

*Office of Sustainability and Resilience & Public Works Dept.*

# Orange County Flood Vulnerability Assessment

**August 26, 2025**



*This work was funded in part through a grant agreement from the Florida Department of Environmental Protection's Office of Resilience and Coastal Protection Resilient Florida Program. The views, statements, findings, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida or any of its subagencies.*



# Agenda

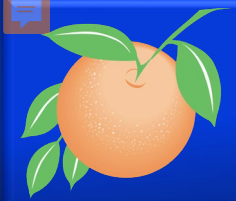
- Overview and Background
- Project Scope and Goals
- Grant Requirements
- Analysis Approach
- Overview of Findings
- Next Steps
- Summary



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# Overview

- **A flood vulnerability assessment was conducted for critical assets in unincorporated Orange County, including those owned or maintained by Orange County, as part of a Resilient Florida Planning Grant we received.**
  - Critical assets included in the vulnerability assessment are eligible for competitive implementation grants.
- **The analysis of potential flooding of assets in future storm events used current asset elevations, reflecting historic or current design standards.**
- **Certain asset types were found to be more prone to future flooding in extreme rainfall events.**
- **Objective- Share the assessment findings for County assets and how this data can inform current and future County initiatives, planning, and policy particularly related to stormwater.**
  - Stormwater Utility – develop prioritized CIP project list
  - Major Basin Master Plan model updates



# Background- Resilient Florida Grant Program

- **Resilient Florida Grant Program – Section 380.093, F.S.**
  - **Created in 2021 when Governor DeSantis signed Senate Bill 1954. The Resilient Florida Program includes grants available across the state intended to address the vulnerabilities to critical assets due to flooding, extreme rainfall, severe weather systems, and sea level rise and the impacts on economic, social, environmental, and public health and safety in our communities.**



# Background

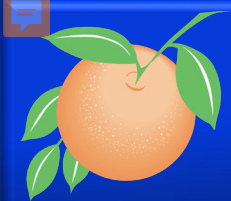
## ▪ Resilient Florida Program – Two Grant Types:

### 1. Planning Grants: provide funding for conducting a vulnerability assessment (VA) of critical assets

- Results are incorporated into a statewide dataset and report developed by FDEP
- Orange County awarded Planning Grant in FY22-23

### 2. Implementation Grants: provide funding for projects seeking to mitigate risks identified in the VA

- VA must be underway to be eligible for implementation grants
- Currently among best funded state programs to receive grants



# Example Implementation Grants

Several awards to inland communities across Central Florida

**\$636,820**  
Stormwater Retention Basin  
Alachua County (21-22)

**\$543,610**  
Stormwater Retention Basin  
Alachua County (21-22)

**\$834,179**  
Drainage Improvements  
City of Williston (21-22)

**\$3,000,000**  
Land Acquisition & Conservation  
Polk County (21-22)

**\$6,375,001**  
Wetland Restoration  
Polk County (24-25)

**\$7,050,000**  
Wetland Restoration  
Polk County (21-22)

**\$239,758**  
Creek Restoration  
City of Gainesville (22-23)

**\$4,746,000**  
Lift Station / Force Main Resiliency  
Gainesville Regional Utilities (21-22)

**\$918,934**  
Bridge Replacement  
Seminole County (23-24)

**\$7,194,500**  
Historic Community Adaptation  
Seminole County (23-24)

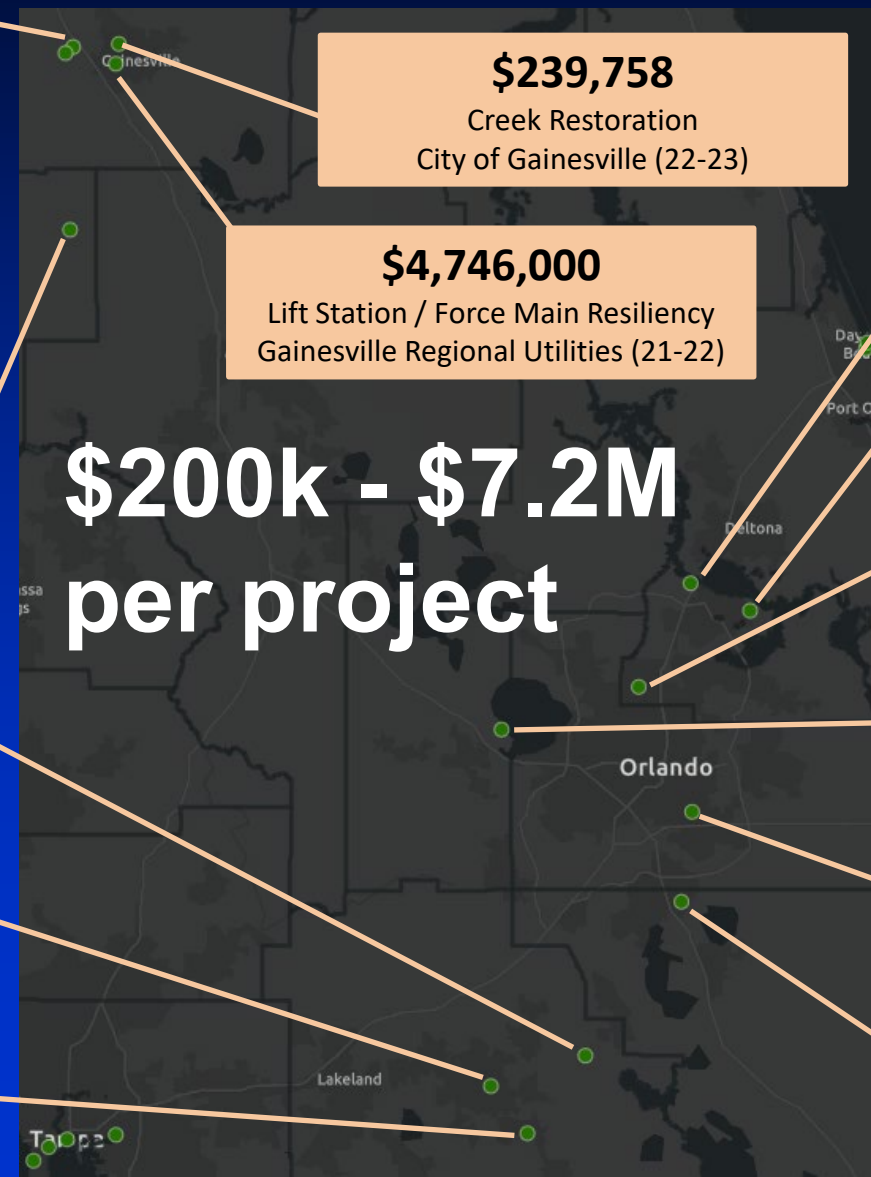
**\$2,588,676**  
Drainage Improvements  
Seminole County (23-24)

**\$1,800,000**  
Retention & Drainage Improvements  
Town of Montverde (21-22)

**\$196,862**  
Roadway Reconstruction  
City of Belle Isle (21-22)

**\$1,529,187**  
Water Treatment Plant Improvements  
Tohopekaliga Water Authority (22-23)

**\$200k - \$7.2M  
per project**





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- Overview and Background
- **Project Scope and Goals**
- Grant Requirements
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# Project Scope and Goals

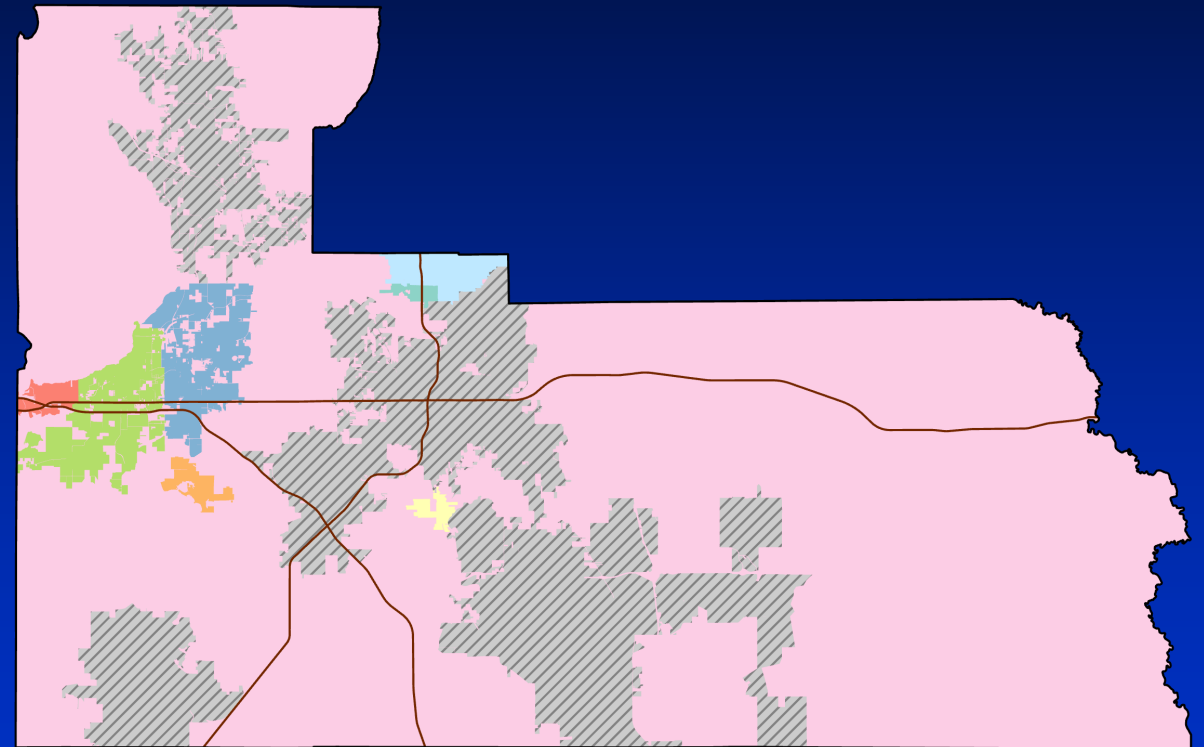
- **Develop countywide vulnerability assessment**
  1. **Map known Critical Assets**
  2. **Identify those Critical Assets Vulnerable to Flooding**
    - **Current and Future Conditions**
- **Follow Grant and Statutory Requirements** (s. 380.093, F.S.)





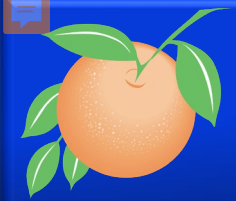
# Project Scope- Area Included

- Unincorporated Orange County
- Partnering municipalities (7)
  - Eatonville
  - Edgewood
  - Maitland
  - Oakland
  - Ocoee
  - Windermere
  - Winter Garden



<b>Legend</b>			
OC Boundary	Major Highways	Edgewood	Windermere
Non-OCVA Municipalities (Excluded)	Eatonville	Maitland	Winter Garden
OCVA Areas	Oakland	Ocoee	Unincorporated OC

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# Major Statutory and Grant Requirements

- Use best available data to inform study
- Flood analysis based on current year, 2040, and 2070 extreme rainfall depths
- Include **unincorporated County and partner jurisdictions**
- Stakeholder Outreach and Engagement
- Grant Reporting

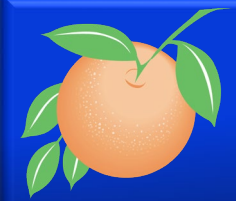




# Stakeholder Involvement

- Formed working group to consider multiple perspectives
- Representatives from:
  - County Divisions
  - Partnering municipalities
- 3 meetings over the course of the analysis
- Identified missing critical asset types

The screenshot shows a meeting slide for "ORANGE COUNTY COMPREHENSIVE VULNERABILITY ASSESSMENT". The slide includes the following text: "Integrated Working Group Meeting 2 - Task 3", "May 13, 2025 | 10:00 a.m. - 11 a.m.", and "Grant No. 23PLN25". It also lists the presenters: "DRUMMOND CARPENTER engineering + research" and "ORANGE COUNTY GOVERNMENT FLORIDA". To the right of the slide is a video conference grid with several participants, including Pete Johnstone, Justin H. Gregory, PE, Murray, Lisa Minnis, Emma Sut..., Max Walla..., Lee Mullon, Cathy Foe..., and Aubrey Lit... Below the slide and grid is a photograph of a meeting room with a microphone in the foreground and people seated at a long table.



# Critical Asset Definition



## Transportation & Evacuation Routes

- Airports
- Bridges
- Bus Terminals
- Ports
- Major Roadways
- Marinas
- Rail Facilities
- Railroad Bridges

**Broad list with no additional descriptions**



## Critical Infrastructure

- Wastewater Treatment Facilities
- Lift Stations
- Stormwater Treatment Facilities
- Pump Stations
- Drinking Water Facilities
- Water Utility Conveyance Systems
- Electric Production and Supply Facilities
- Solid Hazardous Waste Facilities
- Military Installations
- Communications Facilities
- Disaster Debris Management Sites



## Community & Emergency Facilities

- Schools, Colleges, and Universities
- Community Centers
- Disaster Recovery Centers
- Emergency Medical Service Facilities
- Emergency Operations Centers
- Fire Stations
- Health Care/Hospitals
- Law Enforcement Facilities
- Local and State Government Facilities
- Logistical Staging Areas
- Affordable Public Housing
- Risk Shelter Inventory



## Natural, Cultural & Historical

- Conservation Lands
- Parks
- Shorelines
- Surface Waters
- Wetlands
- Historical and Cultural Assets



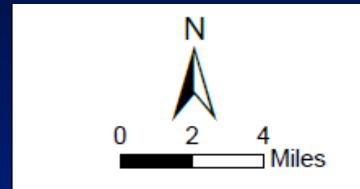
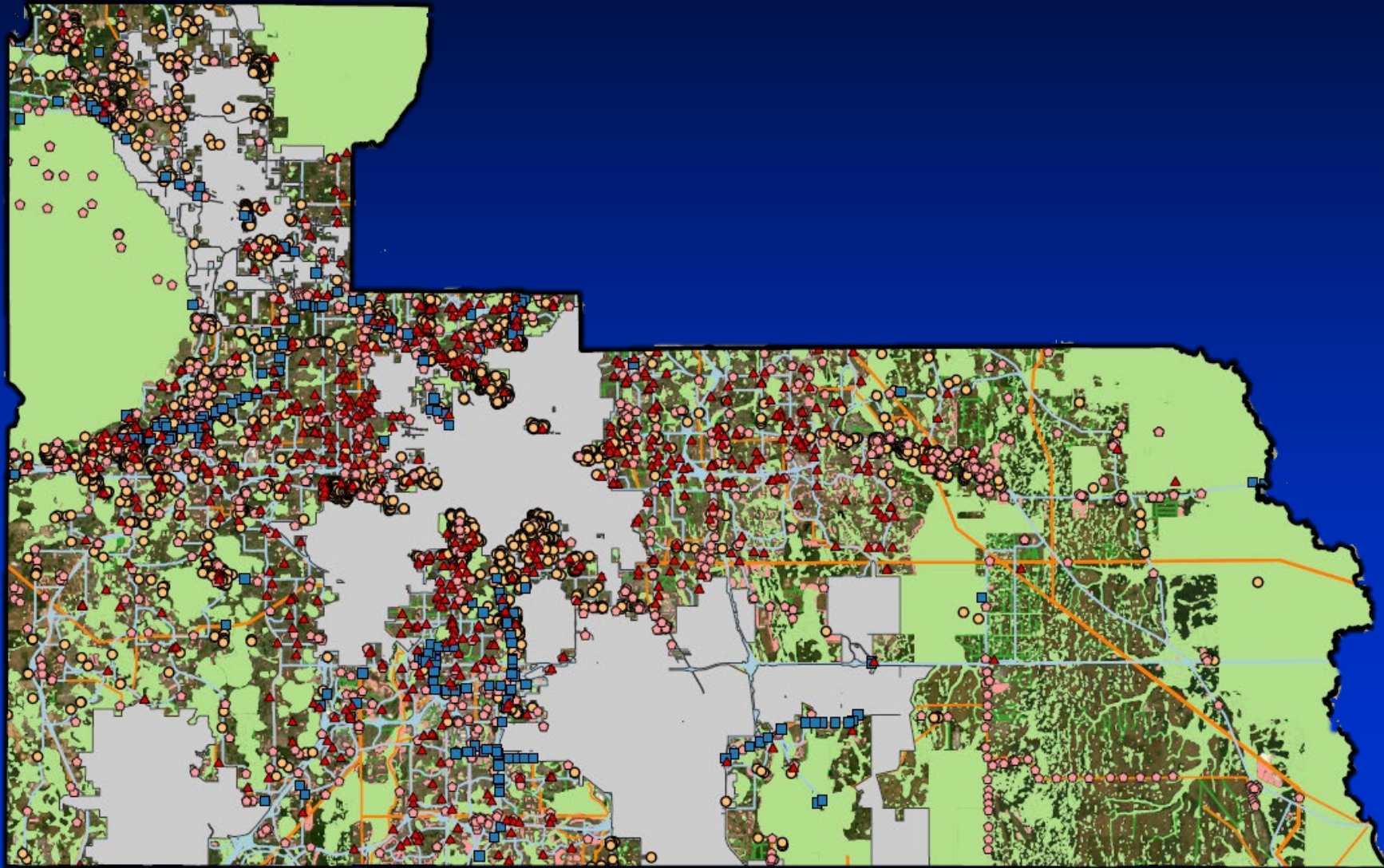
# Critical Asset Inventory

- Reviewed statewide database (FDEP)
  - Deemed insufficient based on comprehensiveness and accuracy
- Developed County database
  - More accurate local data
  - Stakeholder feedback (food security, fuel)
- Critical Assets Total
  - 26,891 (statewide database)
  - 158,552 (updated County database)\*





# Critical Asset Inventory



- ### Legend
- Transportation and Evacuation
  - ◊ Critical Infrastructure
  - ▲ Critical Community Emergency Facilities
  - Natural Cultural Historical Resources
  - Transportation and Evacuation Routes
  - Critical Infrastructure Lines
  - Natural Cultural Historical Resources Lines
  - Natural Cultural Historical Resources Areas
  - Critical Infrastructure Areas
  - ▭ Orange County Boundary
  - ▭ Non-OCVA Municipalities (Excluded)

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# Flood Analysis – Requirements

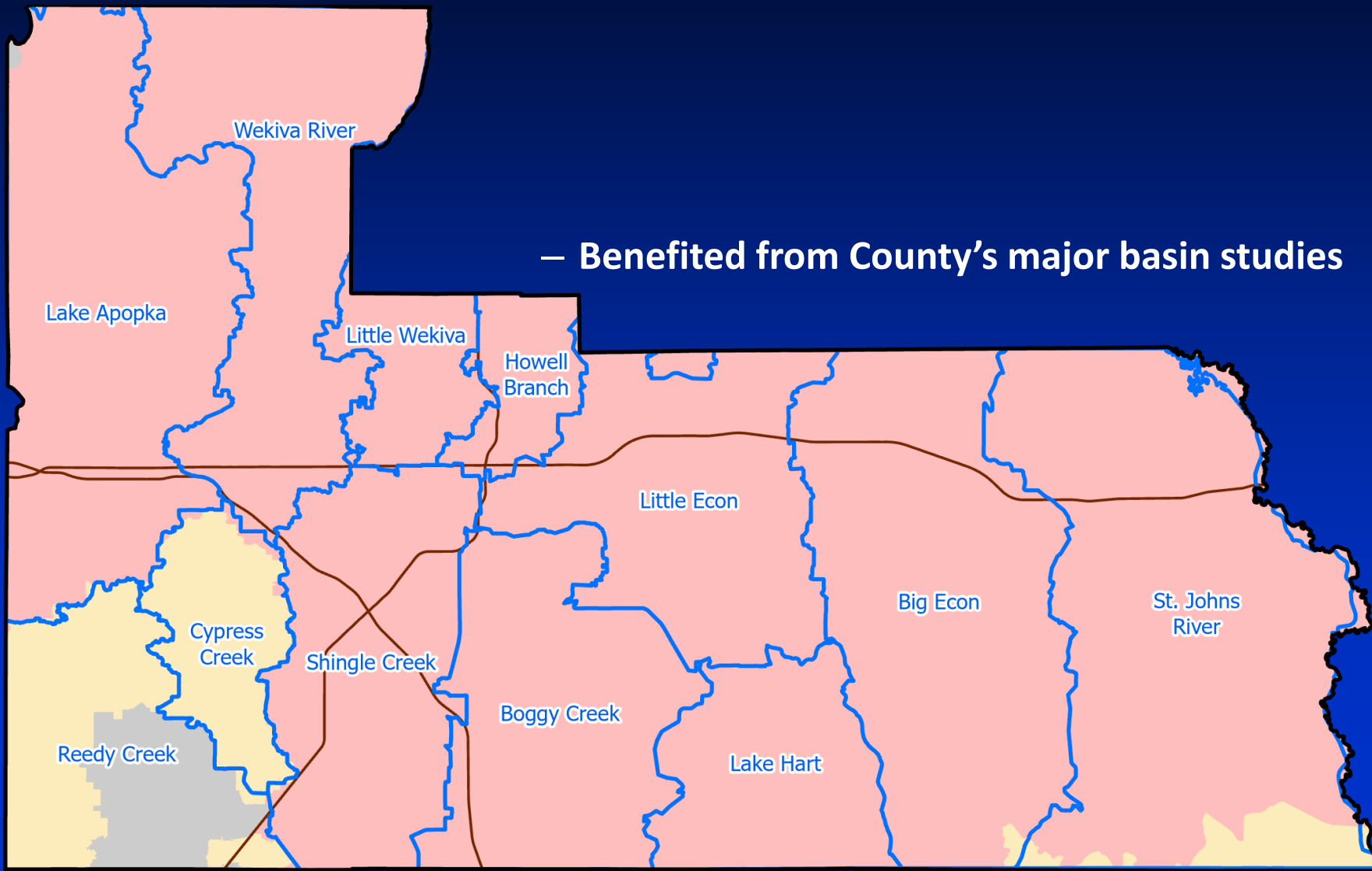
- **Statutorily Required Storm Events**
  - 100-year (1% annual chance)
    - *Similar risk shown on FEMA Flood Maps*
  - 500-year (0.2% annual chance)
- **Statutorily Required Scenarios**
  - Current (2020)
  - Future (2040 and 2070)
- **Develop Countywide Flood Depth Estimates**
  - Must be detailed enough to calculate flood depth or percent inundation at each asset





# Flood Analysis – Models

– Benefited from County’s major basin studies



**Legend**

- OC Boundary
- Major Basins
- Existing Model
- New Rapid 2D Watershed Model
- Outside of Study Area (Excluded)
- Major Highways

N

0    2.5    5    10  
Mi



# Flood Analysis – Rainfall Depth

- Existing Conditions – NOAA Atlas 14
- Future Conditions – USGS Rainfall Future Projections
- **Future levels do not reflect any future flood mitigation**
  - Conservative approach to meet project goals and identify:
    - Impacted assets to support future implementation grants
    - Assets that may be more sensitive to future changes

Storm Event	Rainfall Depth (in)		
	2020	2040	2070
100-yr	10.3	12.3	13.5
500-yr	14.1	17.3	19.3



# Flood Analysis – Rainfall Depth

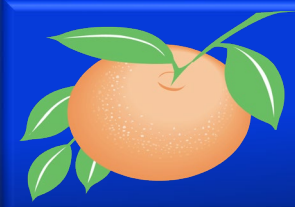
## 24-hour Rainfall Depths Modeled During this Study

Storm Event	Rainfall Depth (in)		
	2020	2040	2070
100-yr	10.3	12.3	13.5
500-yr	14.1	17.3	19.3

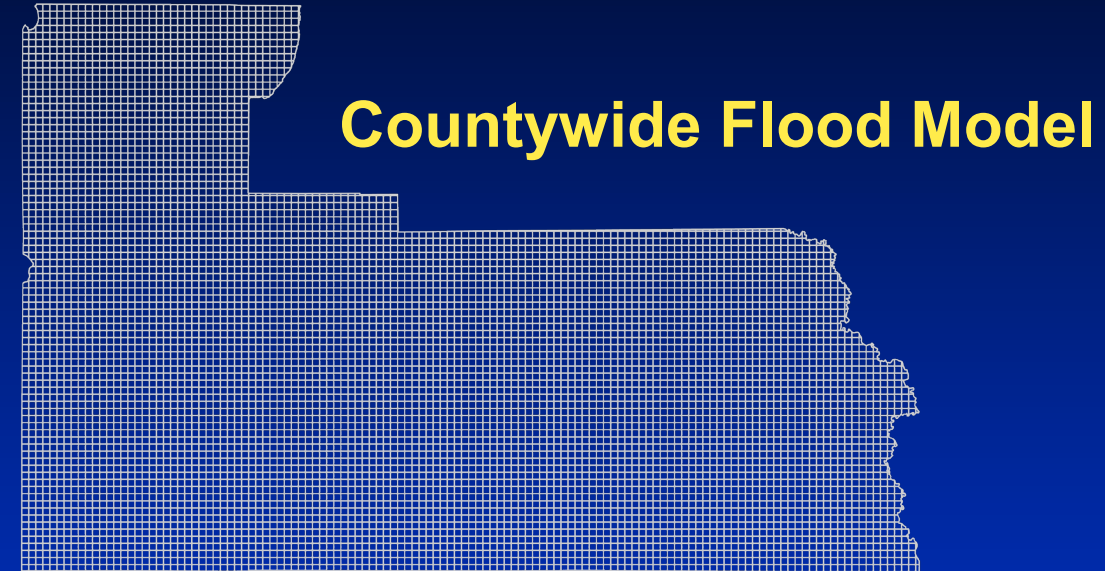
- The range of model rainfall depths (including “future”) were recorded across the County during Hurricane Ian.
- Rain intensity may vary across the County during a real storm.
- Model scenarios estimate relative risk. They are not a prediction of what will happen.

## 24-hour Rainfall Depths Recorded at County Gauges During Hurricane Ian

District	Hurricane Ian 24-hour Rainfall (in)	24-Hour Storm Event (Approx.)
1	8.3 – 19.4	50 – 1000+ year
2	4.6 – 17.2	2 – 1000+ year
3	11.9 – 14.6	200 – 500 year
4	11.5 – 12.4	200 year
5	10.2 – 13.7	100 – 500 year
6	12.2 – 13.2	200 – 400 year
Average	11.7	200 year

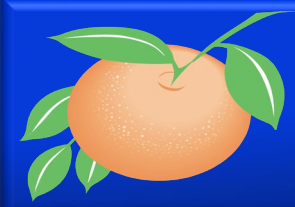


# Comparison to County's Major Basin Studies



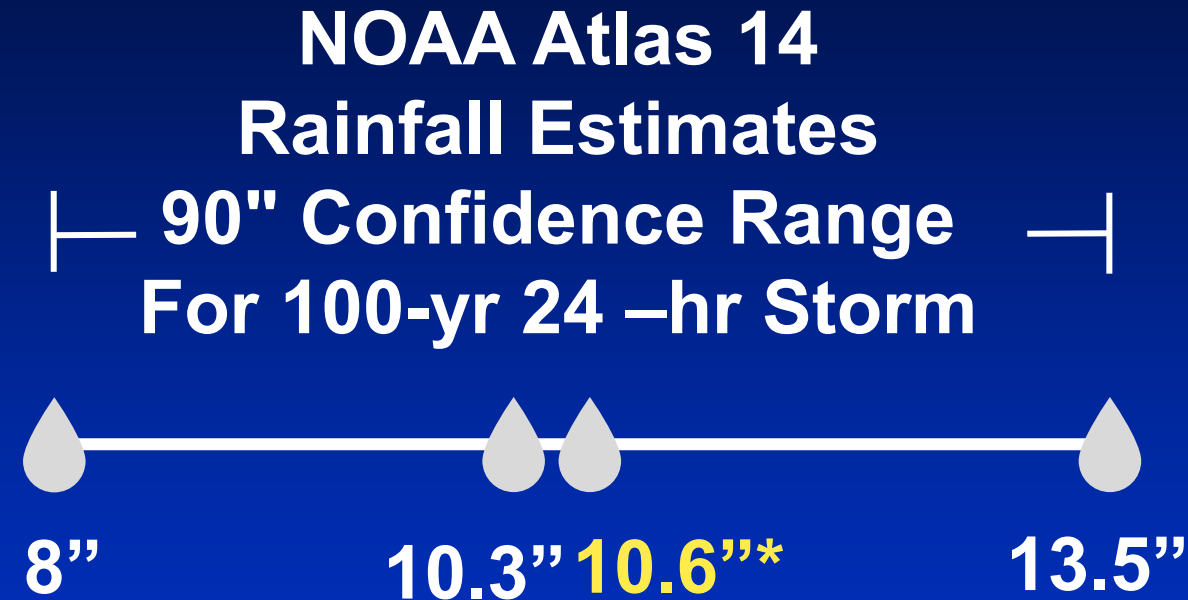
- **Determine Flood Level of Service**
  - Smaller, More Frequent Storms (10, 25, 100 yr)
- **Develop Capital Improvement Plan Strategy**
- **Update FEMA Regulatory Floodplains**

- **Meet Statutory Requirements**
- **Determine Vulnerability of Critical Assets to Extreme Rainfall Events**
  - Larger, Less Frequent Storms (100 yr, 500 yr)
- **Make the County Eligible for Resilient Florida Implementation Grant**



# Comparison to County's Major Basin Studies

- Different tools to address flood risk
- Vulnerability does not mean failing level of service
- Storms analyzed are much larger than local, state, national standards for infrastructure
- Rainfall assumptions based on NOAA Atlas 14 Publication
  - Used the Average near the Executive Airport (10.3 inches)




*\* Current County  
Regulatory Standard*



# Flood Model Results










**Legend**

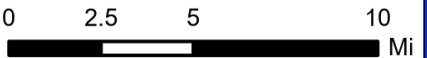
 OC Boundary

Inundation Depth in Feet

**Value**

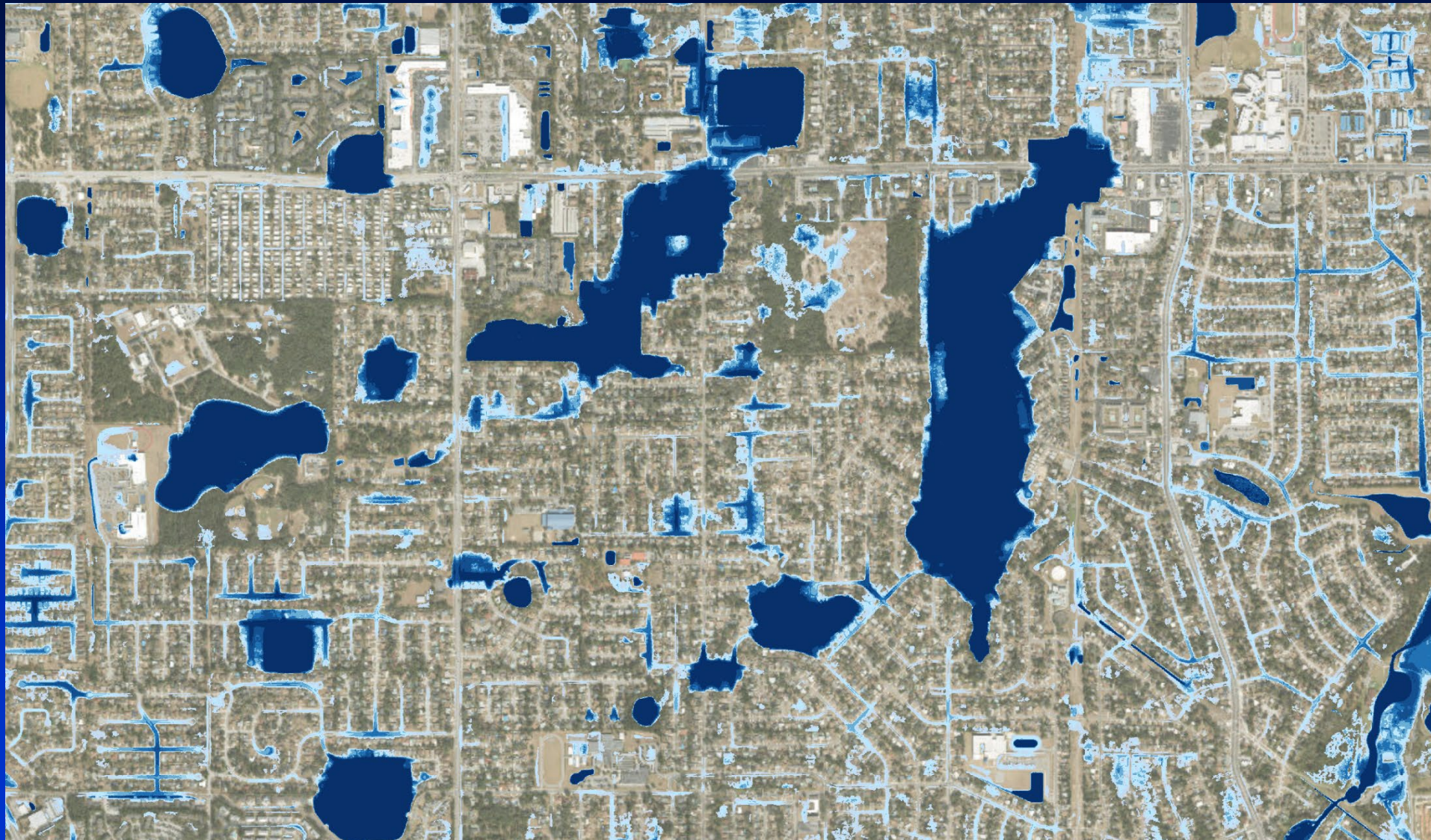
	< 0.5
	0.6 - 1
	1.1 - 1.5
	1.6 - 2
	2.1 - 3
	> 3

 N

 0 2.5 5 10 Mi









# Flood Model Results (Example)



**Legend**  
Inundation Depth in Feet

**Value**

	< 0.5
	0.6 - 1
	1.1 - 1.5
	1.6 - 2
	2.1 - 3
	> 3

**500-year  
(2070)**





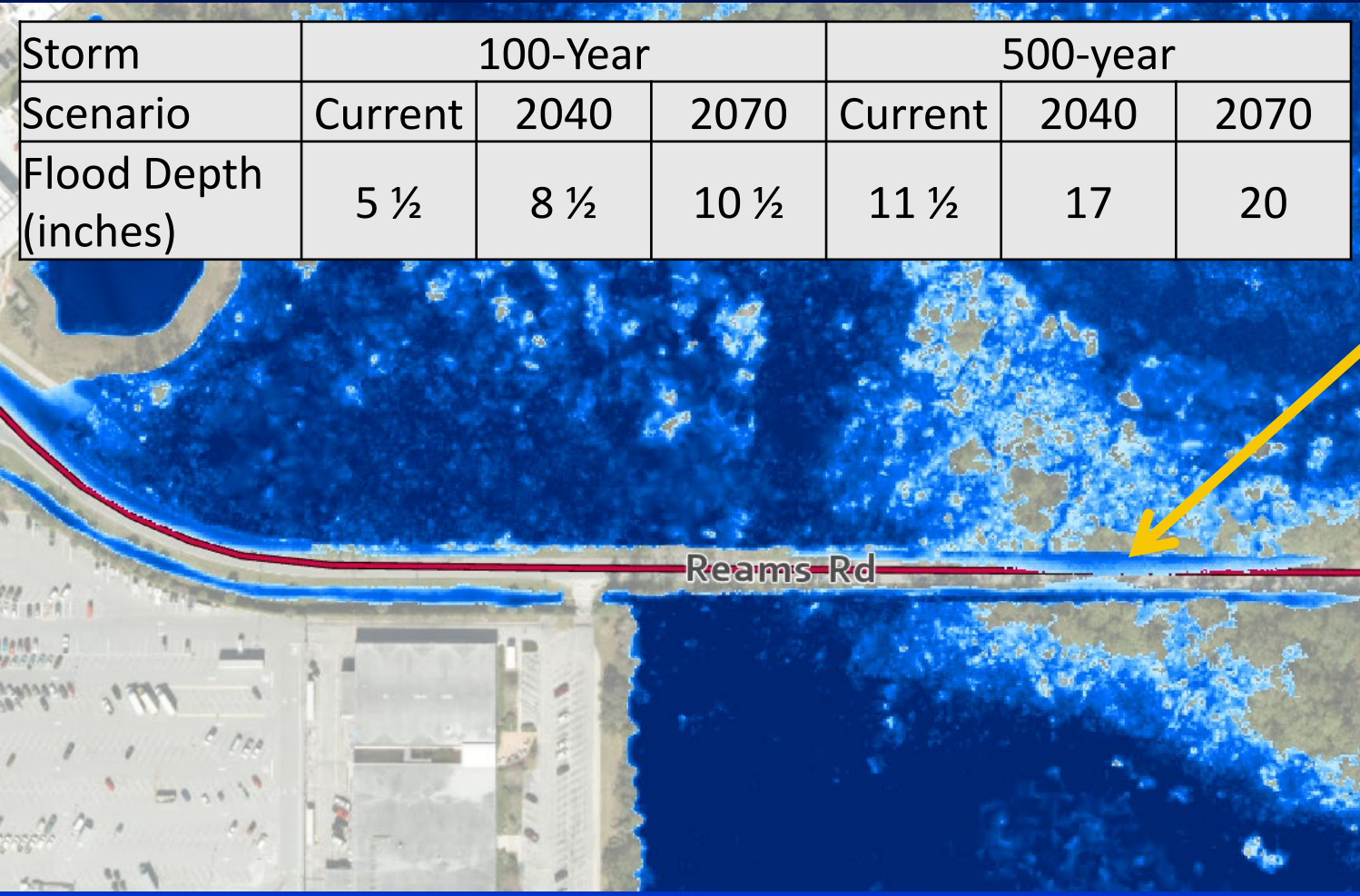
# Mapping Critical Asset Flood Vulnerability

- Applied Flood Depth Results to Mapped Assets
- Various Approaches Were Needed to Estimate Vulnerability





# Mapping Critical Asset Flood Vulnerability



Max flood depth along road centerline



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# **Summary of Vulnerable Critical Assets (Overall - Regardless of Ownership/Maintenance)**



# Findings - Impacts by Commission District

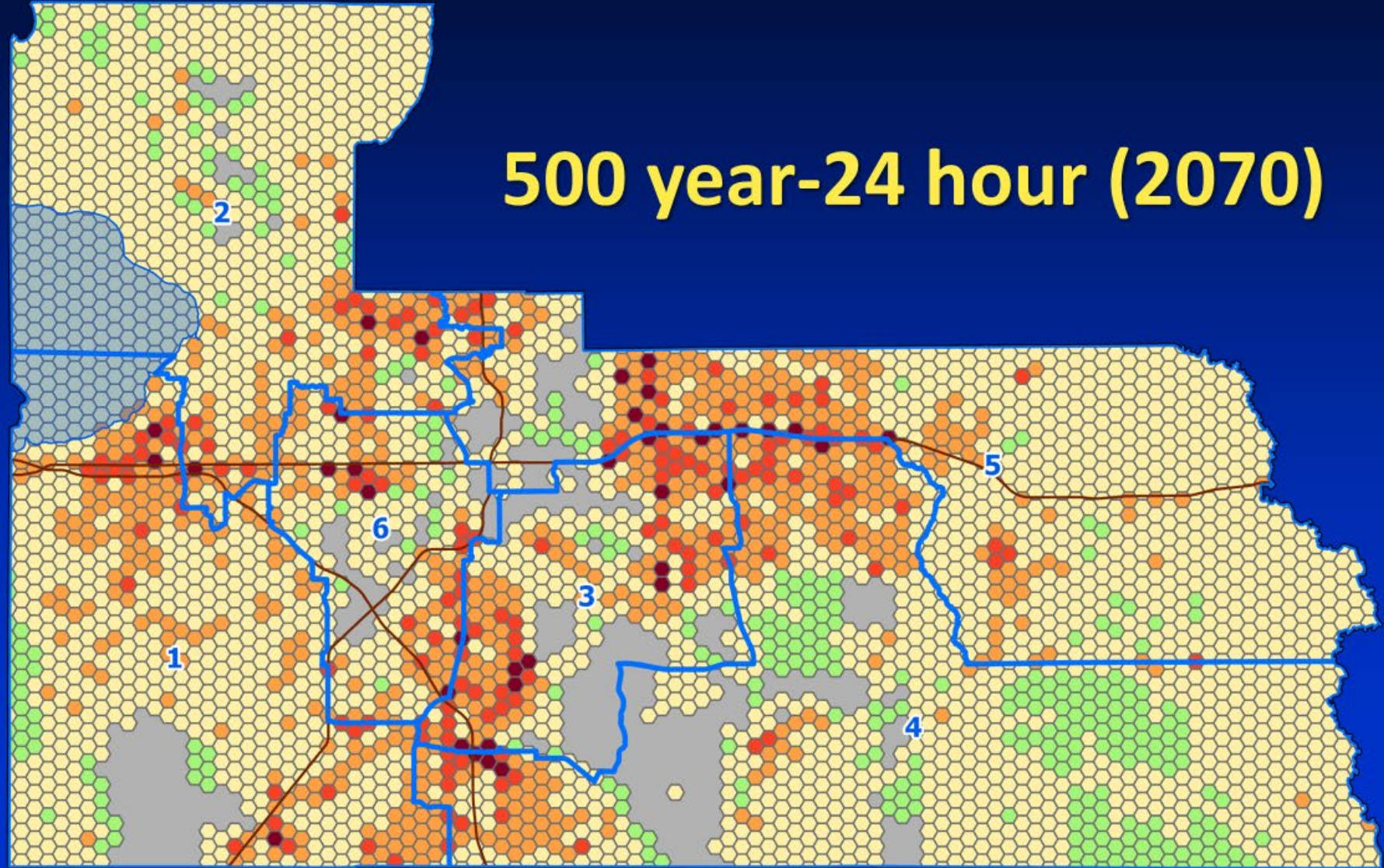
- Percent of assets impacted consistent with ranges in statewide assessment
- Many assets not designed for 100+ year storms
- **Percent of assets impacted was similar across districts**
- Hotspots are best visualized with maps

County Commission District	Asset Total	Number of Impacted Assets (% of total within District)					
		100-year			500-year		
		2020	2040	2070	2020	2040	2070
1	6,161	1,966 (32%)	2,211 (36%)	2,341 (38%)	2,393 (39%)	2,640 (43%)	2,817 (46%)
2	5,019	1,265 (25%)	1,463 (29%)	1,587 (32%)	1,639 (33%)	1,893 (38%)	2,023 (40%)
3	3,985	1,633 (41%)	1,761 (44%)	1,847 (46%)	1,869 (47%)	2,091 (53%)	2,171 (55%)
4	5,462	2,040 (37%)	2,194 (40%)	2,271 (42%)	2,303 (42%)	2,473 (45%)	2,553 (47%)
5	5,794	1,805 (31%)	2,061 (36%)	2,187 (38%)	2,248 (39%)	2,494 (43%)	2,582 (45%)
6	2,515	853 (34%)	959 (38%)	1,016 (40%)	1,044 (42%)	1,129 (45%)	1,183 (47%)



# Findings – Impacts by Commission District

## 500 year-24 hour (2070)



**Legend (500y 2070)**

- Commission Districts
- OC Boundary
- Lake Apopka
- Major Highways

**Assets Impacted per 0.25 sqmi**

- 0
- 1 - 10
- 11 - 20
- 21 - 30
- 31 - 70

N

0 2.5 5 10 Mi



# Findings – Impacts by Asset Category

- **Critical Infrastructure and Transportation and Evacuation Routes** were identified as most vulnerable
- Total impacted asset list useful for understanding flood risk within community

Asset Category	Asset Total Count	Number of Impacted Assets (% of category total)					
		100 -year			500-year		
		2020	2040	2070	2020	2040	2070
Critical Infrastructure	14,597	<b>6,125</b> (42%)	<b>6,735</b> (46%)	<b>7,070</b> (48%)	<b>7,215</b> (49%)	<b>7,916</b> (54%)	<b>8,258</b> (57%)
Transportation and Evacuation Routes	3,398	<b>741</b> (22%)	<b>894</b> (26%)	<b>977</b> (29%)	<b>1,009</b> (30%)	<b>1,197</b> (35%)	<b>1,283</b> (38%)
Natural, Cultural, and Historical Resource	11,285	<b>2,547</b> (23%)	<b>2,885</b> (26%)	<b>3,075</b> (27%)	<b>3,149</b> (28%)	<b>3,520</b> (31%)	<b>3,718</b> (33%)
Critical Community and Emergency Facilities	2,764	<b>66</b> (2%)	<b>86</b> (3%)	<b>100</b> (4%)	<b>180</b> (4%)	<b>161</b> (6%)	<b>213</b> (8%)

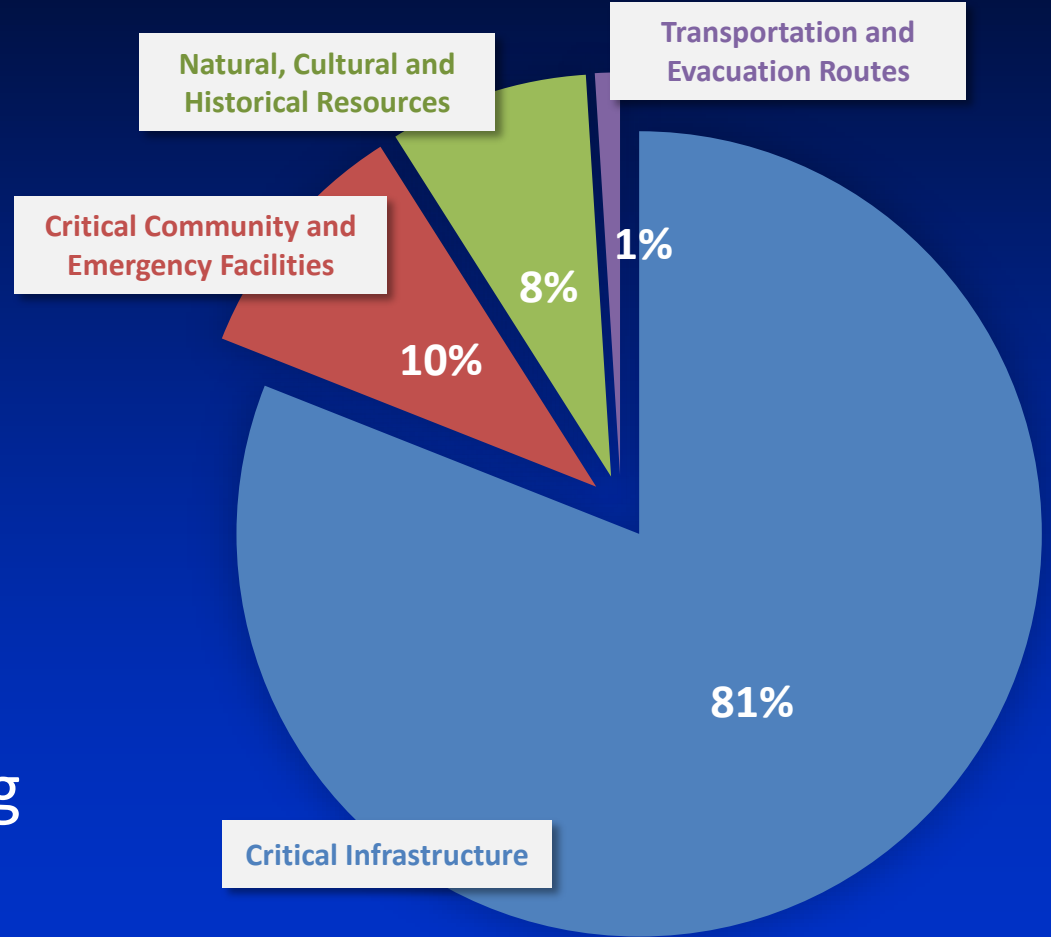


# Summary of Vulnerable Critical Assets (County Owned/Maintained)



# Findings – Vulnerable County Assets Summary

- **3,656** critical assets owned or maintained by the County were identified
- **1,491 – 2,087 (41 - 57%)** were identified as impacted depending on scenario



- **Critical Infrastructure**  
– 40% of which are stormwater ponds
- **Critical Community and Emergency Facilities**
- **Natural, Cultural, and Historical Resources**
- **Transportation and Evacuation Routes**  
– Not including roadways



# Findings – Most Vulnerable County Assets

**Primarily Horizontal Infrastructure are the Most Vulnerable County Owned Assets**

## 1. Stormwater Ponds

– *Designed for appropriate (smaller) storms but secondary infrastructure may be at risk*

## 2. Pump Stations

## 3. Lift Stations

Asset Type	Total Count	100-Year			500-Year		
		2020	2040	2070	2020	2040	2070
Ponds	1,919	1,255 (65.4%)	1,363 (71.0%)	1,414 (73.7%)	1,432 (74.6%)	1,556 (81.1%)	1,604 (83.6%)
Pump Stations	17	5 (29.4%)	9 (52.9%)	10 (58.8%)	10 (58.8%)	13 (76.5%)	13 (76.5%)
Stormwater Monitoring and Communication	25	7 (28.0%)	8 (32.0%)	10 (40.0%)	10 (40.0%)	13 (52.0%)	14 (56.0%)
EPA Superfund and Brownfield sites	8	2 (25.0%)	3 (37.5%)	3 (37.5%)	3 (37.5%)	3 (37.5%)	3 (37.5%)
Marinas and Boat Ramps	14	3 (21.4%)	6 (42.9%)	7 (50.0%)	8 (57.1%)	8 (57.1%)	8 (57.1%)
Solid Waste Management Facilities	88	11 (12.5%)	15 (17.0%)	15 (17.0%)	16 (18.2%)	23 (26.1%)	28 (31.8%)
EV Charging Stations	9	1 (11.1%)	1 (11.1%)	1 (11.1%)	1 (11.1%)	1 (11.1%)	1 (11.1%)
Communication Towers	37	3 (8.1%)	5 (13.5%)	5 (13.5%)	5 (13.5%)	9 (24.3%)	10 (27.0%)
Wastewater Treatment Facilities and Lift Stations	748	57 (7.6%)	81 (10.8%)	106 (14.2%)	115 (15.4%)	155 (20.7%)	184 (24.6%)



# Findings – Roadway Impacts

- Identified from FDOT data
- Of interest to the County regardless of ownership (e.g., evacuation routes)
- Impact expressed as flood length and percent of total road length

## Impacted Major Roadways

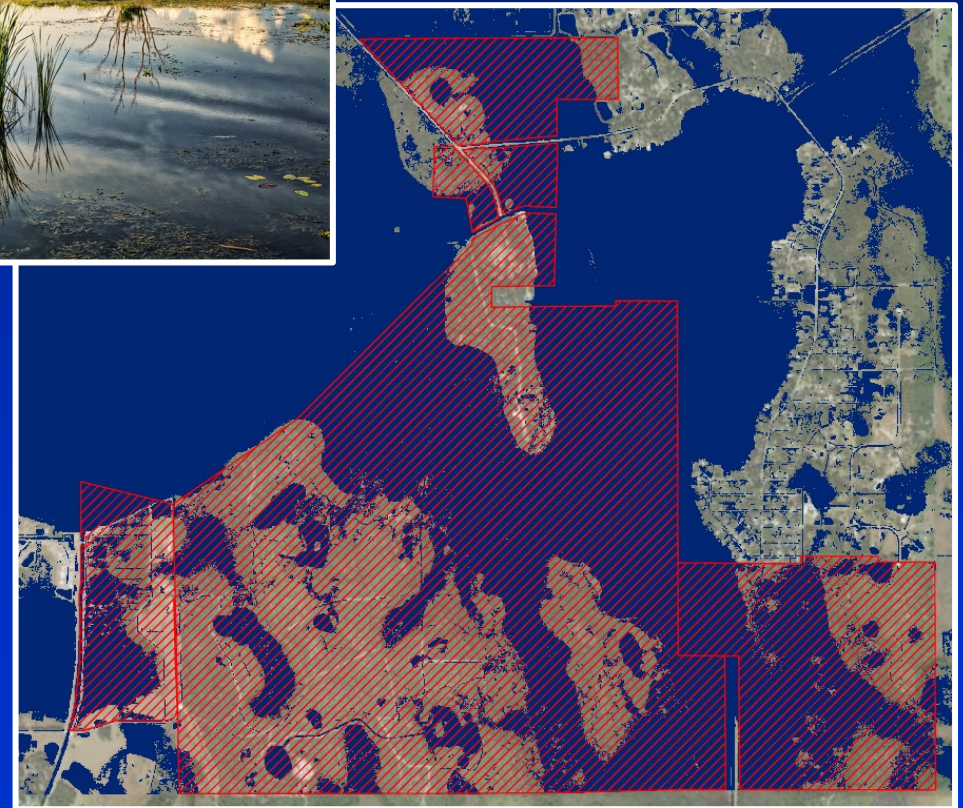
Total Count	100-Year			500-Year		
	2020	2040	2070	2020	2040	2070
2,011	574 (28.5%)	689 (34.3%)	751 (37.3%)	777 (38.6%)	924 (45.9%)	988 (49.1%)

## Length of Flooded County Maintained Roads (100-year, 2020) - Preliminary

Total Road Length (miles)	Flooded Road Miles (% Road Length Flooded)	
	Flood Depth > 3 Inches <i>FDEP Medium Risk</i>	Flood Depth > 6 Inches <i>FDEP High Risk</i>
3,088	491 (16%)	329 (11%)



# Findings – Park & Conservation Area Impacts



- Often meant to store water
- Not intended to be used during extreme weather events

*Green PLACE providing floodplain services*





# Impacted Assets Summary (Changes by 2070)

## ▪ Largest total change

- Ponds (349)
- WWTF & Lift Stations (127)
- Solid Waste Management (17)
- Schools (15)

## ▪ Largest percent change

- Bus Terminals
- Fueling Stations
- Pump Stations
- Marinas

## Largest change relative to current 100-year impact count

- Schools
- Wells
- Communication Towers
- WWTF & Lift Stations

*\*Excludes stormwater assets (manholes, inlets, etc.)*



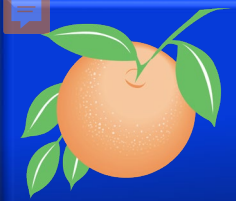
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# Next Steps

- **Complete grant**
  - Conduct final stakeholder outreach/education
    - Sustainability Advisory Board
    - Regionally Significant Asset Owners (~35)
    - Representative Community Organizations





# Next Steps

- Evaluate and prioritize projects for Resilient Florida Implementation Grants countywide
- CIP planning within Departments and Divisions
- Inform Public Works Department's efforts on stormwater infrastructure and planning
  - Stormwater Utility
    - Phase 2
  - Major Basin Master Plan model updates





# Next Steps

## Status of Stormwater Utility Fee

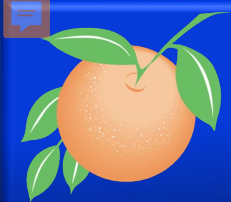
### ■ Phase 2

– Project started in August 2025

– Tasks include:

- impervious area database to capture data for all County parcels
- Develop Credit Policy
- Draft billing file
- Develop and implement a Community Outreach Program
  - Public Meetings
  - Community Survey
    - » Provide input on areas of need throughout the county
    - » New Stormwater Community Feedback Survey
- Develop prioritized project list (informed by VA and Basin updates)
- Board work session early 2026





# Next Steps

## Estimated Additional CIP Needs

- Stormwater \$415M
- Roadway \$497M
- Water Quality \$468M
- Total \$1.38B
  
- 25 year goal to fund
- Additional \$55.2M per year needed

Level of Service	Estimated Capital Improvement Project Backlog	CIP Implementation Plan Term	Annual CIP Budget
A	Prioritized Implementation	10 Years	\$138.0 million
B	Phased Implementation	25 Years	\$55.2 million
C	Inspection-Based Implementation	50 Years	\$27.6 million
D	Critical Needs Only Implementation	100 Years	\$13.8 million
	Current Funding	>100 Years	\$10.8 million

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- **Completed flood risk analyses for critical assets within the County and sharing the findings and data with asset owners.**
- **Horizontal infrastructure was identified as the most vulnerable assets owned by the County.**
- **Coordinating internally with different departments on next steps to incorporate the findings from this data into future planning and initiatives, including the work on the stormwater utility, basin plan updates and evaluate projects for grants.**