.48	-14.9%
285848082191701	WILSON HEAD SPRING	GUM SLOUGH	0.001	Yes	Decreasing	8	0.98	16	0.72	-0.26	-26.3%
284123082353901	BETEE JAY SPRING	CHASSAHOWITZKA	0.541	No	Increasing	18	0.32	17	0.32	0.01	2.4%
282607082383401	BOBHILL SPRING	ARIPEKA	0.775	No	Increasing	15	0.61	11	0.63	0.02	3.9%
284610082070401	CANAL 485A SPRING 1B	PANASOFFKEE	0.865	No	Increasing	8	1.02	14	1.13	0.12	11.6%
284302082343301	CRAB SPRING	CHASSAHOWITZKA	0.095	No	Increasing	5	0.49	5	0.54	0.05	10.5%
285733082135101	GUM SPRINGS NO. 1	GUM SLOUGH	0.800	No	Increasing	7	0.92	12	0.99	0.08	8.7%
285316082352101	IDIOTS DELIGHT SPRING	KINGS BAY	0.749	No	Increasing	6	0.19	4	0.19	0.00	1.8%
284758082352501	PUMPHOUSE SPRING	HOMOSASSA	0.087	No	Increasing	13	0.43	6	0.49	0.06	13.2%
290609082261401	RAINBOW SWAMP #3 SPRING	RAINBOW	0.207	No	Increasing	5	1.30	5	1.40	0.10	7.7%
284357082354801	RUTH SPRING	CHASSAHOWITZKA	0.391	No	Increasing	5	0.50	4	0.54	0.04	8.0%
283246082370801	SALT SPRING	WEEKI WACHEE	0.077	No	Increasing	10	0.44	4	0.51	0.07	15.1%
285737082134601	ALLIGATOR SPRING	GUM SLOUGH	0.847	No	Decreasing	8	1.16	12	1.01	-0.15	-12.8%
284230082344301	BAIRD SPRING	CHASSAHOWITZKA	0.903	No	Decreasing	5	0.22	4	0.22	0.00	-1.4%
284524082040501	BELTONS MILLPOND MAIN SPRING	PANASOFFKEE	0.856	No	Decreasing	8	0.14	13	0.13	-0.01	-3.6%
284111082360201	BLUE RUN SPRING	CHASSAHOWITZKA	0.948	No	Decreasing	11	0.26	4	0.26	0.00	-1.3%
284742082021901	FENNEY SPRING	PANASOFFKEE	0.905	No	Decreasing	9	0.16	15	0.16	0.00	-1.2%
285731082135301	GUM SPRINGS MAIN	GUM SLOUGH	0.198	No	Decreasing	10	1.05	14	1.00	-0.05	-4.9%
285714082141301	GUM SPRINGS NO. 2	GUM SLOUGH	0.513	No	Decreasing	6	1.03	11	1.02	-0.01	-1.1%
284936082345201	HALLS RIVER HEAD SPRING	HOMOSASSA	0.571	No	Decreasing	10	0.30	4	0.27	-0.03	-9.5%
290606082261301	RAINBOW #4 SPRING	RAINBOW	0.923	No	Decreasing	14	1.31	13	1.31	0.00	-0.1%
290610082261401	BUBBLING SPRING	RAINBOW	0.508	No		17	1.15	15	1.15	0.00	0.0%

Spring Recharge Basin	Trend	Group A vs. Group C (Baseline versus Current) # of Springs	Group A vs. Group C (Baseline versus Current) % of total	Group B vs Group C (Previous versus Current) # of Springs	Group B vs Group C (Previous versus Current) % of total
King's Bay	Increasing Trend	2	50%	4	80%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	2	50%	1	20%
Chassahowitzka	Increasing Trend	4	67%	2	29%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	2	33%	5	71%
Homosassa	Increasing Trend	7	100%	6	75%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	0	0%	5	71%
Weeki Wachee	Increasing Trend	2	100%	1	50%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	0	0%	5	71%
Rainbow	Increasing Trend	2	33%	3	50%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	4	67%	3	50%
Aripeka	Increasing Trend	2	67%	2	67%
	Decreasing Trend	0	0%	0	0%
	No Significant Change	1	33%	1	33%
Panasoffkee	Increasing Trend	NA	NA	0	0%
	Decreasing Trend	NA	NA	0	0%
	No Significant Change	NA	NA	3	100%
Gum Slough	Increasing Trend	NA	NA	0	0%
	Decreasing Trend	NA	NA	1	20%
	No Significant Change	NA	NA	4	80%

Table 3. Summary of Wilcoxon Rank-Sum Test Results for Study Area Selection

Table 4. General Hydrogeology of the study area (Modified from Fretwell, 1985)

SYSTEM	SERIES	STRATIGRAPHIC UNIT	THICKNESS feet (meters)	LITHOLOGY	WATER PRODUCING CHARACTERISTICS
Quaternary	Holocene and Pleistocene	Undifferentiated deposits	0 - 10 (0 - 30)	Soil, sand, and clay of marine and estuarine terraces, alluvial, lake and eolian deposits	Generally not a source of water
Tertiary	Pliocene and Miocene	Hawthorn Group	0 - 100 (0 - 30)	Predominantly clay; some grayish-green, waxy; some interbedded sand and limestone, phosphatic clay, marl, calcareous sandstone, limestone residuum	Confining layer in some places; generally not a source of water
Tertiary	Oligocene	Suwannee Limestone	0 - 150 (0 - 45)	Limestone, cream to tan colored, fine-grained, fossiliferous, thin-bedded to massive, porous	Many domestic and irrigation wells produce water from the lower part
Tertiary	Eocene (upper)	Ocala Limestone	100 - 150 (30 - 45)	Limestone, white to tan fossiliferous, masssive, soft to hard, porous	Yields large quanities of water to wells completed above evaporites
Tertiary	Eocene (middle)	Avon Park Formation	200 - 800 (60 - 250)	Limestone and dolomite. Limestone is light to dark-brown, highly fossiliferous, and porosity is variable in lower part. Dolomite is gray to dark-brown, very fine to microcrystalline and contains porous fossil molds, thin beds of carbonaceous material, and peat fragments. Formation generally contains evaporites in lower portion.	Yields large quanities of water to wells completed above evaporites

Table 5. Coastal Springs Nutrient-Monitoring Network Sites used for Geostatistical Analysis of Nitrate within the Study Area

Station	County	Type	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	UTM Easting	UTM Northing	District Universal ID			
									Type	Station	Site	Sequence
ABDONEY SPRING	CITRUS	SPRING	0.460	0.832	284748.692	823510.052	345199.720	3186511.970	FLO	163	287	0
ARIPEKA #1 SPRING	HERNANDO	SPRING	0.538	0.863	282618.736	823931.534	337559.130	3146902.980	FLO	125	234	0
ARIPEKA #2 SPRING	HERNANDO	SPRING	0.571	0.875	282606.990	823932.206	337535.860	3146541.690	FLO	125	233	0
BAIRD SPRING	CITRUS	SPRING	0.196	0.679	284226.786	823441.033	345855.230	3176593.060	FLO	153	279	0
BELCHER SPRING	CITRUS	SPRING	0.435	0.821	284748.287	823510.628	345183.930	3186499.710	FLO	163	286	0
BETTY JAY SPRING	HERNANDO	SPRING	0.252	0.721	284125.394	823529.411	344517.180	3174720.810	FLO	148	274	0
BLACK SPRING	CITRUS	SPRING	0.340	0.774	285238.628	823557.196	344041.640	3195453.640	FLO	164	300	0
BLUE RUN SPRING	HERNANDO	SPRING	0.243	0.714	284112.502	823605.165	343541.440	3174336.990	FLO	149	275	0
BOAT SPRING	HERNANDO	SPRING	0.334	0.771	282611.718	823923.055	337786.840	3146683.780	FLO	126	235	0
BOBHILL SPRING	HERNANDO	SPRING	0.627	0.895	282604.958	823827.975	339282.580	3146455.180	FLO	128	237	0
BUBBLING SPRING	MARION	SPRING	1.082	1.019	290604.396	822605.337	360377.670	3220050.490	FLO	144	257	0
CATFISH SPRING	CITRUS	SPRING	0.229	0.704	285353.435	823555.198	344126.810	3197755.570	FLO	164	301	0
CHASSAHOWITZKA #1 SPRING	CITRUS	SPRING	0.452	0.828	284258.245	823430.346	346158.030	3177557.530	FLO	150	276	0
CHASSAHOWITZKA #2 SPRING	CITRUS	SPRING	0.450	0.827	284258.947	823428.350	346212.480	3177578.410	FLO	150	277	0
CHASSAHOWITZKA MAIN SPRING	CITRUS	SPRING	0.413	0.810	284255.441	823434.393	346047.080	3177472.680	FLO	151	278	0
CRAB SPRING	CITRUS	SPRING	0.455	0.830	284302.502	823433.603	346071.390	3177689.730	FLO	155	280	0
HALLS RIVER #1 SPRING	CITRUS	SPRING	0.160	0.647	284920.880	823538.205	344474.430	3189359.810	FLO	162	285	0
HIDDEN RIVER #2 SPRING	CITRUS	SPRING	0.519	0.856	284607.010	823503.634	345332.060	3183379.800	FLO	135	248	0
HIDDEN RIVER HEAD SPRING	CITRUS	SPRING	0.549	0.867	284607.357	823459.689	345439.200	3183389.060	FLO	136	249	0
HOMOSASSA #1 SPRING	CITRUS	SPRING	0.393	0.801	284757.169	823517.860	344991.500	3186775.730	FLO	134	245	0
HOMOSASSA #2 SPRING	CITRUS	SPRING	0.376	0.793	284757.151	823517.810	344992.850	3186775.150	FLO	134	246	0
HOMOSASSA #3 SPRING	CITRUS	SPRING	0.413	0.810	284757.156	823517.851	344991.740	3186775.320	FLO	134	247	0
HOMOSASSA RIVER #1 SPRING	CITRUS	SPRING	0.408	0.808	284753.847	823523.573	344835.230	3186675.540	FLO	87	243	0
HOUSE SPRING	CITRUS	SPRING	0.268	0.731	285344.299	823524.509	344954.330	3197463.170	FLO	165	293	0
HUNTERS SPRING	CITRUS	SPRING	0.279	0.738	285339.541	823533.090	344719.920	3197319.830	FLO	165	292	0
IDIOTS DELIGHT SPRING	CITRUS	SPRING	0.172	0.658	285316.669	823521.932	345012.740	3196611.750	FLO	166	296	0
MAGNOLIA SPRING	HERNANDO	SPRING	0.369	0.789	282602.111	823908.965	338166.130	3146382.810	FLO	127	236	0
MANATEE SANCTUARY SPRING	CITRUS	SPRING	0.265	0.730	285323.995	823533.876	344692.200	3196841.590	FLO	166	295	0
MCCLAIN SPRING	CITRUS	SPRING	0.357	0.783	284746.570	823513.897	345094.590	3186448.040	FLO	163	290	0
MILLERS CREEK SPRING	CITRUS	SPRING	0.103	0.582	285404.813	823612.375	343666.270	3198122.090	FLO	167	302	0
POTTERS CREEK SPRING	CITRUS	SPRING	0.351	0.780	284354.943	823547.352	344091.880	3179330.540	FLO	158	281	0
PUMPHOUSE SPRING	CITRUS	SPRING	0.381	0.795	284746.955	823517.646	344993.090	3186461.250	FLO	163	291	0
RAINBOW #1 SPRING	MARION	SPRING	0.935	0.984	290609.192	822615.104	360115.420	3220201.350	FLO	9	258	0
RAINBOW #2 SPRING	MARION	SPRING	1.032	1.008	290608.315	822614.487	360131.770	3220174.150	FLO	9	259	0
RAINBOW #3 SPRING	MARION	SPRING	1.027	1.006	290607.618	822614.137	360140.970	3220152.580	FLO	9	260	0
RAINBOW #4 SPRING	MARION	SPRING	1.251	1.055	290606.727	822613.771	360150.530	3220125.030	FLO	9	261	0
RAINBOW #5 SPRING	MARION	SPRING	0.450	0.827	290554.642	822611.180	360216.040	3219752.190	FLO	145	266	0
RAINBOW #6 SPRING	MARION	SPRING	0.812	0.952	290534.262	822542.327	360988.450	3219115.390	FLO	145	267	0
RAINBOW #7 SPRING	MARION	SPRING	0.865	0.966	290531.977	822536.559	361143.540	3219043.170	FLO	145	268	0
RAINBOW #8 SPRING	MARION	SPRING	0.466	0.834	290504.626	822544.075	360930.130	3218203.740	FLO	145	269	0
RAINBOW BRIDGE SEEP NORTH	MARION	SPRING	0.481	0.840	290606.992	822615.982	360090.860	3220133.930	FLO	9	263	0
RAINBOW EAST SEEP	MARION	SPRING	1.031	1.007	290609.916	822614.911	360120.910	3220223.570	FLO	9	264	0
RAINBOW SEEP 1A	MARION	SPRING	0.877	0.969	290610.044	822615.367	360120.910	3220227.660	FLO	9	265	0

Table 5. Coastal Springs Nutrient-Monitoring Network Sites used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Type	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	UTM Easting	UTM Northing	District Universal ID			
									Type	Station	Site	Sequence
RAINBOW SWAMP #1 SPRING	MARION	SPRING	1.300	1.064	290535.906	822506.349	361961.760	3219154.260	FLO	146	273	0
RAINBOW SWAMP #2 SPRING	MARION	SPRING	1.219	1.048	290536.906	822506.349	361962.130	3219185.040	FLO	146	272	0
RAINBOW SWAMP #3 SPRING	MARION	SPRING	1.374	1.078	290534.744	822515.268	361720.210	3219121.390	FLO	146	270	0
RAINBOW SWAMP #4 SPRING	MARION	SPRING	1.257	1.056	290534.780	822516.424	361688.950	3219122.870	FLO	146	271	0
RUTH SPRING	CITRUS	SPRING	0.413	0.811	284355.183	823543.869	344186.470	3179336.660	FLO	159	282	0
RYLES SPRING	CITRUS	SPRING	0.020	0.395	284113.672	823649.697	342333.220	3174389.280	FLO	160	283	0
SALT SPRING	HERNANDO	SPRING	0.407	0.808	283246.617	823708.386	341614.670	3158788.820	FLO	137	250	0
TARPON HOLE #2 SPRING	CITRUS	SPRING	0.153	0.640	285253.923	823537.356	344585.470	3195917.200	FLO	164	299	0
TARPON HOLE SPRING	CITRUS	SPRING	0.158	0.645	285254.416	823541.008	344486.750	3195933.710	FLO	164	298	0
THREE SISTERS #2 SPRING	CITRUS	SPRING	0.200	0.682	285317.195	823523.109	344981.070	3196628.370	FLO	166	297	0
THREE SISTERS RUN SPRING	CITRUS	SPRING	0.160	0.647	285317.121	823522.302	345002.900	3196625.800	FLO	166	294	0
TROTTER #1 SPRING	CITRUS	SPRING	0.437	0.822	284746.889	823510.833	345177.800	3186456.760	FLO	163	289	0
TROTTER MAIN SPRING	CITRUS	SPRING	0.451	0.827	284747.299	823510.971	345174.240	3186469.430	FLO	163	288	0
WATERFALL SPRING	MARION	SPRING	1.138	1.031	290604.501	822608.956	360127.980	3220054.930	FLO	143	256	0
WEEKI WACHEE LITTLE SPRING	HERNANDO	SPRING	0.359	0.784	283048.428	823451.519	345286.580	3155101.350	FLO	138	251	0
WEEKI WACHEE MAIN SPRING	HERNANDO	SPRING	0.520	0.856	283102.002	823423.419	346056.010	3155509.110	FLO	25	56	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
ALTIZER	HERNANDO	0.010	0.334	282850	822319	230	105	4	200.00	364090.010	3151253.620	WEL	1175	11753	0
ANTONEN	CITRUS	0.009	0.331	285348	821738	50	40	4	50.00	373862.850	3197254.240	WEL	1092	11817	0
ARNOW	CITRUS	0.040	0.466	285240	823302	60	-	-	10.00	348806.660	3195461.080	WEL	1248	787	0
ARTHUR UMHOLTZ-HRS	MARION	0.008	0.320	290905	823115	182	169	4	90.00	352095.730	3225742.230	WEL	1838	11577	0
AUBIN	CITRUS	0.900	0.975	285335	823218	-	-	-	20.00	350020.710	3197138.460	WEL	1282	821	0
AUSTIN	CITRUS	0.870	0.967	285543	823103	170	-	4	90.00	352102.810	3201052.100	WEL	1871	1323	0
BAGGET	HERNANDO	0.448	0.826	283630	822754	160	-	-	160.00	356784.300	3165500.040	WEL	1414	953	0
BAKER	HERNANDO	0.049	0.489	282808	822300	125	82	4	137.00	364591.850	3149955.050	WEL	1177	11754	0
BAPTIST CHURCH PASTORIUM	CITRUS	2.456	1.238	285000.544	823440.224	60	-	3	10.00	346062.340	3190559.710	WEL	1243	782	0
BARBER, M.	MARION	0.002	0.238	290517	822049	180	133	4	95.00	368930.740	3218518.450	WEL	1814	11779	0
BARRETT, B.	MARION	1.784	1.147	290552	822728	60	46	4	80.00	358156.100	3219724.000	WEL	1888	1344	0
BARTLETT	HERNANDO	0.329	0.768	283749	823234	128	98	4	30.00	349210.130	3168027.070	WEL	1178	11755	0
BETTY JAY SPRING WELL	HERNANDO	0.095	0.572	284114.856	823536.843	60	48	-	5.00	344311.120	3174399.160	WEL	1370	909	0
BILL MEADORS-HRS	HERNANDO	2.835	1.281	283118	822754	110	70	4	77.00	356666.920	3155897.430	WEL	1374	913	0
BISARD	HERNANDO	0.620	0.893	282650	823108	100	53	4	60.00	351288.790	3147714.620	WEL	1179	11756	0
BLACK	CITRUS	0.006	0.302	285050	821600	100	-	2	40.00	376458.890	3191747.210	WEL	1286	825	0
BLAIR	HERNANDO	0.003	0.253	282630	822209	110	63	4	101.00	365944.630	3146923.080	WEL	1180	11757	0
BOEHL	CITRUS	0.030	0.435	285418	822106	41	40	4	45.00	368239.300	3198240.360	WEL	1296	835	0
BOUEHARD, W.	MARION	1.174	1.039	291214	822625	-	-	-	65.00	360003.190	3231461.240	WEL	1625	1164	0
BRETTHAUSER	CITRUS	0.127	0.613	284804	822129	74	68	2	74.00	367484.750	3186736.430	WEL	1299	838	0
BRIDGES	HERNANDO	1.883	1.162	282717	822921	100	78	-	62.00	354209.910	3148509.200	WEL	1412	951	0
BRIDGET WILLIAMSON-H	MARION	0.868	0.967	291913	821745	200	154	4	140.00	374189.250	3244194.670	WEL	1600	1139	0
BROOKS	CITRUS	0.288	0.744	284054	822138	159	120	4	118.00	367089.700	3173504.790	WEL	1094	11759	0
BROWN V.	CITRUS	0.093	0.569	284356	822249	160	130	4	80.00	365227.350	3179128.420	WEL	1095	11760	0
BROWN W.	CITRUS	0.010	0.332	285011	822117	85	79	4	80.00	367854.620	3190641.530	WEL	1096	11761	0
BRUCE BUMPUS-HRS	MARION	1.051	1.012	290710.90	822044.34	90	79	4	90.00	369078.680	3221995.100	WEL	2013	11857	0
BURNS	CITRUS	0.350	0.779	284937	822307	126	126	3	45.00	364861.120	3189629.400	WEL	1297	836	0
C BEDILLION-HRS	HERNANDO	0.029	0.431	282759	822312	95	76	4	88.00	364262.280	3149681.820	WEL	1182	11690	0
C ELLINGHUYSEN-HRS	HERNANDO	0.458	0.831	283942	822155	174	159	4	88.00	366602.950	3171294.070	WEL	1183	11676	0
C V HARRISON-HRS	HERNANDO	0.958	0.990	282726	822930	105	52	4	70.00	353968.530	3148789.230	WEL	1368	907	0
CALAMARI	HERNANDO	0.014	0.363	283319	821755	140	120	4	120.00	372990.580	3159433.990	WEL	1404	11557	0
CALLUNDER	CITRUS	0.290	0.745	285321	822423	152	-	4	80.00	362882.750	3196547.970	WEL	1301	840	0
CASE	CITRUS	0.310	0.757	285149	822048	40	-	4	50.00	368674.790	3193648.860	WEL	1262	801	0
CAYLOR	CITRUS	0.410	0.809	284916	823244	65	43	4	10.00	349212.650	3189175.680	WEL	1097	11823	0
CHAPMAN	HERNANDO	0.218	0.696	283848	821945	-	-	-	95.00	370113.700	3169592.350	WEL	1874	1326	0
CHASFIN	CITRUS	0.007	0.305	285629	822521	245	243	4	110.00	361380.990	3202353.120	WEL	1098	11810	0
CHASSAHOWITZKA #1	CITRUS	0.512	0.853	284318.932	823306.362	176	166	4	9.82	348445.190	3178164.400	WEL	465	199	0
CLEMENS	CITRUS	0.330	0.769	285311	823424	77	65	4	5.00	346597.660	3196444.490	WEL	1099	11795	0
COOMER	MARION	0.003	0.258	290424	821953	170	102	4	70.00	370426.410	3216869.960	WEL	1815	11780	0
CORWIN	HERNANDO	0.057	0.506	282851	823508	112	105	4	34.00	344808.850	3151523.040	WEL	1185	11762	0
CRYSTAL RIVER SHALLOW	CITRUS	0.060	0.513	285422.502	823613.714	53	3	6	8.11	343637.370	3198657.070	WEL	455	189	0
CRYSTAL SHORES	CITRUS	0.005	0.287	285223.546	823534.641	129	96	4	5.00	344646.470	3194981.170	WEL	1240	779	0
CULPEPPER	CITRUS	0.300	0.751	285227	823317	-	-	-	10.00	348395.020	3195066.260	WEL	1276	815	0
CUTRONE	CITRUS	0.004	0.270	284914	821842	64	-	-	50.00	372036.170	3188840.130	WEL	1266	805	0
DALTON	PASCO	0.043	0.474	282547	823337	-	-	-	50.00	347210.230	3145827.540	WEL	1642	1181	0
DANIELS	PASCO	1.007	1.002	282514	823057	135	-	4	70.00	351550.840	3144756.230	WEL	1643	1182	0
DANNY MORDENTI-HRS	HERNANDO	0.163	0.650	282647	823322	125	104	4	50.00	347642.230	3147668.910	WEL	1377	11558	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
DASSEL	CITRUS	0.198	0.681	284618	821949	170	166	-	80.00	370159.480	3183443.400	WEL	1292	831	0
DAVID ERVIN-HRS	HERNANDO	0.468	0.835	283603	822253	130	78	4	109.00	364950.520	3164571.900	WEL	1186	11682	0
DEUTSCHMAN	CITRUS	0.009	0.330	284704	821707	61	56	4	48.00	374568.070	3184810.980	WEL	1291	11542	0
DICKS	HERNANDO	0.423	0.815	283737	822415	200	180	-	70.00	362757.030	3167490.880	WEL	1873	1325	0
DIGGS	HERNANDO	0.021	0.400	282842	822237	160	-	-	115.00	365229.380	3150994.270	WEL	1396	935	0
DIKEMAN, F.	MARION	0.473	0.837	290545	822559	145	82	4	100.00	360559.620	3219479.050	WEL	1597	11578	0
DISPONZIO	CITRUS	0.090	0.564	285244	822542	270	-	2	120.00	360728.980	3195434.690	WEL	1319	858	0
DUNNELLON HS 3	MARION	0.694	0.917	290545	822440	155	59	6	45.00	362695.430	3219453.300	WEL	1584	1123	0
DUNNELLON MSS	MARION	0.130	0.616	290410	822700	-	-	-	50.00	358874.490	3216575.080	WEL	1605	1144	0
DYER	CITRUS	0.210	0.690	285127	823504	105	79	4	10.00	345471.300	3193257.790	WEL	1100	11796	0
EATON	CITRUS	0.080	0.549	285955	823428	-	-	4	30.00	346654.570	3208881.140	WEL	1307	846	0
EDWARDS, R.	MARION	0.670	0.909	290620	822810	-	-	-	100.00	357031.360	3220599.950	WEL	1590	1129	0
EICHHORN	PASCO	0.002	0.240	282011	823118	170	-	2	68.00	350861.750	3135438.000	WEL	1639	1178	0
ELHEROT	CITRUS	0.290	0.745	285508	823122	200	200	4	110.00	351574.450	3199981.410	WEL	1101	11804	0
ENGEL, R.	MARION	0.270	0.733	290620	822820	100	84	4	80.00	356761.030	3220603.320	WEL	1817	11782	0
ENZ	CITRUS	0.060	0.513	285128	822736	240	233	4	120.00	357611.700	3193133.030	WEL	1102	11818	0
EXLEY	CITRUS	0.400	0.804	285332	823310	60	38	4	10.00	348610.860	3197064.470	WEL	1103	11806	0
FAVOT	HERNANDO	0.137	0.624	283158	822328	195	85	-	160.00	363912.270	3157042.500	WEL	1407	946	0
FERGUSON, R.	MARION	0.151	0.638	291718	821627	200	132	4	150.00	376254.880	3240631.860	WEL	1819	11784	0
FICKES	CITRUS	0.555	0.870	284615	823128	48	42	4	60.00	351201.470	3183578.050	WEL	1277	11543	0
FLEEGLER, D.	MARION	0.104	0.584	290742	823017	165	143	4	100.00	353630.340	3223167.280	WEL	1609	1148	0
FOWLER	CITRUS	1.472	1.096	284828	821831	138	135	4	50.00	372318.770	3187421.070	WEL	1104	11763	0
FRENZEL	CITRUS	0.030	0.435	285052	821850	60	60	4	50.00	371852.660	3191858.740	WEL	1105	11808	0
FUNK	HERNANDO	1.801	1.150	282726	823404	72	63	4	35.00	346515.280	3148884.080	WEL	1189	11764	0
GOODWIN K	CITRUS	0.080	0.549	285107	822122	120	84	4	70.00	367738.780	3192366.650	WEL	1106	11819	0
GREENE	HERNANDO	0.704	0.920	283154	823540	-	-	-	10.00	344013.380	3157166.970	WEL	1411	950	0
GRETHER	CITRUS	0.189	0.673	285007	823116	216	181	4	85.00	351618.220	3190714.670	WEL	1279	818	0
HAGIN	PASCO	0.132	0.618	282243	823156	125	100	3	60.00	349886.310	3140129.210	WEL	1636	1175	0
HAROLD E SELPH-HRS	HERNANDO	0.440	0.823	283759	822527	115	94	4	105.00	360809.760	3168191.080	WEL	1190	11677	0
HARRISON T.	HERNANDO	0.429	0.818	283739	822257	150	105	4	100.00	364876.000	3167527.780	WEL	1192	11765	0
HARTLE	CITRUS	0.250	0.719	285541	823213	134	88	4	50.00	350206.420	3201014.960	WEL	1109	11812	0
HAYES	CITRUS	0.140	0.627	285456	823528	12	-	2	10.00	344907.180	3199699.520	WEL	1315	854	0
HENDRICKSON	HERNANDO	1.148	1.033	283229	823446	197	189	-	30.00	345495.440	3158224.780	WEL	1409	948	0
HENDRY	CITRUS	0.005	0.280	285011	821837	57	55	4	45.00	372191.040	3190592.960	WEL	1110	11766	0
HERBERT	CITRUS	0.009	0.323	285546	823628	81	60	3	10.00	343303.030	3201260.460	WEL	1111	11802	0
HERNANDO BEACH SUPPLY	HERNANDO	0.003	0.260	282921.544	823758.021	195	107	3	8.00	340179.720	3152494.960	WEL	1375	914	0
HILLER	CITRUS	0.005	0.284	284549	821638	35	32	4	43.00	375329.670	3182494.230	WEL	1112	11767	0
HOBBS, M.	MARION	0.216	0.695	290335	822827	161	153	4	70.00	356508.320	3215526.910	WEL	1820	11785	0
HOLDER MINE	CITRUS	0.210	0.690	284811	822252	-	-	-	40.00	365236.960	3186977.750	WEL	1289	828	0
HOMO SWD BRADSHAW 2	CITRUS	0.376	0.793	284734.716	823429.470	100	92	8	8.00	346294.340	3186067.170	WEL	1271	810	0
HOMOSASSA WELL 3	CITRUS	0.221	0.698	284550.649	823453.662	99	81	3	5.00	345595.810	3182872.600	WEL	894	628	0
HOUSTON	CITRUS	0.005	0.286	285027	822307	180	70	4	30.00	364879.050	3191168.320	WEL	1284	823	0
HOWARD	CITRUS	0.116	0.600	284005	821838	-	-	-	93.00	371958.840	3171942.130	WEL	1870	1322	0
HOWERTON	CITRUS	0.007	0.308	284642	821501	70	63	4	42.00	377977.530	3184097.540	WEL	1278	817	0
HOYER	CITRUS	0.476	0.838	284038	822332	133	110	4	98.00	363989.670	3173047.970	WEL	1113	11768	0
HRS 19A ZOLINGER	CITRUS	0.018	0.385	284239.485	823429.127	78	72	4	6.00	346183.480	3176979.660	WEL	1108	11851	0
HRS 54 KOSTER	HERNANDO	0.117	0.600	283255.148	823430.105	120	84	4	22.00	345919.960	3158994.080	WEL	1191	11694	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
HUNT	CITRUS	0.320	0.763	285902	822802	99	97	4	80.00	357080.130	3207115.530	WEL	1114	11811	0
J H JACKSON-HRS	HERNANDO	0.429	0.818	283719	822550	109	84	3	98.00	360170.460	3166967.430	WEL	1389	928	0
JACK SKIPPER-HRS	MARION	0.243	0.715	290450	822717	240	220	4	95.00	358429.950	3217811.950	WEL	1884	1340	0
JACK TEAGLE-HRS	MARION	1.136	1.031	291535	822040	70	57	4	75.00	369391.480	3237537.700	WEL	1631	1170	0
JACKSON C.	CITRUS	0.240	0.713	284314	821852	-	-	-	47.00	371642.830	3177763.210	WEL	1280	819	0
JARVIS	HERNANDO	0.062	0.517	282704	822218	120	80	-	95.00	365711.710	3147972.270	WEL	1403	942	0
JEFF CUBBAGE-HRS	MARION	0.004	0.268	290110	822407	60	50	4	40.00	363487.080	3210978.200	WEL	1821	11854	0
JOYNER	CITRUS	0.220	0.698	285342	823408	116	91	4	5.00	347043.740	3197392.930	WEL	1115	11822	0
JULIAS	CITRUS	0.060	0.513	285220	823507	73	50	4	5.00	345411.780	3194890.210	WEL	1116	11794	0
KAVORIS	HERNANDO	0.002	0.217	282942	822046	-	-	-	100.00	368268.720	3152806.660	WEL	1406	945	0
KELLNER	CITRUS	0.150	0.637	285815	822453	112	92	4	70.00	362178.100	3205606.630	WEL	1308	847	0
KELLY	CITRUS	0.540	0.864	290135	823139	185	-	4	90.00	351267.800	3211899.230	WEL	1268	807	0
KELSO	HERNANDO	0.060	0.513	282634	823213	157	-	-	45.00	349514.230	3147244.660	WEL	1413	952	0
KING, J.	MARION	0.163	0.650	291125	823050	163	122	4	110.00	352826.730	3230042.890	WEL	1594	1133	0
KINSMAN TR BN	MARION	1.232	1.051	290909	821733	150	76	4	100.00	374308.310	3225600.000	WEL	1824	11787	0
KIRKWOOD	CITRUS	0.040	0.466	285152	823527	-	-	-	5.00	344858.330	3194035.620	WEL	1257	796	0
KOLASA	HERNANDO	0.008	0.321	283735	822646	250	180	4	95.00	358655.520	3167478.140	WEL	1195	11769	0
KOON, R.	MARION	1.009	1.002	291206	822623	-	-	-	55.00	360054.190	3231214.330	WEL	1592	1131	0
KREIDER	CITRUS	0.050	0.491	284759	822554	95	83	2	50.00	360298.190	3186666.680	WEL	1320	859	0
KREMNETZ	CITRUS	2.300	1.219	285539	822234	-	-	-	60.00	365884.760	3200760.810	WEL	1267	806	0
KURTH	CITRUS	0.030	0.435	285136	822618	220	185	4	110.00	359728.300	3193353.500	WEL	1260	799	0
LADD	CITRUS	0.660	0.906	285236	823238	170	-	4	10.00	349455.300	3195329.490	WEL	1256	795	0
LAYTON	CITRUS	0.550	0.868	284640	822033	137	108	4	90.00	368961.370	3183025.890	WEL	1117	11816	0
LECANTO WELL # 1	CITRUS	0.286	0.743	284338.603	822705.461	169	168	4	32.80	358244.780	3178646.500	WEL	368	102	0
LECANTO WELL # 7	CITRUS	0.040	0.466	285254	823230	30	20	4	8.00	349679.240	3195880.710	WEL	846	580	0
LEDINGTON	HERNANDO	0.282	0.740	283805	822133	250	220	4	100.00	367166.270	3168301.870	WEL	1197	11771	0
LESTER KNOUSE-HRS	MARION	0.004	0.271	291917	821408	175	146	4	160.00	380044.310	3244254.520	WEL	1825	11852	0
LEWIS	CITRUS	0.150	0.637	285410	823521	-	-	3	5.00	345077.790	3198281.090	WEL	1310	849	0
LISOTTA	CITRUS	0.380	0.795	285255	822805	260	253	4	100.00	356858.970	3195820.500	WEL	1287	826	0
LOGHT	CITRUS	0.140	0.627	285602	822740	147	114	4	90.00	357607.180	3201567.860	WEL	1118	11800	0
LYONS	CITRUS	0.330	0.769	285137	823244	34	30	4	10.00	349269.100	3193515.600	WEL	1119	11814	0
M F BRADFORD-HRS	HERNANDO	2.078	1.190	283104	822947	160	126	4	45.00	353589.650	3155504.430	WEL	1372	911	0
M POLK-HRS (HARRISON P)	HERNANDO	0.045	0.479	283117	822358	250	137	4	225.00	363082.110	3155790.120	WEL	1199	11688	0
M T MONROE-HRS	HERNANDO	0.802	0.949	283720	823147	125	70	4	50.00	350475.090	3167118.110	WEL	1360	899	0
MAGLIO	HERNANDO	0.078	0.546	283738	822324	289	147	-	80.00	364142.400	3167505.490	WEL	1362	901	0
MAGNOLIA SPRINGS WELL	HERNANDO	0.001	0.191	282605.595	823909.546	110	85	-	5.00	338151.780	3146490.270	WEL	1402	941	0
MANCINI, N.	MARION	0.006	0.292	290749	823121	75	75	4	70.00	351903.340	3223404.970	WEL	1591	1130	0
MARSHALL	HERNANDO	0.263	0.728	283547	823153	150	84	-	40.00	350275.510	3164257.820	WEL	1365	904	0
MASARYKTOWN DEEP WEL	PASCO	0.462	0.832	282540.457	822755.595	76	29	6	65.71	356478.510	3145478.920	WEL	892	626	0
MATHIS, E.	MARION	0.700	0.919	290904	822023	88	63	4	75.00	369713.140	3225497.440	WEL	1886	1342	0
MC GEE	CITRUS	1.200	1.044	284737	821948	90	65	4	75.00	370213.760	3185874.530	WEL	1300	839	0
MILDRED WATHEN-HRS 14	HERNANDO	1.112	1.025	283159	823458	67	42	4	15.00	345157.090	3157305.740	WEL	1200	11681	0
MILLER M	CITRUS	0.004	0.275	284918	821947	145	97	4	60.00	370275.620	3188982.790	WEL	1120	11807	0
MILLER T	CITRUS	0.360	0.785	285108	823413	40	-	4	10.00	346845.590	3192654.620	WEL	1121	11797	0
MILLER W	HERNANDO	0.004	0.270	283949	821624	88	40	4	55.00	375591.150	3171410.400	WEL	1142	11772	0
MONCK	CITRUS	0.498	0.847	284034	822247	200	126	4	140.00	365209.730	3172910.700	WEL	1122	11773	0
MOORE	CITRUS	0.001	0.201	284857	821602	123	-	4	40.00	376367.620	3188269.940	WEL	1263	802	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
MORGAN, W.	MARION	0.001	0.212	290829	822118	-	-	-	100.00	368214.610	3224437.150	WEL	1593	1132	0
MOTT	CITRUS	0.010	0.333	284833	822008	60	58	4	70.00	369690.830	3187604.160	WEL	1123	11821	0
MUNN	CITRUS	0.001	0.183	285503	823547	-	-	-	10.00	344395.490	3199921.900	WEL	1317	856	0
MURPHY, M.	MARION	0.001	0.208	290448	822016	204	79	4	85.00	369812.840	3217615.700	WEL	1887	1343	0
NEEDLEMAN	CITRUS	0.010	0.331	285306	823518	80	80	3	5.00	345132.680	3196310.080	WEL	1124	11793	0
NEEMI, C.	MARION	0.315	0.760	290540	822720	220	195	4	130.00	358367.820	3219351.970	WEL	1599	1138	0
NEIDER, J.	MARION	0.428	0.817	291354	822130	85	58	4	65.00	368005.890	3234444.420	WEL	1603	1142	0
NORRIS WL AT HOMOSASSA	CITRUS	0.090	0.564	284804.579	823517.398	50	44	12	6.00	345007.060	3187003.660	WEL	978	712	0
NORTH LECANTO DEEP W	CITRUS	0.270	0.733	285413.299	822842.970	335	288	4	68.87	355842.310	3198215.020	WEL	835	569	0
NORTON	CITRUS	0.075	0.541	284634	822736	160	158	4	89.00	357500.600	3184084.060	WEL	1303	842	0
OLDNETTLE	CITRUS	0.680	0.912	285308	822607	275	-	4	104.00	360060.610	3196181.550	WEL	1302	841	0
OLSEN	HERNANDO	0.649	0.902	283247	823321	75	63	-	35.00	347812.950	3158748.580	WEL	1376	915	0
OPPERMAN	CITRUS	0.030	0.435	285717	822239	65	-	3	40.00	365784.440	3203778.700	WEL	1275	814	0
ORMOND WARE-HRS	MARION	0.236	0.710	290545	822607	60	42	4	40.00	360343.330	3219481.680	WEL	1602	1141	0
P J MULLADY-HRS	HERNANDO	0.641	0.900	283329	823018	135	116	4	105.00	352802.890	3159977.740	WEL	1385	924	0
PARKER	HERNANDO	0.013	0.357	282940	822205	240	92	4	200.0	366119.940	3152769.370	WEL	1875	1327	0
PARKSIDE FLORAL CITY	CITRUS	0.120	0.604	284328.091	821811.689	103	100	4	40.00	372722.730	3178155.600	WEL	1245	784	0
PARMENTER	CITRUS	0.260	0.726	285837	823320	62	-	4	30.00	348463.210	3206455.930	WEL	1253	792	0
PAUL JOHNSON-HRS	HERNANDO	0.486	0.843	283440	822503	270	243	4	150.00	361388.970	3162058.630	WEL	1380	919	0
PAUL L BUBNICK-HRS	HERNANDO	0.025	0.416	283024	822136	260	135	4	230.00	366923.810	3154114.590	WEL	1202	11689	0
PAULINE MAUGHAN-HRS	MARION	0.375	0.792	290210	822537	82	63	4	50.00	361074.390	3212854.130	WEL	1828	11858	0
PETER DAMIEN-HRS	MARION	0.208	0.689	291250	822055	100	50	4	65.00	368928.260	3232463.600	WEL	1613	1152	0
PINEAU	CITRUS	0.477	0.839	284858	821544	220	195	4	50.00	376855.890	3188295.530	WEL	1295	834	0
PORT PARADISE	CITRUS	0.140	0.627	285259	823532	-	-	2	5.00	344750.510	3196099.700	WEL	1290	829	0
PRESBYTERIAN YOUTH CAMP	HERNANDO	0.010	0.334	283202.799	823701.075	75	66	3	10.00	341795.180	3157437.430	WEL	282	16	0
PRUITT CENTRAL	MARION	2.432	1.235	290620	822310	-	-	-	70.00	365141.280	3220501.740	WEL	1627	1166	0
PRUITT NORTH	MARION	0.343	0.776	290729	822230	-	-	-	80.00	366247.370	3222612.900	WEL	1607	1146	0
PRUITT SOUTH	MARION	0.019	0.390	290510	822310	-	-	-	70.00	365115.950	3218347.150	WEL	1612	1151	0
QUEEN LUCKY-HRS	MARION	1.139	1.031	291645	822146	75	51	4	70.00	367635.020	3239712.900	WEL	1829	11853	0
R YONKE-HRS	MARION	0.575	0.877	290755	821955	105	81	4	90.00	370445.700	3223365.060	WEL	1633	11586	0
RALPH S SWOPE-HRS	HERNANDO	6.654	1.568	282935	822732	110	91	4	76.00	357226.470	3152720.090	WEL	1398	11564	0
RANKIN	CITRUS	0.160	0.647	285213	822922	115	-	4	65.00	354756.690	3194553.740	WEL	1251	790	0
RATHBUN	CITRUS	0.290	0.745	285207	823304	-	-	-	10.00	348739.200	3194446.060	WEL	1261	800	0
RAY BIEDERMAN-HRS	MARION	0.745	0.932	290522	822547	120	92	4	60.00	360875.460	3218767.170	WEL	1830	11856	0
RAYUNEC	CITRUS	1.940	1.170	284429	823117	85	59	4	50.00	351458.140	3180311.660	WEL	1125	11774	0
RB SPG #1 EAST	MARION	0.830	0.957	290613	822615	-	-	-	55.00	360137.550	3220346.160	WEL	1588	1127	0
RB SPG #2 WEST	MARION	0.940	0.985	290613	822815	-	-	-	55.00	356893.510	3220386.170	WEL	1587	1126	0
RB SPG #3 NURS	MARION	0.900	0.975	290609.867	822614.989	-	-	-	50.00	360118.780	3220222.090	WEL	1589	1128	0
RECORD	CITRUS	0.007	0.307	285408	822522	380	220	4	70.00	361301.820	3198013.610	WEL	1126	11815	0
REEDER	CITRUS	0.300	0.751	285217	823215	115	90	2	20.00	350070.870	3194736.590	WEL	1249	788	0
REGNIER	CITRUS	0.117	0.601	284114	822103	196	189	4	82.00	368046.660	3174109.560	WEL	1298	837	0
RHAME	CITRUS	0.380	0.795	285239	822259	-	-	-	85.00	365143.180	3195228.540	WEL	1288	827	0
RICHARD CULBRETH-HRS	MARION	0.130	0.616	292726	822215	110	84	4	110.00	367083.680	3259452.770	WEL	1832	11729	0
ROBERTS	CITRUS	0.000	0.150	285824	823446	-	-	4	30.00	346130.060	3206086.610	WEL	1306	845	0
ROBERTS	CITRUS	0.080	0.549	285207	822615	350	180	4	145.00	359821.150	3194306.660	WEL	1128	11820	0
ROBERTS T	CITRUS	0.320	0.763	285549	822857	123	120	4	90.00	355517.160	3201193.610	WEL	1127	11809	0
ROMEO ELEM. N.	MARION	1.095	1.022	290855	822720	143	90	6	60.00	358441.980	3225354.170	WEL	1611	1348	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
ROMERO	CITRUS	0.030	0.435	285350	823452	-	-	4	5.00	345855.110	3197654.990	WEL	1250	789	0
ROMP 107	HERNANDO	0.171	0.657	283925.155	822723.439	240	140	8	116.03	357661.790	3170851.480	WEL	38	10739	0
ROMP 109 OCALA	CITRUS	0.116	0.600	284331.119	822153.676	260	189	6	157.13	366701.070	3178316.210	WEL	323	57	0
ROMP 113 OCALA	CITRUS	0.266	0.730	285123.635	822449.898	150	130	4	129.93	362092.860	3192915.750	WEL	30	10729	0
ROMP 120 COTTON PLAN	MARION	0.006	0.300	291100.368	821905.759	403	110	8	76.04	371822.320	3229028.070	WEL	21	10719	0
ROMP 97	HERNANDO	0.004	0.267	282605.774	823457.738	355	310	6	32.54	345002.890	3146403.640	WEL	45	10747	0
ROMP CENTRALIA DEEP	HERNANDO	0.490	0.844	283652.327	823131.456	170	122	6	39.44	350868.250	3166231.530	WEL	587	321	0
ROMP TR 19-2 DEEP	HERNANDO	0.028	0.428	283242.445	823656.215	302	277	6	6.99	341943.730	3158655.940	WEL	745	479	0
ROMP TR 21-3 AVON PA	CITRUS	0.000	0.144	285235.329	823417.136	252	240	6	6.11	346751.210	3195315.860	WEL	678	412	0
RUBIN	CITRUS	0.300	0.751	285719	823344	-	-	-	20.00	347781.910	3204063.630	WEL	1255	794	0
RUGGIERO, R.	MARION	0.841	0.960	291245	822950	120	123	4	120.00	354478.800	3232484.630	WEL	1834	11789	0
SAVAGE	CITRUS	0.003	0.255	285143	821726	120	50	4	49.00	374146.060	3193403.480	WEL	1129	11775	0
SAVINO	CITRUS	0.100	0.579	285215	823356	40	32	4	10.00	347333.480	3194710.790	WEL	1130	11813	0
SCHWINDT	CITRUS	0.520	0.856	285732	822115	-	-	3	50.00	368063.770	3204214.160	WEL	1304	843	0
SEESE	HERNANDO	0.703	0.920	283517	822427	225	130	4	80.00	362380.470	3163185.860	WEL	1359	11565	0
SEIBT, R.	MARION	0.665	0.908	290518	822555	60	46	4	100.00	360657.670	3218646.670	WEL	1892	1349	0
SHAW J.	CITRUS	0.477	0.839	284315	823352	78	64	-	7.0	347223.340	3178088.440	WEL	1285	824	0
SHAW, R.	HERNANDO	0.030	0.435	283620	822352	210	135	-	94.00	363353.960	3165113.710	WEL	1369	908	0
SHEFFIELD C	CITRUS	0.330	0.769	285350	823345	49	35	4	10.00	347670.020	3197630.950	WEL	1131	11805	0
SHELLERT	CITRUS	0.280	0.739	284852	823237	80	30	4	10.00	349392.820	3188434.510	WEL	1132	11824	0
SIEBEL, R.	MARION	0.791	0.946	291107	822050	-	-	-	70.00	369026.940	3229291.700	WEL	1890	1346	0
SKINNER, C.	MARION	0.101	0.580	290841	823054	110	105	4	100.00	352653.680	3224996.170	WEL	1626	1165	0
SMITH	CITRUS	0.170	0.657	285720	823230	125	97	4	70.00	349785.720	3204068.160	WEL	1133	11798	0
STANLEY	HERNANDO	2.917	1.289	283252	822734	120	105	4	120.00	357245.810	3158783.890	WEL	1206	11776	0
STEFKE	CITRUS	0.060	0.513	290026	823127	300	-	-	140.00	351565.070	3209771.180	WEL	1309	848	0
STEWART	HERNANDO	0.005	0.277	282925	822220	138	120	-	100.00	365706.800	3152312.370	WEL	1366	905	0
SUGARMILL MZ1 DUAL SH	CITRUS	0.012	0.350	284453.912	823303.163	155	75	6	10.00	348570.040	3181086.780	WEL	726	460	1
SWEEN	CITRUS	0.070	0.532	285907	823204	130	-	4	110.00	350532.320	3207352.490	WEL	1247	786	0
TAYLOR	HERNANDO	0.287	0.743	282849	822600	147	107	4	100.00	359711.250	3151274.240	WEL	1207	11777	0
THOMAS	CITRUS	0.020	0.395	285358	822210	60	30	4	50.00	366498.760	3197644.660	WEL	1254	793	0
THOMAS	CITRUS	0.040	0.466	290221	823205	45	30	2	45.00	350582.780	3213324.260	WEL	1869	1321	0
THOMAS	CITRUS	0.280	0.739	285752	823146	126	-	4	120.00	350989.650	3205037.680	WEL	1258	797	0
TOLLE	CITRUS	0.460	0.832	285332	822926	100	65	4	35.00	354678.850	3196986.670	WEL	1252	791	0
TOM GRUSENMEYER-HRS	MARION	1.270	1.058	291925	821740	185	156	4	140.00	374328.210	3244562.540	WEL	1606	1145	0
TOWNSEND	CITRUS	0.090	0.564	285057	822917	62	-	3	40.00	354862.850	3192212.820	WEL	1259	798	0
TREANOR	HERNANDO	0.416	0.812	283153	823406	85	63	-	30.00	346568.170	3157102.490	WEL	1397	936	0
TURNER	MARION	0.216	0.695	290740	822945	160	145	4	125.00	354494.450	3223094.710	WEL	1837	11791	0
USGS OBS WELL CE 14D	MARION	0.010	0.331	290312.306	822508.768	190	112	6	60.00	361843.150	3214734.910	WEL	409	143	0
VANCE	HERNANDO	2.500	1.243	283139	822730	119	84	-	90.00	357327.210	3156535.810	WEL	1390	929	0
VARN	CITRUS	0.315	0.760	284013	821752	-	-	-	75.00	373210.230	3172174.730	WEL	1274	813	0
VARONA	CITRUS	0.020	0.395	285256	823409	100	-	4	5.00	346997.920	3195977.410	WEL	1265	804	0
VAVERCHEK	CITRUS	0.006	0.293	285544	823357	45	33	4	10.00	347391.300	3201144.160	WEL	1134	11803	0
VEDDER	HERNANDO	0.001	0.188	283858	823013	304	274	4	70.00	353065.980	3170101.990	WEL	1208	11778	0
VOSCINAR	HERNANDO	0.602	0.886	282629	822632	120	84	-	67.00	358789.350	3146975.890	WEL	1363	902	0
W DARCANGELO-HRS	HERNANDO	0.703	0.920	283659	822904	200	126	4	125.00	354894.000	3166416.010	WEL	1209	11674	0
W FLAHERTY-HRS	HERNANDO	2.639	1.259	283516	822803	138	105	4	95.00	356511.920	3163225.480	WEL	1379	918	0
WALDRON, W.	MARION	3.234	1.321	291154	822744	-	-	-	100.00	357861.940	3230871.960	WEL	1894	1351	0

Table 6. Wells used for Geostatistical Analysis of Nitrate within the Study Area (continued)

Station	County	Nitrate (mg/L)	Transformed Nitrate	Latitude	Longitude	TD	CD	DIA	LSE	UTM Easting	UTM Northing	SWFWMD Universal ID			
												Type	Station	Site	Seq
WARD B.	HERNANDO	1.820	1.153	283335	822412	-	-	-	120.00	362751.220	3160041.800	WEL	1364	903	0
WARD T.	HERNANDO	1.975	1.175	283325	822452	-	-	-	120.00	361660.600	3159746.800	WEL	1383	922	0
WEEKI II	HERNANDO	0.013	0.357	282637.284	822214.512	69	68	4	101.00	365778.540	3147118.560	WEL	289	23	0
WEEKI WACHEE WELL	HERNANDO	0.035	0.451	283201	823156	259	176	4	36.49	350105.060	3157303.030	WEL	946	680	0
WHEELER	CITRUS	0.580	0.879	285517	823437	-	-	3	10.00	346297.040	3200327.460	WEL	1313	852	0
WILKEY	CITRUS	1.100	1.023	285840	823313	90	90	4	30.00	348653.900	3206545.790	WEL	1135	11792	0
WISE	HERNANDO	0.141	0.628	283150	822503	-	-	-	160.00	361327.120	3156826.490	WEL	1415	954	0
WOOD	CITRUS	0.170	0.657	285422	823512	50	45	4	5.00	345326.510	3198647.190	WEL	1318	857	0
WOODFIELD	CITRUS	0.196	0.679	284534	821451	50	40	2	50.00	378226.790	3182001.860	WEL	1264	803	0
WYLUPEK	HERNANDO	0.506	0.851	283707	821953	-	-	-	110.00	369861.890	3166486.280	WEL	1384	923	0

Table 7. Kruskal-Wallis Results for Seasonality in Potential Network Wells within the Homosassa Spring-Recharge Basin (Medians are in mg/L)

Nitrate				
Season	**N**	**Median**	**Average Rank**	**Z-Score**
Fall	11	0.34	24.1	0.04
Winter	12	0.41	24.4	0.12
Spring	12	0.36	21.6	-0.7
Summer	12	0.39	25.8	0.54
P-Value = 0.899	**Result: No Difference in medians**			

Total Nitrogen				
Season	**N**	**Median**	**Average Rank**	**Z-Score**
Fall	11	0.40	24.2	0.06
Winter	12	0.47	25.9	-0.56
Spring	12	0.41	23.5	-0.16
Summer	12	0.50	22.4	-0.46
P-Value = 0.937	**Result: No Difference in medians**			

Calcium				
Season	**N**	**Median**	**Average Rank**	**Z-Score**
Fall	11	40.2	27.0	0.82
Winter	12	37.9	20.9	-0.91
Spring	12	36.3	21.5	-0.72
Summer	12	41.7	26.9	0.84
P-Value = 0.563	**Result: No Difference in medians**			

Magnesium				
Season	**N**	**Median**	**Average Rank**	**Z-Score**
Fall	11	5.7	25.3	0.35
Winter	12	5.6	24.1	0.04
Spring	12	5.5	22.8	-0.35
Summer	12	6.1	23.9	-0.02
P-Value = 0.979	**Result: No Difference in medians**			

Total Alkalinity				
Season	**N**	**Median**	**Average Rank**	**Z-Score**
Fall	11	119.0	24.3	0.09
Winter	12	115.5	21	-0.89
Spring	12	114.5	22.3	-0.49
Summer	12	124.1	28.4	1.29
P-Value = 0.568	**Result: No Difference in medians**			

Field Parameters	MDL	Units
Temperature	0.01	Degrees C
Color	5	PCU
Specfic Conductance, Field	1	uS/cm
Oxygen, Dissolved, Field	0.1	mg/L
pH, Field	0.1	SU
Turbidity, Field	0.08	NTU

Laboratory Analytes	MDL	Units
Specfic Conductance	1	uS/cm
Alkalinity, Total (as CaCO3)	1	mg/L
Nitrogen, Total	0.1	mg/L
Organic Nitrogen, Dissolved	0.01	mg/L
Ammonia, Dissolved (as N)	0.012	mg/L
Nitrite, Dissolved (as N)	0.006	mg/L
Nitrogen, Kjeldahl, Total	0.01	mg/L
Nitrate, Dissolved (as N)	0.01	mg/L
Nitrate+Nitrite, Dissolved (as N)	0.01	mg/L
Phosphorus, Total (as P)	0.01	mg/L
Orthophosphate, Dissolved (as P)	0.01	mg/L
Organic Carbon, Total	0.3	mg/L
Calcium, Dissolved	0.5	mg/L
Magnesium, Dissolved	0.25	mg/L
Sodium, Dissolved	0.25	mg/L
Potassium, Dissolved	0.25	mg/L
Chloride, Dissolved	0.06	mg/L
Sulfate, Dissolved	0.12	mg/L
Fluoride, Dissolved	0.02	mg/L
Silica, Dissolved	0.5	mg/L
Iron, Dissolved	30	ug/L
Strontium, Dissolved	250	ug/L
Residuals, Dissolved	25	mg/L
Turbidity, Lab	0.08	NTU

Table 8. Field Parameters and Lab Analytes List for Monitoring Network

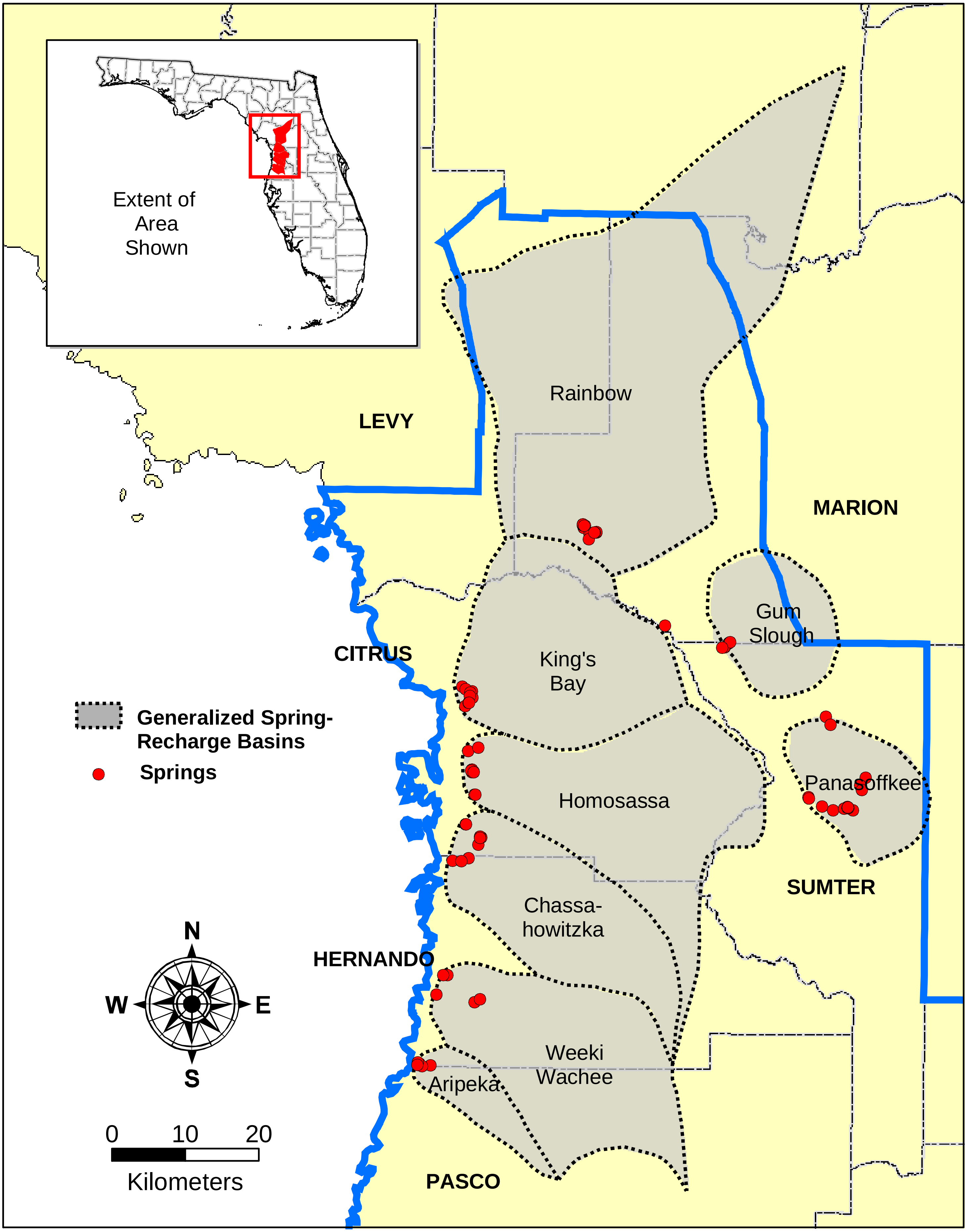

Figure 1. Location of Springs and Generalized Spring-Recharge Basins

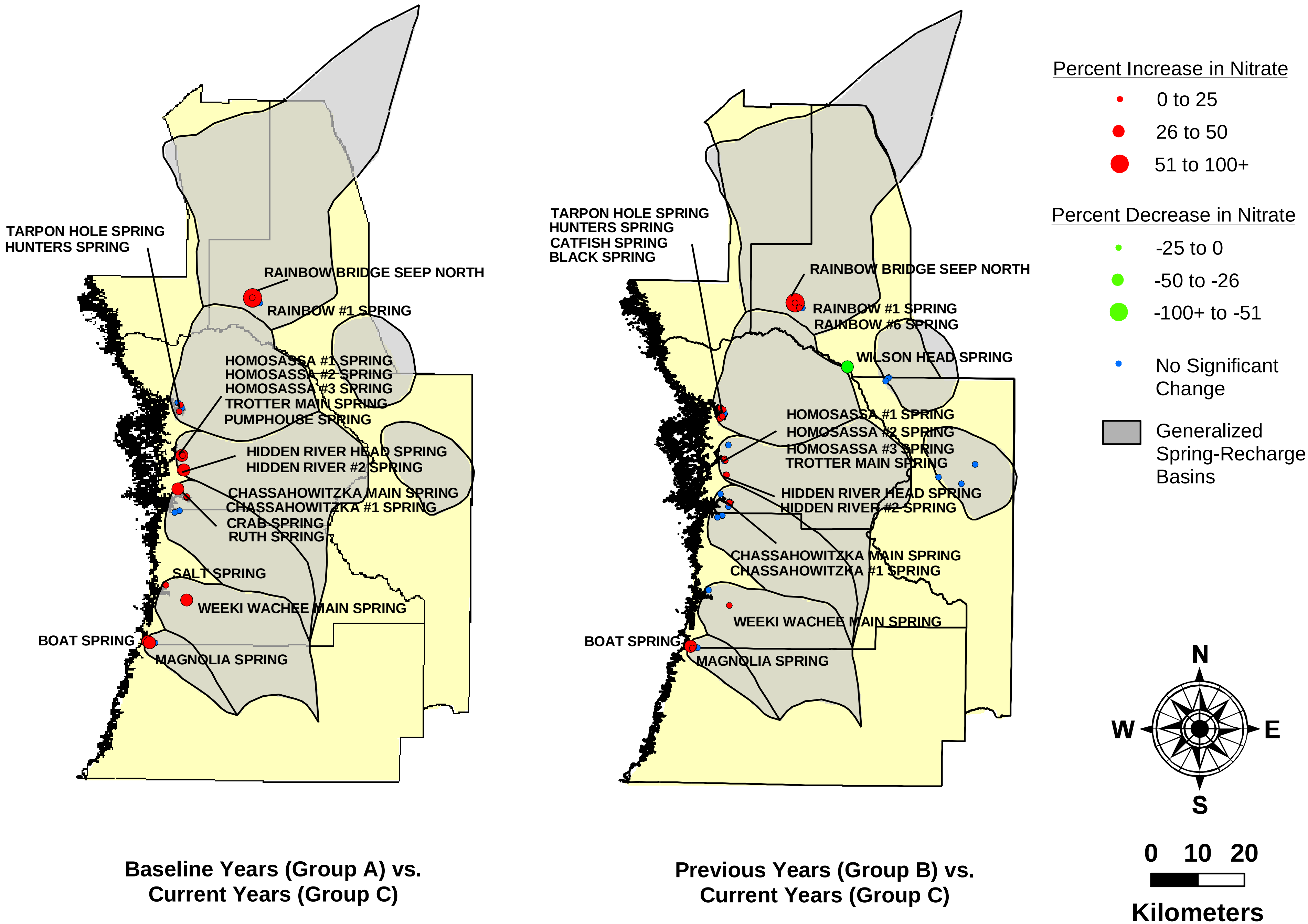

Figure 2. Spring-Recharge Basins within the Northern Portion of the SWFWMD that Exhibit Increasing Trend in Nitrate Concentration

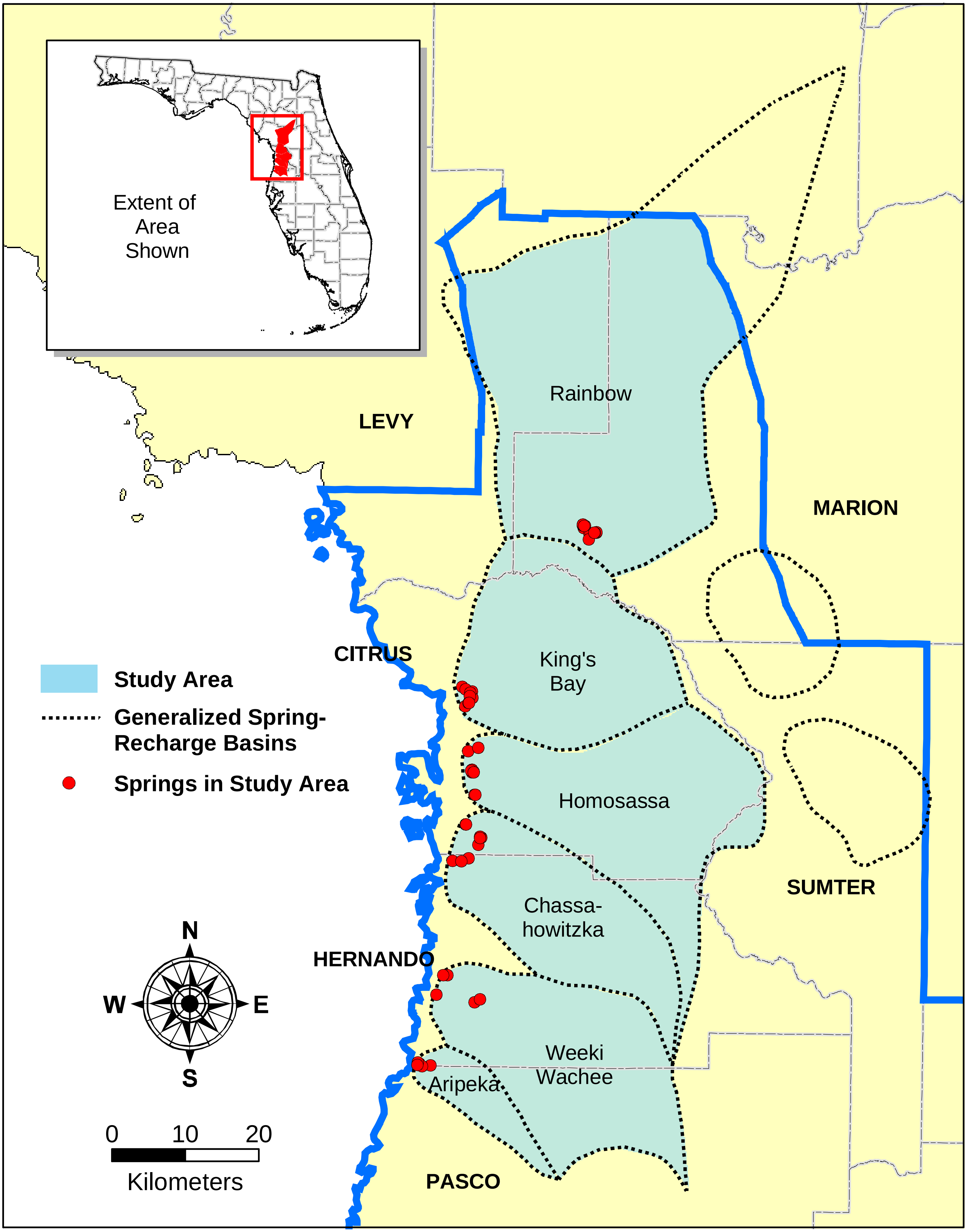

Figure 3. Location of Study Area, Springs, and Generalized Spring Recharge Basins

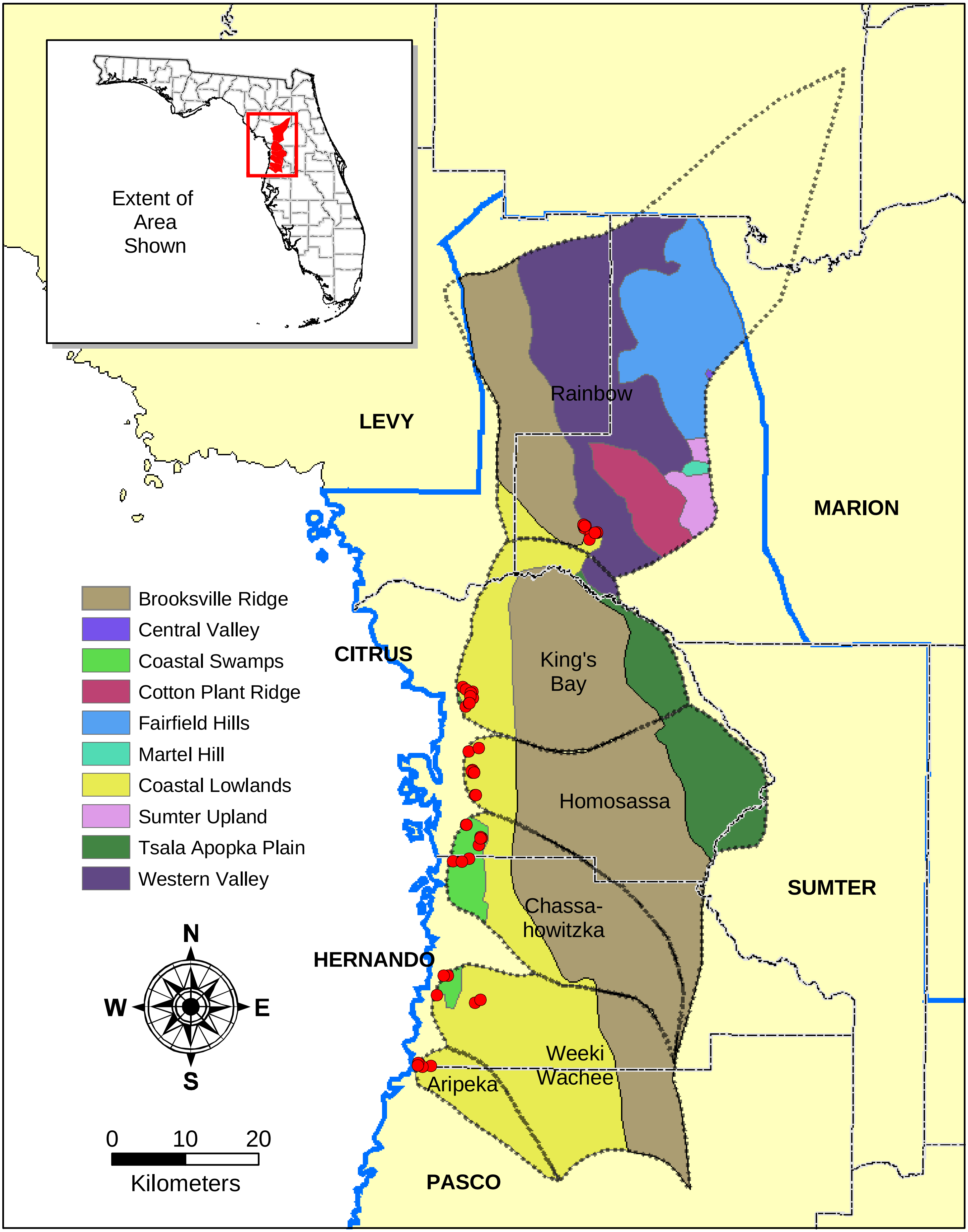

Figure 4. Physiographic Regions within the Study Area (White, 1970)

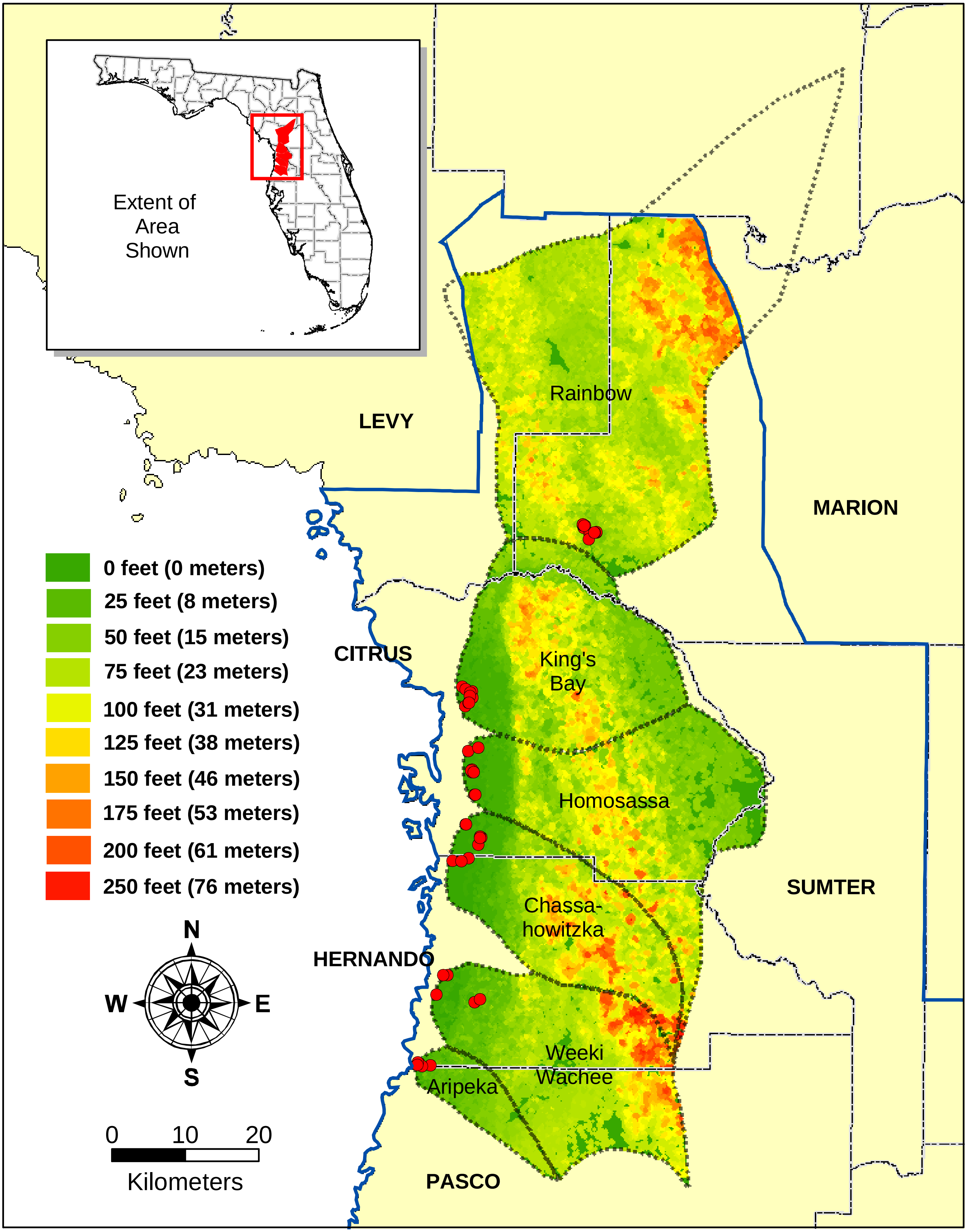

Figure 5. Land Surface Elevation within the Study Area

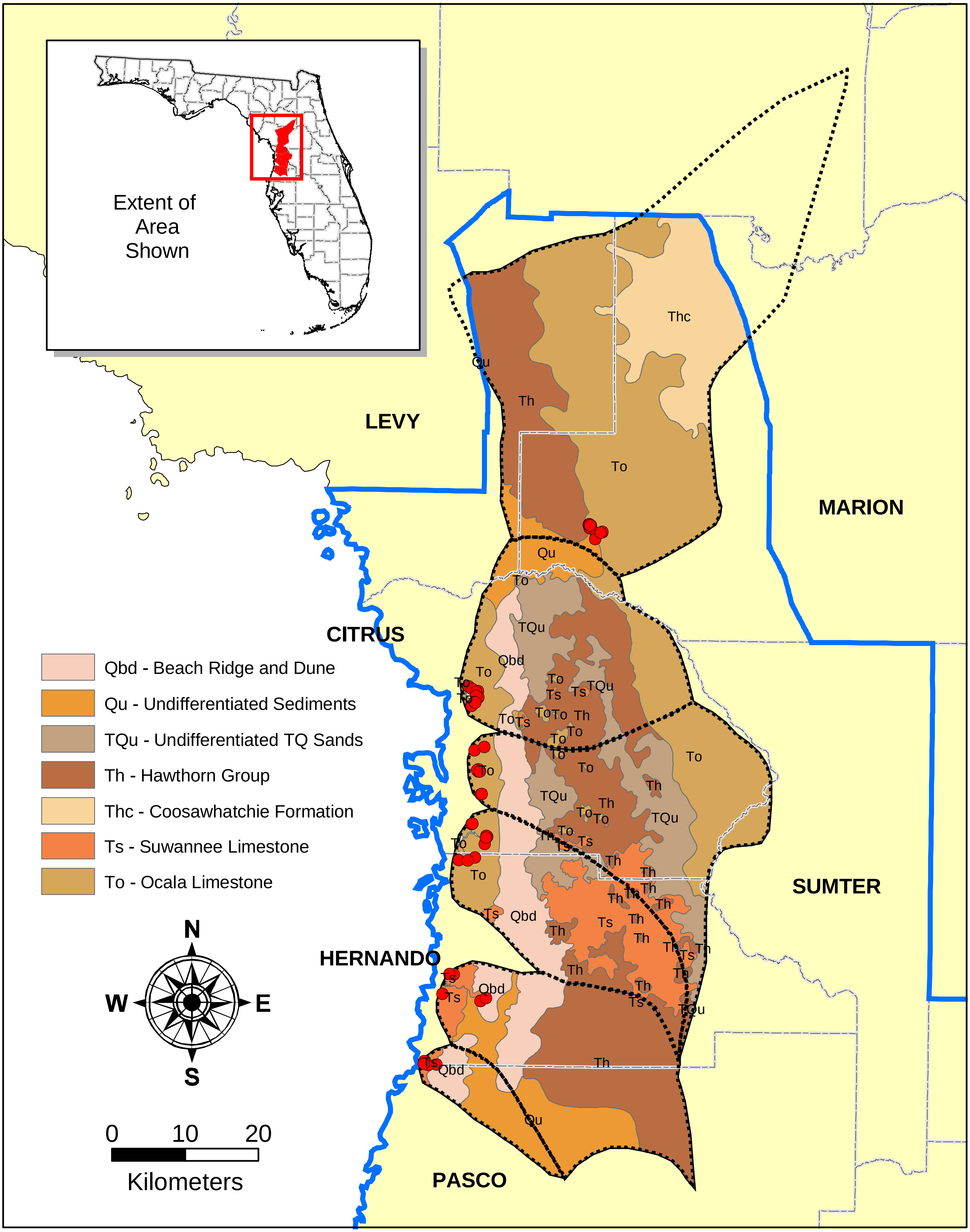

Figure 6. Geology within the Study Area (Scott et al, 2001)

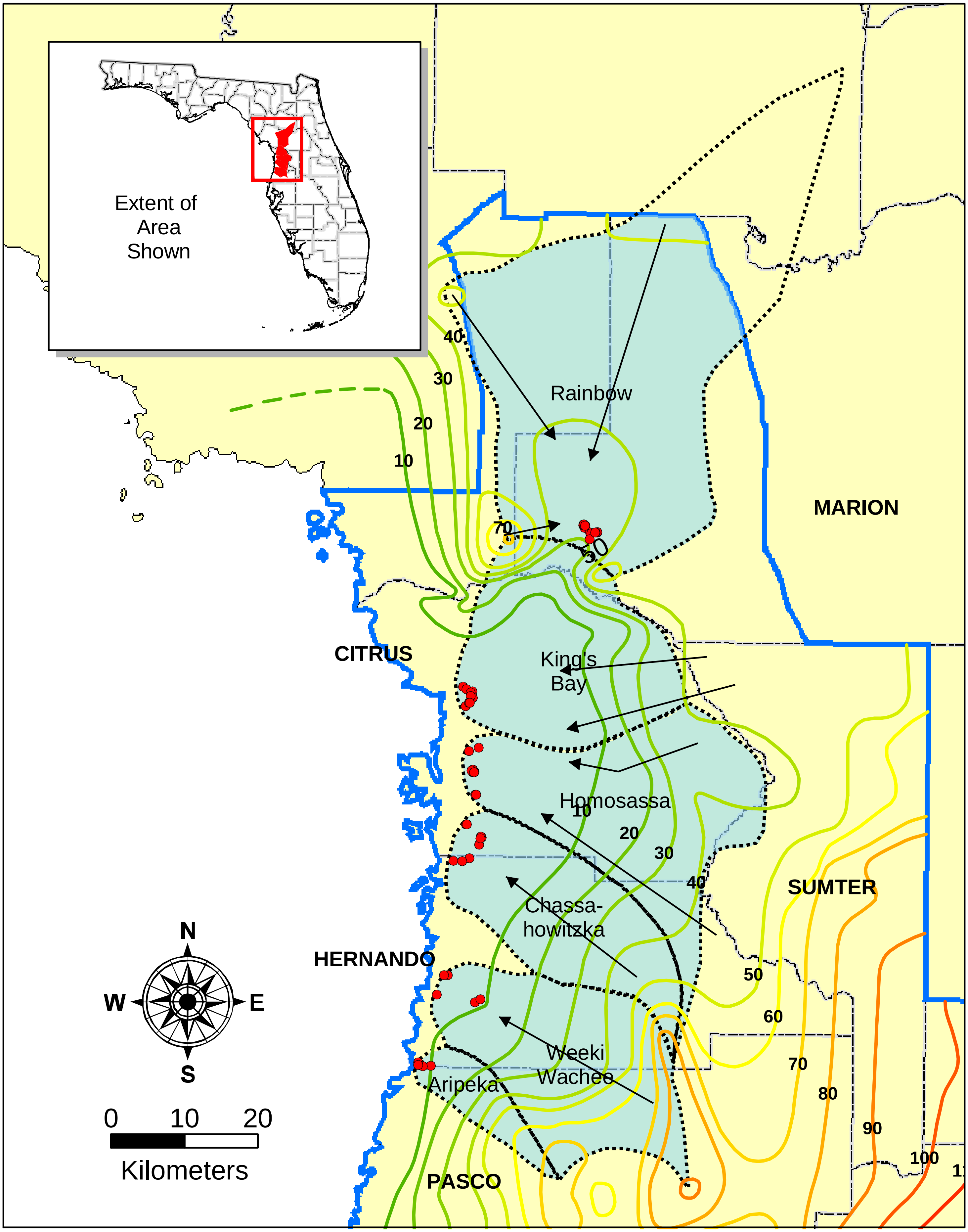

Figure 7. Potentiometric Surface of the Upper Floridan Aquifer within the Study Area - May 2003. Arrows denote general direction of ground-water flow.

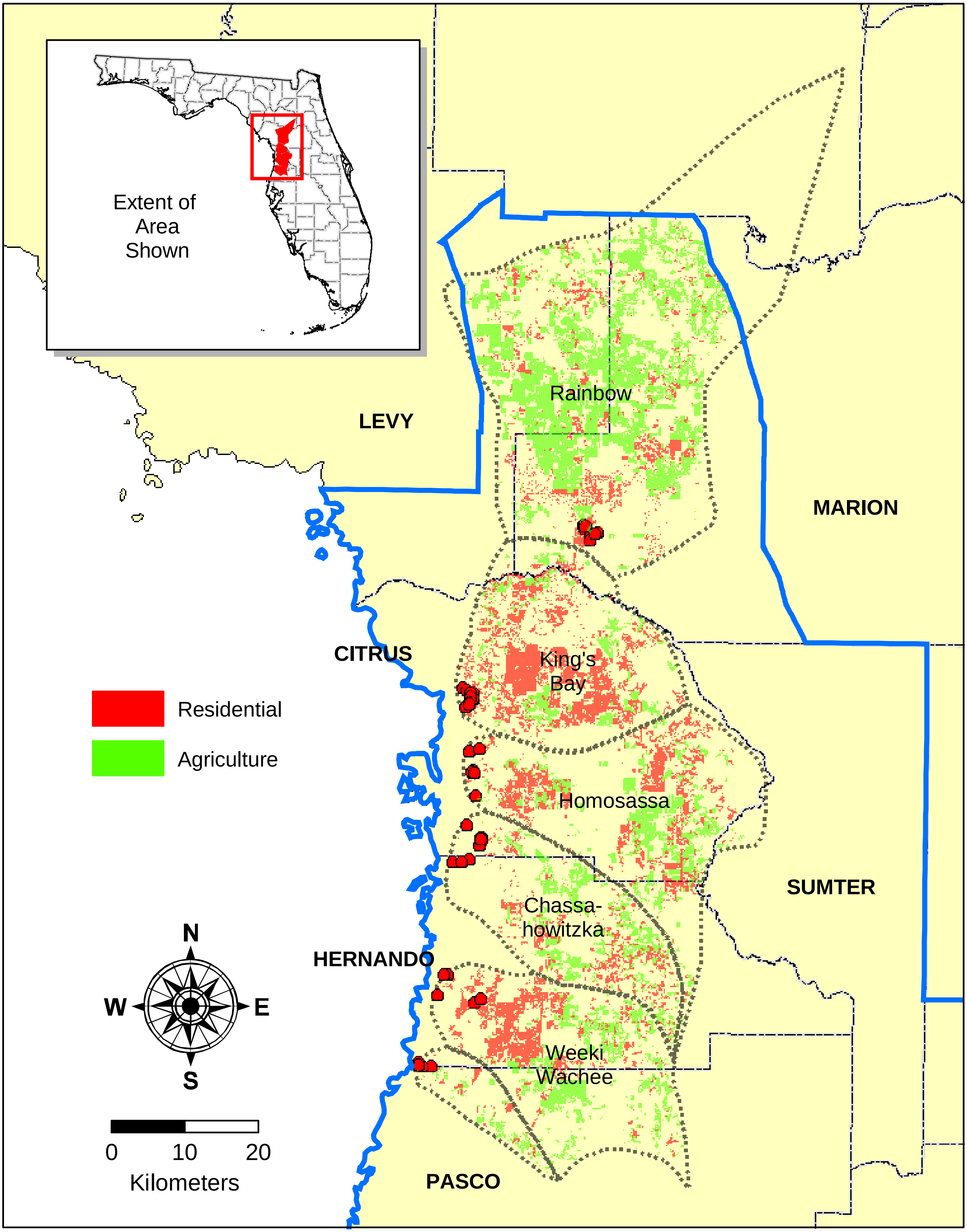

Figure 8. 1999 Residential and Agriculture Land-Use within the Study Area

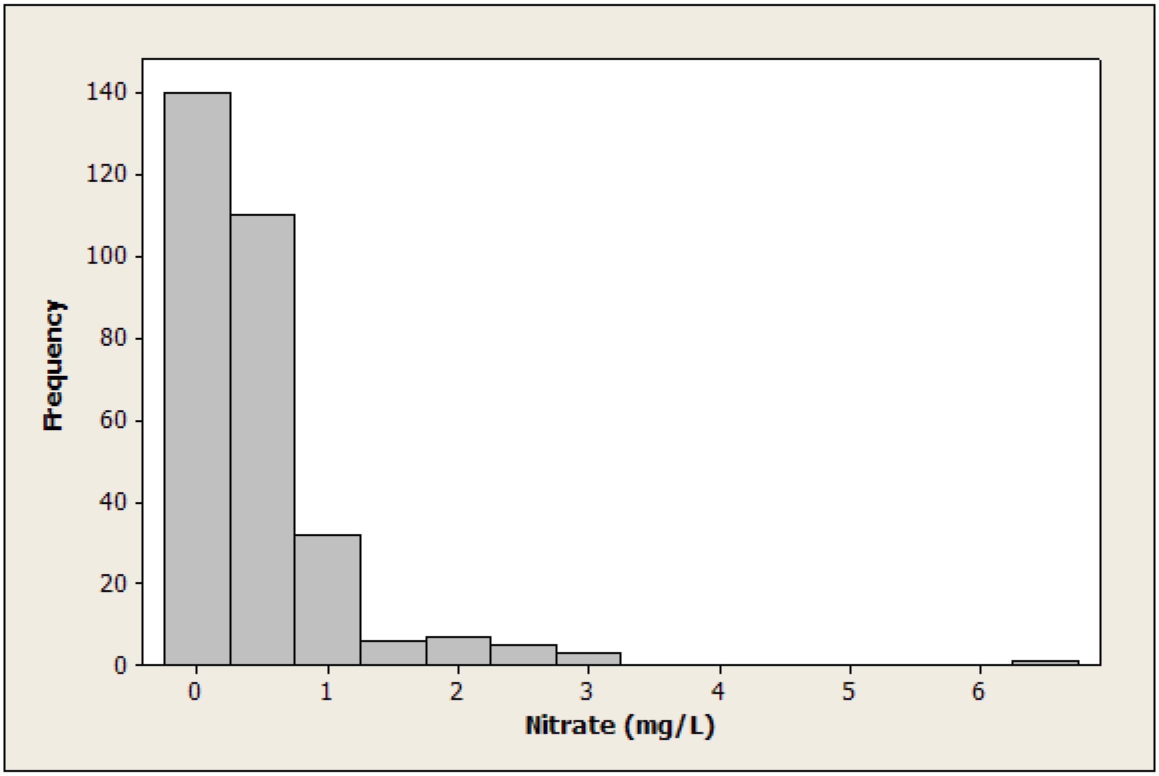

Figure 9A. Histogram of Original Nitrate Dataset with a mean of 0.46 mg/L and a median of 0.28 mg/L.

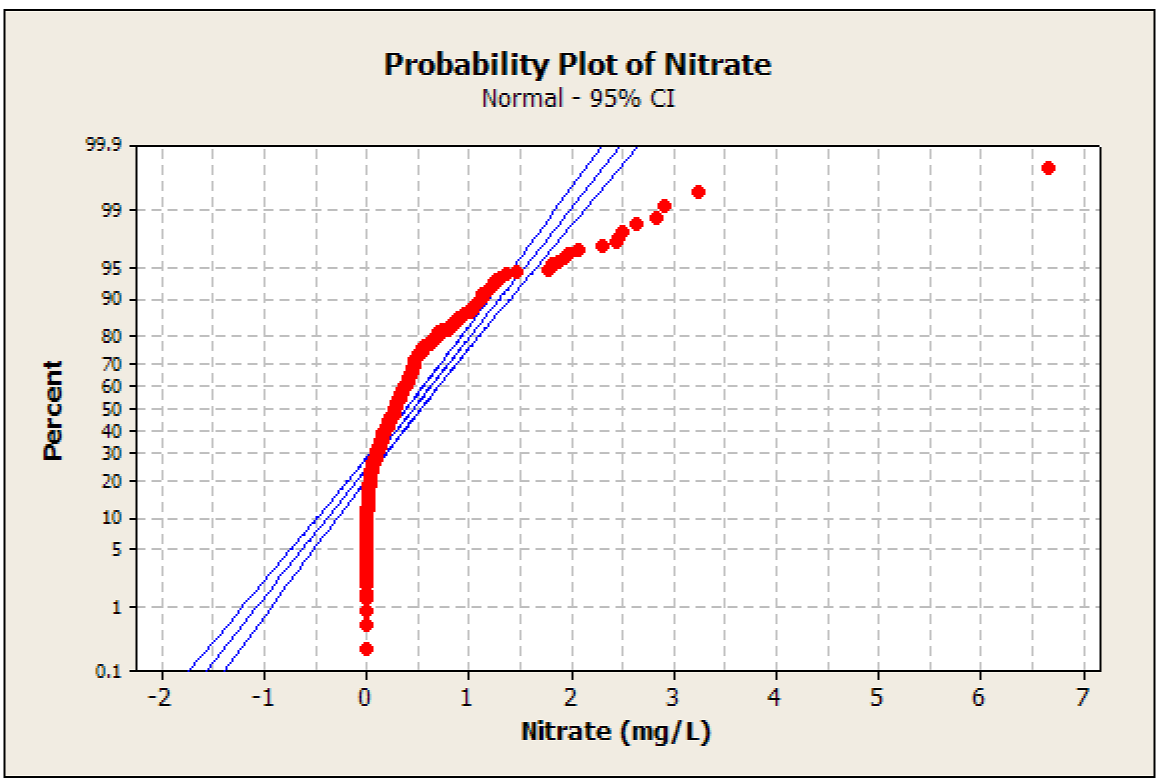

Figure 9B. Probability Plot of original Nitrate Dataset with a mean of 0.46 mg/L and a median of 0.28 mg/L.

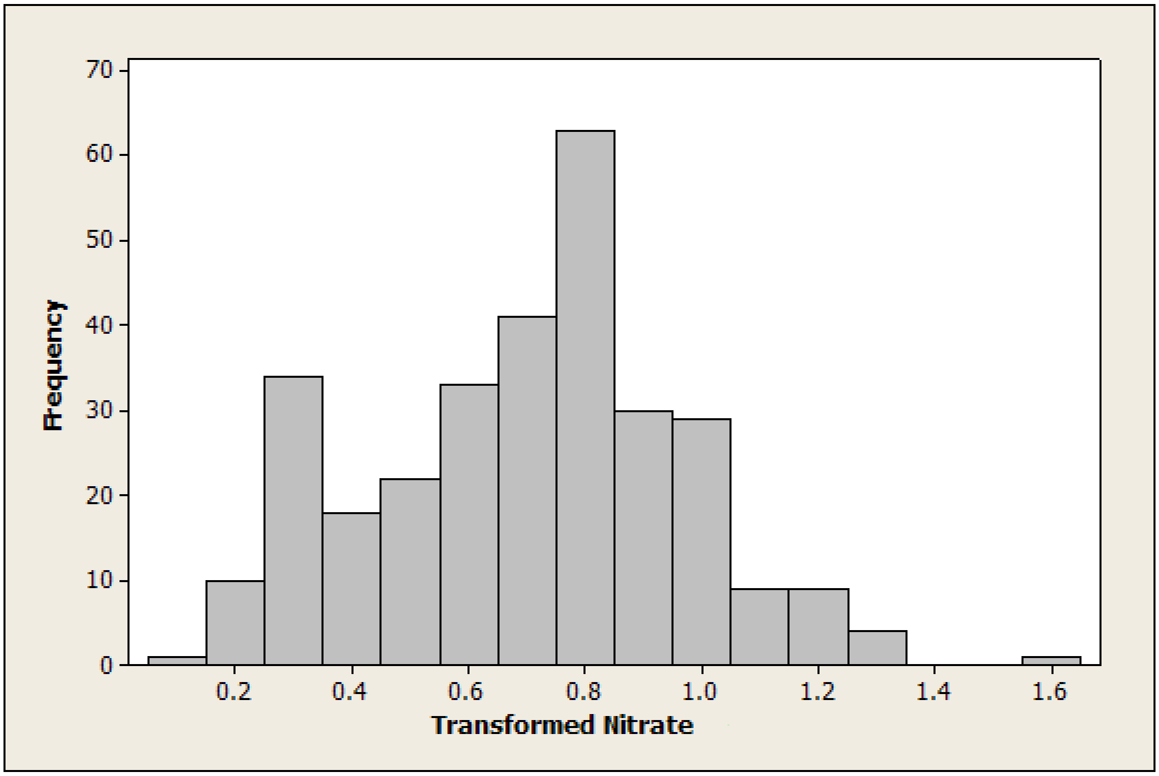

Figure 10A. Histogram of Transformed Nitrate Dataset with a mean of 0.70 and a median of 0.74.

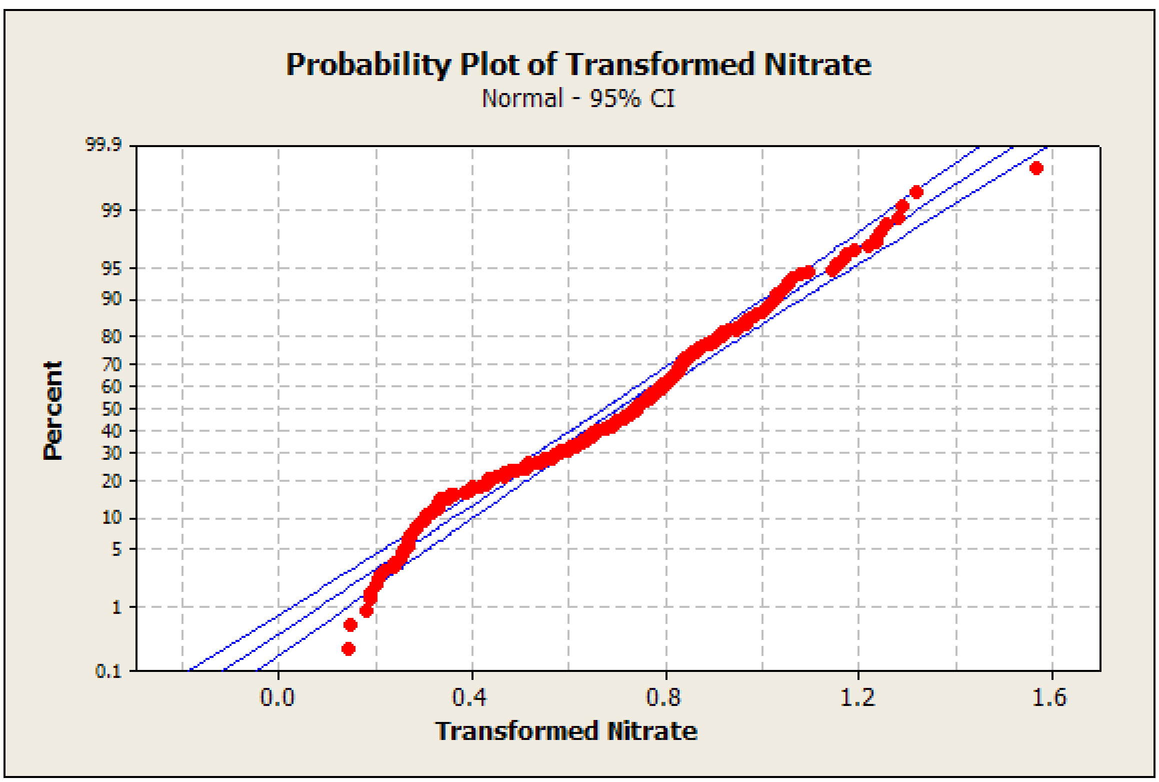

Figure 10B. Probability Plot of Transformed Nitrate Dataset with a mean of 0.70 and a median of 0.74.

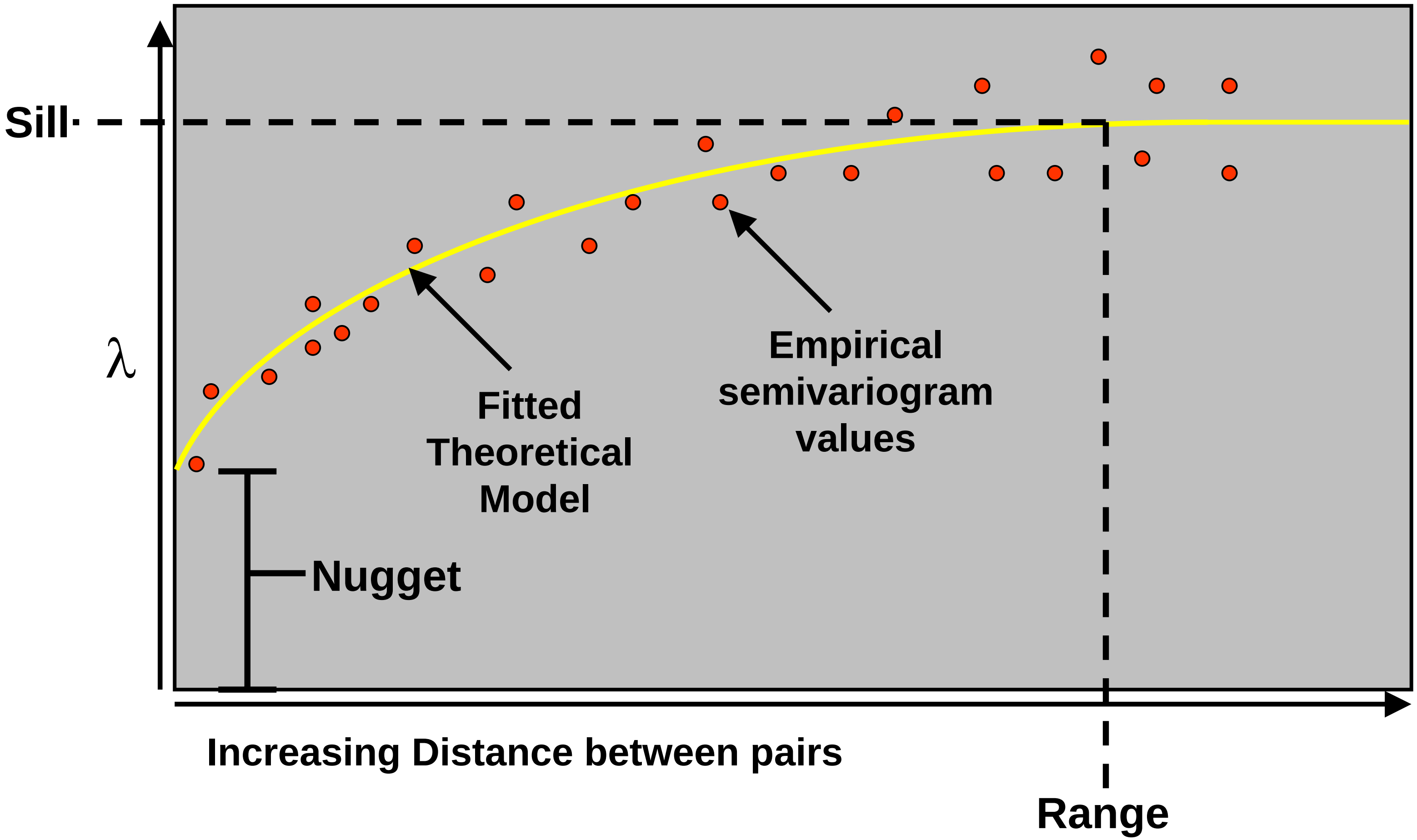

Figure 11. Example of a Semivariogram

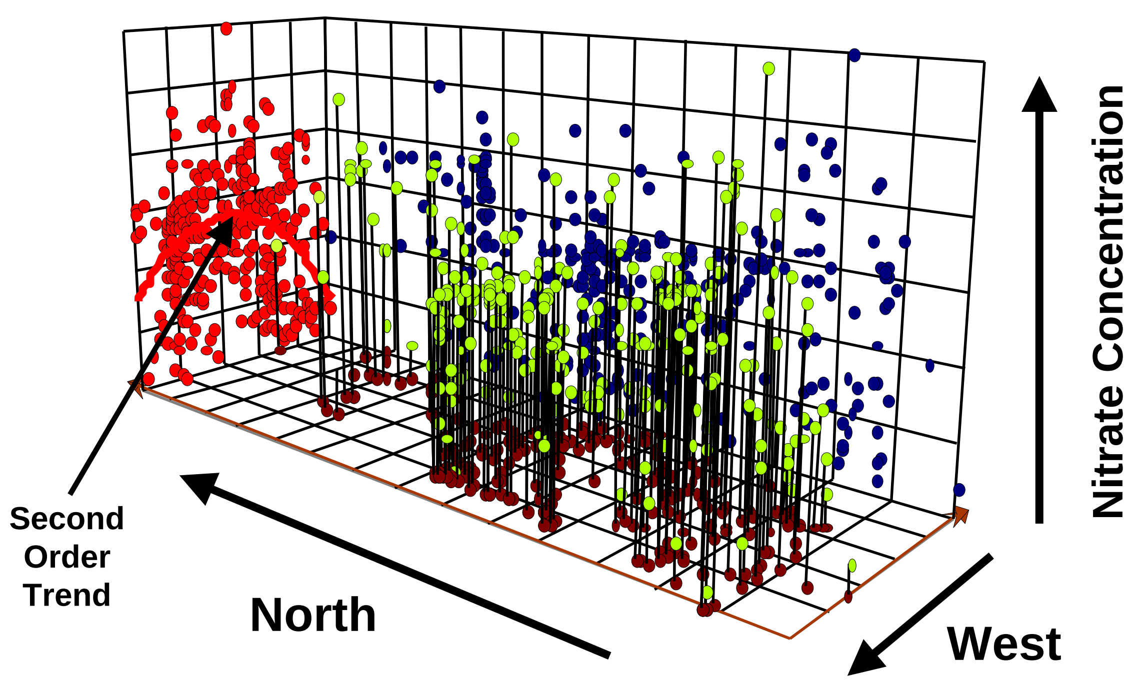

Figure 12. Trend Analysis of Transformed Nitrate Data

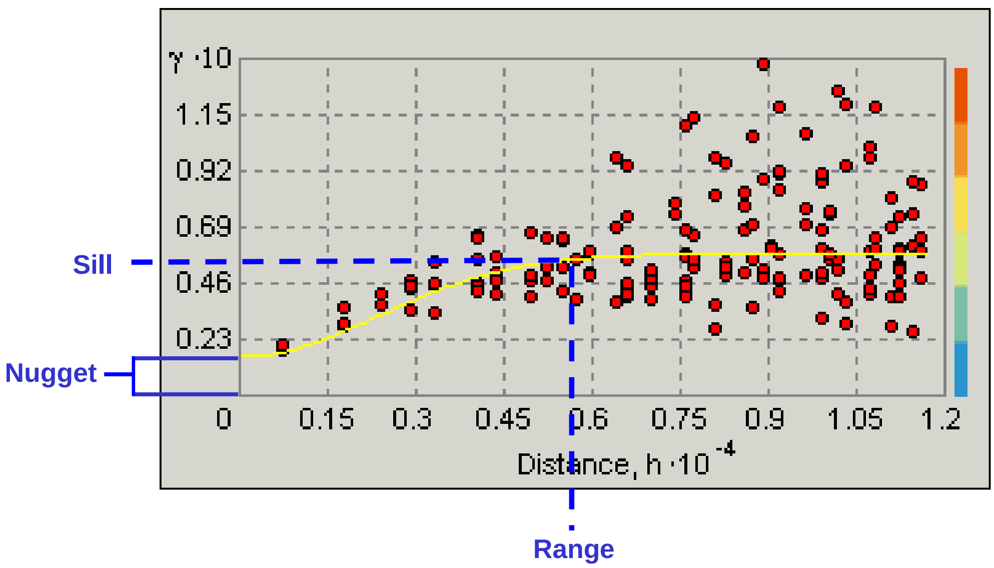

Figure 13. Omni-directional semivariogram with a lag spacing of 10, lag distance of 1,175 meters and maximum distance of 12,000 meters.

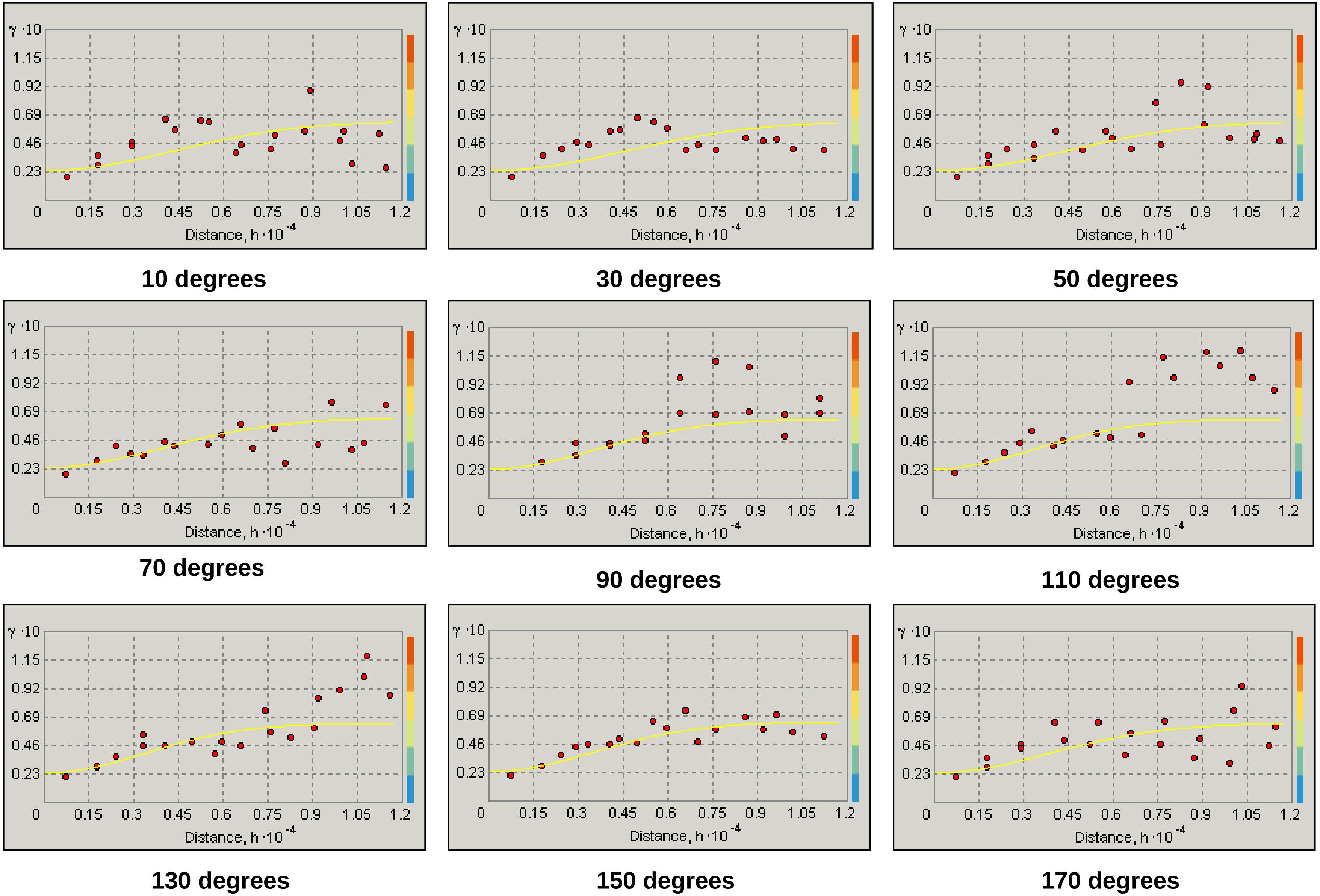

Figure 14. Directional semiariograms from 10 to 170 Degrees Measured from the North and Fitted with Discrete Models.

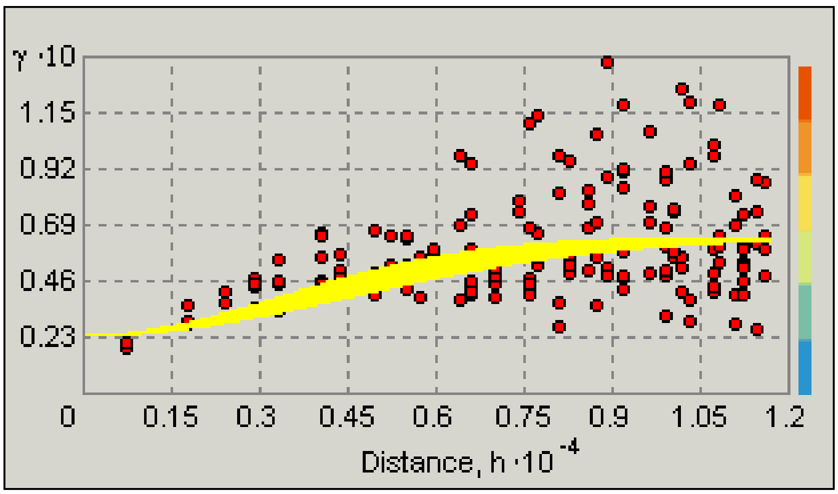

Figure 15. Theoretical semivariogram adjusted for anisotropy with a lag distance of 1,175 meters, minor range of 8,203 meters at 122 degrees, major range of 11,117 meters at 32 degrees, sill of 0.064 and a nugget of 0.024.

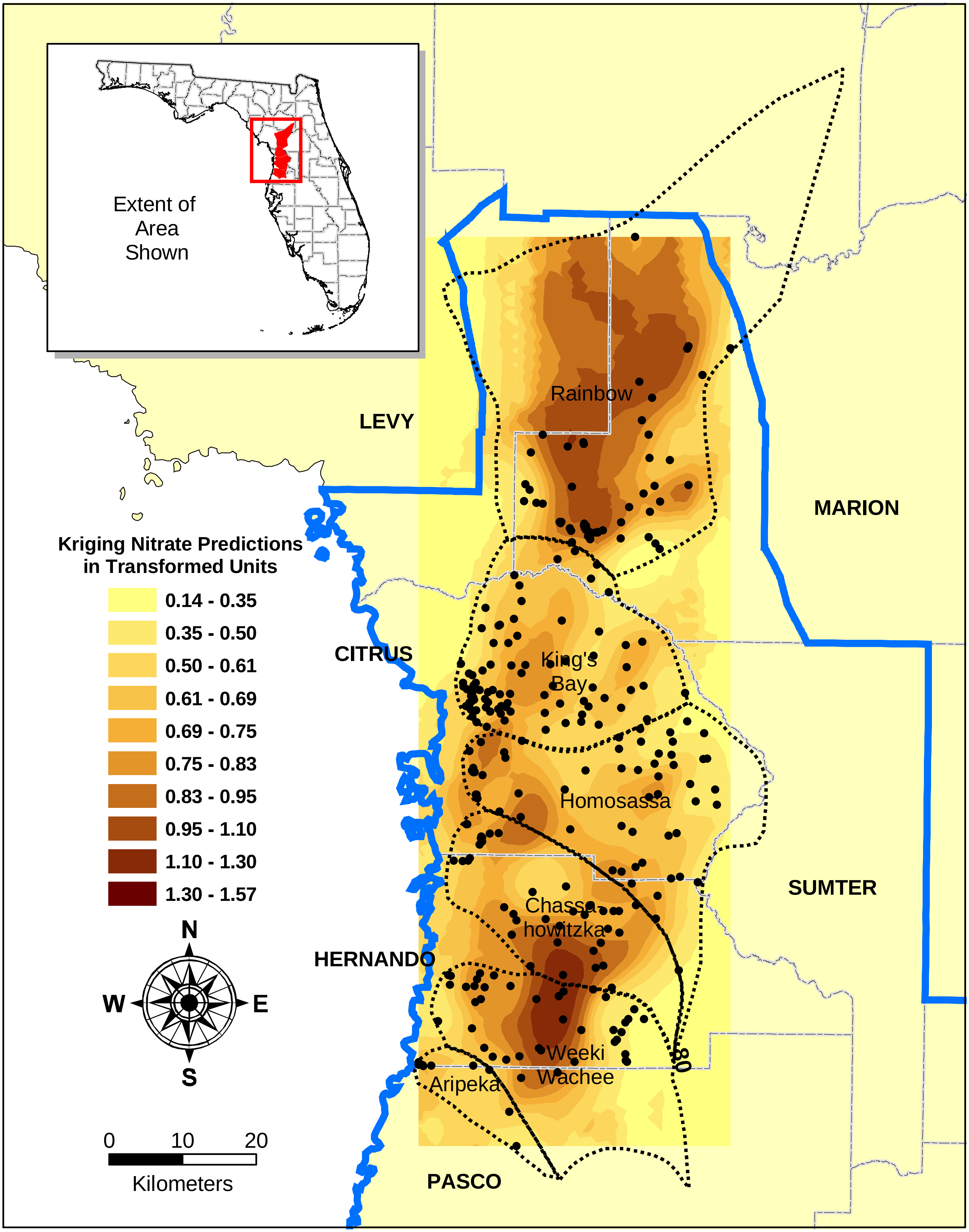

Figure 16. Predicted Transformed Nitrate Concentrations Produced from Geostatistical Analysis (units are equivilant to the original units in mg/L raised to 0.24)

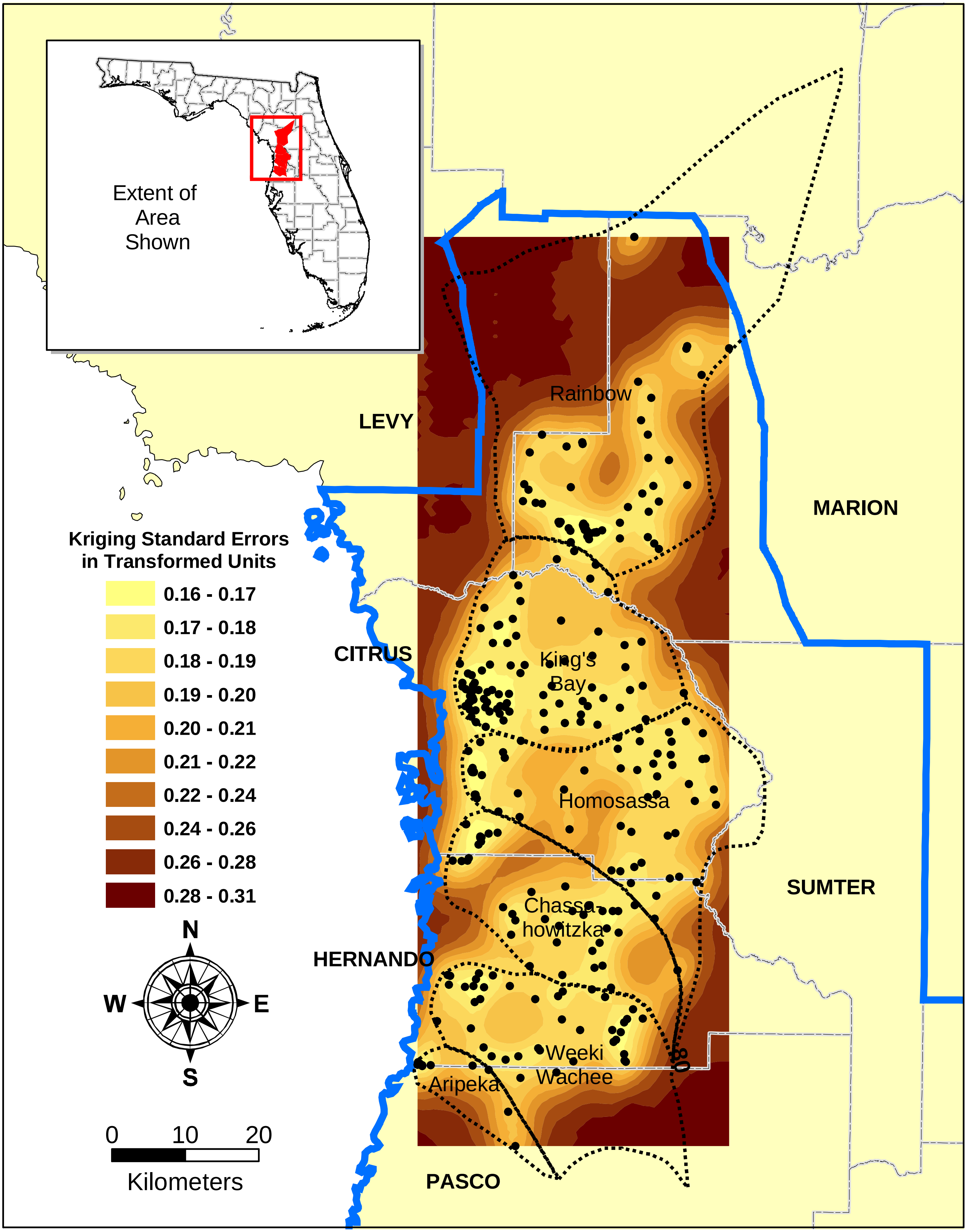

Figure 17. The Standard Errors (Kriging Errors) of the Transformed Nitrate Concentration Predictions (units are equivalent to the original units in mg/L raised to 0.24)

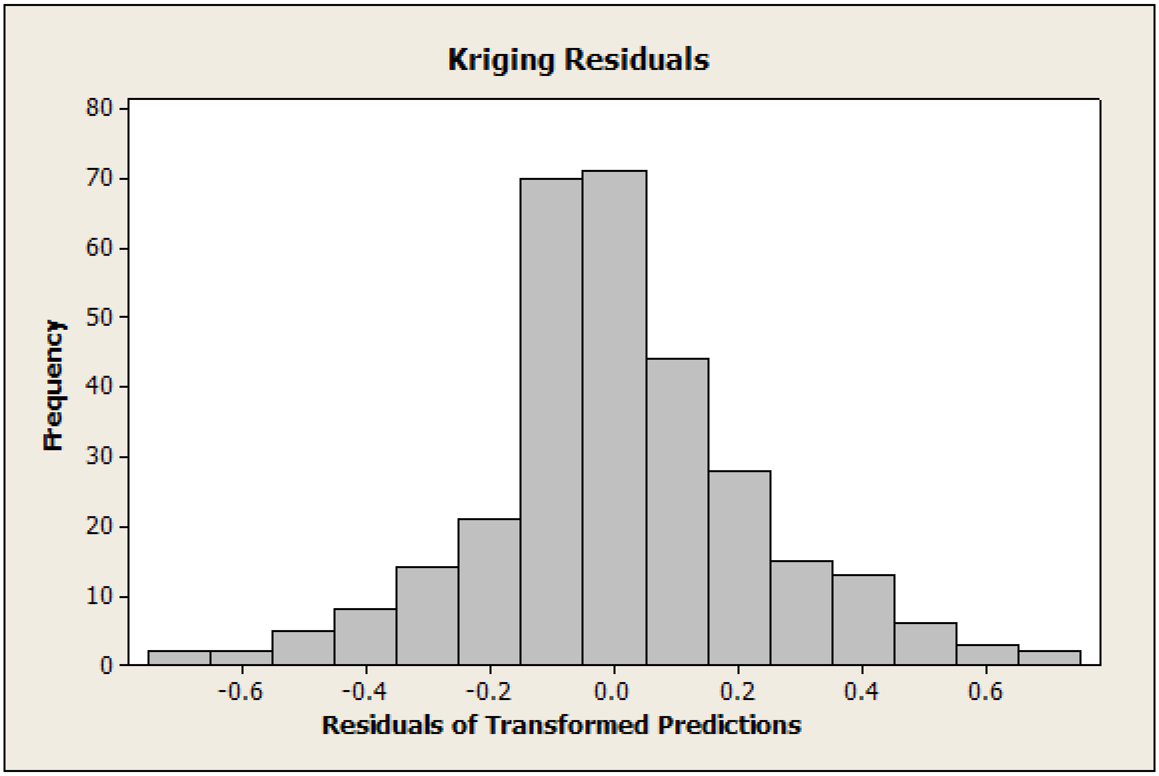

Figure 18. Histogram of Kriging Residuals.

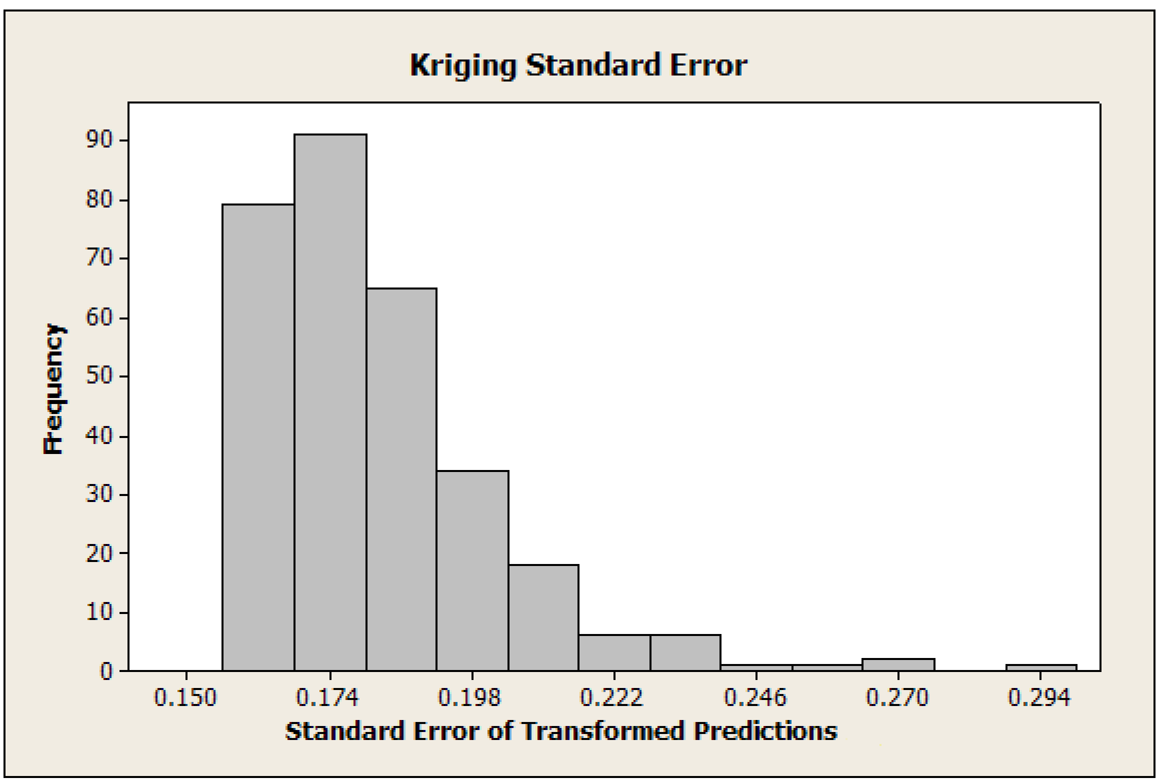

Figure 19. Histogram of Transformed Standard Errors with a mean of 0.181, a median of 0.178, and a standard deviation of 0.02.

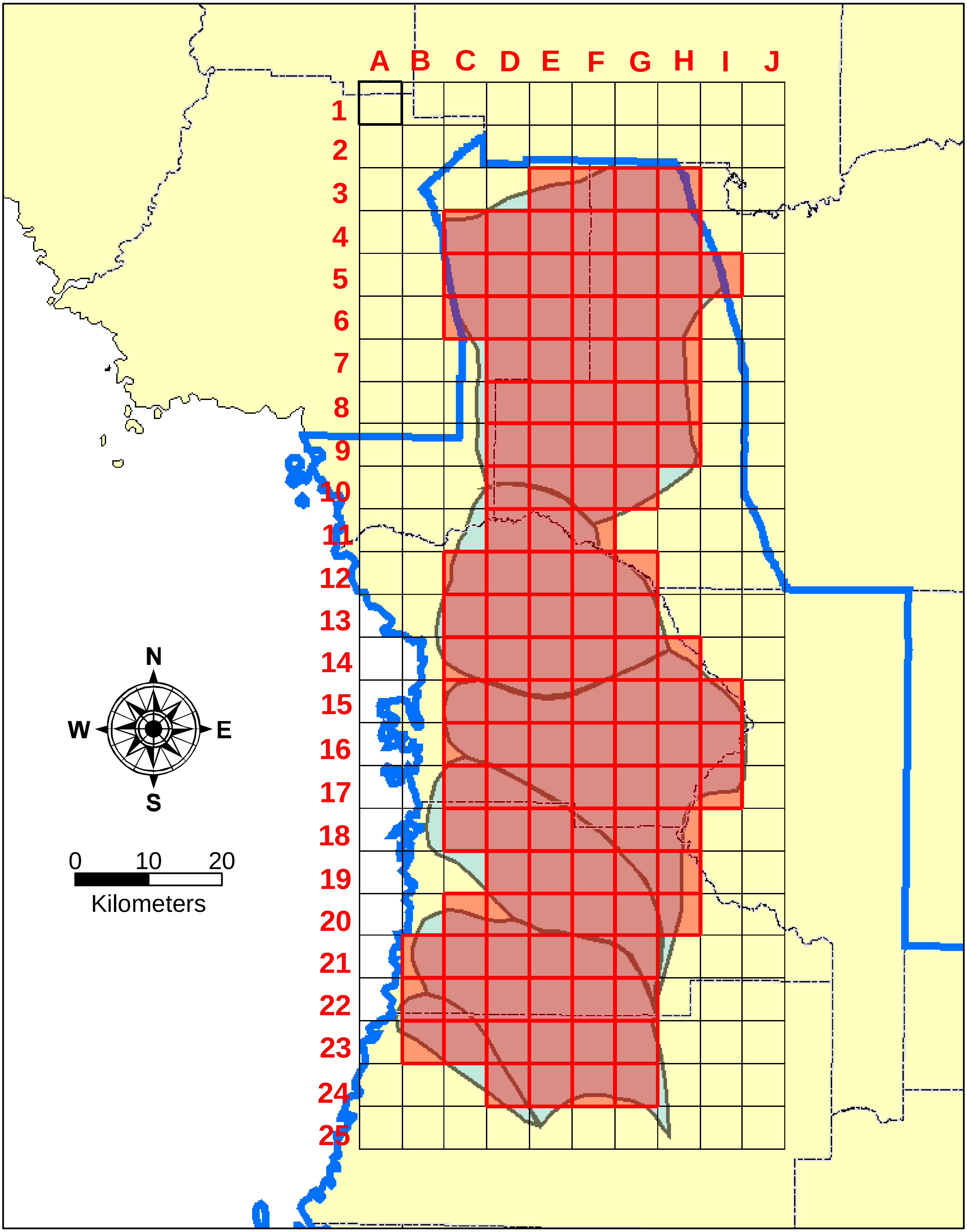

Figure 20. Grid Cells Included for Well Selection (denoted by red shading)

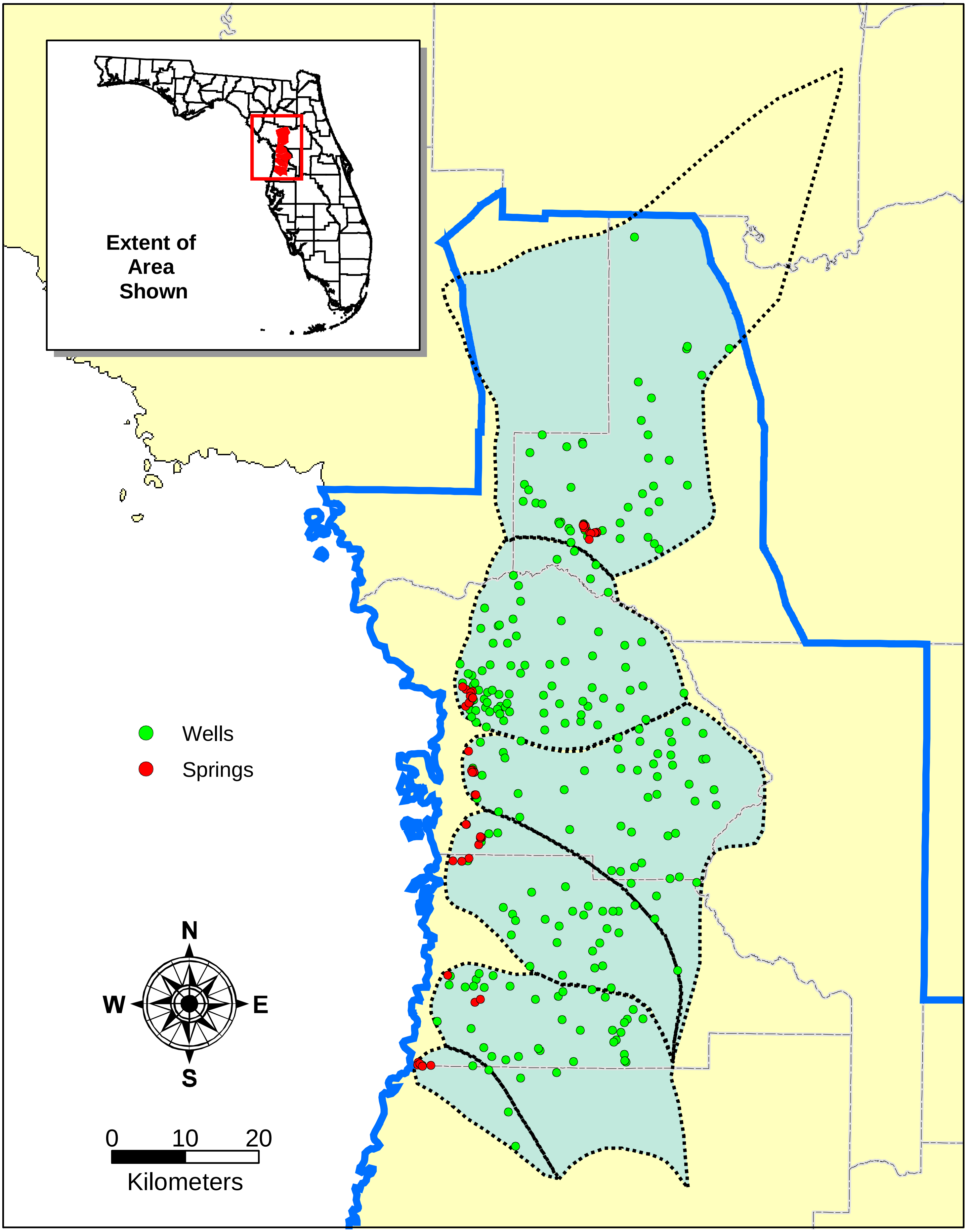

Figure 21. Original Network of Wells and Springs used for Geostatistical Analysis

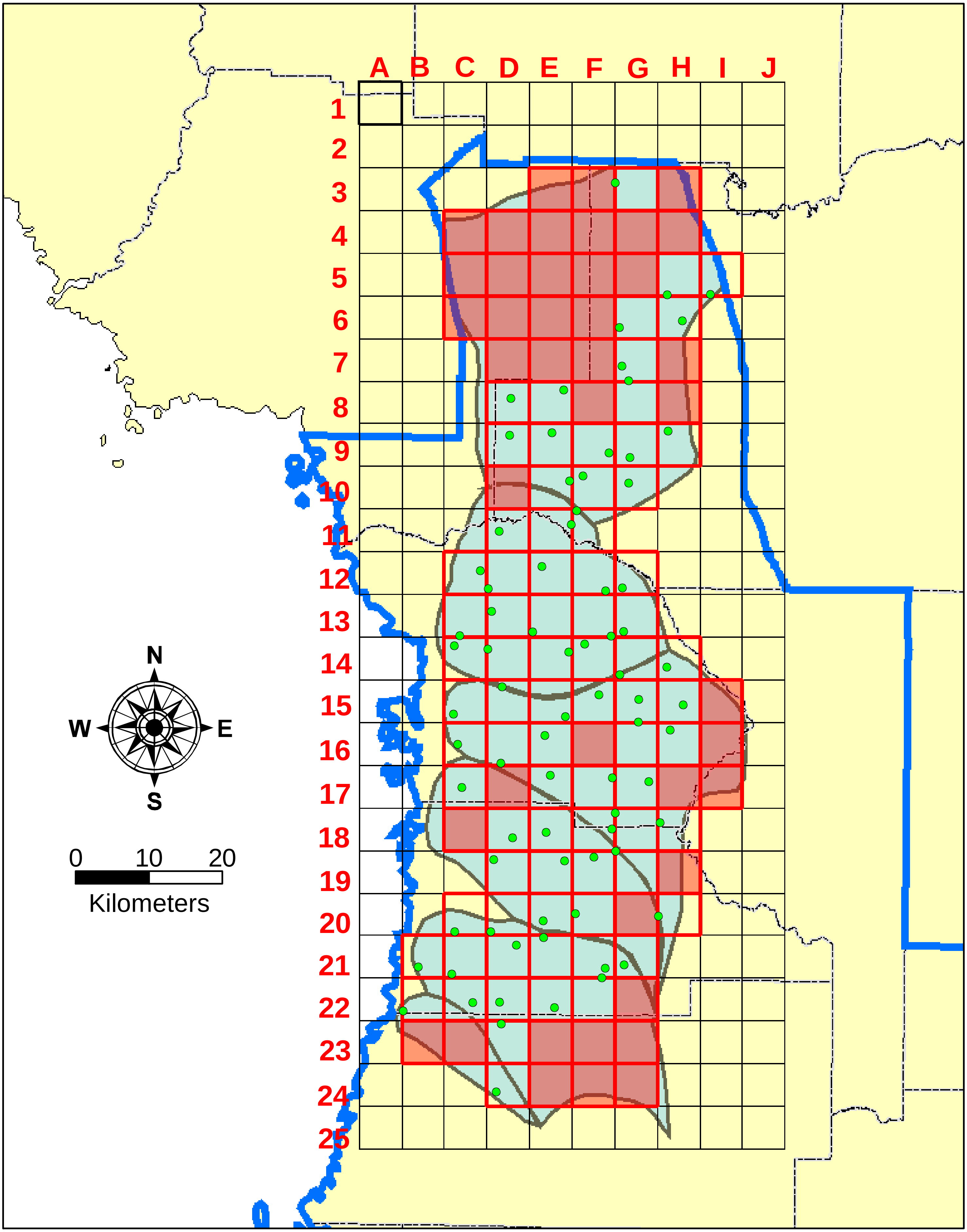

Figure 22. Network Selections using First Priority Wells from the Original Network (78 wells)

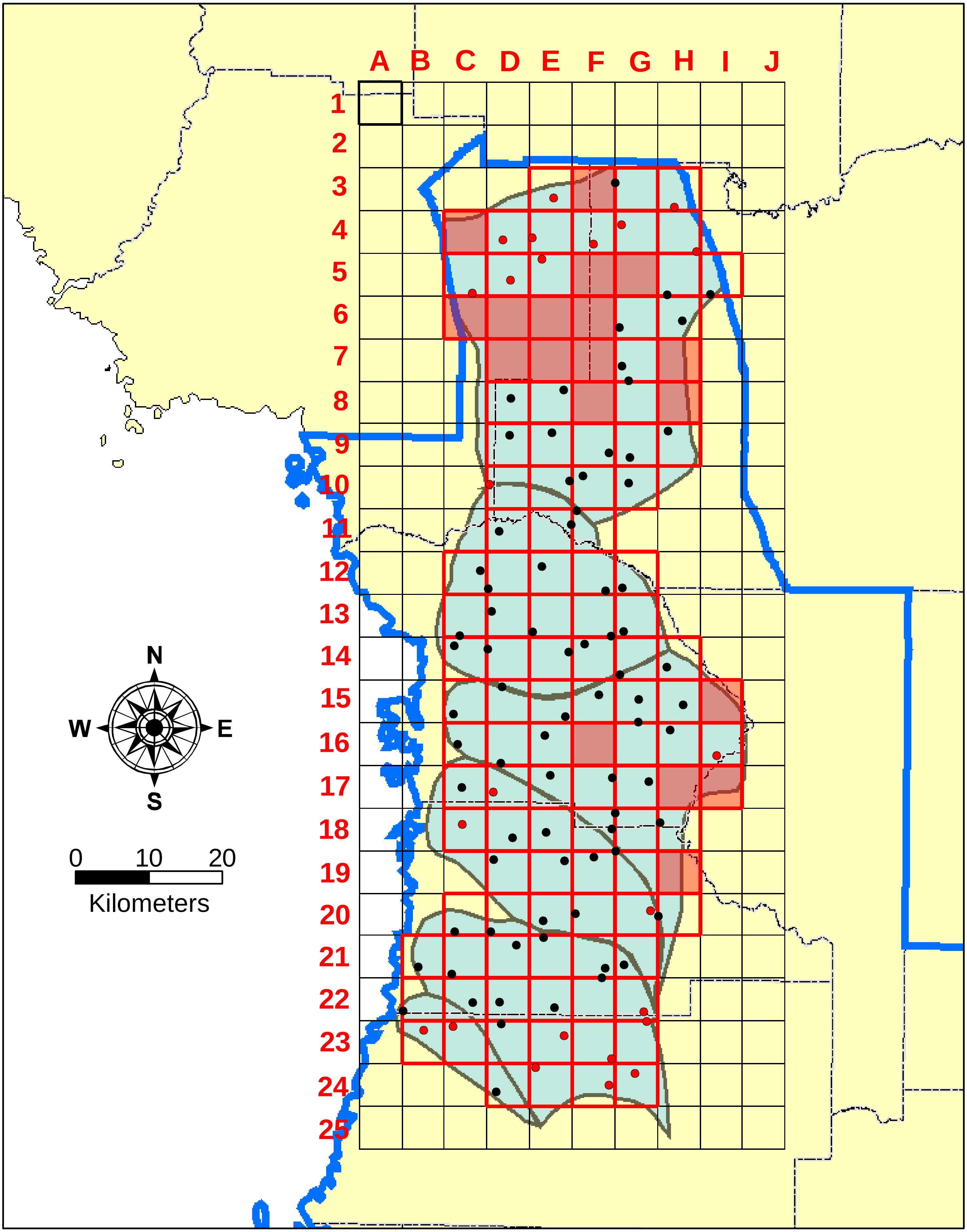

Figure 23. Network Selections using First Priority Wells selected from the WMDB (24 wells denoted in red, previous selections denoted in black)

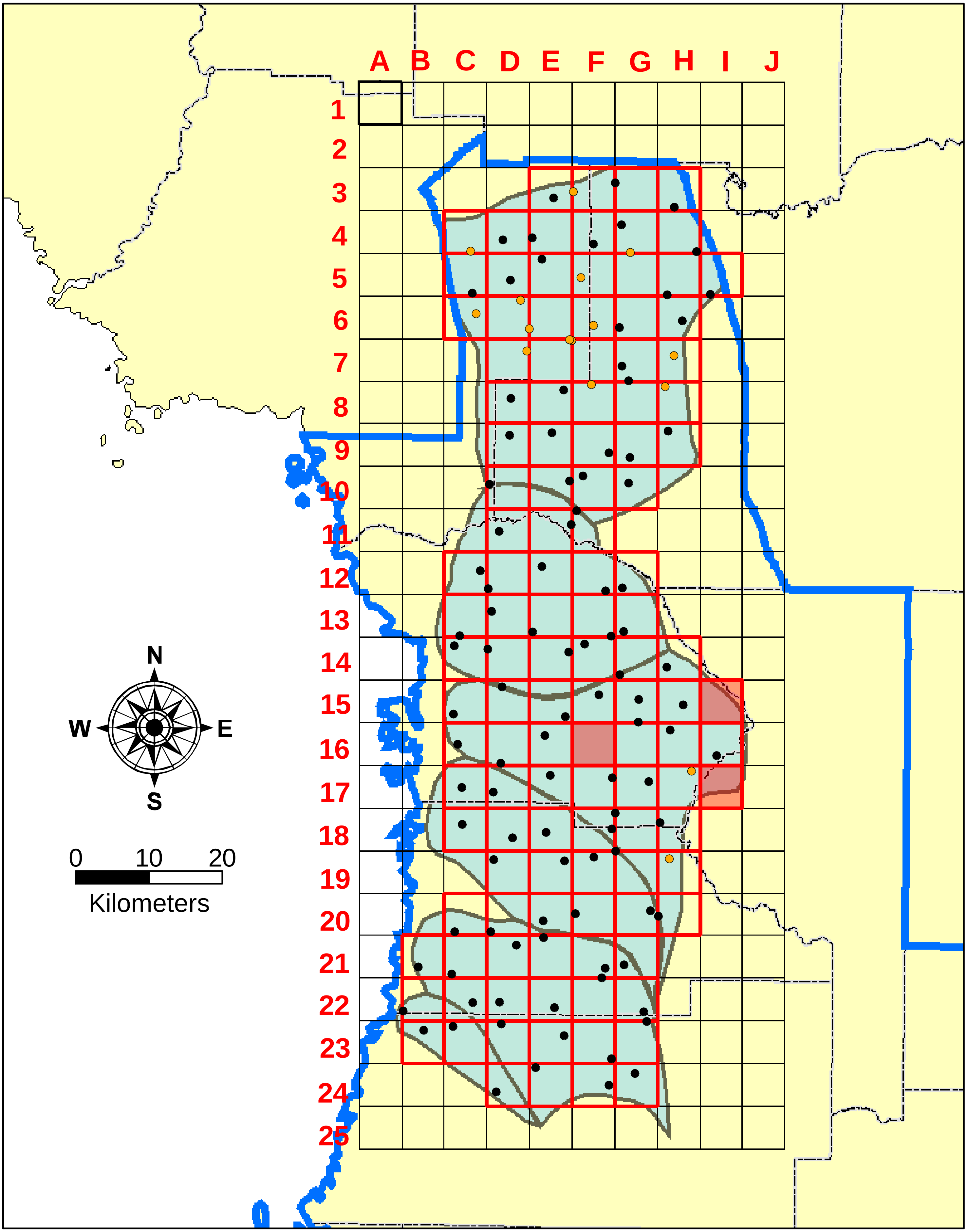

Figure 24. Network Selections using First Priority Wells selected from the REG Database (16 wells denoted in orange, previous selections denoted in black)

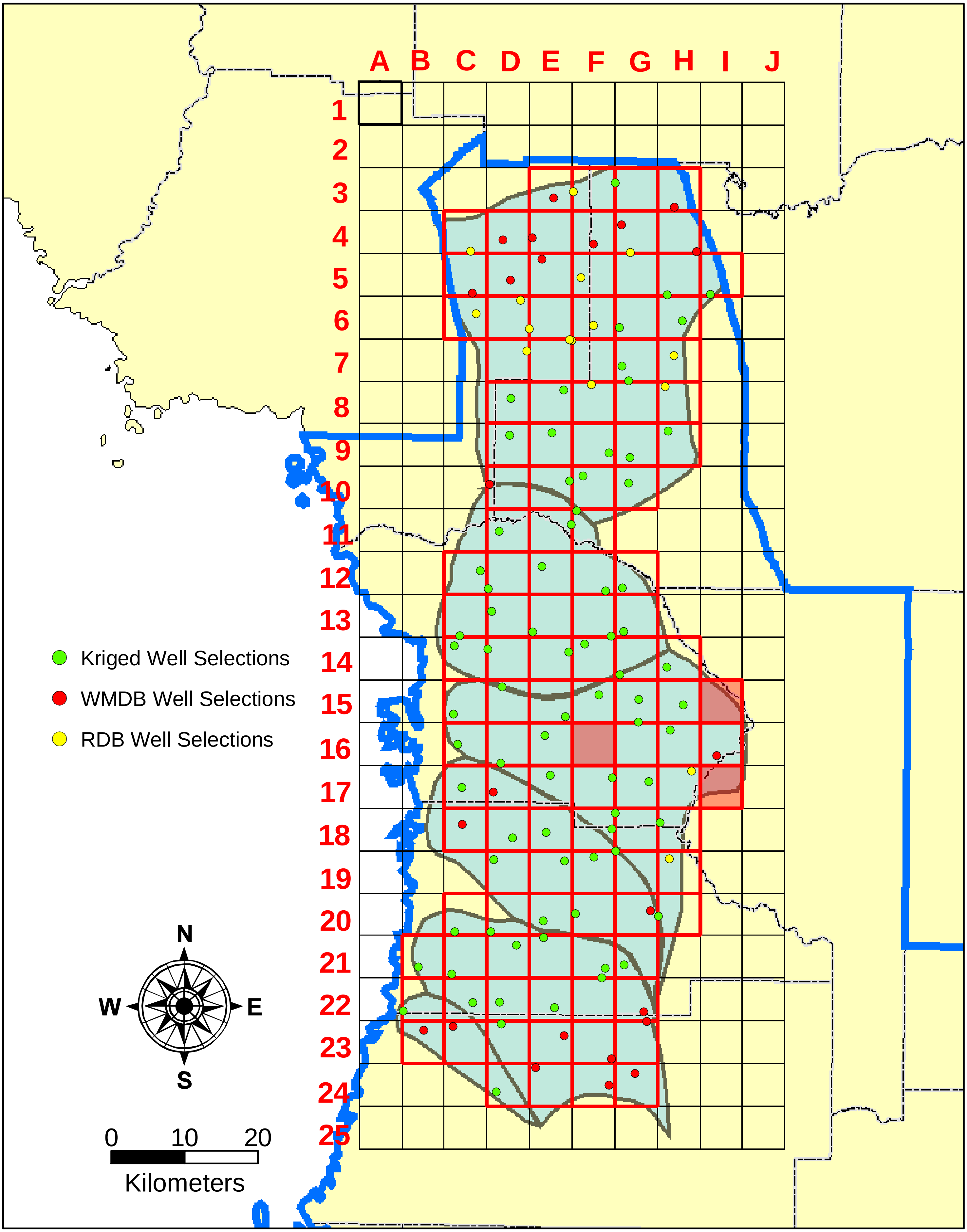

Figure 25. Final Network Selections (118 wells)

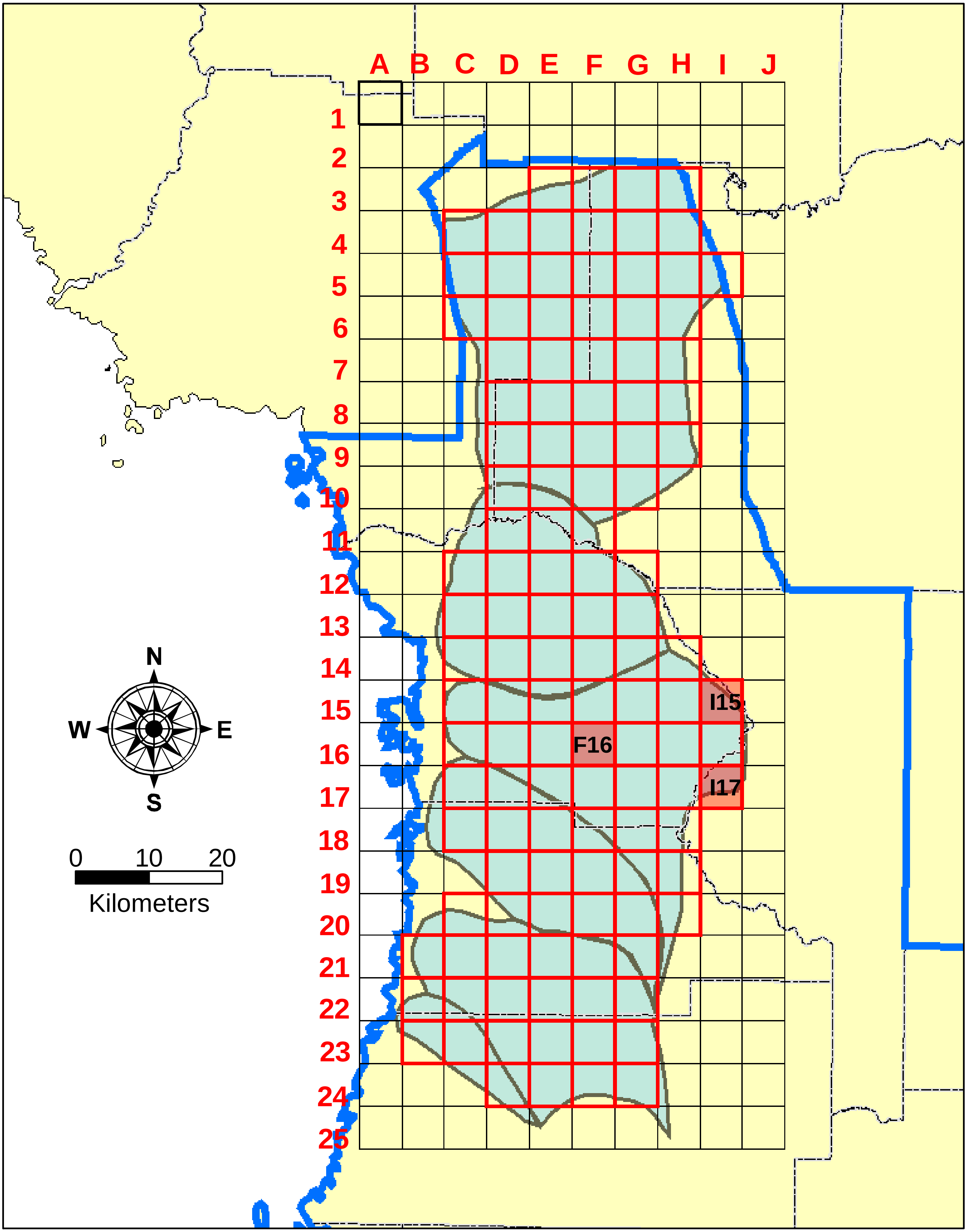

Figure 26. Grid Cells that Lack Known Wells to Include in Network (3 cells denoted by red shading)

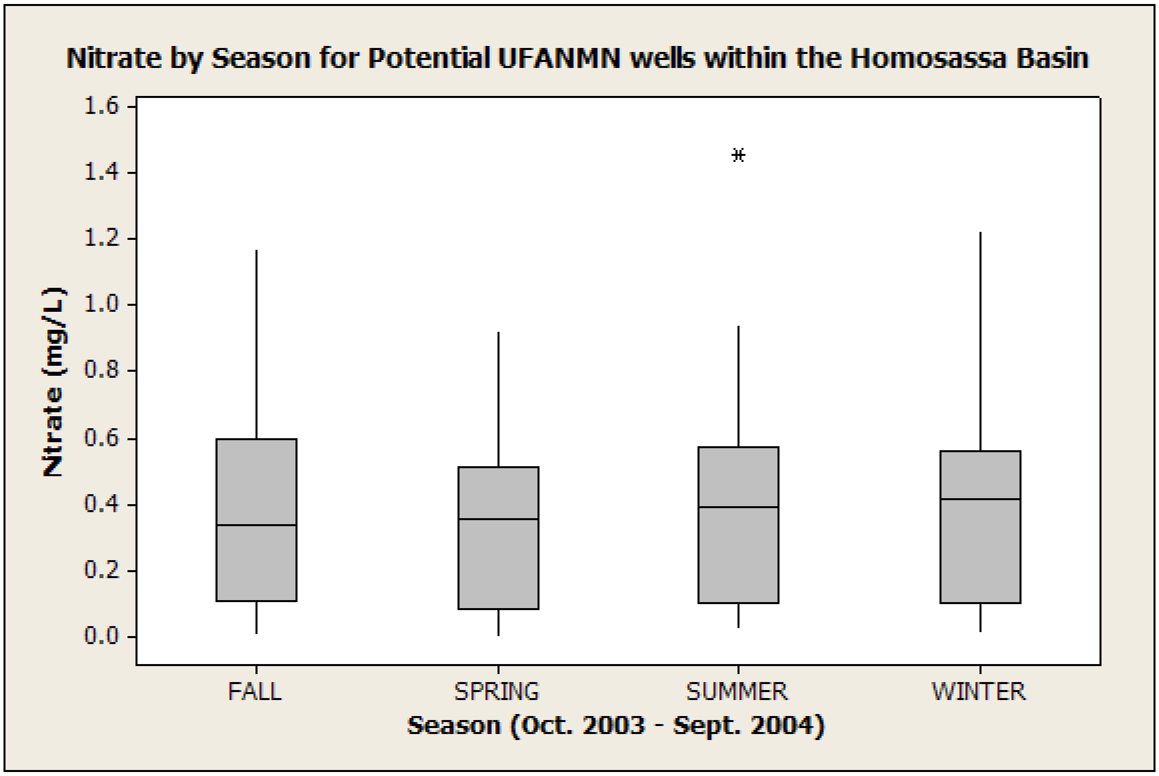

Figure 27A. Boxplots of Nitrate by Season for Potential Network wells in the Homosassa Spring-Recharge Basin

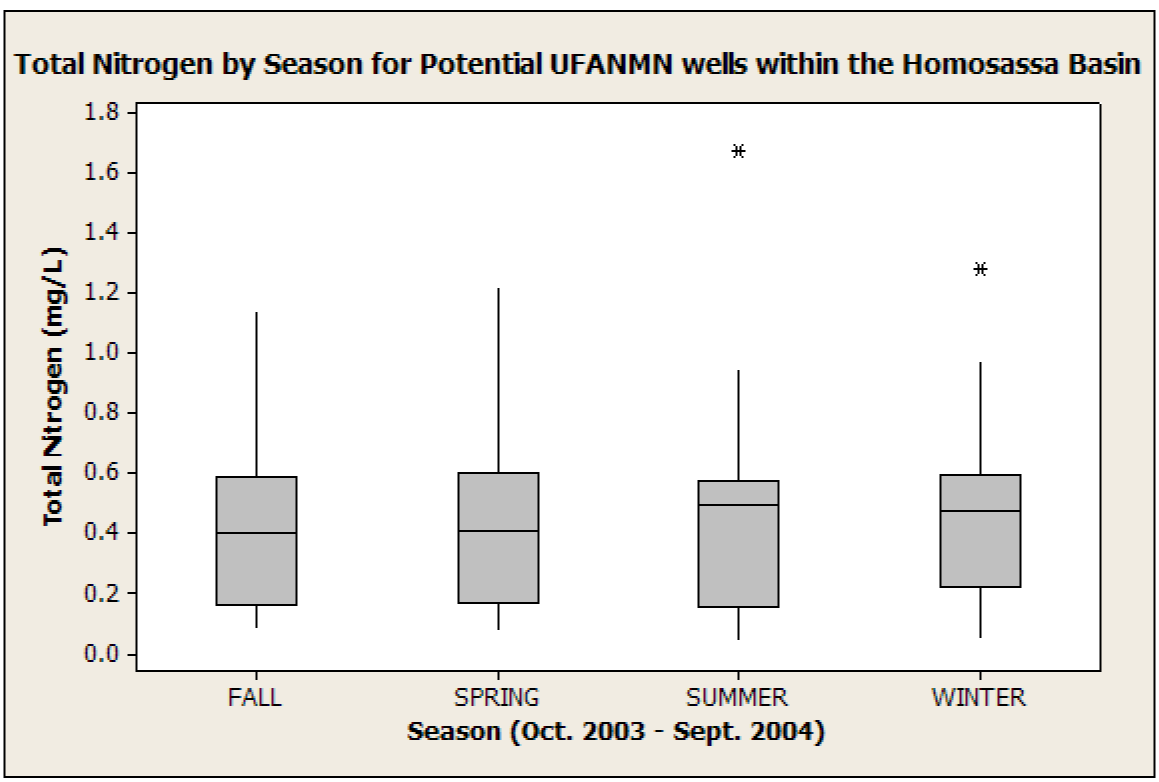

Figure 27B. Boxplots of Total Nitrogen by Season for Potential Network wells in the Homosassa Spring-Recharge Basin

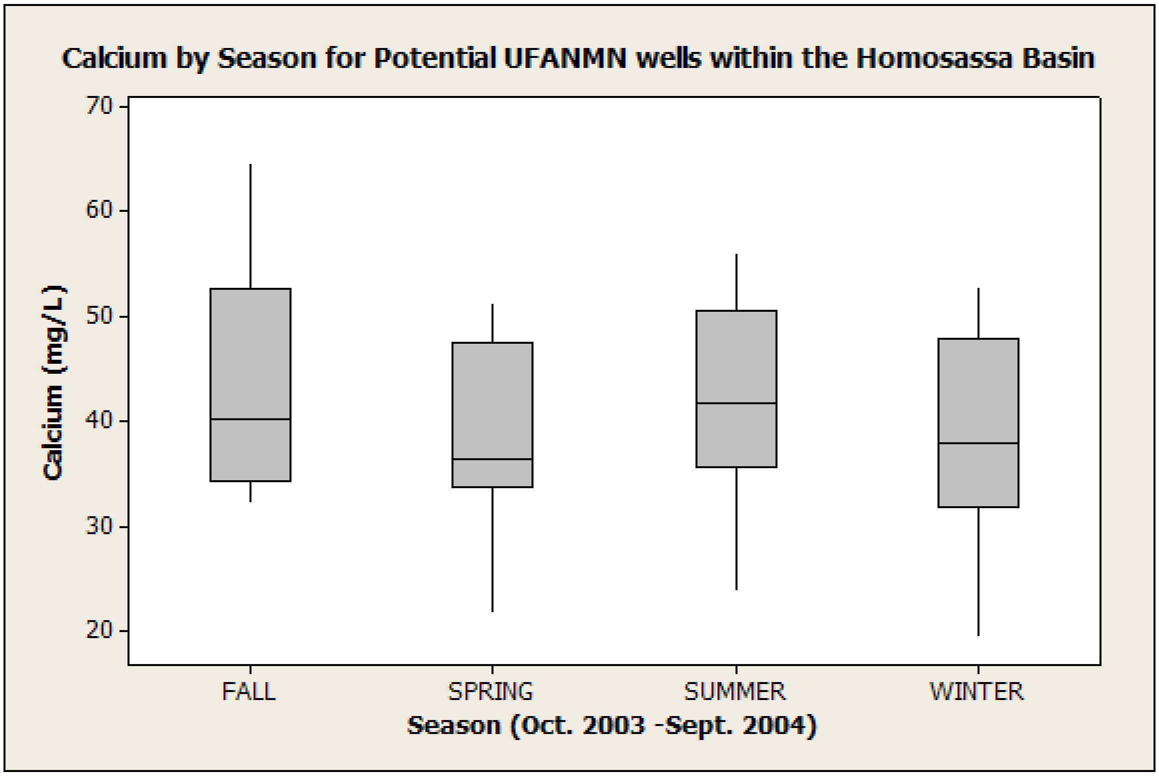

Figure 27C. Boxplots of Calcium by Season for Potential Network wells in the Homosassa Spring-Recharge Basin

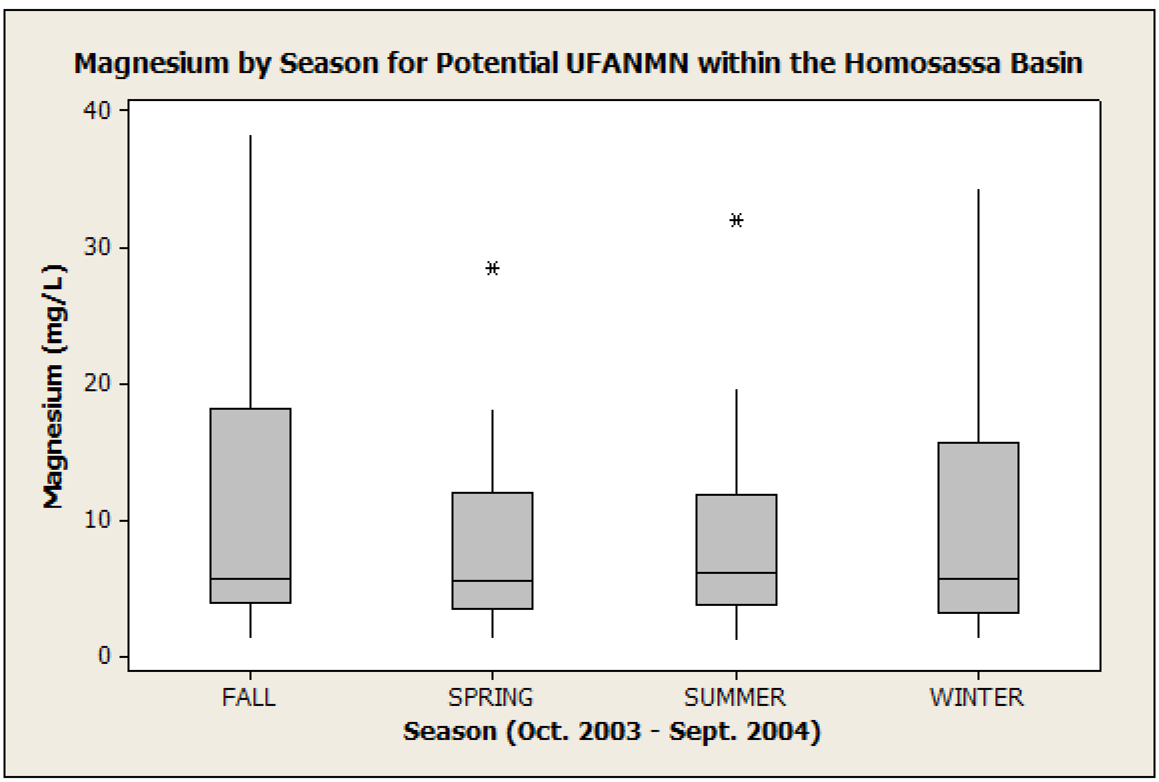

Figure 27D. Boxplots of Magnesium by Season for Potential Network wells in the Homosassa Spring-Recharge Basin

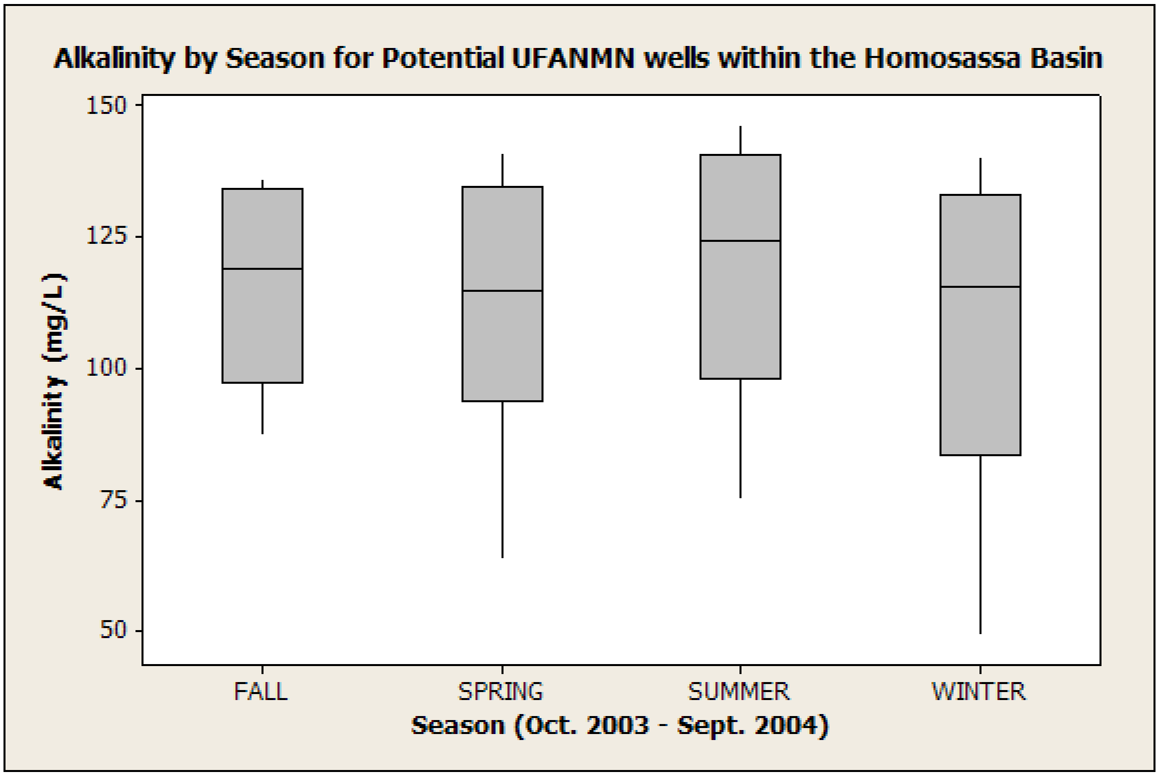

Figure 27E. Boxplots of Total Alkalinity by Season for Potential Network wells in the Homosassa Spring-Recharge Basin

Appendix A. Nutrient Geochemistry Concepts

Nitrogen

“Nitrogen exists as nitrogen gas (N_2); nitrogen dioxide gas (NO_2); and other oxides that are collectively known as NO_x; ammonia and ammonium (NH_3, NH_4^+); nitrite (NO_2^-); and nitrate (NO_3^-); and other inorganic and organic compounds. The gaseous phases exist in the atmosphere and soil but are not of much importance in the saturated zones of aquifers. Organic nitrogen, ammonium, nitrite, and nitrate are considered important in ground-water systems. These compounds are related through a sequence of reduction and oxidation reactions primarily driven by microbial processes, with oxidation being the normal sequence in aerobic ground-water systems” (Upchurch, 1992). The reaction is as follows:

$$\text{Organic Nitrogen (TKN)} \rightarrow NH_4^- \rightarrow NO_2^- \rightarrow NO_3^-$$

Oxidation→
← Reduction

Sources of organic nitrogen include: atmospheric nitrogen, animal wastes, decaying plant matter, and solid waste. Inorganic nitrogen may come in the form of synthetic fertilizers used for crop production and turf-grass maintenance

Ammonium

The presence of ammonium (NH_4^-) in ground-water systems may be the result of animal waste, decay of plant matter, and the use of synthetic fertilizers. In general, high concentrations of ammonium in the Floridan aquifer are indicative of near-source sample collection. This is attributed to the behavior of ammonium in aerobic and anaerobic environments. In aerobic settings, ammonium will oxidize to nitrite and ultimately to nitrate; however, it will persist when oxygen is deficient.

Nitrite

Nitrite (NO_2^-) is the intermediate nitrogen product between ammonium and nitrate. In aerobic environments (dissolved oxygen > 0.03 mg/L), ammonium is almost immediately oxidized into nitrite and then to nitrate. Hence, nitrite persists near the source of nitrogen loading. Consequently, nitrite concentrations in the Floridan aquifer are generally below detection.

Nitrate

Nitrate (NO_3^-) is the oxidized end product of the previously mentioned redox reaction. Plants utilize nitrate located within the root zone of the soil horizon. If nitrate is abundant and not absorbed within the root zone, it will migrate downward into ground-water aquifers. Nitrate is nearly inert in the ground-water environment and can travel significant distances from a nitrogen source (Champion and Starks, 2001). The natural or background concentration of nitrate in the Floridan aquifer is <0.01 mg/L (Upchurch, 1992). Nitrate is the only form of nitrogen that has had a drinking water standard (10 mg/L) (FDER, 1989a). The health concern that prompted the standard is called methemoglobinemia. This condition inhibits the blood from carrying oxygen and thus results in oxygen deprivation especially in infants and young children.

Nitrate acts as a fertilizer in soils and surface-water bodies. It may lead to excessive plant and algae growth and eventual eutrophication of surface-water bodies. In springs, nitrate may be responsible for the increased growth of nuisance vegetation such as *Lyngbya* and *Hydrilla*. These invasive plants can "choke off" the spring runs by limiting flow and must be manually eliminated from these areas.

Phosphorus

Total Phosphorus

Total Phosphorus includes complex organic compounds as well as simple inorganic phosphorus. High phosphorus concentrations in ground water may indicate localized contamination by organic sources such as human and animal wastes. Detectable concentrations of phosphorus may also indicate where recharge water may come into contact with phosphate-rich sediments prior to infiltrating the Floridan aquifer.

Phosphate

To some degree, the presence of phosphate, specifically orthophosphate, (PO_4^{3-}) is just as important as the occurrence of nitrate in regards to plant growth. Both of these nutrients are needed by plants to thrive. Phosphate is an essential nutrient for all living things, and, just as with nitrate, excessive orthophosphate concentrations are linked to significant plant growth and eutrophication of surface-water bodies. Besides the naturally occurring phosphate-bearing sediments of the Hawthorn Group, other sources of orthophosphate include inorganic and organic fertilizers, organic tissues, animal wastes, human waste effluent, and industrial effluent. The median concentration of phosphate within the Floridan aquifer is 0.04 mg/L. In general, phosphate concentrations in the Floridan should be at or near the detection limit. Phosphate is soluble in acidic waters, but once phosphate comes in contact with the alkaline water of the Floridan aquifer, precipitation of phosphate occurs in the form of carbonate-hydroxylapatite, and it becomes immobile. In many cases, the precipitate replaces limestone within the aquifer (Upchurch, 1992).

Appendix B. Cross-Validation Summary Statistics

Summary statistics and graphs can be made by comparing the predicted value to the actual value from cross-validation. Let $\hat{Z}(\mathbf{s}_i)$ be the predicted value from cross-validation, let $z(\mathbf{s}_i)$ be the observed value, and let $\hat{\sigma}(\mathbf{s}_i)$ be the prediction standard error for location $\mathbf{s}_i$. Then some of the summary statistics given by the Geostatistical Analyst are:

1. Mean prediction errors,

$$\frac{\sum_{i=1}^{n}\left(\hat{Z}(\mathbf{s}_i) - z(\mathbf{s}_i)\right)}{n} .$$

2. Root-mean-square prediction errors,

$$\sqrt{\frac{\sum_{i=1}^{n}\left(\hat{Z}(\mathbf{s}_i) - z(\mathbf{s}_i)\right)^2}{n}} .$$

3. Average kriging standard error,

$$\sqrt{\frac{\sum_{i=1}^{n}\hat{\sigma}(\mathbf{s}_i)}{n}} .$$

4. Mean standardized prediction errors,

$$\frac{\sum_{i=1}^{n}\left(\hat{Z}(\mathbf{s}_i) - z(\mathbf{s}_i)\right)/\hat{\sigma}(\mathbf{s}_i)}{n} .$$

5. Root-mean-square standardized prediction errors,

$$\sqrt{\frac{\sum_{i=1}^{n}\left[\left(\hat{Z}(\mathbf{s}_i) - z(\mathbf{s}_i)\right)/\hat{\sigma}(\mathbf{s}_i)\right]^2}{n}} .$$

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
B21	1	HERNANDO BEACH SUPPLY	WEL	1375	914	0	0.225	Yes	195	107	3	340179.720	3152494.960	SPRGNET
B21	2	CSPR 6 UPPER FLDN	WEL	2068	13278	0	-	No	95	43	6	340226.379	3155880.940	WMDB
B21	3	CSPR 6 WQ INTERFACE FLDN	WEL	2068	17359	0	-	No	160	135	6	340226.400	3155882.479	WMDB
B21	4	WEEKI WACHEE 4 (PLUGGED)	WEL	2373	17465	0	-	No	308	221	4	343376.807	3155586.046	WMDB
B21	5	WW PRESERVE 4 UP FLDN	WEL	2373	17560	0	-	No	523	481	6	343364.479	3155579.129	WMDB
B22	1	MAGNOLIA SPRINGS WELL	WEL	1402	941	0	0.168	Yes	110	85	-	338151.780	3146490.270	SPRGNET
B22	2	ROMP TR 18 3 INT FLO	WEL	44	10746	0	-	No	378	58	16	339748.215	3146827.859	WMDB
B22	3	ROMP TR 18 3 UPPER AVPK	WEL	44	10794	0	-	No	510	480	3	339748.232	3146829.090	WMDB
B22	4	ROMP TR 18 3 LOW AVPK	WEL	44	10794	1	-	No	622	592	2	339748.232	3146829.090	WMDB
B23	1	ROY CLAYTON HRS	WEL	2619	18350	0	-	No	45	32	2	340975.360	3143875.860	WMDB
B23	2	CSPR 7 ARIPEKA UP FL	WEL	1962	13121	0	-	No	110	60	6	338038.920	3144391.250	WMDB
C4	1	LEE A THOMAS & RYAN B THOMAS #2 (DID#2)	WEL		30748	0	-	No	70	66	4	347364.208	3250142.267	RDB
C4	2	JOHN M. DEAN #1 (DID#1)	WEL		26368	0	-	No	120	0	8	345149.557	3250380.440	RDB
C4	3	VINCE E DEAN #4 (DID#4)	WEL		35451	0	-	No	140	80	8	344309.346	3252842.161	RDB
C4	4	GRADY E & WILBUR F DEAN #3 (DID#3)	WEL		17079	0	-	No	148	70	12	346653.889	3253312.030	RDB
C4	5	LEE A & BEVERLY J THOMAS #3 (DID#3)	WEL		38539	0	-	No	150	100	12	346918.001	3253324.158	RDB
C4	6	J C PENDRAY & SONS INC #1 (DID#1)	WEL		37650	0	-	No	150	102	8	349298.522	3251268.490	RDB
C4	7	DAVID BENTON #1 (DID#1)	WEL		37123	0	-	No	150	84	8	347116.786	3252052.046	RDB
C4	8	LEE A THOMAS & RYAN B THOMAS #4 (DID#4)	WEL		35809	0	-	No	170	80	8	347695.878	3250119.025	RDB
C4	9	LOUIS A VOIGHT #1 (DID#1)	WEL		34924	0	-	No	175	100	8	345835.956	3250285.490	RDB
C4	10	OLGA M SPANJER IRREVOCABLE TRUST #S (DID#5)	WEL		35450	0	-	No	190	85	8	347718.317	3252069.498	RDB
C5	1	BULLOCK HUBER	WEL	666	400	0	-	No	91	68	4	347588.500	3244404.290	WMDB
C6	1	THOMAS H. OVERSTREET #1 (DID#1)	WEL		13828	0	-	No	132	0	10	348114.295	3241599.174	RDB
C6	2	AURORA DAIRY FLORIDA LLC #SW 2 (DID#13)	WEL		10569	0	-	No	134	102	8	348340.794	3239863.083	RDB
C6	3	AURORA DAIRY FLORIDA LLC #IW 4 (DID#4)	WEL		31265	0	-	No	137	82	12	347499.193	3240832.156	RDB
C6	4	AURORA DAIRY FLORIDA LLC #IW 2 (DID#2)	WEL		31264	0	-	No	200	160	12	348914.260	3240768.013	RDB
C6	5	FREDDY BELL #10 (DID#10)	WEL		17796	0	-	No	200	120	10	349453.140	3243388.014	RDB
C6	6	AURORA DAIRY FLORIDA LLC #IW 5 (DID#5)	WEL		31266	0	-	No	214	132	12	347535.864	3239137.386	RDB
C6	7	FREDDY BELL #2 (DID#2)	WEL		14280	0	-	No	214	123	8	348829.572	3243613.966	RDB
C6	8	J BARRY LAMB #1 (DID#1)	WEL		34387	0	-	No	225	83	4	348017.527	3242052.439	RDB
C6	9	AURORA DAIRY FLORIDA LLC #SW 1 (DID#8)	WEL		16383	0	-	No	235	182	8	348319.327	3239872.606	RDB
C6	10	AURORA DAIRY FLORIDA LLC #IW 3 (DID#14)	WEL		31272	0	-	No	251	146	12	348184.871	3240820.828	RDB
C6	11	J BARRY LAMB #3 (DID#3)	WEL		17345	0	-	No	300	100	10	348356.935	3242065.456	RDB
C6	12	AURORA DAIRY FLORIDA LLC #PIVOT 6 (DID#7)	WEL		10568	0	-	No	305	249	12	347525.566	3238348.421	RDB
C6	13	AURORA DAIRY FLORIDA LLC #PIVOT 7 (DID#15)	WEL		31273	0	-	No	360	324	12	348316.640	3238759.651	RDB
C12	1	WILKEY	WEL	1135	11792	0	0.171	Yes	90	90	4	348653.900	3206545.790	SPRGNET
C12	2	PARMENTER	WEL	1253	792	0	0.171	Yes	62	-	4	348463.210	3206455.930	SPRGNET
C12	3	RUBIN	WEL	1255	794	0	0.174	Yes	-	-	-	347781.910	3204063.630	SPRGNET
C12	4	ROBERTS	WEL	1306	845	0	0.188	Yes	-	-	4	346130.060	3206086.610	SPRGNET
C12	5	EATON	WEL	1307	846	0	0.207	Yes	-	-	4	346654.570	3208881.140	SPRGNET
C12	6	AZZARATTI	WEL	1093	11801	0	-	No	29	26	4	346448.971	3207652.157	WMDB
C12	7	CE 6	WEL	451	185	0	-	No	68	-	4	345543.385	3208772.608	WMDB
C12	8	JOHNSON	WEL	405	139	0	-	No	186	-	-	349434.072	3208228.469	WMDB
C13	1	ROMERO	WEL	1250	789	0	0.161	Yes	-	-	4	345855.110	3197654.990	SPRGNET
C13	2	LEWIS	WEL	1310	849	0	0.161	Yes	-	-	3	345077.790	3198281.090	SPRGNET

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
C13	3	WOOD	WEL	1318	857	0	0.162	Yes	50	45	4	345326.510	3198647.190	SPRGNET
C13	4	HAYES	WEL	1315	854	0	0.164	Yes	12	-	2	344907.180	3199699.520	SPRGNET
C13	5	MUNN	WEL	1317	856	0	0.167	Yes	-	-	-	344395.490	3199921.900	SPRGNET
C13	6	SHEFFIELD C	WEL	1131	11805	0	0.167	Yes	49	35	4	347670.020	3197630.950	SPRGNET
C13	7	WHEELER	WEL	1313	852	0	0.169	Yes	-	-	3	346297.040	3200327.460	SPRGNET
C13	8	VAVERCHEK	WEL	1134	11803	0	0.174	Yes	45	33	4	347391.300	3201144.160	SPRGNET
C13	9	GERRITS E J	WEL	887	621	0	-	No	109	-	4	345687.198	3203321.674	WMDB
C14	1	NEEDLEMAN	WEL	1124	11793	0	0.159	Yes	80	80	3	345132.680	3196310.080	SPRGNET
C14	2	PORT PARADISE	WEL	1290	829	0	0.160	Yes	-	-	2	344750.510	3196099.700	SPRGNET
C14	3	CLEMENS	WEL	1099	11795	0	0.162	Yes	77	65	4	346597.660	3196444.490	SPRGNET
C14	4	VARONA	WEL	1265	804	0	0.162	Yes	100	-	4	346997.920	3195977.410	SPRGNET
C14	5	CULPEPPER	WEL	1276	815	0	0.162	Yes	-	-	-	348395.020	3195066.260	SPRGNET
C14	6	ROMP TR 21 3 AVON PA	WEL	678	412	0	0.162	Yes	252	240	6	346751.210	3195315.860	SPRGNET
C14	7	ARNOW	WEL	1248	787	0	0.162	Yes	60	-	-	348806.660	3195461.080	SPRGNET
C14	8	JULIAS	WEL	1116	11794	0	0.162	Yes	73	50	4	345411.780	3194890.210	SPRGNET
C14	9	SAVINO	WEL	1130	11813	0	0.163	Yes	40	32	4	347333.480	3194710.790	SPRGNET
C14	10	CRYSTAL SHORES	WEL	1240	779	0	0.163	Yes	129	96	4	344646.470	3194981.170	SPRGNET
C14	11	RATHBUN	WEL	1261	800	0	0.164	Yes	-	-	-	348739.200	3194446.060	SPRGNET
C14	12	LADD	WEL	1256	795	0	0.164	Yes	170	-	4	349455.300	3195329.490	SPRGNET
C14	13	JOYNER	WEL	1115	11822	0	0.164	Yes	116	91	4	347043.740	3197392.930	SPRGNET
C14	14	EXLEY	WEL	1103	11806	0	0.165	Yes	60	38	4	348610.860	3197064.470	SPRGNET
C14	15	KIRKWOOD	WEL	1257	796	0	0.166	Yes	-	-	-	344858.330	3194035.620	SPRGNET
C14	16	DYER	WEL	1100	11796	0	0.168	Yes	105	79	4	345471.300	3193257.790	SPRGNET
C14	17	MILLER T	WEL	1121	11797	0	0.170	Yes	40	-	4	346845.590	3192654.620	SPRGNET
C14	18	LYONS	WEL	1119	11814	0	0.170	Yes	34	30	4	349269.100	3193515.600	SPRGNET
C14	19	ELLIS	WEL	1314	853	0	-	No	23	-	-	347364.865	3197080.768	WMDB
C14	20	CRYSTAL SHORES ESTATES	WEL	1241	780	0	-	No	155	30	4	344520.429	3194915.263	WMDB
C15	1	NORRIS WL AT HOMOSASSA	WEL	978	712	0	0.161	Yes	50	44	12	345007.060	3187003.660	SPRGNET
C15	2	HOMO SWD BRADSHAW 2	WEL	1271	810	0	0.168	Yes	100	92	8	346294.340	3186067.170	SPRGNET
C15	3	BAPTIST CHURCH PASTORIUM	WEL	1243	782	0	0.176	Yes	60	-	3	346062.340	3190559.710	SPRGNET
C15	4	CAYLOR	WEL	1097	11823	0	0.180	Yes	65	43	4	349212.650	3189175.680	SPRGNET
C15	5	SHELLERT	WEL	1132	11824	0	0.183	Yes	80	30	4	349392.820	3188434.510	SPRGNET
C15	6	CSPR 1 FL HOMOSASSA ATTRACTION	WEL	2209	1552	0	-	No	61	52	8	346038.690	3186808.610	WMDB
C15	7	CANVAS EXPERTS	WEL	1294	833	0	-	No	-	-	-	346508.672	3187671.785	WMDB
C16	1	HOMOSASSA WELL 3	WEL	894	628	0	0.173	Yes	99	81	3	345595.810	3182872.600	SPRGNET
C16	2	SUGARMILL MZ1 DUAL SH	WEL	726	460	0	0.184	Yes	155	75	6	348570.040	3181086.780	SPRGNET
C16	3	HOMO SP WATER DIST #1	WEL	1272	811	0	-	No	86	40	8	345532.746	3185652.845	WMDB
C17	1	HRS 19A ZOLINGER	WEL	1108	11851	0	0.164	Yes	78	72	4	346183.480	3176979.660	SPRGNET
C17	2	SHAW J.	WEL	1285	824	0	0.166	Yes	78	64	-	347223.340	3178088.440	SPRGNET
C17	3	BETTY JAY SPRING WELL	WEL	1370	909	0	0.174	Yes	60	48	-	344311.120	3174399.160	SPRGNET
C17	4	CHASSAHOWITZKA 2	WEL	465	201	0	-	No	47	41	4	348472.529	3178133.812	WMDB
C17	4	CHASSAHOWITZKA #1	WEL	465	199	0	0.178	Yes	176	166	4	348445.190	3178164.400	SPRGNET
C17	5	CSPR 3 FLORIDAN	WEL	2067	13281	0	-	No	67	25	6	346216.775	3178109.209	WMDB
C18	1	ROMP TR 20 3 UPPER FLDN	WEL	2082	13371	0	-	No	200	100	6	348216.611	3171107.313	WMDB
C18	2	ROMP TR 20 2 UPPER FLDN	WEL	2083	13397	0	-	No	303	103	6	346188.877	3171983.538	WMDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
C18	3	ROMP TR 20 2	WEL	2083	13344	0	-	No	453	443	6	346192.570	3171977.150	WMDB
C18	4	ROMP TR 20 3 UFWQM	WEL	2082	13370	0	-	No	540	520	6	348217.610	3171113.360	WMDB
C20	1	MILDRED WATHEN HRS 14	WEL	1200	11681	0	0.167	Yes	67	42	4	345157.090	3157305.740	SPRGNET
C20	2	TREANOR	WEL	1397	936	0	0.169	Yes	85	63	-	346568.170	3157102.490	SPRGNET
C20	3	HENDRICKSON	WEL	1409	948	0	0.169	Yes	197	189	-	345495.440	3158224.780	SPRGNET
C20	4	GREENE	WEL	1411	950	0	0.171	Yes	-	-	-	344013.380	3157166.970	SPRGNET
C20	5	HRS 54 KOSTER	WEL	1191	11694	0	0.176	Yes	120	84	4	345919.960	3158994.080	SPRGNET
C20	6	OLSEN	WEL	1376	915	0	0.179	Yes	75	63	-	347812.950	3158748.580	SPRGNET
C20	7	DELAROSA MARY (HRS) FLDN	WEL	1399	938	0	-	No	125	102	3	344309.570	3156947.888	WMDB
C20	8	ROMP TR 19 3 AVPK	WEL	855	589	0	-	No	603	440	6	345105.640	3159584.257	WMDB
C20	9	WHCWS MONITOR 1 DEEP	WEL	1410	949	0	-	No	613	598	2	349271.719	3158890.556	WMDB
C21	1	CORWIN	WEL	1185	11762	0	0.200	Yes	112	105	4	344808.850	3151523.040	SPRGNET
C21	3	WEEKI WACHEE SPRINGS	WEL	2210	1550	0	-	No	-	-	6	346222.197	3155598.611	WMDB
C21	3	OAKHILL GOLF COURSE 1	WEL	1408	947	0	-	No	485	78	10	347553.576	3153682.455	WMDB
C21	4	WEEKI WACHEE 2 UFA UFLOR	WEL	2864	2207	0	-	No	570	510	6	344399.355	3156645.310	WMDB
C21	5	WEEKI WACHEE 3 UFLOR WQ	WEL	1074	2211	0	-	No	0	0	-	345386.850	3155862.635	WMDB
C21	6	WEEKI WACHEE F FLDN	WEL	2986	2422	0	-	No	0	0	6	345591.217	3154862.514	WMDB
C22	1	DANNY MORDENTI HRS	WEL	1377	11558	0	0.177	Yes	125	104	4	347642.230	3147668.910	SPRGNET
C22	2	KELSO	WEL	1413	952	0	0.180	Yes	157	-	-	349514.230	3147244.660	SPRGNET
C22	3	FUNK	WEL	1189	11764	0	0.186	Yes	72	63	4	346515.280	3148884.080	SPRGNET
C22	4	DALTON	WEL	1642	1181	0	0.186	Yes	-	-	-	347210.230	3145827.540	SPRGNET
C22	5	ROMP 97	WEL	45	10747	0	0.198	Yes	355	310	6	345002.890	3146403.640	SPRGNET
C23	1	EMORY W BREITRICK HRS	WEL	2620	18351	0	-	No	135	104	4	344932.620	3144410.650	WMDB
C23	2	CBARWF 2W CREWS LAKE DP	WEL	1056	12789	0	-	No	160	120	6	349220.219	3140155.695	WMDB
C23	4	REED	WEL	1645	1184	0	-	No	86	-	3	345863.720	3144829.250	WMDB
C23	5	DEBORAH SILVERTHORN HRS	WEL	2617	18348	0	-	No	58	42	2	345233.630	3140343.090	WMDB
D4	1	FUGATE	WEL	576	310	0	-	No	207	-	-	351784.837	3251668.883	WMDB
D5	1	ORAWITZ WILLISTON HIGHLAND	WEL	1561	1100	0	-	No	95	-	4	352792.376	3246175.503	WMDB
D6	1	VICTOR RONES #1 (DID#1)	WEL		17826	0	-	No	115	70	8	354172.070	3243451.165	RDB
D6	2	CORRIE F BELL #3 (DID#3)	WEL		27251	0	-	No	120	0	4	353784.298	3243973.686	RDB
D6	3	FREDDY & ADRIENNE BELL W W GAY #3 (DID#3)	WEL		11455	0	-	No	130	81	8	353345.562	3240081.951	RDB
D6	4	ROBERT A BAKER #1 (DID#1)	WEL		34582	0	-	No	148	105	4	354103.477	3240671.020	RDB
D6	5	CORRIE F BELL #8 (DID#8)	WEL		35274	0	-	No	150	105	8	352556.370	3243726.629	RDB
D6	6	ROBERT A BAKER #2 (DID#2)	WEL		34865	0	-	No	150	130	8	354030.884	3240629.773	RDB
D6	7	WILLIAM M HICKS TRUSTEE #1 (DID#1)	WEL		32315	0	-	No	175	100	10	354544.262	3238393.586	RDB
D6	8	CORRIE F BELL #10 (DID#10)	WEL		35275	0	-	No	190	105	8	353365.087	3243604.405	RDB
D6	9	CORRIE F BELL #9 (DID#9)	WEL		35805	0	-	No	200	120	8	352495.707	3242982.047	RDB
D6	10	C NEAL ANDERSON #5 (DID#5)	WEL		17921	0	-	No	200	150	10	350874.389	3240363.147	RDB
D6	11	FREDDY & ADRIENNE BELL W W GAY #1 (DID#1)	WEL		32316	0	-	No	200	100	8	352903.696	3240122.446	RDB
D6	12	FREDDY BELL #1 (DID#1)	WEL		14279	0	-	No	220	126	12	349798.917	3243477.958	RDB
D6	13	CORRIE F BELL #2 (DID#2)	WEL		15178	0	-	No	230	190	12	352707.209	3243269.016	RDB
D6	14	AURORA DAIRY FLORIDA LLC #IW 1 (DID#1)	WEL		31263	0	-	No	265	124	12	349687.138	3240717.441	RDB
D7	1	JAMES B BAXTER #1 (DID#1)	WEL		34408	0	-	No	80	62	4	355023.761	3236532.549	RDB
D7	2	GEORGE C VERNER JR #1 (DID#1)	WEL		26496	0	-	No	90	0	8	355076.252	3233546.779	RDB
D7	3	RUBY NOBLES #2 (DID#2)	WEL		32418	0	-	No	95	0	2	354500.628	3233410.949	RDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
D7	4	GEORGE C VERNER JR #2 (DID#2)	WEL		26497	0	-	No	140	0	6	355000.567	3233626.555	RDB
D7	5	GEOFFREY P. & PAMELA J. BERNARD #1 (DID#1)	WEL		32744	0	-	No	210	82	8	352408.106	3237059.659	RDB
D7	6	JAMES B BAXTER #3 (DID#3)	WEL		37406	0	-	No	250	120	8	354977.666	3236708.006	RDB
D8	1	KING, J.	WEL	1594	1133	0	0.205	Yes	163	122	4	352826.730	3230042.890	SPRGNET
D8	2	RUGGIERO, R.	WEL	1834	11789	0	0.215	Yes	120	123	4	354478.800	3232484.630	SPRGNET
D9	1	SKINNER, C.	WEL	1626	1165	0	0.177	Yes	110	105	4	352653.680	3224996.170	SPRGNET
D9	2	FLEEGLER, D.	WEL	1609	1148	0	0.178	Yes	165	143	4	353630.340	3223167.280	SPRGNET
D9	3	TURNER	WEL	1837	11791	0	0.181	Yes	160	145	4	354494.450	3223094.710	SPRGNET
D9	4	ARTHUR UMHOLTZ HRS	WEL	1838	11577	0	0.186	Yes	182	169	4	352095.730	3225742.230	SPRGNET
D9	5	MANCINI, N.	WEL	1591	1130	0	0.186	Yes	75	75	4	351903.340	3223404.970	SPRGNET
D9	6	ERMEL, R.	WEL	1586	1125	0	-	No	183	-	----4	352903.059	3229672.951	WMDB
D9	7	LAKE BONABLE FLORIDAN	WEL	1001	735	0	-	No	749	-	-	352457.240	3224413.512	WMDB
D10	1	T & J RANCH	WEL	635	369	0	-	No	115	-	-	349944.584	3218319.859	WMDB
D10	2	HOBBS, M.	WEL	1820	11785	0	-	No	161	153	----4	356508.320	3215526.910	WMDB
D11	1	KELLY	WEL	1268	807	0	0.186	Yes	185	-	4	351267.800	3211899.230	SPRGNET
D11	2	STEFKE	WEL	1309	848	0	0.188	Yes	300	-	-	351565.070	3209771.180	SPRGNET
D11	3	THOMAS	WEL	1869	1321	0	0.207	Yes	45	30	2	350582.780	3213324.260	SPRGNET
D11	4	CE77	WEL	1050	768	0	-	No	190	171	4	355040.616	3213140.743	WMDB
D11	5	COWART EMORY	WEL	25	10723	0	-	No	203	105	6	349562.361	3211828.832	WMDB
D11	6	BREAUX	WEL	1269	808	0	-	No	250	-	4	351098.527	3213440.829	WMDB
D12	1	SMITH	WEL	1133	11798	0	0.174	Yes	125	97	4	349785.720	3204068.160	SPRGNET
D12	2	SWEEN	WEL	1247	786	0	0.176	Yes	130	-	4	350532.320	3207352.490	SPRGNET
D12	3	THOMAS	WEL	1258	797	0	0.182	Yes	126	-	4	350989.650	3205037.680	SPRGNET
D12	4	FORGET	WEL	1316	855	0	-	No	86	-	4	349944.649	3207944.723	WMDB
D13	1	HARTLE	WEL	1109	11812	0	0.176	Yes	134	88	4	350206.420	3201014.960	SPRGNET
D13	2	ELHEROT	WEL	1101	11804	0	0.177	Yes	200	200	4	351574.450	3199981.410	SPRGNET
D13	3	AUSTIN	WEL	1871	1323	0	0.180	Yes	170	-	4	352102.810	3201052.100	SPRGNET
D13	4	PINE RIDGE	WEL	618	352	0	-	No	200	-	-	354307.795	3201916.555	WMDB
D14	1	LECANTO WELL # 7	WEL	846	580	0	0.165	Yes	30	20	4	349679.240	3195880.710	SPRGNET
D14	2	AUBIN	WEL	1282	821	0	0.169	Yes	-	-	-	350020.710	3197138.460	SPRGNET
D14	3	REEDER	WEL	1249	788	0	0.169	Yes	115	90	2	350070.870	3194736.590	SPRGNET
D14	4	RANKIN	WEL	1251	790	0	0.179	Yes	115	-	4	354756.690	3194553.740	SPRGNET
D14	5	TOLLE	WEL	1252	791	0	0.180	Yes	100	65	4	354678.850	3196986.670	SPRGNET
D14	6	TOWNSEND	WEL	1259	798	0	0.190	Yes	62	-	3	354862.850	3192212.820	SPRGNET
D15	1	GRETHER	WEL	1279	818	0	0.189	Yes	216	181	4	351618.220	3190714.670	SPRGNET
D16	1	RAYUNEC	WEL	1125	11774	0	0.206	Yes	85	59	4	351458.140	3180311.660	SPRGNET
D16	2	FICKES	WEL	1277	11543	0	0.208	Yes	48	42	4	351201.470	3183578.050	SPRGNET
D16	3	DECKANT	WEL	2949	2372	0	-	No	145	132.5	4	352092.359	3181333.230	WMDB
D17	1	CHRISTENSEN	WEL	2948	2371	0	-	No	77	63	4	350464.850	3176346.480	WMDB
D17	2	STINO	WEL	2950	2373	0	-	No	130	63	4	351555.770	3178909.490	WMDB
D18	1	VEDDER	WEL	1208	11778	0	0.212	Yes	304	274	4	353065.980	3170101.990	SPRGNET
D19	1	M T MONROE HRS	WEL	1360	899	0	0.177	Yes	125	70	4	350475.090	3167118.110	SPRGNET
D19	2	ROMP CENTRALIA DEEP	WEL	587	321	0	0.178	Yes	170	122	6	350868.250	3166231.530	SPRGNET
D19	3	W DARCANGELO HRS	WEL	1209	11674	0	0.193	Yes	200	126	4	354894.000	3166416.010	SPRGNET
D19	4	MARSHALL	WEL	1365	904	0	0.193	Yes	150	84	-	350275.510	3164257.820	SPRGNET

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
D20	1	WEEKI WACHEE WELL	WEL	946	680	0	0.198	Yes	259	176	4	350105.060	3157303.030	SPRGNET
D20	2	P J MULLADY HRS	WEL	1385	924	0	0.205	Yes	135	116	4	352802.890	3159977.740	SPRGNET
D20	3	H L MINCKLER HRS	WEL	1391	930	0	-	No	165	84	4	353100.975	3162066.893	WMDB
D21	1	M F BRADFORD HRS	WEL	1372	911	0	0.207	Yes	160	126	4	353589.650	3155504.430	SPRGNET
D21	2	EARL WALKER HRS	WEL	1378	917	0	-	No	108	84	4	355003.728	3155517.965	WMDB
D22	1	BISARD	WEL	1179	11756	0	0.181	Yes	100	53	4	351288.790	3147714.620	SPRGNET
D22	2	BRIDGES	WEL	1412	951	0	0.183	Yes	100	78	-	354209.910	3148509.200	SPRGNET
D22	3	C V HARRISON HRS	WEL	1368	907	0	0.183	Yes	105	52	4	353968.530	3148789.230	SPRGNET
D22	4	CBARWF 2NW SPG HILL 12 DP	WEL	1055	12790	0	-	No	150	100	6	353567.268	3147432.942	WMDB
D22	5	CBARWF 1NW KUKA DEEP	WEL	1058	12787	0	-	No	150	100	6	355273.756	3145418.024	WMDB
D23	1	DANIELS	WEL	1643	1182	0	0.199	Yes	135	-	4	351550.840	3144756.230	SPRGNET
D23	2	HAGIN	WEL	1636	1175	0	0.233	Yes	125	100	3	349886.310	3140129.210	SPRGNET
D23	3	WOLFE WELL CBAR 1W DEEP	WEL	1030	755	0	-	No	777	112	14	352639.580	3140756.207	WMDB
D23	4	CBARWF WRW FLDN	WEL	46	10748	0	-	No	1314	1239	8	354855.972	3141298.542	WMDB
D24	1	EICHHORN	WEL	1639	1178	0	0.269	Yes	170	-	2	350861.750	3135438.000	SPRGNET
D24	2	CBARWF 1SW SOUTHWEST DP	WEL	1066	12816	0	-	No	130	100	6	353456.188	3136709.154	WMDB
E3	1	ROMP 134 SHALLOW AGW	WEL	20	1365	0	-	No	35	21	4	358670.160	3257386.610	WMDB
E4	1	BLUE GROTTO #2 WELL	WEL	2668	34770	0	-	No	110	84	4	355747.750	3251934.320	WMDB
E4	2	SCL RR AT WILLISTON	WEL	502	236	0	-	No	104	-	-	360495.976	3251804.559	WMDB
E4	3	DEVILS SINK FLDN	WEL	749	483	0	-	No	50	-	-	356912.716	3254158.314	WMDB
E5	1	WILLISTON AIRPORT	WEL	389	123	0	-	No	135	-	-	357063.496	3249014.916	WMDB
E6	1	HYGIN & JOHANNA JAUSS #3 (DID#3)	WEL		25819	0	-	No	100	63	8	355382.238	3239523.263	RDB
E6	2	JAMES EDWARD BLITCH #1 (DID#1)	WEL		33186	0	-	No	150	0	8	358194.341	3238942.948	RDB
E6	3	HYGIN & JOHANNA JAUSS #2 (DID#2)	WEL		25818	0	-	No	160	110	8	355510.591	3238832.618	RDB
E6	4	HYGIN & JOHANNA JAUSS #4 (DID#4)	WEL		25820	0	-	No	205	84	8	355791.192	3239524.846	RDB
E7	1	FLORA P. ANDREWS #1 (DID#1)	WEL		27703	0	-	No	65	0	2	360847.095	3238070.972	RDB
E7	2	NEAL O & BILLIE JO SCHERER #1 (DID#1)	WEL		17025	0	-	No	100	60	8	356552.779	3233381.567	RDB
E7	3	REUBEN & MARIA HERNANDEZ #1 (DID#1)	WEL		16865	0	-	No	125	60	8	358590.508	3235391.102	RDB
E7	4	CORRIE F JR & ADRIENNE BELL #3 (DID#3)	WEL		38882	0	-	No	150	60	2	357198.976	3236436.420	RDB
E7	5	CORRIE F JR & ADRIENNE BELL #2 (DID#2)	WEL		38883	0	-	No	150	60	4	357341.192	3236905.059	RDB
E7	6	CORRIE F JR & ADRIENNE BELL #1 (DID#1)	WEL		38881	0	-	No	150	60	5	357307.665	3236901.169	RDB
E7	7	RICHARD A GRIFFIN SR TRUSTEE OF #2 (DID#2)	WEL		23355	0	-	No	160	0	3	358084.074	3232775.312	RDB
E7	8	SHARON MILLS #1 (DID#1)	WEL		15219	0	-	No	160	104	8	359658.214	3237434.432	RDB
E7	9	HYGIN & JOHANNA JAUSS #1 (DID#1)	WEL		25817	0	-	No	175	100	10	355751.065	3236612.906	RDB
E7	10	RICHARD A GRIFFIN SR TRUSTEE OF #1 (DID#1)	WEL		23354	0	-	No	265	0	8	358186.466	3233429.482	RDB
E7	11	ROY R LANE SR & TODD LANE #1 (DID#1)	WEL		17920	0	-	No	270	110	8	357549.566	3235993.937	RDB
E7	12	VERNON MARKHAM #1 (DID#1)	WEL		29142	0	-	No	300	93	8	357726.569	3234946.213	RDB
E8	1	KOON, R.	WEL	1592	1131	0	0.188	Yes	-	-	-	360054.190	3231214.330	SPRGNET
E8	2	BOUEHARD, W.	WEL	1625	1164	0	0.188	Yes	-	-	-	360003.190	3231461.240	SPRGNET
E8	3	WALDRON, W.	WEL	1894	1351	0	0.193	Yes	-	-	-	357861.940	3230871.960	SPRGNET
E8	4	HERSHEL KYPER SOUTH OF ROM	WEL	874	608	0	-	No	86	-	-	359784.802	3229062.412	WMDB
E9	1	ROMEO ELEM. N.	WEL	1611	1348	0	0.218	Yes	143	90	6	358441.980	3225354.170	SPRGNET
E10	1	RAY BIEDERMAN HRS	WEL	1830	11856	0	0.160	Yes	120	92	4	360875.460	3218767.170	SPRGNET
E10	2	RB SPG #3 NURS	WEL	1589	1128	0	0.160	Yes	-	-	-	360118.780	3220222.090	SPRGNET
E10	3	ORMOND WARE HRS	WEL	1602	1141	0	0.160	Yes	60	42	4	360343.330	3219481.680	SPRGNET

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
E10	4	SEIBT, R.	WEL	1892	1349	0	0.161	Yes	60	46	4	360657.670	3218646.670	SPRGNET
E10	5	DIKEMAN, F.	WEL	1597	11578	0	0.161	Yes	145	82	4	360559.620	3219479.050	SPRGNET
E10	6	RB SPG #1 EAST	WEL	1588	1127	0	0.162	Yes	-	-	-	360137.550	3220346.160	SPRGNET
E10	7	NEEMI, C.	WEL	1599	1138	0	0.164	Yes	220	195	4	358367.820	3219351.970	SPRGNET
E10	8	BARRETT, B.	WEL	1888	1344	0	0.166	Yes	60	46	4	358156.100	3219724.000	SPRGNET
E10	9	JACK SKIPPER HRS	WEL	1884	1340	0	0.168	Yes	240	220	4	358429.950	3217811.950	SPRGNET
E10	10	EDWARDS, R.	WEL	1590	1129	0	0.171	Yes	-	-	-	357031.360	3220599.950	SPRGNET
E10	11	RB SPG #2 WEST	WEL	1587	1126	0	0.171	Yes	-	-	-	356893.510	3220386.170	SPRGNET
E10	12	ENGEL, R.	WEL	1817	11782	0	0.172	Yes	100	84	4	356761.030	3220603.320	SPRGNET
E10	13	DUNNELLON MSS	WEL	1605	1144	0	0.175	Yes	-	-	-	358874.490	3216575.080	SPRGNET
E10	14	BM VOGT SPRINGS FLORIDAN	WEL	653	387	0	-	No	115	-	-	356234.079	3215222.268	WMDB
E10	15	SCE 170 RAINBOW GOLF COUR	WEL	23	10721	0	-	No	137	125	4	357623.883	3220407.757	WMDB
E10	16	RAINBOW SPGS NR DUNNEL FL	WEL	691	425	0	-	No	442	125	6	358735.541	3218577.641	WMDB
E10	17	DUNNELLON MSN FLDN	WEL	1605	1350	0	-	No	-	-	-	358874.239	3216575.173	WMDB
E11	1	PAULINE MAUGHAN HRS	WEL	1828	11858	0	0.195	Yes	82	63	4	361074.390	3212854.130	SPRGNET
E11	2	SECTION 12 MINE	WEL	328	62	0	-	No	36	-	-	359039.255	3210138.986	WMDB
E11	3	CE 11 CHARLES RUSH FLADN	WEL	733	467	0	-	No	78	-	2	356098.136	3213007.386	WMDB
E12	1	HUNT	WEL	1114	11811	0	0.235	Yes	99	97	4	357080.130	3207115.530	SPRGNET
E12	2	CITRUS SPRING GOLF COURSE	WEL	898	632	0	-	No	102	-	2	356143.876	3207989.047	WMDB
E12	3	HOGAN	WEL	1321	860	0	-	No	110	-	4	361104.390	3204110.812	WMDB
E13	1	NORTH LECANTO DEEP W	WEL	835	569	0	0.179	Yes	335	288	4	355842.310	3198215.020	SPRGNET
E13	2	ROBERTS T	WEL	1127	11809	0	0.188	Yes	123	120	4	355517.160	3201193.610	SPRGNET
E13	3	LOGHT	WEL	1118	11800	0	0.192	Yes	147	114	4	357607.180	3201567.860	SPRGNET
E13	4	LECANTO 6	WEL	835	571	0	-	No	78	55	4	355887.087	3198264.671	WMDB
E13	5	DELTONA OLD HOMESTEAD	WEL	883	617	0	-	No	94	-	-	358075.254	3202177.761	WMDB
E13	6	BEVERLY HILLS 6 T	WEL	890	624	0	-	No	176	-	4	357210.008	3200095.044	WMDB
E14	1	DISPONZIO	WEL	1319	858	0	0.169	Yes	270	-	2	360728.980	3195434.690	SPRGNET
E14	2	ROBERTS	WEL	1128	11820	0	0.170	Yes	350	180	4	359821.150	3194306.660	SPRGNET
E14	3	OLDNETTLE	WEL	1302	841	0	0.173	Yes	275	-	4	360060.610	3196181.550	SPRGNET
E14	4	KURTH	WEL	1260	799	0	0.176	Yes	220	185	4	359728.300	3193353.500	SPRGNET
E14	5	LISOTTA	WEL	1287	826	0	0.179	Yes	260	253	4	356858.970	3195820.500	SPRGNET
E14	6	ENZ	WEL	1102	11818	0	0.181	Yes	240	233	4	357611.700	3193133.030	SPRGNET
E14	7	MOORE	WEL	1273	812	0	-	No	52	-	4	356470.687	3192900.809	WMDB
E14	8	MILLER	WEL	1322	861	0	-	No	235	220	4	355491.345	3196945.847	WMDB
E14	9	CITRUS HILLS PRODUCTION	WEL	1283	822	0	-	No	342	280	12	358815.512	3196385.432	WMDB
E14	10	CITRUS HILLS WRW 630 FL	WEL	2072	13313	0	-	No	650	302	4	359021.310	3196842.845	WMDB
E14	11	CITRUS HILLS DEEP	WEL	461	195	0	-	No	0	0	0	359039.534	3196870.945	WMDB
E15	1	KREIDER	WEL	1320	859	0	0.215	Yes	95	83	2	360298.190	3186666.680	SPRGNET
E16	1	NORTON	WEL	1303	842	0	0.221	Yes	160	158	4	357500.600	3184084.060	SPRGNET
E16	2	LECANTO WELL # 3	WEL	807	541	0	-	No	63	59	4	358420.000	3184853.447	WMDB
E16	3	CSPR 2 UPPER FLORIDAN	WEL	2066	13283	0	-	No	95	55	6	356990.289	3185939.190	WMDB
E17	1	LECANTO WELL # 1	WEL	368	102	0	0.249	Yes	169	168	4	358244.780	3178646.500	SPRGNET
E17	2	SUGARMILL WOODS #1	WEL	2936	2352	0	-	No	120	70	6	356621.232	3179432.827	WMDB
E17	3	ENOCH BOOTH WELL	WEL	2671	1877	0	-	No	125	-	3	356513.024	3178248.657	WMDB
E17	4	SUGARMILL WOODS #4 (ROMP 108)	WEL	2937	2353	0	-	No	230	190	6	355420.759	3179927.920	WMDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
E18	1	ROMP 107	WEL	38	10739	0	0.217	Yes	240	140	8	357661.790	3170851.480	SPRGNET
E18	2	R B PARKER HRS	WEL	1401	940	0	-	No	120	63	4	359904.563	3171956.719	WMDB
E19	1	J H JACKSON HRS	WEL	1389	928	0	0.177	Yes	109	84	3	360170.460	3166967.430	SPRGNET
E19	2	KOLASA	WEL	1195	11769	0	0.178	Yes	250	180	4	358655.520	3167478.140	SPRGNET
E19	3	HAROLD E SELPH HRS	WEL	1190	11677	0	0.179	Yes	115	94	4	360809.760	3168191.080	SPRGNET
E19	4	BAGGET	WEL	1414	953	0	0.180	Yes	160	-	-	356784.300	3165500.040	SPRGNET
E19	5	W FLAHERTY HRS	WEL	1379	918	0	0.193	Yes	138	105	4	356511.920	3163225.480	SPRGNET
E19	6	BROWN EDMOND (HRS) FLDN	WEL	1187	11678	0	-	No	133	79	4	360170.642	3166967.231	WMDB
E19	7	M PRYSTUPA HRS	WEL	2016	13183	0	-	No	235	222	4	357364.697	3165555.530	WMDB
E20	1	STANLEY	WEL	1206	11776	0	0.190	Yes	120	105	4	357245.810	3158783.890	SPRGNET
E20	2	EDDIE SMITH HRS	WEL	1381	920	0	-	No	153	105	4	356775.662	3160328.899	WMDB
E20	3	C H COMBS HRS	WEL	1184	11683	0	-	No	170	117	4	360213.888	3156931.736	WMDB
E21	1	VANCE	WEL	1390	929	0	0.179	Yes	119	84	-	357327.210	3156535.810	SPRGNET
E21	2	BILL MEADORS HRS	WEL	1374	913	0	0.180	Yes	110	70	4	356666.920	3155897.430	SPRGNET
E21	3	RALPH S SWOPE HRS	WEL	1398	11564	0	0.194	Yes	110	91	4	357226.470	3152720.090	SPRGNET
E21	4	TAYLOR	WEL	1207	11777	0	0.202	Yes	147	107	4	359711.250	3151274.240	SPRGNET
E21	5	SPRING HILL FLDN	WEL	2838	2203	0	-	No	107	80	6	356776.698	3156808.187	WMDB
E21	6	C HAMILTON HRS	WEL	1387	926	0	-	No	119	92	4	360010.514	3151270.745	WMDB
E21	7	CBARWF 4N AP MASARYK FLDN	WEL	875	609	0	-	No	251	80	8	357737.459	3151308.491	WMDB
E22	1	VOSCINAR	WEL	1363	902	0	0.205	Yes	120	84	-	358789.350	3146975.890	SPRGNET
E22	2	MASARYKTOWN DEEP WEL	WEL	892	626	0	0.207	Yes	76	29	6	356478.510	3145478.920	SPRGNET
E22	3	ROMP 98 FLDN	WEL	1032	756	0	-	No	143	79	6	358687.954	3150123.897	WMDB
E22	4	CBARWF 2N MASARYK CNL FLDN	WEL	1053	12786	0	-	No	150	100	6	357739.025	3147252.519	WMDB
E22	5	CBARWF 1N FINEST FARMS DP	WEL	1057	12788	0	-	No	150	80	6	357709.947	3145317.866	WMDB
E23	1	CBARWF 1NE AL BAR NE DP	WEL	1067	12817	0	-	No	170	120	6	360106.087	3143102.710	WMDB
E24	1	CBARWF DUCK POND FLDN	WEL	2646	18432	0	-	No	138	77	6	356195.111	3138757.661	WMDB
E24	2	SR 52 WELL	WEL	644	378	0	-	No	73	38	6	358234.540	3133708.090	WMDB
E24	3	CBARWF 1SE PHILLIPS B1 DP	WEL	374	108	0	-	No	206	79	6	358745.047	3135916.480	WMDB
E24	4	CBARWF 1S PASCO TRAILS DP	WEL	1063	12781	0	-	No	150	100	6	355865.822	3134079.332	WMDB
E24	5	CBARWF 1E PHILLIPS DEEP	WEL	1062	12782	0	-	No	150	100	6	359229.422	3137828.126	WMDB
E24	6	CBARWF 2E AL BAR EAST DP	WEL	1065	12813	0	-	No	150	100	6	360260.158	3139034.556	WMDB
F3	1	WHITEHURST CATTLE CO INC #4 (DID#4)	WEL		25754	0	-	No	150	0	12	361393.313	3258231.705	RDB
F3	2	WHITEHURST CATTLE CO INC #6 (DID#6)	WEL		25756	0	-	No	330	0	12	363049.144	3259227.484	RDB
F4	1	STOKES GWSI WELL	WEL	1618	1157	0	-	No	83	55	4	364117.490	3251090.440	WMDB
F5	1	HARRELL H & DEBBIE K PHILLIPS JR #3 (DID#1)	WEL		35807	0	-	No	130	100	8	362384.930	3246536.044	RDB
F6	1	CECIL N BENTON #1 (DID#1)	WEL		17327	0	-	No	60	0	8	364113.815	3239999.655	RDB
F6	2	CECIL N & JANE F BENTON #2 (DID#2)	WEL		27371	0	-	No	62	62	4	362340.644	3242926.266	RDB
F6	3	CECIL N & JANE F BENTON #1 (DID#1)	WEL		14724	0	-	No	100	42	8	362362.242	3242637.537	RDB
F7	1	FLORA P. ANDREWS #2 (DID#2)	WEL		14955	0	-	No	103	0	10	361159.655	3237912.610	RDB
F7	2	DONALD L SMITH #1 (DID#1)	WEL		14568	0	-	No	155	126	10	361228.732	3233786.428	RDB
F8	1	T RICHARD BARBER JR TST T #3 (DID#3)	WEL		24567	0	-	No	81	50	4	363852.586	3231958.458	RDB
F8	2	T RICHARD BARBER JR TST T #2 (DID#2)	WEL		34759	0	-	No	140	133	10	364331.195	3231868.405	RDB
F8	3	T RICHARD BARBER JR TST T #1 (DID#1)	WEL		13823	0	-	No	407	149	10	363347.648	3231969.419	RDB
F9	1	PRUITT NORTH	WEL	1607	1146	0	0.186	Yes	-	-	-	366247.370	3222612.900	SPRGNET
F9	2	CE # 12	WEL	1011	745	0	-	No	46	38	2	362271.551	3222973.255	WMDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
F9	3	ALLEN BELL HRS	WEL	1610	1149	0	-	No	106	102	4	361545.797	3225007.699	WMDB
F9	4	JOHN BURREL HRS	WEL	1615	11582	0	-	No	180	146	4	366833.219	3226484.793	WMDB
F9	5	SCE 118 LK TROPICANA RANCH	WEL	468	202	0	-	No	205	-	2	362339.810	3225860.727	WMDB
F10	1	DUNNELLON HS 3	WEL	1584	1123	0	0.165	Yes	155	59	6	362695.430	3219453.300	SPRGNET
F10	2	PRUITT CENTRAL	WEL	1627	1166	0	0.178	Yes	-	-	-	365141.280	3220501.740	SPRGNET
F10	3	PRUITT SOUTH	WEL	1612	1151	0	0.189	Yes	-	-	-	365115.950	3218347.150	SPRGNET
F10	4	CE 13 FLDN	WEL	1046	764	0	-	No	93	43.2	4	361910.290	3217689.299	WMDB
F11	1	USGS OBS WELL CE 14D	WEL	409	143	0	0.188	Yes	190	112	6	361843.150	3214734.910	SPRGNET
F11	2	JEFF CUBBAGE HRS	WEL	1821	11854	0	0.220	Yes	60	50	4	363487.080	3210978.200	SPRGNET
F11	3	CE 75	WEL	903	637	0	-	No	82	-	-	361865.336	3213367.913	WMDB
F11	4	ROMP 121 AVPK	WEL	1040	760	0	-	No	602	143	12	364609.738	3213839.807	WMDB
F11	6	PRUITT DEEP	WEL	1885	1341	0	-	No	1000	-	-	365468.305	3211478.089	WMDB
F12	1	OPPERMAN	WEL	1275	814	0	0.194	Yes	65	-	3	365784.440	3203778.700	SPRGNET
F12	2	KELLNER	WEL	1308	847	0	0.209	Yes	112	92	4	362178.100	3205606.630	SPRGNET
F12	3	COONS HRS	WEL	1246	785	0	-	No	38	21	3	365794.340	3204652.170	WMDB
F13	1	THOMAS	WEL	1254	793	0	0.182	Yes	60	30	4	366498.760	3197644.660	SPRGNET
F13	2	RECORD	WEL	1126	11815	0	0.183	Yes	380	220	4	361301.820	3198013.610	SPRGNET
F13	3	KREMNETZ	WEL	1267	806	0	0.190	Yes	-	-	-	365884.760	3200760.810	SPRGNET
F13	4	CHASFIN	WEL	1098	11810	0	0.198	Yes	245	243	4	361380.990	3202353.120	SPRGNET
F13	5	CAMP MINING FLDN	WEL	880	614	0	-	No	91	0	14	364230.946	3201669.009	WMDB
F14	1	CALLUNDER	WEL	1301	840	0	0.179	Yes	152	-	4	362882.750	3196547.970	SPRGNET
F14	2	RHAME	WEL	1288	827	0	0.184	Yes	-	-	-	365143.180	3195228.540	SPRGNET
F14	3	ROMP 113 OCALA	WEL	30	10729	0	0.187	Yes	150	130	4	362092.860	3192915.750	SPRGNET
F14	4	ROMP 113 FLDN	WEL	30	12137	0	-	No	180	130	6	362092.814	3192916.209	WMDB
F15	1	BURNS	WEL	1297	836	0	0.182	Yes	126	126	3	364861.120	3189629.400	SPRGNET
F15	2	HOUSTON	WEL	1284	823	0	0.182	Yes	180	70	4	364879.050	3191168.320	SPRGNET
F15	3	HOLDER MINE	WEL	1289	828	0	0.194	Yes	-	-	-	365236.960	3186977.750	SPRGNET
F15	4	HOLDER MINE PERM UFA FLDN	WEL	1289	2390	0	-	No	343	310	6	364901.097	3186690.969	WMDB
F17	1	ROMP 109 OCALA	WEL	323	57	0	0.194	Yes	260	189	6	366701.070	3178316.210	SPRGNET
F17	2	BROWN V.	WEL	1095	11760	0	0.206	Yes	160	130	4	365227.350	3179128.420	SPRGNET
F18	1	C ELLINGHUYSEN HRS	WEL	1183	11676	0	0.177	Yes	174	159	4	366602.950	3171294.070	SPRGNET
F18	2	MONCK	WEL	1122	11773	0	0.178	Yes	200	126	4	365209.730	3172910.700	SPRGNET
F18	3	HOYER	WEL	1113	11768	0	0.194	Yes	133	110	4	363989.670	3173047.970	SPRGNET
F18	4	ANNUTTELIGA FMW 1 FLADN	WEL	2575	18303	0	-	No	560	150	6	363950.387	3174022.409	WMDB
F19	1	MAGLIO	WEL	1362	901	0	0.172	Yes	289	147	-	364142.400	3167505.490	SPRGNET
F19	2	SHAW, R.	WEL	1369	908	0	0.172	Yes	210	135	-	363353.960	3165113.710	SPRGNET
F19	3	HARRISON T.	WEL	1192	11765	0	0.173	Yes	150	105	4	364876.000	3167527.780	SPRGNET
F19	4	DICKS	WEL	1873	1325	0	0.174	Yes	200	180	-	362757.030	3167490.880	SPRGNET
F19	5	SEESE	WEL	1359	11565	0	0.175	Yes	225	130	4	362380.470	3163185.860	SPRGNET
F19	6	DAVID ERVIN HRS	WEL	1186	11682	0	0.186	Yes	130	78	4	364950.520	3164571.900	SPRGNET
F19	7	HAROLD E SELPH HRS	WEL	1190	11677	0	-	No	115	94	4	365065.794	3167494.574	WMDB
F19	8	SEABOARD RR WELL	WEL	975	709	0	-	No	231	0	6	361755.856	3165501.573	WMDB
F19	9	CLARENCE SMITH	WEL	40	10741	0	-	No	361	297	6	366615.653	3162859.737	WMDB
F20	1	WARD T.	WEL	1383	922	0	0.177	Yes	-	-	-	361660.600	3159746.800	SPRGNET
F20	2	WARD B.	WEL	1364	903	0	0.179	Yes	-	-	-	362751.220	3160041.800	SPRGNET

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
F20	3	PAUL JOHNSON HRS	WEL	1380	919	0	0.180	Yes	270	243	4	361388.970	3162058.630	SPRGNET
F20	4	FAVOT	WEL	1407	946	0	0.188	Yes	195	85	-	363912.270	3157042.500	SPRGNET
F20	5	ROMP 105 SH	WEL	41	12972	0	-	No	95	82	4	362631.416	3159621.597	WMDB
F20	6	ROMP 105 AVPK	WEL	41	10742	0	-	No	490	470	2	362637.283	3159611.985	WMDB
F20	7	ROMP 105 AVPK	WEL	41	10742	0	-	No	700	685	3	362637.283	3159611.985	WMDB
F20	8	JOSE MENA	WEL	464	198	0	-	No	0	0	-	366657.462	3156980.180	WMDB
F21	1	STEWART	WEL	1366	905	0	0.168	Yes	138	120	-	365706.800	3152312.370	SPRGNET
F21	2	PARKER	WEL	1875	1327	0	0.170	Yes	240	92	4	366119.940	3152769.370	SPRGNET
F21	3	ALTIZER	WEL	1175	11753	0	0.173	Yes	230	105	4	364090.010	3151253.620	SPRGNET
F21	4	PAUL L BUBNICK HRS	WEL	1202	11689	0	0.182	Yes	260	135	4	366923.810	3154114.590	SPRGNET
F21	5	WISE	WEL	1415	954	0	0.182	Yes	-	-	-	361327.120	3156826.490	SPRGNET
F21	6	M POLK HRS (HARRISON P)	WEL	1199	11688	0	0.184	Yes	250	137	4	363082.110	3155790.120	SPRGNET
F21	7	R H SHOEMAKER HRS	WEL	1386	925	0	-	No	190	90	4	365575.993	3152744.903	WMDB
F22	1	DIGGS	WEL	1396	935	0	0.167	Yes	160	-	-	365229.380	3150994.270	SPRGNET
F22	2	BAKER	WEL	1177	11754	0	0.169	Yes	125	82	4	364591.850	3149955.050	SPRGNET
F22	3	C BEDILLION HRS	WEL	1182	11690	0	0.172	Yes	95	76	4	364262.280	3149681.820	SPRGNET
F22	4	JARVIS	WEL	1403	942	0	0.174	Yes	120	80	-	365711.710	3147972.270	SPRGNET
F22	5	WEEKI II	WEL	289	23	0	0.181	Yes	69	68	4	365778.540	3147118.560	SPRGNET
F22	6	BLAIR	WEL	1180	11757	0	0.185	Yes	110	63	4	365944.630	3146923.080	SPRGNET
F23	1	SAWYER CB 4E FLDN REPL	WEL	863	2210	0	-	No	130	100	6	366548.201	3139993.329	WMDB
F23	2	CBARWF 2NE BARTHLE A N DP	WEL	1060	12784	0	-	No	150	100	6	362536.463	3144449.167	WMDB
F23	3	SAWYER CB 4E	WEL	863	597	0	-	No	246	71	6	366880.297	3139918.476	WMDB
F24	1	CR 581 NORTH FLDN	WEL	2832	2101	0	-	No	130	77	6	366231.055	3136361.957	WMDB
F24	2	CBARWF 3E BARTHLE B DEEP	WEL	1061	12783	0	-	No	150	100	6	362272.452	3139291.654	WMDB
F24	3	CBARWF 1ESE BARTHLE C S DP	WEL	1059	12785	0	-	No	150	100	6	361594.647	3136348.211	WMDB
G3	1	RICHARD CULBRETH HRS	WEL	1832	11729	0	0.298	Yes	110	84	4	367083.680	3259452.770	SPRGNET
G4	1	STEVE FRANKUM HRS	WEL	1632	1171	0	-	No	120	84	4	367959.820	3253716.380	WMDB
G5	1	BELL MOUNTAIN INC #W7 (DID#7)	WEL		39117	0	-	No	200	150	4	369157.748	3249937.795	RDB
G5	2	BELL MOUNTAIN INC #W6 (DID#6)	WEL		38564	0	-	No	200	147	4	368052.025	3249695.090	RDB
G5	3	BELL MOUNTAIN INC #W3 (DID#3)	WEL		38561	0	-	No	202	146	4	367944.999	3249767.144	RDB
G5	4	BELL MOUNTAIN INC #W5 (DID#5)	WEL		38563	0	-	No	220	133	4	368202.110	3249847.273	RDB
G5	5	BELL MOUNTAIN INC #W4 (DID#4)	WEL		38562	0	-	No	220	182	4	368108.995	3249956.107	RDB
G5	6	BELL MOUNTAIN INC #W1 (DID#1)	WEL		38559	0	-	No	220	220	4	367420.329	3248714.234	RDB
G5	7	BELL MOUNTAIN INC #W2 (DID#2)	WEL		38560	0	-	No	260	173	8	368100.078	3249189.644	RDB
G6	1	QUEEN LUCKY HRS	WEL	1829	11853	0	0.233	Yes	75	51	4	367635.020	3239712.900	SPRGNET
G6	2	BLICHTON TOWER WELL	WEL	1617	1156	0	-	No	147	126	4	370769.394	3238785.527	WMDB
G7	1	NEIDER, J.	WEL	1603	1142	0	0.198	Yes	85	58	4	368005.890	3234444.420	SPRGNET
G7	2	JACK TEAGLE HRS	WEL	1631	1170	0	0.203	Yes	70	57	4	369391.480	3237537.700	SPRGNET
G8	1	PETER DAMIEN HRS	WEL	1613	1152	0	0.196	Yes	100	50	4	368928.260	3232463.600	SPRGNET
G8	2	SIEBEL, R.	WEL	1890	1346	0	0.197	Yes	-	-	-	369026.940	3229291.700	SPRGNET
G8	3	ROMP 120 COTTON PLAN	WEL	21	10719	0	0.209	Yes	403	110	8	371822.320	3229028.070	SPRGNET
G8	4	SCE 173 RAINBOW PK ESTATE	WEL	631	365	0	-	No	84	-	2	368405.920	3226959.141	WMDB
G9	1	BRUCE BUMPUS HRS	WEL	2013	11857	0	0.180	Yes	90	79	4	369078.680	3221995.100	SPRGNET
G9	2	MORGAN, W.	WEL	1593	1132	0	0.180	Yes	-	-	-	368214.610	3224437.150	SPRGNET
G9	3	MATHIS, E.	WEL	1886	1342	0	0.180	Yes	88	63	4	369713.140	3225497.440	SPRGNET

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
G9	4	R YONKE HRS	WEL	1633	11586	0	0.184	Yes	105	81	4	370445.700	3223365.060	SPRGNET
G10	1	BARBER, M.	WEL	1814	11779	0	0.183	Yes	180	133	4	368930.740	3218518.450	SPRGNET
G10	2	MURPHY, M.	WEL	1887	1343	0	0.183	Yes	204	79	4	369812.840	3217615.700	SPRGNET
G10	3	COOMER	WEL	1815	11780	0	0.198	Yes	170	102	4	370426.410	3216869.960	SPRGNET
G10	4	CULBREATH RICH FLDN	WEL	1889	1345	0	-	No	80	63	4	369216.650	3215128.931	WMDB
G12	1	SCHWINDT	WEL	1304	843	0	0.212	Yes	-	-	3	368063.770	3204214.160	SPRGNET
G12	2	DRAKE RANCH SH FLDN	WEL	1816	11781	0	-	No	33	33	4	369999.887	3207824.253	WMDB
G12	2	ROMP 116 DEEP	WEL	325	59	0	-	No	55	39	6	369707.791	3203797.045	WMDB
G12	3	CE 24 DRAKE RANCH	WEL	813	547	0	-	No	45	-	-	371083.382	3207904.420	WMDB
G12	4	DRAKE RANCH DP FLDN	WEL	1630	1169	0	-	No	-	-	-	369999.894	3207824.868	WMDB
G13	1	BOEHL	WEL	1296	835	0	0.198	Yes	41	40	4	368239.300	3198240.360	SPRGNET
G14	1	GOODWIN K	WEL	1106	11819	0	0.178	Yes	120	84	4	367738.780	3192366.650	SPRGNET
G14	2	FRENZEL	WEL	1105	11808	0	0.178	Yes	60	60	4	371852.660	3191858.740	SPRGNET
G14	3	CASE	WEL	1262	801	0	0.186	Yes	40	-	4	368674.790	3193648.860	SPRGNET
G14	4	ELMER HEALTH FLORIDAN	WEL	728	462	0	-	No	53	-	-	372379.846	3195423.405	WMDB
G14	5	DOT HWY 41 WELL	WEL	929	663	0	-	No	450	290	18	368767.651	3192577.890	WMDB
G15	1	MILLER M	WEL	1120	11807	0	0.171	Yes	145	97	4	370275.620	3188982.790	SPRGNET
G15	2	MOTT	WEL	1123	11821	0	0.172	Yes	60	58	4	369690.830	3187604.160	SPRGNET
G15	3	CUTRONE	WEL	1266	805	0	0.172	Yes	64	-	-	372036.170	3188840.130	SPRGNET
G15	4	HENDRY	WEL	1110	11766	0	0.173	Yes	57	55	4	372191.040	3190592.960	SPRGNET
G15	5	BROWN W.	WEL	1096	11761	0	0.177	Yes	85	79	4	367854.620	3190641.530	SPRGNET
G15	6	FOWLER	WEL	1104	11763	0	0.177	Yes	138	135	4	372318.770	3187421.070	SPRGNET
G15	7	BRETTHAUSER	WEL	1299	838	0	0.183	Yes	74	68	2	367484.750	3186736.430	SPRGNET
G15	8	SR 44 COUNTY PARK	WEL	503	237	0	-	No	48	-	-	371454.871	3190200.860	WMDB
G15	9	HIGHLANDS VFD	WEL	650	384	0	-	No	114	-	-	369215.815	3186347.253	WMDB
G15	10	INVERNESS VILLAGE EAST WEL	WEL	852	586	0	-	No	195	-	-	367294.773	3191447.995	WMDB
G16	1	MC GEE	WEL	1300	839	0	0.173	Yes	90	65	4	370213.760	3185874.530	SPRGNET
G16	2	DASSEL	WEL	1292	831	0	0.184	Yes	170	166	-	370159.480	3183443.400	SPRGNET
G16	3	LAYTON	WEL	1117	11816	0	0.186	Yes	137	108	4	368961.370	3183025.890	SPRGNET
G16	4	LAYTON	WEL	1117	11816	0	-	No	137	108	4	368973.912	3184133.612	WMDB
G16	5	JACK ECKERD FOUND WE	WEL	1281	820	0	-	No	160	126	4	370912.780	3180594.689	WMDB
G17	1	JACKSON C.	WEL	1280	819	0	0.192	Yes	-	-	-	371642.830	3177763.210	SPRGNET
G17	2	PARKSIDE FLORAL CITY	WEL	1245	784	0	0.194	Yes	103	100	4	372722.730	3178155.600	SPRGNET
G18	1	BROOKS	WEL	1094	11759	0	0.176	Yes	159	120	4	367089.700	3173504.790	SPRGNET
G18	2	REGNIER	WEL	1298	837	0	0.183	Yes	196	189	4	368046.660	3174109.560	SPRGNET
G18	3	HOWARD	WEL	1870	1322	0	0.185	Yes	-	-	-	371958.840	3171942.130	SPRGNET
G18	4	CHAPMAN	WEL	1874	1326	0	0.186	Yes	-	-	-	370113.700	3169592.350	SPRGNET
G18	5	W BLIZZARD	WEL	37	10738	0	-	No	140	95	6	372716.388	3171687.418	WMDB
G18	6	WSF ENVIRONMENTAL CENTER	WEL	457	191	0	-	No	143	-	-	369360.559	3170216.174	WMDB
G18	7	OAK FOREST SUBMERSIBLE	WEL	36	10737	0	-	No	274	245	8	371842.218	3173667.034	WMDB
G19	1	LEDINGTON	WEL	1197	11771	0	0.182	Yes	250	220	4	367166.270	3168301.870	SPRGNET
G19	2	WYLUPEK	WEL	1384	923	0	0.215	Yes	-	-	-	369861.890	3166486.280	SPRGNET
G19	3	WESLY MITCHELL HRS	WEL	1395	934	0	-	No	64	59	4	372058.855	3166184.970	WMDB
G19	4	W A EPLING HRS	WEL	1393	932	0	-	No	98	73	4	370510.718	3163739.771	WMDB
G19	5	DELMAS NIX	WEL	39	10740	0	-	No	219	200	28	371744.923	3164803.231	WMDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
G20	1	MAURICE E CAIN HRS	WEL	1392	931	0	-	No	170	155	4	371911.300	3160153.670	WMDB
G20	2	W THOMAS MUNDEN HILL	WEL	42	10743	0	-	No	259	117	8	372324.372	3158148.402	WMDB
G21	1	KAVORIS	WEL	1406	945	0	0.197	Yes	-	-	-	368268.720	3152806.660	SPRGNET
G21	2	RHINEHART MYCK HRS	WEL	1204	11684	0	-	No	126	118	4	370326.136	3156877.500	WMDB
G21	3	FRANKLIN GILLIS HRS	WEL	1188	11691	0	-	No	290	105	4	372644.441	3152573.529	WMDB
G21	4	ROMP BR 1A NEFF LAKE DEEP	WEL	2670	13237	0	-	No	1067	190	2	370716.209	3152010.353	WMDB
G22	1	P A HANNAWAY HRS	WEL	1201	11692	0	-	No	355	104	5	370972.420	3146405.250	WMDB
G22	2	BLACKETT NR LAKE NEFF	WEL	43	10744	0	-	No	428	310	6	370912.198	3150838.205	WMDB
G23	1	PLESS PARK FLDN	WEL	2971	2408	0	-	No	180	150	6	371388.102	3145055.701	WMDB
G23	2	HOBBS BUTCH	WEL	2721	1895	0	-	No	0	0	4	372461.848	3142817.048	WMDB
G24	1	PIKE, M.	WEL	1958	1425	0	-	No	-	-	-	369790.940	3137953.830	WMDB
H3	1	ERIC HAMACHER HRS	WEL	1619	1158	0	-	No	105	81	4	375129.690	3256097.840	WMDB
H4	1	LEVERETT GWSI WELL	WEL	1621	1160	0	-	No	90	63	2	378191.110	3250061.580	WMDB
H4	2	ALEX BENDERSKY HRS	WEL	1812	11731	0	-	No	120	84	4	375200.730	3250309.580	WMDB
H5	1	BRIDGET WILLIAMSON H	WEL	1600	1139	0	0.195	Yes	200	154	4	374189.250	3244194.670	SPRGNET
H5	2	TOM GRUSENMEYER HRS	WEL	1606	1145	0	0.197	Yes	185	156	4	374328.210	3244562.540	SPRGNET
H5	3	ROY RIGGSBY HRS	WEL	1596	1135	0	-	No	140	121	4	378227.014	3248367.704	WMDB
H6	1	FERGUSON, R.	WEL	1819	11784	0	0.233	Yes	200	132	4	376254.880	3240631.860	SPRGNET
H6	2	EDITH AUDETT HRS	WEL	1598	11579	0	-	No	180	154	4	375483.946	3239223.986	WMDB
H7	1	ARAM BAZARIAN #G 1 (DID#1)	WEL		15677	0	-	No	140	126	6	375079.680	3235906.475	RDB
H7	2	JAMES J & MARGARET DESMOND CRUPI #3 (DID#3)	WEL		25488	0	-	No	140	120	4	374790.956	3235011.357	RDB
H7	3	JAMES J & MARGARET DESMOND CRUPI #1 (DID#1)	WEL		11530	0	-	No	180	84	6	374535.852	3234893.180	RDB
H8	1	PATRICK & ELIZABETH EVERARD #1 (DID#2)	WEL		28359	0	-	No	95	84	4	373879.695	3231665.911	RDB
H8	2	PATRICK & ELIZABETH EVERARD #2 (DID#3)	WEL		15322	0	-	No	140	107	6	373646.572	3231735.291	RDB
H8	3	SORTED OAKS FARM #2 (DID#2)	WEL		25149	0	-	No	200	0	4	372969.879	3228201.992	RDB
H8	4	JOHN C. & CHARLOTTE C. WEBER #6 (DID#6)	WEL		13887	0	-	No	230	0	6	375636.794	3228511.278	RDB
H8	5	SORTED OAKS FARM #4 (DID#4)	WEL		13853	0	-	No	254	0	8	373019.789	3228317.186	RDB
H8	6	JOHN C. & CHARLOTTE C. WEBER #2 (DID#2)	WEL		21994	0	-	No	425	0	10	374098.905	3228227.053	RDB
H9	1	KINSMAN TR BN	WEL	1824	11787	0	0.235	Yes	150	76	4	374308.310	3225600.000	SPRGNET
H9	2	VANIA PVT SUPPLY WEL	WEL	1620	1159	0	-	No	85	0	4	373975.940	3224864.944	WMDB
H14	1	SAVAGE	WEL	1129	11775	0	0.190	Yes	120	50	4	374146.060	3193403.480	SPRGNET
H14	2	ANTONEN	WEL	1092	11817	0	0.233	Yes	50	40	4	373862.850	3197254.240	SPRGNET
H15	1	MOORE	WEL	1263	802	0	0.183	Yes	123	-	4	376367.620	3188269.940	SPRGNET
H15	2	PINEAU	WEL	1295	834	0	0.187	Yes	220	195	4	376855.890	3188295.530	SPRGNET
H15	3	BLACK	WEL	1286	825	0	0.203	Yes	100	-	2	376458.890	3191747.210	SPRGNET
H15	4	TWITTY	WEL	1270	809	0	-	No	28	-	2	373437.896	3188085.823	WMDB
H15	5	KINSEY FLDN	WEL	2834	2103	0	-	No	0	0	4	372897.716	3191163.834	WMDB
H15	5	SR 44 E OF INVERNESS FLAD	WEL	819	553	0	-	No	40	-	-	373714.059	3191037.932	WMDB
H15	6	PHILLIPS FLDN	WEL	2835	2104	0	-	No	0	0	4	372887.427	3191214.122	WMDB
H15	6	SCHWEIN WELL	WEL	2833	2102	0	-	No	-	-	4	372949.309	3191147.876	WMDB
H16	1	DEUTSCHMAN	WEL	1291	11542	0	0.189	Yes	61	56	4	374568.070	3184810.980	SPRGNET
H16	2	HILLER	WEL	1112	11767	0	0.189	Yes	35	32	4	375329.670	3182494.230	SPRGNET
H16	3	HOWERTON	WEL	1278	817	0	0.193	Yes	70	63	4	377977.530	3184097.540	SPRGNET
H16	4	WOODFIELD	WEL	1264	803	0	0.209	Yes	50	40	2	378226.790	3182001.860	SPRGNET
H16	5	HOMER FISHER	WEL	847	581	0	-	No	60	-	-	377788.077	3181544.517	WMDB

Appendix C. Final Upper Floridan Aquifer Nutrient Monitoring Network Well Selections (continued)

Cell	Priority	Station	SWFWMD Universal ID				Standard Error	Kriged?	TD	CD	DIA	UTM Easting	UTM Northing	Source
			Type	Station	Site	Sequence								
H16	6	FERRIS PACKAGE CO FLDN	WEL	279	13	0	-	No	400	200	8	373471.903	3181252.086	WMDB
H16	7	DUVAL ISLAND NR FLORAL CIT	WEL	651	385	0	-	No	0	0	0	375553.387	3183107.321	WMDB
H17	1	EVERETT J. & ELLA M. SUTTON #3 (DID#3)	WEL		13802	0	-	No	54	0	4	377499.288	3179235.547	RDB
H17	2	THOMAS W. & MARY L. HARRISON #1 (DID#1)	WEL		24832	0	-	No	60	0	6	376669.657	3177779.104	RDB
H17	3	RAY A. MORRIS #1 (DID#1)	WEL		14355	0	-	No	69	0	8	375155.042	3178439.818	RDB
H17	4	THOMAS W. & MARY L. HARRISON #3 (DID#3)	WEL		14694	0	-	No	70	46	6	376962.700	3178984.798	RDB
H17	5	THOMAS W. & MARY L. HARRISON #2 (DID#2)	WEL		14693	0	-	No	73	44	6	377194.000	3179614.917	RDB
H17	6	PATRICK JEAN & ANITA KIEHL #1 (DID#1)	WEL		12325	0	-	No	90	75	10	378334.958	3176539.253	RDB
H17	7	ESTATE OF CLINTON E MARSH #1 (DID#1)	WEL		20262	0	-	No	100	40	8	378486.808	3178971.862	RDB
H17	8	EVERETT J. & ELLA M. SUTTON #1 (DID#1)	WEL		15145	0	-	No	180	0	6	377284.718	3179341.850	RDB
H17	9	STEPHEN M & VICKIE MCMANUS #1 (DID#1)	WEL		19062	0	-	No	320	0	10	374696.083	3176611.383	RDB
H18	1	VARN	WEL	1274	813	0	0.187	Yes	-	-	-	373210.230	3172174.730	SPRGNET
H18	2	MILLER W	WEL	1142	11772	0	0.228	Yes	88	40	4	375591.150	3171410.400	SPRGNET
H18	3	C R APPEL HRS	WEL	1400	11556	0	-	No	48	42	2	375752.125	3171223.759	WMDB
H18	4	TOWNSEN PARK UP FLDN	WEL	2994	2428	0	-	No	100	50	6	375429.172	3169734.608	WMDB
H18	5	JERRYS BAIT & TACKLE	WEL	1388	927	0	-	No	150	60	4	375816.218	3169591.969	WMDB
H18	6	LUGENE COYER HRS	WEL	1196	11679	0	-	No	165	147	4	373872.683	3170659.067	WMDB
H18	7	USDA FARM	WEL	343	77	0	-	No	205	110	5	374366.980	3168653.242	WMDB
H19	1	UNITED STATES DEPT OF #PEAN (DID#9)	WEL		22321	0	-	No	205	0	4	374441.925	3167237.412	RDB
H20	1	CALAMARI	WEL	1404	11557	0	0.270	Yes	140	120	4	372990.580	3159433.990	SPRGNET
H20	2	MAURICE E CAIN HRS	WEL	1392	931	0	-	No	170	155	4	371911.393	3160153.698	WMDB
H20	3	W THOMAS MUNDEN HILL	WEL	42	10743	0	-	No	259	117	8	372324.372	3158148.402	WMDB
I5	1	LESTER KNOUSE HRS	WEL	1825	11852	0	0.262	Yes	175	146	4	380044.310	3244254.520	SPRGNET
I16	1	ROMP 110 AVPK	WEL	1025	11123	0	-	No	563	83	6	380905.528	3181327.477	WMDB