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Resilience Impacts of Changing Building Practices

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Resilience Impacts of Changing Building Practices

May 11, 2018

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The 30 Minute Game Plan…

Part 1 – Project Overview

Part 2 – Flood Vents

Part 3 – Clustered Green Space Buyouts

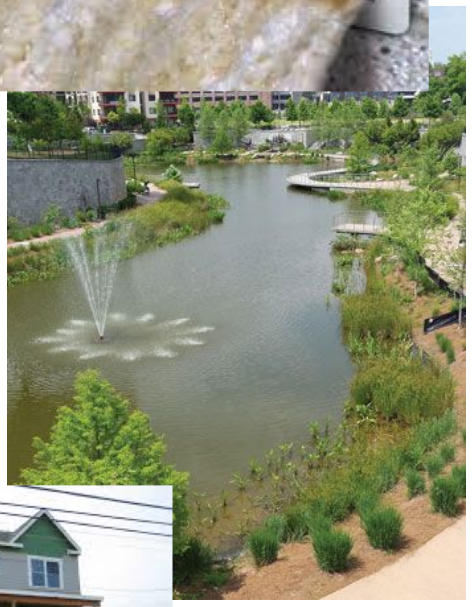
Part 4 – Raising Structure BFE

Part 5 – Key Takaways

Part 1 – Project Overview

General Project Objectives

- Develop an approach for answering specific research questions.
- Exploratory -- to think through the practical social, political, and financial hurdles to adopting these practices.
- Project is underway -- analyses are forthcoming.

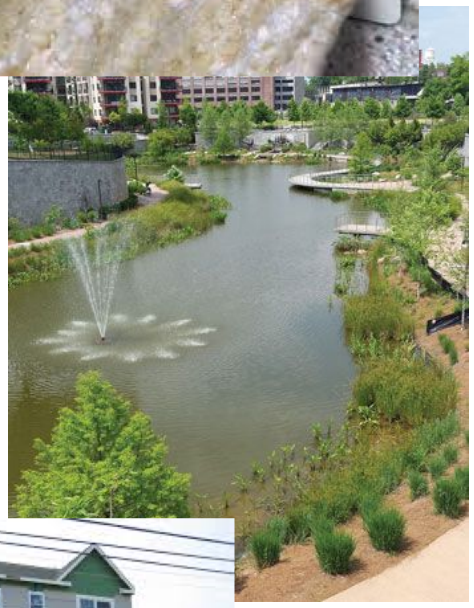


Specific Project Objectives

- Measure the return on investment (ROI) for deploying selected resilient building codes and development practices.

- Compare current practices to phased intervention practices:

    1. Flood Vents
    2. Clustered Green Space Buyouts
    3. Raising Structures



Part 2 – Flood Vents

Research Questions

What is the expected reduction in damage from continued adoption of flood vents under several storm scenarios?

How do these reductions in damage translate into reduced displaced populations and health savings?

Updated HAZUS Inventory

- Refined HAZUS inventory foundation types to better reflect ground truth.
- Applied one of these to each Census block:
  - 100% Crawl
  - 100% Slab
  - 90% Slab/10% Crawl
  - 89% Crawl/11% Slab
  - 66% Crawl/34% Slab
  - 93% Crawl/5% Basement/2% Slab

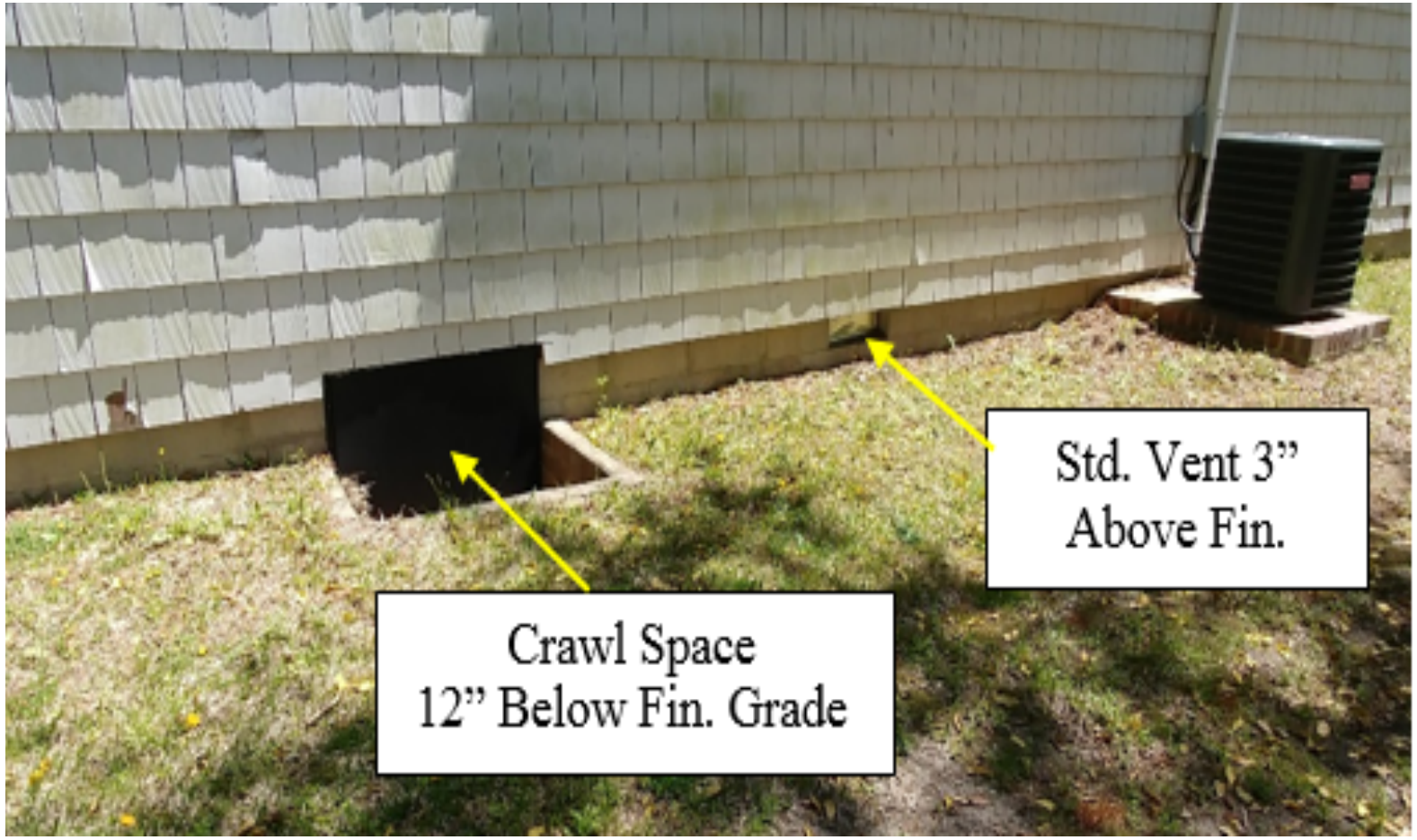
Updated to reflect actual foundation types in study area.

Mixed Category Foundations

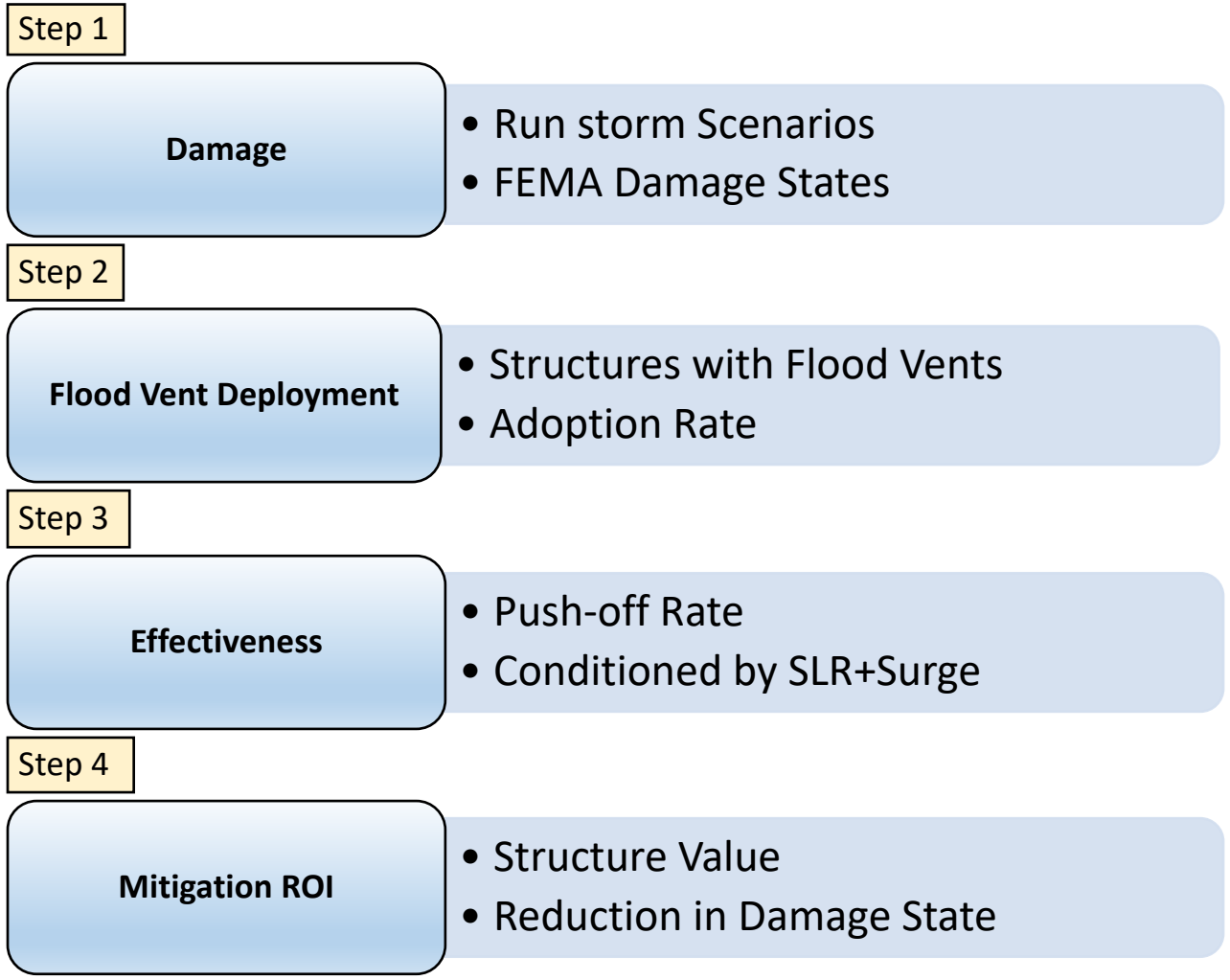
Example…

Mixed Category Foundation

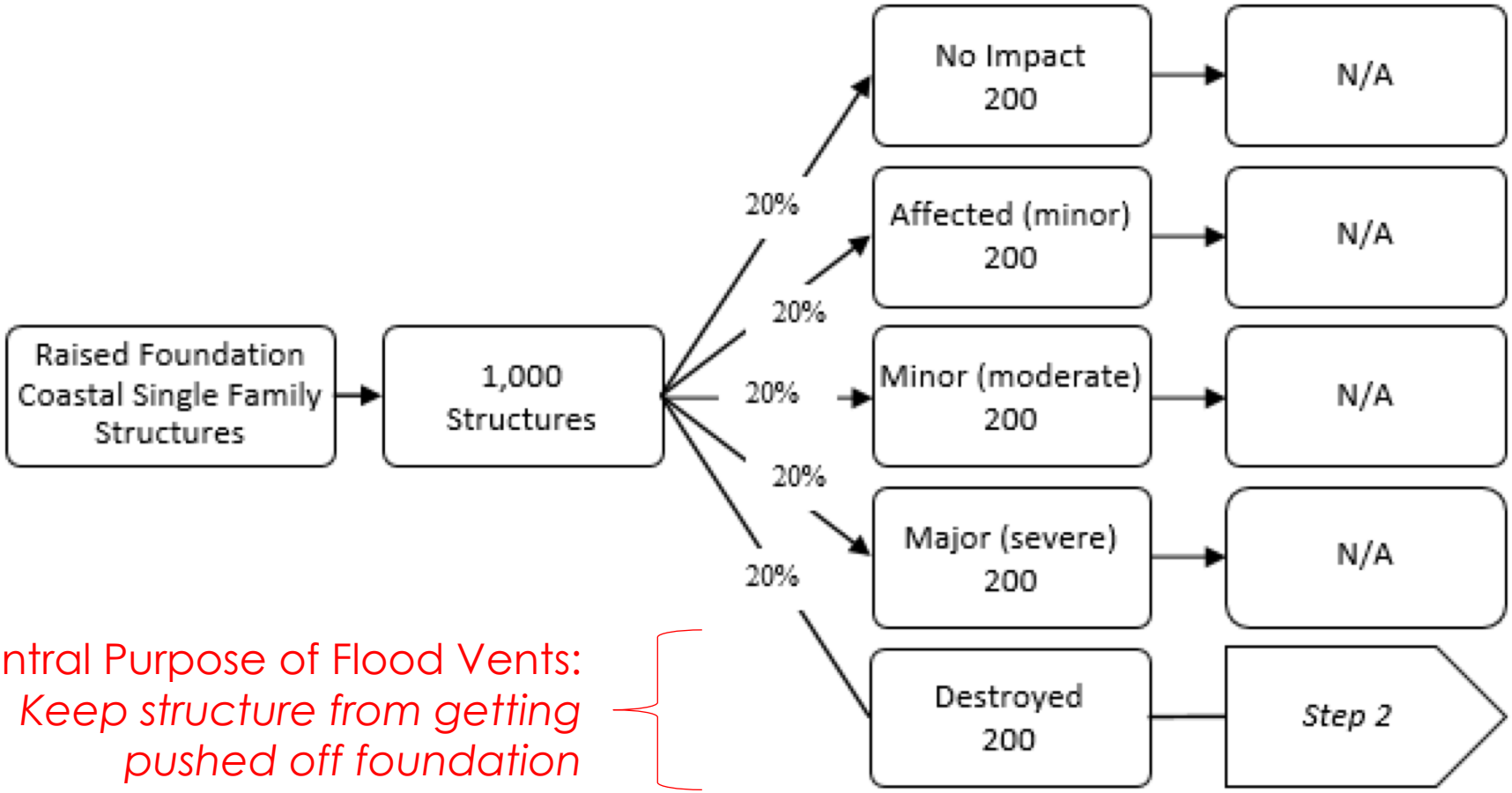
Example…



The High Level Process

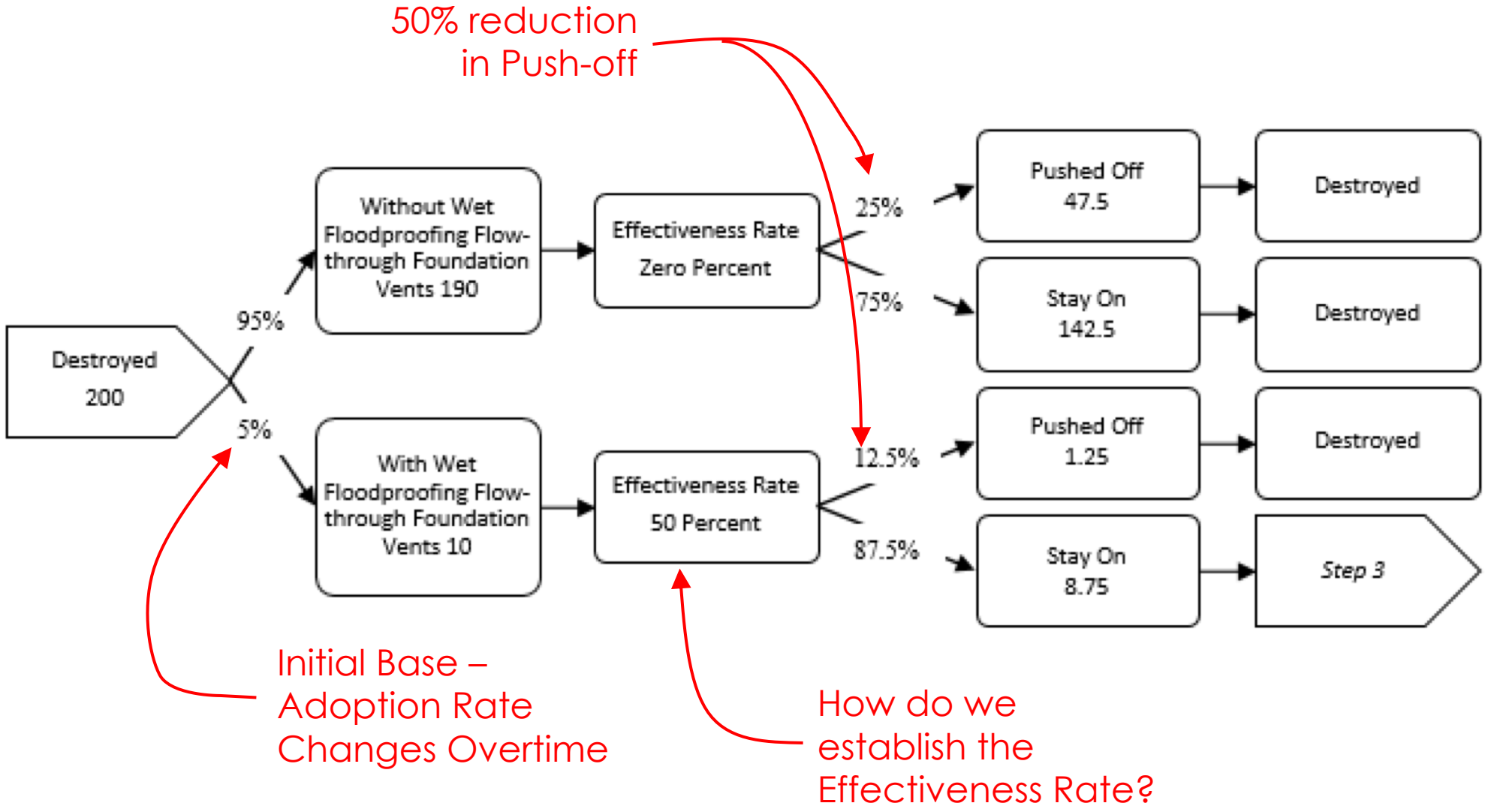


The Process



Central Purpose of Flood Vents:
Keep structure from getting pushed off foundation

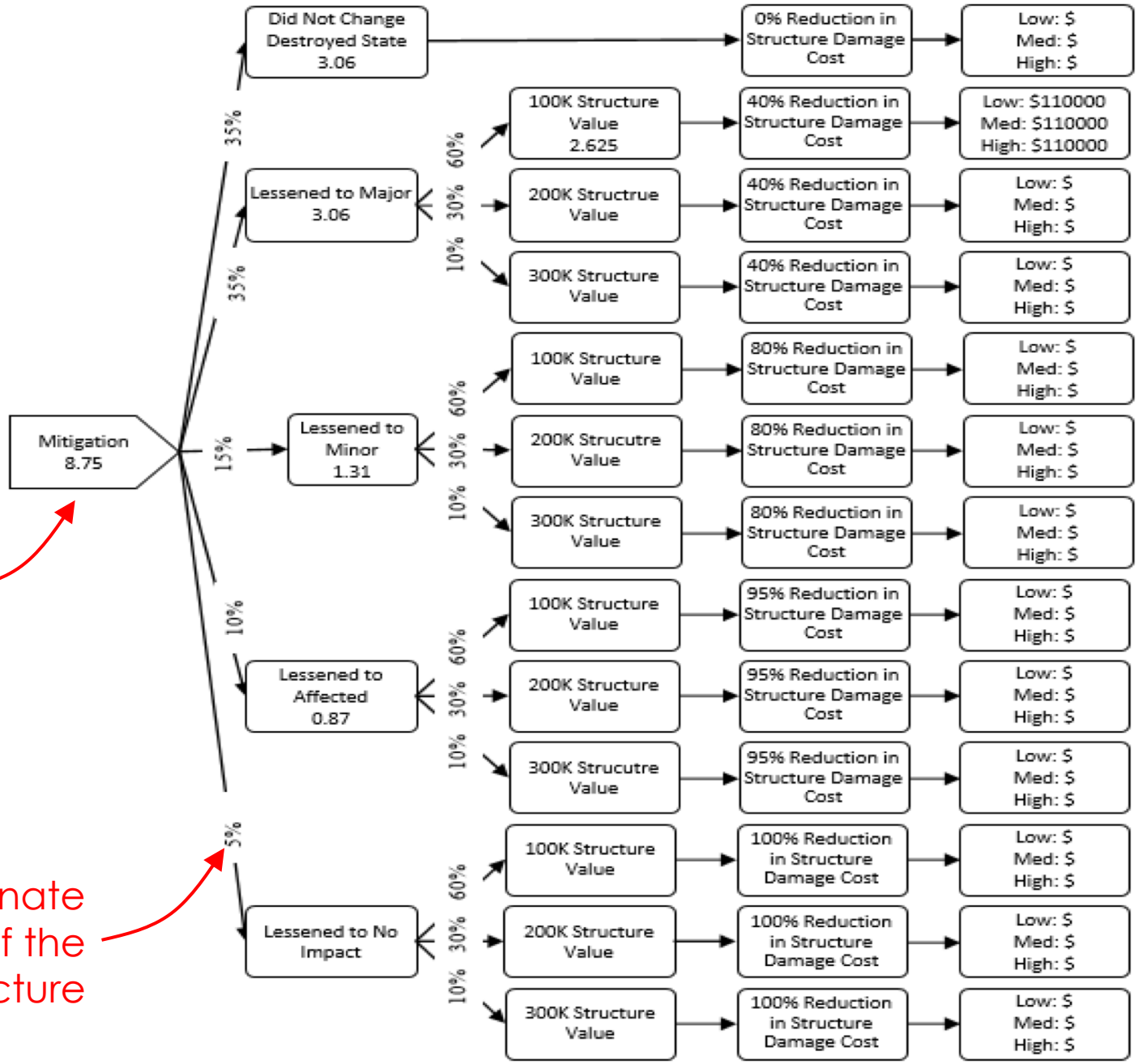
The Process


50% reduction
in Push-off
Destroyed
200
95%
5%
Without Wet Floodproofing Flow-through Foundation Vents 190
With Wet Floodproofing Flow-through Foundation Vents 10
Effectiveness Rate
Zero Percent
Effectiveness Rate
50 Percent
25%
75%
12.5%
87.5%
Pushed Off
47.5
Stay On
142.5
Pushed Off
1.25
Stay On
8.75
Destroyed
Destroyed
Destroyed
Step 3
Initial Base –
Adoption Rate
Changes Overtime
How do we
establish the
Effectiveness Rate?

The Process

This is the number of structures that otherwise would have been pushed off

Vents rarely eliminate entirely the impact of the event on the structure



Obstructions: LNFOs and SNFOs

Large Non-fixed Objects (LNFOs)
Small Non-fixed Objects (SNFOs)

Definition:

- Items surrounding the structure that may be moved by the force of moving water or buoyed by rising water.
- When moved by water, these objects can impede the effectiveness of the vents by blocking the flow of water and/or interfere with the mechanical functioning of the vents.

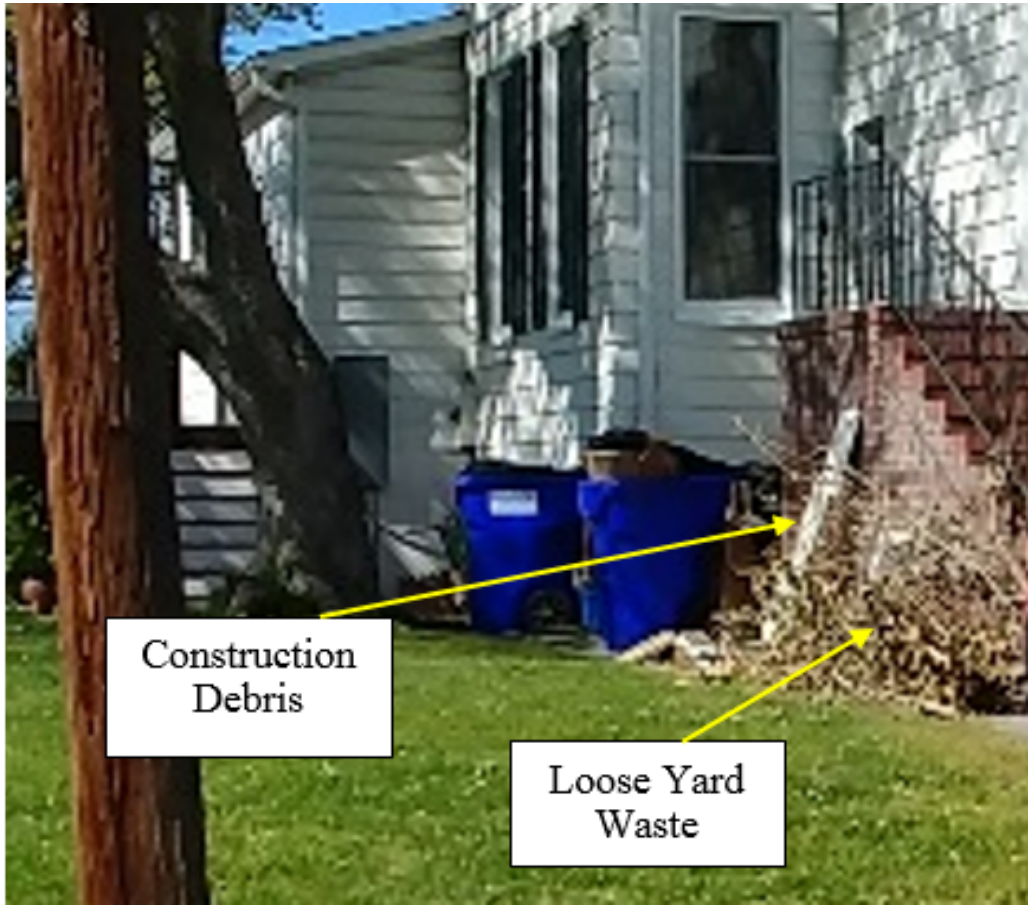
- Flood Vents typically within 12” of finish grade.
- Often proximate shrubs and flower beds.

LNFOs

LNFOs

Raised Structure on Relatively Small Lot, Proximity of Fencing Material

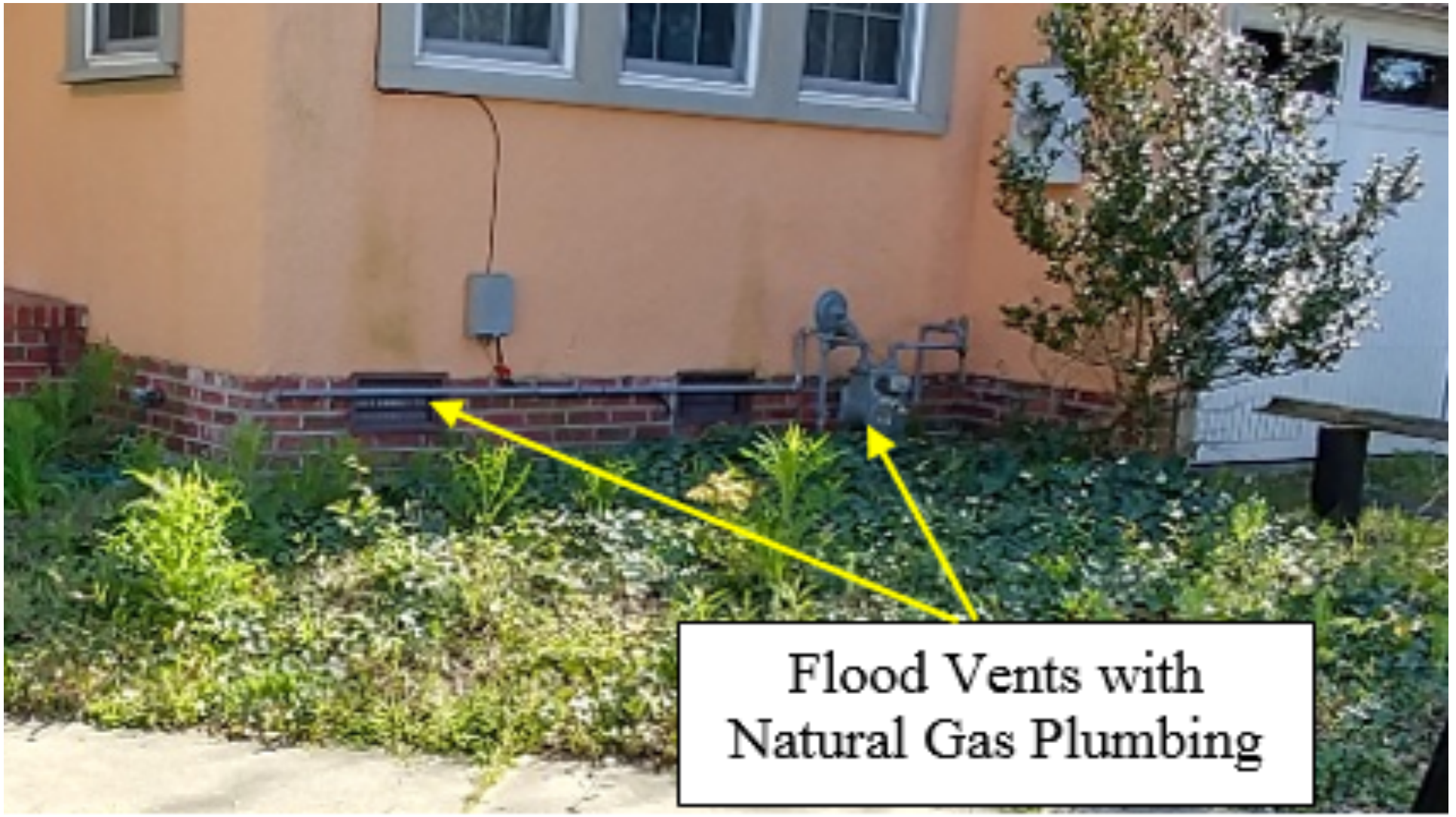
LNFOs & SNFOs


Construction Debris
Loose Yard Waste

Flower Pots Near Vents
Bagged Yard Waste

SNFOs

Fixed Structure Objects – Natural Gas



Fixed Structure Objects – Electrical Service

Part 3 – Clustered Greenspace Buyouts

Research Questions

What is the expected reduction risk, over time, from implementing a clustered buyout program?

How do these reductions in damage translate into reduced displaced populations and health savings?

Scenarios

3 Storm Scenarios:

- Historic storm: 1933 Chesapeake-Potomac
- Quasi-historic storm: “Sandtrina”
- Quasi-historic storm: “Hugoswan”

Storm scenarios simulations:

- Current conditions
- 2’ SLR

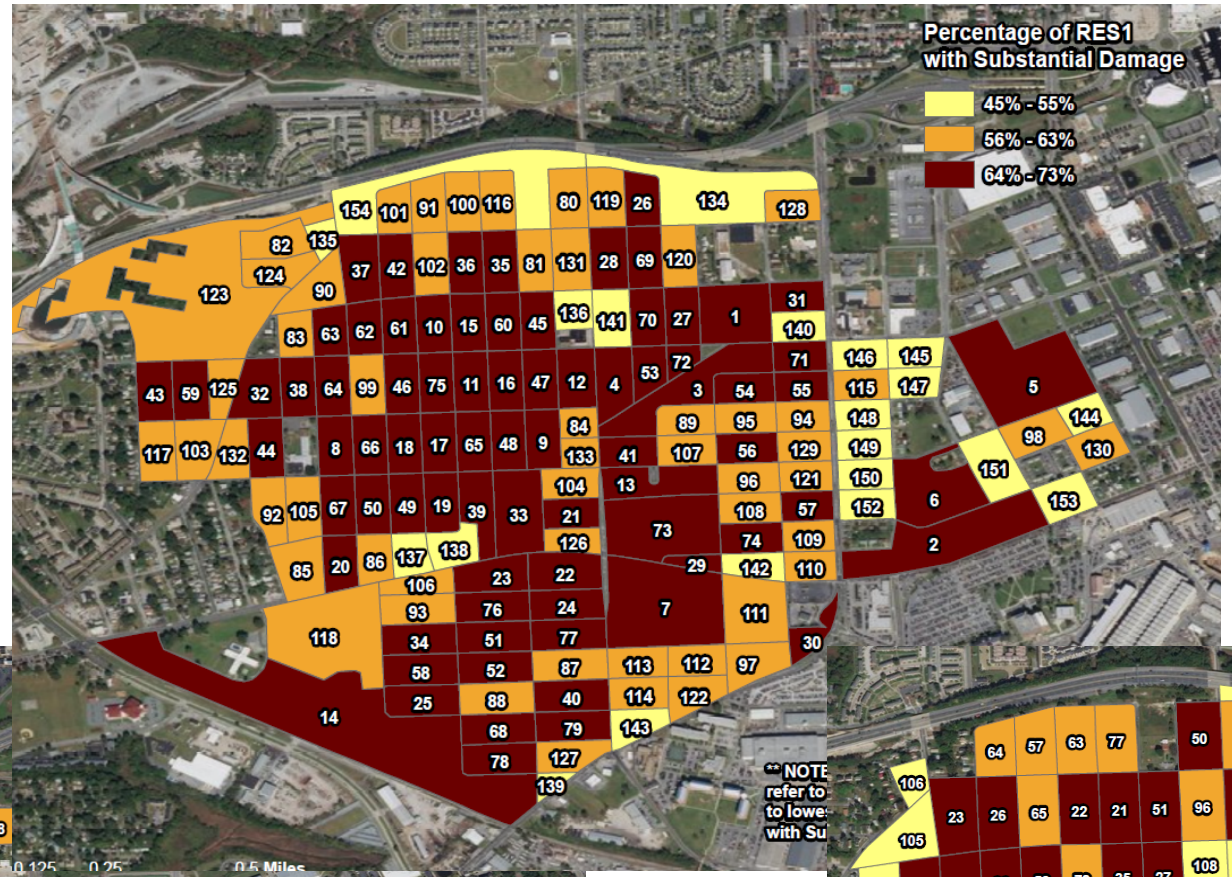
Green Space Adoption

- Run HAZUS scenarios
- Identify green space adoption areas based on substantial damage estimates
- Select residential parcels for purchase/buy-out and estimate costs
- Adjust damage estimates based phased adoption of green space
- Report adjusted damage estimates.
- Report estimated displaced populations
- Estimate discontinuity of medical regimens and public health cost.

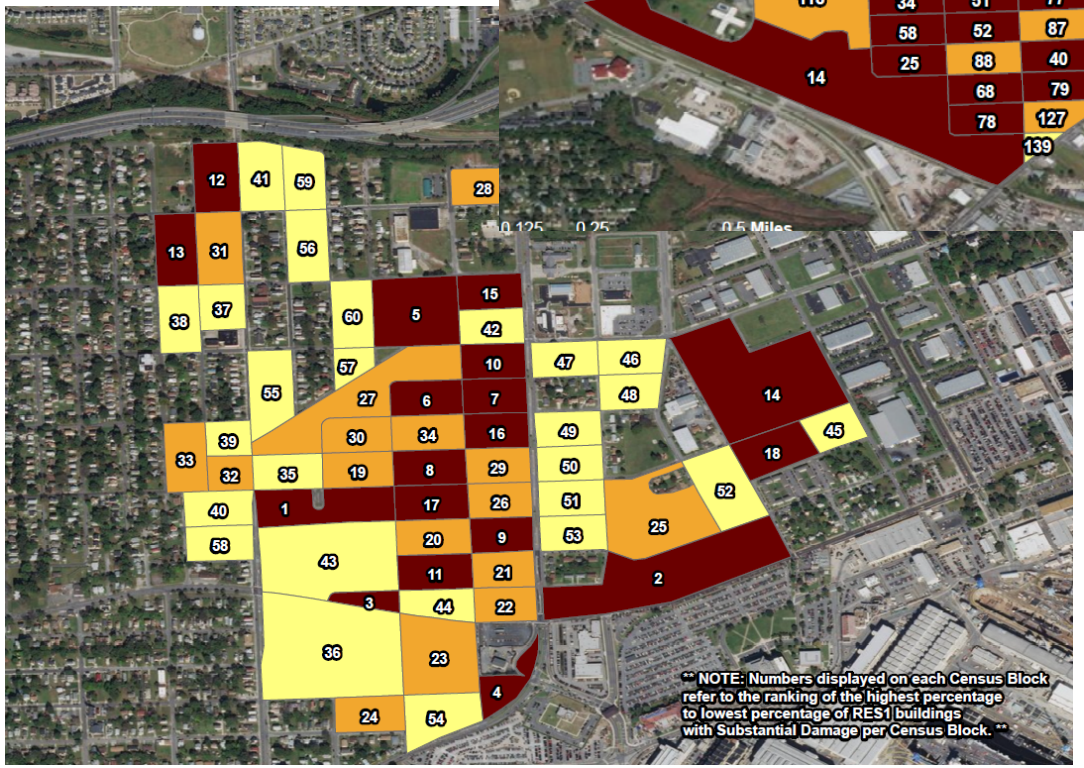
Algorithm to Identify Target Buyout Cluster

- Step 1: Run the 33 Chesapeake-Potomac storm, the Hugo storm, and the Sandtrina storm scenario, each with 2ft sea level rise.
- Step 2: For each storm, identify city neighborhoods with residential structures characterized with substantial damage; identify blocks that receive substantial damage from all three storms
- Step 3: Further identify all blocks that receive substantial damage to greater > 57.0% to Res1 structures.
- Step 4: Within these selected Step 3 blocks, identify all blocks that contain only Res1 and Res2 structures; that is, blocks that are 100% Res1 and Res2.
- Step 5: Within these selected Step 4 blocks, identify any clusters of five or more contiguous blocks.
- Step 6: Identify any blocks proximate to the cluster that: 1) are > 57.0 percent substantial damage to Res 1 structure, 2) have one or more sides of the block's polygon perimeter shared with blocks within the identified cluster, and 3) contain two or fewer non-residential structures (e.g., commercial, religious, agriculture). Include these blocks in the cluster.

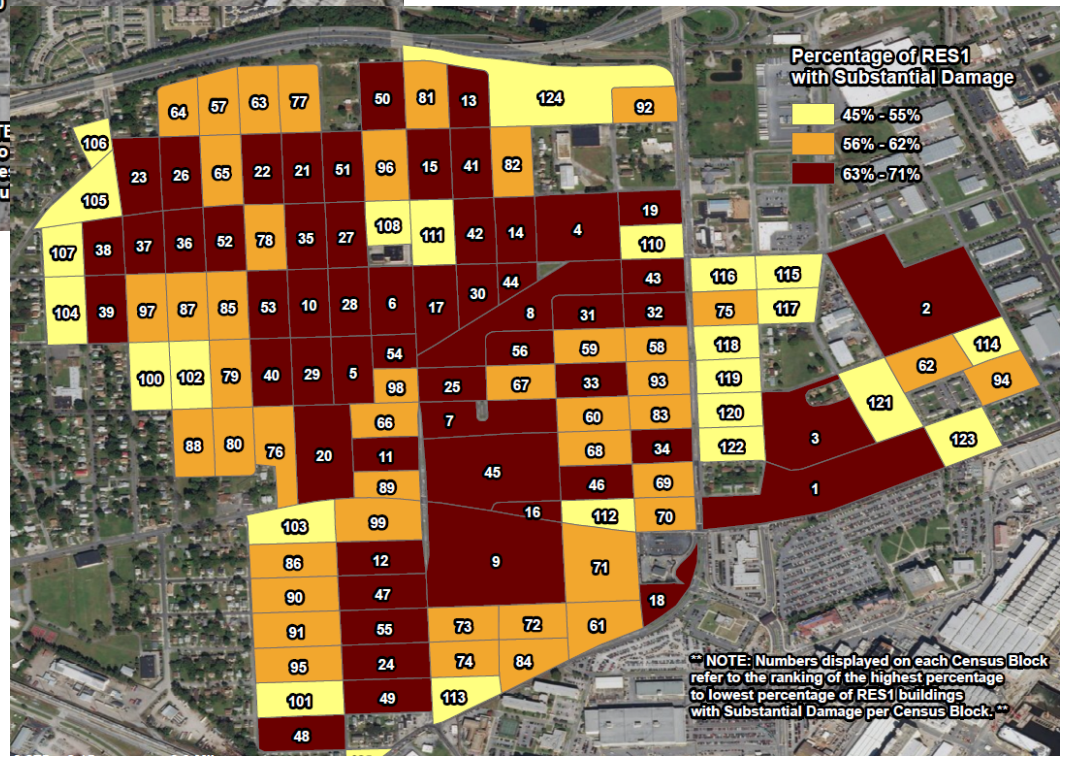
Sandtrina with SLR



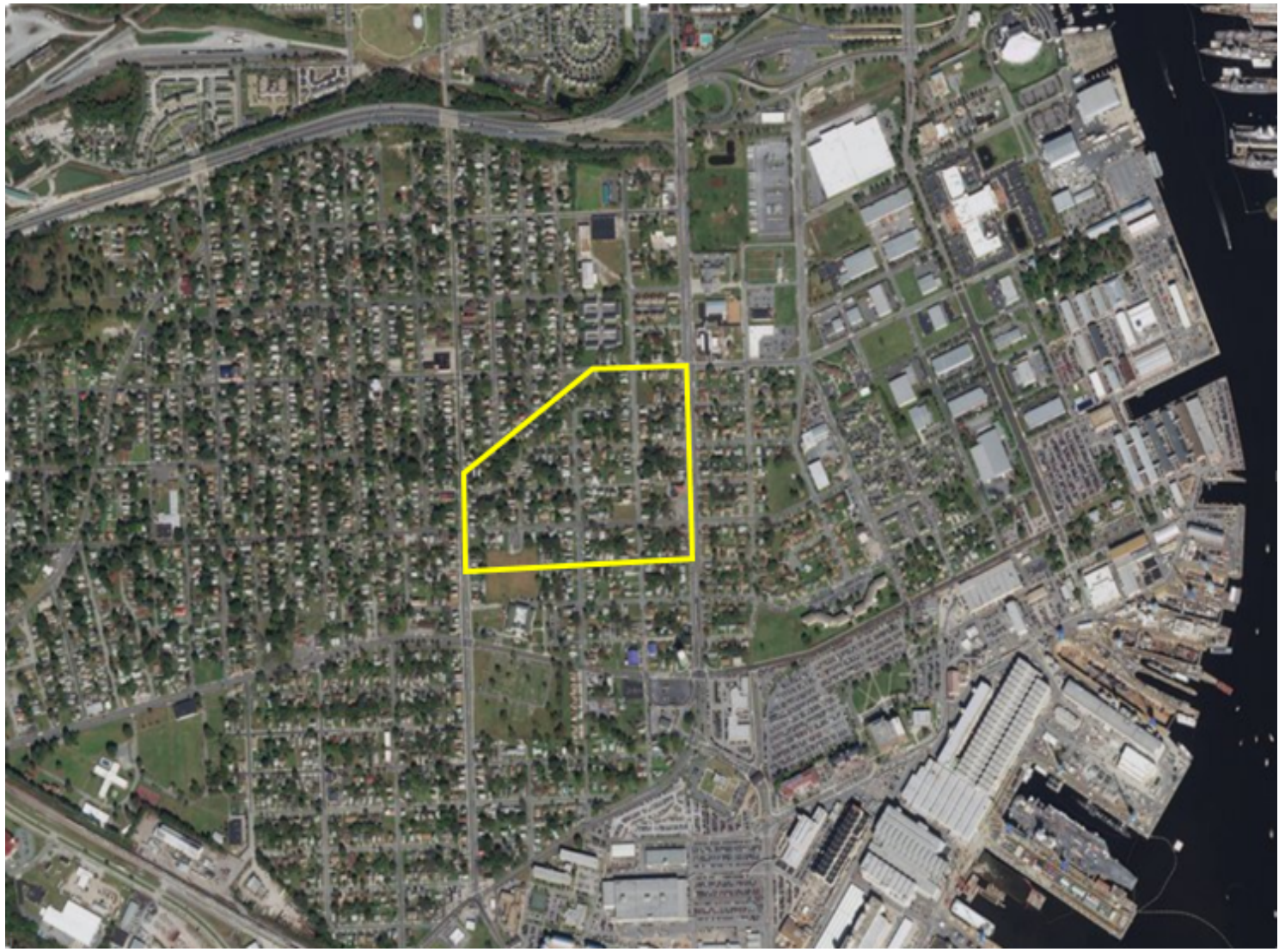
Hugoswan with SLR



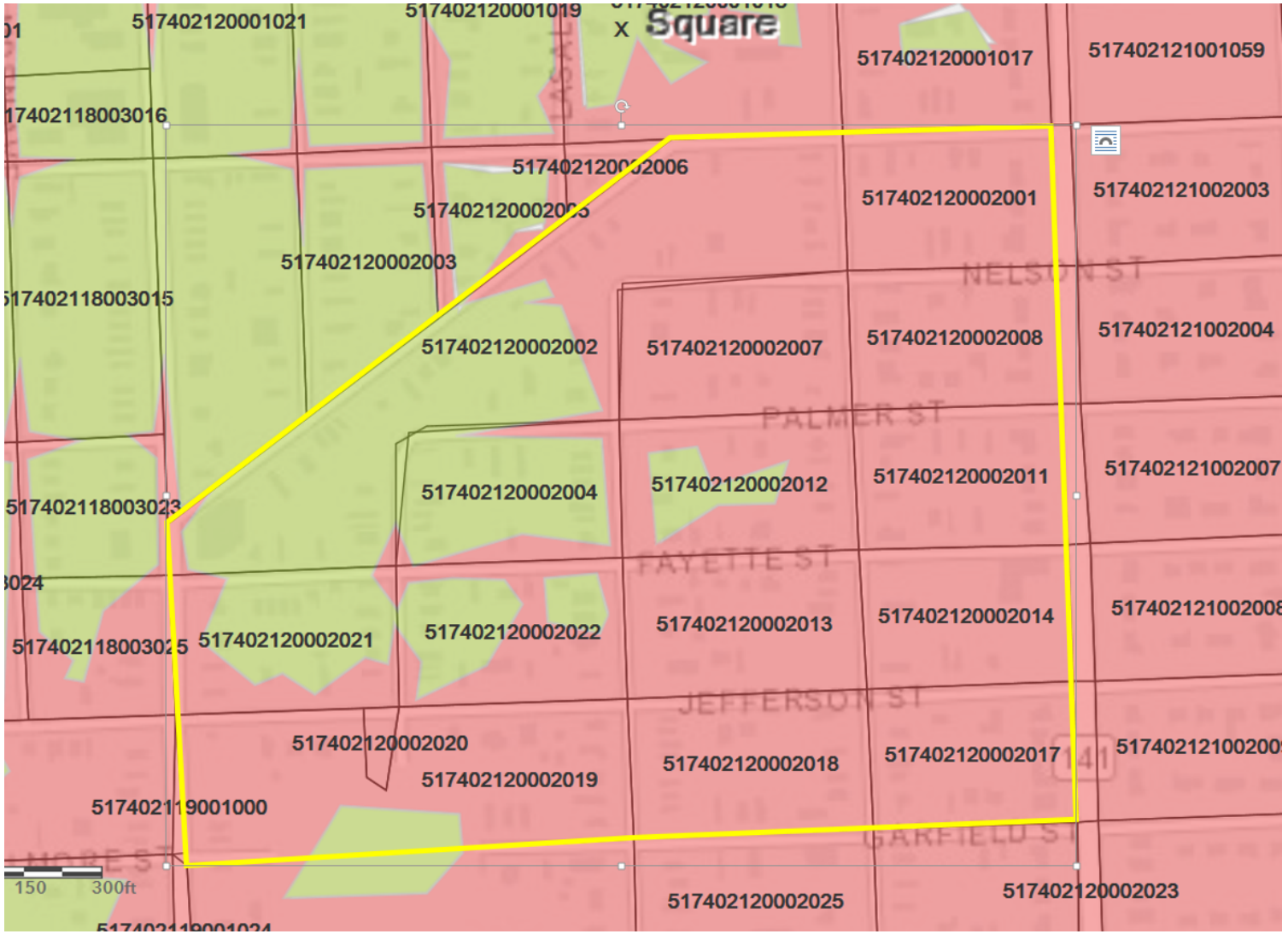
Chesapeake-Potomac with SLR



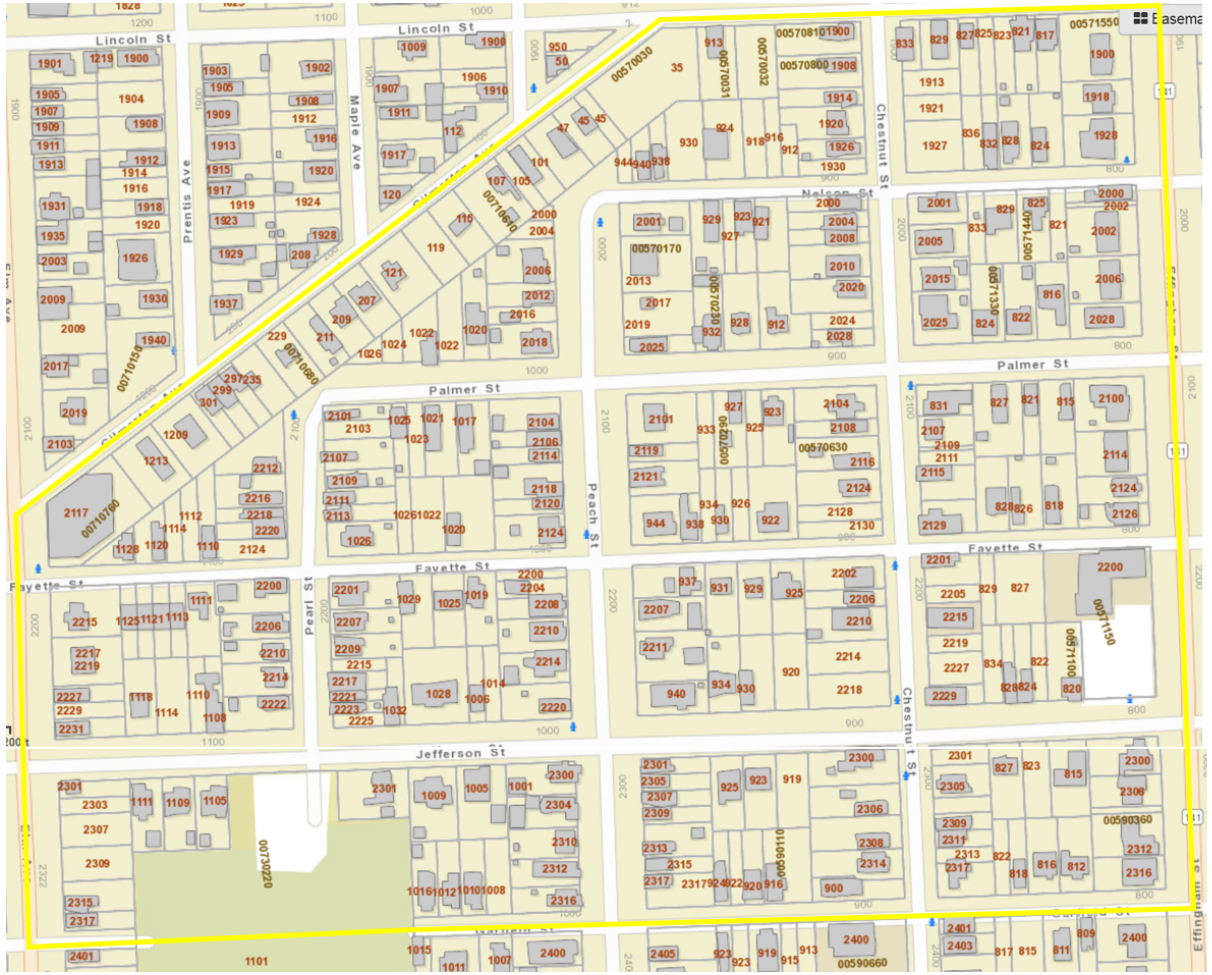
Optimized High Risk Clustered Blocks



Relationship to AE Zone



Establish Parcel Property & Structure Value



Greenspace Adoption

Greenspace Adoption

Shallow
Basin

Part 4 – Raising Structure BFE

Research Questions

What is the expected reduction in risk, over time, from implementing raising existing structures and requiring new construction using increased BFE?

How do these reductions in damage translate into reduced displaced populations and health savings?

Raising Structures

- Run HAZUS scenarios
- Identify % of new homes in study area
- Adjust damage estimates based phased adoption of elevated structures
- Report adjusted damage estimates
- Report estimated change in displaced populations
- Estimate change discontinuity of medical regimens and public health cost.

Secondary Tradeoff Issues

- Risk from height of structure
  - Risk of acute injury is greater due to stair height.
- Structure will not meet needs with onset or instantaneous mobility issues.
  - Height will not accommodate retrofitting with ramps.
- Ingress/egress of emergency responders.
- Over time, the pool of homes accessible to those with mobility impairments shrink.
- Insurance tradeoffs.

Stair System

Example…

Increased Porch Risers

Example…

Part 5 – Key Takaways

Flood Vents Takeaways

1. Foundation type and zone limit number of potential structures.

2. Adoption rate conditioned by property value, ownership, and risk perceptions.

3. Reduction in risk is conditioned by the concept of effectiveness.

Clustered Greenspace Buyouts Takeaways

1. Identification of buyout balances multiple, often competing, constraints.
2. Advantages to clustered approach are open space and enhanced livability.
3. Open space plan may be shelf-ready after an event.

Raising Structure BFE Takeaways

1. Need to better document secondary health and insurance tradeoffs.

2. Decrease pool of housing options for those with mobility limitations, elderly, and young families with children.

3. Increased insurance.

Thank You!