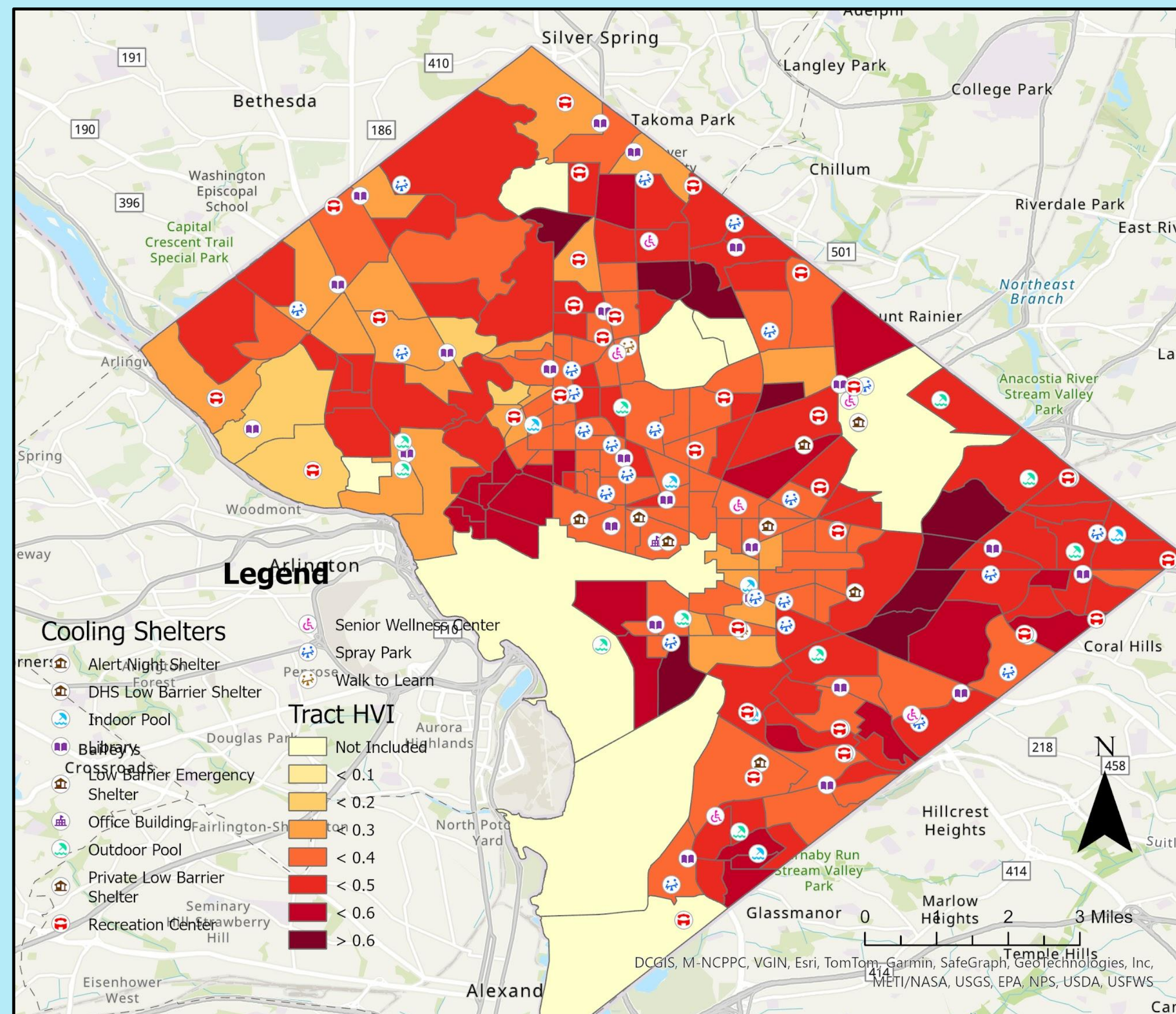




Optimization of DC Cooling Shelter Locations

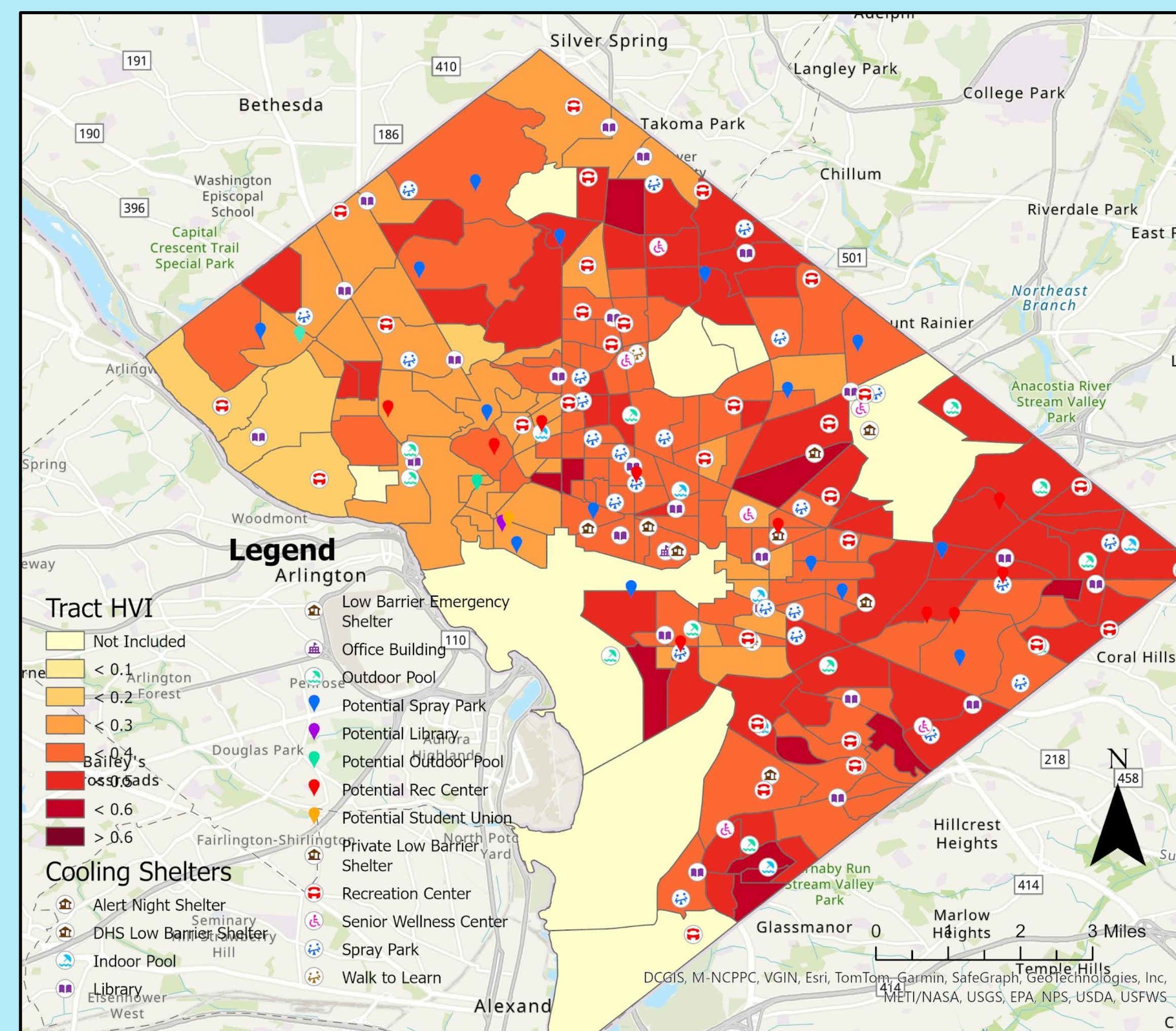
Introduction

We created a map that overlaid the locations of current cooling shelters on the census tracts of DC. We also looked at public transportation routes throughout the city, including the metro and bus lines, to ensure accessibility. The tracts were color-coded based on their Heat Vulnerability Index (HVI), which was calculated using equations provided by the Washington DC Department of Energy and Environment. After investigating the tracts with the highest HVI, we identified potential cooling shelter locations and looked at cooling shelters that had improved their cooling facilities beyond their original designation. After optimization, the average HVI for DC was reduced from 0.40 to 0.36.



Optimized Heat Vulnerability Index Map

By adding new cooling shelters based on need, the average HVI was reduced by **10.51%**



Current Heat Vulnerability Index Map

Showing the existing cooling shelters. The current average HVI is **0.404**. There are currently **130** cooling shelters in DC



Limitations

Some tracts were excluded from our consideration. This is due to some tracts not containing residential land uses. The tracts we excluded for this reason are: The National Mall, Joint Base Anacostia-Bolling, Blue Plains WWTP, The National Arboretum, MedStar Washington Hospital Center, Rock Creek Golf Course, Georgetown University, and Catholic University



Research

HVI is calculated based on demographics including race, income, and health, as well as including tree cover, ambient temperature and accessibility to cooling shelter.

The equations used are:

Heat Sensitivity Index

$$ComponentIndex_i = \left(\frac{PopulationShare_j - MinimumCensusTractShare}{MaximumCensusTractShare - MinimumCensusTractShare} \right) \times \left(\frac{1}{n} \right)$$

Where:

i = variable; j = census tract; n = number of variables (in this case 9)

Heat Exposure Index

$$ComponentIndex_i = \left(\frac{PopulationShare_j - MinimumCensusTractShare}{MaximumCensusTractShare - MinimumCensusTractShare} \right) \times \left(\frac{1}{x} \right)$$

Where:

i = variable; j = census tract; x = weight (between 0 and 1)

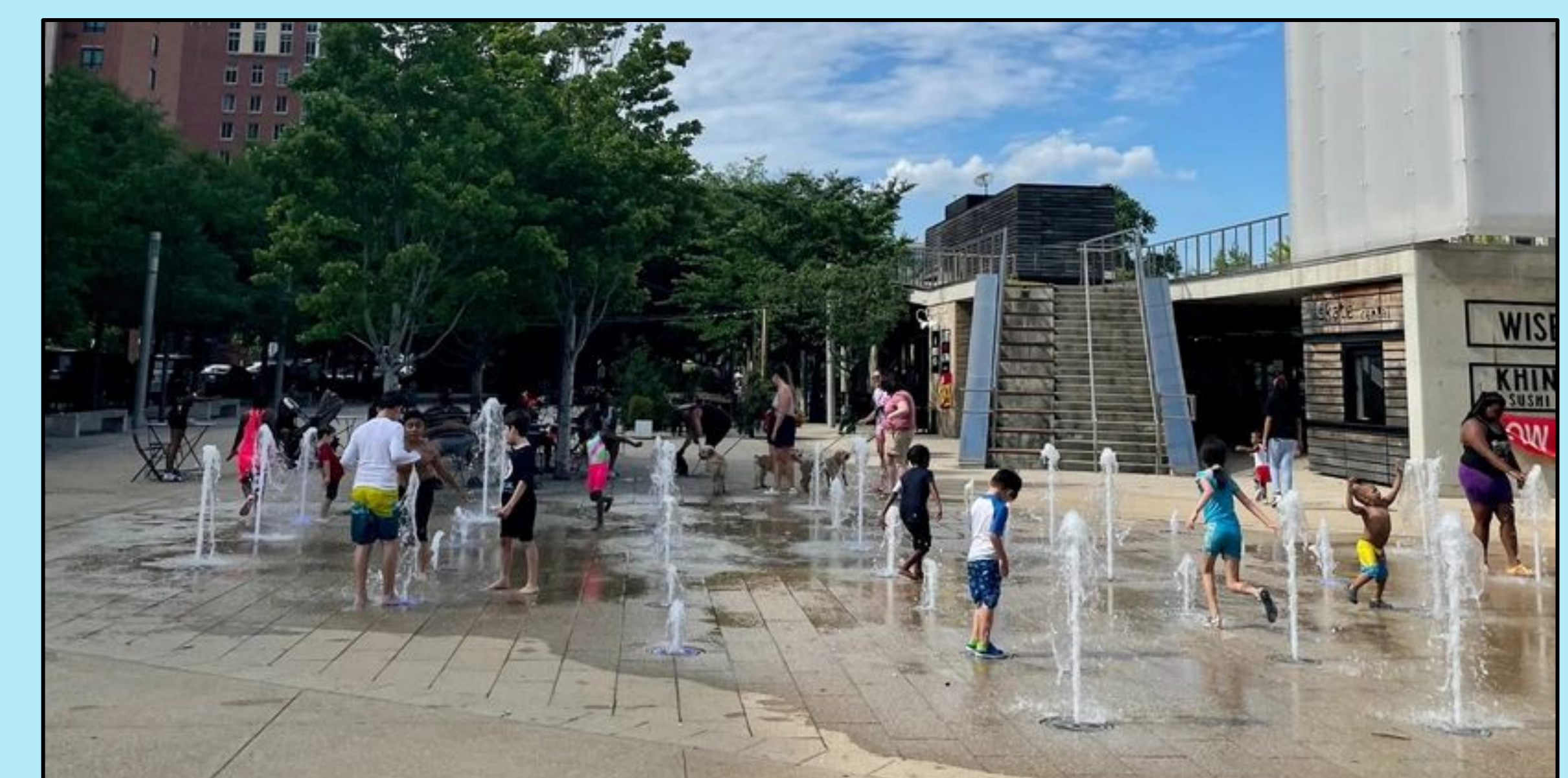
Data Collection

For the HVI equations, the demographics and The given weights are shown are accessibility rankings:



- | | |
|-----------------------------|------------------------------------|
| 1. Low barrier shelters - 3 | 5. Outdoor Pools - 5 |
| 2. Libraries - 1 | 6. Senior Centers - 5 |
| 3. Rec centers - 1 | 7. Splash Parks - 5 |
| 4. Indoor pools - 3.5 | 8. Youth/Young Adult Providers - 5 |
| ○ Includes walk-to-learn | 9. Office Buildings - 4 |

Using tools in ArcGIS, we found how many cooling shelters were within a .5 radius to the centroid of each tract. By multiplying these weights by the distance and averaging, we found the average accessibility for each tract



Canal Park Splash Pad is an example of the type of splash pad we are proposing (right)

References
<https://familytripguides.com/dc-splash-parks-and-pads/>