2023 RESILIENCE FOCUS AREA STRATEGY APPENDICES

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APPENDIX A. RESULTS SUMMARY TABLE



RFA PRIORITIZATION MATRIX AND RESULTS

| | | | | | | | | | | RFA | | | | | | | |
|---|-------------------|--------------------|--------------|---|------------------------------------|-----------------|----------------|------------------|-------------------|-----------------|-------------------------|-------------------------------------|-----------------|-------------|-----------------|------------|--------------|
| | | | C&O Canal | National Arboretum/ Kingman Island | Kenilworth Park/Watts Branch | Foggy Bottom | RFK Stadium | National Mall | Anacostia Park | Potomac Park | SW/ Buzzard Point | Joint Base Anacostia -Bolling | George- town | Oxon Run | Poplar Point | SE Blvd | Navy Yard |
| Criteria | | Criteria Weight | со | NA | WB | FB | RF | NM | AP | РТ | sw | JB | GT | ох | РР | SE | NY |
| Social Vulnerability Index | Vulnerable People | 6 | 0.61 | 4.28 | 5.20 | 0.62 | 3.64 | 0.87 | 5.18 | 0.00 | 3.62 | 2.67 | 0.95 | 5.18 | 5.68 | 4.25 | 0.60 |
| Equity Emphasis Area Tool | Vulnerable People | 6 | 0.00 | 2.40 | 3.60 | 1.20 | 3.60 | 2.40 | 3.60 | 0.00 | 2.40 | 1.20 | 0.00 | 3.60 | 3.60 | 3.60 | 0.00 |
| DC Community Risk Assessment | Vulnerable People | 6 | 1.20 | 6.00 | 6.00 | 2.40 | 6.00 | 2.40 | 6.00 | 3.60 | 6.00 | 6.00 | 2.40 | 6.00 | 6.00 | 4.80 | 6.00 |
| Assets for Socially Vulnerable Population | Vulnerable People | 12 | 2.40 | 0.00 | 9.60 | 2.40 | 2.40 | 7.20 | 7.20 | 0.00 | 12.00 | 0.00 | 2.40 | 12.00 | 2.40 | 0.00 | 7.20 |
| Total Population | Vulnerable People | 12 | 2.74 | 1.18 | 10.93 | 2.53 | 2.23 | 3.35 | 5.40 | 0.00 | 7.38 | 4.45 | 0.79 | 12.00 | 0.92 | 1.15 | 4.58 |
| Population Density | Vulnerable People | 3 | 1.20 | 0.60 | 1.20 | 1.20 | 1.20 | 0.60 | 1.80 | 0.00 | 2.40 | 0.60 | 1.80 | 3.00 | 0.60 | 3.00 | 2.40 |
| Building Footprints within FEMA Flood Hazard Area - 100-year | Vulnerable Assets | 5 | 0.23 | 0.00 | 4.10 | 0.30 | 0.08 | 5.00 | 0.07 | 1.88 | 0.92 | 0.02 | 4.36 | 1.85 | 0.09 | 0.28 | 0.08 |
| Building Footprints within FEMA Flood Hazard Area - 500-year | Vulnerable Assets | 1 | 0.01 | 0.00 | 0.42 | 0.09 | 0.03 | 1.00 | 0.13 | 0.12 | 0.48 | 0.00 | 0.07 | 0.26 | 0.04 | 0.07 | 0.09 |
| Building Footprints within Bluespots | Vulnerable Assets | 3 | 0.07 | 0.00 | 1.52 | 0.50 | 0.06 | 3.00 | 0.52 | 0.38 | 1.43 | 0.03 | 1.04 | 0.29 | 0.10 | 0.12 | 0.57 |
| Building Footprints within Future Tidal Inundation (2070) | Vulnerable Assets | 1 | 0.00 | 0.00 | 0.40 | 0.40 | 0.20 | 0.60 | 0.00 | 1.00 | 0.60 | 0.00 | 0.20 | 0.00 | 0.00 | 0.20 | 0.00 |
| Right-of-Way Areas within FEMA Flood Hazard Area - 100-year | Vulnerable Assets | 6 | 0.00 | 0.00 | 3.60 | 2.40 | 0.00 | 6.00 | 0.00 | 0.00 | 1.20 | 2.40 | 2.40 | 1.20 | 0.00 | 0.00 | 0.00 |
| Right-of-Way Areas within FEMA Flood Hazard Area - 500-year | Vulnerable Assets | 2.5 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 2.00 | 0.00 | 0.00 | 2.00 | 2.00 | 0.50 | 0.50 | 0.00 | 0.00 | 0.50 |
| Right-of-Way Areas within Bluespots | Vulnerable Assets | 4 | 0.00 | 0.00 | 1.60 | 2.40 | 1.60 | 4.00 | 0.80 | 0.00 | 2.40 | 2.40 | 1.60 | 1.60 | 0.80 | 0.00 | 1.60 |
| Right-of-Way Areas within Future Tidal Inundation (2070) | Vulnerable Assets | 2.5 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| Critical & Community Assets | Vulnerable Assets | 20 | 5.99 | 0.02 | 10.07 | 2.86 | 6.62 | 9.50 | 2.55 | 0.00 | 20.00 | 15.94 | 0.48 | 9.04 | 3.10 | 0.11 | 11.96 |
| Land Ownership | Actionability | 5 | 0.16 | 0.86 | 5.00 | 0.11 | 2.66 | 0.61 | 1.02 | 0.00 | 2.46 | 2.66 | 0.10 | 4.29 | 2.71 | 0.24 | 1.25 |
| Space Availability | Actionability | 5 | 0.04 | 1.60 | 1.98 | 0.01 | 0.06 | 0.00 | 1.10 | 0.03 | 0.96 | 0.35 | 0.00 | 4.76 | 5.00 | 0.48 | 0.66 |
| SUBTOTAL | Vulnerable People | 45 | 8.15 | 14.46 | 36.53 | 10.35 | 19.07 | 16.82 | 29.17 | 3.60 | 33.80 | 14.92 | 8.35 | 41.78 | 19.20 | 16.80 | 20.77 |
| SUBTOTAL | Vulnerable Assets | 45 | 6.29 | 0.02 | 22.21 | 9.95 | 8.59 | 33.10 | 4.08 | 3.37 | 29.04 | 24.29 | 11.14 | 14.74 | 4.14 | 0.78 | 14.80 |
| | Actionability | 10 | 0.20 | 2.45 | 6.98 | 0.11 | 2./3 | 0.61 | 2.13 | 0.03 | 3.42 | 3.02 | 0.10 | 9.06 | /./1 | 0.72 | 1.91 |
| TOTAL SCORE | | 100 | 14.04 | 10.94 | 05.72 | 20.42 | 50.38 | 50.53 | 30.38 | 7.01 | 00.20 | 42.22 | 17.30 | 00.07 | 31.03 | 10.30 | 37.40 |
| SUBTOTAL RANKING | Vulnerable People | | 14 | 11 | 2 | 12 | 7 | 8 | 4 | 15 | 3 | 10 | 13 | 1 | 6 | 9 | 5 |
| SUBTOTAL RANKING | Vulnerable Assets | | 10 | 15 | 4 | 8 | 9 | 1 | 12 | 13 | 2 | 3 | 7 | 6 | 11 | 14 | 5 |
| SUBTOTAL RANKING | Actionability | | 12 | 7 | 3 | 13 | 6 | 11 | 8 | 15 | 4 | 5 | 14 | 1 | 2 | 10 | 9 |
| OVERALL RANKING | | | 14 | 13 | 2 | 10 | 9 | 4 | 7 | 15 | 1 | 5 | 11 | 3 | 8 | 12 | 6 |

APPENDIX B. VULNERABLE PEOPLE MAPS

CDC's Social Vulnerability Index

Equity Emphasis Area (EEA) Tool

Community Risk Assessment (CRA)

Assets for Socially Vulnerable People

Total Population

Population Density





CENTER FOR DISEASE CONTROL'S SOCIAL VULNERABILITY INDEX (SVI)

The <u>CDC SVI</u>¹ helps public health officials and emergency response planners meet the needs of socially vulnerable populations in emergency response and recovery efforts. The CDCSVI uses 2020 U.S. Census data to determine the social vulnerability of every census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The SVI ranks each tract on 16 social factors, including poverty, lack of vehicle access, and crowded housing, and compares them to other tracts within the District.





EQUITY EMPHASIS AREA TOOL

Equity Emphasis Areas (EEAs)² are a regional planning concept adopted by the Metropolitan Washington Council of Governments to elevate equity and inform future growth and investment decisions. EEAs are 364 of the region's more than 1,300 census tracts with higher-than-average concentration of low-income, traditionally disadvantaged racial and ethnic population groups, or both.





COMMUNITY RISK ASSESSMENT

The CRA is developed by the District of Columbia Homeland Security and Emergency Management Agency. The District of Columbia Community Risk Assessment (CRA)³ used age, race, disability, and economic demographics at the 2017 Ward-level to determine the social and population vulnerability of each Ward based on a handful of hazard scenarios including severe weather, flood, climate change, and social vulnerability. The all-hazards scenario, mapped below, identifies locations where people especially vulnerable to disasters are located.





ASSETS FOR SOCIALLY VULNERABLE PEOPLE

The <u>Assets of Childcare Centers</u>,⁴ <u>Senior Living Facilities</u>,⁵ and <u>Affordable Housing</u>⁶ units available through OpenData.DC.gov were used to assess areas where vulnerable populations are likely located.

METHODOLOGY





TOTAL POPULATION

PT

11

0.00

<u>2020 U.S. Census</u>⁷ population data was used to determine the total population within each RFA. The U.S. Census is developed and released by the federal government's Census Bureau agency who provides current facts and figures about America's people and economy.

METHODOLOGY





POPULATION DENSITY

2020 U.S. Census⁷ population data was used to determine the population density within each RFA. The data is developed and released by the U.S. Census Bureau, who provides current facts and figures about America's people and economy.



APPENDIX C. VULNERABLE ASSET MAPS

Blue Spots

FEMA 100- and 500-year Flood Hazard Areas

2070 Tidal Inundation

Building Footprint Areas within Flood Hazards

Right-of-Way (ROW) Areas Within Flood Hazards

Critical and Community Assets





BLUESPOTS

Bluespots are identified using an ArcGIS tool developed by the Danish Road Institute as a screening method for assessing flood risk. A bluespots analysis identifies surface depressions in topography where rainfall will collect without a means of conveyance. Bluespots show the maximum extents water may fill up before reaching a pour point and spill out.





FEMA 100- AND 500-YEAR FLOOD HAZARD AREAS

The Federal Emergency Management Agency (FEMA) produces Flood Insurance Rate Maps and identifies <u>Special</u> <u>Flood Hazard Areas</u>⁸ as part of the National Flood Insurance Program.

- The 100-year Flood Hazard Area represents a flooding event with a 1% annual chance of occurrence.
- The 500-year Flood Hazard Area represents a flooding event with a 0.2% annual chance of occurrence.





2070 TIDAL INUNDATION

Projected 2070 tidal inundation levels were determined by pulling <u>NOAA's Sea Level Rise Viewer intermediate high</u> <u>sea level rise 2022 projections</u>⁹ and <u>NOAA's Tides and Currents mean higher-high water (MHHW) level¹⁰ for</u> the DC area.





BUILDING FOOTPRINT AREAS WITHIN FLOOD HAZARDS

Building footprints were available through <u>OpenData.DC.gov</u>.¹¹ Using ArcGIS, building footprint areas were overlaid on top of each flood hazard. The 'intersect' geospatial tool was used to find the total building footprint areas that sit within a flood hazard.





BUILDING FOOTPRINT AREAS WITHIN FLOOD HAZARDS

METHODOLOGY

- 1. CALCULATE RAW SCORE The Building score for each flood hazard (bluespots, FEMA 100-year and 500-year flood zones, and 2070 projected tidal inundation) was calculated by taking a summation of building footprint areas within each flood hazard in each RFA using the 'intersect' geospatial tool in ArcGIS. This number was then multiplied by a damage factor and an age factor.
 - The damage factor represents the type of building located within a flood hazard. Higher weightings were assigned to commercial / institutional building types.
- The building age factor represents the age of the building located within a flood hazard. Higher weightings were assigned to older buildings that likely do not meet current flood regulations.

| DAMAGE FACTOR | | AGE FACTOR | | | | | | |
|---------------|-----|--|------|--|--|--|--|--|
| Residential | 1.0 | Bldgs. pre-1985: Pre-First FIRM regulations | 1.50 | | | | | |
| Commercial | 1.4 | 1985–2010: Current version of flood regs | 1.25 | | | | | |
| Institutional | 1.4 | 2010-2020: New Construction Codes in effect | 1.00 | | | | | |
| Industrial | 0.8 | 2020-onward: New construction code to current construction | 0.75 | | | | | |

Raw Building Score = Total Building Footprint x Damage Factor x Age Factor

- 2. DEFINE METRIC SCORE WEIGHTING Raw scores were reviewed and manually divided into ranges to determine the percent of total maximum metric score.
- **3. CALCULATE METRIC SCORE -** The metric score is calculated by multiplying the metric score weighting by the maximum metric score.

RESULTS

| RFA ID | FEMA 100-YEAR METRIC SCORE | FEMA 500-YEAR METRIC SCORE | BLUESPOTS METRIC SCORE | 2070 TIDAL INUNDATION METRIC SCORE |
|--------|-------------------------------|-------------------------------|---------------------------|---------------------------------------|
| | (Max. 6 points) | (Max. 2.5 points) | (Max. 4 points) | (Max. 2.5 points) |
| NM | 6.00 | 2.00 | 4.00 | 2.00 |
| WB | 3.60 | 0.50 | 1.60 | 0.00 |
| FB | 2.40 | 0.50 | 2.40 | 0.50 |
| JB | 2.40 | 2.00 | 2.40 | 1.50 |
| GT | 2.40 | 0.50 | 1.60 | 0.50 |
| SW | 1.20 | 2.00 | 2.40 | 0.00 |
| OX | 1.20 | 0.50 | 1.60 | 0.00 |
| СО | 0.00 | 0.00 | 0.00 | 0.00 |
| NA | 0.00 | 0.00 | 0.00 | 0.00 |
| RF | 0.00 | 0.00 | 1.60 | 0.00 |
| AP | 0.00 | 0.00 | 0.80 | 0.00 |
| PT | 0.00 | 0.00 | 0.00 | 0.00 |
| PP | 0.00 | 0.00 | 0.80 | 0.00 |
| SE | 0.00 | 0.00 | 0.00 | 0.00 |
| NY | 0.00 | 0.50 | 1.60 | 0.00 |



RIGHT-OF-WAY (ROW) AREAS WITHIN FLOOD HAZARDS

Right-of-way delineations were available through <u>OpenData.DC.gov</u>.¹² Using ArcGIS, ROW areas were overlaid on top of each flood hazard. The 'intersect' tool was used to find the total ROW areas that sit within a flood hazard.





RIGHT-OF-WAY (ROW) AREAS WITHIN FLOOD HAZARDS

METHODOLOGY

- 1. CALCULATE RAW SCORE The ROW score for each flood hazard (bluespots, FEMA 100-year and 500-year flood zones, and 2070 projected tidal inundation) was calculated by taking a summation of ROW areas within each flood hazard in each RFA using the 'intersect' geospatial tool in ArcGIS.
- 2. DEFINE METRIC SCORE WEIGHTING Raw scores were interpolated between the minimum and maximum values to determine the percent of total maximum metric score.
- **3. CALCULATE METRIC SCORE -** The metric score is calculated by multiplying the metric score weighting by the maximum metric score.

| RFA ID | 100-YEAR AREA (ACRES) | 500-YEAR AREA (ACRES) | BLUESPOTS METRIC SCORE | 2070 TIDAL INUNDATION METRIC SCORE |
|--------|--------------------------|--------------------------|---------------------------|---------------------------------------|
| | (Max. 5 points) | (Max. 1 point) | (Max. 3 points) | (Max. 1 point) |
| NM | 5.00 | 1.00 | 3.00 | 0.60 |
| GT | 4.36 | 0.07 | 1.04 | 0.20 |
| WB | 4.10 | 0.42 | 1.52 | 0.40 |
| PT | 1.88 | 0.12 | 0.38 | 1.00 |
| OX | 1.85 | 0.26 | 0.29 | 0.00 |
| SW | 0.92 | 0.48 | 1.43 | 0.60 |
| FB | 0.30 | 0.09 | 0.50 | 0.40 |
| SE | 0.28 | 0.07 | 0.12 | 0.20 |
| CO | 0.23 | 0.01 | 0.07 | 0.00 |
| PP | 0.09 | 0.04 | 0.10 | 0.00 |
| NY | 0.08 | 0.09 | 0.57 | 0.00 |
| RF | 0.08 | 0.03 | 0.06 | 0.20 |
| AP | 0.07 | 0.13 | 0.52 | 0.00 |
| JB | 0.02 | 0.00 | 0.03 | 0.00 |
| NA | 0.00 | 0.00 | 0.00 | 0.00 |

RESULTS



CRITICAL AND COMMUNITY ASSETS

The count of critical and community assets available through <u>OpenData.DC.gov</u> were totaled within each RFA including asset categories of emergency services, energy, transportation, water and wastewater, ecological, educational, and community.





CRITICAL AND COMMUNITY ASSETS

METHODOLOGY

1. CALCULATE RAW SCORE - The number of critical and community assets were totaled within each RFA and then multiplied by an importance factor depending on the asset category, as shown below:

| ASSET CATEGORY | ASSET | IMPORTANCE FACTOR | | | | |
|--|--|----------------------|-------------|-------------------------------------|--|--|
| Emergency | Police Stations | 1 | | | | |
| Services | Fire Stations | 1 | | | | |
| | Hospitals | 1 | | | | |
| | Emergency Operations Centers | 1 | | | | |
| Energy | Wireless Towers | 0.5 | | | | |
| | Power Generation Stations | 0.5 | | | | |
| | Charging Stations | 0.5 | | | | |
| | Electric Power Transmission Lines | 0.5 | | | | |
| Transportation | Airports | 1 | | | | |
| | Metro Stations | 0.33 | | | | |
| | Metro Lines | 0.33 | | | | |
| | Train Lines | 0.33 | | | | |
| Waste and | Drinking Water Reservoirs / Treatment Facilities | 2 | | | | |
| Wustewuter | Wastewater Treatment Facilities (Public) | 2 | METRIC SCOR | | | |
| | Pump Stations | 0.5 | RFA | TIDAL INUNDATION AREA (ACRES) | | |
| Ecological | Contaminated and Superfund Sites | 0.5 | ID | | | |
| Educational | Schools | 1 | | | | |
| | Libraries | 1 | SW | 20.00 | | |
| Governmental | Military Facilities | 2 | JB | 15.94 | | |
| | Jails and Correctional Facilities | 1 | NY | 11.96 | | |
| Community | Homeless Shelters | 0.4 | WB | 10.07 | | |
| | Recreation Centers | 0.4 | NM | 9.50 | | |
| | Public Housing | 0.4 | OX | 9.04 | | |
| | Resilience Hubs | 0.4 | RF | 6.62 | | |
| | Cooling Centers | 0.4 | CO | 5.99 | | |
| | | | PP | 3.10 | | |
| 2. DEFINE METRIC | FB | 2.86 | | | | |
| into ranges to de | AP | 2.55 | | | | |
| 3. CALCULATE MET | ng the metric | GT | 0.48 | | | |
| score weighting by the maximum metric score of 20. | | | | 0.11 | | |
| | | | | | | |
| | | | PT | 0 00 | | |

APPENDIX D. ACTIONABILITY MAPS

Land Ownership

Space Availability





LAND OWNERSHIP

District and federal land ownership data is available through <u>OpenData.DC.gov</u>.¹³ District owned land provides potential areas to implement mitigation projects.





SPACE AVAILABILITY

Data on District owned parks and recreational areas is available through <u>OpenData.DC.gov</u>.¹⁴ Parks and recreational areas provide potential areas to implement mitigation projects.



REFERENCES

¹ "CDC/ATSDR SVI Data and Documentation Download." Agency for Toxic Substances and Disease Registry, last modified October 26, 2020, <u>https://www.atsdr.cdc.gov/placeandhealth/</u> svi/data_documentation_download.html.

² "Equity Emphasis Areas for TPB's Enhanced Environmental Justice Analysis." Metropolitan Washington Council of Governments, accessed June 28, 2023, <u>https://www.mwcog.org/</u> <u>transportation/planning-areas/fairness-and-accessibility/environmental-justice/equi-</u> <u>ty-emphasis-areas/</u>.

³ Homeland Security and Emergency Management Agency. "District Preparedness System Community Risk Assessment." April 2017, 44.

⁴ "Child Development Centers." Open Data DC, last modified August 30, 2022, <u>https://openda-</u> ta.dc.gov/datasets/child-development-centers/explore?location=38.894844%2C-77.01500 0%2C12.00.

⁵ "Nursing Homes." Open Data DC, last modified March 6, 2021, <u>https://opendata.dc.gov/</u> <u>datasets/nursing-homes/explore?location=38.890605%2C-77.022347%2C12.84.</u>

⁶ "Affordable Housing." Open Data DC, last modified December 8, 2021, <u>https://opendata.</u> <u>dc.gov/datasets/affordable-housing/explore?location=38.893693%2C-77.019147%2C12.20</u>.

⁷ "CDC/ATSDR SVI Data and Documentation Download." Agency for Toxic Substances and Disease Registry, last modified October 26, 2020, <u>https://www.atsdr.cdc.gov/placeandhealth/</u> <u>svi/data_documentation_download.html</u>.

⁸ "National Flood Hazard Layer." Federal Emergency Management Agency, last modified August 26, 2021, <u>https://www.fema.gov/flood-maps/national-flood-hazard-layer</u>.

* "Sea Level Rise and Coastal Flooding Impacts." National Oceanic and Atmospheric Administration, accessed June 28, 2023, <u>https://coast.noaa.gov/slr/#/layer/sce/9/-</u> 8574674.61046468/4704307.797506922/15/satellite/48/0.8/2070/interHigh/midAccretion.

¹⁰ "NOAA Tides & Currents." Tides & Currents, accessed June 28, 2023, <u>https://tidesandcur-</u> rents.noaa.gov/stationhome.html?id=8594900.

¹¹ "Building Footprints." Open Data DC, last modified February 4, 2022, <u>https://opendata.</u> <u>dc.gov/datasets/DCGIS::building-footprints/explore?location=38.893548%2C-77.019147%</u> <u>2C11.92</u>.

¹² "Street Right of Way." Open Data DC, last modified August 13, 2022, <u>https://opendata.</u> <u>dc.gov/datasets/DCGIS::street-right-of-way/explore?location=38.892475%2C-77.020630%</u> <u>2C12.84</u>.

¹³ "District Government Land (Owned, Operated, and or managed)." Open Data DC, last modified August 13, 2022, <u>https://opendata.dc.gov/datasets/DCGIS::district-govern-</u> <u>ment-land-owned-operated-and-or-managed/explore</u>.

¹⁴ "Parks and Recreation Areas." Open Data DC, last modified August 13, 2022, <u>https://open-data.dc.gov/datasets/parks-and-recreation-areas/explore?location=38.911049%2C-77</u>.004830%2C12.93.