Resiliency Innovations:
Science, Tools, and Projects

Greg Dobson, Director of Geospatial Technology
UNC Asheville's NEMAC

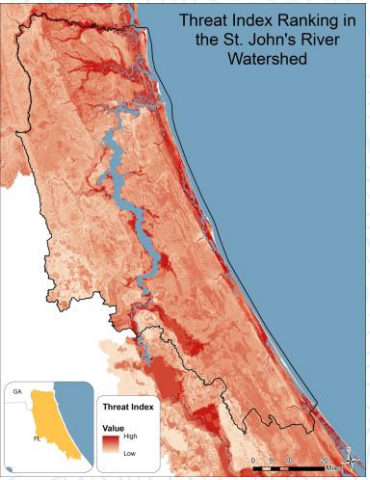
Jeff Hicks, CEO
FernLeaf Interactive

Jim Fox, Director
UNC Asheville's NEMAC

UNC Asheville | NEMAC National Environmental Modeling & Analysis Center

FERNLEAF INTERACTIVE

Coastal Resiliency Assessment



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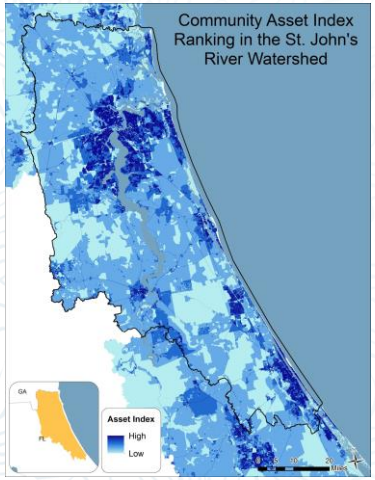

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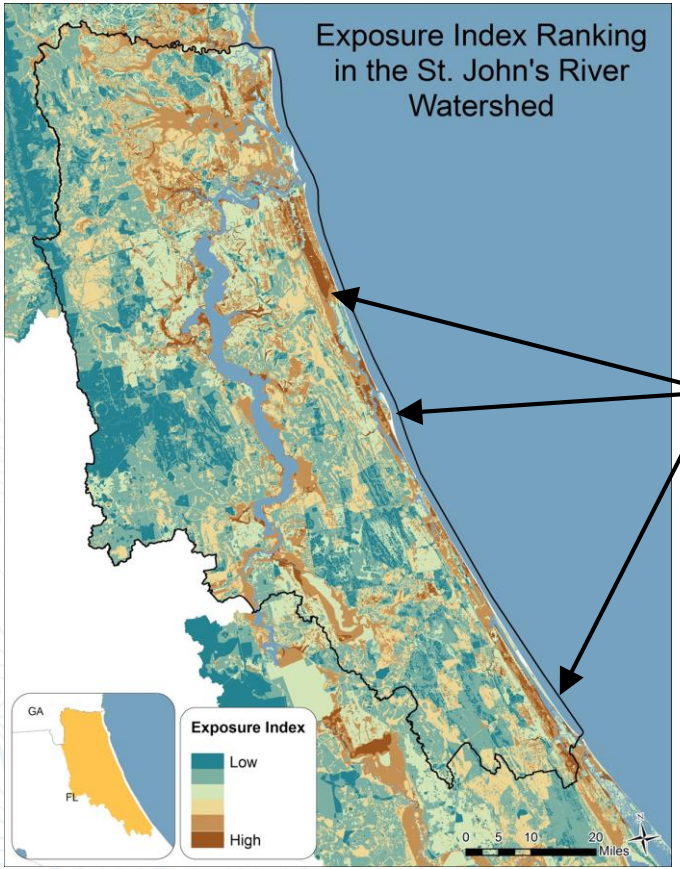


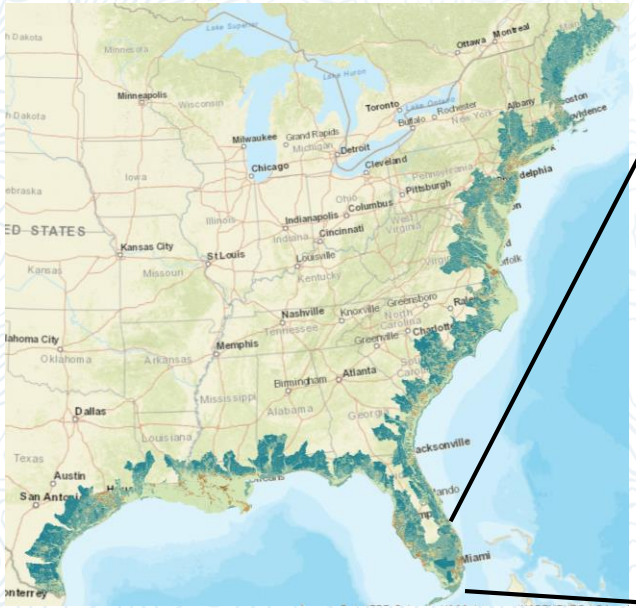
Helps communities understand where the most people and assets are exposed

Threat Index Ranking

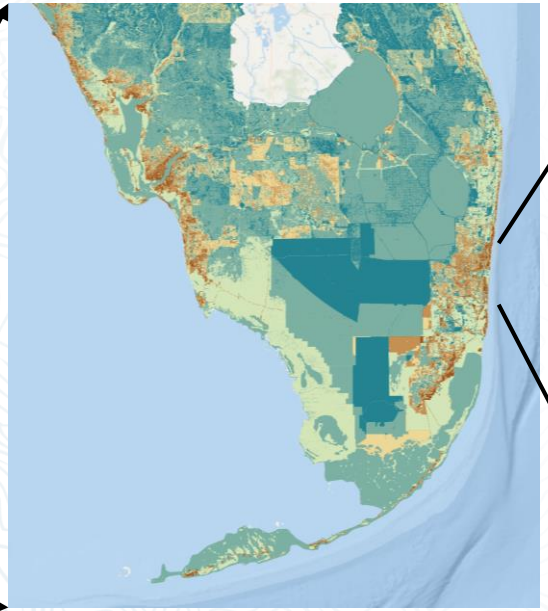
Asset Index Ranking	1 - Low	2 - Med	3 - High
3 - High	3	6	9
2 - Med	2	4	6
1- Low	1	2	3

Coastal Resiliency Assessment

Scalable



East and Gulf Coasts



South Florida

Greater Ft. Lauderdale

U.S. Climate Resilience Toolkit

Information and tools to help you understand and address your climate risks

U.S. Climate Resilience Toolkit
toolkit.climate.gov

https://toolkit.climate.gov/

Steps to Resilience:

Did you know?

Why should I care?

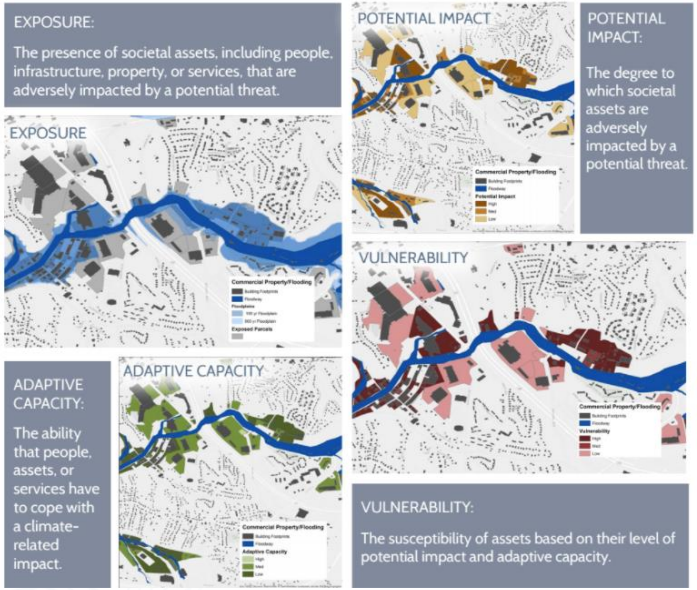
What can we do about it?

U.S. Climate Resilience Toolkit

Information and tools to help you understand and address your climate risks

U.S. Climate Resilience Toolkit
toolkit.climate.gov

Making sense of a complex system using a risk-based process to build resilience



Develop plans with options that are <u>actionable</u> and <u>prioritized</u>

AccelAdapt™

UNC Asheville | NEMAC National Environmental Modeling & Analysis Center | FERNLEAF INTERACTIVE

Continually Assess

AccelAdapt | City of Asheville

Commercial Property/Flooding

Commercial properties exposed to flooding can be affected by inundation of flood waters, leading to structural loss or damage and also resulting in loss of property and economic revenue. One of the greatest impacts in the floods of 2004 was from business interruption. Properties that are business-related with older structures in the floodplain (without baseflood elevation) and that have not implemented flood-proofing measures are most vulnerable. Properties with structures in the floodway and 100-year floodplain have a higher risk than those in the 500-year floodplain. A relatively large proportion of commercial properties exposed to flooding (75%) have high vulnerability and risk. Commercial properties that are most vulnerable and at-risk are found along the major Swannanoa and French Broad river corridors (Biltmore Village and the River Arts District), but are also found in North Asheville just north of Beaver Lake.

Residential Property/Flooding

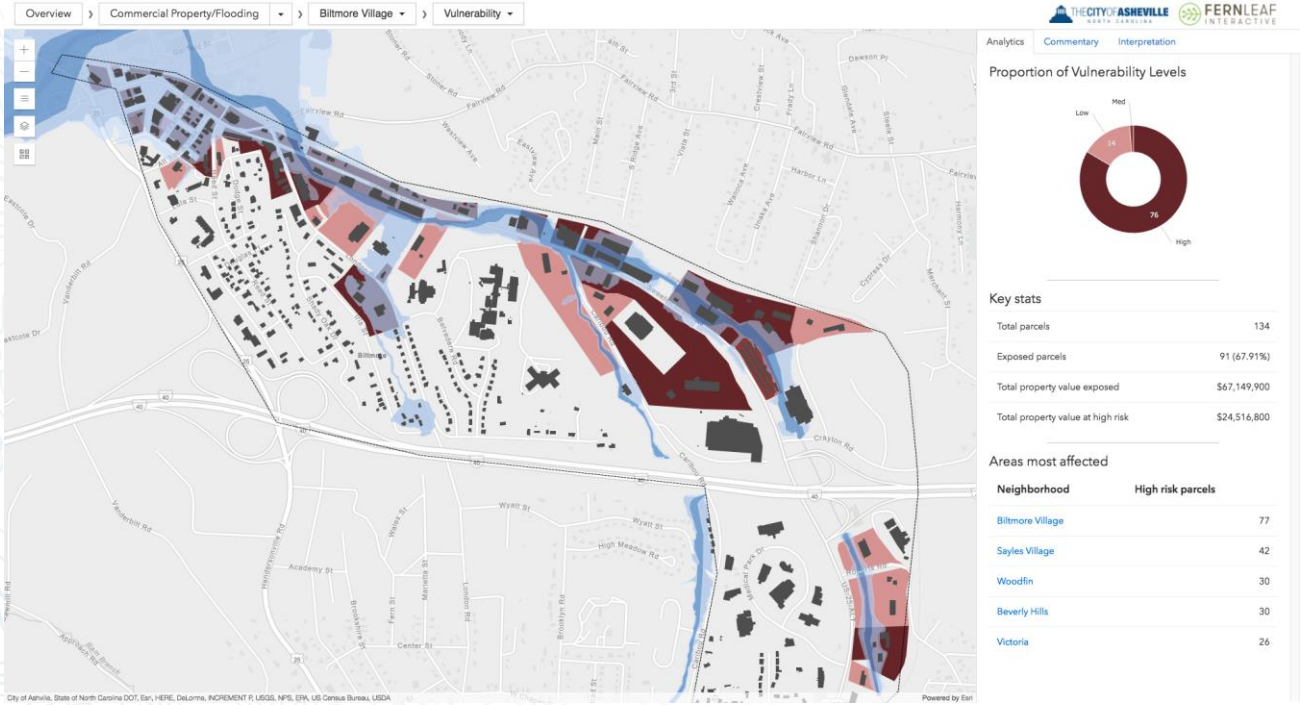
Residential properties have a relatively small proportion exposed citywide (3.7%), but have among the highest total number of properties that are exposed and that have high vulnerability and risk. Areas with high vulnerability and risk for flooding are found across the city, mostly due to the potential for flooding along smaller streams and tributaries that eventually feed into the Swannanoa and French Broad Rivers. Some of these areas are in East Asheville (Haw Creek), North Asheville (Beaverdam Creek), West Asheville (Hominy Creek), and South Asheville (Sweaten Creek). A few of these areas with high vulnerability and risk are also areas with relatively low household income.

Residential Property/Landslides

Residential properties were assessed based on the type of residence (e.g., multiple-residence, manufactured, or single-residence). Multiple-residence, apartment, manufactured, and mobile home park properties in debris flow pathways that were built without meeting current steep slope development requirements are most vulnerable. Properties with structures in debris flow pathways with a higher probability of instability have higher risk.

Critical Infrastructure/Landslides

Residential properties were assessed based on the type of residence (e.g., multiple-residence, manufactured, or single-residence). Multiple-residence, apartment, manufactured, and mobile home park properties in debris flow pathways that were built without meeting current steep slope development requirements are most vulnerable. Properties with structures in debris flow pathways with a higher probability of instability have higher risk.

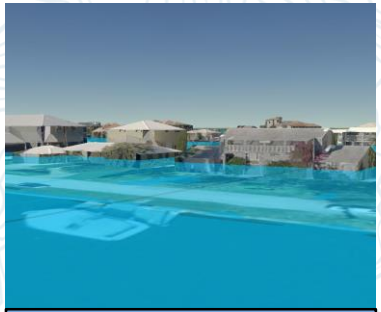


3D GIS Visualization

UNC Asheville | NEMAC National Environmental Modeling & Analysis Center

FERNLEAF INTERACTIVE

1ft Sea-level Rise



5ft Sea-level Rise

FLUX.LAND

REAL-TIME FLOOD MAP

FADI MASOUD

Assistant Professor of Landscape
Architecture + Urbanism
University of Toronto

MIHO MAZEREEUW

Associate Professor of
Architecture + Urbanism
Director – Urban Risk Lab
Massachusetts Institute of Technology

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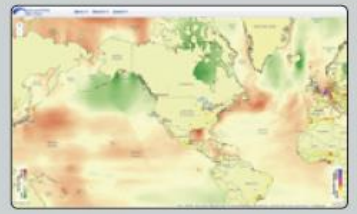
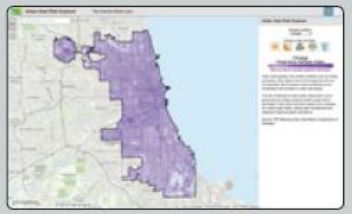
UNIVERSITY OF TORONTO
JOHN H. DANIELS FACULTY OF
ARCHITECTURE, LANDSCAPE, AND DESIGN

MIT | UrbanRISKLab



Sea-level-rise & vertical land movement for cities

Visualisation of location specific variations in sea level rise



Urban Heat Risk Explorer

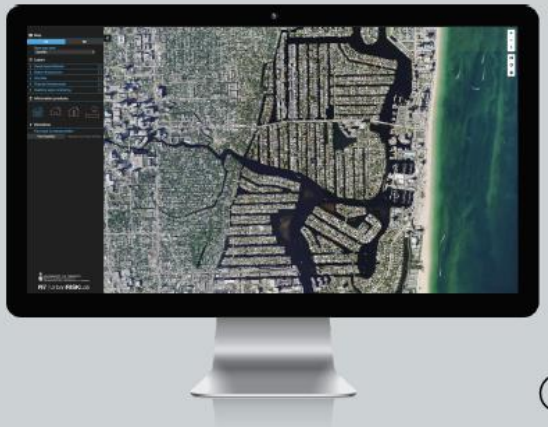
Heat islands, surface perviousness, tree canopies as heat maps for 6 US city-regions

Modelling community erosion from climate change

Effects of land-use, mitigation strategies on soil erosion alongwith future climate uncertainty

Coastal resilience

Exploration, simulation & projective modelling toolkit



PostGIS, pgSQL RDB; suitable for storing geometric datasets & conducting geospatial operations

Node server for concurrent requests; asynchronous data handling & back-end analysis

Cross-platform, cloud mapping service; allowing visualization of vector map layers & front-end analysis

Existing online tools

Usage modules

1

Awareness, communication & education tools

- Trigger a dialogue about the dynamic hydrological conditions & increased vulnerability due to climate change, sea-level rise

2

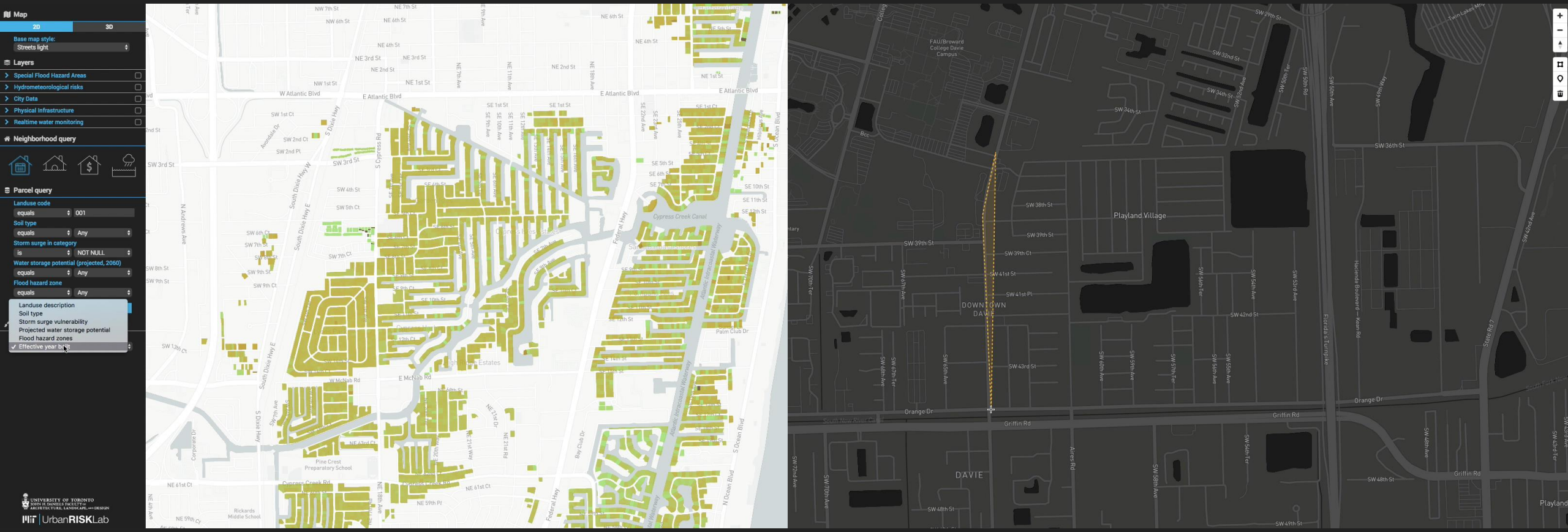
Planning & inter-agency coordination tools

- Preparedness, mitigation and resilient urbanisation efforts
- Analysis & scenario modelling

3

Actionable insights for developers & individuals

- Flexible codes & standards
- Repository for projects & interventions


Map
2D
3D
Base map style:
Streets light
Layers
Special Flood Hazard Areas
Hydrometeorological risks
City Data
Physical Infrastructure
Realtime water monitoring
Neighborhood query
Parcel query
Landuse code
equals
001
Soil type
equals
Any
Storm surge in category
is
NOT NULL
Water storage potential (projected, 2060)
equals
Any
Flood hazard zone
equals
Any
Landuse description
Soil type
Storm surge vulnerability
Projected water storage potential
Flood hazard zones
Effective year built
UNIVERSITY OF TORONTO
JOHN H. DANIELS FACULTY of ARCHITECTURE, LANDSCAPE, and DESIGN
MIT | UrbanRISKLab
E Atlantic Blvd
W Atlantic Blvd
S Dixie Hwy
Federal Hwy
Cypress Creek Canal
Atlantic Intracoastal Waterway
E McNab Rd
Palm Club Dr
S Ocean Blvd
Pine Crest Preparatory School
Rickards Middle School
Playland Village
DOWNTOWN DAVIE
DAVIE
Orange Dr
Griffin Rd
SW 36th St
SW 42nd St
SW 48th St
SW 49th St
Florida's Turnpike
Hacienda Boulevard – Keen Rd
FAU/Broward College Davie Campus

Map

2D | 3D

flux Broward map

Planning for uncertainty
Preparedness, mitigation & resilience

TOOLS | MAP CONFIG | ABOUT

LAYERS

- Special Flood Hazard Areas
- Hydrometeorological risks
- Infrastructure
- Other
- Storm Surge
- City data
- Realtime

Layer Info

Style layer

Layer : 3D buildings with Landuse

Style : Landuse description

Change style

Cataloging of architecture, landscape and infrastructure project proposals for mitigation & resilience.

Controls and standards emerging from dynamic process-driven ecological paradigms permit diversity and incentivize flexibility.

WAREHOUSES, AND DISTRIBUTION CENTERS

Landuse Code : 048

Effective year built : 1978

Status : Existing

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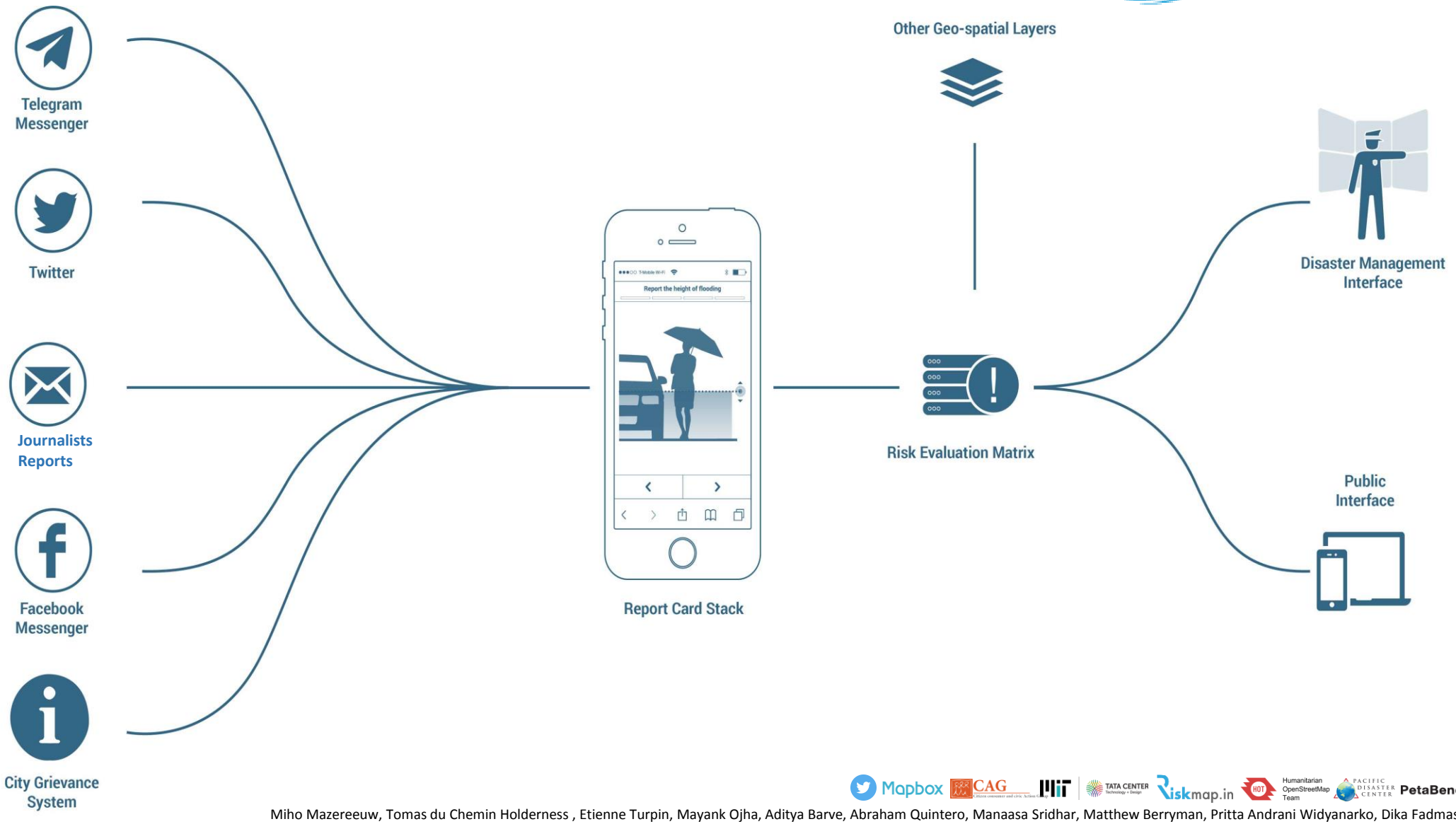
Real-time Flood Reporting and Mapping Platform

RiskMap.us



BROWARD COUNTY FLORIDA

MIT | UrbanRISKLab

Miho Mazereeuw, Tomas du Chemin Holderness , Etienne Turpin, Mayank Ojha, Aditya Barve, Abraham Quintero, Manaasa Sridhar, Matthew Berryman, Pritta Andrani Widyanarko, Dika Fadmastuti, Christina Geros, Nashin Mahtani, Emir Hartato

REAL-TIME WATER LEVELS

my.sfwmd.gov

Refresh

Report generation started at 07/26/2017 06:30:13
Data for this report was last updated on 07/26/2017 06:24:25
NOTE: The values shown below are displayed in Eastern Standard Time (EST)

REALTIME HOME PAGE>> FORT_LAUDERDALE
Click on a record below to view detailed Data.

"db" link is to DBHYDRO information
"JN/SITE" locations can be a Junction (JN) or Site
Hydraulic Element Set (HES) name suffix designate the control types of -C (Culvert), -P (Pump), -L (Lock), -S (Spillway), or -F (Flashboard).
Upstream, Downstream, and Flow data are in black color if the value is recorded in last one hour. Purple if between 1 and 24 hours. Brown if more than 24 hours old.

Flow - (cfs) *Stage - (Feet, NGVD)*

db	WCS	JN/SITE	Plot	HES	UPSTREAM	DOWNSTREAM	Flow	STATE	1	2	3
		G204_5_6		G204-C	11.12	10.58	0	No Weir Flow	11.65	11.64	11.92
				G205-C	12.21	10.92	5	6 Weirs Bays @12.09ft	12.06	12.07	12.12
				G206-C	12.42	10.57	7	Unavailable	12.20	12.20	12.20
		G371		G371-S	9.89	10.18	0	All Gates Closed	.01	.02	
		G54		G54-S	3.69	1.48	317	1 Gate Open @2.63ft	.01	2.63	.01
		G56		G56-S	7.81	-.44	146	1 Gate Open @0.5ft	-.01	.50	.00
		G57		G57-S	4.46	-.46	0	1 Gate Open @0.24ft	.24	.02	
		G64		G64-C	12.90	12.00	Unavailable	All Gates Closed	.00		
		G65		G65-C	6.13	4.49	12	1 Gate open @0.49ft	.49		
		G87		G87-C	Unavailable	Unavailable	Unavailable	NA			
		LHPS		LHPS-P	5.53	3.47	Unavailable	All Pumps Off	0	0	0
		S11		S11A-S	13.00	11.85	959	4 Gates Open @1.5ft	1.50	1.50	1.50
				S11B-S	13.03	11.88	640	4 Gates Open @1ft	1.00	1.00	1.00
				S11C-S	13.08	11.82	0	All Gates Closed	.00	.00	.00
		S124_S125		S124-C	3.94	4.30	0	Unavailable	.00	.00	.02
				S125-C	3.75	3.98	0	All Gates Closed	-.01		
		S13		S13-P	1.40	.81	197	All Pumps Off	0	0	0
				S13-S	1.40	.81	0	1 Gate Open @5.49ft	5.49		

RiskMap.us

https://riskmap.us/map/broward

Search

Will you allow riskmap.us to access your location?
Learn more...
Remember this decision
Don't Allow
Allow Location Access

South County Regional Park
Fran Reich Preserve
Boca Rato
Water Conservation Area 2A
Water Conservation Area 2B
Pompano Beach
Southwest Ranches
West Lake Park
Water Conservation Area 3A
Water Conservation Area 3B
Oleta River State Park
FLL

en | es

Info

MIT | UrbanRISKLab

RiskMap.us harnesses the power of social media to gather, sort, and display information about flooding in real time.

RiskMap.us is a project initiated by the Urban Risk Lab at MIT as a free, transparent platform for public reporting and disaster management in cities around the world.

The platform asks the public to report through their preferred social media interface. It then gathers, sorts, and visualizes the data using CogniCity Open Source Software - an enterprise-level platform for emergency response and disaster management.

This framework creates a real-time map which is immediately made available for residents, communities, and government agencies, reducing risk togather

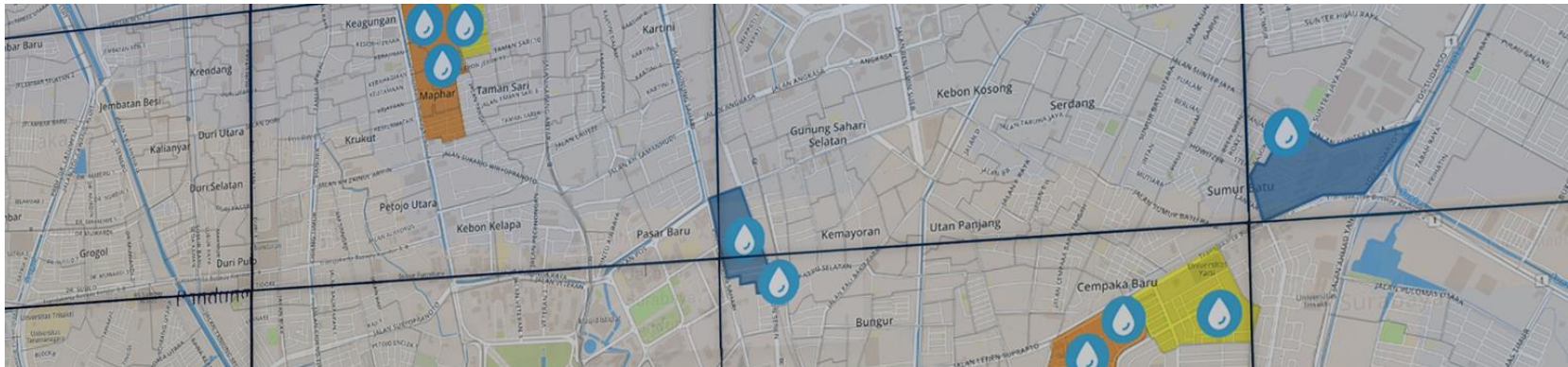
NOTE: For any emergency situation that requires immediate assistance from the police, fire department or ambulance, please call 911

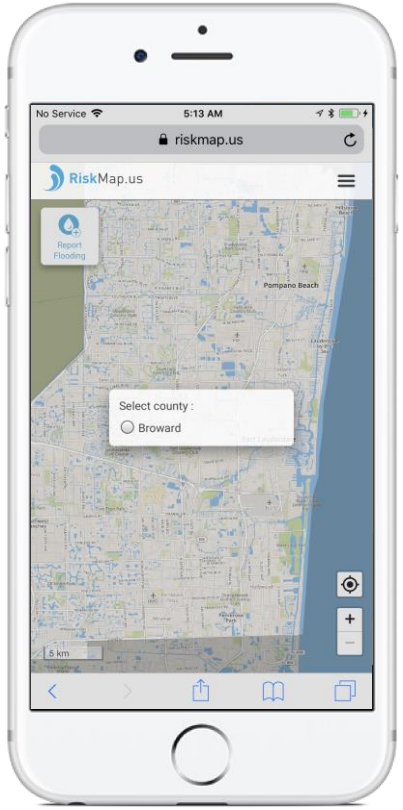
Implementing partner

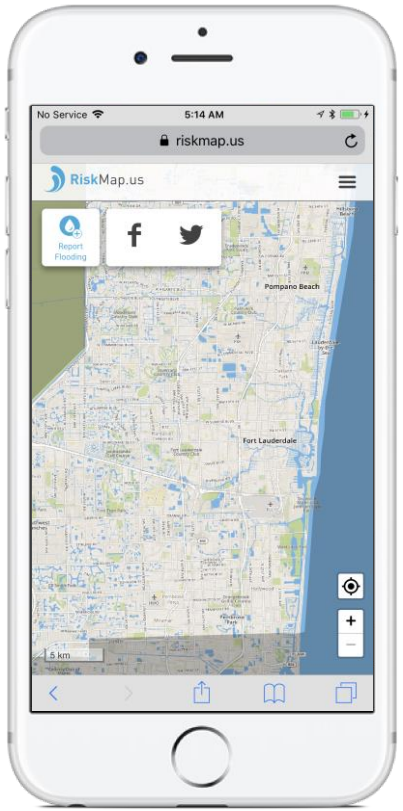
BROWARD COUNTY FLORIDA

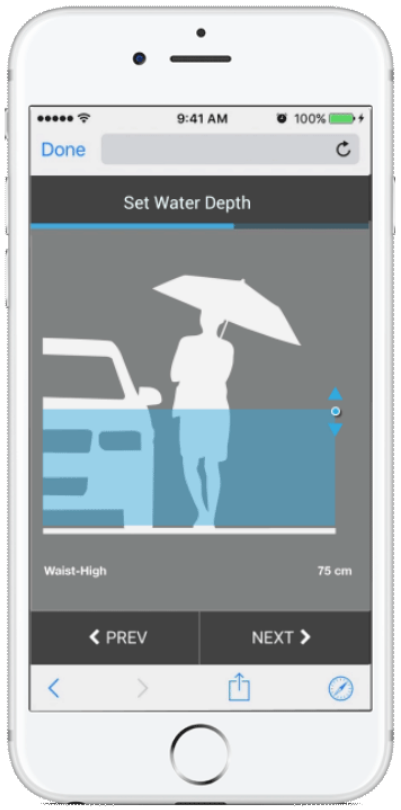
Data partners

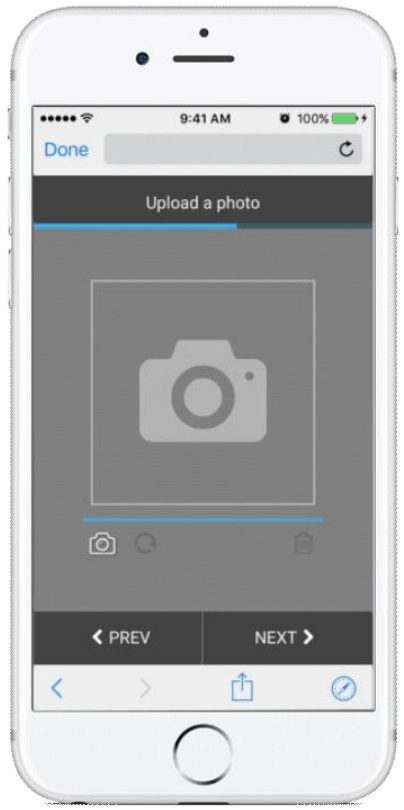
Mapbox



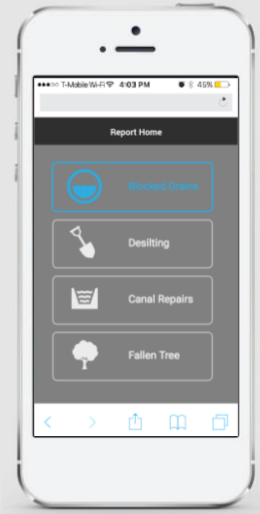




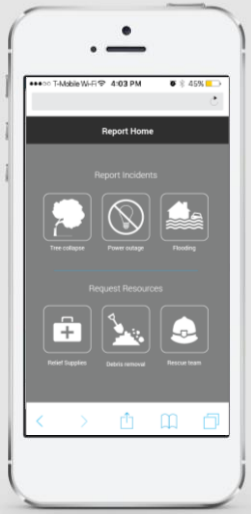


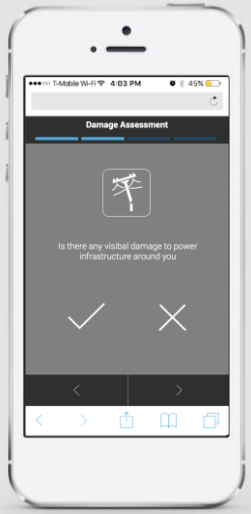


PRE Hurricane Preparedness Cards



Real-Time Reporting Cards





Shelter navigation and way finding, types of evacuation centers, capacity of evacuation centers

Post Disaster Assessment Cards

RiskMap.us
MIT | UrbanRISKLab

BROWARD'S $15BN QUESTION

USING RESILIENCE ANALYTICS TO EFFECTIVELY MANAGE FLOODING

Daniel Stander
Global Managing Director
Risk Management Solutions

January 8, 2018

DISCLAIMER

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DISCLAIMER #2

ALL MODELS ARE WRONG, …

…BUT SOME ARE USEFUL.

George E. P. Box

DISCLAIMER #3

Every event teaches us something new

FORT LAUDERDALE

HOLLYWOOD

What's the VaR?
How might it change?
How do I best reduce it?

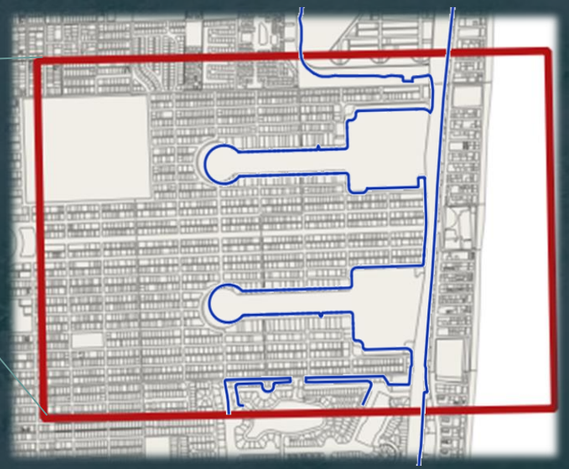
FORT LAUDERDALE

$13.1bn

$1.8bn

HOLLYWOOD

FORT LAUDERDALE



HOLLYWOOD

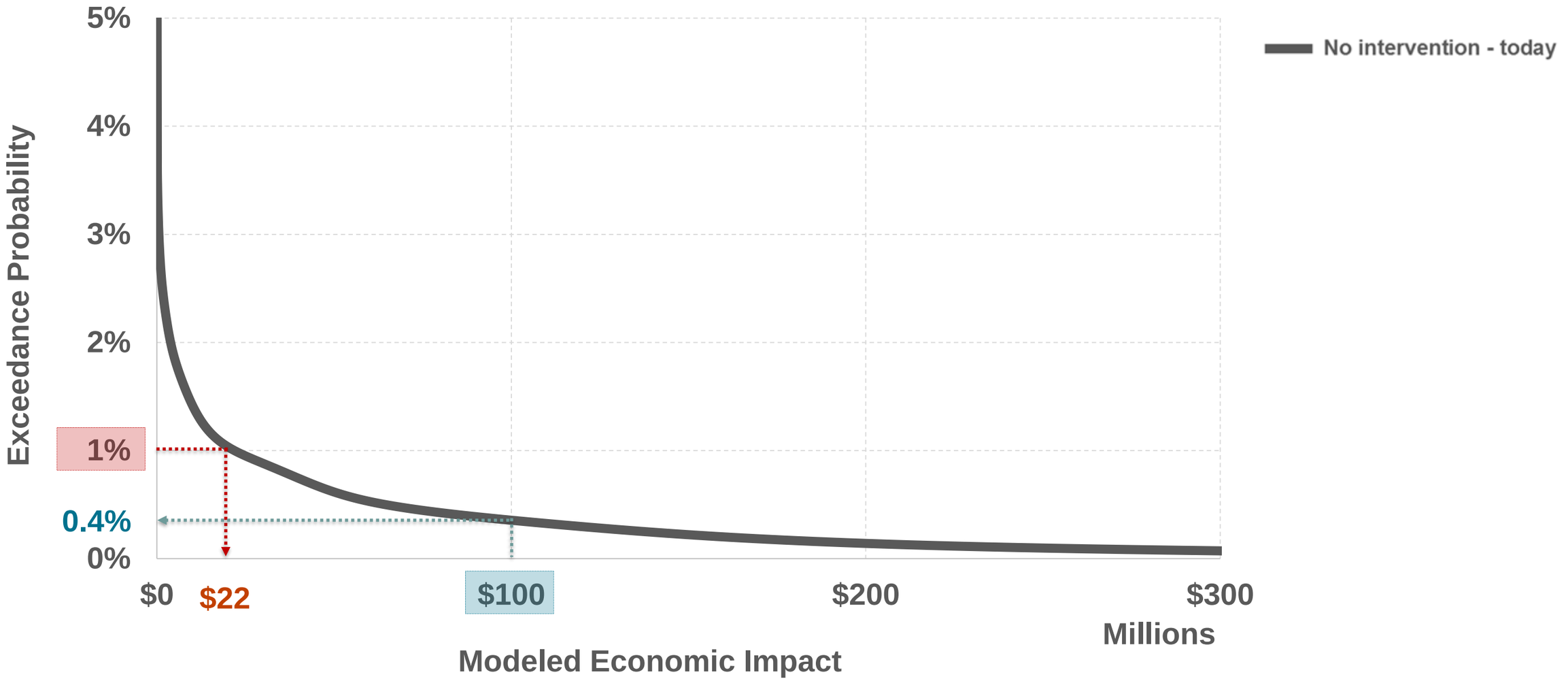
What's the VaR?

How might it change?

How do I best reduce it?

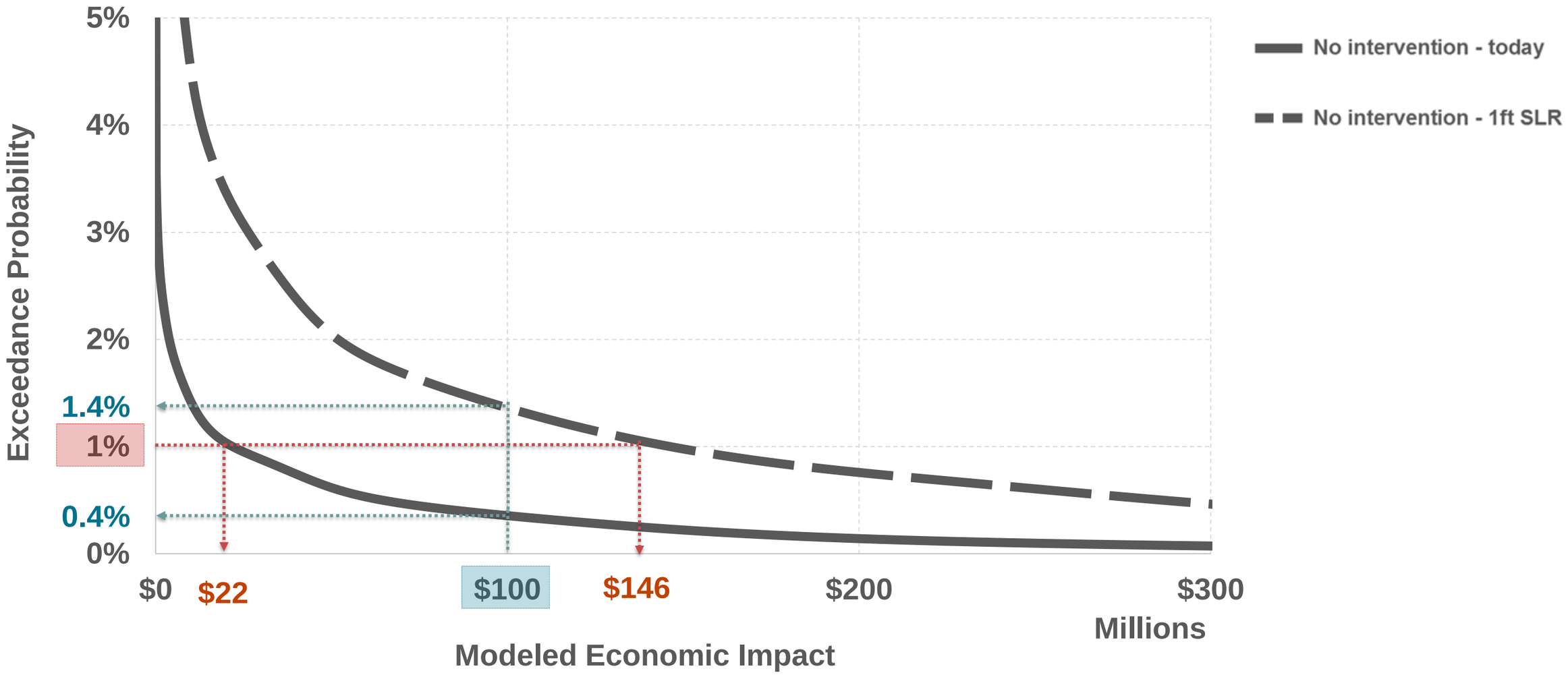
WHAT MIGHT STORM-DRIVEN FLOODING COST TODAY?

1% CHANCE IT MIGHT COST ≥$22M; 0.4% IT COSTS ≥$100M



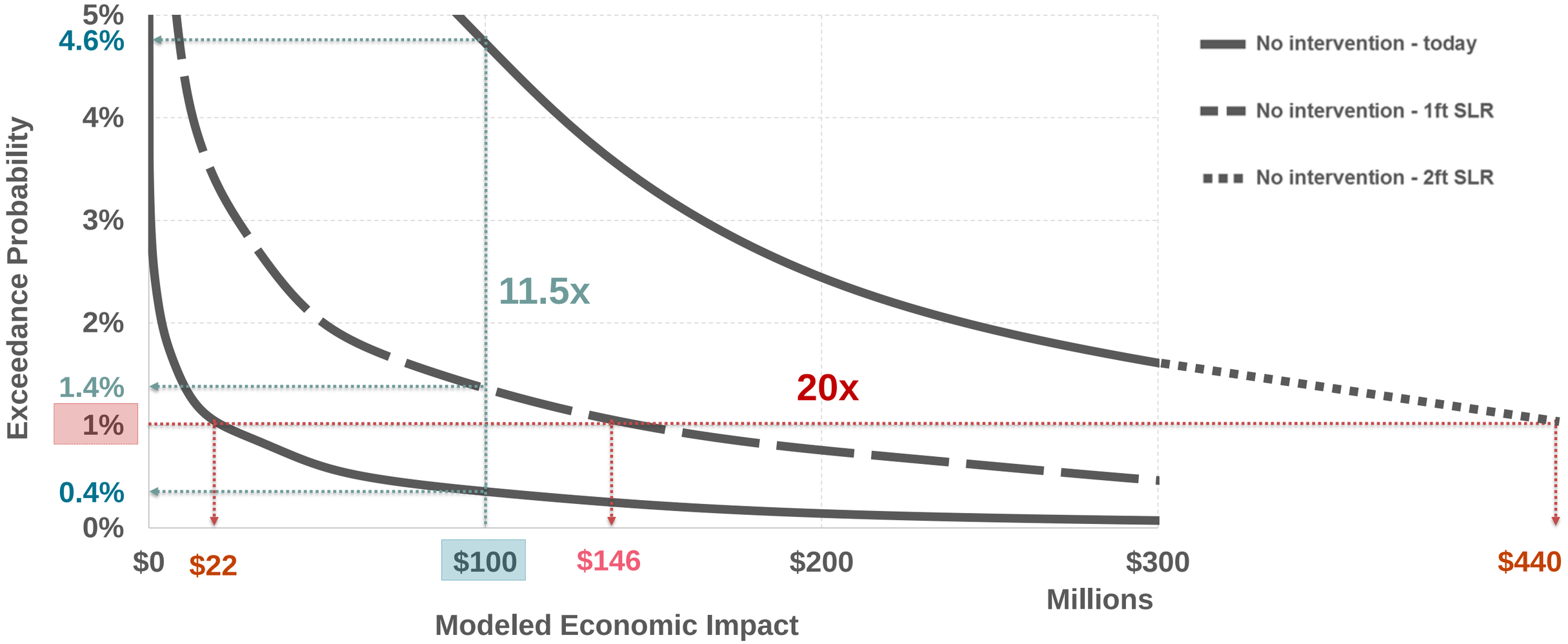
AND ASSUMING 1FT SLR?

1% COST OF INACTION ≥$146M; 1.4% IT COSTS ≥$100M

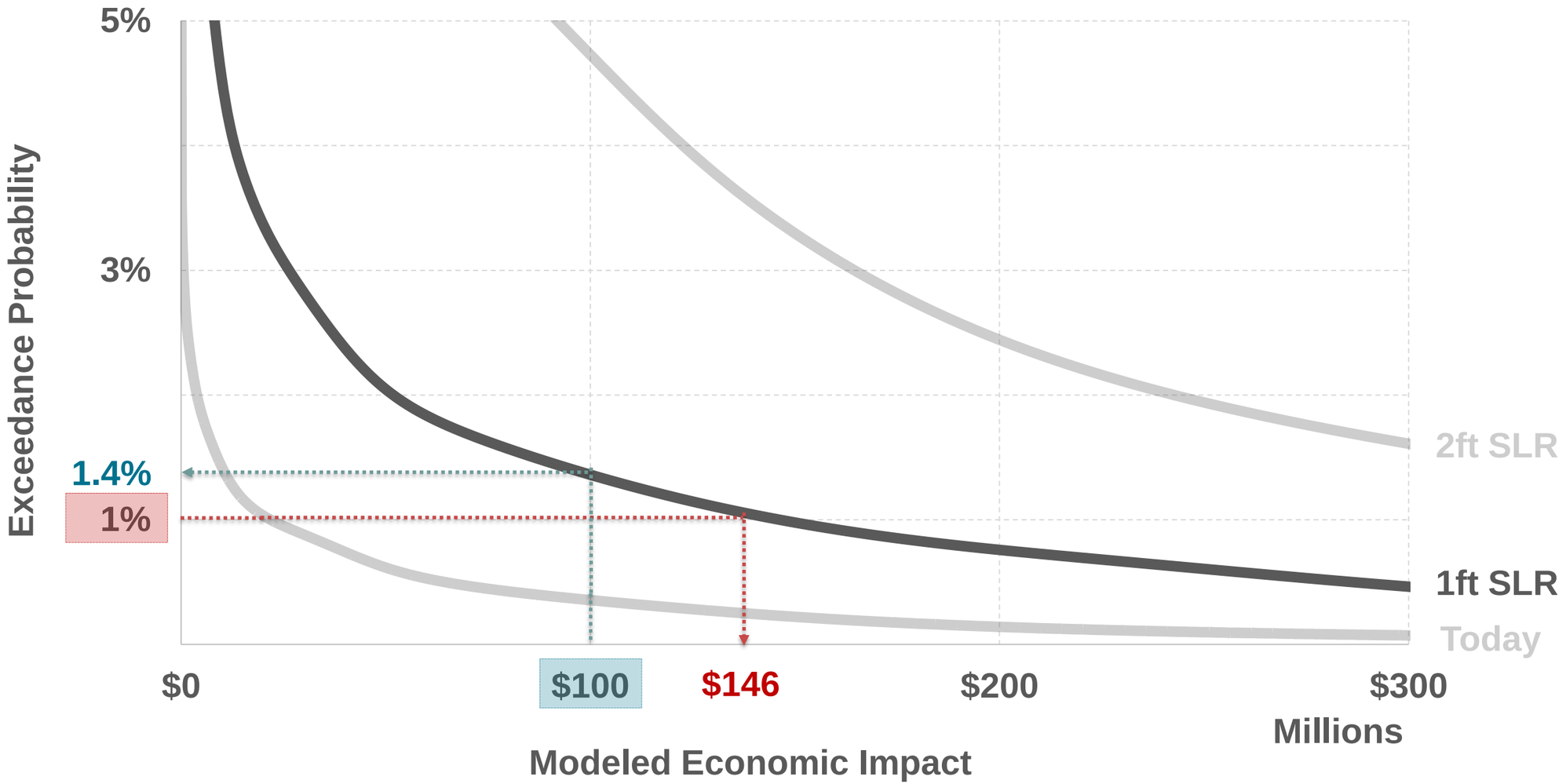


AND ASSUMING 2FT SLR?

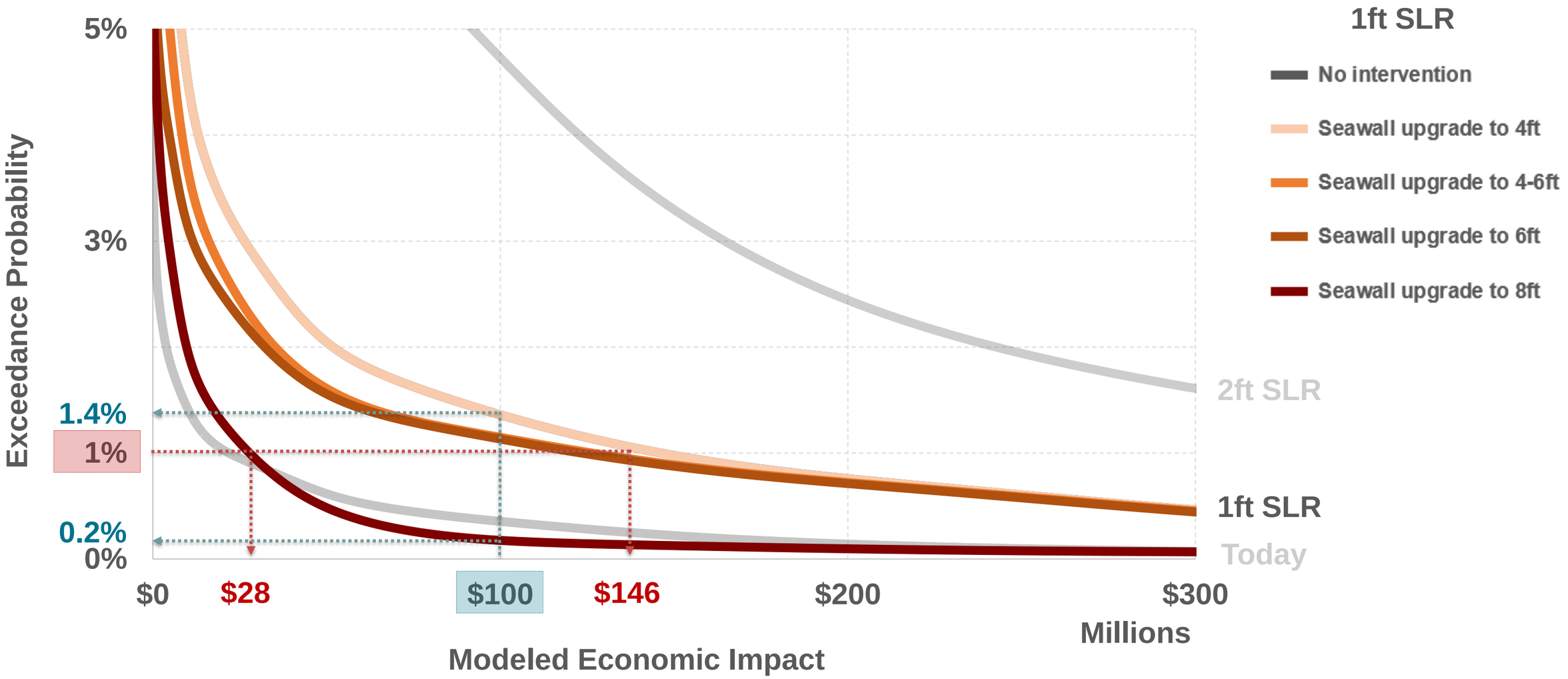
1% COST OF INACTION ≥$440M; 4.6% SURGE COSTS ≥$100M / ANNUM



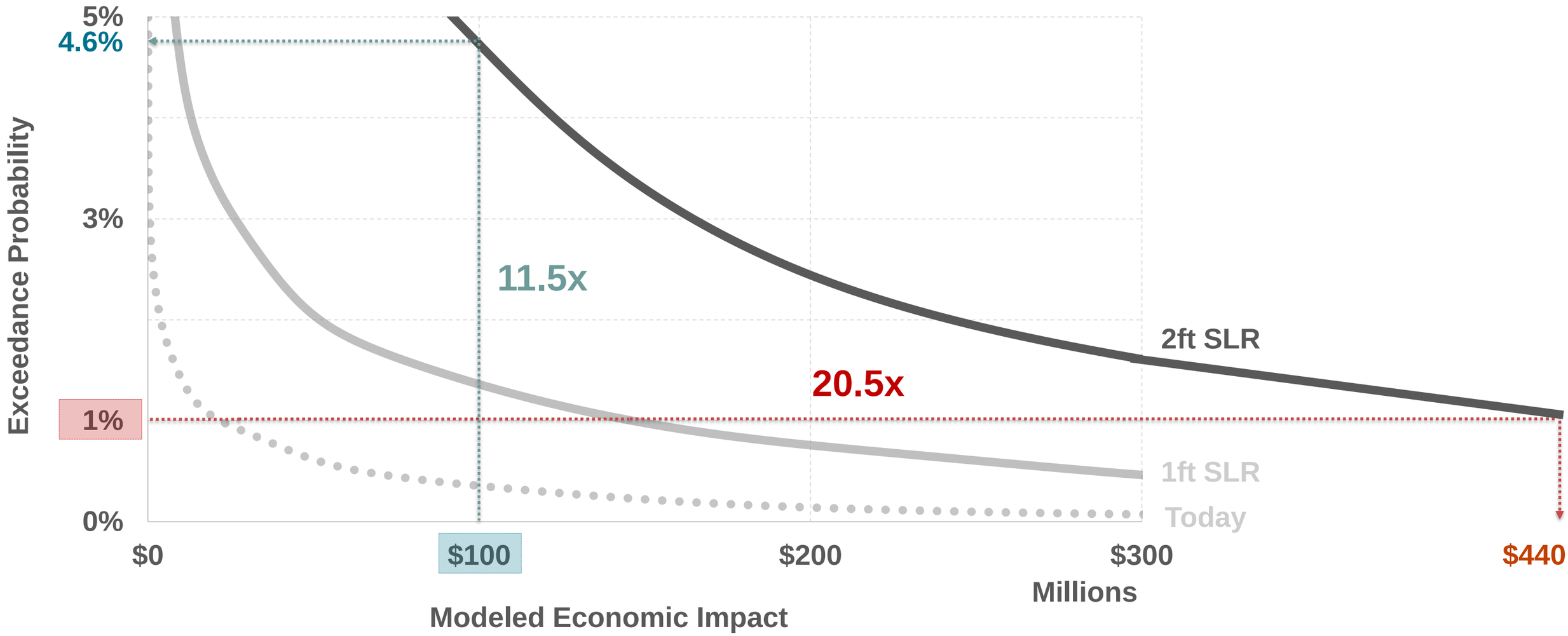
LET'S ASSUME WE'RE DEFENDING FOR 1FT OF SLR…



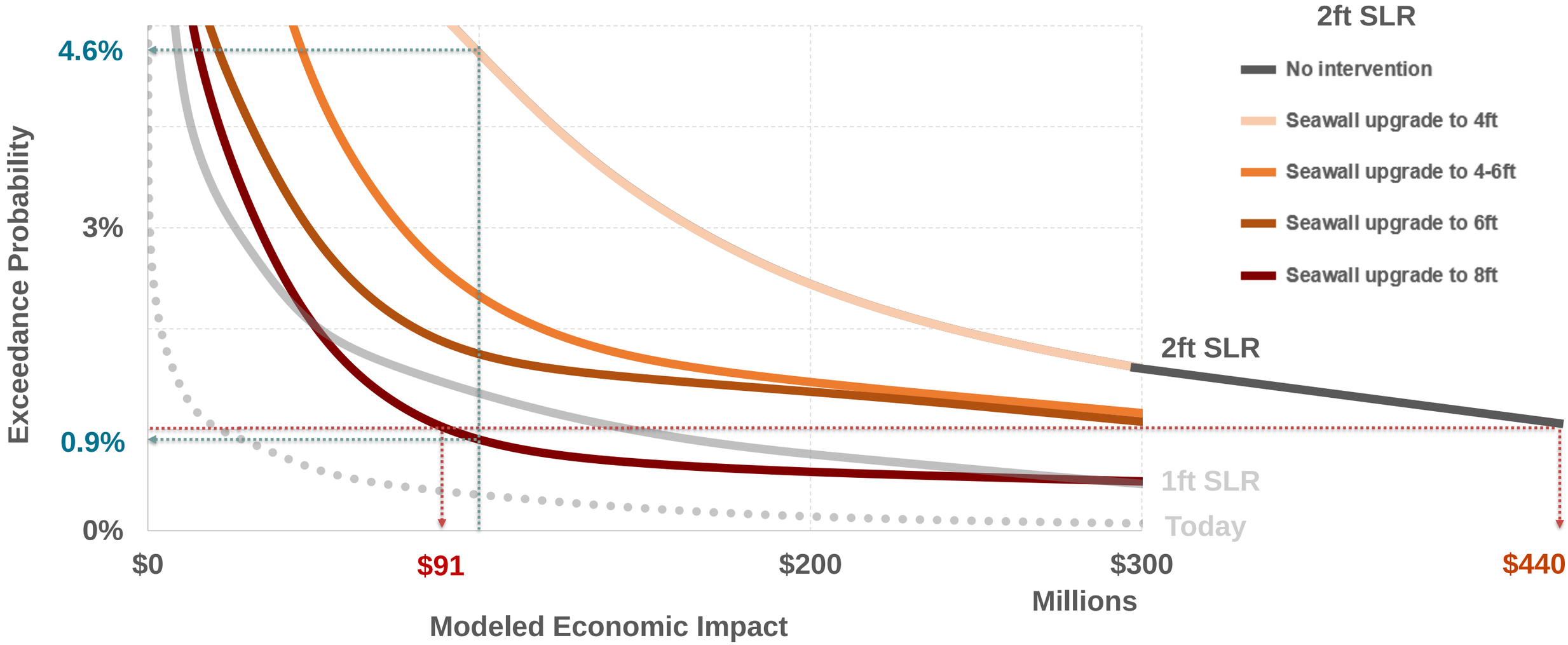
LET'S ASSUME WE'RE DEFENDING FOR 1FT OF SLR
8FT → STATUS QUO AT 1%; DOUBLES RESILIENCE TO EXTREMES



NOW ASSUME WE'RE DEFENDING FOR 2FT OF SLR…



NOW ASSUME WE'RE DEFENDING FOR 2FT OF SLR…
8FT → WORTH $350M AT THE 1%; BUT DOES NOT HOLD THE LINE



DIFFERENT INTERVENTIONS HAVE VERY DIFFERENT ROI…
…AND OPTIMAL SOLUTION IS VERY SENSITIVE TO GOALS