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# **BROWARD RESILIENCE UPDATE**

**Broward Climate Change Task Force  
February 24, 2021**

**Environmental Protection  
and Growth Management  
Department**



# OVERVIEW

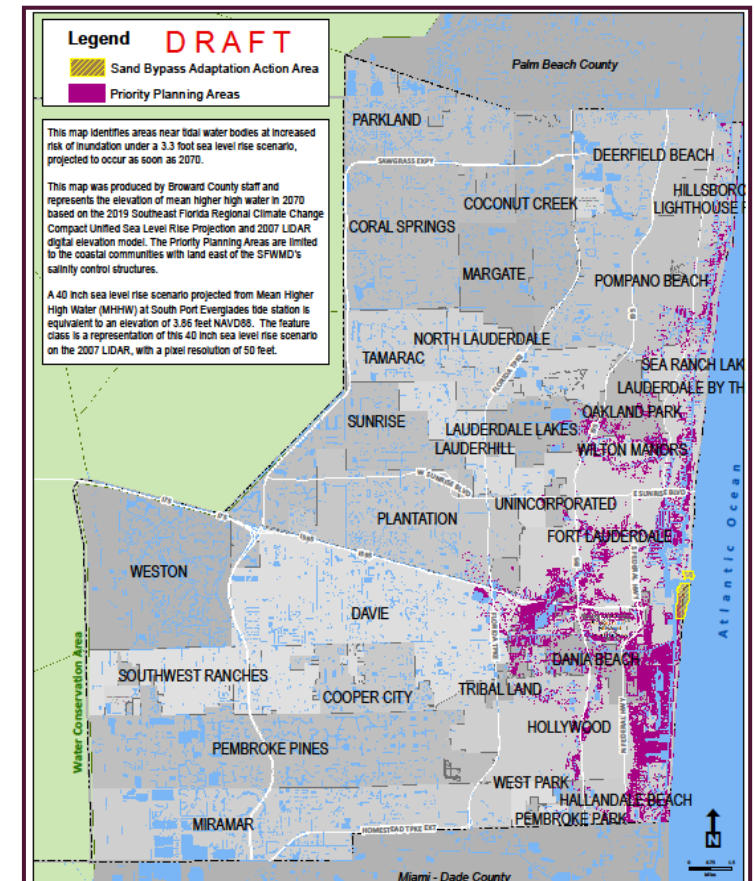
- Review of Resilience Policy and Standards
- 100 – Year Future Conditions Flood Map
- Economic Resilience
- County-wide Resilience Plan
- C&SF Flood Resiliency Study
- Broward County Resilience Dashboard
- Compact Resilience Snapshot

# EVOLUTION OF RESILIENCE POLICY AND STANDARDS

- Sea Level Rise Projection – 2012, 2015, 2019
- Priority Planning Area Map – 2012, 2015, 2020
- Future Conditions Map Series – 2017
- Resilience Standards
  - Drainage infrastructure - 2017
  - Tidal flood barriers - 2020
  - 100-Yr Flood elevations – 2020\*
  - Design storms–2020\*

\* In Process

2020 Updated Map  
3.3 ft SLR = 17.6 mi<sup>2</sup>



# 100-YEAR FLOOD ELEVATIONS

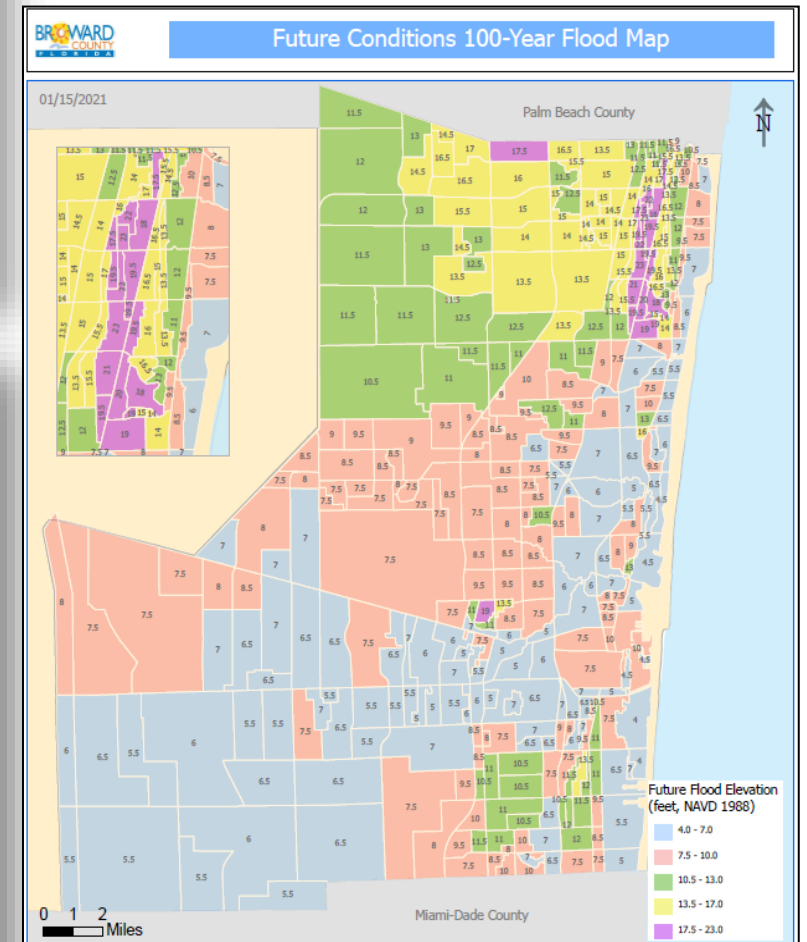
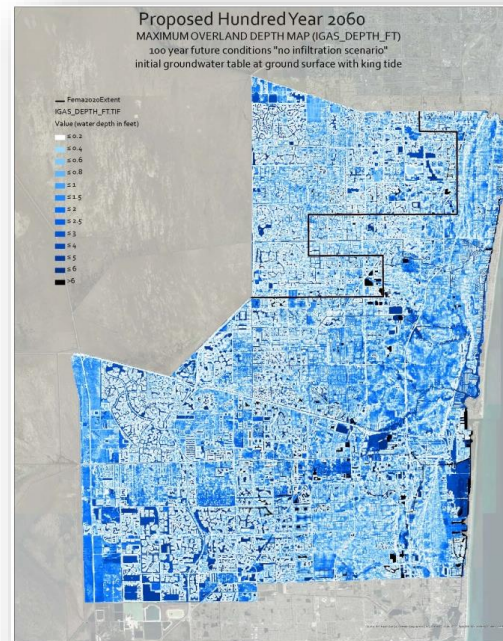
County code requires higher of the following:

- Current 100-yr flood map developed in 1977
- FEMA maps - existing conditions
- Site specific 100-year calculation
- 18 inches above crown of road



# 100-YEAR FUTURE CONDITIONS FLOOD MAP

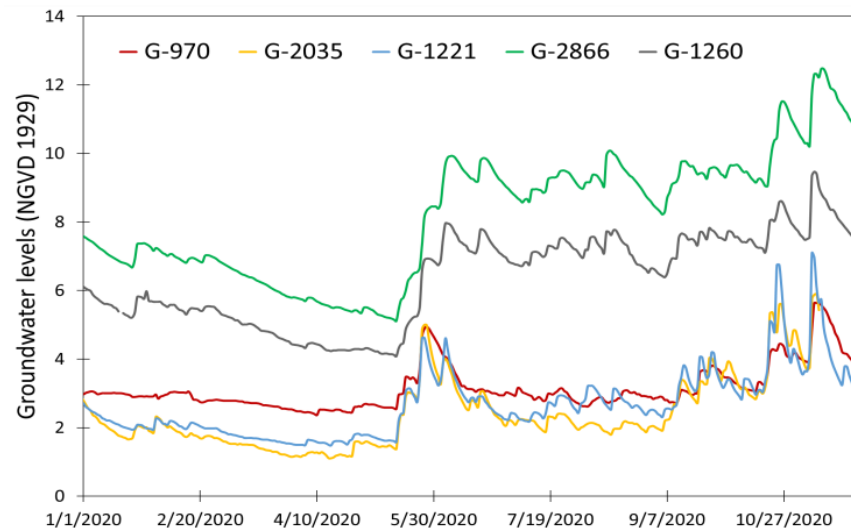
- Accounts for:
  - 2 Feet SLR
  - King tides
  - Increase rainfall (13%)
  - Ground saturation
- 368 discrete flood areas
- Informed by basins, topographic features, drainage
- Similar to Eta conditions





# LOCAL FLOODING - NOVEMBER 9, 2020

## Broward Rainfall



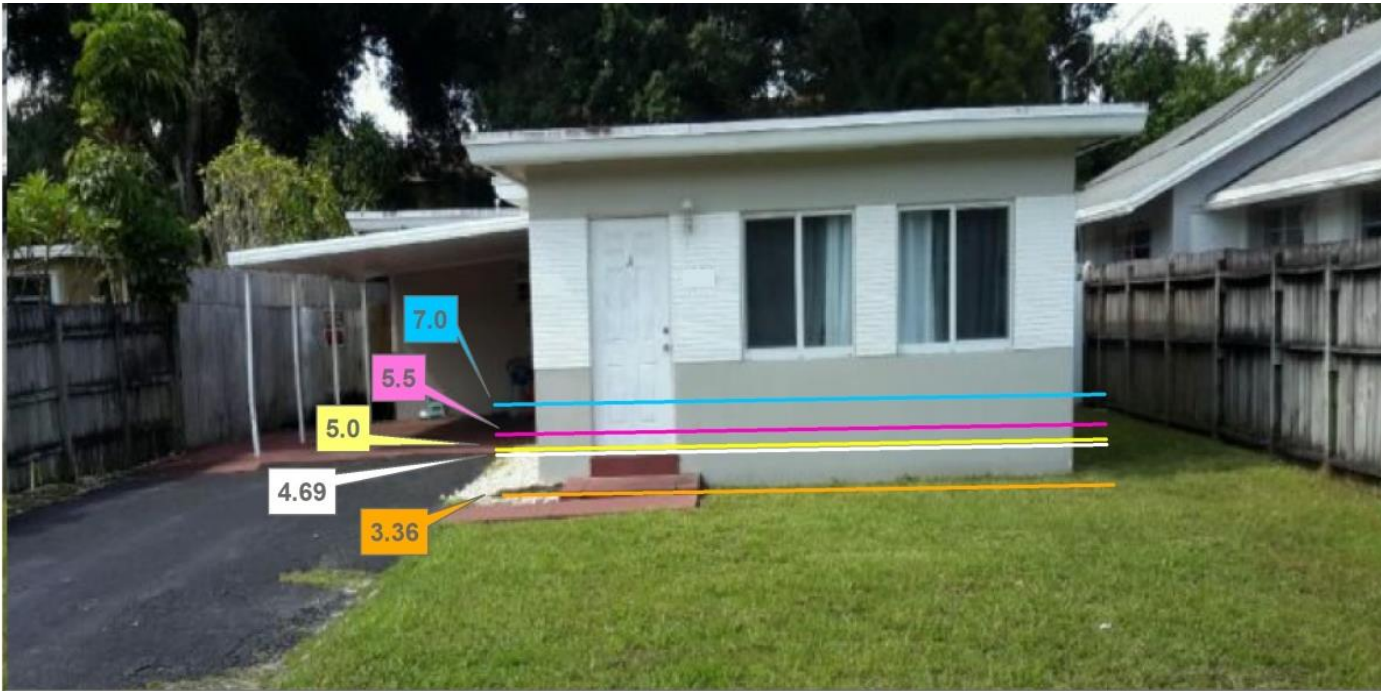
Month	30-year Normal	Year 2020
January	2.2	2.5
February	2.6	2.0
March	3.2	0.4
April	2.9	3.3
May	5.1	14.8
June	8.8	6.2
July	6.5	8.7
August	7.4	7.0
September	8.0	10.8
<b>October</b>	<b>5.5</b>	<b>17.7</b>
<b>November</b>	<b>3.3</b>	<b>12.6</b>
December	2.2	-

4 X historic average

Groundwater Table



# COMMERCIAL AND RESIDENTIAL RELEVANCE



Future Conditions 100-Year Flood Map 7.0 Ft ———  
 Existing 100-Year flood map 5.5 Ft ———  
 FEMA 2014 Flood Elevation 5.0 Ft ———  
 Finished Floor Elevation 4.69 Ft ———  
 Lowest Adjacent Grade next to Building 3.36 Ft ———

Photo: Broward County Property Appraiser  
All Elevations NAVD 1988



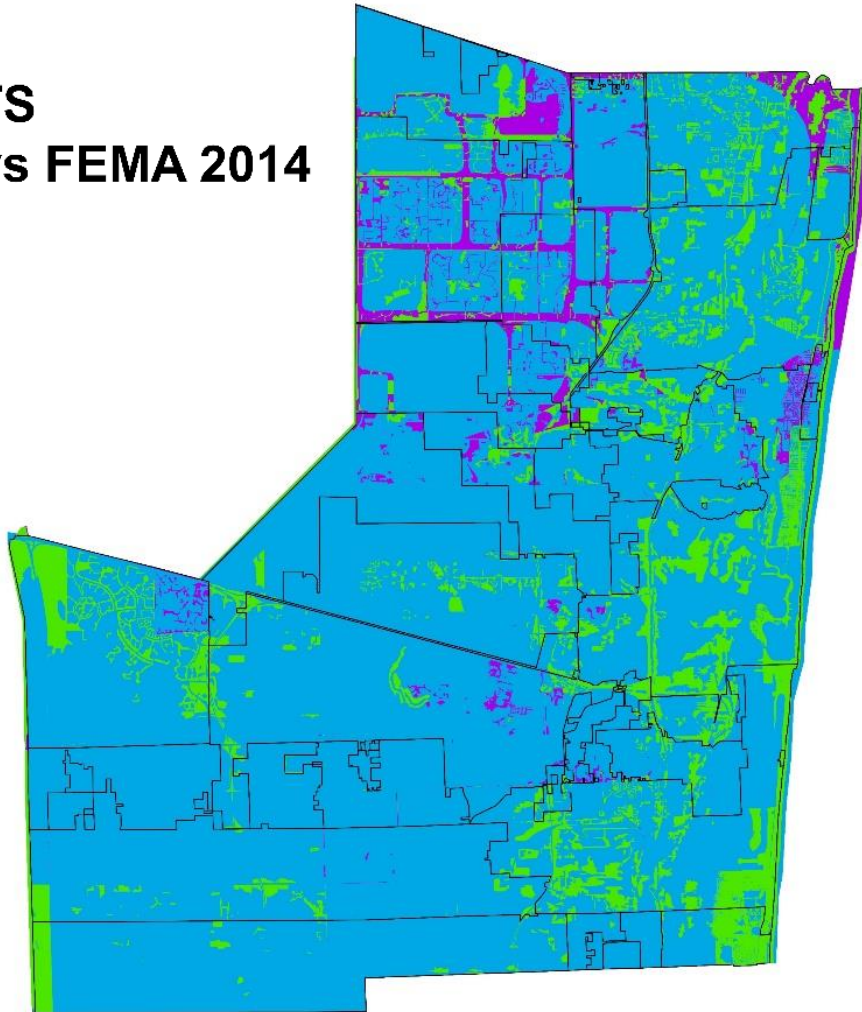
Future Conditions 100-Year Flood Map: 7.0 Feet ———  
 Minimum Floor Elevation per SFWMD ERP: 6.5 Ft ———  
 FEMA 2014 Flood Elevation 6.0 Feet ———  
 Existing 100-Year Flood Map 5.5 Feet ———

Photo: Broward County Property Appraiser  
All Elevations NAVD 1988

# FLOOD ELEVATION CHANGE COMPARISON

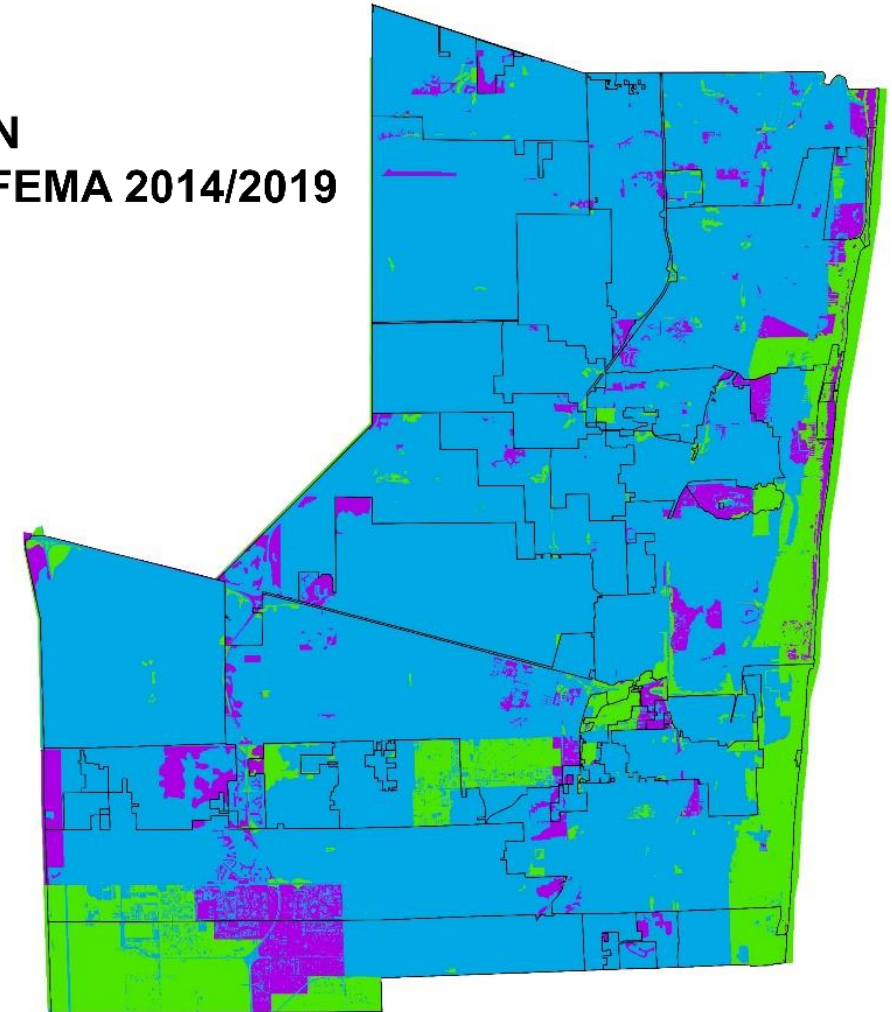
1977 COMMUNITY MAP COMPARED TO  
ADOPTED FEMA 2014 FLOOD ELEVATIONS

**Legend**  
= CITY LIMITS  
1977 MAP vs FEMA 2014  
■ HIGHER  
■ LOWER  
■ EQUAL



PROPOSED FUTURE FLOOD MAP COMPARED TO HIGHER OF  
ADOPTED FEMA 2014 / PROPOSED FEMA 2019 FLOOD ELEVATIONS

**Legend**  
= CITY LIMITS  
FLOOD\_UNION  
NEW MAP vs FEMA 2014/2019  
■ HIGHER  
■ LOWER  
■ EQUAL





# ELEVATION CHANGE COMPARISON

## Jurisdiction Specific Flood Elevation Change Comparison

CITY	FLOOD ELEVATION COMPARISON 1977 COMMUNITY FLOOD MAP VS FEMA 2014			FLOOD ELEVATION COMPARISON PROPOSED FUTURE ELEVATIONS VS. HIGHER OF FEMA 2014 / 2019		
	HIGHER	LOWER	SAME	HIGHER	LOWER	SAME
COCONUT CREEK	82.8%	6.6%	10.6%	94.9%	0.3%	4.9%
COOPER CITY	99.4%	0.4%	0.2%	72.7%	27.3%	0.0%
CORAL SPRINGS	72.0%	8.9%	19.1%	98.1%	0.3%	1.6%
COUNTY REGIONAL FACILITY	79.3%	20.7%	0.0%	85.2%	10.4%	4.4%
DANIA BEACH	87.1%	11.8%	1.1%	72.6%	22.6%	4.8%
DAVIE	93.0%	5.0%	2.0%	83.5%	10.7%	5.8%
DEERFIELD BEACH	66.2%	22.9%	10.9%	88.0%	3.5%	8.5%
FORT LAUDERDALE	70.2%	27.5%	2.3%	67.9%	22.2%	9.9%
HALLANDALE BEACH	57.1%	42.8%	0.0%	53.7%	46.1%	0.1%
HILLSBORO BEACH	8.3%	61.3%	30.5%	0.0%	69.2%	30.8%
HOLLYWOOD	73.0%	26.7%	0.3%	68.3%	28.1%	3.6%
LAUDERDALE BY THE SEA	58.9%	18.2%	23.0%	0.0%	64.3%	35.7%
LAUDERDALE LAKES	96.0%	3.3%	0.7%	99.2%	0.7%	0.1%
LAUDERHILL	91.0%	4.6%	4.4%	95.6%	1.6%	2.7%
LAZY LAKE	74.4%	25.6%	0.0%	56.9%	6.1%	37.0%
LIGHTHOUSE POINT	72.4%	21.0%	6.6%	59.8%	10.5%	29.7%
MARGATE	73.0%	7.0%	20.0%	99.9%	0.1%	0.0%
MIRAMAR	94.4%	5.6%	0.0%	39.3%	46.3%	14.4%

CITY	FLOOD ELEVATION COMPARISON 1977 COMMUNITY FLOOD MAP VS FEMA 2014			FLOOD ELEVATION COMPARISON PROPOSED FUTURE ELEVATIONS VS. HIGHER OF FEMA 2014 / 2019		
	HIGHER	LOWER	SAME	HIGHER	LOWER	SAME
NORTH LAUDERDALE	77.6%	8.2%	14.2%	97.2%	2.3%	0.5%
OAKLAND PARK	86.1%	11.4%	2.5%	95.0%	3.1%	1.9%
PARKLAND	73.9%	10.8%	15.3%	95.3%	2.0%	2.7%
PEMBROKE PARK	99.2%	0.7%	0.0%	83.5%	0.1%	16.5%
PEMBROKE PINES	95.3%	4.6%	0.2%	79.7%	8.6%	11.7%
PLANTATION	92.6%	6.9%	0.4%	95.8%	0.2%	4.0%
POMPANO BEACH	77.6%	19.9%	2.5%	79.7%	14.2%	6.1%
SEA RANCH LAKES	70.6%	2.4%	27.1%	0.0%	64.9%	35.1%
SOUTHWEST RANCHES	99.6%	0.3%	0.0%	72.1%	5.9%	22.1%
SUNRISE	93.6%	4.1%	2.4%	91.8%	1.7%	6.5%
TAMARAC	86.5%	6.6%	6.9%	98.1%	0.8%	1.1%
TRIBAL LAND	82.7%	17.0%	0.3%	84.9%	0.2%	15.0%
UNDESIGNATED	31.6%	50.9%	17.4%	5.9%	88.6%	5.5%
UNINCORPORATED	83.2%	11.1%	5.6%	89.3%	2.1%	8.7%
WEST PARK	97.5%	2.5%	0.0%	94.9%	0.0%	5.1%
WESTON	78.4%	19.8%	1.8%	96.1%	2.0%	1.9%
WILTON MANORS	96.3%	3.7%	0.0%	17.8%	28.7%	53.5%

# BUSINESS CASE FOR RESILIENCE

## Community-wide Adaptation

- A combination of soft and hard engineering investments at the open coast, intracoastal, and inland areas.

## Building-level Adaptation

- A combination of structural improvements to property itself.



Note: Building-level adaptation will not provide benefit to regional infrastructure or to coastal resources such as beaches.



## THE BUSINESS CASE FOR RESILIENCE

IN SOUTHEAST FLORIDA

Regional Economic Benefits of Climate Adaptation

MOODY'S  
INVESTORS SERVICE

SECTOR IN-DEPTH  
28 November 2017

Rate this Research >>

Environmental risks  
Evaluating the impact of climate change on US state and local issuers

## Benefit-Cost Analysis Results

Community-wide:

$$\begin{array}{l} \text{Benefits*} \\ \$37.9B \end{array} \div \begin{array}{l} \text{Cost*} \\ \$18.2B \end{array} = \begin{array}{l} \text{Benefit-Cost Ratio} \\ 2.08 \end{array}$$

Job Years Supported\*\*

85,000

Building-level:

$$\begin{array}{l} \text{Benefits*} \\ \$17.6B \end{array} \div \begin{array}{l} \text{Cost*} \\ \$4.4B \end{array} = \begin{array}{l} \text{Benefit-Cost Ratio} \\ 3.97 \end{array}$$

Job Years Supported\*\*

56,000

# COUNTY AVERAGES INFLUENCED BY LOCAL CONDITIONS

Systemic  
Mitigates 90%  
Surge and SLR  
Impacts

County	Cumulative Impacts Avoided	Cumulative Adaptation Costs	Net Impacts	Benefit-Cost Ratio
Broward	\$9,601	\$4,128	\$5,473	2.33
Miami-Dade	\$19,461	\$2,101	\$17,360	9.26
Monroe	\$3,182	\$7,669	-\$4,487	0.41
Palm Beach	\$9,087	\$4,325	\$4,762	2.10
<b>Total</b>	<b>\$41,331</b>	<b>\$18,223</b>	<b>\$23,108</b>	<b>2.27</b>

e.g., beaches, dunes, seawalls

Building Level  
Mitigates 90%  
Surge Impacts

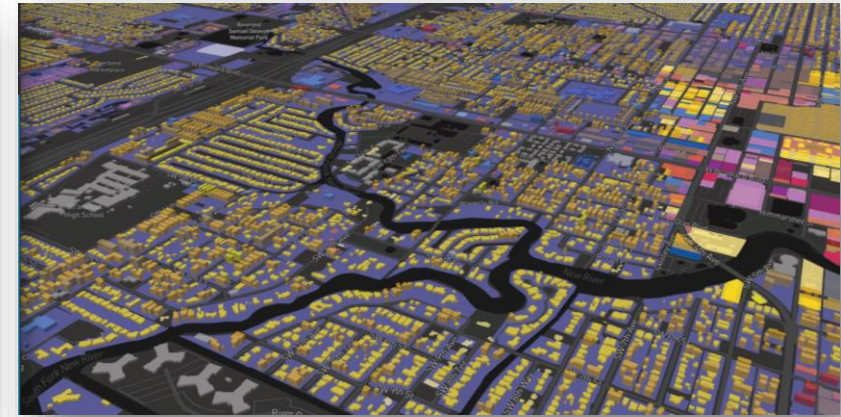
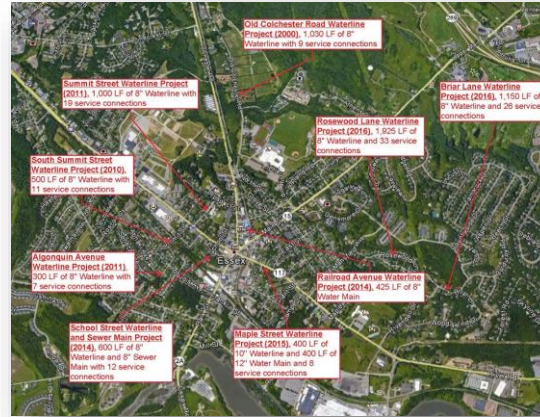
County	Cumulative Impacts Avoided	Cumulative Adaptation Costs	Net Benefits	Benefit-Cost Ratio
Broward	\$4,541	\$1,495	\$3,046	3.04
Miami-Dade	\$9,255	\$1,786	\$7,469	5.18
Monroe	\$459	\$598	-\$139	0.77
Palm Beach	\$7,016	\$1,140	\$5,876	6.16
<b>Total</b>	<b>\$21,271</b>	<b>\$5,019</b>	<b>\$16,252</b>	<b>4.24</b>

e.g., flood proof, elevate



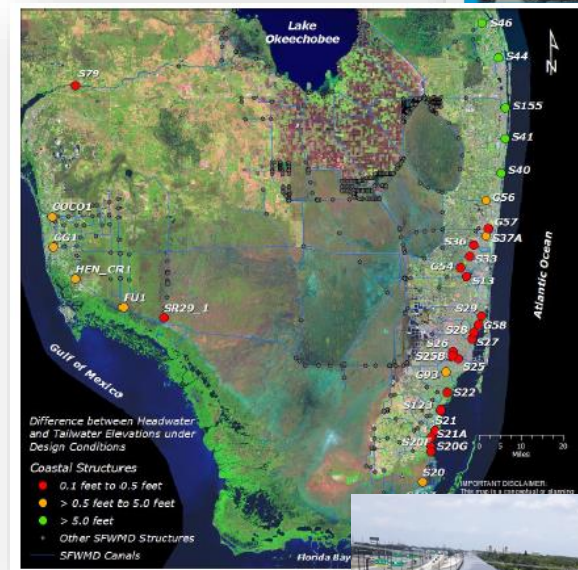
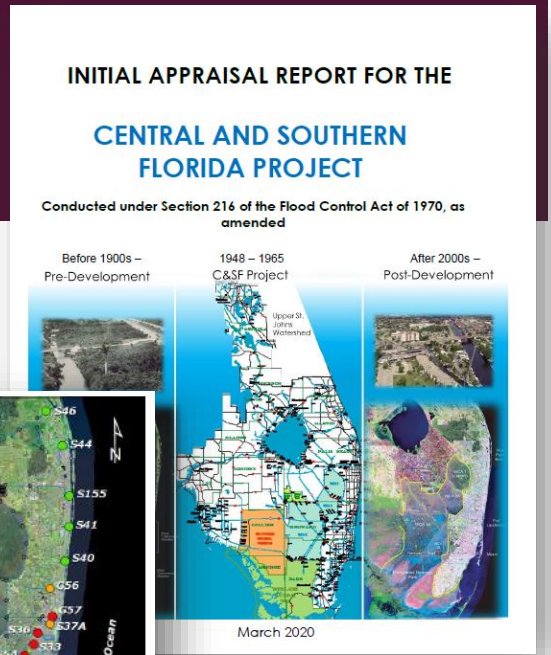
# COUNTY-WIDE RESILIENCE PLAN

- Project elements
  - Basin-level analysis
  - Redevelopment strategies
  - Water storage and management
  - Infrastructure siting
- Deliverables
  - Planning level cost estimates
  - 3D Visuals / key corridors
  - Phased implementation plan
  - Shared database and planning platform
  - Quantified flood and risk reduction
- Outcome
  - Organized investment
  - Multi-decade plan



# PENDING RESILIENCE NEED

- C&SF Flood Resiliency Study
  - System initiated in 1948
  - Today, 18 Structures at capacity
  - Threat to flood protection and water supply
  - Appraisal Report approved by USACE
  - SFWMD committed as local partner
  - Need: Funding of USACE Workplan for study leading to construction





# BROWARD RESILIENCE DASHBOARD

- Storyboard
- Tools, trends and investments
- Emissions
- Solar projects
- EV installations
- Resilience projects
- Water conservation
- Green infrastructure
- Flood Factor

The screenshot displays the 'Broward County Resilience' dashboard. At the top, there is a navigation bar with tabs for 'Broward's Approach', 'Climate Action Plans', 'Solar and Electric', 'Resilience Projects', 'GHG Emissions Inventory', 'Water Resources', 'Flux Map', and 'Division Website'. Below this, the 'Broward's Approach for a Changing Climate' section features a descriptive paragraph and a sub-navigation bar with tabs for 'Flooding', 'Clean Energy', 'Drinking Water', 'Beach & Shore', and 'Resiliency Projects'. The main content area is divided into two parts: a storyboard on the left and a map on the right. The storyboard contains five numbered cards: 1. Rainfall (with a photo of a lake), 2. Tidal Flooding (with a photo of a flooded area), 3. Sea Level Rise (with a photo of a beach), 4. Groundwater Rise (with a USGS map), and 5. Flood Risk (with a photo of a person in floodwaters). The map on the right shows Broward County with numbered markers (1-5) corresponding to the storyboard cards, overlaid on a satellite view. The map includes labels for various cities and towns such as Boca Raton, Coral Springs, Tamarac, Pompano Beach, Plantation, Davie, Weston, Pembroke Pines, Hollywood, North Miami, and Carol Gty.



## Climate Action Plans & Sea Level Rise Projection

### 1 Southeast Florida Climate Compact

We are a proud partner of the [Southeast Florida Regional Climate Change Compact](#). The Compact is a joint commitment of Broward, Palm Beach, Miami-Dade, and Monroe Counties to partner in mitigating the causes and adapting to the consequences of climate change.

In 2014, the Compact was designated a [Climate Action Champion](#) by the White House.

The Compact hosts an annual [Regional Climate Leadership Summit](#). Learn more and download materials and recordings from the 2015 Summit. The [9th Annual Summit](#) was hosted by Broward County in December 2017.

### 2 Regional Climate Action Plan

### 3 Broward County Climate Action Plan

### 4 Sea Level Rise Projection (Graph)

### 5 Sea Level Rise Projection (Full Report)

[CLIMATE ACTION PLAN](#)[RESOURCES](#)[EVENTS](#)[NEWS](#)[ABOUT](#)[SUBSCRIBE](#)

# Advancing Resilience Solutions Through Regional Action

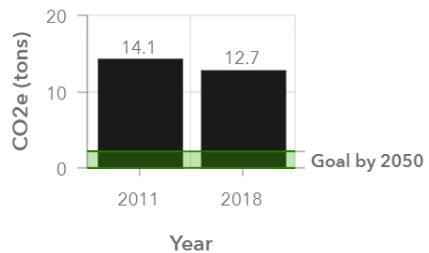
[LEARN ABOUT THE COMPACT](#)[LEARN ABOUT THE REGIONAL CLIMATE ACTION PLAN](#)



# Broward County 2020 Greenhouse Gas Emissions Inventory

Powered by Broward County GIS

## CO2e per capita (in tons)\*



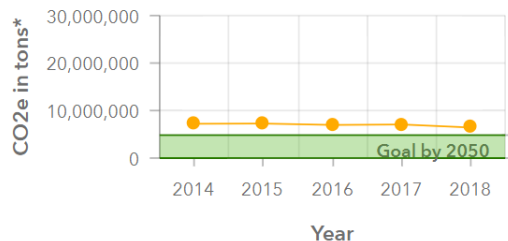
Population 2011\*\*: 1,742,012

Population 2018\*\*: 1,909,151

\* Based on Emissions Total 2

\*\* Census Bureau, American Community

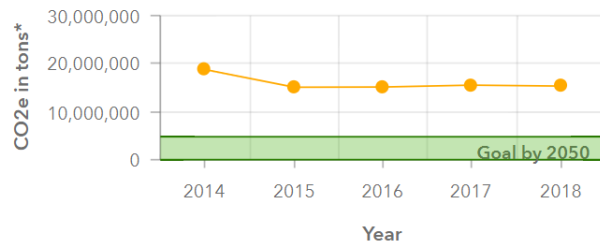
## Urban Sector



\* carbon dioxide equivalent (methane + other gasses)

Goal by 2050 is based upon the County's goal of 80% reduction of GHG emissions

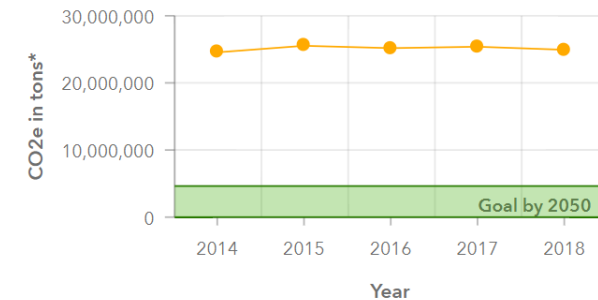
## Urban Sector with Transportation



\* carbon dioxide equivalent (methane + other gasses)

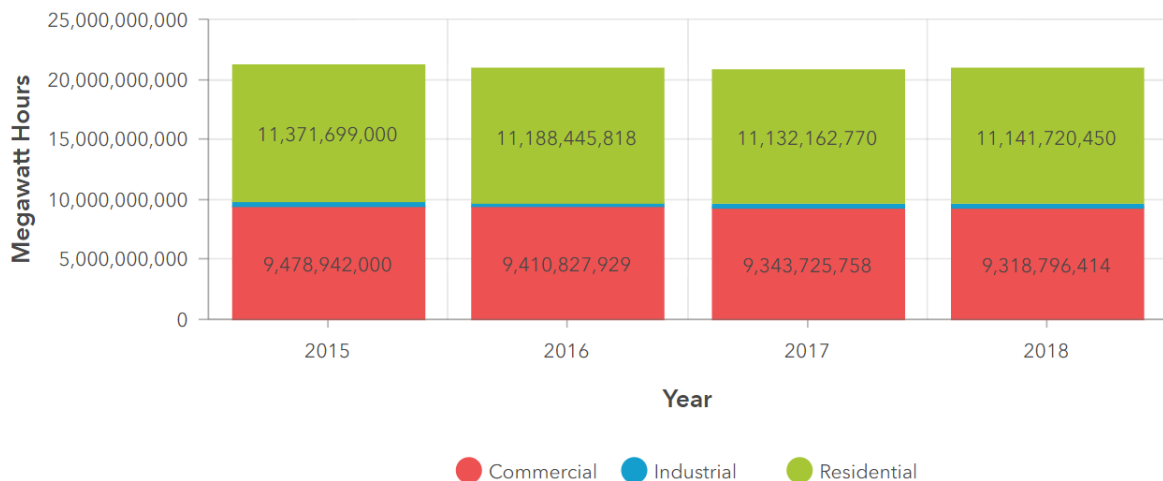
Goal by 2050 is based upon the County's goal of 80% reduction of GHG emissions

## Urban Sector with Transportation and Upstream Impacts of Activities

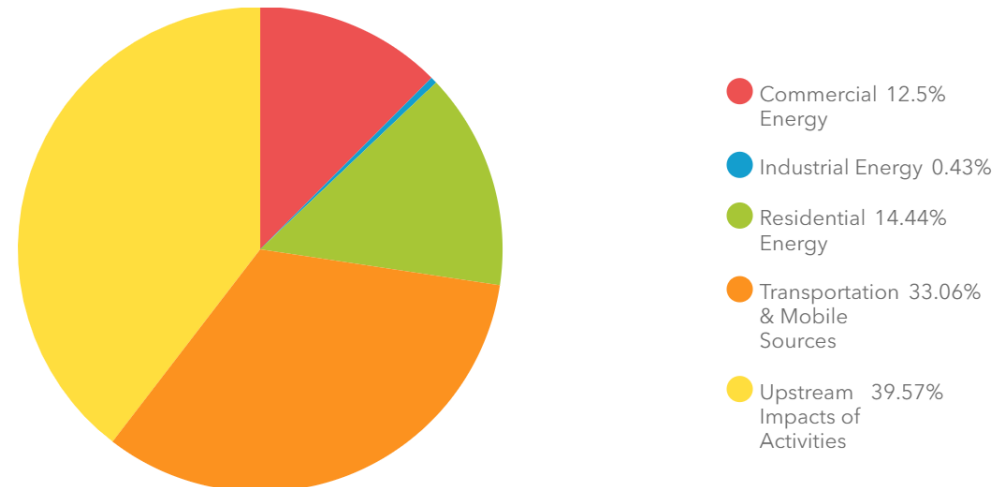


\* carbon dioxide equivalent (methane + other gasses)

## Electricity Use (MWH) per Sector



## Cumulative CO2e by Sector, including upstream (2015-2018)



\*\* solid waste emissions not included



# Saltwater Intrusion, Priority Planning Areas, Flood Conditions



## Find your home's Flood Factor

Past floods, current risks, and future projections based on peer-reviewed research from the world's leading flood modelers.



Intended for non-commercial, informational purposes only. See [terms of use](#). For commercial use [click here](#).  
The Flood Factor model is designed to approximate flood risk and not intended to include all possible risks or mitigations of flood.



# MUNICIPAL RESILIENCE SNAPSHOT

- Resilience Roundtable Recommendation
- Coordinated via Compact
- Municipal and Equity Workgroup
- Includes Mitigation and Adaptation Priorities
- Equity Embedded Across Focal Areas
- To Include Community Vetting
- Annual Assessment and Communication Tool
- Roll Out Fall '21



# BROWARD SCHOOLS ENVIRONMENTAL PARTNERSHIP

*Please join us for the*

## Third Annual Broward Youth Climate Summit

A Virtual 3-Day Conference for BCPS Students in Grades 5-12

March 9, 10, 11, 2021  
9:00 AM - 12:00 PM



March 9, 2021 at 9:00 AM  
Keynote Speakers  
Renowned astrophysicist  
Dr. Neil deGrasse Tyson,  
comedian Chuck Nice,  
and climatologist  
Dr. Gavin Schmidt  
Join a Cosmic Queries  
episode of StarTalk exclusively  
for Broward Youth Climate Summit  
participants!

The Youth Climate Summit provides a platform for BCPS students to advocate for policy change and provides students a voice for promoting environmental sustainability. Students who attend the Summit will have the opportunity to learn from youth and experts on the global climate change challenge, its regional implications, and local actions everyone can take to address the challenge.

RSVP to <http://bit.ly/3dBrowardYouthClimateRSVP>  
Any questions please email Dr. Lisa Milenkovic at [lisa.milenkovic@browardschools.com](mailto:lisa.milenkovic@browardschools.com)

**BROWARD YOUTH CLIMATE SUMMIT**  
For our future

In partnership with the Broward County Public Schools Applied Learning Department, Broward County Environmental Planning and Community Resilience Division, and the Museum of Discovery and Science



- E-learning Modules
  - 8 modules/8 months
  - Broad range of topics
  - Lead up to Youth Summit
- 3<sup>rd</sup> Annual Youth Summit
  - Mandatory module
  - Student led sessions
  - 5000+ attendees

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# QUESTIONS?

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Dr. Jennifer Jurado

Chief Resilience Officer, Deputy Director

[jjurado@broward.org](mailto:jjurado@broward.org)