SARASOTA COUNTY

FUTURE CONDITIONS FLOODPLAIN ANALYSES

Sarasota County | January 2019

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FUTURE CONDITIONS FLOODPLAIN ANALYSES

Prepared for:

Sarasota County

1001 Sarasota Center Boulevard

Sarasota, Florida 34240

Prepared by:

Jones Edmunds & Associates, Inc.

7230 Kyle Ct

Sarasota, FL 34240

Jones Edmunds Project No.: 19006-058-01

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1 INTRODUCTION

1.1 PURPOSE

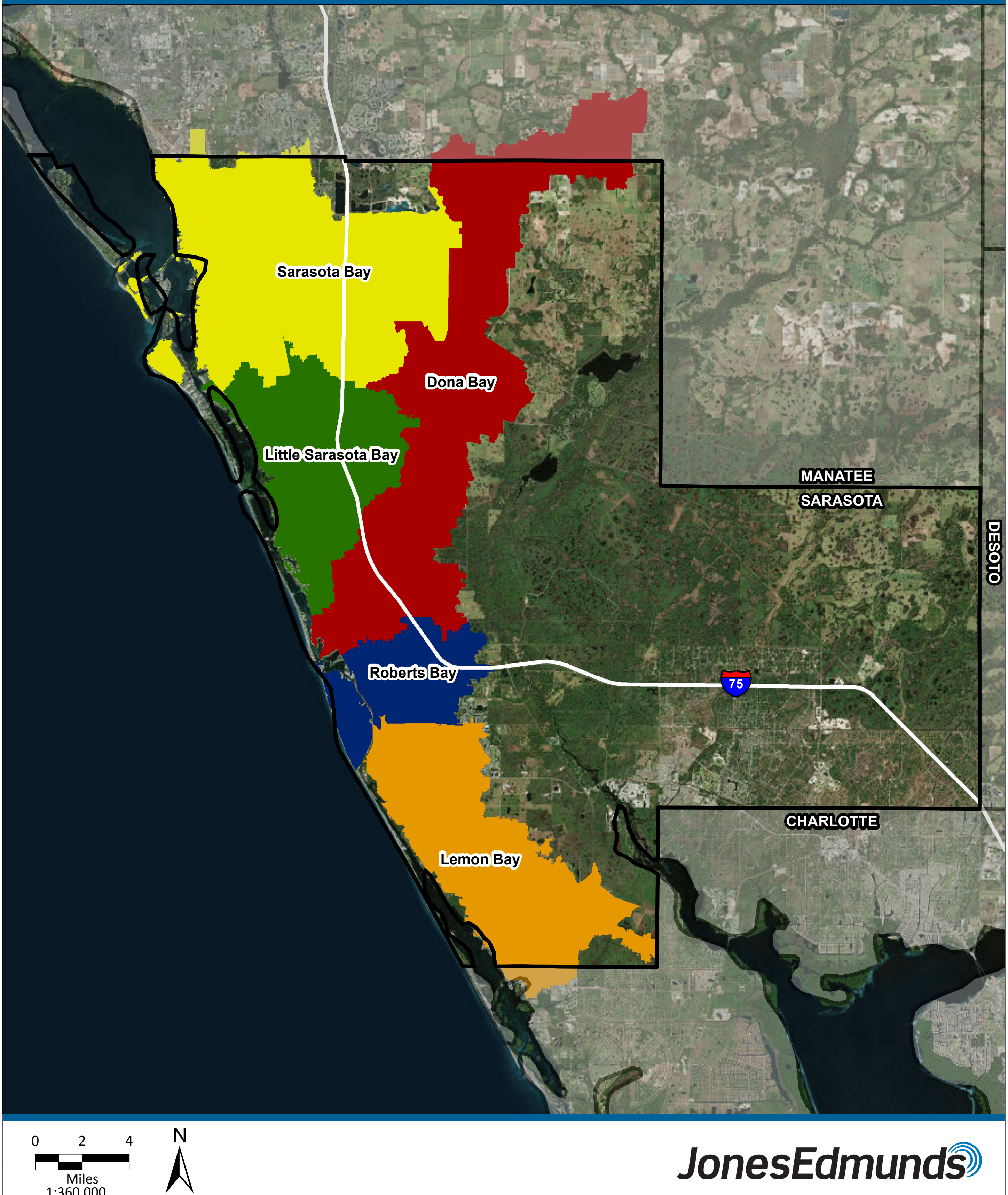
The National Oceanic and Atmospheric Administration (NOAA) estimates that sea-level rise (SLR) will impact coastal communities in the next 25 years. Planning for SLR impacts and future development conditions will aid communities in becoming more resilient to climate changes. The purpose of this analysis is to produce mapping information to depict the changes regarding the extent of flood hazards in response to changes in future hydrologic conditions and projected SLR scenarios of 2, 4, 6.17, 8, and 10 feet in five watersheds in Sarasota County. The watersheds include recently updated models for Phillippi Creek, Lemon Bay, Dona Bay, Roberts Bay, and Little Sarasota Bay (Figure 1-1). The 6.17 feet represents the NOAA 2017 projection that corresponds to the intermediate-high relative sea-level change for 2100.

For the watershed models to be effectively used to evaluate future conditions and SLR, the five watersheds were merged with the adjacent coastal models. The combined models allow for determination of coastal tailwater effects on inland portions.

Figure 1-1

Sarasota County Watersheds

Sarasota County Future Conditions Floodplain Analyses



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2 EXISTING CONDITIONS

To effectively model the coastal influences due to SLR and future hydrologic changes, the geographic information systems (GIS) data for the five watersheds were merged with their respective coastal models. These coastal models included:

- Coastal Fringe Phase I – Robert Bay.
- Coastal Fringe Phase II – Lemon Bay.
- Coastal Fringe Phase III – Sarasota Bay, Little Sarasota Bay, and Dona Bay.
- Coastal Fringe Lyons Bay.
- Island of Venice.
- Whitaker Bayou.
- Hudson Bayou.

2.1 LEMON BAY

The Lemon Bay watershed boundaries were revised to be consistent with Roberts Bay and Coastal Fringe Phase II boundaries. Hydraulic connections between the watersheds were updated accordingly. Basin areas, stage areas, weir inverts, and cross-sections were revised where necessary due to the boundary changes. The two geodatabases were then merged. The combined geodatabase was used to export the model information to Interconnected Pond Routing Version 3 (ICPR3) and to simulate the 100-year/24-hour design storm. The results from the combined model were compared to the results from the individual models. Differences in node stages were observed in areas along the boundary between the previous watershed models. These differences were expected since the models are hydraulically connected and node elevations are now dynamically calculated between the watersheds.

2.2 ROBERTS BAY

The Island of Venice watershed drains to Roberts Bay and the Gulf of Mexico. The model was developed in 2009, and elevation data were based on the National Geodetic Vertical Datum of 1929 (NGVD 29). Before merging the model with the Roberts Bay watershed, the Island of Venice data were converted to the County's current Geographic Watershed Information Systems (GWIS) format to be consistent with the Roberts Bay watershed data format. In additional, elevation data in the Island of Venice watershed were converted to the North American Vertical Datum of 1988 (NAVD 88). The two model geodatabases were combined and exported to ICPR3 to simulate the 100-year/24-hour design storm. The results were compared with the previous individual model results to ensure that the conversion was reasonable.

Additional boundaries along the Roberts Bay watershed were revised to be consistent with the Lemon Bay, Dona Bay, and Coastal Fringe Phase III watersheds. Hydraulic connections between the watersheds were updated accordingly. Basin areas, stage areas, weir inverts, and cross-sections were revised where necessary.

Once the boundaries were revised to be consistent, the Island of Venice/Roberts Bay watershed was combined with the Dona Bay portion of Coastal Fringe Phase III to form a single Roberts Bay watershed. The combined geodatabase was exported to ICPR3 and the 100-year/24-hour design storm was simulated. Due to its large size, the combined Roberts

Bay model took approximately 1 week to run. To optimize the run time of the model, several adjustments were made, such as thinning the cross-section and stage area data. However, the data thinning did not improve the run-time significantly. Unlike other watershed models for Sarasota County, the Roberts Bay model contains areas as small as 0.00001 acre-foot (ac-ft) in the stage-storage data. This may lead to some instabilities in the model or make the model take longer to converge on a solution and increase the run time. By changing the minimum storage values to 0.01 ac-ft (consistent with other models for this area), the model run-time improved significantly. The results from the combined model were compared against the results from the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.3 Dona Bay

The Dona Bay watershed shares its boundary with the Little Sarasota Bay, Phillippi Creek, Roberts Bay, and Coastal Fringe Lyons Bay watersheds.

The Coastal Fringe Lyons Bay watershed was originally developed using elevations referenced to the NGVD 29 datum. The watershed geodatabase was also recently converted to GWIS. Reviewing the data revealed discrepancies between the model and geodatabase. Therefore, the geodatabase was rectified to match the ICPR3 model inputs. Elevation data were also converted to NAVD 88 to be consistent with the County's other watershed models.

Several issues were identified in the Coastal Fringe Lyons Bay watershed model, and the County recognizes that the model will require additional work (not included in this scope) to accurately represent existing conditions in that watershed. For this study, many basins were aggregated and hydraulic parameters were revised based on Light Detection and Ranging (LiDAR) information to reasonably represent the main channel system that drains into Lyons Bay. Since the basins were changed for the purpose of this study, the hydrologic parameters (i.e., Curve Number [CN] and Time-of-Concentration [TC]) were also revised using the Natural Resource Conservation Service CN and Technical Release-55 methodologies.

The Dona Bay watershed boundaries were revised to be consistent with Little Sarasota Bay, Phillippi Creek, Roberts Bay, and the new Coastal Fringe Lyons Bay geodatabases. Hydraulic connections between the watersheds were revised. Basin areas, stage areas, weir inverts, and cross-sections were updated as necessary.

The Coastal Fringe Lyons Bay geodatabase was then merged with the Dona Bay geodatabase. The combined geodatabase was exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the results of the individual watershed models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.4 Little Sarasota Bay

The Little Sarasota Bay watershed boundaries were revised to be consistent with Dona Bay, Phillippi Creek, Coastal Fringe Phase I, and Coastal Fringe Phase III watersheds. Hydraulic connections between the watersheds were revised accordingly. Basin areas, stage areas, weir inverts, and cross-sections were updated where appropriate. The Coastal Fringe

Phase III watershed was then merged with the Little Sarasota Bay watershed. The combined geodatabase was then exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.5 SARASOTA BAY

The Sarasota Bay watershed combined model includes Phillippi Creek, Hudson Bayou, Whitaker Bayou, Coastal Fringe Phase III, and the majority of Coastal Fringe Phase I. Before merging with the Sarasota Bay watershed, the Hudson Bayou and Whitaker Bayou models were converted to NAVD 88. Boundaries and hydraulic connections between the watersheds were revised to be consistent with each other. Basin areas, stage areas, weir inverts, and cross-sections were updated as necessary. The combined geodatabase was then exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

3 FUTURE CONDITIONS

3.1 BACKGROUND

Two factors used for developing the future conditions floodplain map for this Study are future development in the watershed and SLR.

3.1.1 FUTURE DEVELOPMENT IN THE WATERSHED

As Sarasota County recovers from the recent economic downturn, the next 5 years indicate an increased growth rate with almost 24,000 new residents projected from 2015 to 2020, at an average annual increase of approximately 1.2 percent per year. Long-term projections indicate that the County could reach nearly a half-million residents by 2040.

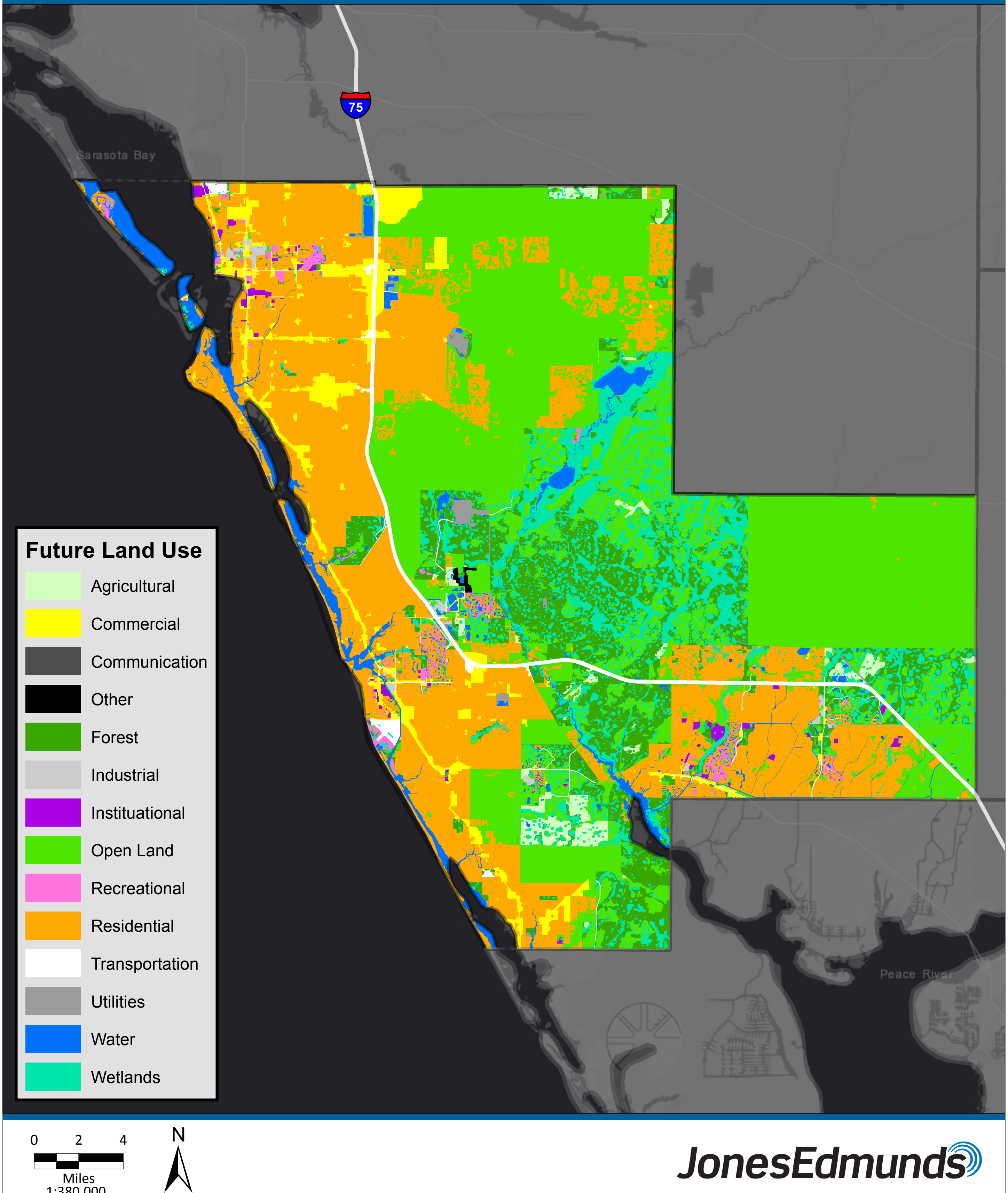
Changes in future development will influence the peak discharge of floods by modifying how rainfall is stored on and/or run off the land into tributaries. In undeveloped areas such as forests and grasslands, rainfall is collected and stored on vegetation, in the soil column, and in surface depressions. When this storage capacity is filled, runoff flows slowly over land or as subsurface flow. In contrast, urban areas have less capacity to store rainfall, since much of the urban land surface is covered by roads and buildings. Construction of these roads and buildings often involves removing vegetation, soil, and depressions from the land surface. The permeable soil is replaced by impermeable surfaces such as roads, roofs, parking lots, and sidewalks that store little water, reduce infiltration of water into the ground, and accelerate runoff to ditches and streams. In suburban areas, where lawns and other permeable landscaping may be common, rainfall can saturate thin, compressed soils and produce overland flow that runs off quickly. Dense networks of ditches and culverts in cities reduce the distance that runoff must travel over land or through subsurface flow-paths to reach streams and rivers.

Since land use can greatly affect the runoff potential, mapping of future floodplains must consider future land uses. Figure 3-1 illustrates the future land use designations for Sarasota County.

Figure 3-1

Sarasota County Future Land Use

Sarasota County Future Conditions Floodplain Analyses



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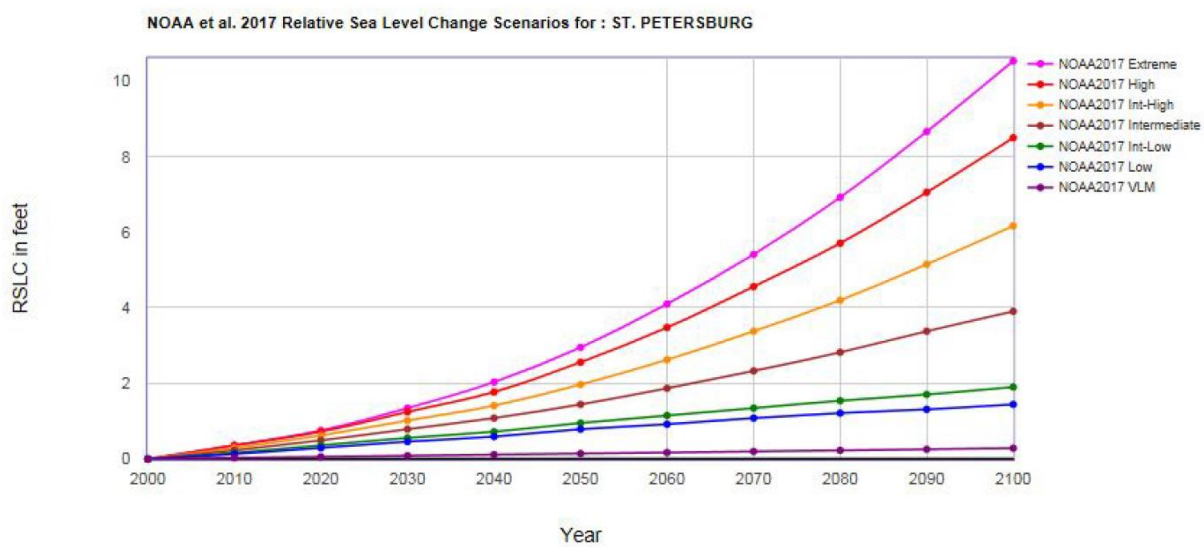
3.1.2 Climate Change and Sea Level Rise

Global sea level has been rising over the past century, and the rate has increased in recent decades. The two major causes of global sea level rise (SLR) are thermal expansion caused by warming of the ocean and the increased melting of land-based ice, such as glaciers and ice sheets.

As sea level rises, low-lying coastal areas will be increasingly prone to coastal and inland flooding. Storm surge and wave heights during hurricanes will increase as coastal water depths increase with sea level rise, amplifying the damage potential of hurricanes. Because stormwater drainage systems rely mainly on gravity, sea level rise may reduce their effectiveness and potentially exacerbated inland flooding during rain events, especially in low-lying interior floodplains. Climate change can potentially increase the impact and frequency of flooding events.

Error! Reference source not found. illustrates the Relative Sea Level Change (RSLC) S cenarios for St. Petersburg, Florida, as calculated using the NOAA projections and regional corrections (NOAA, 2017).

Figure 3-2 Relative Sea Level Change Projections – Gauge: 8726520, St. Petersburg, FL



3.2 Methodologies

The future land use layers for Sarasota County, Manatee County, and City of Sarasota were combined into a single layer. Several future land use categories were revised to match existing land use categories to develop composite CNs for each watershed. In some cases, existing CN values may be higher than values calculated for future conditions. Several reasons may account for this, including that some CN values may have been manually adjusted in the individual watershed to better calibrate the model. Therefore, in cases where the existing CN is higher than the calculated CN based on future conditions, the existing CN was retained for use in the future floodplain analyses.

The Community Rating System encourages communities to model, at a minimum, the projected intermediate-high RSLC for 2100. According to the recent NOAA 2017 projections, this value is currently 6.17 feet. Since these values are subject to change and vary by planning horizon, the model evaluated variable RSLC values of 2, 4, 6.17, 8, and 10 feet. In the model, the RSLC is the new tailwater condition on which the analysis is based. In each of the tailwater scenarios, the initial conditions were revised for all nodes that were affected by the tailwater including all hydraulically connected nodes. Each scenario was modeled using the 100-year/24-hour design storm for the watersheds. Level-pool inundation areas were developed for each of the modeled RSLC scenarios. The inundation areas were mapped using GIS by assigning flood elevations to the basins and comparing those elevations to the County's LiDAR. Figure 3-2, Figure 3-3, Figure 3-4, Figure 3-5, and Figure 3-6 show the inundation areas for each watershed resulting from these scenarios. Appendix A contains large-size figures for these watersheds.

Figure 3-3

Future Conditions Inundation - Lemon Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

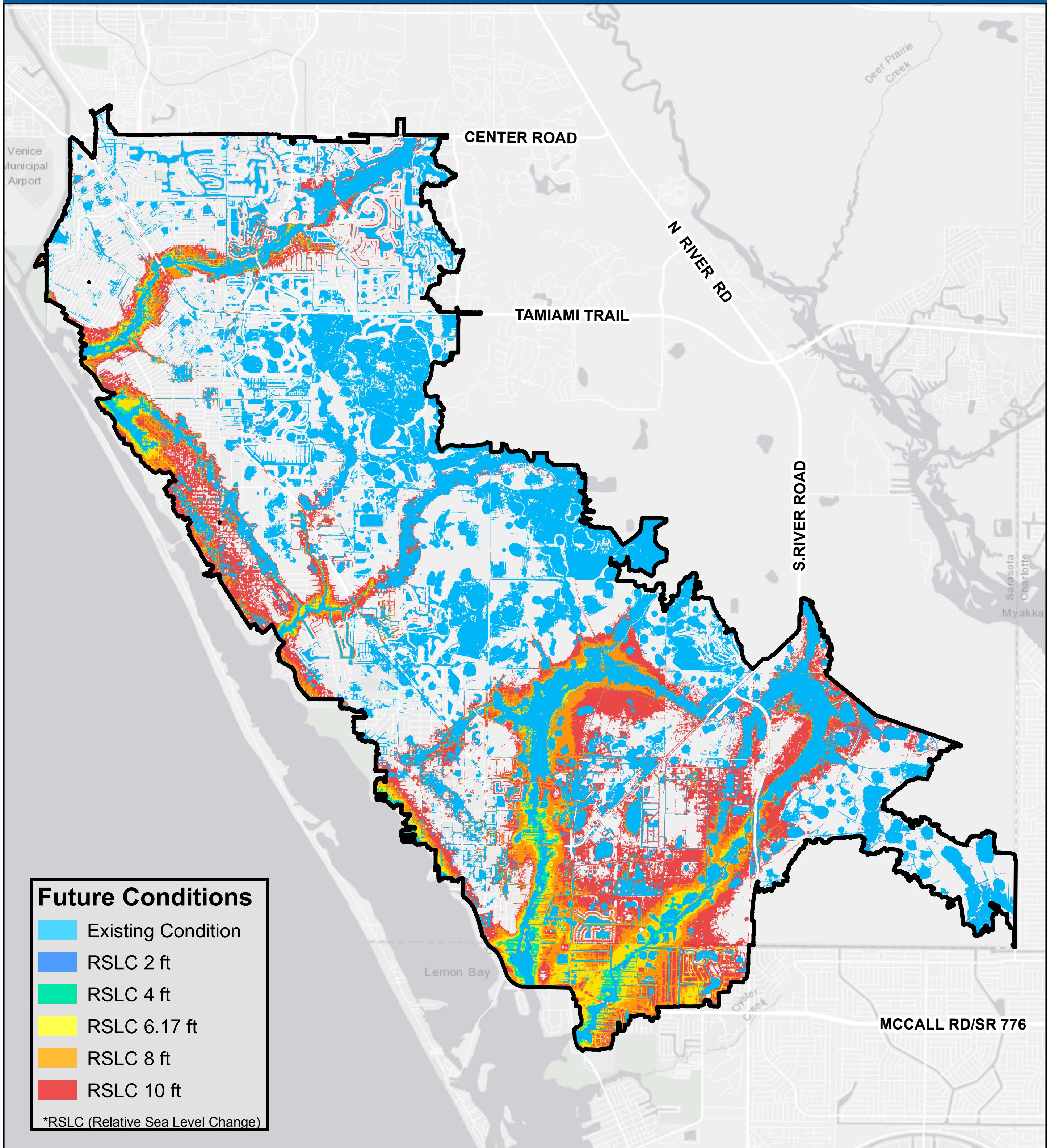


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Figure 3-4

Future Conditions Inundation - Roberts Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

Sarasota County

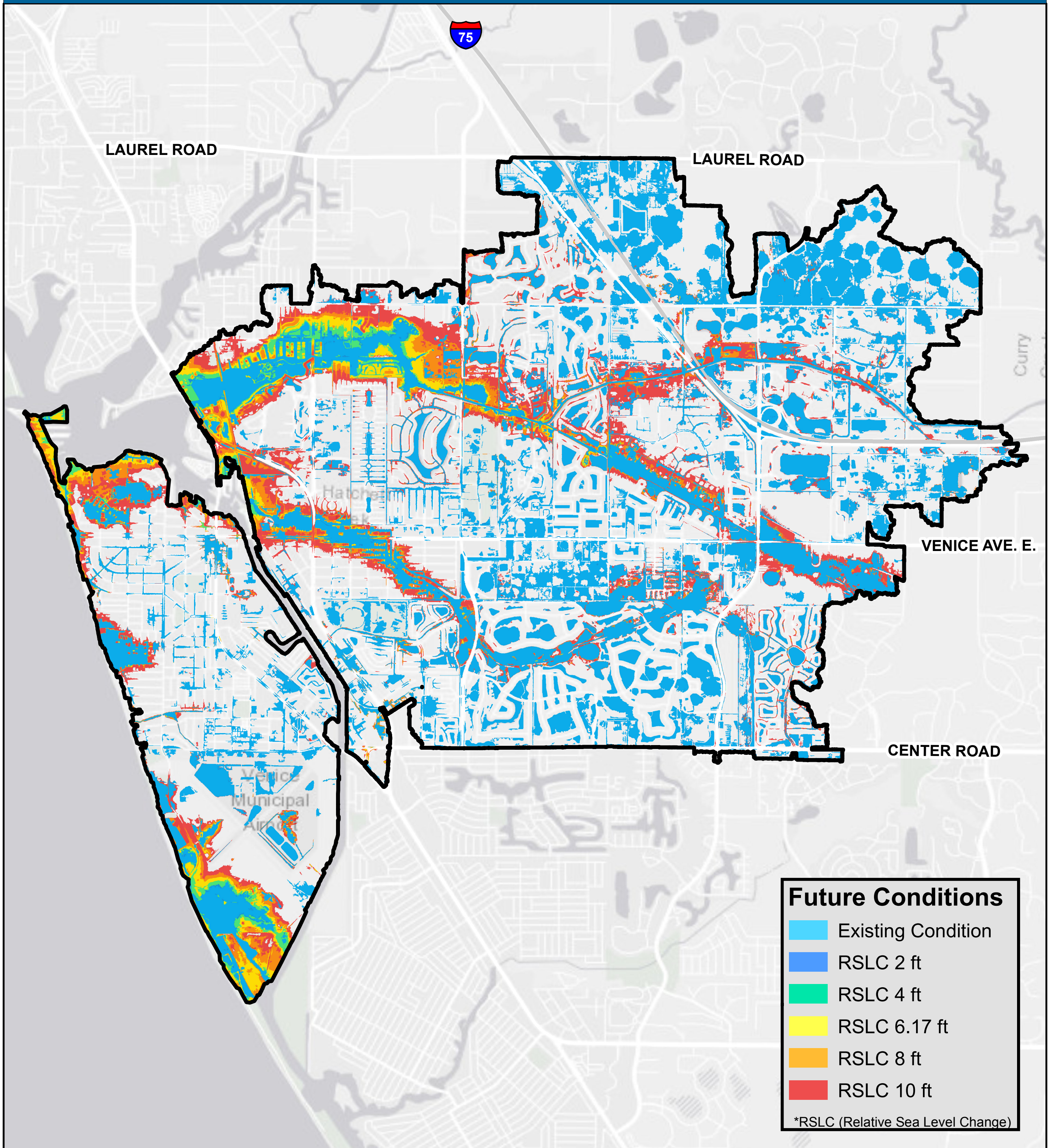

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Figure 3-5

Future Conditions Inundation - Dona Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

Sarasota County

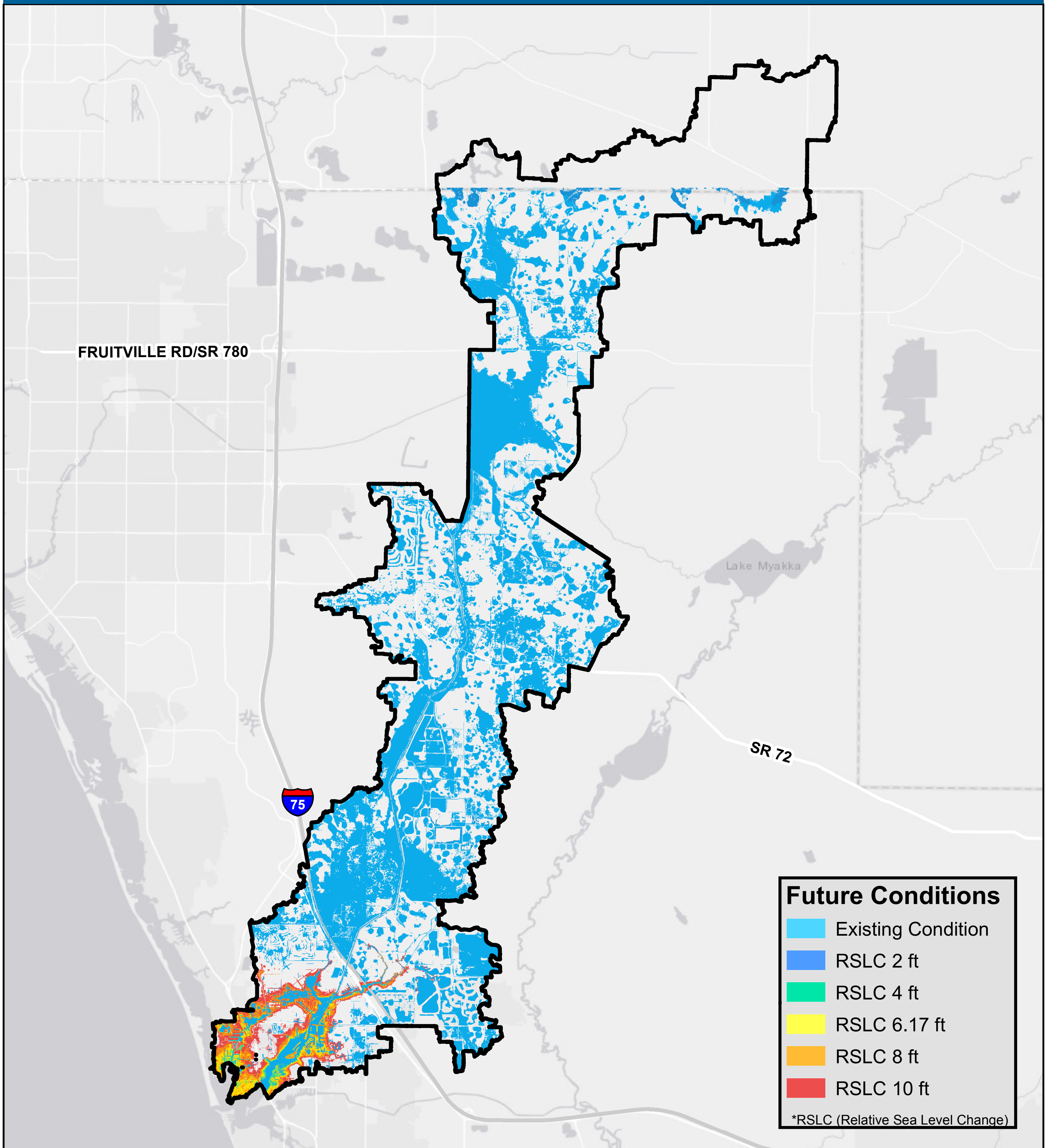

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Figure 3-6

Future Conditions Inundation - Little Sarasota Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

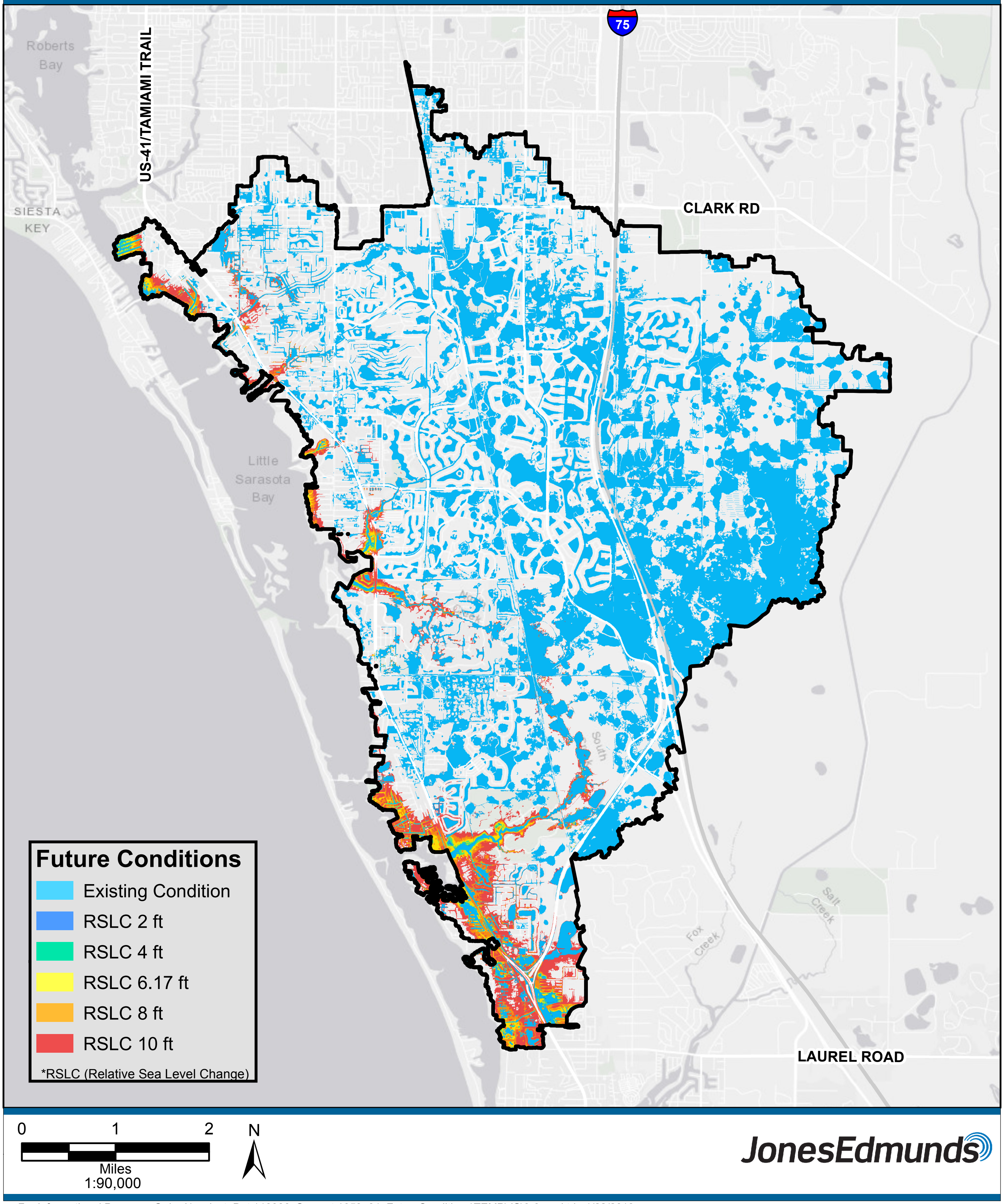

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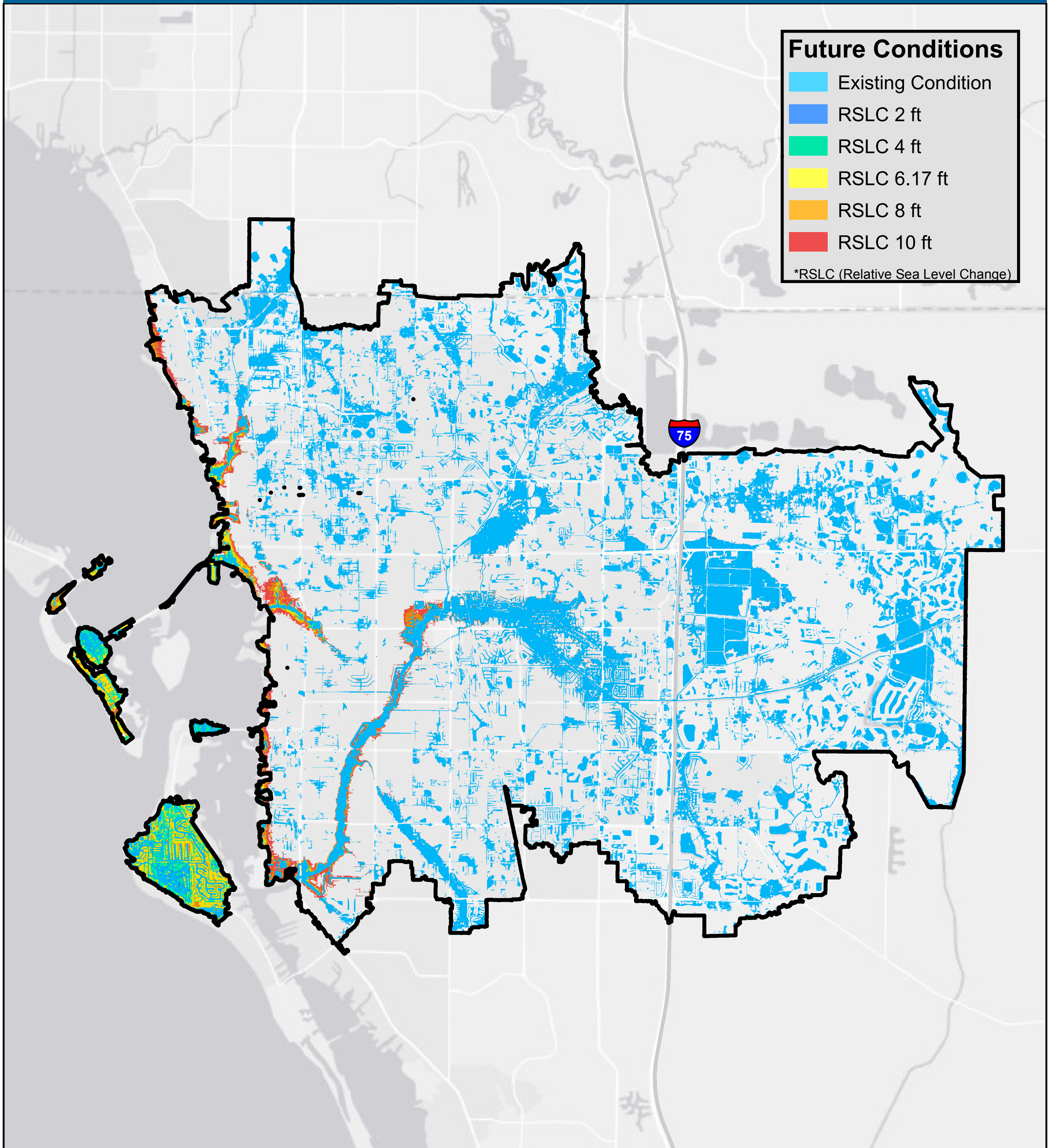
Figure 3-7

Future Conditions Inundation - Sarasota Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

Sarasota County



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Appendix A

Full-Size Watershed Figures