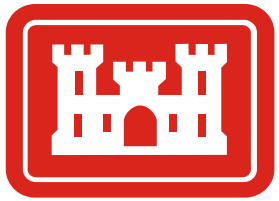

Interagency Performance Evaluation Task Force (IPET)

Consequence Assessment: Loss Analysis

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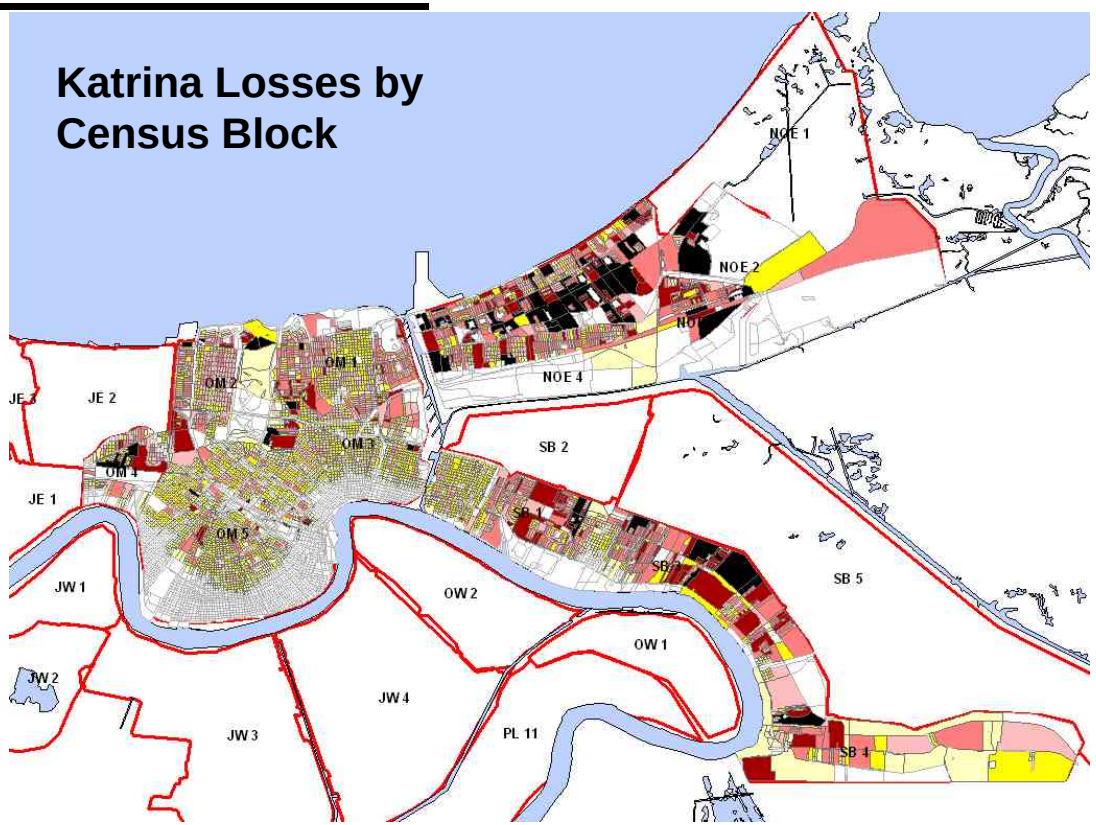
Overview

Develop an assessment of losses resulting from hurricane Katrina and **estimates of direct economic losses and potential fatalities for risk assessment**



Loss Categories

Human Health and Safety

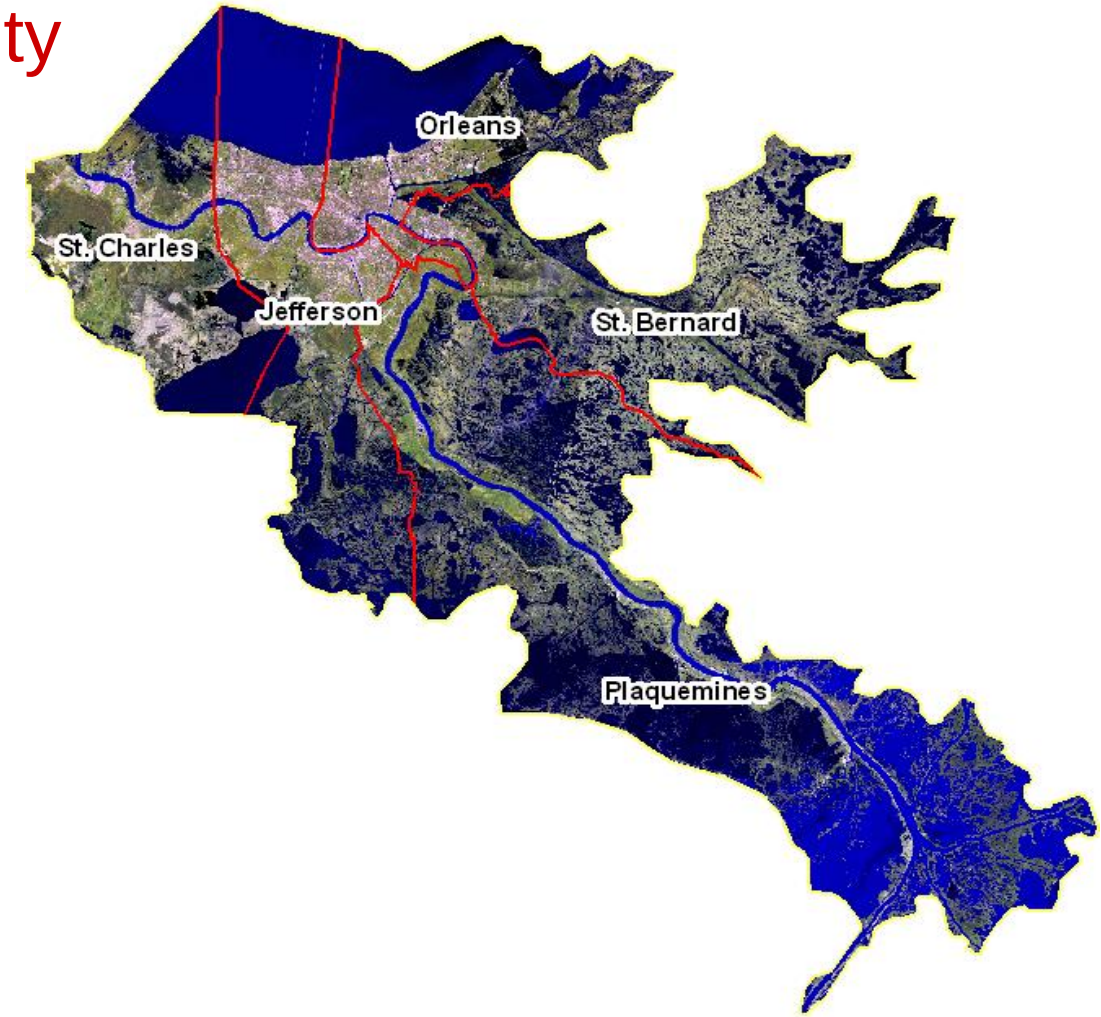
- Mortality
  - Loss of life uncertainty modeling
- Morbidity

Economic

- Direct
  - Depth/Damage w/uncertainty
- Indirect

Environmental

Social, Cultural and Historical



Loss of Life Modeling Approach

Loss of Life Modeling: Estimate potential loss of life associated with different flood elevations in each of 25 polders for two scenarios:

- Scenario 1--Given population & housing stock as of August 2005 (pre-Katrina)
- Scenario 2--Given population & housing stock expected as of June 2006 (post-Katrina)

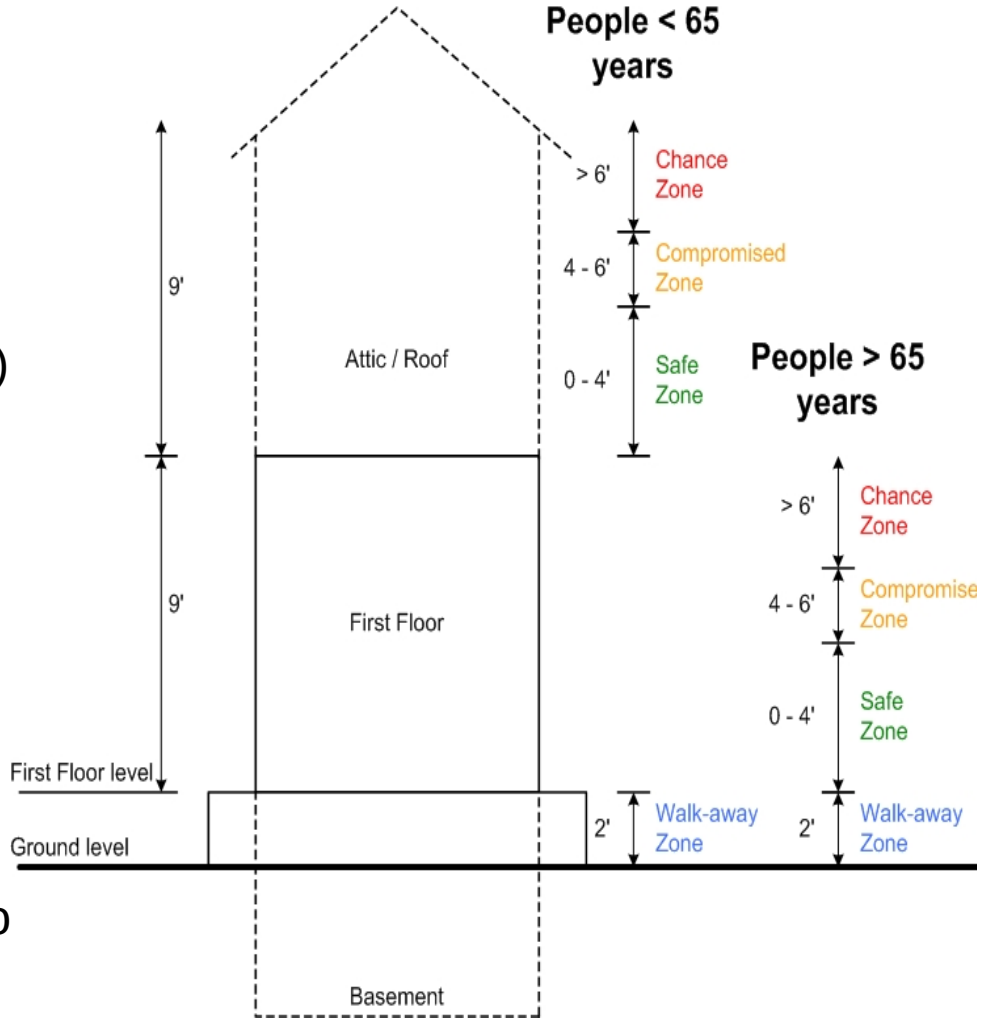
LIFESim (a spatially distributed, dynamic simulation model), as calibrated to the actual Katrina event, is used to estimate how the population in flooded areas will be vertically distributed in relation to flood elevations

LIFESim Warning & Evacuation and Loss of Life Modules were used. The Inundation and Loss of Shelter modules were not used because inundation rates and water flow velocity estimates were not available

LIFESim Model Outputs

For each maximum flood elevation, the following output statistics are estimated for each polder

- Number of people in the *walk away* zone (less than 2 ft. inundation at ground level)
- Number of people in the *safe zone* (less than 4 ft. inundation on highest habitable level of structures)
- Number of people in the *compromised zone* (between 4 ft. and less than 6 ft. inundation on highest habitable level of structures)
- Number of people in the *chance zone* (greater than or equal to 6 ft. inundation o highest habitable level)



Accounting for Age in Vertical Distribution of Population at Risk

LIFESim assumes:

- During flooding all people will vertically move to the highest habitable level
- People under the age of 65 can climb to a higher level—e.g., attic or roof
- People 65 and over can not
  - People 65 and over face over 90% chance of death if water reaches 6 ft. above floor of highest habitable level of structures

Uncertainty analysis:

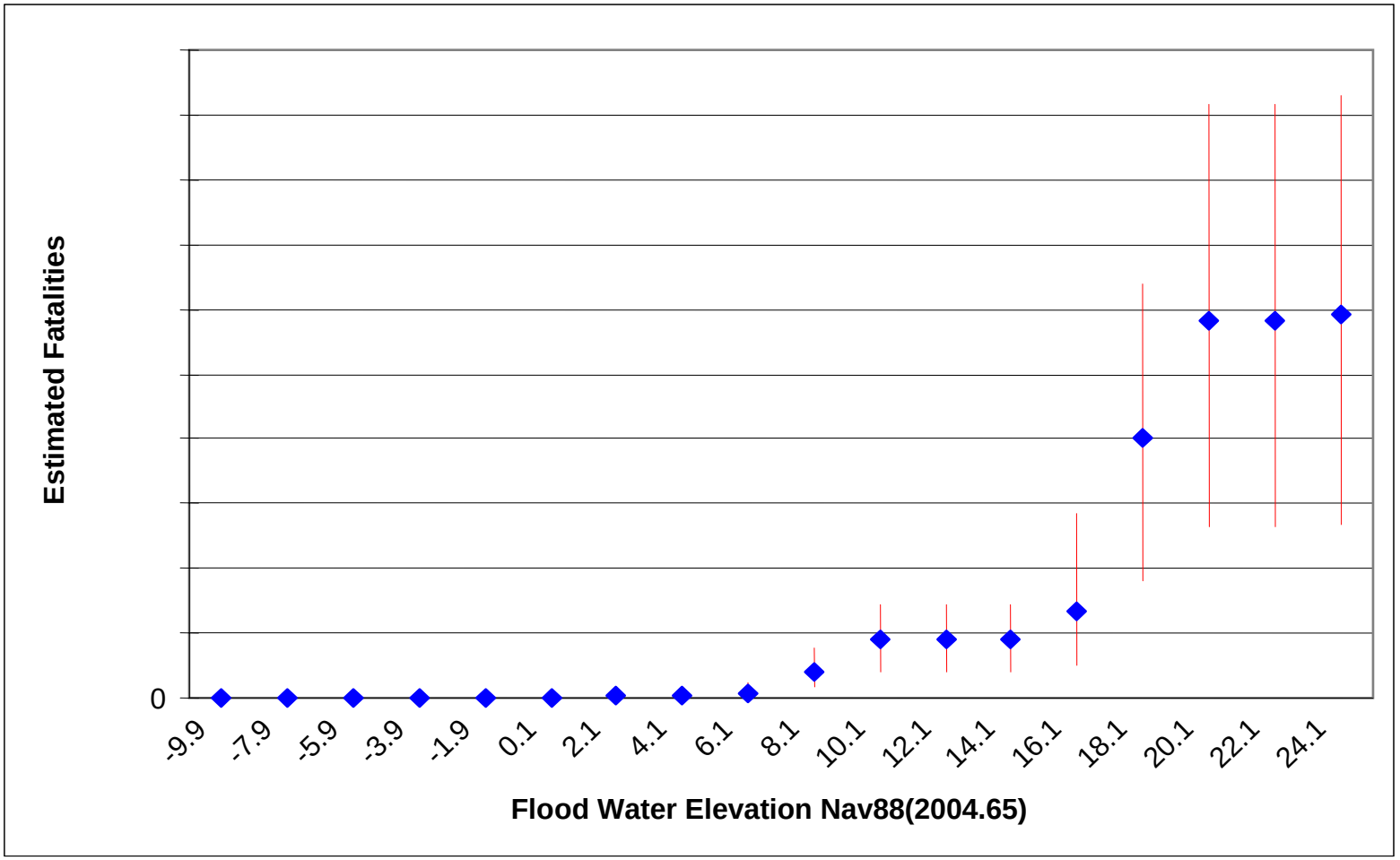
- The LIFESim estimates of populations at risk by flood zone are then imported into a Monte Carlo uncertainty model to estimate potential loss of life given assumed distributions for various uncertain parameters
- The uncertain parameters include: pre-storm evacuation rates, rescue efficiency in different flood zones, and fatality rates in different flood zones

Assumed Distributions for Uncertain Parameters

Based on various information sources & model calibration results, uncertainty analysis was run using following distributions

- Evacuation Rate: triangular (65%,80%, 95%)
- Rescue Efficiency, Safe Zone: uniform (99.5%,100%)
- Rescue Efficiency, Compromised or Chance Zone: uniform (95%,100%)
- Fatality Rate in Safe Zone: non-parametric with mean 0.023%
- Fatality Rate in Compromised Zone: non-parametric with mean 12%
- Fatality Rate in Chance Zone: non-parametric with mean 91.75%

Example Results 1: Estimated Fatalities (Mean & 90% CI) by Flood Elevation for St. Bernard Parish Basin 1 Under Pre-Katrina Conditions



Direct Economic Consequences

Objective

Estimate flood damages from Katrina

Develop flood elevation-property damage relationships by basin for risk analysis

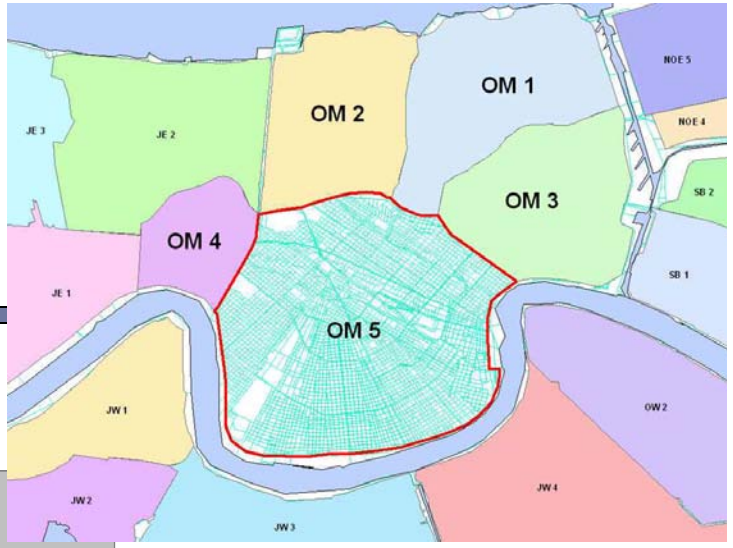
- Residential
  - -Single Family
  - -Multifamily
  - -Mobile Homes
- Commercial
- Industrial
- Vehicles
- Public
- Public Utilities/ Infrastructure (not in risk analysis)

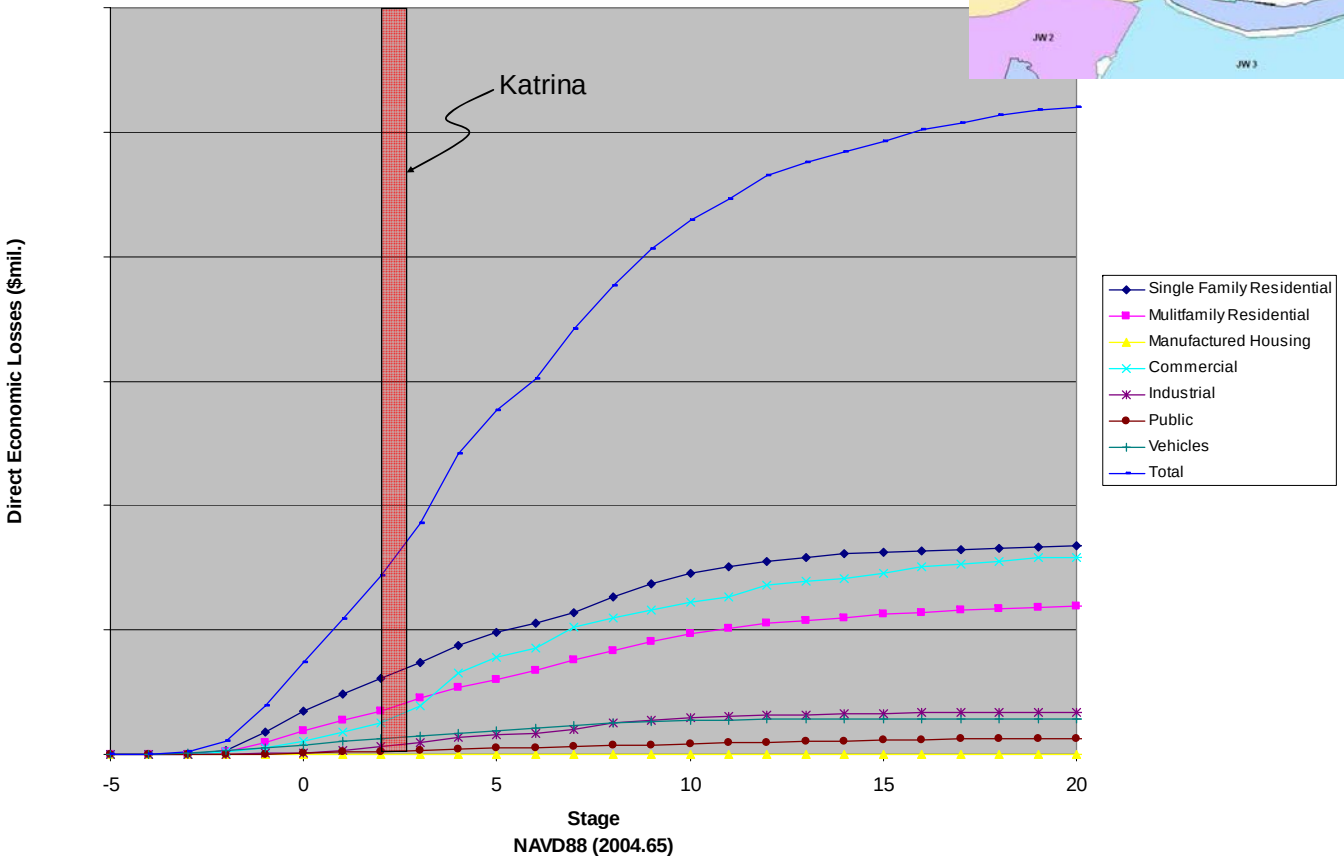
Direct Economic Consequences

Approach

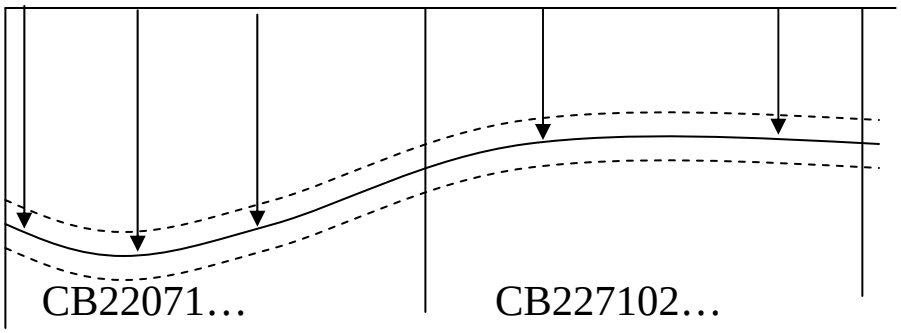
- Census Block resolution
- HAZUS-MH used as starting point for property exposed
- Adjustments in each damage category based on sample comparisons to New Orleans District inventory
- Ground elevation for each block using IPET LIDAR based DEM
- New Orleans District damage-curves applied
- Uncertainties quantified based on error in DEM, variability in depth across census block, and property value estimated errors

Orleans Metro-Basin 5: Preliminary Elevation - Flood Damage (mean values)





Quantifying Depth Uncertainty



Depth	% Damage
-1	0
0	10
1	15
2	25
3	40
4	50
5	65
6	70
7	85

					Depth			Damage		
Census Block	# Single Family	Mean Value ('000)	Total Value	WSE	Min	Mean	Max	Min	Mean	Max
CB22071…	40	120	4800	WSE1	1.5	3	5	960	1920	3120
CB227102…	60	135	8100	WSE1	1	1	2	1215	1215	2025

For illustrative purposes only

Orleans Metro-Basin 5: Preliminary Elevation – Total Flood Damage with Uncertainty