HARRIS-GALVESTON SUBSIDENCE DISTRICT

Flood Risk and Financial Impacts of Projected Subsidence in the Spring Creek Watershed, Southeast Texas, USA

Presented by:

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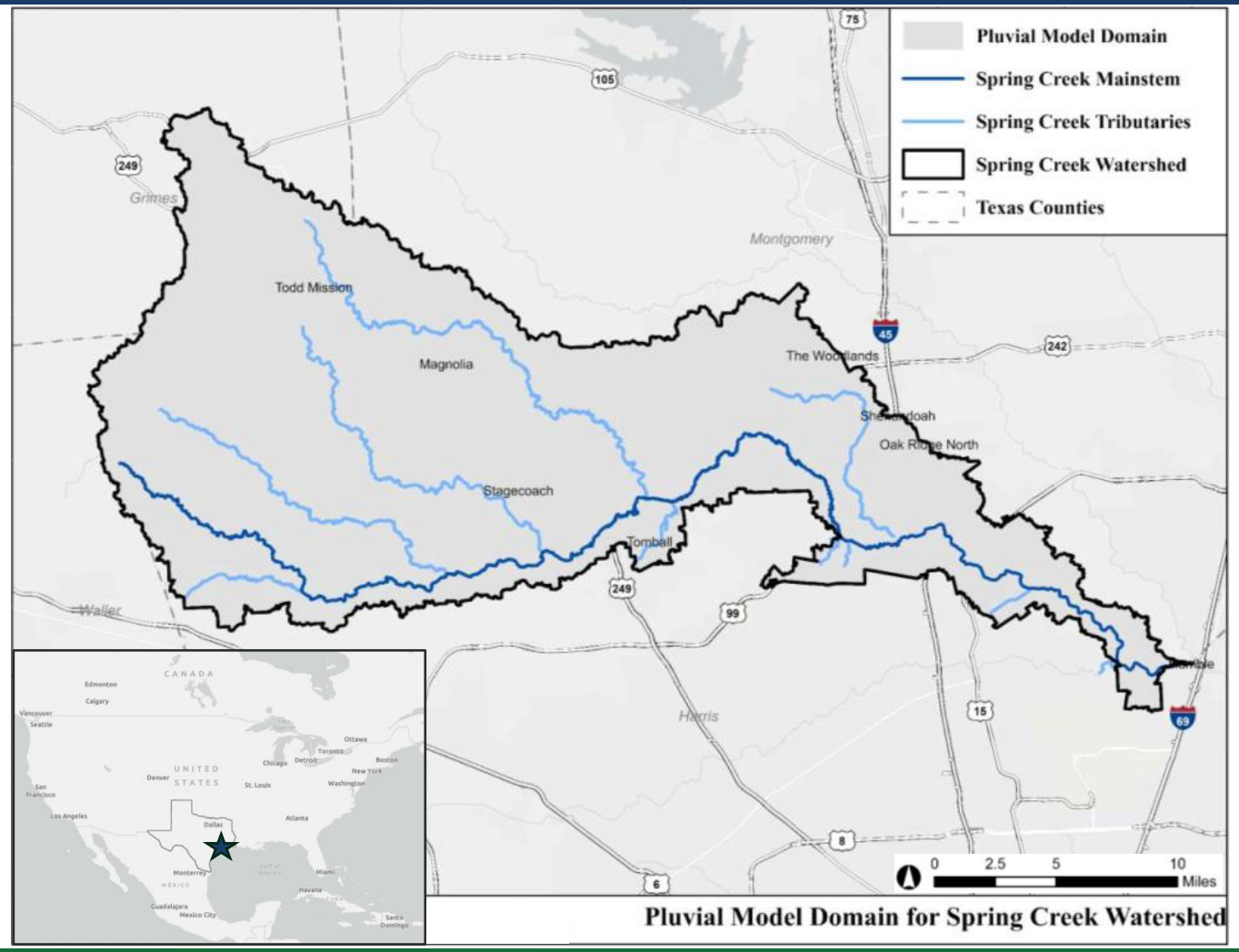
Evaluation of Subsidence Impacts

First study to evaluate projected subsidence on **inland flood risk** and estimate economic impacts.

- 1,015 km^2
- 113-km natural channel
- 7 major tributaries



Pluvial Model Domain for Spring Creek Watershed

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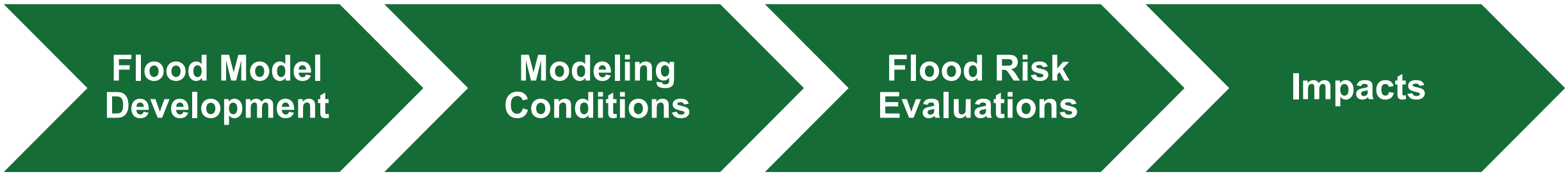
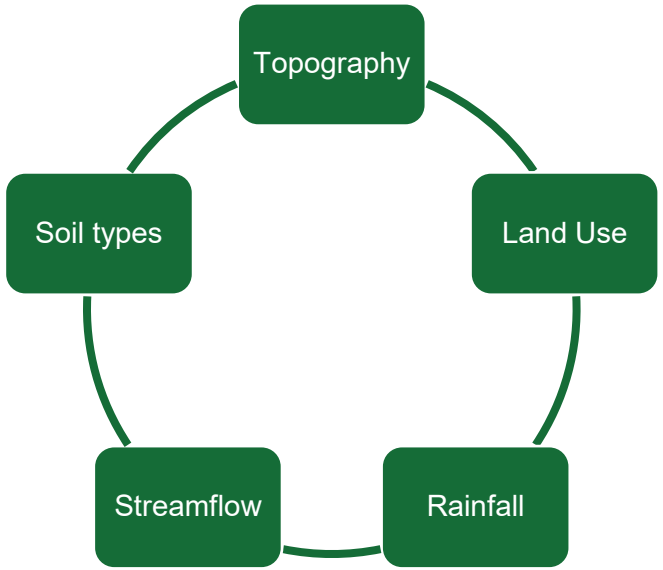
Spring Creek

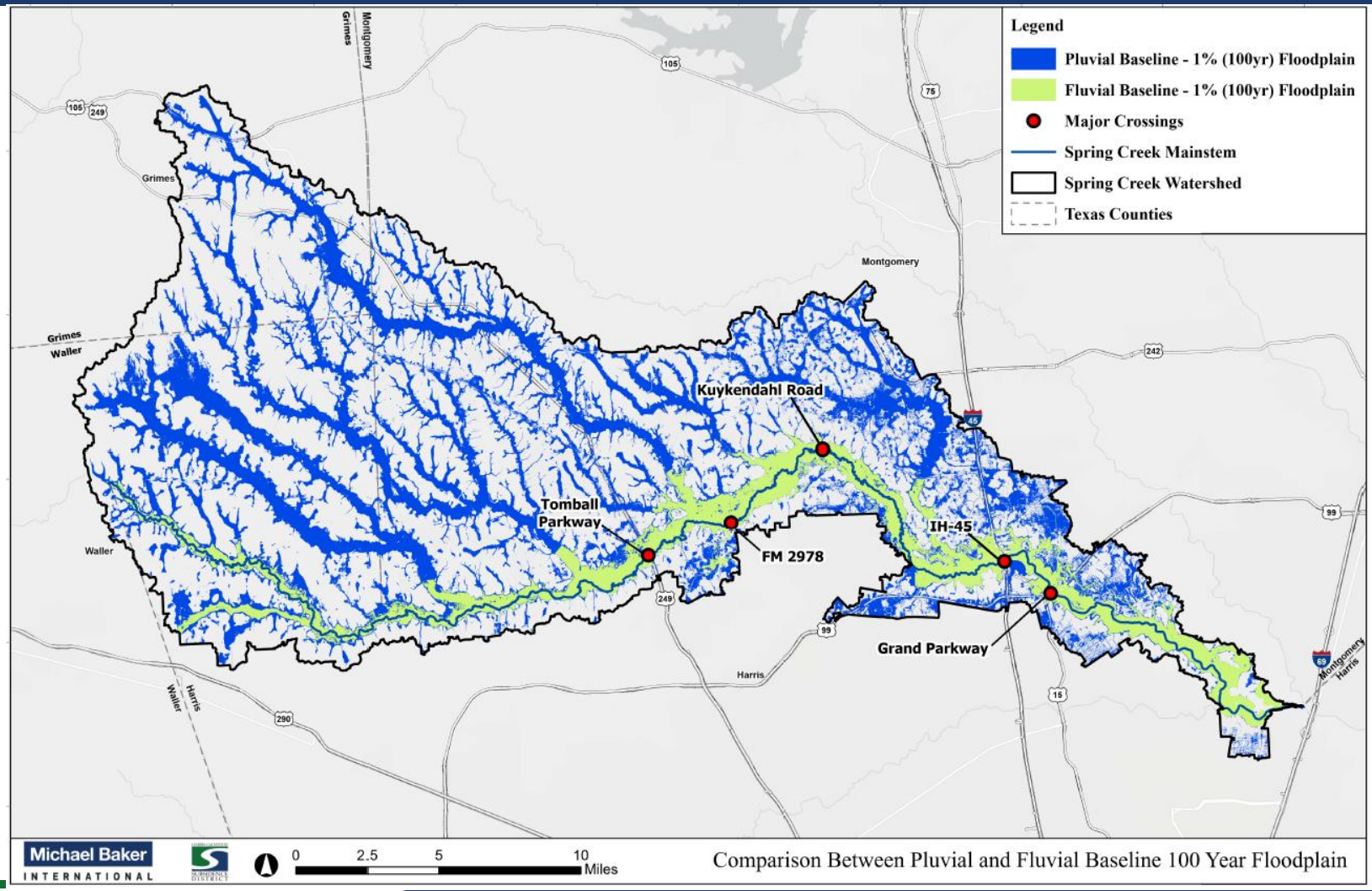
Conceptual Model



H&H Model Selection

- MAAPnext model for **riverine** flooding.
  - Covers about **30%** of watershed
- HEC-RAS 2D Rain-on-Mesh for **pluvial** flooding.
  - Covers **100%** of watershed





Comparison Between Pluvial and Fluvial Baseline 100 Year Floodplain

Flood Model Development | Tiered Approach

Low

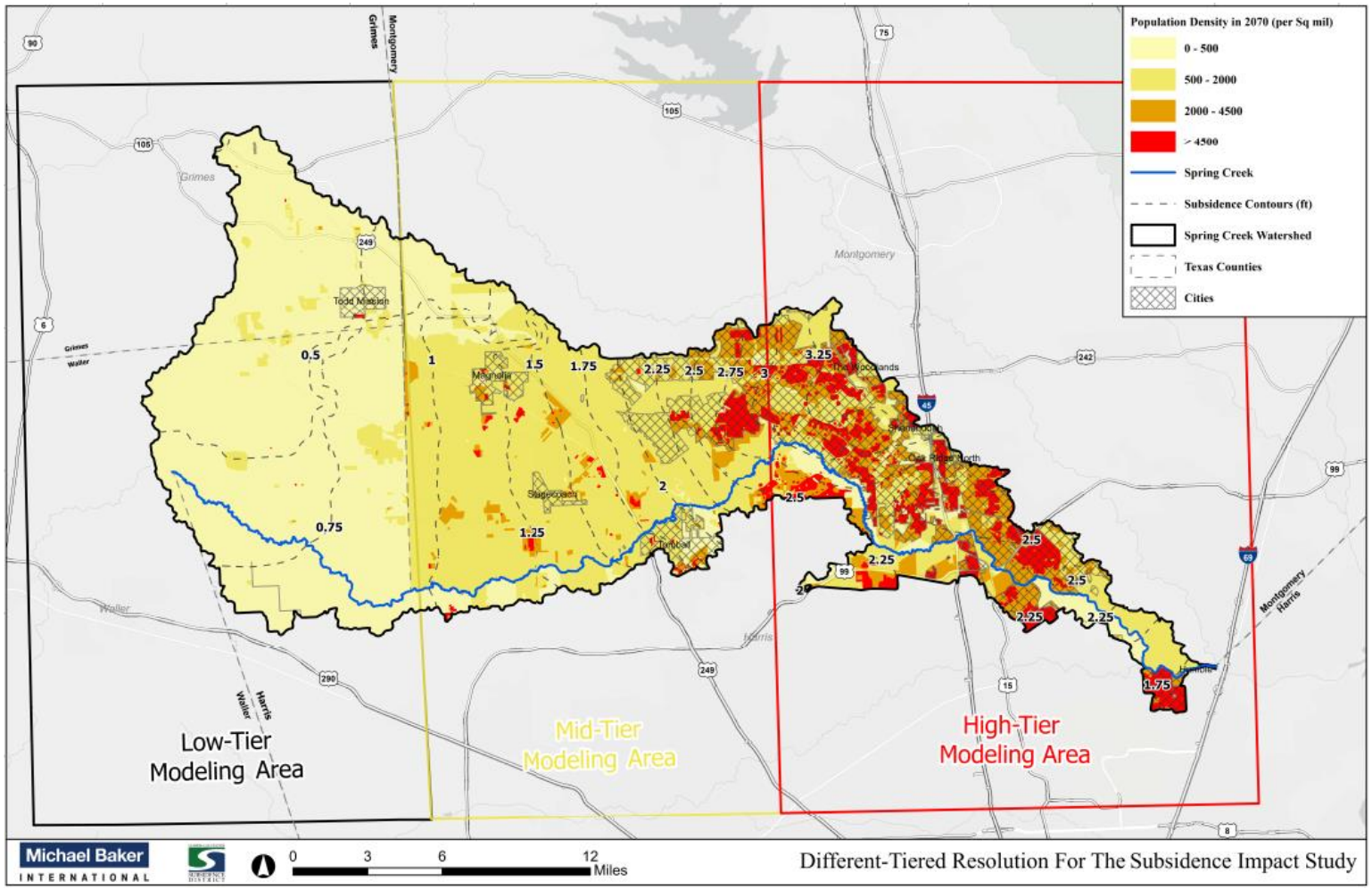
- 2,000-foot (ft) cell size
- Least projected subsidence and population growth
- Western portion of watershed

Mid

- 1,000-ft cell size
- Moderate projected subsidence
- Central portion of watershed

High

- 500-ft cell size
- Most projected subsidence and population growth plus along tributaries
- Eastern portion of watershed



Different-Tiered Resolution For The Subsidence Impact Study

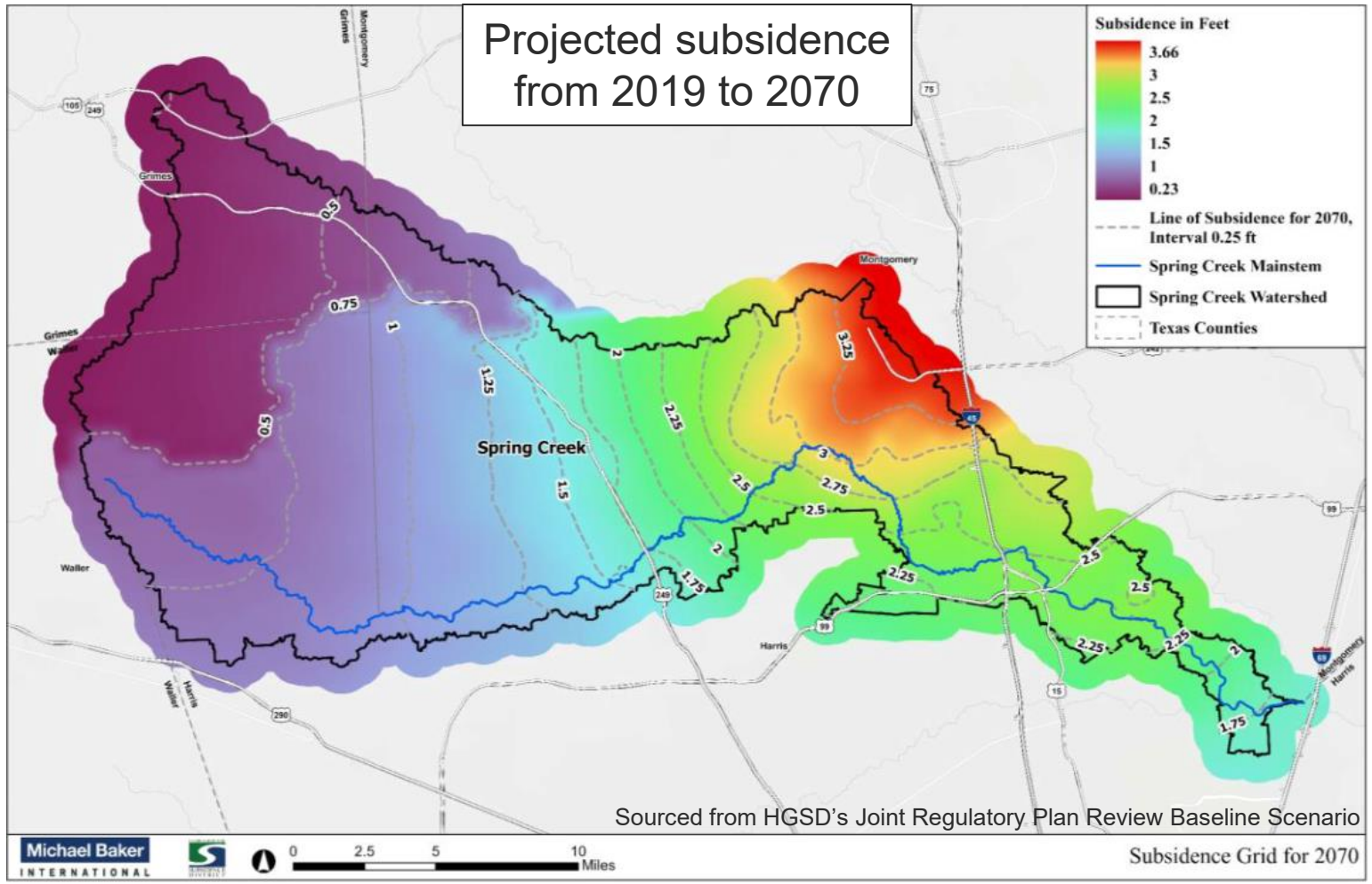
Modeling Conditions

Baseline

- 2020 terrain and land use
- Calibration and comparison

Subsidence with Future Development (SFD)

- Projected 2070 subsided terrain
- Projected 2070 population data
- Projected 2070 land use/land cover



Flood Risk Evaluations | Storm Event Simulations

Calibration

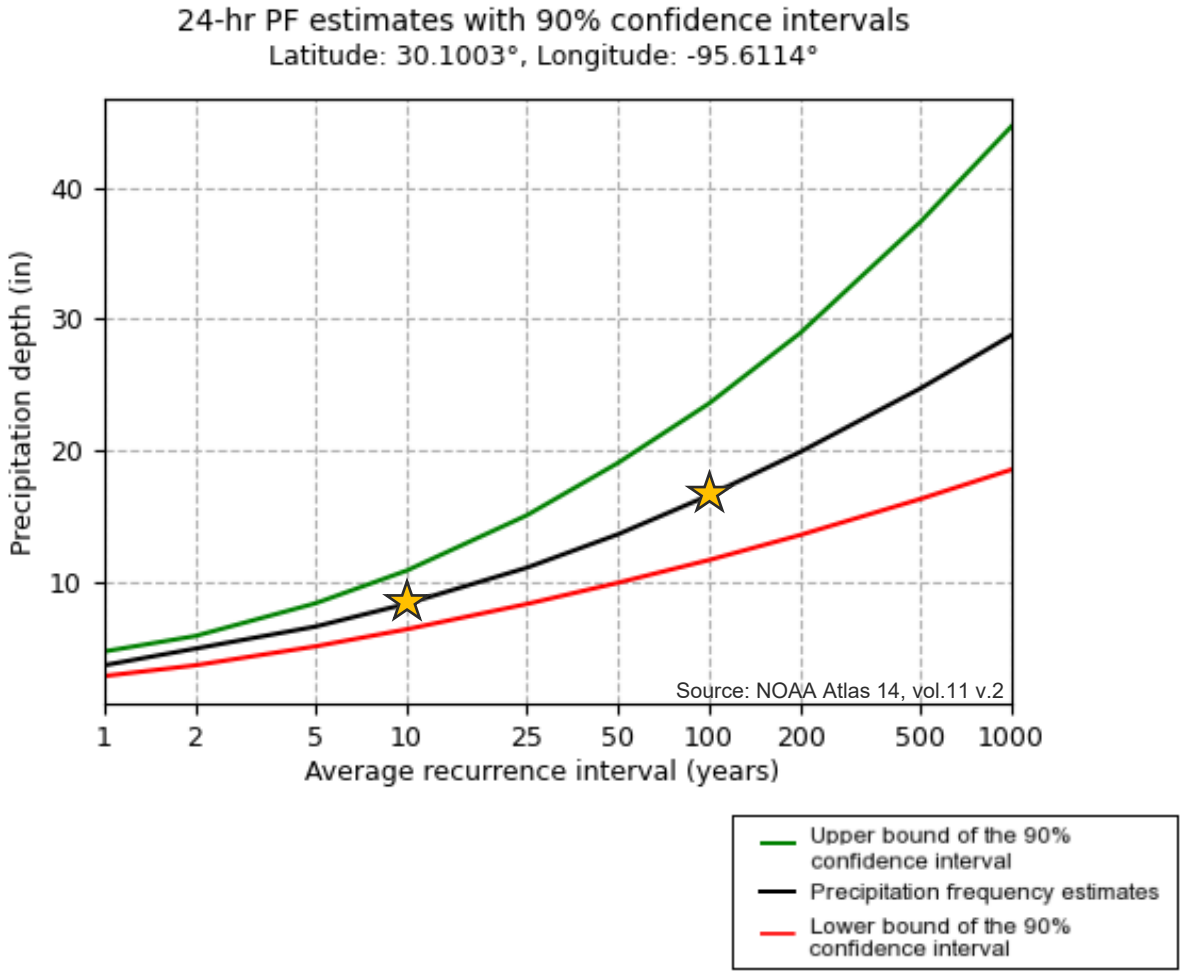
- Hurricane Harvey (2017)
- Hurricane Beryl (2024)

100-year

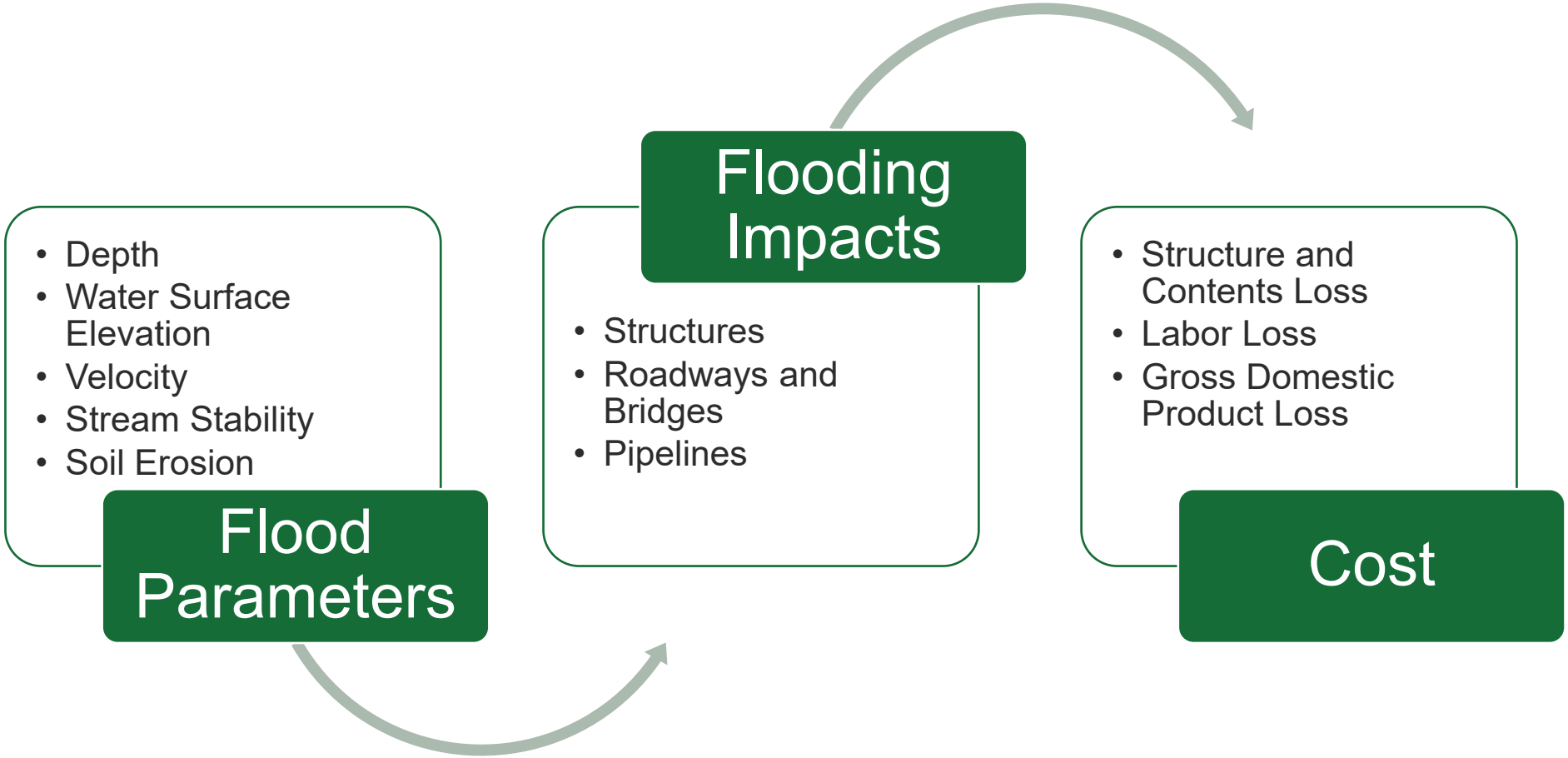
- 1% Annual Exceedance Probability (AEP)
- 16 inches (41 cm) in 24-hrs

10-year

- 10% AEP
- 8 inches (20 cm) in 24-hrs

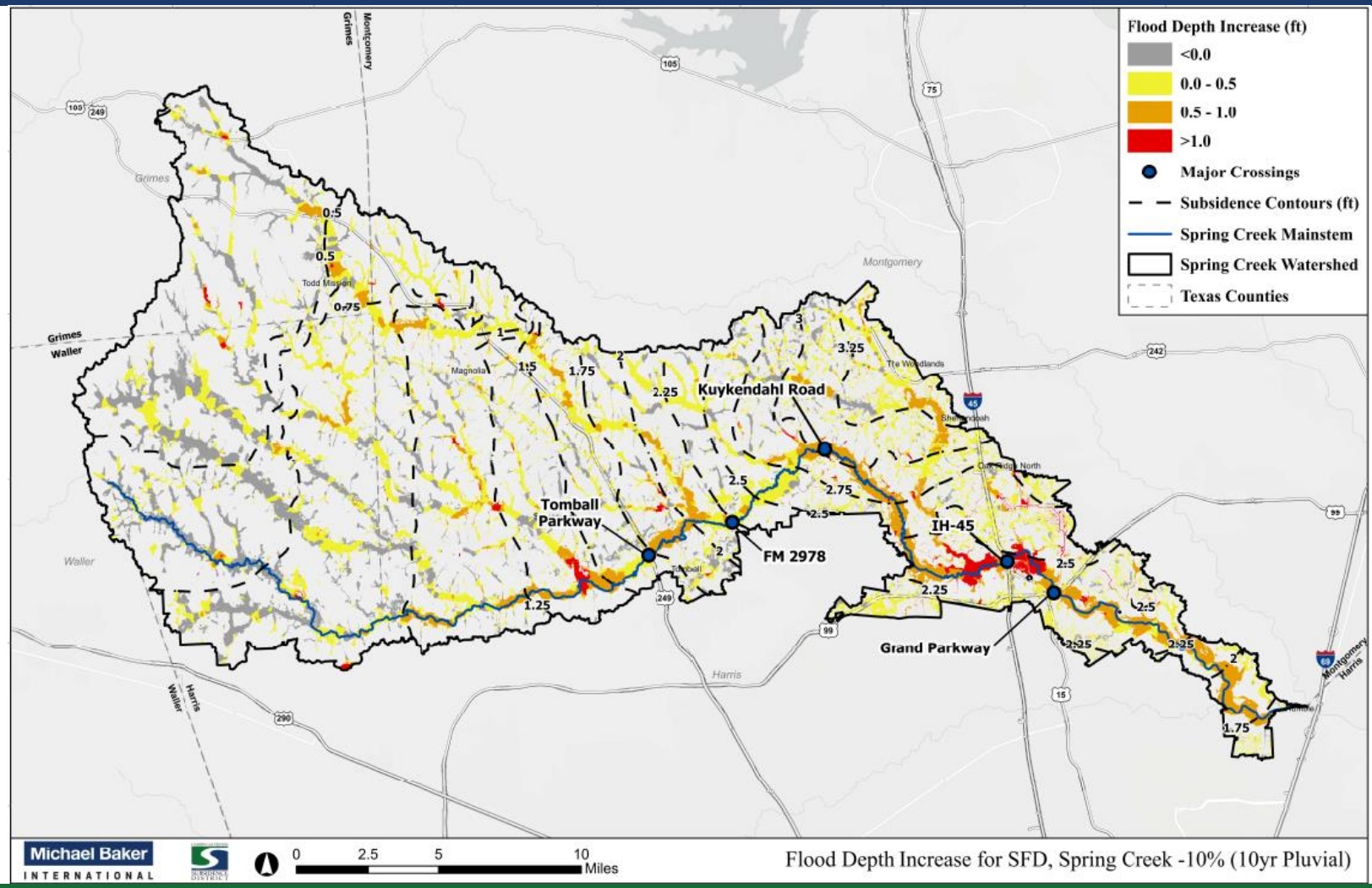


Impact Analysis



Flooding Impacts | SFD 10-yr Event

- Floodplain expanded over **200** acres
- Average flood depth increased by **6** inches
- Streamflow increase by **100** cfs
- Additional **200** flooded structures, majority residential
- Flooded roadways increased by **5** miles



Flood Depth Increase for SFD, Spring Creek -10% (10yr Pluvial)

Economic Impacts | SFD 10-yr Event

Flood depth 30 cm or less

0 to 15 centimeters

451 Newly flooded structures

$19 million in direct loss

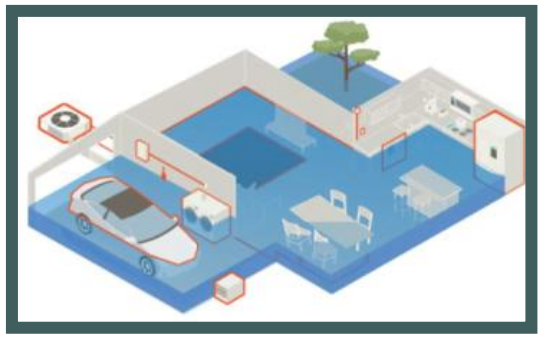
15 to 30 centimeters

137 Newly flooded structures

$29 million in direct loss

Flood depth greater than 0.3 meters

0.3 – 0.9 meters



269 Newly flooded structures

$37 million in direct loss

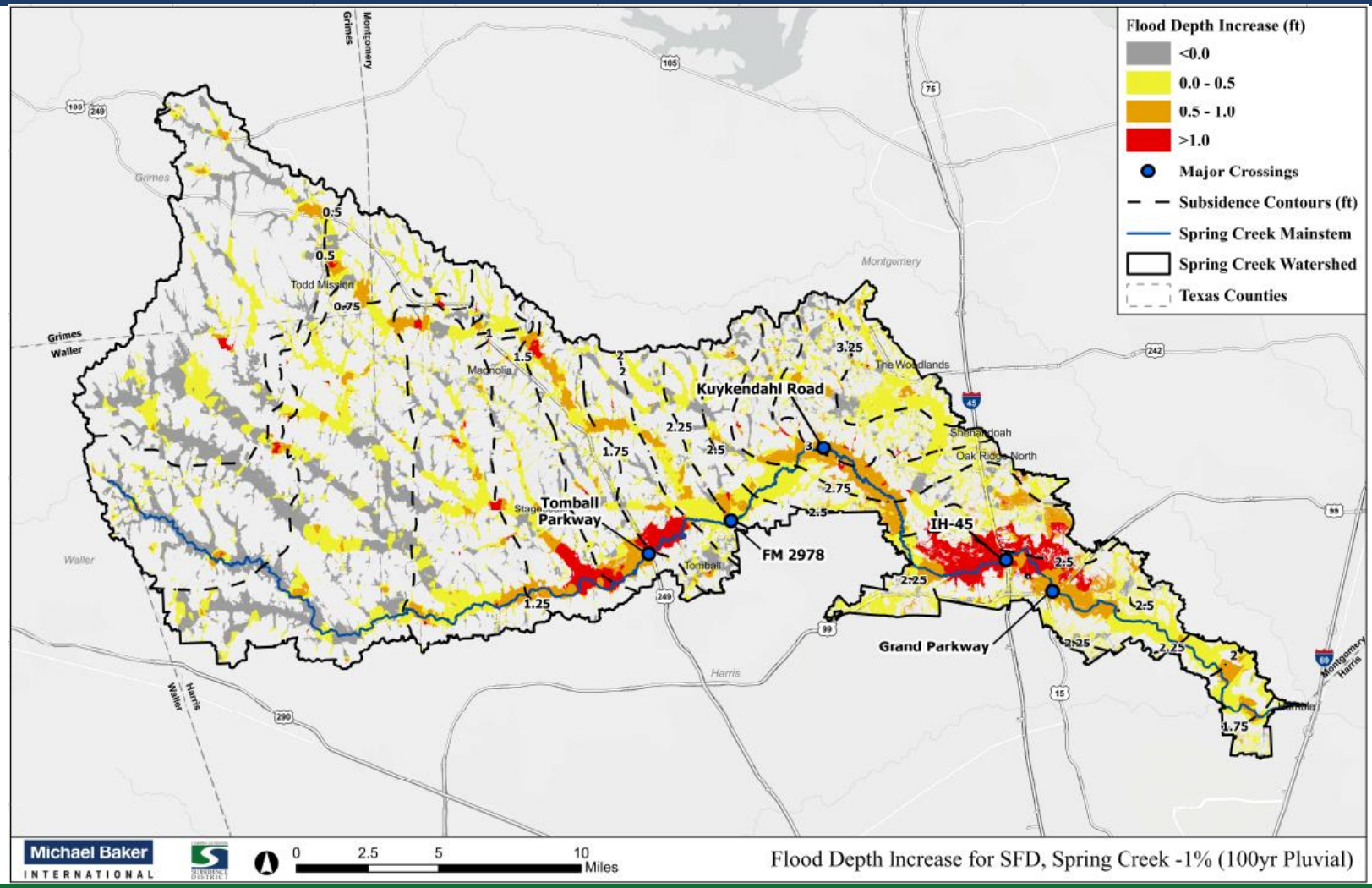
Greater than 0.9 meters

82 Newly flooded structures

$28 million in direct loss

Flooding Impacts | SFD 100-yr Event

- Floodplain expanded over **1,700** acres
- Average flood depth increased by **1** foot
- Streamflow increase by **3,500** cfs
- Additional **3,700** flooded structures, majority residential
- Flooded roadways increased by **40** miles



Flood Depth Increase for SFD, Spring Creek -1% (100yr Pluvial)

Economic Impacts | SFD 100-yr Event

Flood depth 30 cm or less

0 to 15 centimeters

700 Newly flooded structures

$13 million in direct loss

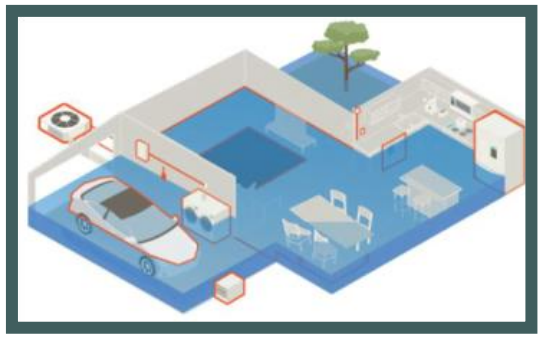
15 to 30 centimeters

819 Newly flooded structures

$30 million in direct loss

Flood depth greater than 0.3 meters

0.3 – 0.9 meters



1,748 Newly flooded structures

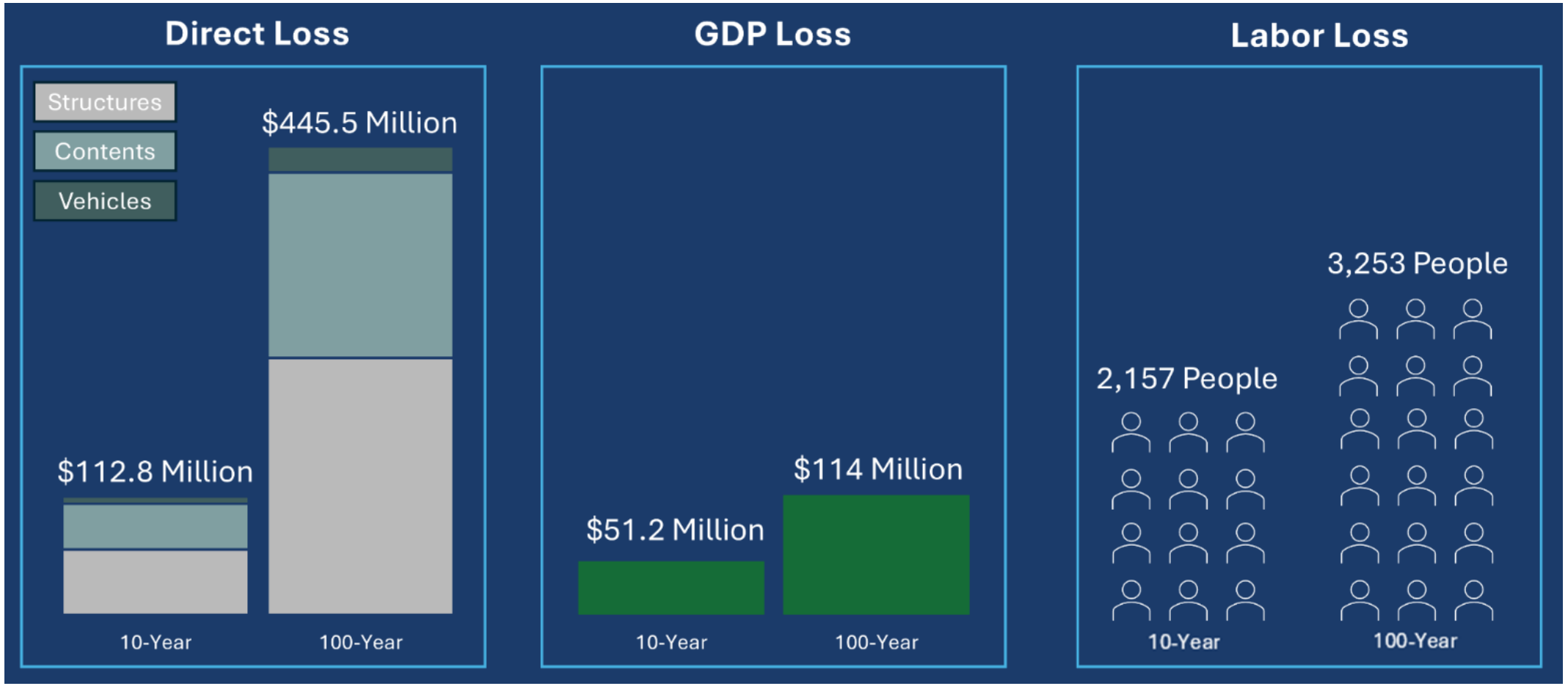
$236 million in direct loss

Greater than 0.9 meters

448 Newly flooded structures

$166 million in direct loss

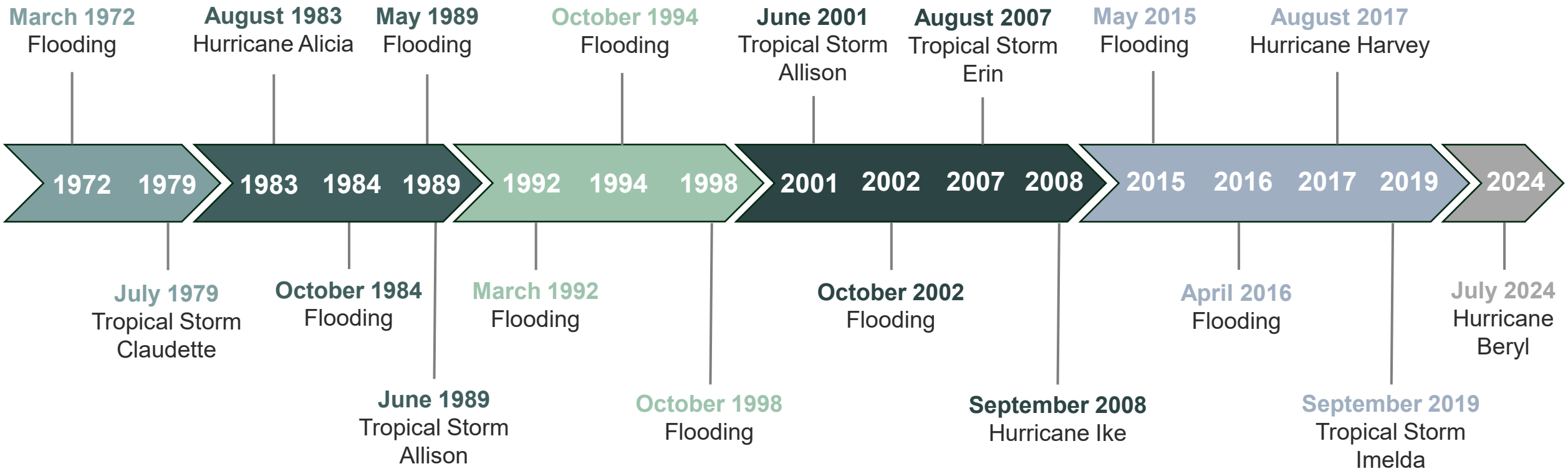
Assessed Economic Impacts from Projected Subsidence



Costs are estimated for a **SINGLE** event across a 50-year time span.

Historical Perspective on Flood Events

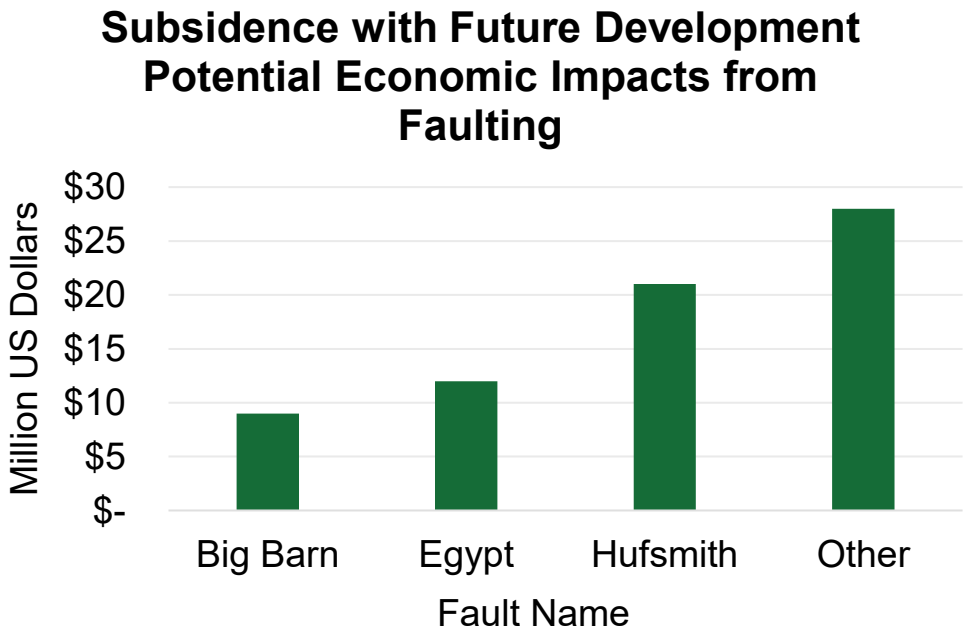
Over the past 52 years of measured data, **18 major flooding events** have occurred in the region.

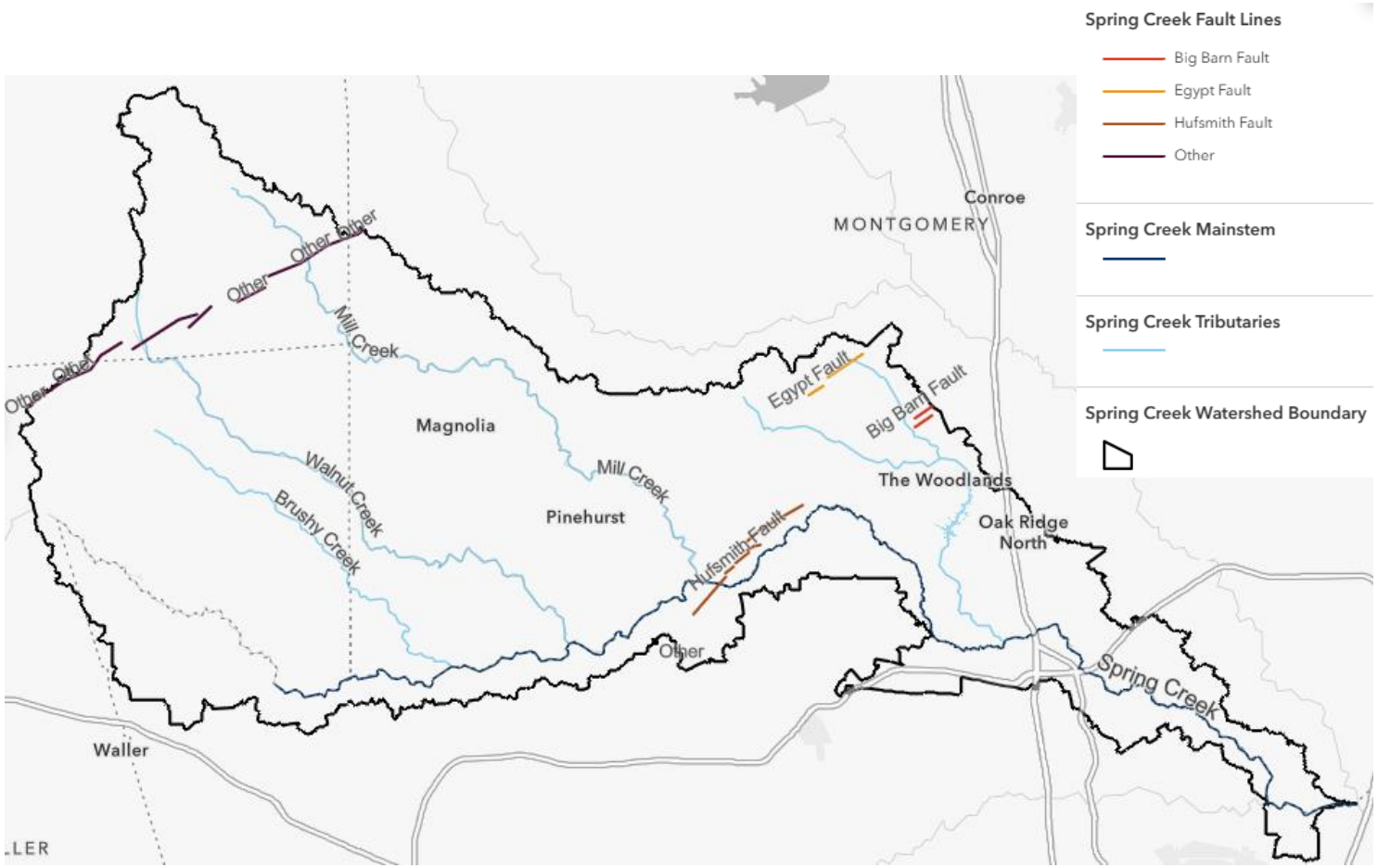


Source: Federal Emergency Management Agency (FEMA) disaster declaration data

Other Potential Losses | Faulting

Total assessed within 200-ft hazard zone is about **$71 million**.





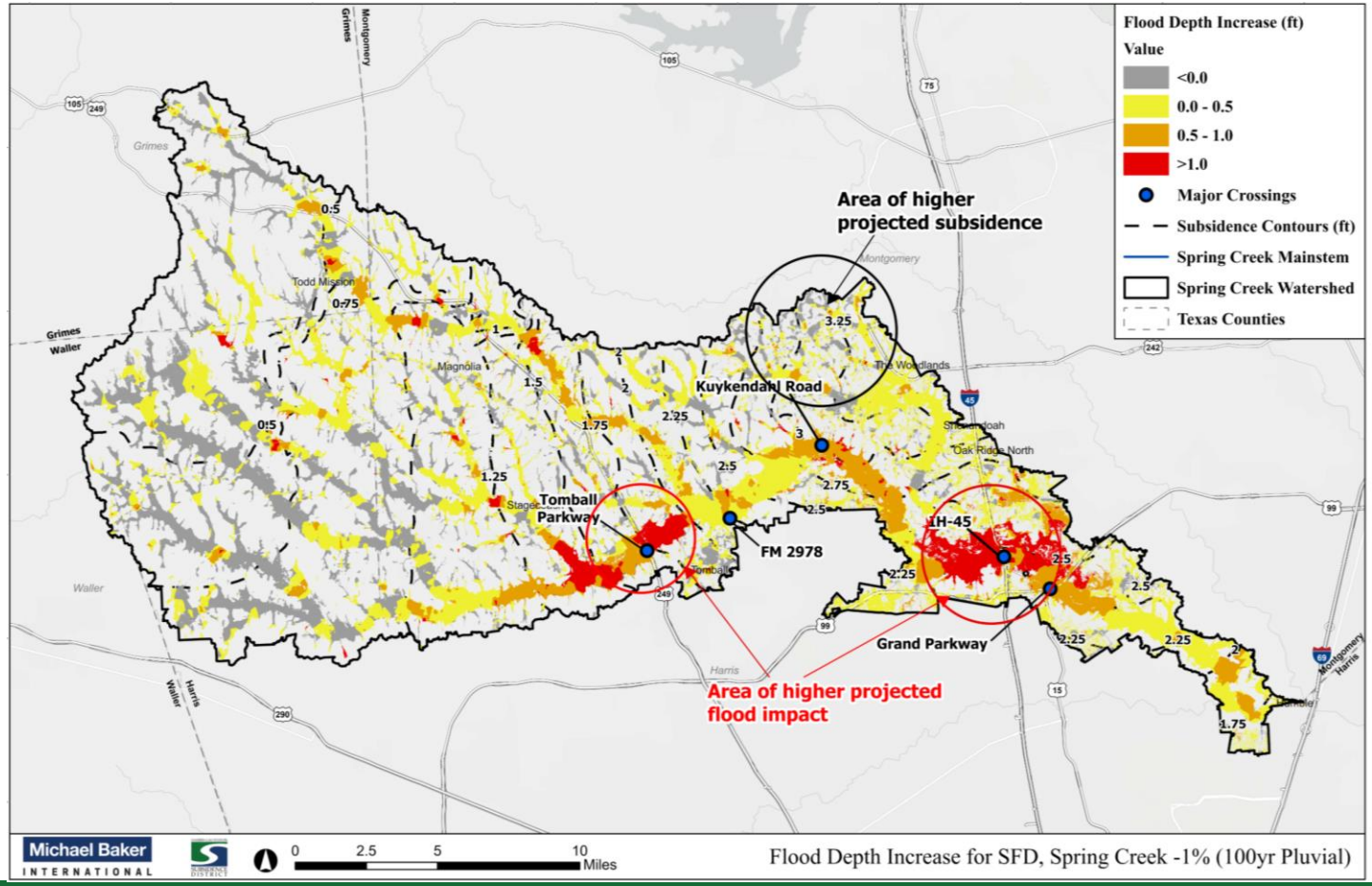
Conclusions

Costs are estimated for a **SINGLE** event across a 50-year time span. This region experienced multiple major flooding events over the recent decades.

Flood Event	Economic Loss	Subsidence with Future Development (Million US Dollars)
10-year	Direct Loss	113
	Indirect Loss (GDP)	51
	Total Loss	**164**
100-year	Direct Loss	446
	Indirect Loss (GDP)	114
	Total Loss	**560**

Excludes $71 million estimated for faulting damages

Greatest flood impacts were experienced **downstream** in the watershed rather than within the area with the most projected subsidence.



More Information | Acknowledgements

- Scan the QR code for the study's webpage. →

- Discover more of our Research by visiting our website at: **HGSUBSIDENCE.ORG/SCIENCE-RESEARCH/DISTRICT-RESEARCH**

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