

WHERE THE RUBBER MEETS THE ROAD NOISE

Estimating Population Impacted by Excessive Noise Along I-93

Background

When interstate I-93 was initially constructed in the 1970s, sound wall noise barriers were constructed in several communities through which it passed, including along the northbound lanes bordering the Ten Hills neighborhood of Somerville. The residences bordering the southbound lanes, however, were left exposed.

Chronic exposure to excessive noise has been linked to sleep disturbance, high blood pressure, and ischemic heart disease. Additionally, I-93 passes through multiple Massachusetts Environmental Justice Communities, designated as such due to a high concentration of minority residents.

These residents are thus subjected to the compound stressors of noise pollution, air pollution, and minority group status.

This study, part of an ongoing partnership between Tufts University and the Somerville Transportation Equity Partnership (STEP), seeks to quantify population exposure to excessive noise near I-93 in order to inform calls for the implementation of sound wall noise barriers or other noise reduction techniques along the southbound lanes of I-93.

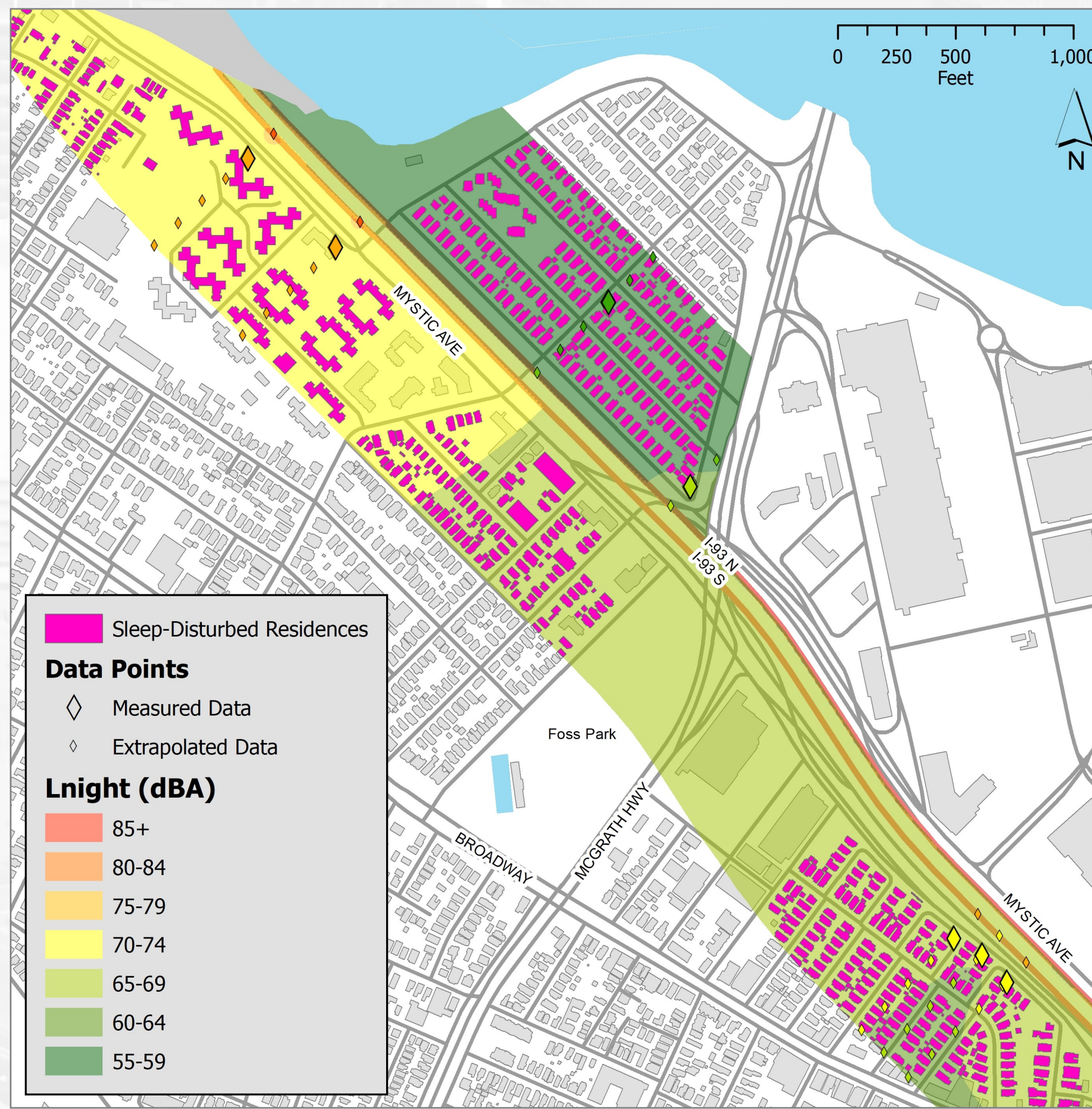
Methods

Second-by-second noise data was collected between July and August of 2018 at 5-ft elevation from 7 locations along I-93. All measurements were taken on weekdays with sound level meters oriented towards the highway.

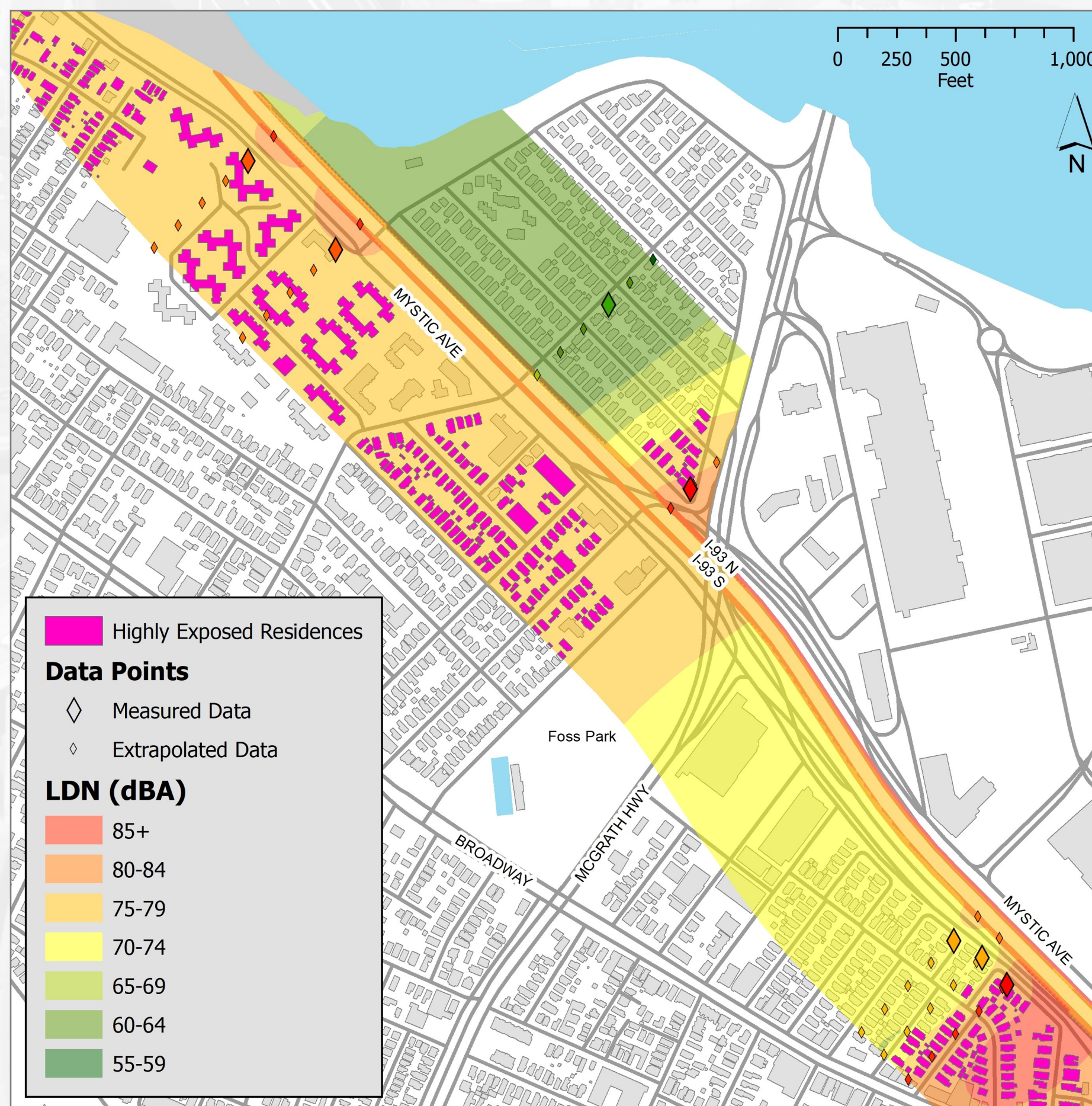
Data was cleaned and processed in a Python environment, yielding L_{night} (average sound level between the hours of 10pm and 7am) and L_{DN} (average sound level over 24 hours with added weight on nighttime noise) noise descriptors for each location. A distance-based noise decay function was also used to extrapolate data points along transects between the highway and sampling locations. This data was then subjected to a smoothed spline interpolation bisected by I-93 and extending 700ft (the approximate distance to the crest of the hill on which the Ten Hills neighborhood is situated). The Assembly Row district was excluded due to lack of data.

A combination of City of Somerville Assessor's Data and conversations with building managers yielded a count of all residential bedrooms in the study area. This served as the lower bound for the population estimate. The upper bound was set as 1.25 times the number of bedrooms to reflect cohabitating couples and the possibility of over-occupied apartments.

Nighttime Noise Levels



Average 24hr Noise Levels



Location	L_{night} (dBA)	L_{DN} (dBA)
70 80 90 Mystic River Rd	77.3	83.5
Mystic Activity Center	77.4	84.6
50 Puritan Rd	55.5	63.4
10 12 Ten Hills Rd	65.4	85.6
16 New Hampshire Ave	71.5	78.2
14 16 Maine Ave	70.4	76.7
9 11 Maine Ave	71.0	86.7

Results

All residences in the study area were exposed to nighttime noise levels in excess of WHO guidance for maintaining regular sleep cycles, with a minimum L_{night} ten decibels higher than the recommended value of 45dBA. The majority of residences to the south of the highway were exposed to average 24-hour noise levels with L_{DN} in excess of 75dBA. Such noise levels are usually deemed unacceptable for residential areas by the USEPA. All told, more than 4420 residents in the study area may be experiencing disturbed sleep due to excessive highway noise, and more than 2760 may be experiencing the long-term effects of extreme noise pollution.

Of additional note is the presence of the Mystic Activity Center in the highly-exposed area. While staff were unable to provide an estimate of average occupancy, especially in light of the ongoing pandemic, the exposure of young children to excessive noise during afterschool and daycare programs is another cause for concern.

The areas of low noise to the north of the highway reflect well the presence of the noise wall sound barriers serving the Ten Hills neighborhood, though this may also be due to the fact that the 50 Puritan Rd monitoring site was the furthest from the highway, and may have been experiencing unaccounted-for attenuation from other buildings, vegetation, or topography.

Next Steps

This study presents a concerning preliminary estimate of the number of people impacted by excessive noise near interstate I-93, a high proportion of whom are minorities. These findings are part of a growing body of data in support of the construction of sound wall noise barriers along the southbound lanes of I-93 in Somerville.

More data from this study exists to be analyzed, including noise measurements collected at 15- and 25-ft elevations, as well as ground-level readings collected in March of 2019 at Foss Park. Modeling efforts would be improved by an increased number and spread of sampling locations, as well as use of dedicated noise propagation software and GIS packages which take into account additional site characteristics.

4420-6630 Residents

Potentially Exposed to $L_{night} > 45dBA$, "Disruptive to Sleep" According to WHO

2760-4142 Residents

Potentially Exposed to $L_{DN} > 75dBA$, "Unacceptable" by EPA Standards

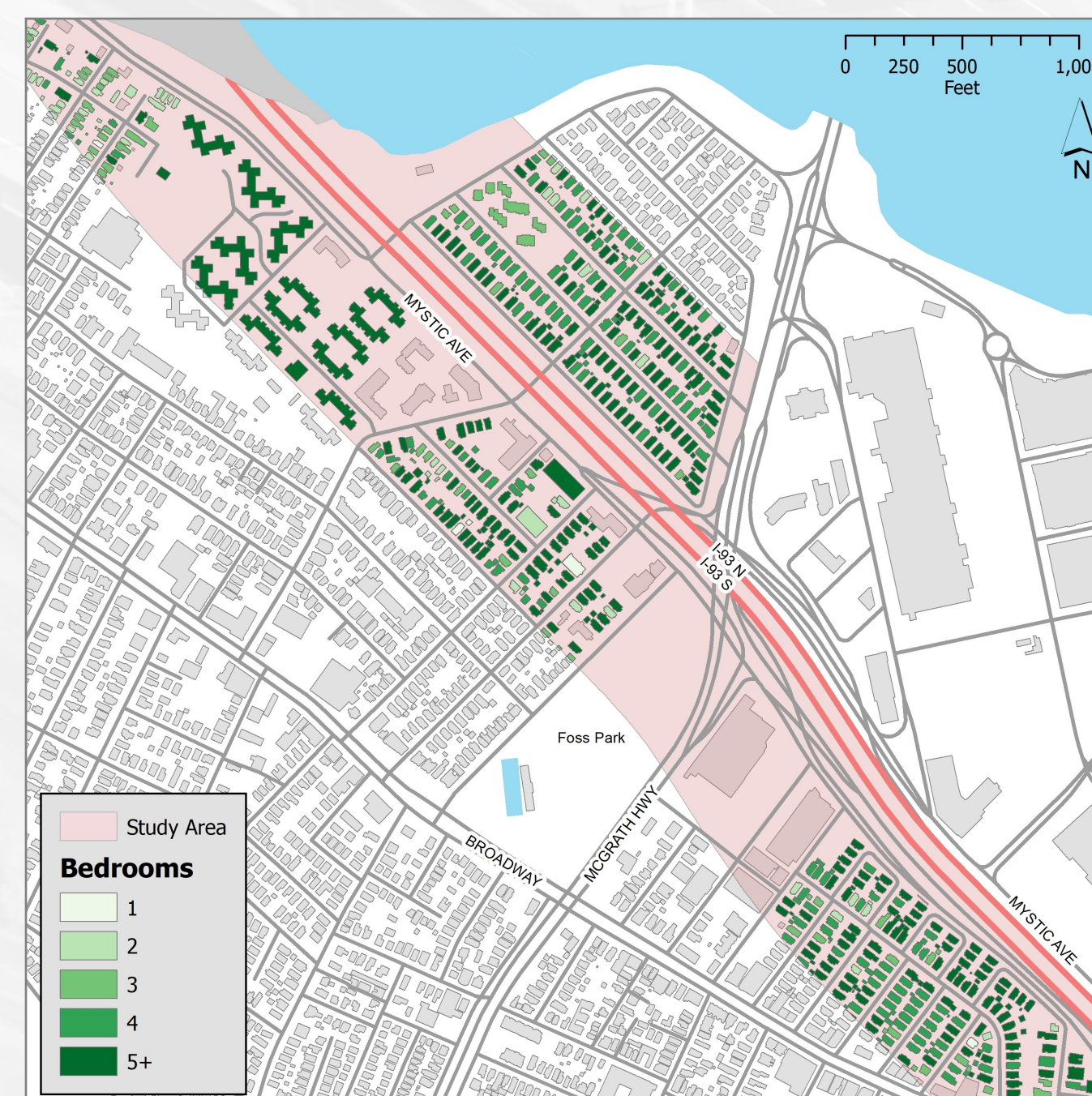
Sampling Locations



Land Use



Bedroom Count



Credits

Cartography by Miguel Rothe
Original Study by Doug Leaffer

Special Thanks: Laurie Baise, Marshall Pontrelli, David Gute, Doug Brugge, Grace Wang, David Chen, Wig Zamore, Elin Reiser

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Projection: NAD83 MA Mainland State Plane FIPS2001 (Feet)

Data Sources: MassGIS, City of Somerville, Tufts University, Somerville Transportation Equity Partnership

References:

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