Map

Description automatically generated**Supplementary Materials**

***Figure S1****: An elevation map of the city of Philadelphia in meters. Source: University of Vermont Spatial Analysis Laboratory, 2018. Base Map Source: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community.*

***Table S1****: The variables chosen for each individual vulnerability index within this study.*

|  | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Index** | **Original Variable Name** | **Variable Description** | **Year** | **Source** | **Resolution** |
| Inundation Vulnerability | Qpeak | Flood extent for a 10-year, 24-hour design storm for Philadelphia | 2015 | Hosseiny et al., 2020 | Micro subbasins |
| Built-Environment Vulnerability | STORIES | Number of stories in a building | 2017 | Philadelphia Water Department | Parcel |
|  | YR\_BUILT | Year building was built | 2017 | Philadelphia Water Department | Parcel |
|  | BASMT | Presence of a basement on parcel | 2017 | Philadelphia Water Department | Parcel |
|  | CAT\_CD | Building type on parcel | 2017 | Philadelphia Water Department | Parcel |
|  | TOP | Topography of parcel | 2017 | Philadelphia Water Department | Parcel |
|  | Imminently Dangerous Buildings | Licenses and Inspections department code violations for imminently dangerous buildings | 2020 | Open Data Philly  (www.opendataphilly.com) | Point |
|  | Unsafe Buildings | Licenses and Inspections department code violations for unsafe buildings | 2020 | Open Data Philly  (www.opendataphilly.com) | Point |
|  | Schools | Point locations of public schools | 2021 | Open Data Philly  (www.opendataphilly.com) | Point |
|  | Hospitals | Point locations of hospitals | 2021 | Open Data Philly  (www.opendataphilly.com) | Point |
|  | Fire Department Facilities | Point locations of fire department stations | 2012 | Open Data Philly  (www.opendataphilly.com) | Point |
|  | SEPTA Bus Stops | Point locations of the SEPTA bus stops in Philadelphia | 2020 | SEPTA Open Data  (www.septa.opendata.arcgis.com) | Point |
|  | SEPTA Trolley Stops | Point locations of the SEPTA trolley stops in Philadelphia | 2020 | SEPTA Open Data  (www.septa.opendata.arcgis.com) | Point |
|  | SEPTA High Speed Rail Stops | Point locations of the SEPTA high speed rail stations for the Norristown, Broad Street, and Market-Frankford lines | 2020 | SEPTA Open Data  (www.septa.opendata.arcgis.com) | Point |
| Social Vulnerability | RELATIONSHIP BY HOUSEHOLD TYPE (INCLUDING LIVING ALONE) FOR THE POPULATION 65 YEARS AND OVER | Residents over the age of 65 that live alone | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | EDUCATIONAL ATTAINMENT FOR THE POPULATION 25 YEARS AND OVER | Residents 25 and older with no high school diploma | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | EMPLOYMENT STATUS FOR THE POPULATION 16 YEARS AND OVER | Unemployed residents | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | HISPANIC OR LATINO ORIGIN BY RACE | Hispanic or Latino residents | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | HOUSEHOLD LANGUAGE BY HOUSEHOLD LIMITED ENGLISH-SPEAKING STATUS | A household in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." In other words, all members 14 years old and over have at least some difficulties with English | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | SEX BY AGE | Residents under the age of 18 | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | SEX BY AGE | Residents over the age of 65 | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | POVERTY STATUS IN THE PAST 12 MONTHS BY HOUSEHOLD TYPE BY AGE OF HOUSEHOLDER | Residents living in poverty | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
|  | RACE | African American residents | 2015-2019  5-year estimates | American Community Survey | Census Block Group |
| GSI Maintenance Needs Index | Maintenance | The predicted maintenance impacts to GSI for the City of Philadelphia including litter, leaf litter, and sediment impacts | 2018 - 2020 | Homet et al., 2022 | Neighborhoods |

***Table S2****: The ranking methodology for levels of overall vulnerability using the existence of known co-benefits as a marker of something that could potentially improve overall vulnerability to climate-related events.*





***Table S3****: The ranking methodology for levels of predicted GSI maintenance impacts using the requirements within the Philadelphia GSI maintenance manual for GSI types (Philadelphia Water Department, 2012) as a marker of low, medium, or high maintenance need.*

Chart, scatter chart

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**Figure S2**: Scatterplot of the Inundation Index rankings (X) based on z-scores against the average of the Social Vulnerability Index and the Built-Environment Vulnerability Index rankings (Y). The yellow lines represent the separation between low and medium vulnerability ranks, where Z= +- 1. The red lines represent Z= +-2, where the plot is separated between medium and high vulnerability ranks.

Chart, box and whisker chart

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**Figure S3**: A boxplot of the rank percentiles of the OVI scores including the Regional, Standardized, and Z-Score methods. A total of 1,294 census block groups were included in this analysis, with 36 groups being removed due to null values from census data. An assumption of normality (Shapiro Wilk test: W=0.9554 , p < 2.2e-16 ) was not satisfied and failed to satisfy with a transformation while homogeneity of variances (Bartlett’s test: K-squared= 1.931e-05, p= 1) was satisfied. This data conforms to a non-parametric one-way ANOVA design and an ANOVA analysis was used (F2,1294= 3.695, p=0.0249). A posteriori Tukey’s test shows that the Regional scoring method is significantly different than the other two methods of Standardized and Z-Scores (letters A and B above each group). The line in each boxplot represents the mean ranked percentile for that scoring method (Regional= 0.4736, Standardized= 0.5004, and Z-Score=0.5004 ). The outer edges of each box represent one standard deviation from the mean for that scoring method (Regional= 0.2888, Standardized= 0.2888, and Z-Score= 0.2888).

Map

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**Figure S4:** Spatial analysis of the scoring agreement between all three scoring methods for the OVI. A result of 2 out of 3 indicates that only two scoring methods were considered similar to each other, a score of 3 out of 3 indicates that all three methods agreed in the vulnerability scores for a block group.