Appendix F

Hydrogeology

CONTENTS

FIGURES

F.1: HYDROSTRATIGRAPHY FOR THE REGIONAL SIMULATION MODEL

The elevation of the base of the aquifer to be simulated in RSM was generated from a combination of data sources (**Figure F-1**).

In the southeast, Miami-Dade, Broward and southern Palm Beach counties, the elevation was based on hydrostratigraphic picks for the top of the Tamiami confining unit from select wells used in development of the LECR model. The top of the Tamiami confining unit corresponds to layers one and two of the LECR.

In the southwest, Hendry, Lee and Collier counties, the base RSM model is the base of the Water Table aquifer. This is hydrostratigraphically equivalent to the top of the Tamiami Confining unit. The dataset for this region was compiled from various historic District reports, and consultant data previously compiled for District modeling efforts in Lee and Collier counties.

The hydrostratigraphy for the rest of the RSM area; northern Palm Beach, southern Martin, and parts of Okeechobee, Highlands and Glades counties, was interpolated from a well distributed sampling of points extracted from other District models. In the east, this data was extracted from the base of layer 2 of the LECR model. In the northwest, it was extracted from the base of layer 1 of the Glades-Okeechobee-Highlands (GOH) model.

Where the GOH model data meets the well data from the lower west coast, there is an inconsistency of which the users of this dataset should be aware. The GOH model used the top of the Intermediate Confining Unit as the base of its first layer. Where the lower Tamiami aquifer is unconfined, this is equivalent to the base of the Water Table aquifer. It is likely, however, that some confinement for the lower Tamiami exists in the southeastern portion of Glades county. In which case, the unit mapped as the base of the RSM in Glades County, and the unit mapped in adjacent Hendry County will not be hydrostratigraphically equivalent. . The rapid depth change visible in the elevation surface for this area is likely due to this discrepancy (figure 2). Unfortunately, data to support a more refined discretization of the Surficial Aquifer System in Glades County is not currently available.

The location of the well data, and extracted model data points, along with the elevation used for the base of the RSM surface, and source of that information have been documented. This information is provided in a separate document: **rsm_hydrotratpoints.xls**.

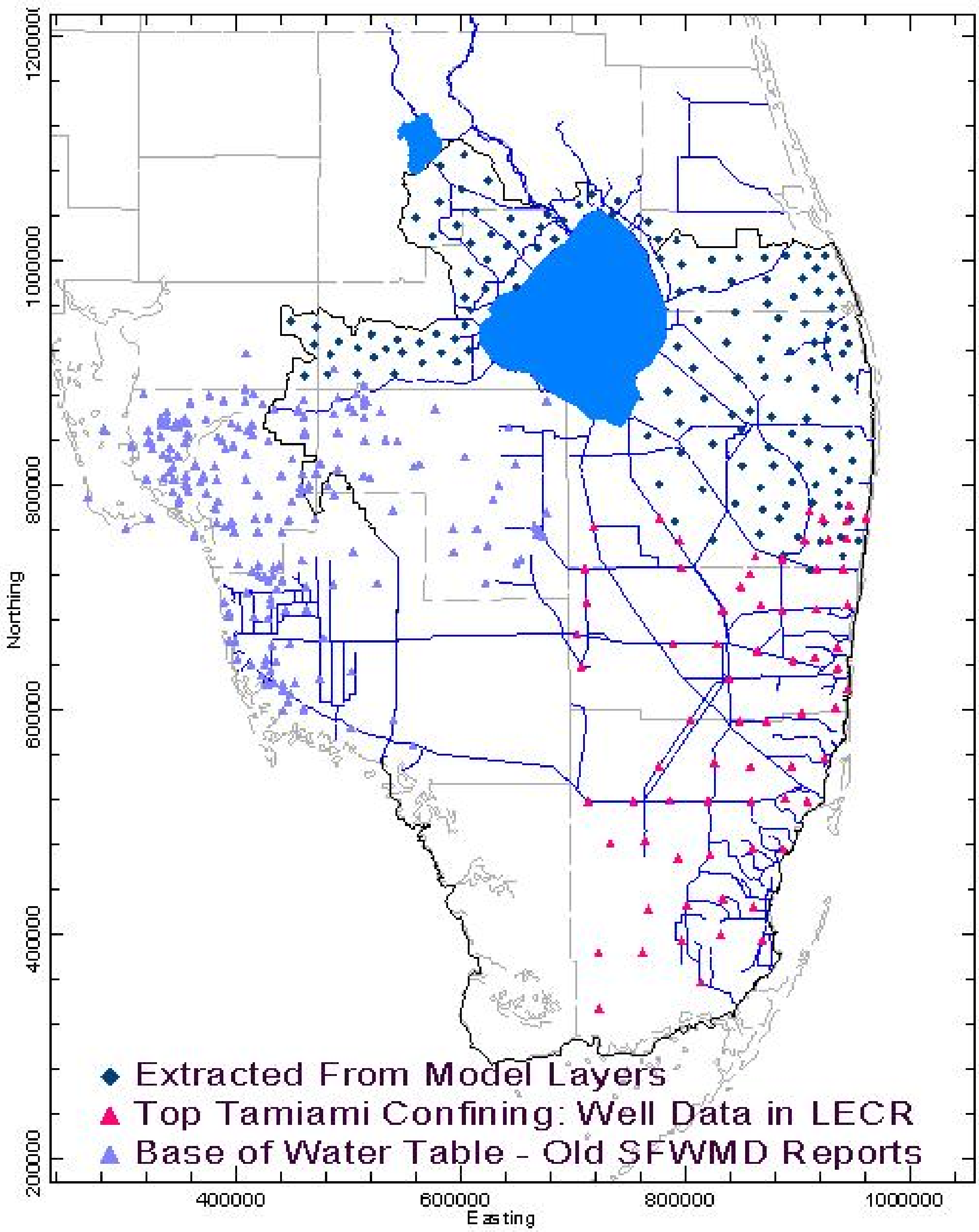

Figure F-1. Data points used to generate the elevation surface for the base of the RSM.

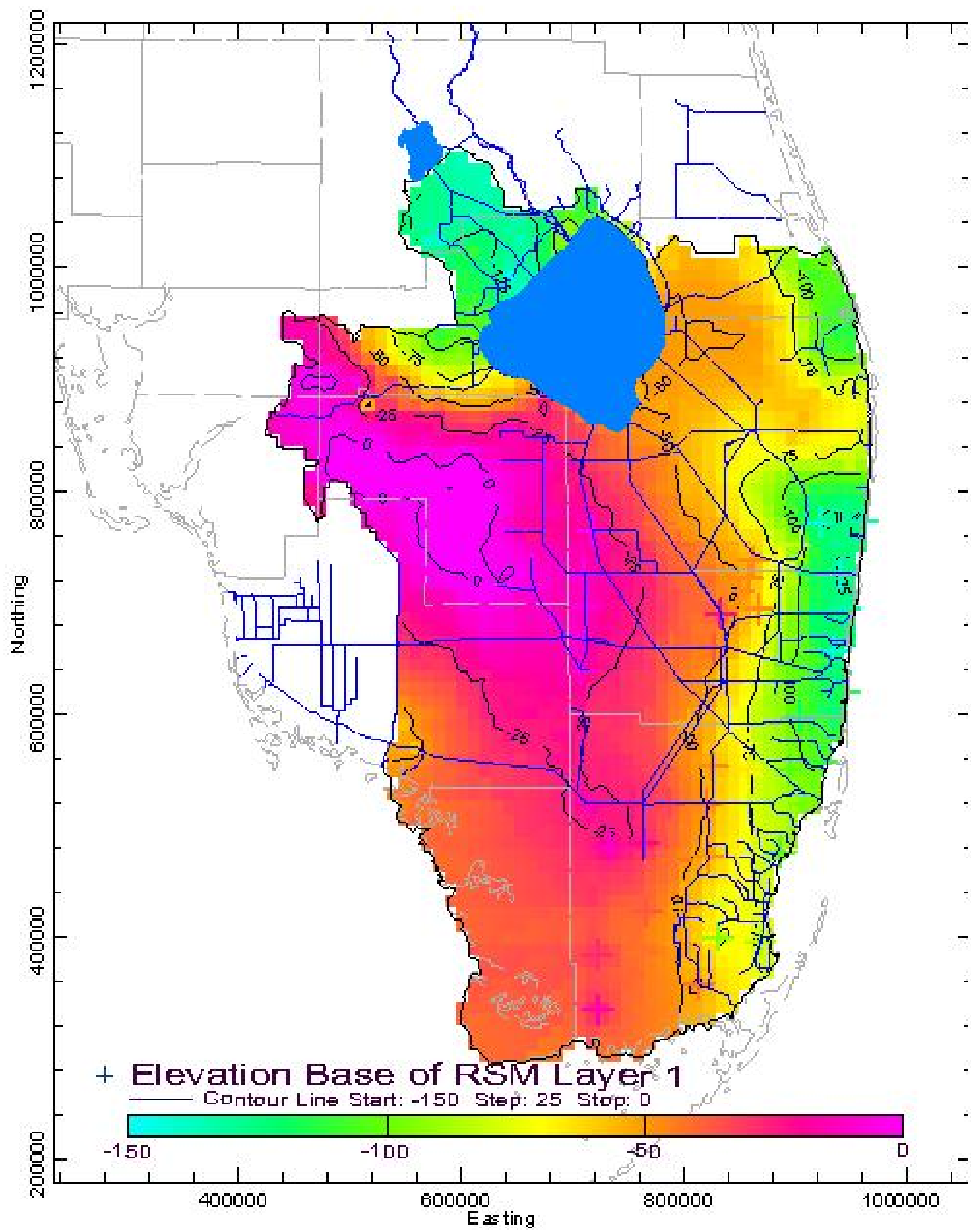

Figure F-2. Elevation [FT NGVD] of the base of the RSM.

The elevation surface pictured in **Figure F-2** was generated by inverse distance weighted (IDW) interpolation using Viewlog software. Output has been provided in ASCII format for easy importation to GIS. A relatively coarse grid (2 mile x 2 mile) was used for the interpolation, with the objective of covering the entire model area at a scale commiserate with the separation of the data points.

For areas north of the SFRSM domain, a grid was initially generated from the well data through interpolation using the inverse distance weighted (IDW) method of kriging. A composite grid was created and mesh values were assigned using a TIN surface to smooth the transition between the NSRSM and SFRSM domains. A final grid was generated for input to the NSRSM mesh. Final elevation values are displayed in **Figure F-3**.

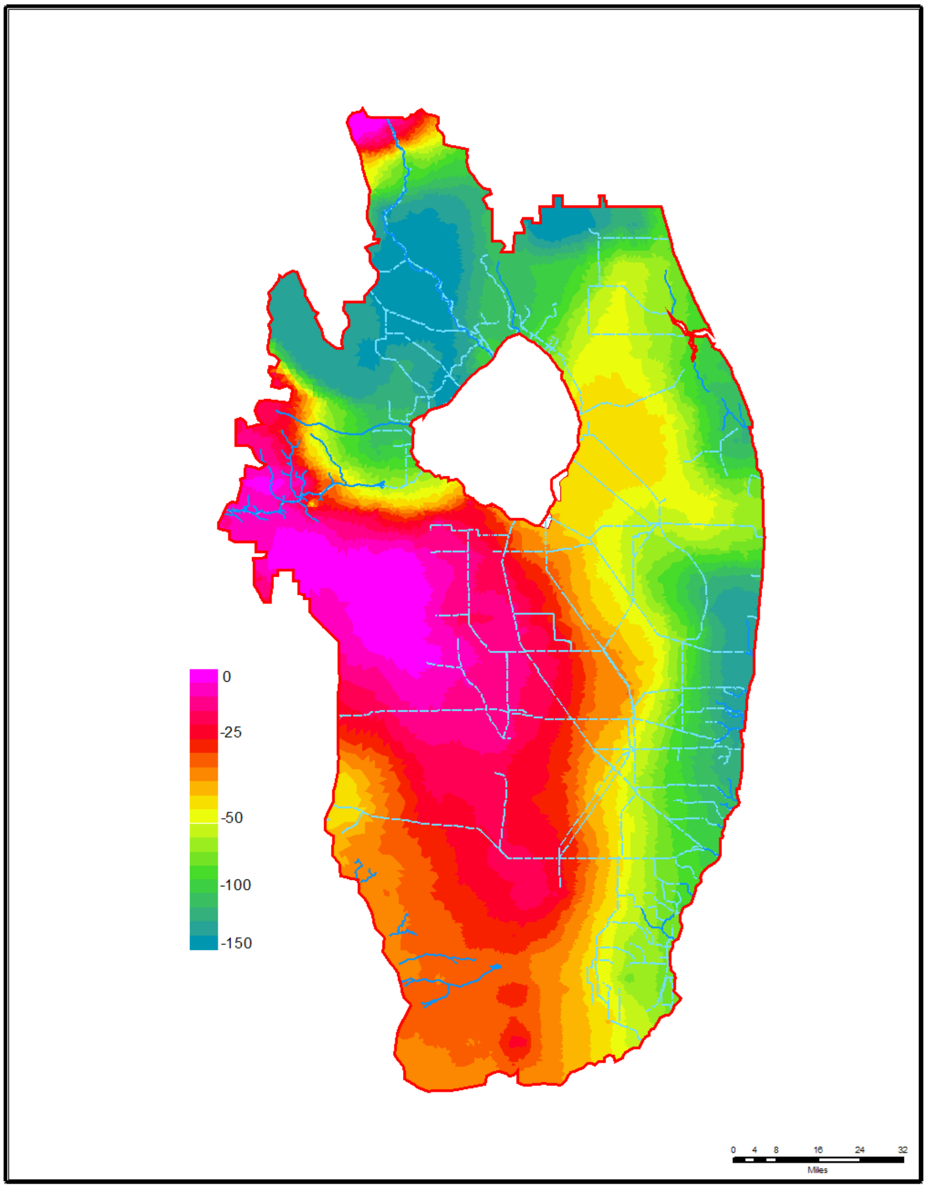

Figure F-3. Elevation [FT NGVD] of NSRSM base.

Northern NSRSM Data Verification

In areas north of the SFRSM domain, elevations were verified using hydrostratigraphic layers and cross-section subsets of data from Reese and Richardson 2004.

Figure F-4 is a base map of cross-section locations for maps of the extent and thickness of the hydrostratigraphic units existing in the basins north of Lake Okeechobee. **Figure F-5** through **Figure F-7** correspond to the lines in the base map.

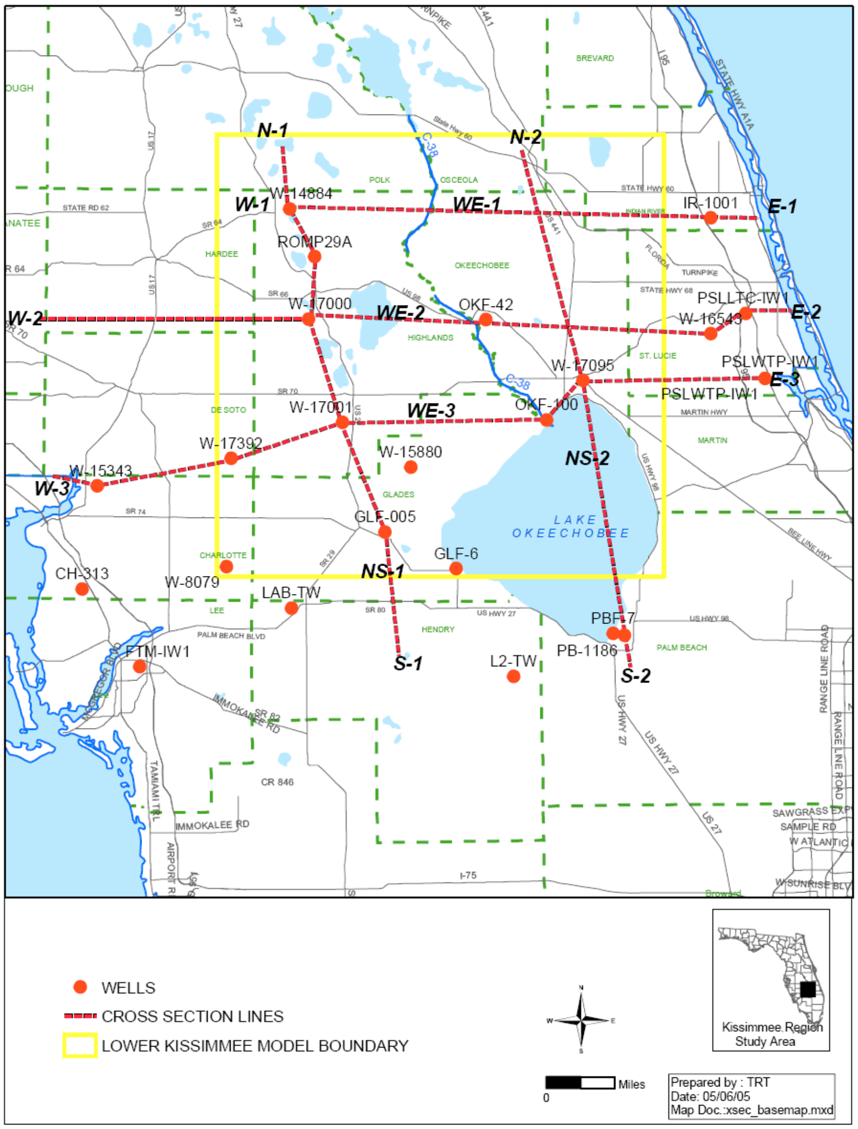

Figure F-4. Hydrostratigraphic Units Base Map.

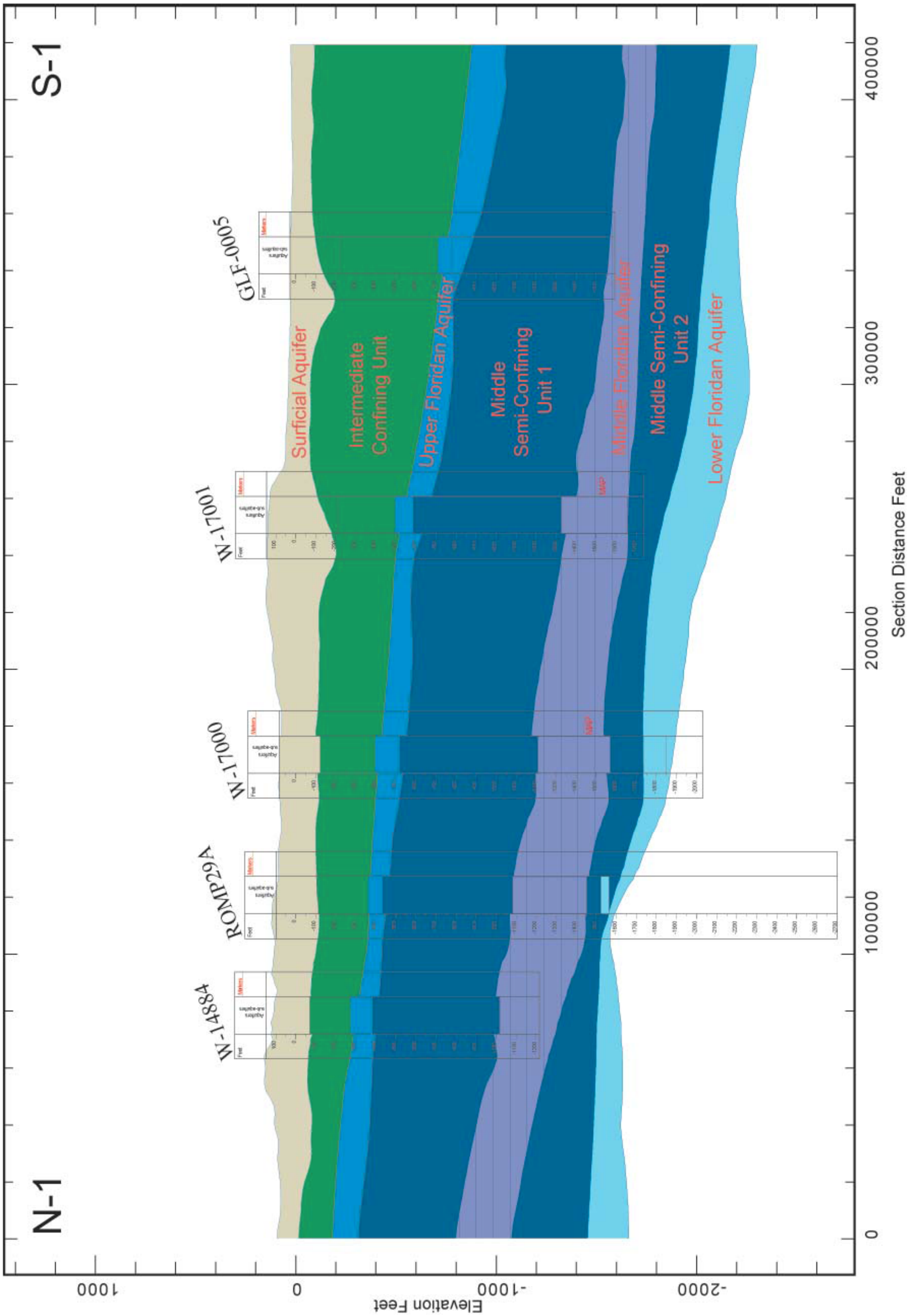

Figure F-5. Geologic and Hydrologic Layers and Their Thicknesses.

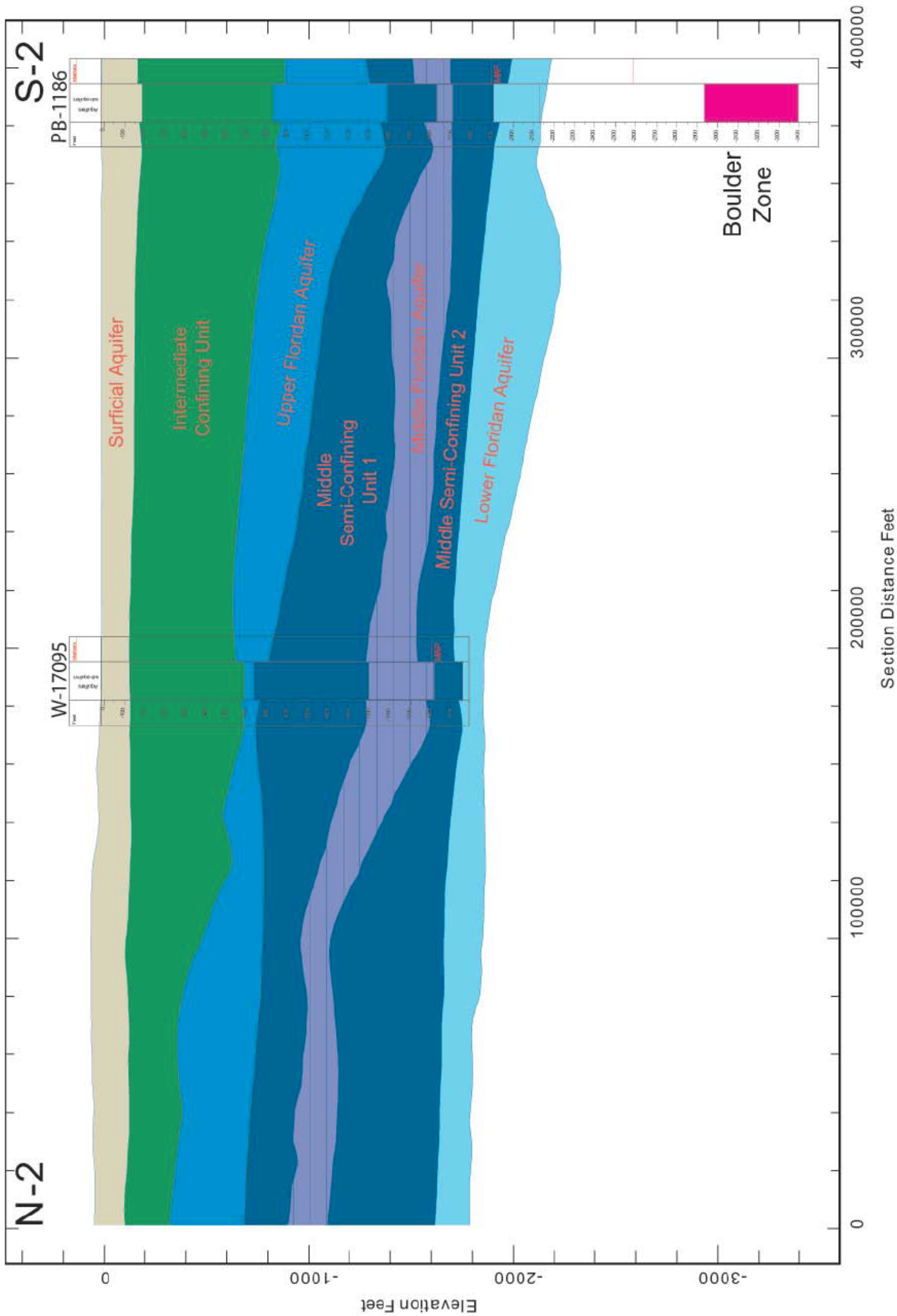

Figure F-6. Geologic and Hydrologic Layers and Their Thicknesses.

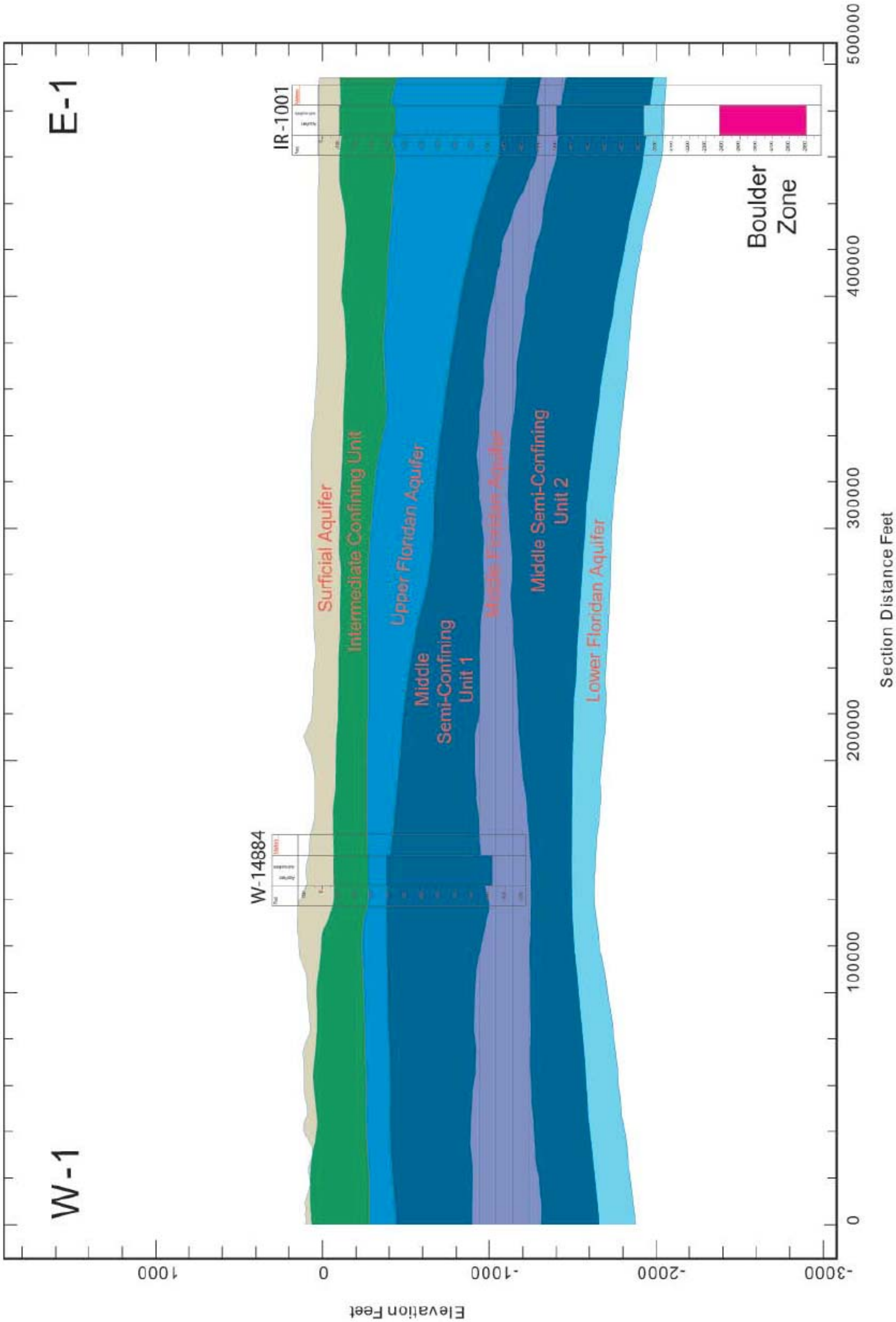

Figure F-7. Geologic and Hydrologic Layers and Their Thicknesses

F.2: TRANSMISSIVITY VALUES FOR THE REGIONAL SIMULATION MODEL

A combination of data sources were used to create the transmissivity grid for the Regional Simulation Model (RSM) area, including, transmissivity values from DBHYDRO, hydraulic conductivity values extracted from the Lower East Coast Regional (LECR) and Glades-Okeechobee-Highlands (GOH) models, and hydraulic conductivity values from a 1988 USGS report. The transmissivity grid is shown on Figure F-8.

The hydrostratigraphic surface for the base of the aquifer, recently completed by Emily Richardson, was used to determine the thickness of the RSM. The RSM thickness map is shown on Figure F-9.

DBHYDRO transmissivity

DBHYDRO was queried to gather acceptable transmissivity values from aquifer pumping tests (APTs). Acceptable DBHYDRO transmissivity values were determined using the following methodology:

- Data from DBHYDRO was queried to give back any APTs that fell within the lateral RSM boundaries. This yielded 238 APTs shown on Figure F-10.
- This data was further subset to only include APTs in which any part of the tested interval was above the base of the RSM. This yielded 107 APTs. Shown on Figure F-11.
- Ideally, the tested interval of the APT would have tested 100% of the RSM thickness and it would not have gone below the confining unit at the base of the RSM. However, there was not a single APT that met these criteria. Different criteria for choosing acceptable APT transmissivity results were weighed to balance the need to get the most lateral coverage and still maintaining the integrity of the APT transmissivity data. After playing with the data the final criteria to choose acceptable values were: APTs that tested at least 30% of the RSM thickness and APTs that did not exceed beyond the base of the RSM by more than 40% of the RSM thickness. Using these criteria 45 acceptable APTs were found within the RSM boundaries. These 45 APTs are shown on Figure F-12.

LECR and GOH hydraulic conductivity

Other transmissivity values were derived using the hydraulic conductivity values from the LECR and GOH models and multiplying them by the RSM thickness. This was helpful near Lake Okeechobee where there is not much shallow APT data available. The locations of these points are shown on Figure F-13.

Hydraulic conductivity values from USGS report

Even with the two aforementioned transmissivity data sets there was still a big gap in the western portions of Broward and Miami-Dade counties and the eastern portions of Collier and Monroe counties. Transmissivity values for this area were calculated by using the hydraulic conductivity values for silty-sand from the following report: Fish, Johnnie, 1988, *Hydrogeology, Aquifer Characteristics, and Ground-Water flow of the Surficial Aquifer System, Broward County, Florida,* USGS Water Resources Investigations Report 87-4034.

In this area the Biscayne aquifer to the east pinches out here and the gray limestone to the west plunges under this area. Because of the higher hydraulic conductivities to the east and west of this area Viewlog assigned artificially high transmissivity values here. Eight points were chosen to create transmissivity values for this area using the hydraulic conductivity values from the USGS report and the RSM thickness in this area. The location of these eight points are shown on Figure F-14.

Viewlog Transmissivity Grid

These three sets of transmissivity values were combined to create the transmissivity grid in Viewlog, shown in Figure F-8. The transmissivity grid was generated by 3rd order linear quick kriging using Viewlog. Output has been provided in ASCII format for easy importation to GIS: **RSM_WTT.XYZ**. A relatively coarse grid (2 mile x 2 mile) was used for the interpolation, with the objective of covering the entire model area at a scale commiserate with the separation of the data points.

All the transmissivity values used to create the grid, as well as the hydraulic conductivity points from the LECR and GOH models, are included in a separate document: **RSM_TransData.xls**.

NSRSM regions outside of the SFRSM domain include the Lower Kissimmee River Basin, Fisheating Creek watershed, and a portion of the St. Lucie River Basin. Hydraulic conductivity in these regions was estimated based on averaged values assigned to the northern region of the SFRSM dataset. Estimates were within data ranges reported in literature (SFWMD, 2002). NSRSM hydraulic conductivity and maximum transmissivity values are shown in Figures F-15 and F-16. Conductivity values for each cell exist in an input file used by the model.

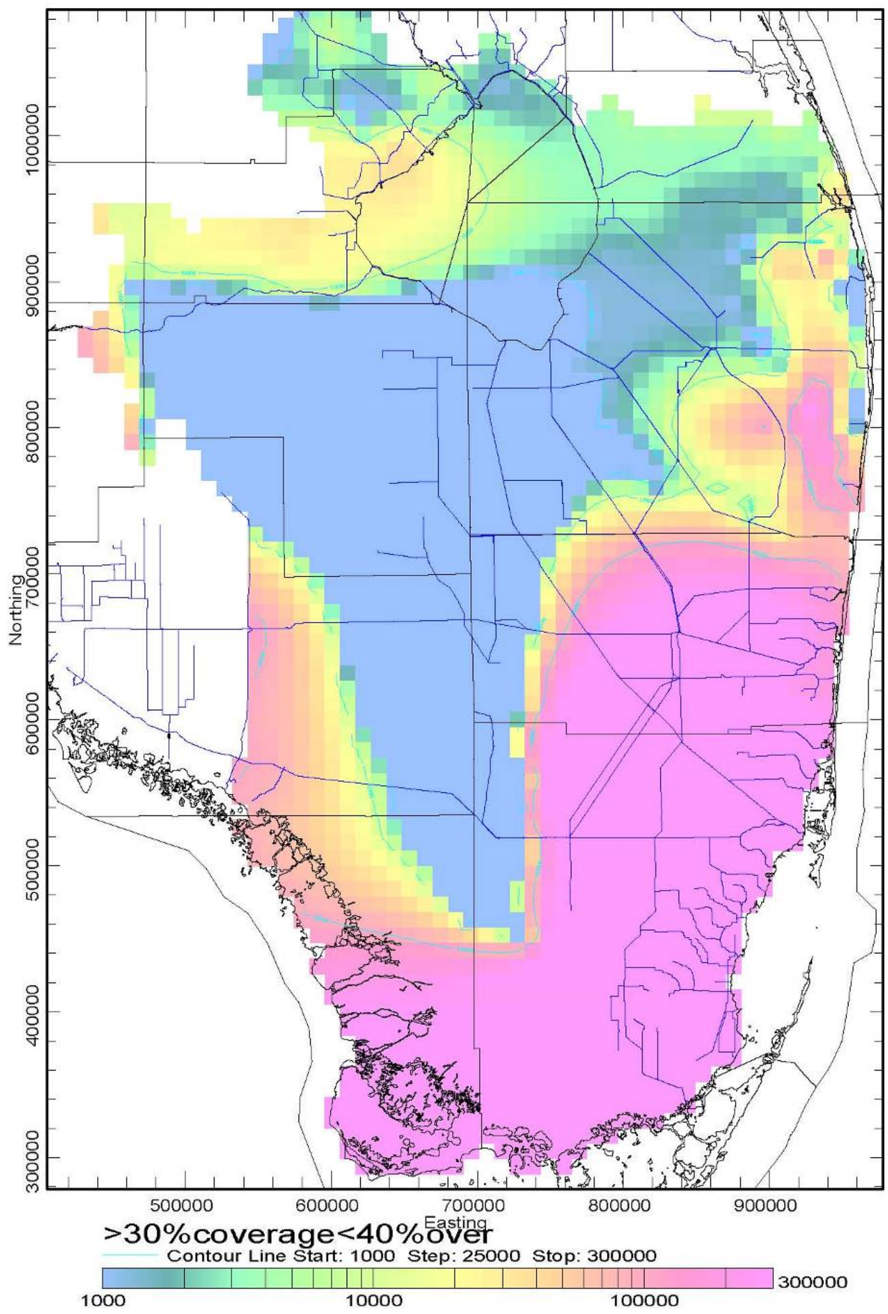

Figure F-8. Transmissivity values of the Regional Simulation Model

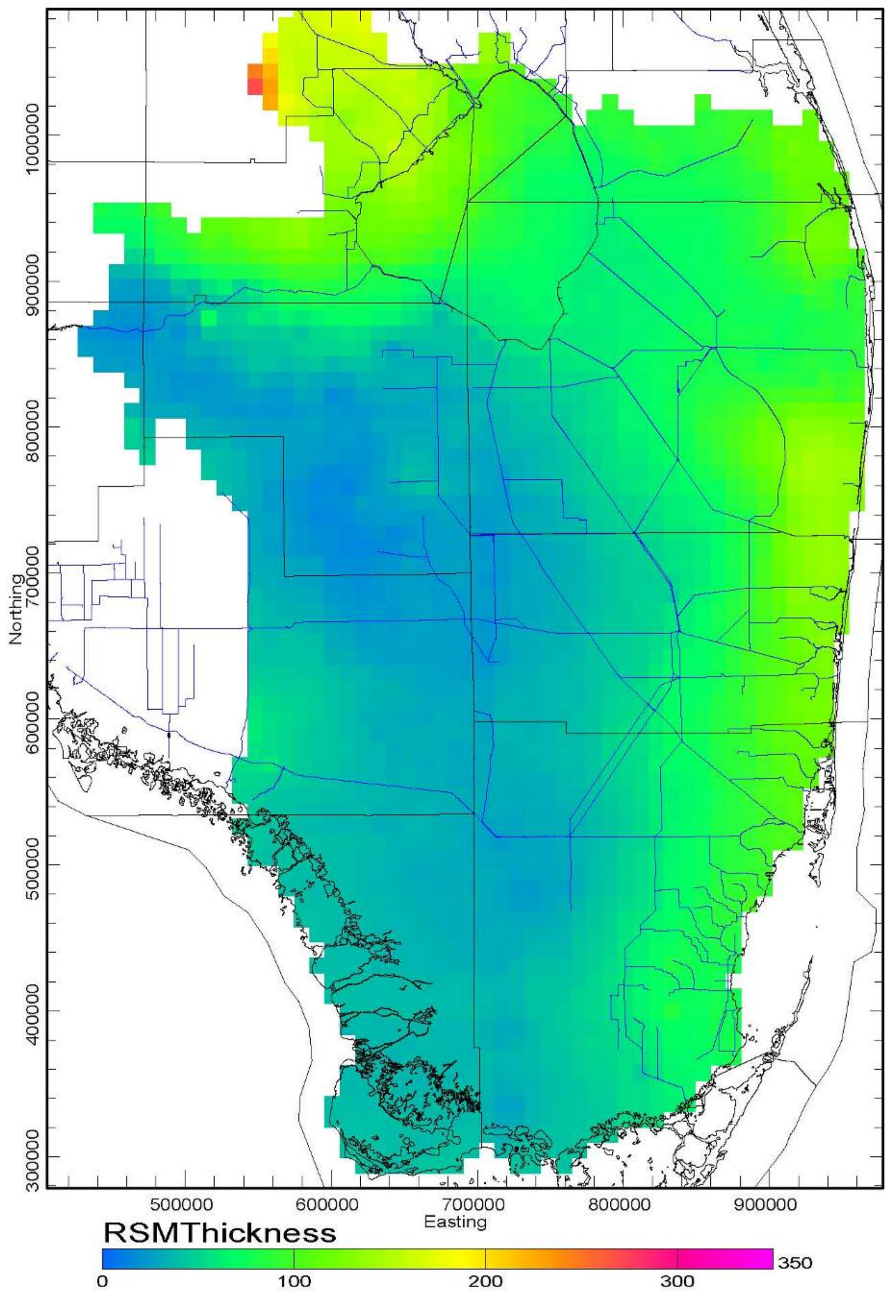

Figure F-9. Thickness of the RSM.

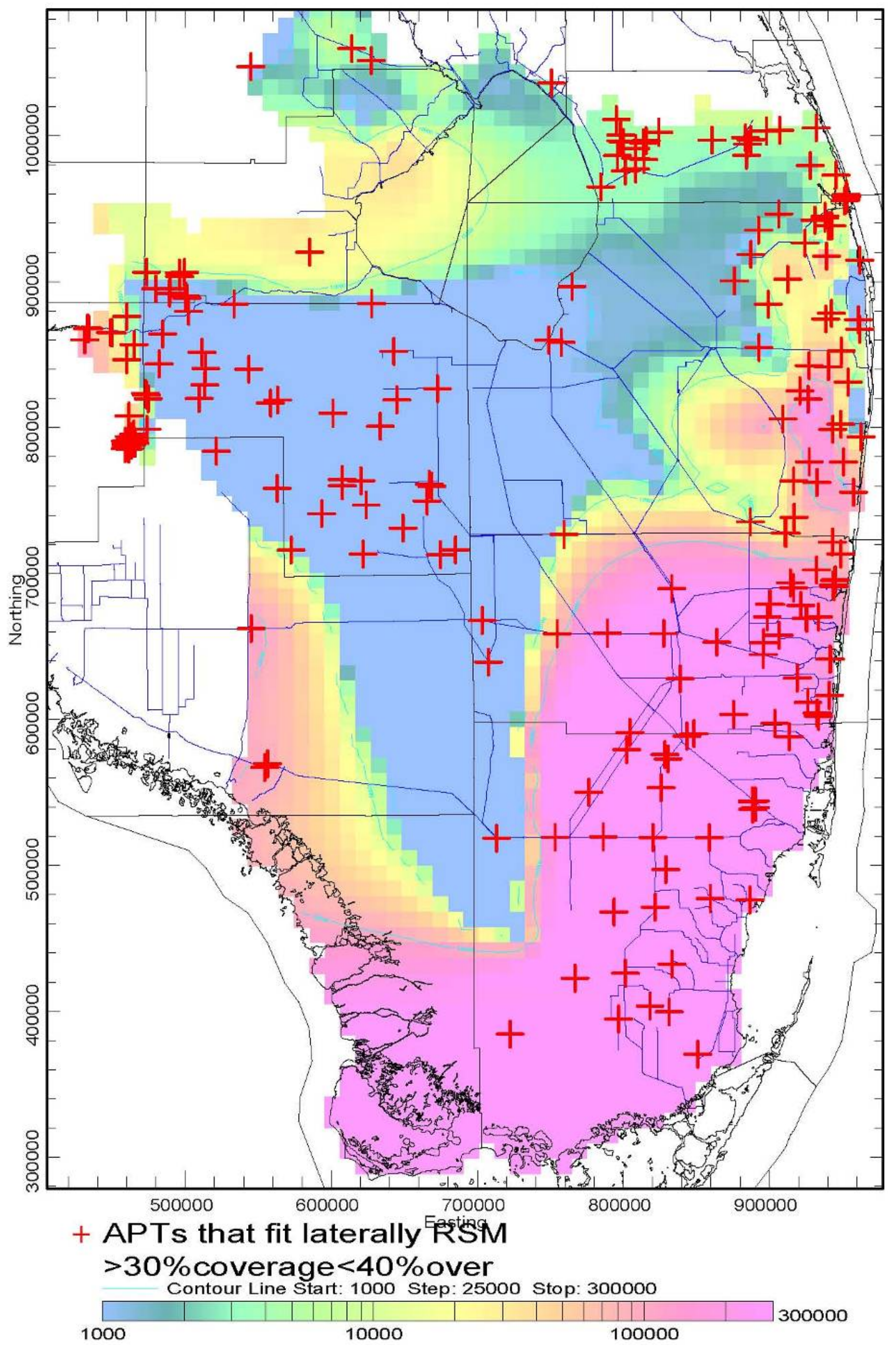

Figure F-10. DBHYDRO APTs that laterally fit within the RSM.

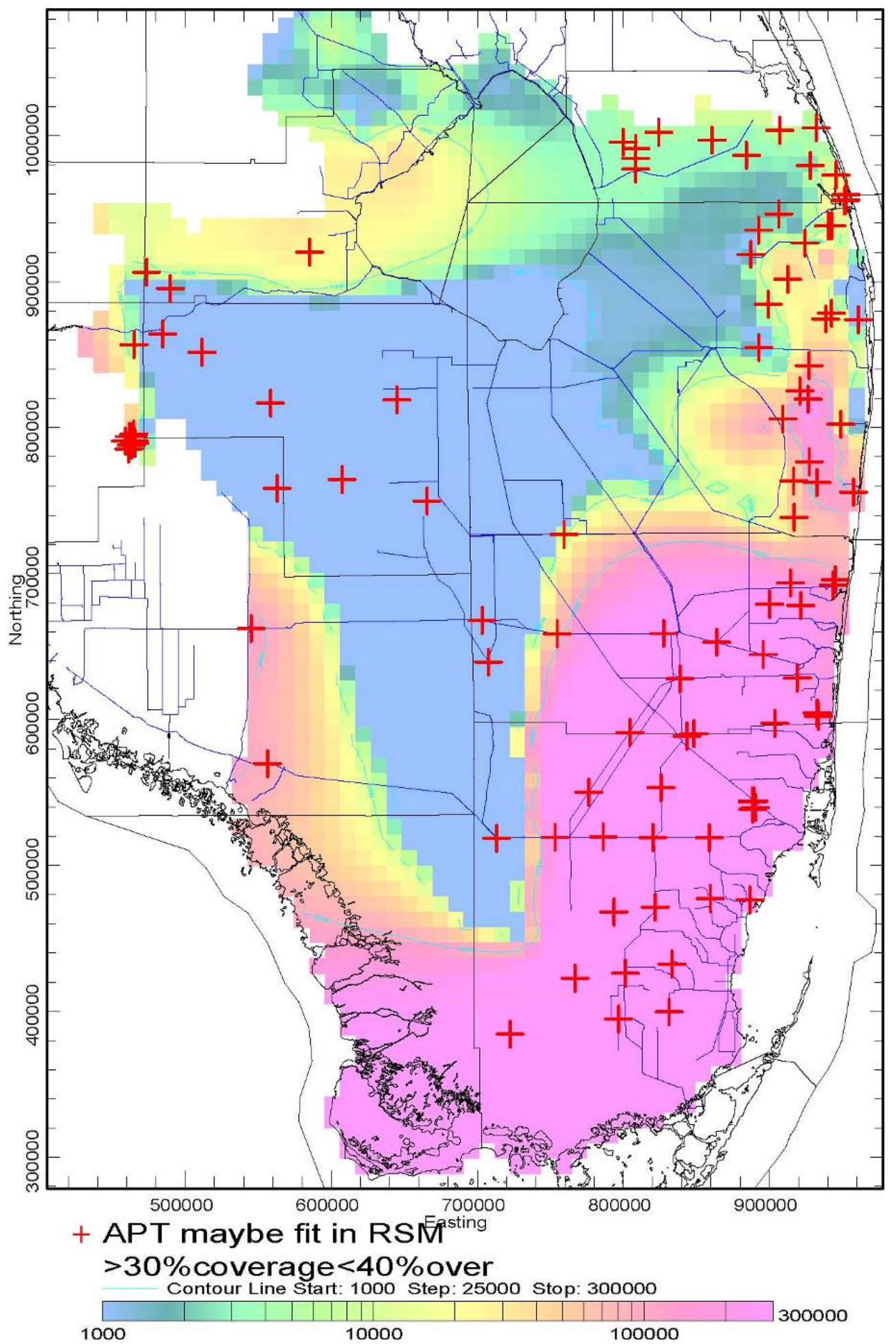

Figure F-11. DBHYDRO APTs in which any part of the tested interval was above the base of the RSM

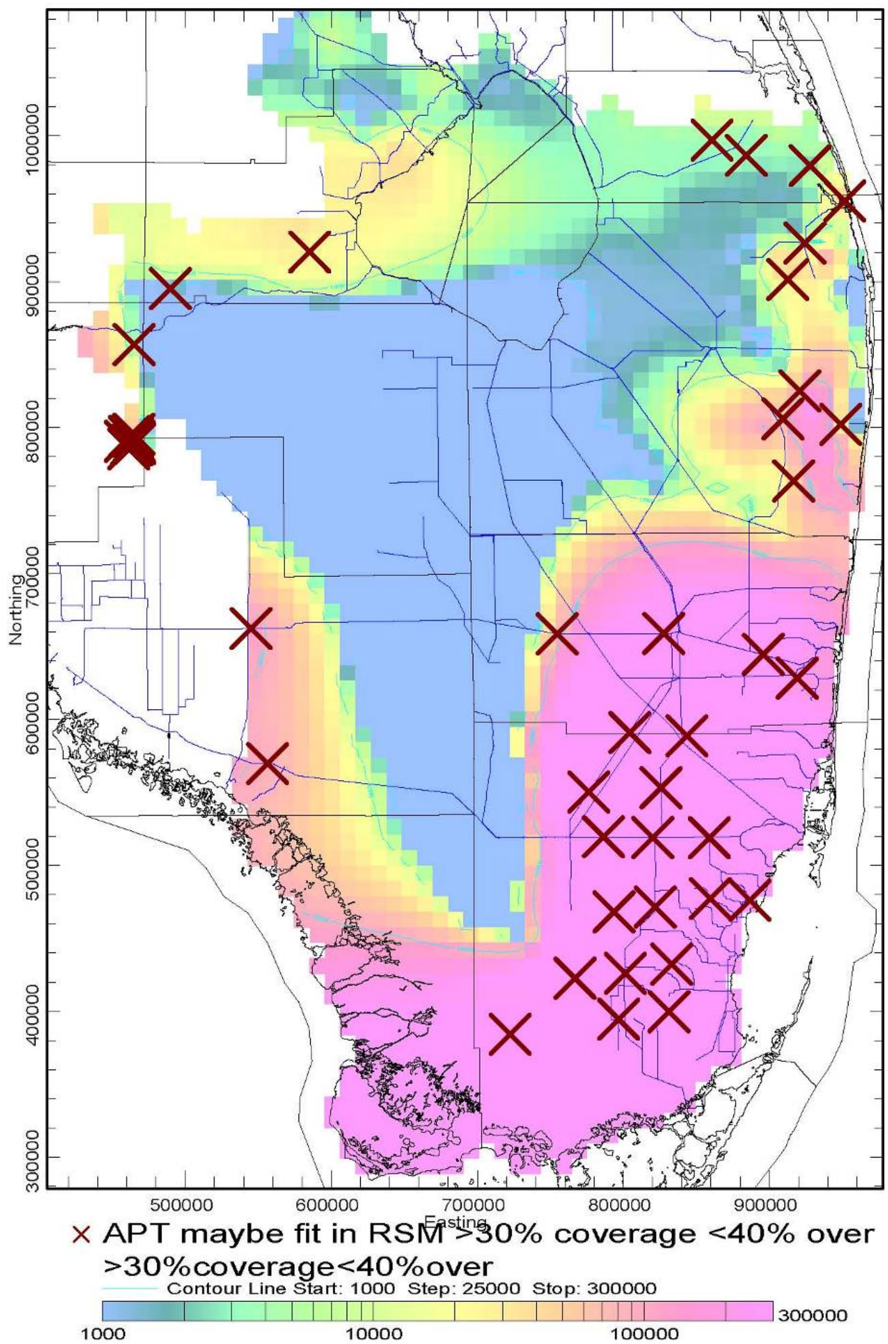

Figure F-12. DBHYDRO APTs that tested at least 30% of the RSM thickness and that did not exceed beyond the base of the RSM by more than 40% of the RSM thickness

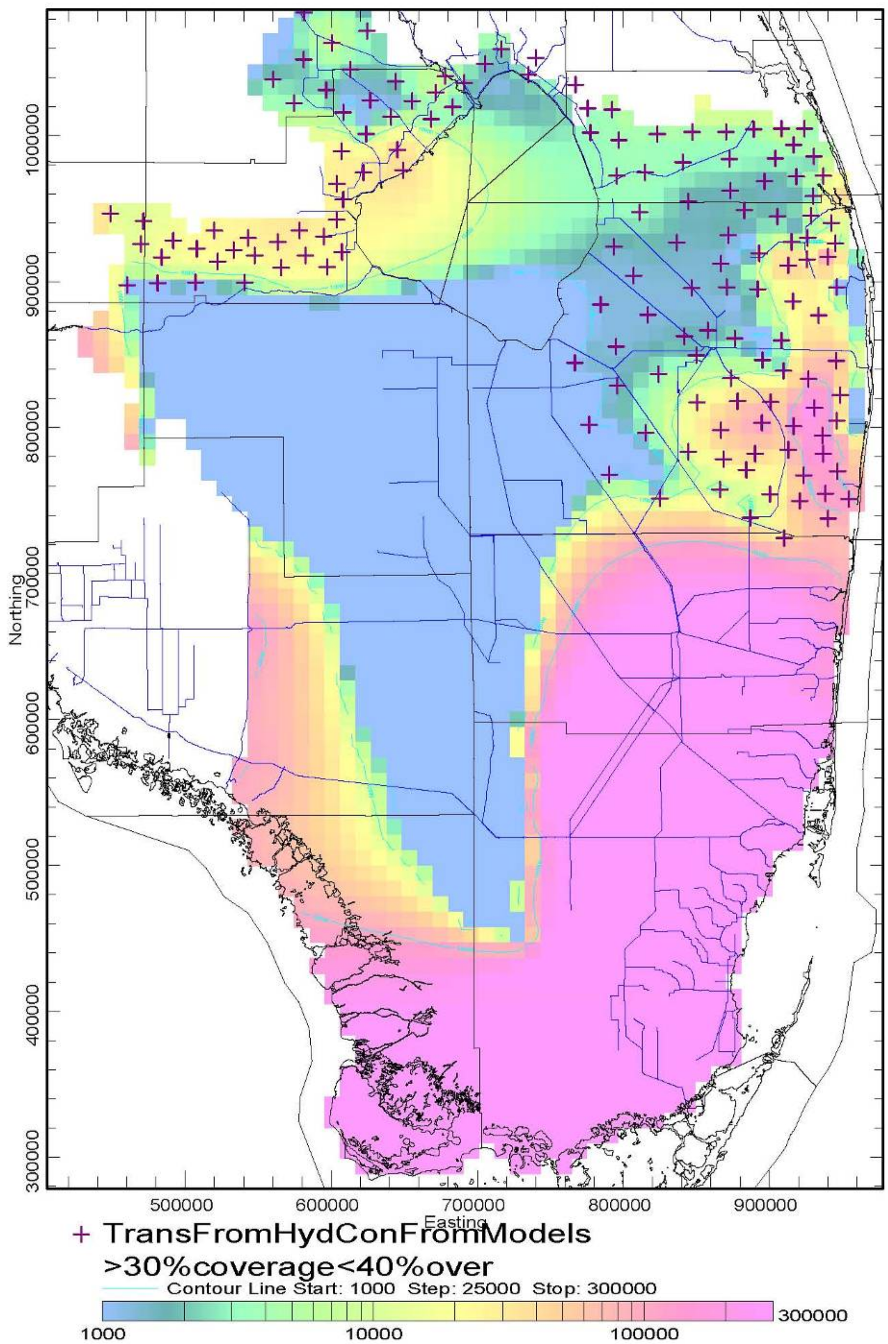

Figure F-13. Hydraulic conductivity points from the LECR and GOH models.

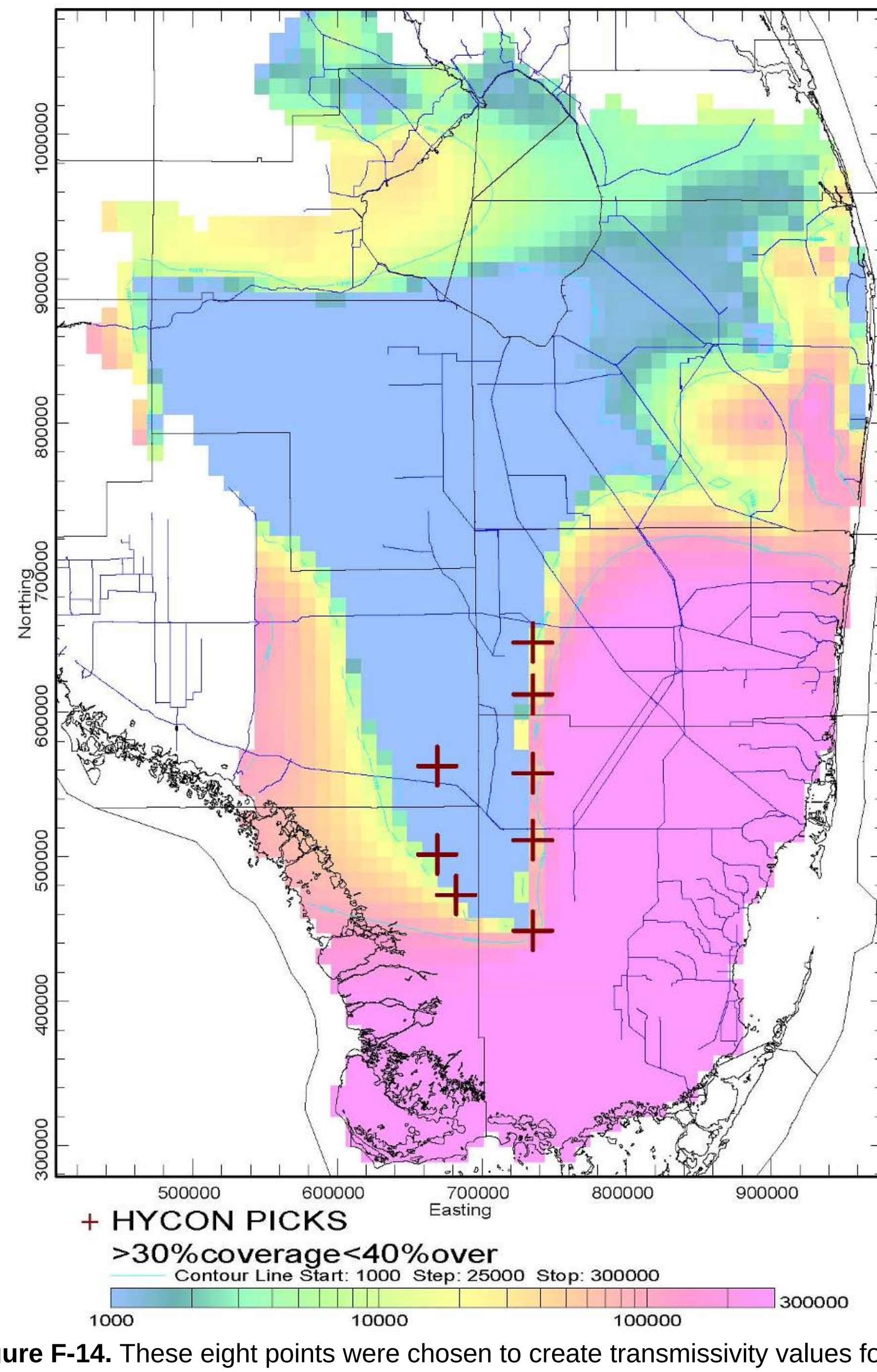

Figure F-14. These eight points were chosen to create transmissivity values for this area using the hydraulic conductivity values from the 1988 USGS report.

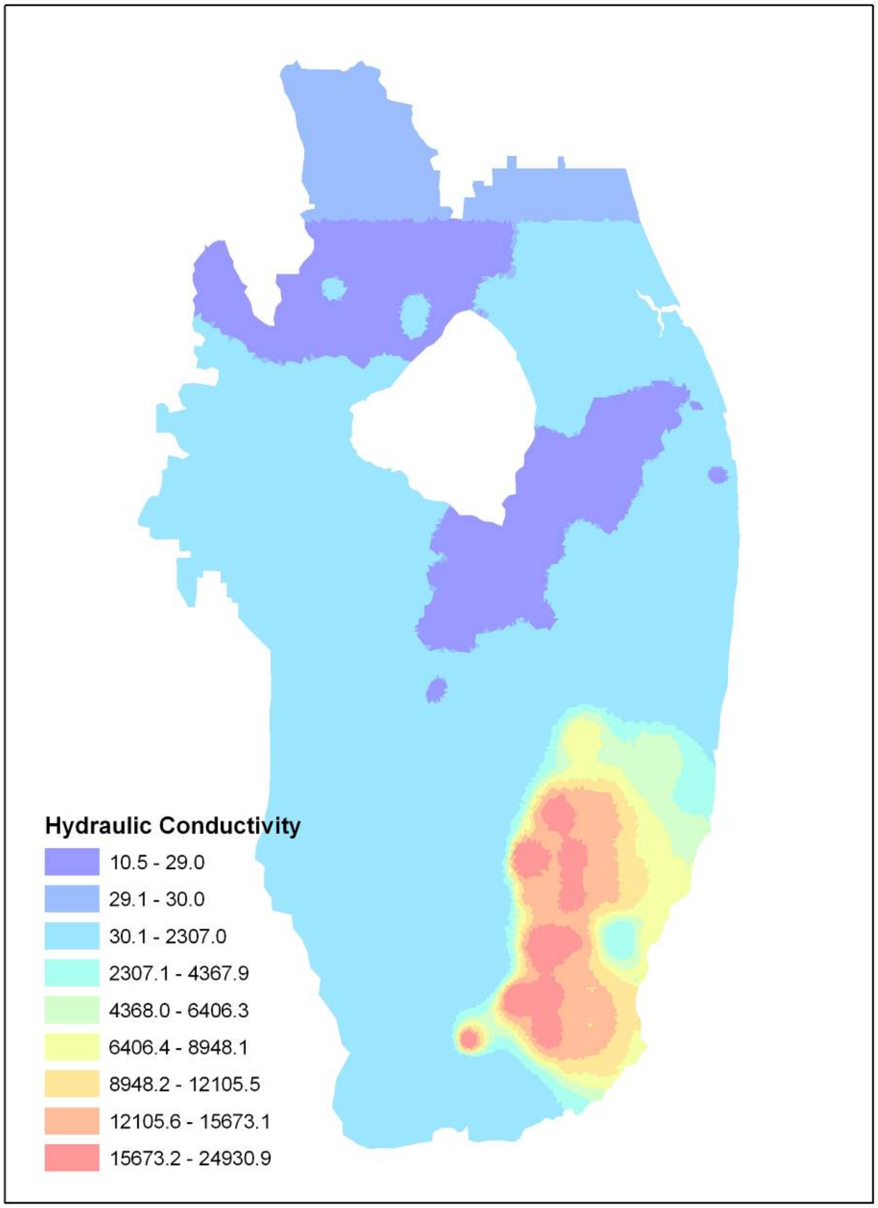

Figure F-15. NSRSM Hydraulic Conductivity

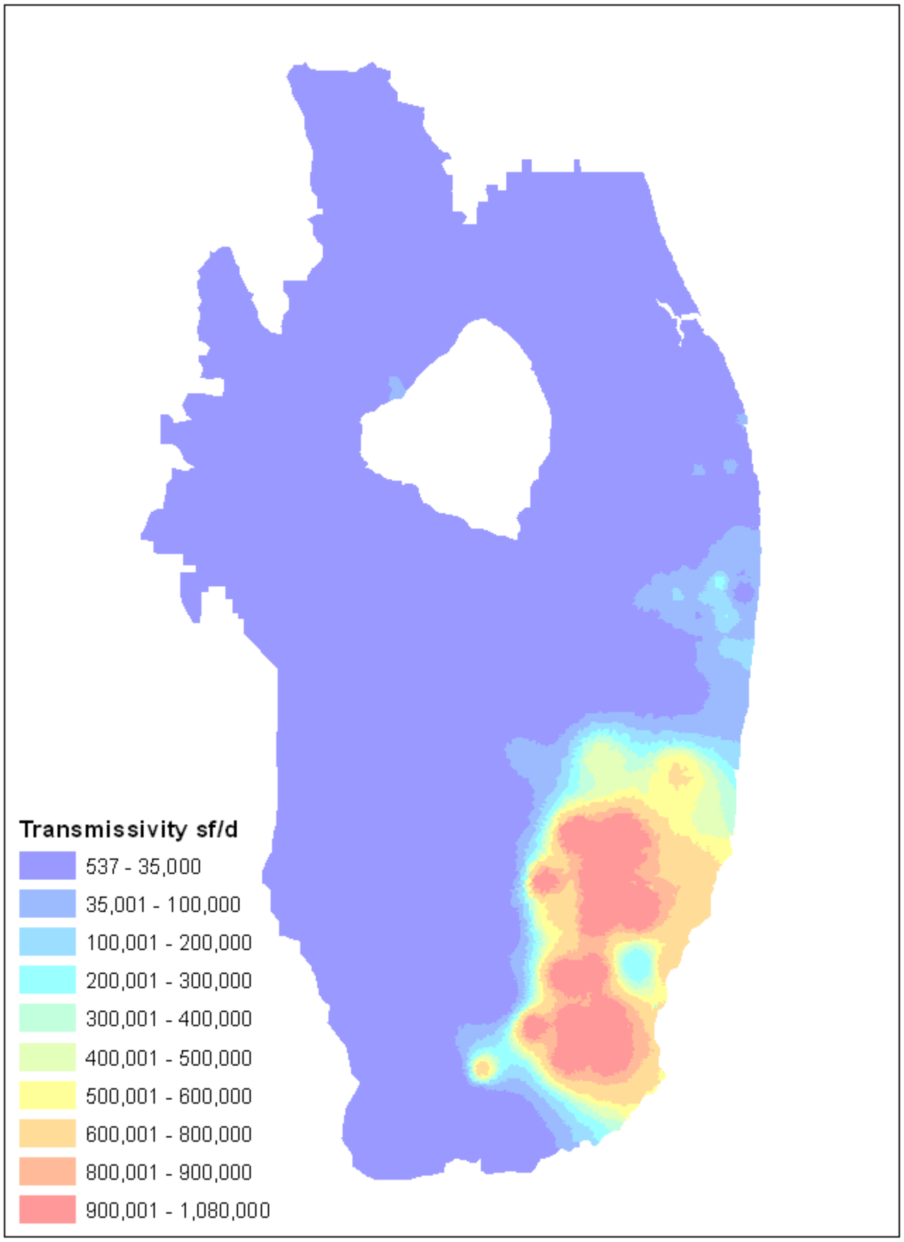

Figure F-16. NSRSM maximum transmissivity values