Linking Flood Risk to Resilience

MERIT: A Decision Support Tool for Risk-based Resilience Investment

Funded by: US Department of Homeland Security
Science & Technology Directorate

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Linking risk to resilience for practical decision making

- Communities need to understand their risk, but risk models are designed for experts
- Communities are unique and resilience means something different to each community
- How does a community prioritize investments while taking into account risk, resilience, and their own priorities?
- ***How do we give a community the information they need to start the conversation?***

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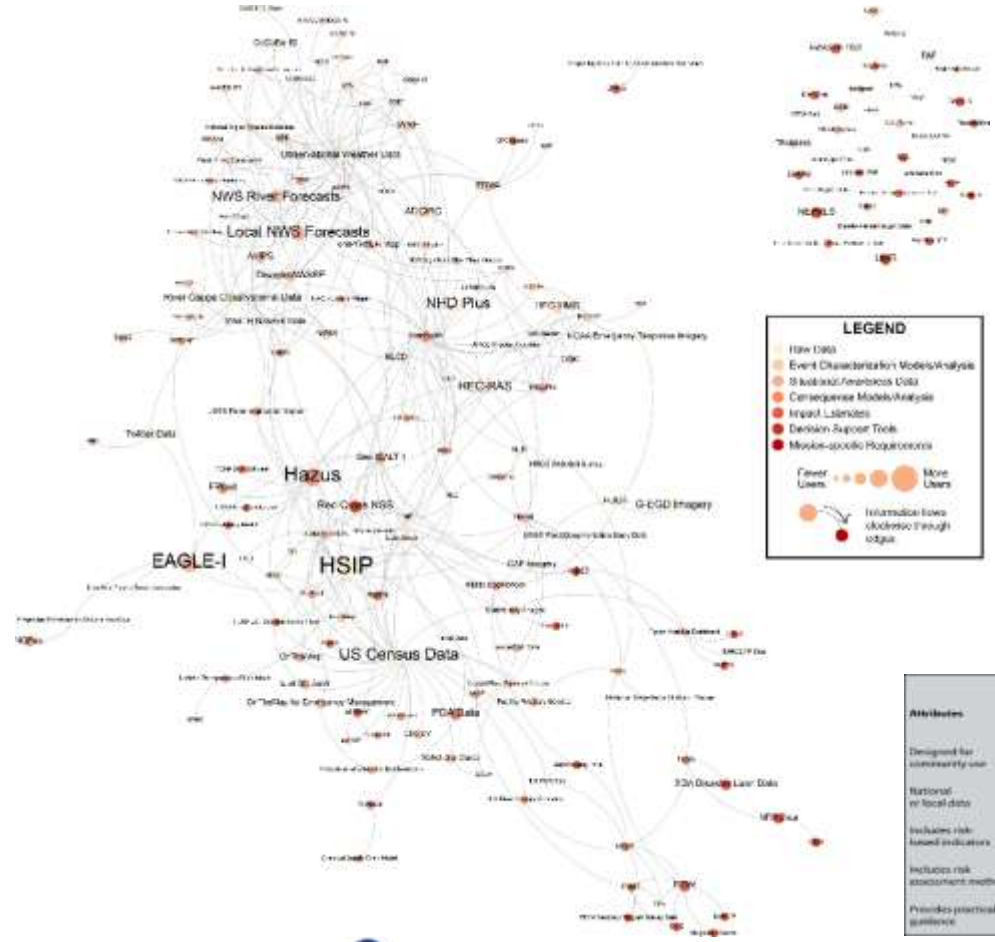
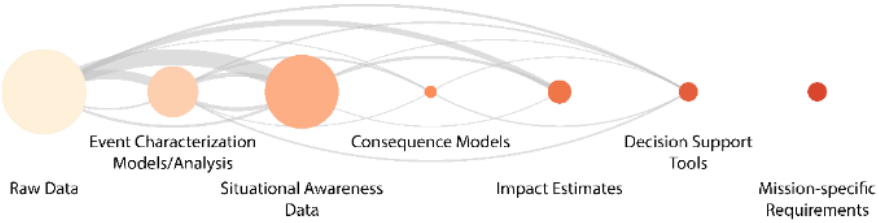
The gap: Linking flood risk to practical recovery and mitigation decisions





Attributes	Resilience Indices and Assessment Methods												Requirements to Evaluate Resilience Investments
	SoVI	BRIC	Resilience Capacity Index	MIST Guide	Zurich Framework	Rockefeller CRI	CARRI CRS	MIRPLD Framework	UN Scorecard for Cities	Coastal Resilience Index	Community Rating System	SPUR	
Designed for community use	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
National or local data	National	National	National	Both	Local	Local	Local	National	Local	Local	National	Local	Both
Includes risk-based indicators	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Includes risk assessment method	N/A	N/A	N/A	No	N/A	N/A	N/A	No	No	No	No	Yes	Yes
Provides practical guidance	No	No	No	Yes	Broad guidance	Broad guidance	Yes	No	No	Broad guidance	Yes	Yes	Yes

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Risk communication and human-centered design

- Intuitive cues
- Map process and navigation up front
- Consistent use of color, font, and terms
- Use plain language
- Provide anchors to daily experience
  - Provide a reference point for flood depths (e.g., waist-high water)

Melkonyan, 2011; National Oceanic and Atmospheric Administration, 2016; Vaughan and Buss, 1998

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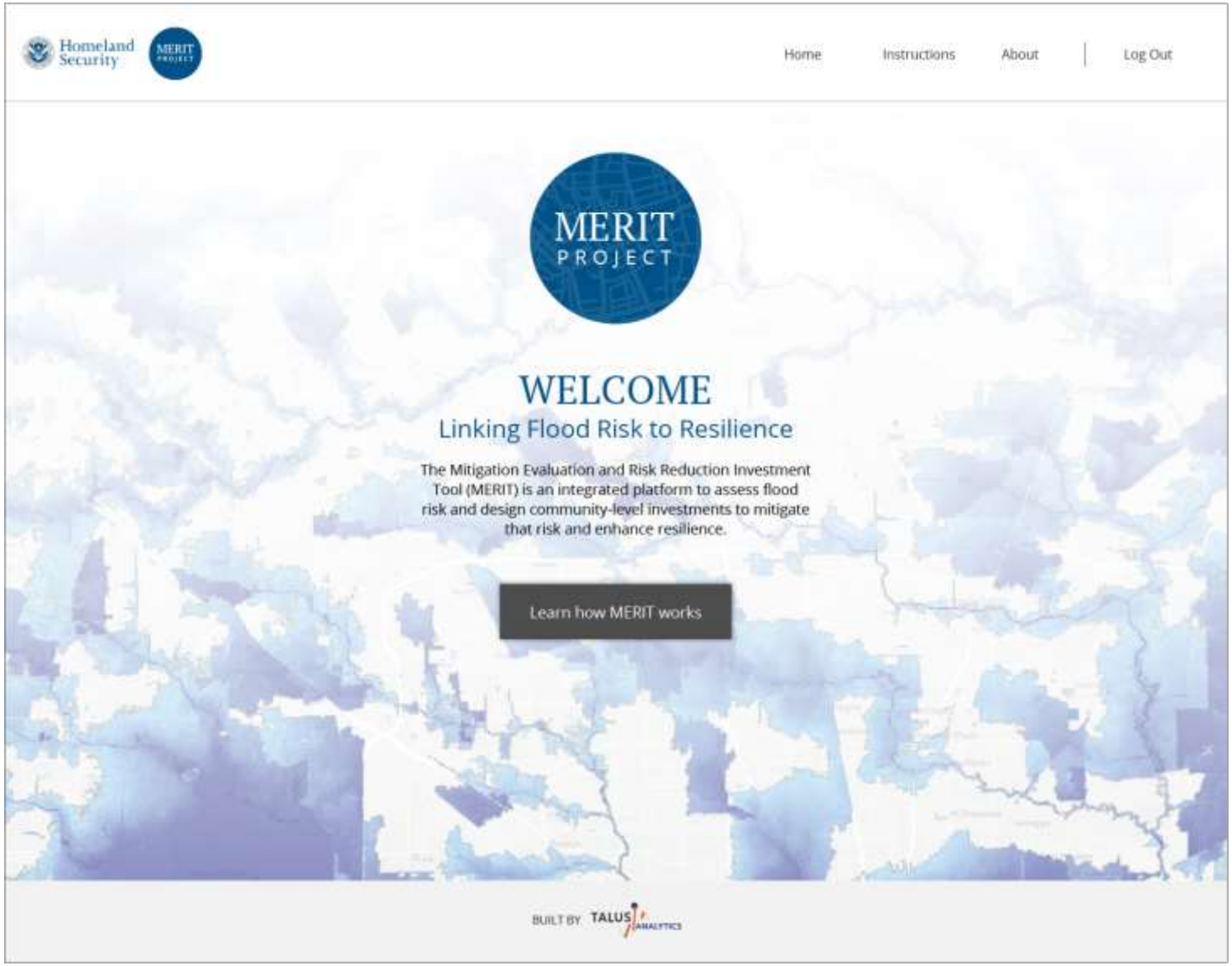

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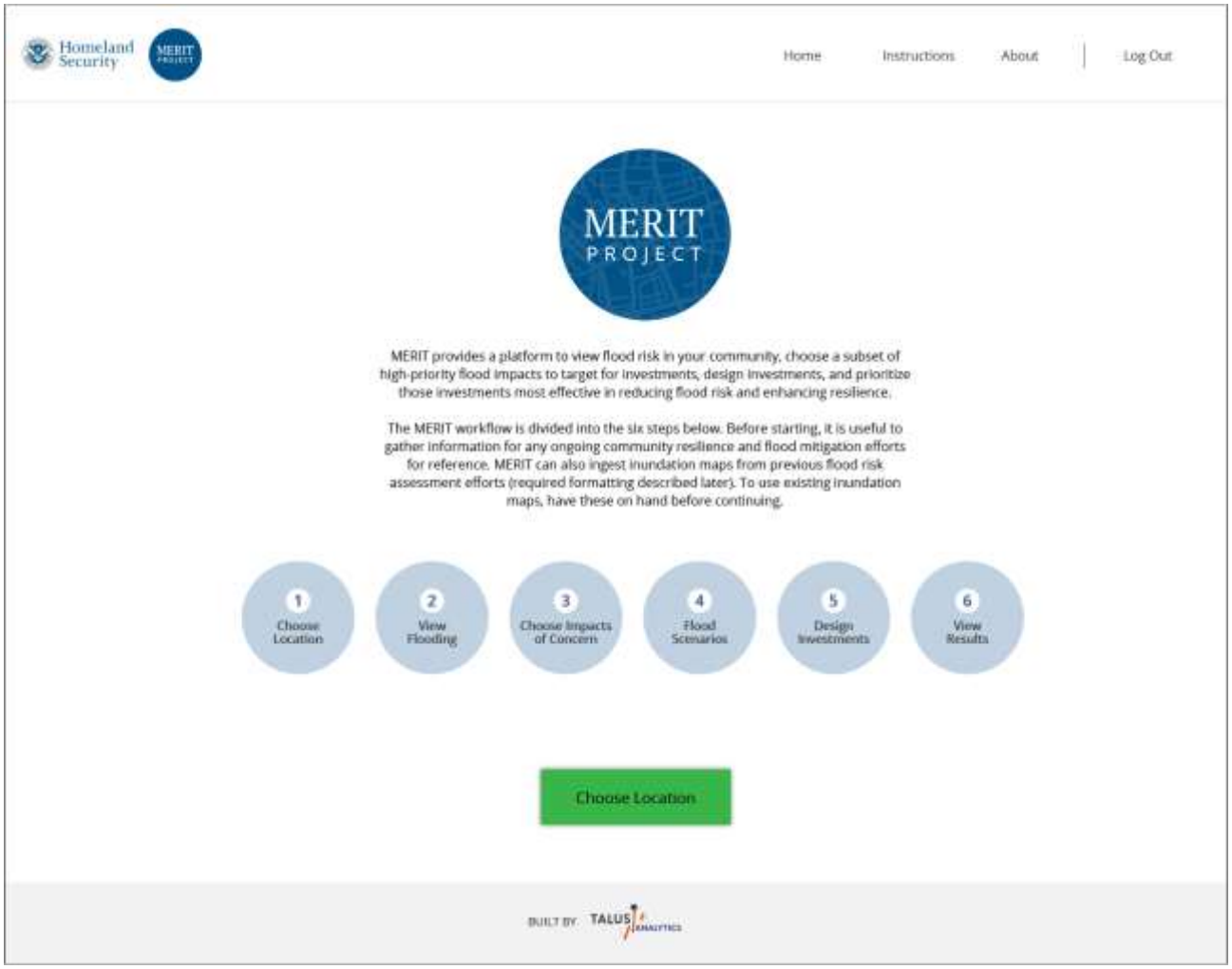
What are you getting yourself into?



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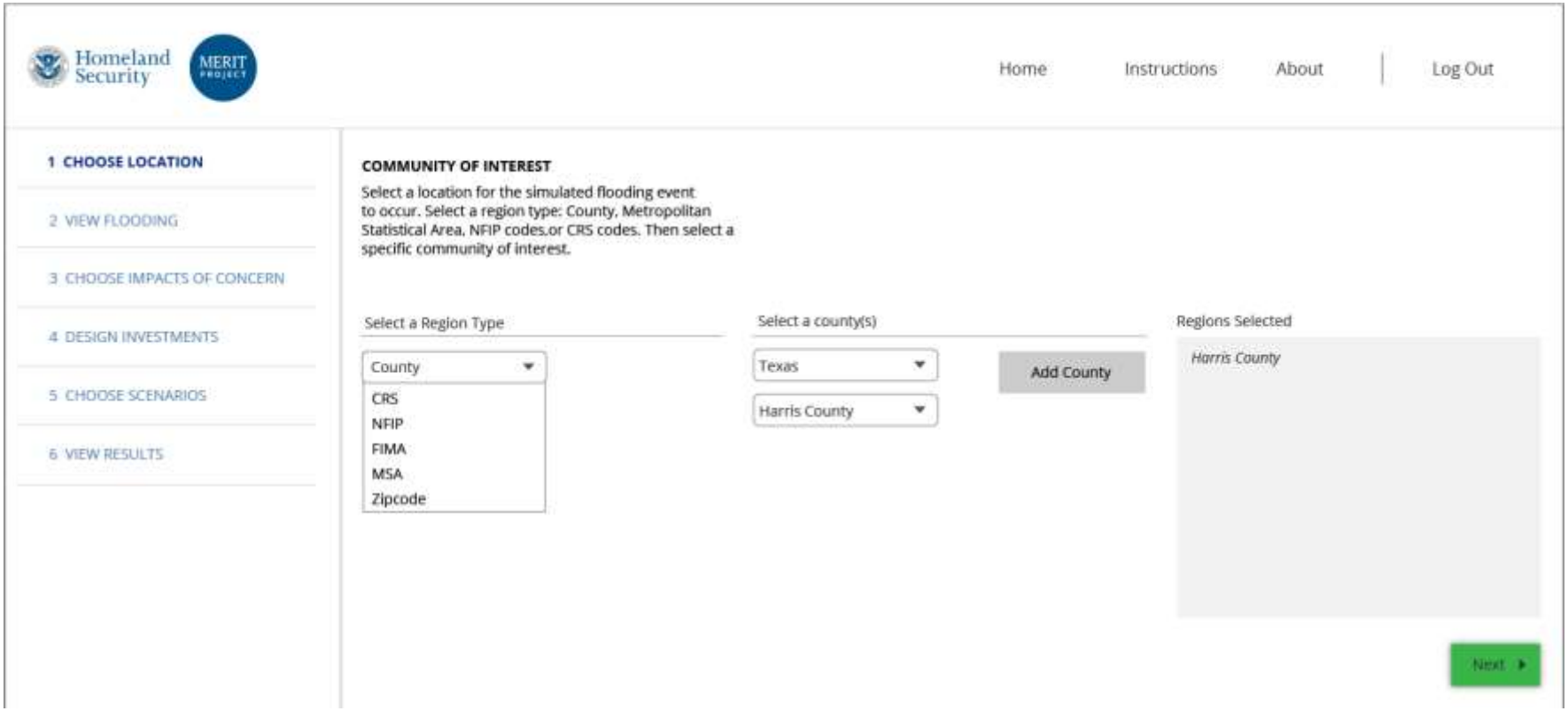
Who are you? Identify your community



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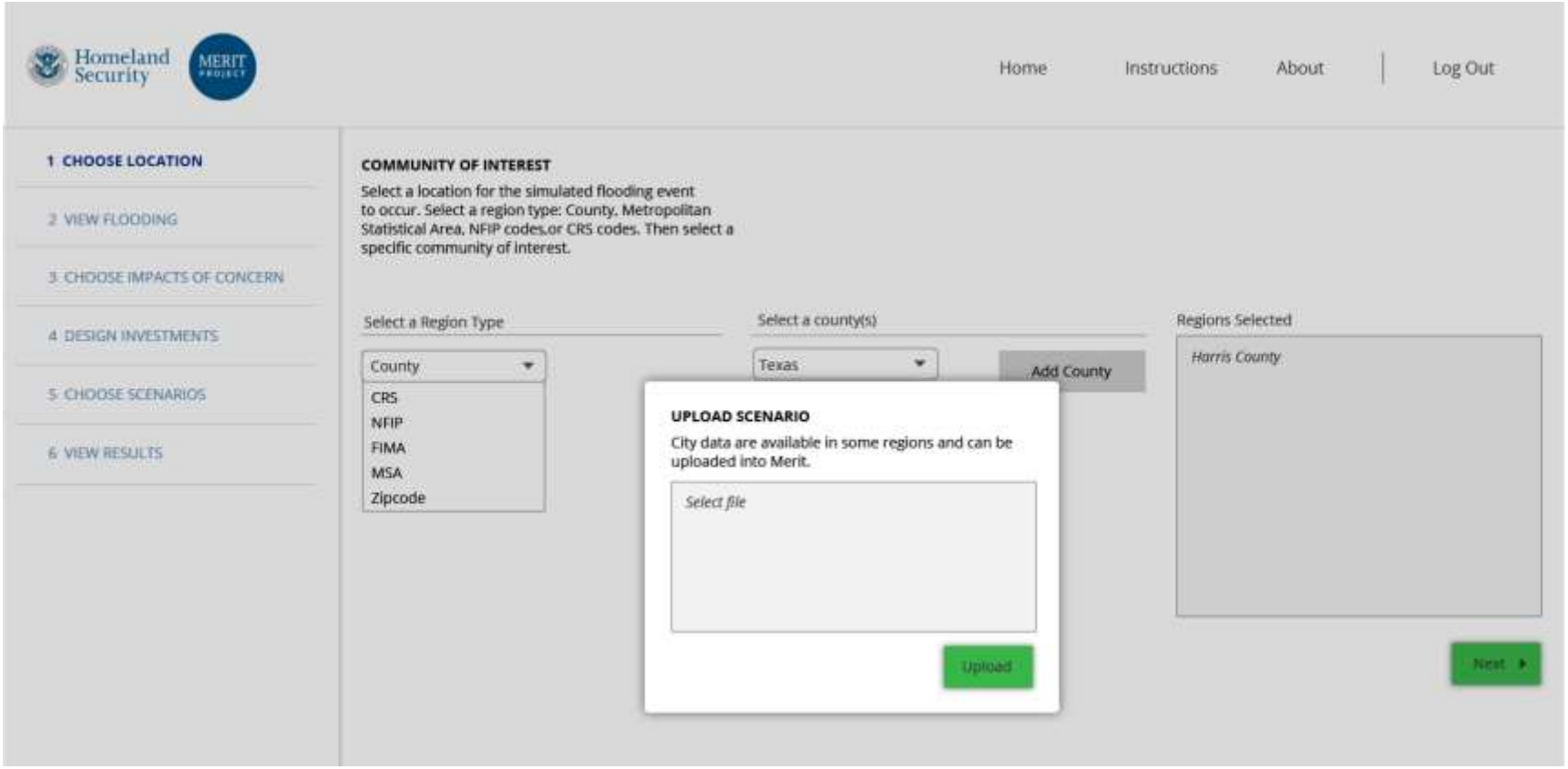
Building on what you already know



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Flood mapping: Rapid risk assessment

- Developed a rapid risk assessment method in collaboration with FEMA, drawing on NFIE and NWM methods
- Supports rapid overlay with infrastructure and population
- No subject matter expertise required
- Deterministic; assesses range of events

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Flood mapping: Rapid risk assessment

Riverine

- Interpolation of riverine gage flows
- Lateral projection and compare water level to DEM for inundation

Coastal

- Interpolate select coastal gages with still water elevations liked to AEP (from RENCI)
- Project inland, comparing water elevation to DEM

Estuarine

- Proof of concept takes simple maximum between riverine and coastal inundation estimates

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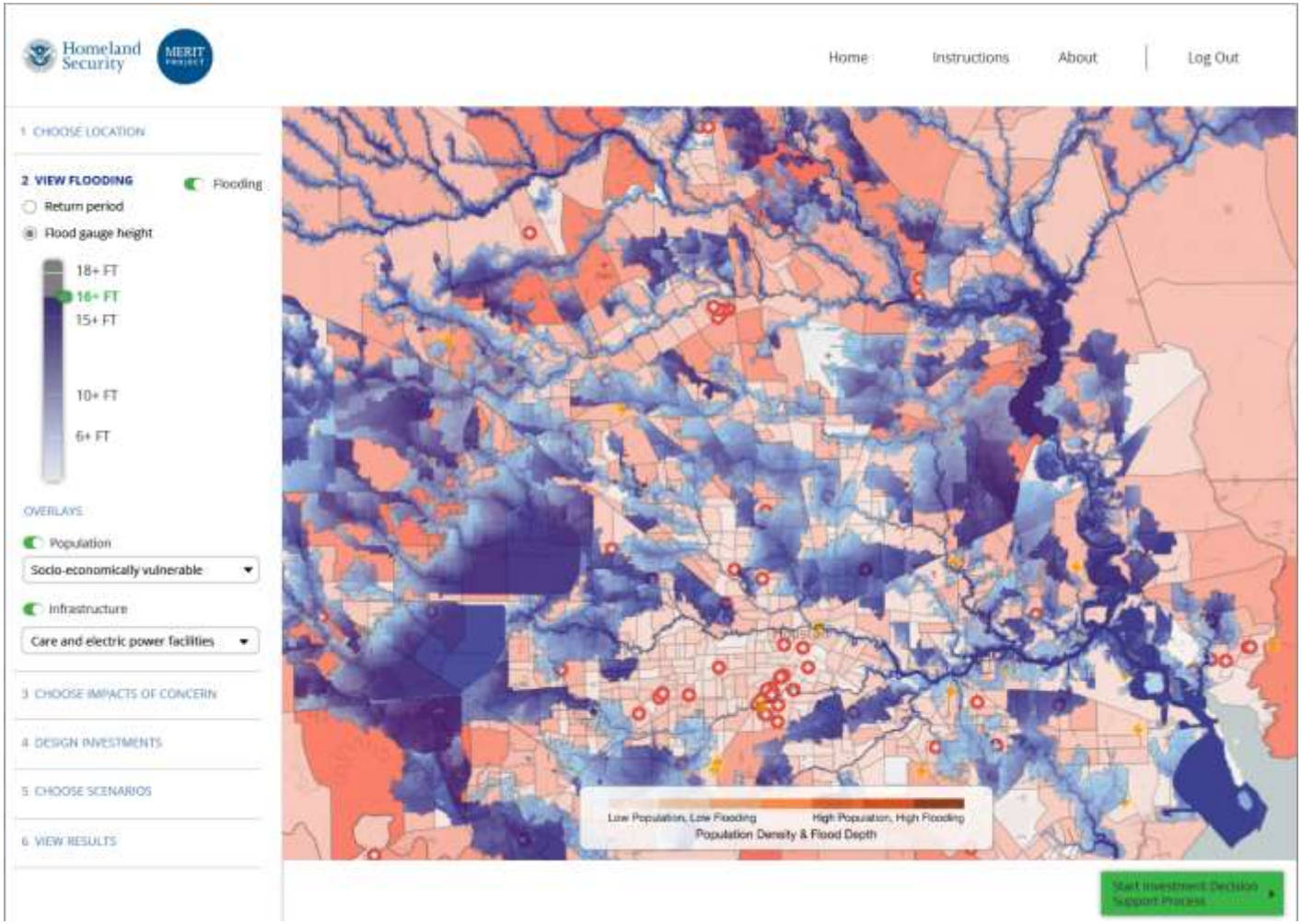
What goes underwater?



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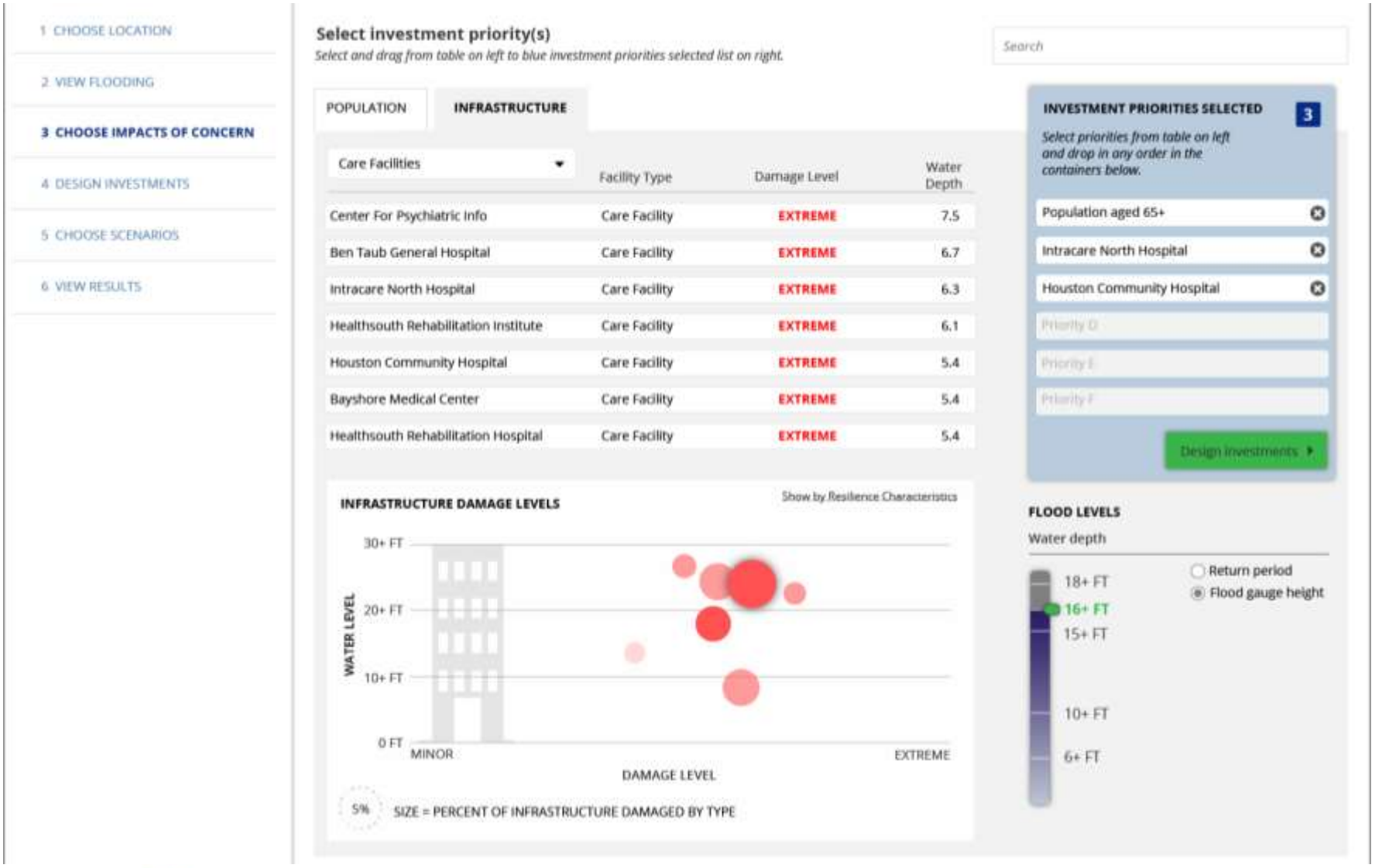
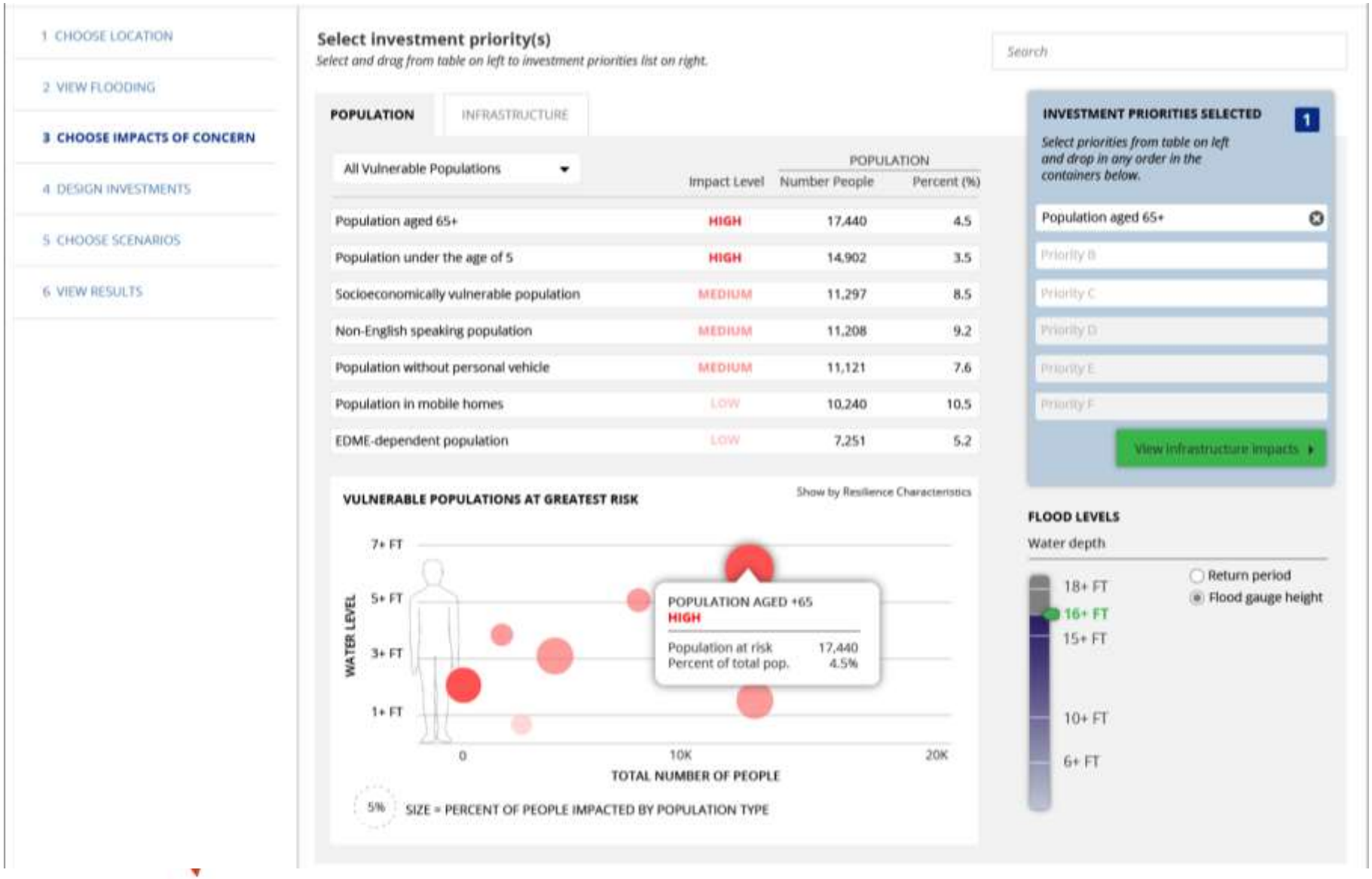
Which impacts are of highest priority?

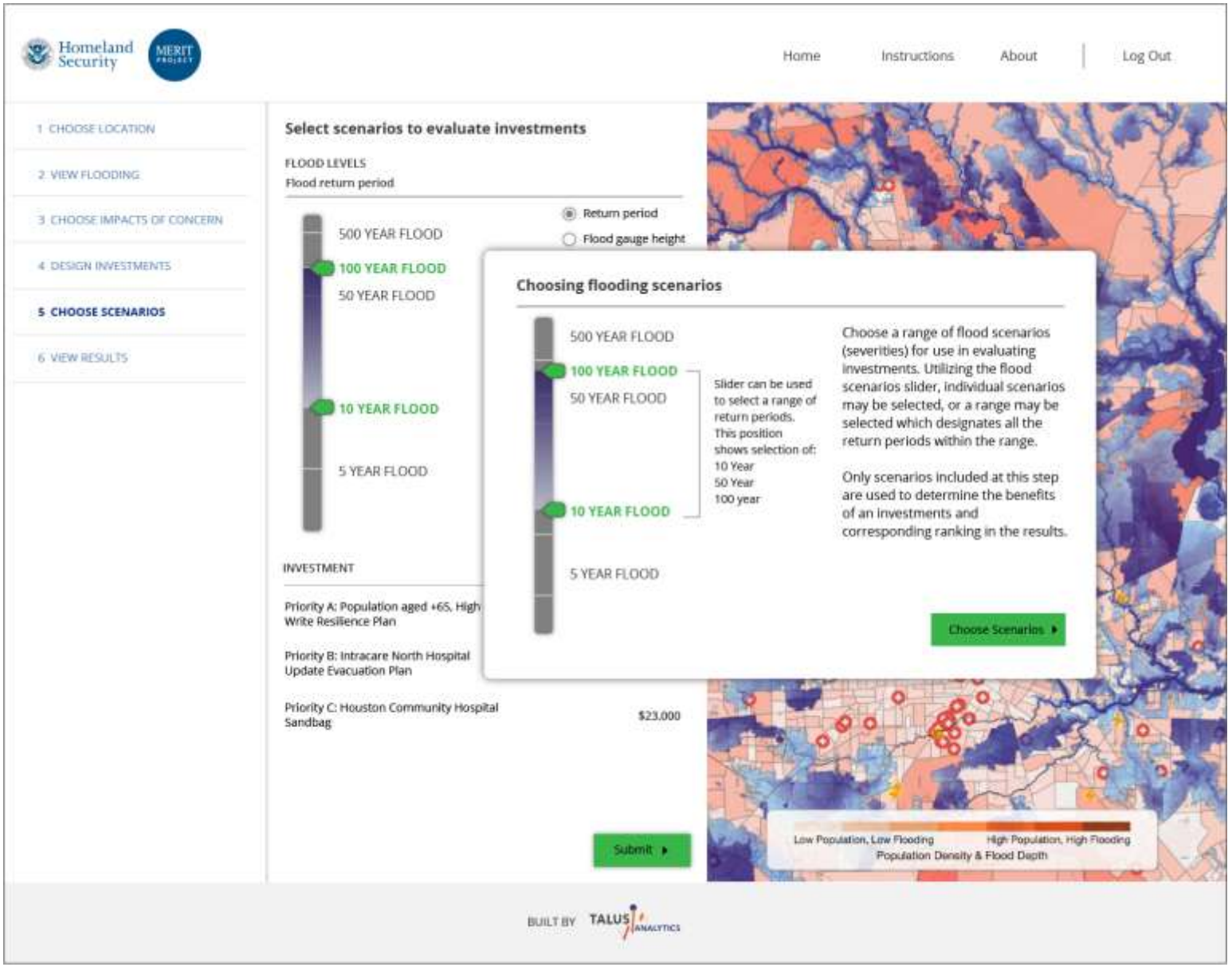
Choose infrastructure priorities



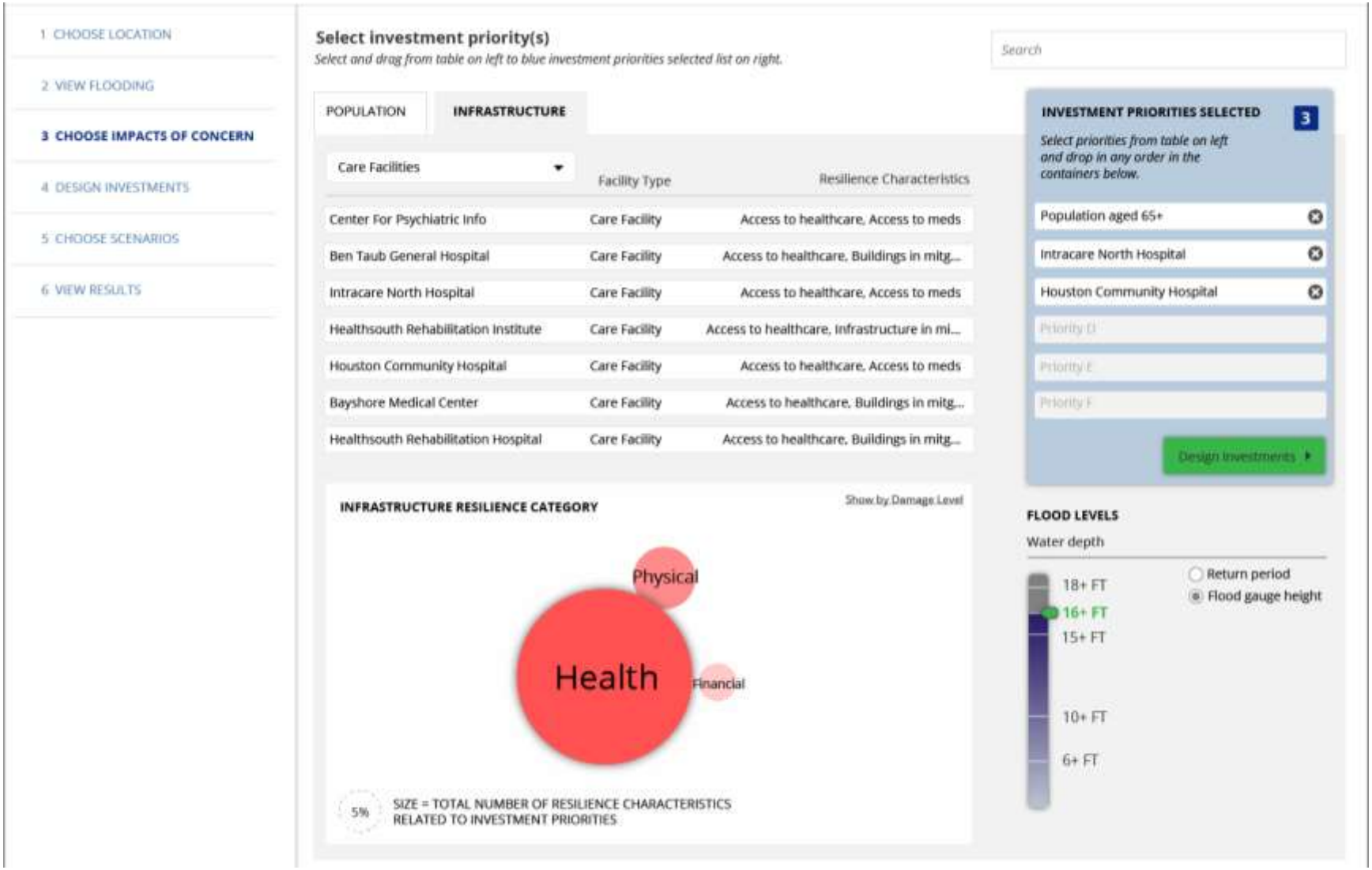
Which impacts are of highest priority?
Choose population priorities



Choose scenarios for investment ranking



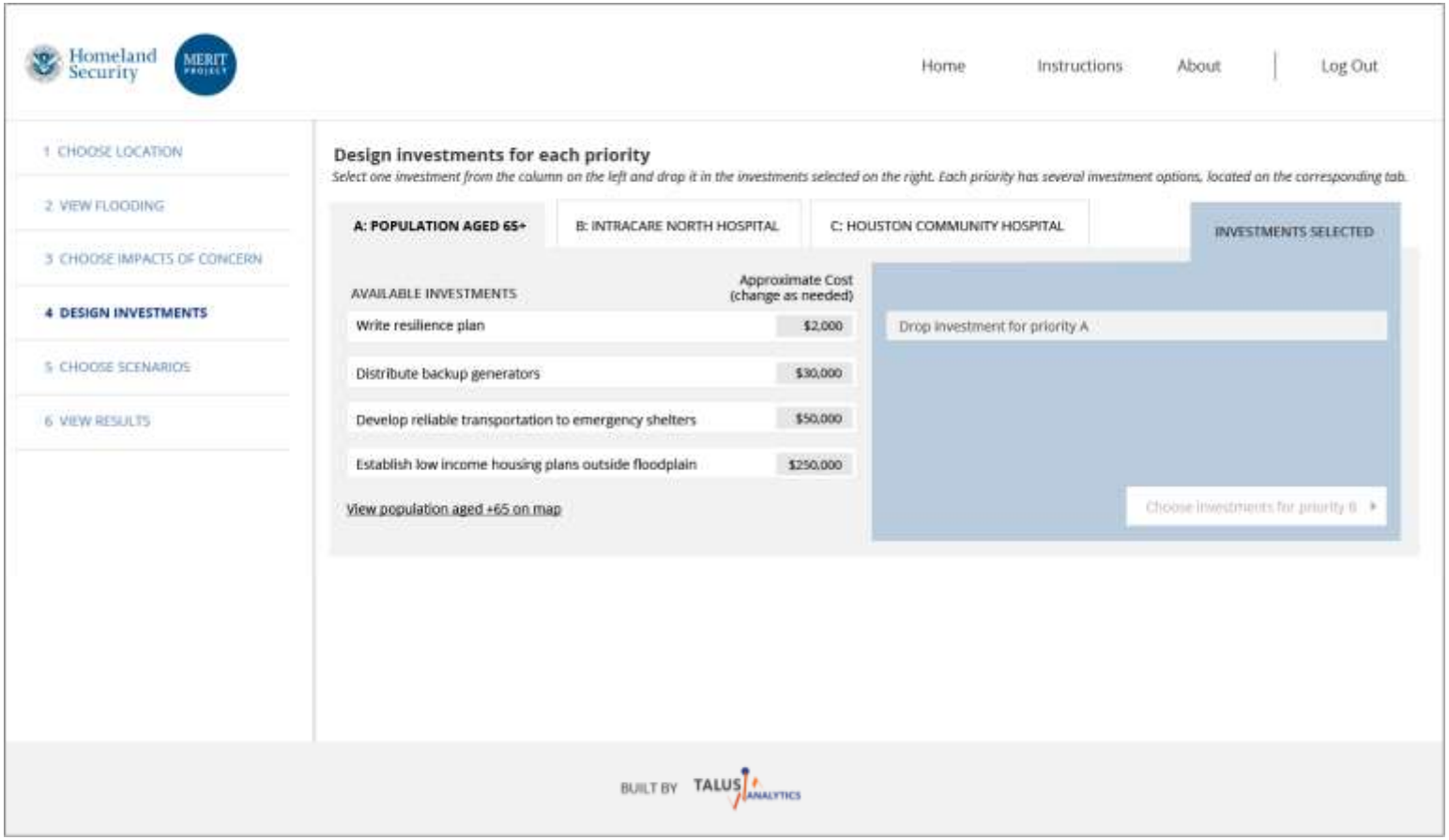
How do these investments address resilience?



Prioritizing resilience characteristics

- Research-based crosswalk between investments and relevant community resilience characteristics
  - How might this mitigation investment also enhance community resilience?
- Used core domains to categorize resilience characteristics and to summarize in terms familiar to users (e.g., health, environmental, economic, social, etc.)

Design Investments:
What can you do to mitigate flood impacts?



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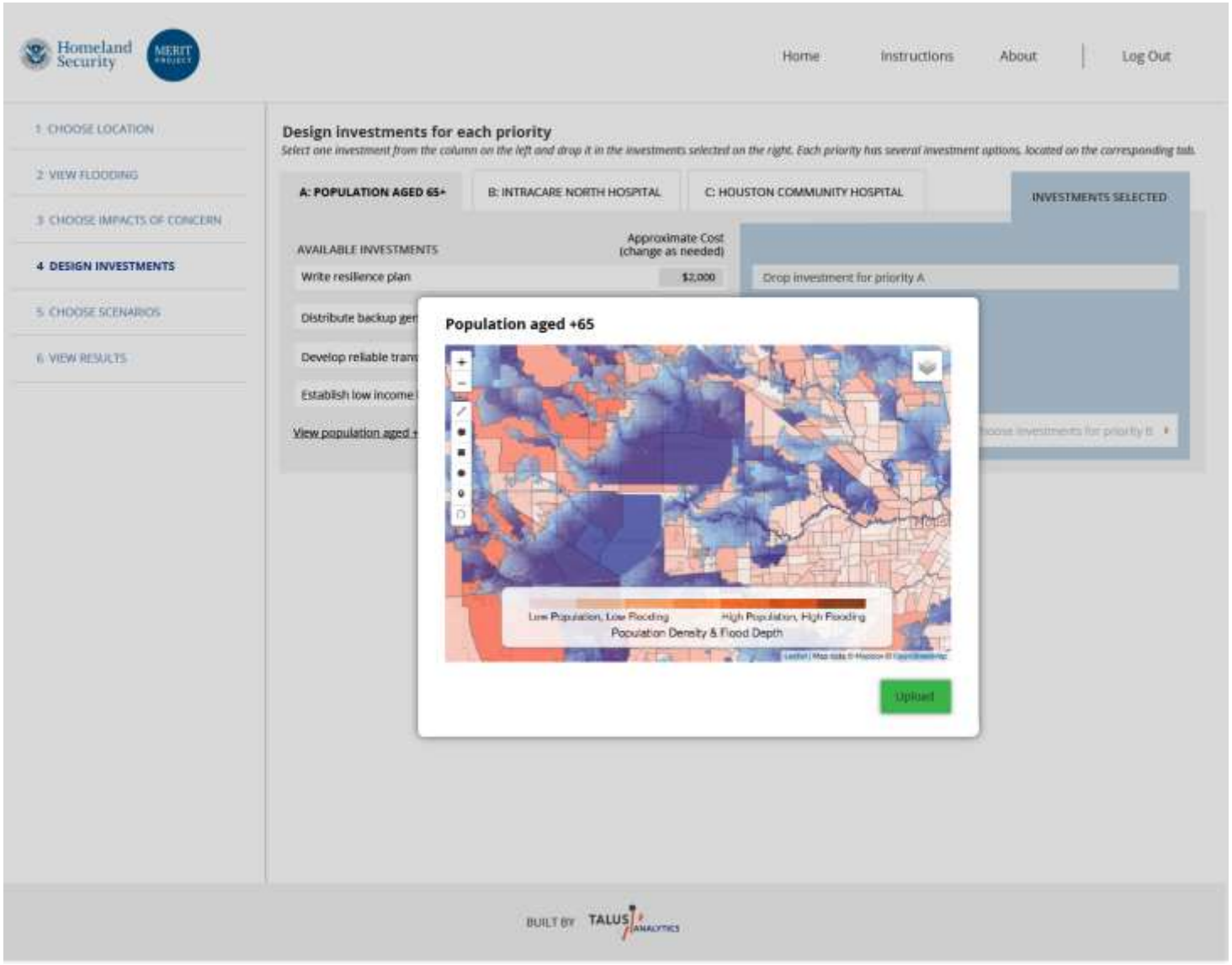
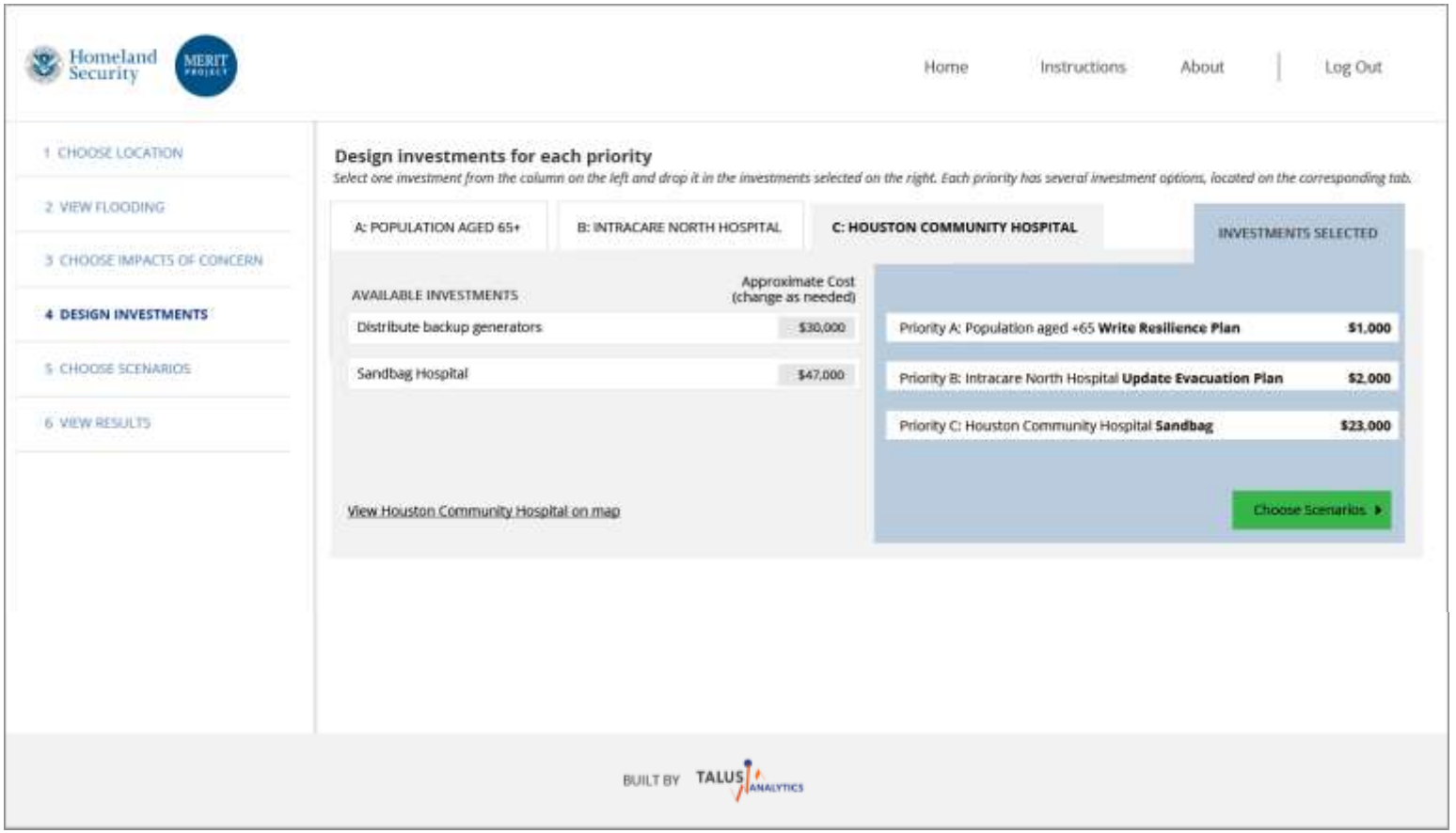
Design Investments:
View on map for context



Design Investments – Completed



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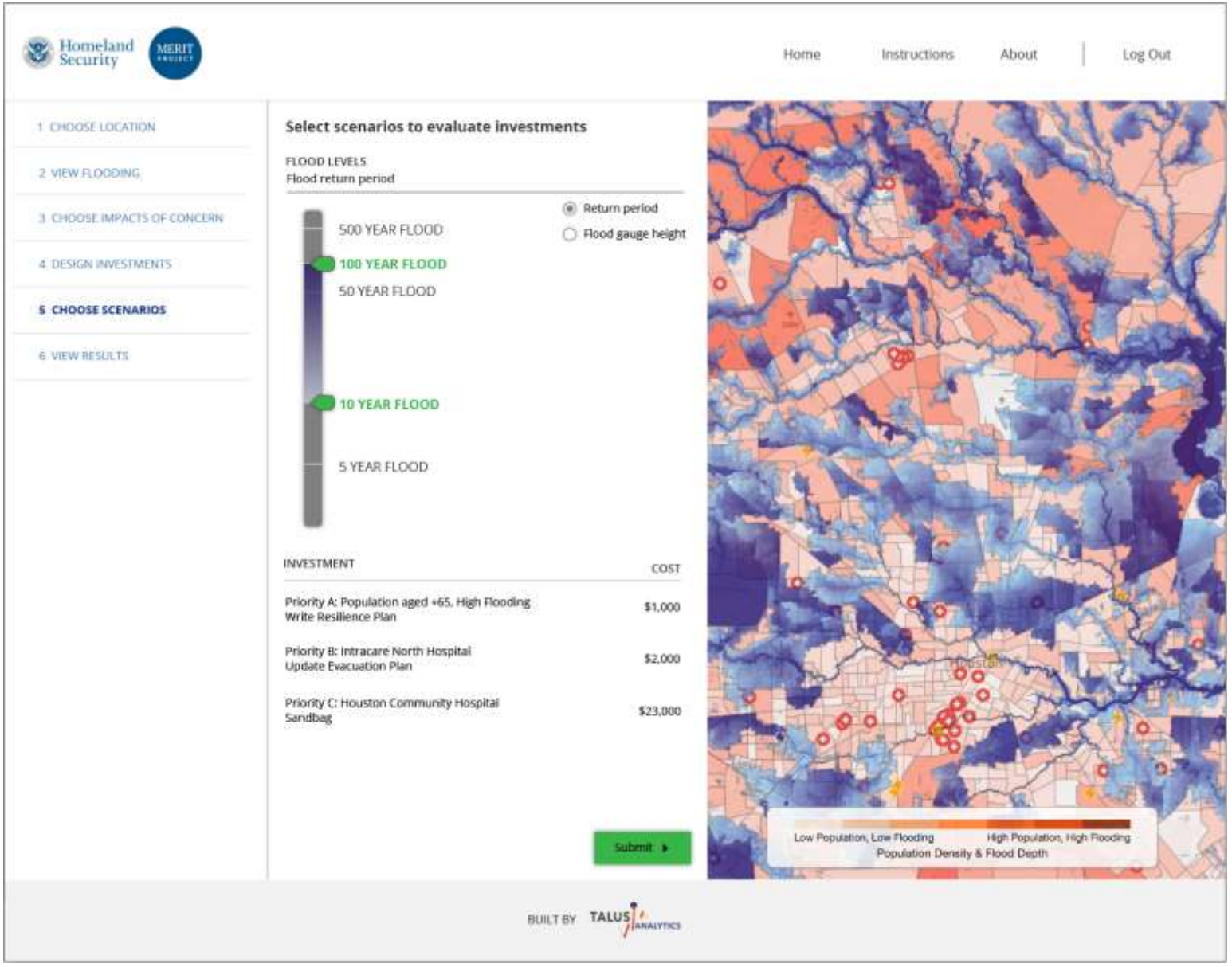
Confirm and submit to view results



Linking Impacts to Benefit

- Mean investment benefit is used to rank investments relative to each other
- Benefit weighted by the probability the flood will occur (from water gage history statistics)

- Weights are calculated as:

$$m(w_i) = AEP(w_{i+1}) - AEP(w_i)$$

- Mean investment benefit is weighted sum:

$$< b > = \sum_i m(w_i) b(w_i)$$

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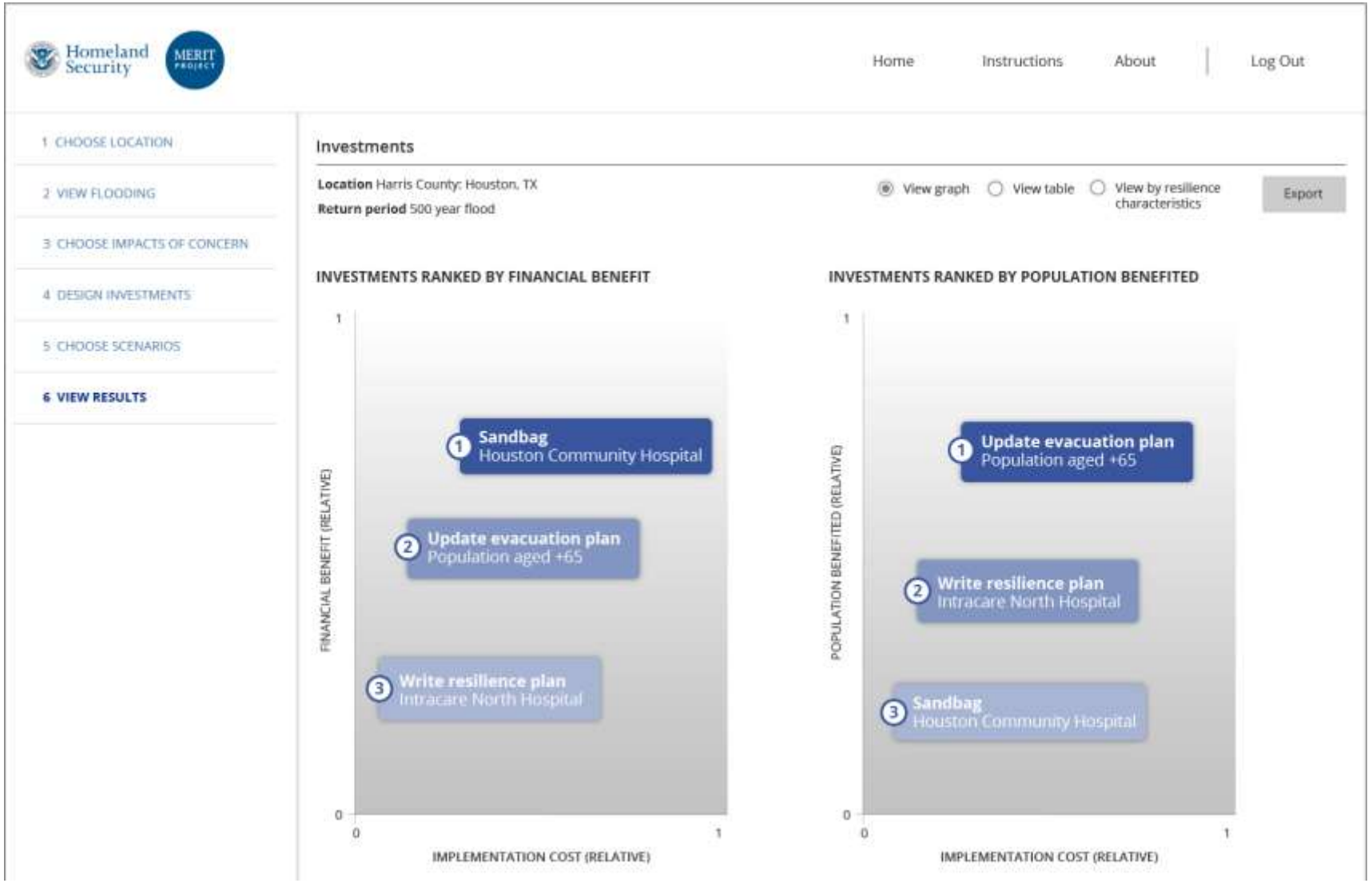
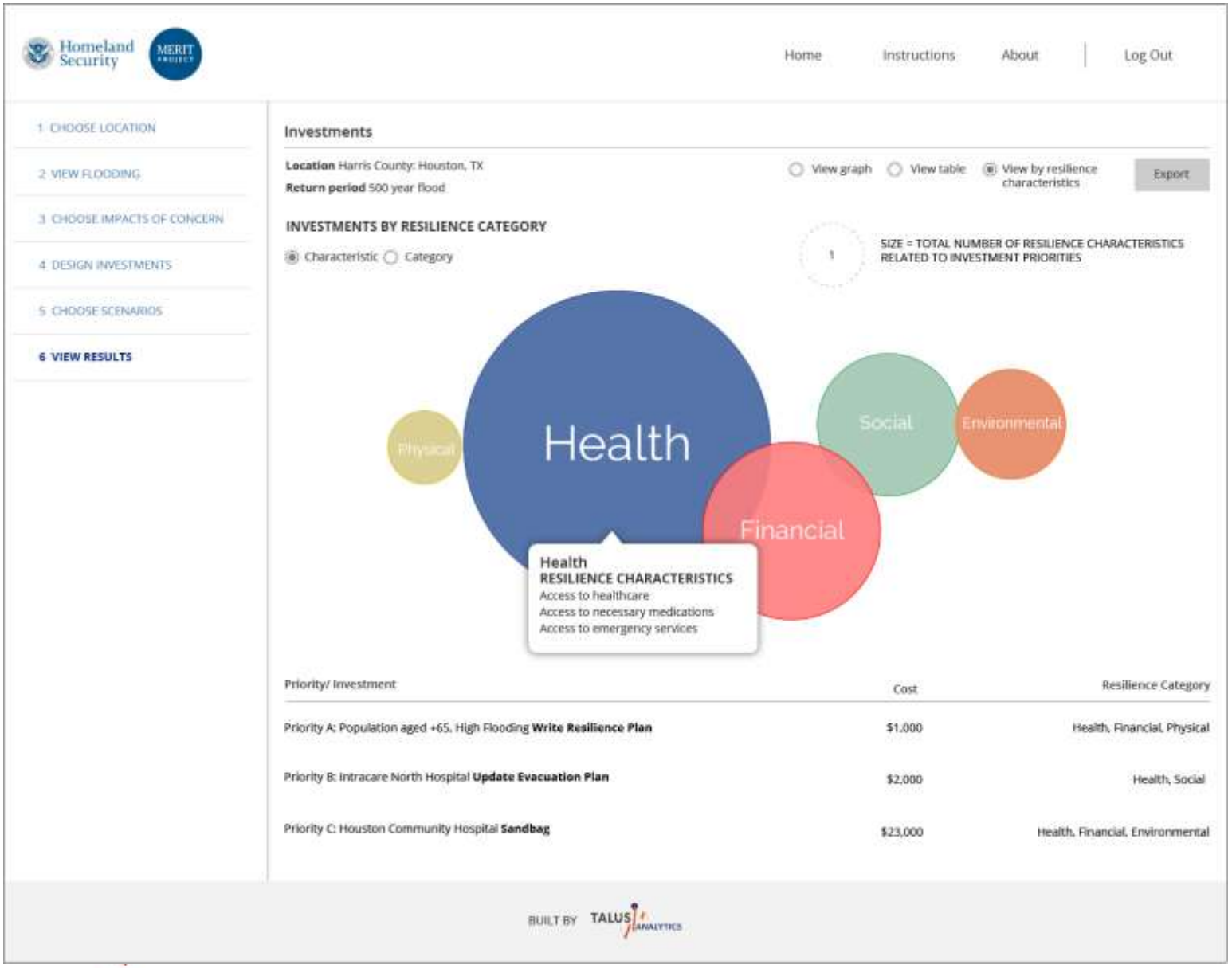
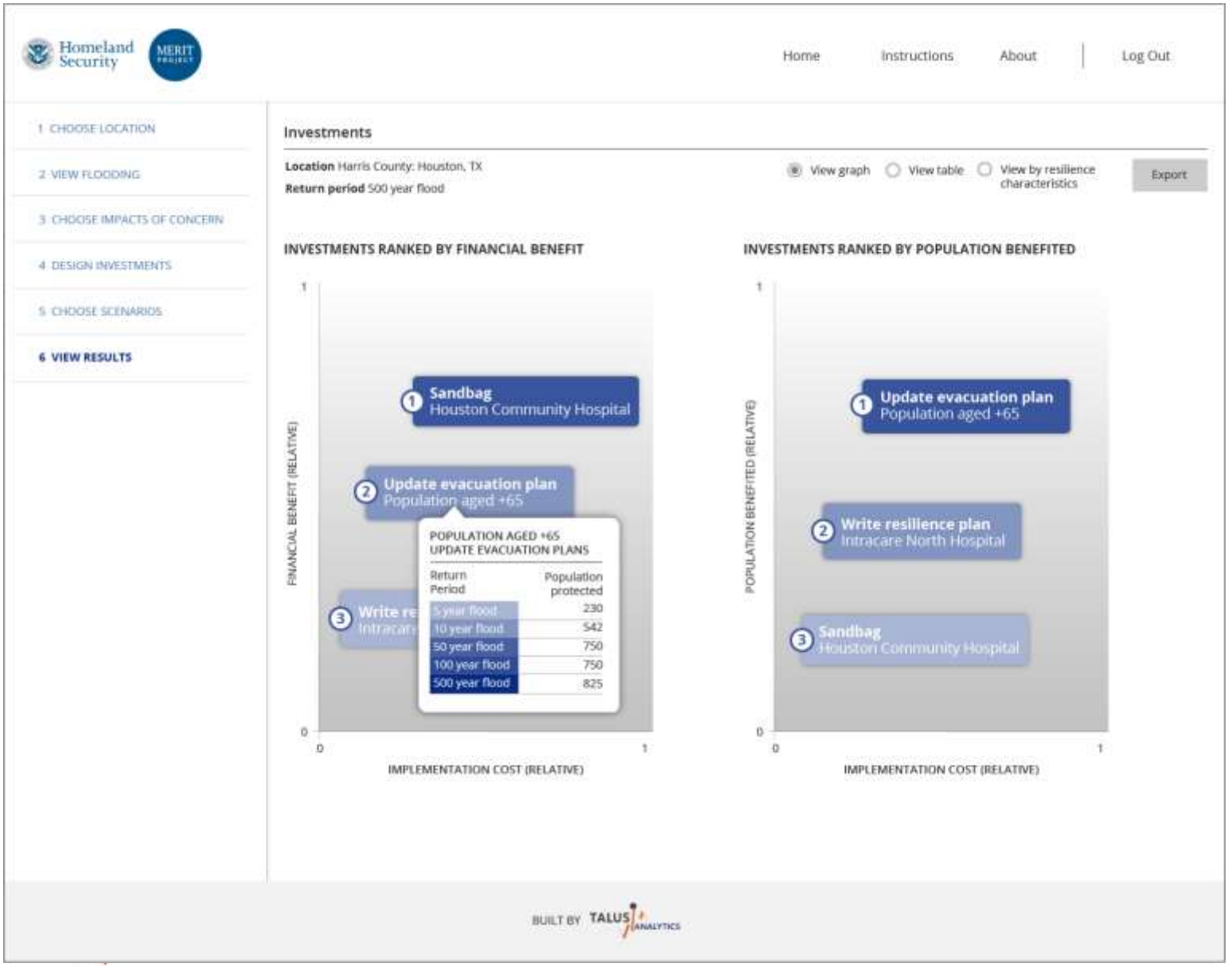
Rank investments for comparative analysis and communication



Link investments to resilience



Keep it simple. Drive discussion.



Next Steps

- Complete initial MERIT prototype
  - Gather feedback from Federal stakeholders and community end-users
- Revise prototype workflow and visualizations
- Publish inundation mapping and resilience cross-walk
- Define integrations with Federal partners
  - FEMA programs (Community Hazard Mitigation Plans, CRS, HMGP)
  - NIST Community Resilience Guide
- Build the fully-integrated, robust platform

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