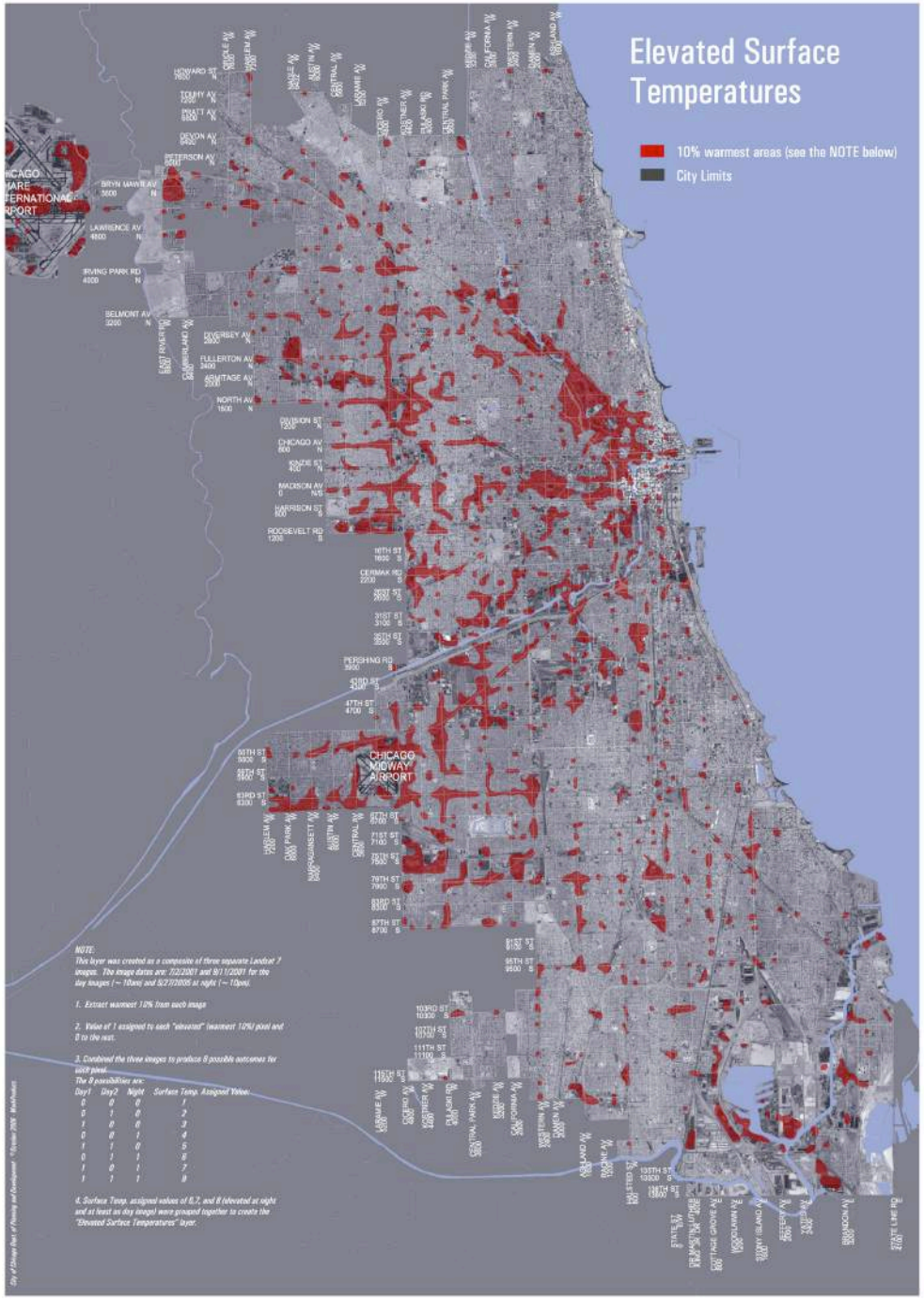
Advancements…

1. Next Generation Vulnerability Assessments
2. Response Strategies
3. Housing – protective element

Vulnerability = Exposure (physical)
+ Sensitivity (social)

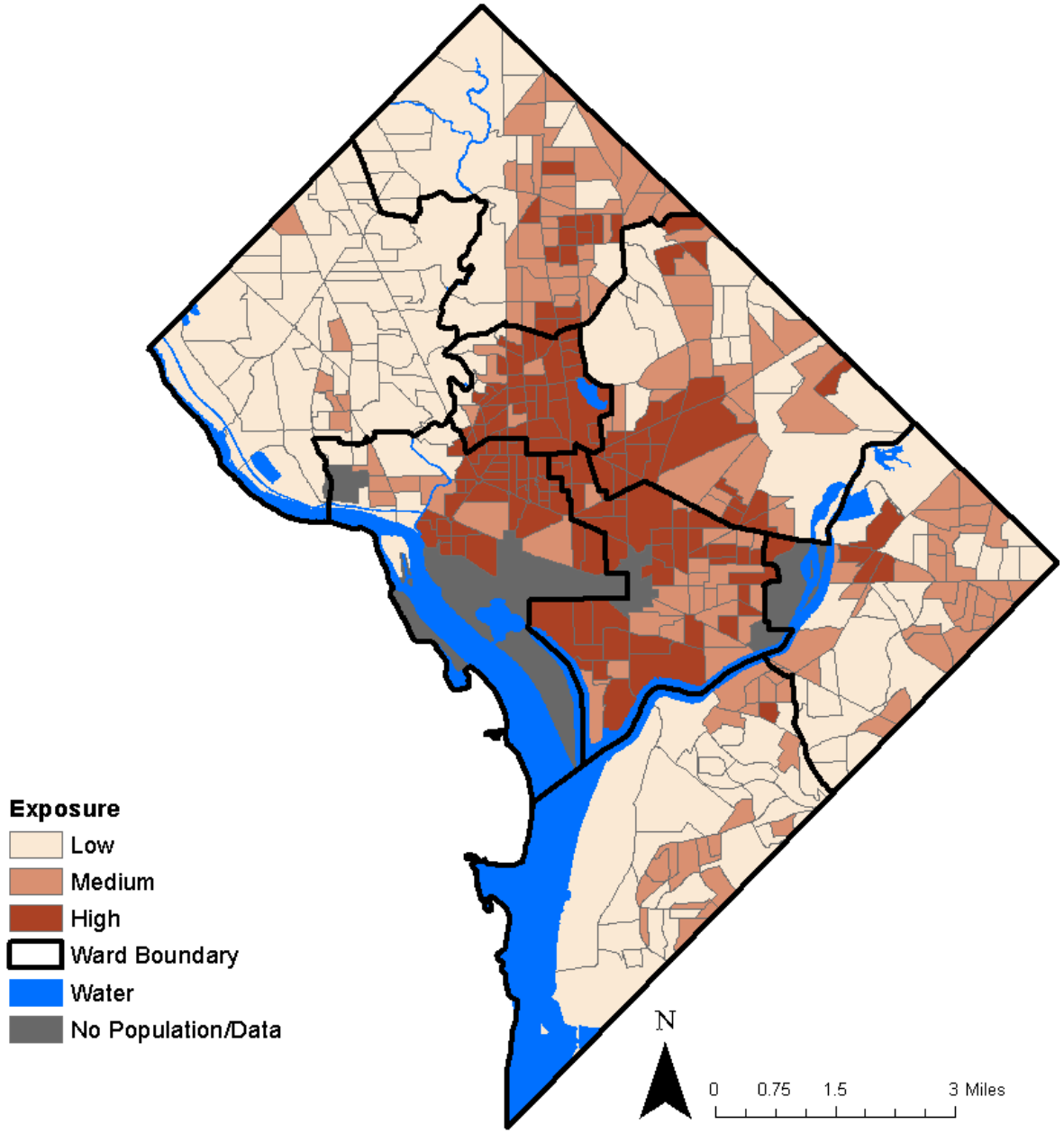

Elevated Surface Temperatures
10% warmest areas (see the NOTE below)
City Limits
CHICAGO MIDWAY AIRPORT
NOTE:
This layer was created as a composite of three separate Landsat 7 images. The image dates are: 7/2/2001 and 9/11/2001 for the day images (~ 10am) and 9/27/2005 at night (~ 10pm).
1. Extract warmest 10% from each image
2. Value of 1 assigned to each "elevated" (warmest 10%) pixel and 0 to the rest.
3. Combined the three images to produce 8 possible outcomes for each pixel.
The 8 possibilities are:
Day1 Day2 Night Surface Temp. Assigned Value...
0 0 0 1
0 1 0 2
1 0 0 3
0 0 1 4
1 1 0 5
0 1 1 6
1 0 1 7
1 1 1 8
4. Surface Temp. assigned values of 6,7, and 8 (elevated at night and at least on day image) were grouped together to create the "Elevated Surface Temperatures" layer.
City of Chicago Dept. of Planning and Development • October 2006 • Mark Pickett

Exposure 1: Environmental Exposure

Indicators:

Impervious Surface

Area Without Tree Canopy

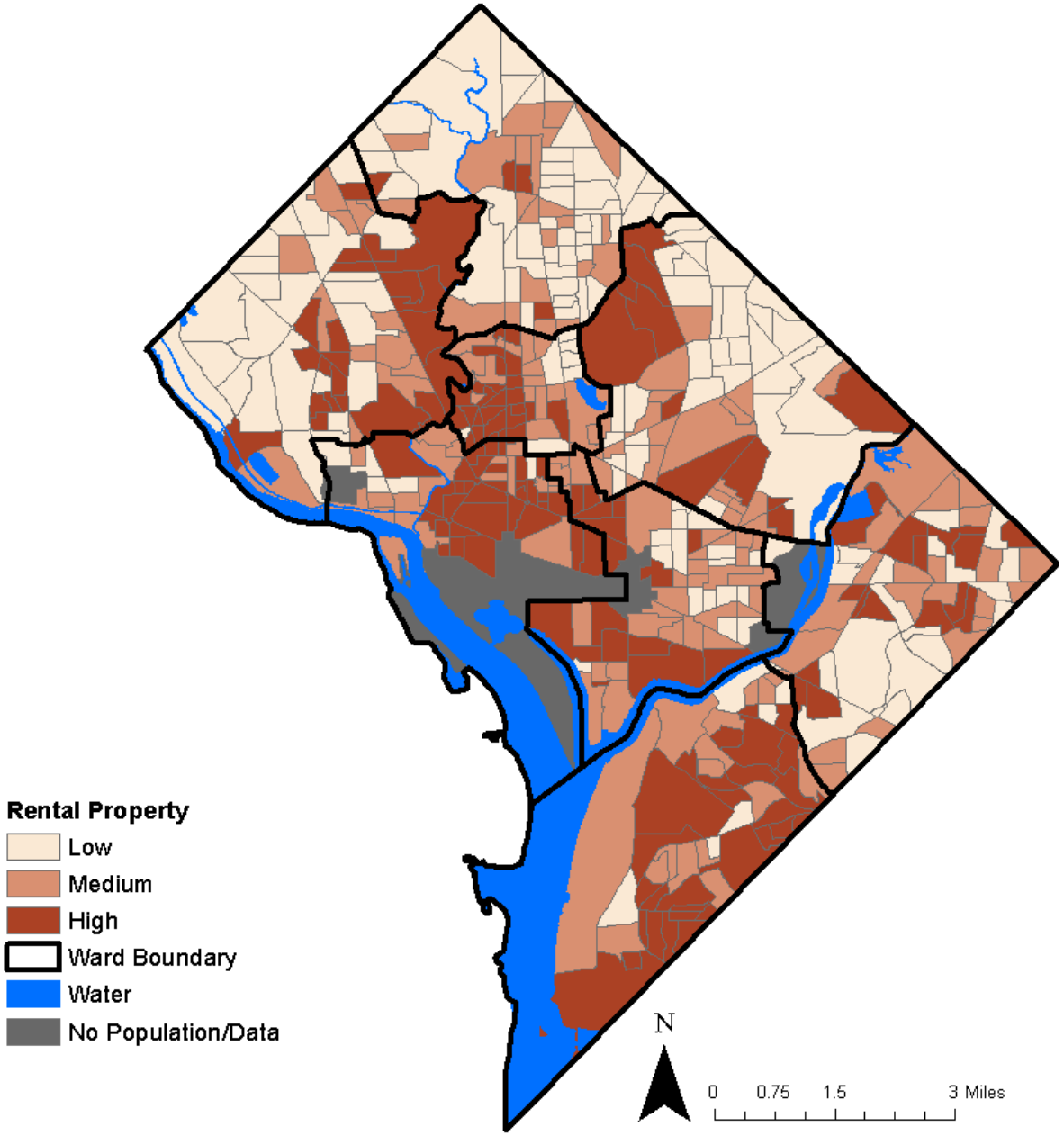


Exposure 2: Housing Quality

Indicators:

Proportion Renter

Units With Less than 4 Rooms

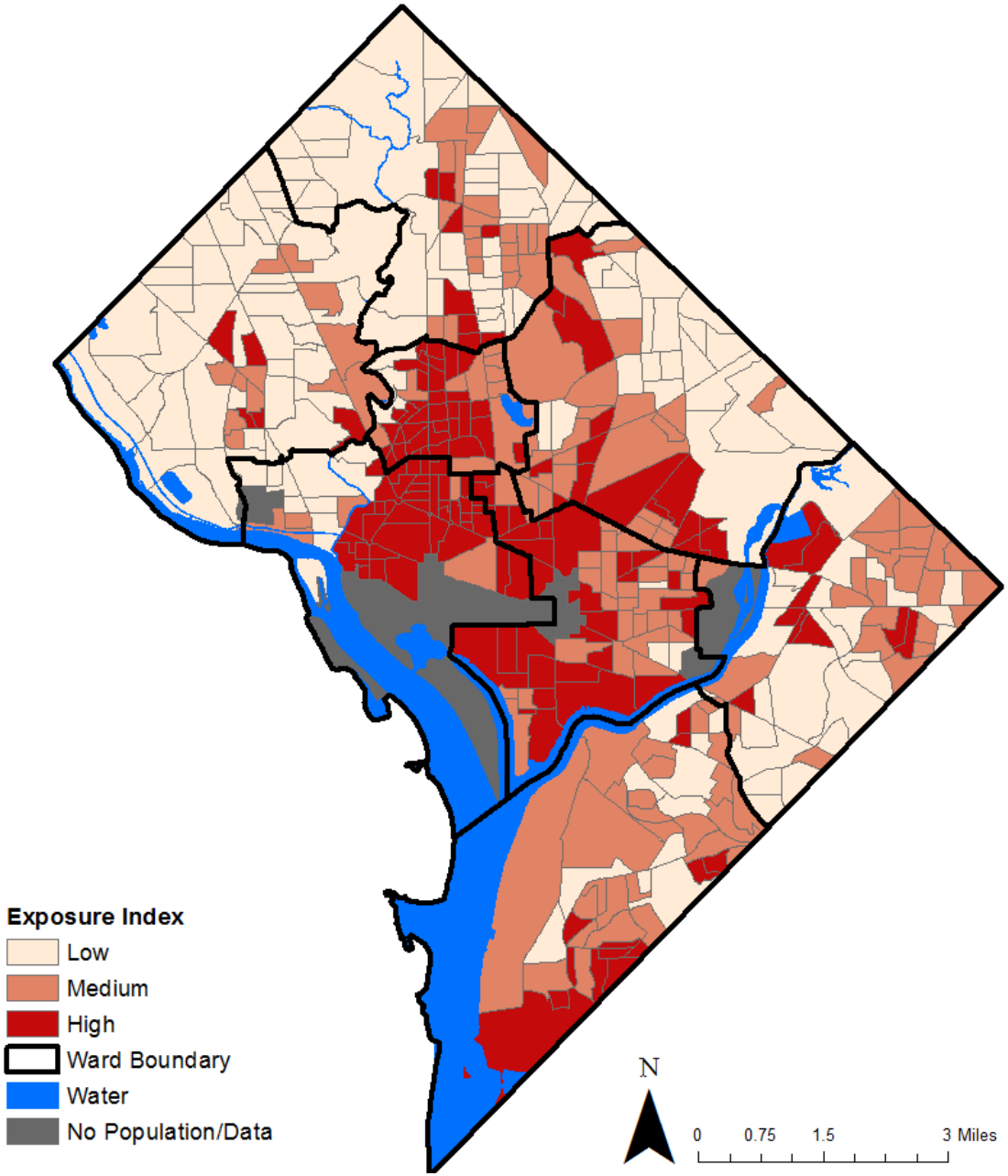


Exposure Index

Components:

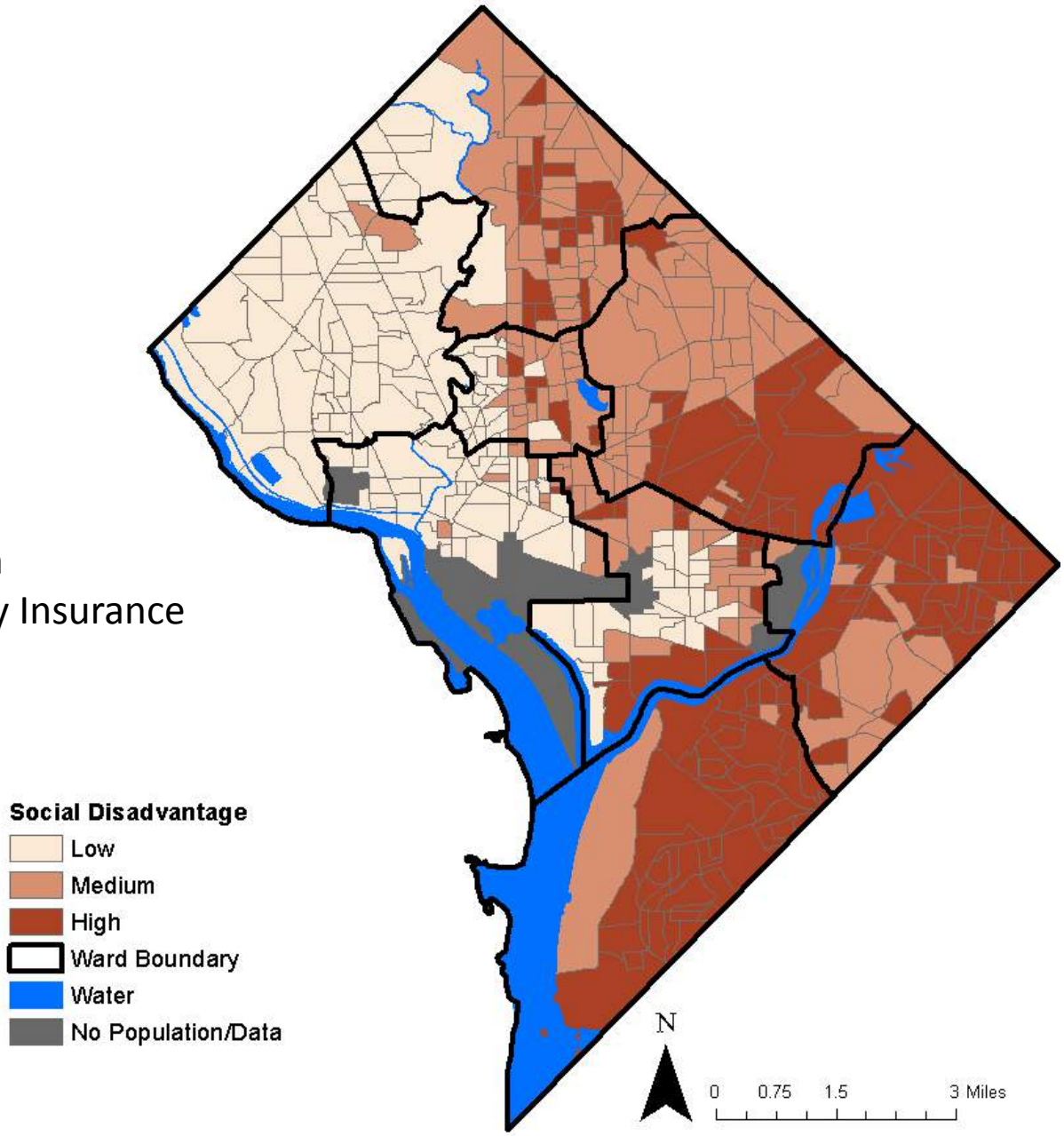
Rental Property

Environmental Exposure



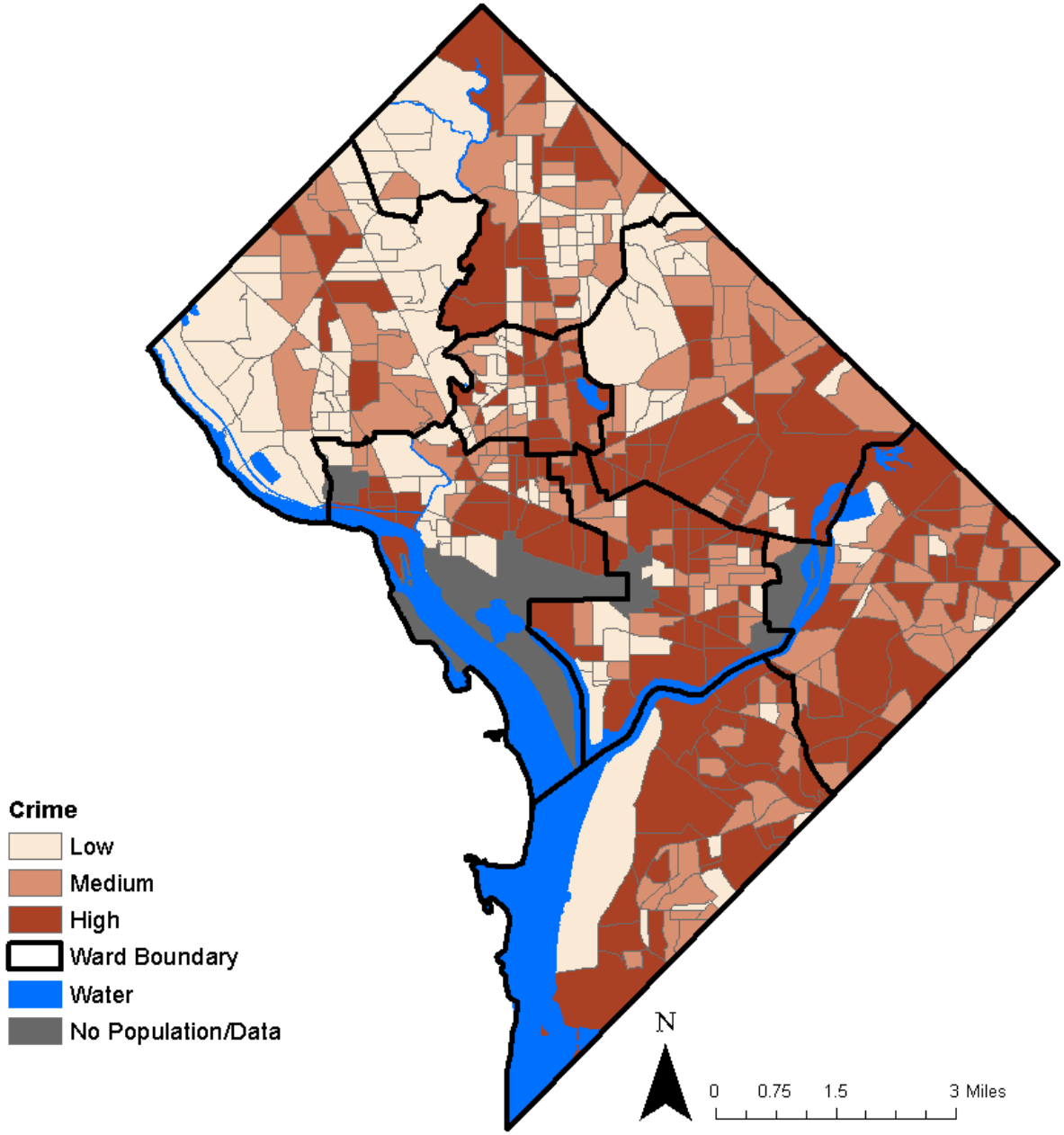
Sensitivity 1: Social Disadvantage

Indicators:
Poverty
Minority
Less than High School Education
Receiving Supplemental Security Insurance



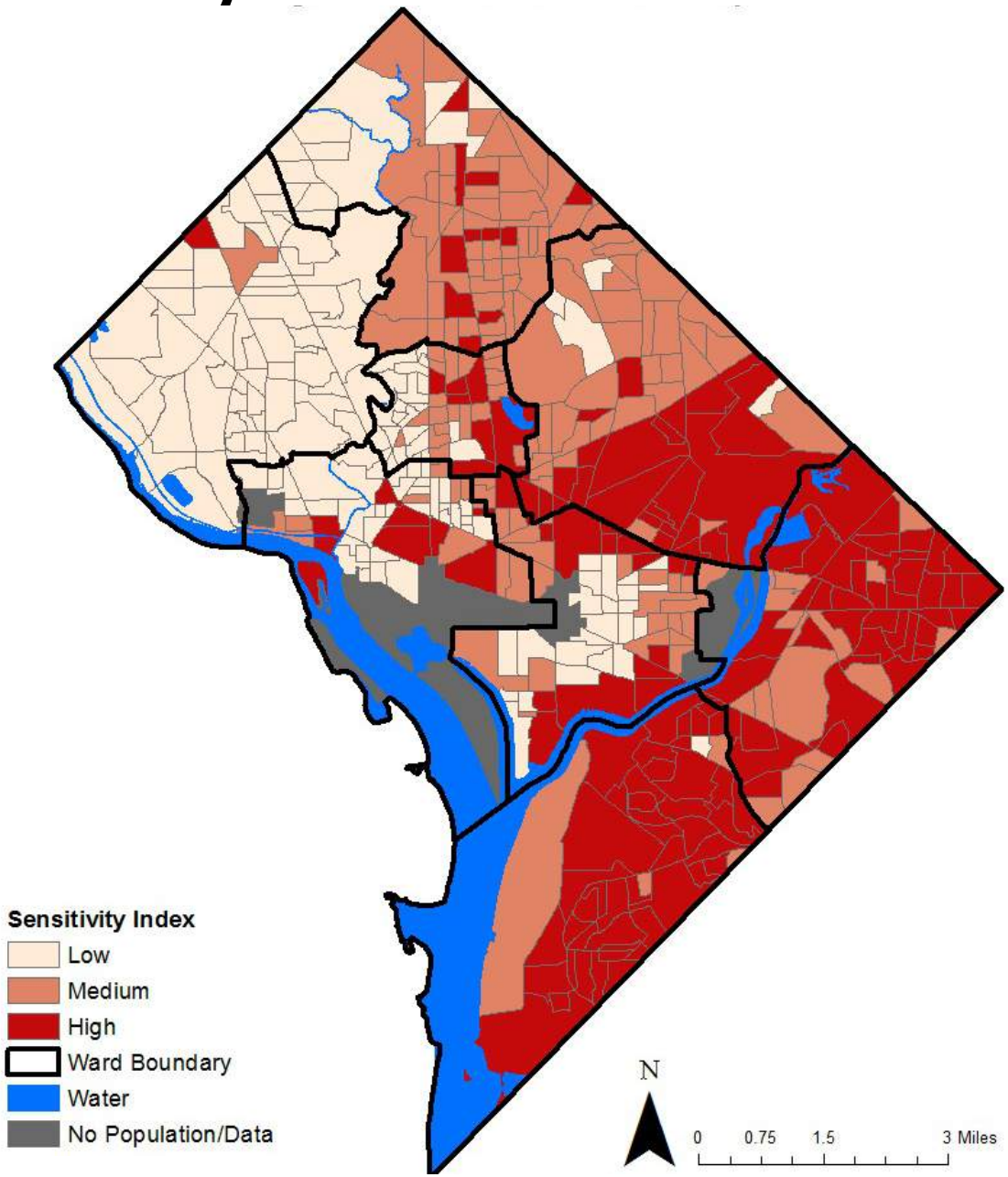
Sensitivity 2: Crime

Indicators:
Total Crime
Property Crime
Violent Crime



Sensitivity Index

Components:
Social Disadvantage
Crime

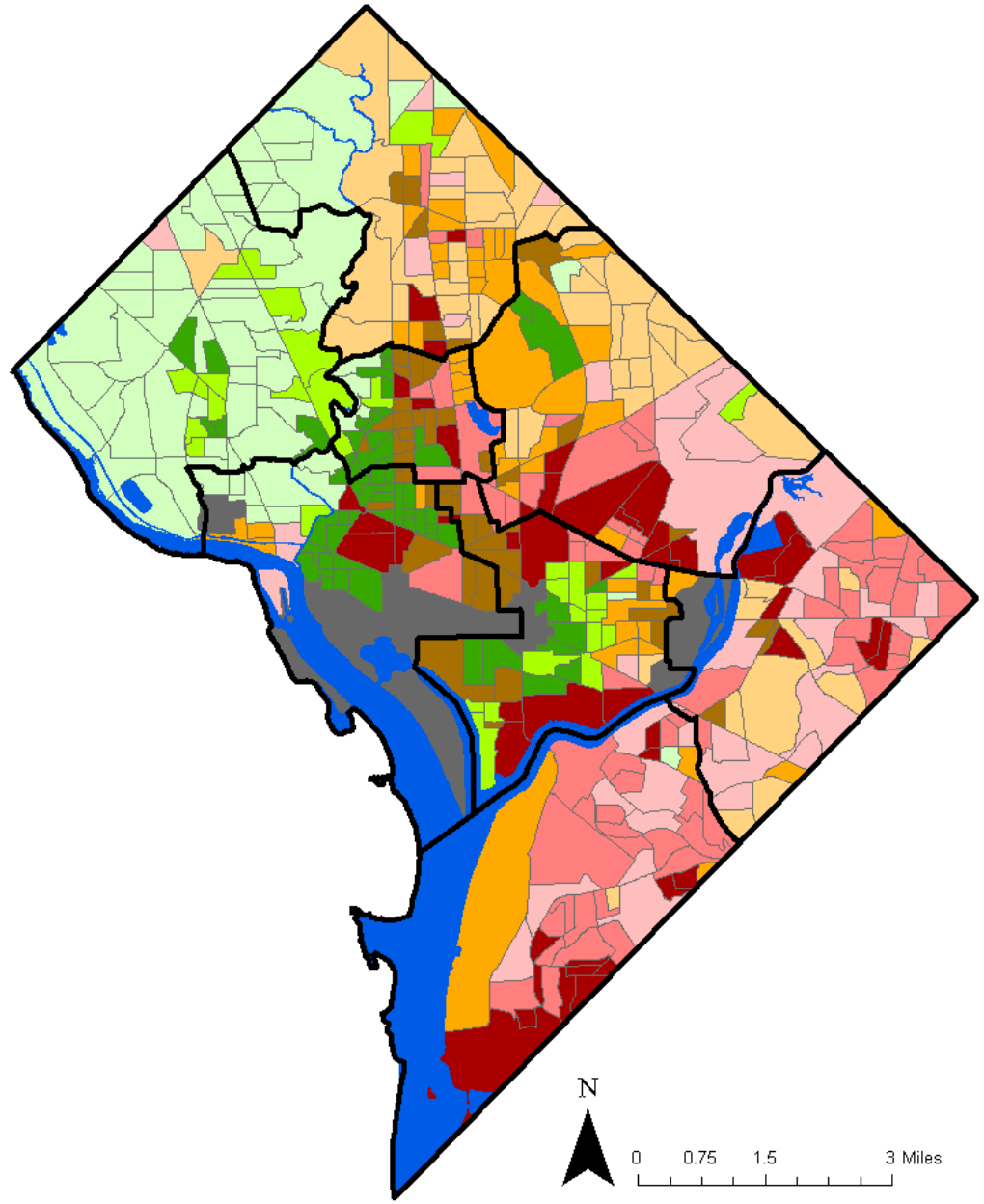


Vulnerability Index

Index

		Sensitivity		
		S1	S2	S3
Exposure	E1	1	2	3
	E2	4	5	6
	E3	7	8	9

Ward Boundary
Water
No Population/Data

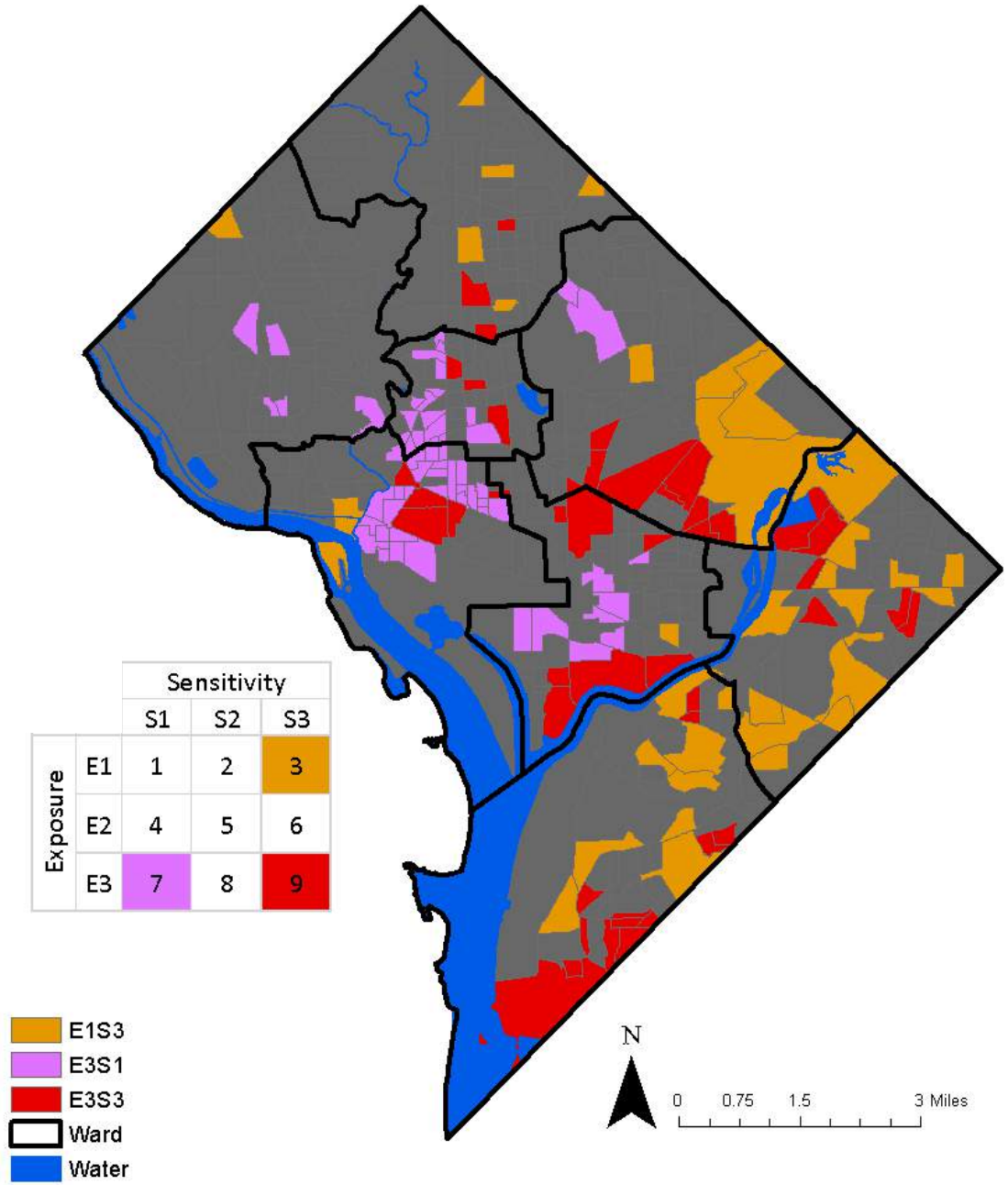


Prioritizating Actions

- Vulnerable People (Orange)
  - Cooling centers (Fixed and Mobile)
  - Emergency Prep. Workshops
  - Weatherization subsidy programs

- Vulnerable Places (Pink)
  - Enhance tree canopy
  - Pervious paving
  - Reflective roofs

- Vulnerable People/Vulnerable Places (Red)
  - Cooling centers (Fixed and Mobile)
  - Workshops
  - Weatherization subsidy programs
  - Enhance tree canopy
  - Pervious paving
  - Reflective roofs



Types of Response Strategies

Beyond emergency response….

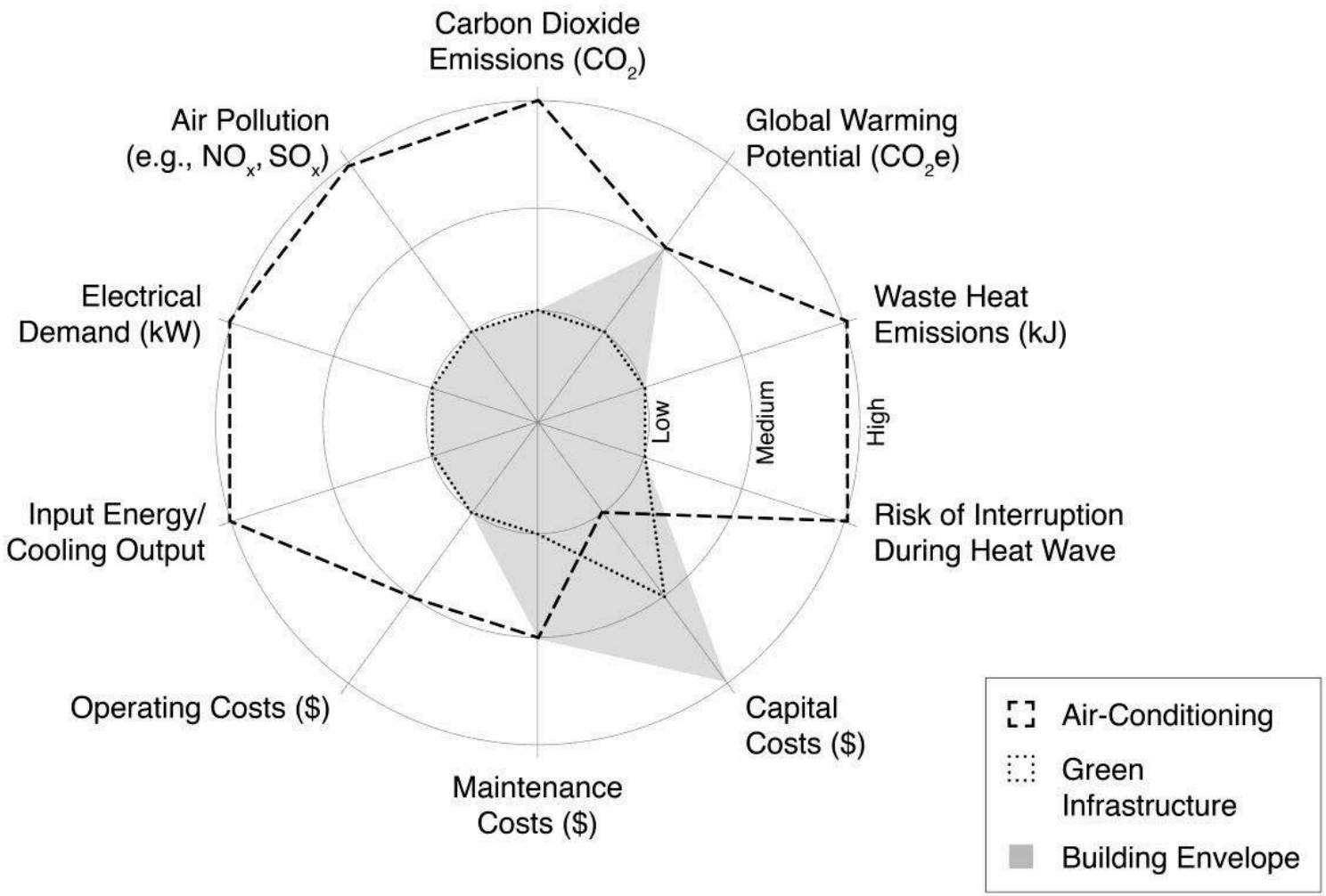
1. Air Conditioning (A/C) strategies
2. Building Envelope
3. Neighborhood Characteristics

Strategy 1: Increase A/C

- Local implications – more waste heat and utility poverty
- Regional implications – more black outs – peak energy demand for many of the regions of the world now occurs in summer not winter
- Global implications – this is an adaptation strategy that worsens climate change mitigation
  (electricity – energy source)

Some short-term gains – Many medium and long-term losses

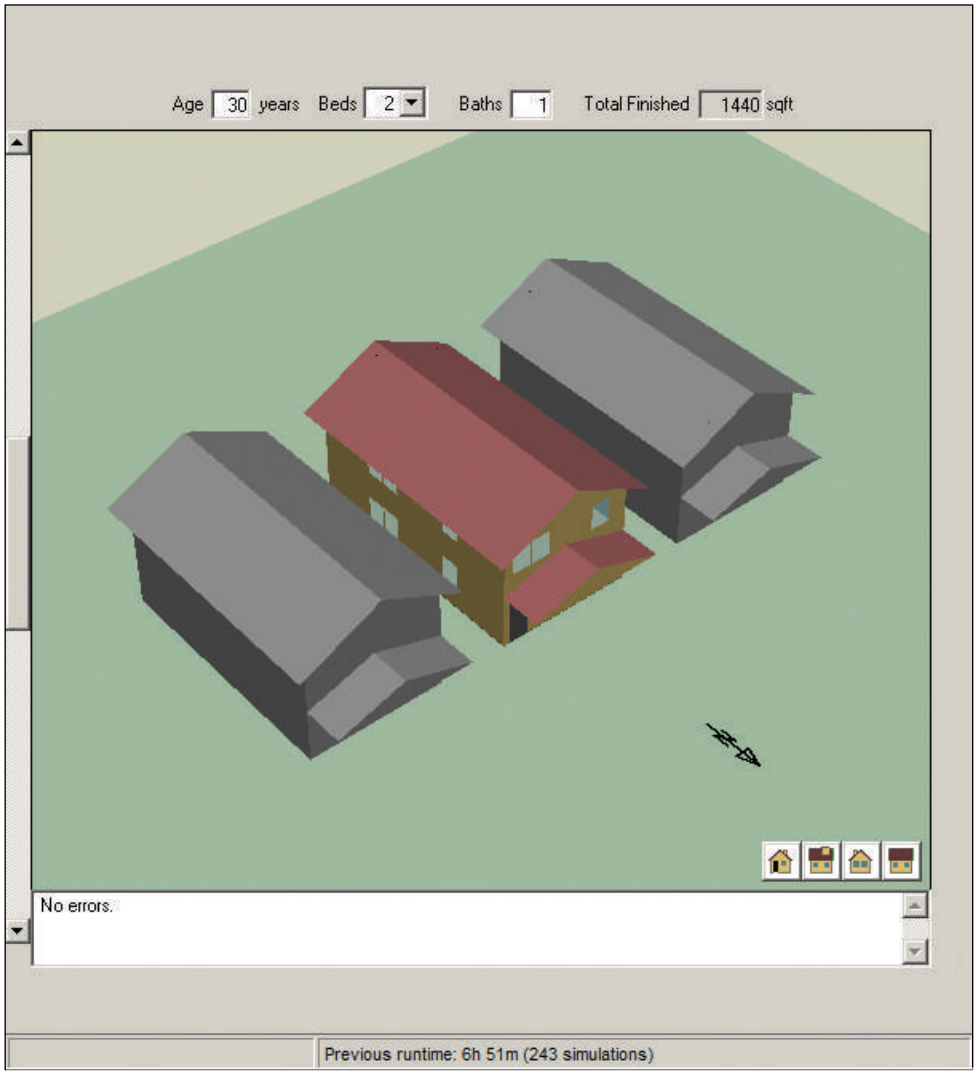
Relative Strengths and Weaknesses of the Three Strategies

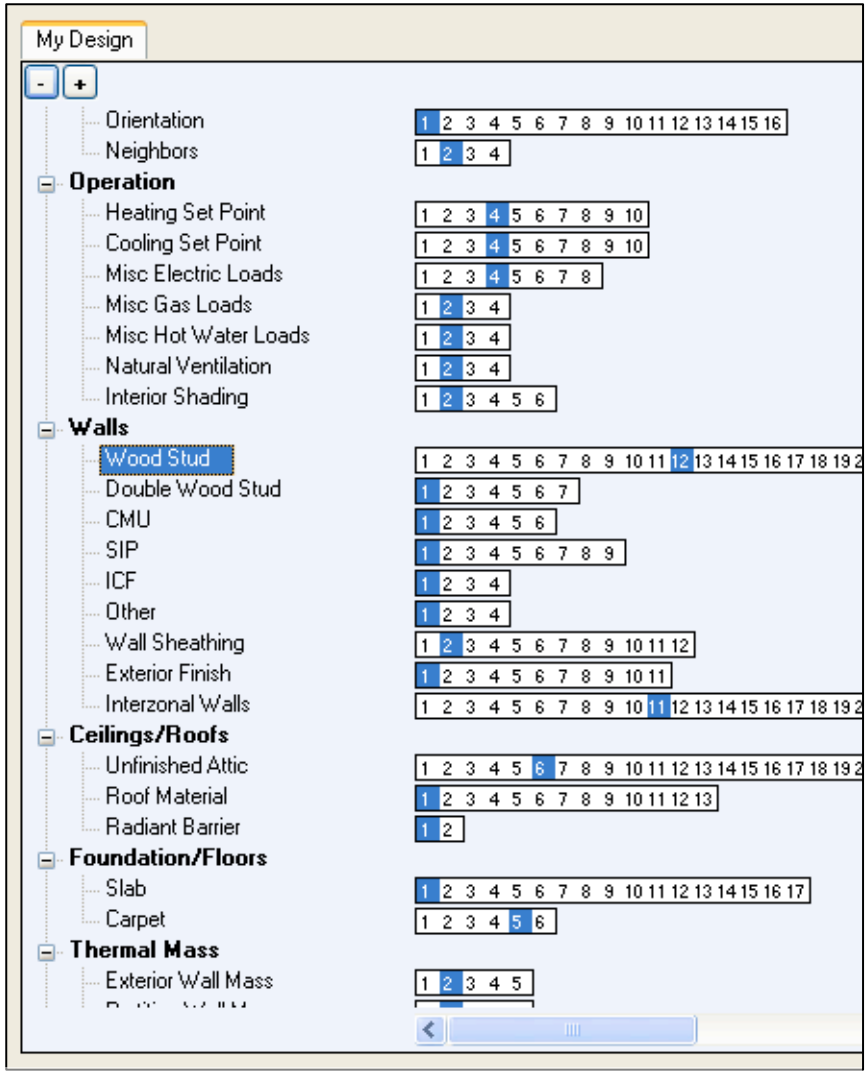


Amend Weatherization Programs to Add Summer Comfort?

- Study site: Cuyahoga County, Ohio
- $6,200 to improve energy efficiency and comfort in low-income housing

BEopt/EnergyPlus Modeling





National Renewable Energy Laboratory/ Department of Energy

Five Structure Types: Wood Frame Basement, Wood Frame Crawl Space, Wood Frame Slab, Solid Wall Basement, Manufactured Housing

What are the impacts of Weatherization on A/C?

Wood Frame House with Basement (84^0 C)

Pre-weatherization 4,070 KWh Costing $500

Post-weatherization 2,232 KWh Costing $274

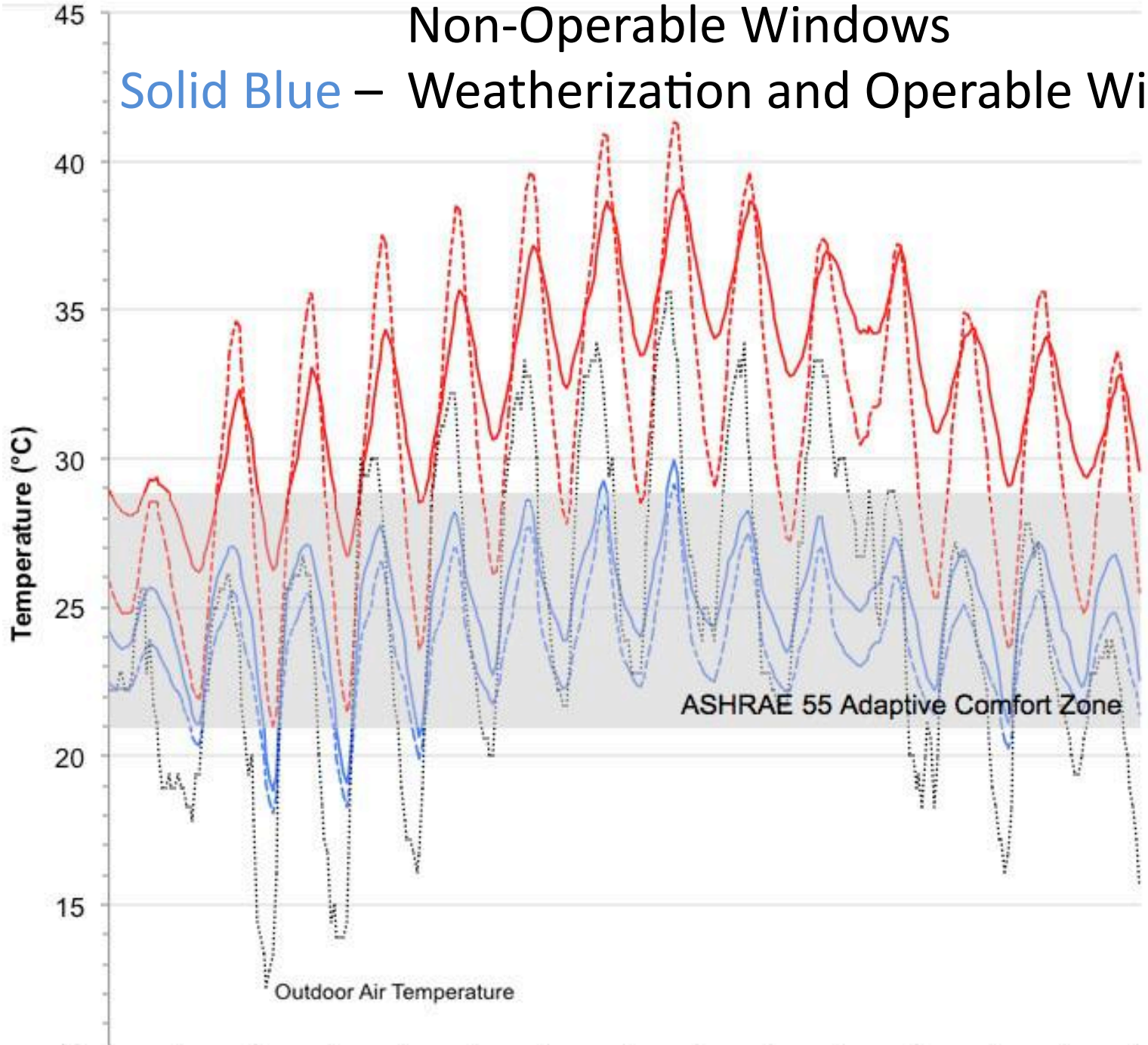
Saving 45.2% KWh and $226

A/C System size –

- Pre-weatherization 6 ton
- Post-weatherization 3 ton

Solid Red – No Weatherization and Non-Operable Windows

Solid Blue – Weatherization and Operable Window



Gray Zone – Acceptable Indoor Temperature