APPENDIX A: EQUITY INDEX

Methods

A citywide overview of socio-economic and built environment variables is presented to help identify communities that would most benefit from green infrastructure investment. Using existing indices as models, a "Green Infrastructure Equity Index" was developed for the City of Buffalo at the census block group level that looks specifically at "equity voids" that could be addressed by the indirect benefits provided by investment in green infrastructure. Two types of variables are included in the index: socioeconomic variables related to disadvantage and vulnerability, and environmental factors related to both exposure to environmental risks and access to environmental amenities.

The socioeconomic factors include: (1) percent minority, (2) percent low-income, (3) percent of adults who have not completed high school, (4), percent under age 5, (5) percent over age 64, (6) percent owner-occupancy, (7) percent of households in linguistic isolation, and (8) percent of population (age 16 and up) either unemployed or not in labor force. These factors were chosen to represent at-risk populations who are either expected to have a higher need for green infrastructure or to be differentially impacted by a lack of it and due to their regular inclusion in studies of environmental justice as groups that are often environmentally disadvantaged. These data were downloaded from the U.S. Census Bureau's American Community Survey, 5-year estimates, 2012-2016.

The built environment measures included (9) proximity to traffic, (10) ozone levels, (11) particulate matter, (12) park access, (13) tree canopy cover, (14) percent of impervious surfaces, (15) amount of vacant land, (16) residential vacancies, and (17) commercial vacancies. These factors were chosen because they either can be addressed through green infrastructure or because they represent a direct measure of need for green infrastructure within the

community. Traffic, ozone, and particulate matters were downloaded from the U.S. Environmental Protection Agency's EJ Screen Application. A description of their derivation is available in the EJ Screen technical documentation. The data used to calculate park access and vacant land come from Erie County Parcel Data available through NYS GIS Clearinghouse. The tree canopy cover data and the impervious surface data were made available by members of the Rain Check project team. Data on residential vacancies was obtained from the American Community Survey, and data on commercial vacancies was downloaded from the HUD-USPS Administrative Data on Vacancies. While there are certainly other factors that could be incorporated into an index, this set represents a starting point to be used as a proof of concept. This is a flexible framework that would easily enable incorporation of additional measures as warranted.

Each of the measures represents a raw number that indicates some level of disadvantage. However, there are not necessarily benchmarks against which to compare the raw scores. Rather, the raw scores represent a way to compare block groups to each other to determine relative levels of disadvantage. In order to meaningfully combine the variables, we standardized each set of raw values to scores from 0 to 1, where 0 indicated the least disadvantaged score in the city and 1 indicated the most disadvantaged. For tree canopy cover and owner occupancy variables where a high score is not actually disadvantageous, we subtracted the result from 1 to keep a score of 1 consistently indicating highest disadvantage. We then calculated the index value by adding the standardized scores for each of the seventeen variables. An index score of 0 would indicate a single block group that had the most advantageous measure for each variable, while a score of 17 would indicate a single block group that had the least advantageous measure for each variable, though no such block groups exist in reality.

Citywide Overview

When mapped collectively, the seventeen indicators used for the GI Equity Index reveal clear geographic patterns in the distribution of socioeconomic and environmental disadvantage across neighborhoods of Buffalo. Socioeconomic markers of disadvantage, like poverty, educational attainment and workforce participation, are often clustered together in similar parts of the city where adverse environmental factors are also common. A broad overview of how these socioeconomic and environmental indicators of disadvantage are distributed across Buffalo's neighborhoods and the sewer basins targeted for GI investments by Rain Check 2.0 is provided below.

Socioeconomic Measures of Disadvantage

Race and Ethnicity

People of color make up most of the population on the East and West Sides of the city (see figure 1). Buffalo's African American community is centered on the East Side, while the West Side is home to the majority of the city's Hispanic and foreign born residents. Communities of color on the city's East and West Sides are correlated with higher residential vacancy rates and more vacant land. Buffalo neighborhoods with more people of color also tend to have higher shares of low income households and adults who are not employed.

Low Income Households

Low income households are concentrated on the east and west sides of Buffalo (see figure 2). In some areas, like the Broadway-Fillmore district on the East Side and Black Rock on the West Side, more than two-thirds of households have incomes that are less than double the federal poverty line. By comparison, neighborhoods in North and South Buffalo, and the Elmwood Village, typically have less than 30% of households with incomes under that threshold. The presence of low-income households is often tied to higher shares of adults without a high school degree and renter-occupied households, and low workforce participation rates.

Educational Attainment

Areas with the greatest shares of adults without a high school diploma or equivalent are concentrated on the West Side—in neighborhoods such as Front Park, Lakeview, and Black Rock—as well as on the East Side, particularly in the Cold Spring, Emerson, and Broadway-Fillmore neighborhoods. More than 25% of adults age 25 and over in these neighborhoods do not have a high school degree (see figure 3). This is also true for the Perry and First Ward neighborhoods bordering the city's central business district. On the other hand, in most neighborhoods of North Buffalo, South Buffalo and the Elmwood Village, less than 10% of adults lack a high school diploma. The prevalence of adults without a high school diploma is correlated with high shares of unemployed adults, low income households, and limited English speakers.

Young Children and Older Adults

Areas with large shares of young children (under 5 years old) and older adults (over 64 years) are dispersed throughout the City. Parts of South Buffalo have some of the highest shares of population under the age of 5, along with Black Rock on the city's West Side (see figure 4). Parts of the East Side, including Masten Park, Grider and Lovejoy also have relatively high shares of population under the age of 5 (over 8.5%) compared to the city overall (6.7%). Older adults (age 65 and up) are also common on the East Side (see figure 5), making up a relatively large share of the population in the Cold Spring, Fruit Belt, and MLK Park neighborhoods. Many other parts of the city, from the Waterfront neighborhood on the lower West Side, to pockets of North and South Buffalo, also have higher shares of older adults than the city as a whole.

Owner-Occupancy

Neighborhoods made up of mostly renters with low owner-occupancy

rates are another sign of socioeconomic disadvantage. These places are dispersed throughout pockets of Buffalo, including the central business district, as well as Allentown and Elmwood Village where college students and young adults make up larger shares of the population (see figure 6). However, as the prevalence of renter-occupied households is strongly correlated with low incomes, many neighborhoods on the West and East Sides have some of the city's lowest owner-occupancy rates.

Limited English Speakers

Limited English speaking households are most abundant on the city's West Side, where many Hispanic and foreign born residents live (see figure 7). The neighborhoods with the most limited English speakers are in the lower West Side, the heart of Buffalo's Hispanic community. High concentrations of limited-English speakers extend further north on the West Side, from the Grant-Ferry neighborhood to Black Rock and Riverside, where many Hispanics, immigrants and refugees reside. Some neighborhoods on the East Side, like Broadway-Fillmore, Kaisertown, and Perry, also have a higher share of limited English speaking households than the city overall (4.3%). In Buffalo, the presence of limited English speakers is correlated with lower incomes and lower levels of educational attainment.

Unemployment and Labor Force Participation

Low employment levels among the population (age 16 and up), a factor including both unemployed workers as well as those who are not participating in the labor force, is most widespread on the East Side. Most of the neighborhoods with the lowest employment levels fall on the East Side, including the Fruit Belt, Masten Park, Leroy, MLK Park, and Emerson neighborhoods (see figure 8). The University district, around the University at Buffalo's south campus, and the neighborhood around Buffalo State College, where many students live, also

have some of the lowest employment levels in the city. Parts of the West Side, including the lower West Side and the Riverside neighborhood have lower workforce participation rates than the city overall (59%). Low employment levels have a relatively strong correlation with high shares of low-income households, people of color, and adults without a high school diploma.

Summary of Socioeconomic Indicators of Disadvantage

When aggregated together, the block groups showing the greatest levels of socioeconomic disadvantage are clustered in Buffalo's East and West sides (see figure 9). Overall, socioeconomic disadvantage is most widespread on the city's East Side. One cluster of high socioeconomic disadvantage exists in areas bordering Main Street, in the Fruit Belt, Masten Park, and Cold Spring neighborhoods. Further into the East Side, the Kingsley, Broadway-Fillmore, MLK Park, and Emerson neighborhoods also reveal some of the city's highest measures of socioeconomic disadvantage. Another pocket of high socioeconomic disadvantage exists just east of the city's downtown, in the Perry and Willert Park neighborhoods. Socioeconomic disadvantage on the city's East Side is triggered by a number of factors that tend to be correlated, including high concentrations of people of color, low income households, populations over 64 years old, adults without a high school diploma and low employment levels.

Areas of high socioeconomic disadvantage also line Buffalo's West Side—from the Columbus neighborhood neighboring the central business district, through the Front Park, Grant-Ferry, Black Rock, and Riverside neighborhoods. Socioeconomic disadvantage on the city's West Side is largely driven by a high concentration of low income households, limited English speakers, adults without a high school diploma, and low owner-occupancy rates. Measures of socioeconomic disadvantage across other parts of the city, in North Buffalo,

South Buffalo, and the Elmwood Village are lower than Buffalo overall. This is due to relatively higher incomes, educational attainment, employment levels, owner-occupancy rates, and concentrations of non-Hispanic white populations.

Environmental Measures of Disadvantage

Traffic Proximity and Volume

Proximity to high volumes of traffic raises environmental concerns for residents nearby, such as noise and air pollution. The proximity to high traffic volumes is highest on the city's West Side, along Interstate 190 beside the Niagara River (see figure 10). The highway bends eastward near downtown, moving high volumes of traffic through parts of South Buffalo, like First Ward, Valley and Seneca neighborhoods. The Kensington Expressway (Route 33) lends relatively high traffic proximity scores to the East Side, most notably in Leroy, Kenfield, and the Hamlin Park neighborhood where Route 33 meets the Scajaquada Expressway (Route 198). Highly–trafficked surface roads also lead to elevated traffic levels—most notably along Bailey Avenue which runs north-south on the East Side, and the northern section of Main Street near the University at Buffalo's south campus.

Air Quality

Ozone levels and particulate matter (PM2.5) concentrations in the air are strongly correlated with one another. Both these indicators follow a simple geographic pattern in Buffalo. Ozone levels (measured in parts per billion) are lowest on the east end of the city, and increase gradually moving west (see figure 11). Similarly, the lowest particulate matter concentrations (PM2.5) (in micrograms per cubic meter) exist in the south-eastern end of the city, and increase moving northwest to the Black Rock and Riverside neighborhoods which have the city's highest levels of particulate matter (see figure 12).

However, the data show little variation in these air quality indicators across Buffalo—the difference between the city's maximum and minimum Ozone levels is only 0.5 parts per billion. Consequently, when normalizing these values and adding them to the GI equity index calculation, these small variations in measured Ozone levels, and particulate matter concentration across the city, can be overemphasized, amplifying high and low scores to appear more extreme when in reality they deviate only slightly from city averages.

Atmospheric concentrations of Ozone and particulate matter do not vary greatly over small areas, like at the scale of a single city, since they can be carried long distances by wind. Also, there are limitations in the EPA EJSCREEN data. The data is created through a combination of modeling and monitor data. There are a limited number of monitors across the country, and near Buffalo. The only active Ozone monitor near Buffalo is by UB North Campus. There is also a PM2.5 monitor here, along with one at 185 Dingens Street in Buffalo and another along I-90 in Cheektowaga. Since the model produces data with a higher level of uncertainty as you move to smaller geographic scales, EPA only provides these indicators at the census tract level, and assigns those values to block groups. For more information, please see the EJSCREEN technical documentation available on the EPA website.

Access to Public Open Space

Access to public parks, recreational spaces, and playgrounds is relatively convenient for most residents throughout the city—an estimated 86% of the population live within a 10-minute walk of a public open space. But looking at the average time it takes for residents of different neighborhoods to walk to the nearest public open space does reveal a few relative gaps in park access across Buffalo (see figure 13). Neighborhoods with relatively limited park access tend to fall in areas with more socioeconomic disadvantages. This includes parts of the East Side—like Kenfield, Genesee-Moselle, Emerson, and Kaisertown—as

well as the West Side, especially Black Rock, Riverside, and Forest. However, some of Buffalo's most advantaged neighborhoods also have longer walks to the nearest public park, including parts of North Buffalo, and the Bryant neighborhood in Elmwood Village.

Tree Canopy and Impervious Surface Coverage

About 15% of Buffalo's land area is covered by tree canopy, while nearly 55% of the city's land is impervious. These factors have an obvious inverse correlation—more pavement in an area likely means fewer trees. With a high density of commercial buildings and surface parking lots, the central business district has the highest impervious surface coverage (86%) in the city along with a low tree canopy coverage (9%). Moving east, a large cluster of neighborhoods with a low tree canopy cover stretches through the southern part of the East Side, from Perry and Willert Park to Kaisertown (see figure 14). Neighborhoods with commercial districts, like North Delaware, Grant-Ferry and Allentown, also have reduced tree canopy cover and larger impervious areas (see figure 15). Meanwhile, some of the most socioeconomically advantaged areas of the city, such as the Elmwood Village and Parkside neighborhood, have some of the lowest levels of impervious surfaces and highest tree canopy coverage across Buffalo. Areas with low tree canopy coverage and a high degree of impervious surfaces are somewhat correlated with concentrations of adults lacking a high school diploma and low-income households.

Vacant Land

Across the city of Buffalo, about 13.5% of land is vacant and unused. Most vacant land lies on the East Side where many vacant homes were demolished. In some East Side neighborhoods, such as Masten Park, Emslie, and Broadway-Fillmore, more than a quarter of land sits vacant (see figure 16). In other East Side neighborhoods, like MLK Park and the Fruit Belt, more than 20% of land is vacant. Parts of South Buffalo, like the

Valley neighborhood, also have a greater share of vacant land than the city overall. The prevalence of vacant land is tied to high residential vacancy rates and a number of socioeconomic factors, such as concentrations of people of color, low incomes, and adults without a high school diploma.

Vacancy Rates

Across the city of Buffalo, 10% of residential addresses and 16% of commercial addresses sit vacant, based on data from June, 2018. Overall, the East Side has the most widespread vacancy concerns, where neighborhood vacancy rates on average are about 14% for residential addresses and 21% for commercial spaces. A cluster of neighborhoods surrounding the Fruit Belt, including Johnson, Kingsley and Broadway-Fillmore, own some of the highest residential vacancy rates in Buffalo (see figure 17). Other areas of high residential vacancy exist on the city's West Side, in the Front Park, and Grant-Ferry neighborhoods. Neighborhoods with high commercial vacancy rates are more dispersed, but many exist on the East Side, including the Johnson, Hamlin Park, Lovejoy, and Kensington neighborhoods (see figure 18). High commercial vacancy rates also occur in South Buffalo, near Cazenovia Park, and on the West Side near Front Park and Riverside Park. Commercial and residential vacancy rates are often tied to one another in more distressed parts of the city, but not necessarily. For instance, Riverside has a relatively well-intact residential neighborhood, but owns one of the city's highest commercial vacancy rates (30%). Moreover, high residential vacancy rates are more strongly correlated with high shares of people of color, low incomes, and unemployment than with high rates of commercial vacancy.

Summary of Environmental Indicators of Disadvantage

When aggregating each of these indicators together, the West Side shows the highest level of overall environmental disadvantage (see figure 19). This is largely due to the elevated proximity to high traffic volumes, and greater concentrations of Ozone and particulate matter in the air. The East Side also has a high degree of environmental disadvantage compared to the city as a whole, predominantly due to the abundance of vacant land and higher vacancy rates, both residential and commercial. However, due to limited park access, low tree canopy coverage, and a high percentage of impervious surfaces in some socioeconomically advantaged parts of the city, the overall trend in environmental equity index is not as well-defined as the map of socioeconomic disadvantage.

Green Infrastructure Equity Index

When combined, the socioeconomic and environmental equity indices reveal spatial patterns that echo trends common among most indicators of disadvantage. Specifically, the West and East Sides of the city stand out as areas of greatest disadvantage (see figure 20). Neighborhoods on the city's West Side receive the highest average combined GI equity index score, indicating a greater need for GI investments. This is due to elevated measures of environmental disadvantage, including high vacancy rates, traffic volumes, and Ozone and particulate matter levels, as well as socioeconomic factors, such as low incomes, limited English fluency, low educational attainment, and low owner-occupancy rates.

Overall, the need for GI, as measured by this index, appears most widespread on Buffalo's East Side, where high markers of disadvantage among nearly all of the seventeen distinct factors included in this analysis are shown across many neighborhoods. The most pronounced markers of disadvantage on the East Side include low workforce participation levels, high shares of people of color, high vacancy rates, and an abundance of vacant land.

Outside of the city's East and West sides, few neighborhoods receive overall equity index scores that exceed the citywide average. Notable exceptions include the central business district, which has a small residential population but is relatively disadvantaged due to environmental factors, and the First Ward and Valley neighborhoods of South Buffalo, due to a number of factors including low incomes, nearby traffic levels, vacant land, and unoccupied addresses. Throughout the rest of the city, from North Buffalo, the Elmwood Village, and most parts of South Buffalo, the overall equity index scores fall below the city average, indicating a lower relative need for GI investments in these locations.

Measures of Disadvantage in Target CSO Basins

In general, the sewer basins targeted by Buffalo Sewer through Rain Check 2.0 overlap with areas of high need for GI investments, as suggested by this index. These targeted basins predominantly lie on the city's East Side, which showed the most widespread level of disadvantage of any community in Buffalo. The overall need for GI, as well as the factors that lead to higher measures of disadvantage, vary across these basins.

Priority CSO 14

Covering much of the central business district, CSO basin 14 has a heightened need for GI investments, mainly due to environmental factors. The basin has the highest impervious surface coverage of any target area, along with a small tree canopy footprint. CSO 14 also has the highest traffic volumes of any priority CSO basin, due to commuter traffic and the proximity to major highways. Being in the active downtown area, basin 14 has the smallest share of vacant land cover and lowest vacancy rates of any targeted basin.

Although basin 14 has the fewest number of residents, the population here is more disadvantaged than the city overall. The wide majority of households here are renter-occupied (85%), more than any other targeted basin. As it intersects the city's Hispanic community in the lower West Side, basin 14 also has the highest share of limited English speaking households (9.3%)—more than double the city rate.

While the need for GI in basin 14 is high, based on the high degree of impervious surfaces and presence of disadvantaged population groups, the feasibility of many GI investment options may be relatively limited, due to such factors as low owner-occupancy rates and a smaller amount of vacant land. However, the presence of major employers and large surface parking lots may present alternative prospects for green infrastructure.

Priority CSO 26

Among all targeted basins, the need for GI investments may be highest in CSO 26, as it scores higher in the overall GI equity index than any target basin. CSO 26 falls on the city's East Side in neighborhoods like Emslie, and Broadway-Fillmore, where marginalized population groups are concentrated. Other parts of the basin intersect the First Ward and Valley neighborhoods in South Buffalo, which are also home to socioeconomically disadvantaged populations. Basin 26 has the highest share of low income households (73% with incomes less than double the federal poverty line), and adults without a high school diploma (25%) of any targeted basin. People of color comprise most (82%) of the population in basin 26. Just over half (51%) of people age 16 and over participate in the labor force (compared to 59% for Buffalo overall).

Many neighborhoods in CSO 26 are also marked by environmental concerns, such as limited tree canopy coverage and vacancy. With about 30% of its land area covered by vacant lots, basin 26 has more than double the vacant land coverage of the city overall, indicating an abundance of opportunities for GI investments.

Priority CSO 27

CSO basin 27, lying just east of basin 26, shares many similar disadvantages. Neighborhoods in this basin, like Kaisertown, Valley, and Babcock, are marked by low incomes and educational attainment levels. However, the overall socioeconomic disadvantage falls just under the city average due to the large population of non-Hispanic whites, and higher rates of owner-occupancy, workforce participation, and English fluency than the city overall.

CSO basin 27 stands out for a few environmental indicators of GI need. The basin has the highest vacancy rates, both commercial (16%) and residential (24%), of the six targeted sewer basins, along with a relatively high share of vacant land (15%). Basin 27 also has the lowest tree canopy coverage of any targeted basin—7.4% which is half that of the city as a whole. As Interstate 190 runs through the basin, neighborhoods in CSO 27 also have a notably high proximity to heavy traffic.

Priority CSO 28

Basin 28 lies within South Buffalo where the neighborhoods are generally more socioeconomically advantaged than other targeted investment areas. Of the six basins targeted by Rain Check 2.0, CSO 28 has the highest household incomes, educational attainment levels, workforce participation rates, and shares of non-Hispanic white population.

Basin 28 also ranks positively in terms of environmental concerns—it has the lowest impervious surface coverage (53%) and residential vacancy rate (5%) of any targeted basin. It also has a relatively high tree canopy coverage (16%) and a low share of vacant land area (11%). Due to these relative advantages, basin 28 has the lowest overall need for GI investments as rated by this equity index. Strategies for GI investments that involve residents may be most feasible in this area, since neighborhoods here are well intact with plenty of owner-occupied housing units.

Priority CSO 33

Basin 33 encompasses most of the Schiller Park, Lovejoy, and Kaisertown neighborhoods. Incomes and educational attainment levels are generally lower here than across the city as a whole, but overall, this area is less socioeconomically disadvantaged than most other priority basins. These areas have higher of owner-occupancy rates, employment levels, and a relatively large share of non-Hispanic whites.

The basin also performs relatively well on a few environmental indicators, with 10% of land sitting vacant (compared to 13.5% citywide), and lower Ozone and particulate matter levels in the air than the city overall. But the basin also has less tree canopy and more impervious surface coverage than the city overall.

Although scoring relatively positively in this index, there is still a need for GI investment in basin 33. Like all targeted basins, a diverse portfolio of GI investments and robust engagement strategies are needed in basin 33 to alleviate equity concerns while meeting goals for stormwater management.

Priority CSO 53

The most extensive basin with a population that makes up nearly one-quarter of Buffalo, CSO basin 53 on the East Side has an elevated need for GI investments due to a number of interconnected factors. Covering most of Buffalo's African American community on the East Side, this basin has the largest share of people of color (86%) of any target area. Basin 53 also has lower rates of workforce participation and owner-occupancy, and higher poverty levels than the city overall. From an environmental perspective, the basin is marked by a relatively large share of vacant land (16%) and high vacancy rates, but also has the highest tree canopy coverage (16%) of any priority basin.

Looking at these indicators at a basin-wide level masks some of the significant environmental and socioeconomic disadvantages of neighborhoods within basin 53, like Grider and Masten Park.

As is true for all other targeted areas, equity concerns must be investigated at a neighborhood level when investing in GI in CSO 53.

Conclusion

By aggregating a wide array of socioeconomic and environmental indicators of disadvantage, the GI equity index provides a fair depiction of the relative need for GI investments across the city of Buffalo. While key general considerations for future GI investments can be drawn from these findings, it is critical to reexamine these issues at a more discrete level, and robustly engage the local community when making investment decisions and implementing GI.

Many areas of greatest need for GI, as represented by this equity index, fall within the sewer basins targeted by Rain Check 2.0, and align with other areas targeted for investment by the city and state, such as areas targeted for investment by Empire State Development programs for revitalization on the East Side. While programs like these largely focus on physical improvements, to safeguard the long-term value of green infrastructure investments, it is critical to also invest in building social capital and developing the local workforce in these areas. This will alleviate equity concerns in these communities while improving the overall sustainability of GI projects and building momentum for additional investments.

All these factors point to the need for Rain Check 2.0 to pursue a dynamic approach. Reflecting on equity, from citywide issues to neighborhood concerns, can guide the various phases of this approach—when engaging neighborhoods, partnering with diverse stakeholders, collaborating with other strategic initiatives, and incentivizing a wide array of GI investment strategies. Integrating equity considerations into a robust and adaptive Rain Check 2.0 program will help ensure that GI investments have a long-term positive impact on the environment, the economy, and all the communities of Buffalo.

Table 1: Equity Index Indicators

Category	Indicator	Measure	Data Source
Socio-economic Factors	Race and Ethnicity	Percent of population that are not non-Hispanic White	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Income	Percent of residents living in households with incomes less than twice the federal poverty line	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Educational Attainment	Percent of adults age 25+ who have not completed high school/equivalent	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Young Children	Percent of population under 5 years old	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Older Adults	Percent of population over 64 years old	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Limited English Speakers	Percent of households in which no member age 14 and over (1) speaks English at home or (2) speaks a language other than English at home and speaks English "very well"	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
	Unemployment and Labor Force Participation	Percent of population (age 16+) that are unemployed or not in the labor force	U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
Built Environment Factors	Traffic Proximity	Traffic proximity and volume	Environmental Protection Agency, EJScreen, 2018
	Ozone Levels	Ozone level in air (ppb)	Environmental Protection Agency, EJScreen, 2018
	Particulate Matter	PM2.5 level in air ($\mu g/m^3$)	Environmental Protection Agency, EJScreen, 2018
	Access to Public Open Space	Average walk time (min.) from homes to a public park or playground	UBRI analysis of parcel data (Erie County Dept. Environment and Planning, 2016), public recreation lands (NYS DEC, 2017), U.S. Census Bureau, (2012-2016 ACS 5 Year Estimates), address points (NYS GIS Program Office, 2017), and streets (NYS DOT, 2017)
	Tree Canopy Cover	Percent of land area covered by tree canopy	evolveEA/Arcadis, 2018
	Impervious Surface Cover	Percent of land area that is impervious	U.S. Geological Survey, National Land Cover Dataset, Impervious Surfaces, 2011
	Vacant Land	Percent of land area that is vacant/unused land	Erie County Department of Environment and Planning, 2016
	Residential Vacancy Rates	Percent of residential addresses that are vacant	U.S. Department of Housing and Urban Development, U.S. Postal Service Vacant Address Data, June 2018
	Commercial Vacancy Rates	Percent of commercial addresses that are vacant	U.S. Department of Housing and Urban Development, U.S. Postal Service Vacant Address Data, June 2018

Figure 1

People of Color as Share of Population by Block Group, City of Buffalo, 2016

Source: US Census Bureau, American Community Survey, 5-year estimates, 2012-2016.

% People of Color
- 0% - 20%
- 20.1% - 45%
- 45.1% - 75%
- 75.1% - 90%
- 90.1% - 100%
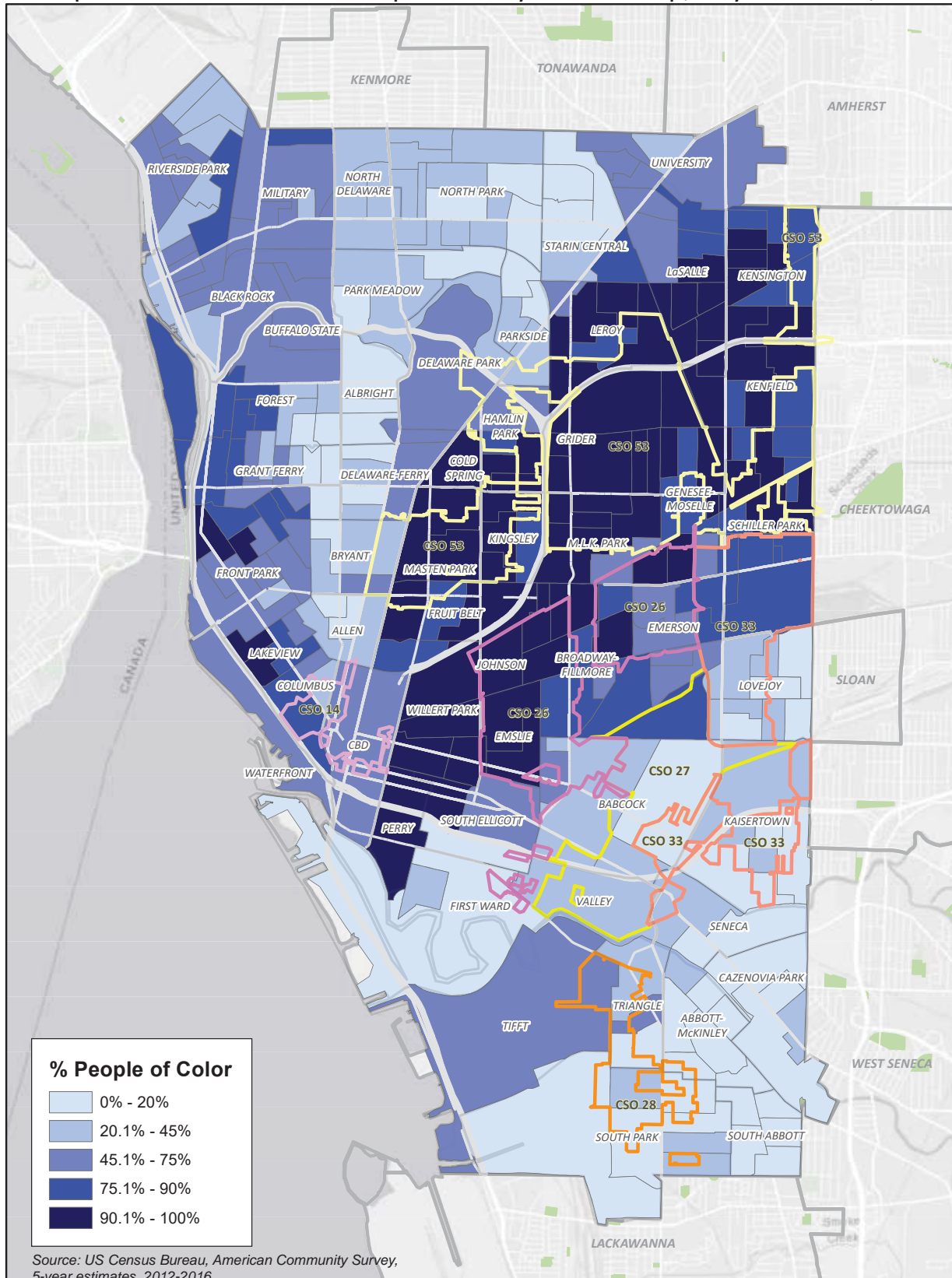
Figure 2

Concentration of Low-Income Households by Block Group, City of Buffalo, 2016

% of Households with Incomes less than 2x the Federal Poverty Line

- 0% - 30%
- 30.1% - 50%
- 50.1% - 60%
- 60.1% - 75%
- 75.1% - 100%

Source: US Census Bureau, American Community Survey, 5-year estimates, 2012-2016.
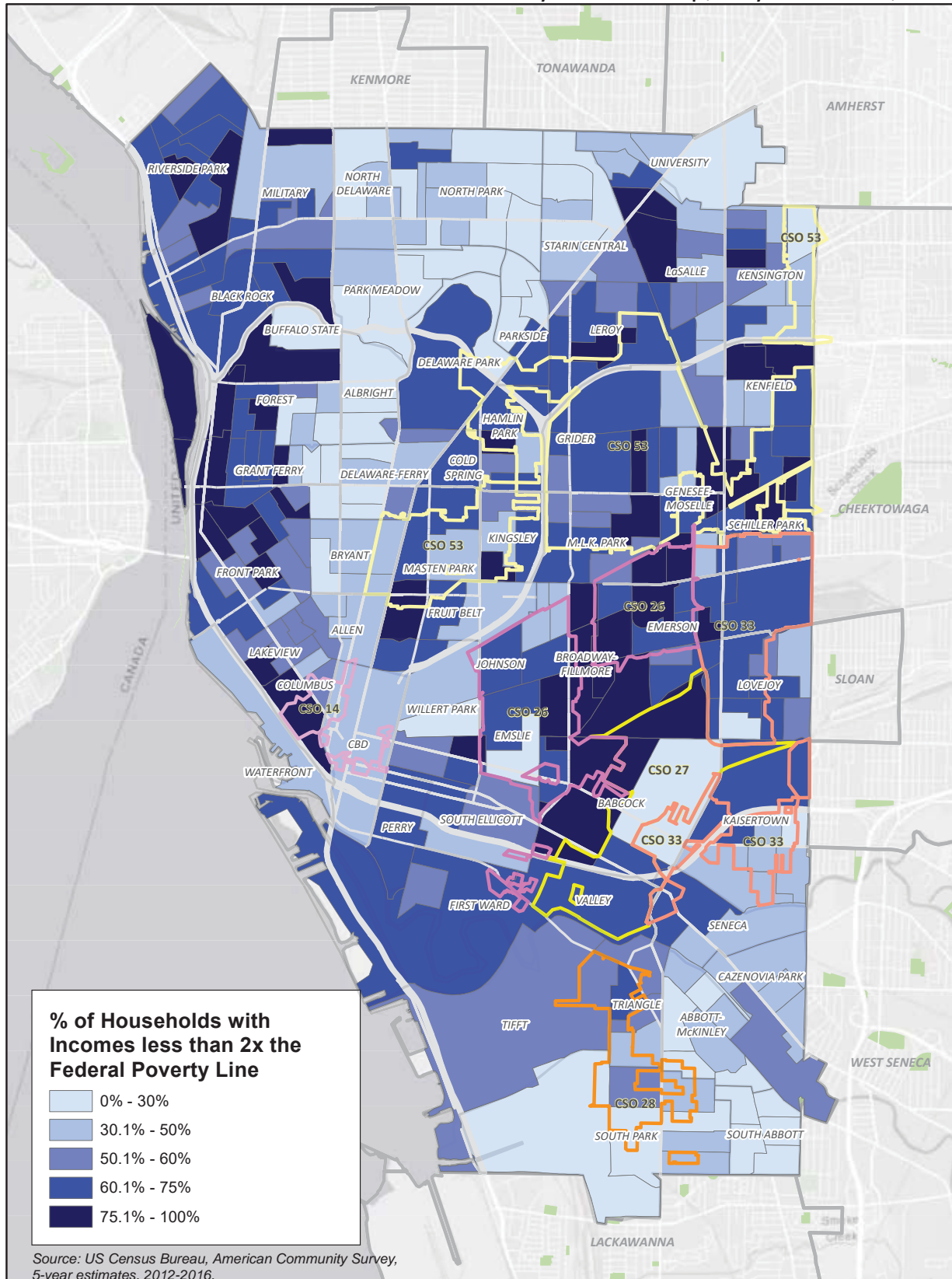
Figure 3

Share of Adults without High School Diploma/Equivalent by Block Group, City of Buffalo, 2016

% Adults (Age 25+) without High School Diploma/Equivalent

- 0% - 7%
- 7.1% - 14%
- 14.1% - 21%
- 21.1% - 30%
- 30.1% - 59.1%

Source: US Census Bureau, American Community Survey, 5-year estimates, 2012-2016.
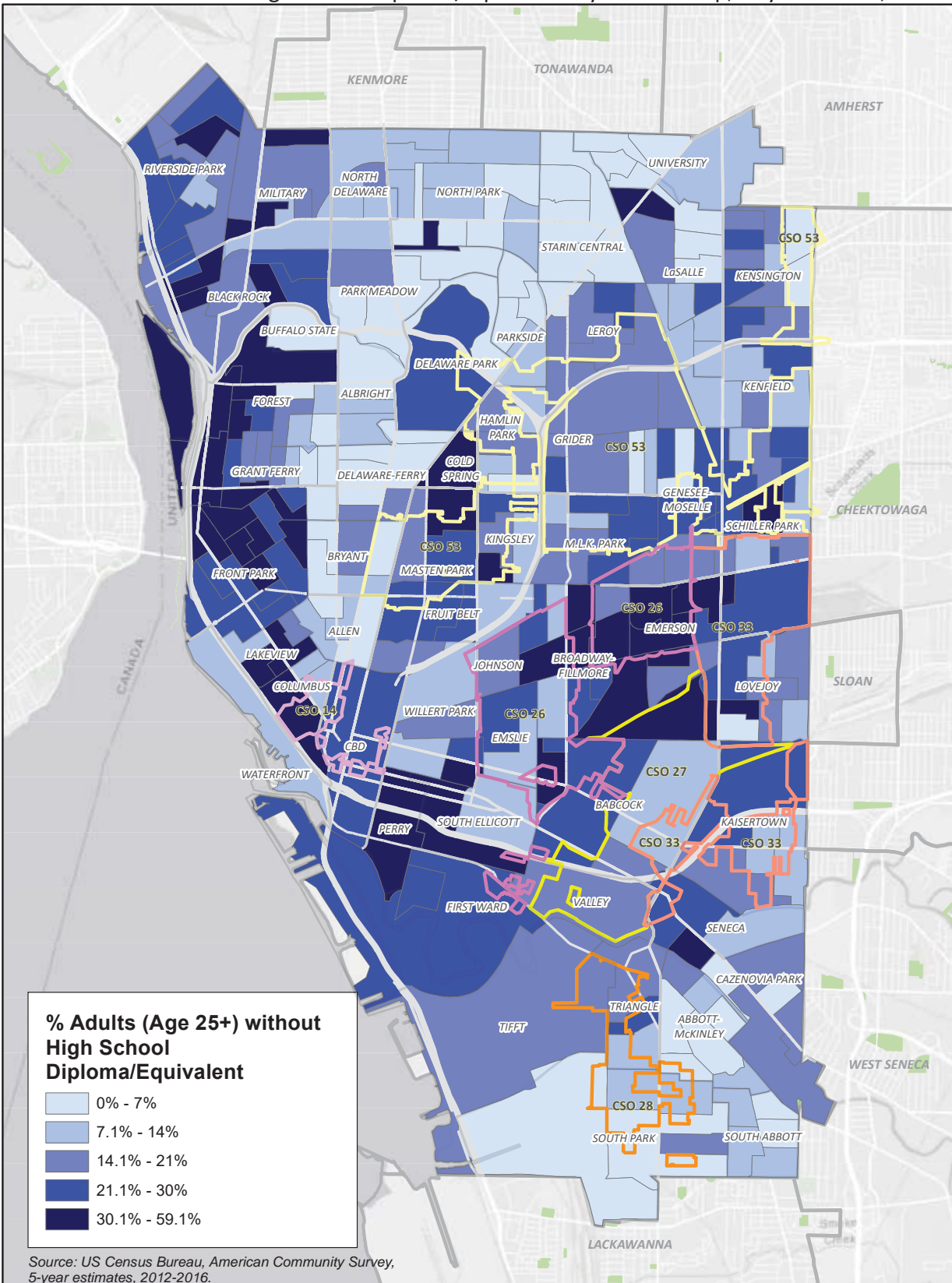
Figure 4

Percent of Population Under 5 Years Old by Block Group, City of Buffalo, 2016

% Under 5 Years Old
- 0% - 2.5%
- 2.6% - 5%
- 5.1% - 7%
- 7.1% - 11%
- 11.1% - 20.7%

Source: US Census Bureau, American Community Survey,
5-year estimates, 2012-2016.
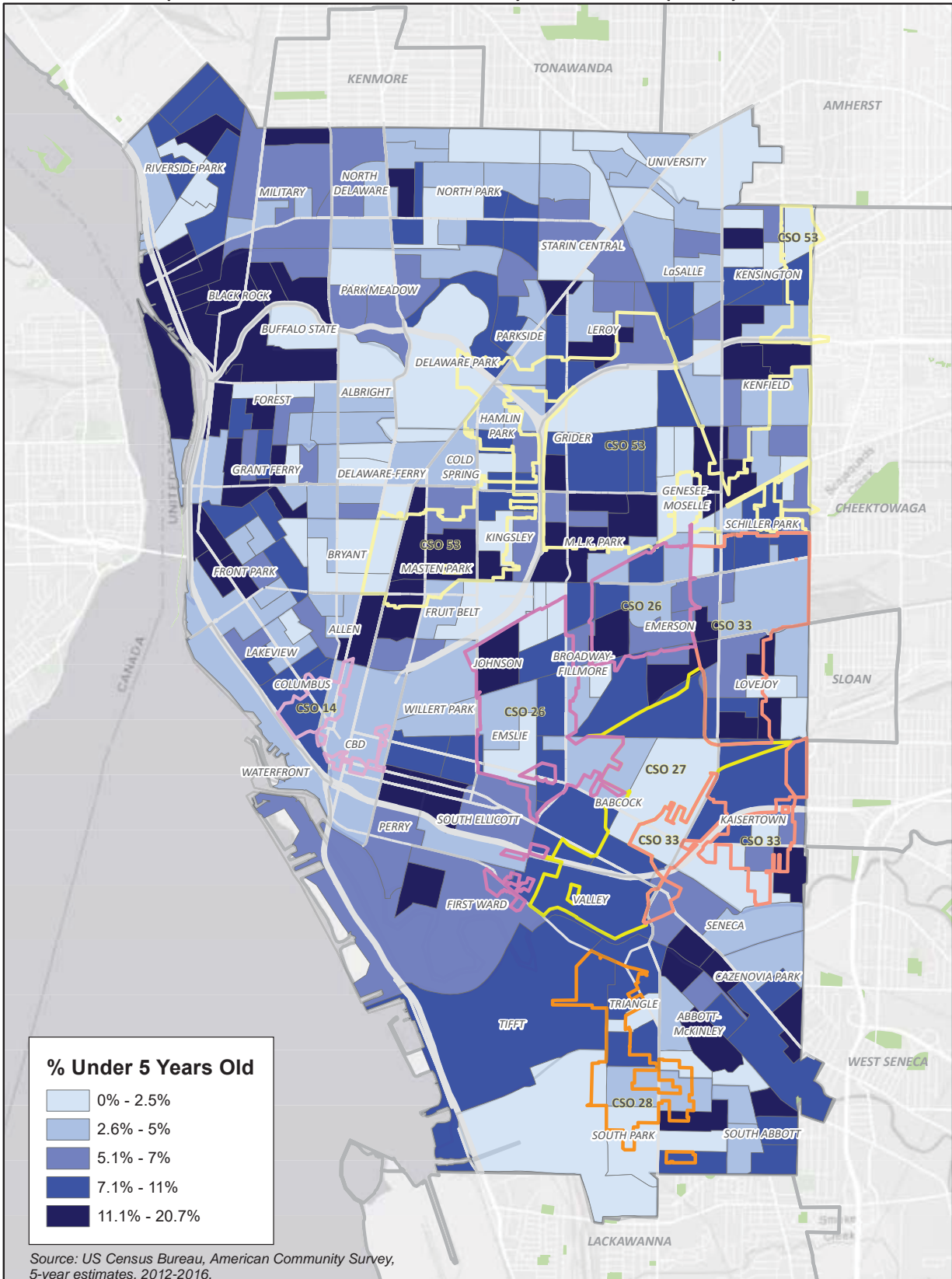
Figure 5

Percent of Population Over 64 Years Old by Block Group, City of Buffalo, 2016

% Over 64 Years Old
- 0% - 6.3%
- 6.4% - 10.1%
- 10.2% - 13.7%
- 13.8% - 18.3%
- 18.4% - 33.3%

Source: US Census Bureau, American Community Survey,
5-year estimates, 2012-2016.
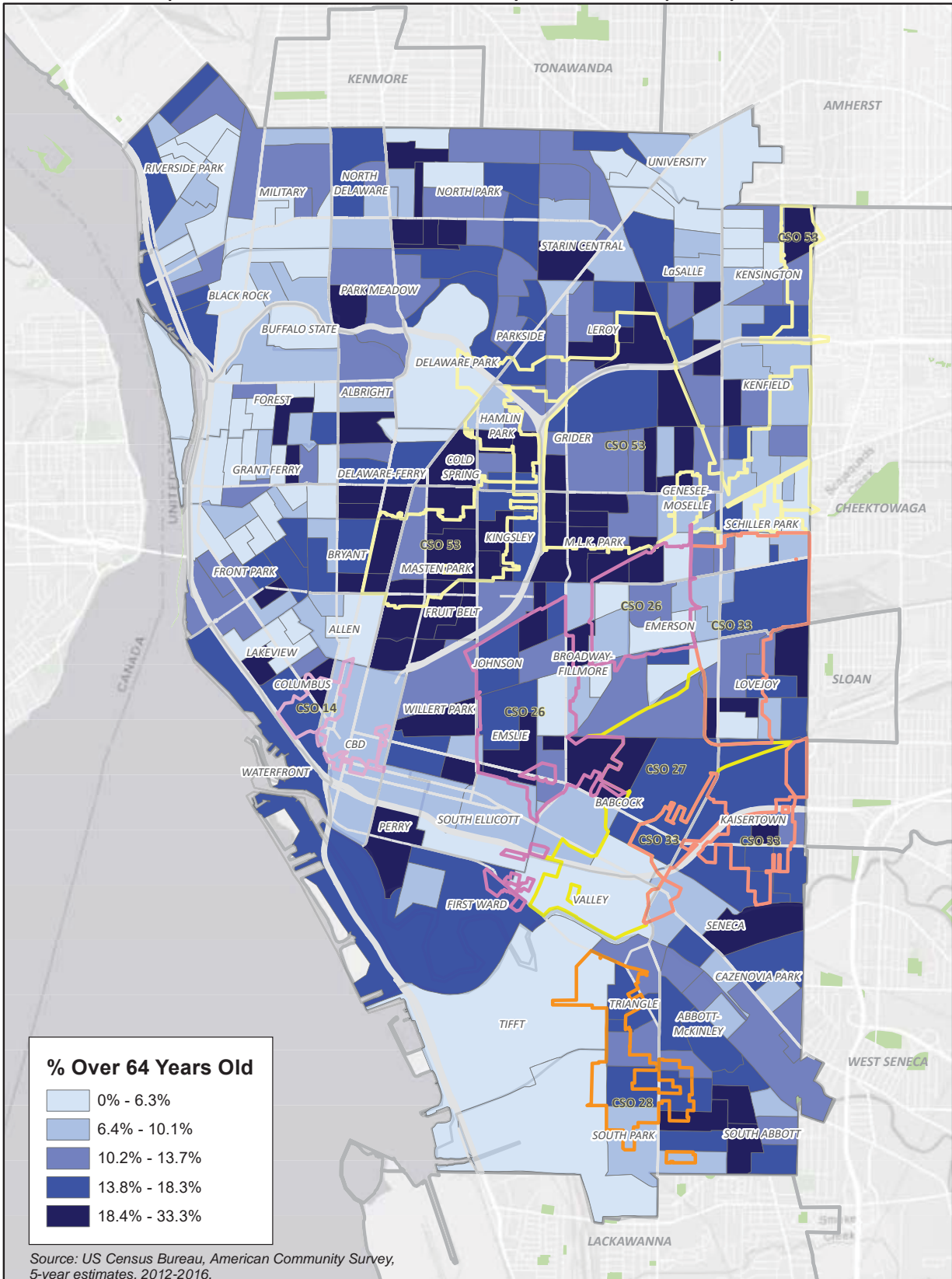
Figure 6

Share of Households that are Owner-Occupied by Block Group, City of Buffalo, 2016

% Households that are Owner-Occupied

- 0% - 26.3%
- 26.4% - 35.9%
- 36% - 46.9%
- 47% - 60.6%
- 60.7% - 100%

*Source: US Census Bureau, American Community Survey,
5-year estimates, 2012-2016.*
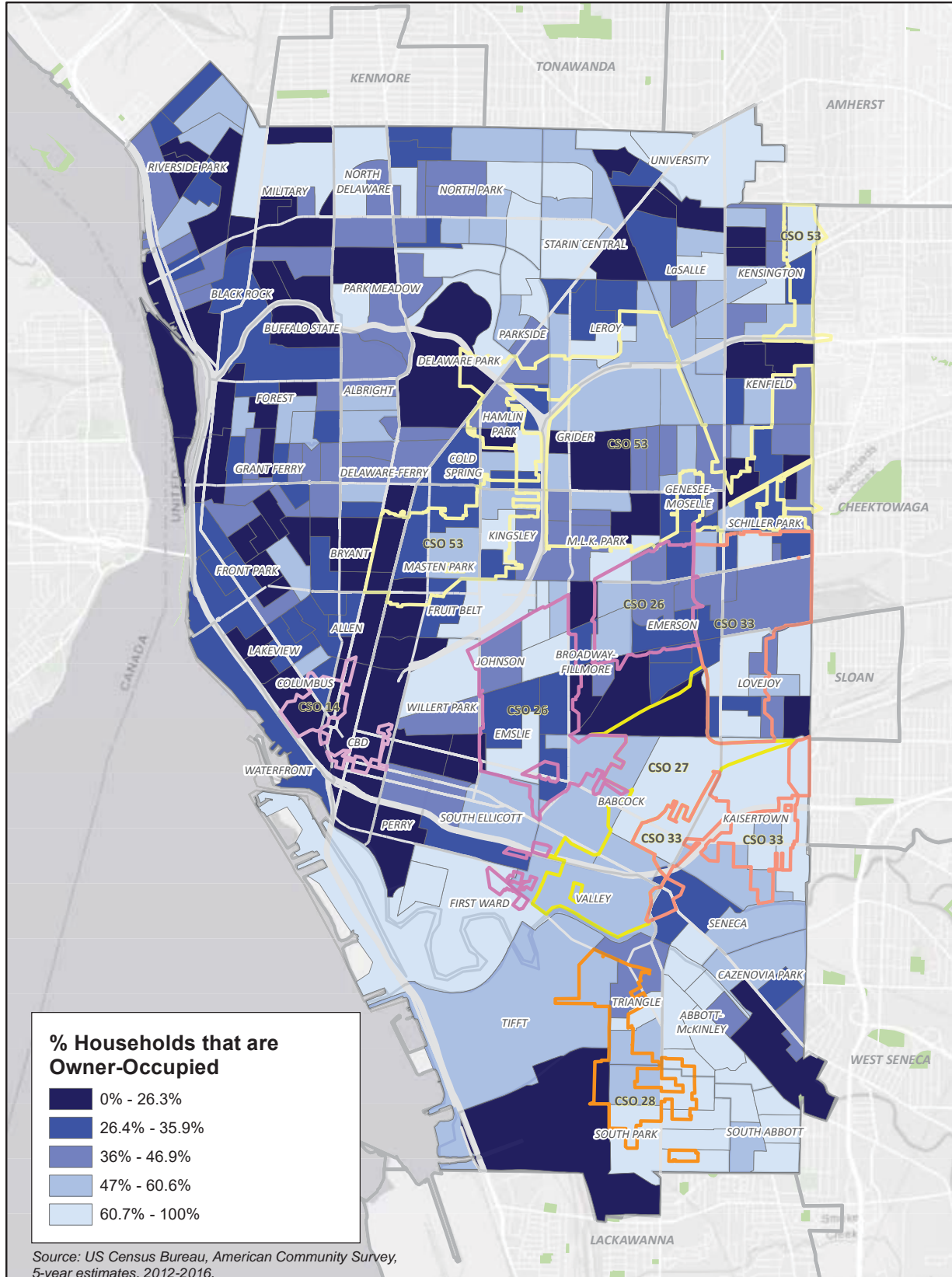
Figure 7

Share of Householders that are Limited English Speakers by Block Group, City of Buffalo, 2016

% of Householders that are Limited English Speakers

- 0%
- 0.1% - 3%
- 3.1% - 6%
- 6.1% - 15%
- 15.1% - 46.8%

Source: US Census Bureau, American Community Survey, 5-year estimates, 2012-2016.
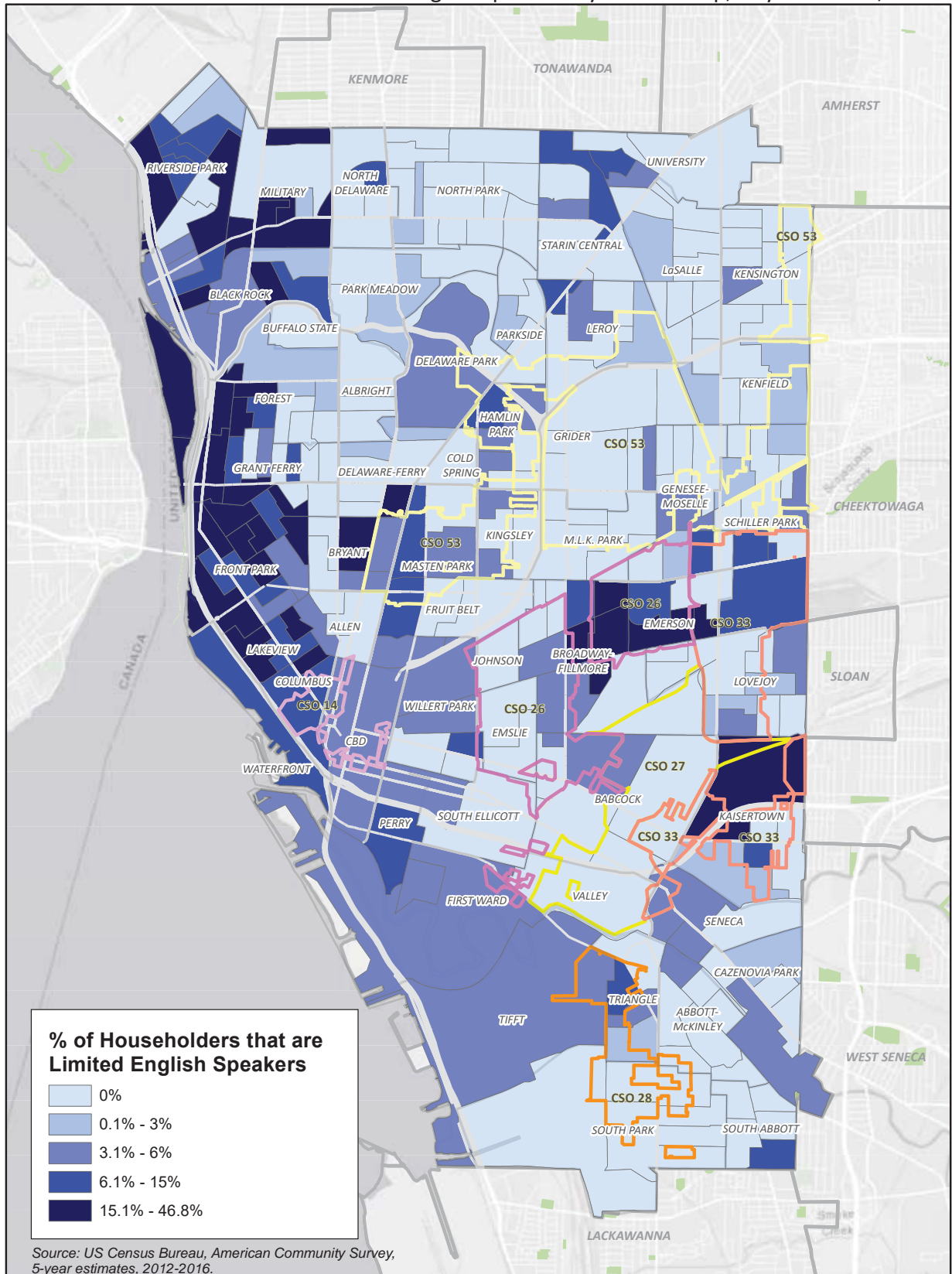
Figure 8

Share of Population 16+ Unemployed or Not in the Labor Force, by Block Group, City of Buffalo, 2016

% Population Age 16+ that are Unemployed or Not in the Labor Force

- 0% - 35%
- 35.1% - 45%
- 45.1% - 55%
- 55.1% - 65%
- 65.1% - 85.6%

Source: US Census Bureau, American Community Survey, 5-year estimates, 2012-2016.
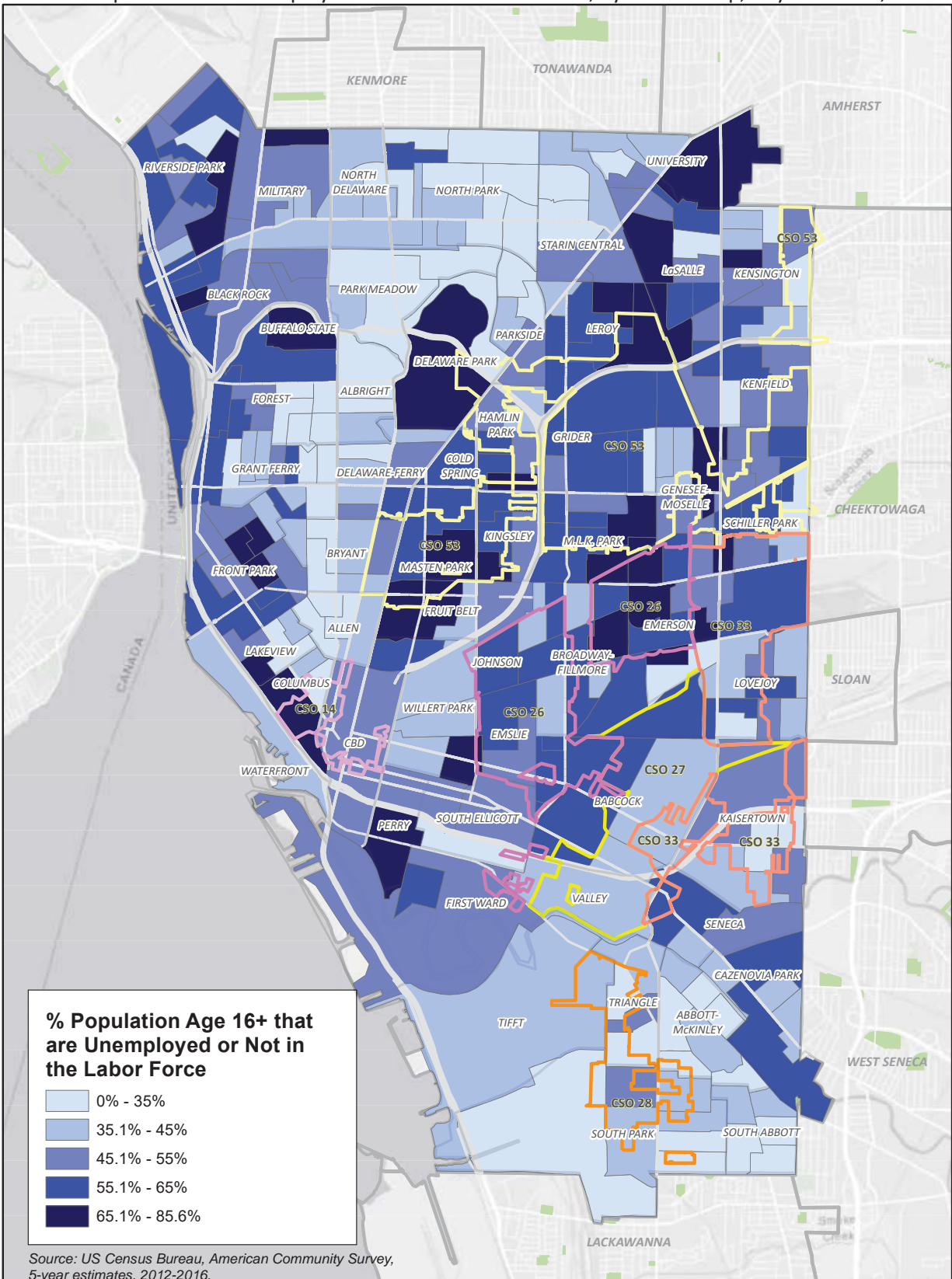
Figure 9

Socioeconomic Equity Index, Block Groups, City of Buffalo

Socioeconomic Equity Index

(Higher scores are more disadvantaged)

- 1.0 - 2.3 (Bottom 20% of Block Groups)
- 2.4 - 3.1
- 3.2 - 3.6
- 3.7 - 4.2
- 4.3 - 6.7 (Top 20% of Block Groups)

Source: UBRI analysis, 2018.
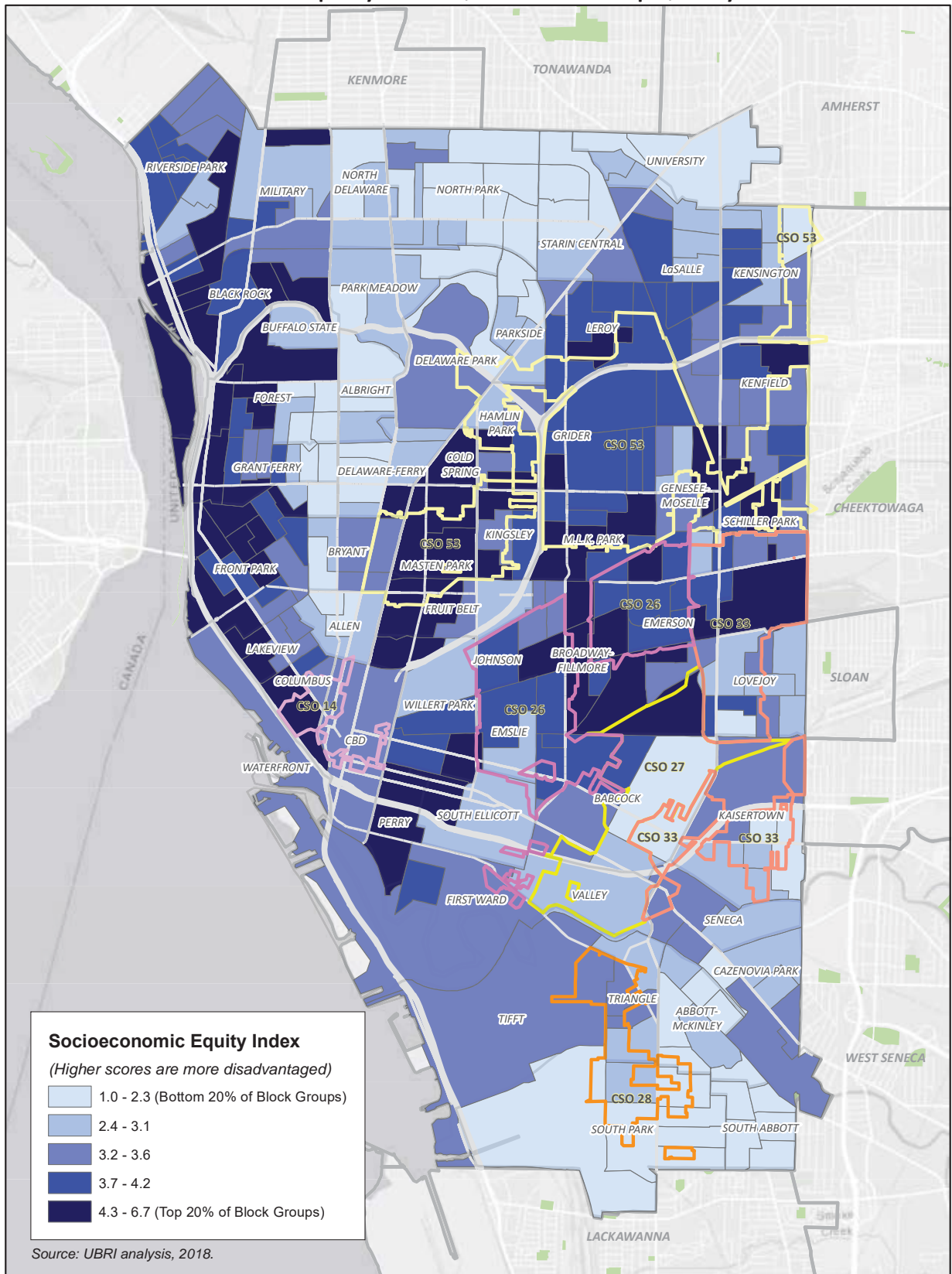
Figure 10

Traffic Proximity and Volume by Block Group, City of Buffalo

Vehicles per day within 0.5km divided by distance (m)

- 0 - 20
- 21 - 90
- 91 - 700
- 701 - 2,200
- 2,201 - 21,312

Source: US Environmental Protection Agency, EJScreen data, calculated from US DOT, Highway Performance Monitoring System, 2014.
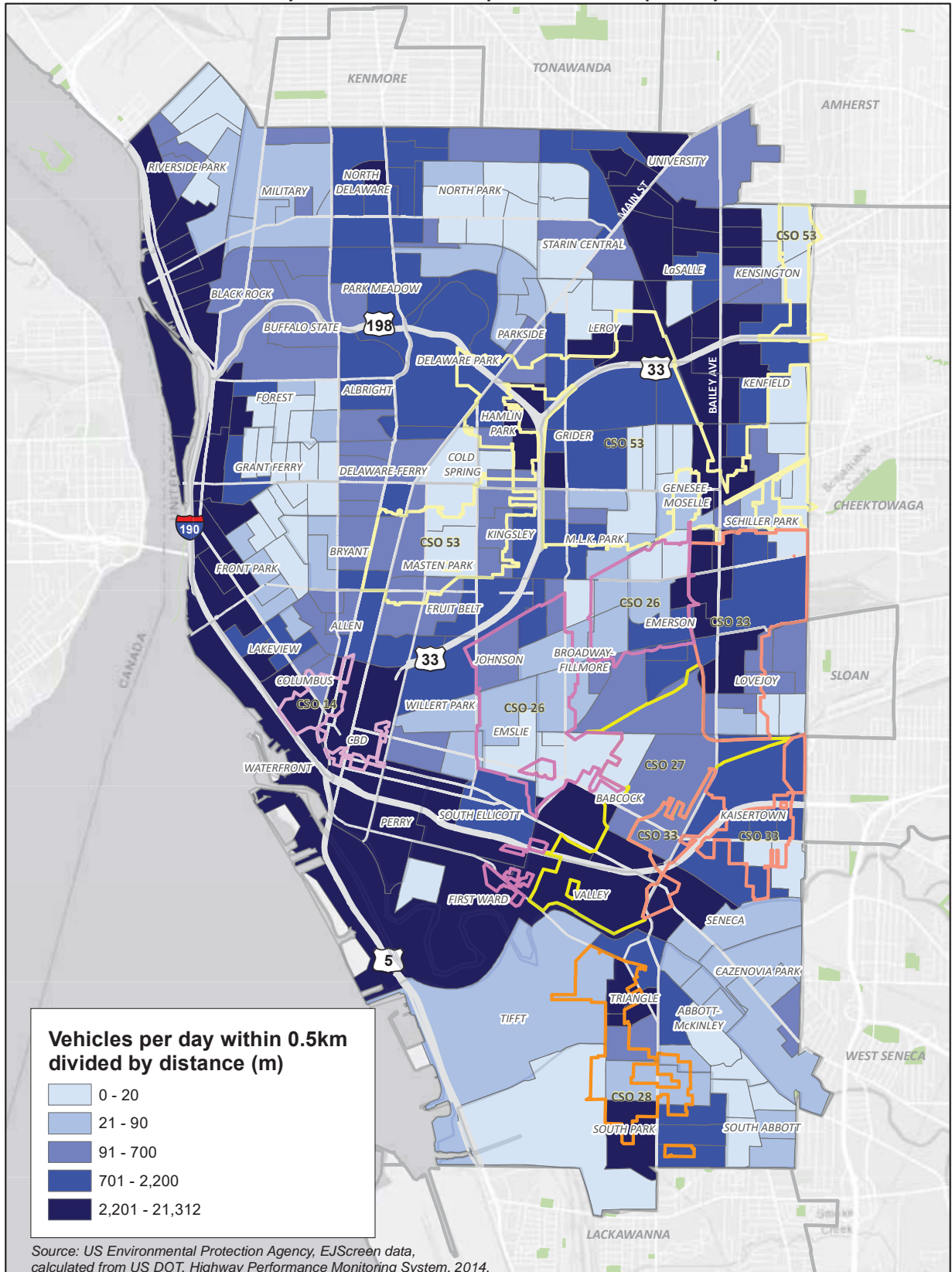
Figure 11

Ozone Levels in Air by Block Group, City of Buffalo

Maximum 8-hr level of Ozone in air in parts per billion

- 42.128 - 42.217
- 42.218 - 42.369
- 42.37 - 42.517
- 42.518 - 42.623
- 42.624 - 42.737

Source: US Environmental Protection Agency, EJScreen data, 2013.
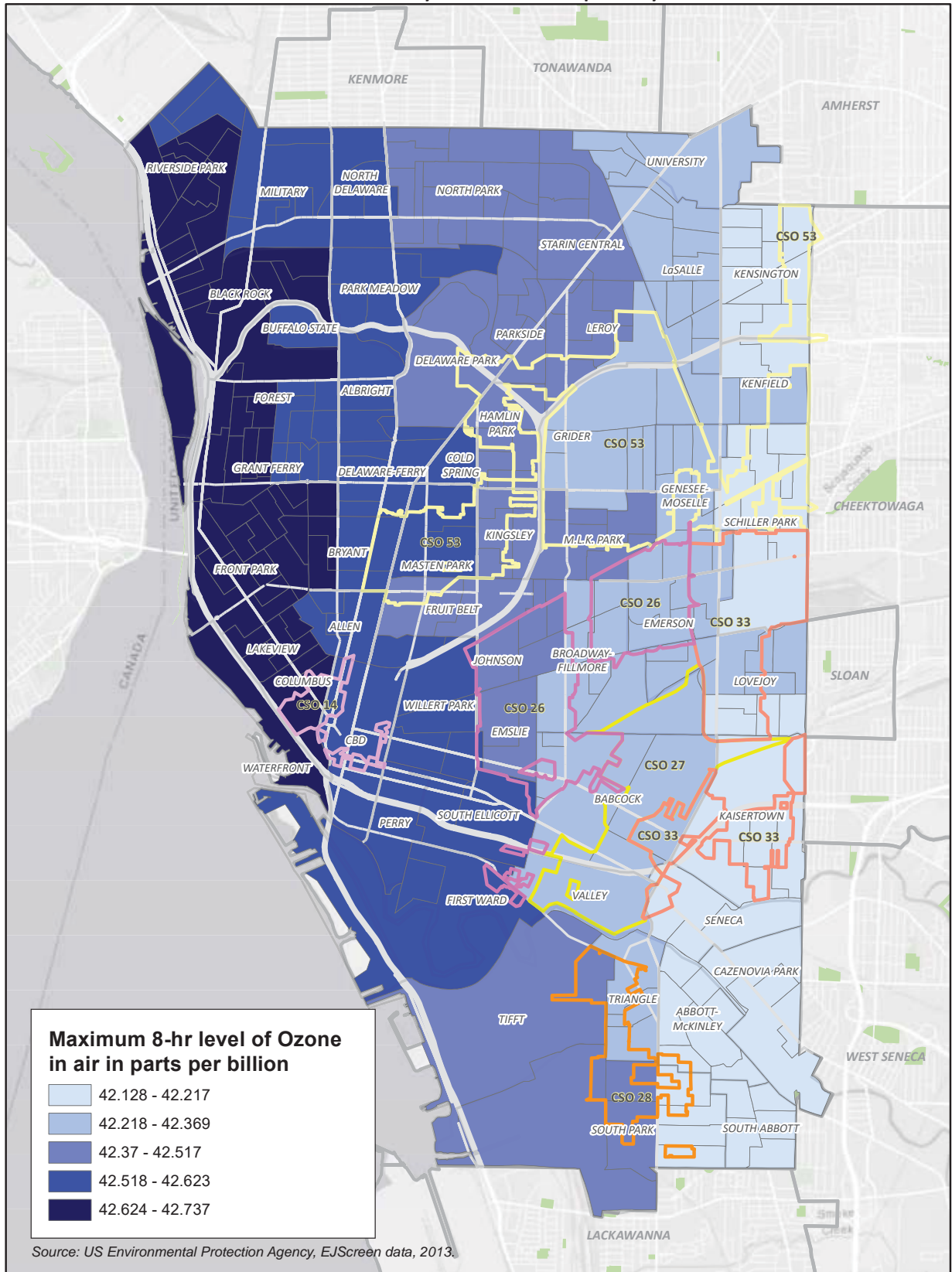
Figure 12

Particulate Matter (PM2.5) Concentration by Block Group, City of Buffalo

Particulate Matter (PM2.5) Concentration (µg/m^3)

- 9.902 - 10.1
- 10.101 - 10.2
- 10.201 - 10.25
- 10.251 - 10.3
- 10.301 - 10.43

Source: US Environmental Protection Agency, EJScreen data, 2013.
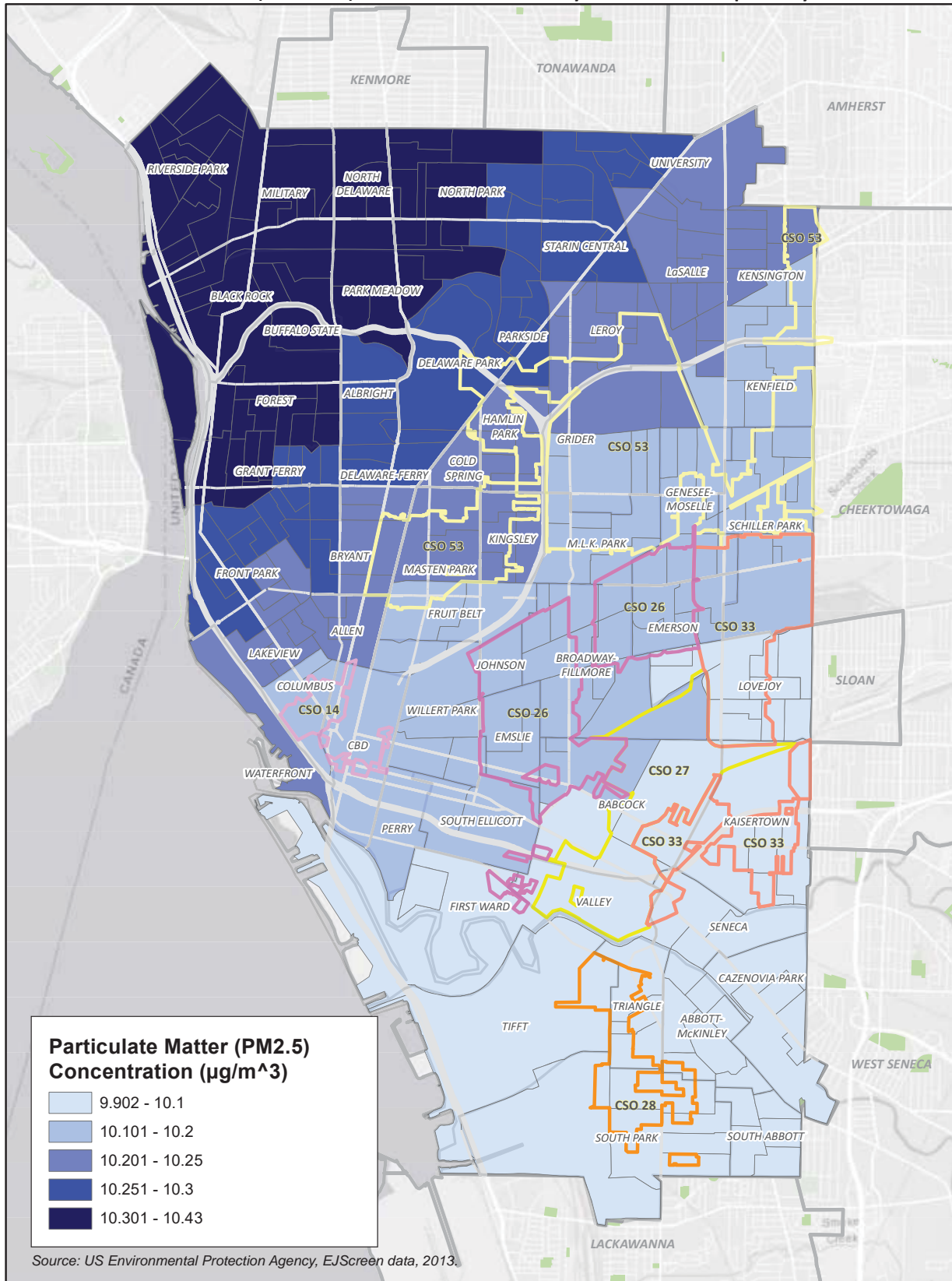
Figure 13

Average Walk Time to Public Open Space by Block Group, City of Buffalo

Average walk time (min.) from homes to a public park or playground

- 0 - 3.8
- 3.9 - 4.9
- 5 - 5.9
- 6 - 7.7
- 7.8 - 16.4

Source: UBRI analysis, 2018.
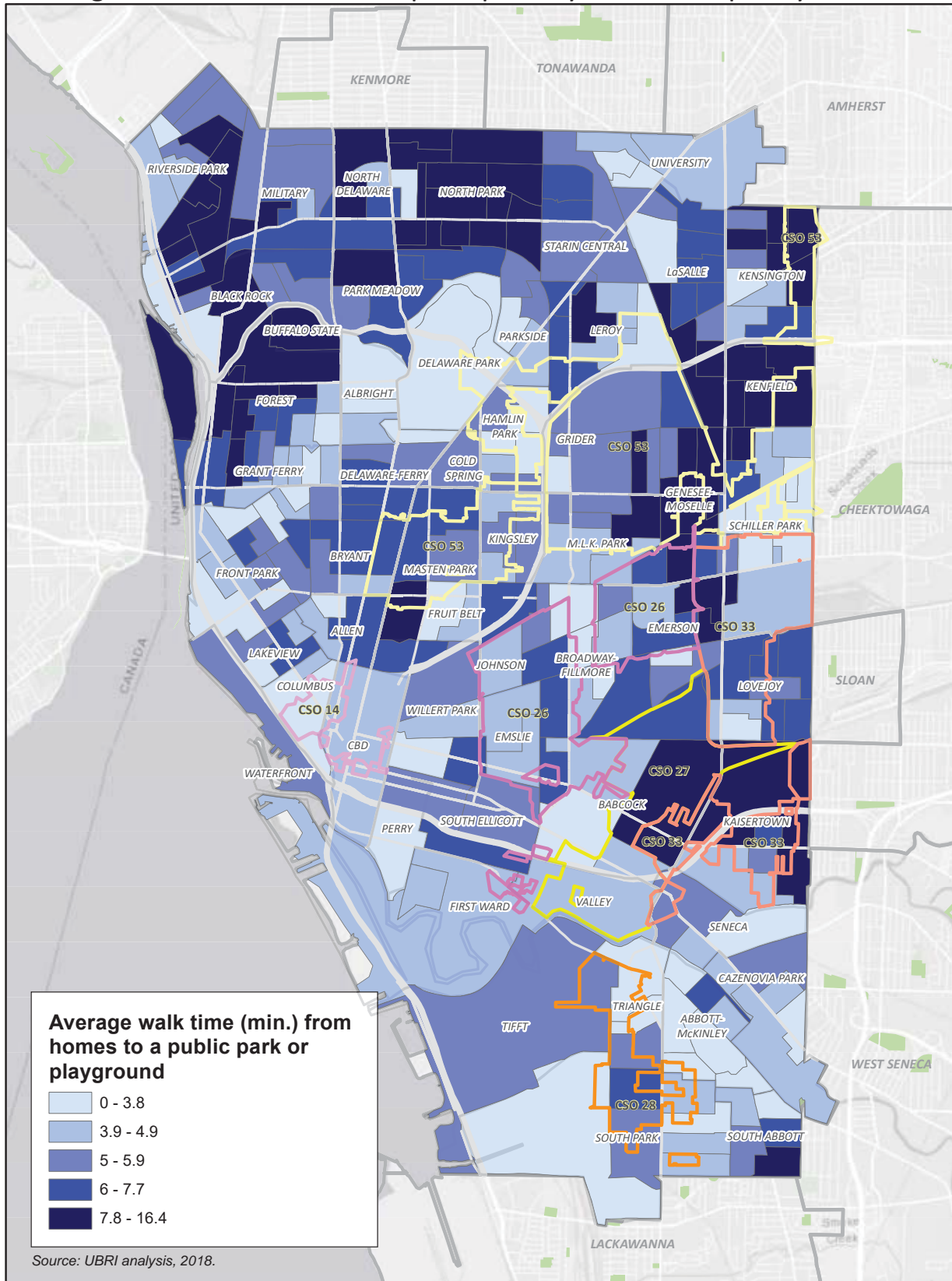
Figure 14

Tree Canopy Coverage by Block Group, City of Buffalo

% Land Area Covered by Tree Canopy

- 2.9% - 11%
- 11.1% - 15%
- 15.1% - 18%
- 18.1% - 22%
- 22.1% - 33.1%

Source: UBRI, Evolve, and Arcadis, 2018.
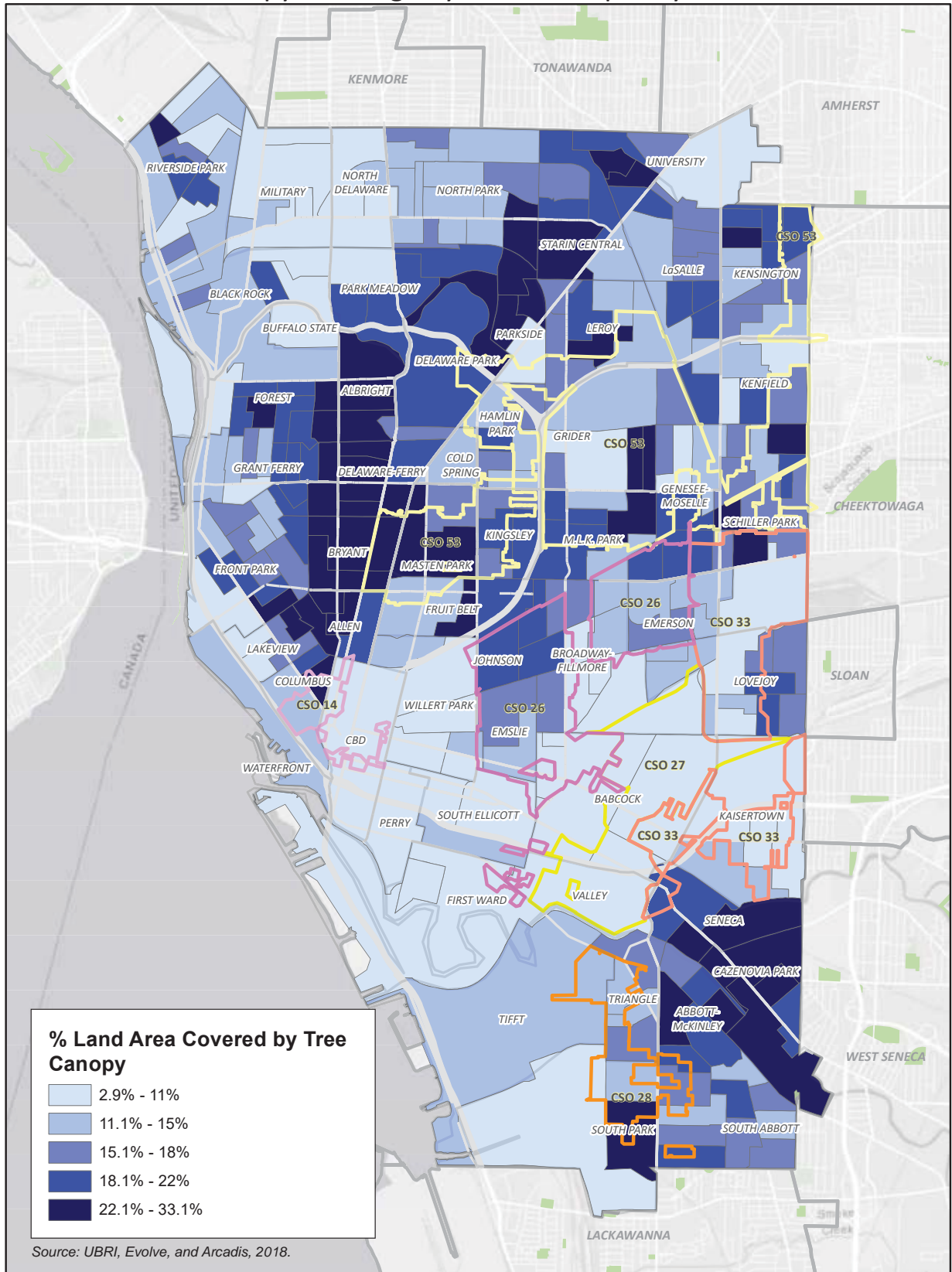
Figure 15

Impervious Surface Coverage by Block Group, City of Buffalo

% Land Area Covered by Impervious Surfaces

- 13.6% - 50%
- 50.1% - 60%
- 60.1% - 65%
- 65.1% - 70%
- 70.1% - 85.8%

Source: UBRI analysis of USGS, land cover data, 2011.
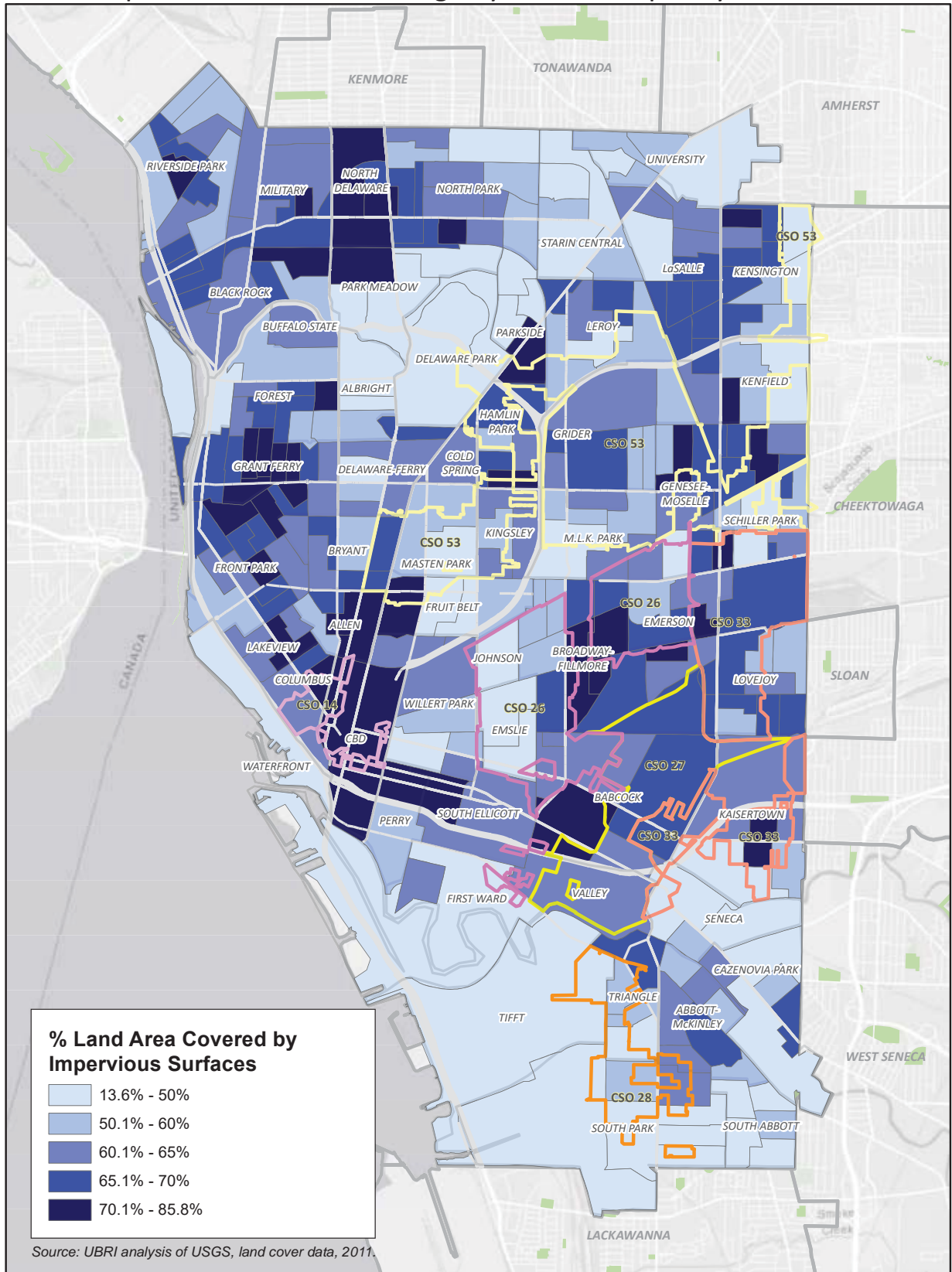
Figure 16

Vacant Land by Block Group, City of Buffalo

% Land Area that is Vacant Land

- 0% - 2%
- 2.1% - 5%
- 5.1% - 9%
- 9.1% - 18%
- 18.1% - 46.3%

Source: UBRI analysis of parcel data from Erie County, 2016.

Figure 17

Residential Vacancy Rates, City of Buffalo, June, 2018

Residential Vacancy Rate

- 0% - 5.5%
- 5.6% - 9%
- 9.1% - 14%
- 14.1% - 17%
- 17.1% - 50%

Source: HUD, USPS Address Vacancies, June, 2018
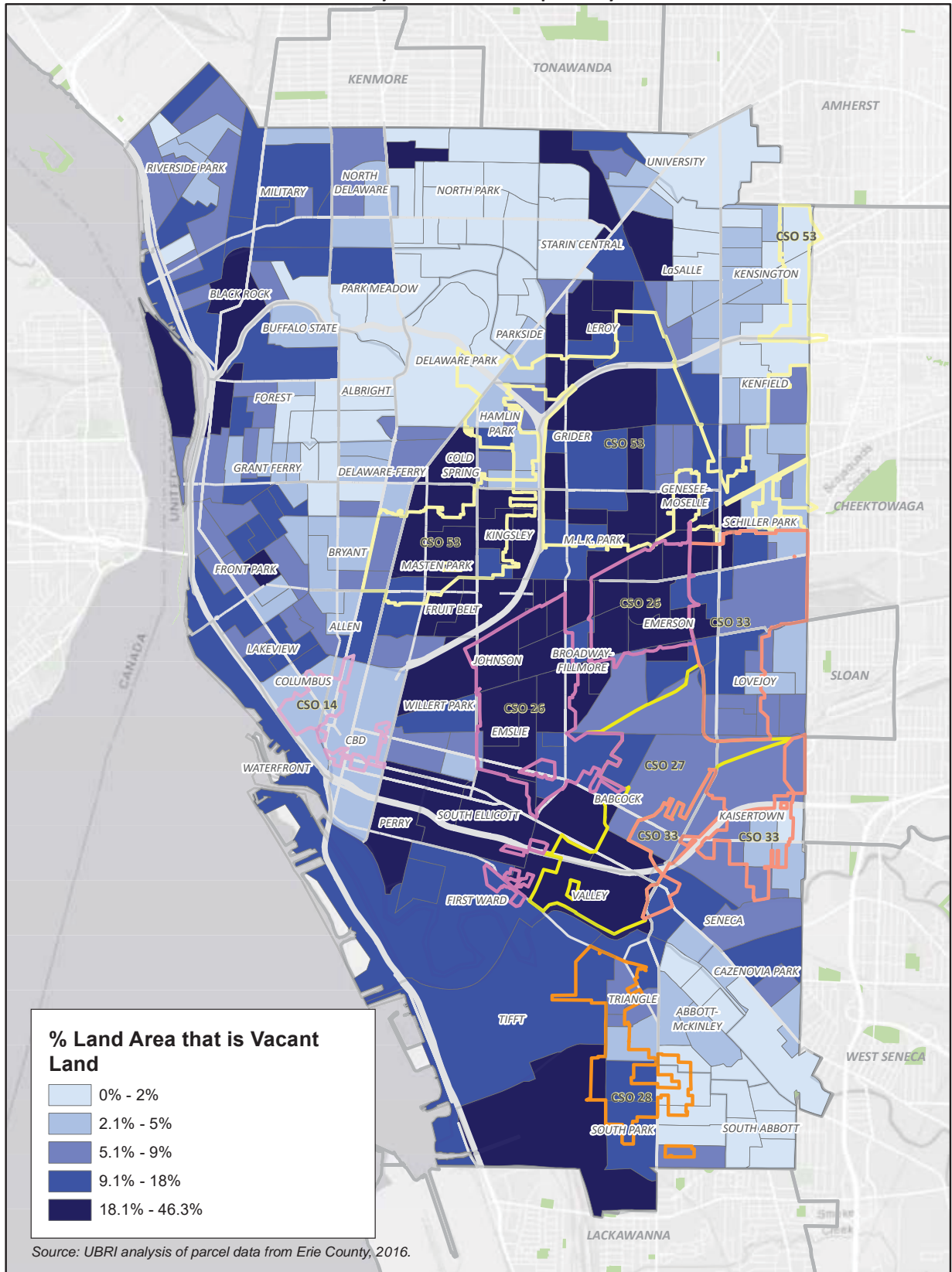
Figure 18

Commercial Vacancy Rates, City of Buffalo, June, 2018

Commercial Vacancy Rate

- 0% - 11.7%
- 11.8% - 15.9%
- 16% - 20.6%
- 20.7% - 26.1%
- 26.2% - 38.8%

Source: HUD, USPS Address Vacancies, June, 2018
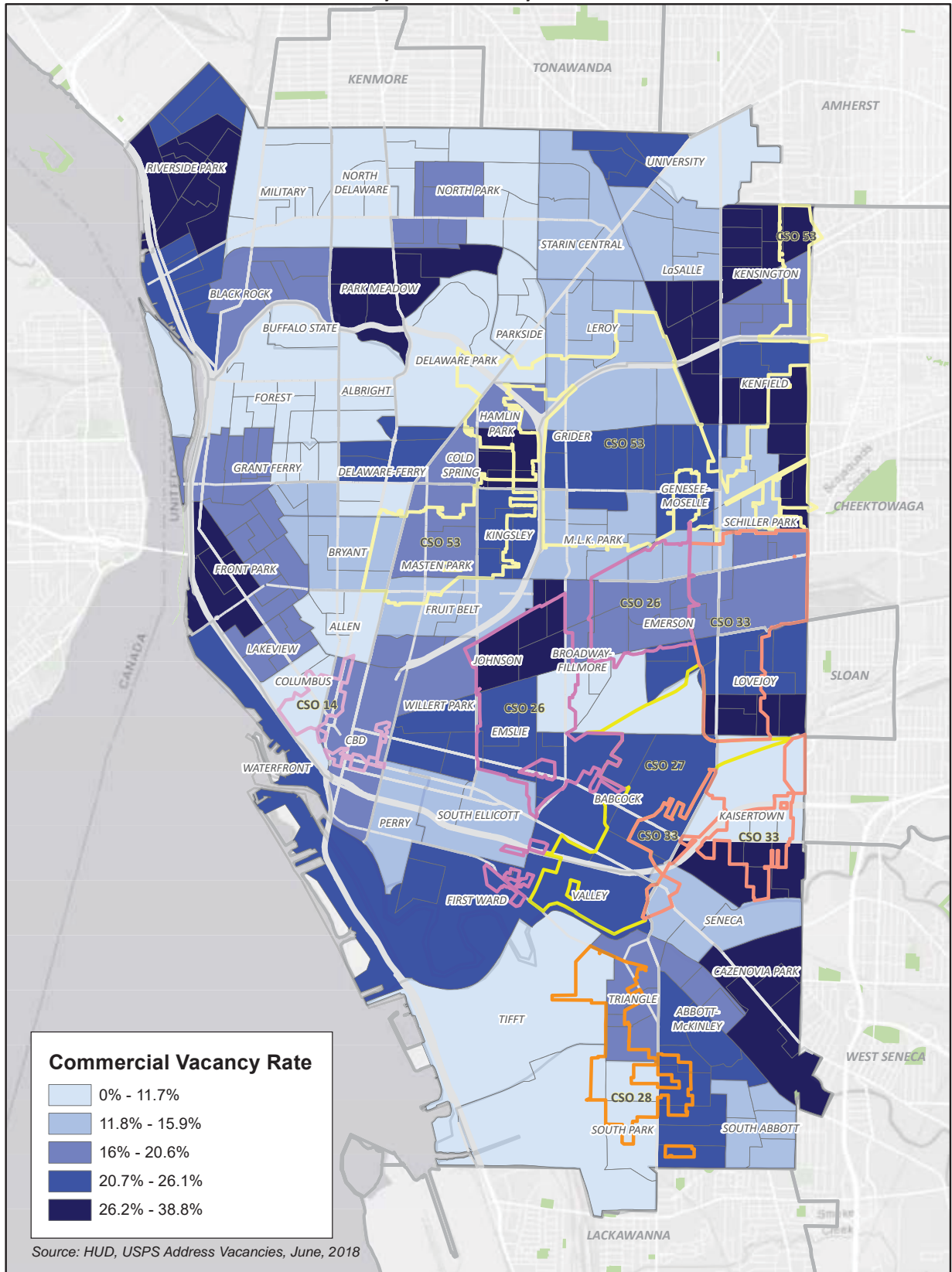
Figure 19

Environmental Equity Index, Block Groups, City of Buffalo

Environmental Equity Index

(Higher scores are more disadvantaged)

- 1.5 - 3.0 (Bottom 20% of Block Groups)
- 3.1 - 3.5
- 3.6 - 3.9
- 4.0 - 4.2
- 4.3 - 5.6 (Top 20% of Block Groups)
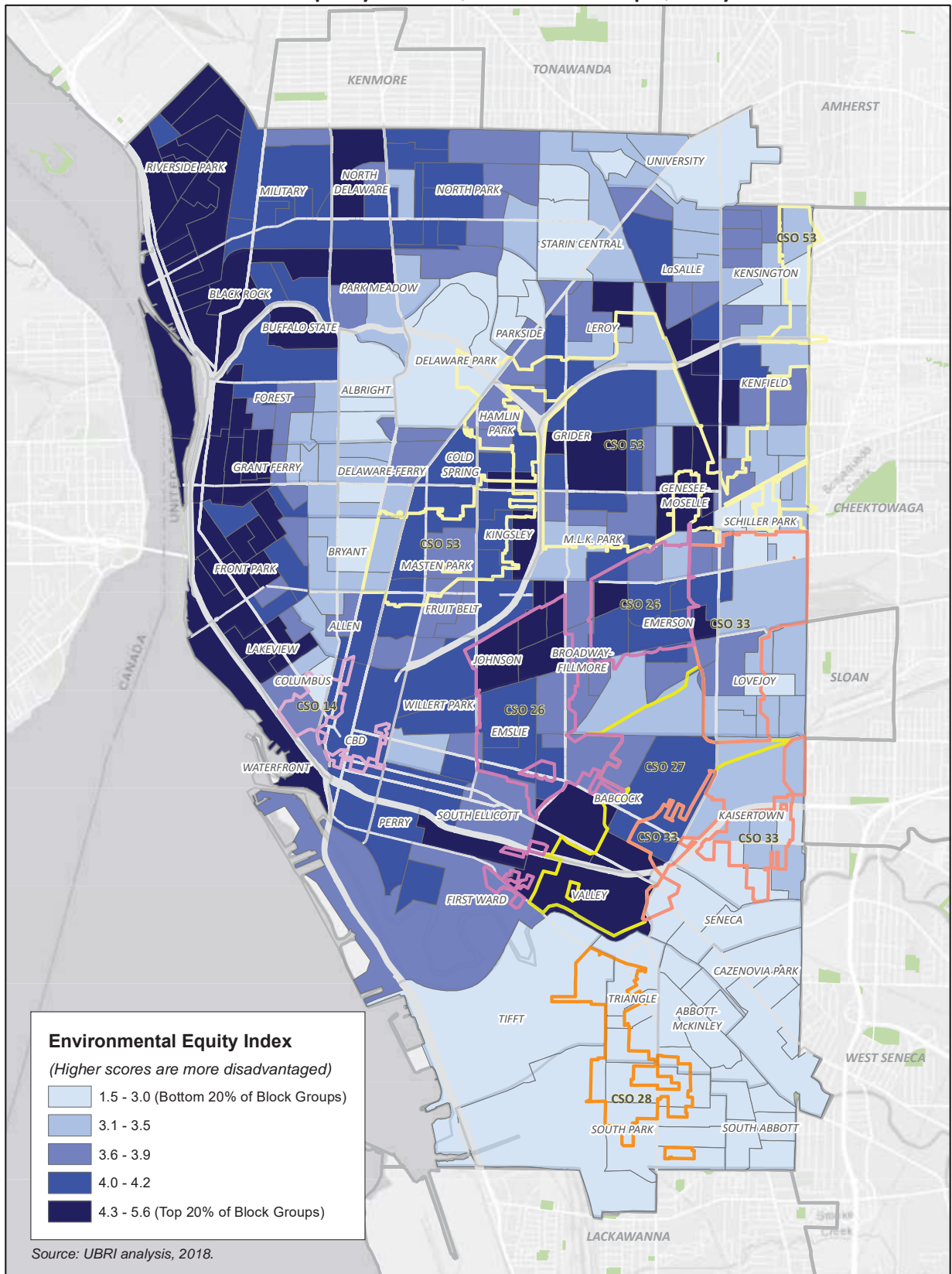
Source: UBRI analysis, 2018.

Figure 20

Green Infrastructure Equity Index, Block Groups, City of Buffalo

GI Equity Index Score

(Higher scores are more disadvantaged)

- 3.4 - 5.4 (Bottom 20% of Block Groups)
- 5.5 - 6.7
- 6.8 - 7.6
- 7.7 - 8.2
- 8.3 - 11.3 (Top 20% of Block Groups)

Source: UBRI analysis, 2018.