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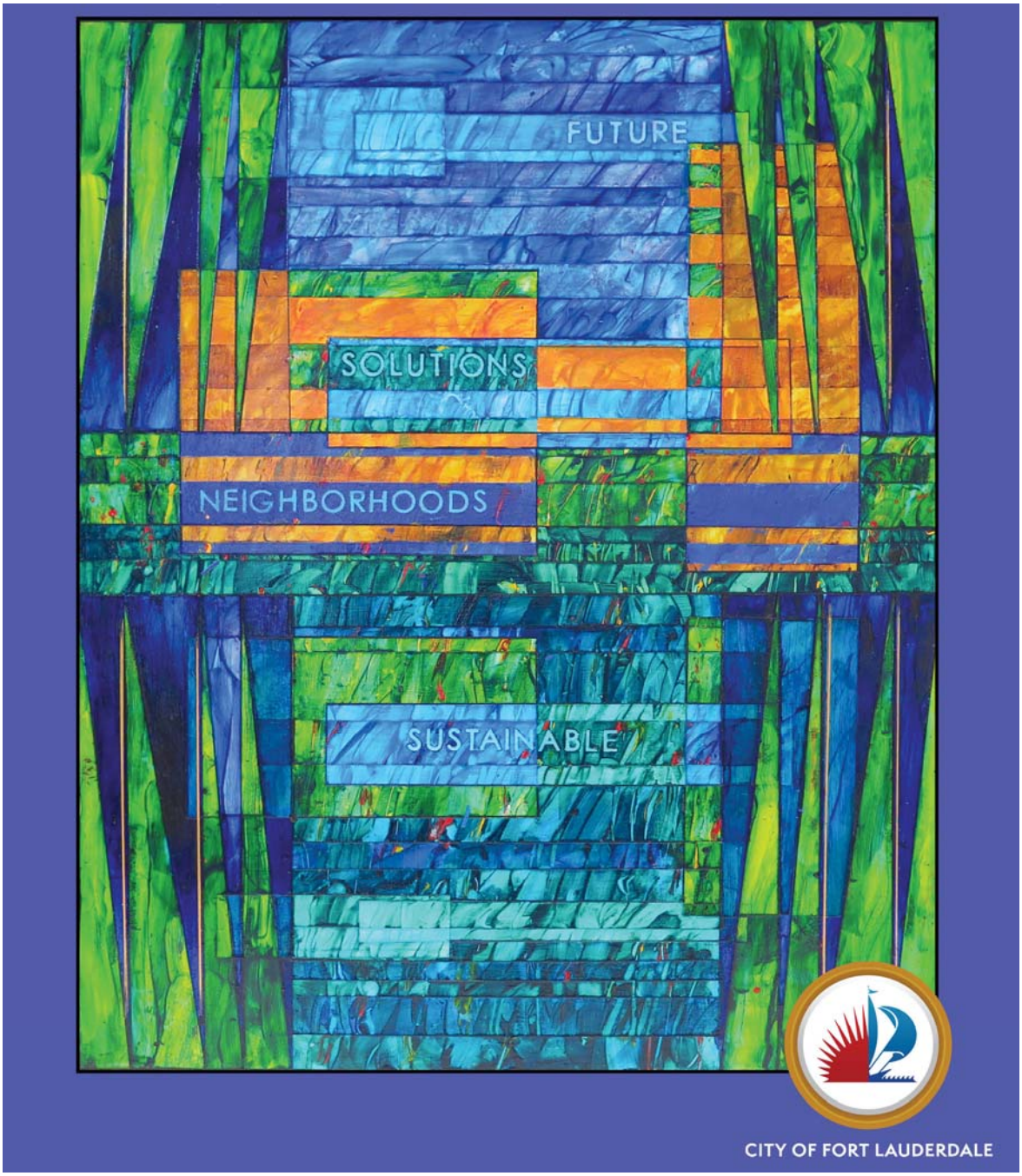

Stormwater Master Plan Design and Implementation Program – 2021 Update

January 18, 2022

43193

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Appendix A: Conceptual Improvement Exhibits

1. Background

The City of Fort Lauderdale, located in the state of Florida (the "City") is implementing a stormwater management program to address chronic flooding and other stormwater management issues throughout its neighborhoods. Twenty-first century stormwater master planning and design for low-lying coastal areas requires new thinking. Solutions must be flexible, pragmatic, include a balance of conventional and innovative approaches, and utilize the natural environment as an asset. Development of those solutions is underway. The City's approach to meeting the challenges of stormwater management and resiliency to tidal and rainfall driven flooding is focused on the following objectives:

- Data collection and the development of a citywide hydraulic model that has been and will continue to be utilized in assessing all areas of the City to develop engineering plans and solutions to flood related issues.
- Addressing appropriate levels of service and protection across the entire City (over the long-term). Including the mitigation of future negative impacts from climate change, such as sea-level rise, elevated water table, and increase precipitation events.
- Making meaningful progress in improving flood protection in the most severely impacted areas in the near-term. The City-wide stormwater program is intended to be an evolving initiative that allows the prioritization of areas in need of stormwater improvements, by order of severity, availability of funds/resources, and cost benefit to the City's daily operations, residents, and businesses.

To that end, the following summarizes the City's Stormwater Master Plan Modeling and Design Implementation Program status and efforts to date (through October 2021).

2. Data Collection

A significant data collection effort was undertaken to support various aspects of the City-wide stormwater management program, including citywide stormwater modeling and utility data collection; watershed planning and establishing neighborhood levels of service (LOS); the development of comprehensive engineering design plans based on the model results, which will address chronic neighborhood flooding; permitting and construction management services related to implementation of the stormwater infrastructure design; and community relations and outreach services designed to familiarize and obtain feedback from the neighbors that will benefit from the proposed stormwater infrastructure upgrade.

Topographical mapping of the entire City using high density LiDAR (Light Detection and Ranging) technology was completed. The accuracy of the LiDAR data was confirmed through rigorous field checks using conventional survey techniques. The LiDAR data were arranged in "tiles" covering the entire City as shown in **Figure 2-1**. The City-wide high-density LiDAR facilitated in the generation of accurate ground surface models which were critical for the hydrologic/hydraulic stormwater model development. The LiDAR data also proven beneficial in evaluating seawall cap elevations and determining additional topographic features. Examples of LiDAR data collected within the City are shown in **Figure 2-2.** This topographical mapping model allows City staff to quickly assess drainage issues city-wide as they arise, and quickly narrow down on the stormwater solutions needed to address attenuate flooding in these areas. This tool has reduced the time and effort that would have been spent on topographical surveys and various other data gathering activities.

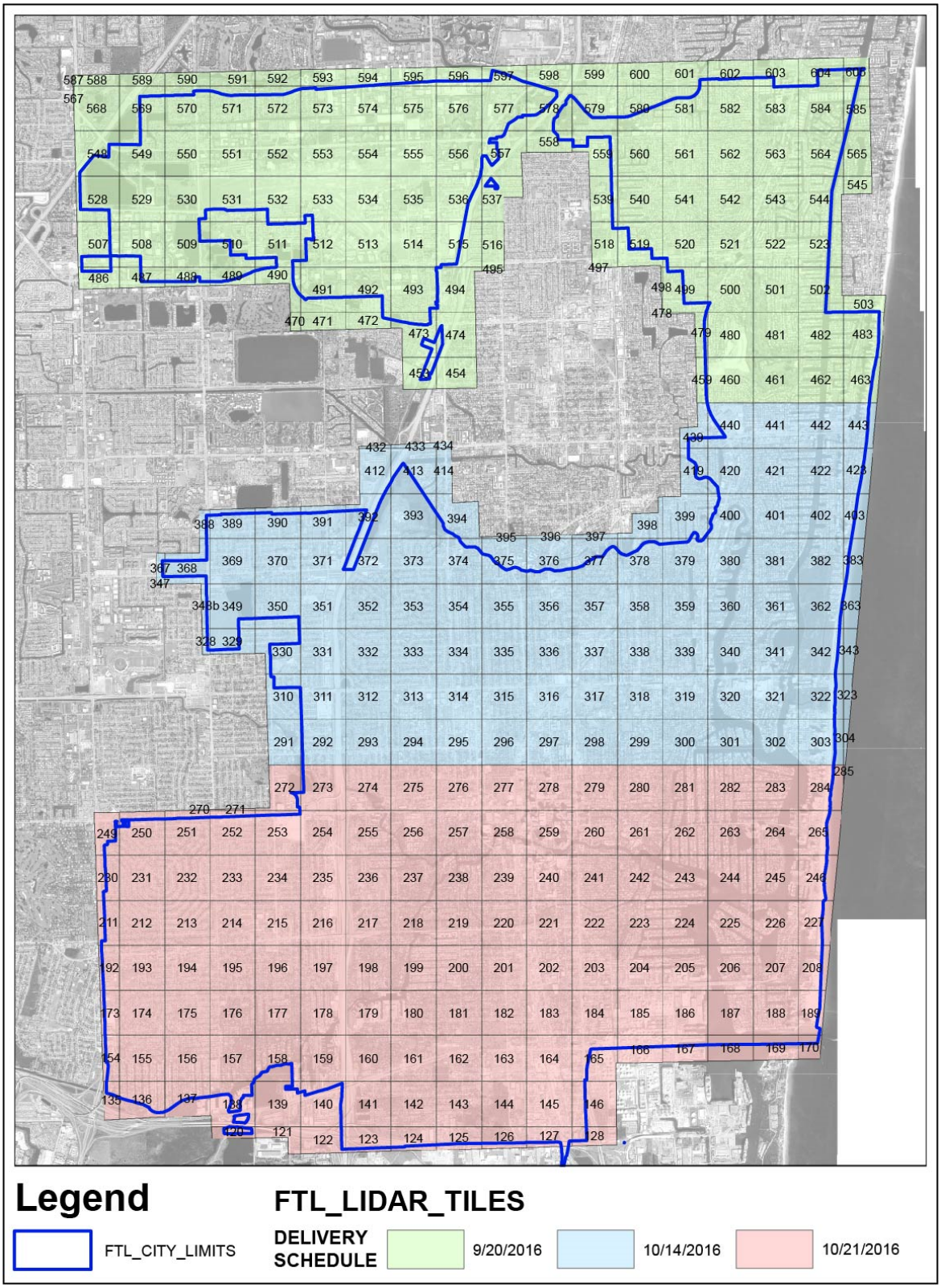


Figure 2-1: High Density LiDAR Tile Key Map

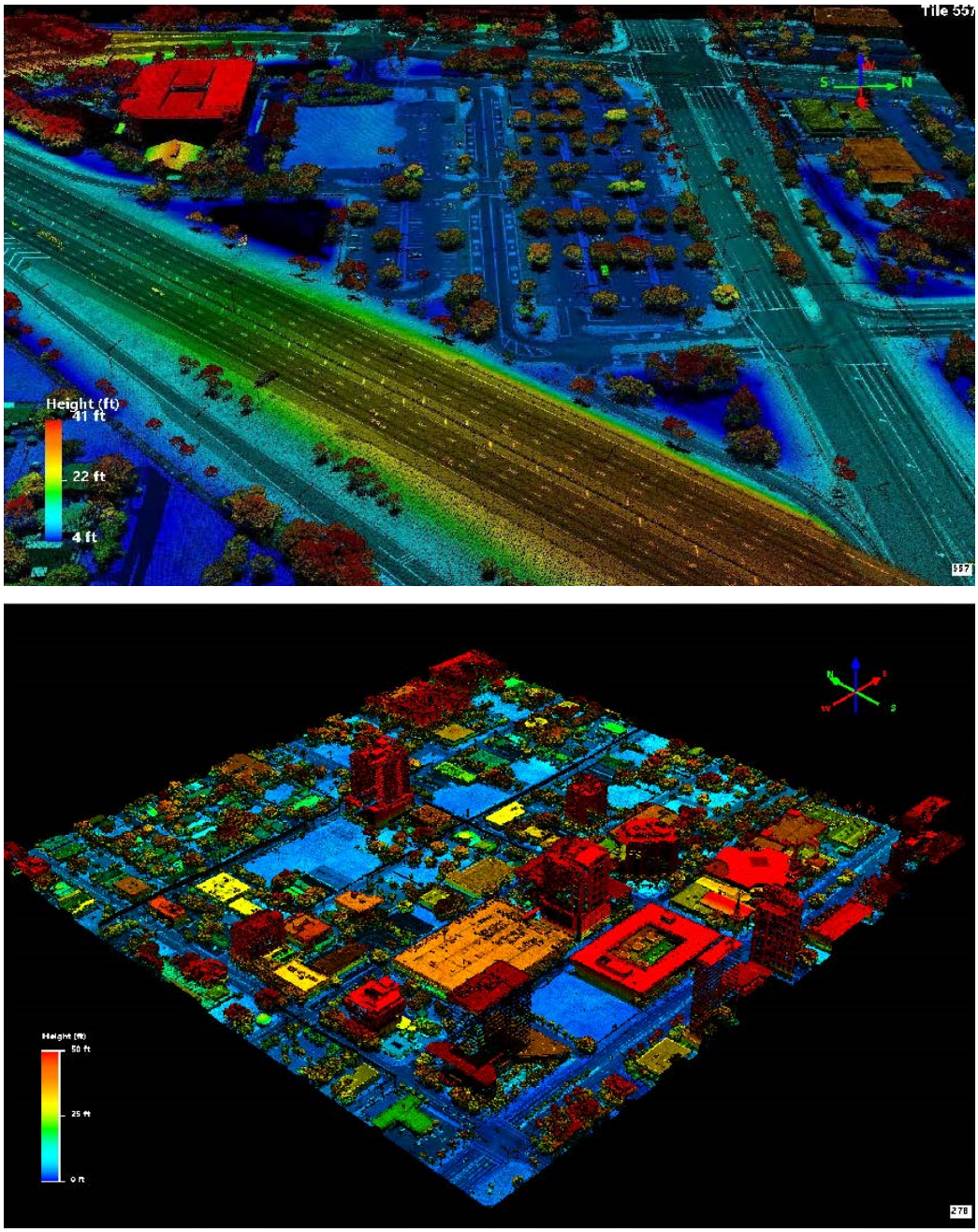


Figure 2-2: High Density LiDAR Examples

- Traditional field surveying and record drawing accumulation (from various sources) for collection of below-ground stormwater infrastructure data was also completed.
- An updated stormwater geodatabase was developed, and data collected from the survey efforts noted above were migrated to that system for the City's future use. Additionally, stormwater asset information collected as part of specific design surveys is also being migrated to the stormwater geodatabase.

3. Watershed Modeling

A hydrologic/hydraulic stormwater model of the City was developed and utilized. The modeling effort consisted of a comprehensive basin by basin analysis of the existing and proposed stormwater system and how it reacts to different conditions, including future projected climatological and land use conditions. The City contains many distinct neighborhoods, as shown in **Figure 3-1**, and was subdivided into 10 primary watersheds (see **Figure 3-2**). Model results were used to help develop conceptual plans to address priority neighborhoods' stormwater issues specifically in the areas found to be most susceptible to chronic flooding. This effort directly informed preliminary and final design in the initial priority neighborhoods, which are discussed below. Moving forward, the model will continue to be utilized extensively to assess all areas of the City and develop comprehensive stormwater solutions. These solutions will be implemented as funds become available and will be programed for execution over the next 10 years, following the initial priority areas.

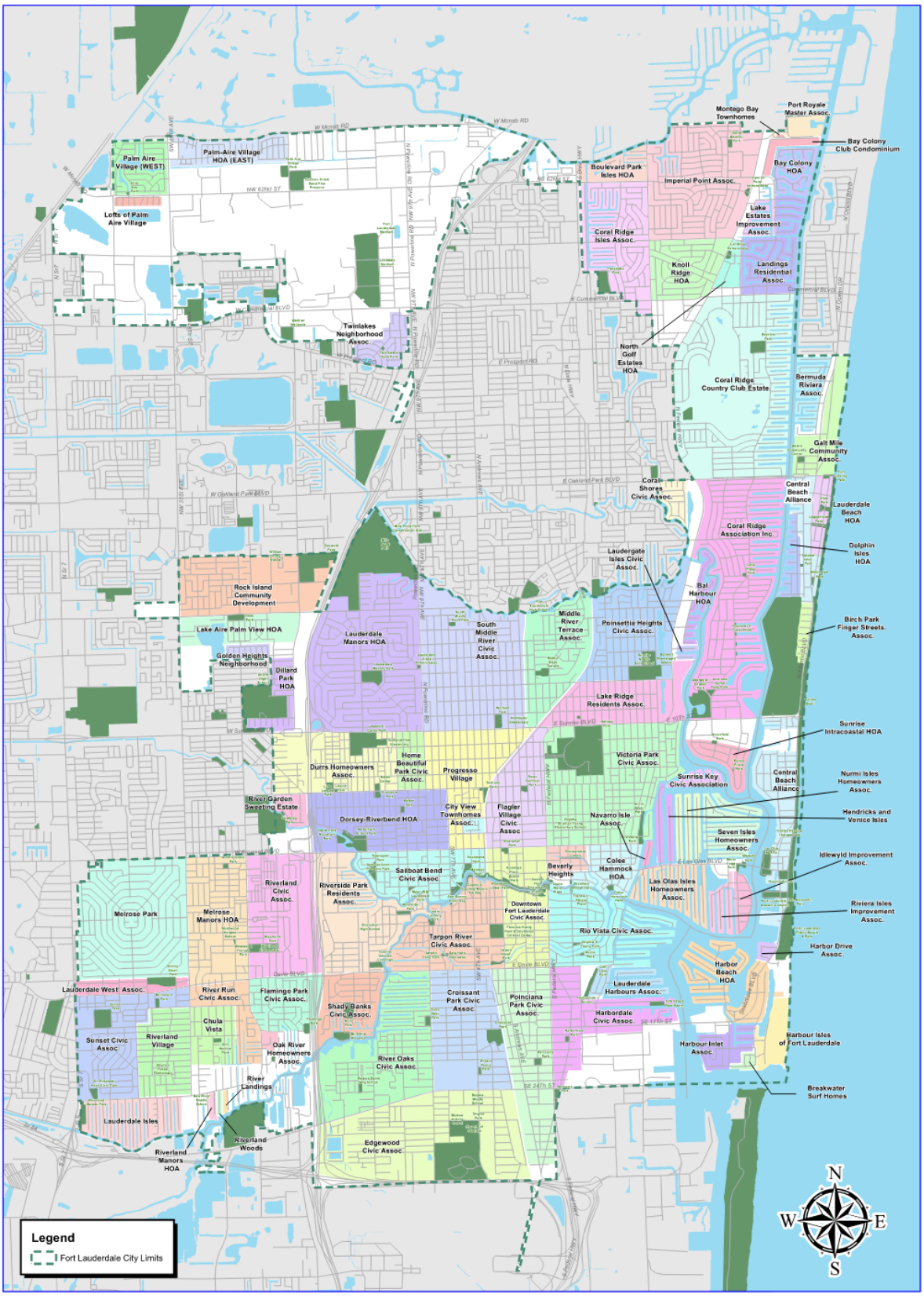


Figure 3-1: Fort Lauderdale Neighborhoods

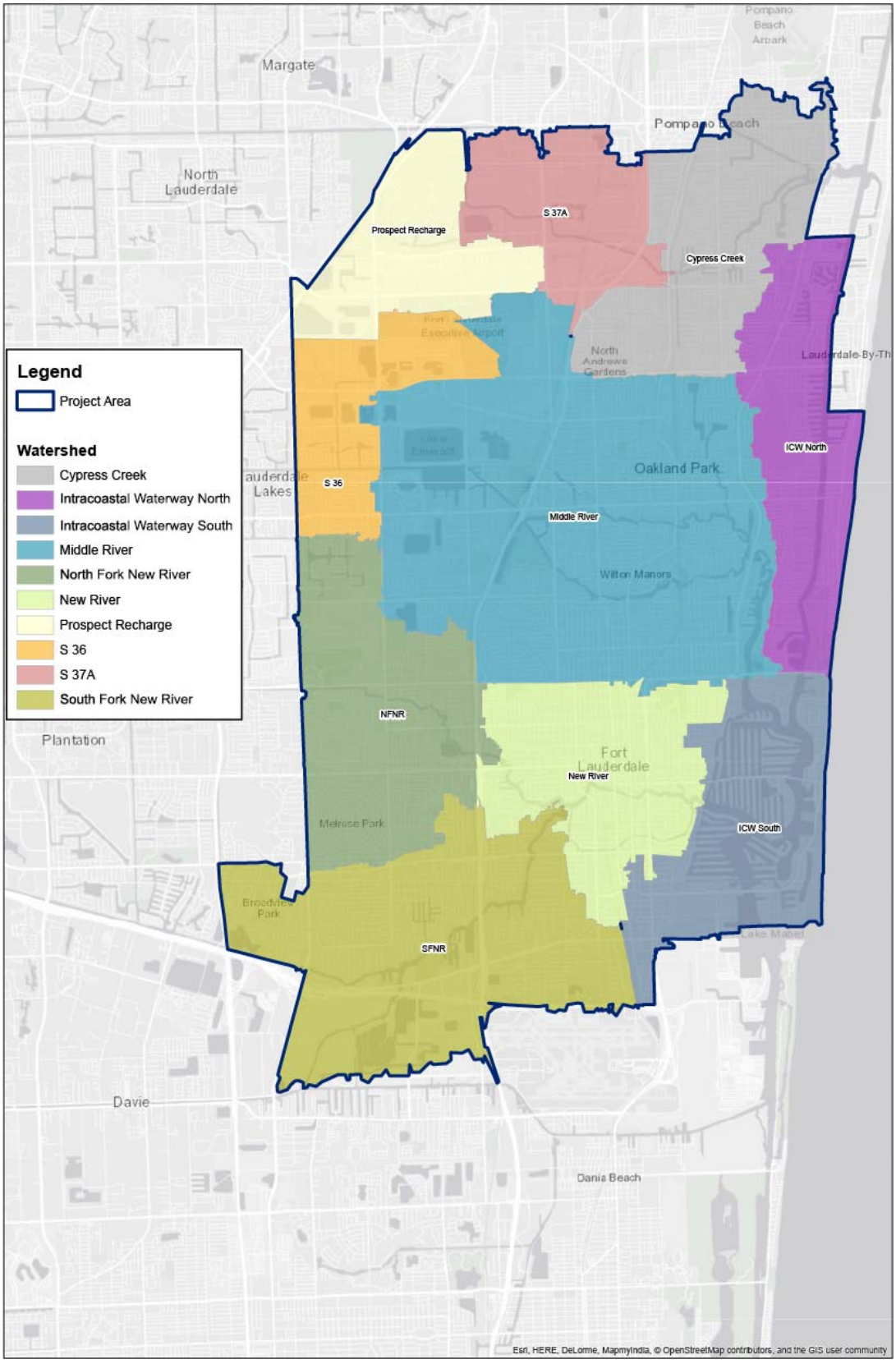


Figure 3-2: Fort Lauderdale Primary Watersheds

4. Neighborhood Capital Improvement Planning

4.1 Seven Priority Neighborhoods

Stormwater focused capital improvement planning primarily targeted seven neighborhoods and the watersheds in which they are located (see **Table 4-1**). Plans for current improvements must consider impacts of future conditions. Direct and indirect impacts of rising seas, extreme tides, increased precipitation events, and higher groundwater levels (as a result) will affect significant areas of the City. City sponsored and funded community investments alone will not be able to adequately address the situation in certain locations. Policies, new and revised codes, and redevelopment criteria, particularly in areas within current and future floodplains, should be used in conjunction with community investments and programmatic changes. Resilience improvements in some areas should be strategically phased and coordinated and may require modifications to both public and private property.

It is recommended that the City be intentional about continuing coordination and communication with adjacent municipalities, Broward County, Florida Department of Transportation, South Florida Water Management District and others. Resilience will be best achieved through a collaborative effort of many stakeholders. Opportunities for joint funding and project execution will exist, as will the chance to share in the innovative efforts that will be needed to remain resilient in the face of a changing climate.

Table 4-1: Seven Priority Neighborhoods and Corresponding Watersheds

Neighborhood	Watershed(s)
Edgewood	South Fork New River
Victoria Park	New River, ICW South
Progresso Village	New River
Southeast Isles	ICW South, New River
Durrs	North Fork New River
Dorsey - Riverbend	North Fork New River, New River
River Oaks	South Fork New River

Depictions of model-predicted flooding for the four watersheds which contain the seven priority neighborhoods are shown in **Figures 4-1 through 4-8**. The included flood maps reflect 10-year, 24-hour and 100-year, 72-hour storm event simulations based on current conditions. Similar simulations were conducted for future conditions (2035 and 2060). Based on these model results, field reconnaissance, and miscellaneous data/reports from the City, Conceptual Improvement Exhibits were created (see **Appendix A**). These improvement plans were Conceptually Permitted by Broward County.

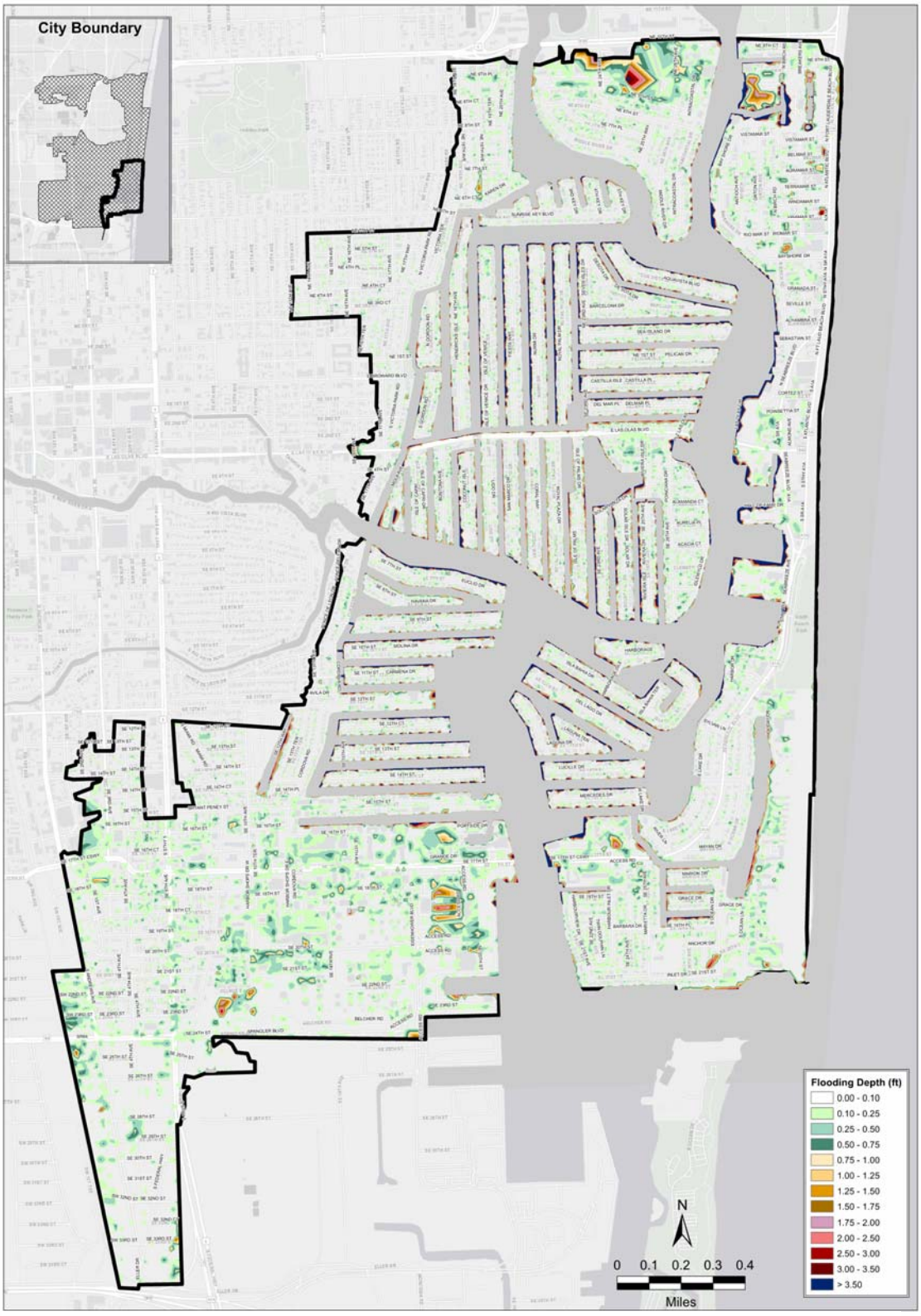


Figure 4-1: Intracoastal Waterway South Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

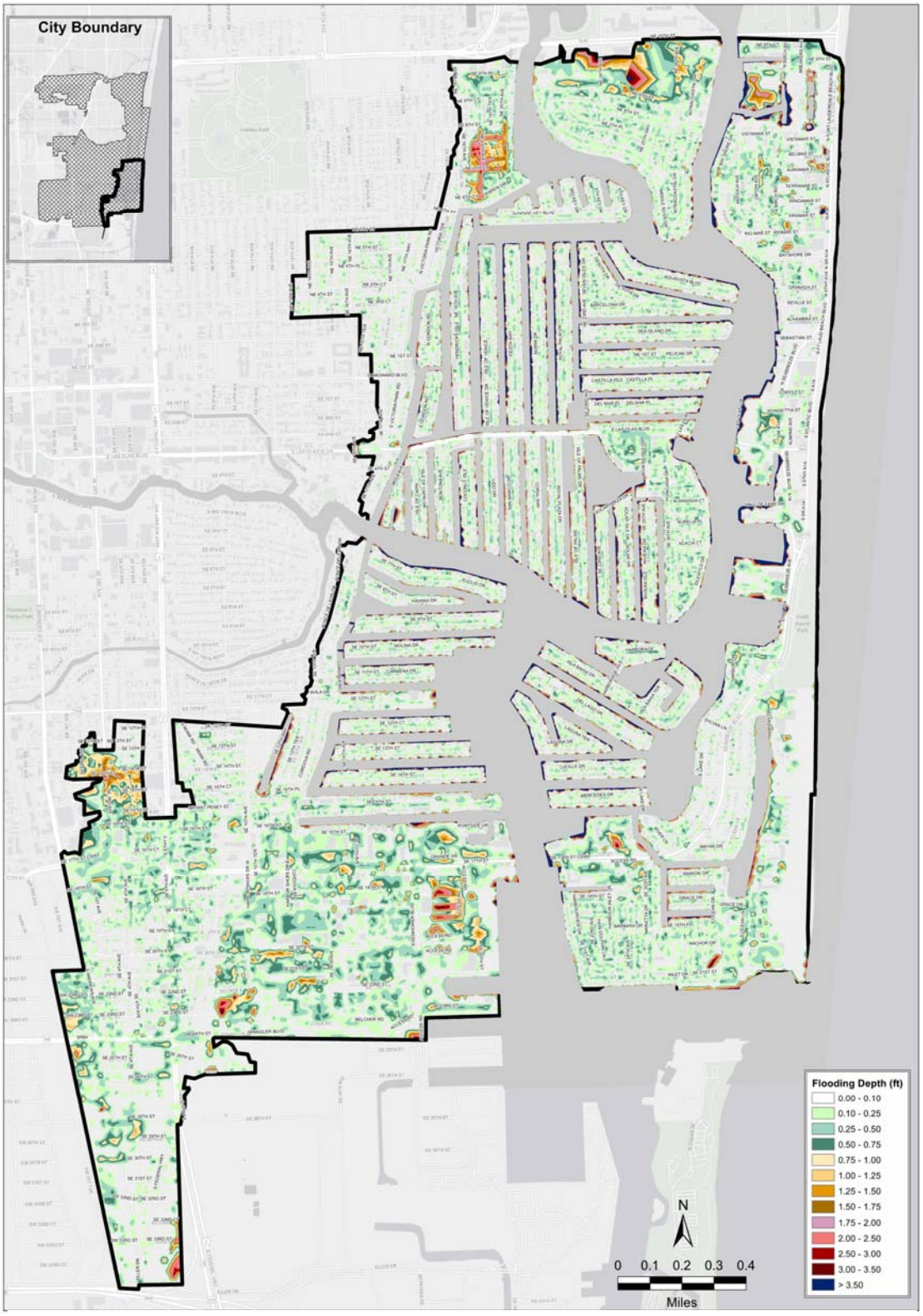


Figure 4-2: Intracoastal Waterway South Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

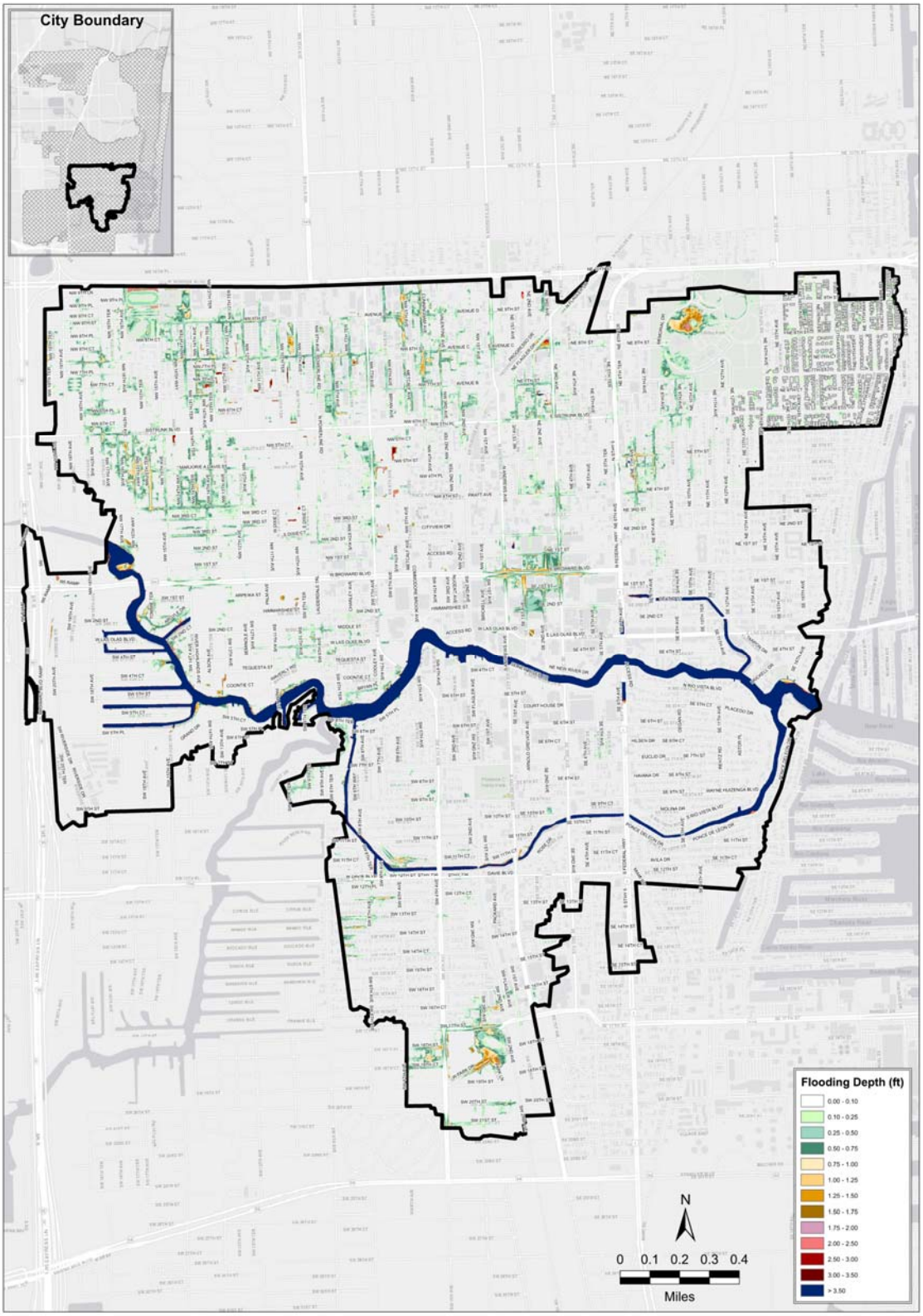


Figure 4-3: New River Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

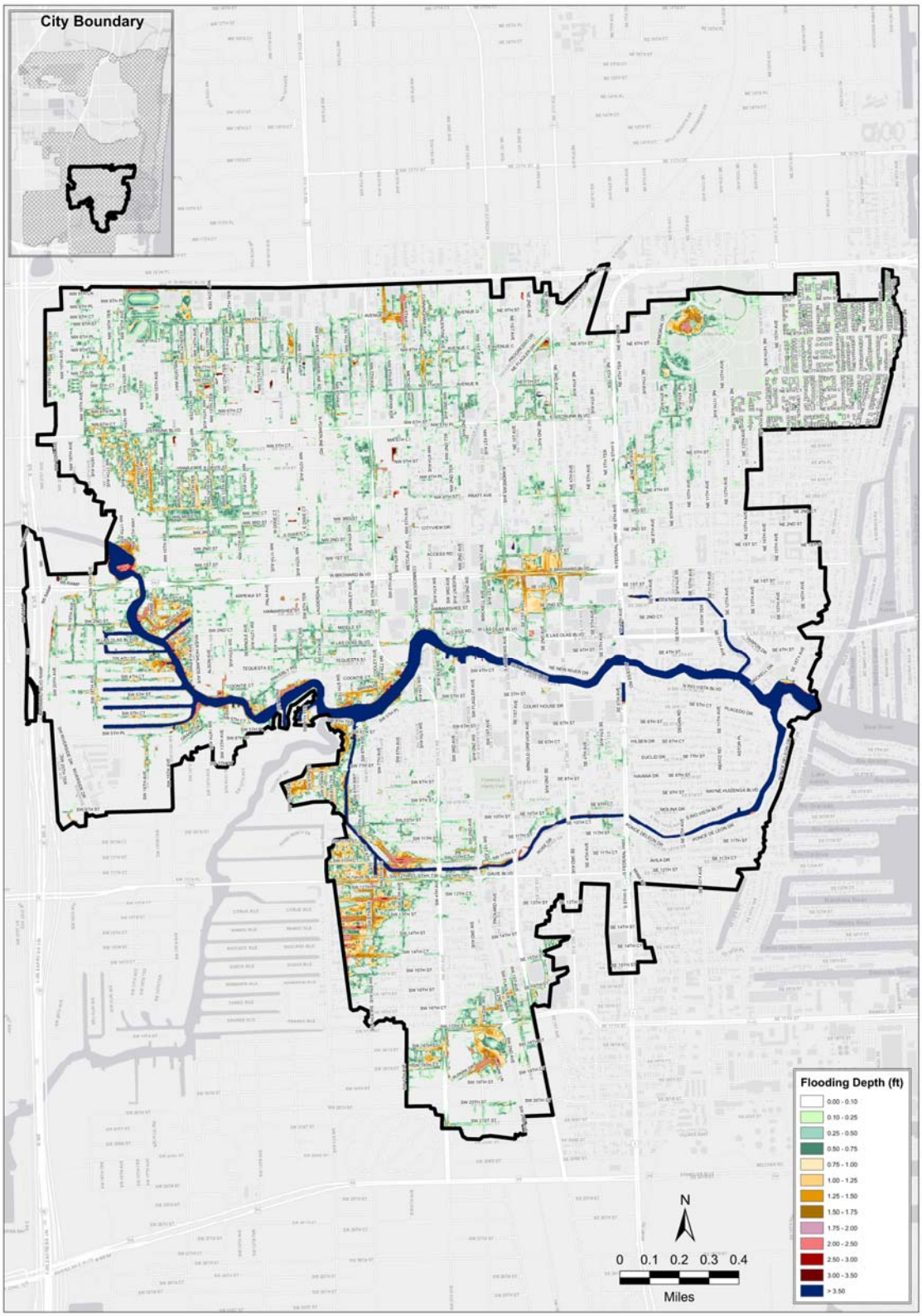


Figure 4-4: New River Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

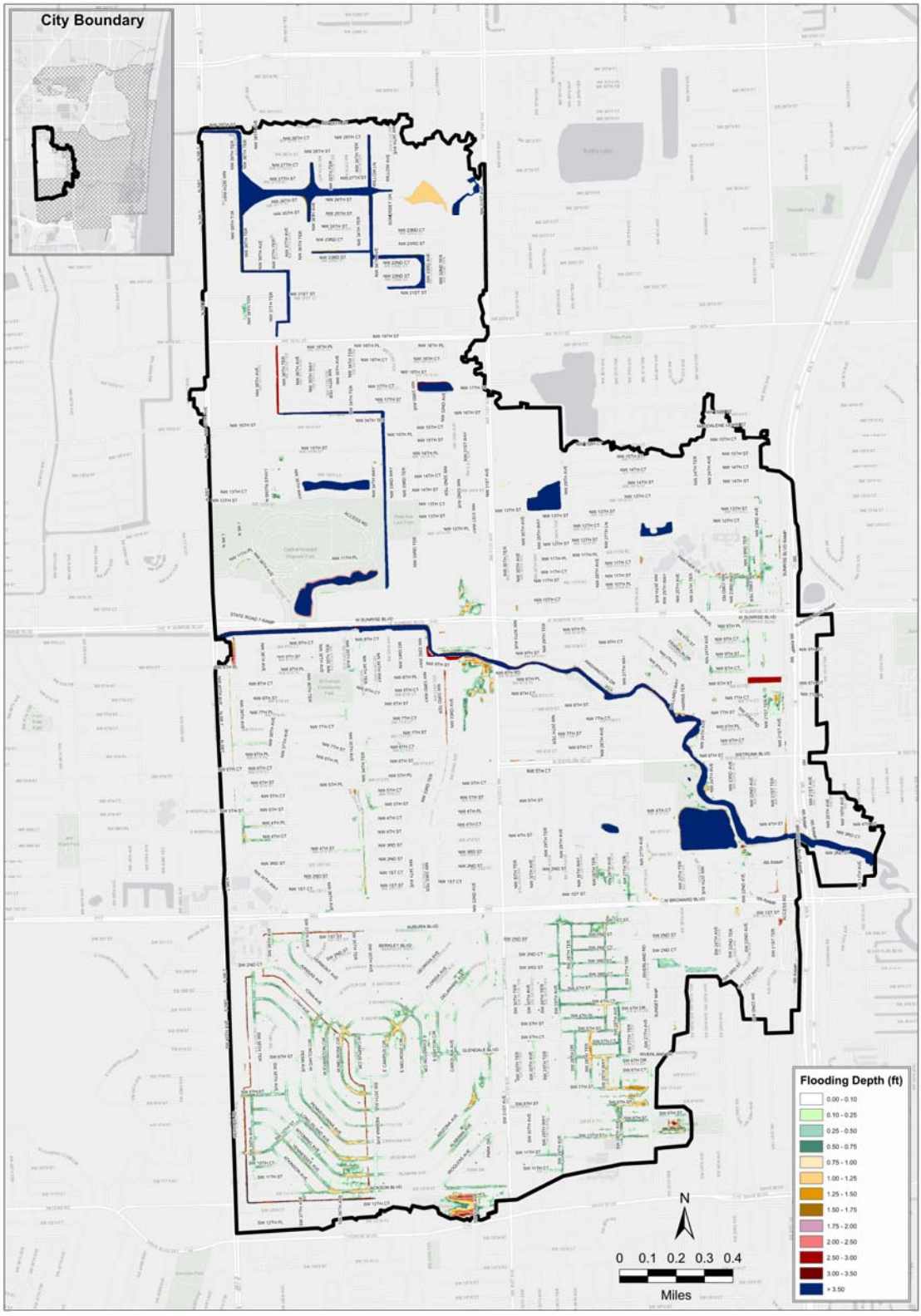


Figure 4-5: North Fork New River Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

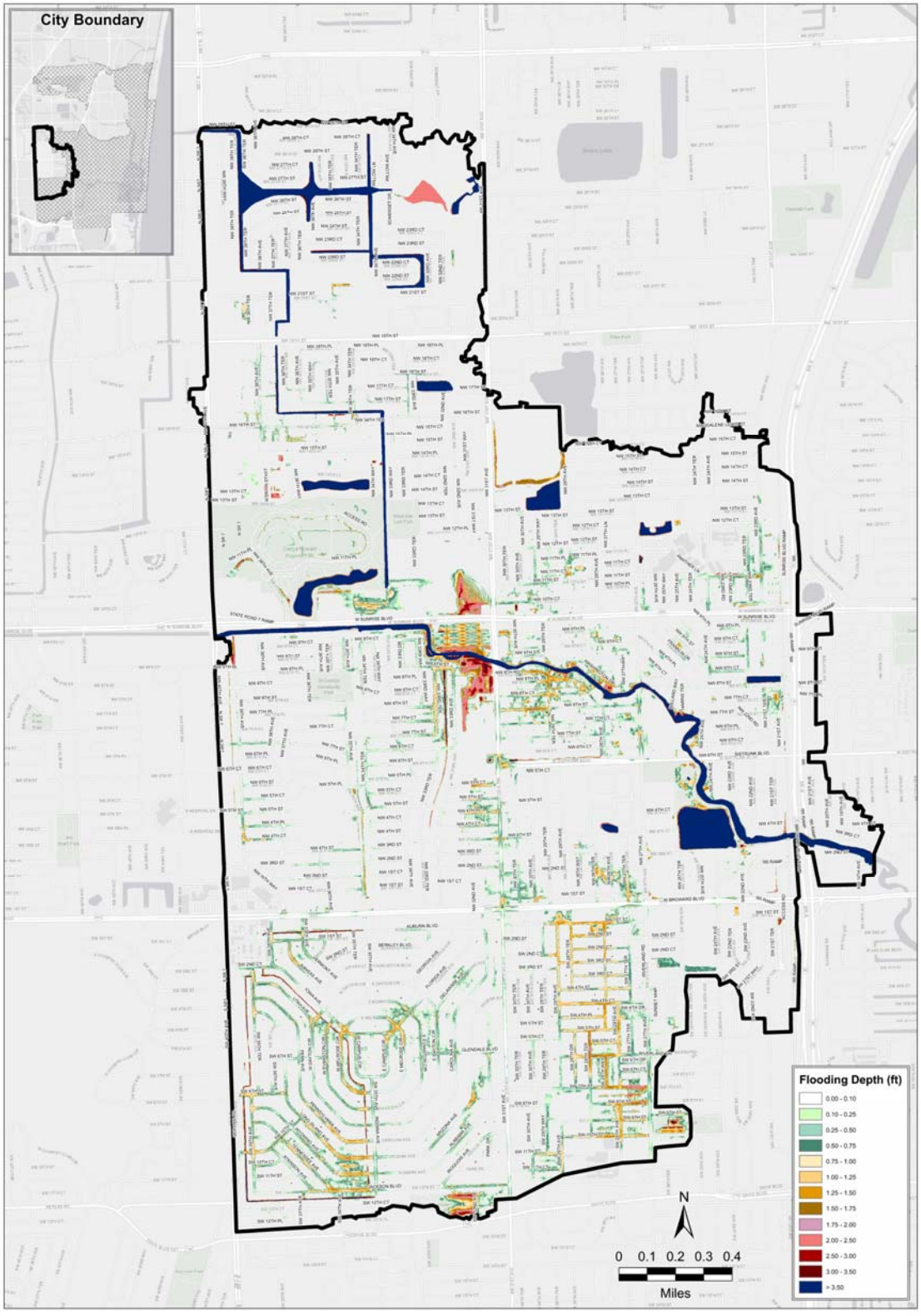


Figure 4-6: North Fork New River Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

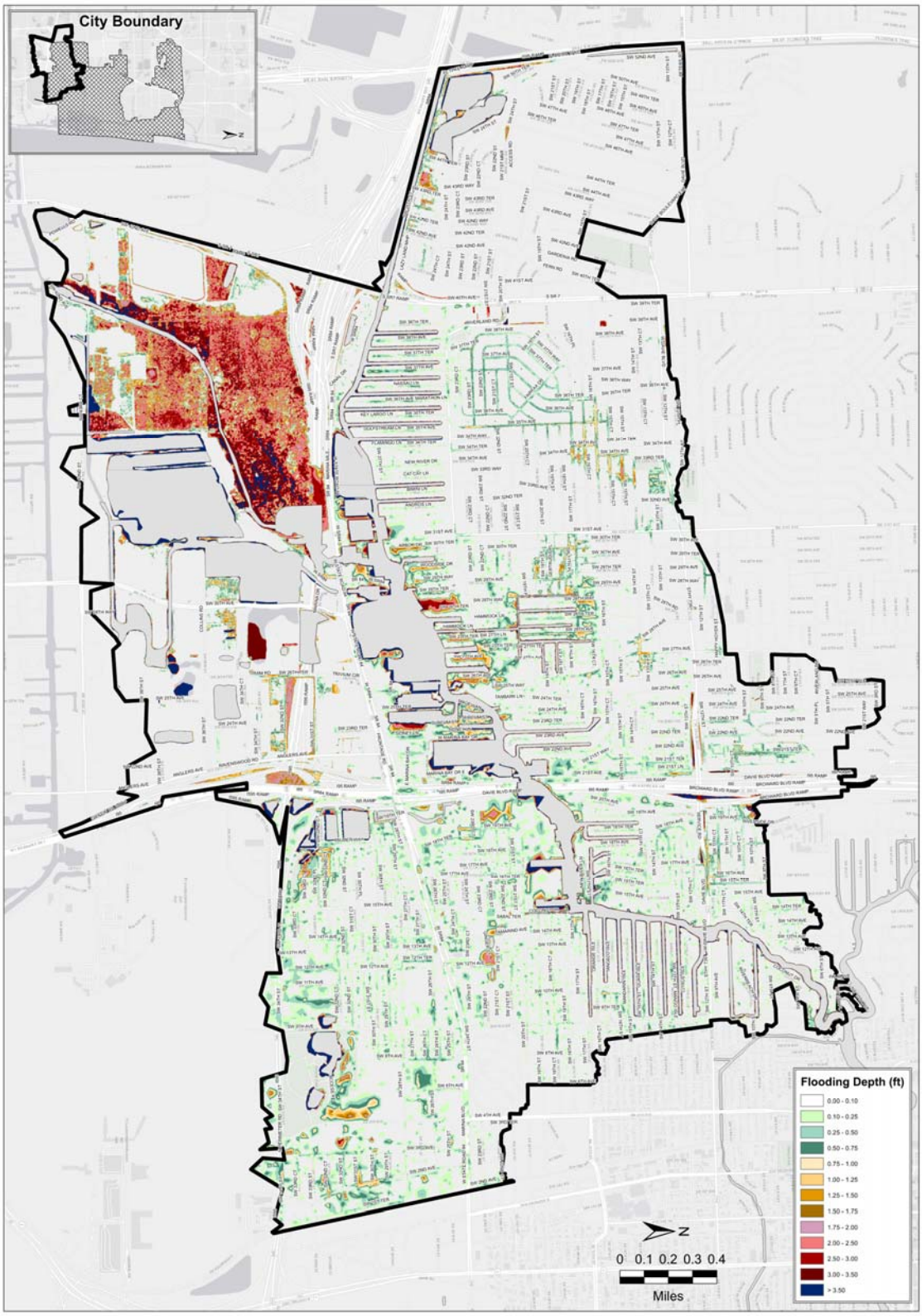


Figure 4-7: South Fork New River Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

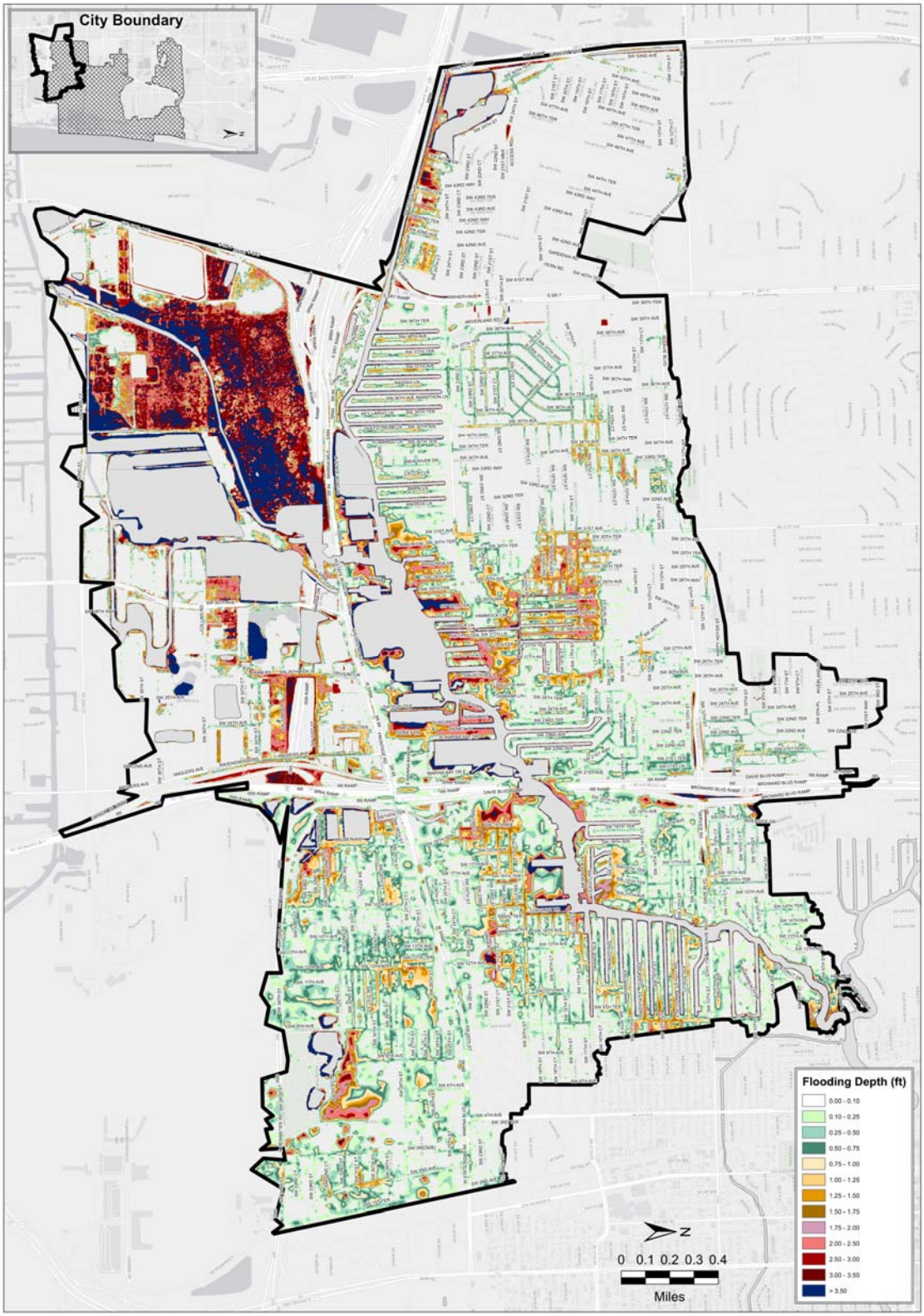


Figure 4-8: South Fork New River Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

4.2 Planning Beyond the Seven Priority Neighborhoods

The modeling effort provides a basis for stormwater investment beyond the seven priority neighborhoods. Depictions of model-predicted flooding for the balance of the 10 watersheds are shown in **Figures 4-9 through 4-18**. As noted previously, the included flood maps reflect 10-year, 24-hour and 100-year, 72-hour storm event simulations based on current conditions, and similar simulations were conducted for future conditions (2035 and 2060). While specific improvements for these areas are set for future planning, the City has begun financially planning for improvements in these areas. City consultant, Stantec Consulting Services, Inc., in its "FY 2020 Stormwater Fund Financial Sustainability Analysis (December 15, 2020)" planned for $200M in funding for the seven priority neighborhoods and (starting in 2026) $232M in funding for further stormwater infrastructure investment (beyond the seven priority neighborhoods).

It is anticipated that the second wave of funding (approximately $232M) would be used for stormwater infrastructure investments in the next 7 to 10 neighborhoods (of the over 50 which exist in the City). The data collected to date (LiDAR, conventional survey, as-builts, etc.), the Citywide watershed modeling completed, and the standard design details and specifications developed were done to support the City's stormwater improvement program for the long-term. Thus, they will support the planning and design of these future investments. Similar to the seven priority neighborhoods, these investments are expected to take the better part of a decade to move through the entire cycle, from planning through construction and implementation.

4.3 Melrose Manors/Riverland

An additional geographic area which the model simulations surfaced as highly vulnerable to stormwater flooding was the area within the Melrose Manors and Riverland neighborhoods (see **Figure 4-19**). This vulnerability was strongly confirmed during the notable Fall 2020 rainfall events. That period of rainfall showed the significant impacts of an extreme multi-day rainfall event occurring following a period of saturating antecedent precipitation. As such, it was recommended that the Melrose Manors/Riverland area be elevated into consideration for infrastructure investment along with the seven priority neighborhoods.

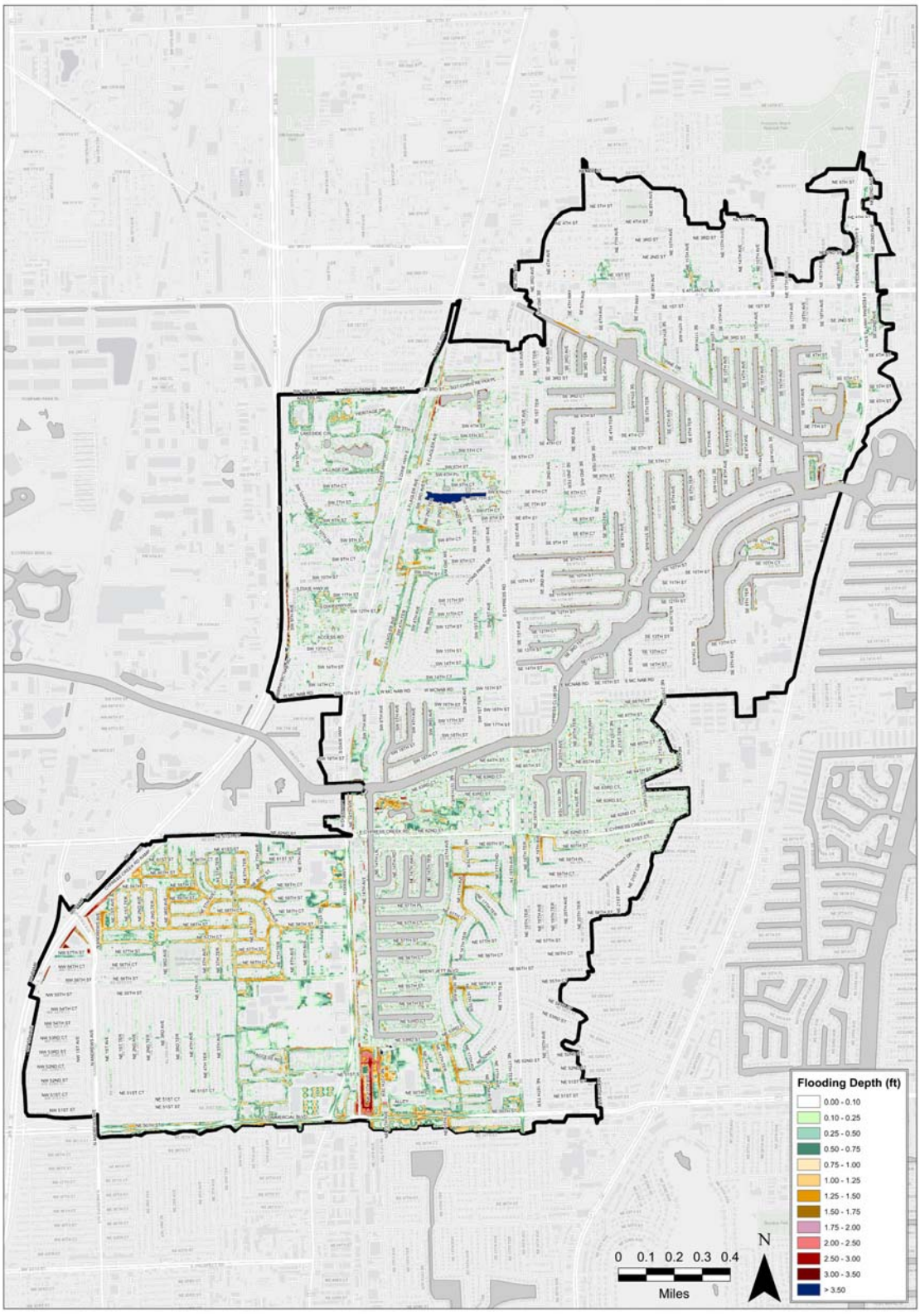


Figure 4-9: Cypress Creek Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

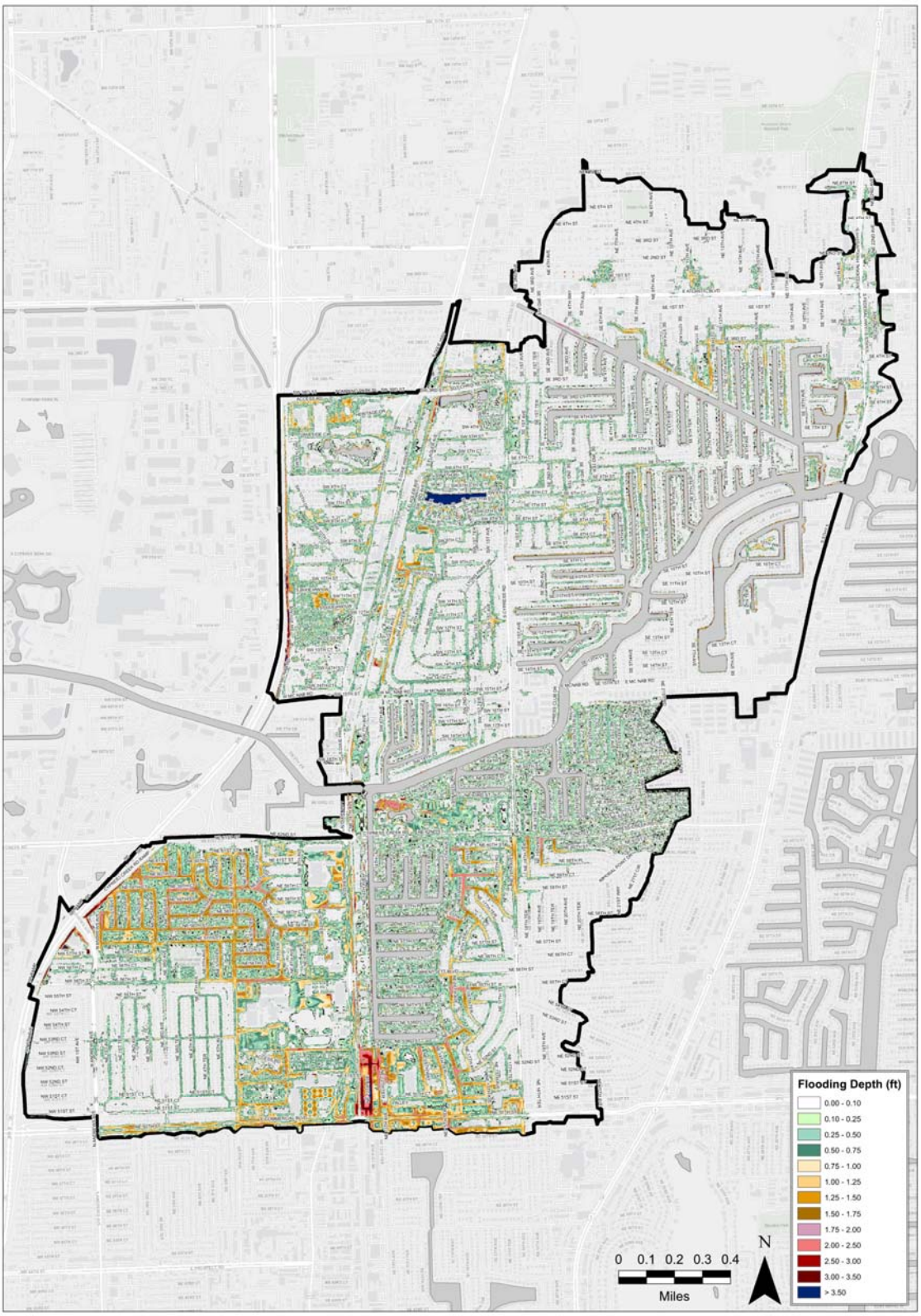


Figure 4-10: Cypress Creek Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

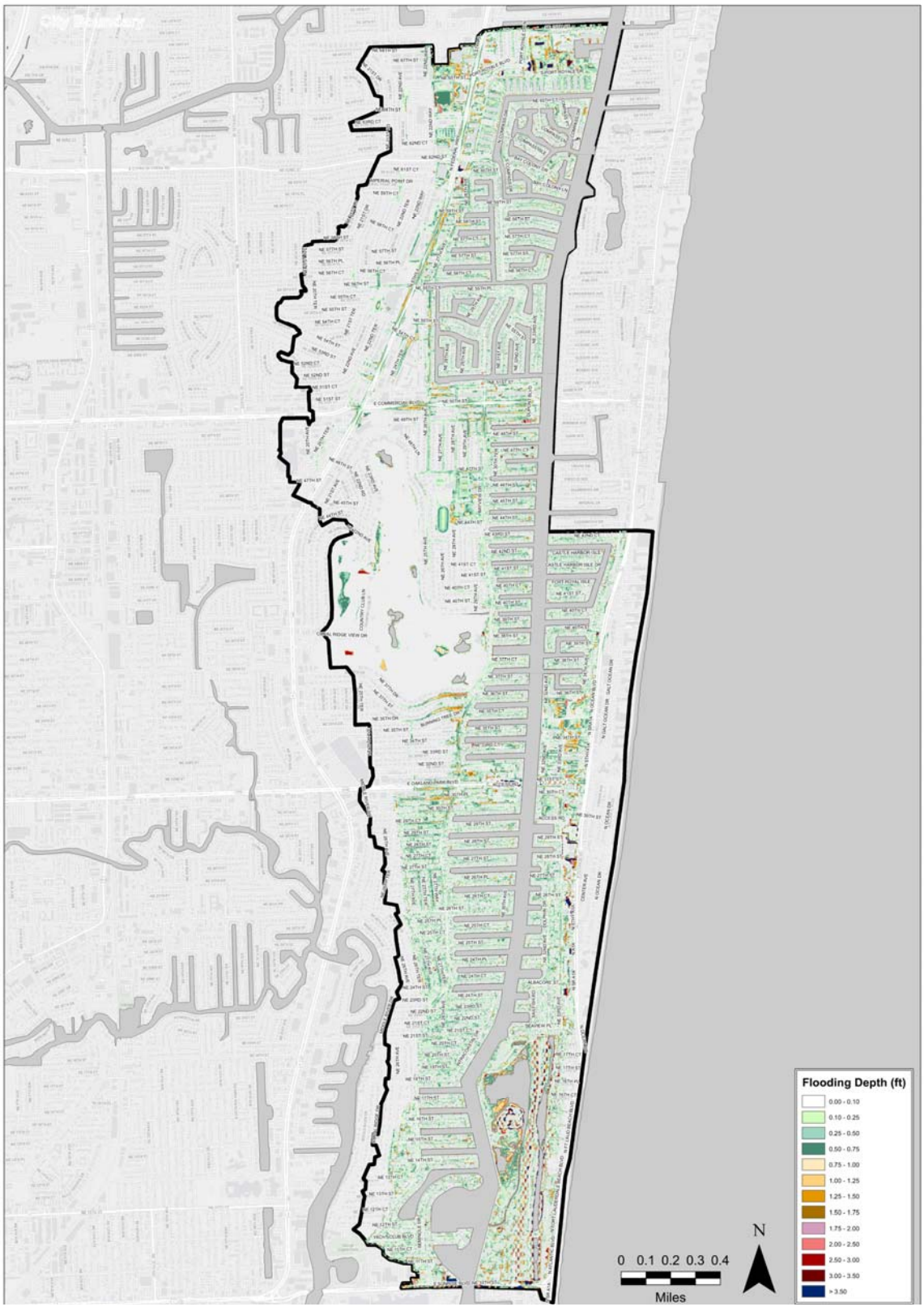


Figure 4-11: Intracoastal Waterway North Ground Surface Flooding Depth 10-Year 24-Hour Storm Event

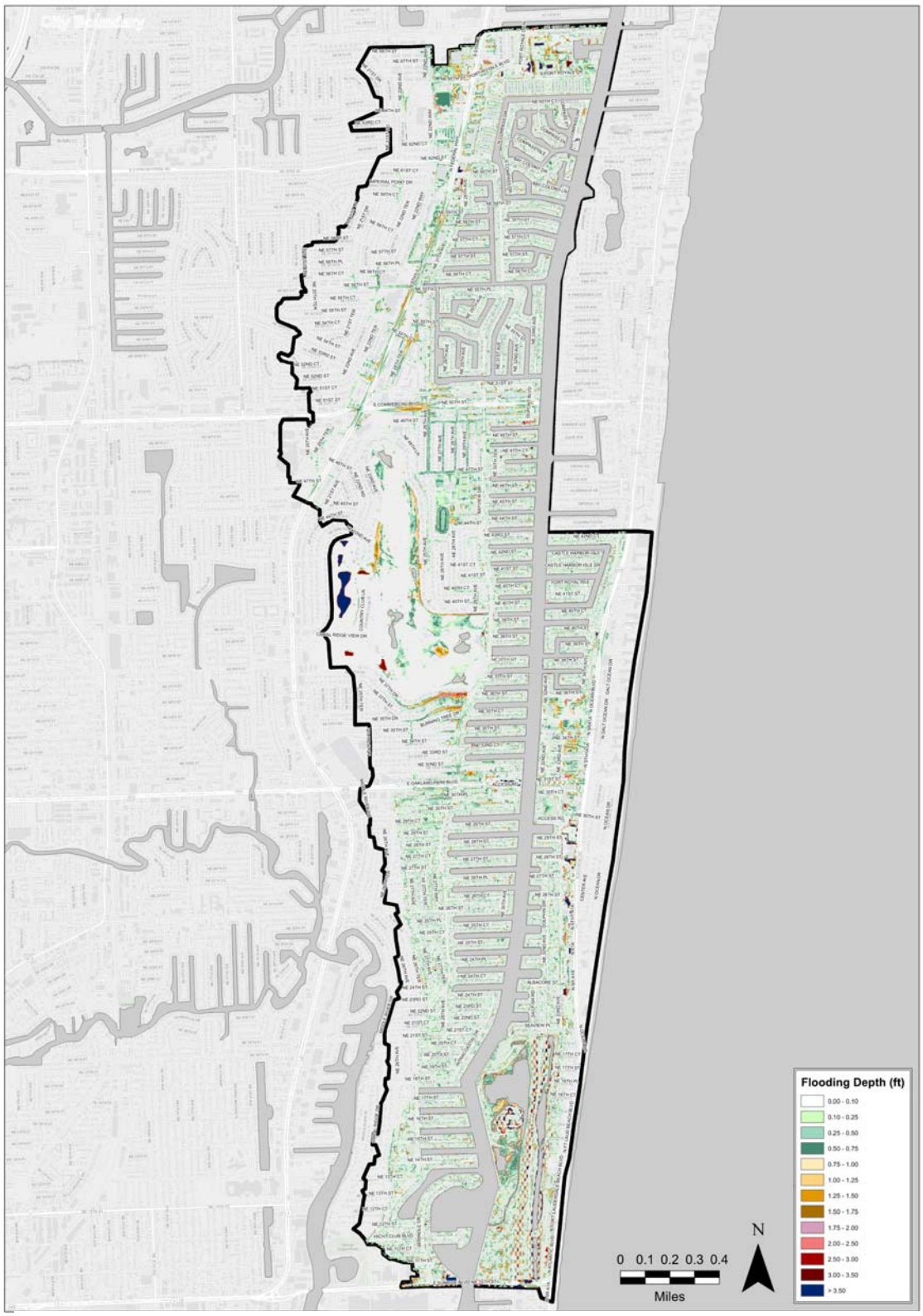


Figure 4-12: Intracoastal Waterway North Ground Surface Flooding Depth 100-Year 72-Hour Storm Event

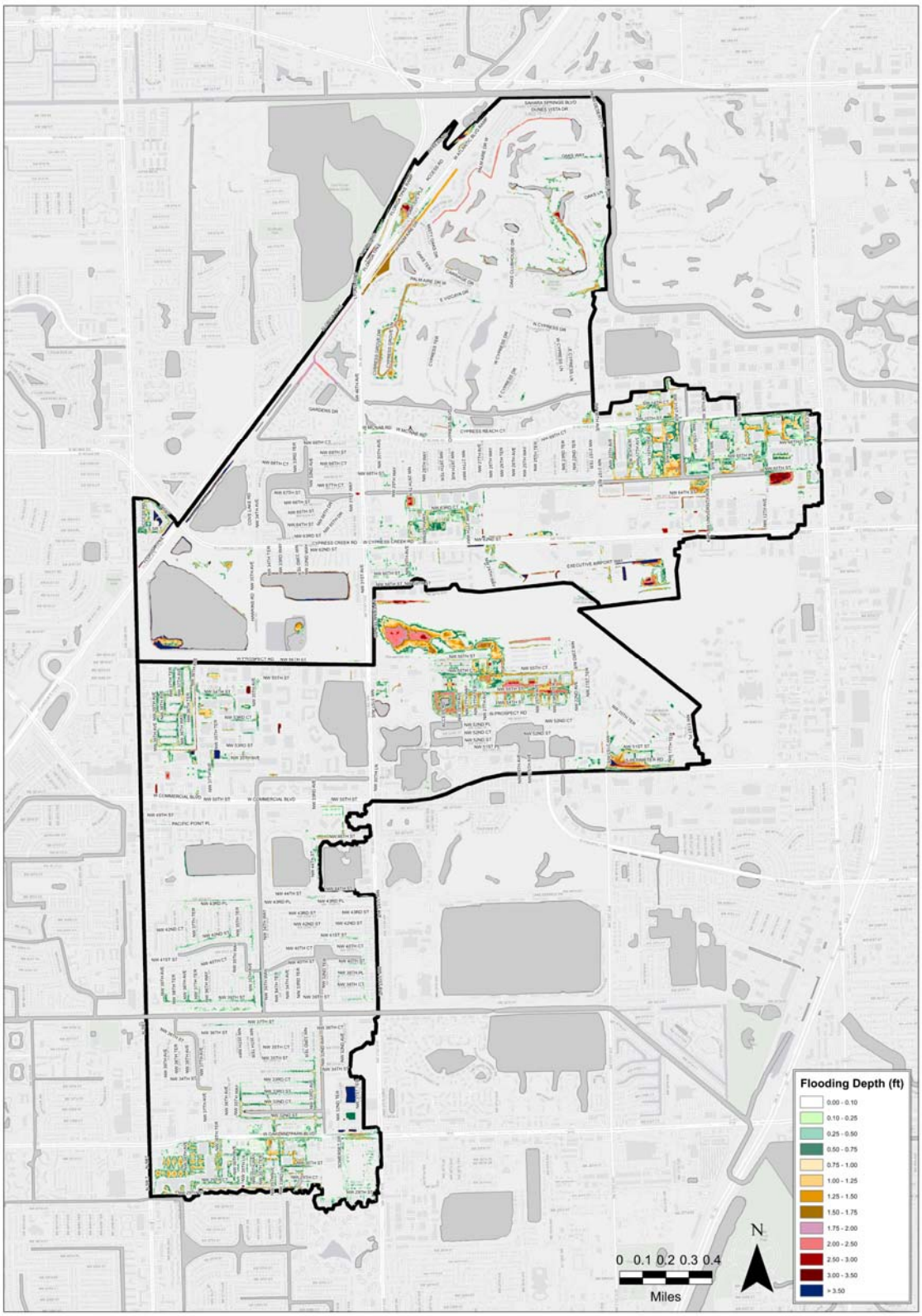


Figure 4-13: Prospect Recharge & S-36 Ground Surface Flooding Depth 10-Year 24-Hour

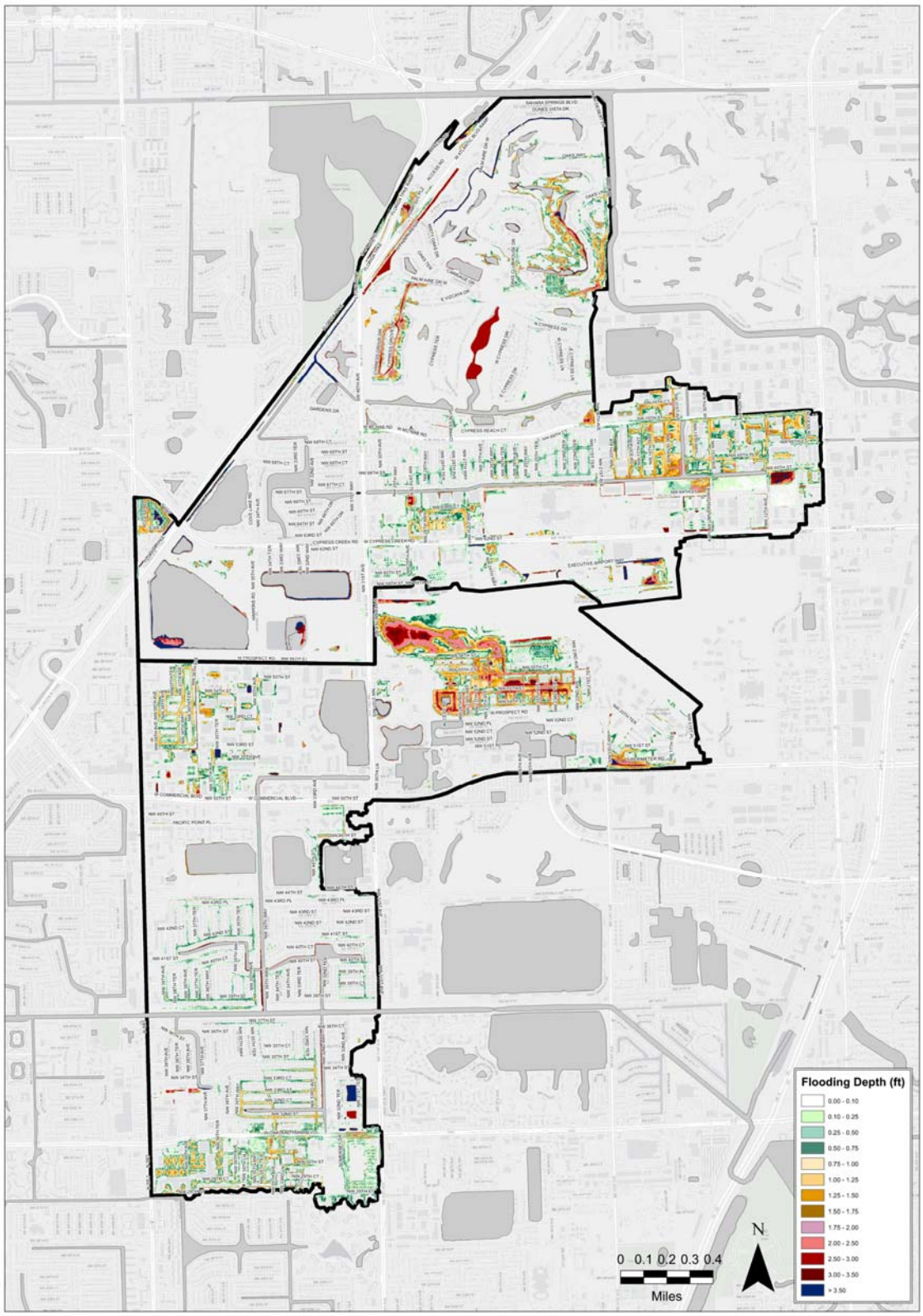


Figure 4-14: Prospect Recharge & S-36 Ground Surface Flooding Depth 100-Year 72-Hour

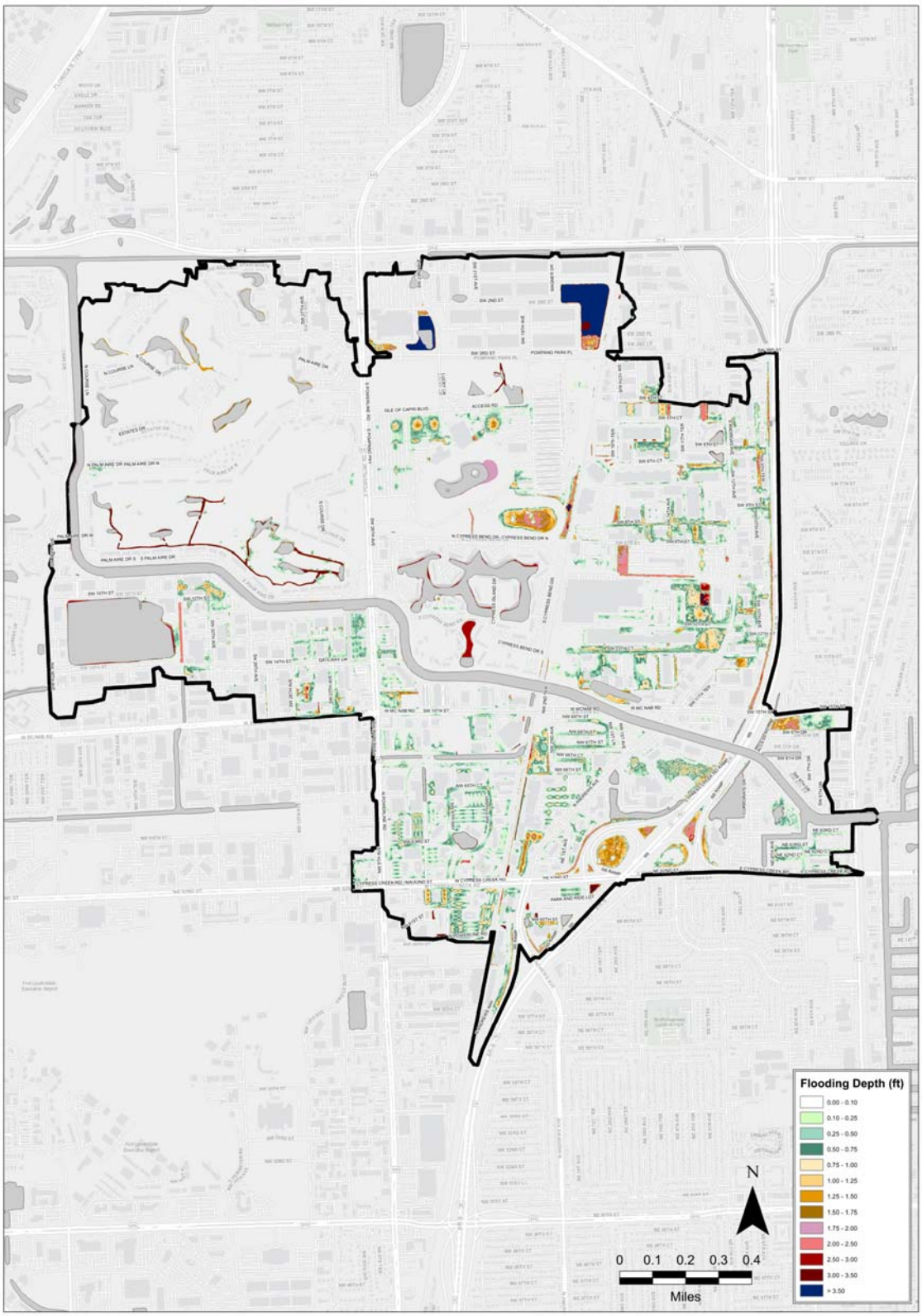


Figure 4-15: S-37A Ground Surface Flooding Depth 10-Year 24-Hour

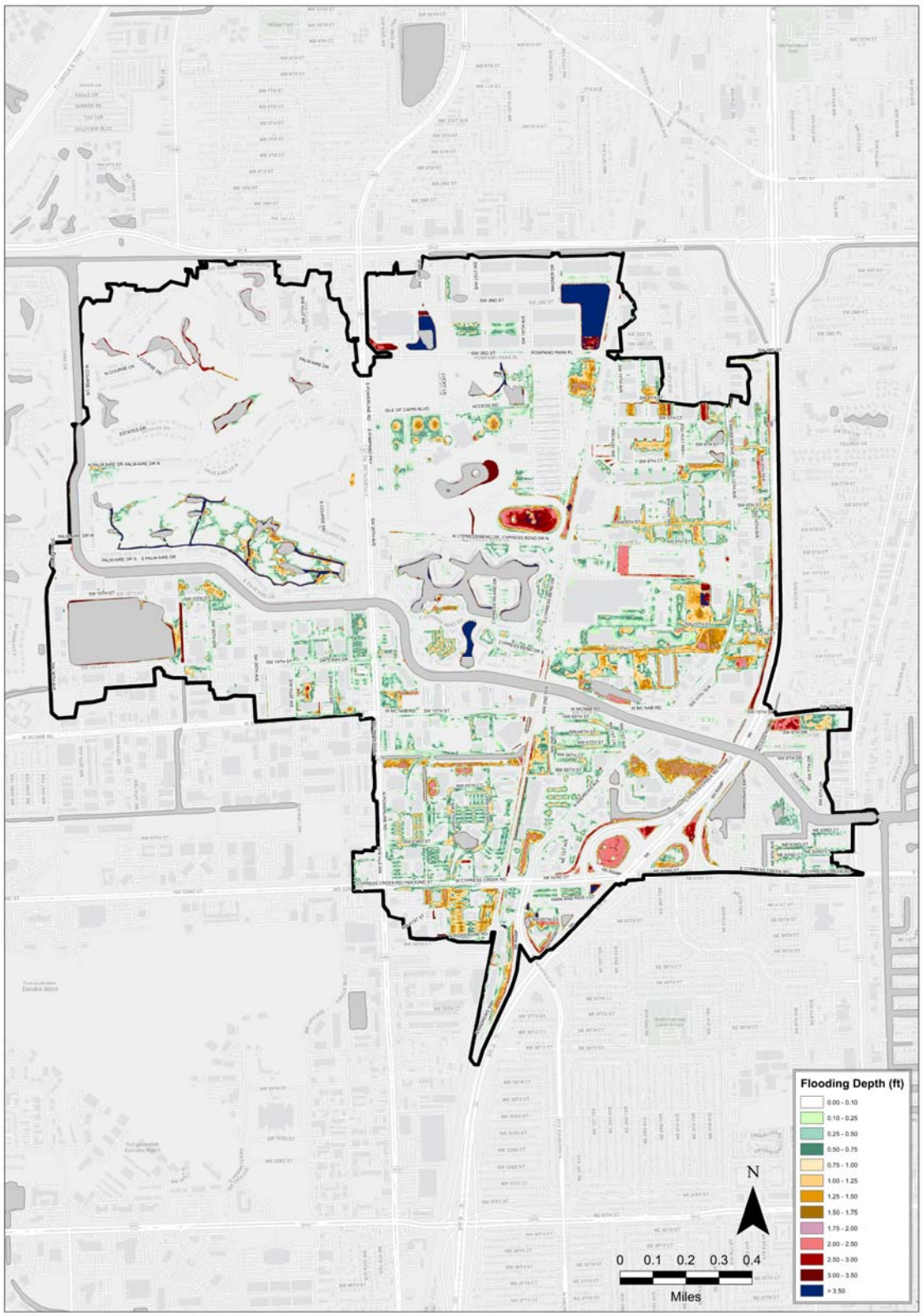


Figure 4-16: S-37A Ground Surface Flooding Depth 100-Year 72-Hour

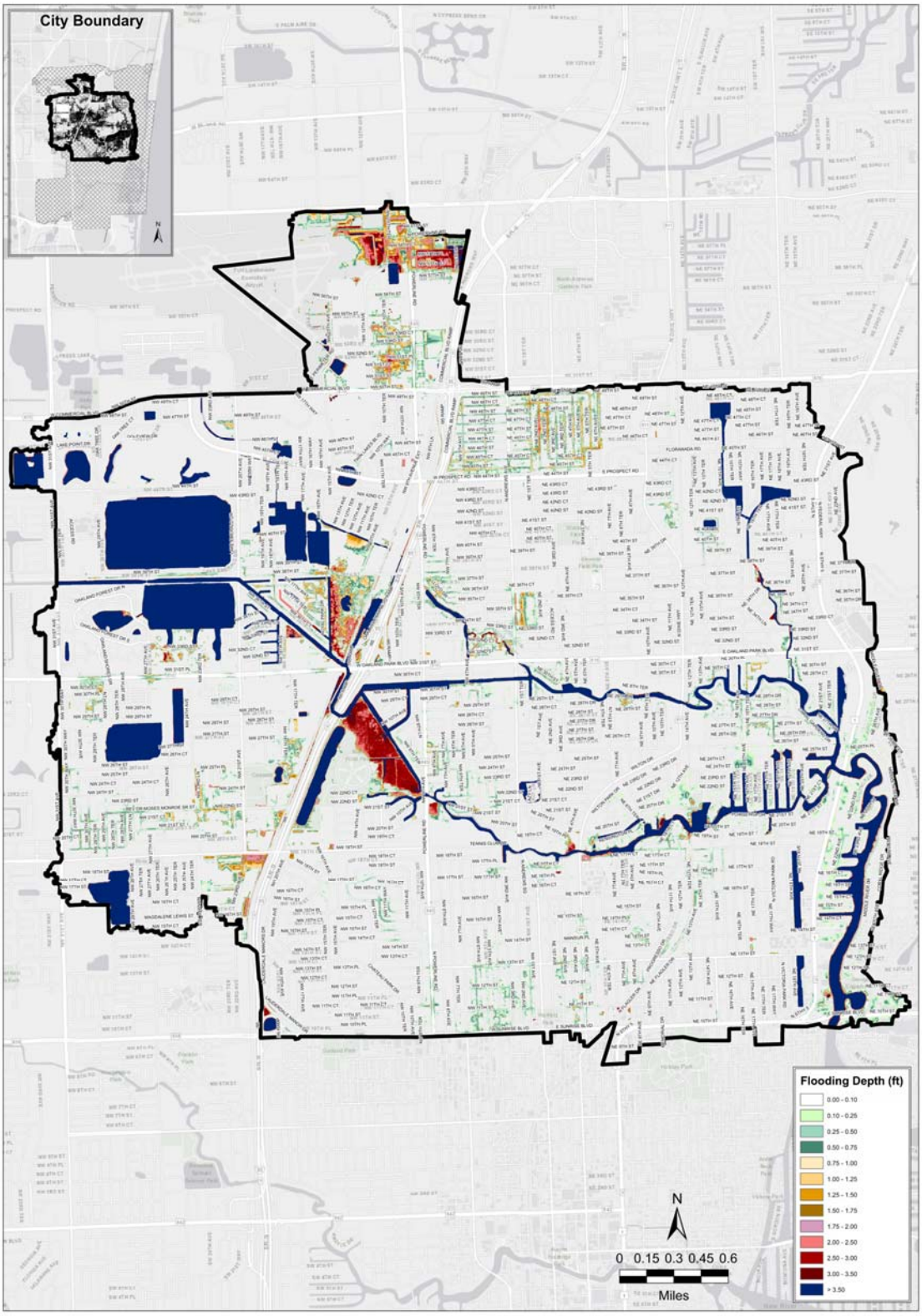


Figure 4-17: Middle River Ground Surface Flooding 10-Year 24-Hour

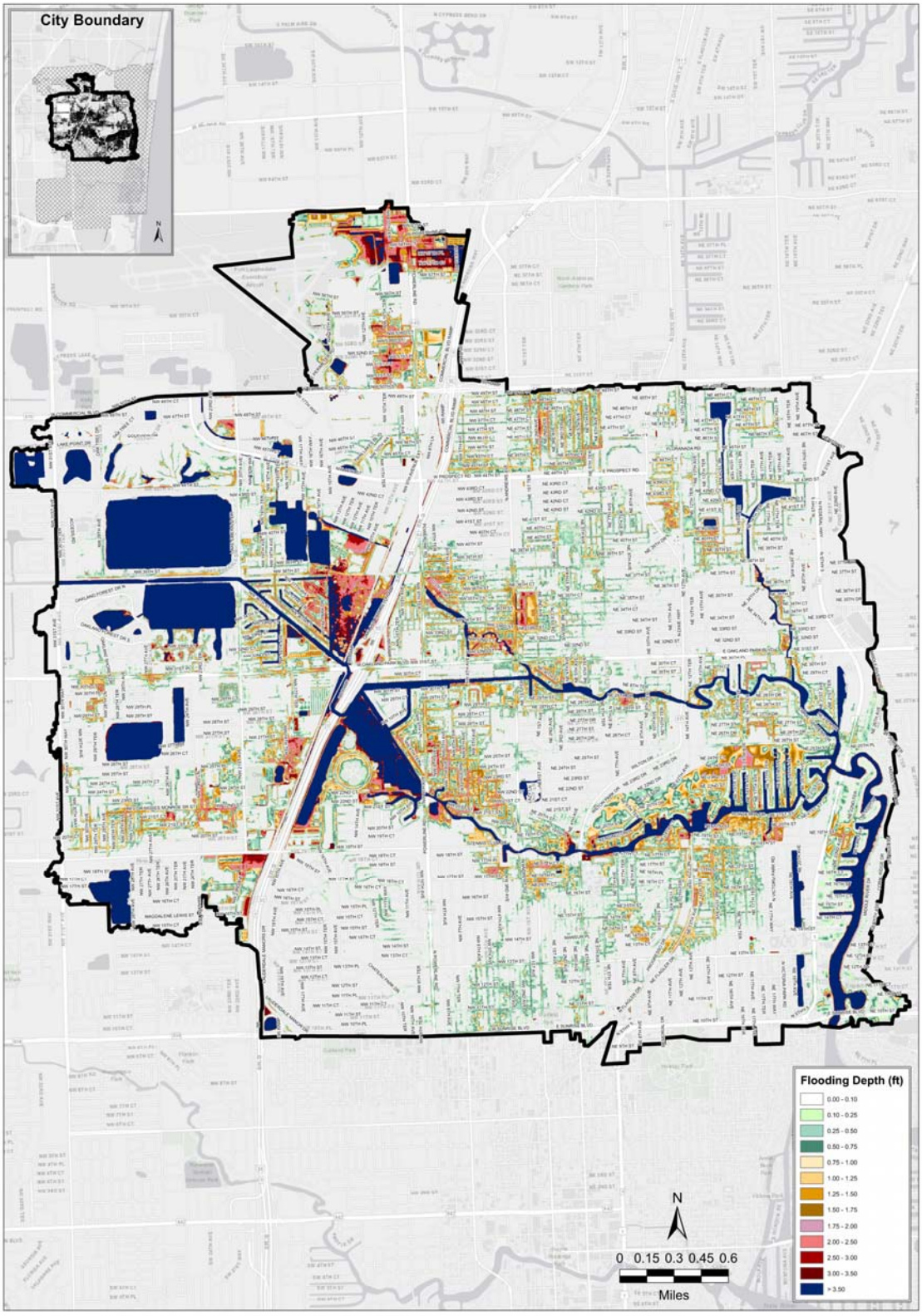


Figure 4-18: Middle River Ground Surface Flooding 100 Year 72 Hour

4.4 Identifying the Next Areas of Investment

It is recommended that the further identification of and planning for the next slate of 7 - 10 neighborhoods (identified in 4.3) to receive stormwater/resiliency infrastructure investment begin in calendar year 2022. Doing so will allow the appropriate time for modeling, conceptual plan development, design, permitting, and bidding, such that those projects will be ready to move into construction once the first seven neighborhoods are complete (or near complete).

4.5 Citywide Benefits

In addition to the obvious benefits associated with the specific neighborhood stormwater infrastructure investments, there are a variety of other more general benefits the City will realize via the Stormwater Program investments made to date. The following are among those benefits:

- Improved quality of important City Waterways – the addition of water quality treatment best management practices (BMPs) to serve areas with previously untreated stormwater discharges will provide general benefits to residents. Old corroded and broken infrastructure is currently being replaced in the priority areas with watertight concrete and engineered plastic pipe. The old pipes and structure allowed siltation and other foreign debris to discharge into the City's waterway and canals, contributing to the overall decline in water quality. The new pipe/structure materials, combined with water quality structures and baffles, will greatly reduce the contaminants being discharged into the New River and will allow for a cleaner and healthier system of waterways to be enjoyed by the community.

- Focused approach to priority neighborhoods as it relates to the City's functionality, transportation, and commerce. The priority areas consist of major throughfares and commercial zones that affect the functionality of the City. Areas such as the Las Olas Corridor and Isles is one of the main and most historic thoroughfares to the barrier island and contains a large portion of the City's resorts, restaurants, and condominiums. Another priority area being addressed is Sistrunk Boulevard (NW 6th Street), a major roadway that provides egress/ingress to several historical African American neighborhoods. Flooding in these areas severely impact the functionality of the City as whole, by limiting access to residences, commercial areas, and office buildings. Replacing the stormwater infrastructure in these critical areas will safeguard the City's functionality, transportation, commerce, and climate resilience for the upcoming decades.

- Reallocation of operation and maintenance resources. Currently, the priority areas being constructed under the first tier of this program, consume the majority of operational and maintenance resources, as they are some of the oldest and lowest elevation areas in the City. The capital (stormwater) investment in the priority neighborhoods will free up operational and maintenance resources formerly consumed attending to flooding and other drainage related issues. These resources can be reallocated to manage similar issues in other City neighborhoods and commercial areas.

- Application of Citywide Stormwater Model and LiDAR – these resources, developed in the initial phases of the program, can be used to evaluate, solve operational issues, and implement smaller/routine capital projects to address localized drainage problems. The LiDAR data has been

utilized successfully in the designing of stormwater improvement projects. The use of terrain modeling software has enabled City staff to quickly assess the topography of flooding areas and develop rapid engineering solutions for implementation. The LiDAR data has proven to be an indispensable problem-solving tool for operational/capital projects throughout the City.

- Asset Management - data collected and geodatabase developed in early phase of the program will allow the City to develop a comprehensive asset management program, currently under development. As part of the program's earlier phases, more than 5000 stormwater structures and pipes physical attributes (including age and condition) have been collected and GIS referenced. The remaining structures and pipes are expected to be collected in future phases as funding become available. The asset management program will serve in the targeting and prioritizing areas of concern and congruently aide in the practice of cost cutting decisions regarding infrastructure replacement.
- Use of standardized stormwater construction details and specifications – these work products, developed for the seven priority neighborhoods, can be reused for both future City investments and for private development projects.

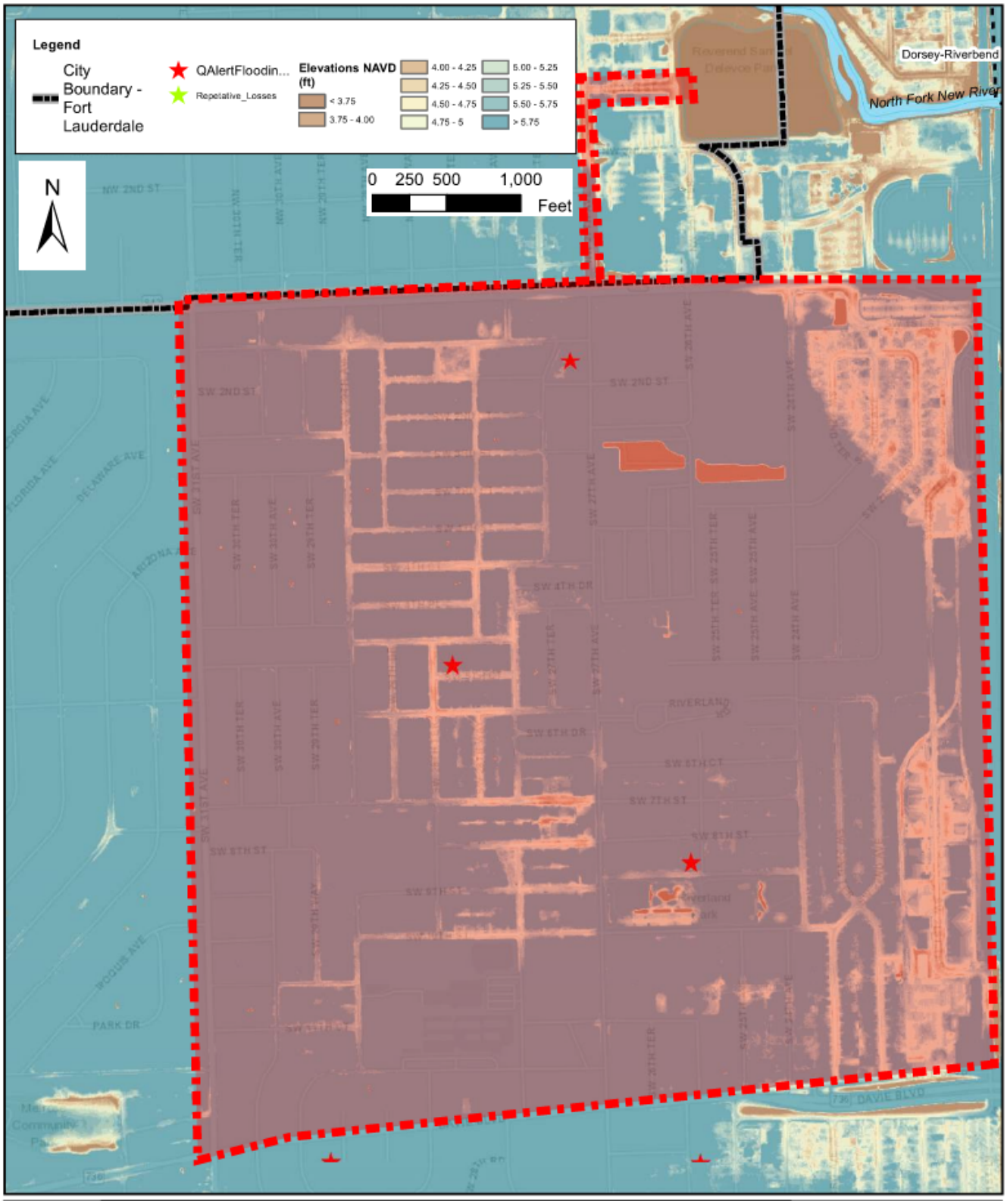


Figure 4-19: Melrose Manors and Riverland Neighborhoods

5. Seven Priority Neighborhoods – Design and Permitting

5.1 Neighborhood Overviews

As noted previously, seven neighborhoods were identified as priorities for initial stormwater infrastructure investment. This section provides an overview of those areas, including the design and permitting approach and efforts to date. **Figure 5-1** shows the location and limits of the seven neighborhoods.

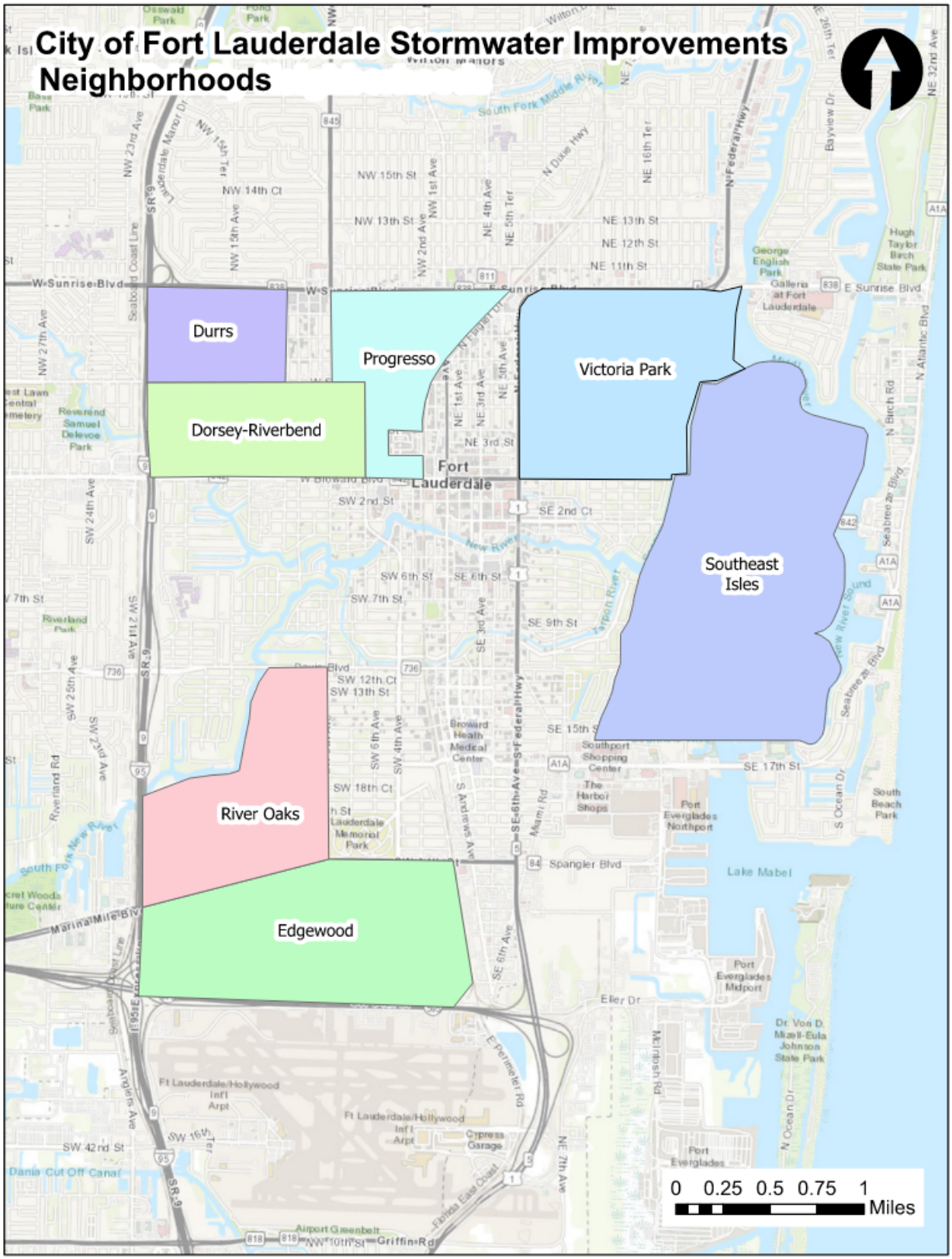


Figure 5-1: Location and Limits of the Neighborhoods

Dorsey - Riverbend

The Dorsey-Riverbend neighborhood is located east of I-95 and is bounded by NW 7th Avenue to the east, NW 6th Street (W. Sistrunk Boulevard) to the north, and State Road 842 (W. Broward Boulevard) to the south. The North Fork New River (NFNR) passes through the southwest portion of the neighborhood. The neighborhood occupies a total area of approximately 380 acres (0.6 mi^2). The elevations in the neighborhood range from approximately 3.6 feet NAVD 88 to approximately 10.6 feet NAVD 88, with lower elevations generally located within the central portion of the neighborhood.

Currently, the neighborhood is primarily served by two City-owned stormwater systems (divided approximately along NW 11th Avenue) but is also served by private drainage collection systems and the FDOT drainage collection system on W. Broward Boulevard[1]. Many segments of the storm sewer drainage system, particularly in northern areas of the neighborhood, are undersized for their respective drainage areas.

The western portion of the current Dorsey-Riverbend stormwater system serves a significant portion of the neighborhood (approximately 0.3 mi^2). The Durrs neighborhood, located directly north of Dorsey-Riverbend, discharges its stormwater into Dorsey-Riverbend's primary collector line at the intersection of NW 15th Avenue and W. Sistrunk Boulevard. Moving south, secondary drainage lines feed into the main collector line, before reaching the outfall to the NFNR, near the intersection of NW 15th Way and NW 3rd Court, and adjacent to North Fork Elementary School.

The eastern portion of the current Dorsey-Riverbend stormwater system serves approximately 0.2 mi^2 in the northeast portion of the neighborhood. This system contributes stormwater flow eastward along NW 5th Street (Marjorie A. Davis Street) and discharges to the Progresso Village neighborhood stormwater system.

Durrs

The Durrs Neighborhood is located on the western side of central Fort Lauderdale, bounded by I-95 on the west, Sunrise Boulevard (State Road 845) on the north, NW 12th Avenue on the east, and Sistrunk Boulevard/NW 6th Street on the south. The neighborhood is comprised of approximately 237 acres (0.37 mi^2). The elevations in the neighborhood range from approximately 1.0 feet NAVD 88 to approximately 12.5 feet NAVD 88; low areas are dispersed throughout the neighborhood.

The existing stormwater system for the Durrs Neighborhood generally consists of drainage inlets, small diameter storm drainage pipes, and roadside swales. Many of the storm drainage systems are located within the City of Fort Lauderdale's right-of-way and the majority of the storm drainage pipes within Durrs are less than eighteen (18") inches in diameter.

Progresso Village

The Progresso Village neighborhood is bounded by State Road 838 (W. Sunrise Boulevard) to the north, the FEC Railway to the east, NW 9th Avenue (Powerline Road) north of NW 6th Street (W. Sistrunk Boulevard) and NW 7th Avenue (Avenue of the Arts) south of NW 6th Street (W. Sistrunk Boulevard) to

[1] An area of approximately 0.03 mi^2 in the southwest portion of the neighborhood (south of the NFNR) drains into the Florida Department of Transportation collection system on W. Broward Boulevard.

the west, and State Road 842 (W. Broward Boulevard) to the south. The neighborhood occupies a total area of approximately 315 acres (0.5 mi^2). The elevations in the neighborhood range from approximately 1.1 feet NAVD 88 to approximately 12.7 feet NAVD 88.

Currently, the neighborhood is primarily served by a City-owned stormwater system but is also served by private drainage systems (mainly exfiltration trenches), the FDOT drainage systems on W. Broward Boulevard and W. Sunrise Boulevard, and the Broward County drainage systems along NW 9th Avenue (Powerline Road) and NW 7th Avenue (Avenue of the Arts).

Stormwater in Progresso Village is collected and conveyed on the ground surface through a combination of swales, roadway shoulders and curb and gutter systems to catch basin and curb inlets. Once collected, stormwater runoff is conveyed through underground piping which is comprised of tertiary, secondary and primary drainage pipes which exit the neighborhood and outfall to the North Fork New River (NFNR).

The County-owned primary line on Powerline Road collects stormwater runoff along its route and from secondary lines (including from the Dorsey-Riverbend neighborhood) and conveys the stormwater southward through a pipe network. The FDOT system collects stormwater runoff along its route and conveys the stormwater southward through a pipe network. This line then combines with the City collection system at the intersection of NW 5th Avenue and NW 2nd Street. This primary line collects stormwater runoff along its route and from secondary lines and conveys the water southward along SW 5th Avenue through a pipe, which leads to an outfall at the NFNR located behind the Broward Center for the Performing Arts.

Victoria Park

The Victoria Park neighborhood is bounded by Federal Highway to the west, Sunrise Boulevard to the north, Broward Boulevard to the south, and the Middle River to the east. The neighborhood encompasses approximately 668 acres of total land area and approximately 3,600 individual parcels (primarily residential). The existing stormwater system within the Victoria Park neighborhood is generally comprised of two independent drainage systems on each side of the coastal ridge. The existing stormwater system on the east side of the coastal ridge primarily consists of multiple outfalls which discharge into the Middle River. The existing stormwater system on the west side of the coastal ridge primarily consists of multiple independent pipe networks, which either do not have an outfall or are interconnected to other stormwater systems, such as the FDOT stormwater systems along Federal Highway and Sunrise Boulevard. Significant roadway segments throughout the Victoria Park neighborhood do not have any existing stormwater infrastructure.

Edgewood

The Edgewood neighborhood is located east of I-95 and is bounded by I-595 to the south, State Road (SR) 84 to the north and the FEC Railroad to the east. The neighborhood occupies a total area of approximately 750 acres (1.17 mi^2). The elevations in the neighborhood range from approximately 1.9 feet NAVD 88 to approximately 12.2 feet NAVD 88, with most of the lower elevation areas in the central section and adjacent to Osceola Creek. The eastern section is primarily industrial and commercial, while the remainder of the neighborhood is primarily residential. Snyder Park and the Edgewood Passive Park provide large open spaces for recreation.

Most of the existing stormwater management infrastructure exists in the eastern section of Edgewood, with relatively little infrastructure in the majority of the residential (central and western) areas. The eastern section has storm drainage infrastructure that connects to the SR 84 storm drainage infrastructure, as well as isolated sections of exfiltration trench.

River Oaks

The River Oaks neighborhood is located east of I-95 and South Fork New River and is bounded by State Road 84 to the south, Davie Road to the north, and SW 9th Avenue to the east. The neighborhood occupies a total area of approximately 518 acres (0.81 mi^2). The elevations in the neighborhood range from approximately 1.5 feet NAVD 88 to approximately 13.0 feet NAVD 88, with most of the lower elevation areas occurring south of SW 20th Street and adjacent to the Preserve Park. Adjacent to South Fork New River and State Road 84 are primarily industrial and commercial land uses, while the rest of the neighborhood is primarily residential.

The overall existing storm drainage system is disconnected with many separate drainage systems located throughout the neighborhood. The northern portion of the neighborhood, north of SW 17th Street, has several individual outfalls (to the canals) that function well in providing discharge of stormwater runoff. However, there are many areas that lack any type of conveyance system. A seventy-two (72") inch diameter storm drain exists in SW 12th Avenue from State Road 84 to a residential canal. This trunk line is a Florida Department of Transportation (FDOT) storm drain that does not capture or convey runoff from within the River Oaks neighborhood. It is strictly used for FDOT roadways and does not appear to have additional capacity for the River Oaks neighborhood. There is an outfall to an existing canal along the west right-of-way of Coconut Drive that does serve the southeastern portion of the neighborhood. There are several independent systems located in the southwestern portion of the neighborhood that consist of exfiltration trenches and swales to disperse the collected runoff. The southwestern section was designed primarily for swale drainage and surface flow towards the Preserve Park. Osceola Creek is located on the western edge of the neighborhood and drains to the South Fork New River under I-95.

Southeast Isles

The Southeast Isles neighborhood is located in the southeast section of Fort Lauderdale. The area includes many coastal neighborhoods, situated on narrow islands, which typically contain one street. The islands are connected by small strips of land or bridges to facilitate pedestrian and automobile traffic. Private homes line the streets and are fronted by canals that provide dock access. The land surface in the Southeast Isles neighborhood is relatively flat with a range of elevations from below sea level to 9.8 ft NAVD. The total area of the neighborhood is approximately 1,240 acres (1.94 mi^2), which includes both the land and the vast amount of water within the neighborhood.

Currently, the Southeast Isles stormwater system consists of inlets and outfalls with the majority of the pipe diameters ranging from 6-inches to 18-inches. Most of the storm drainage infrastructure connects the street level inlets to an outlet that drains directly into the canals. There are two stormwater pump stations within the Southeast Isles area; one is located off SE 25th Ave and the other is located off Coconut Isle Dr. In addition, the present system includes about 88 tidal valves.

Melrose Manors/Riverland

The Melrose Manors/ Riverland neighborhoods lies within the North Fork New River and South Fork New River Watersheds.
Currently, these neighborhoods have no stormwater infrastructure and positive outfalls, and are low lying, ranging between 1.8' to 5' NAVD. Because of this, medium to intense seasonal rainfall causes severe widespread flooding. The flooding persists for days or weeks with only soil storage recovery available for drainage.

5.2 City-Wide Flooding Evaluations

Past flooding reports were reviewed to better understand drainage concerns. Data from the City's QAlert service, FEMA Repetitive Loss records, neighborhood outreach meetings, and the 2009 Stormwater Master Plan were compiled to ascertain where to focus improvement efforts.

In addition, field visits were conducted during dry and wet conditions to ascertain the general condition of facilities as well as areas of poor drainage and more pronounced flooding. The right of way (and particularly swale) conditions was observed (paved, vegetated, encroachments, etc.).

Lastly, in conjunction with the information gained from the flooding reports and field reconnaissance, the neighborhood stormwater management system's performance under a variety of storm events and present and future climatological conditions was simulated using the new, comprehensive City Stormwater Model. The sum of this information was considered in the development of proposed City-wide stormwater system improvements.

5.3 City-Wide Proposed System Improvements

Proposed improvements for the various phases of the City-wide stormwater system project varied amongst the different neighborhoods, but included: new, expanded and/or upsized stormwater collection and conveyance systems; new or restored swale systems, exfiltration trenches, water quality structures, one-way valves (for backflow prevention), raised seawalls, created wetlands, and stormwater pumping stations. Approximated asset investments associated with the seven priority neighborhoods are reported below:

- 100,000 linear feet of new storm drainage pipe
- 31,000 linear feet of replaced storm drainage pipe
- 21,000 linear feet of exfiltration trench
- 75,000 square feet of new and restored swales
- 2 drainage wells
- 11 water quality structures
- 7 pump stations
- 150 backflow preventers

- 3,500 square yards of permeable pavement
- 9 acres of created wetlands
- 6,000 linear feet of seawall replacement
- 3,500 linear feet of canal and creek maintenance

These proposed improvements are intended to reduce flood stage and time of inundation above road crowns for a 10-year, 24-hour design storm event and to protect against structural flooding in a 100-year,72-hour storm event, wherever feasible.

5.4 Water Quality

Some level of water quality treatment is being provided in each of the prioritized neighborhood improvement projects, based on the ability to integrate such features given existing conditions and constraints. Such conditions and constraints include limited and congested rights of way, built out conditions, and relatively high-water tables. While different water quality based best management practices (BMP's) were used (to varying degrees) in the different locations, commonly used elements include exfiltration trenches, restored swales, permeable pavement, and specifically designed water quality structures located upstream of certain pump stations and outfalls. Additionally, the new infrastructure will be utilizing materials that are less susceptible to degradation and corrosiveness as they age, ensuring that the water quality discharge does not worsen over time. As part of the permitting process and following regulatory agencies standards, all new infrastructure is required to meet the current water quality standards.

5.5 Neighborhood Outreach

Community involvement is a key factor in the long-term success of the stormwater improvement initiatives. For each of the priority neighborhoods, public outreach was conducted throughout the planning and design process. Three individual meetings were held with each of the respective Neighborhood Associations. Public input was actively sought, and neighbors provided information regarding flooding conditions and previous experiences. Meetings during the design phase were used to communicate design concepts and expectations, as well as answer residents' questions.

5.6 Design

Design efforts have been completed for those neighborhood improvement projects which have already been bid (River Oaks, Edgewood, and several of the Seawall Replacements in the Southeast Isles). For the majority of the other neighborhoods, designs have been substantially completed and require only modifications to address condition changes associated with the passage of time and to ready the documents for final bidding. This effort will likely be most considerable for the Victoria Park and Southeast Isles neighborhoods.

5.7 Permitting

The primary permitting effort associated with the designs for the seven priority neighborhoods was through the Broward County Environmental Protection Permitting and Growth Management Department. The main approvals necessary included Environmental Resource Permits/Surface Water Management Licenses (ERP/SWML) and Environmental Resource Licenses (ERL). ERL's were not necessary for all neighborhoods. In addition, an overall Conceptual Permit for the seven-neighborhood program was obtained using the comprehensive City-wide stormwater model. **Table 5-1** reflects the status of permitting for each of the neighborhoods. Note that final construction permit applications and issuance have been timed to (closely) coincide with the schedule for construction contract bidding.

Table 5-1: Permitting Status

Neighborhood	Conceptual ERP/SWML	Construction ERP/SWML	ERL
Southeast Isles[2]	Obtained	Pending	Pending
River Oaks	Obtained	Obtained	Obtained
Edgewood	Obtained	Obtained	Obtained
Dorsey/Riverbend	Obtained	Obtained	Obtained
Durrs	Obtained	Obtained	N/A
Progresso Village	Obtained	Obtained	N/A
Victoria Park	Obtained	Pending	Pending
Melrose Manors / Riverland	N/A	Pending	Pending

[2] Certain seawall replacements within the Southeast Isles neighborhood have been permitted and constructed or are in construction.

5.8 Construction Cost Estimates and Tentative Scheduling

Construction cost estimates were developed for each of the seven neighborhoods in 2018. These estimates were used by Stantec in the aforementioned "FY 2020 Stormwater Fund Financial Sustainability Analysis (December 15, 2020)". Those estimates were revised in 2021 based on finalization of the plans for certain neighborhoods and receipt of bids on others. For remaining neighborhoods, costs were escalated based on the associated passage of time. The respective 2018 and 2021 construction cost estimates are shown in **Tables 5-2 and 5-3**. In addition, estimates were made for remaining professional services, including construction inspection and engineering services during construction (see **Table 5-4**). Note that due to anticipation of some cost reductions in the seven priority neighborhood costs, the 2021 estimates also include the Melrose Manors/Riverland project.

Table 5-2: City of Fort Lauderdale - Stormwater Master Plan Priority Neighborhoods Opinion of Probable Construction Cost (OPCC) (January 2018)

Neighborhood	OPCC with 20% Contingency	OPCC with 20% Contingency (+15%)	OPCC with 20% Contingency (-10%)
Southeast Isles[3]	$36,924,000	$42,462,600	$33,231,600
River Oaks	$32,912,900	$37,849,900	$29,621,600
Edgewood	$26,208,000	$30,139,200	$23,587,200
Dorsey/Riverbend	$17,307,500	$19,903,700	$15,576,800
Durrs	$18,060,000	$20,769,000	$16,254,000
Progresso Village	$23,257,800	$26,746,500	$20,932,000
Victoria Park	$15,887,100	$18,270,200	$14,298,400
Total	**$170,557,300**	**$196,141,100**	**$153,501,600**

[3] *The Southeast Isles Neighborhood opinion of probable cost includes individual seawall projects that are in various design and construction phases in addition to the overall neighborhood improvements project.*

Table 5-3: City of Fort Lauderdale - Stormwater Master Plan Priority Neighborhoods Plus Melrose Manors/Riverland (Updated through July 2021)

Neighborhood	Opinion of Probable Construction Cost	Opinion of Probable Construction Cost (+15%)	Opinion of Probable Construction Cost (-10%)
Southeast Isles[4]	$42,512,700	$47,709,100	$39,048,400
River Oaks	$32,444,000	$37,310,600	$29,199,600
Edgewood	$20,650,200	$23,747,700	$18,585,200
Dorsey/Riverbend	$19,270,900	$22,161,500	$17,343,800
Durrs	$20,108,800	$23,125,100	$18,097,900
Progresso Village	$25,896,200	$29,780,600	$23,306,500
Victoria Park	$17,689,300	$20,342,700	$15,920,400
Melrose Manors / Riverland	$30,050,600	$34,558,200	$27,045,600
Total	**$208,622,700**	**$238,735,500**	**$188,547,400**

Note: *Opinions of probable construction cost are estimated and are subject to adjustment depending on changes in project scope and specific improvement elements. They include a 20% contingency, except for those projects that have already gone to bid (Edgewood and River Oaks).*

[4] *The Southeast Isles Neighborhood opinion of probable cost includes individual seawall projects that are in various design and construction phases in addition to the overall neighborhood improvements project.*

Table 5-4: City of Fort Lauderdale - Stormwater Master Plan Priority Neighborhoods Plus Melrose Manors/Riverland Anticipated Professional Services Remaining

Neighborhood	Anticipated Professional Services Remaining ($)		Total ($)
	Design/Permit/Bid	Const. Services	
Southeast Isles[5]	$762,100	$3,424,100	$4,186,200
River Oaks	$68,100	$3,149,300	$3,217,400
Edgewood	$87,800	$2,379,300	$2,467,100
Dorsey/Riverbend	$482,000	$1,761,800	$2,243,800
Durrs	$238,600	$1,575,600	$1,814,200
Progresso Village	$445,400	$2,504,200	$2,949,600
Victoria Park	$304,300	$1,710,600	$2,014,800
Melrose Manors / Riverland	$2,824,200	$2,905,900	$5,730,100
Total	**$5,212,500**	**$19,410,800**	**$24,623,200**

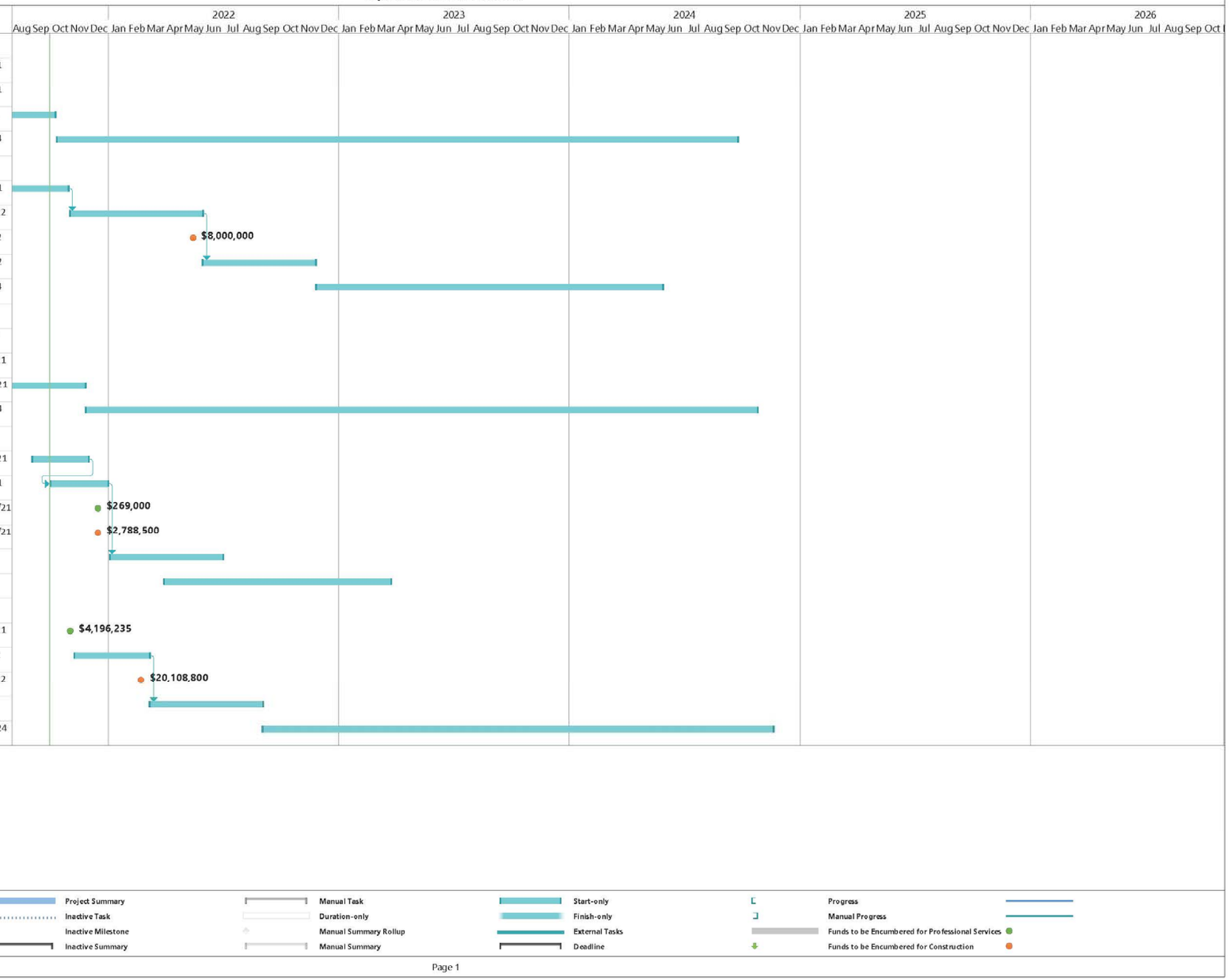
Note: *Anticipated costs for remaining professional services are estimated and are subject to adjustment depending on detailed design/construction management activities and the City's desired level of service*

In addition, a tentative implementation schedule (including approximate fund encumbrance timing) is shown in **Figure 5-2**.

[5] *The Southeast Isles Neighborhood opinion of probable cost includes individual seawall projects that are in various design and construction phases in addition to the overall neighborhood improvements project.*

CITY OF FORT LAUDERDALE
STORMWATER MASTER PLAN AND DESIGN IMPLEMENTATION PROGRAM SCHEDULE
Updated: October 1, 2021

Task Name	Duration	Start	Finish
*** River Oaks Underground**			
Design/Bid Documents	120 days	Sun 11/1/20	Sun 2/28/21
Permitting	90 days	Thu 12/31/20	Tue 3/30/21
Bid and Award	222 days	Mon 3/1/21	Fri 10/8/21
Construction through Final Completion	1080 days	Mon 10/11/21	Tue 9/24/24
***River Oaks Pump Station**			
Design/Bid Documents	363 days	Sun 11/1/20	Fri 10/29/21
Permitting	211 days	Mon 11/1/21	Mon 5/30/22
Fund Construction	0 days	Sun 5/15/22	Sun 5/15/22
Bid and Award	180 days	Mon 5/30/22	Fri 11/25/22
Construction through Final Completion	550 days	Sat 11/26/22	Tue 5/28/24
***Edgewood**			
Design/Bid Documents	210 days	Sun 11/1/20	Sat 5/29/21
Permitting	180 days	Thu 12/31/20	Mon 6/28/21
Bid and Award	180 days	Sun 5/30/21	Thu 11/25/21
Construction through Final Completion	1065 days	Fri 11/26/21	Fri 10/25/24
† Osceola Creek			
Design/Bid Documents	90 days	Thu 9/2/21	Tue 11/30/21
Permitting	92 days	Fri 10/1/21	Fri 12/31/21
Fund Professional Services	0 days	Wed 12/15/21	Wed 12/15/21
Fund Construction	0 days	Wed 12/15/21	Wed 12/15/21
Bid and Award	180 days	Mon 1/3/22	Fri 7/1/22
Construction through Final Completion	360 days	Wed 3/30/22	Fri 3/24/23
Durrs			
Fund Professional Services	0 days	Mon 11/1/21	Mon 11/1/21
Design/Bid Documents	120 days	Mon 11/8/21	Mon 3/7/22
Fund Construction	0 days	Mon 2/21/22	Mon 2/21/22
Bid and Award	180 days	Mon 3/7/22	Fri 9/2/22
Construction through Final Completion	810 days	Fri 9/2/22	Tue 11/19/24



Project Program: Schedule
Date: Thu 9/30/21

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
Deadline
Progress
Manual Progress
Funds to be Encumbered for Professional Services
Funds to be Encumbered for Construction

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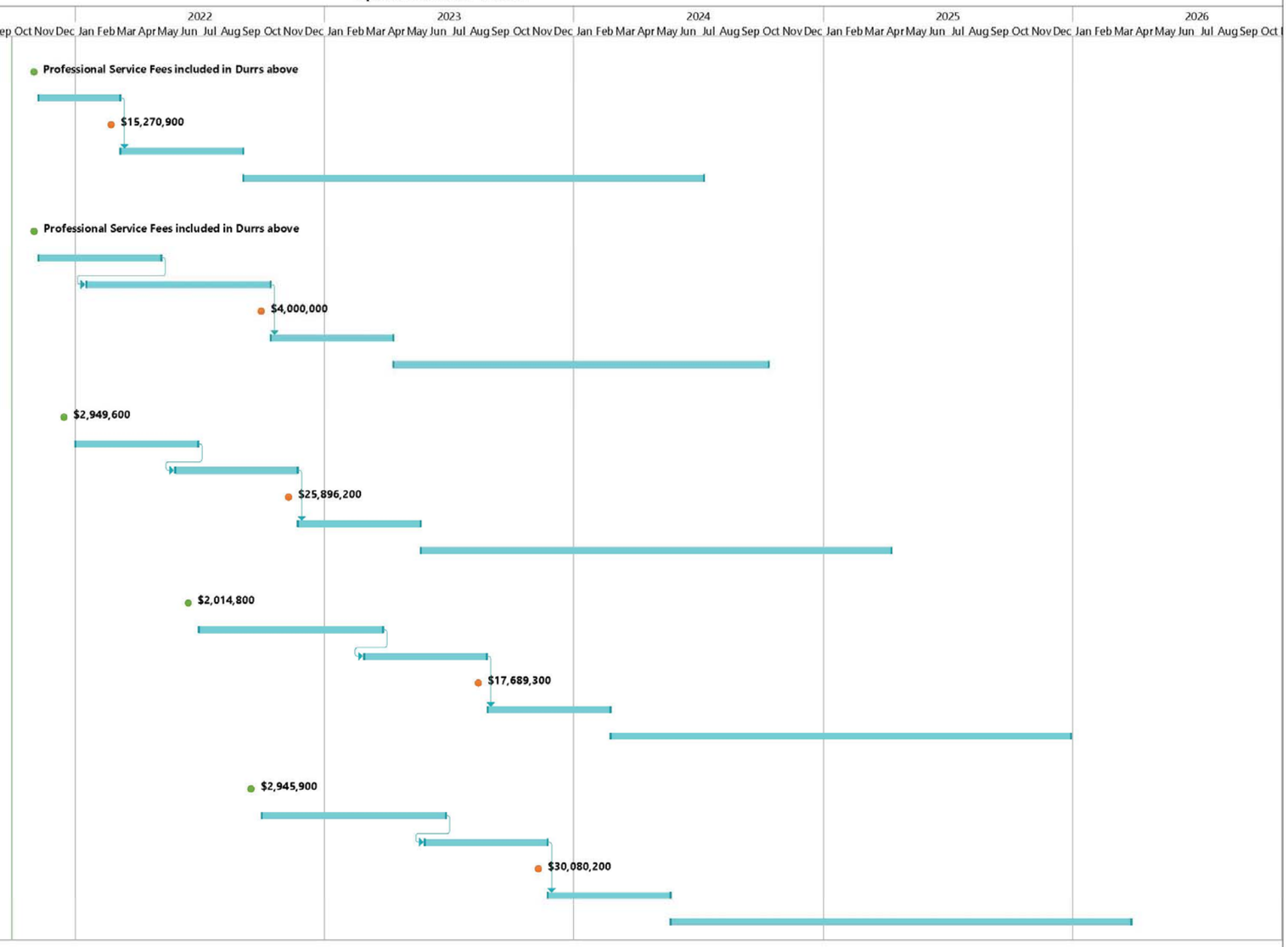
Figure 5-2: Implementation Schedule

CITY OF FORT LAUDERDALE
STORMWATER MASTER PLAN AND DESIGN IMPLEMENTATION PROGRAM SCHEDULE
Updated: October 1, 2021

Task Name	Duration	Start	Finish
Dorsey Underground			
Fund Professional Services	0 days	Mon 11/1/21	Mon 11/1/21
Design/Bid Documents	120 days	Mon 11/8/21	Mon 3/7/22
Fund Construction	0 days	Tue 2/22/22	Tue 2/22/22
Bid and Award	180 days	Tue 3/8/22	Sat 9/3/22
Construction through Final Completion	675 days	Sun 9/4/22	Tue 7/9/24
Dorsey Pump Station			
Fund Professional Services	0 days	Mon 11/1/21	Mon 11/1/21
Design/Bid Documents	180 days	Mon 11/8/21	Fri 5/6/22
Permitting	270 days	Mon 1/17/22	Thu 10/13/22
Fund Construction	0 days	Fri 9/30/22	Fri 9/30/22
Bid and Award	180 days	Fri 10/14/22	Tue 4/11/23
Construction through Final Completion	550 days	Wed 4/12/23	Sat 10/12/24
Progresso Village			
Fund Professional Services	0 days	Wed 12/15/21	Wed 12/15/21
Design/Bid Documents	180 days	Sat 1/1/22	Wed 6/29/22
Permitting	180 days	Fri 5/27/22	Tue 11/22/22
Fund Construction	0 days	Wed 11/9/22	Wed 11/9/22
Bid and Award	180 days	Wed 11/23/22	Sun 5/21/23
Construction through Final Completion	690 days	Mon 5/22/23	Thu 4/10/25
Victoria Park			
Fund Professional Services	0 days	Wed 6/15/22	Wed 6/15/22
Design/Bid Documents	270 days	Fri 7/1/22	Mon 3/27/23
Permitting	180 days	Tue 2/28/23	Sat 8/26/23
Fund Construction	0 days	Mon 8/14/23	Mon 8/14/23
Bid and Award	180 days	Mon 8/28/23	Fri 2/23/24
Construction through Final Completion	675 days	Sat 2/24/24	Mon 12/29/25
Southeast Isles			
Fund Professional Services	0 days	Thu 9/15/22	Thu 9/15/22
Design/Bid Documents	270 days	Sat 10/1/22	Tue 6/27/23
Permitting	180 days	Sun 5/28/23	Thu 11/23/23
Fund Construction	0 days	Fri 11/10/23	Fri 11/10/23
Bid and Award	180 days	Fri 11/24/23	Tue 5/21/24
Construction through Final Completion	675 days	Wed 5/22/24	Fri 3/27/26



Project Program: Schedule
Date: Thu 9/30/21

Task | Split | Milestone | Summary
Project Summary | Inactive Task | Inactive Milestone | Inactive Summary
Manual Task | Duration-only | Manual Summary Rollup | Manual Summary
Start-only | Finish-only | External Tasks | Deadline
Progress | Manual Progress | Funds to be Encumbered for Professional Services | Funds to be Encumbered for Construction

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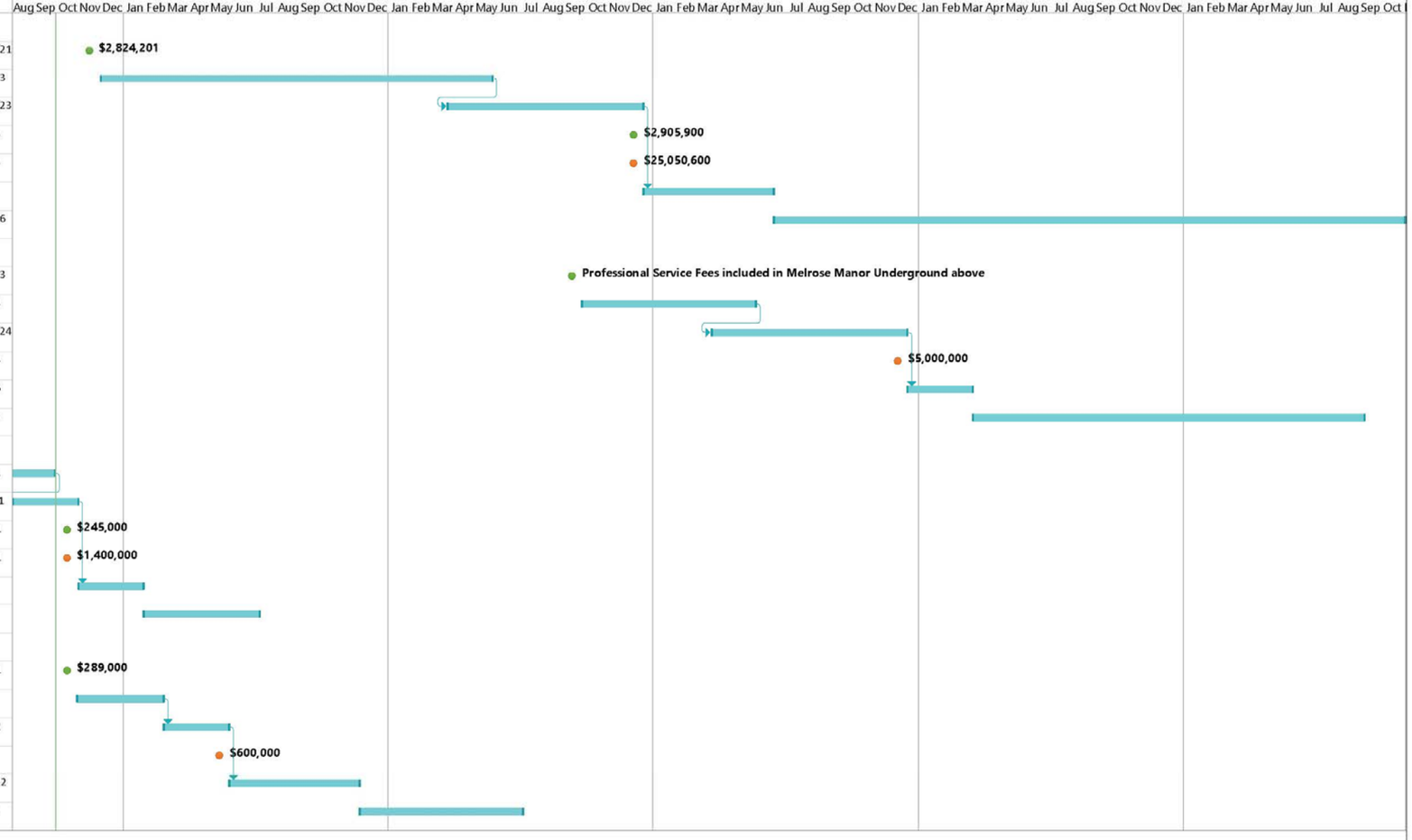
CITY OF FORT LAUDERDALE
STORMWATER MASTER PLAN AND DESIGN IMPLEMENTATION PROGRAM SCHEDULE
Updated: October 1, 2021

Task Name	Duration	Start	Finish
Melrose Manor Underground			
Fund Professional Services in Design	0 days	Mon 11/15/21	Mon 11/15/21
Design/Bid Documents	540 days	Wed 12/1/21	Wed 5/24/23
Permitting	270 days	Fri 3/24/23	Mon 12/18/23
Fund Professional Services in Constructi	0 days	Tue 12/5/23	Tue 12/5/23
Fund Construction	0 days	Tue 12/5/23	Tue 12/5/23
Bid and Award	180 days	Tue 12/19/23	Sat 6/15/24
Construction through Final Completion	870 days	Sun 6/16/24	Mon 11/2/26
Melrose Manor Pump Station			
Fund Professional Services	0 days	Mon 9/11/23	Mon 9/11/23
Design/Bid Documents	240 days	Mon 9/25/23	Tue 5/21/24
Permitting	270 days	Fri 3/22/24	Mon 12/16/24
Fund Construction	0 days	Tue 12/3/24	Tue 12/3/24
Bid and Award	90 days	Tue 12/17/24	Sun 3/16/25
Construction through Final Completion	540 days	Mon 3/17/25	Mon 9/7/26
f Hendricks Isle Seawalls			
Design/Bid Documents	90 days	Thu 7/1/21	Tue 9/28/21
Permitting	90 days	Mon 8/2/21	Sat 10/30/21
Fund Professional Services	0 days	Fri 10/15/21	Fri 10/15/21
Fund Construction	0 days	Fri 10/15/21	Fri 10/15/21
Bid and Award	90 days	Sun 10/31/21	Fri 1/28/22
Construction through Final Completion	160 days	Sat 1/29/22	Thu 7/7/22
Merle Fogg Seawall			
Fund Professional Services	0 days	Fri 10/15/21	Fri 10/15/21
Design/Bid Documents	120 days	Fri 10/29/21	Fri 2/25/22
Permitting	90 days	Sat 2/26/22	Thu 5/26/22
Fund Construction	0 days	Fri 5/13/22	Fri 5/13/22
Bid and Award	180 days	Fri 5/27/22	Tue 11/22/22
Construction through Final Completion	225 days	Wed 11/23/22	Wed 7/5/23



Project Program: Schedule
Date: Thu 9/30/21

Task	Project Summary	Manual Task	Start-only	Progress	
Split	Inactive Task	Duration-only	Finish-only	Manual Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Funds to be Encumbered for Professional Services	
Summary	Inactive Summary	Manual Summary	Deadline	Funds to be Encumbered for Construction	

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Appendix A: Conceptual Improvement Exhibits