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LITTLE SARASOTA BAY WATERSHED MANAGEMENT PLAN MODEL UPDATE

Sarasota County | May 2024

LITTLE SARASOTA BAY WATERSHED MANAGEMENT PLAN

MODEL UPDATE

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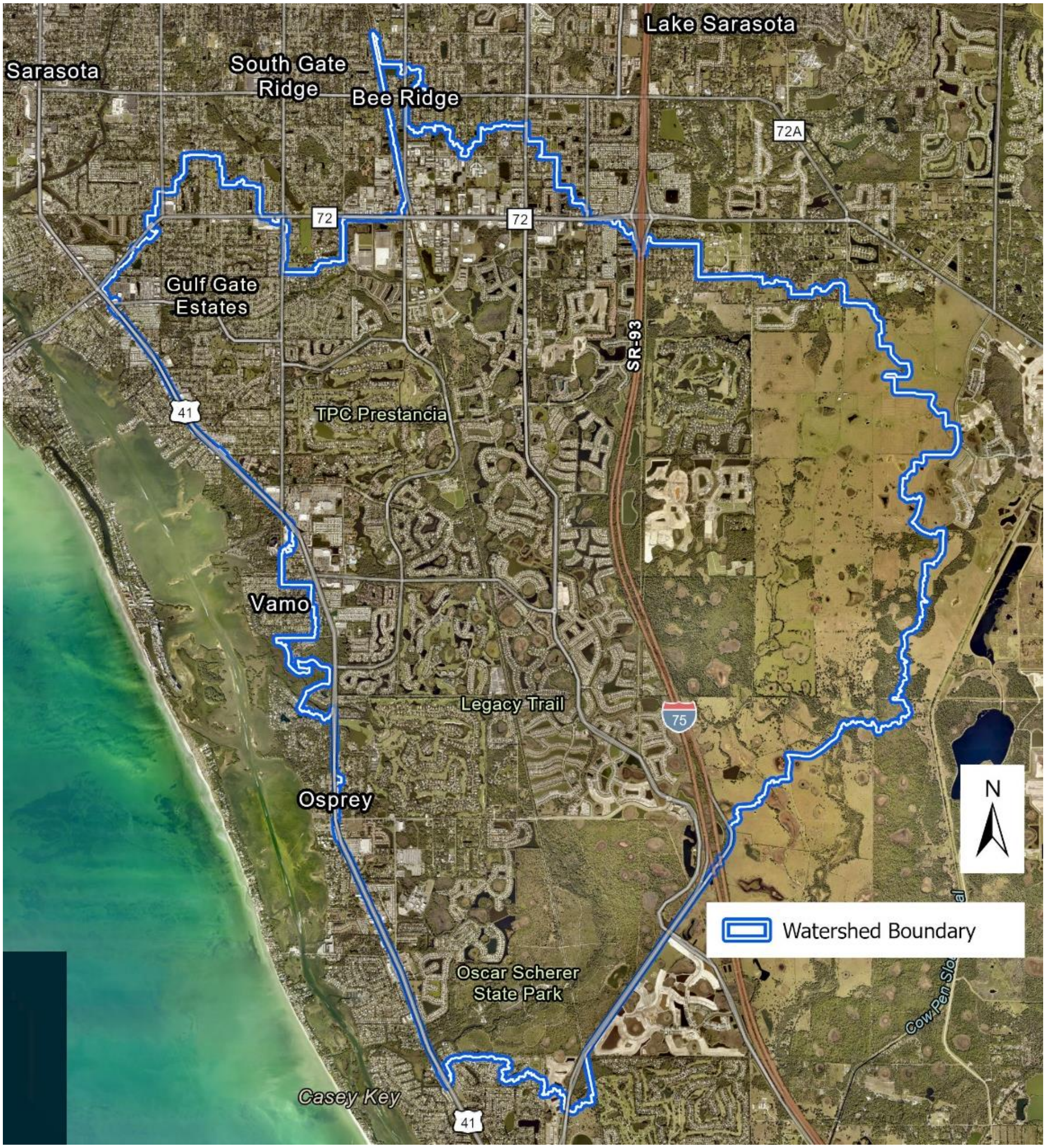
1 PURPOSE AND OBJECTIVES

Sarasota County understands the importance of maintaining up-to-date watershed-scale models for planning purposes. The County has been using the Interconnected Channel and Pond Routing software Version 3 (ICPR3) for stormwater modeling; however, Streamline Technologies, Inc. discontinued support for ICPR3 in 2016. ICPR3 has been replaced by ICPR Version 4 (ICPR4), and the County is converting its watershed models from ICPR3 to ICPR4. The County contracted Jones Edmunds to convert four watershed models from ICPR3 to ICPR4 and update the models for six watersheds under the Request for Professional Services (RPS) #202061MN of Sarasota County Contract No. 2021-268. This Technical Memorandum documents the model update for the Little Sarasota Bay Watershed Management Plan. Figure 1 illustrates the Little Sarasota Bay Watershed location.

Jones Edmunds converted the Little Sarasota Bay Watershed Model from ICPR3 to ICPR4 in prior tasks. This task consists of updating the watershed model to incorporate new developments that have occurred over the years using enhanced 2019 light detection and ranging (LiDAR) data obtained from the Southwest Florida Water Management District (SWFWMD) and addressing watershed boundary gaps and overlaps with adjacent watersheds.

Figure 1 Location Map



2 MODEL UPDATE

The previous Little Sarasota Bay Watershed Management Plan model update was completed in 2017 using the 2007 LiDAR data. For this update, the new 2019 LiDAR was used to refine the watershed boundaries, incorporate new developments, and address gaps and overlaps with adjacent watersheds. The model updates also include a quality-control check of the input parameters to ensure that the information from the previous model is reasonable.

2.1 Topographic Void Update

The 2019 LiDAR reflects the new developments that have occurred as well as the more detailed and refined surface information that results from advanced topographic data capture technologies. Jones Edmunds reviewed the SWFWMD Environmental Resource Permits (ERPs), 2019 LiDAR, and 2020 aerial imagery to identify developments that would have a significant impact on the watershed model. Some of the developments identified for updates are topographic voids in the 2019 LiDAR. Topographic voids are areas in the digital elevation model (DEM) that do not represent actual ground conditions based on aerial imagery review. After reviewing the areas of new development, we identified several topographic void areas that were large enough to cause notable inaccuracies in the model results and floodplain mapping if not addressed. We updated the DEM in these areas to reflect current conditions. Table 1 lists the developments where we conducted DEM updates.

Table 1 Topographic Void Developments

Project Name	ERP Number
Grand Pavilion Shopping Center	ERP_027278_001 ERP_027278_002
Heartland Dental	ERP_043660_003
Seaside Springs Apartments	ERP_043660_001
Grand Park	ERP_001552_006
Sage on Palmer Ranch	ERP_041916_004
Promenade Estate PH1	ERP_041916_006
Promenade Estate PH2	ERP_041916_007

For each area, Jones Edmunds georeferenced the applicable design drawings in a geographic information system (GIS). These drawings were used to digitize ponds, building pads, parking lots, ditches, and any other features that would assist in updating the terrain. Figure 2 illustrates the topographic features used to update the terrain for the Grand Park development. Figure 3 shows the before and after DEM for the Grand Park development.

2.2 New Developments Update

Several developments have occurred in the watershed since the model was last updated in 2017. Table 2 lists the developments that have significant impacts on the watershed model and were included in the model update.

Figure 2 Grand Park Development DEM Update Features

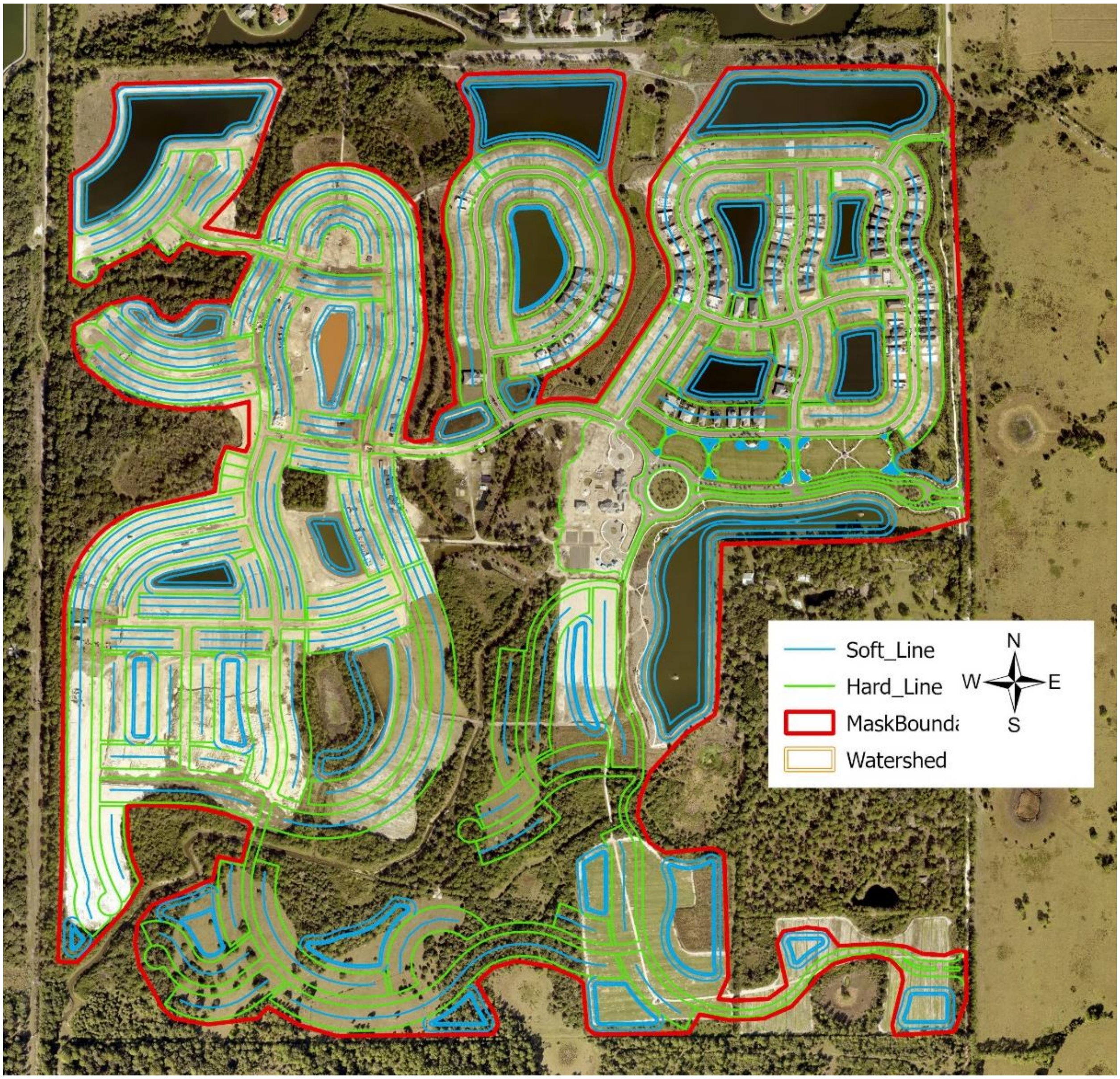


Figure 3 Grand Park Topographic Void DEM Comparison

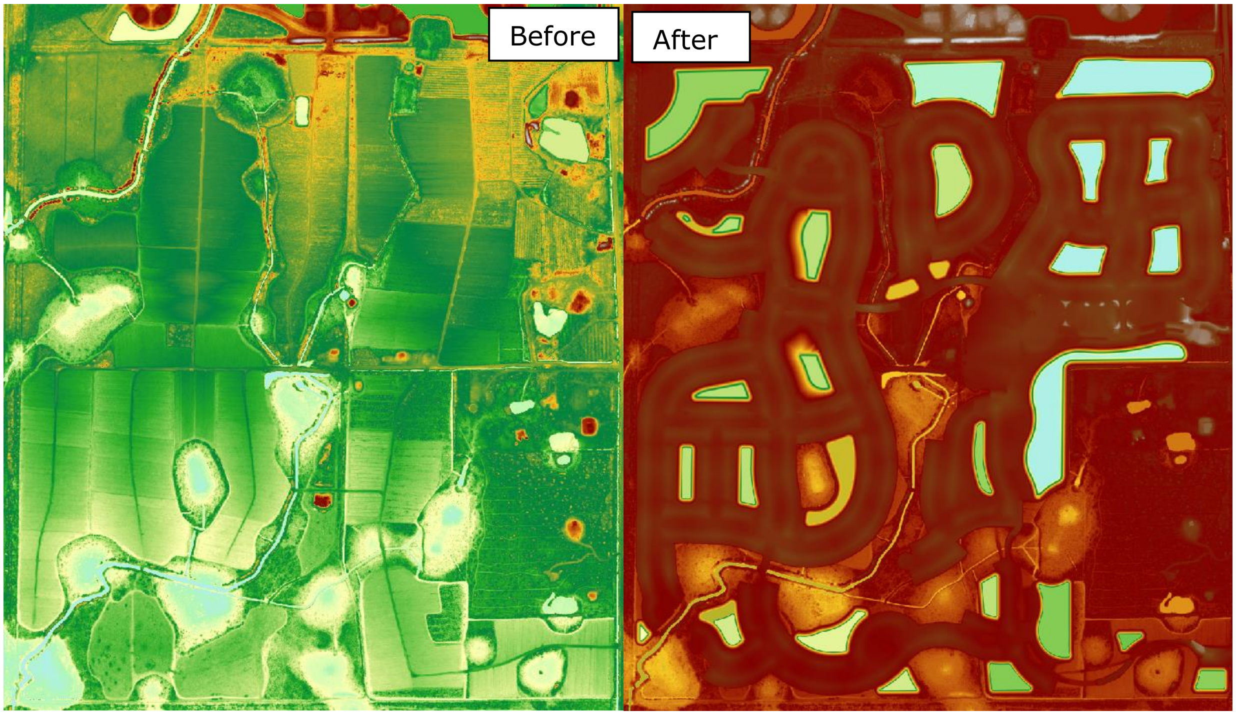


Table 2 Significant Developments in the Little Sarasota Bay Watershed

Project Name	ERP Permit Plans
Grand Pavilion Shopping Center	ERP_027278_001_approved_asbuilt_plans ERP_027278_002_Permitted_plans
Edgewater	ERP_029788_002_Permitted_plans
Cobblestone on Palmer Ranch	ERP_001293_104_submitted_asbuilt_plans ERP_001293_122_Permitted_plans.
Arbor Lakes	ERP_001293_114_Approved_asbuilt_plans
Anson on Palmer Ranch	ERP_001293_115_Permitted_plans
Promenade at Palmer Ranch	ERP_001293_116_submitted_asbuilt_plans
Grand Park	ERP_001552_006_Permitted_plans
The Oaks Club	ERP_002968_022_Asbuilt
Legacy Estate on Palmer Ranch Phase 2B	ERP_041845_001_Submitted_asbuilt_plans
Legacy Estates	ERP_041845_001_Submitted_asbuilt_plans
Esplanade	ERP_041916_002_Permitted_plans
Promenade Estate PH1	ERP_041916_006_submitted_asbuilt_plans
Promenade Estate PH2	ERP_041916_007_submitted_asbuilt_plans
Sage on Palmer Ranch	ERP_041916_004_Permitted_plans
Bay Street Extension	ERP_041916_001_submitted_asbuilt_plans
Rivo Lake Subdivision	ERP_042231_001_approved_asbuilt_plans ERP_042231_003_submitted_asbuilt_plans

Project Name	ERP Permit Plans
Sarasota Ford Receiving Center	ERP_042824_000_Submitted_asbuilt_plans
Sarasota 500	ERP_042824_001_Permitted_plans
Spacebox	ERP_043660_004_Permitted_plans
Heartland Dental	ERP_043660_003_Permitted_plans
Seaside Springs Apartments	ERP_043660_001_Submitted_asbuilt_plans

Jones Edmunds reviewed the development plans and compared the design elevations and topographic data to the LiDAR data. Each development was reviewed for:

- Drainage patterns and catchment delineations.
- Hydraulically significant structures.
- Elevations and profiles.
- Topography.
- Initial stages.

Based on our review, we re-delineated the model catchments, incorporated new or revised hydraulic structures, and parameterized the watershed model according to the design data. In areas adjacent to the new development, we updated curve numbers (CNs), impervious areas, times-of-concentration (Tc), storage, overland weirs, and cross sections. Table 3 compares the model input data of the previous version of the model (existing model) and the updated version of the model.

Table 3 Comparison of Existing and Updated Model Elements

Model Element	Existing Model (count)	Updated Model (count)
Catchments	1,655	2,925
Node	2,004	3,615
Drop Structure	477	529
Pipe	824	898
Channel	491	473
Weir	1,981	1,925
Rating Curve	19	19
Watershed Area	21,011.03 acres	20,564.78 acres

2.3 Watershed Boundary Update

Since the previous update of the Little Sarasota Bay Watershed Management Plan, updates to other adjacent watershed models in the County have occurred. Surrounding watersheds that have been updated include Phillippi Creek, Dona Bay, and Coastal Fringe Little Sarasota Bay. In addition, Jones Edmunds is developing the Lyon's Bay watershed model for the County. These updates required that the boundaries along the Little Sarasota Bay Watershed also be updated to be consistent with the adjacent watersheds to represent the interflow between the areas more accurately. Jones Edmunds revised the Little Sarasota Bay Watershed boundary catchments to be consistent with the new LiDAR and the surrounding watersheds. The revisions included updating the storage, CNs, and Tc characteristics of the newly revised catchments.

Jones Edmunds also ensured that the hydraulic connections were consistent between the watershed models (i.e., a conduit leaving one watershed is connected to the appropriate node of the adjacent watershed and that the parameter data is identical).

2.4 Quality Assurance/Quality Control

Jones Edmunds develops watershed models using defined procedures for quality assurance. Many tasks associated with model development and/or model conversion are captured in our Standard Operating Procedures (SOPs) to ensure consistency and accuracy. We also have many tools to aid in the quality control of watershed products, including tools for parameterization, automated checks of model inputs, and floodplain delineation tools that meet Federal Emergency Management Agency (FEMA) standards for floodplain mapping.

Jones Edmunds performed a quality-control check of the input parameters to ensure that the information from the previous model was accurately represented. While checking the model inputs for reasonableness, we identified and corrected several issues in the previous model. These issues included:

- The maximum area in the stage-storage data exceeded the basin area.
- The modeled acreage does not match the acreage derived from the GIS data.
- Initial stages were revised to eliminate unintended initial flows.
- Federal Highway Code equal to 0 was revised to reflect the appropriate conditions.

3 VERIFICATION

After updating the Little Sarasota Bay Watershed Model, Jones Edmunds conducted model calibration and verification. The goal of a calibration/verification is to ensure that the model reasonably reflects observed conditions of historical storm events and can be reliably used to predict system performance under design storm conditions. The purpose of the model calibration process is to modify the model input parameters (generally coefficients) within an acceptable engineering range until the model results best match the actual recorded data. The model verification simulation is to verify the model "setup" matches the recorded data (hydrograph) for a separate storm event. An ideal verification event would have a different depth and/or duration than the calibration storm event. A model is considered calibrated and verified when the same model setup produces results that reasonably match both storm events in terms of peak, timing, and volume. Once the model's validity is confirmed, the model can be relied on as a tool to develop accurate flood risk data, analyze the flood protection level-of-service (FPLOS), and analyze proposed conditions. The following subsections document the model calibration/verification approach and results for the updated ICPR4 Little Sarasota Bay Watershed Model.

3.1 Model Calibration and Verification Approach

The Little Sarasota Bay model was previously calibrated and verified during model updates in 2016. The task in this Contract was to validate the previous calibration and verification efforts or update the calibration by adjusting the model hydraulic parameters, if required, to ensure that the model still simulates the system hydrologic and hydraulic responses after conducting the model updates.

The approach assumed that the model input parameters (in particular, the Manning's n values) were largely accurate and that this effort was primarily conducted to identify any model updates that could change the model simulation performance, potential model inaccuracies, and/or calibrate any locations/tributaries in the model that were not previously calibrated. No rating curve (flow) data are available for any of the streamflow gauge locations, which limits our ability to calibrate the model along channel reaches. Because of these aspects, no large-scale changes were made to the Manning's n values unless clearly required. However, several gauges are available with recorded water elevations, which we used to compare to the model results. Section 3.5.3 discusses the specifics regarding the actual model parameter adjustments.

3.2 Historical Storm Event(s) Selection

Selecting the historical storm events to be used for the calibration and verification considered several factors:

- Magnitude of the storm events(s).
- Availability of rainfall and water-level data.
- Antecedent moisture conditions (AMC).
- Recency of the storm event.
- Temporally isolated rainfall.
- Needs from adjacent watersheds for boundary conditions.

We considered all of the previously noted items to determine the most appropriate storm events to use for the Little Sarasota Bay Watershed, although the most important considerations were the first two, i.e., event magnitude and data availability. We used these two factors to initially filter the gauge data. We graphed and reviewed the water-level data for the period of record for the highest peak stages at each gauge. We reviewed the rainfall data associated with those events having the highest peaks to determine the time of year, temporal distribution, and magnitude of the rainfall data. We used this information to determine if the rainfall data were appropriate for model calibration/verification. The remaining factors were then considered with emphasis given to more recent events.

Based on the data, Hurricane Ian in September 2022 and Tropical Storm (TS) Eta in November 2020 were the most suitable storm events for the Little Sarasota Bay Watershed calibration and verification. However, because watershed models are being updated and calibrated across the entire County, the selection of calibration/verification events across all watersheds was considered prudent. To do this, we coordinated with Collective Water Resources (who is conducting the calibration/verification for half of the County) and performed a cursory review of the gauge and rainfall data for the other half of the County watersheds. Based on these efforts, both consultants determined that these two events could be used to calibrate and verify model results for all County watersheds.

3.3 Available Gauge Data

During the calibration process, Jones Edmunds assessed the suitability and reliability of gauge data for making model parameter changes. The selected storm events were thoroughly reviewed for usability, and data that was deemed unsuitable or unreliable was disregarded. In some cases, a correction factor was applied.

3.3.1 Recorded Water-Level Data

The Sarasota County Automated Rainfall Monitoring System (ARMS) program is equipped with a network of remote monitoring stations throughout the County that record rainfall and water-level information. Six gauging stations are within the Little Sarasota Bay Watershed. Data from four out of the six stations were used in one or both selected events.

The gauge that was determined to be unusable was Holiday Bayou. Although data are available, our review of the data from 2004 through 2023 (period of record) shows issues in the water-level recording data after 2016. In many instances, the data show the weir as flowing well over 6 inches above the weir for extended periods. For example, the recorded data indicate that the weir is flowing with over 6 inches of head from June 2020 to January 2021 and July 2021 through March 2023. This trend was not seen in the recorded data before 2016 and is likely erroneous. Based on this review, Jones Edmunds determined that the data should not be used for the model calibration and verification. Furthermore, the model at Holiday Bayou was previously calibrated and verified in 2016 and no changes were made during this update to necessitate model calibration.

The other gauge data that were omitted from the calibration and verification was NO-1. Although data are available at the NO-1 gauge on North Creek, the updated model simulated significantly lower stages for the calibration and verification event compared to the recorded data. Based on these discrepancies, Jones Edmunds used the DEM, aerial, and stormwater inventory to review the area and the data for potential issues, including missing model connections, and found the model to have no obvious errors or omissions. Model hydrology input and channel Manning's n values were reviewed and were determined to be within reasonable ranges. We also performed a sensitivity analysis by changing all CNs in the North Creek area to 98 and simulated the calibration event. Although these changes brought the simulated stage(s) up, the recorded stage is still over 1 foot above the simulated stage. A possible reason for this discrepancy is the channel geometry may not be well represented. Further evaluation of this area is required.

A correction factor of 0.5 foot was applied at the Matheny Creek gauge similar to the previous calibration/verification in 2016. We also performed a field visit to verify the inconsistency between gauge readings and conditions observed in the field. During our field investigation, we observed the depth over the weir to be negligible although the gauge was recording a stage that would indicate the depth over the weir to be approximately 6 inches.

Table 4 summarizes the ARMS gauge sites with the suitability of their usage for the verification process. Figure 4 shows the locations of the ARMS gauge sites.

Table 4 Sarasota County ARMS Gauges in Little Sarasota Bay Watershed

Station ID	Station Name	Data Usable for Model Calibration (Ian)	Data Usable for Model Verification (Eta)
SO-1	Oscar Scherer	No	Yes
MAT-1	Matheny C. Battery	Yes*	Yes*
CAT-1C	Central Pkwy Battery	Yes	Yes
EL-1	Pinehurst Battery	Yes	Yes
NO-1	Oaks II Battery	Yes	Yes
HB-1	Holiday Bayou	No	No

*Gauge correction factor applied.

3.3.2 Rainfall Data

Jones Edmunds obtained the Next Generation Weather Radar (NEXRAD) rainfall data from SWFWMD. The data is quantified through a 2-kilometer (km) grid with each cell containing rainfall depth distributions at 15-minute intervals. The rainfall distribution grid was intersected with the model subbasins, and each subbasin received the rainfall distribution (and depth) for the grid cell that contained the centroid of the subbasin polygon. Figure 5 depicts the NEXRAD grid cells used for the Little Sarasota Bay Watershed and surrounding watershed areas, showing the range of rainfall depth totals for cells used in the model calibration event. NEXRAD rainfall totals were also compared to the ARMS rainfall data totals to verify the accuracy of the NEXRAD data. Overall, the data compared within reasonable limits with no significant discrepancies to warrant any rainfall data changes.

Figure 4 Sarasota County ARMS Gauge Locations

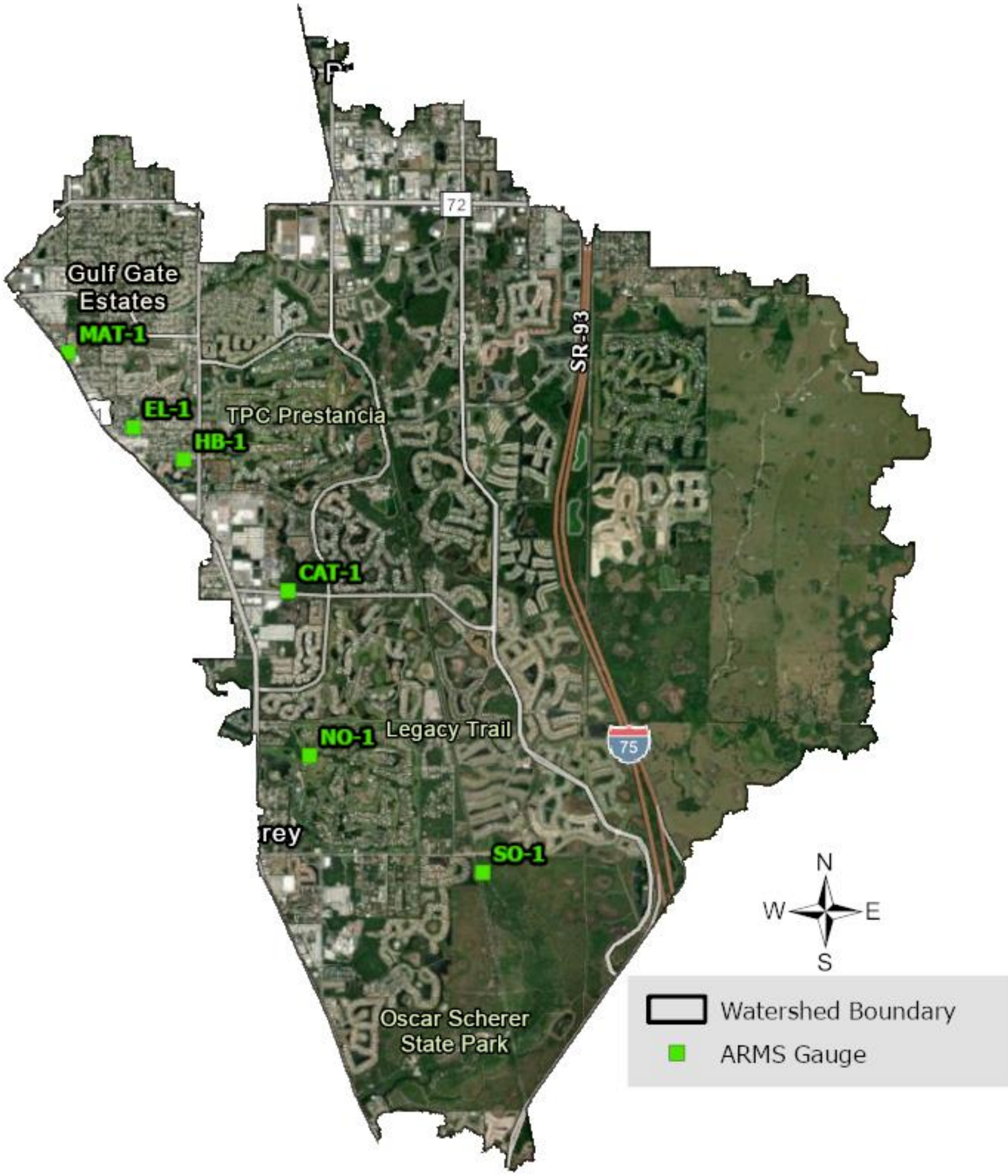
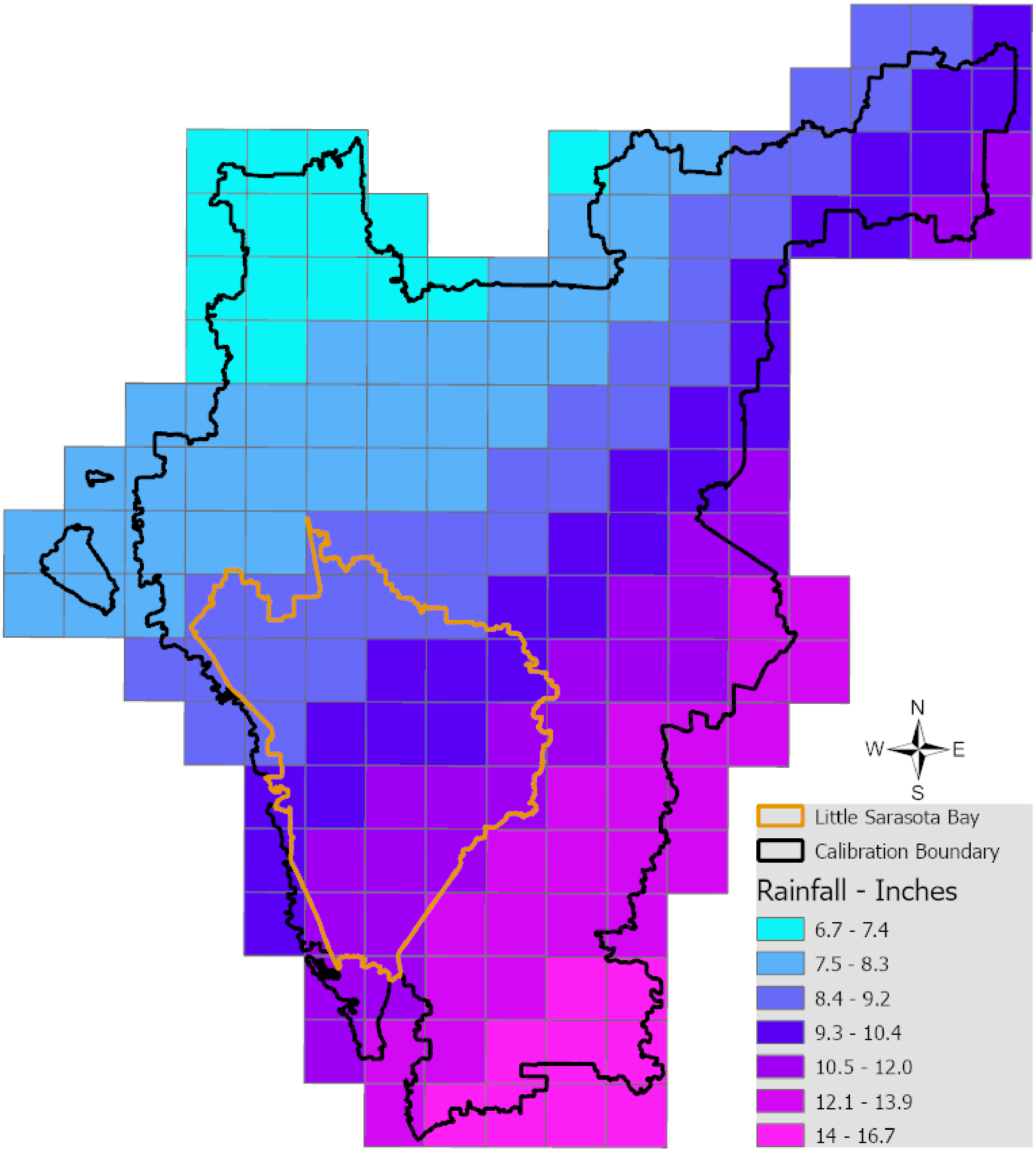


Figure 5 Hurricane Ian Modeled Calibration Rainfall Totals



3.4 Model Calibration

After updating the Little Sarasota Bay Watershed Model with new developments, Jones Edmunds simulated a real storm to compare model-predicted results with known stage observations at the gauges in the watershed. We compared the model results to the gauge data and reviewed/adjusted the appropriate model parameters to obtain a reasonable stage hydrograph match for the Hurricane Ian storm event. The following subsections describe the model calibration details.

3.4.1 Calibration Storm – Hurricane Ian

Hurricane Ian was a Category 4 storm that made landfall just south of Punta Gorda, Florida, at 4:30 PM, September 28, 2022. In addition to Category 4 winds, it also brought heavy rainfall. Rainfall depths in the Little Sarasota Bay Watershed ranged from 8 to 12 inches. Figure 5 shows the rainfall depths for the Hurricane Ian calibration storm. Advantages of using this event for calibration include:

1. **Recent Storm:** This event occurred recently and reflects current land use conditions.
2. **Regional Storm:** This event was regional in nature; therefore, the entire watershed contributed to the observed flows.
3. **Uniform AMC:** This event began with uniform soil moisture conditions across the watershed.

3.4.2 Calibration Storm – Event-Specific Model Input Data

To perform a calibration event, specific model input data must be reviewed to determine if modifications need to be made that differ from the standard design storm model setup. These typically include boundary conditions, initial conditions (initial stages and/or flows), and sometimes the soil AMC. For the Little Sarasota Bay Watershed Model, only one model boundary condition exists because the model has been combined with Phillippi Creek, Dona Bay, Coastal Fringe Roberts Bay North, and Coastal Fringe Little Sarasota Bay. This approach more accurately represents interflows between basin models. The only boundary condition represents the tidal condition, which was represented using the gauge data from Venice Inlet at Crow’s Nest Marina.

Initial conditions in the system were left the same as the design events. The initial flows in the Little Sarasota Bay channel systems were considered negligible based on a review of the data. Lastly, the rainfall data preceding the Hurricane Ian event showed that the soil conditions appear suitable for conducting model simulations with CNs for an AMC II condition.

3.4.3 Parameter Adjustments

This task was to verify and/or adjust model parameters to provide a reasonable match between simulated and measured stages. After the initial model run, the model peak stages compared reasonably well for most gauges. No change was made to the calibration model.

3.4.4 Calibration Results

Figures 6 through 8 present stage hydrographs for the gauge locations with viable data (refer to Table 4). In general, the model shows a reasonable response to rainfall runoff and the stage hydrographs match well with the recorded gauge data, particularly in the timing and peak stages.

The Operations staff told us that detailed structure operations were not available for the Hurricane Ian event. However, we did discover that a flow blockage occurred at Clark Road that was not cleared until a month after the storm had passed. This could be why the recession limb on the observed stage hydrographs stays elevated for so long. We also reviewed the verification results, which do not show a prolonged stage recession (discussed more in subsequent sections). We determined that the disparities in the calibration hydrographs were attributed to abnormal structure operations or flow blockage. Based on these reasons, no additional changes were made to the calibration model.

Figure 6 Calibration Stage Hydrograph Comparison – MAT-1 at Matheny Creek

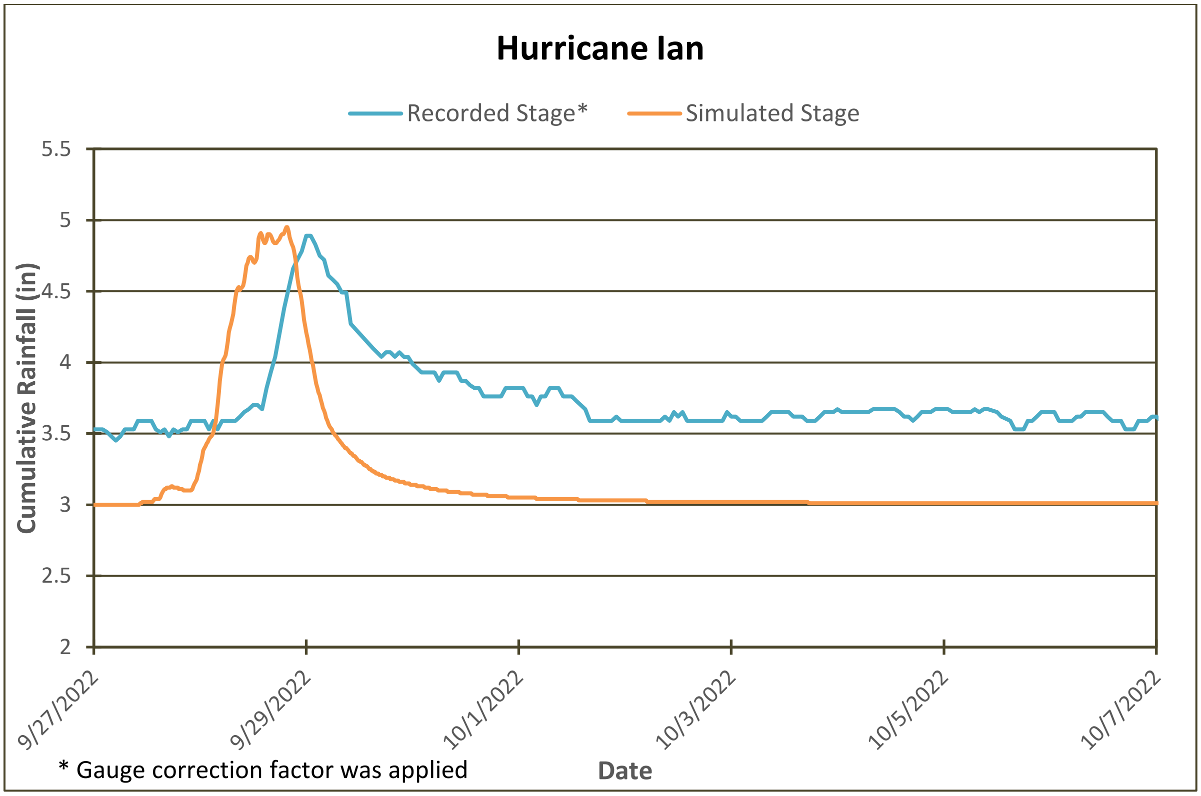


Figure 7 Calibration Stage Hydrograph Comparison – EL-1 at Pinehurst Street

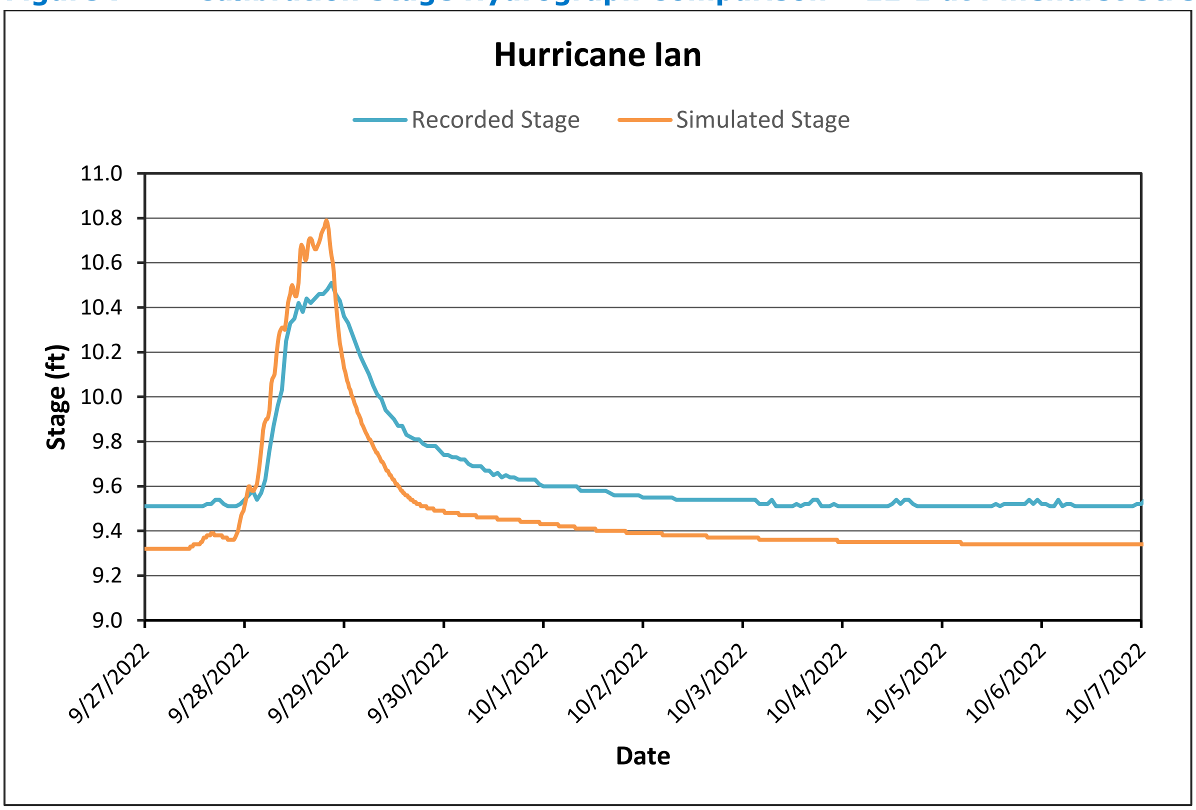
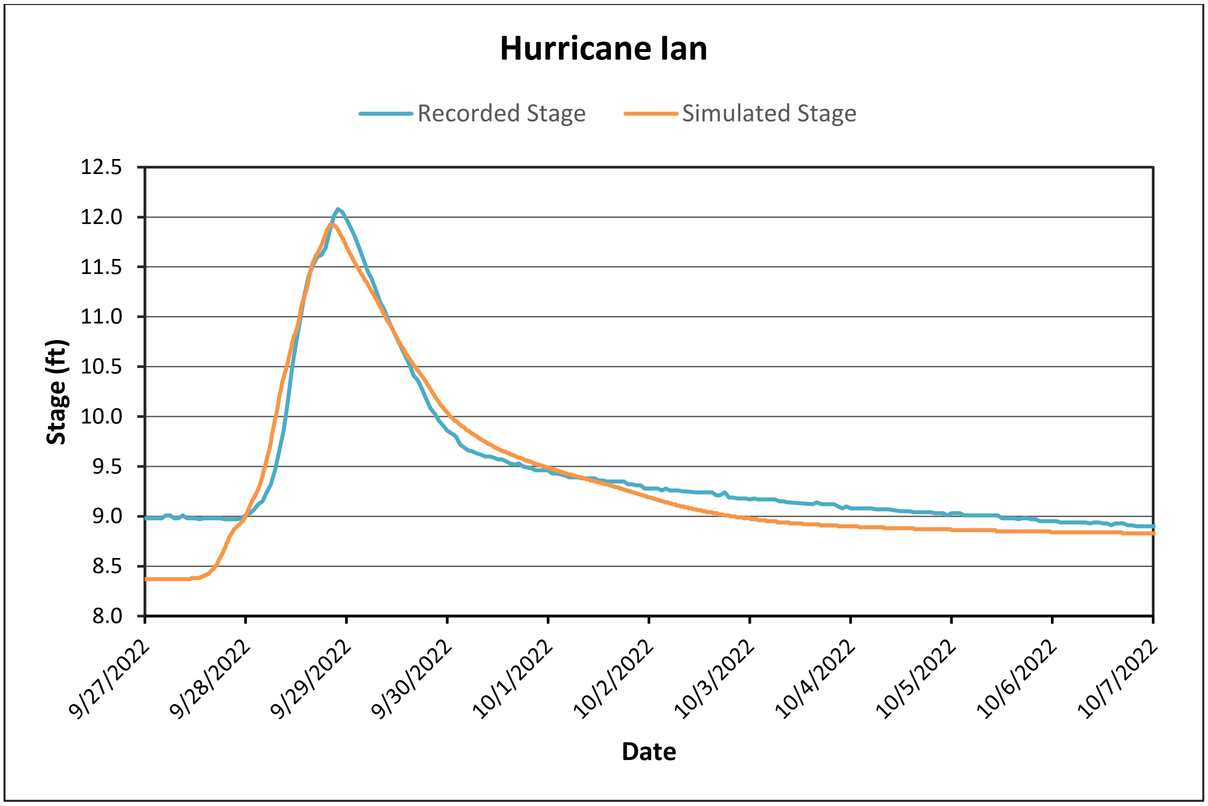


Figure 8 Calibration Stage Hydrograph Comparison – CAT-1C at Sarasota Parkway



The timing of the recorded and simulated stage for MAT-1 at Matheny Creek is notably shifted. The same shift is seen in the gauge-recorded rainfall data and the NEXRAD data. The simulated timing at Matheny Creek is consistent with other gauges in the area; therefore, no change was made at this location.

Table 5 summarizes the modeled peak stages compared to simulated peak stages. The SO-1 Oscar Scherer Park gauge data appear to have been shifted and are likely missing the peak stages; as a result, the data are not suitable for calibration. The average peak stage difference is 0.17 foot (absolute value), which is within an acceptable range.

Table 5 Observed Stages Compared to Simulated Peak Stages – Hurricane Ian Calibration Event

ARMS Gauge	Recorded Peak Stage (ft NAVD88)	Simulated Stage (ft NAVD88)	Difference (foot)
SO-1	N/A	13.61	N/A
MAT-2	4.89*	4.95	0.06
EL-1	10.51	10.79	0.28
CAT-1C	12.08	11.92	-0.16

*Gauge correction factor was applied. N/A = Not Available.

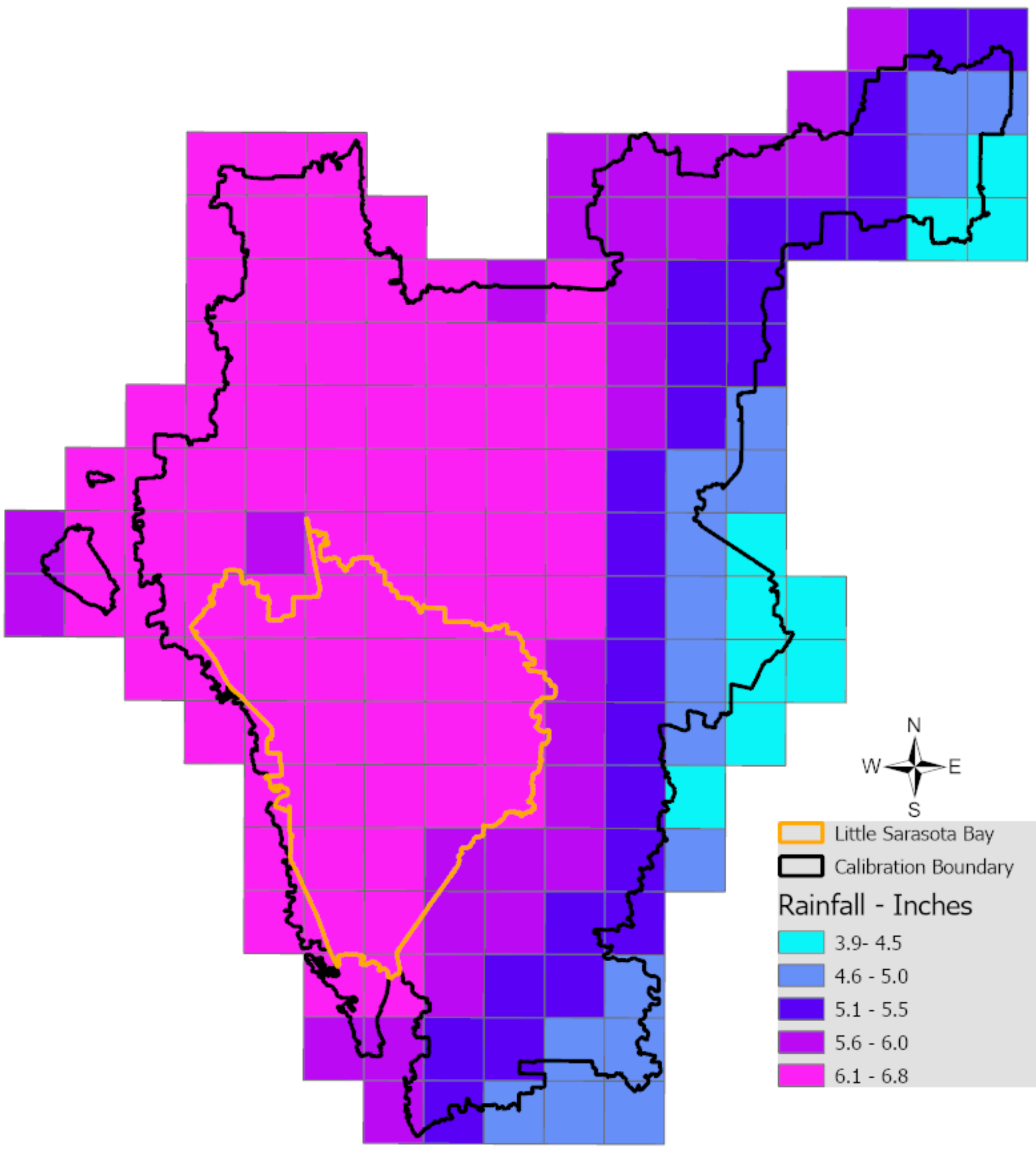
3.5 Model Verification

After calibration, Jones Edmunds verified the model by simulating a second real storm to provide confidence that the calibrated model adequately simulates the watershed hydrologic and hydraulic responses to a separate and different storm. We selected TS Eta.

3.5.1 Verification Storm – TS Eta

TS Eta began to impact southwest Florida on November 8, 2020. Although much of the rainfall occurred on November 11, the model was simulated from November 10 through November 21. During this period, rainfall averaged 6.7 inches across all gauges in the Little Sarasota Bay Watershed. Figure 9 shows the model verification event rainfall depths for the entire combined model, including the Little Sarasota Bay Watershed. As with the calibration, NEXRAD rainfall distributions were applied to each basin based on the intersection of the basin's centroid with the NEXRAD grid cells.

Figure 9 Rainfall Verification Map – TS Eta Rainfall Totals



3.5.2 Verification Storm – Event-Specific Model Input Data

As with the calibration event, specific model input data were reviewed to determine if modifications were needed that differed from the standard design storm model setup, including boundary conditions, initial conditions (initial stages and/or flows), and soil AMC. The model boundary conditions were set up identically to the calibration event. The approach to setting up the initial conditions in the system was also the same as the calibration event.

The big difference in the model input data setup for the verification event was the soil conditions. Because the event was in November, careful review of the rainfall data preceding the TS Eta event was necessary since the event occurred outside the Florida "wet" season. Our review of the rainfall in the watershed over the 5-day period preceding November 11 revealed that an average of 0.4 inch of rain fell across the Little Sarasota Bay Watershed. Table 6 shows that the AMC is determined by the previous 5-day rainfall total based on accepted Soil Conservation Service (SCS) methodology.

Table 6 SCS Runoff Guide for Determination of AMC

	Total 5-Day Antecedent Rainfall (inches)	
AMC	Dormant Season (November - May)	Growing Season (June – October)
I	< 0.5	< 1.4
II	0.5 to 1.1	1.4 to 2.1
III	> 1.1	> 2.1

Source: Technical Publication No. 85-5, *A Guide to SCS Runoff Procedures* (Suphunvorranop, 1985).

Based on the rainfall data and the criteria above, the correct AMC to use for the TS Eta verification event is AMC I. Jones Edmunds used the widely accepted SCS method for modifying CNs from AMC II to AMC I and used this to update the model input.

Jones Edmunds simulated the model using AMC I and AMC II CNs to allow for a thorough review of the verification model considering AMC I CNs are not frequently used. We conducted the AMC II simulation first, which initially showed over-predicted stages; however, we reviewed the hydrologic conditions leading up to the verification event and determined that the AMC built into the standard CNs was not appropriate for this event period. Based on this, the model was simulated using AMC I as well.

3.5.3 Verification Results

Figures 10 through 13 present stage hydrograph comparisons for the gauge locations with viable data (Table 4). Although recorded water-level data for the verification event were available for the Oscar Scherer Park gauge, these data were missing from the calibration simulation. The simulated verification event confirms that the model's response to rainfall runoff is within reasonable ranges. The figures show that model stage hydrographs match reasonably well with the recorded gauge data for the AMC I model simulation, particularly in the timing and shape of the hydrographs.

Figure 10 Verification Stage Hydrograph Comparison – SO-1 at Oscar Scherer Park

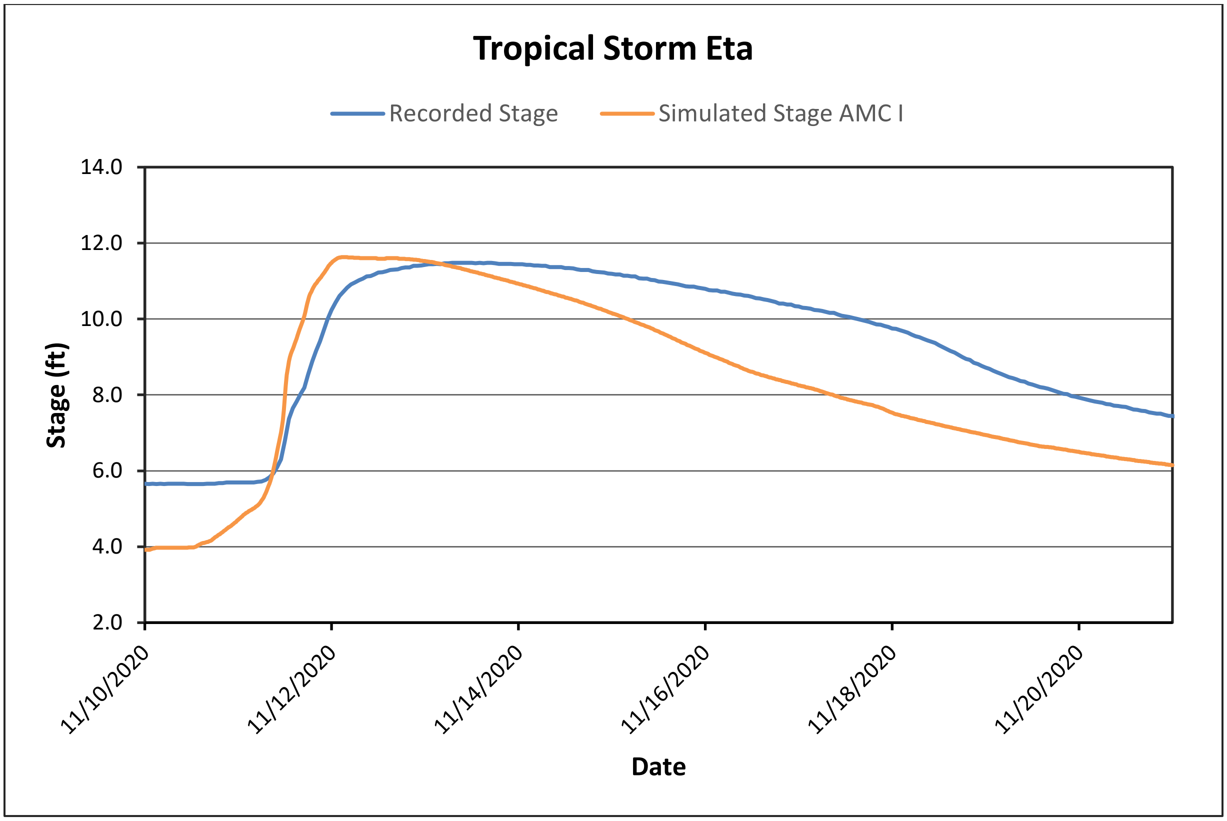
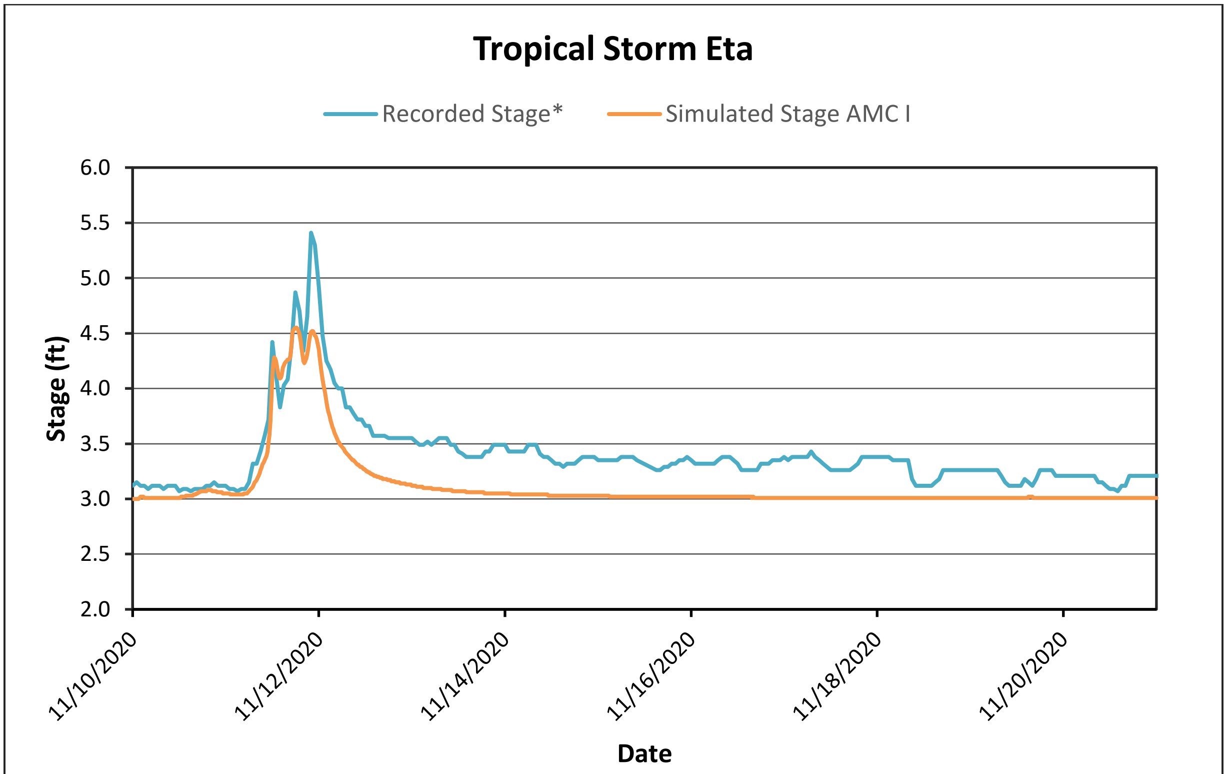


Figure 11 Verification Stage Hydrograph Comparison – MAT-1 at Metheny Creek



* Gauge Correction factor was applied

Figure 12 Verification Stage Hydrograph Comparison – EL-1 at Pinehurst Street

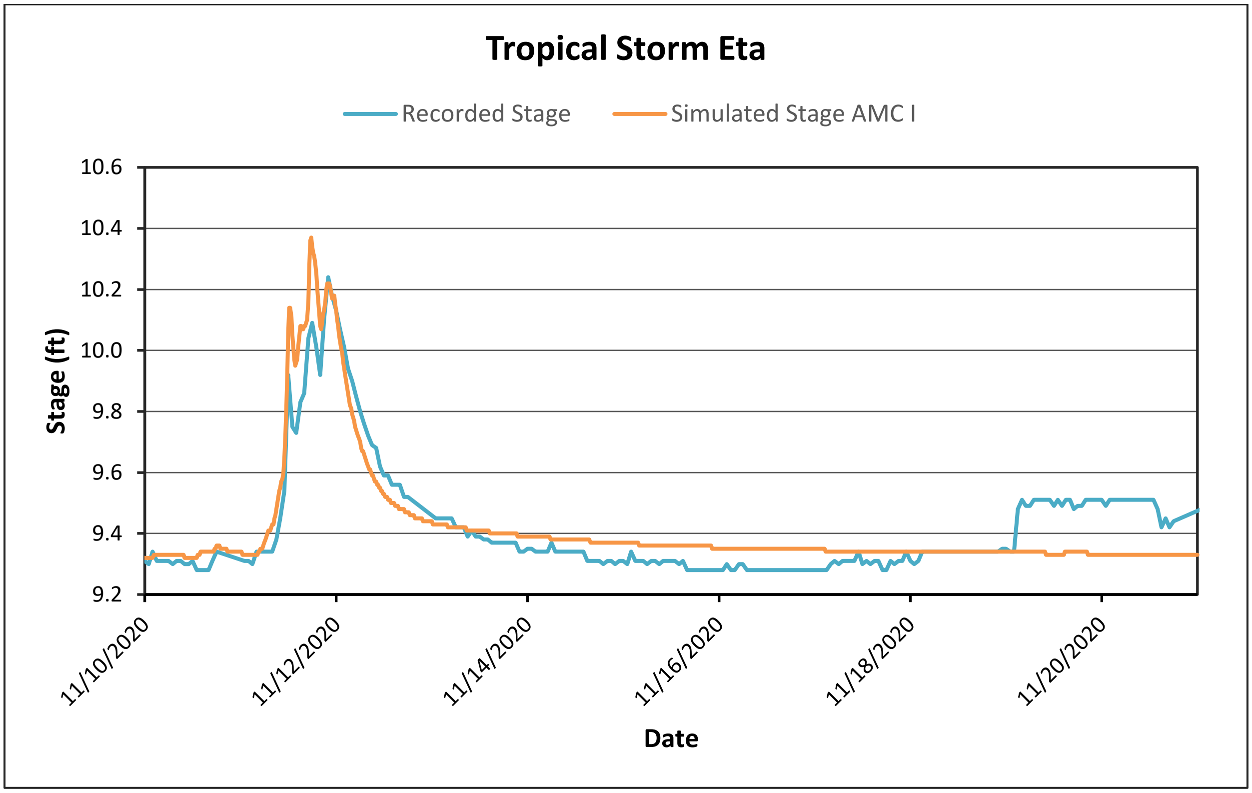
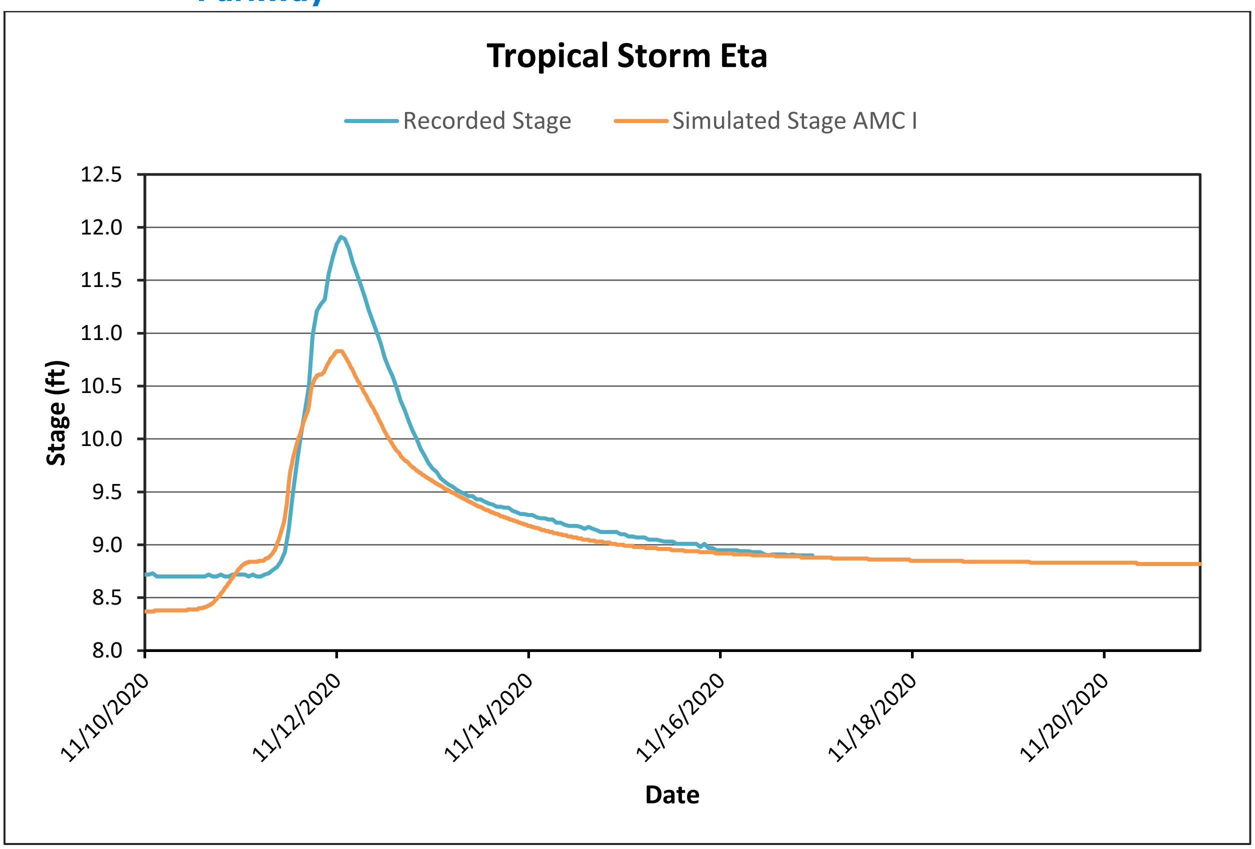


Figure 13 Verification Stage Hydrograph Comparison – CAT-1C at Sarasota Parkway



The model verification comparison at CAT-1C shows the simulated stage as conspicuously low. We reviewed the model parameters in the area surrounding the CAT-1C gauge and found that all parameters are within a reasonable range. The previous subsection showed that the calibration comparison at this gauge matches within 0.16 foot. On further review of the calibration results comparison and the rainfall data for Hurricane Ian and TS Eta, the simulated verification peak stage here is expected to be lower than the simulated calibration peak stage. The recorded NEXRAD rainfall total for Hurricane Ian is approximately 9.5 inches, whereas the TS Eta recorded total is approximately 6.5 inches, approximately 3 inches less. Based on these data, the recorded peak stage for both storms is not expected to be essentially the same (each peak stage is approximately elevation 12.0 ft NAVD88). Accordingly, the rainfall data and/or the recorded stage data for the verification may be flawed, causing the model deviation. The model was also previously calibrated to TS Debby (June 2012) and a no-name storm from June 2013, and minimal model changes were made to the area. Based on this information, the model is calibrated/verified within reasonable limits.

Table 7 summarizes the recorded gauge peak stages compared to model simulated peak stages. Omitting CAT-1C, the average peak stage difference for the gauge comparison is 0.38 foot (absolute value).

Table 7 Observed Peak Stages to Simulated Peak Stages with AMC I – TS Eta Verification Event

ARMS Gauge	Observed Peak Stage (ft NAVD88)	Simulated Stage (ft NAVD88)	Difference (foot)
SO-1	11.48	11.63	0.15
MAT-1	5.41*	4.55	-0.86
EL-1	10.24	10.37	0.13
CAT-1C	11.91	10.83	-1.08

*Gauge Correction factor was applied.

4 BOUNDARY CONDITIONS UPDATE

Since the model for the Little Sarasota Bay Watershed as well as the adjacent watersheds are concurrently being updated along their boundaries, it is important that the boundary conditions reflect the changes within each watershed. Historically, developing the boundary conditions is an iterative process of updating the time-stage data of adjacent watersheds until both watershed models produce consistent results. The new ICPR4 engine has improved the computation time. This improvement, along with advancements in computer hardware and memory management, made simulating countywide models feasible. Therefore, Jones Edmunds merged all the County's watershed geodatabases into one geodatabase. Figure 14 illustrates the extent of the countywide watershed model. Updates made during the merge include:

- Updating the basin delineation to eliminate gaps and overlaps.
- Renaming nodes and links to ensure no duplicates exist.
- Updating link features to ensure the polyline feature originates and terminates at nodes.
- Updating link spatial features to match the model inputs.
- Retaining the feature that has a credible source (i.e., survey, as-built, etc.) where the same feature had mismatched information.

Table 8 summarizes the hydrologic and hydraulic features within the Countywide geodatabase.

Table 8 Countywide Hydrologic and Hydraulic Features

Basins	Nodes	Rating Curves	Pipes	Channels	Weirs	Drop Structures
17,320	20,083	123	9,549	3,425	26,928	3,248

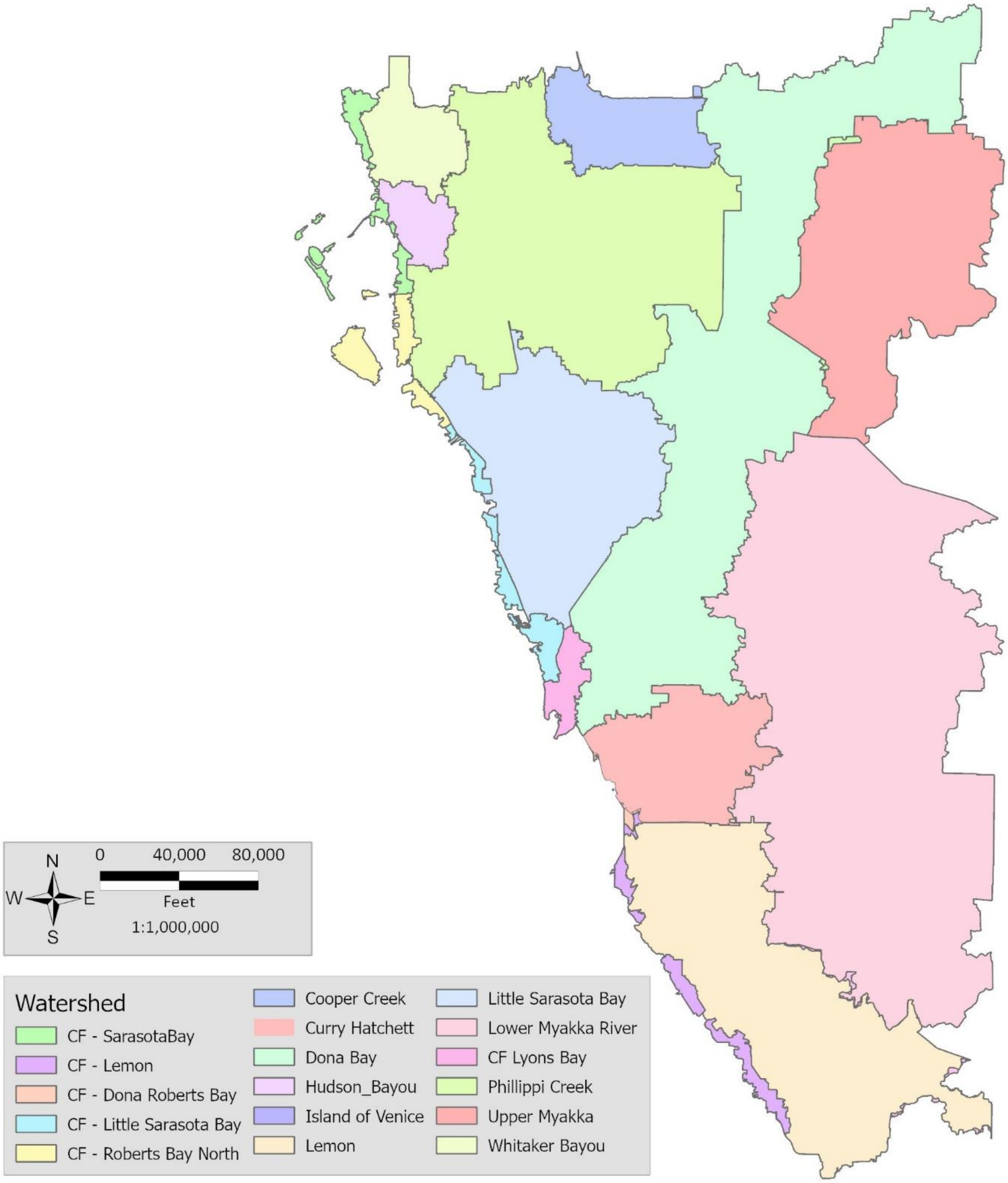
Jones Edmunds created the countywide model using Streamline Technologies' toolbox to export the model data from SWFWMD's Geographic Watershed Information System (GWIS) 2.1 geodatabase and import it into the ICPR4 model. We simulated the 10-, 25-, 50-, 100-, and 500-year storm events using the SCS Type-II Florida-Modified Rainfall Distribution. Table 10 shows the rainfall depths that we derived for these storms from rainfall isohyet maps provided in SWFWMD's *Guidelines and Specifications (G&S)* (2020).

Table 9 Design Storm Rainfall Depths Using 24-Hour Duration and Type II Florida-Modified Distribution

Return Frequency (years)	Rainfall Depth (inches)
10	7.0
25	8.0
50	9.0
100	10.0
500	12.4

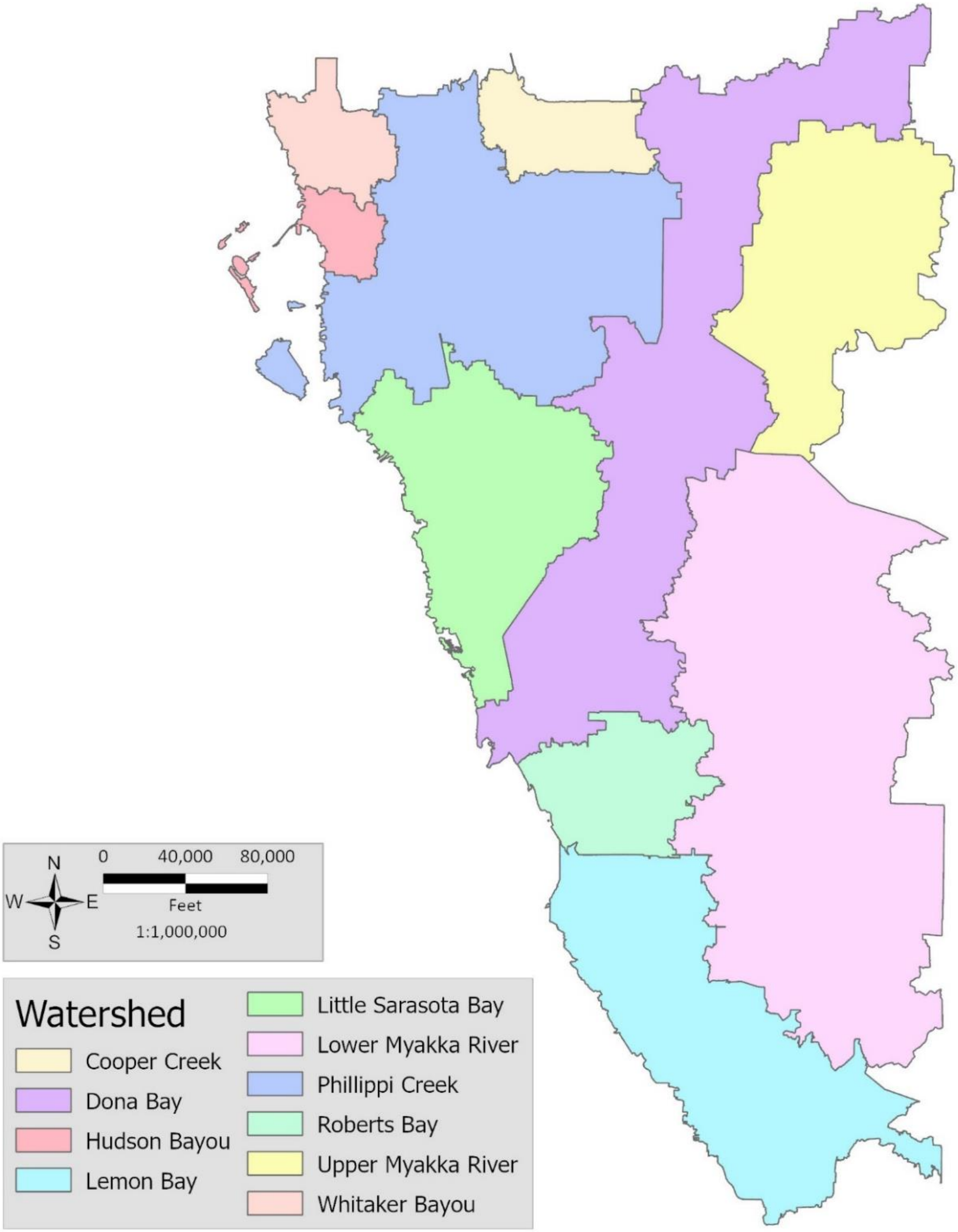
The County maintains 16 models; six models are coastal models that were developed with the intent to be merged with the adjacent riverine watersheds. Under the County's guidance, Jones Edmunds combined the coastal basins into the appropriate watershed. Figure 15 illustrates the resulting 10 watershed boundaries.

Figure 14 Sarasota County's Watershed Model Boundaries



Using the countywide watershed model, Jones Edmunds extracted the Little Sarasota Bay Watershed into a separate geodatabase. We updated the boundary nodes for Little Sarasota with the time-stage data from the countywide model, and we simulated the 10-, 25-, 50-, 100-, and 500-year storm events for the Little Sarasota Watershed. Jones Edmunds verified that the results of the Little Sarasota Watershed model were consistent with the overall countywide model.

Figure 15 Sarasota County's Updated Watershed Boundaries



5 FLOODPLAIN DELINEATION

Jones Edmunds developed level pool floodplains for the 100-year/24-hour design storm event. We delineated the floodplain extents using the 2019 SWFWMD enhanced ground-surface digital terrain model (DTM) and existing conditions model results. We determined the mapped floodplain water-surface elevations based on peak water-surface elevations at the model nodes.

In areas of natural land cover (e.g., forest), floodplain generation using high-resolution terrain data typically results in delineation of numerous small polygons or holes within polygons. The small polygons or holes are generated because of small variations in elevation sometimes caused by objects such as fallen trees, tree canopy, or other conditions where the DTM may not reflect the bare-earth elevation. We excluded inundated areas less than 2,500 square feet (ft^2) from the final delineations. We also filled gaps less than 2,500 ft^2 in flooded areas.

6 LEVEL OF SERVICE

The FPLOS evaluation identifies the location and severity of the flooding problems within the watershed.

6.1 FPLOS CRITERIA

The FPLOS designations characterize flooding due to rainfall events, and can be categorized as either meeting or not meeting the following design conditions:

- Category I – Structures. Building finished-floor elevations are at or above the 100-year/24-hour flood elevation.
- Category II – Road Access. Roads are passable during flooding. Passable is defined as roadway flooding less than 6 inches deep at the outside edge of pavement during a specific design storm. Table 10 describes the road access design storm criteria by roadway classifications.

Table 10 Category II – Road Access Design Criteria

Road Category	Storm Design
Evacuation Route	>100-Year*
Arterial	100-Year
Collector	25-Year
Neighborhood	10-Year

* For Evacuation Route, 0 inches of flooding is allowed for the 100-year storm event.

The model results do not consider potential effects from tidal surges – tidal storm-surge analysis requires a separate type of modeling and is not part of this study.

6.2 SUPPORTING DATA

Jones Edmunds evaluated stormwater FPLOS for all subbasins in Little Sarasota Bay in accordance with the methods described in Sarasota County's Unified Development Code (UDC), Appendix C14 (Sarasota County Government, 2023). The supporting data used for evaluating the FPLOS include:

- 2019 Hydro-enhanced DEM raster.
- Inundation polygons.
- Inundation depth grid for the 100-, 25-, and 10-year/24-hour design storms.
- Sarasota County building footprint polygons.
- Sarasota County Streets.
- Sarasota County 2040 Future Thoroughfare Plan Roads.
- 2022 aerial imagery.

6.3 FPLOS METHODOLOGY

The following sections describe the FPLOS evaluation methodologies for roadways and structures.

6.3.1 Structures

Jones Edmunds used the BuildingFootprints geodatabase provided by Sarasota County to identify structures with finished-floor elevations that are below the 100-year/24-hour flood elevation (i.e., FPLOS deficient). According to the metadata for the GIS features, the building footprints were derived using photogrammetry. The data were updated to include elevations. The elevation dataset was last updated in 2014. Since then, more building footprints were added to the data as recently as November 2022. However, the building footprints that were added did not have the finished floor elevations (FFE) attributed.

Jones Edmunds reviewed the available elevation data for the building footprints and found the information to be significantly inconsistent with the 2019 LiDAR. Therefore, we re-evaluated the FFE for the building footprints using the new LiDAR data to ensure more accuracy and consistency with the model information. The LiDAR was also used to parameterize the floodplain model.

New building footprints were also available that were generated from the 2019 LiDAR. The geometry of these footprints was not as refined as the previous dataset. However, they are more consistent with the new LiDAR. These footprints were used as the basis to determine the FFE from the new LiDAR and the results of the analysis were assigned to the older, but more refined, building footprints. The following steps summarize the procedures for determining the FFE for buildings.

1. Buffer the building footprints sourced from the 2019 LiDAR by 5 feet.
2. Determine the mean and maximum elevations in the buffer area.
3. Calculate the average of the mean and maximum elevations to estimate the FFE for buildings other than mobile or manufactured homes.
4. For mobile or manufactured homes, add 1 foot to estimate the FFE.
5. Assign the FFE to the more refined building footprints.

The above approach was compared with available survey data for reasonableness. FFE values were then compared to the flood-depth grid to determine whether the building meets the FPLOS conditions for Category I. Non-habitable structures were removed from the list of deficient structures.

The Little Sarasota Bay Watershed contains 86 deficient structures for the 100-year/24-hour design storm. Figure 16 and Table 11 highlight the locations of the structures within the watershed that did not meet the FPLOS conditions for Category I.

6.3.2 Roadway

Jones Edmunds determined the Roadway FPLOS by evaluating the flood depth at each segment for the different classes of roads within the study area. Sarasota County maintains a GIS road centerlines dataset called Streets, which uses the Sarasota County (SARCO) street classifications. The roads are classified according to their function. The County also maintains a Thoroughfare polyline feature class that defines Evacuation Routes and a Thoroughfare spreadsheet that contains all major road functional classes. Using the evacuation routes and the Thoroughfare spreadsheet, the Sarasota County streets were reclassified to the appropriate FPLOS roadway classifications consistent with the County's

UDC (Table 10). Table 12 describes how each street class was reclassified to be consistent with the FPLOS roadway classifications.

Figure 16 FPLOS-Deficient Structures Locations within the Watershed

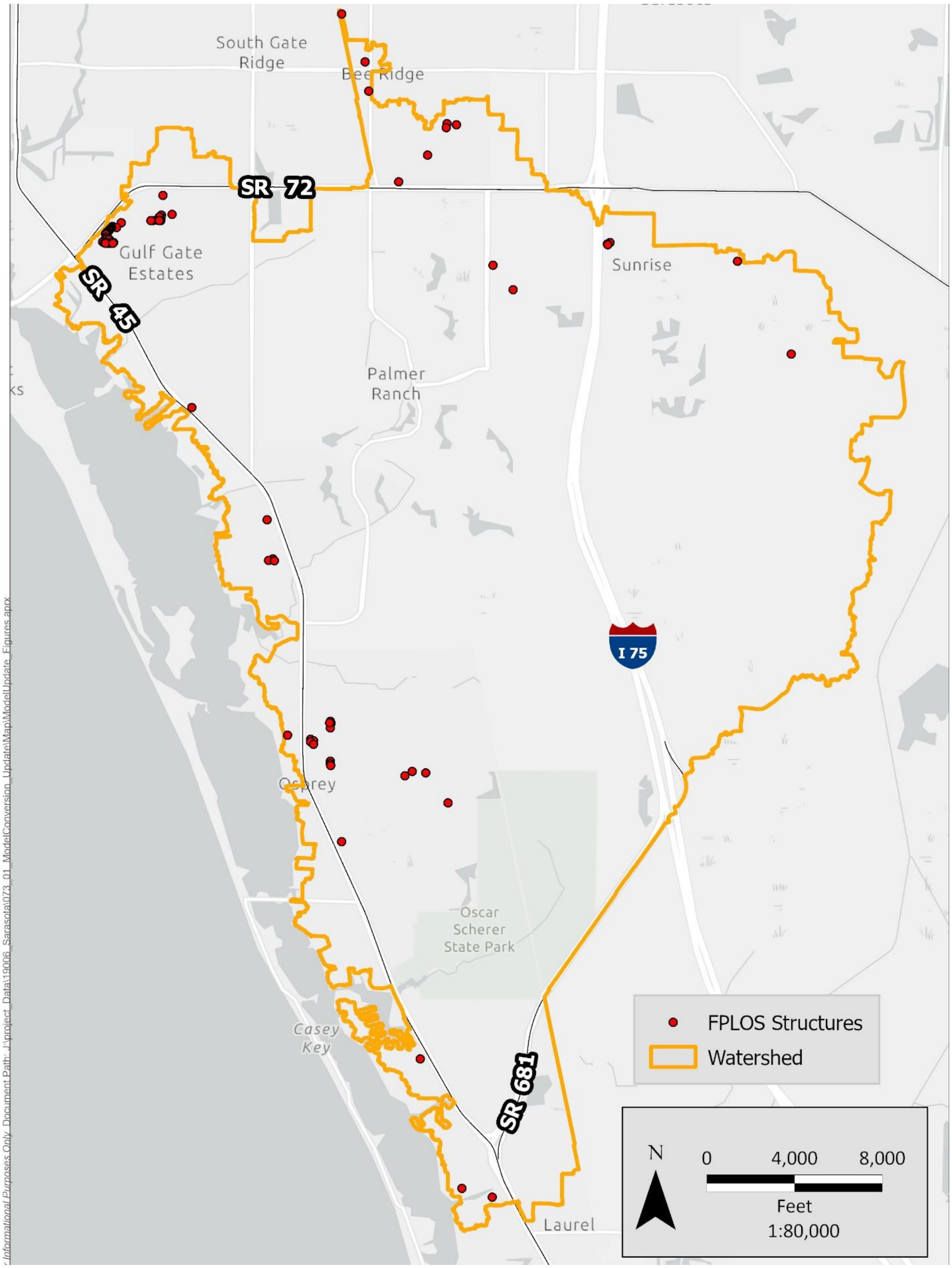


Table 11 FPLOS-Deficient Structures Data

Building Type	Address	FFE	Node	Stage 100YR	Stage 25YR	Stage 10YR
Multiple Single Family Dwellings	4214 Wilkinson Road	34.24	61805	34.45	34.18	33.94
2-Family Dwelling	4733 George Avenue	34.6	61640	34.62	34.46	34.28
Single Family Detached	4930 Mcintosh Road	34.42	61480	34.54	34.23	33.94
Single Family Detached	5224 Summerwood Court	35.6	62600	35.67	35.54	35.46
Single Family Detached	5225 Summerwood Court	35.25	62680	35.67	35.55	35.46
Single Family Detached	5232 Summerwood Court	35.25	62600	35.67	35.54	35.46
Store – One Story	4583 Clark Road	25.91	62070	26.53	25	23.65
Single Family Detached	2944 Lexington Street	16.2	40606	16.27	16.06	15.84
Single Family Detached	3050 Williamsburg Street	16.07	40263	16.09	15.74	15.51
Single Family Detached	2944 Williamsburg Street	15.14	40260	15.22	14.61	14.34
Single Family Detached	2933 Concord Street	14.74	40241	15.22	14.61	14.36
Single Family Detached	2929 Concord Street	15.18	40241	15.22	14.61	14.36
Single Family Detached	2908 Concord Street	15.15	40241	15.22	14.61	14.36
Single Family Detached	2922 Concord Street	15.08	40241	15.22	14.61	14.36
Single Family Detached	2934 Concord Street	14.87	40241	15.22	14.61	14.36
Single Family Detached	2928 Concord Street	14.79	40241	15.22	14.61	14.36
Single Family Detached	2902 Concord Street	15.08	40260	15.22	14.61	14.34
2-Family Dwelling	2627 Linda Street	13.37	40299	13.52	13.06	12.82
Single Family Detached	2456 Terry Lane	13.35	40297	13.51	13.04	12.74
Multi-Family Apartments 5 to 9 Units	6302 Gateway Avenue	13.31	40297	13.51	13.04	12.74
Single Family Detached	2452 Terry Lane	13.15	40297	13.51	13.04	12.74
Single Family Detached	2450 Terry Lane	13.03	40297	13.51	13.04	12.74
Single Family Detached	2446 Terry Lane	13.04	40297	13.51	13.04	12.74
Single Family Detached	2444 Terry Lane	12.89	40297	13.51	13.04	12.74
Single Family Detached	2440 Terry Lane	12.68	40297	13.51	13.04	12.74
Single Family Detached	2438 Terry Lane	12.72	40297	13.51	13.04	12.74
Single Family Detached	2436 Terry Lane	13.03	40297	13.51	13.04	12.74
Single Family Detached	2436 Terry Lane	13.1	40297	13.51	13.04	12.74
Single Family Detached	2428 Terry Lane	13.45	40297	13.51	13.04	12.74
Single Family Detached	2424 Terry Lane	13.37	40297	13.51	13.04	12.74
Single Family Detached	2424 Terry Lane	13.27	40297	13.51	13.04	12.74
Single Family Detached	2414 Terry Lane	13.42	40297	13.51	13.04	12.74
Single Family Detached	2402 Terry Lane	13.43	40292	13.51	13.04	12.73
Single Family Detached	2330 Terry Lane	12.94	40297	13.51	13.04	12.74
Single Family Detached	2328 Terry Lane	12.74	40297	13.51	13.04	12.74
Single Family Detached	2334 Terry Lane	13.44	40297	13.51	13.04	12.74
Single Family Detached	2402 Terry Lane	13.46	40292	13.51	13.04	12.73

Building Type	Address	FFE	Node	Stage 100YR	Stage 25YR	Stage 10YR
Single Family Detached	2330 Terry Lane	12.89	40292	13.51	13.04	12.73
Single Family Detached	2343 Terry Lane	13.49	40293	13.51	13.04	12.74
Single Family Detached	6113 Hawkins Road	34.88	80790	34.95	34.8	34.63
Single Family Detached	2333 Terry Lane	13.23	40292	13.51	13.04	12.73
Single Family Detached	2339 Terry Lane	13.48	40293	13.51	13.04	12.74
Single Family Detached	2321 Terry Lane	12.71	40292	13.51	13.04	12.73
Single Family Detached	2327 Terry Lane	13.09	40292	13.51	13.04	12.73
Single Family Detached	2327 Terry Lane	13.24	40292	13.51	13.04	12.73
Single Family Detached	2325 Terry Lane	13.15	40292	13.51	13.04	12.73
Single Family Detached	2333 Terry Lane	13.15	40292	13.51	13.04	12.73
Single Family Detached	2331 Terry Lane	13.25	40292	13.51	13.04	12.73
Single Family Detached	2321 Terry Lane	12.84	40292	13.51	13.04	12.73
Single Family Detached	2319 Terry Lane	13	40292	13.51	13.04	12.73
Single Family Detached	2337 Terry Lane	13.44	40292	13.51	13.04	12.73
Single Family Detached	2315 Terry Lane	13.31	40292	13.51	13.04	12.73
Single Family Detached	6101 Hawkins Road	34.67	80790	34.95	34.8	34.63
Single Family Detached	6101 Hawkins Road	34.67	80790	34.95	34.8	34.63
Single Family Detached	7066 Hawkins Road	33.91	80559	34.31	34.24	34.2
Single Family Detached	6530 Mandarin Road	21.62	80808	21.72	21.56	21.47
Residential Vacant Site	Mandarin Road	20.79	80841	21.68	21.16	20.95
AG – Grazing Land Soil Capability Class	7990 Dove Avenue	24.74	80590	24.84	24.37	24.2
Auto Sales (New)	7745 S Tamiami Trail	11.09	5350	11.19	11.07	11
Single Family Detached	1911 Marbeth Street	13.66	5667	13.89	13.77	13.63
Single Family Detached	1930 Joyce Street	12.05	NI2710	12.11	11.98	11.91
Single Family Detached	1858 Joyce Street	11.93	NI2710	12.11	11.98	11.91
2-Family Dwelling	1932 Joyce Street	10.99	NI2710	12.11	11.98	11.91
Single Family Detached	418 Glenwood Avenue	12.07	7OA42	12.15	11.98	11.89
Single Family Detached	352 Glenwood Avenue	11.22	7OA42	12.15	11.98	11.89
Single Family Detached	322 Glenwood Avenue	11.94	7OA42	12.15	11.98	11.89
Multiple Single Family Dwellings	224 Palmetto Avenue	13.8	NI0060	13.94	13.86	13.8
Single Family Detached	236 Washington Avenue	12.98	7OA59A	13.13	12.94	12.75
Single Family Detached	233 Pennsylvania Avenue	12.83	7OA59A	13.13	12.94	12.75
2-Family Dwelling	230 Washington Avenue	12.42	7OA59A	13.13	12.94	12.75
Single Family Detached	213 Pennsylvania Avenue	12.55	7OA59A	13.13	12.94	12.75
Single Family Detached	50 N Glenwood Avenue	12.01	7OA38C	12.49	12.13	11.9
Single Family Detached	12 N Glenwood Avenue	11.64	7OA38C	12.49	12.13	11.9
Single Family Detached	10 N Glenwood Avenue	12.49	7OA38C	12.49	12.13	11.9
Residential Vacant Site	688 E Bay Street	13.99	7738	14.21	14.03	13.81
Single Family Detached	94 Longbow Trail	14.16	7743	14.21	14.03	13.81

Building Type	Address	FFE	Node	Stage 100YR	Stage 25YR	Stage 10YR
Single Family Detached	623 S Tamiami Trail	15.22	80126	15.36	15.25	15.18
Single Family Detached	2611 Broad Street	4.51	NI1751	5.02	4.73	4.36
Single Family Detached	325 Citrus Drive	6.2	NI1480	6.25	6.08	5.62
Single Family Detached	113 James Street	8.02	NI1400	8.06	8.02	7.99
Single Family Detached	630 E Bay Street	13.97	7738	14.21	14.03	13.81
Single Family Detached	352 Glenwood Avenue	11.79	7OA42	12.15	11.98	11.89
Single Family Detached	501 Eaglenook Way	14.66	80103	14.78	14.6	14.49

Note: AG = Agricultural.

Table 12 SARCO Street Class

SARCO Thoroughfare	FPLOS Road Class
Freeway/Expressways	Evacuation[1]
Major Arterials	Arterial or Evacuation[1]
Minor Arterials	Arterial or Evacuation[1]
Major Collectors	Collectors or Evacuation[1]
Minor Collectors	Collectors
Significant Local Roads	Neighborhood

1 If a road is designated as an evacuation route according to the County's Thoroughfare polyline feature class, it is reclassified to be an evacuation route; otherwise, it is reclassified as Arterial, Collector, or Neighborhood.

The allowable flood depth for all roadway classifications is 6 inches except for Evacuation Road. No flooding is allowed for an evacuation road. Jones Edmunds assumed that the edge-of-pavement (EOP) is 3 inches lower than the road center line (i.e., the crown of the road), which corresponds to the average roadway width of 24 feet with a 2-percent cross-slope from the crown of the road. This assumption is for the initial identification of FPLOS-deficient roadway segments.

Jones Edmunds employed GIS processing to develop the flood-depth raster to identify the portions of the road in which the EOP would be under water and above the allowable flood depth for each road classification. The duration of the flooding was calculated using the assumed EOP and model results. The deficient roadways were also visually checked for the reasonableness of results. Isolated deficient segments of streets less than 25 feet were not considered FPLOS deficient. Figure 17 shows the FPLOS-deficient roadways within the watershed. Table 13 summarizes the results from the street FPLOS evaluation by roadway class. Table 14 presents the roadway segments not meeting FPLOS design criteria. In summary, approximately 3.7 percent of evacuation routes, 0.3 percent of arterial, 1.6 percent of collector, and 2 percent of neighborhood roads did not meet the FPLOS conditions for Category II.

Table 13 Roadway FPLOS Summary

FPLOS Roadway Classification	FPLOS Deficient	Linear Feet	Percent
Evacuation	No	208,851	96.3
	Yes	8,020	3.7
Arterial	No	84,469	99.7
	Yes	238	0.3
Collector	No	83,940	98.4
	Yes	1,379	1.6
Neighborhood	No	1,515,831	98
	Yes	30,805	2

Figure 17 FPLOS-Deficient Roadways

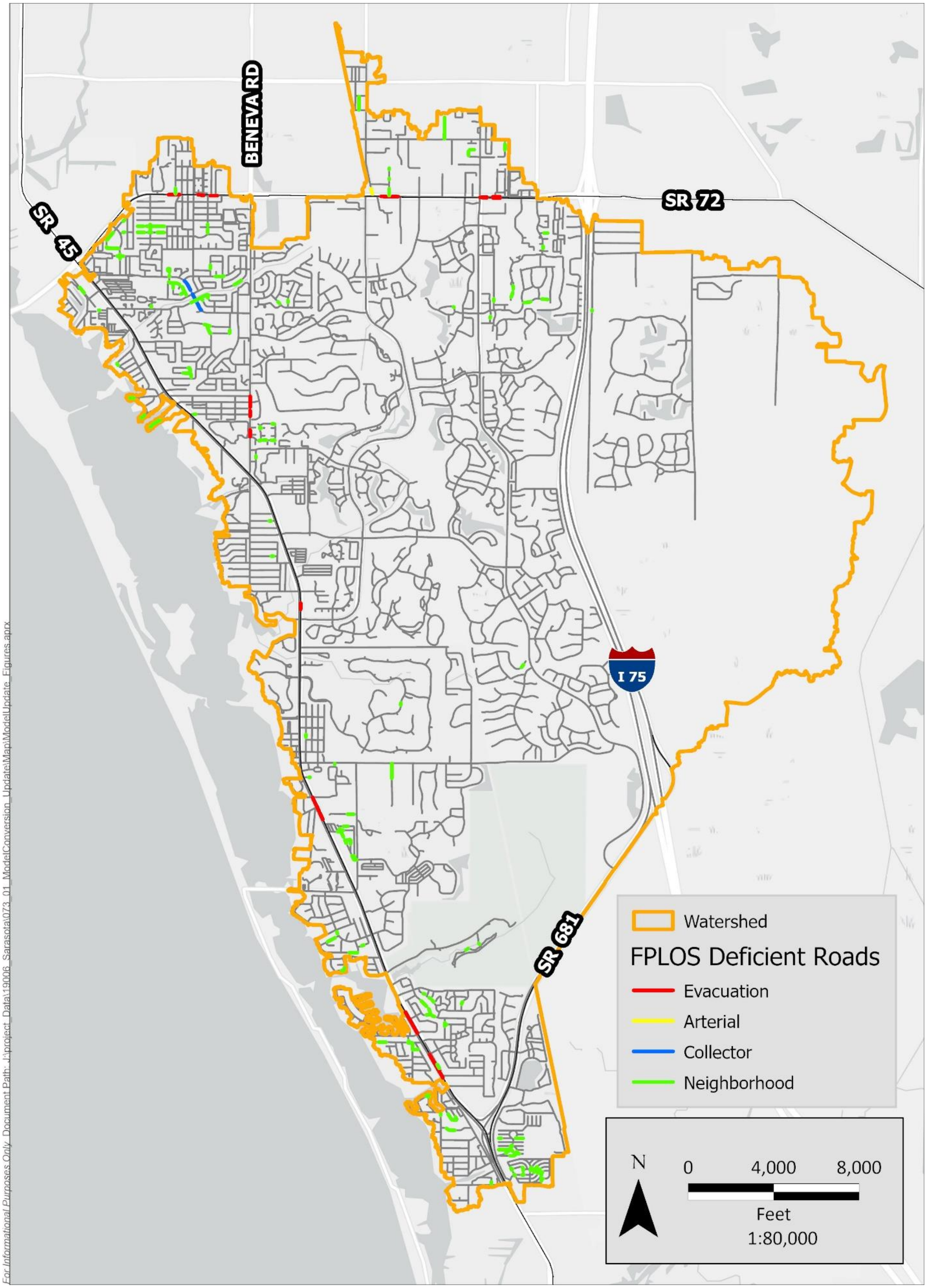


Table 14 Depth, Duration, and Extent of Roadway not meeting FPLOS Design Criteria

Street ID	Full Name	From Address	To Address	Road Classification	Length FT	Node	EOP	Design Storm	Flood Stage	Depth	Duration
ST_102012_022012	Mcintosh Road	5701	5999	Arterial	175	61200	28.5	100YR	29.09	0.59	7.25
ST_102012_022012	Mcintosh Road	5701	5999	Arterial	63	61200	28.3	100YR	29.09	0.79	9
ST_102012_000669	Gulf Gate Drive	3001	3029	Collector	530	40119	12	25YR	13.4	1.4	5.5
ST_102012_027007	Gulf Gate Drive	2831	2899	Collector	522	40151	12.5	25YR	13.46	0.96	4.75
ST_102012_027014	Gulf Gate Drive	2901	2999	Collector	327	40119	12	25YR	13.4	1.4	5.5
ST_102012_000065	Clark Road	3333	3399	Evacuation	79	40801	20.4	100YR	20.5	0.1	0.75
ST_102012_000242	S Tamiami Trail	2301	2599	Evacuation	743	NI0440	7.52	100YR	7.87	0.35	3.25
ST_102012_000298	Clark Road	3301	3313	Evacuation	43	40801	20.3	100YR	20.5	0.2	0.75
ST_102012_000301	Clark Road	3315	3331	Evacuation	201	40801	20.1	100YR	20.5	0.4	1.25
ST_102012_000522	Beneva Road	7723	7749	Evacuation	180	5406	14.8	100YR	14.93	0.13	0.75
ST_102012_000592	Clark Road	4571	4651	Evacuation	429	63084	26.2	100YR	26.53	0.33	1.75
ST_102012_000639	Beneva Road	7601	7679	Evacuation	288	5408	14.9	100YR	15.19	0.29	12.5
ST_102012_001100	Beneva Road	7901	7909	Evacuation	87	5400	14.3	100YR	14.58	0.28	2.5
ST_102012_001308	Beneva Road	7681	7721	Evacuation	221	5408	15	100YR	15.19	0.19	8.25
ST_102012_001376	S Tamiami Trail	9001	9349	Evacuation	304	60200	6.1	100YR	6.58	0.48	5
ST_102012_001633	Clark Road	5401	5499	Evacuation	219	64046	32.3	100YR	32.71	0.41	1
ST_102012_001922	S Tamiami Trail	301	509	Evacuation	682	7314	12.8	100YR	13.16	0.36	3.25
ST_102012_001922	S Tamiami Trail	301	509	Evacuation	328	7302	13.8	100YR	14.26	0.46	2.75
ST_102012_001998	N Tamiami Trail	0	0	Evacuation	121	NI1710	7.38	100YR	7.61	0.23	1.75
ST_102012_002069	Beneva Road	7825	7899	Evacuation	239	5400	14.2	100YR	14.58	0.38	3.25
ST_102012_002090	Clark Road	2953	3051	Evacuation	326	40805	16.7	100YR	16.75	0.05	1.25
ST_102012_002187	N Tamiami Trail	0	0	Evacuation	984	NI0510	7.42	100YR	7.61	0.19	2
ST_102012_002187	N Tamiami Trail	0	0	Evacuation	48	NI1710	7.42	100YR	7.61	0.19	1.75
ST_102012_021259	Clark Road	3201	3239	Evacuation	268	40820	19.1	100YR	19.57	0.47	1.5
ST_102012_022824	S Tamiami Trail	2151	2299	Evacuation	372	NI0440	7.58	100YR	7.87	0.29	3
ST_102012_023542	Clark Road	3053	3075	Evacuation	105	40804	16.7	100YR	16.94	0.24	2
ST_102012_026210	Beneva Road	7751	7823	Evacuation	93	5406	14.6	100YR	14.93	0.33	1
ST_102012_026998	Clark Road	4523	4569	Evacuation	261	63086	25.9	100YR	26.55	0.65	3.5

Street ID	Full Name	From Address	To Address	Road Classification	Length FT	Node	EOP	Design Storm	Flood Stage	Depth	Duration
ST_102012_026998	Clark Road	4523	4569	Evacuation	125	63084	26.4	100YR	26.53	0.13	1
ST_102012_028155	Clark Road	0	0	Evacuation	238	64042	31.8	100YR	32.61	0.81	1.25
ST_102012_028155	Clark Road	0	0	Evacuation	328	64046	32.3	100YR	32.71	0.41	1
ST_102012_028402	N Tamiami Trail	0	0	Evacuation	111	NI1710	7.37	100YR	7.61	0.24	1.75
ST_102012_028991	Clark Road	5301	5399	Evacuation	328	64042	31.2	100YR	32.61	1.41	1.25
ST_102012_028991	Clark Road	5301	5399	Evacuation	124	64046	32.5	100YR	32.71	0.21	0.75
ST_01272017_113637	Greenbrook Drive	5356	5498	Neighborhood	165	7542	14.3	10YR	15.23	0.93	55.5
ST_03072018_133386	Rain Song Road	8700	8754	Neighborhood	76	80799	20.2	10YR	21.02	0.82	20.8
ST_03072018_134178	Long Shore Loop	5905	5953	Neighborhood	316	80901	20.8	10YR	22.14	1.34	96.3
ST_03072018_134184	Long Shore Loop	5865	5903	Neighborhood	274	80901	20.9	10YR	22.14	1.24	96.3
ST_03202014_035223	Explorer Drive	2	52	Neighborhood	30	7162	13.8	10YR	15.87	2.07	96.3
ST_05312013_032534	Holy Spirit Lane	3900	3998	Neighborhood	51	7122	15.4	10YR	16.01	0.61	84
ST_102012_001003	1st Street	11	20	Neighborhood	48	NB3020	13.2	10YR	14.16	0.96	93
ST_102012_001025	Access	0	0	Neighborhood	88	5686	13.8	10YR	14.58	0.78	4.75
ST_102012_002658	Tavernier Drive	101	199	Neighborhood	268	NI1751	3.39	10YR	4.36	0.97	4.75
ST_102012_003428	Palm Drive	141	207	Neighborhood	94	NK3050	6.73	10YR	7.68	0.95	84
ST_102012_004346	1st Street E	267	261	Neighborhood	139	NK3050	6.68	10YR	7.68	1	84
ST_102012_004403	Gateway Avenue	6501	6699	Neighborhood	125	40291	11.8	10YR	12.72	0.92	3
ST_102012_004484	Kingston Boulevard	3885	3895	Neighborhood	113	40183	16.9	10YR	17.39	0.49	5
ST_102012_004802	Mall Drive	2629	2699	Neighborhood	159	40291	11.8	10YR	12.72	0.92	3
ST_102012_005061	Spanish Lakes Drive	0	0	Neighborhood	25	NK3075	6.79	10YR	7.65	0.86	6.75
ST_102012_005191	Bispham Road	2621	2999	Neighborhood	155	40120	12.3	10YR	13.15	0.85	4.25
ST_102012_005191	Bispham Road	2621	2999	Neighborhood	170	40121	12.7	10YR	13.41	0.71	3.75
ST_102012_005255	Valley Forge Street	2901	2999	Neighborhood	322	40240	13.2	10YR	14.36	1.16	9.75
ST_102012_005255	Valley Forge Street	2901	2999	Neighborhood	67	40260	13.7	10YR	14.34	0.64	2.75
ST_102012_005308	Linda Street	2601	2713	Neighborhood	72	40299	12.2	10YR	12.82	0.62	3.25
ST_102012_005495	Sarah Avenue	5601	5723	Neighborhood	42	62205	26.8	10YR	27.55	0.75	15.5
ST_102012_005495	Sarah Avenue	5601	5723	Neighborhood	52	62250	28.1	10YR	29.11	1.01	12.5
ST_102012_005506	Woodwind Drive	6863	6933	Neighborhood	29	40136	10.4	10YR	11.24	0.84	1.75

Street ID	Full Name	From Address	To Address	Road Classification	Length FT	Node	EOP	Design Storm	Flood Stage	Depth	Duration
ST_102012_005687	George Avenue	4901	4999	Neighborhood	624	61375	33.5	10YR	34.31	0.81	4.5
ST_102012_005908	Mall Drive	2501	2627	Neighborhood	133	40291	11.8	10YR	12.72	0.92	3
ST_102012_006107	Montana Avenue	217	399	Neighborhood	349	NI1780	7.22	10YR	9.05	1.83	96.3
ST_102012_006469	Landlubber Lane	1	99	Neighborhood	107	NI3160	3.52	10YR	4.95	1.43	93.3
ST_102012_006522	Tropic Drive	310	334	Neighborhood	133	80127	13.9	10YR	15.18	1.28	20
ST_102012_006542	Park Lane Drive	133	332	Neighborhood	123	80126	14	10YR	15.18	1.18	17.8
ST_102012_006686	Anchor Way	6601	6637	Neighborhood	179	40234	12.1	10YR	13.51	1.41	5
ST_102012_006754	Cove Terrace	7301	7321	Neighborhood	103	NB3090	11.4	10YR	12.16	0.76	2
ST_102012_006781	Ashton Manor Drive	5301	5499	Neighborhood	274	64267	35.4	10YR	36.53	1.13	17
ST_102012_007197	Lake Drive	411	499	Neighborhood	257	NK3050	6.16	10YR	7.68	1.52	84.3
ST_102012_007432	Spanish Lakes Drive	0	0	Neighborhood	57	NK3075	6.77	10YR	7.65	0.88	7
ST_102012_007633	Terry Lane	2501	2691	Neighborhood	82	40299	12.1	10YR	12.82	0.72	3.75
ST_102012_008247	Concord Street	2801	2899	Neighborhood	273	40212	13.2	10YR	14.18	0.98	2.5
ST_102012_008247	Concord Street	2801	2899	Neighborhood	174	40260	13.2	10YR	14.34	1.14	3.75
ST_102012_008468	Village Drive	225	239	Neighborhood	210	NK3050	5.94	10YR	7.68	1.74	84.3
ST_102012_008514	Safe Harbor Drive	2715	2799	Neighborhood	303	40233	11.3	10YR	12.51	1.21	3.25
ST_102012_009001	Markridge Road	3201	3259	Neighborhood	64	40161	14.1	10YR	14.77	0.67	4.5
ST_102012_009033	Matisse Circle W	129	199	Neighborhood	87	NI1640	8.82	10YR	9.47	0.65	1.75
ST_102012_010448	Nelson Avenue	6053	6099	Neighborhood	55	40268	16.1	10YR	16.78	0.68	4
ST_102012_010578	Village Drive	209	223	Neighborhood	34	NK3050	6.61	10YR	7.68	1.07	84
ST_102012_011133	Anchor Way	0	0	Neighborhood	174	40234	12.1	10YR	13.51	1.41	5
ST_102012_011549	Cove Terrace	7669	7699	Neighborhood	187	NI0190	3.34	10YR	4.29	0.95	2.5
ST_102012_011560	Eugene Street	2101	2199	Neighborhood	85	5350	10.2	10YR	11	0.8	4.75
ST_102012_012311	Colonial Drive	6101	6123	Neighborhood	286	40260	13.2	10YR	14.34	1.14	3.75
ST_102012_012572	Villa Park Drive	517	529	Neighborhood	143	NI2180	5.66	10YR	6.79	1.13	5
ST_102012_012829	Easton Court	6965	6999	Neighborhood	94	40183	16.7	10YR	17.39	0.69	5.25
ST_102012_012870	Bispham Road	2601	2619	Neighborhood	181	40119	11.7	10YR	13.09	1.39	5.25
ST_102012_012870	Bispham Road	2601	2619	Neighborhood	102	40120	12.3	10YR	13.15	0.85	4
ST_102012_012983	2Nd Street W	246	254	Neighborhood	249	NK3050	5.8	10YR	7.68	1.88	84.3

Street ID	Full Name	From Address	To Address	Road Classification	Length FT	Node	EOP	Design Storm	Flood Stage	Depth	Duration
ST_102012_012983	2Nd Street W	246	254	Neighborhood	269	NK2855	6	10YR	7.67	1.67	6.25
ST_102012_013220	Santa Cruz	342	355	Neighborhood	148	NK3075	6.66	10YR	7.65	0.99	7.25
ST_102012_013554	Boca Ciega Street	1	9	Neighborhood	75	NK2690	6.67	10YR	7.68	1.01	8
ST_102012_014662	Timberwood Circle	7819	7819	Neighborhood	47	5334	13.9	10YR	14.85	0.95	7
ST_102012_014682	Pineglen Court	7901	7999	Neighborhood	37	5336	13.9	10YR	14.85	0.95	7
ST_102012_014714	La Costa Drive	0	0	Neighborhood	91	NK3075	6.61	10YR	7.65	1.04	7.5
ST_102012_014945	Timberwood Circle	0	0	Neighborhood	147	5336	13.6	10YR	14.85	1.25	9
ST_102012_015273	Summerwood Court	5101	5299	Neighborhood	233	62600	34.2	10YR	35.46	1.26	13
ST_102012_015273	Summerwood Court	5101	5299	Neighborhood	773	62680	34	10YR	35.46	1.46	13
ST_102012_015295	Telegraph Road	8301	8399	Neighborhood	50	80770	20.5	10YR	21.73	1.23	6.5
ST_102012_015531	Marbeth Street	1701	1999	Neighborhood	91	65165	12.8	10YR	13.63	0.83	4.25
ST_102012_015702	Safe Harbor Drive	2861	2899	Neighborhood	154	40118	11.3	10YR	12.44	1.14	5
ST_102012_015750	Post Road	2501	2899	Neighborhood	182	40155	14.2	10YR	15.19	0.99	5
ST_102012_015841	Villa Drive	209	299	Neighborhood	39	NI3260	3.48	10YR	4.36	0.88	3.75
ST_102012_016546	James Street	1301	1399	Neighborhood	98	NI1400	7.29	10YR	7.99	0.7	85.5
ST_102012_016613	Bispham Road	3001	3199	Neighborhood	62	40121	12.8	10YR	13.41	0.61	3
ST_102012_016939	San Carlos Street	0	0	Neighborhood	71	NK3075	6.59	10YR	7.65	1.06	7.5
ST_102012_017277	3Rd Street W	301	219	Neighborhood	61	NK3050	6.65	10YR	7.68	1.03	84
ST_102012_017286	Bluewater Avenue	6555	6623	Neighborhood	158	40162	14.7	10YR	15.31	0.61	5.75
ST_102012_017440	Captiva Street	0	0	Neighborhood	36	NK3075	6.8	10YR	7.65	0.85	6.75
ST_102012_017719	Doral Court	5701	5799	Neighborhood	174	80928	29.1	10YR	29.84	0.74	1.25
ST_102012_018188	5th Street E	90	96	Neighborhood	352	NK3054	8.06	10YR	9.67	1.61	25.8
ST_102012_018233	Anchor Way	6639	6699	Neighborhood	110	40234	12.7	10YR	13.51	0.81	4
ST_102012_018534	Angelico Drive	201	299	Neighborhood	91	NI1640	8.6	10YR	9.47	0.87	1.75
ST_102012_018835	5th Street W	135	123	Neighborhood	111	NK2854	7.86	10YR	8.98	1.12	87.8
ST_102012_018909	Roxbury Drive	6701	6899	Neighborhood	394	40125	13.4	10YR	14.45	1.05	5.25
ST_102012_018920	Chase Circle	3001	3099	Neighborhood	140	40121	12.7	10YR	13.41	0.71	3.75
ST_102012_019097	Markridge Road	3101	3129	Neighborhood	34	40161	14.1	10YR	14.77	0.67	4.5
ST_102012_019468	Valley Forge Street	2801	2899	Neighborhood	326	40212	12.9	10YR	14.18	1.28	3

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ST_102012_019468	Valley Forge Street	2801	2899	Neighborhood	73	40260	13.6	10YR	14.34	0.74	2.75
ST_102012_019478	Palm Drive	101	139	Neighborhood	104	NK3050	6.13	10YR	7.68	1.55	84.3
ST_102012_019533	White Pine Court	3601	3699	Neighborhood	73	5334	13.9	10YR	14.85	0.95	7
ST_102012_019760	Timberwood Circle	0	0	Neighborhood	145	5336	13.8	10YR	14.85	1.05	7.75
ST_102012_019813	Markridge Road	3131	3199	Neighborhood	294	40161	13.8	10YR	14.77	0.97	5
ST_102012_019843	Faith Avenue	101	899	Neighborhood	661	7733	12.7	10YR	13.81	1.11	15.5
ST_102012_020146	Matisse Circle W	101	127	Neighborhood	84	NI1640	8.87	10YR	9.47	0.6	1.75
ST_102012_020436	Sarah Avenue	5725	5799	Neighborhood	306	62040	24.6	10YR	25.9	1.3	11
ST_102012_020490	Da Vinci Drive	125	149	Neighborhood	251	NI2190	5.82	10YR	7.08	1.26	4.5
ST_102012_020490	Da Vinci Drive	125	149	Neighborhood	350	NI2540	5.81	10YR	7.07	1.26	4.5
ST_102012_020611	Villa Park Drive	513	515	Neighborhood	63	NI2180	5.84	10YR	6.79	0.95	4.25
ST_102012_020766	Palmetto Street	2601	2699	Neighborhood	220	NI1751	3.57	10YR	4.36	0.79	4.5
ST_102012_020766	Palmetto Street	2601	2699	Neighborhood	77	NI0480	3.64	10YR	4.36	0.72	3.75
ST_102012_021149	Approach Road	6119	6199	Neighborhood	104	80926	27.2	10YR	28.09	0.89	2.5
ST_102012_021255	Four Knot Lane	201	265	Neighborhood	397	NI1530	3.88	10YR	5.15	1.27	2.75
ST_102012_021310	Tropic Drive	292	308	Neighborhood	224	80124	13.6	10YR	15.22	1.62	11.3
ST_102012_021402	Edgewood Drive	100	198	Neighborhood	202	7138	14.1	10YR	15.14	1.04	9.75
ST_102012_021973	Boca Ciega Street	117	118	Neighborhood	109	NK2690	6.65	10YR	7.68	1.03	8.5
ST_102012_022171	Timberwood Circle	7821	7889	Neighborhood	123	5334	13.8	10YR	14.85	1.05	7.75
ST_102012_022200	Bounty Drive	7201	7229	Neighborhood	370	40154	13.9	10YR	15.19	1.29	5.25
ST_102012_022215	Bayshore Road	1901	1909	Neighborhood	60	NI1170	7.23	10YR	8.06	0.83	1
ST_102012_022229	Montana Avenue	201	207	Neighborhood	190	NI0480	3	10YR	4.36	1.36	5.5
ST_102012_022296	Villa Park Drive	501	511	Neighborhood	87	NI2180	5.77	10YR	6.79	1.02	4.5
ST_102012_022463	Palm Air Drive	190	244	Neighborhood	169	80124	13.6	10YR	15.22	1.62	11.3
ST_102012_022471	Captiva Street	124	145	Neighborhood	174	NK2690	6.7	10YR	7.68	0.98	8
ST_102012_022521	Bellini Circle	415	499	Neighborhood	181	NI1140	4.89	10YR	5.79	0.9	1.5
ST_102012_022712	Nutmeg Avenue	5701	5799	Neighborhood	245	40752	15.7	10YR	16.77	1.07	2.75
ST_102012_022882	Avenue A	6501	6899	Neighborhood	337	NB2050	9.45	10YR	10.78	1.33	1.75
ST_102012_022942	Sun Air Circle	272	250	Neighborhood	443	80127	13.9	10YR	15.18	1.28	20.5

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ST_102012_022952	Approach Road	6703	6899	Neighborhood	369	80896	19.9	10YR	21.09	1.19	12.8
ST_102012_022984	South Creek Drive	500	598	Neighborhood	101	NI1820	3.76	10YR	4.95	1.19	1.25
ST_102012_023010	Pine View Circle	0	0	Neighborhood	210	5121	12	10YR	13.4	1.4	4.75
ST_102012_023063	Gardiners Bay Circle	4901	4999	Neighborhood	36	60565	20.1	10YR	20.77	0.67	9.5
ST_102012_023091	San Carlos Street	0	0	Neighborhood	33	NK3075	6.51	10YR	7.65	1.14	7.75
ST_102012_023101	Sanibel Street	168	189	Neighborhood	221	NK2690	6.71	10YR	7.68	0.97	8
ST_102012_023144	Gateway Avenue	6387	6499	Neighborhood	84	40291	11.6	10YR	12.72	1.12	3.5
ST_102012_023164	Park Lane Drive	0	0	Neighborhood	162	80126	13.7	10YR	15.18	1.48	22.8
ST_102012_023178	Washington Avenue	201	299	Neighborhood	130	7OA59A	11.9	10YR	12.75	0.85	3
ST_102012_023451	La Costa Drive	0	0	Neighborhood	56	NK3075	6.48	10YR	7.65	1.17	7.75
ST_102012_023508	Lookout Point Drive	101	207	Neighborhood	383	NI1860	3.18	10YR	4.38	1.2	1.25
ST_102012_023525	Colonial Drive	6053	6099	Neighborhood	86	40260	13	10YR	14.34	1.34	4
ST_102012_023691	Southpointe Drive	1701	1899	Neighborhood	541	NI0030	3.45	10YR	4.84	1.39	3.25
ST_102012_023905	Sandalwood Drive	1701	1799	Neighborhood	187	NI0160	3.34	10YR	4.66	1.32	87.5
ST_102012_023973	Bispham Road	2449	2599	Neighborhood	248	40119	11.5	10YR	13.09	1.59	5.75
ST_102012_024115	La Costa Drive	0	0	Neighborhood	48	NK3075	6.65	10YR	7.65	1	7.25
ST_102012_024120	Safe Harbor Drive	2701	2713	Neighborhood	222	40233	11.3	10YR	12.51	1.21	3
ST_102012_024182	Village Drive	241	289	Neighborhood	242	NK3050	5.94	10YR	7.68	1.74	84.3
ST_102012_024421	Half Moon Drive	6701	6899	Neighborhood	210	40118	11.4	10YR	12.44	1.04	4.75
ST_102012_024421	Half Moon Drive	6701	6899	Neighborhood	239	40233	11.3	10YR	12.51	1.21	3
ST_102012_024453	Laurencin Drive	401	475	Neighborhood	125	80013	8.87	10YR	9.73	0.86	6
ST_102012_024460	Southbay Drive	1411	1439	Neighborhood	88	NI1910	4.59	10YR	5.2	0.61	2.5
ST_102012_024670	Timberwood Circle	7813	7817	Neighborhood	29	5334	13.9	10YR	14.85	0.95	7
ST_102012_024865	Van Dyck Drive	125	199	Neighborhood	198	NI2190	5.76	10YR	7.08	1.32	5
ST_102012_025109	Dante Drive	301	399	Neighborhood	686	NI1540	5.44	10YR	7.04	1.6	3.75
ST_102012_025161	Pine View Circle	2201	2299	Neighborhood	621	5121	11.7	10YR	13.4	1.7	5
ST_102012_025192	Cavallini Drive	1	399	Neighborhood	419	NI2360	6.54	10YR	7.75	1.21	2.75
ST_102012_025440	Santa Cruz	0	0	Neighborhood	103	NK3075	6.47	10YR	7.65	1.18	7.75
ST_102012_025452	Tropic Drive	138	146	Neighborhood	93	80126	14	10YR	15.18	1.18	16.8

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ST_102012_025466	Tropic Drive	0	0	Neighborhood	62	80126	13.9	10YR	15.18	1.28	19.8
ST_102012_025616	Spanish Lakes Drive	212	233	Neighborhood	298	NK2690	6.63	10YR	7.68	1.05	8.5
ST_102012_025747	Terry Lane	2301	2499	Neighborhood	609	40292	11.3	10YR	12.72	1.42	3.75
ST_102012_025747	Terry Lane	2301	2499	Neighborhood	461	40297	11.3	10YR	12.73	1.43	4.25
ST_102012_025925	Da Vinci Drive	151	153	Neighborhood	230	NI2190	5.83	10YR	7.08	1.25	4.5
ST_102012_025981	Mandarin Road	0	0	Neighborhood	103	80838	20.1	10YR	20.99	0.89	12.8
ST_102012_026493	Timberwood Circle	7805	7809	Neighborhood	86	5334	13.8	10YR	14.85	1.05	7.5
ST_102012_026511	N Tamiami Trail	0	0	Neighborhood	197	NI0510	6.13	10YR	6.89	0.76	2.75
ST_102012_026546	Tropic Drive	288	290	Neighborhood	111	80124	13.5	10YR	15.22	1.72	11.8
ST_102012_026653	San Carlos Street	257	264	Neighborhood	63	NK3075	6.6	10YR	7.65	1.05	7.5
ST_102012_026806	Mac Ewen Drive	888	898	Neighborhood	108	7020	10.1	10YR	10.9	0.8	9.5
ST_102012_026845	Old Ashwood Drive	5101	5299	Neighborhood	408	64440	35.2	10YR	36.1	0.9	8.25
ST_102012_026955	Lockwood Terrace	3001	3099	Neighborhood	136	40120	12.3	10YR	13.15	0.85	4.25
ST_102012_027133	Woodwind Drive	6935	6999	Neighborhood	24	40136	10.3	10YR	11.24	0.94	2
ST_102012_027135	Antigua Place	7141	7299	Neighborhood	154	5211	14.4	10YR	15.02	0.62	3.75
ST_102012_027135	Antigua Place	7141	7299	Neighborhood	40	40154	14.2	10YR	15.19	0.99	5
ST_102012_027254	Tropic Drive	336	350	Neighborhood	270	80126	14	10YR	15.18	1.18	18.3
ST_102012_027254	Tropic Drive	336	350	Neighborhood	32	80127	13.9	10YR	15.18	1.28	20.5
ST_102012_027615	Nelson Avenue	6101	6199	Neighborhood	172	40267	16	10YR	16.77	0.77	4
ST_102012_027685	Post Road	2901	3199	Neighborhood	91	40155	14.3	10YR	15.19	0.89	4.75
ST_102012_027757	Oscar Scherer State Park	0	0	Neighborhood	46	80032	3.31	10YR	3.85	0.54	14.3
ST_102012_027896	Safe Harbor Drive	2801	2859	Neighborhood	285	40118	11.3	10YR	12.44	1.14	5.25
ST_102012_027942	Joyce Street	1801	1999	Neighborhood	101	NI2710	11.1	10YR	11.91	0.81	5
ST_102012_028019	Lake Drive	201	409	Neighborhood	233	NK3050	6.11	10YR	7.68	1.57	84.3
ST_102012_017921	Lexington Street	2901	2998	Neighborhood	63	40607	15.1	10YR	15.74	0.64	15.76
ST_102012_022463	Palm Air Dr	190	244	Neighborhood	530	80127	14.1	10YR	15.18	1.08	15.18
ST_102012_028021	Concord Street	2901	2999	Neighborhood	265	40260	13.2	10YR	14.34	1.14	3.75
ST_102012_028021	Concord Street	2901	2999	Neighborhood	393	40241	12.8	10YR	14.36	1.56	16
ST_102012_028274	South Creek Drive	1757	1799	Neighborhood	104	NI1820	3.89	10YR	4.95	1.06	1.25

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ST_102012_030637	Burney Road	101	299	Neighborhood	288	7140	14.1	10YR	15.07	0.97	10.3