

Water Management, Flood Risk and Resiliency Planning

Northwest Council of Elected Officials
April 8, 2019



Water Resources Challenges

- ☐ Sea level rise
- ☐ Extreme rainfall and drought
- ☐ Coastal and inland flooding
- ☐ Increased storm intensity
- ☐ Saltwater intrusion
- ☐ Water quality
- ☐ Environment
- ☐ Public Health and Safety



Flood Risk is Prominent, and On the Rise

❑ Climate Impacts

- Rainfall and Storms
- Storm Surge
- Tidal Flooding

Climate change 'triple threat' increases severe flooding risk in biggest US cities

❑ Development Trends

- Value of Assets
- Location of People



Storms Set Rainfall Records, Cause Flooding in South Florida

June 9, 2017

City of Margate – Jun. 2017

And other times during the same year...



Lauderhill – Nov. 2017



City of Coral Springs – Jun. 2017



City of Coral Springs – Sep. 2017

And with Greater Regularity

Flood watch extended for Broward as rain refuses to let up in South Florida

By [David J. Neal](#) and
[Carli Teproff](#)

May 20, 2018 08:19 AM, Updated May 21, 2018 06:09 AM

In a 24-hour period — from 6 p.m. Saturday to 6 p.m. Sunday — just over 14 inches of rain fell near Coconut Creek, about 11 inches fell in Lauderhill



Lauderhill – May 2018

Rainy Season Has Arrived With A Vengeance

May 21, 2018 at 12:15 pm Filed Under: Local TV, Rain, Rietle Creighton, Storms, Weather



Hurricanes are slowing, which could be a big problem

By [Brandon Miller](#), CNN
Updated 2:40 PM ET, Thu June 7, 2018



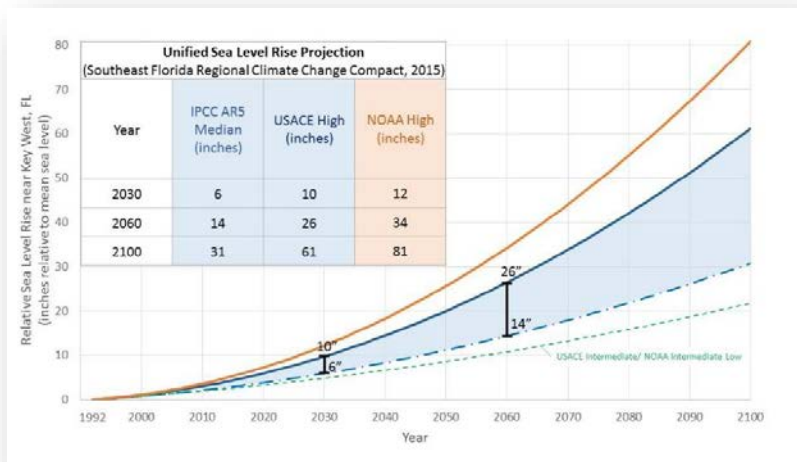
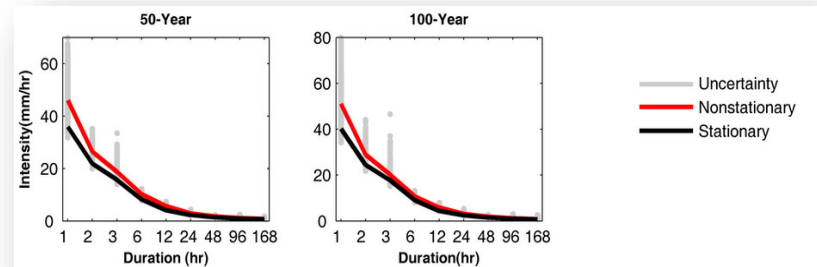
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Parkland – May 2018

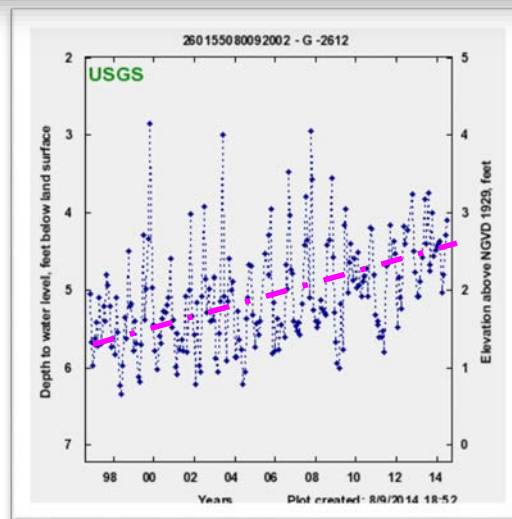
Primary Variables

- ❑ Sea level rise
- ❑ Rising groundwater elevation
- ❑ Changes rainfall intensity

Modeled increase in rainfall intensity, duration, frequency

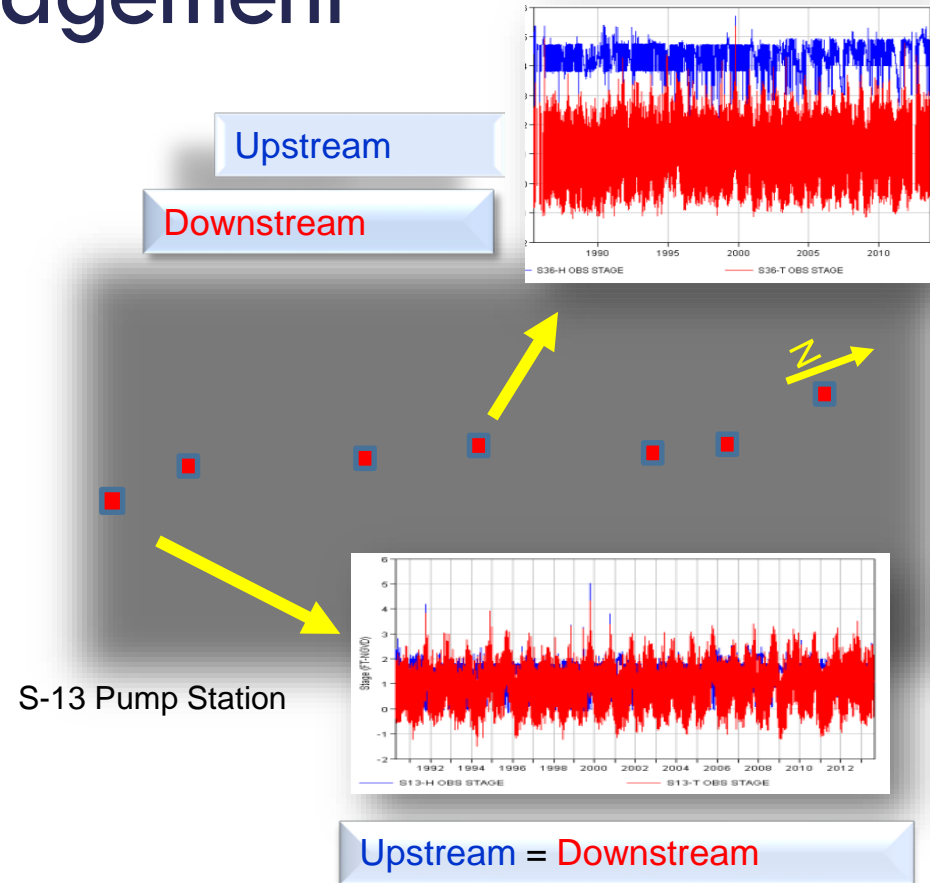
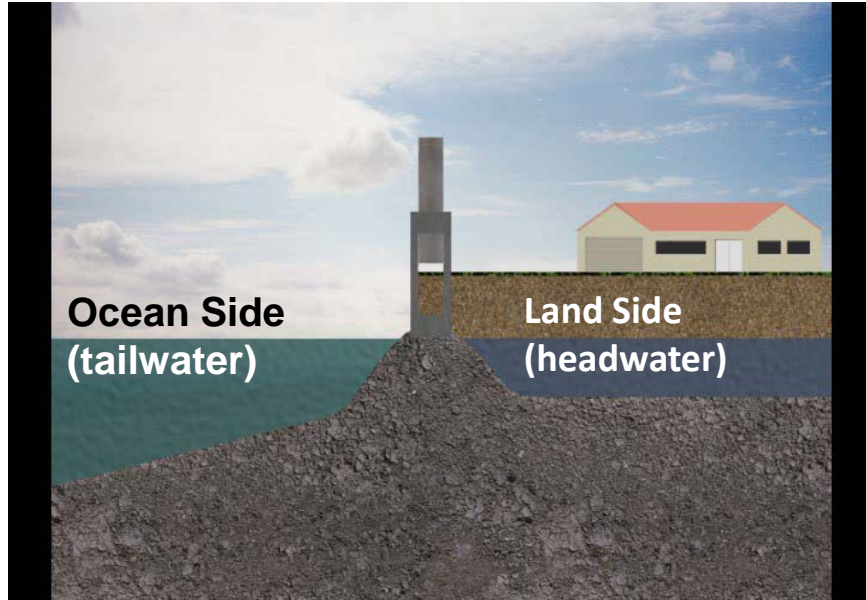


2015 SE FL Regional SLR Projection



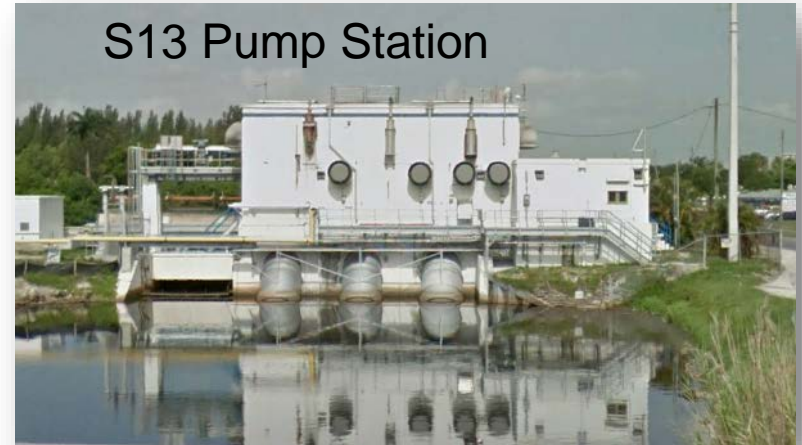
Measured Rise in Groundwater Table

Impacts on Flood Management

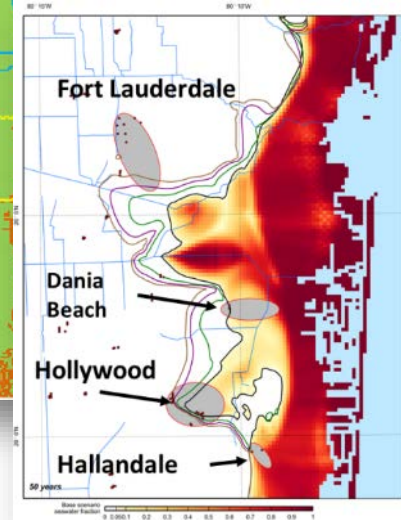
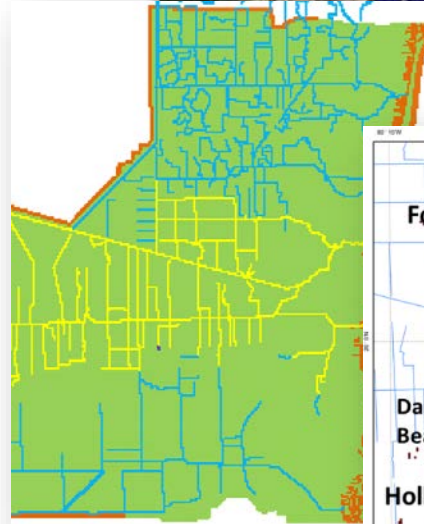
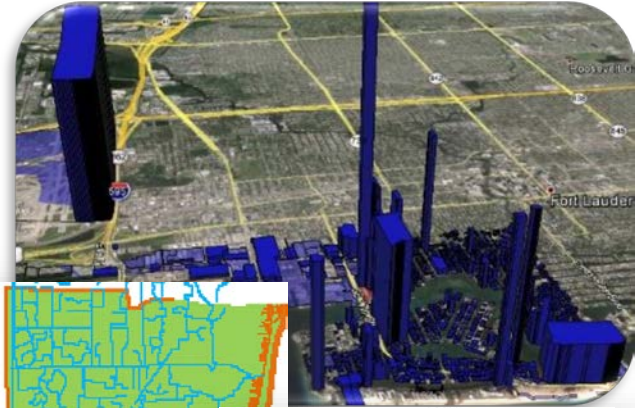
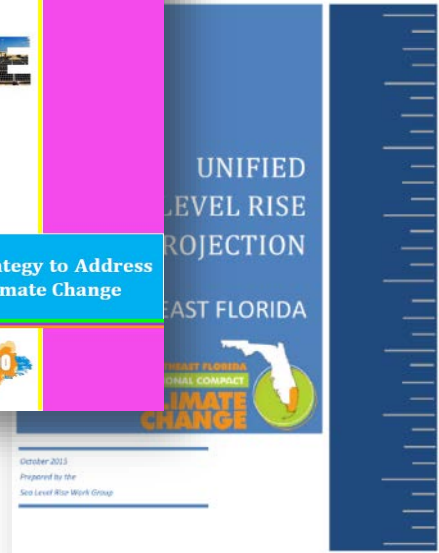
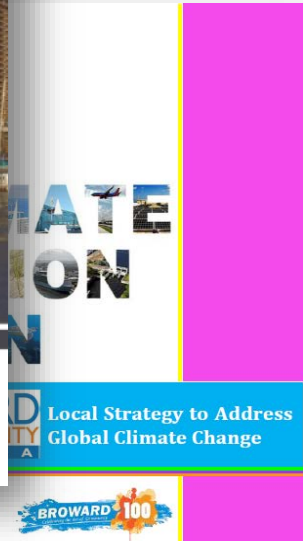
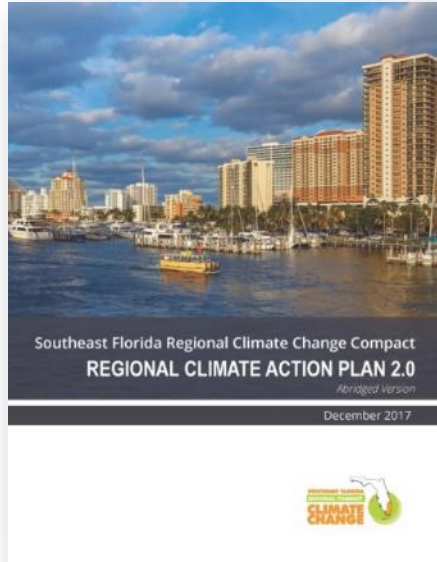


Combined Impacts

- ❑ Drainage Systems
 - Loss of soil storage
 - Reduction function of drainage wells
- ❑ Wastewater Systems
 - Increase infiltration and inflow
- ❑ Septic Systems
 - Impacts to drainage fields
 - Reduced treatment and function
- ❑ Water Management Operations



Regional Plans and Tools



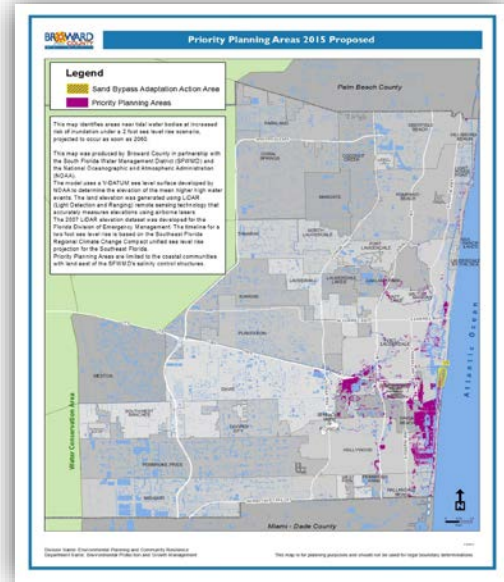
Expanding Resiliency Efforts

❑ Evolving Policy

- Priority Planning Areas
- Adaptation Action Areas
- Comp Plan/Land Use



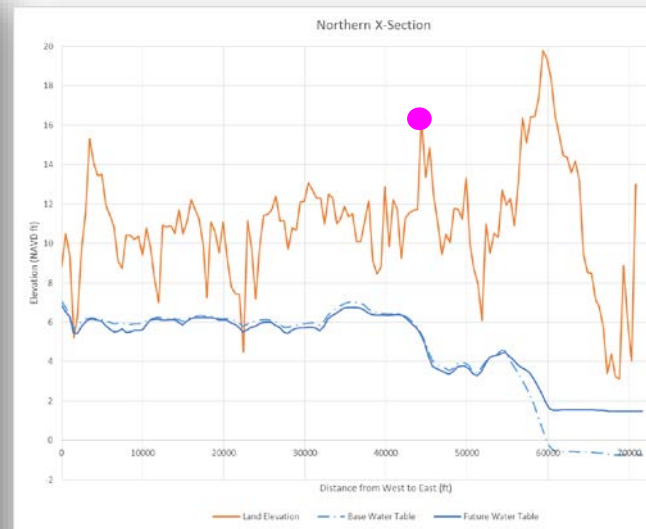
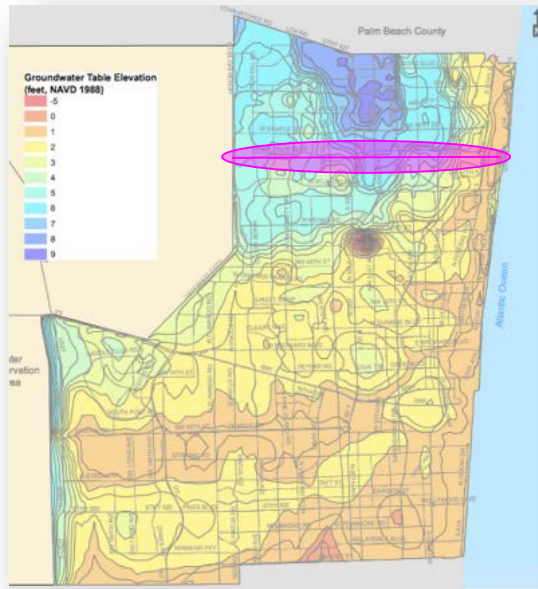
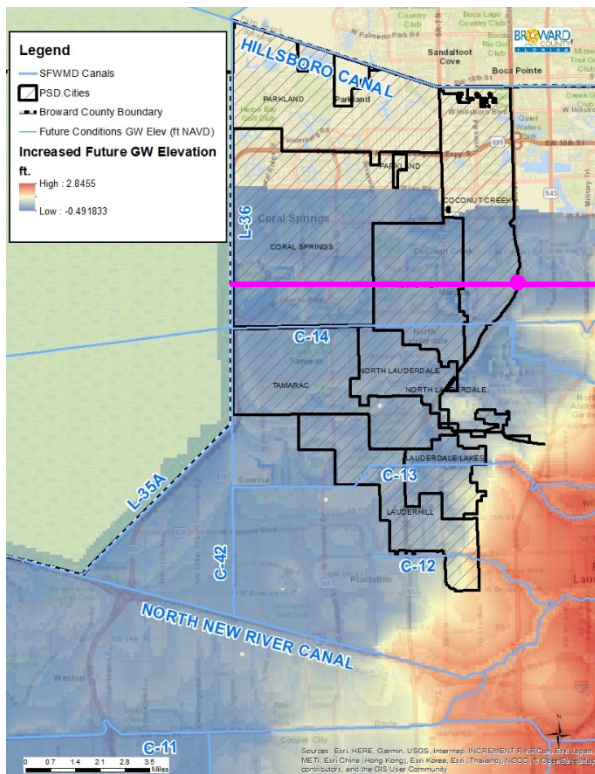
- ❑ Future conditions map series – code of ordinances (May 2017)
- ❑ Infrastructure Planning



- ❑ 3-year timeline
 - Drainage infrastructure (2017)
 - Coastal flood barriers (2018)
 - Flood elevations (2019)

Future Conditions GW Table Map

- 2060-2069 average groundwater conditions
- 9% increase in rainfall



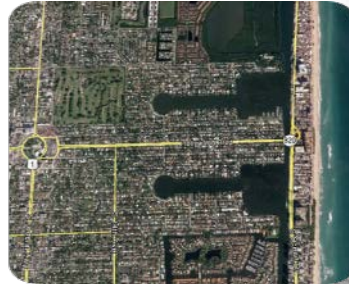


US Army Corps
of Engineers®

USACE-Broward Resiliency Study



- ❑ Resilient Sea Wall Top Elevations
- ❑ Calibrated hydrodynamic model
 - 2 feet sea level rise
 - High tides
 - 25-yr storm surge
- ❑ Economic study
 - Damage loss reduction
 - Analysis by sector



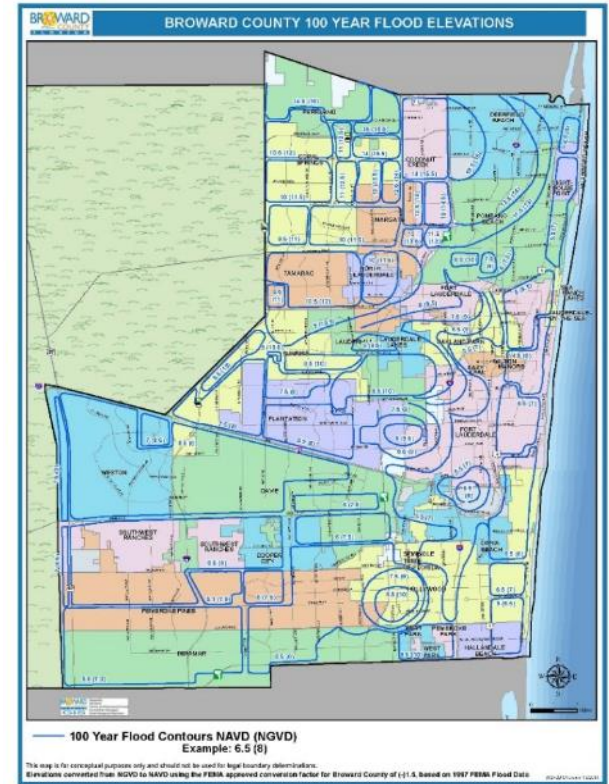
Proposed Resilience Standard

- ❑ Uniform standard for seawalls & flood barriers
 - **5 feet NAVD**
- ❑ Allows for **4 feet NAVD until 2035**
 - Future tidal flooding avoided, through 2070.
 - Limited or no surge protection.
- ❑ Requires **5 feet NAVD by 2050**
 - High frequency storm surge protection provided (~1 foot).
 - Some economic losses avoided.
 - 71-87% of seawalls will need to be raised more than 2 feet.



Future Conditions 100-Yr Flood Elevation Map

- ❑ Multi-jurisdictional cost share- 10 partners
- ❑ Approach
 - Integrate sea level rise
 - Capture changes in groundwater
 - Address NFIP/CRS criteria
 - Will NOT be used to set FEMA FIRMS, But update finished floor requirements
- ❑ September 2019



Community Engagement

- Stakeholder Workshops
 - Central- June 26
 - North - June 25
 - South - June 27
- Follow-up through January 2019

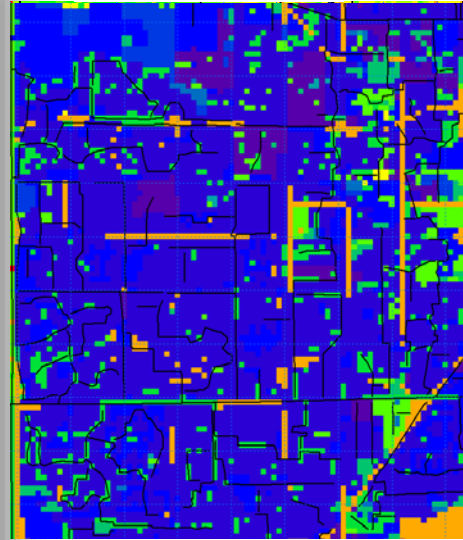
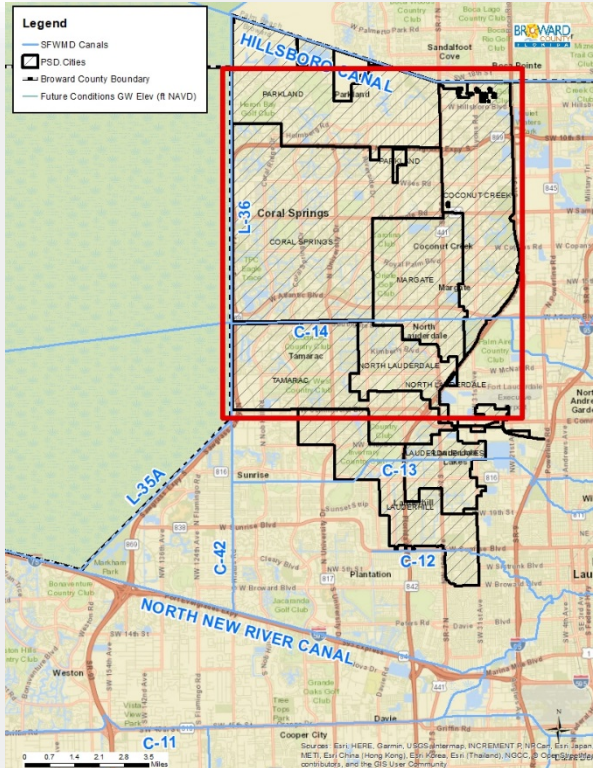


Stakeholder Data Contributions

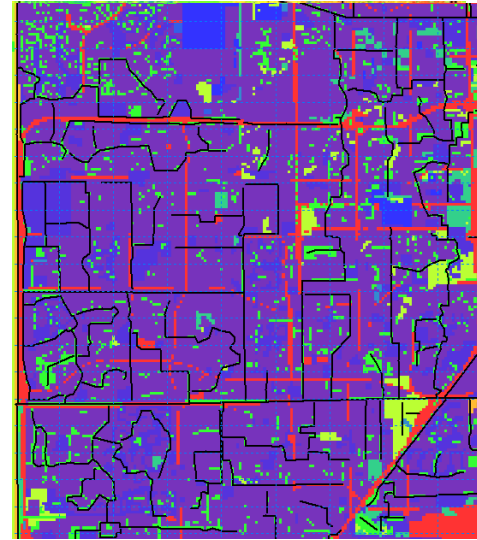
Stakeholder	Data Received from Stakeholder
	Description
Broward County Water Control District	Control_structure shapefile; WCD 2 Control Structure Attributes.xlsx; WCD 2 Control Structures Map.pdf
Central Broward Water Control District	CBWCD EXHIBIT_A_District_Boundary_Map_2013.pdf; 100_Year_Flood_Map.pdf; 10_Year_Flood_Map.pdf; GIS Data.pdf Conduits; Model Data, Cross section, pipes
Coral Springs	Drainage.zip (Drainage_Pipe shapefile; Drainage_Structure shapefile), 140312 CORAL SPRINGS EXISTING.zip (140312 CORAL SPRINGS EXISTING.ICP)
Cooper City	SWLines shapefile; SWOutfalls shapefile; SWStructures shapefile
Coral Springs Improvement District	CSID Drainage model 2007.pdf; CSID24X36map_COLOR.pdf
Dania Beach	General drainage data, plans, master plan reports, and pump station information
Fort Lauderdale	FortLauderdaleStormwater.gdb; ICPR model files and related data and presentations; 5-foot City DEM
Hallandale Beach	CITY HALLANDALE MAPs, Drains, Final As-Builts; 22-April.pdf; Construction Plans
Hollywood	General drainage data, reports, and pump station information
Lauderdale-by-the-Sea	2010-4-27 Item 6 G.pdf; 2010-4-27 SWMP Report no Appendices.pdf; 2010-4-27 SWMP Report to Comm.pdf; LBTS Revised_Drainage_Map 2015.pdf
Lauderhill	Pump station information
Lighthouse Point	LHP Drainage Map_2017.pdf
North Springs Water Improvement District	171016-11_Permit_20171108.pdf; Summary of Pumping-Scenarios.pdf
Oakland Park	Pump station information
Old Plantation Water Control District	OPWCD GATE STRUCTURES.pdf; OPWCD GEN INFO.pdf; OPWCD NW Culvert.pdf; OPWCD REVISED PLANTATION_MAP.pdf
Parkland	Drainage Map markups, researching other data sources (ERPs, etc.)
Pine Tree Water Control District	Limited drainage map information
Plantation	Data provided by Old Plantation and Plantation Acres covers the City
Plantation Acres Improvement District	1990-09-24 SFWMD Staff Report.pdf; 1990-10-11 SFWMD Permit.pdf; 2000-02-16 Pump Curve.pdf; 2017_Historical_Graph.pdf; 2017_PAID_Rain.pdf; 2017-12-07 facilitiesPL.pdf; 2017DAILY WATERLEELPLOTS.pdf; 2018-03-06 districtmap-DISTRICTMAP.pdf; Average2017.pdf; Buildout2-002.out.zip (links; nodes; storms; report.txt; summary.txt)
Pompano Beach	180322 Avondale - Construction Plans.pdf; 161800 - Esquire Lake Stormwater_22x34.pdf; Pompano Beach Chronic Sites.zip (2018ChronicSites shapefile); Pompano Beach SWMP 1 – Overall Report.pdf; Pompano Beach SWMP 2 – Appendix A.pdf; PompanoBchStormwater6.21.2018.gdb
South Broward Drainage District	GIS for SBDD Facilities Report & Water Control Plan, Maps, ICPR Models for Facilities Report 2013 SBDD Facilities Report & Water Control Plan; Water Level and Pump Data
South Florida Water Management District	Tidal data, permits, infrastructure data
Sunrise	Sunrisestormwaterpumpcapacities 9-7-18.pdf; City of Sunrise SW Basin Maps.pdf; Sunrise Weirs - Basins 15, 17, 18.pdf; City of Sunrise SW Basin 18 Map.pdf
Tamarac	Culvert improvement data, GIS stormwater infrastructure, pump stations data, outfall maps
Weston	Weston_Drainage, GIS Data, Pump station data

Model Improvements

Land Use



2014 Model



Updated Model

Flood Insurance and Risk-Rating

- ❑ Risk-based rates on a granular level, nationwide
- ❑ Move to improve transparency and arrive at actuarial rates
- ❑ Roll-out in 2020
- ❑ CRS Credits provide flood policy discounts
 - Planning for SLR
 - Setting higher standards
 - Related activities - Targeted Outreach
- ❑ Resiliency measures vital to reducing risk, and rates!



Broward County:

- **204,211 flood policies (12% state total)**
- **22 participating CRS cities and county**

Milliman to design new flood risk rating plan for NFIP

🕒 16th November 2017 - Author: [Staff Writer](#)

The Federal Emergency Management Agency (FEMA) has selected flood risk innovator Milliman to design a new rating plan for National Flood Insurance Programme (NFIP) policies nationwide.

The U.S. government programme to provide homeowners with flood insurance, NFIP, has recently been reauthorised and is undergoing reforms after it was hit with an estimated \$7-10 billion in claims from hurricane Harvey, triggering its \$1 billion of reinsurance cover.

Milliman will use its technology and analysis for sophisticated modelling and pricing techniques for FEMA, as the government agency initiates the redesigning of flood insurance products used across the National Flood Insurance Programme (NFIP).



Participating Broward CRS Communities

- Broward
- Coconut Creek
- Cooper City
- Coral Springs
- Dania Beach
- Davie
- Deerfield Beach
- Fort Lauderdale
- Hallandale Beach
- Hillsboro Beach
- Hollywood
- Lauderdale by the Sea
- Lauderdale
- Lighthouse Point
- Margate
- Miramar
- North Lauderdale
- Oakland Park
- Parkland
- Pompano Beach
- Sunrise
- Tamarac
- Weston

FEMA
Federal Insurance and Mitigation Administration

Fact Sheet
Community Rating System
June 2017

The National Flood Insurance Program (NFIP) Community Rating System (CRS) was implemented in 1990 as a voluntary program for recognizing and encouraging community floodplain management activities exceeding the minimum NFIP standards. Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join the CRS.

1,444 Communities Participate in the CRS
Nearly 3.6 million policyholders in 1,444 communities participate in the CRS by implementing local mitigation, floodplain management, and outreach activities that exceed the minimum NFIP requirements.

Under the CRS, flood insurance premium rates are discounted to reward community actions that meet the three goals of the CRS, which are: (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management.

Although CRS communities represent only 5 percent of the over 22,000 communities participating in the NFIP, more than 69 percent of all flood insurance policies are written in CRS communities.

CRS Classes
The CRS uses a class rating system that is similar to fire insurance rating to determine flood insurance premium reductions for residents. CRS Classes¹ are rated from 9 to 1. Today, most communities enter the program at a CRS Class 9 or Class 8 rating, which entitles residents in Special Flood Hazard Areas (SFHAs) to a 5 percent discount on their flood insurance premiums for a Class 9 or a 10 percent discount for Class 8. As a community engages in additional mitigation activities, its residents become eligible for increased NFIP policy premium discounts. Each CRS Class improvement produces a 5 percent greater discount on flood insurance premiums for properties in the SFHA.

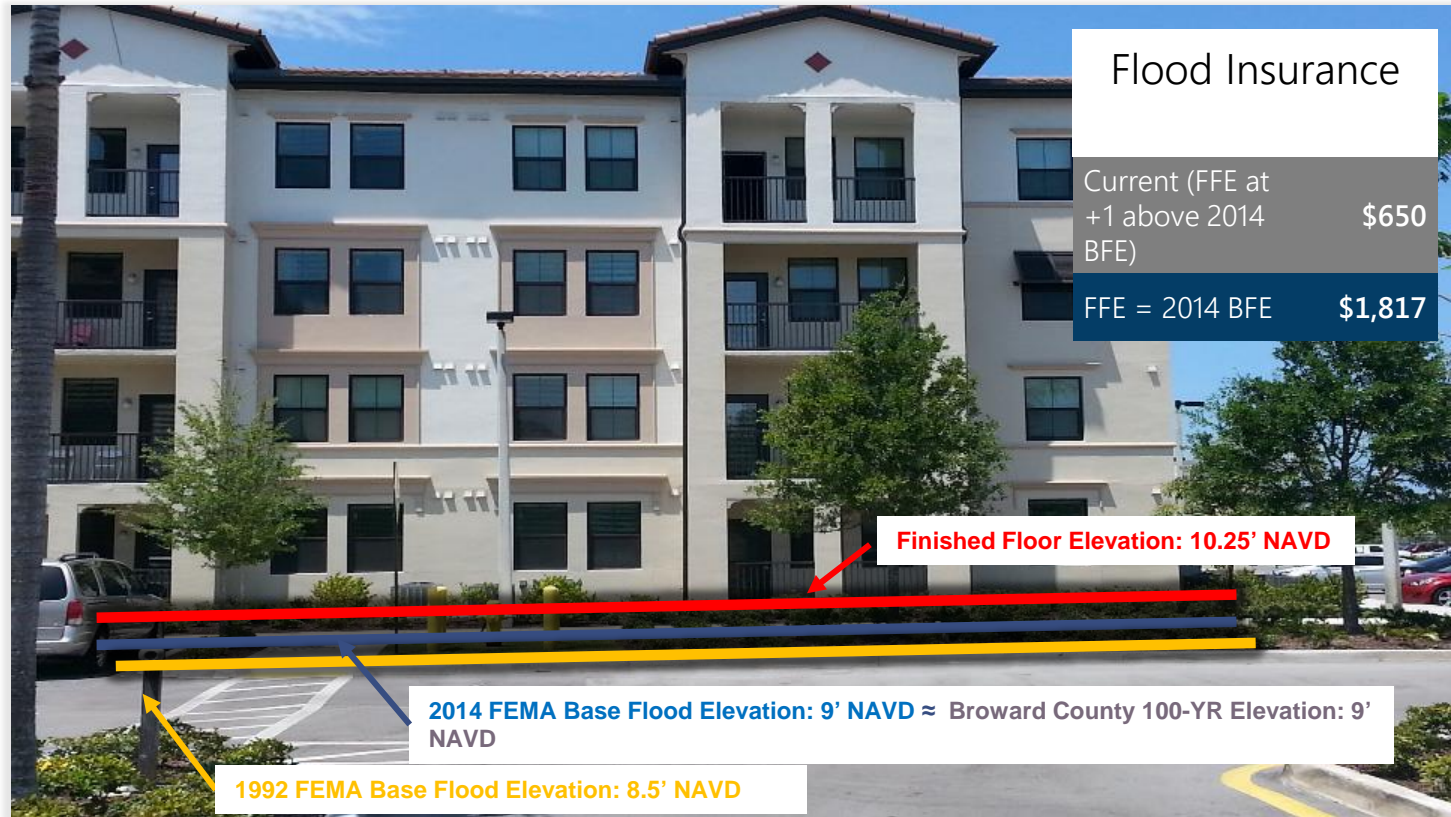
¹ CRS Class changes occur on May 1 and October 1 of each year. The data contained in this fact sheet were current through May 2017.

Best of the Best
Seven communities occupy the highest levels of the CRS. Each built a floodplain management program tailored to its own particular hazards, character, and goals. Under these programs, each community carries out numerous and varied activities, many of which are credited by the CRS. The average discount in policyholder premiums varies according to a community's CRS Class and the average amount of insurance coverage in place.

- **Roseville, California** was the first to reach the highest CRS rating (Class 1). Floods in 1995 spurred Roseville to strengthen its floodplain management program. Today the City earns points for almost all CRS-creditable activities. The average premium discount for policies in the Special Flood Hazard Area (SFHA) is \$963.
- **Comprehensive planning** has been a key to Tulsa, Oklahoma in reducing flood damage from the dozens of creeks within its jurisdiction. The City (Class 2) has cleared more than 900 buildings from its floodplain. The average SFHA premium discount is \$709.
- **King County, Washington** (Class 2) has preserved more than 100,000 acres of floodplain open space and receives additional CRS credit for maintaining it in a natural state. The average premium discount in the SFHA is \$722.
- **Pierce County, Washington** (Class 2) maintains over 80 miles of river levees. The County mails informational brochures to all floodplain residents each year. The average premium discount in the SFHA is \$646.
- **Fort Collins, Colorado** (Class 2) uses diverse approaches to keep its large student population informed. Identifying and protecting critical facilities and continually improving its GIS system help the city maintain its exemplary program. The average premium discount in the SFHA is \$703.
- **Sacramento County, California** has steadily improved its rating since joining the CRS in 1992. Now a Class 2, the County's more significant activities are disjunct public outreach on protecting waterways, purchasing flood insurance, and preparing for floods. The average premium discount in the SFHA is \$395.
- **Thurston County, Washington** has a history of planning for hazard mitigation, watershed protection, and open spaces. Combining that with strict development standards and stormwater management has helped the County achieve Class 2. The average premium discount in the SFHA is \$577.

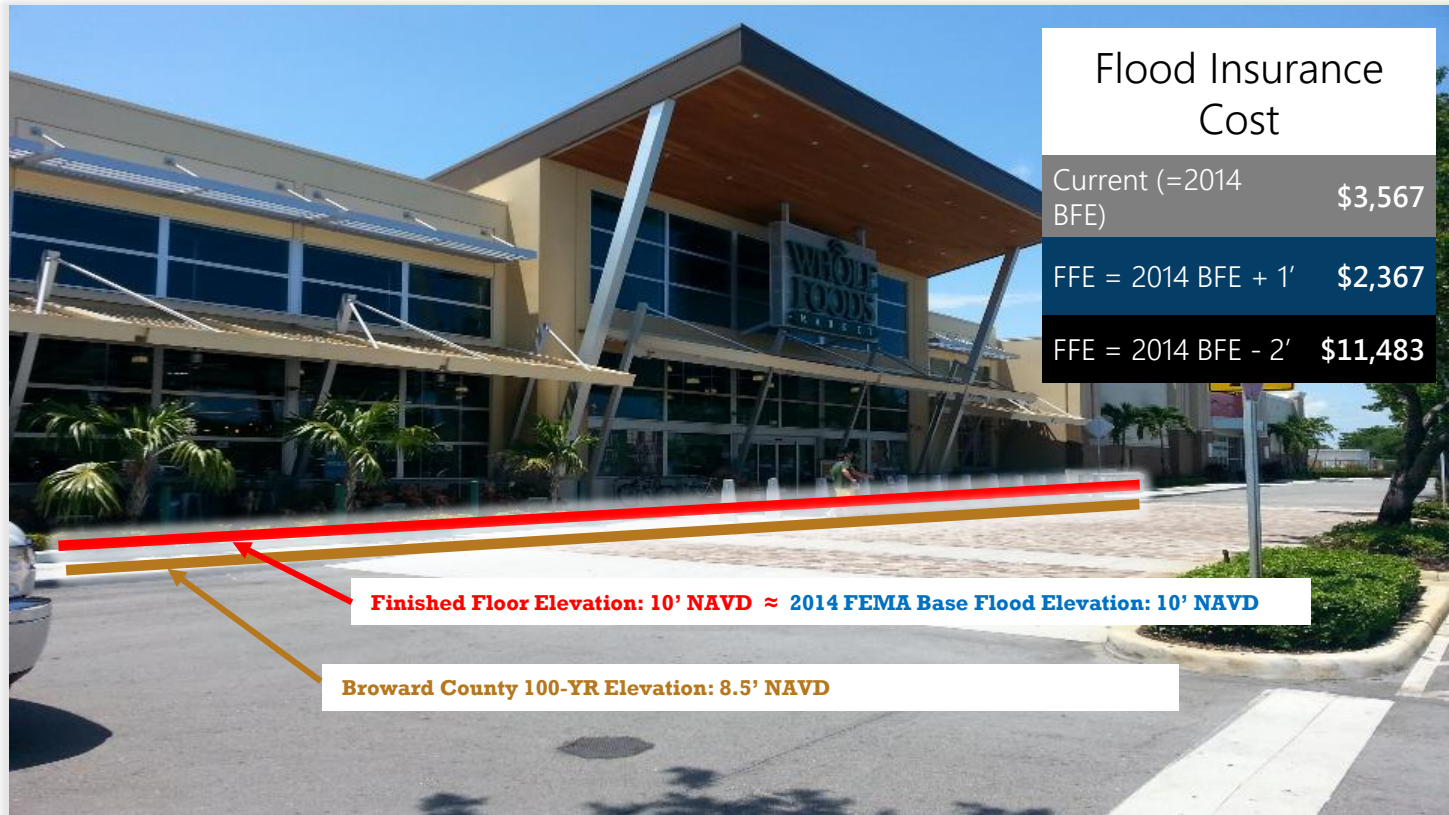
FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards.

Premiums **double** every foot below base flood elevation



Originally presented on 4/28/2016 by L. Vialpando

Broward county 100-year Elevation maps need update



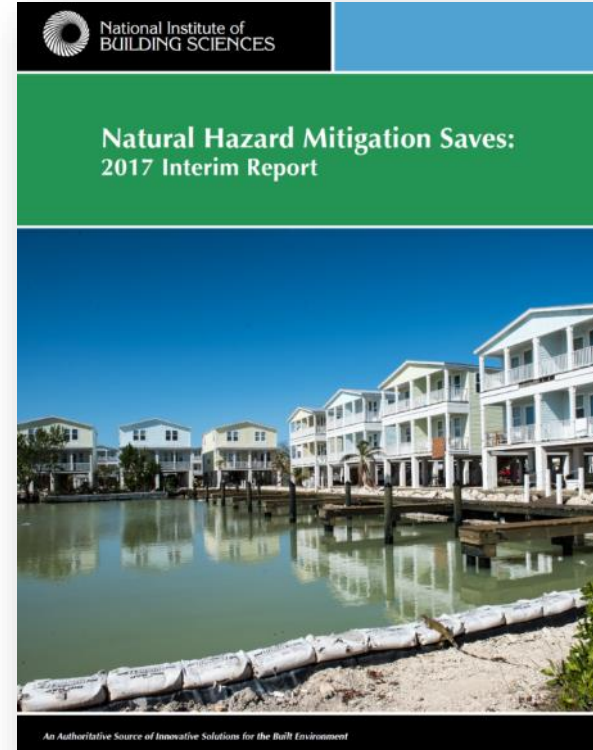
Reinforcing the Benefits of Hazard Mitigation

The Institute's project team looked at the results of 23 years of federally funded mitigation grants provided by the Federal Emergency Management Agency (FEMA), U.S. Economic Development Administration (EDA) and U.S. Department of Housing and Urban Development (HUD) and found mitigation funding **can save the nation \$6 in future disaster costs, for every \$1 spent** on hazard mitigation.

10-year Update

Findings: **6:1 Cost/Benefit Ratio** (up from 4:1)

Basis: 23 years of Federal agency grant data



Economic Basis for Action

- ❑ Protect infrastructure
- ❑ Reduce flood risk and losses
- ❑ Protect credit ratings
- ❑ Improve insurance affordability
- ❑ Protect property values/tax base

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

MOODY'S
INVESTORS SERVICE

Bloomberg
**South Florida's Real Estate
Reckoning Could Be Closer
Than You Think**

**Moody's Warns Cities to Address
Climate Risks or Face Downgrades**

By **Christopher Flavelle**
November 29, 2017 4:00 AM
From **Climate Changed**



Bloomberg

**BUSINESS
INSIDER**

**Cities and states could see their credit ratings crash if
they don't start preparing for climate change**



Jeremy Berke
© Dec. 1, 2017, 9:16 AM 2,407

Anticipated Needs

Raise/Harden/Relocate



Elevate Roads
and Critical Infrastructure



Distributed Storage



Green
Infrastructure



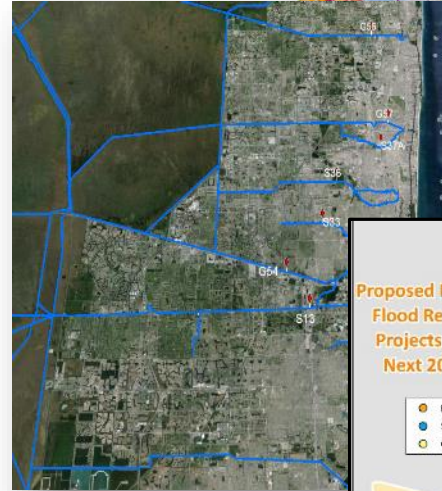
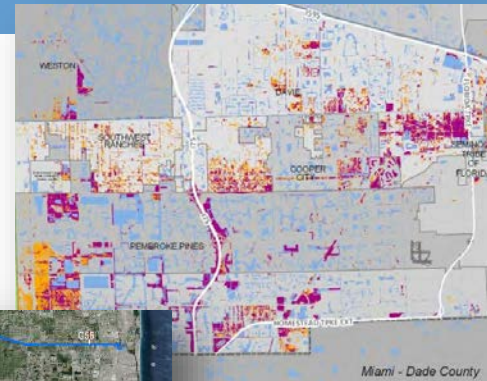
Stormwater Enhancements



A Path Forward



- ❑ Conduct regional risk assessment
 - Future flood map and infrastructure
- ❑ Provide basin-level analysis, county-wide
- ❑ Identify priority capital improvements for flood protection
- ❑ Advance a resilient infrastructure investment plan



Questions?

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