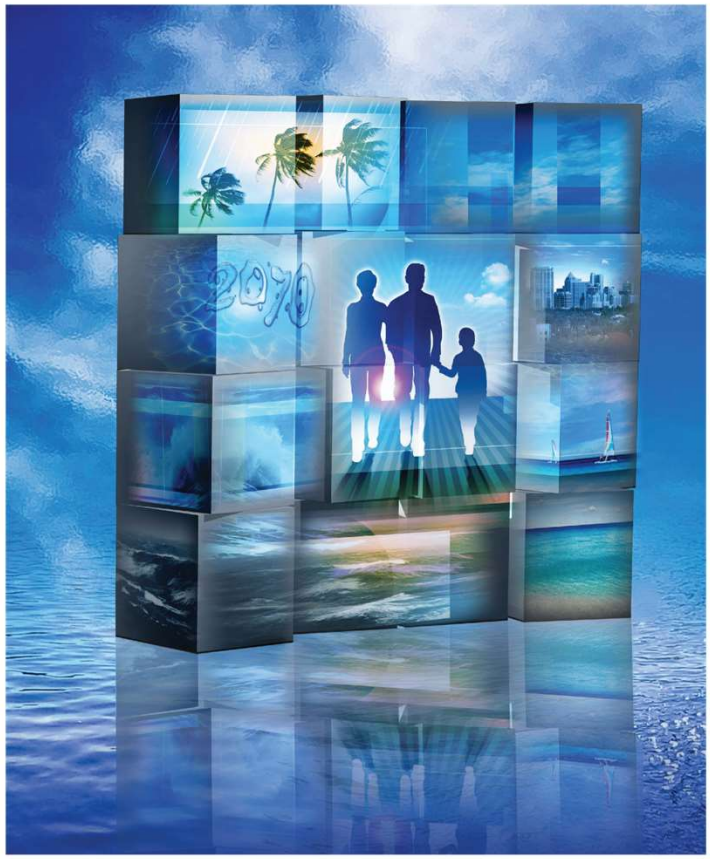
Countywide Risk Assessment and Resilience Plan

Resilience Steering Committee Meeting

August 10, 2022

Outline

1. **Resilience Plan Progress Update**
2. **Preliminary Data Request**
3. **Hydrologic Modeling**
   a) Basics of south Florida water management
   b) Broward County Future Conditions 100-Year Flood Elevation Map
   c) Model adaptation for Resilience Plan
   d) Event simulations, boundary conditions, outputs
4. **Introduction to Economic Modeling Methodology**
5. **Other**
6. **Adjournment**



1

Resilience Plan Progress Update

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Predecessor Work by the County has been instrumental

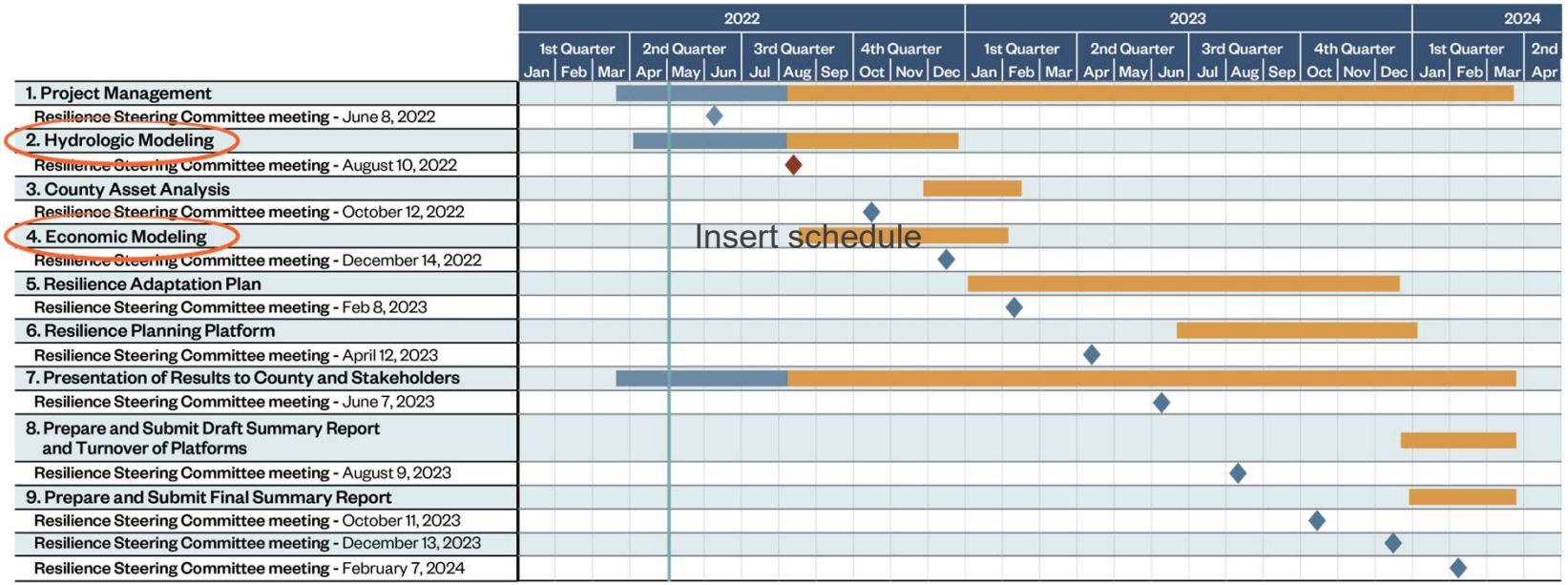
Revised (Future) Groundwater Maps

Revised Design Rainfall Amounts

Revised (Future) 100 yr Flood Elevation Maps

Countywide Risk Assessment and Resilience Plan

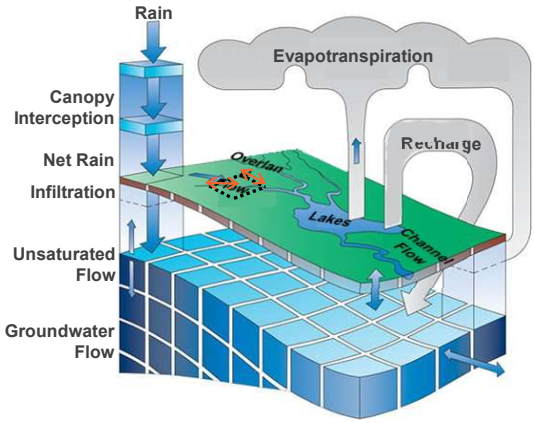
Tasks are progressing on schedule to date



Current Focus is on Hydrologic Modeling and Economic Modeling Methodology

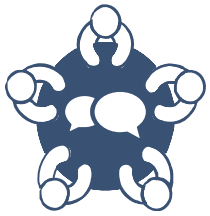
Looking ahead ...

- Continue Hydrologic Modeling
- Complete Economic Modeling Methodology and begin implementation



MIKE SHE- MIKE HYDRO RIVER

- Complete Baseline Hydrologic Modeling
- Continue Economic Modeling
- Begin County Asset Analysis



[RSC Meetings 10/12 & 12/14]

October 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

December 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
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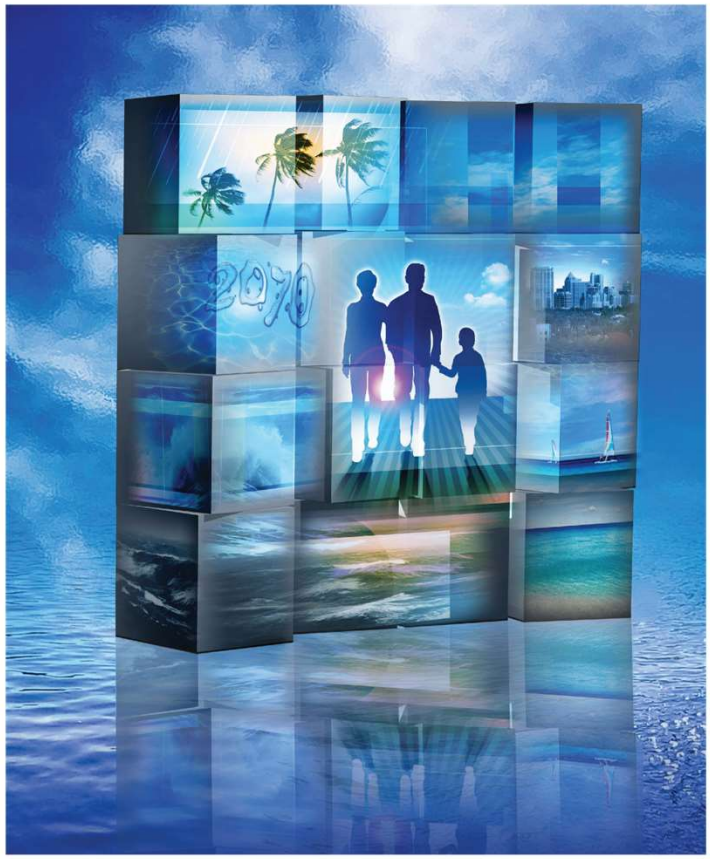

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Preliminary Data Request

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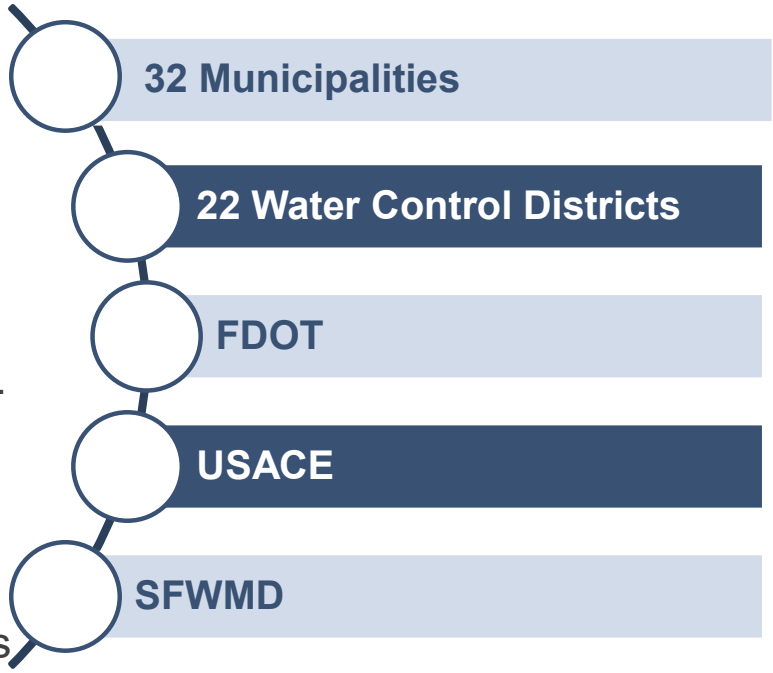
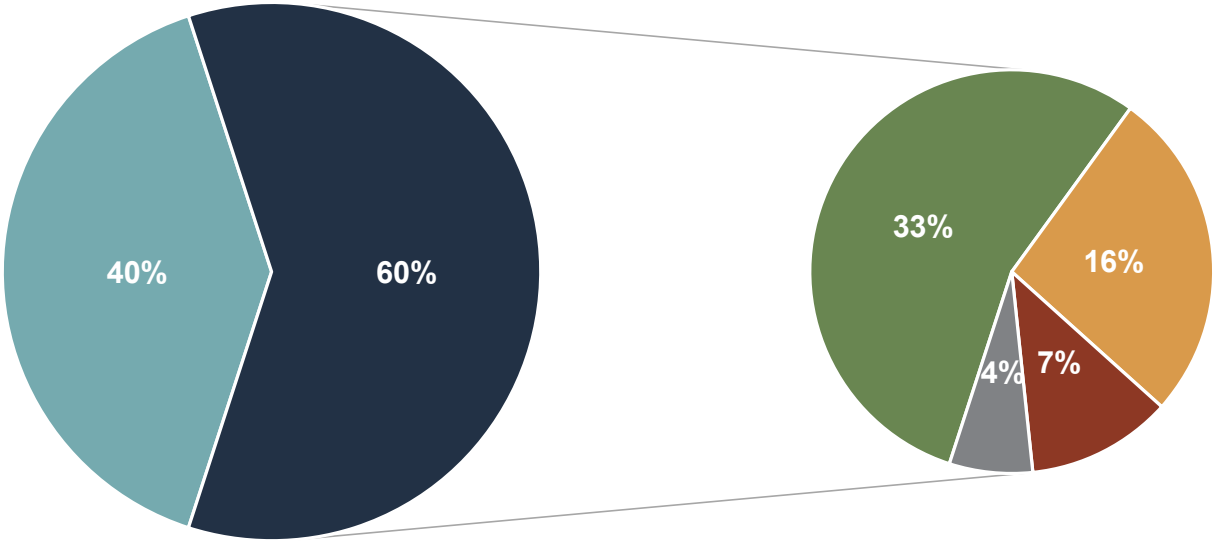
Preliminary Data Request

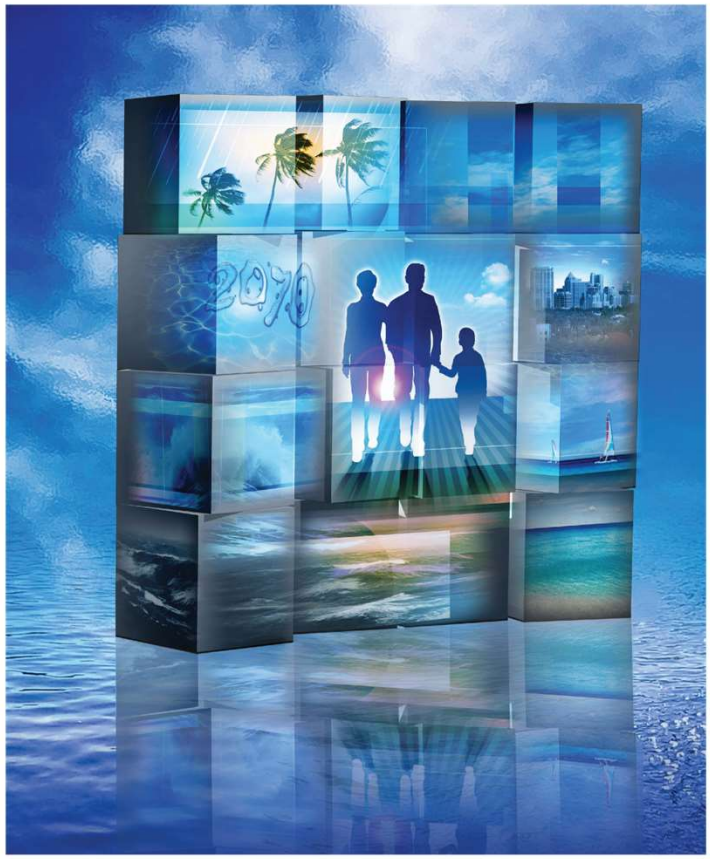
- An introduction to the Plan was provided by Broward County on June 15th.
- All data requests were sent the last week of June.
- The program “HubSpot” and coordination with subconsultant Brizaga allowed for an efficient relay of information and smooth communication with requestees.
- The data requests were different depending on the recipient of the request.
- Individual/personal follow up with certain stakeholders is on-going.



Responsiveness of Stakeholders



- Responsive
- Awaiting response to Original Request. Reminder Email Sent.
- Data Received
- Request Noted. Expecting Data.
- Data Not Readily Available
- Data Within Hazen's System



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Hydrologic Modeling

a) Basics of south Florida water management

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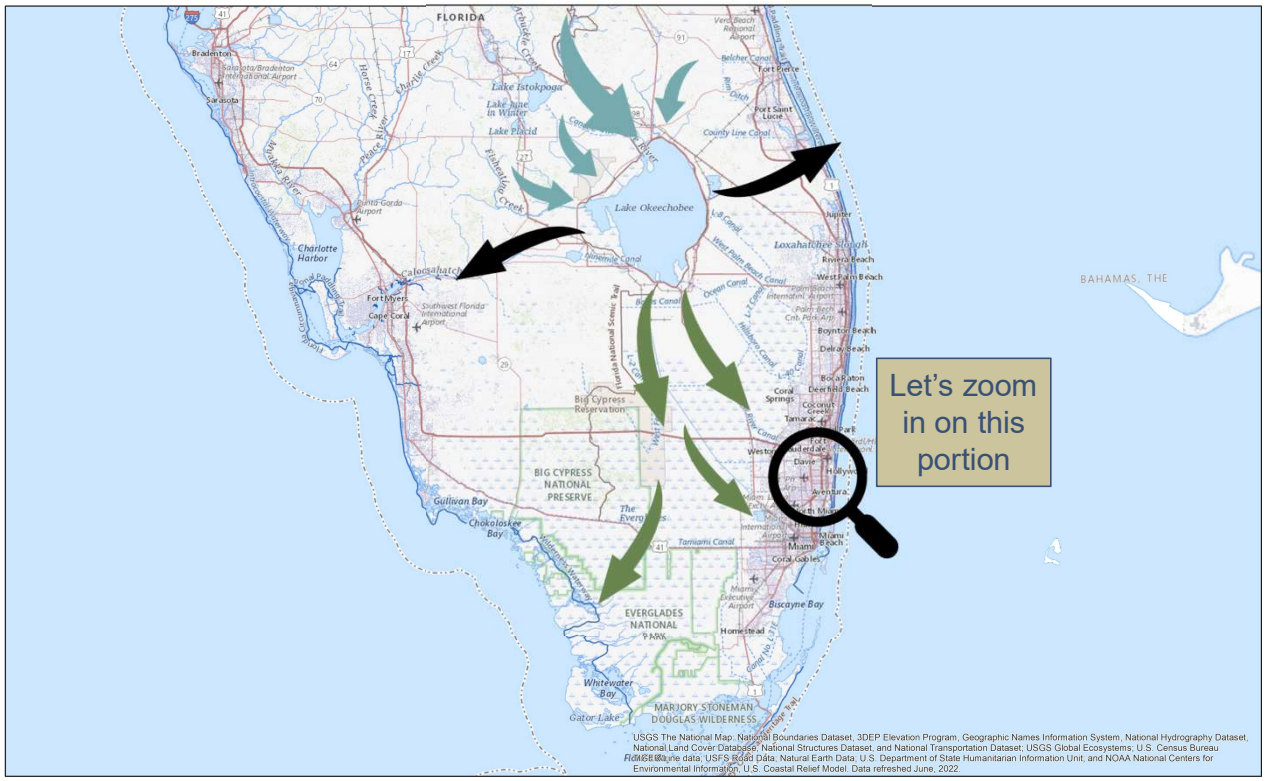
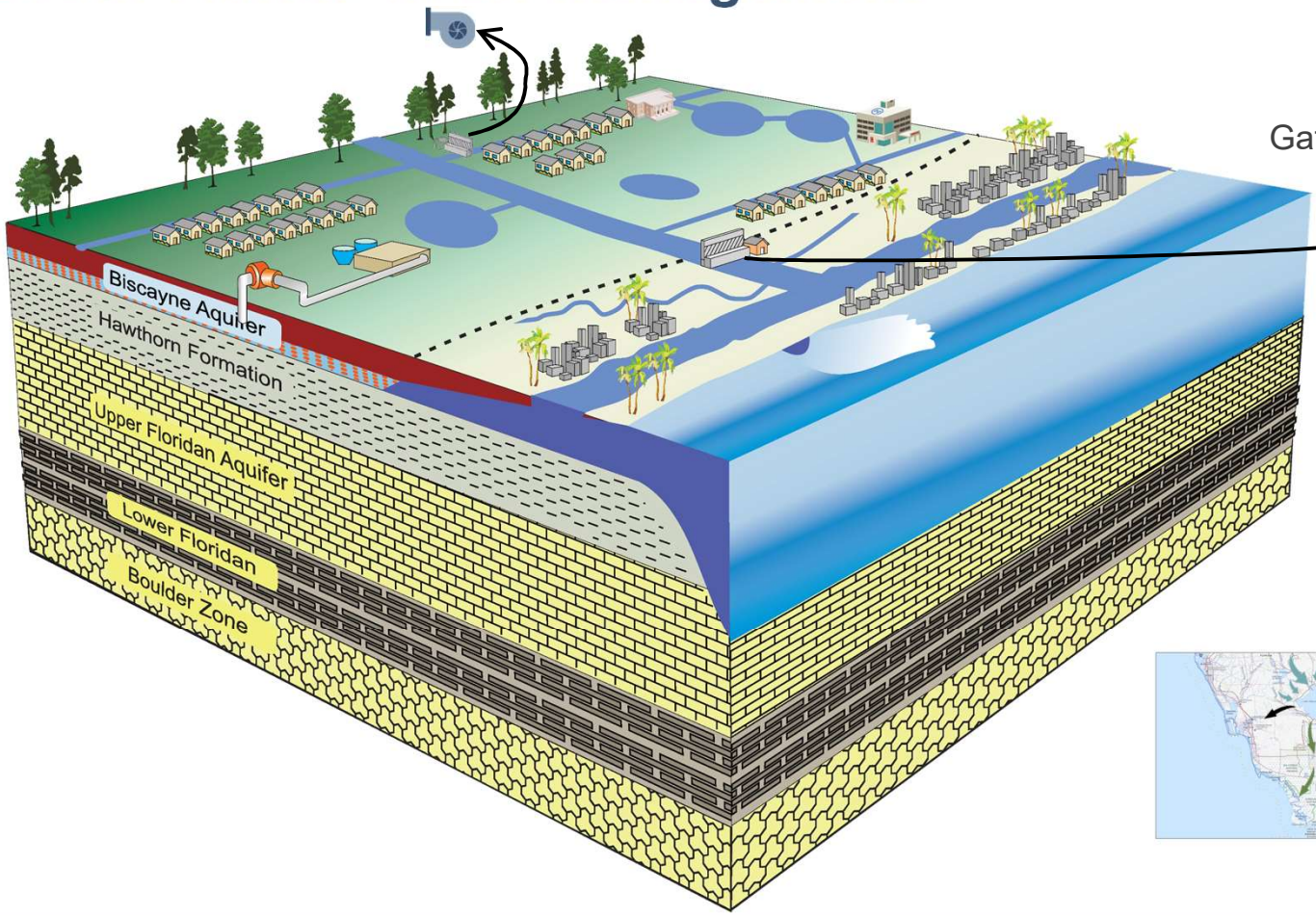
Basis of south Florida water management



Water in south Florida flows south from Lake Okeechobee

Basis of south Florida water management



Gated Coastal Structure

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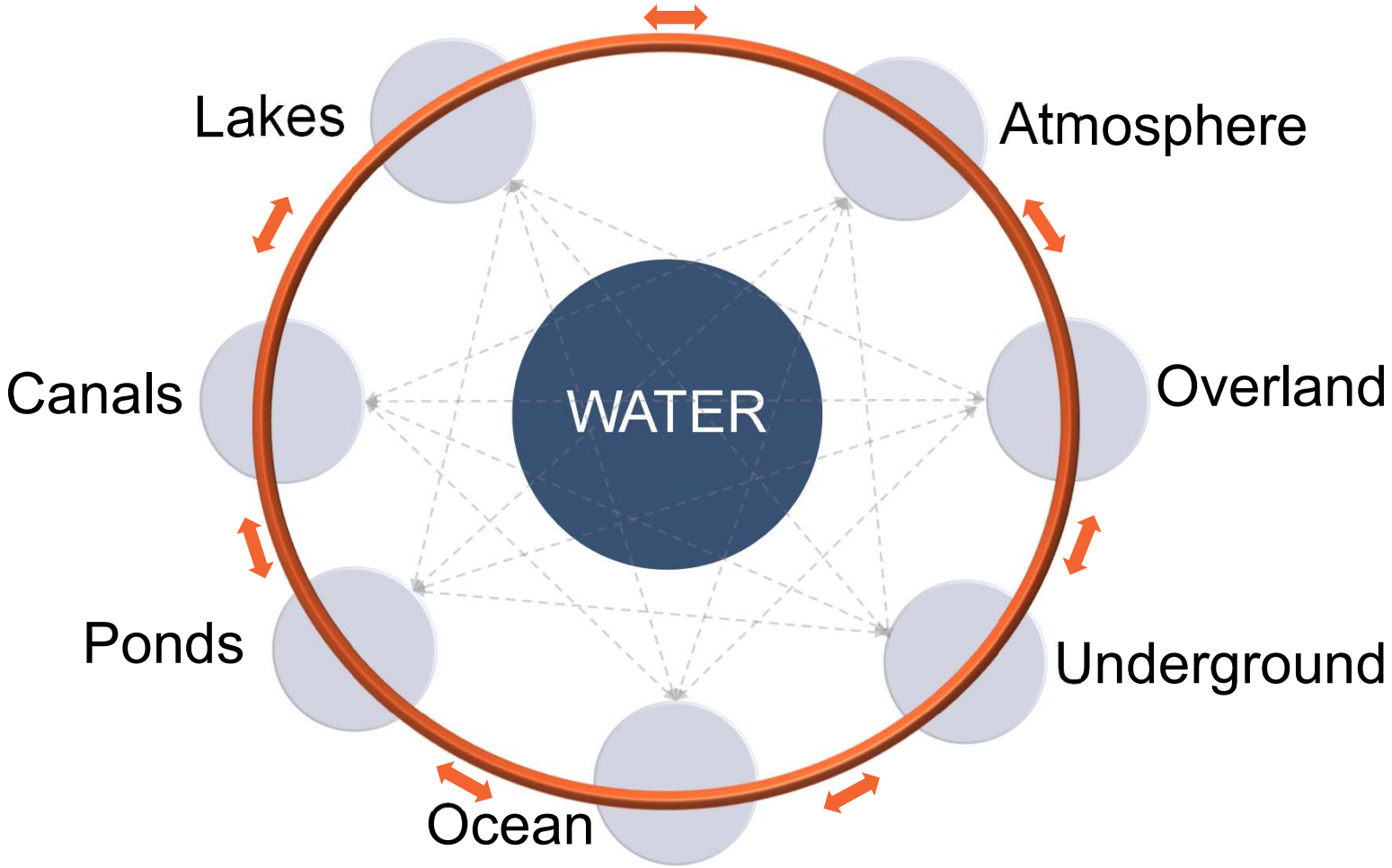
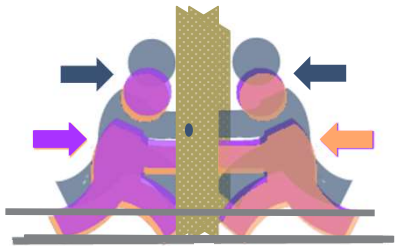
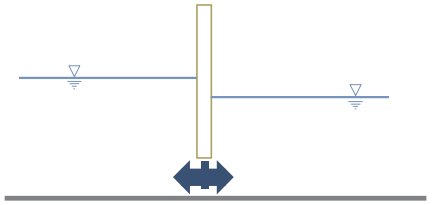
To know why they are needed, let's focus on Water and how it moves



Two important concepts

1)Water movement is defined by the availability of energy



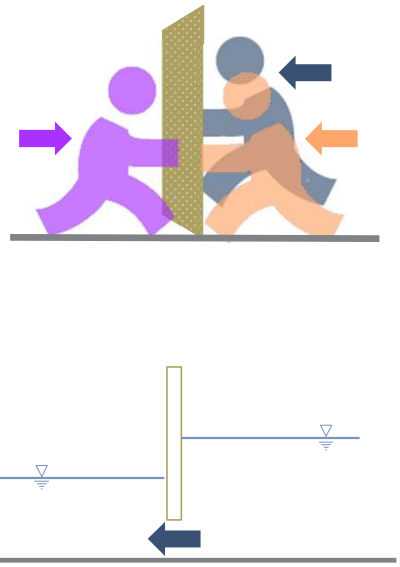


Higher Water Level = More Energy

“Boundary Conditions”

Two important concepts

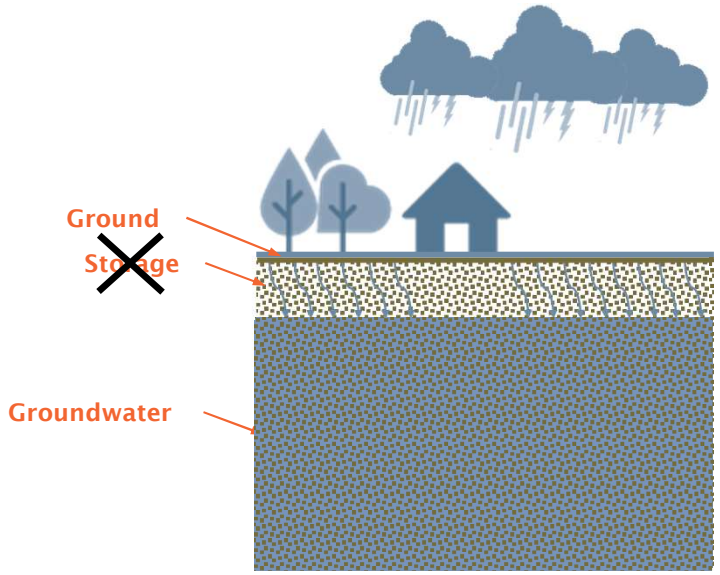
1)Water movement is defined by the availability of energy



Higher Water Level = More Energy

“Boundary Conditions”

2) Storage matters



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Two important concepts

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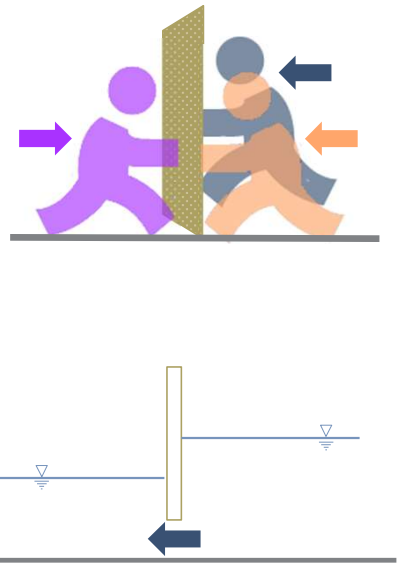

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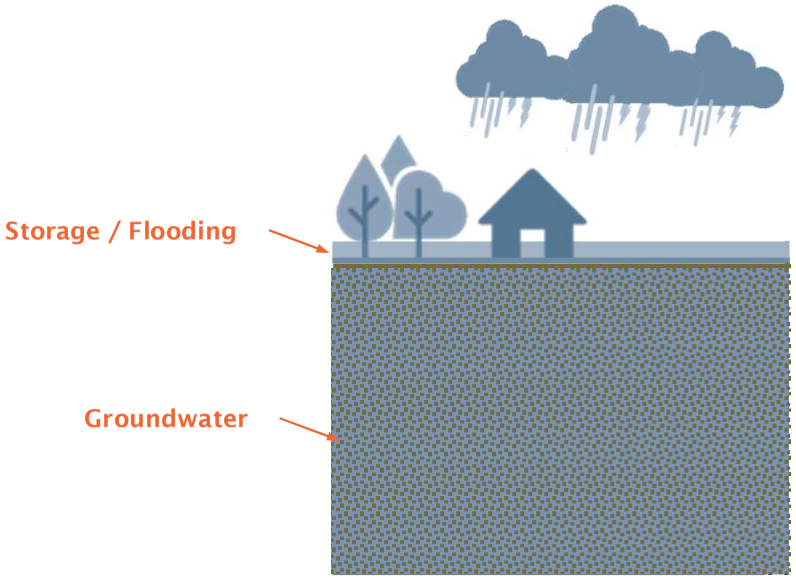
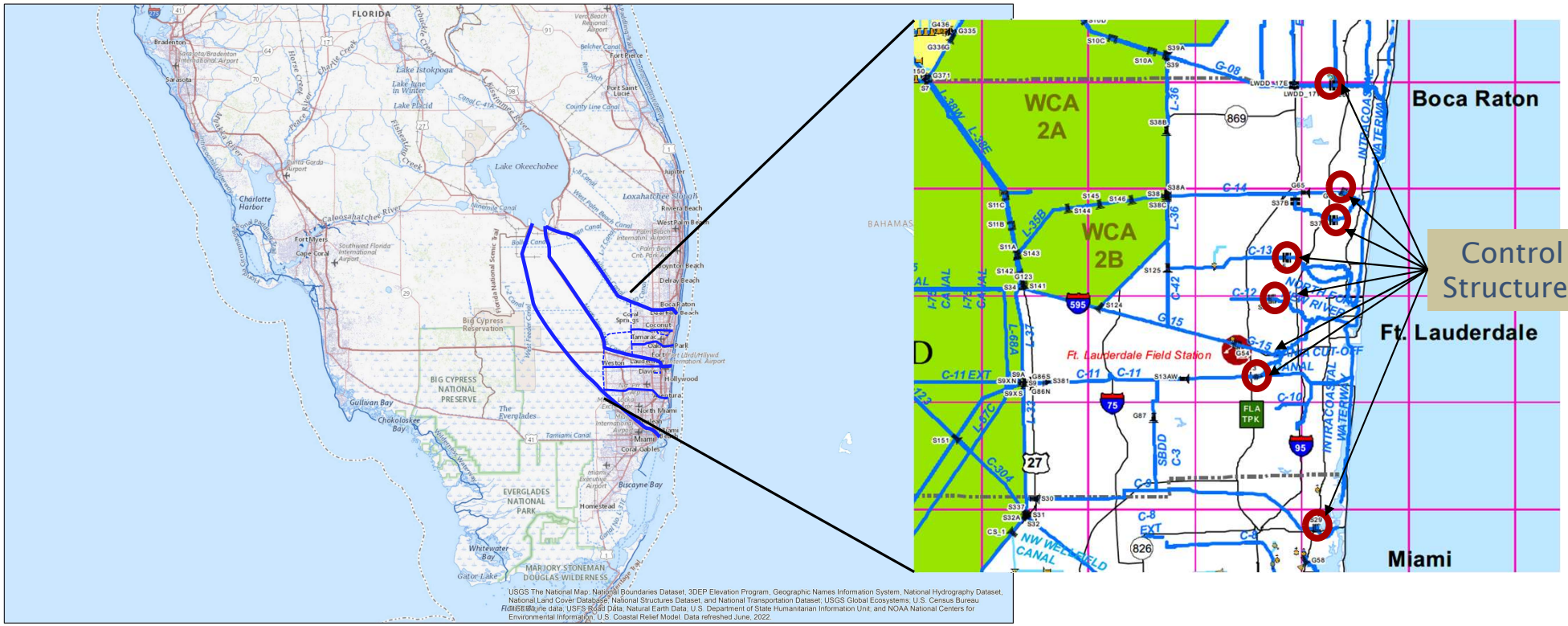


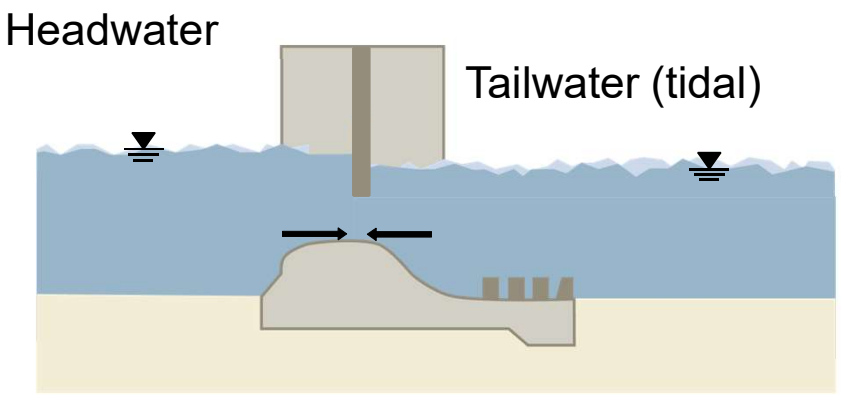
Groundwater Level at the beginning of the storm defines how much storage is available

“Initial Conditions”

Back to the Big Picture

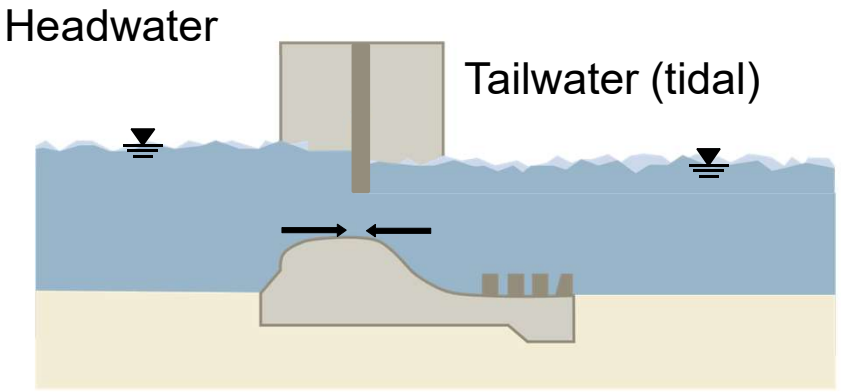


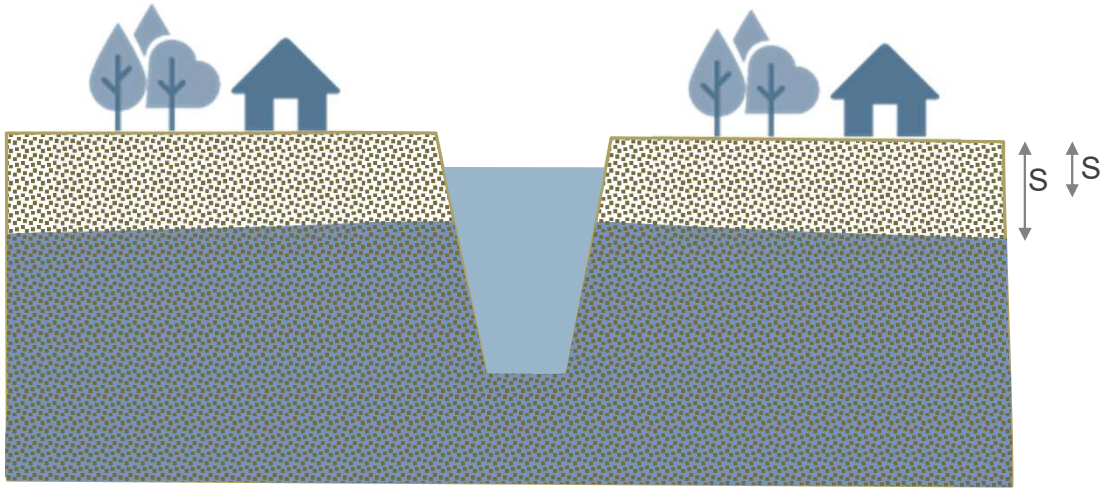
Gated Coastal Structure, effect on water levels



- Gated Structures are used to control water level upstream, preventing salt water from moving inland.
- When sea level rises, the structures will be used to limit saltwater intrusion.
- However, there is a price …

Gated Coastal Structure, effect on water levels





The storage capacity will be reduced as the headwater elevation increases to limit saltwater intrusion as the sea level rises over time.

Typical Stormwater Management System

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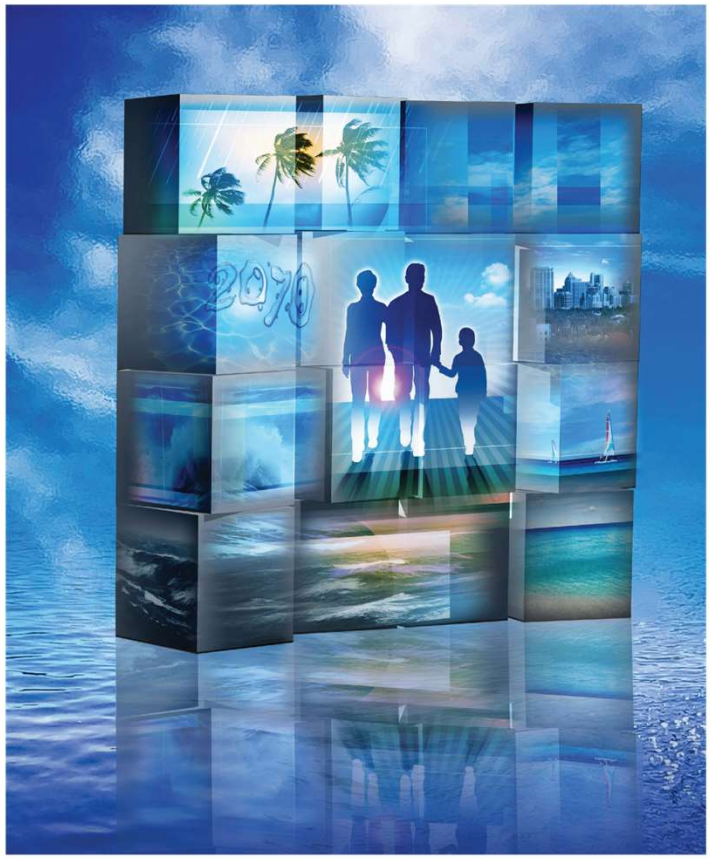

3

Hydrologic Modeling

b) Broward County future conditions 100-year flood modeling mapping

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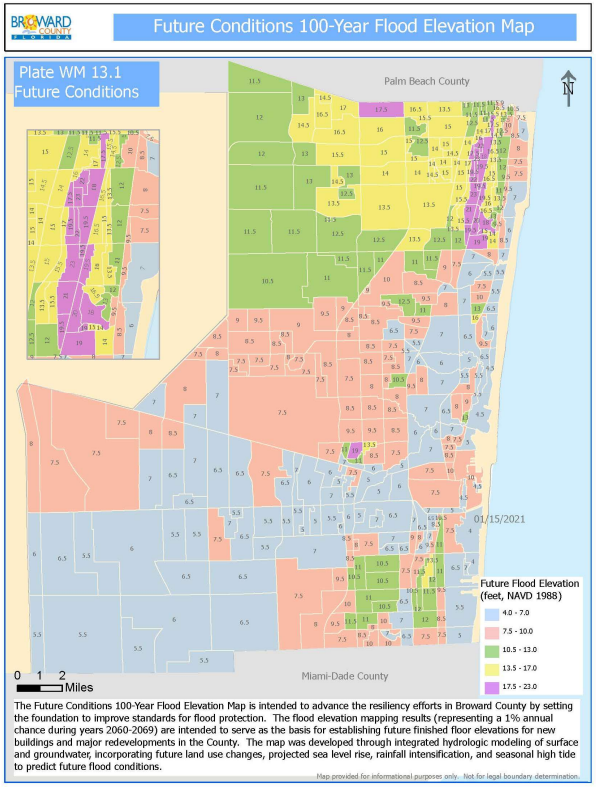
Broward County Future Conditions 100-Year Flood Elevation Map

- Future conditions (**sea level rise, increased precipitation,** etc) will require higher finished floor elevations in many cases

- **Increased finished floor elevations** will enhance resilience

Example: **Broward County Convention Center**

- 100 yr flood conditions
- Storm surge
- Key infrastructure – elevated by 6 feet



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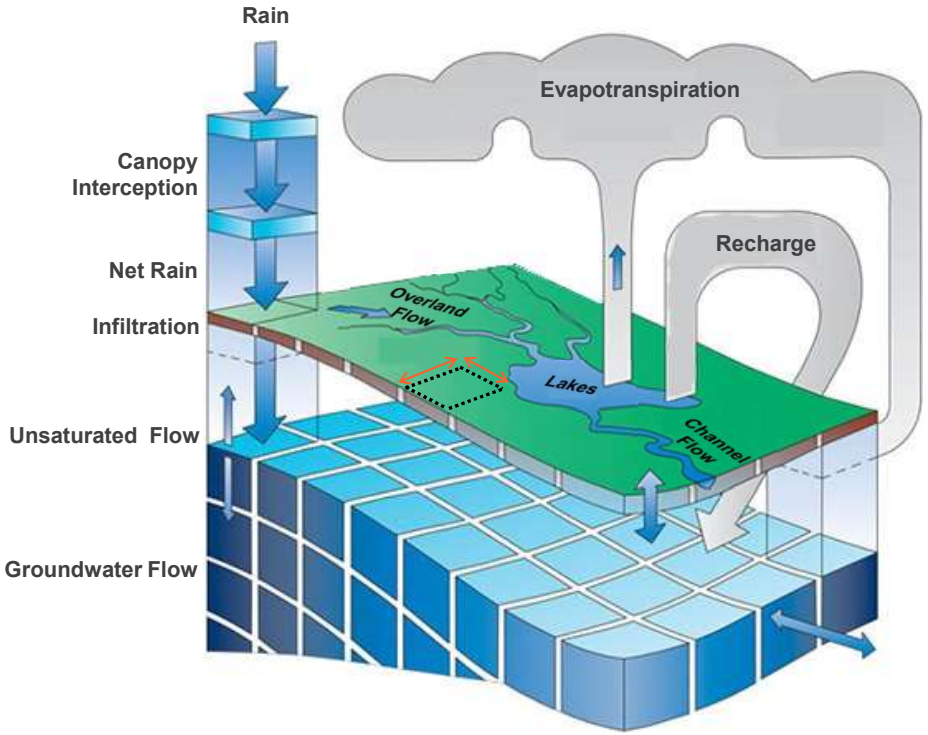
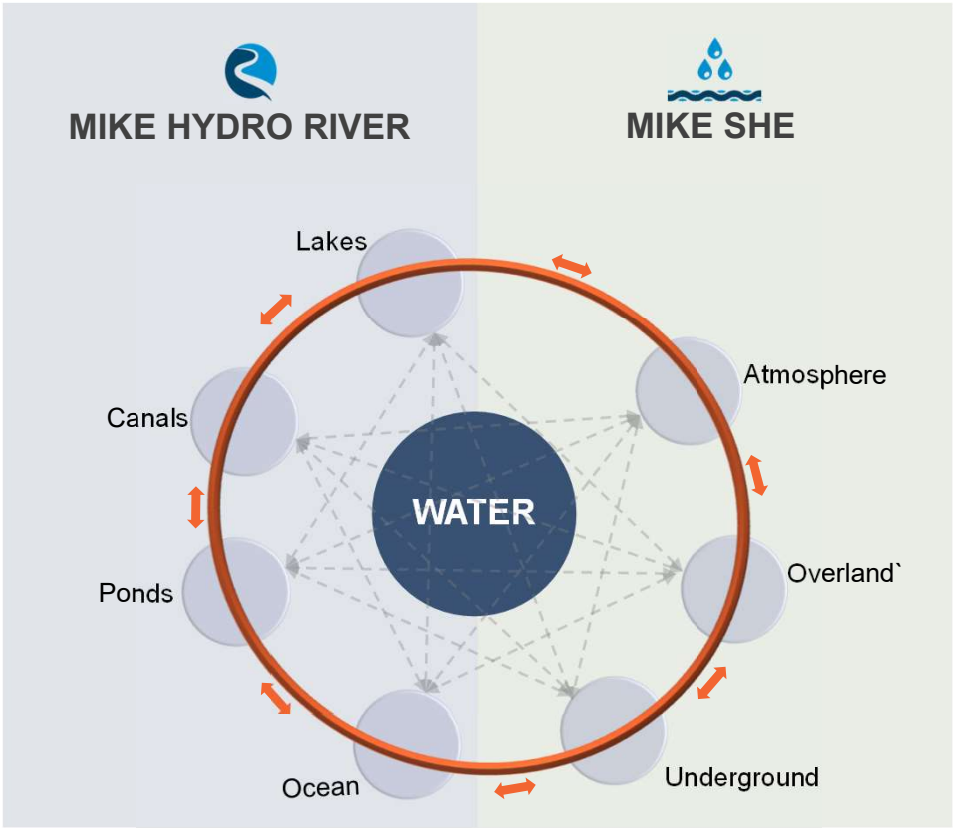


MIKE SHE- MIKE HYDRO RIVER



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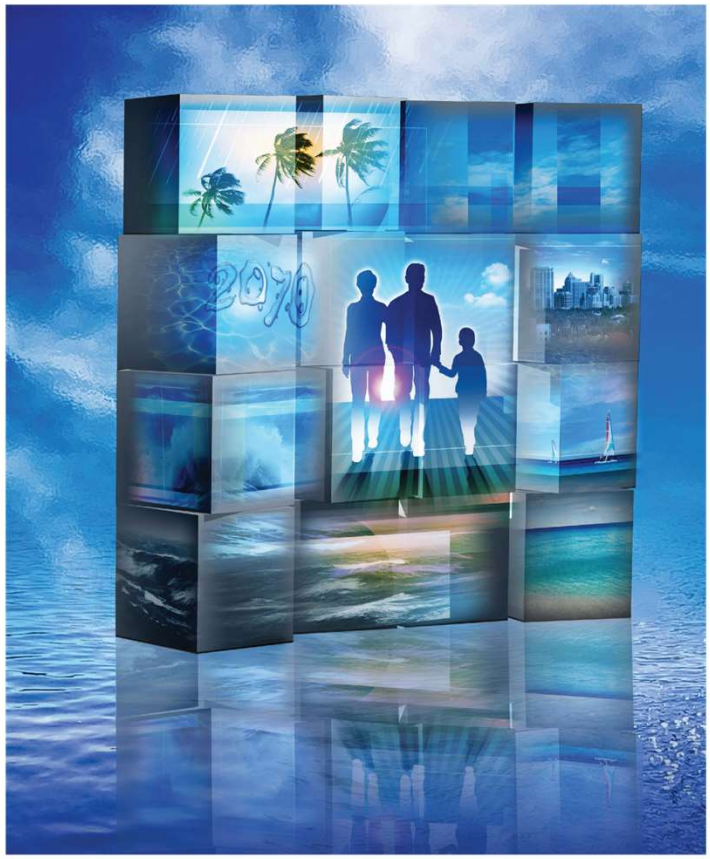

3

Hydrologic Modeling

c) Model adaptation for Resilience Plan

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Model adaptation for Resilience Plan

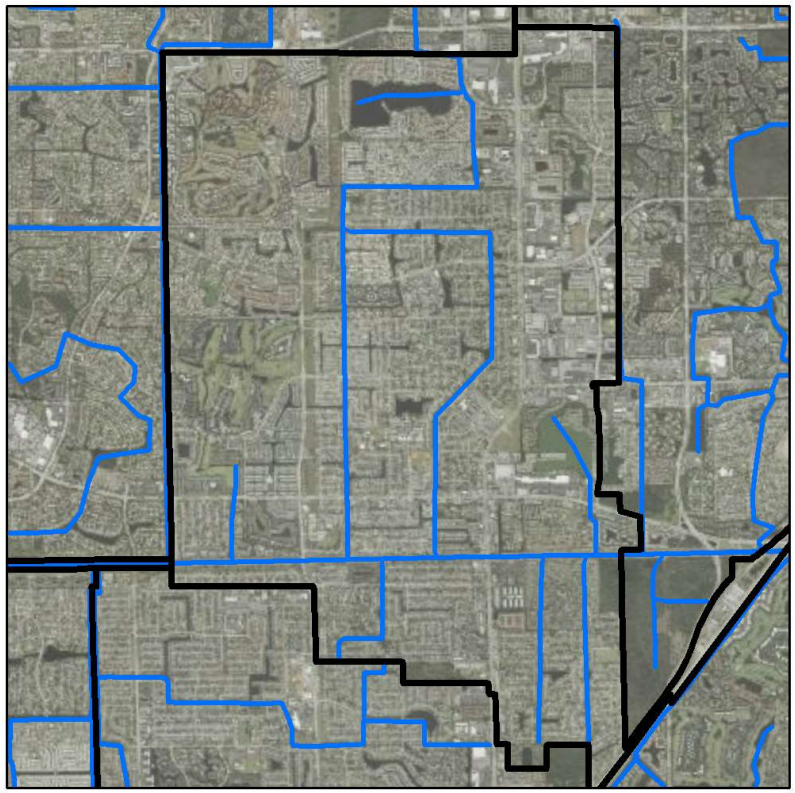
The MIKE SHE – MIKE Hydro River model used to develop the 100-yr flood elevation map is being refined to incorporate proposed adaptation strategies.

These refinements include but are not limited to:

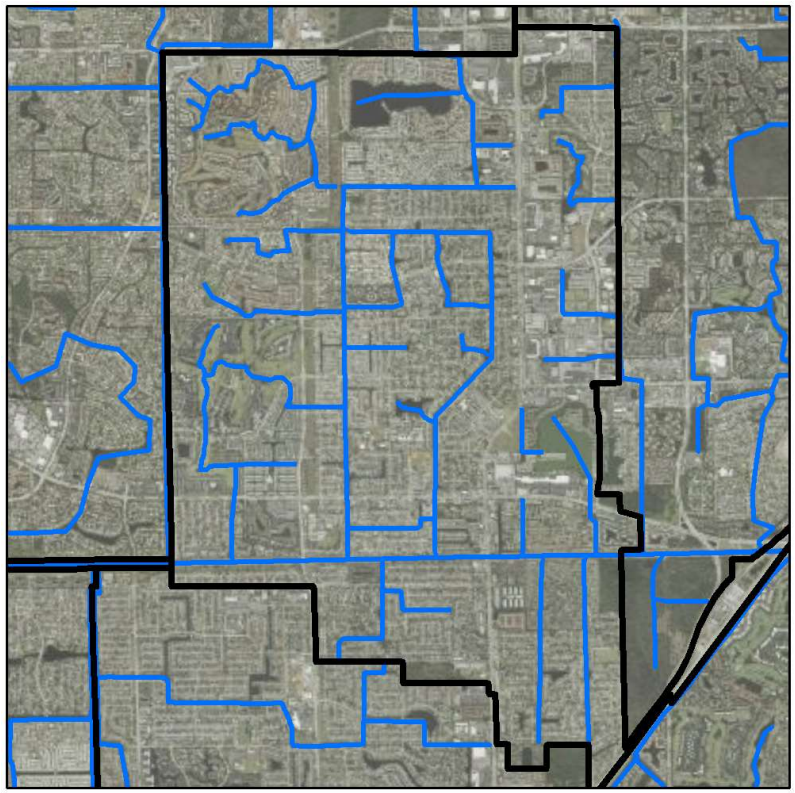
- The increased density of canal networks represented in the model
- The increased detail of Pervious / Impervious areas
- Inclusion of additional control and conveyance infrastructure obtained from stakeholders
- The use of higher resolution elevation data to represent Broward County
- Updates to the future rainfall amounts based on recent studies
- Updates to the boundary conditions (Sea Level Rise projections)

Model adaptation for Resilience Plan

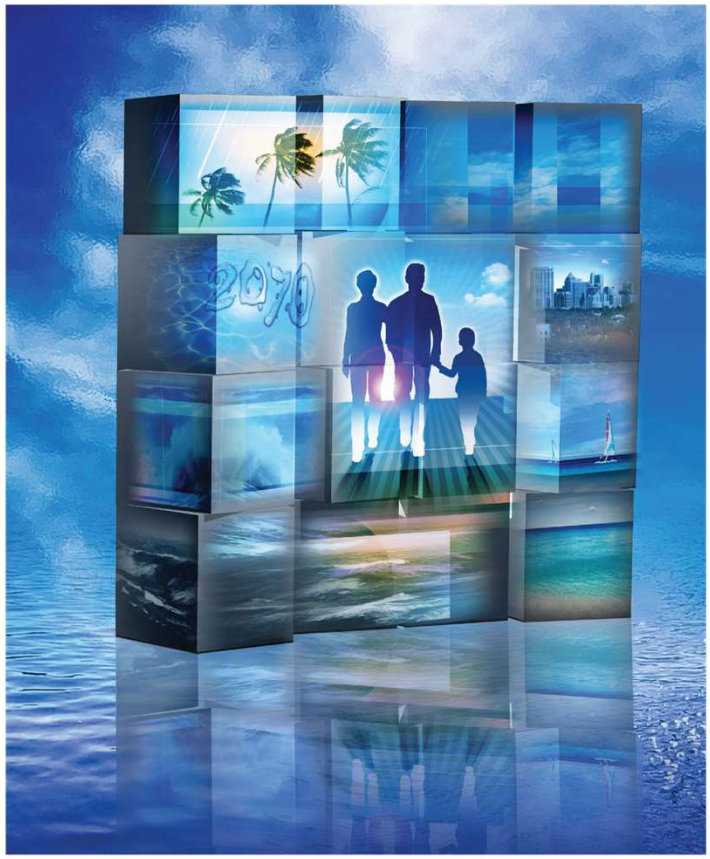
- Increase density of canal network represented in the model



Before Refinement



After Refinement



3

Hydrologic Modeling

d) Event simulations, boundary conditions, outputs

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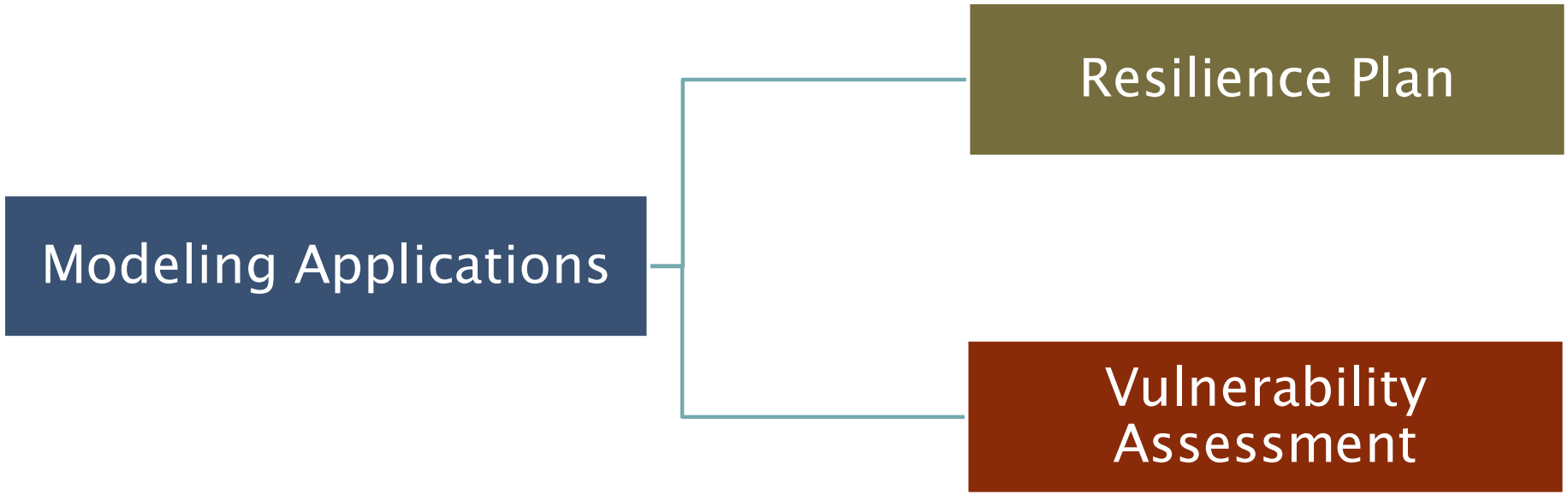
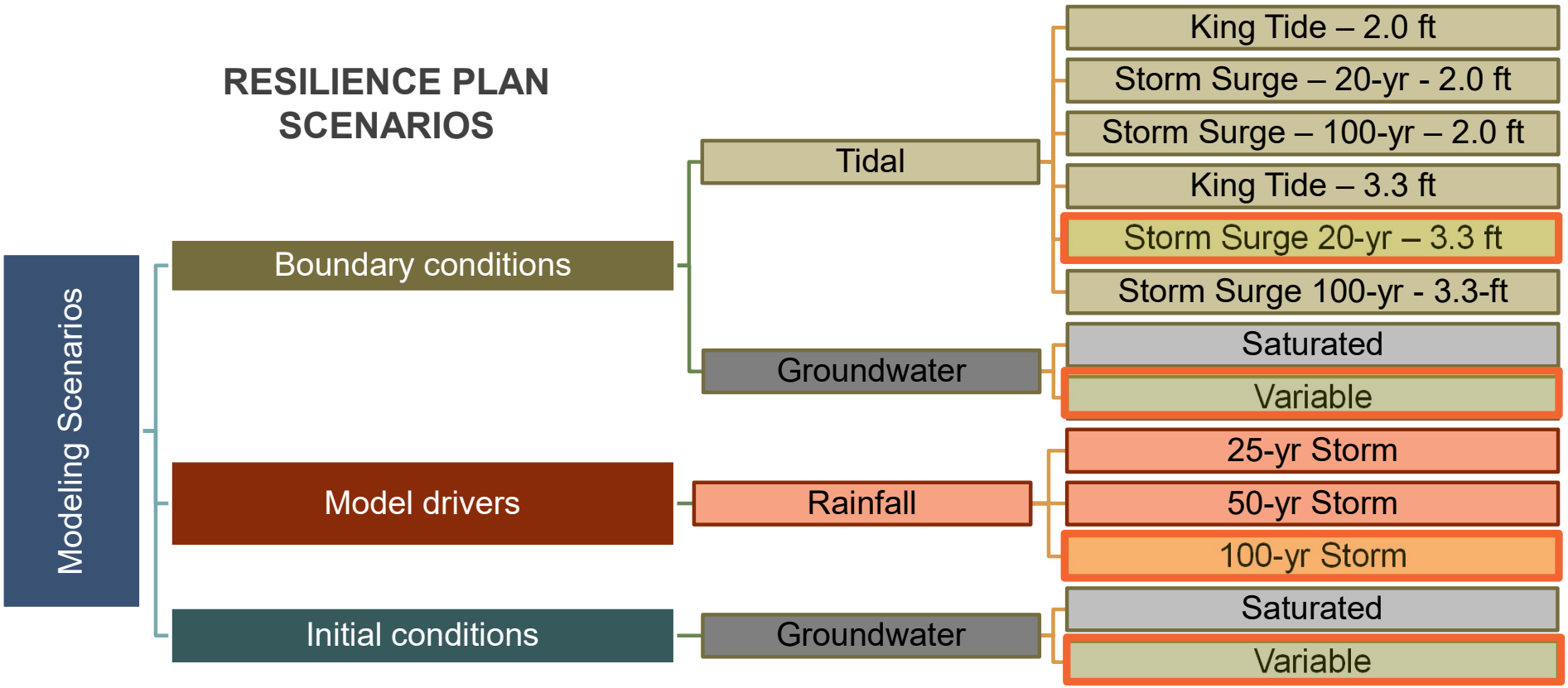
Event simulations, boundary conditions, outputs



Event simulations, boundary conditions, outputs



24 SCENARIOS

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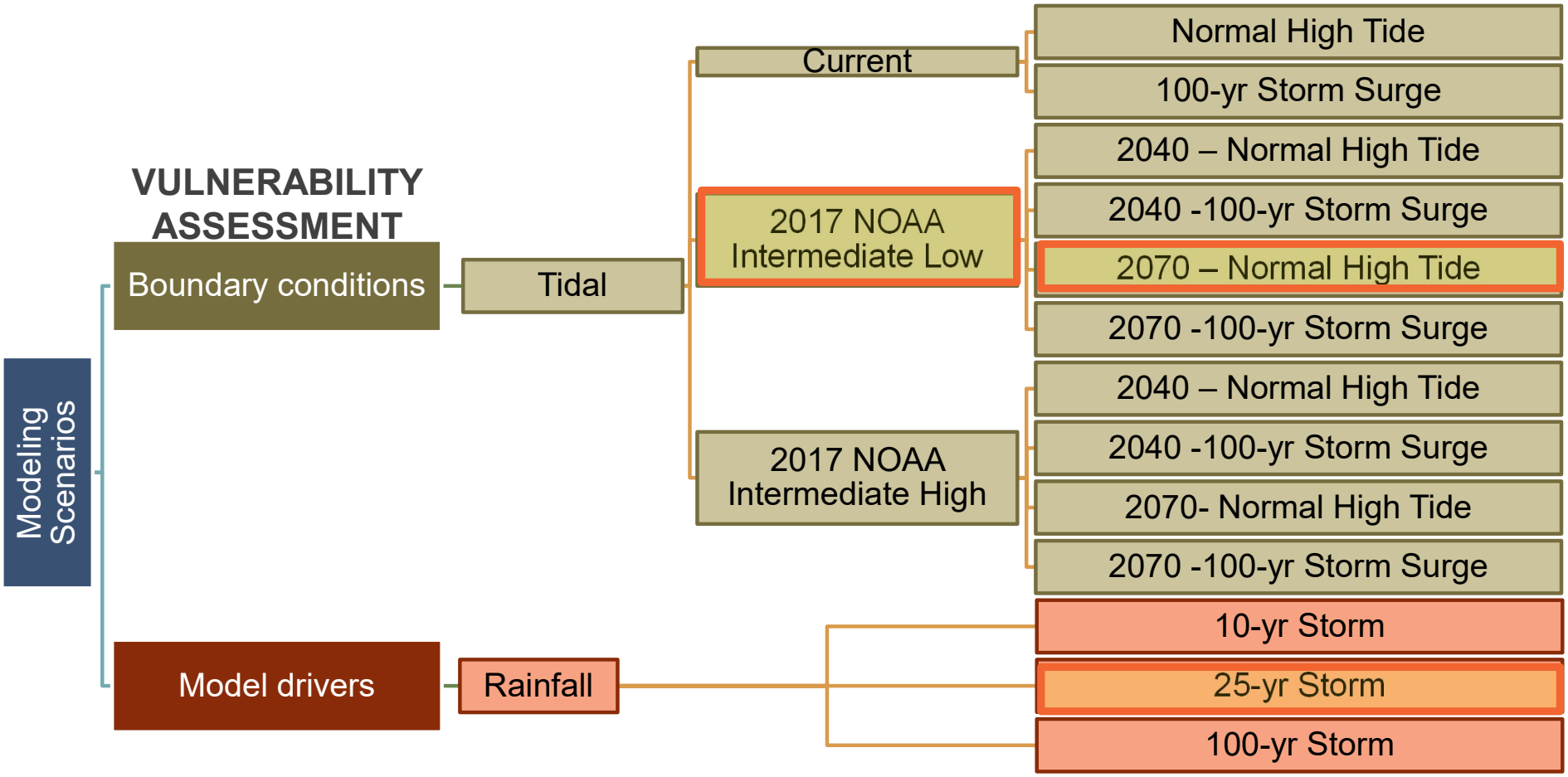
Event simulations, boundary conditions, outputs



30 SCENARIOS

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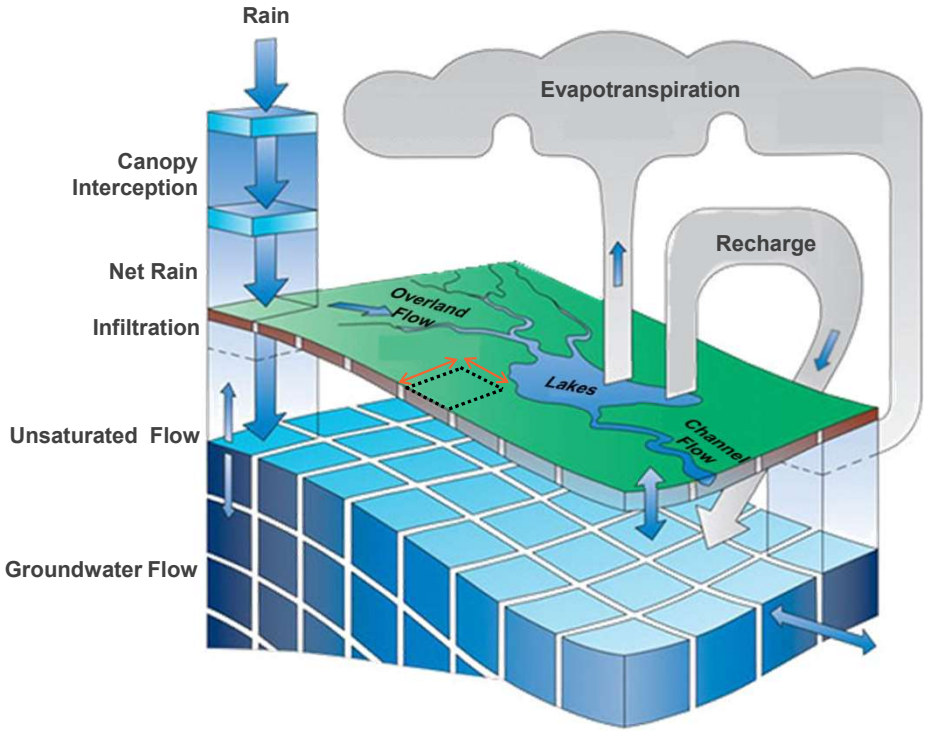
Event simulations, boundary conditions, outputs



MIKE SHE- MIKE HYDRO RIVER

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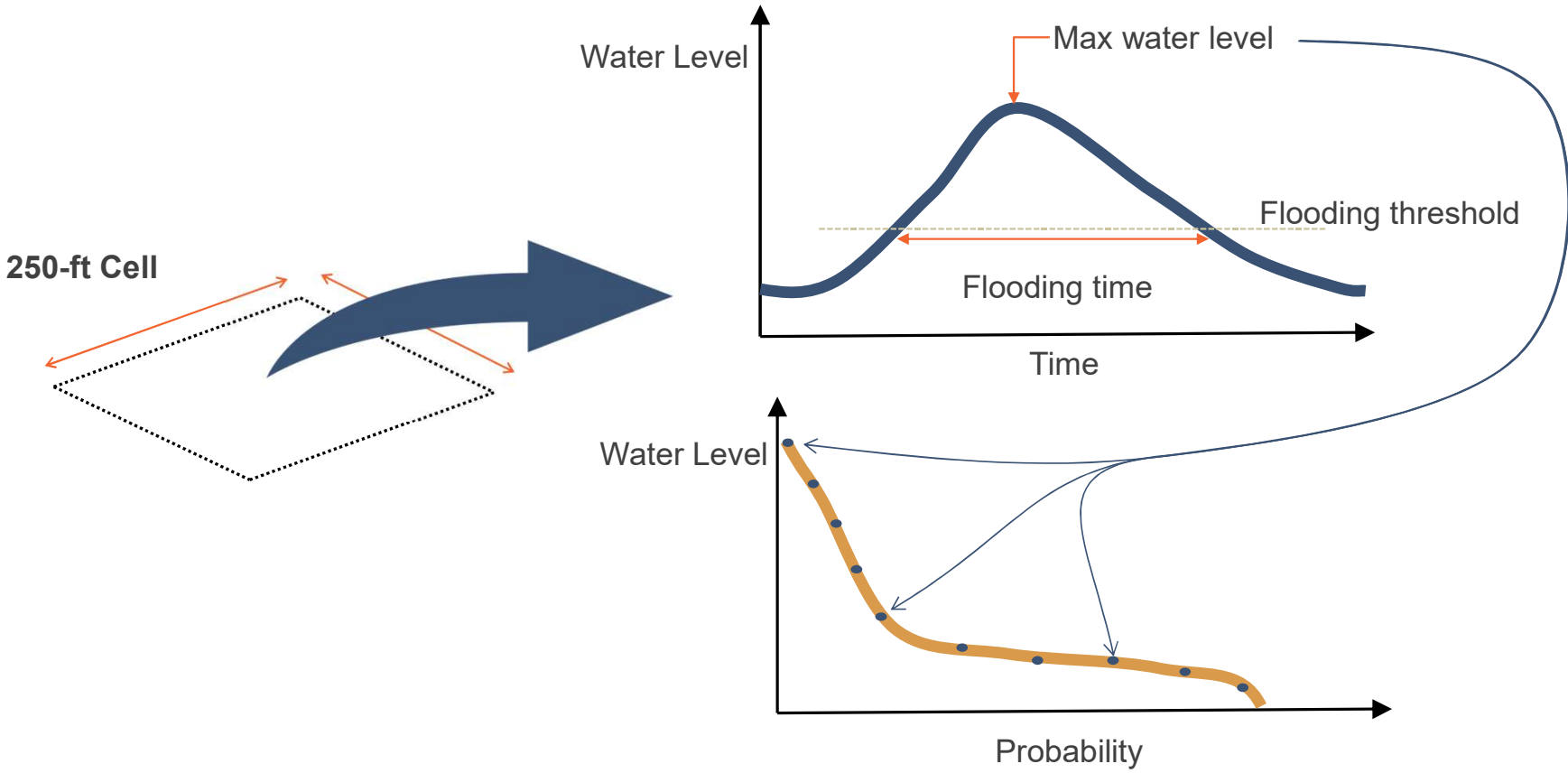

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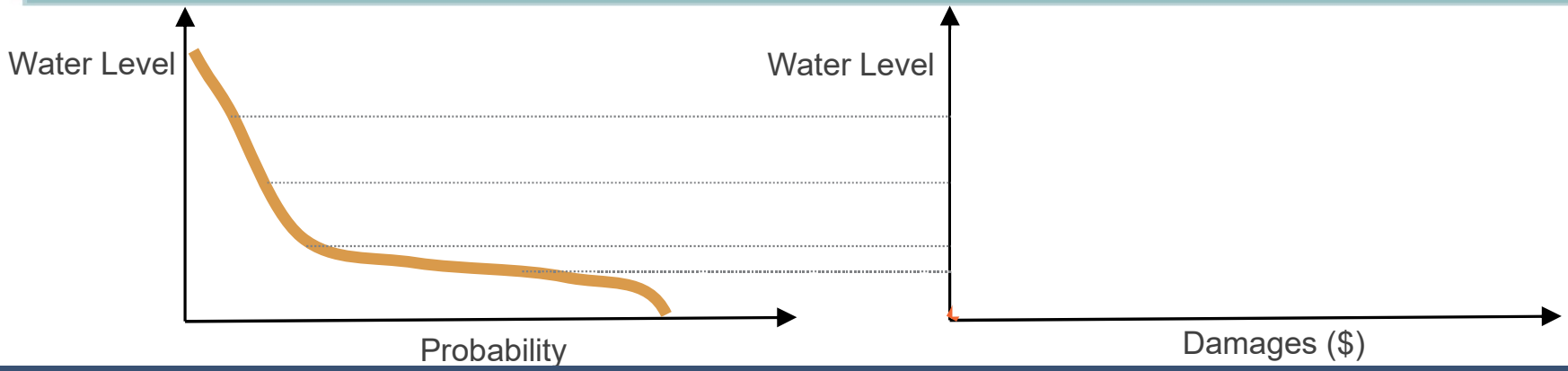

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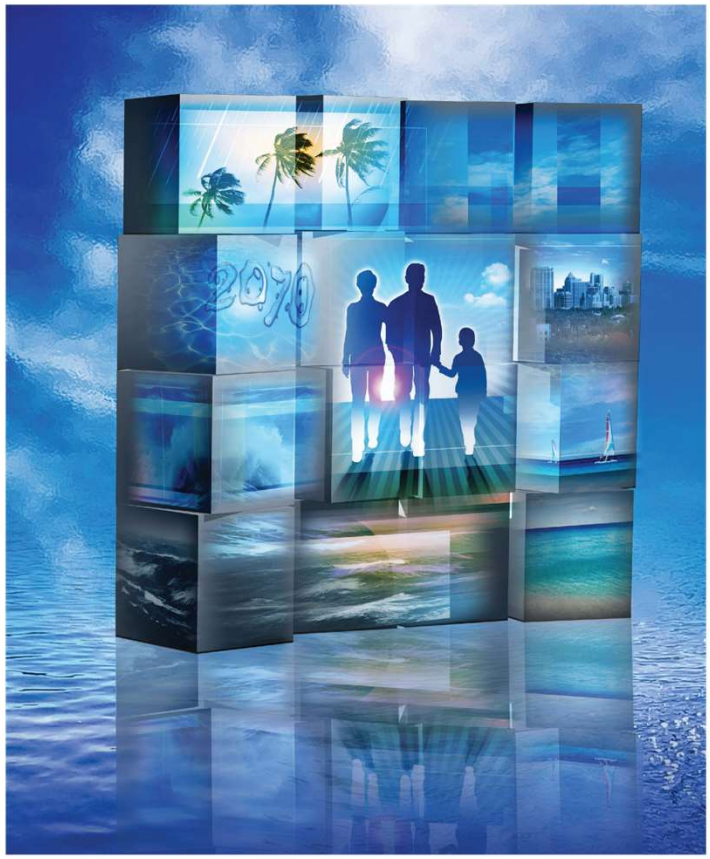


4
Introduction to Economic Benefits Modeling Methodology

Economic modeling will provide estimates of adaptation strategy benefits

Economic benefits will be measured:

- In dollars
- By geographic area
- In five-year increments
- By type of beneficiary

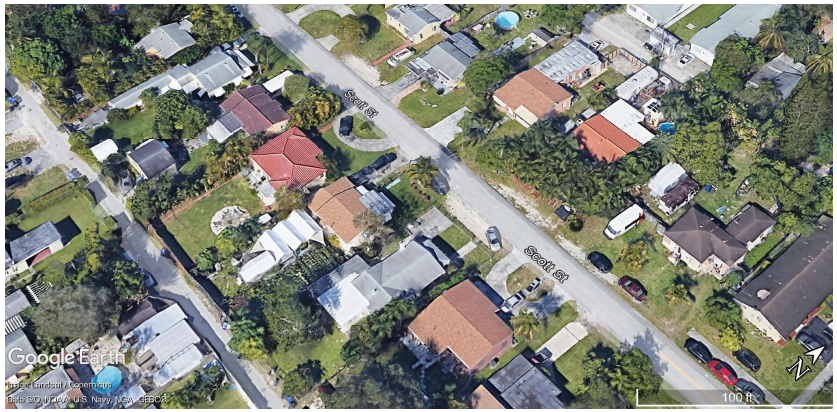
… to help determine economic feasibility, cost-sharing arrangements, and funding options and strategies

Adaptation strategy benefits are those expected to improve future well-being of Broward County residents

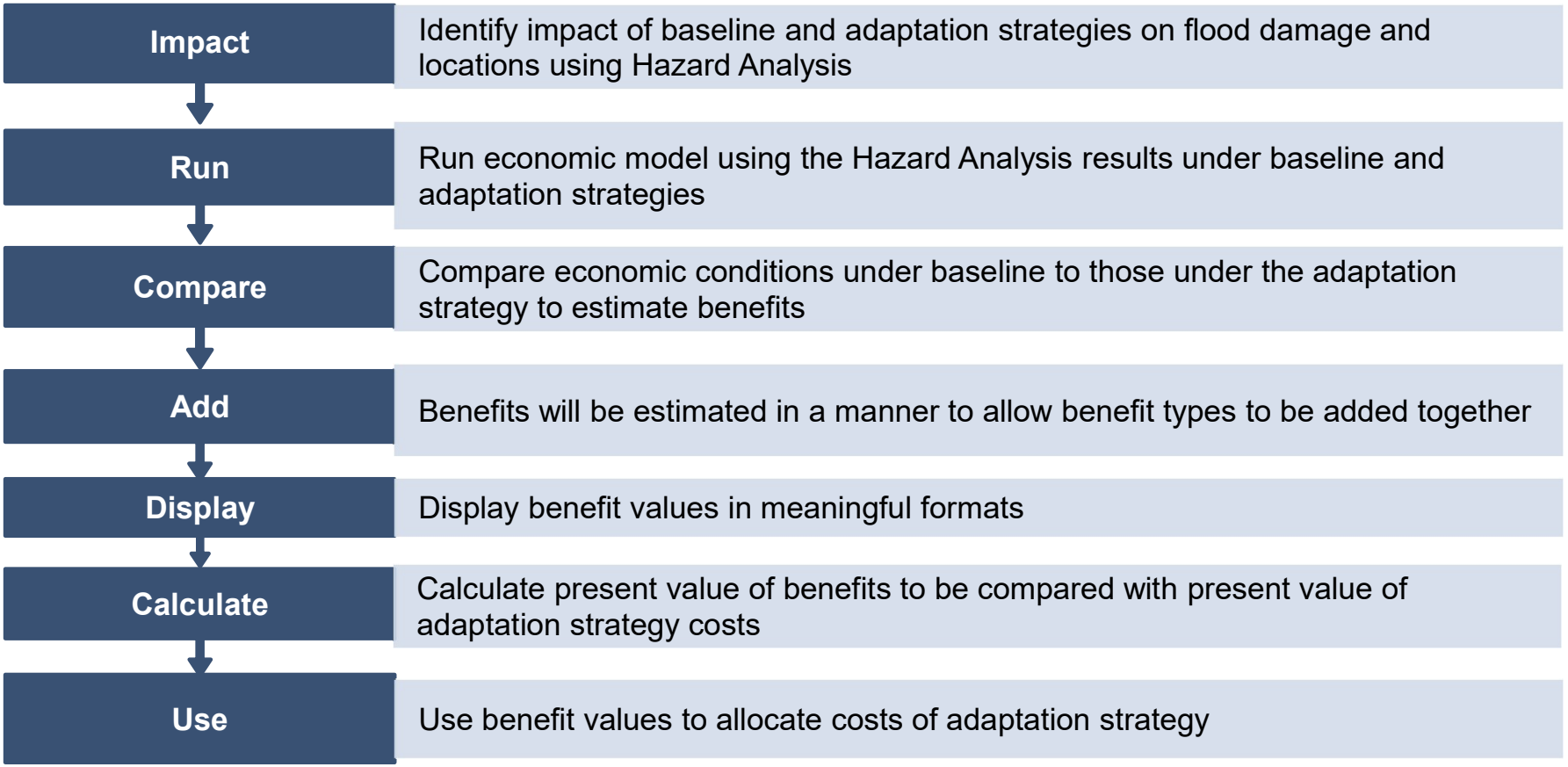
- All benefits are relative to a baseline predicated on no adaptation measures
- **Overall Benefits** are the differences in County:
  - Population, including vulnerable populations;
  - Housing stock and value;
  - Number of jobs and value;
  - Amenities and value
- **"With"** the adaptation strategy.

Types of benefits to be measured in dollars by location

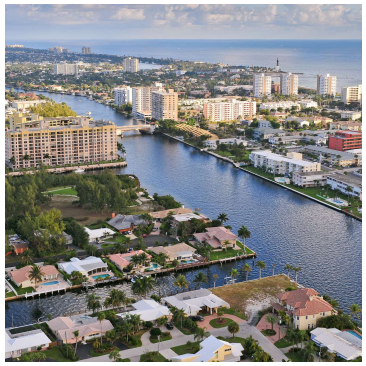
Avoided Loss in:	Avoided Cost of:	Avoided Reduction in:
Resident and Business income	Emergency services	Property values
Neighborhood amenities (a.k.a. - Increases in quality and availability of goods and services)	Property insurance premiums	Value of Recreation days (willingness-to-pay)
	Mortgage interest rates	Value of Environmental amenities (willingness-to-pay)
	Electricity cost to cool properties	
Tax revenue to County and local governments	County borrowing and credit	Government services



Economic contribution of adaptation strategies, as they mitigate climate change impacts provides dollar value of benefits



First economic forecast – Baseline Conditions ("What if we do nothing?")



Hazard Exposure

Frequency, duration, extent of flooding – properties, roads, essential infrastructure

Flood damage repair costs

Heating degree days

Socio-economic projections

First Party Loss

Building and asset damage

Lost income from business interruption

Cost of lost access to services

Humanitarian (health) impacts

Indirect Impacts

Resident and business income

Population, Jobs, Investment

Economic Growth

Beaches, recreation areas
Natural environment

Insurance availability and affordability

Real estate values

Tax revenue and government spending/Credit quality

Key Impact Metrics

Economic activity (by sector)

Household impacts

Asset values

County finances

Distribution of impacts

Baseline Conditions Forecast

1

- Depth, duration and extent of flooding
- Exposure:
  - properties (residential by type, commercial by sector)
  - roads
  - utilities
  - other infrastructure and assets
- Scenarios and probabilities (current and up to 2070)

2. Future socioeconomic exposures

- Socio-economic projections
  - Demographics
  - Production
  - Land use

3. Direct damages

- Building and asset damages
- Lost income from business interruption
- Cost of loss of access to services
- Relief and recovery costs
- Humanitarian (health) impacts

4. Second-order impact modelling

- Impact on resident and business income
- Impact on jobs

5. Long term economic modelling

- Impacts on investment
- Impacts on economic growth
- Impacts on population

6. Willingness to pay modelling

- Impacts on natural capital
- Other non-market impacts

7. Financial modelling

- Impacts on insurance availability/ affordability
- Impacts on credit quality
- Impacts on property value
- Fiscal impacts

8. Equity

- Allocation of impacts across socioeconomic groups

Required data inputs for the economic analysis

County GIS data: https://bcgis.broward.org/GISData.htm

Modeling Effort	Data/models from County	Outside data/models
Future socioeconomic exposures	• Future land use, demographic, and economic projections (2040 Plan) - GIS and Excel-based • US Census data	Macroeconomic data sources Example: Federal Reserve growth forecasts
Second order impact modeling	Spatial data on infrastructure assets	• IMPLAN table • Production capacity • Behavioural parameters if available
Financial modeling	• Tax revenue • Spending • Contingent liabilities • Property values	• Property sales tax income • Mortgage interest rates calculations • Adaptive Regional Input Output (ARIO) model inputs • Hedonic models of property values • Recreational and environmental value models
Equity and allocation	Understanding key vulnerable groups	• Net change in resident income from ARIO model • Long-term economic modelling indicators • Public health and education data

Next Steps:

1. Feedback from the Steering Committee
   - Key sectors to emphasize
   - Vulnerable groups
   - Data sources

2. Develop methods and data to estimate economic benefits of adaptation strategies

Thank you

Hazen