

# ROLE OF BROWARD COUNTY SWM PROGRAM IN IMPLEMENTATION OF RESILIENCE POLICIES



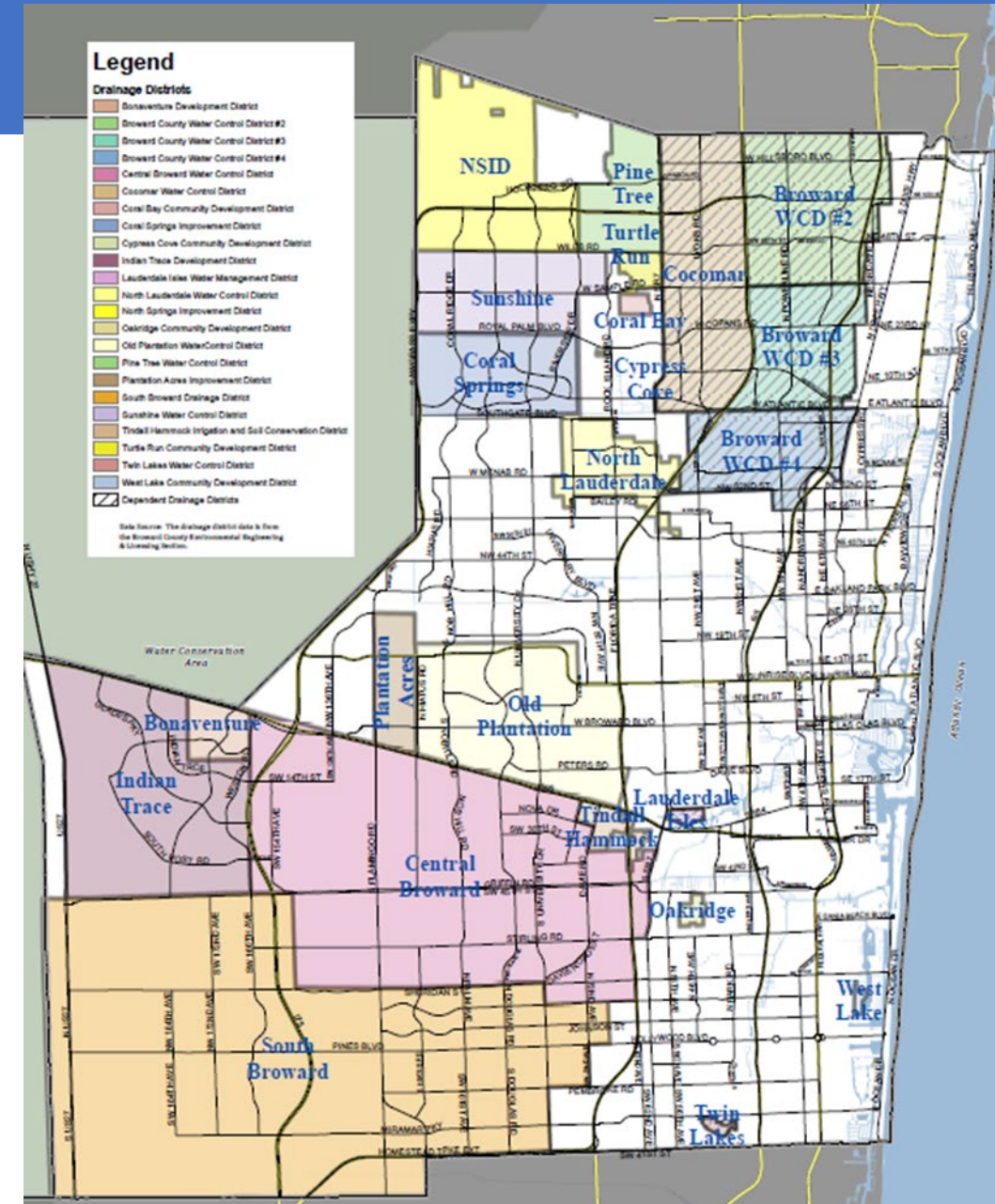
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ENVIRONMENTAL PERMITTING DIVISION  
*OCTOBER 17, 2024*

# Outline

- Broward County Surface Water Management (SWM) Licensing Program
- SWM Program Requirements
- SWM Systems Design
- Future Conditions Map Series
- Development and Redevelopment Patterns
- Innovative Designs for SWM Systems

# Broward County Surface Water Management (SWM) Licensing Program

- Broward County Code of Ordinances – Chapter 27, Article V
- Established in 1989
- Jurisdiction: Countywide, except for Independent Drainage Districts, Seminole Tribe of Florida Reservation, SFWMD and FDOT ROW, TIFF and Submerged Lands
- Licensing Exemption: Single-family dwellings or duplexes on lots less than two (2) acres in size (must still comply with Code requirements)



# SWM Licensing Program

- Section §27-54 of Code: “Prior to the commencement of construction, modification, alteration, replacement or operation of any facility or the commencement of any activity that may cause or be a source of pollution, or that may impact, eliminate, reduce or control pollution of the air, ground, groundwaters, surface waters or other natural or biological resources, the owner and/or operator shall obtain a RED license .....”
- Purpose of SWM License:
  - Protection of Finished Floor Elevations (FFEs), parking areas and roadways
  - No flooding impacts to adjacent properties (pre vs post conditions)
  - Meet allowable discharges and water quality requirements



# SWM License Requirements

- Finished Floor Elevations – set at or above of 100-year elevations
  - 1977 Broward County (BC) 100-year Flood Elevation Map
  - 2021 BC 100-year Future Conditions Flood Elevation Map
  - Site-specific 100-year Flood Elevation or Master License
  - FEMA Maps 100-year elevation plus a free board (1' to 2') – FL Building Code
  - Crown of Road plus 18"; CCCL; Manufactured Home; City Code Requirements
- Water quantity or stormwater runoff attenuation (elevation and discharge limitations) - controls to protect existing and proposed buildings, roadways, parking lots, etc. from flooding
- Water quality treatment (must retain “first-flush” of stormwater on site) - protects receiving waters such as lakes, canals, the Everglades, and the ocean from pollutants in stormwater runoff

# SWM System Design

- Stormwater management systems are designed to control discharges by collecting, conveying, storing, absorbing, inhibiting, treating, using, and reusing stormwater



# SWM System – Typical Components

- Swales
- Storm drains
- Exfiltration trenches
- Underground storage/vaults
- Detention/Retention areas
- Drainage wells
- Culverts
- Lakes and wetlands
- Grading (pervious, impervious, and buildings areas)



# Typical SWM Systems

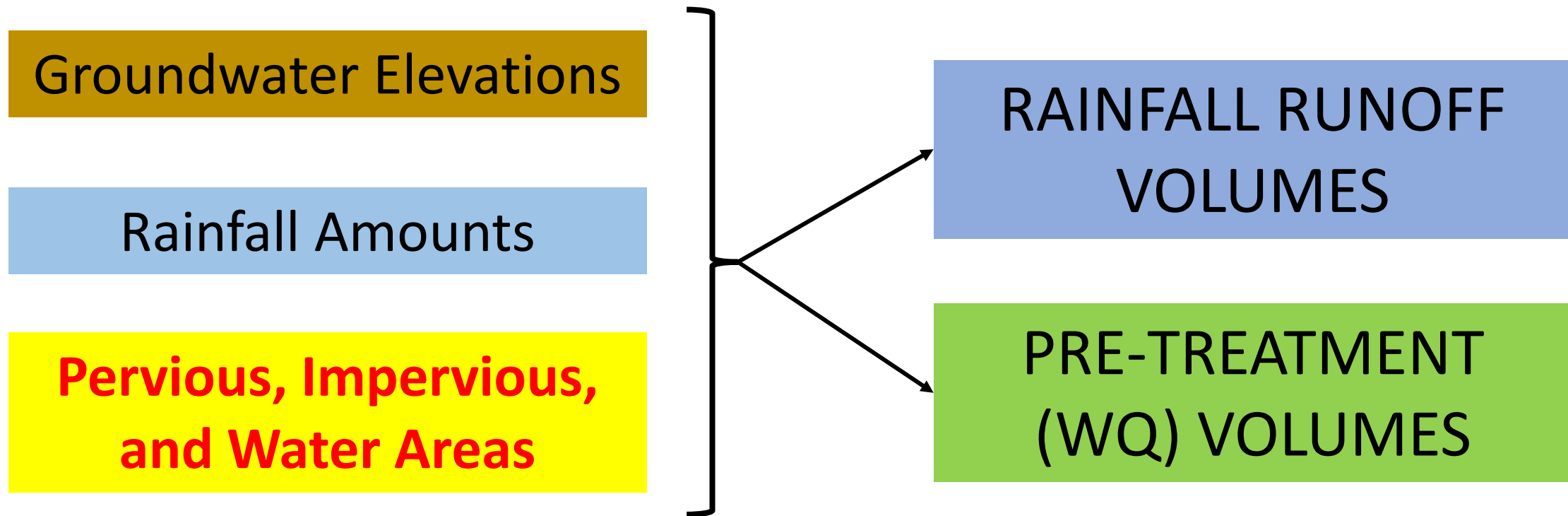
**Western part of County; large parcels; meets SWM rules and regulation adopted in the 1970s and 1980's**



# Key Factors in Designing of SWM Systems

- Groundwater Elevations (SWM Code)
- Rainfall Amounts (SWM Code)
- Pervious, Impervious, and Water Areas (Designer)
- Runoff Volumes (SWM Code-calculated)
- Pre-treatment (Water Quality) Volumes (SWM Code-calculated)
- Allowable Discharge (SWM Code)
- Storage of Runoff Volumes on site's SWM System (Designer)

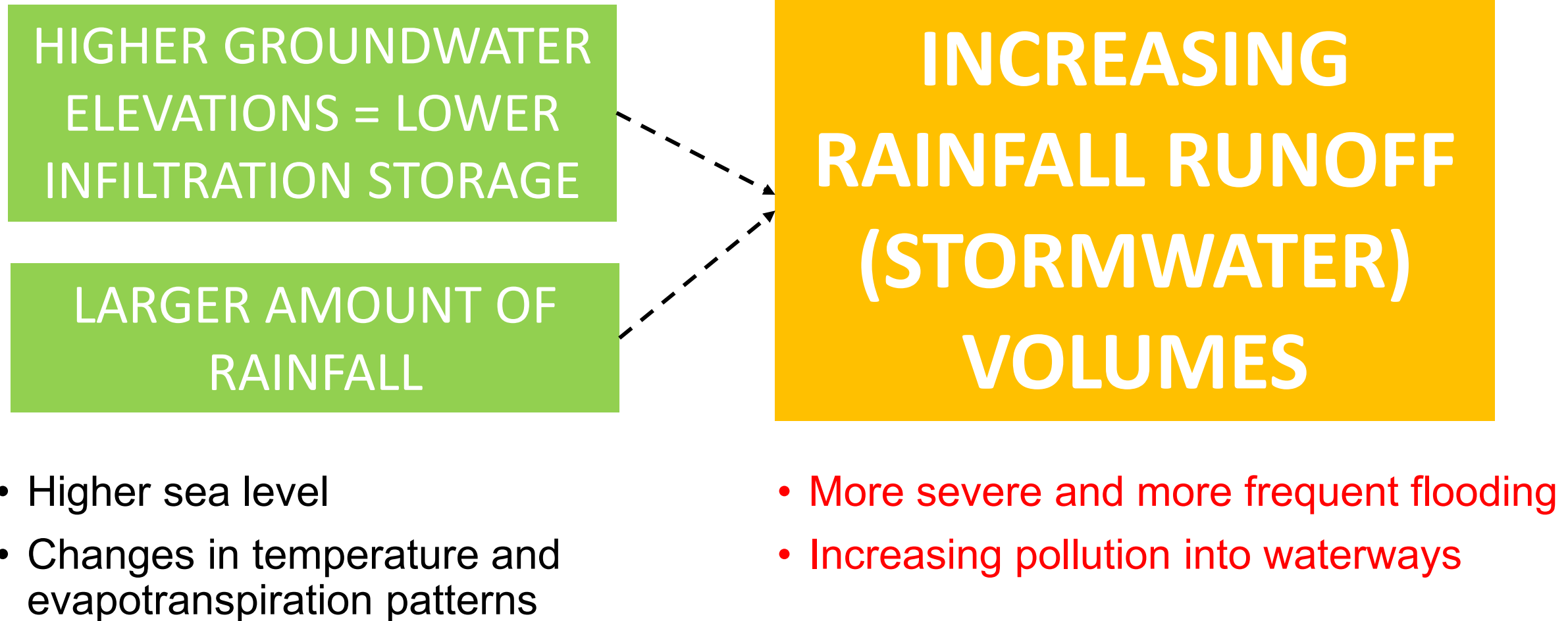
# Runoff and Pre-treatment (WQ) Volumes



\*Controlled by SWM Code

**\*Controlled by Designer (and Planning Code)**

# Runoff and Pre-treatment (WQ) Volumes (Cont'd)



# Broward County Groundwater Maps

Plate WM 2.1  
Adopted in 2000

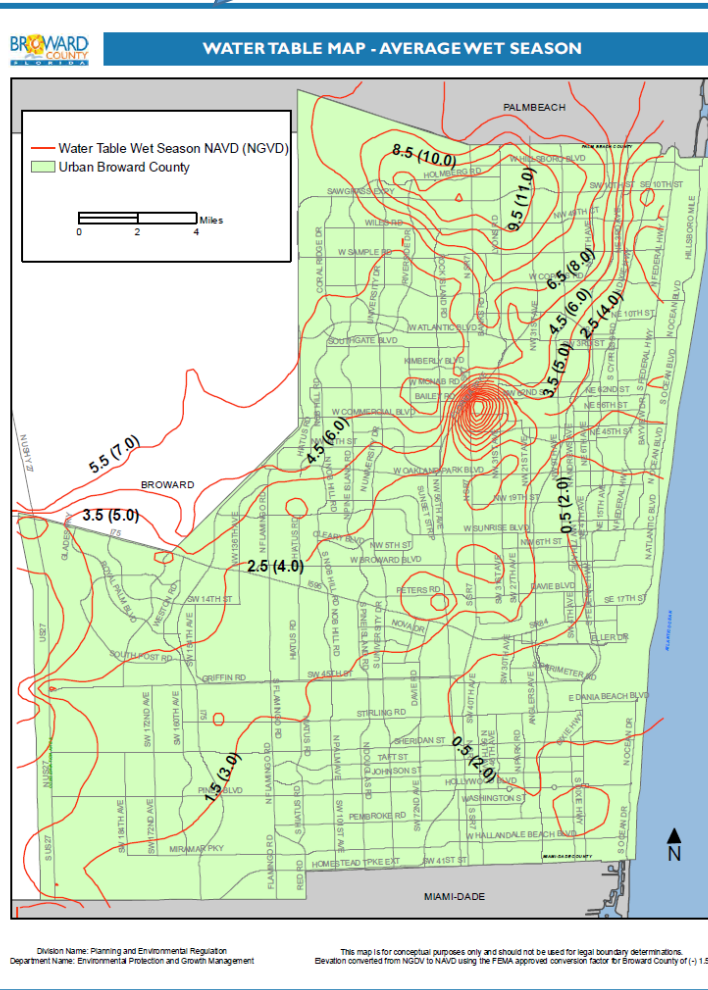


Plate WM 2.2  
2060 Future Conditions Map  
Adopted in 2017

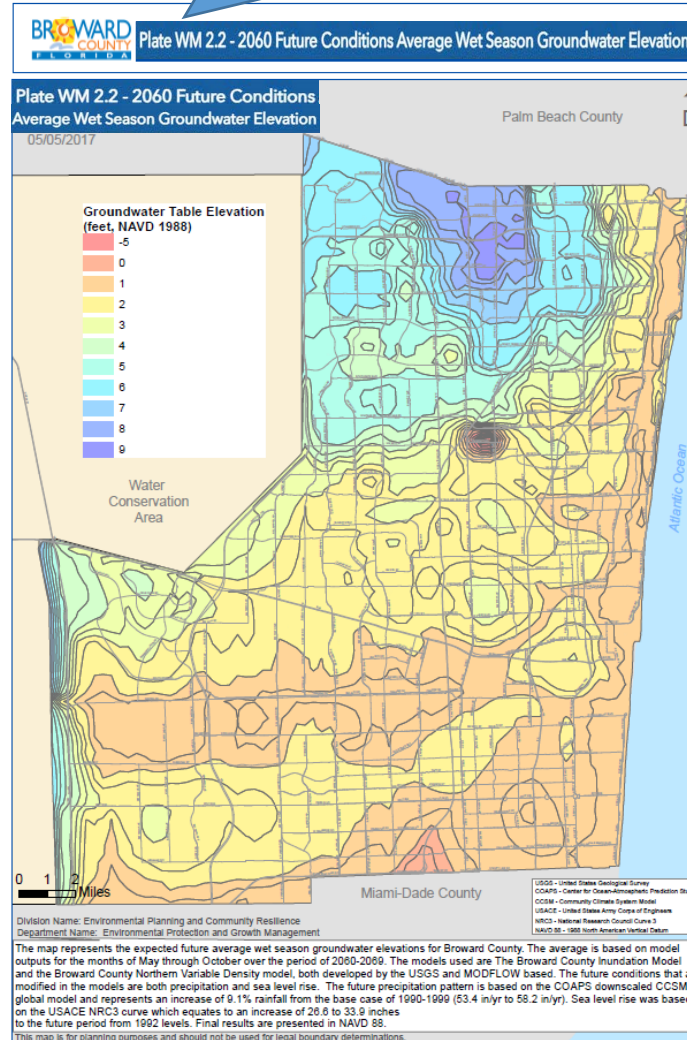
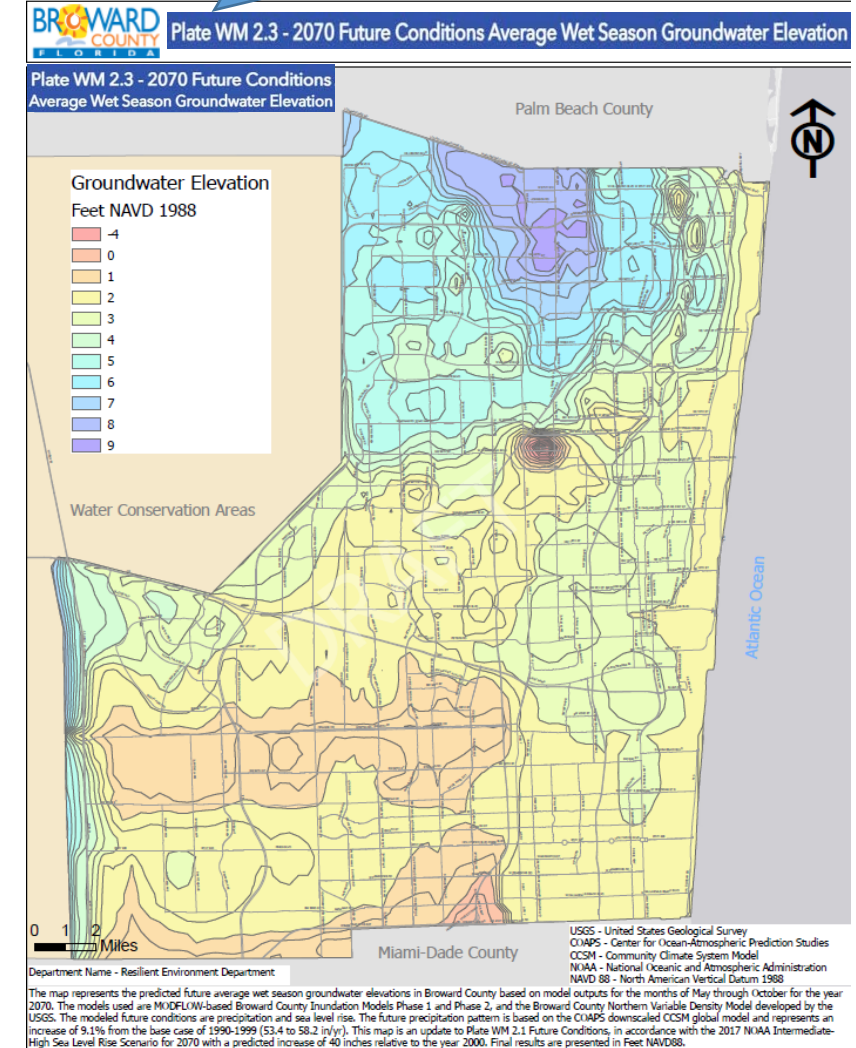
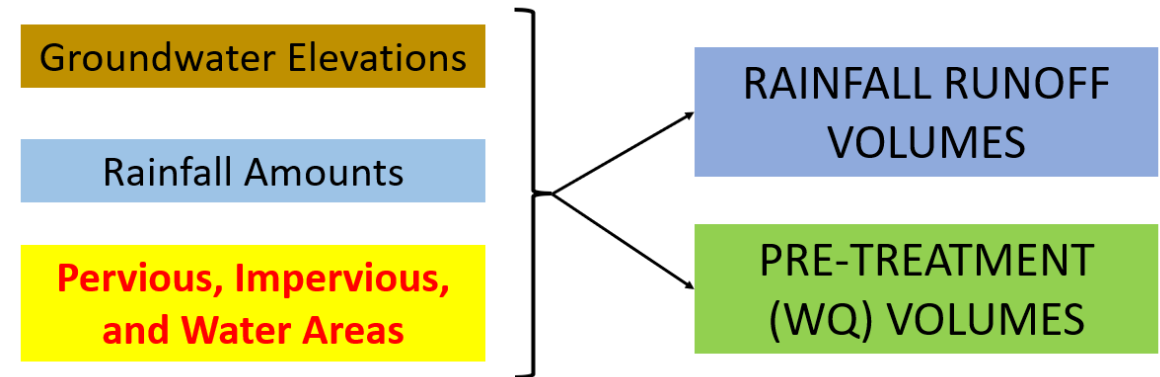


Plate WM 2.3  
2070 Future Conditions Map  
Adopted in 2024

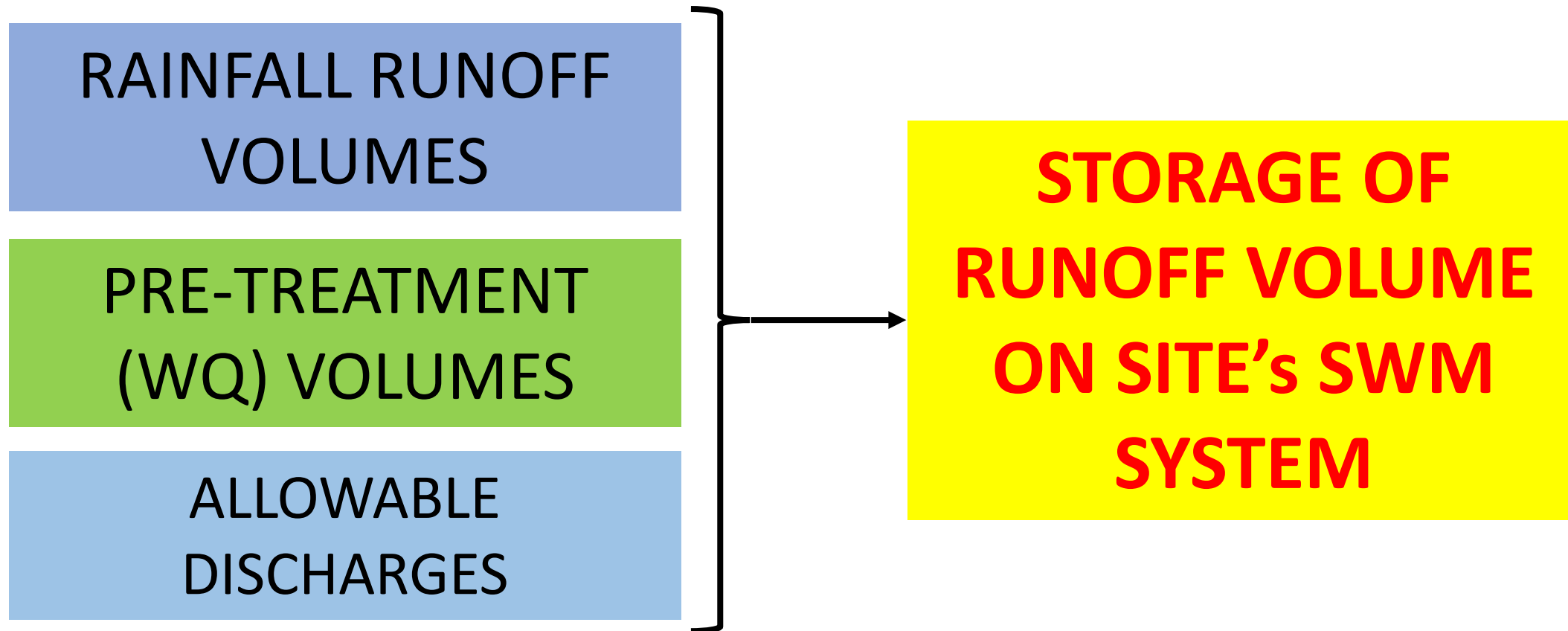


# Key Factors in Designing of SWM Systems

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- Rainfall Amounts (SWM Code)
- Pervious, Impervious, and Water Areas (Designer)
- Runoff Volumes (SWM Code-calculated)
- Pre-treatment (Water Quality) Volumes (SWM Code-calculated)
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- Storage of Runoff Volumes on site's SWM System (Designer)



# Designing of SWM Systems



\*Controlled by SWM Code

**\*Controlled by Designer**

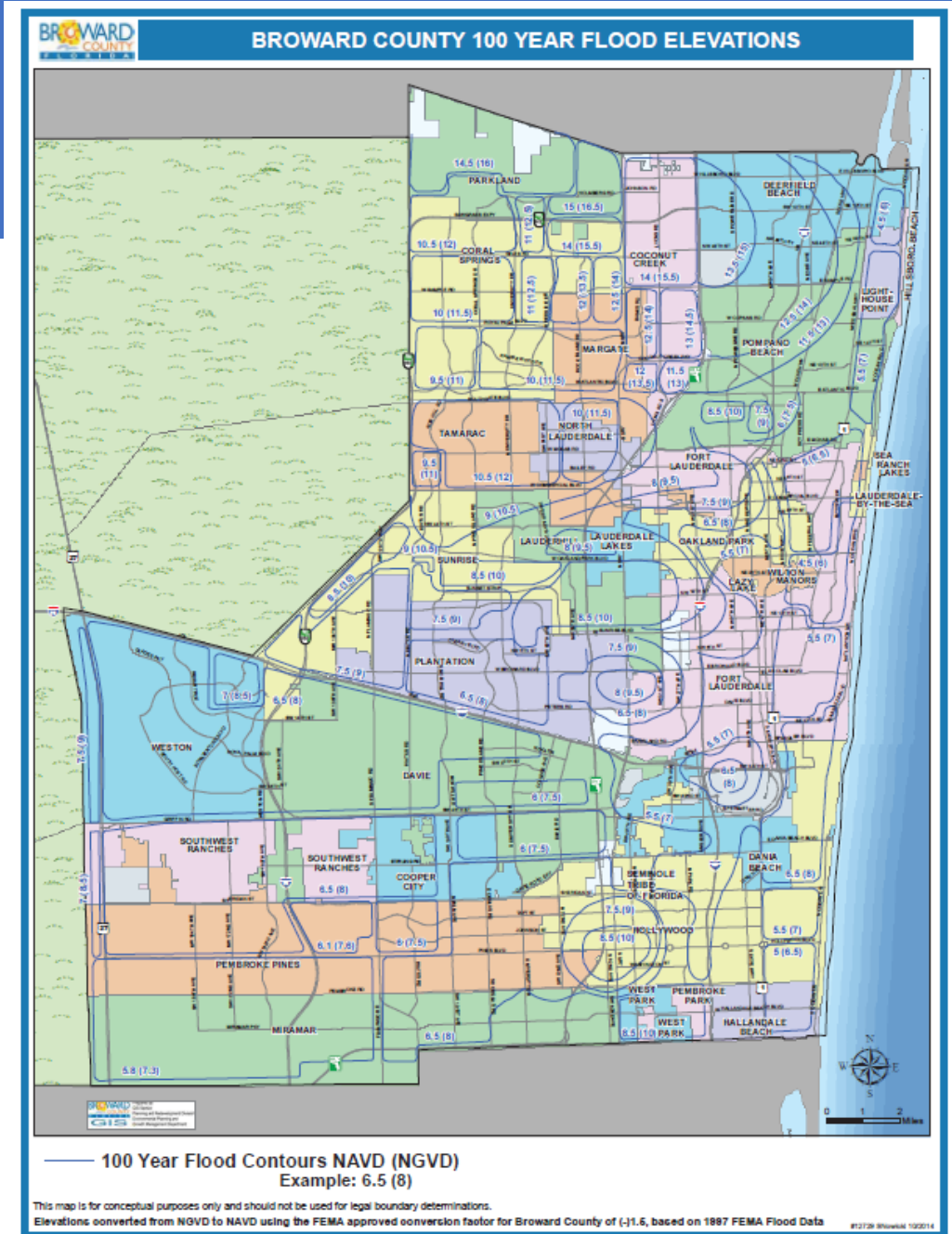
# Designing of SWM Systems vs. Code Requirements

- SWM System design determines (pre and post conditions):
  - Site-specific elevations for 5-, 10-, 25-, and 100-year events
  - Discharge rates for 5-, 10-, 25-, and 100-year events
- Broward County Code requirements:
  - Pre-treatment volume (WQ) is provided prior to any discharge
  - Meet allowable discharges (25-year event)
  - Parking areas and roadways are not flooded during 5-year and 10-year events
  - Minimum FFE is at highest of applicable 100-year elevation
  - No flooding impacts to adjacent properties (pre vs post conditions)

# Finished Floor Elevations (FFE) Requirements

- FFE must be set at or above of 100-year elevations as determined by:
  - 1977 Broward County 100-year Flood Elevation Map
  - 2021 Broward County 100-year Future Conditions Flood Elevation Map
  - Site-specific 100-year Flood Elevation or Master License
  - FEMA Maps 100-year elevation plus free board (1' to 2') – FL Building Code
  - FDEP Coastal Construction Control (CCCL) – FL Building Code
  - Crown of Road plus 18"; Manufactured Home; City Code Requirements
- Non-residential properties have option to dry-floodproofed

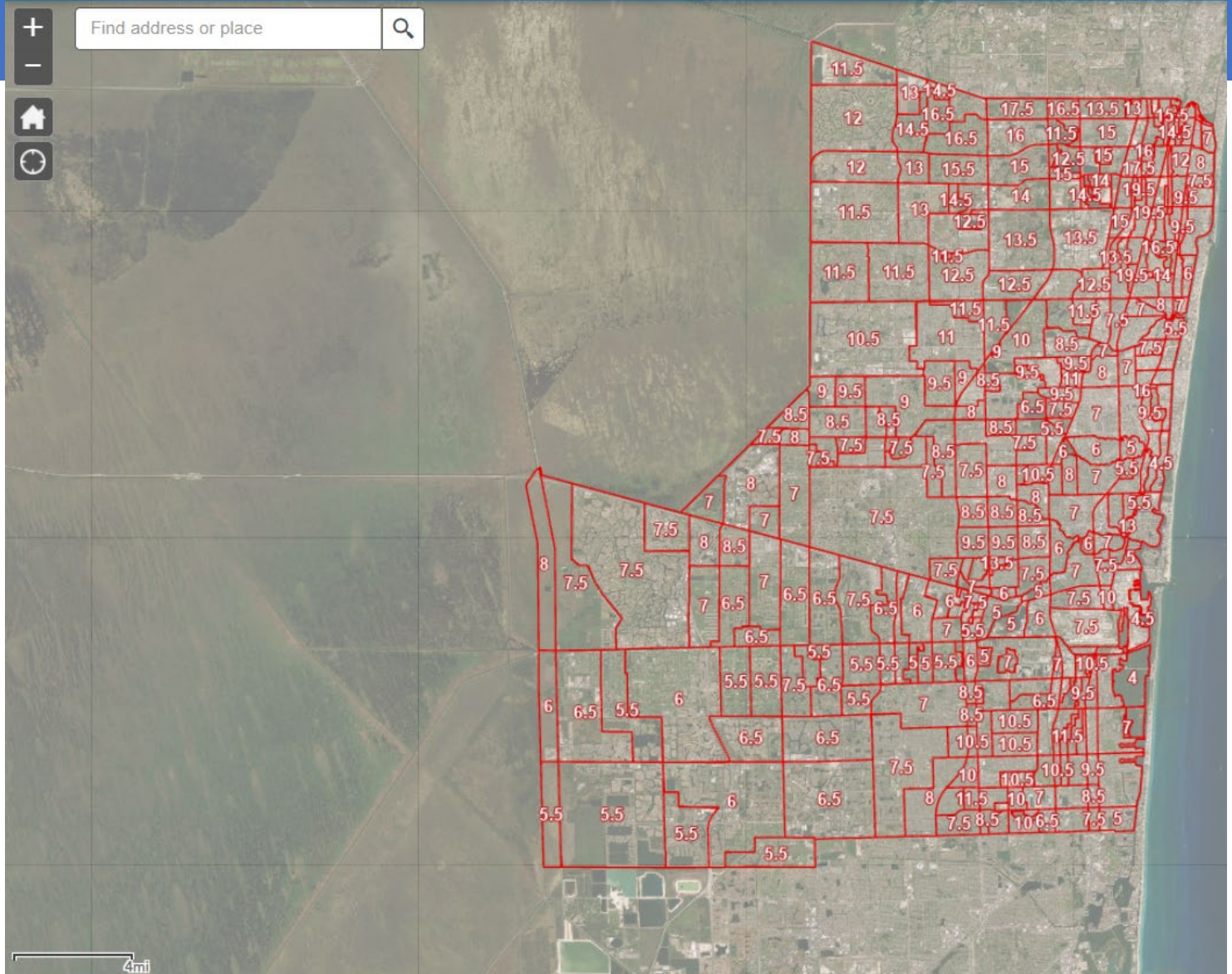
# 1977: Broward County 100-year Flood Elevation Map



<https://www.broward.org/Environment/WaterPrograms/Documents/100YearFloodMap.pdf>

# 2021: Broward County 100-year Future Conditions Flood Elevation Map

Plate WM 13.1 - Future Conditions 100-Year Flood Map 2060



<https://bcgis.maps.arcgis.com/apps/webappviewer/index.html?id=ec160b81e7f84bdeacda62575e817380>

[illegible]

- New FEMA Map became effective on July 31, 2024 –**
- Incorporated updates to coastal flooding risk (storm surge and wave action)
- 

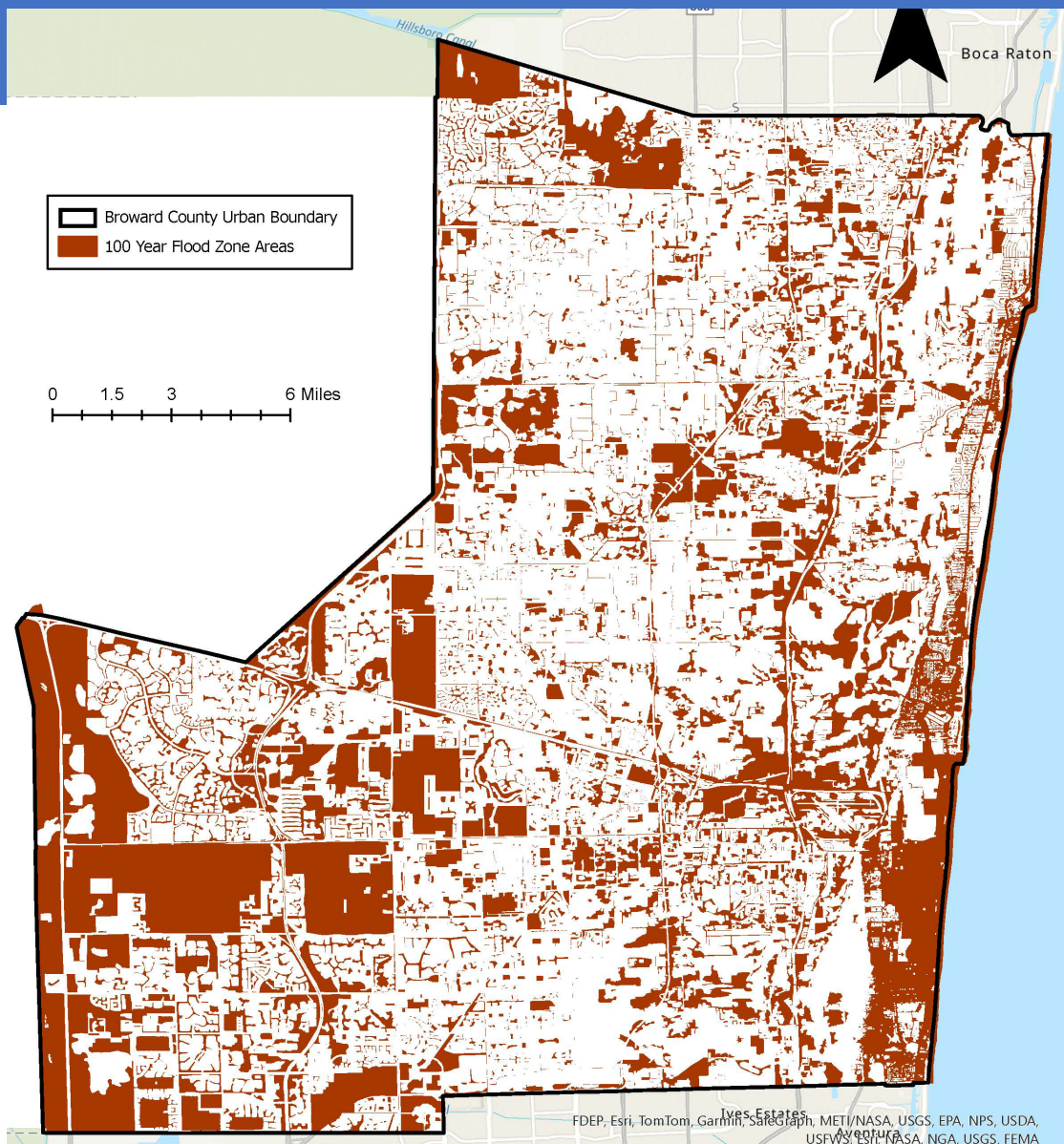
- Broward County Website:  
<https://experience.arcgis.com/experience/8dfc61c972e148f8b12953ddffe299c9/>
- FEMA Flood Map Service Center Website:  
<https://msc.fema.gov/portal/home>

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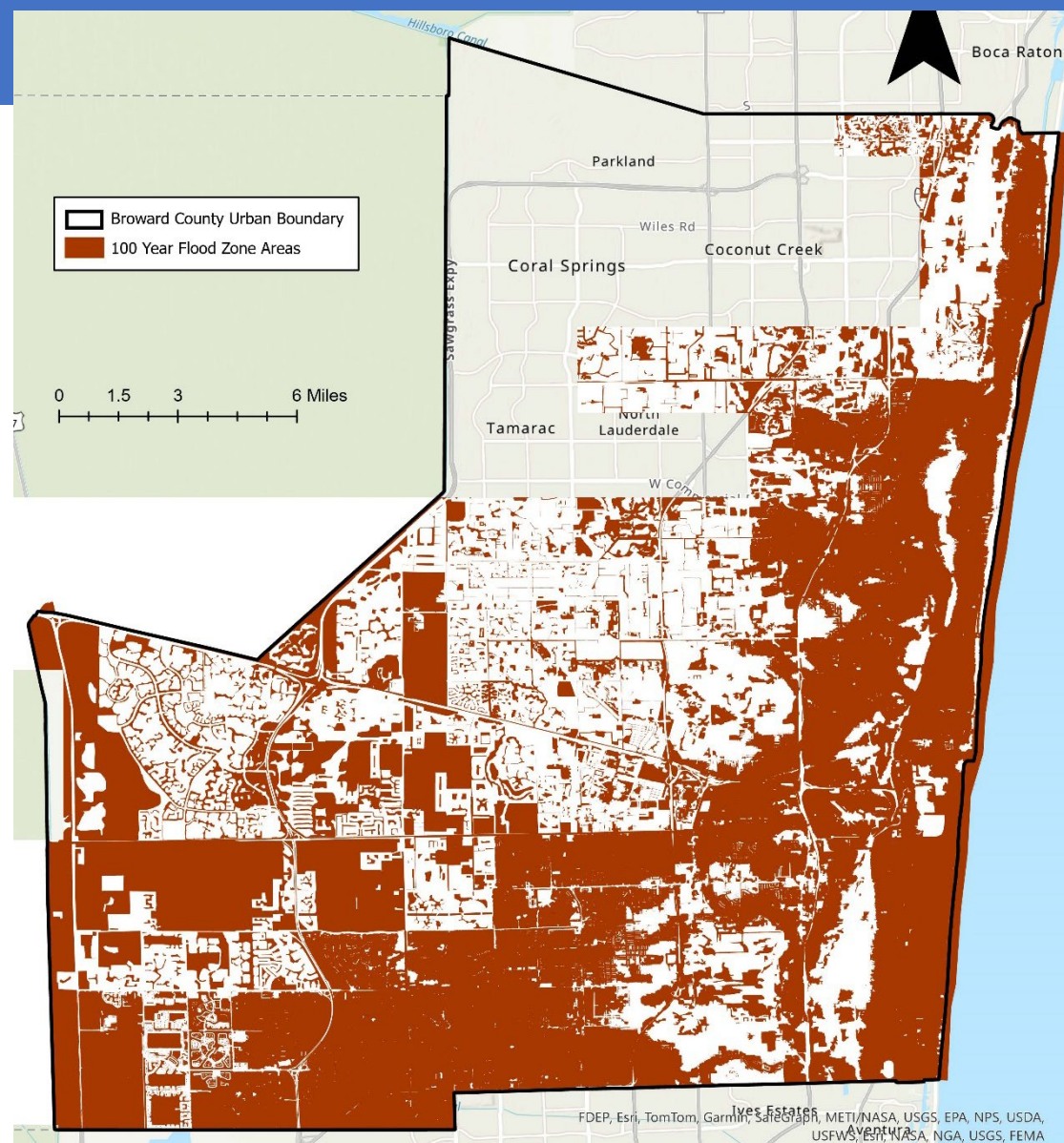
- <https://msc.fema.gov/portal/home>

Figure 1. The proposed research model.

# FEMA Map (8/18/2014)

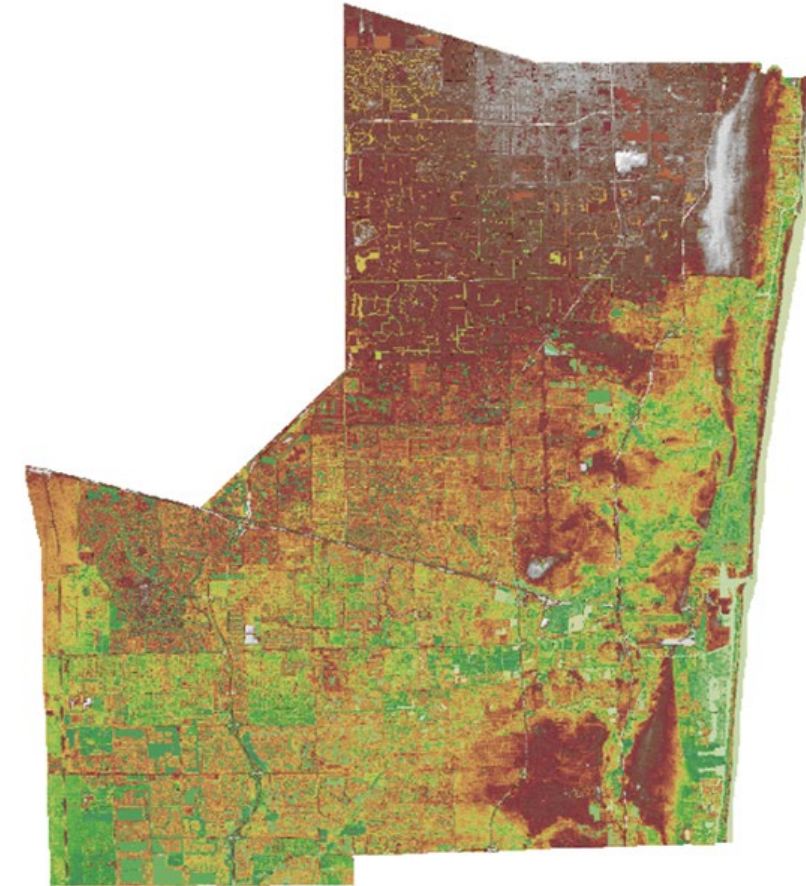
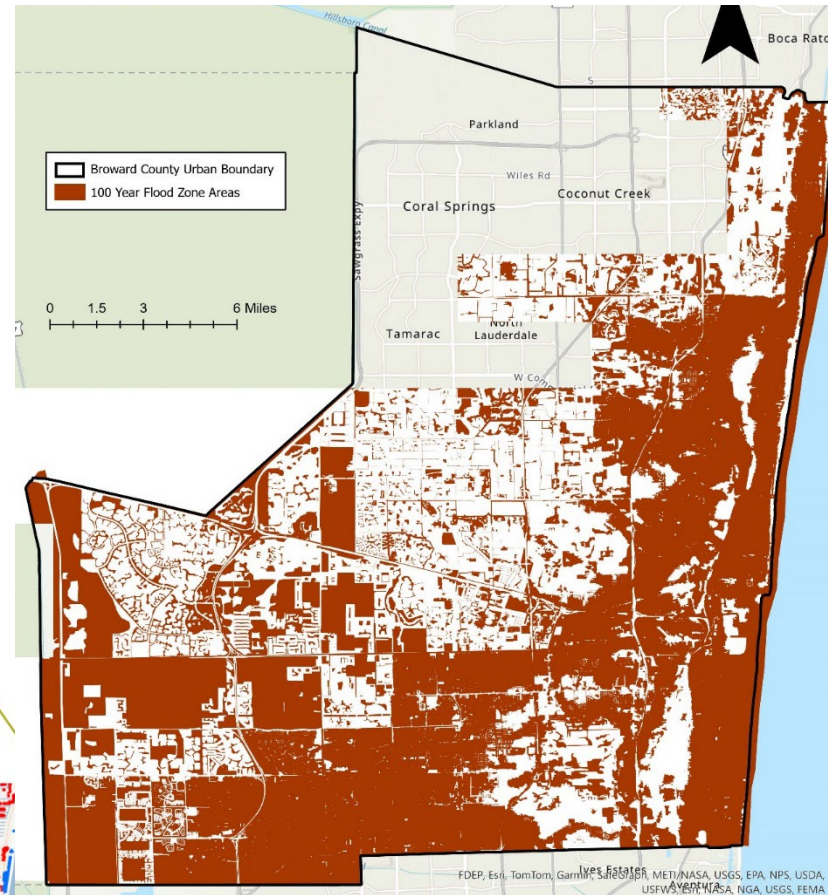
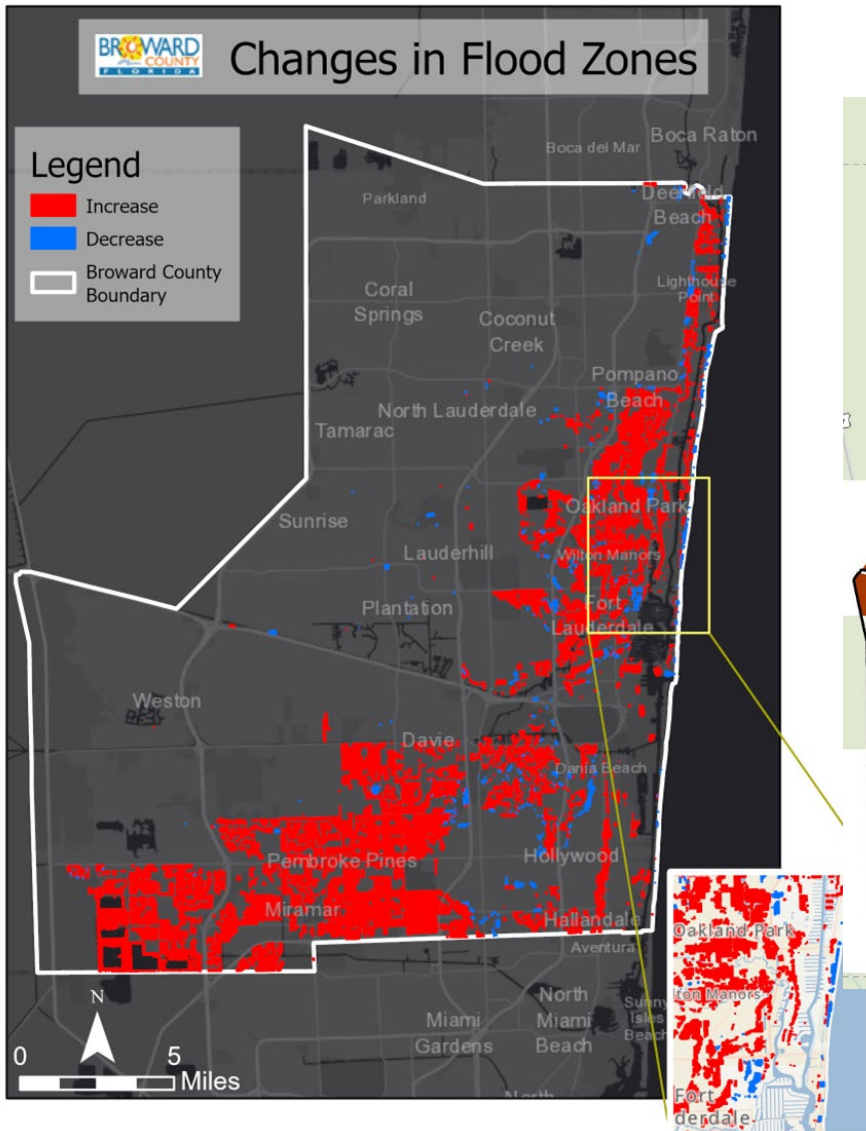


# Revised FEMA Map (7/31/2024)



# 7/31/2024 FEMA MAP and LIDAR ELEVATIONS

## ■ LIDAR ELEVATIONS

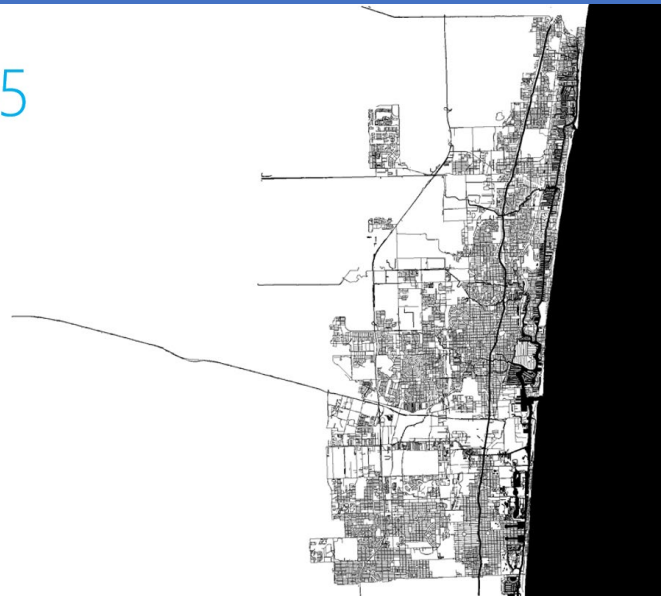


# Development Timeline

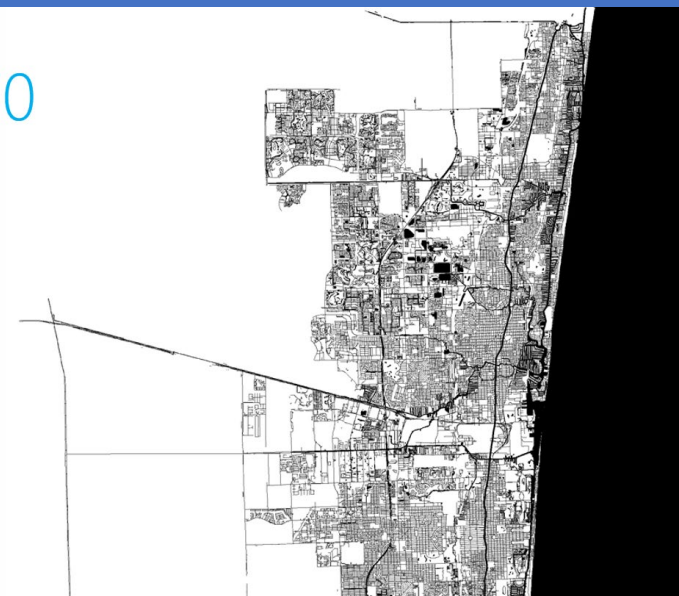
1924



1965



1970



1980



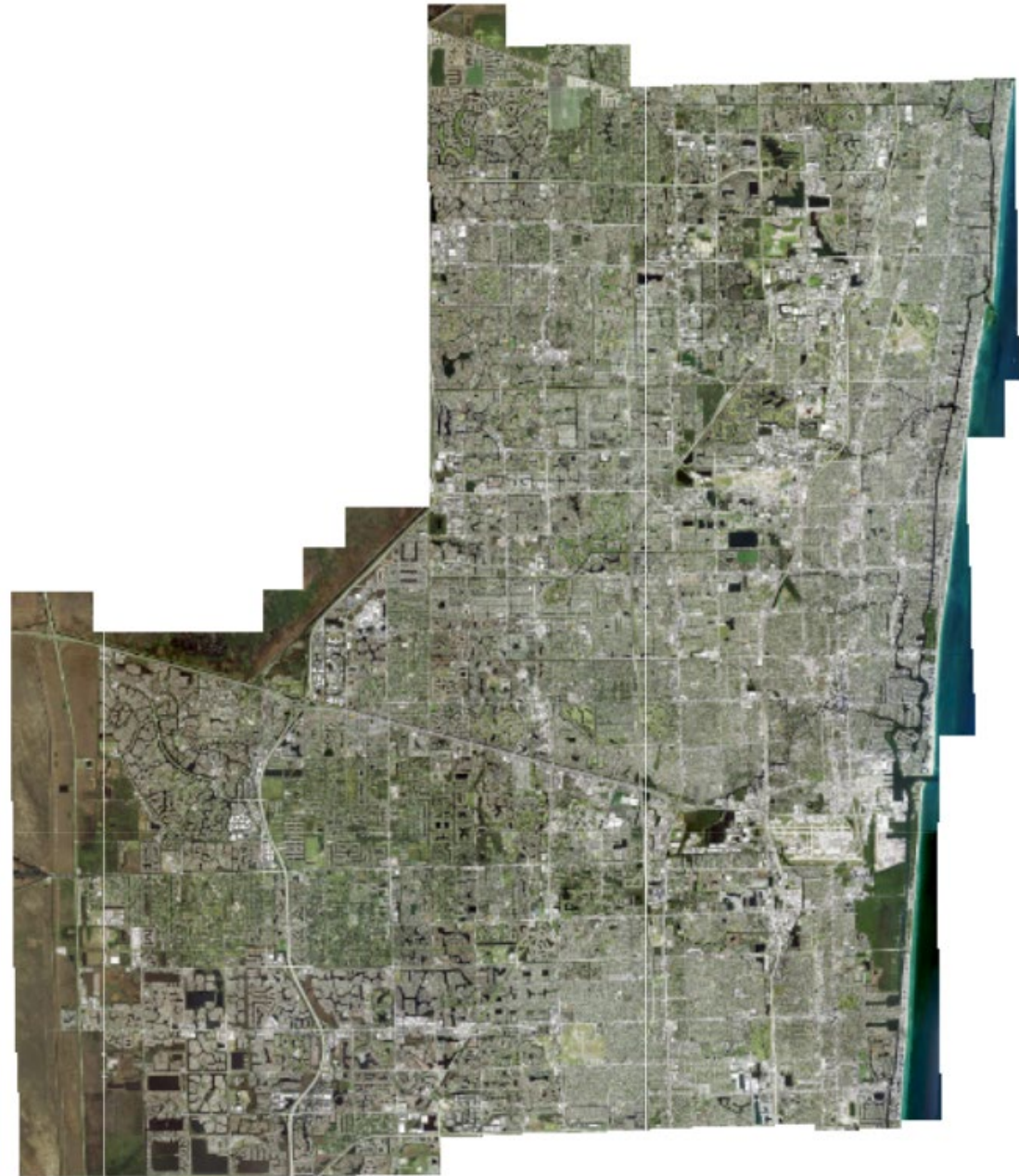
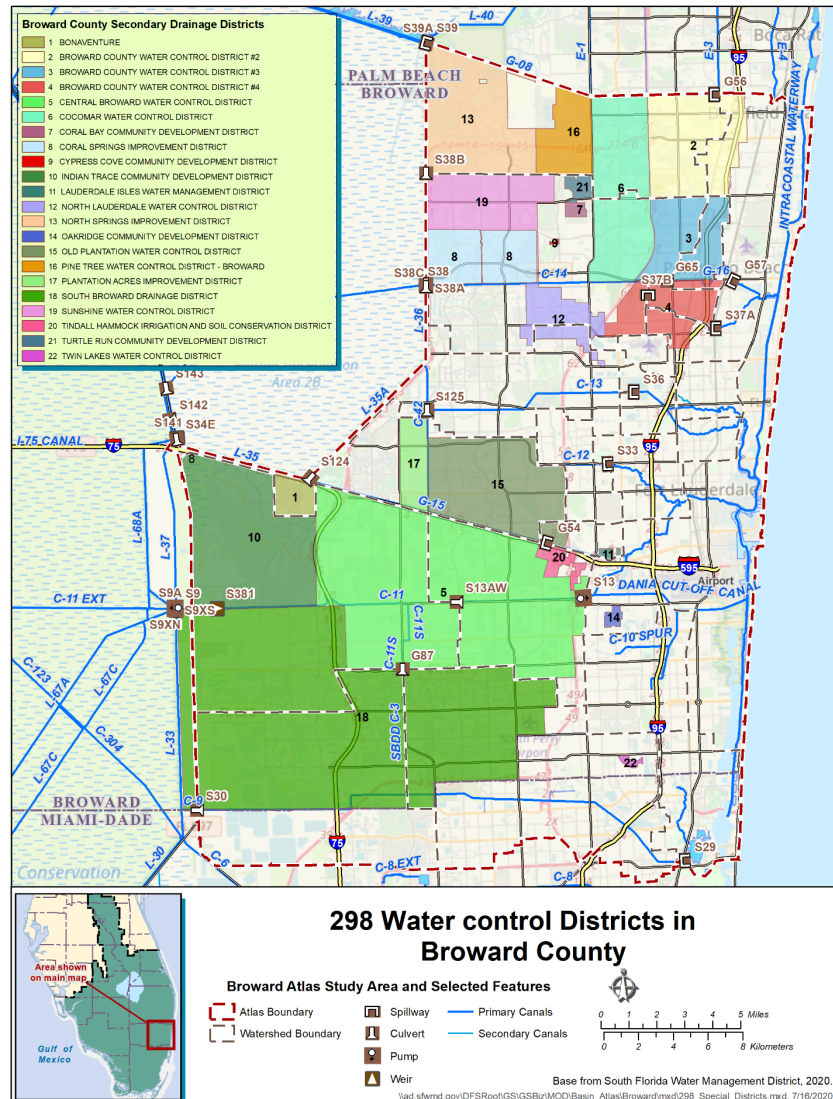
1990



2000



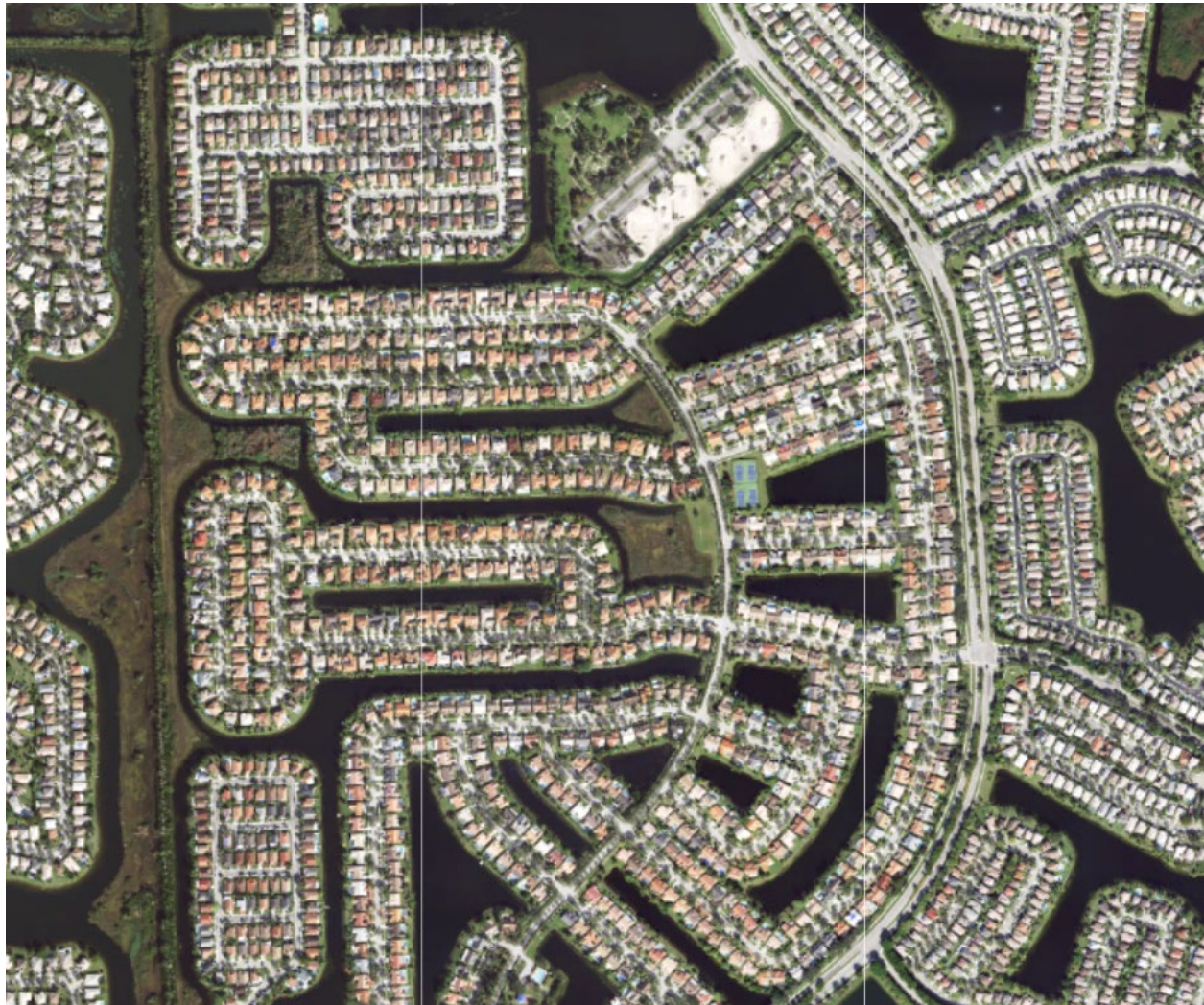
# Development and Redevelopment Patterns



# Development and Redevelopment Patterns (Cont'd)

## Typical SWM Systems

**Pembroke Pines – 1990s**



**Hollywood – 1960s**



# Development and Redevelopment Patterns (Cont'd)

Typical SWM Systems  
(University Dr. b/n Johnson and Sheridan)

1963



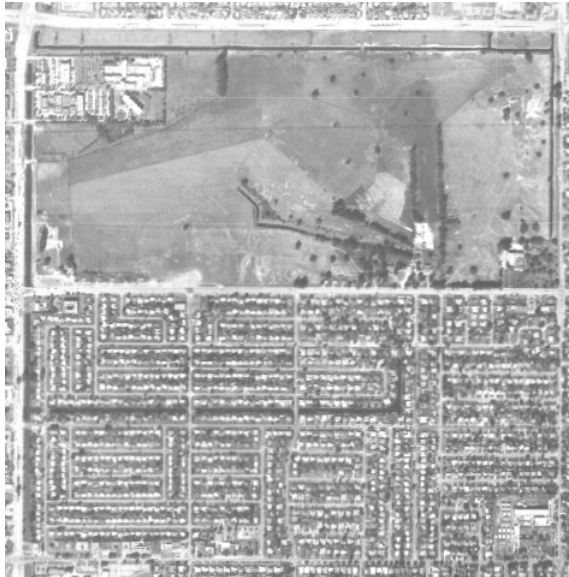
1967



1969



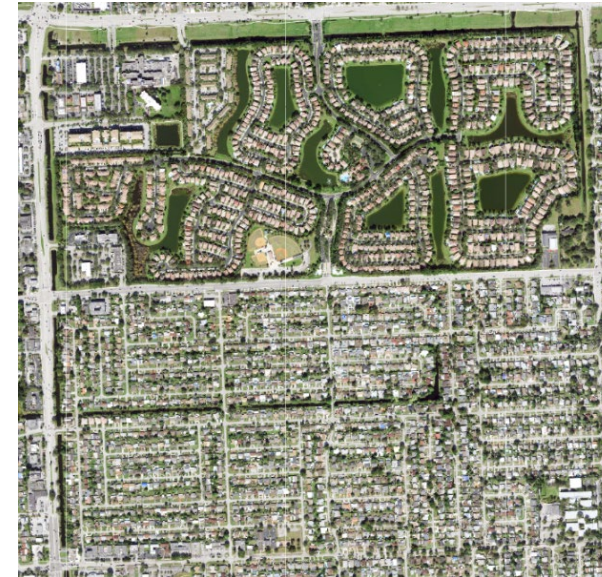
1995



2000



2024



# Development and Redevelopment Patterns (Cont'd)

**Typical SWM Systems  
Hollywood <1950s**



# Development and Redevelopment Patterns (Cont'd)

## Redevelopment of Golf Course into Residential (Single Family)

2015



2024



# Development and Redevelopment Patterns (Cont'd)

## Typical Redevelopment - Residential Multifamily SWM System (highly impervious)

2015



2024



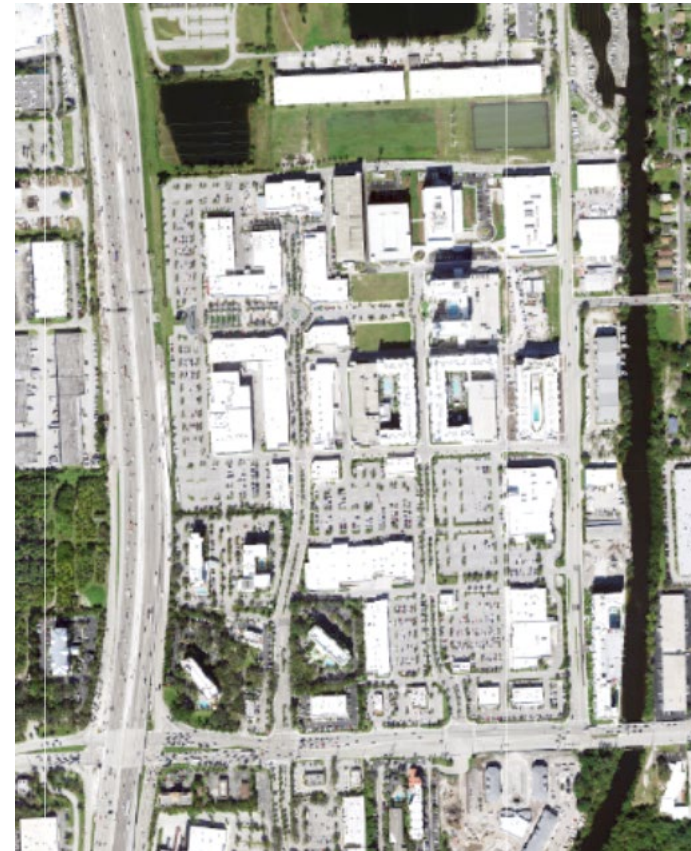
# Development and Redevelopment Patterns (Cont'd)

## Typical Redevelopment - Commercial SWM System (highly impervious)

2015



2024



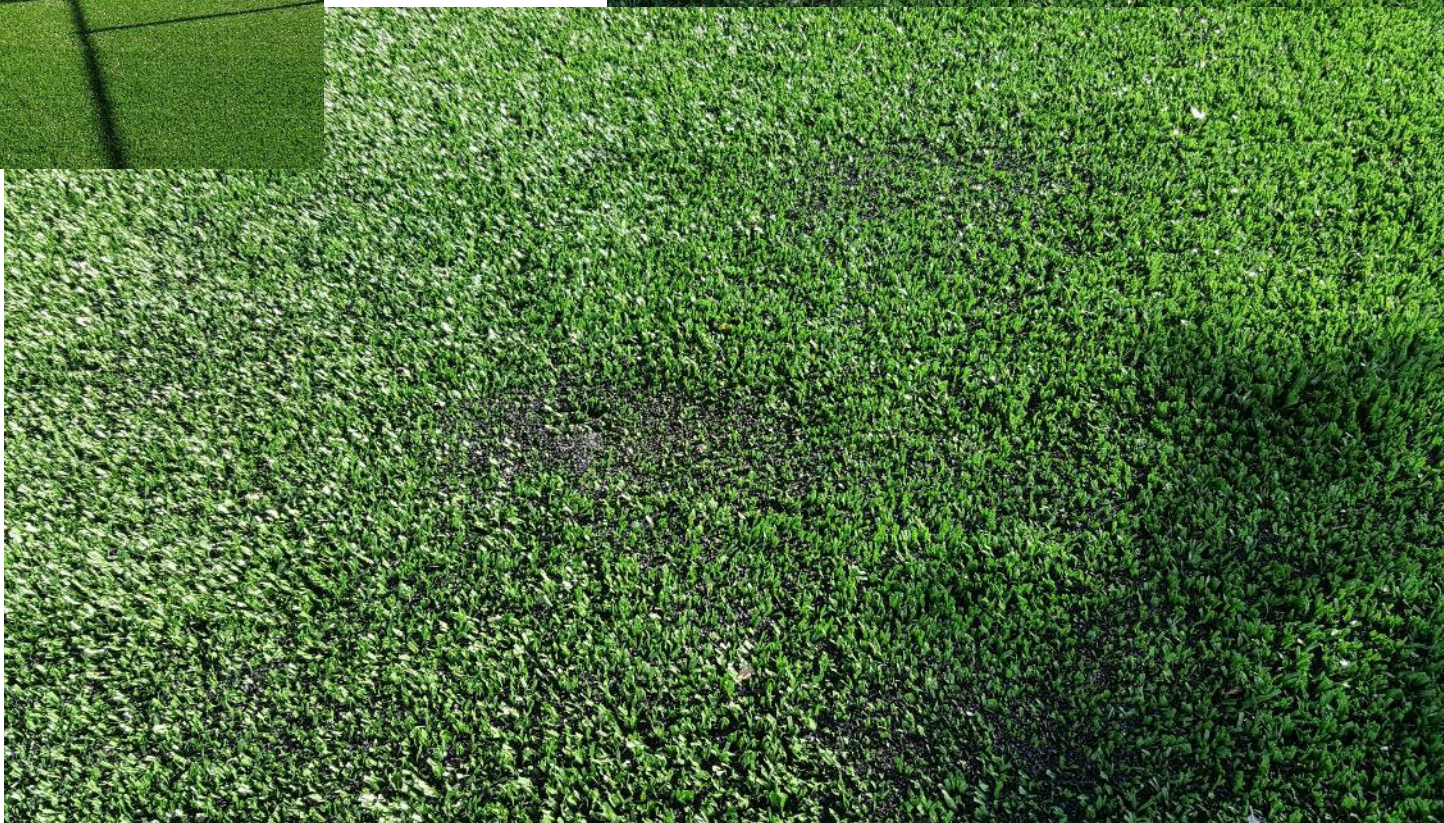
# Innovative Designs for SWM Systems

- Pervious Pavements
- Artificial Turf
- Rainwater Tanks

# Pervious Pavements



# Artificial Turf



# Rainwater Tanks



# Considerations for Broward Next

- Increase community resilience, minimize flood impacts, and protect infrastructure
- Continue identifying needs for upgrades in the current flood control system
- Promote/Require use of alternative stormwater storage options and/or increase storage
- Promote/Require more pervious cover

**Questions?**