



Miami Shores Village

10050 N.E. SECOND AVENUE
 MIAMI SHORES, FLORIDA 33138-2382
 TELEPHONE: (305) 795-2207
 FAX: (305) 756-8972

MacAdam Glinn
 MAYOR

Sean Brady
 VICE MAYOR

Jonathan Meltz
 COUNCILMAN

Alice Burch
 COUNCILWOMAN

Steven Zelkowitz
 COUNCILMAN

Tom Benton
 VILLAGE MANAGER

Richard Sarafan
 VILLAGE ATTORNEY

MEMORANDUM

TO: Mayor Glinn Vice Mayor Brady
 Councilwoman Burch Councilman Meltz
 Councilman Zelkowitz

FROM: Tom Benton, Village Manager

DATE: June 13, 2018

RE: Environmental Vulnerability Study

At the regular Village Council meeting of October 17, 2017, the Village Council approved the hiring of Coastal Risk Consulting to do an environmental vulnerability study for the Village. The purpose of the study was to study the effects of sea level rise, tidal flooding and storm surge in the Village. The study includes specific recommendations and the approximate cost associated with implementing these recommendations. Attached please find a copy of Coastal Risk's final report for your review and comments. Representatives from Coastal Risk Consulting will make a presentation and answer any questions the Council may have concerning this project. Upon acceptance by the Village Council, this entire document will be prominently posted on our Village webpage and will be referenced in our newsletter and on social media.

Should you have any questions concerning this document, please do not hesitate to contact my office.

TB:eak

Mgr-2682



Miami Shores Village Environmental Vulnerability Study

June 13, 2018



EXECUTIVE SUMMARY

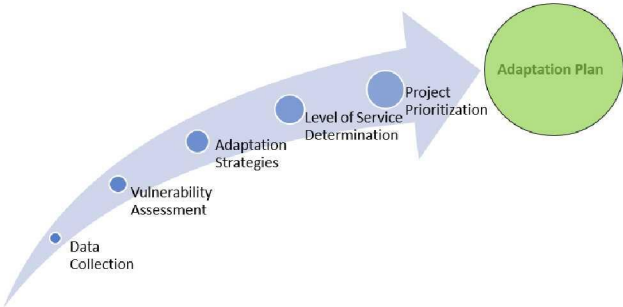
Background

Miami Shores is located along Biscayne Bay in northern Miami-Dade County, Florida and is home to approximately 10,000 people. Over the past decade, they have experienced increasingly more frequent flooding resulting in property damage and lower quality of life as a result of these events. Coastal Risk Consulting, LLC and Pennoni were retained by Miami Shores Village to assess their infrastructure vulnerability to flooding caused by environmental changes and to develop effective adaptation strategies to best protect the Village from those changes.

Vulnerability Assessment and Adaptation Plan

Data was collected from the Village, Miami-Dade County, and other agencies pertaining to the existing infrastructure and historic flooding locations including: high resolution LiDAR, tidal records, NOAA Sea Lake Overland Surge from Hurricanes (SLOSH) model, and current Village operational procedures in advance of predicted high tide and major storm events. Coastal Risk used that data along with their advanced geospatial modeling capabilities to analyze and predict climate impacts including flooding, tidal changes, storm surge, and sea-level and groundwater rise. The proprietary model uses publicly-available databases and best practices from National Oceanic and Atmospheric Administration (NOAA), which are integrated with Coastal Risk’s geospatial analysis tools to forecast flood risk and future change flooding due to sea level rise.

The Vulnerability Assessment looked at three types of risks: 1) tidal or non-storm “nuisance” flooding; 2) storm surge flooding, and 3) heavy rainfall flooding. Tidal flooding risks were modeled for the entire Village under current conditions for 2018, predicted conditions in 2033, and predicted conditions in 2048. Maximum storm surge conditions for the entire Village were modeled for 2018 resulting from a Category 1 hurricane, a Category 3 hurricane, and a Category 5 hurricane. Rainfall flooding based on topographic information and predicted storm intensity was modeled for the entire Village for the year 2018. The analysis identified several “at-risk” areas of the Village which either experience flooding under existing conditions or are predicated to experience flooding by the year 2048.



Adaptation Strategies were suggested for the critical facilities, non-critical facilities, drainage system, roadways, sewer systems, and seawalls within the “at-risk” areas. Strategies were identified for three categories including: retreating from the hazard, elevating above the hazard, and structural modifications to minimize the risk of damage from the hazard.

For the purposes of this study, the following Levels of Service parameters were established through discussions with Village staff.

- Standing water on roadways up to 6 inches deep (maximum) for no longer than 72 hours following the end of a 10-year, 24 hours storm.
- Distance from ground surface above septic tanks drain field to groundwater must be at least 42 inches. (Chapter 64E-6, Florida Administrative Code)
- The Village will consider, as part of the Capital Improvement Planning, raising roads in flood susceptible areas to reflect potential sea level rise. (Comprehensive Plan Policy 6.6)
- Standing water in habitable areas of buildings is not acceptable under any storm event.
- Seawalls shall be constructed to a minimum elevation of 5.5 ft NGVD with a foundation design to support a future extension to 6.5 ft NGVD (Ordinance 2018-04).
- Finished Floor elevation of buildings within flood hazard areas shall be no lower than two feet above base flood elevation. (Ordinance 2018-02)
- The area of the Biscayne Canal (C-8) shall remain in a near natural state where it passes through the Miami Shores Golf Course. The Village shall mitigate any unavoidable loss of habitat along the canal bank. (Comprehensive Plan Policy 2.7)

Adaptation strategies for the various “at-risk” areas of the Village were evaluated based on the per-protected-user costs weighted for various criteria, FEMA’s STAPLEE criteria, and Envision rating tools. The implementation cost for each strategy was based on a long-term costs analysis through the year 2038. The projects were then prioritized based on the evaluation results and expected timing of the damage from the hazard (short term or long term).

Recommendations

The final step of this planning process is to adopt and implement the Adaptation Plan. Implementation is only possible with funding for the plan components. Funding assistance for Stormwater subprojects may be through Florida Department of Environmental Protection’s (FDEP’s) Clean Water Act Section 319 Grants, FDEP Total Maximum Daily Load (TMDL) Grants, State Revolving Fund Grants and Loans, Federal Emergency Management Agency (FEMA) Grants, Community Development Block Grants, Water Pollution Control Bonds, US Army Corps of Engineers (USACE) Aquatic Ecosystem Restoration Program, South Florida Water Management District (SFWMD) Cooperative Funding Program for Surface Water Improvements, Special Taxing Districts, and future legislative appropriations.

Certain areas of the Village are already experiencing flooding impacts while our models show other areas will begin to experience impacts within the planning period (by the year 2038). Areas that are currently experiencing damage are recommended for implementation in the next five years (short-term). Other projects are recommended for implementation in the next twenty year (long-term). These recommendations are based on the best data and models currently available. The following table summarizes the main adaptation recommendations and suggested implementation period. In addition, as part of

the Capital Improvement Program planning, we recommend the Village include an evaluation of the accuracy of the sea level rise forecasts and adjust the implementation schedule accordingly.

Project	Budget Estimate	Urgency
Sewer Facility Plan	\$40,000	Short-term
Stormwater Facility Plan	\$80,000	Short-term
Septic to Sewer Conversion and Stormwater Improvements for Areas with Current Damage	\$49,000,000	Short-term
Stormwater Improvements Only for Areas with Existing Sewer and Predicated Flooding	\$2,000,000	Long-term
Septic to Sewer Conversion and Stormwater Improvements for Areas with Predicted Damage	\$34,330,000	Long-term
TOTAL	\$85,450,000	

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1 Introduction

Coastal Risk Consulting LLC and Pennoni were retained by Miami Shores Village, located in Miami-Dade County, Florida, to perform an Environmental Vulnerability Study focusing on the effects of sea level rise (SLR), tidal flooding and storm surge.

Coastal Risk Consulting (Coastal Risk) utilized its state-of-the-art technology to model current and future flood risks due to tides, storm surge, and heavy rainfall, through the year 2048. Coastal Risk uses as a centerpiece of its flood modeling the spatial extent of non-storm or nuisance flooding, which is related to factors such as sea level rise, tidal forcing, groundwater depth, and local subsidence. In addition to the locations within the community where flooding will likely occur, the model projects how many days per year and how deep tidally-related flooding will be.

The Coastal Risk and Pennoni Team (the Team) presented maps showing flood risk to the community for public comment. The Team then worked with Village staff to develop a level of service that would meet the needs of the community. Finally, the Team developed and prioritized short- and long-term adaptation strategies to provide Miami Shores Village with the timeline and budget information necessary to enact a successful sea level rise mitigation plan.

2 About Miami Shores

Miami Shores Village is a residential community located just north of Miami, Florida, on the coast of Biscayne Bay. It is home to approximately 10,000 people and includes two small commercial areas along NE 2nd Ave and Biscayne Blvd. Biscayne Bay is the eastern boundary of the community, and most of the shoreline is privately owned. The exception is Bayfront Park, which extends as a narrow strip between N Bayshore Drive and a sea wall for 3 blocks. The Village also includes the Biscayne C8 drainage canal, which is managed by the South Florida Water Management District, and a private canal between N 102nd St and N 103rd St.

Tides along this part of Biscayne Bay normally range around 2 feet due to the effect of lunar orbital cycles, thermal expansion of water as it reaches its peak warmth during late summer and early fall, and seasonal changes in onshore winds and atmospheric pressure. The highest of all annual high tides, often called "king tides", occur during the fall when these factors enhance tidal levels and can lead to localized or "nuisance" flooding. As described below, Coastal Risk's modeling framework analyzes tidal patterns and projections of future sea level rise to determine the specific areas of land surface that will be affected by tidally influenced flooding, as well as how often the flooding will occur in future years.

As is the case over much of South Florida, Miami Shores Village sits on bedrock that is primarily limestone. Limestone is highly porous, so it readily stores and conducts water.

The permeable nature of limestone means that rising sea levels will cause the inland water table to rise, reducing the available water storage capacity of the ground. As the water tables rise, the ground is able to absorb less water in the event of heavy rainfall, increasing the risk of rainfall-induced flooding. When sea level rises to even greater heights in the coming decades, the limestone bedrock will allow the water table to seep up from the ground itself, making seawalls and other protective external barriers less effective to prevent flooding in low-lying areas.

3 Methodology

Coastal Risk Consulting has developed advanced geospatial modeling capabilities designed to analyze and predict current and future climate impacts (flooding, tidal changes, storm surge, sea-level rise, groundwater conditions, etc.) at the parcel-level for coastal communities throughout the United States. Our proprietary modeling framework forecasts the probability of both tidal flooding and storm surge inundation on individual property parcels over the next 30-years. The model uses publicly-available databases and best practices from National Oceanic and Atmospheric Administration (NOAA), which are integrated with Coastal Risk's geospatial analysis tools to forecast current flood risk and future change flooding due to sea level rise.

Key components of Coastal Risk's modeling include high-resolution LiDAR measurements of surface topography. This information provides a simple graphical visualization to identify the location and extent of low-lying areas. It also gives context to the Coastal Risk modeling results and assists with evaluation and prioritization of adaption strategies.

The Coastal Risk modeling framework integrates this information with local tidal records, simulations of hurricane storm surge using the NOAA Sea Lake Overland Surge from Hurricanes (SLOSH) model, and scientific projections of future sea level rise to predict current and future changes in flood risk. The Coastal Risk storm surge model is a proprietary application of the NOAA SLOSH model, which is widely used to quantify storm surge risk and in state-ordered hurricane evacuations.

Three types of flood risk are examined in this document: 1) tidal or non-storm "nuisance" flooding, which arises from sea water rising above existing land; 2) storm surge flooding associated with hurricanes passing over or near the Village; and, 3) heavy rainfall flooding, which results when rainfall exceeds the drainage and ground storage capacity. The sections below outline the flood risks for Miami Shores under current conditions and highlights how these flood risks will change in the future due to sea level rise.

The Coastal Risk Team held a public meeting in Miami Shores on February 13, 2018. At this meeting Team staff presented their initial findings to Village staff and the public and gathered feedback about the residents' experiences with flooding during recent king tides and Hurricane Irma. Attendees had the opportunity to view maps indicating forecasted flooding scenarios, to speak with Coastal Risk Team staff, and to leave written comments. The comments are summarized below in Section 1.4.

4 Vulnerability Assessment

Phase 1 of this environmental vulnerability study assesses the risk of coastal flooding due to extreme high tides, storm surge, and heavy rainfall on the built environment of Miami Shores Village, including residential areas and infrastructure. It also includes a summary of how some neighboring communities are addressing coastal flooding.

4.1 Tidal Flooding

This section summarizes the current and future flood risks due to tidal flooding in Miami Shores Village. Tidal flooding is the temporary inundation of low-lying areas by seawater during high tide events. It is not a result of rainfall. These models show what impacts can be expected, if no additional mitigation steps are taken to reduce these flooding risks.

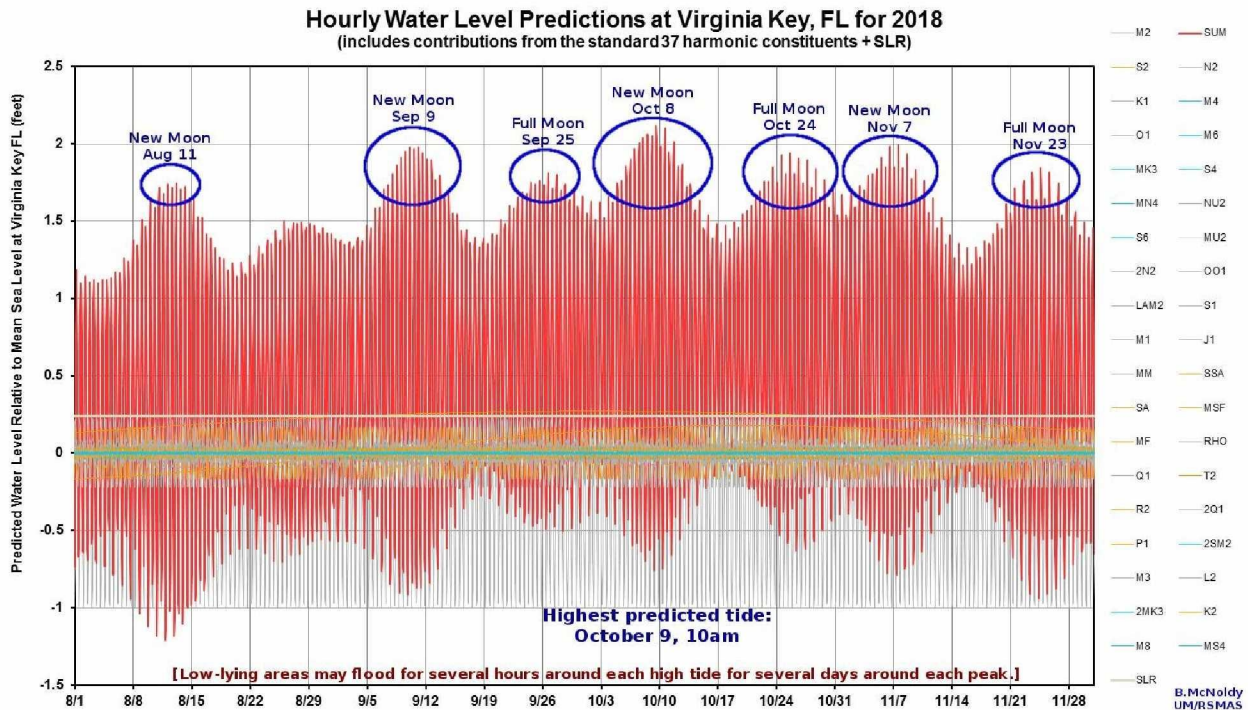


Figure 1 The 2018 forecasted water elevation at Virginia Key, the closest NOAA tidal gauge to Miami Shores
 Source: Dr. Brian McNoldy, Univ. of Miami, Coastal Risk Science Advisor.



Figure 2 Tidal flooding prediction by Coastal Risk models during the highest tides for 2018.

Figure 2 shows the model predictions for tidal flooding during the highest expected tidal events of 2018. The northern neighborhood of Shores Estates is highly exposed to tidal flooding, as well as some low-lying pockets directly adjacent to the canals and Biscayne Bay. These findings are consistent with the comments that residents and Village staff expressed about areas of their highest concern.



Figure 3 Forecasted tidal flooding for 2033

Next, Coastal Risk extended the tidal flood analysis illustrated above into the future using projections of sea level rise created by NOAA. By 2033, the area affected by tidal flooding has increased due to rising sea levels. More properties are impacted, including several cases where water extends several blocks from the shoreline or canal. In this situation, the ground water is higher, levels of inundation are higher, drainage systems are completely flooded, and it will take longer to drain the area.

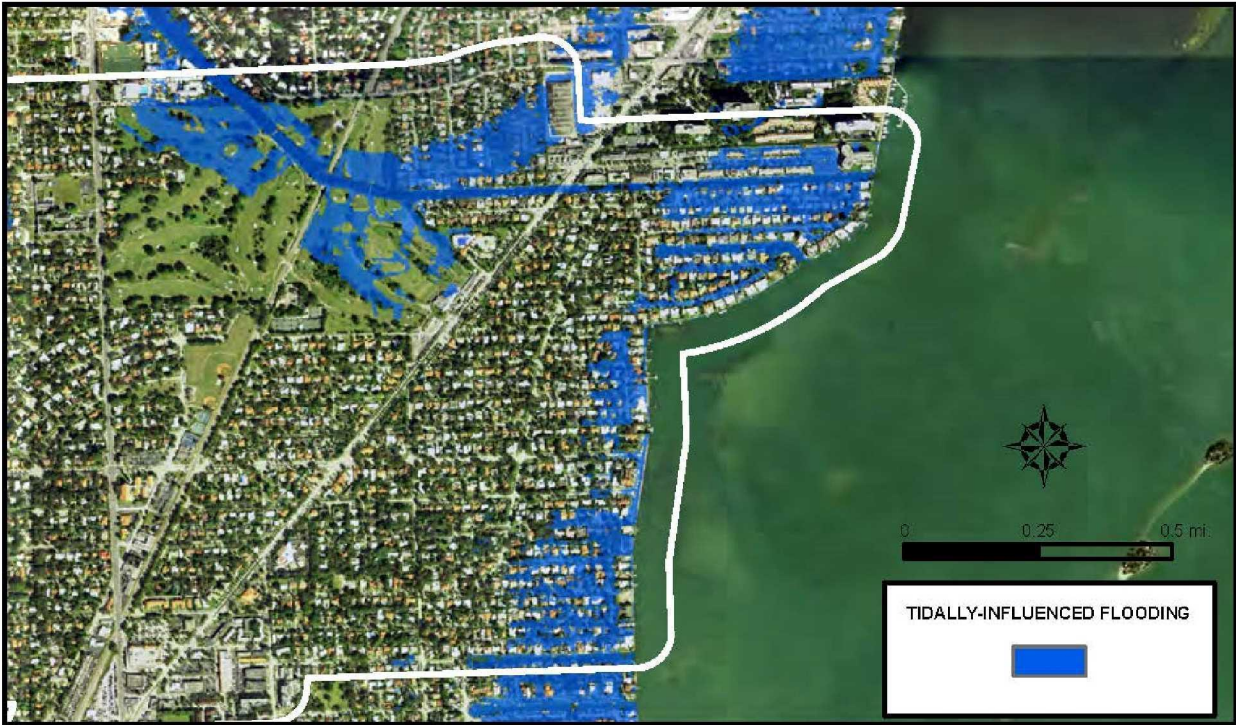


Figure 4 Forecasted tidal flooding for 2048

Over the next three decades, tidal flooding is projected to affect ever-increasing areas, including a significant number of private residential properties that currently have septic tanks, as well as roads and drainage systems. The public golf course will be heavily impacted. This map indicates the flooding expected on the highest tides, but many of the areas marked on this map can expect flooding to happen much more frequently throughout the year.

4.2 Storm Surge Flooding

This section summarizes the current and future flood risks due to storm surge flooding in Miami Shores. Storm surge refers to the increased water levels generated by a tropical cyclone due to the strong winds and lower atmospheric pressure. Storm surges occur for all categories of tropical cyclones, from a tropical storm up to a category 5 hurricane.

While the surge generally increases with the intensity of the storm, there are a number of additional factors that affect storm surge. These factors include the size of the storm, the path of the storm prior to landfall, the proximity of the point of landfall, the coastal topography and offshore ocean bathymetry, and the timing of the storms arrival with local tides.

The analysis below presents the maximum surge that would result from a category 1, 3, or 5 hurricane under current sea level conditions, under worst case scenario: highest impact storm trajectory and arriving at high tide. According to the US National Hurricane Center, the odds of a hurricane coming within 50 nautical miles of the Miami Shores area is 12.5%

Miami Shores Village Environmental Vulnerability Study

for any given year. For a major hurricane, defined as category 3 or higher, the odds of one impacting the region is about 6% in any given year.

As sea level rises, the depth of storm surge will also increase. Because this type of flooding coincides with high winds, waves, and intense rain, the increased depth of flood waters will be all the more destructive.

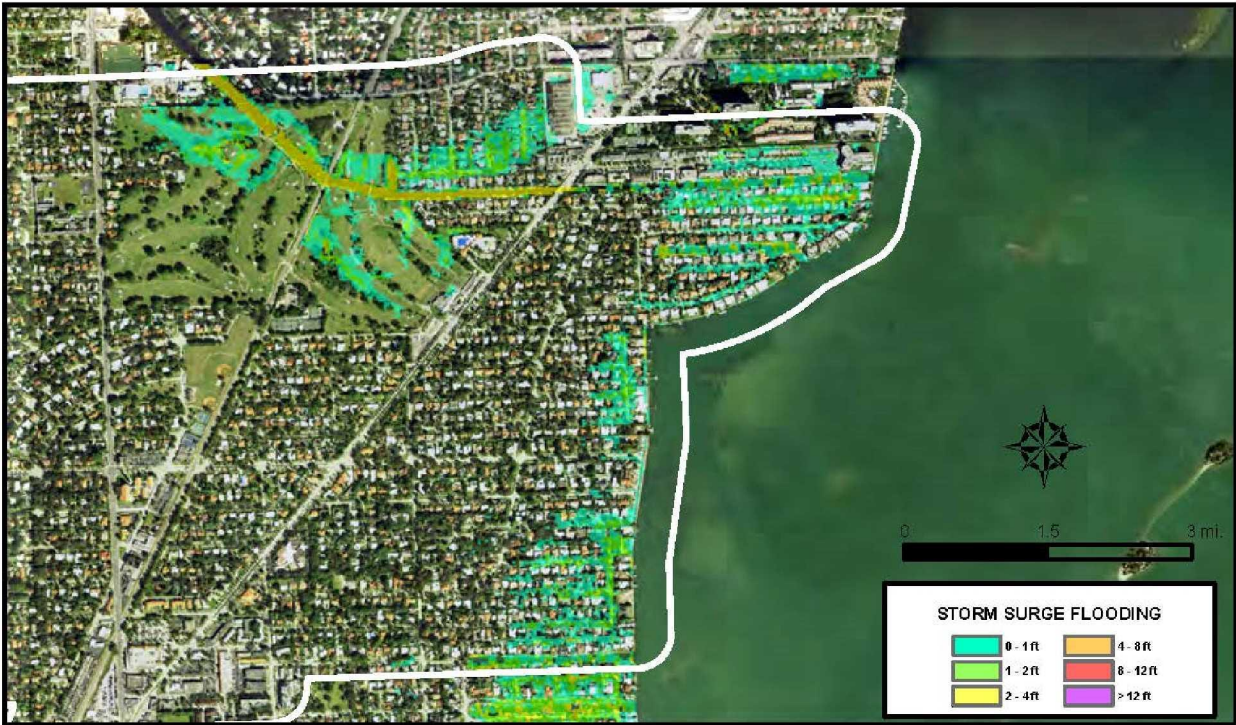


Figure 5 The maximum possible storm surge associated with a category 1 hurricane making landfall near Miami Shores during high tide under 2018 sea level conditions.

Figure 5 depicts the depth of the storm surge (above ground) that will be experienced under current sea level conditions from a hypothetical category 1 hurricane that makes landfall on or near Miami Shores. This figure correlates well with the conditions described by residents when Irma impacted Miami Shores with tropical storm-force winds in September 2017.



Figure 6 The maximum flooding from storm surge associated with a category 3 hurricane making landfall near Miami Shores during high tide under 2018 sea level conditions.

As indicated in Figure 6, a category 3 storm would bring significantly higher water levels into the Village, impacting all properties east of US 1 and nearly all properties north of the Biscayne C8 canal. In the most low-lying areas, residents could expect more than 4 feet of floodwater, unless public and private adaptation measures are taken to reduce the risk.

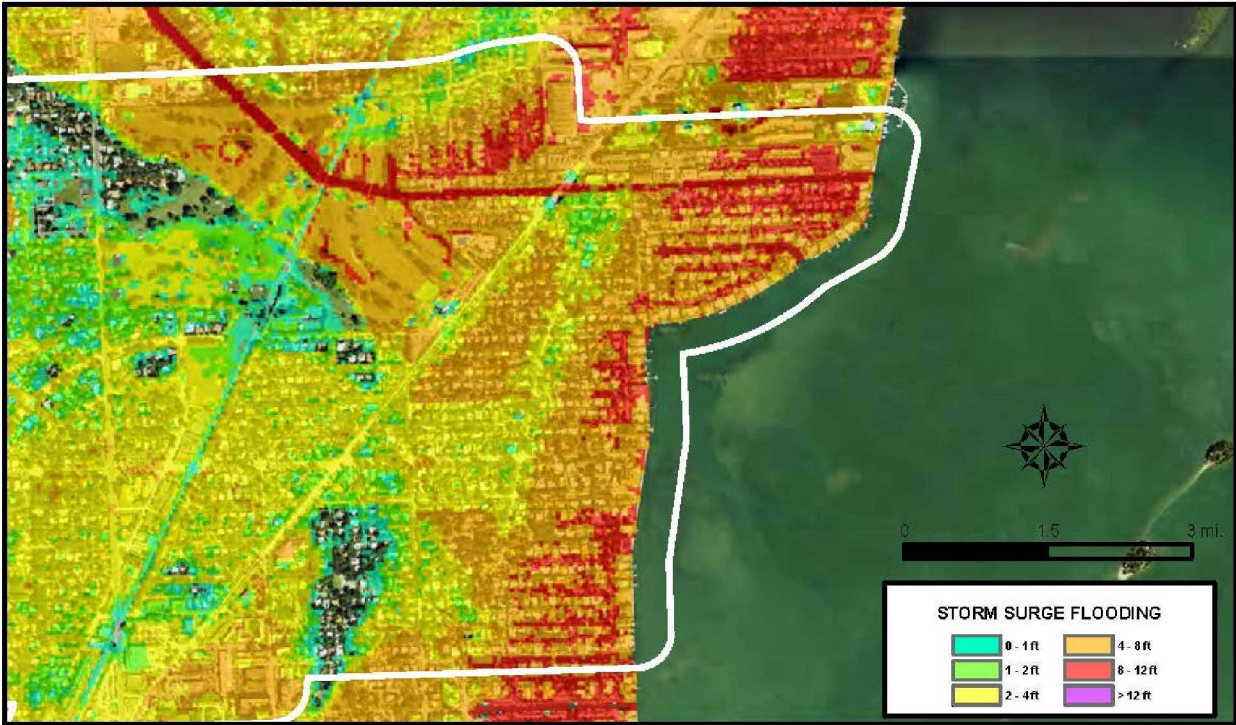


Figure 7 The maximum flooding from storm surge associated with a category 5 hurricane making landfall near Miami Shores during high tide under 2018 sea level conditions.

Figure 7 shows the devastating impacts that could be expected if a category 5 hurricane were to pass near Miami Shores. The flooding would be widespread, impacting nearly every property in the Village. Near the shoreline, floodwaters could be over 8 feet deep. This type of flooding would be also accompanied by high winds and waves likely to cause severe damage to property and infrastructure. Mitigating a storm of this magnitude is not really economically feasible, but it is worth understanding that this level of flooding is possible under the right conditions.

4.3 Rainfall Flooding

Rainfall flooding can occur when precipitation infiltrates into the ground and causes the water table to rise above normal levels. Poor drainage can lead to large areas of standing water after even small rainstorms. As sea level rises, heavy rainfall flooding will become more and more frequent as the average water table height rises in the limestone bedrock underneath, and the ground becomes less absorbent in heavy rain events.



Figure 8 Modeled risk of flooding due to heavy rainfall in 2018 in Miami Shores.

Figure 8 shows the areas that the model forecasts will be impacted by water accumulation and poor drainage due to heavy rainfall. Many properties within one block of the Bay shoreline and along the private canal are at severe risk of flooding due to heavy rainfall. Numerous attendees of the public meeting mentioned drainage problems in their yards and alleys due to heavy and sometimes just moderate rainfall, including several homeowners who live in the high risk areas indicated in Figure 8.

4.4 Public Commentary

Coastal Risk hosted a public meeting in Miami Shores on February 13, 2018. Of the approximately 25 attendees at the public meeting, 14 left written comments and many also spoke directly with Coastal Risk staff to ask questions and offer feedback about their experiences and concerns.

The residents who attended the meeting were all very concerned about flooding in the Village, and offered many questions about when and how the Village would be taking action to resolve the problems. Residents mentioned numerous impacts from sea level rise and flooding including: water damage to vehicles, impassable roads, concerns about slowed emergency response, erosion, mosquitoes breeding in standing water, failed septic tanks, concerns about loss of property values, and expensive repairs in the wake of Irma. Many attendees expressed a sense of urgency and appealed for quick action to address the flooding problems.

Numerous people who reviewed the tidal flooding maps confirmed that the maps accurately reflect the areas that experienced problems during king tides of 2017 and during Hurricane Irma in September 2017.

In the written feedback, attendees were asked about their personal experiences with flooding in Miami Shores, as well as the causes and frequency of that flooding. More than half of the respondents said that flooding happens frequently, while one said that their garage had flooded for the first time in 48 years due to the Irma-related storm surge. Participants mentioned tides, storm surge and heavy rainfall in roughly equal numbers as causes for their flooding.

4.5 Vulnerability Analysis

This analysis shows that parts of Miami Shores are highly vulnerable to coastal flooding. The Village is currently experiencing flooding due to the combined effects of sea level rise, high tides, storm surge, elevated ground water and heavy rainfall. These floods cause negative impacts to the Village, including damage to property and infrastructure, costs to mitigate the flooding, and impacts to the quality of life.

The models indicate that the most vulnerable area of Miami Shores is the neighborhood of Shores Estates. Discussions with residents and Village staff confirm that this neighborhood is currently experiencing flooding during high tides and during heavy rains. Unless action is taken to reduce flooding in this area, problems such as malfunctioning septic systems and impassable roads will cause extreme hardships to residents in the future as well as raise public health and safety concerns.

As sea level rises, flooding will become more widespread through the Village. The areas of flooding will extend to include more properties, and the higher water levels will cause more damage and take longer to recede.

4.6 Summary of Local Communities

Many areas in South Florida are experiencing coastal flooding more severely and more frequently in recent years. These floods can cause damage to buildings and flooded roadways. Storm drains that were designed to flow out can be blocked when sea level rises above the outfall, and in some cases water can backflow up into streets.

Some areas are addressing problems as they arise, implementing targeted mitigation steps such as regulating minimum sea wall heights, drainage improvements including road design and pump stations, and shifting from septic to sanitary sewer systems. Larger municipalities such as Miami Beach are taking a more comprehensive approach to sea level rise and flooding with a public outreach campaign, stormwater master plan, and significant investment in infrastructure over long time scales.

Two south Florida municipalities recently established a minimum elevation for public and private sea walls in an effort to maintain a consistent barrier along their shorelines. In 2016, both Fort Lauderdale and Miami Beach updated regulations on sea wall heights,

mandating that any sea walls built or substantially improved must comply with the new standards (all given in feet North American Vertical Datum of 1988 or NAVD88). In Fort Lauderdale, the minimum allowable sea wall height is now 3.9 feet. In Miami Beach, the regulation specifies that public sea walls must be at least 5.7 feet while private sea walls have a lower standard of 4 feet.

During the course of this study, Miami Shores passed regulations requiring that all new construction or substantial improvement of private seawalls must be at least 4.1 ft NAVD88 (equivalent to 5.5 ft. NGVD, another vertical datum that is used for the regulation). Additionally, the regulation strongly encourages owners to build seawalls that are strong enough to bear an additional foot of elevation in the future.

Road flooding is becoming increasingly common and problematic throughout the region. Consequently, areas such as Monroe County and Miami Beach are investing in elevating their roadways above forecasted flood levels. Road elevation requires long-term planning and a significant investment of public funds. It also requires proper design to maintain streetscapes and improvements in drainage to avoid increased flooding in adjacent low areas and private properties.

Phase 2 of this report will investigate mitigation actions such as those described above, and make recommendations about which adaptation options are most suitable for Miami Shores Village.

4.7 Wetlands

The National Wetland Inventory for Miami Shores shows the pond located just west of Miami Shores Elementary School as the only freshwater resource in the area (see Figure 9). This pond is privately held by the surrounding residential properties. The proposed adaptation measures are located in previously disturbed residential and light commercial neighborhoods.

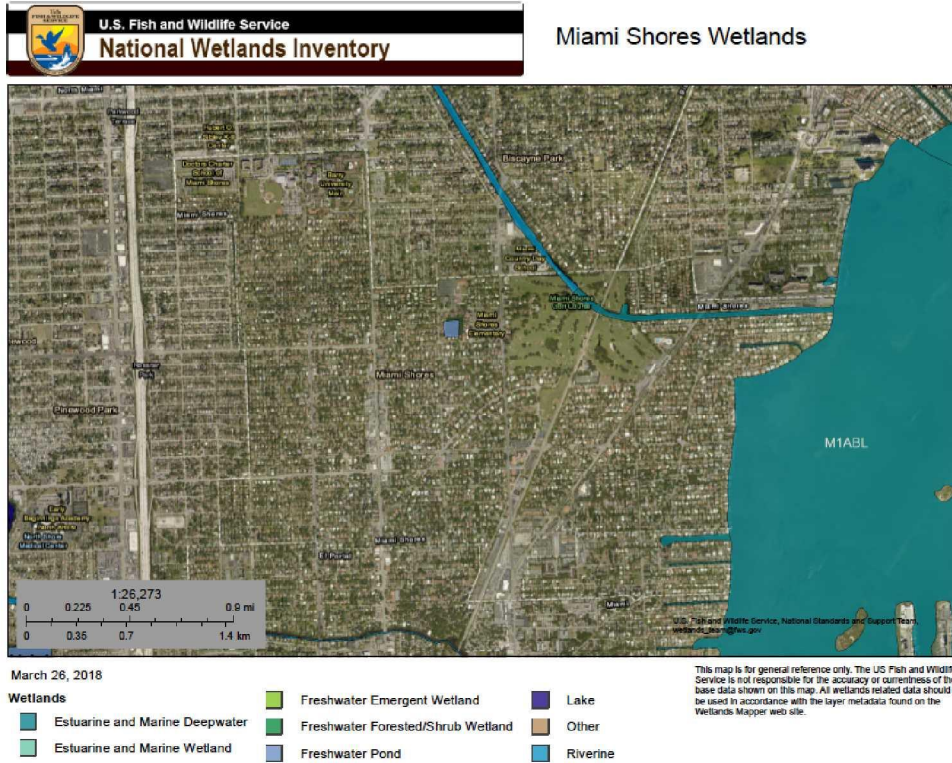


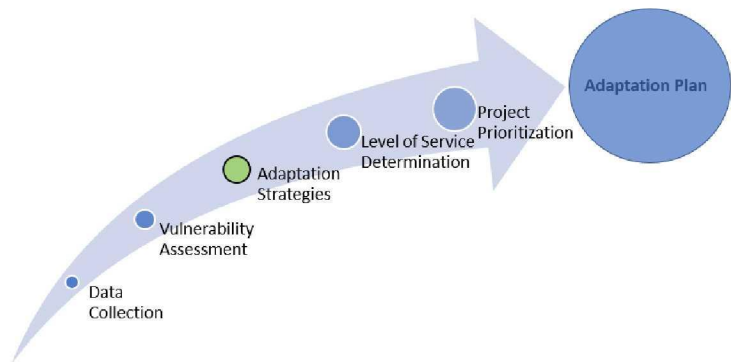
Figure 9 National Wetlands Inventory map covering Miami Shores. Source: US Fish and Wildlife Service

4.8 Archeological and Historical Sites

The Florida Department of Historical Resources was contacted to determine if historical and/or archeological sites were present in the planning area. No archeological sites are reported in Miami Shores, but numerous historical structures are present. The listed resources include numerous structures built prior to 1950 including homes, the railroad, and the bridge over the C8 Canal (see Appendix for full list). Although the proposed adaptation measures are located on existing previously disturbed and developed publicly-owned property, the Department will need to be consulted prior to start of construction to ensure that no archeological and/or historical sites will be disturbed.

5 Adaptation Strategies

The next phase in the development of the adaptation plan is identifying the key infrastructure components within the “at-risk” areas identified in the Vulnerability Analysis phase and evaluating appropriate adaptation strategies. These strategies are chosen from proven



techniques to minimize the Village’s risk of damage resulting from the identified hazards. In this report, our goal is to minimize damage resulting from increasing sea levels and the accompanying flooding.

The first step in determining what strategies are appropriate for the Village is to evaluate the condition of the existing infrastructure. We then determine what types of improvements can mitigate future damage.

5.1 Critical Facilities

Critical facilities provide functions essential to a community, including during a disaster. These include police and fire stations, health care facilities, schools, potable water production facilities, wastewater treatment facilities, and power generating facilities. The list also includes those areas that would cause widespread harm if they were damaged, such as chemical storage facilities and levees.

Table 1 Critical Facilities in Miami Shores

Public Safety <ul style="list-style-type: none">• Miami Shores Police Department• Miami Dade Fire Rescue Station 30• Miami Heart Center (private)
Public Works <ul style="list-style-type: none">• Stormwater• Potable Water (provided by Miami-Dade County and North Miami)• Wastewater Service (provided by Miami-Dade County or by private systems)• Roads• Sanitation• Street Lights
Schools <ul style="list-style-type: none">• Miami Country Day School• St Rose of Lima Catholic School• Doctor's Charter School• Hubert O Sibley Elementary School• Barry University

Ideally, critical facilities should be located outside of high hazard risk areas and most of the Villages critical facilities (Figure 19, see Appendix) are outside of the flood zones. Another consideration is access into and out of the critical facilities. As shown in Figures 12 and 13 (see Appendix), access routes to the Village’s critical facilities are not anticipated to flood, except during extreme storm events.

5.1.1 Accommodation Adaptation Strategy

One of the most common adaptation strategies, which virtually eliminates the risk of flooding to facilities, is to accommodate the hazardous condition by raising facilities above the flood elevation. Typical considerations when accommodating the floods by raising existing homes are shown below. Requiring the homes to be elevated with stem walls as shown rather than filling entire lots reduces the impacts to the flood plain and historic drainage patterns are maintained. This requirement is similar to Miami Shores Ordinance 706-14, Section R322.3.2 for construction in Flood Hazard Areas. Any structures located within the V Zone, must be raised on piers or pilings to allow water to flow through.

Buildings can be raised in their entirety or by creating a higher floor within the existing walls and raising the roof. Raising the driveways and public roadways may require use of a pumped drainage system to maintain existing drainage patterns. This option would limit damage to buildings, but would not necessarily provide a dry route for residents to access the homes during rain events.

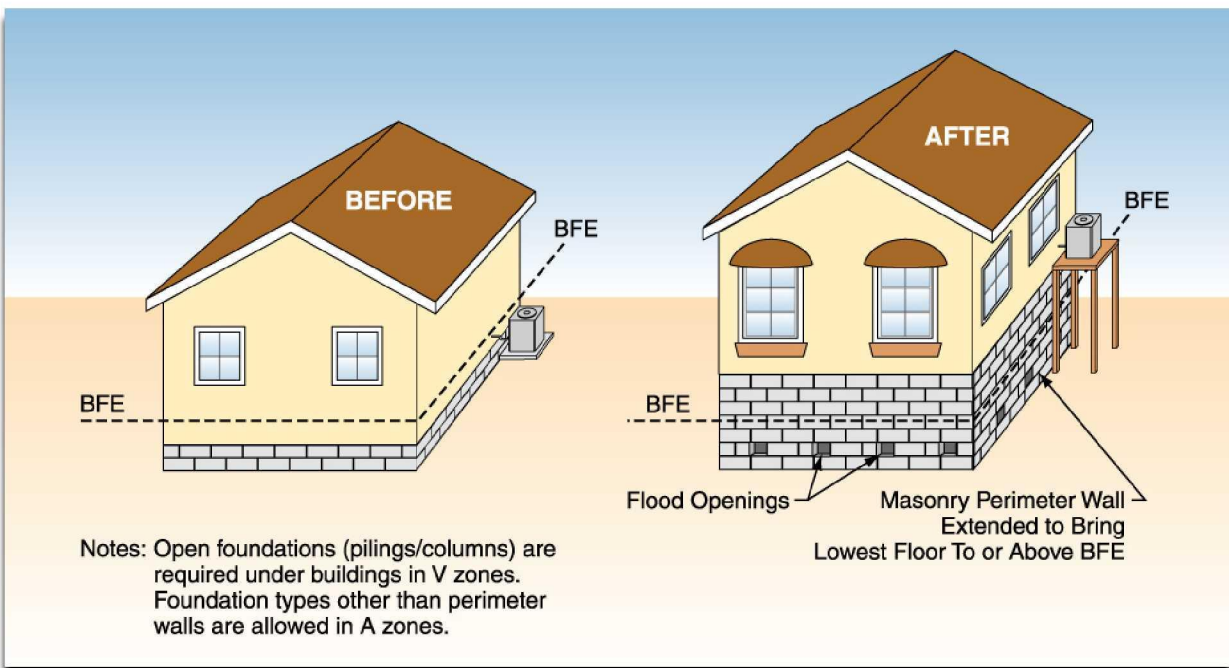


Figure 10 Elevation of structures Figure credit: FEMA . NOTE: The lowest occupied floor in A zone structures and the bottom of the lowest beam in V zone structures should be raised to BFE + freeboard, as defined in ASCE 24.

5.1.2 Retreat Adaptation Strategy

Another adaptation strategy, which virtually eliminate the risk of flooding to facilities, is to retreat from the hazard by moving the facilities out of the area at risk for flooding. If the buildings were moved out of the flood prone area, also referred to as “managed retreat” from the hazard, the area within the flood plain would be restricted from future development. For the Village, this would mean acquiring blocks of privately owned homes

near the waterfront. The flood prone areas could still be used for passive purposes such as public parks. However, residents would be displaced, and the Village taxable area would be reduced.

5.1.3 Floodproofing Adaptation Strategy

There are two categories of protective measures to cope with flooding without moving buildings or structures: dry floodproofing and wet floodproofing.

Dry floodproofing reduces the probability that water will enter a structure or area by sealing openings in advance of anticipated flood conditions. Structures must be evaluated to ensure they could withstand increased pressures, withstand impact from debris, and resist floatation while the surrounding area is under water. Ruggedizing the structure (e.g. use moisture resistant building materials) may be required. FEMA funding cannot be used for this type of protective measure in new, substantially improved, or previously damaged structures located within flood plains. ASCE 24 permits dry-floodproofing in non-residential structures, both new and retrofit projects, except within Flood Zone V. This type of improvement does not usually help gain a reduction in Flood Insurance premiums. Dry floodproofing techniques are best used as short-term measures to combat existing conditions or in areas which only flood occasionally and for short durations. Wooden structures are normally not good candidates for dry floodproofing. The increased buoyancy forces on the underside of the foundation slab must be evaluated prior to implementing this type of strategy.

Wet floodproofing allows the floodwaters to flow into and through the structure or area without causing damage. Structures could be raised on stem walls (no additional areas of the flood plain would be filled other than directly below the buildings). NFIP regulations only grants premium discounts for wet flood proofing if it is used on previously damaged or substantially improved structures that are used solely for storage or building access. Improved areas must be evaluated to verify the openings in the structure or area are sufficient to prevent hydrostatic pressure from the flood waters from causing damage. All electrical connections and components would also need to be retrofitted to operate safely under submerged conditions. Possible damage from floating debris impacting structures should also be considered. The local flood plain administrator should be consulted prior to implementing this strategy.

5.1.4 Minimum Finished Floor Elevations

Miami Shores current Code of Ordinances Section 6-6 (Ordinance 706-14) requires new residential construction to have minimum finished floor elevation at the higher of:

- Eight inches above the highest abutting road crown
- The elevation specified in the Florida Building Code for structures within Flood Hazard Areas.

Non-residential structures are required to have minimum finished floor elevations at the higher of four inches above the highest abutting road crown and the Florida Building Code elevation for structures in Flood Hazard Areas.

Miami Shores Code Section 6-12 (Ordinance 2018-020) defines Flood Hazard Areas as all areas that have determined to be prone to flooding, but not subject to high velocity wave action. In areas designated Zone AO on the Federal Flood Insurance Rate Maps (FIRM), the lowest floor of structures must be at least two feet above the elevation established on the FIRM or three feet above the highest adjacent [road] grade, if an elevation is not established on the FIRM.



5.1.5 National Flood Insurance Program Participation

Since 2000, the Village of Miami Shores has participated in both the National Flood Insurance Program (NFIP) and Community Rating System (CRS), which provides flood insurance discounts on properties within the Village. In 2017, the Village had 877 policies with premiums of \$852,275 and insured values of \$231 million. The policies cover approximately 25% of the homes within the Village. Since 1978, there have been 113 flood insurance claims filed within the Village. One property has repetitive losses. To participate in CRS, the Village complies with certain requirements including maintaining records of FEMA Elevation and Floodproofing Certificates, prohibiting placement of fill within the floodplain, freeboard requirement for finished floor elevations on new buildings, permanent off-site storage of flood and building related documents, and an annual inspection of critical facilities located within the floodplain. As a result of the Village's participation in the program, residents receive discounted flood insurance thereby lessening the risk of loss to individual property owners. In 2004, the Village had 1421 credit points, giving them a Class 8 rating resulting in a 10% discount for Special Flood Hazard Area (SFHA, including Flood Zones A, AE, A1-A30, V, V1-V30, AO, and AH) and 5% discount for non-SHRA (Flood Zones B, C, X, and D). For every additional 500 credits earned by the Village, the discount will increase by 5% up to a maximum of 45%.

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Table 2 2006 Miami Shores Village NFIP Community Rating System Scores

CRS Code	Description	Current Credits
310	Elevation Certificates (162 possible credits). Additional 35 points available if Village uses elevation certificates in computer format and maintains elevations certificates on website.	71
320	Map Information (140 possible credits)	140
330	Outreach Projects (315 possible credits). Additional 130 credits by sending notices directly to properties in flood prone areas. 60 credits for conducting outreach such as “flood awareness week”.	38
340	Hazard Disclosure (81-101 possible credits). Credits given if real estate agent advise prospective buyers of flood hazard.	0
350	Flood Protection Information (66 possible credits). Additional credit for documents provided in library and Village website.	15
360	Flood Protection Assistance (71 possible credits). Community provides technical advice to interested property owners.	0
410	Additional Flood Data (1373 possible credits). Community enacts and enforces regulations that exceed NFIP minimum standards.	0
420	Open Space Preservation (900 possible credits).	305
430	Higher Regulatory Standards (2720 possible credits).	130
440	Flood Data Maintenance (239 possible credits). Make flood plain maps more current, useful, or accurate.	0
450	Stormwater Management (670 possible credits).	342
510	Floodplain Management Planning (359 possible credits).	0
520	Acquisition and Relocation (3200 possible credits).	0
530	Retrofitting (2800 possible credits). Protect government owned buildings from flood damage.	0
540	Drainage System Maintenance (330 credits).	280
610	Flood Warning Program (225 possible credits)	33
620	Levee Safety (900 possible credits). Only available for communities protected by levees.	0
630	Dam Safety (175 possible credits).	67
710	Community Growth Adjustment	1.2
	Total:	1421

5.1.6 Adaptation Action Area Designation

The Florida Growth Management Act [Sections 163.3164(1) and 163.3177(6)(g)(10)] includes an optional comprehensive plan designation for areas that are vulnerable to coastal flooding due to extreme high tides, storm surge, and impacts of sea level rise. The Comprehensive Plan Coastal Management Element would include a policy framework for identifying the action areas and a mechanism for improving community resilience within those areas. While no funding is currently targeted for areas with this designation, creation of Adaptation Action Areas under this law would formally identify those areas within the Village that are particularly vulnerable to flooding. Miami-Dade County’s 2015 Feasibility

Assessment found Adaption Action Areas (AAA) to be a useful tool to bridge the gap between Vulnerability Studies and project implementation. Miami-Dade County Policy LU-3L requires the county to work with local municipalities to identify AAA and develop policies for adaptation and enhance funding potential for infrastructure projects within the designated AAA.

5.2 Non-Critical Facilities

Non-critical facilities provide functions that add to the quality of life within the community, but are not essential for public health or safety. Examples include parks and libraries. Damage to these facilities should be minimized, but they are usually a lower priority to protect than critical facilities.

Table 3 Non-Critical Facilities Owned by Miami Shores

Libraries / Cultural Centers / Museums <ul style="list-style-type: none">• Brockway Memorial Library
Recreation <ul style="list-style-type: none">• Community Center• Ed Abedella Field House / Athletics• Miami Shores County Club Tennis Center• Aquatic Center• Golf Course / Country Club• Constitution Park• North Bayshore Park• Optimist Park• Village Memorial Park
Other <ul style="list-style-type: none">• Landscape irrigation (other than parks)• Landscape (50 beds and barricade areas)• Sidewalks

As discussed in detail in the Critical Facilities section, the following strategies may be implemented by the Village to mitigate the impacts of rising sea levels, surface water elevations, and groundwater tables on Non-Critical Facilities.

Retreat from Hazard: Buildings would be moved out of the flood prone area, also referred to as “managed retreat” from the hazard, and the area within the flood plain would be restricted from future development. For the Village, this would mean acquiring blocks of privately owned homes near the waterfront. The flood prone areas could still be used for passive purposes such as public parks. However, residents would be displaced, and the Village taxable area would be reduced.

Rise above Hazard: The finished floors of residential buildings would be raised to be above the predicted flood elevation. Requiring buildings to be elevated with stem walls

rather than filling entire lots reduces the impacts to the flood plain and maintains historic drainage patterns. Buildings can be raised in their entirety or by creating a higher floor within the existing walls and raising the roof. This option would limit damage to buildings but would not necessarily provide a dry route for residents to access the homes during rain events.

Dry Floodproofing: Dry floodproofing reduces the probability that water will enter a structure or area by sealing openings in advance of anticipated flood conditions. Structures must be evaluated to ensure they could withstand increased pressures, withstand impact from debris, and resist floatation while the surrounding area is under water. Ruggedizing the structure (e.g. use moisture resistant building materials) may be required. FEMA does recognize this type of protective measure for new, substantially improved, or previously damaged structures located within flood plains. Wooden structures are normally not good candidates for dry floodproofing. Dry floodproofing techniques are best used as short-term measures to combat existing conditions or in areas which only flood occasionally and for short durations.

Wet Floodproofing: Wet floodproofing allows the floodwaters to flow into and through the structure or area without causing damage. Structures could be raised on stem walls (no additional areas of the flood plain would be filled other than directly below the buildings). NFIP regulations only recognize wet flood proofing if it is on previously damaged or substantially improved structures used solely for storage or building access. Improved areas must be evaluated to verify the openings in the structure or area are sufficient to prevent hydrostatic pressure from the flood waters from causing damage. All electrical connections and components would also need to be retrofitted to operate safely under submerged conditions. Possible damage from floating debris impacting structures should also be considered.

5.3 Drainage System

As rain falls on the Village, much of the stormwater flows across yards and grassed areas to the roads and gutters. The water then either enters the groundwater through exfiltration or is discharge into surface waters such as the C-8 Canal (Biscayne Canal) and Biscayne Bay. The Village currently has one stormwater pump, located near NE 93rd Street and N Bayshore Drive.

Collection and Conveyance: In approximately 50% of the Village, stormwater is collected in the gutters and roadside swales before being discharged into the aquifer or surface waters. The remainder of the Village relies on sheet flow for stormwater conveyance where the rainfall flows across the land. South Florida stormwater conveyance systems are designed for moderate rainfall events (8 inches in 24 hours).

Standing floodwater is defined as “black” water; containing pollutants such as raw sewage, petroleum and other chemicals, heavy metals and other substances harmful to humans. These substances can be difficult to remove from porous and semi-porous materials including uncoated concrete and soil. In addition, much of the floodwater in Miami Shores contains salt, which kills vegetation and increases the corrosion rate of many materials. In

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order to reduce public health risks and reduce damage to public and privately owned infrastructure, flood water needs to be moved quickly out of neighborhoods.

Much of Miami Shores existing stormwater conveyance system includes asphalt gutters directing water to inlets with discharge into the C-8 Canal (Biscayne Canal) or Biscayne Bay. High water conditions within the canal often result in reverse flow within the pipe network resulting in roadway flooding.

Typical stormwater conveyance systems within the Village are shown below. There are periodic inlets and percolation wells, but not always a conveyance system to direct stormwater into those inlets.



Views of NE 11th Avenue stormwater conveyance (left) and NE 104th Street (right)

Providing gutters along roadways will improve the stormwater conveyance rate in many neighborhoods. Adding stormwater inlets and pipes in the neighborhoods with swales will reduce standing water but will also eliminate the water quality benefit provided by the swales.

Exfiltration Trenches and French Drains: This strategy has been used in areas with localized ponding such on NE 96th Street west of NE 10th Avenue. They can reduce the runoff to lower areas of the Village and improve water quality before it reaches the Biscayne Bay and C-8 Canal (Biscayne Canal).

As the groundwater continues to rise, these systems will become less effective. They can be supplemented with pumped injection wells and surface water discharge points. Water quality treatment will need to be provided prior to pumping stormwater into either the Biscayne Canal or Biscayne Bay. Water quality treatment can be provided by baffle boxes, vortex devices, biological filters, or chemical treatment.

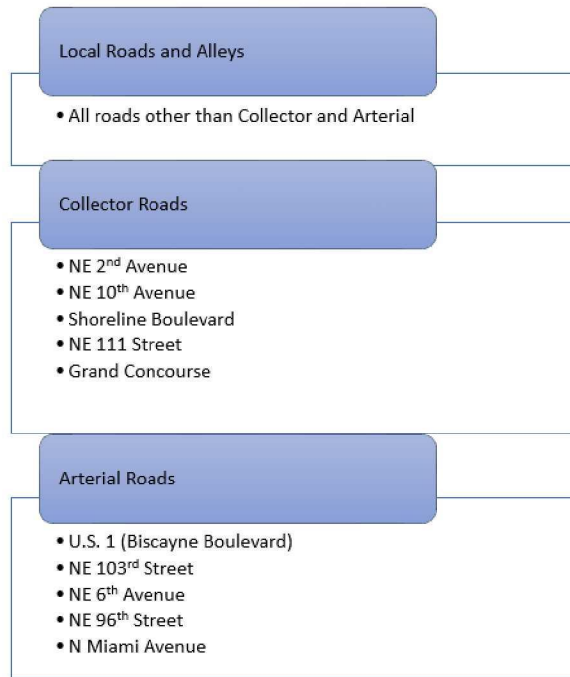
Flap Gates and Temporary Plugs on Gravity Outfalls: These strategies are in use on the Village's existing outfalls. Flap gates located at the downstream end of the outfalls are frequently clogged by debris. To inspect and maintain the flap gates, someone must physically get to the gate location and do an underwater inspection. The gates require a certain amount of head (water height) to build up before they will open. They are prone to being stuck in the open position by debris and need to be replaced periodically.

The Village currently prevents tidal water from flowing up the storm pipes by manually placing plugs in the upstream end of the pipe within a manhole or similar structure. These plugs are placed by Village staff in advance of king tides or other predicted high tide events and then removed once tides have returned to normal.

5.4 Roadways

Historically, minimum roadway elevations in Miami-Dade County are set based on the higher of the ten-year, one-day groundwater elevation and the five-year, one-week groundwater elevation plus 18 inches (Dade County BCC 1959). South Florida Water Management District current design standards are for the roadway crown to be at least two feet above the basin control elevation.

The structural integrity of roads is dependent on the base layers of compacted soil and crushed limerock, shellrock, or concrete. These lower layers do not have the same weight bearing capacity when saturated. Rising groundwater forces air trapped in the soils beneath the pavement toward the surface, increasing pressure on impervious road surface and creating buoyancy issues. The roads may experience stability issues when vehicles drive across pavement in areas with high water tables or standing water, resulting in pavement cracks and potholes.



As shown on Figure 12 (see Appendix), Village roadways east of NE 12th Avenue are tidally influenced today with occasional flooding by saltwater. The salt reacts with the roadway and utility materials resulting in a reduced life expectancy and higher maintenance costs.

5.5 Sewer System

Most of the residences, businesses, and municipal facilities within the Village rely on septic systems and drain fields for treatment and disposal of wastewater. Low-lying areas and high-water table present difficult conditions for efficient on-site wastewater treatment. Many of the homes adjacent to the waterfront have drain fields lower than the water elevations within the adjacent canal. Septic system failures within the Village of Miami Shores represent a potential public health hazard and water quality concern.

The septic systems dispose of the treated wastewater through drain fields located above the groundwater table. As the groundwater table rises, however, the effectiveness of the drain fields will decrease and eventually fail to operate. Prior to complete failure, the ground above the drain field will become “mushy” from the backed up partially treated sewage, toilets and drains will be slow flush or drain, sewage may back up into the house,

and odors will become more prevalent from the sewage becoming stagnant. Older septic tanks may collapse or move upward, if emptied while under floodwater. Wastewater may also contain disease causing bacteria, viruses, and parasites. Once they mix with flood waters, it is difficult for residents to avoid contact with contaminated water. To minimize public health risks, private septic systems should be replaced with a centralized sewer system.

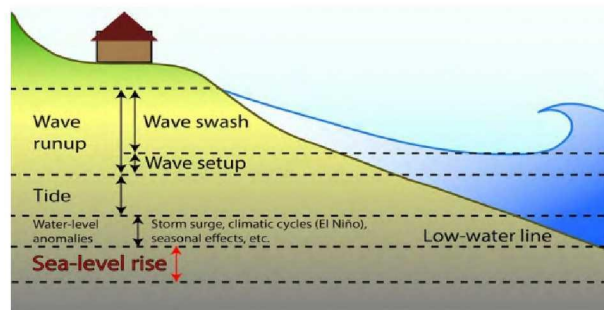
Soils in this area have high to moderate percolation rates and provide minimal biological treatment to the septic tank effluent. The Florida Aquifer Vulnerability Assessment (FAVA) program shows the Village falls within an area of moderate vulnerability to aquifer contamination from land-based contamination.

Many of the septic systems in the area are past their useful life, with some already failing. Non-functional septic systems have a high potential for environmental contamination and a subsequent health risk to the public.

In keeping with initiatives to eliminate private septic systems throughout Florida, improve water quality, and provide a vital public service to the community; connecting the low-lying areas of the Village to centralized sewer will help alleviate the existing deficiency. The Village recently entered into an agreement with Miami-Dade County for operation of the new sewer system serving the commercial area along NE 2nd Avenue.

5.6 Seawalls

The condition and top elevation of the existing seawalls are not adequate to protect the Village from high water levels in Biscayne Bay or the C-8 Canal. The construction materials, condition, and top elevation of the seawalls varies from property to property. In addition, seawalls are not present on all the low-lying properties along the C-8 canal including the Village owned golf course. Earlier in 2018, the Village adopted Ordinance 2018-04 which set the minimum seawall elevation at 5.5 ft NGVD.



From Vitousek, et al., Scientific Reports, May 2017

Most of the waterfront property in the Village is under private ownership, which includes the majority of seawalls. Elevating the seawalls will provide additional protection from tidal flooding but may impact the property owners view of the water. Within Flood Zone V, ASCE 24 and Code Sections 8.5-78 and 8.5-79 allow only minor amounts of nonstructural fill are allowed and an analysis by a registered professional is required which demonstrates the proposed modification will not increase damage to adjacent structures. The impact of floodwater diversion and wave runup should be included in the analysis. Another consideration is that the foundations for existing seawalls may not be structurally adequate to support a higher seawall, requiring the entire seawall to be rebuilt rather than just made taller.

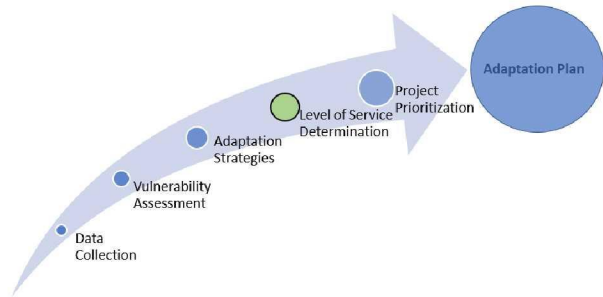
6 Level of Service

The next step in the Adaptation Plan development is to determine Levels of Service for each of the infrastructure components. Level of Service (LOS) is the expected infrastructure condition under certain conditions.

High levels of flood hazard protection are available to the Village. However, each improvement has an associated cost. Higher LOS typically have a higher cost of construction and a lower cost-benefit ratio. Determining the acceptable Level of Service is a balance between the cost of protecting from a hazard and the cost of the damage resulting from the hazard.

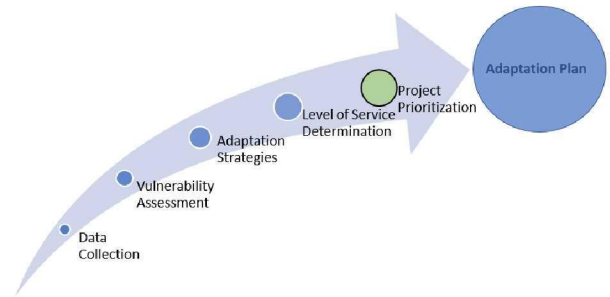
The following flood protection Levels of Service are established from discussions with Village staff and from regulations, for the purpose of this study.

- Standing water on roadways up to 6 inches deep (maximum) for no longer than 72 hours following the end of a 10-year, 24 hours storm.
- Distance from ground surface above septic tanks drain field to groundwater must be at least 42 inches. (Chapter 64E-6, Florida Administrative Code)
- The Village will consider, as part of the Capital Improvement Planning, raising roads in flood susceptible areas to reflect potential sea level rise. (Comprehensive Plan Policy 6.6)
- Standing water in habitable areas of buildings is not acceptable under any storm event.
- Seawalls shall be constructed to a minimum elevation of 5.5 ft NGVD with a foundation design to support a future extension to 6.5 ft NGVD (Ordinance 2018-04).
- Finished Floor elevation of buildings within flood hazard areas shall be no lower than two feet above base flood elevation. (Ordinance 2018-02)
- The area of the Biscayne Canal (C-8) shall remain in a near natural state where it passes through the Miami Shores Golf Course. The Village shall mitigate any unavoidable loss of habitat along the canal bank. (Comprehensive Plan Policy 2.7)



7 Project Prioritization

The final step in the development of the Adaptation Plan is prioritizing the possible projects. This includes developing costs of implementing the project, costs of not improving the infrastructure, and weighing the costs and benefits based on various criteria important to the Village.



Working within a limited budget and in areas already experiencing flooding emphasizes the need to get the “biggest bang for the buck” today, while planning for the future. As the groundwater and surface water elevation continue to rise, improvements can be constructed in the short-term with designs that will continue to function in the long term with minor alterations. Examples include seawalls with foundations adequate to support future heightening of the wall and mechanical equipment installed on elevated equipment pads.

The alternatives cost analysis for the plan is based on a standard design life of 20 years, which results in a planning year of 2038. The infrastructure is anticipated to remain structurally sound after 20 years. However, increases in canal and groundwater elevations are anticipated to impact the system’s effectiveness around that time.

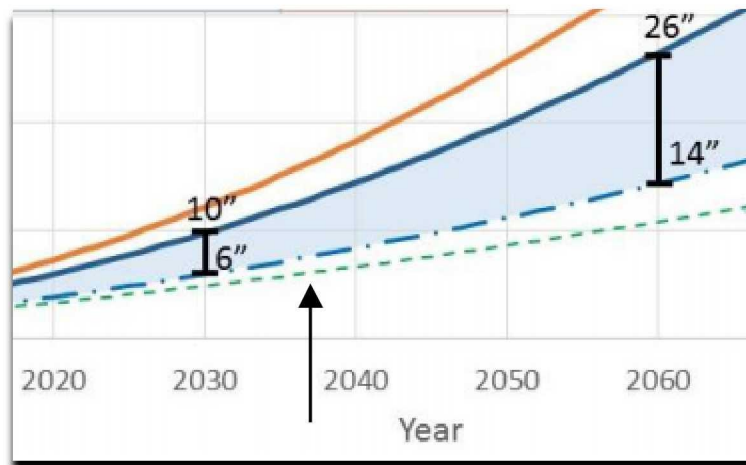


Figure 11 Project Planning Year sea level rise. Figure source: Unified sea level projection - Southeast Florida

The cost details for the alternative strategies include the total long-term project cost inclusive of the construction cost, operation, maintenance, and salvage value. A per-protected-user value for each alternative was then weighted based on considerations including whether the area was subjected to flooding, whether the project would result in a water quality benefit, whether the community was in support of this type of project, and whether the Village had the funds and staff to both construct and operate/maintain the

facility (Long Term Cost or LTC Rating). Each category is rated 1 through 10 and the total of all categories is used to weight the per protected user cost (see Appendix for full results).

The strategies were also evaluated using FEMA's STAPLEE evaluation criteria. The categories rated include Social, Technical, Administrative, Political, Legal, Economic, and Environmental. For each category, a rating of 1, 0, or -1 is assigned. Some categories are given more weight than others. The total of all categories is then used to weight the per protected user cost (see Appendix for full results).

The final evaluation method used the Institute of Sustainable Infrastructure concepts and Envision rating tools. The Envision rating system is a guide of 60 holistic sustainability criteria that comprehensively addresses the environmental, social, and economic impacts to sustainability in project design, construction, and operation according to five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. This evaluation does not directly use the construction or operation and maintenance costs. The Village may elect to have the projects certified through Envision once construction funds have been obligated (see Appendix for full results).

The various adaptation strategies were evaluated for implementation in individual neighborhoods. This type of implementation will minimize the length of time residents are disrupted by construction as well as save costs by constructing the needed improvements at one time rather than as separate contracts.

Figures depicting the model results for the entire Village are included at the end of this report. Analyses of the predicted impacts on the most vulnerable neighborhoods are summarized in the following sections. Although the three evaluation processes use different criteria, the combined results give clear direction for the appropriate strategy for each area of the Village.

7.1 Miami Shores Estates

This neighborhood is bordered by the C-8 Canal to south, the Village golf course and spur canal to the west, Biscayne Boulevard and a shopping plaza to the east, and NE 107th Street to the north. Miami Shores Estates includes 98 single family homes, one 58-unit motel, 7100 linear feet of roads and alleys, and 1800 linear feet of waterfront. As shown on Figures 19 and 20 (see Appendix), NE 10th Place is the only ingress/egress point for the neighborhood and is a priority road for the Village. It currently experiences tidal flooding on the southern end and tidal flooding will be present on more of the roadway by 2038.



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The Miami Shores Estates neighborhood roadways are showing signs of pavement failure, due at least in part to the frequent flooding and high-water table. Pavement cores should be taken before repairs are initiated to ensure the roadway base has not been compromised. Full reconstruction of the roadways closest to the C-8 Canal (Biscayne Canal) will probably be required to repair the existing damage.



NE 10th Ct and NE 105th Street (left) and NE 104th Street (right)

Our models indicate that approximately 30% of the neighborhood streets currently experience flooding due to high tides. By 2033, the tidally influenced flooding will be present on 50% of the roadways and adjacent private properties. The tidal flooding will continue to worsen through the end of the planning period (2038).

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade, which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), all roads in this neighborhood are less than 2.5 feet above the existing groundwater table. Our models (Figure 13, see Appendix) indicate that by 2038, portions of all roadways in this neighborhood will experience over 30 days of tidal flooding. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

The performance of the existing stormwater system relies upon gravity for disposal. As shown in Figure 14 (see Appendix), this neighborhood has four gravity outfalls into the C-8 Canal. As the groundwater and surface water levels rise, the gravity outfalls will no longer function as intended. The rising waters flow from the canal through the stormwater pipes and into lower areas of the neighborhood.

Much of the neighborhood waterfront, but not all, has privately owned seawalls. The existing seawalls are at varying heights with some below the peak stages in the C-8 (Biscayne) Canal. Unlike other areas, seawalls in south Florida do not extend downward to an impervious material, such as bedrock. Miami-Dade is underlain by porous lime rock and the seawalls only serve to slow the water movement. Along with higher seawalls, which will minimize storm surges and wave action, pumps should be added to the stormwater system to drain the neighborhood at rates faster than the rainfall and seepage. To meet

regulatory requirements, a new pump system would need to include additional water quality treatment capabilities, however. The system will also need to include an area (below ground vault or pond) to collect the water to be pumped. The expense of constructing and operating a pumped system will need to be weighed against the cost of repairing flood damage and the reduced quality of life for residents during high tide events. As shown on Figures 15 and 21 (see Appendix), we recommend the selected road, drainage, and seawall improvements for this neighborhood be implemented in the short term (within the next five years).

Although the neighborhood is within the North Miami Sewer service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the south half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be medium or high for most of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by half of the septic systems being currently at medium risk for failure and road/drainage improvements being recommended as short-term projects. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadway, septic system, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways in the southern half of the neighborhood will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways in the southern half of the neighborhood will be elevated up to 18 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$3 million for the septic to sewer conversion and \$4.3 million for the stormwater, seawall, and roadway improvements. Hardening the roads has fewer impacts to the historic drainage patterns and adjacent properties than elevating the roads.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	High	High	High	High
Septic to Sewer Elevate Roads	Mid	Mid	Mid	Mid

7.2 Anco Subdivision

This neighborhood is bordered by the C-8 Canal to south, Biscayne Boulevard (US 1) to the west, Biscayne Bay to the east, and North Miami to the north. The neighborhood is comprised of multi-family condominiums, townhomes and apartments.



This portion of NE 105th Street is 1900 linear feet long. The neighborhood has 1800 linear feet of waterfront.

Models indicate that flooding resulting from high tides is not currently present on the neighborhood street. By 2033, tidally influenced flooding will begin to be observed on parking lots and other low-lying areas along the roadways. By 2038, tidal flooding will be present on the eastern half of the roadway.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), NE 105th Street is less than 2.5 feet above the existing groundwater table. The roadway should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Water and sewer is currently provided to this neighborhood by North Miami, however some older buildings are not connected to it. As shown on Figure 18 (see Appendix), we recommend the remaining buildings in this neighborhood be converted from septic to sewer in the short-term (before 2023).

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadway and property repair costs will continue to rise through the end of the planning period (2038).
2. **Harden Roadways.** The roadway will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Elevate Roadway.** The roadway will be elevated up to 18 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is to eventually harden the roadway as a long-term strategy. Hardening the roads is recommended over elevating the roads because it has fewer impacts to the historic drainage patterns. Budget estimates for implementation is \$2 million for the stormwater, seawall, and roadway improvements.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	High	Low	Low	Mid-Low
Harden Roads	Low	High	Mid	Mid
Elevate Roads	Mid	Mid	Mid	Mid

7.3 Eveningside Subdivision

This neighborhood is bordered by the C-8 Canal to north, Biscayne Boulevard (US 1) to the east, the Village golf course the west, and Miami Shores Aquatic Center on the south. The neighborhood is comprised of 25 single-family homes, 1000 linear feet of roadway, and 1300 linear feet of waterfront



Our models indicate that the neighborhood street is not currently flooded by high tides. In 2048, tidal flooding will still not be present on the roadway surface.

Even when flooding is not visible on the road surface, however, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the road in this neighborhood is less than 2.5 feet above the existing groundwater table. NE 104th Street should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the western half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be medium for most of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by half of the septic systems being currently at medium risk for failure and road/drainage improvements being recommended as short-term projects. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadway, septic system, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways in the southern half of the neighborhood will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways in the southern half of the neighborhood will be elevated up to 18 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to

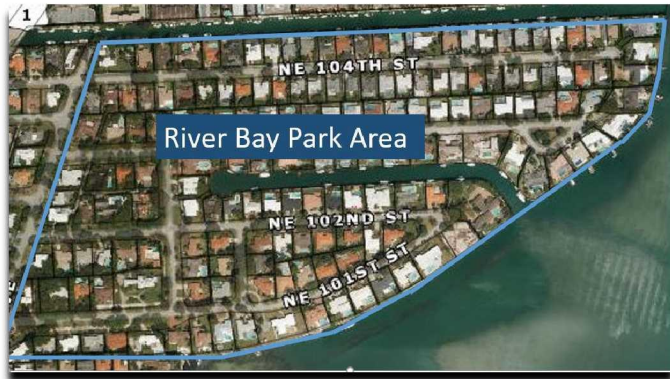
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Harden the Roadways. Budget estimates for implementation are approximately \$1.25 million for the septic to sewer conversion and \$2.75 million for the stormwater, seawall, and roadway improvements.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	High	Low	Mid	Mid
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	Low	Mid	Low	Low

7.4 River Bay Park Area

This neighborhood is bordered by the C-8 Canal to north, Biscayne Bay to the east, NE 12th Avenue to the west, and NE 100th Street on the south. The neighborhood is comprised of 168 single-family homes, 10650 linear feet of roadway, and 8200 linear feet of waterfront.



Models indicate that the eastern end of NE 104th Street is currently flooded by high tides. By 2033, almost all of NE 104th Street east of 12th Avenue will experience tidal flooding. By 2048, tidal flooding will be present on most roads in the area. NE 104th Street already has numerous traverse, longitudinal, and fatigue (alligator) cracking indicating the road sub-grade has failed.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the road in this neighborhood is less than 2.5 feet above the existing groundwater table. The conditions will continue to worsen through 2038. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the eastern half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium and high risks for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be medium or high for most of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by half of the septic systems being currently at medium risk for failure and road/drainage improvements being recommended to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$6.7 million for the septic to sewer conversion and \$5.1 million for the stormwater, seawall, and roadway improvements.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	High	Mid	Mid	Mid

7.5 Earleton Shores Area

This neighborhood is bordered by the NE 100th St to north, Biscayne Bay to the east, NE 12th Avenue to the west, and NE 97th on the south. The neighborhood is comprised of 74 single-family homes, 5000 linear feet of roadway, and 1030 linear feet of waterfront.

Our models indicate that flooding from high tides is not currently present on the roadways within this neighborhood, however discussions with Village staff indicate that the catch basins are filling during king tides and flooding may be imminent. The models show that by 2033, NE 12th Avenue and the eastern ends of adjacent roads will begin to experience tidal flooding. By 2048, tidal flooding will be present on half of roads in the area.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the roads in this neighborhood are less than 2.5 feet above the existing groundwater table. The conditions will continue to worsen through 2038. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.



Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the eastern half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be medium or high for most of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by the septic systems currently being at medium risk for failure and road/drainage improvements being needed to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water

conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.

3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$3.7 million for the septic to sewer conversion and \$2.4 million for the stormwater, seawall, and roadway improvements.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	High	High	High	High
Septic to Sewer Elevate Roads	Mid	Mid	Mid	Mid

7.6 North Bayshore Park Area

This neighborhood is bordered by the River Bay Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and North Bayshore Park Area on the south. The neighborhood is comprised of 60 single-family homes, 5400 linear feet of roadway, and 1900 linear feet of waterfront.



Our models indicate that flooding from high tides is not currently present on the roadways within this neighborhood. By 2033, the eastern end of NE 94th Street will begin to experience tidal flooding. By 2048, tidal flooding will be present on the roads in the eastern half of the area.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on

Figure 12 (see Appendix), the roads in this neighborhood are less than 2.5 feet above the existing groundwater table. The conditions will continue to worsen through 2038. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the eastern half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. The septic systems near the intersection of NE 94th Street and N Bayshore Drive are currently at high risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be medium or high for most of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by the septic systems currently being at medium risk for failure and road/drainage improvements being needed to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$3 million for the septic to sewer conversion and \$3.2 million for the stormwater, seawall, and roadway improvements. The Village should budget another \$2 million for improvements to North Bayside Park including a higher seawall and raised trail with ADA access.

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Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	High	Mid	Mid	Mid

7.7 Watersedge

This neighborhood is bordered by the North Bayshore Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and by unincorporated Miami-Dade County on the south. The neighborhood is comprised of 111 single-family homes, 7700 linear feet of roadway, and 1900 linear feet of waterfront.



Models indicate that flooding from high tides is currently present on limited portions of the neighborhood roadways. By 2033, most of the roads will experience some tidal flooding. By 2048, tidal flooding will be present on all the roads and extend onto private properties. This area already has a pump system with a generator to manage storwater.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the roads in this neighborhood are less than 2.5 feet above the existing groundwater table. The conditions will continue to worsen through 2038. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the eastern half neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium and high risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be high for a large portion of the neighborhood.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a

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short-term action is driven by the septic systems currently being at medium risk for failure and road/drainage improvements being needed to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system. This neighborhood has an existing stormwater pump which will be enhanced as part of the proposed stormwater improvements.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated. Water quality treatment improvements will also be made to comply with regulations for the proposed pumped stormwater discharge. This neighborhood has an existing stormwater pump which will be enhanced as part of the proposed stormwater improvements.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$5.5 million for the septic to sewer conversion and \$2 million for the stormwater, seawall, and roadway improvements. Costs are in 2018 dollars.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	High	Mid	Mid	Mid

7.8 Belvedere Park Area

This neighborhood is bordered by the North Bayshore Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and by unincorporated Miami-Dade County. The neighborhood is comprised of 21 single-family homes and 2100 linear feet of roadway.

Our models indicate that flooding from high tides is not currently present on neighborhood roadways. In 2048, tidal flooding will still not be present on the roads.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the roads in this neighborhood are less than 2.5 feet above the existing groundwater table. The conditions will continue to worsen through 2038. Roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.



Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in the central portion of this neighborhood is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be slightly higher.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the short-term (before 2023). The recommendation for this to be a short-term action is driven by the septic systems currently being at medium risk for failure and road/drainage improvements being needed to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.

- 3. Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$1.1 million for the septic to sewer conversion and \$3 million for the stormwater and roadway improvements. Costs are in 2018 dollars.

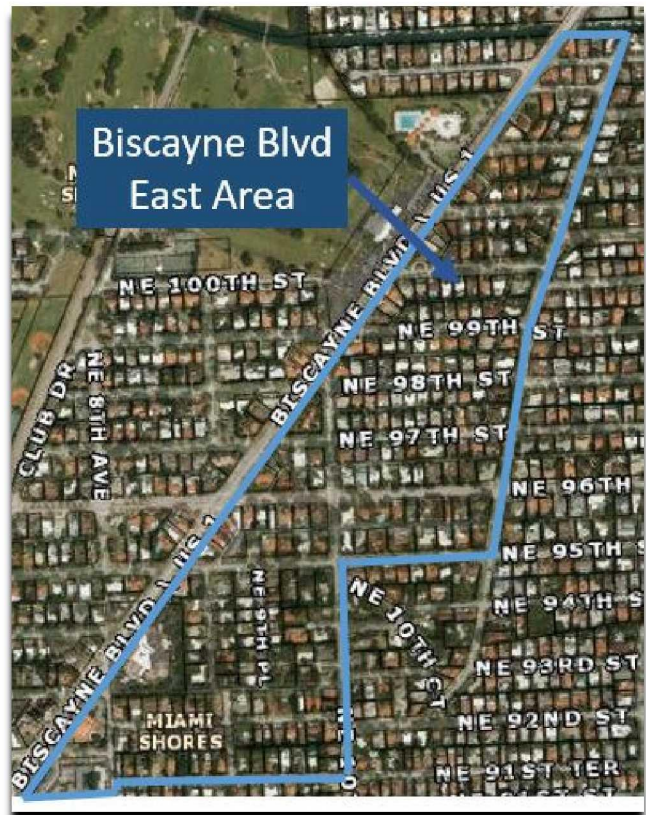
Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	High	Low	Low	Mid-Low
Septic to Sewer Harden Roads	Low	High	High	High-Mid
Septic to Sewer Elevate Roads	Mid	Mid	Mid	Mid

7.9 Biscayne Blvd East Area

This neighborhood is bordered by the North Bayshore Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and by unincorporated Miami-Dade County. The neighborhood is comprised of 225 single-family homes, 25,600 linear feet of roadway, and 325 feet of waterfront.

Our models indicate that flooding from high tides is not currently present on neighborhood roadways. In 2048, tidal flooding will still not be present on the roads.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road



surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the roads in this neighborhood are currently more than 2.5 feet above the existing groundwater table. By 2038, approximately 40% of the roadways will be impacted by high water tables. In the long-term, roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table between NE 98th St and NE 102nd is already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, the risk of septic system failure will be slightly higher.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the long-term (before 2038). The recommendation for this to be a short-term action is driven by the septic systems currently being at medium risk for failure and road/drainage improvements eventually being needed to prevent additional roadbed damage. It will be more economical and less disruptive to residents to construct the roadway improvements at the same time rather than phasing over the entire planning period.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$11.25 million for the septic to sewer conversion and \$8.3 million for the stormwater and roadway improvements. Costs are in 2018 dollars.

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Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Mid	Low	Low	Low
Septic to Sewer Harden Roads	High	High	High	High
Septic to Sewer Elevate Roads	Low	Mid	Mid	Mid

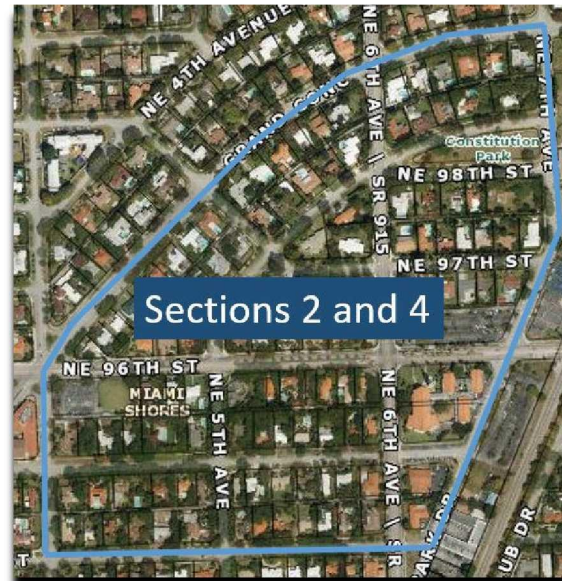
7.10 Sections 2 and 4

This neighborhood is bordered by the North Bayshore Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and by unincorporated Miami-Dade County. The neighborhood is comprised of 102 single-family homes and 13,200 linear feet of roadway.

Our models indicate that flooding from high tides is not currently present on neighborhood roadways. In 2048, tidal flooding will still not be present on the roads.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 12 (see Appendix), the roads in this neighborhood are currently more than 2.5 feet above the existing groundwater table. By 2038, a segment of Grand Concourse and roadways near the Community Center will be impacted by high water tables. In the long-term, roadways in this area should either be raised so that the base and sub-grade are above the groundwater or designed to withstand flooding conditions.

Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems. Figure 16 (see Appendix) shows the groundwater table in portions of the area already less than 4 feet below the ground surface, which places the septic systems at a medium risk for failure. Figure 17 (see Appendix) shows that by the year 2038, approximately 30% of the area will be at medium risk of septic system failure.



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As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the long-term (before 2038). The recommendation for this to be a long-term action is driven by the septic systems currently being at low risk for failure.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated.

The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$5.1 million for the septic to sewer conversion and \$6.4 million for the stormwater and roadway improvements. Costs are in 2018 dollars.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	Low	Low	Low	Low
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	High	Mid	Mid	Mid

7.11 Golf View Estates

This neighborhood is bordered by the North Bayshore Park Area to north, Biscayne Bay to the east, NE 12th Avenue to the west, and by unincorporated Miami-Dade County. The neighborhood is comprised of 17 single-family homes and 560 linear feet of roadway.

Our models indicate that flooding from high tides is not currently present on neighborhood roadways. In 2048, tidal flooding will still not be present on the roads.

Even when flooding is not visible on the road surface, damage can be occurring to the road base and sub-grade which extend 18 inches to 2.5 feet below the road surface. Road base and sub-grade failures are often indicated by pavement cracks and potholes. As shown on Figure 11 (see Appendix), the road in this neighborhood is currently more than 2.5 feet above the existing groundwater table. By 2038, the roadway base will still not be impacted by high groundwater conditions.



Although the neighborhood is within the Miami-Dade Utilities service area, the homes are served by privately owned septic systems.

Figure 16 (see Appendix) shows the groundwater table in the adjacent golf course is already less than 4 feet below the ground surface. Figure 17 (see Appendix) shows that by the year 2038, the eastern end of the neighborhood will be at medium risk of septic system failure.

As shown on Figure 18 (see Appendix), we recommend this neighborhood be converted from septic to sewer in the long-term (before 2038). The recommendation for this to be a long-term action is driven by the septic systems currently being at low risk for failure.

Three strategic plans were evaluated for this neighborhood:

1. **No Action.** The infrastructure would be maintained in its current condition. Roadways, septic systems, and property repair costs will continue to rise through the end of the planning period (2038).
2. **Septic to Sewer Conversion and Harden Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be rebuilt to withstand high water conditions. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system.
3. **Septic to Sewer Conversion and Elevate Roadways.** All parcels will be connected to a centralized sewer system. Roadways will be elevated up to 12 inches above the existing road crown. Seawalls will be raised to a uniform elevation. Stormwater improvements will include a pumped discharge system along with other improvements to maintain historic drainage patterns within the neighborhood after the roadway is elevated.

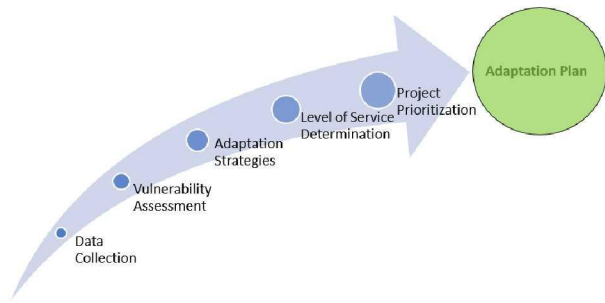
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The following table summarizes analysis included at the end of this report. The recommended strategy for this neighborhood is a Septic to Sewer Conversion and to Harden the Roadways. Budget estimates for implementation are approximately \$1 million for the septic to sewer conversion and \$2.4 million for the stormwater and roadway improvements. Costs are in 2018 dollars.

Strategy	LTC Rating	STAPLEE Rating	Envision Rating	Overall
No Improvements	High	Low	Low	Mid-Low
Septic to Sewer Harden Roads	Mid	High	High	High
Septic to Sewer Elevate Roads	Low	Mid	Mid	Mid

8 Adaptation Plan

The final step of this process is to adopt and implement the Adaptation Plan. Implementation is only possible with funding for the plan components.



Certain areas of the Village are already experiencing flooding impacts, while our models show other areas will begin to experience impacts within the planning period (by the year 2038). Those areas that are currently experiencing damage are recommended for implementation in the next five years (short-term). Other projects are recommended for implementation in the next twenty year (long-term). These recommendations are based on the best data and models currently available. As part of the Capital Improvement Program planning, we recommend the Village include periodic updates of the NOAA sea level rise forecasts over time and adjust the implementation schedule accordingly, as sea level may be rising faster or slower in South Florida than model predictions in 2018.

Miami Shores Village Environmental Vulnerability Study

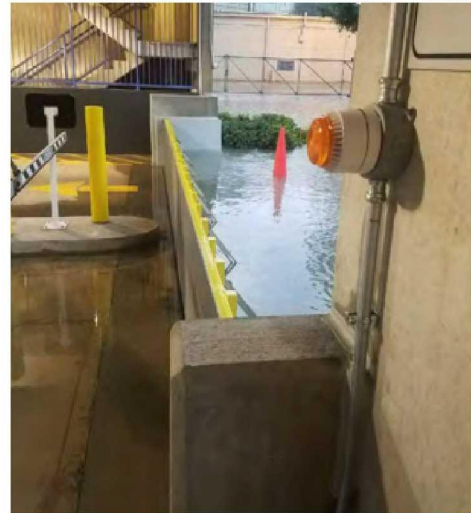
Table 4 Recommended Capital Projects for Sea Level Rise Adaptation Plan Implementation

Project	Budget Estimate	Urgency
Sewer Facility Plan	\$40,000	Short-term
Stormwater Facility Plan	\$75,000	Short-term
Miami Shores Estates: Septic to Sewer Conversion and Stormwater Improvements	\$7,300,000	Short-term
Anco (west end of NE 104 th St): Stormwater Improvements	\$2,000,000	Long-term
Eveningside: Septic to Sewer Conversion and Stormwater Improvements	\$4,000,000	Short-term
Earleton Shores: Septic to Sewer Conversion and Stormwater Improvements	\$11,800,000	Short-term
North Bayshore Area: Septic to Sewer Conversion and Stormwater Improvements	\$8,200,000	Short-term
Watersedge Area: Septic to Sewer Conversion and Stormwater Improvements	\$7,500,000	Short-term
Belvedere Park Area: Septic to Sewer Conversion and Stormwater Improvements	\$4,100,000	Short-term
Biscayne Blvd East Area: Septic to Sewer Conversion and Stormwater Improvements	\$19,550,000	Long-term
Sections 2 and 4 Area: Septic to Sewer Conversion and Stormwater Improvements	\$11,500,000	Long-term
Sections 2 and 4 Area: Septic to Sewer Conversion and Stormwater Improvements	\$3,400,000	Long-term
TOTAL	\$85,450,000	

8.1 Critical Facilities

8.1.1 Short-Term

Dry flood proofing of the police station with retractable barriers and impermeable coatings less than two feet above the base flood elevation. Require any remodeling or repairs below the base flood elevation to utilize flood damage resistant materials.



8.1.2 Long-Term

Raise finished floor elevations within Flood Hazard Areas to comply with the current Florida Building Code, which references ASCE 24. This will require critical facilities to be elevated or protected to two feet above the base flood elevation, which varies from 8 ft NGVD to 11 ft NGVD in the flood prone areas of Miami Shores. Non-critical facilities will be required to be at a minimum of one foot above the base flood elevation. Code requirements allow parking and storage areas within critical facilities to remain below those elevations, but no lower than the nearest roadway. However, emergency personnel need access to operating vehicles even during flood events and may also need materials in the storage areas. The needs of emergency personnel should be considered in determining whether parking and storage areas should be above the minimum elevation required by code.

Critical facilities should also be a minimum of 18 inches above the nearest paved roadway crown, which is not an evacuation route. If the facility is on an unpaved road, the finished floor should be at least 24 inches above the roadway.

Current South Florida Water Management requirements are for buildings to be above the stage resulting from the 100-year, 3-day storm event with no off-site discharge. Although the existing facilities are not required to meet this standard, the stage should be determined and compared to the minimum elevations listed in the preceding paragraphs. The facilities should be raised to the highest of the three elevations.

8.2 Drainage and Roadways

8.2.1 Short-Term

High priority, short-term roadway projects are recommended for the Miami Shores Estates neighborhood and the roadways, which parallel Biscayne Bay. Damaged roadways can either be reconstructed with materials able to withstand long period of standing water or be raised so that the sub-grade is above the water table. A

preliminary evaluation indicates the roadways need to be raised 12 to 18 inches above existing grade to be protected from the rising groundwater or be hardened to withstand flooding conditions.



The construction cost for the two adaptation strategies is similar. The elevated roadways would meet the Village's Level of Service by not having standing water on the roadway. However, the adjacent private properties would no longer be above the road as required by Village code requirements for new construction. Hardening the roadway would leave residents driving and walking through flood water, but would lessen the roadway repair costs. Improving the existing gravity drainage system to incorporate pumps in conjunction with the road hardening will decrease the depth and duration of standing water.

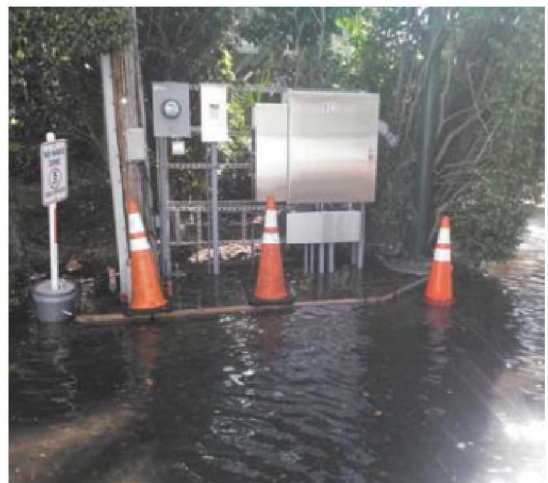
8.2.2 Long-Term

Long-term projects are recommended for the neighborhoods farther inland, which are not currently experiencing damage resulting from high groundwater tables or tidal flooding, such as the area between Biscayne Boulevard and NE 12th Avenue, Sections 2 and 4, and Golf View. Because none of these areas are expected to experience tidal flooding, hardening the roadway will result in decreased maintenance costs while maintaining the look of the neighborhoods.

8.3 Sewer System

8.3.1 Short-Term

Septic-to-sewer conversion is important to all flood prone areas in Miami Shores. To make the conversion a success, the network of existing gravity and pressure lines must be evaluated to determine the most cost effective and efficient order in which to convert neighborhoods. Development of a Sewer Master Facility Plan for septic to sewer conversion will cover details of the conversion and is a requirement of many state and federal grants. Short-term priority neighborhoods for the conversion include Miami Shores Estates, which is within the North Miami service area. The other short-term priority is the conversion of



Source: City of Ft. Lauderdale

neighborhoods along the Biscayne Canal and Biscayne Bay.

8.3.2 Long-Term

Long-term goals are to convert the remaining areas of the Village to central sewer. The conversion can be phased and implemented as roadway repairs are needed. Average cost of design and construction for the conversion is \$50,000 per home in southern Florida.

8.4 Seawalls

8.4.1 Short-Term

Revise Code of Ordinance Division 23 (Ordinance 2018-04) to include a date by which all properties need to comply with minimum sea wall elevation.

Estimated cost: \$500/linear foot for seawalls.



8.4.2 Long-Term

Evaluate sea level elevation every five years and re-examine minimum seawall elevation. Revise ordinance when sea levels are within two feet of minimum seawall elevation.

9 Funding Strategies

Funding assistance for other Stormwater subprojects may be through FDEP's Clean Water Act Section 319 Grants, FDEP TMDL Grants, State Revolving Fund Grants and Loans, FEMA Grants, Community Development Block Grants, Water Pollution Control Bonds, USACE Aquatic Ecosystem Restoration Program, SFWMD Cooperative Funding Program for Surface Water Improvements, Special Taxing Districts, and future legislative appropriations.

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11 Appendix

Table 5 Miami Shores Adaptation Plan Envision Rating System Pre-Analysis: Evaluation Matrix

The Institute of Sustainable Infrastructure's Envision rating system is a guide of 60 holistic sustainability criteria that comprehensively addresses the environmental, social, and economic impacts to sustainability in project design, construction, and operation.

Table 6 Miami Shores Adaptation Plan Long Term Cost Analysis: Evaluation Matrix

The total long-term project costs inclusive of construction cost, operation, maintenance, and salvage value. The total of all categories is then used to weight the per protected user cost.

Table 7 Miami Shores Adaptation Plan STAPLEE Evaluation Matrix

FEMA's STAPLEE evaluation criteria includes Social, Technical, Administrative, Political, Legal, Economic, and Environmental ratings. For each category, a rating of 1, 0, or -1 is assigned. Some categories are given more weight than others.

Figure 12 Miami Shores Existing Road Conditions 2018

Map indicating location and frequency of roads that are currently exposed to tidal flooding of 6 inches or more in 2018 or are being undermined by ground water coming within 2.5 feet of the roadbed, according to Coastal Risk modeling.

Figure 13 Miami Shores Future Road Conditions 2038

Map showing location and frequency of roads that will be exposed to 6 inches or more of tidal flooding or high ground water levels within 2.5 feet of the roadbed in 2038, according to Coastal Risk modeling.

Figure 14 Miami Shores Existing Stormwater Facilities 2018

Map showing the location of stormwater management infrastructure in Miami Shores Village.

Figure 15 Miami Shores Recommended Road and Drainage Improvements

Map indicating locations for recommended short- (0-5 year) and long-term (20 year) adaptation measures: road bed improvements and injection wells and pumps for drainage.

Figure 16 Miami Shores Existing Septic/Sewer Conditions 2018

Map showing existing sewers system and risk level for existing septic tanks due to high ground water in 2018. According to Coastal Risk models, the high risk areas have seasonally high ground water within than 0.5 of the surface, which impairs septic tank functioning. Moderate risk areas have 0.5-3.5 feet clearance and low risk areas have more than 3.5 feet.

Figure 17 Miami Shores Future Septic/Sewer Conditions 2038

Map showing location of existing sewers system and risk level for existing septic tanks due to high ground water in 2038. According to Coastal Risk models, the high risk areas will have seasonally high ground water within than 0.5 of the surface, which impairs septic tank functioning. Moderate risk areas will have 0.5-3.5 feet clearance and low risk areas will have more than 3.5 feet.

Figure 18 Miami Shores Recommended Septic-to-Sewer Improvements

Map showing the location of existing sewer systems in 2018 and areas recommended for short-term (within 5 years) conversion from septic to sewer and long-term (20 years) conversion, both residential and commercial.

Figure 19 Miami Shores Existing Critical Facilities 2018

Map showing location of critical facilities throughout Miami Shores and roads identified by municipal staff as priority access routes, and areas impacted by tidal flooding in 2018 according to Coastal Risk models.

Figure 20 Miami Shores Future Critical Facilities 2038

Map showing location of critical facilities throughout Miami Shores and roads identified by municipal staff as priority access routes, and areas impacted by tidal flooding in 2038, according to Coastal Risk modeling.

Figure 21 Miami Shores Recommended Critical Facilities and Seawall Improvements

Map showing location of seawalls recommended for short-term (0-5 years) and long-term (20 years) improvements and roads for short-term and long-term upgrades.

Figure 22 Miami Shores Existing Seawalls 2018

Map indicating the location of public and private seawalls in Miami Shores in 2018.

MIAMI SHORES - ADAPTATION PLAN
ENVISION RATING SYSTEM PRE-ASSESSMENT ANALYSIS: Evaluation Matrix

	<u>Quality of Life</u>	<u>Leadership</u>	<u>Resource Allocation</u>	<u>Natural World</u>	<u>Climate</u>	<u>Average</u>	<u>Rank</u>
MIAMI SHORES ESTATES							
1 No Improvements	14%	63%	0%	31%	100%	42%	Low
2 Septic to Sewer, Harden Road	30%	89%	72%	70%	100%	72%	High
3 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
ANCO SUBDIVISION							
4 No Improvements	36%	68%	0%	59%	100%	53%	Low
5 Harden Road	45%	89%	67%	59%	100%	72%	Mid
6 Elevate Road	45%	89%	67%	59%	100%	72%	Mid
EVENINGSIDE							
7 No Improvements	14%	63%	0%	31%	100%	42%	Low
8 Septic to Sewer, Harden Road	30%	89%	72%	70%	100%	72%	High
9 Septic to Sewer, Elevation Road	32%	89%	67%	65%	100%	71%	Mid
RIVER BAY PARK							
10 No Improvements	14%	63%	0%	31%	100%	42%	Low
11 Septic to Sewer, Harden Roads	30%	89%	72%	70%	100%	72%	High
12 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
EARLETON SHORES							
13 No Improvements	14%	63%	0%	31%	100%	42%	Low
14 Septic to Sewer, Harden Roads	30%	89%	72%	70%	100%	72%	High
15 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
NORTH BAYSHORE							
16 No Improvements	14%	63%	0%	31%	100%	42%	Low
17 Septic to Sewer, Harden Roads	30%	89%	72%	70%	100%	72%	High
18 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
WATERSEdge							
19 No Improvements	14%	63%	0%	31%	100%	42%	Low
20 Septic to Sewer, Harden Roads	30%	89%	72%	70%	100%	72%	High
21 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
BELVEDERE PARK							
22 No Improvements	14%	63%	0%	31%	100%	42%	Low
23 Septic to Sewer, Harden Roads	30%	89%	72%	70%	100%	72%	High
24 Septic to Sewer, Elevate Roads	32%	89%	67%	65%	100%	71%	Mid
BISCAYNE EAST							
25 No Improvements	14%	63%	0%	31%	100%	42%	Low
26 Septic to Sewer, Harden Road	30%	89%	72%	70%	100%	72%	High
27 Septic to Sewer, Elevation Road	32%	89%	67%	65%	100%	71%	Mid
SECTIONS 2 AND 4							
28 No Improvements	14%	63%	0%	31%	100%	42%	Low
29 Septic to Sewer, Harden Road	30%	89%	72%	70%	100%	72%	High
30 Septic to Sewer, Elevation Road	32%	89%	67%	65%	100%	71%	Mid
GOLF VIEW							
31 No Improvements	14%	63%	0%	31%	100%	42%	Low
32 Septic to Sewer, Harden Road	30%	89%	72%	70%	100%	72%	High
33 Septic to Sewer, Elevation Road	32%	89%	67%	65%	100%	71%	Mid

**MIAMI SHORES - ADAPTATION PLAN
LONG TERM COST ANALYSIS: Evaluation Matrix**

	<u>Cost per home</u>	<u>Risk of Flooding</u>	<u>Water Quality Benefit</u>	<u>Community Support</u>	<u>O&M Funds Available</u>	<u>Weighted Cost per Home</u>	<u>Rank</u>
MIAMI SHORES ESTATES							
1 No Improvements	\$ 130,000	10	10	5	1	\$ 845,000.00	Low
2 Septic to Sewer, Harden Road	\$ 120,000	2	5	3	1	\$ 330,000.00	High
3 Septic to Sewer, Elevate Roads	\$ 130,000	2	3	7	1	\$ 422,500.00	Mid
ANCO SUBDIVISION							
4 No Improvements	\$ 20,000.00	8	5	1	1	\$ 75,000.00	High
5 Harden Road	\$ 40,000.00	3	5	5	1	\$ 140,000.00	Low
6 Elevate Road	\$ 30,000.00	2	5	3	1	\$ 82,500.00	Mid
EVENINGSIDE							
7 No Improvements	\$ 40,000.00	8	10	5	1	\$ 240,000.00	High
8 Septic to Sewer, Harden Road	\$ 150,000.00	3	2	3	1	\$ 337,500.00	Mid
9 Septic to Sewer, Elevation Road	\$ 210,000.00	2	2	7	1	\$ 630,000.00	Low
RIVER BAY PARK							
10 No Improvements	\$ 50,000.00	6	10	8	1	\$ 312,500.00	Low
11 Septic to Sewer, Harden Roads	\$ 70,000.00	6	5	5	1	\$ 297,500.00	Mid
12 Septic to Sewer, Elevate Roads	\$ 60,000.00	2	5	8	1	\$ 240,000.00	High
EARLETON SHORES							
13 No Improvements	\$ 50,000.00	5	10	7	1	\$ 287,500.00	Low
14 Septic to Sewer, Harden Roads	\$ 80,000.00	5	5	3	1	\$ 280,000.00	High
15 Septic to Sewer, Elevate Roads	\$ 90,000.00	2	3	7	1	\$ 292,500.00	Mid
NORTH BAYSHORE							
16 No Improvements	\$ 60,000.00	5	10	7	1	\$ 345,000.00	Low
17 Septic to Sewer, Harden Roads	\$ 100,000.00	5	5	3	1	\$ 350,000.00	Mid
18 Septic to Sewer, Elevate Roads	\$ 100,000.00	2	3	7	1	\$ 325,000.00	High
WATERSEDGE							
19 No Improvements	\$ 50,000.00	5	10	7	1	\$ 287,500.00	Low
20 Septic to Sewer, Harden Roads	\$ 70,000.00	5	5	3	1	\$ 245,000.00	Mid
21 Septic to Sewer, Elevate Roads	\$ 70,000.00	2	3	7	1	\$ 227,500.00	High
BELVEDERE PARK							
22 No Improvements	\$ 60,000.00	7	10	7	1	\$ 375,000.00	High
23 Septic to Sewer, Harden Roads	\$ 180,000.00	5	5	3	1	\$ 630,000.00	Low
24 Septic to Sewer, Elevate Roads	\$ 200,000.00	2	3	7	1	\$ 650,000.00	Mid
BISCAYNE EAST							
25 No Improvements	\$ 70,000.00	5	10	7	1	\$ 402,500.00	Mid
26 Septic to Sewer, Harden Road	\$ 80,000.00	5	5	3	1	\$ 280,000.00	High
27 Septic to Sewer, Elevation Road	\$ 1,600,000.00	2	3	7	1	\$ 5,200,000.00	Low
SECTIONS 2 AND 4							
28 No Improvements	\$ 80,000.00	5	10	7	1	\$ 460,000.00	Low
29 Septic to Sewer, Harden Road	\$ 100,000.00	5	3	3	1	\$ 300,000.00	Mid
30 Septic to Sewer, Elevation Road	\$ 90,000.00	2	3	7	1	\$ 292,500.00	High
GOLF VIEW							
31 No Improvements	\$ 40,000.00	5	10	7	1	\$ 230,000.00	High
32 Septic to Sewer, Harden Road	\$ 180,000.00	5	3	3	1	\$ 540,000.00	Mid
33 Septic to Sewer, Elevation Road	\$ 220,000.00	2	3	7	1	\$ 715,000.00	Low

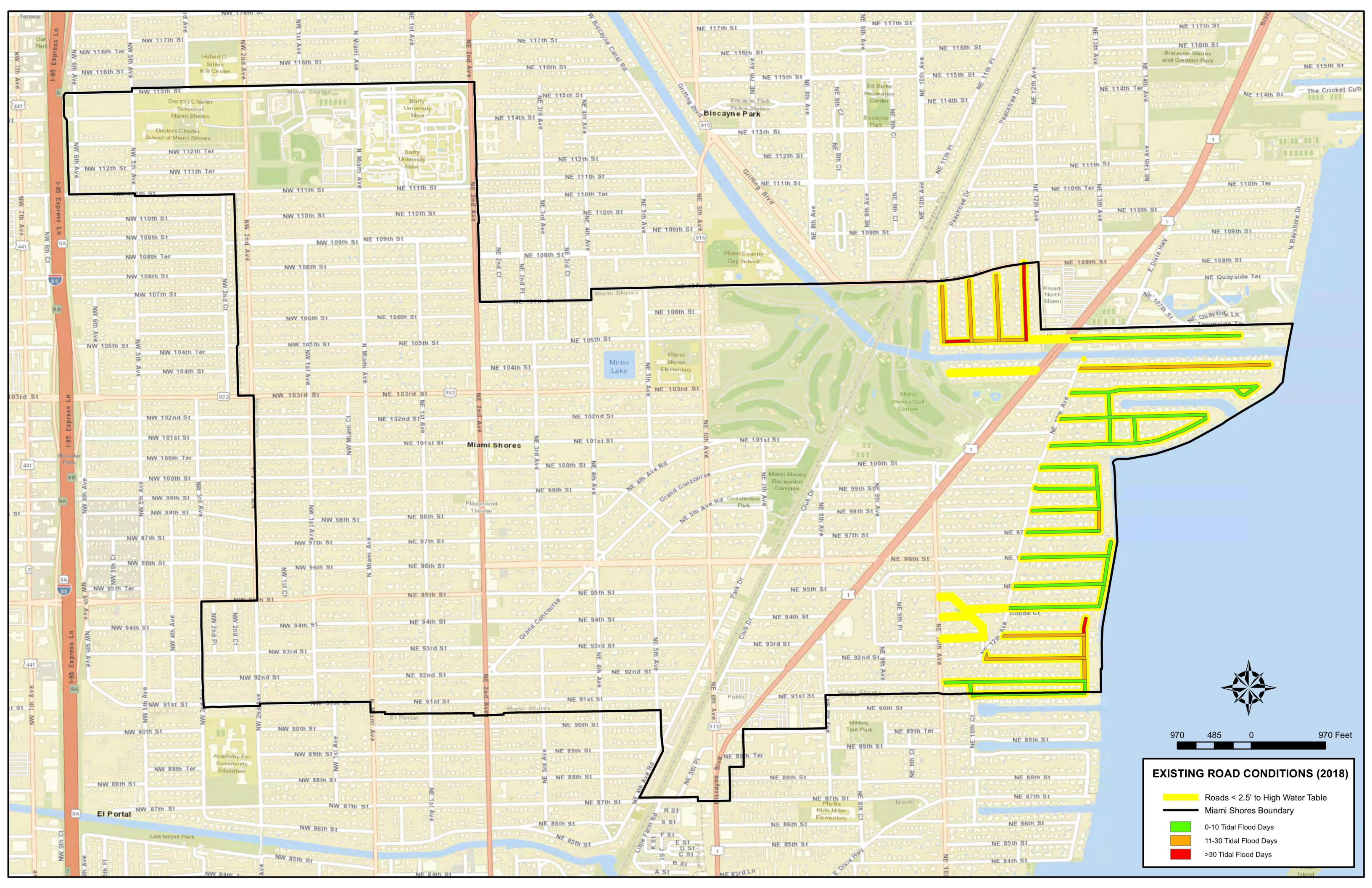
Cost per home based on present worth analysis of life cycle cost over 20 years. Categories are ranked from 1 to 10 with 1 being supported or not likely to adversely impact and 10 being not supported or likely to negatively impact.

MIAMI SHORES - ADAPTATION PLAN
STAPLEE Evaluation Matrix



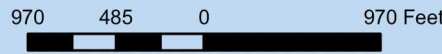
1 = Favorable, 0 = Neutral, -1 = Less Favorable Multiply by number in parenthesis

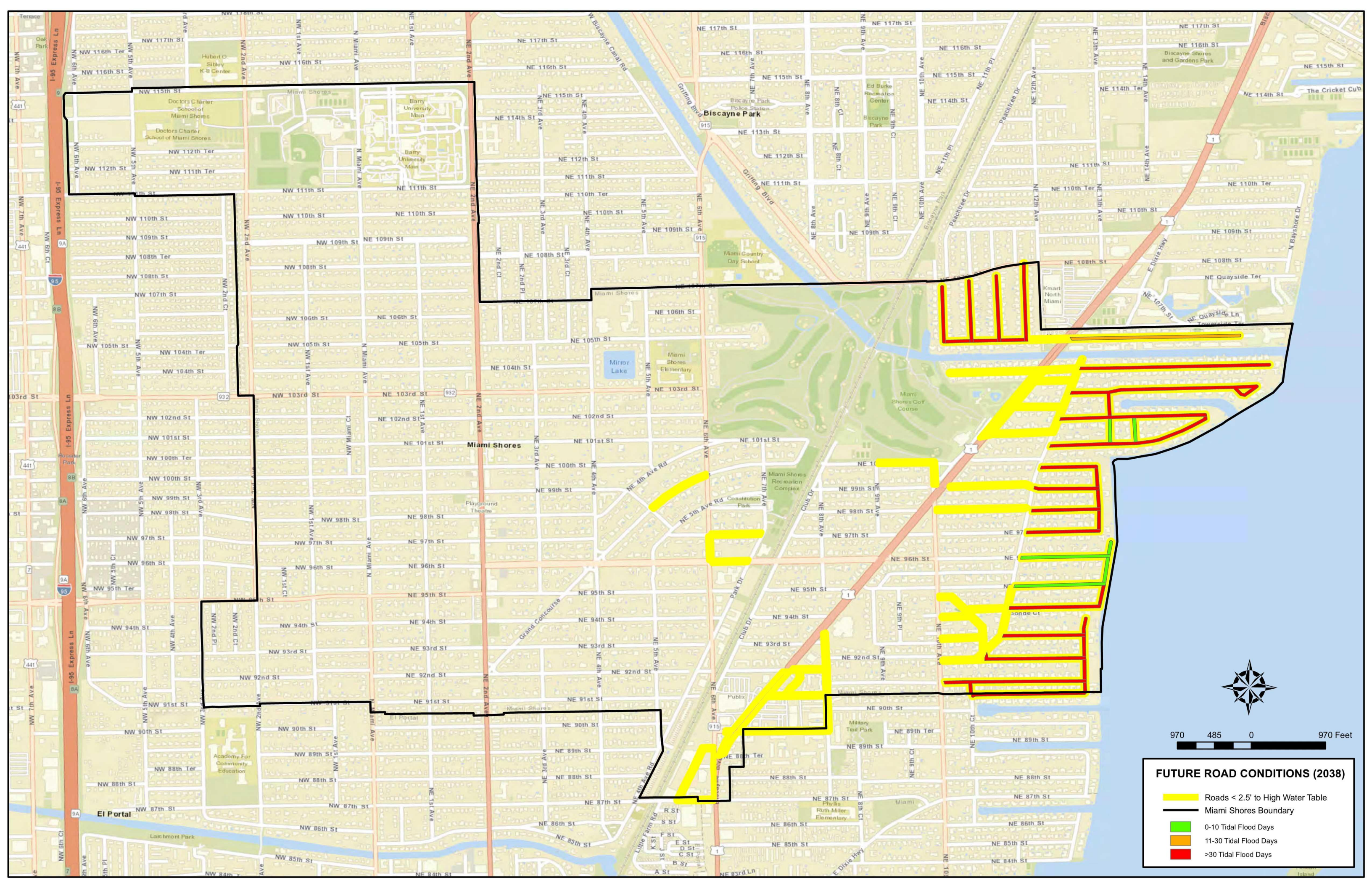
	<u>Social</u>			<u>Technical</u>				<u>Administrative</u>			<u>Political</u>			<u>Legal</u>				<u>Economic</u>				<u>Environmental</u>				<u>Rank</u>				
	Community Acceptance	Effect of Population Segment	Effect of Community (x2)	Technically Feasible (x3)	Long-term Solution	Expertise required & available (x2)	Reasonable Timeframe	Secondary Impacts	Capability to Implement	Funding Allocated	Community Provide Maint. (x3)	Politically Acceptable	Local Champion	Public Support	Authority to Implement (x2)	Comply with Environmental Reg's (x2)	Legal Side Effects/Taking	HOA Bylaws / Deed Restrictions	Potential Legal Challenges	Resonable Cost (x2)	Burden on Economy	Contributes to Economic Goals (x2)	Additional Jobs	Impact Floodplain / Wetland	Natural Environment		Environmental Regulatory App'l	Utility and Transportation System	Total	
1 Miami Shore Estates - No Action	-1	0	0	-1	-1	1	1	-1	1	1	1	-1	-1	-1	1	1	1	0	0	1	0	0	0	0	0	-1	-1	-3		
2 Miami Shores Estates - Alt 2	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	1	1	26	High
3 Miami Shores Estates - Alt 3	0	0	0	1	0	1	1	-1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	1	18		
4 Anco Sub - No Action	1	0	0	-1	-1	1	1	-1	1	1	1	-1	0	-1	1	1	-1	0	0	1	0	0	0	0	0	0	0	0	8	
5 Anco Sub - Harden Rd	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	23	High
6 Anco Sub - Elevate Road	-1	0	0	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	15		
7 Eveningside - No Action	0	0	0	1	-1	1	1	-1	1	1	1	-1	0	-1	1	1	-1	0	0	1	0	0	0	0	0	0	0	-1	12	
8 Eveningside - Sewer, Harden Rd	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	24	High
9 Eveningside - Sewer, Elevate Rd	-1	0	0	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	16		
10 River Bay - No Action	-1	0	0	-1	-1	1	1	-1	1	1	1	-1	0	-1	1	1	-1	0	0	1	0	0	0	0	0	0	0	-1	5	
11 River Bay - Sewer, Harden Rds	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	24	High
12 River Bay - Sewer, Elevate Rds	0	0	0	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	19	
13 Earleton - No Action	-1	0	0	1	-1	1	1	-1	1	1	1	-1	-1	-1	1	1	-1	0	0	1	0	0	0	0	0	0	0	-1	10	
14 Earleton - Sewer, Harden Rds	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	24	High
15 Earleton - Sewer, Elevate Rds	0	0	0	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	19	
16 N Bayshore - No Action	-1	0	0	-1	-1	1	1	-1	1	1	1	-1	0	-1	1	1	-1	0	0	1	0	0	0	0	0	0	0	-1	5	
17 N Bayshore - Sewer, Harden Rds	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	24	High
18 N Bayshore - Sewer, Elevate Rds	0	0	0	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	19	
19 Watersedge - No Actin	0	0	0	1	-1	1	1	0	1	1	1	-1	-1	-1	1	1	-1	0	-1	1	1	0	1	-1	0	0	0	0	13	
20 Watersedge - Sewer, Harden Rds	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	24	High
21 Watersedge - Sewer, Elevate Rds	0	0	-1	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	16	
22 Belvedere Park - No Actin	0	0	0	1	-1	1	1	0	1	1	1	-1	-1	-1	1	1	-1	0	-1	1	1	0	1	-1	0	0	0	0	13	
23 Belvedere Park - Sewer, Harden Rds	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	24	High
24 Belvedere Park - Sewer, Elevate Rds	0	0	-1	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	16	
25 Biscayne East - No Action	0	0	0	1	-1	1	1	0	1	1	1	-1	-1	-1	1	1	-1	0	-1	1	1	0	1	-1	0	0	0	0	13	
26 Biscayne East - Sewer, Harden Rd	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	24	High
27 Biscayne East - Sewer, Elevate Rd	0	0	-1	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	16	
28 Sect 2 & 4 - No Action	0	0	0	1	-1	1	1	0	1	1	1	-1	-1	-1	1	1	-1	0	-1	1	1	0	1	-1	0	0	0	0	13	
29 Sect 2 & 4 - Sewer, Harden Rd	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	24	High
30 Sect 2 & 4 - Sewer, Elevate Rd	0	0	-1	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	16	
31 Golf View - No Action	0	0	0	1	-1	1	1	0	1	1	1	-1	-1	-1	1	1	-1	0	-1	1	1	0	1	-1	0	0	0	0	13	
32 Golf View - Sewer, Harden Rd	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	24	High
33 Golf View - Sewer, Elevate Rd	0	0	-1	1	1	1	1	-1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	16	



EXISTING ROAD CONDITIONS (2018)

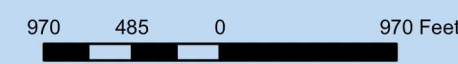
- Roads < 2.5' to High Water Table
- Miami Shores Boundary
- 0-10 Tidal Flood Days
- 11-30 Tidal Flood Days
- >30 Tidal Flood Days

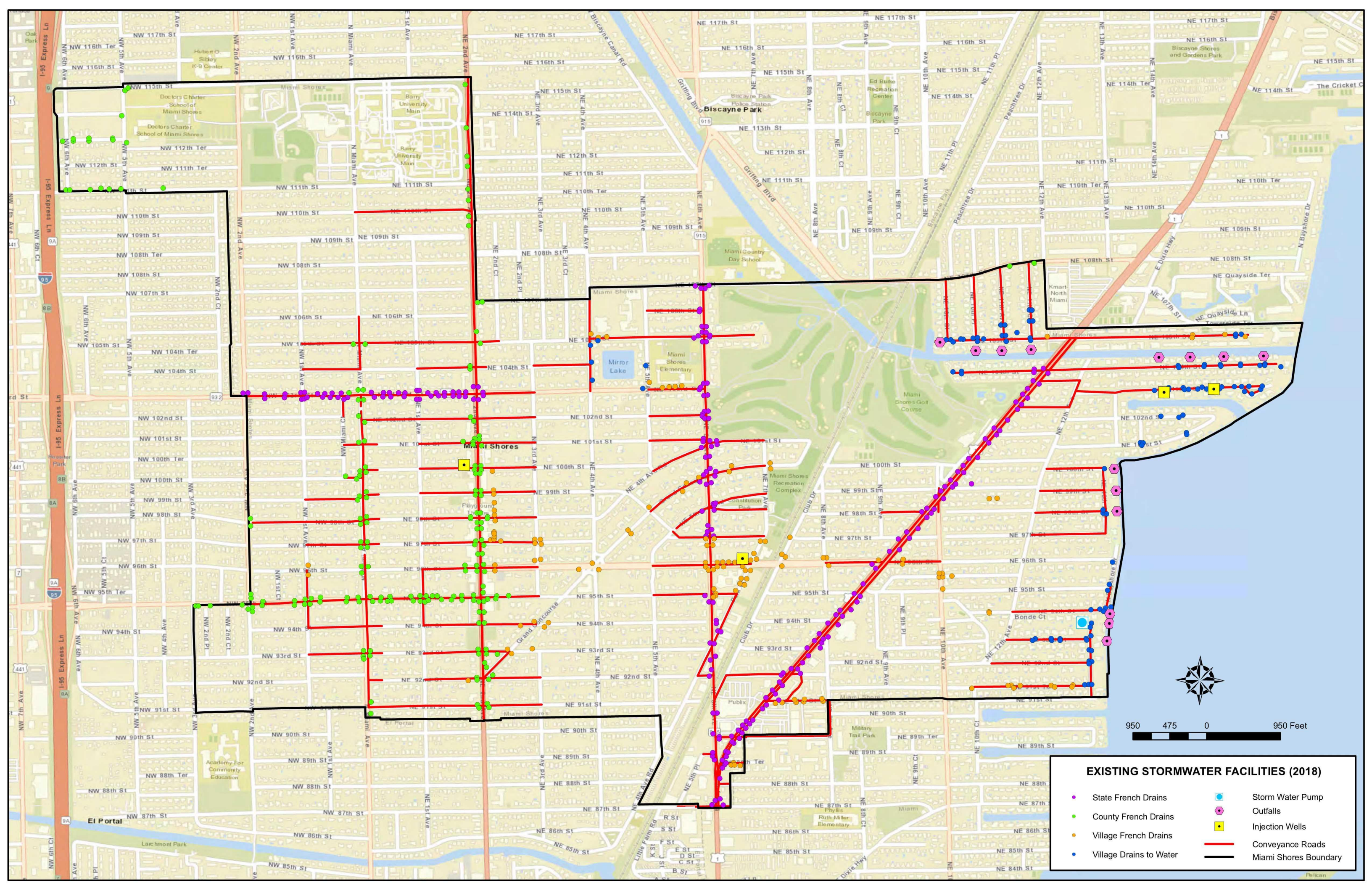




FUTURE ROAD CONDITIONS (2038)

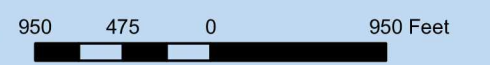
- Roads < 2.5' to High Water Table
- Miami Shores Boundary
- 0-10 Tidal Flood Days
- 11-30 Tidal Flood Days
- >30 Tidal Flood Days

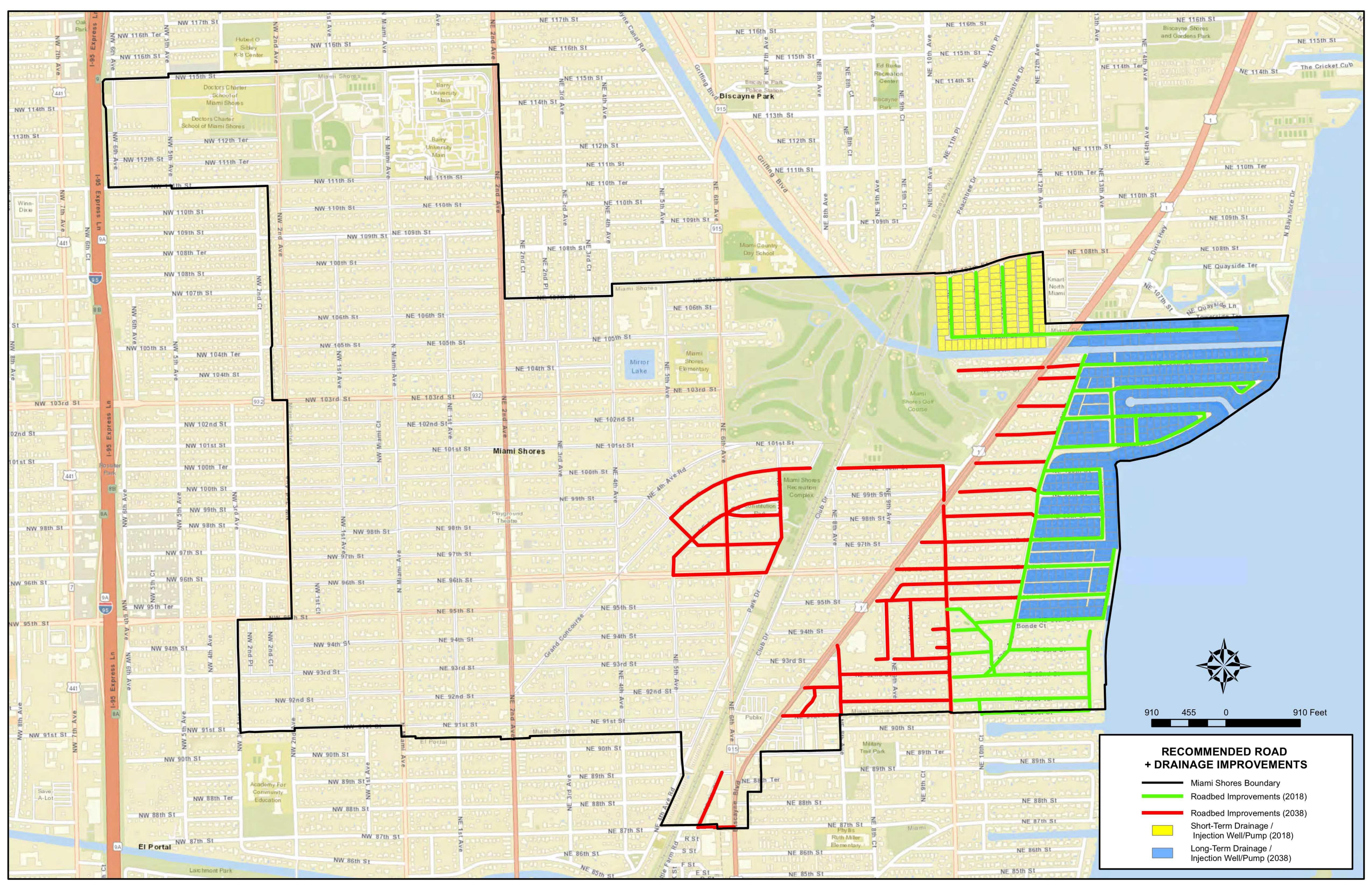




EXISTING STORMWATER FACILITIES (2018)

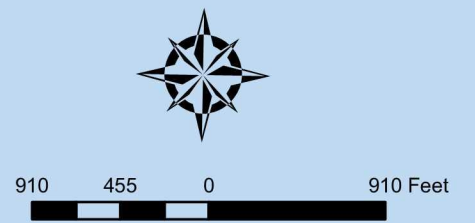
- State French Drains
- County French Drains
- Village French Drains
- Village Drains to Water
- Storm Water Pump Outfalls
- Injection Wells
- Conveyance Roads
- Miami Shores Boundary

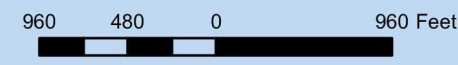
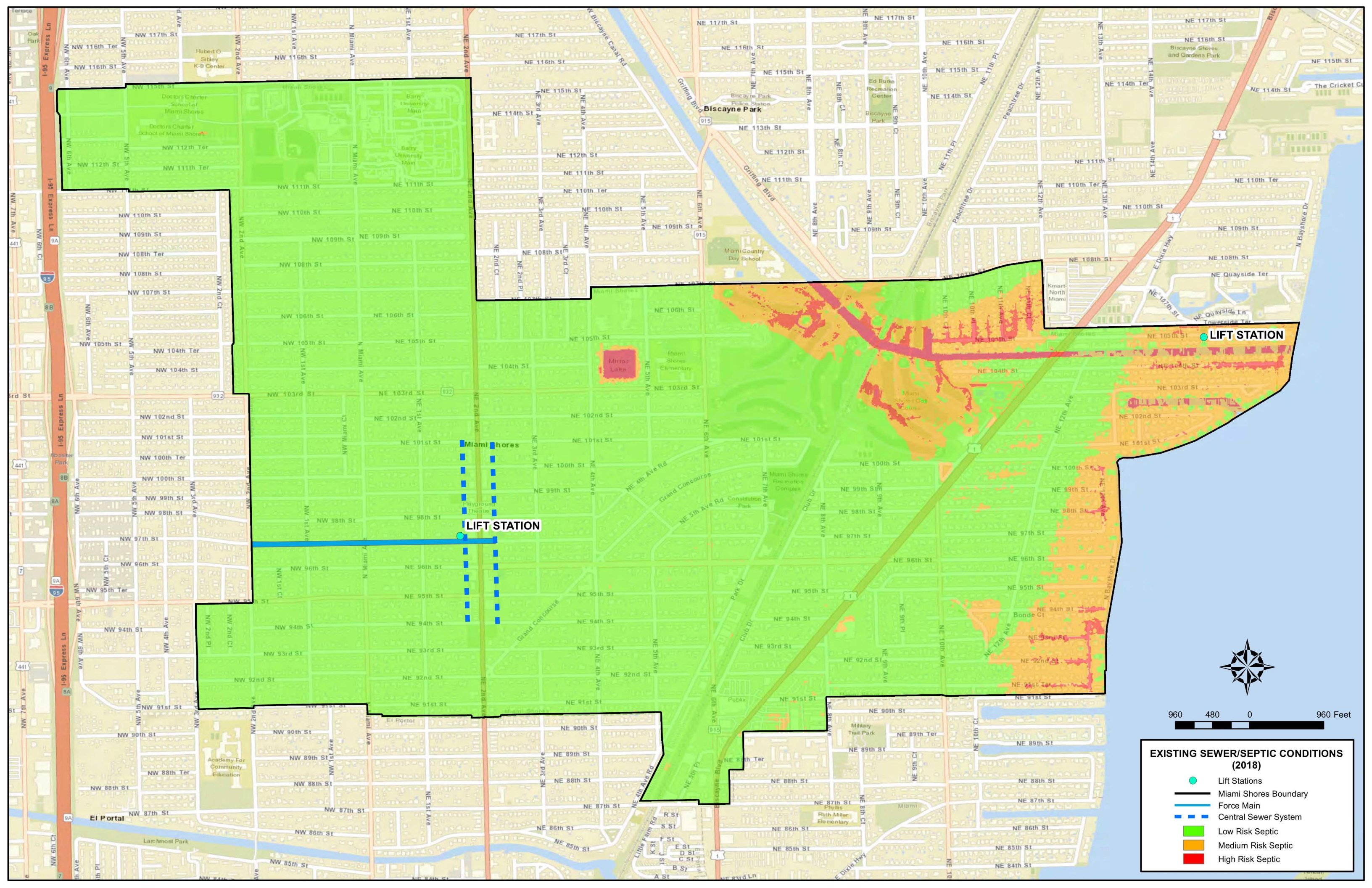




RECOMMENDED ROAD + DRAINAGE IMPROVEMENTS

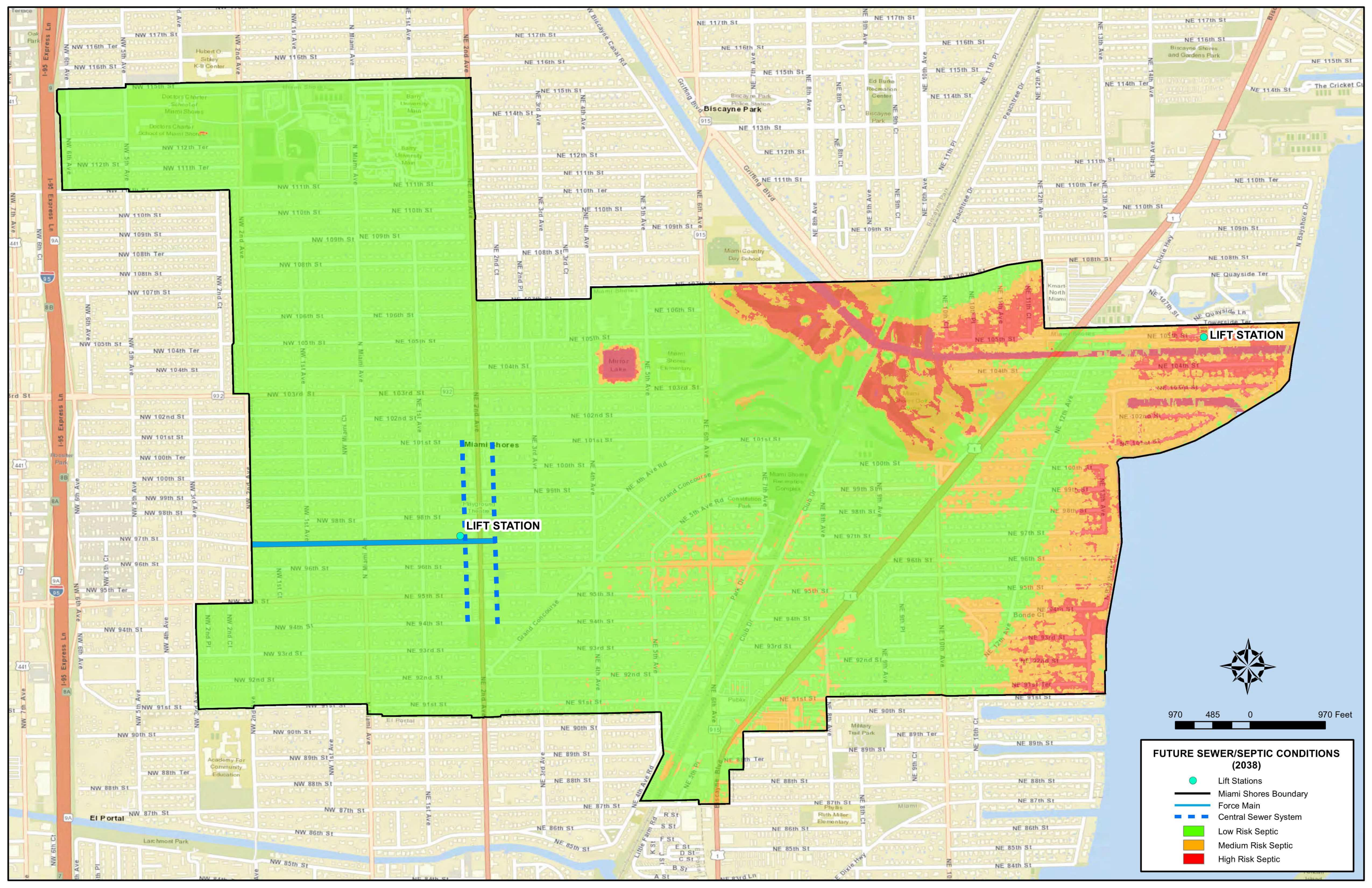
- Miami Shores Boundary
- Roadbed Improvements (2018)
- Roadbed Improvements (2038)
- Short-Term Drainage / Injection Well/Pump (2018)
- Long-Term Drainage / Injection Well/Pump (2038)





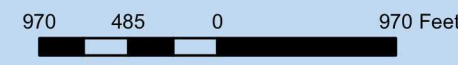
EXISTING SEWER/SEPTIC CONDITIONS (2018)

- Lift Stations
- Miami Shores Boundary
- Force Main
- Central Sewer System
- Low Risk Septic
- Medium Risk Septic
- High Risk Septic



FUTURE SEWER/SEPTIC CONDITIONS (2038)

- Lift Stations
- Miami Shores Boundary
- Force Main
- Central Sewer System
- Low Risk Septic
- Medium Risk Septic
- High Risk Septic



LIFT STATION

LIFT STATION

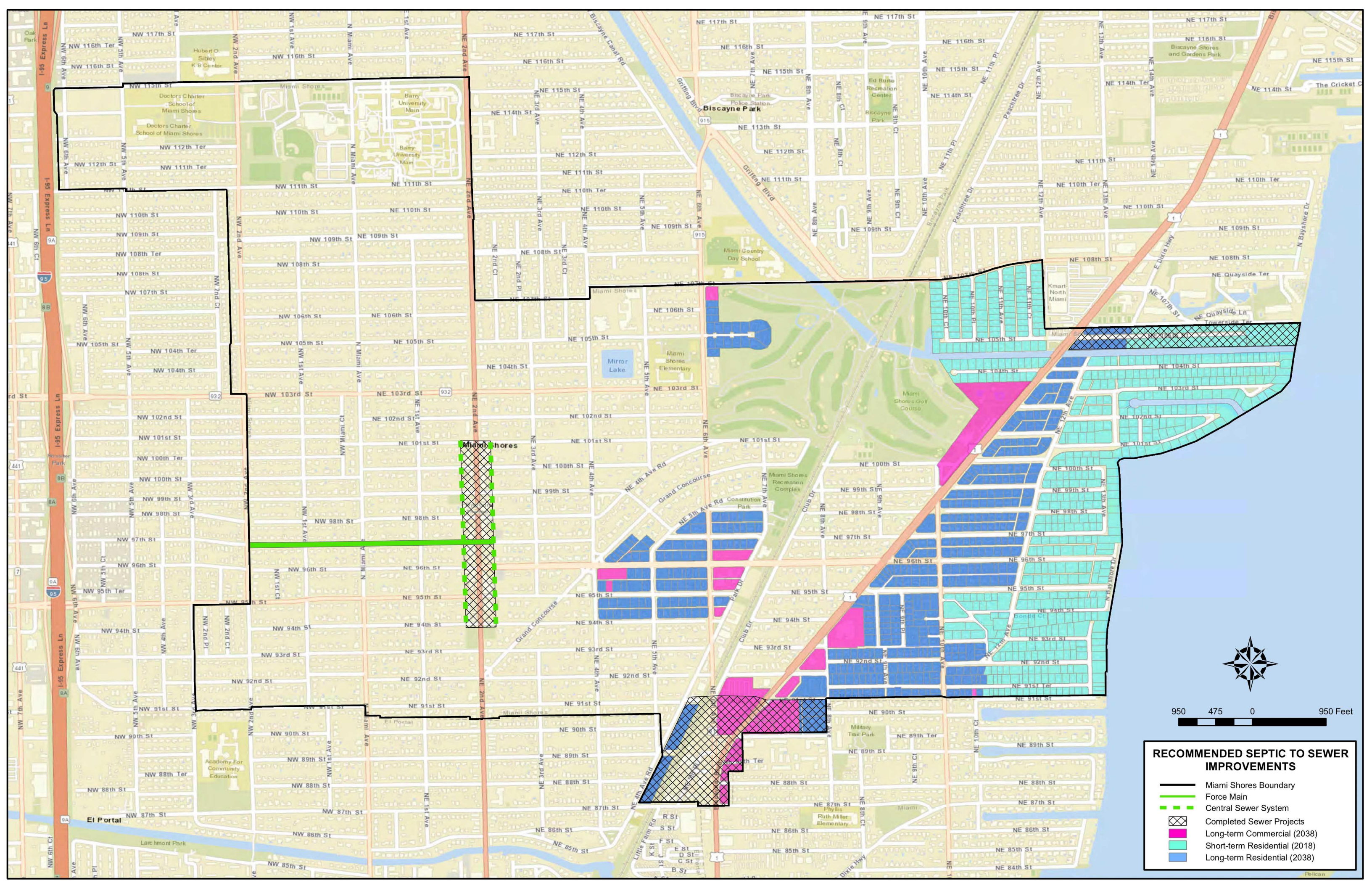
Miami Shores

Biscayne Park

EI Portal

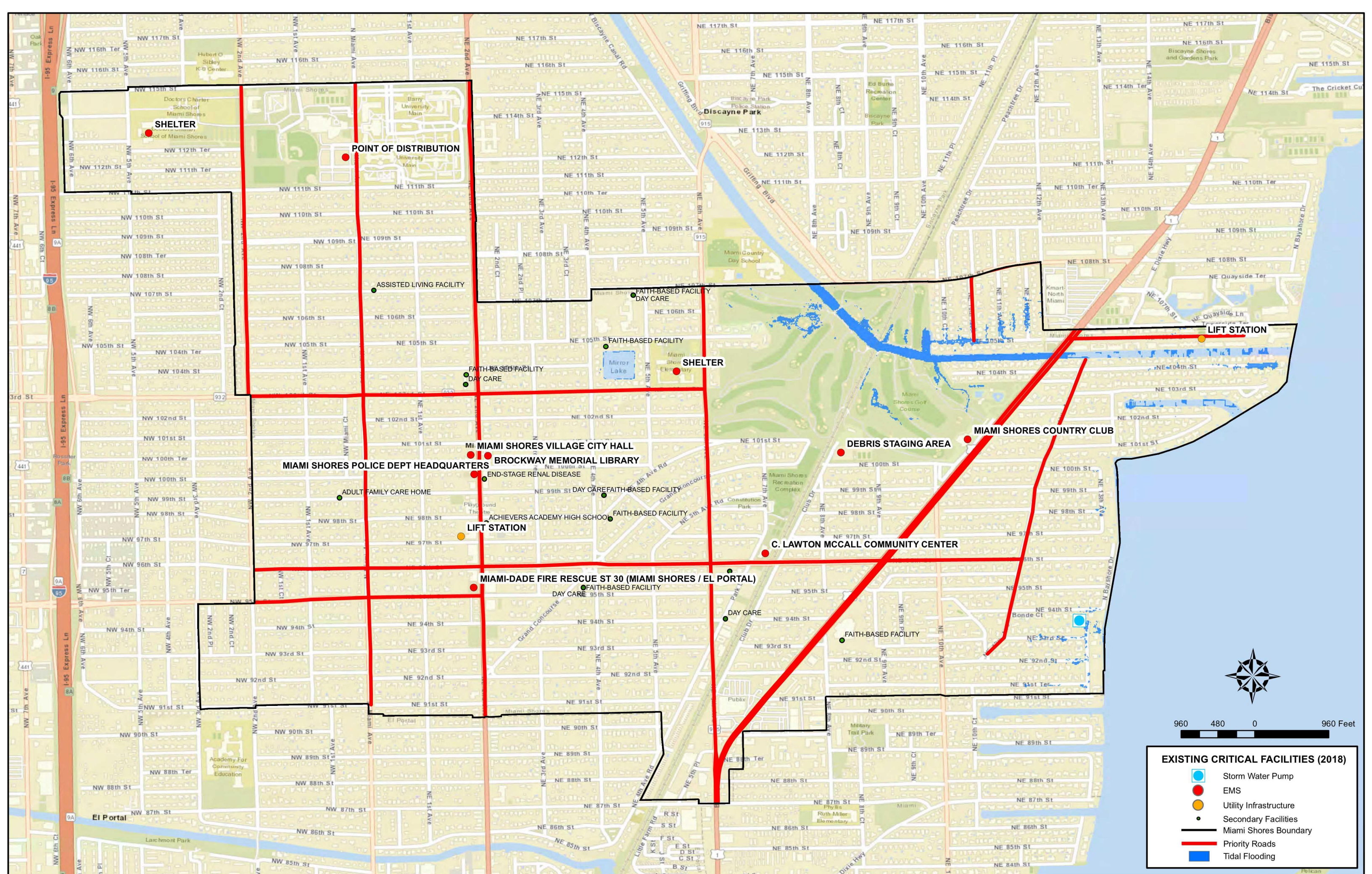
Mirror Lake

FUTURE SEWER/SEPTIC CONDITIONS (2038)



RECOMMENDED SEPTIC TO SEWER IMPROVEMENTS

- Miami Shores Boundary
- Force Main
- Central Sewer System
- Completed Sewer Projects
- Long-term Commercial (2038)
- Short-term Residential (2018)
- Long-term Residential (2038)



SHELTER

POINT OF DISTRIBUTION

ASSISTED LIVING FACILITY

FAITH-BASED FACILITY DAY CARE

FAITH-BASED FACILITY

SHELTER

FAITH-BASED FACILITY DAY CARE

MIAMI SHORES COUNTRY CLUB

LIFT STATION

MIAMI SHORES POLICE DEPT HEADQUARTERS

MIAMI SHORES VILLAGE CITY HALL

BROCKWAY MEMORIAL LIBRARY

END-STAGE RENAL DISEASE

ADULT FAMILY CARE HOME

DAY CARE FAITH-BASED FACILITY

ACHIEVERS ACADEMY HIGH SCHOOL

FAITH-BASED FACILITY

LIFT STATION

C. LAWTON MCCALL COMMUNITY CENTER

MIAMI-DADE FIRE RESCUE ST 30 (MIAMI SHORES / EL PORTAL)

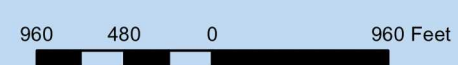
DAY CARE FAITH-BASED FACILITY

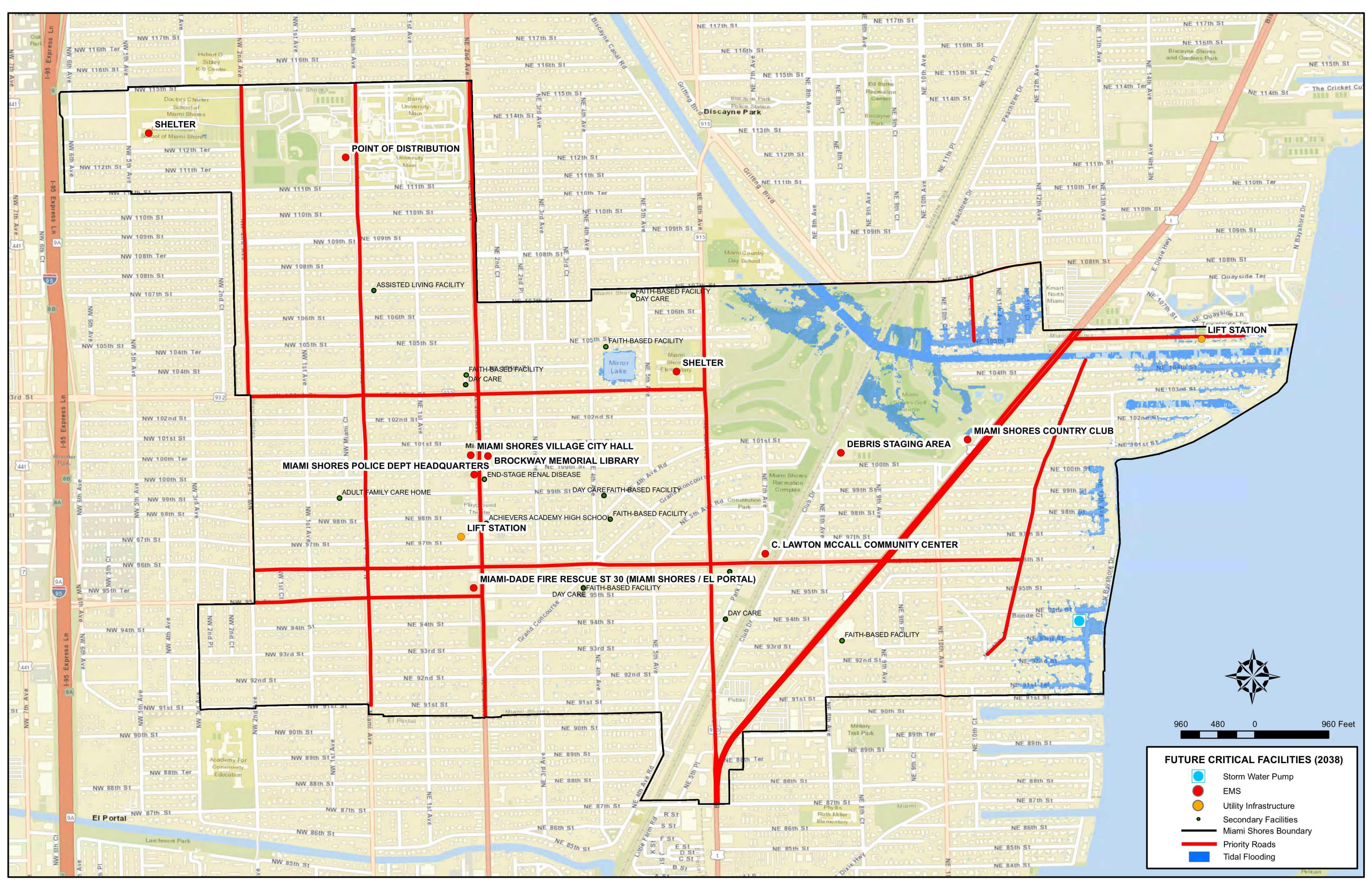
DAY CARE

FAITH-BASED FACILITY

EXISTING CRITICAL FACILITIES (2018)

-  Storm Water Pump
-  EMS
-  Utility Infrastructure
-  Secondary Facilities
-  Miami Shores Boundary
-  Priority Roads
-  Tidal Flooding





SHELTER

POINT OF DISTRIBUTION

ASSISTED LIVING FACILITY

FAITH-BASED FACILITY DAY CARE

FAITH-BASED FACILITY

SHELTER

FAITH-BASED FACILITY DAY CARE

MIAMI SHORES COUNTRY CLUB

DEBRIS STAGING AREA

MIAMI SHORES VILLAGE CITY HALL

BROCKWAY MEMORIAL LIBRARY

END-STAGE RENAL DISEASE

ADULT FAMILY CARE HOME

ACHIEVERS ACADEMY HIGH SCHOOL

LIFT STATION

C. LAWTON MCCALL COMMUNITY CENTER

MIAMI-DADE FIRE RESCUE ST 30 (MIAMI SHORES / EL PORTAL)

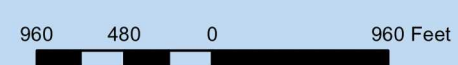
FAITH-BASED FACILITY DAY CARE

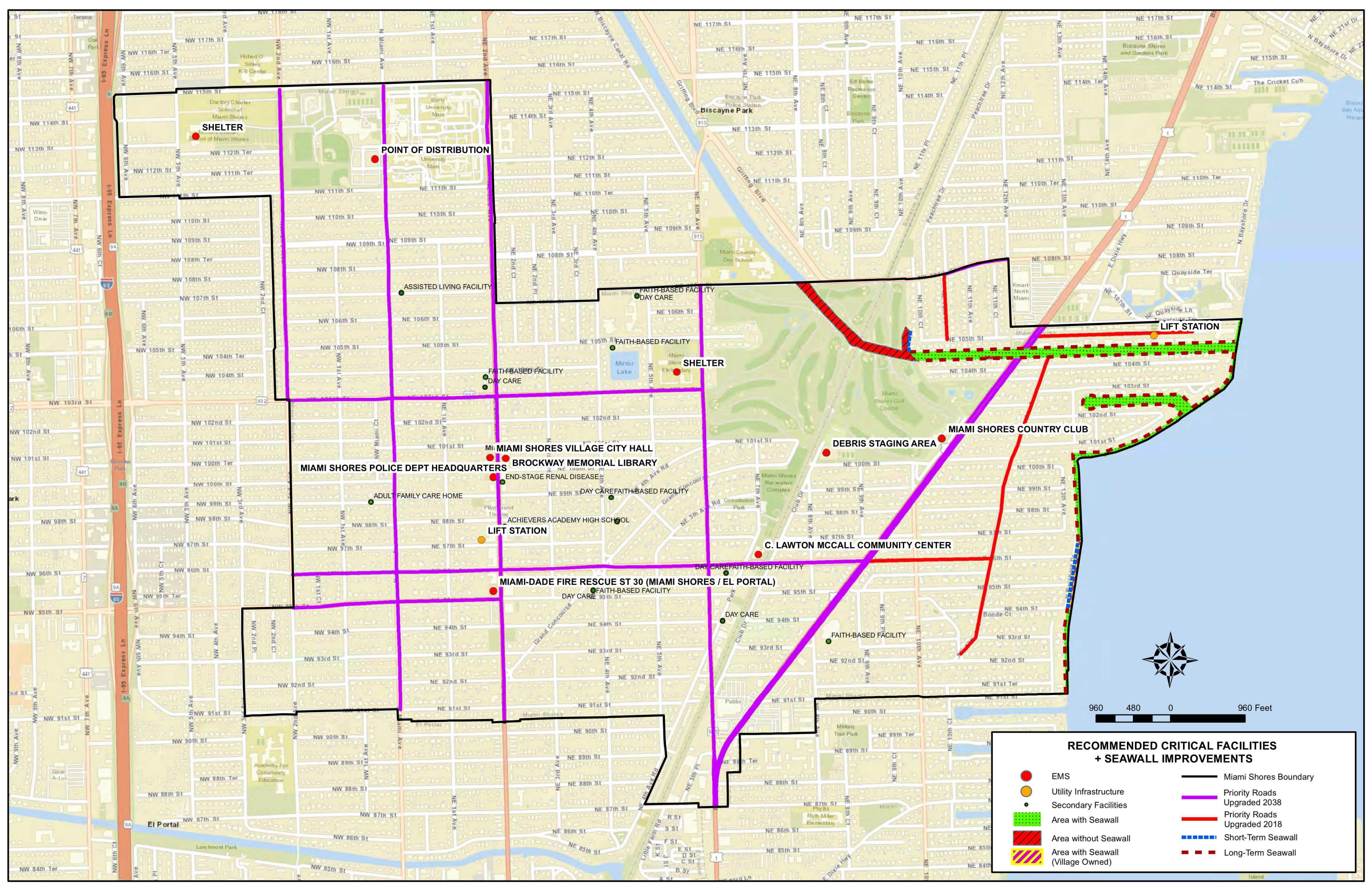
DAY CARE

FAITH-BASED FACILITY

FUTURE CRITICAL FACILITIES (2038)

-  Storm Water Pump
-  EMS
-  Utility Infrastructure
-  Secondary Facilities
-  Miami Shores Boundary
-  Priority Roads
-  Tidal Flooding





SHELTER

POINT OF DISTRIBUTION

ASSISTED LIVING FACILITY

FAITH-BASED FACILITY DAY CARE

FAITH-BASED FACILITY

SHELTER

FAITH-BASED FACILITY DAY CARE

MIAMI SHORES VILLAGE CITY HALL

BROCKWAY MEMORIAL LIBRARY

MIAMI SHORES POLICE DEPT HEADQUARTERS

END-STAGE RENAL DISEASE

ADULT FAMILY CARE HOME

DAY CARE FAITH-BASED FACILITY

ACHIEVERS ACADEMY HIGH SCHOOL

LIFT STATION

MIAMI-DADE FIRE RESCUE ST 30 (MIAMI SHORES / EL PORTAL)

DAY CARE FAITH-BASED FACILITY

C. LAWTON MCCALL COMMUNITY CENTER

DAY CARE

DEBRIS STAGING AREA

MIAMI SHORES COUNTRY CLUB

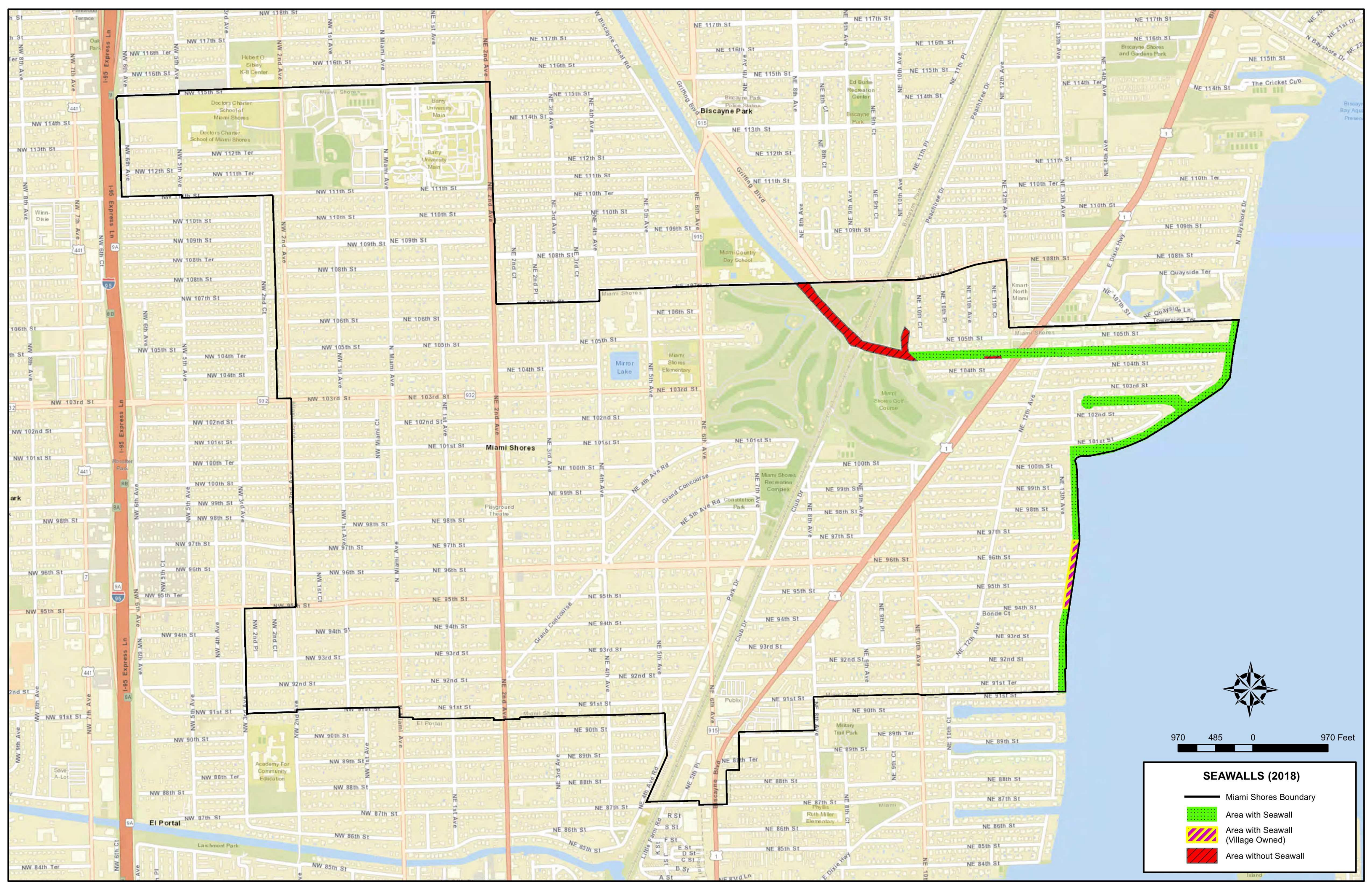
LIFT STATION



960 480 0 960 Feet

RECOMMENDED CRITICAL FACILITIES + SEAWALL IMPROVEMENTS

- EMS
- Utility Infrastructure
- Secondary Facilities
- Area with Seawall
- Area without Seawall
- Area with Seawall (Village Owned)
- Miami Shores Boundary
- Priority Roads Upgraded 2038
- Priority Roads Upgraded 2018
- Short-Term Seawall
- Long-Term Seawall



SEAWALLS (2018)

-  Miami Shores Boundary
-  Area with Seawall
-  Area with Seawall (Village Owned)
-  Area without Seawall