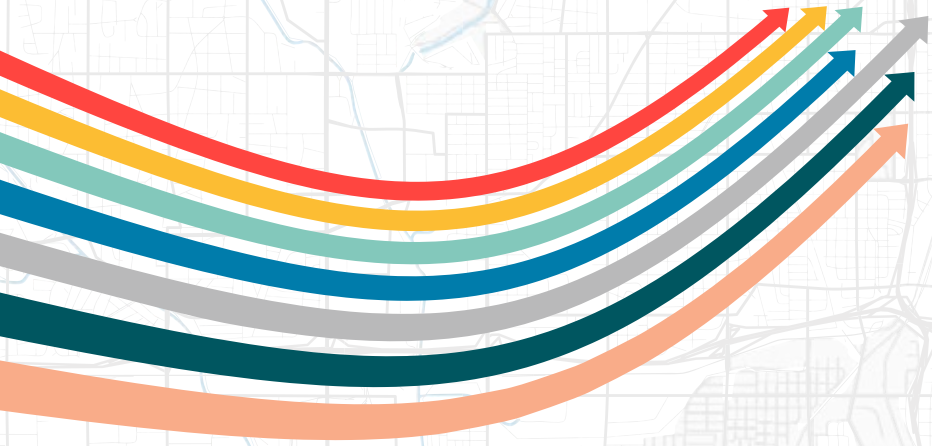
APPENDIX C

NATURAL AND BUILT ENVIRONMENT



Natural Environment

Climate

The MAPA region is located in the interior plains of North America and is within a transitional area between a generally humid climate to the east and an arid climate to the west. The area is not directly influenced by the presence of mountains, oceans, or large inland bodies of water that serve as climatic buffers. This combination of transitional location and lack of climatic buffers result in the region's large range of climatic extremes and rapid changes in weather conditions. The unimpeded invasion of large air masses of differing character is commonplace and often causes extreme weather events.

The MAPA region has a continental climate with relatively warm, humid summers and cold, dry winters. Most precipitation occurs between April through September in the form of showers or thunderstorms. Average annual rainfall is 30.4 inches and average annual snowfall is 27.6 inches. Average monthly climate data for the region are provided in Table C1.

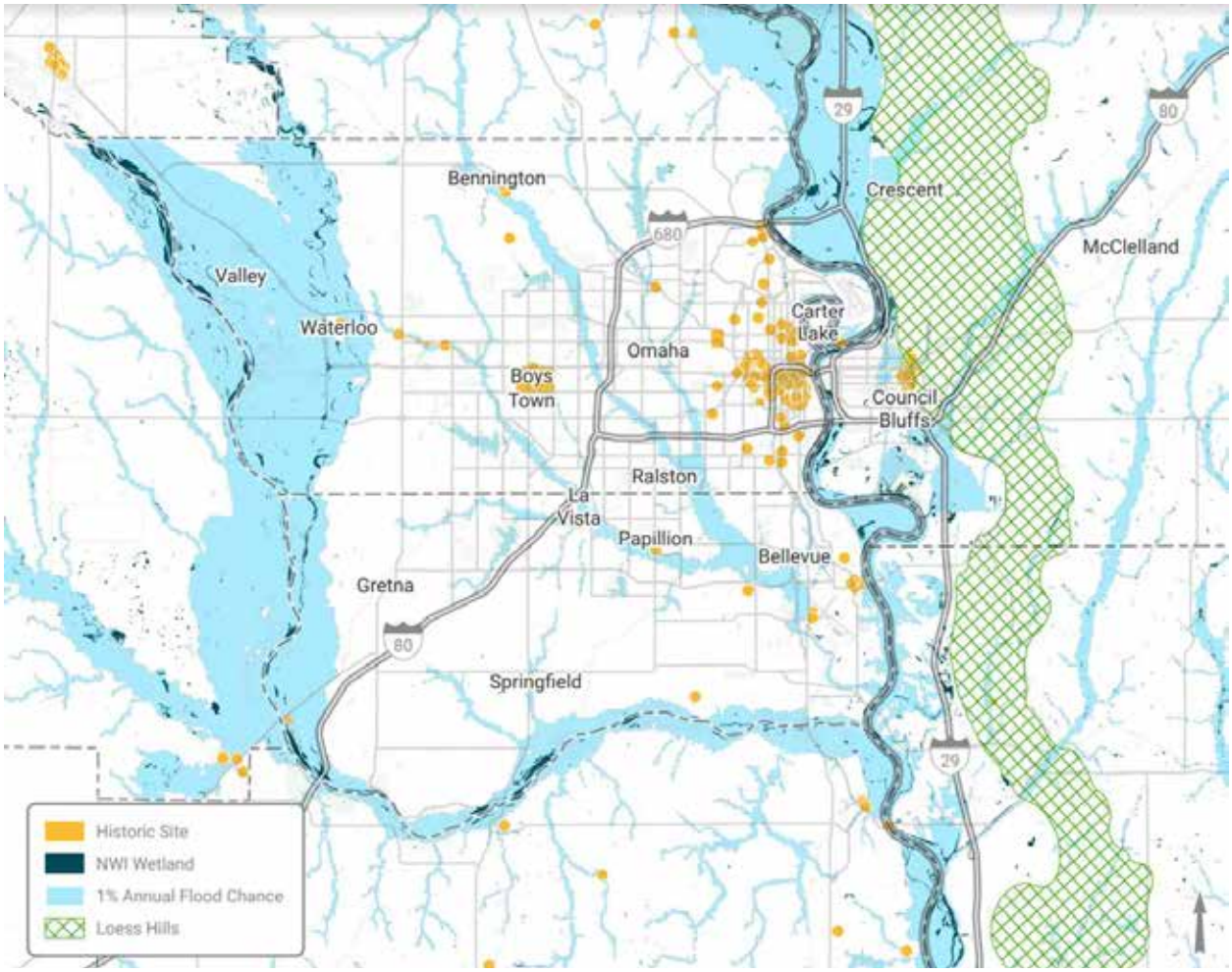
Table C1: Average Monthly Climate Data 1981-2010 Normals (Omaha Eppley Airfield)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AVG TEMP	23.5	28.1	39.5	51.7	62.3	72.1	76.7	74.6	65.7	53.2	38.9	26.0
MAX TEMP	33.4	38.1	50.9	63.7	73.8	83.2	8.73	85.1	77.6	64.7	48.9	35.3
MIN TEMP	13.6	18.1	28.1	39.8	50.9	61.0	66.2	64.0	53.9	41.6	28.8	16.7
PRECIP (IN)	0.72	0.85	1.99	2.96	4.76	4.18	3.83	3.82	2.68	2.15	1.64	1.04

Water Resources

Water sources exist in the MAPA region in the forms of major rivers, lakes, and streams. The Missouri River is the region's largest and most heavily used water resource, both commercially and recreationally. The Elkhorn, Nishnabotna and Platte rivers also traverse the region. Carter Lake and Lake Manawa are the region's two largest lakes, both formed by separate Missouri River floods that occurred in the late 1800s. There are also several key inland wetlands and floodplains in the area which must be considered when building or expanding local infrastructure projects. Figure C1 below shows these key water resources for the region as well as flood plains, historic properties, and the Loess Hills conservation district.

Figure C1: Flood Zones, Wetlands, Conservation Areas and Historic Sites

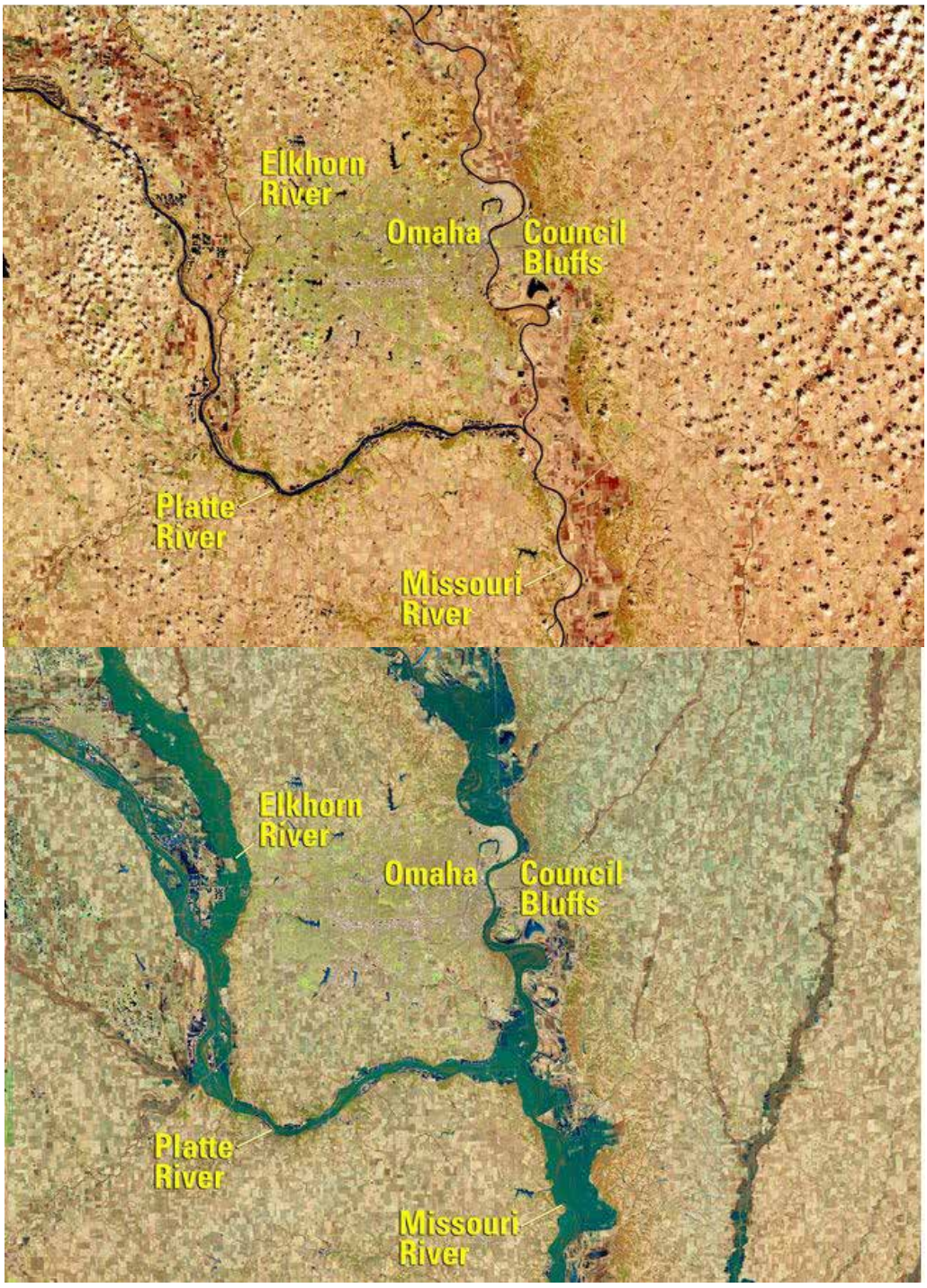


Climate Challenges: Flooding

The Papio-Missouri River Natural Resources District in Nebraska and Golden Hills Resource Conservation and Development in Iowa work to conserve, manage, and enhance the natural resources in the region, including land that is located in flood hazard areas. Flood hazard mitigation is accomplished in different ways, including channelization and dam rehabilitation projects, and by the purchase of properties located in the floodplain. Acquisition programs allow local jurisdictions to acquire properties in flood hazard areas and remove or demolish any structural properties. Once properties are acquired and structures are removed, land is restored to green space with restrictions on development put in place. Buyout programs were implemented with FEMA assistance as a result of Missouri River floods in 1993, 2011 and 2019. Programs as a result of the 2019 flood are currently in progress in Pottawattamie and Sarpy counties.

The flooding in 2011 was unprecedented for several reasons. Heavy rains and delayed snow melt in the upper river basin forced the U.S. Army Corps of Engineers to release record amounts of water from its network of dams. From June through September, portions of all five MAPA counties were inundated with water. Though levees did not fail, they were significantly strained by the record length of inundation. Several bridges and portions of Interstates 29 and 680 were closed off during the flood's duration. Other critical facilities in the region were hindered. The grounds of the Fort Calhoun Nuclear Generating Station were inundated, though the plant was in

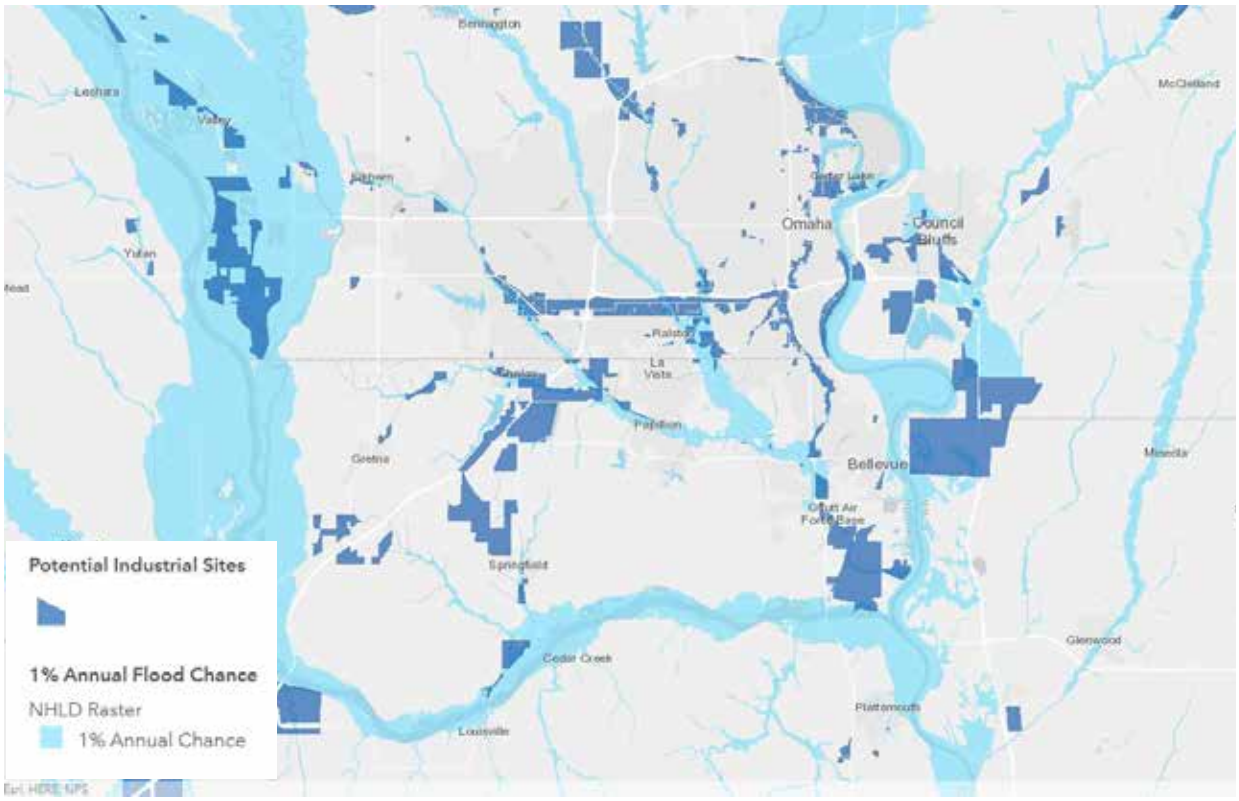
Figure C2: 2019 Spring Flooding Extents - March 2018 vs March 2019 Imagery



shutdown mode for non-related reasons. Eppley Airfield in Omaha had to expend massive resources to keep floodwaters at bay. In Spring 2019, a large weather event, coupled with record snowfall created a large flood event on the Elkhorn and Missouri Rivers which flow through the Omaha-Council Bluffs Metropolitan Area. As shown below (courtesy of NASA) flooding along the Missouri caused rivers to inundate many areas of the region, including Offutt Air Force Base in Bellevue. Portions of Interstate 29 and I-680 were closed for extended periods of time. Increased rainfall in plains states such as Iowa and Nebraska due to climate change has increased the potential for catastrophic flooding on an annual basis.

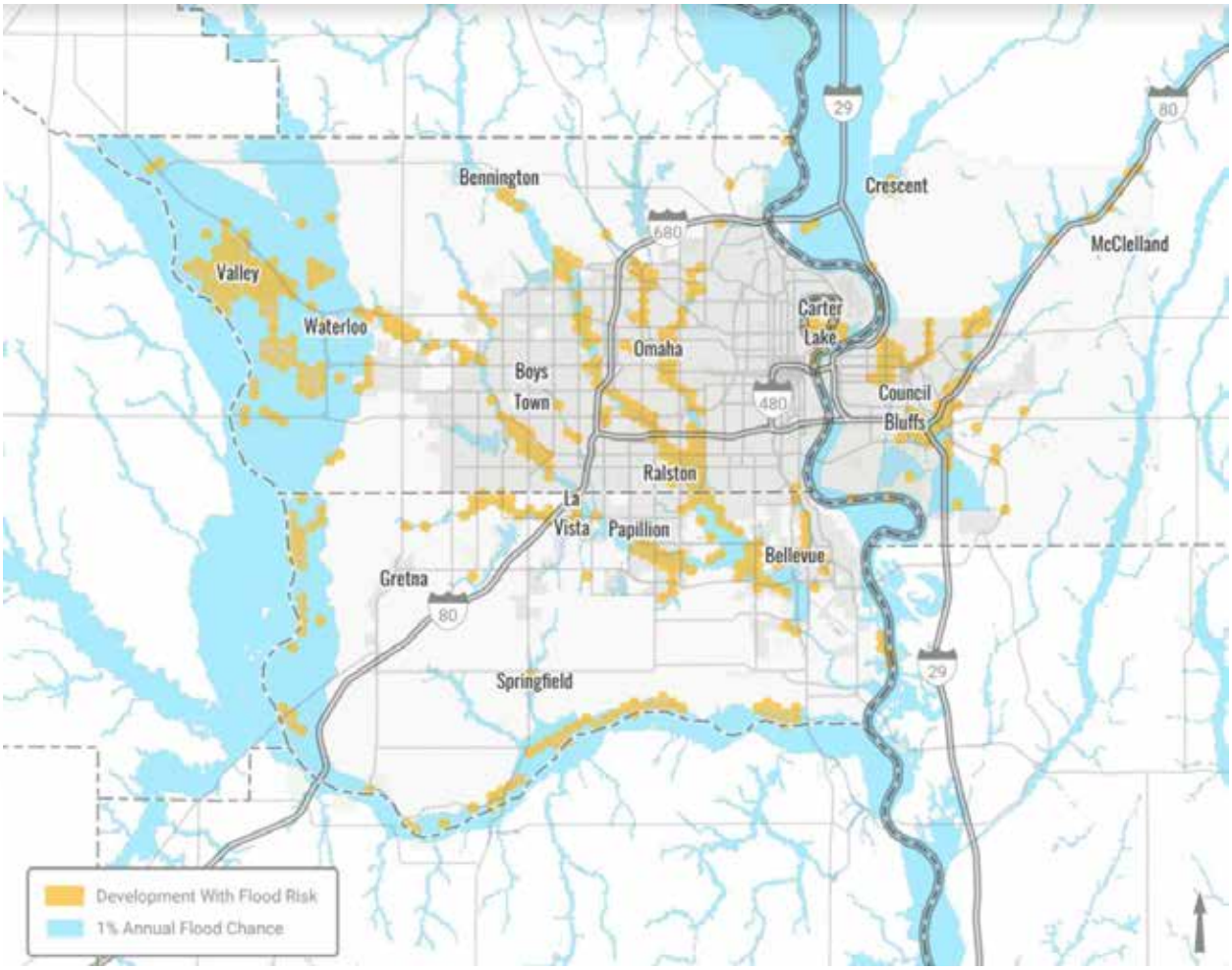
MAPA's regional development report includes a brief analysis of the impact that recurrent flooding will have on property and infrastructure in the region. Figure C3 shows areas of 1% annual chance of flooding and potential industrial sites. These sites are derived from local comprehensive plans. Industrial land uses are often at odds with flood risk. Many communities will identify industrial sites in areas where other land uses may not be suitable but the risk to potential future industrial development remains.

Figure C3: Floodplains and Planned Industrial Growth in the MAPA Region



Similarly, Figure C4 includes grids with commercial and residential parcels that are within flood areas. The 1% annual chance flood areas are based on elevation modeling and the presence of flood control structures but only estimate the location of areas that could be impacted.
Within the metro area we estimate that approximately $3.3 billion in property value is at risk of flooding.

Figure C4: Floodplains and Property at Risk, MAPA 2020 Regional Development Report



Air Quality

The Clean Air Act, as amended in 1990, requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants deemed harmful to humans and the environment. Air quality sensors in both Nebraska and Iowa continuously monitor the levels of harmful gasses, particulates, and elements contained in the ambient air of the MAPA TMA.

As of January 1, 2016, the entire MAPA TMA is in attainment for EPA air quality standards. Though these are likely to change in the coming years. Figure C5 shows the current allowable levels of ground ozone and the Omaha-Council Bluffs levels. In 2008 ozone levels dropped slightly, due to the economic recession, but rose after 2010 during the economic recovery. MAPA's "Little Steps, Cleaner" was designed to educate residents of the region about air quality issues and actions they can take to improve air quality. Since 2012, this program has been funded with support from both the Nebraska Department of Roads and Iowa Department of Transportation with Congestion Management & Air Quality (CMAQ) funding. In recent years the region's design value for ground-level ozone has remained below the standard, but future regulatory changes related to the NAAQS could result in non-attainment for the region. This designation would have significant impacts on the transportation planning process. Hotter summer weather and increases in transportation emissions could threaten our ability to maintain non-attainment status. Figure C6 shows the locations of air quality monitors throughout the region.

Figure C5: Omaha-Council Bluffs Ground-Level Ozone Design Values, 2010-2019

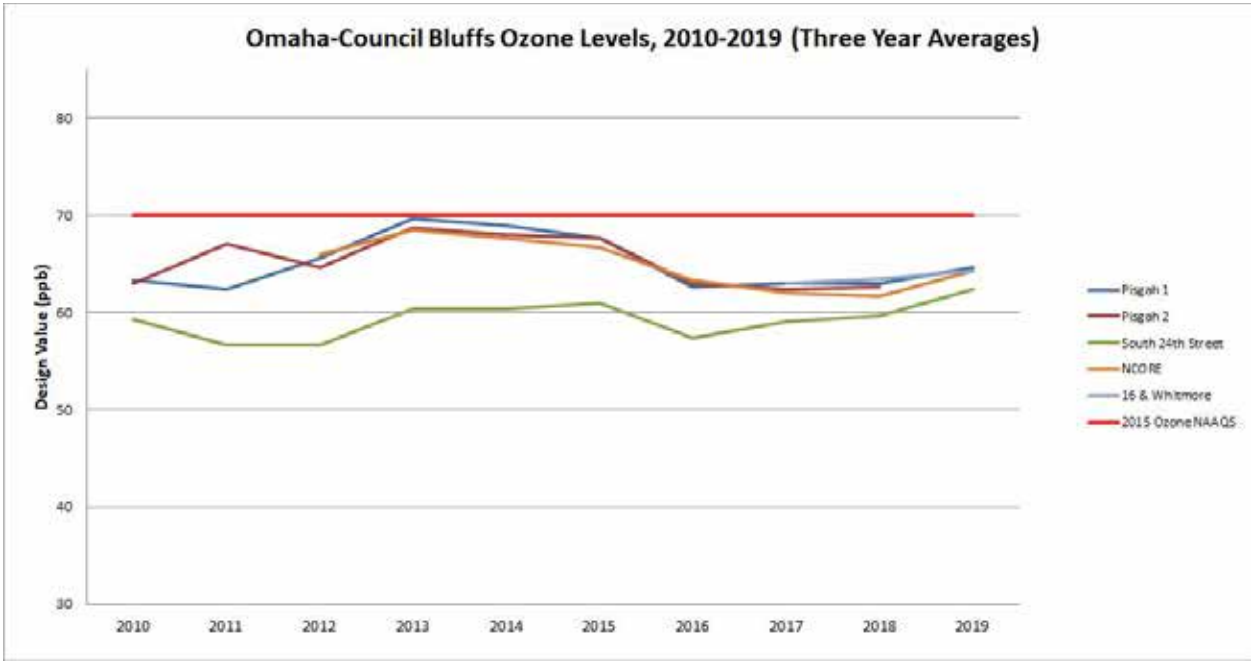
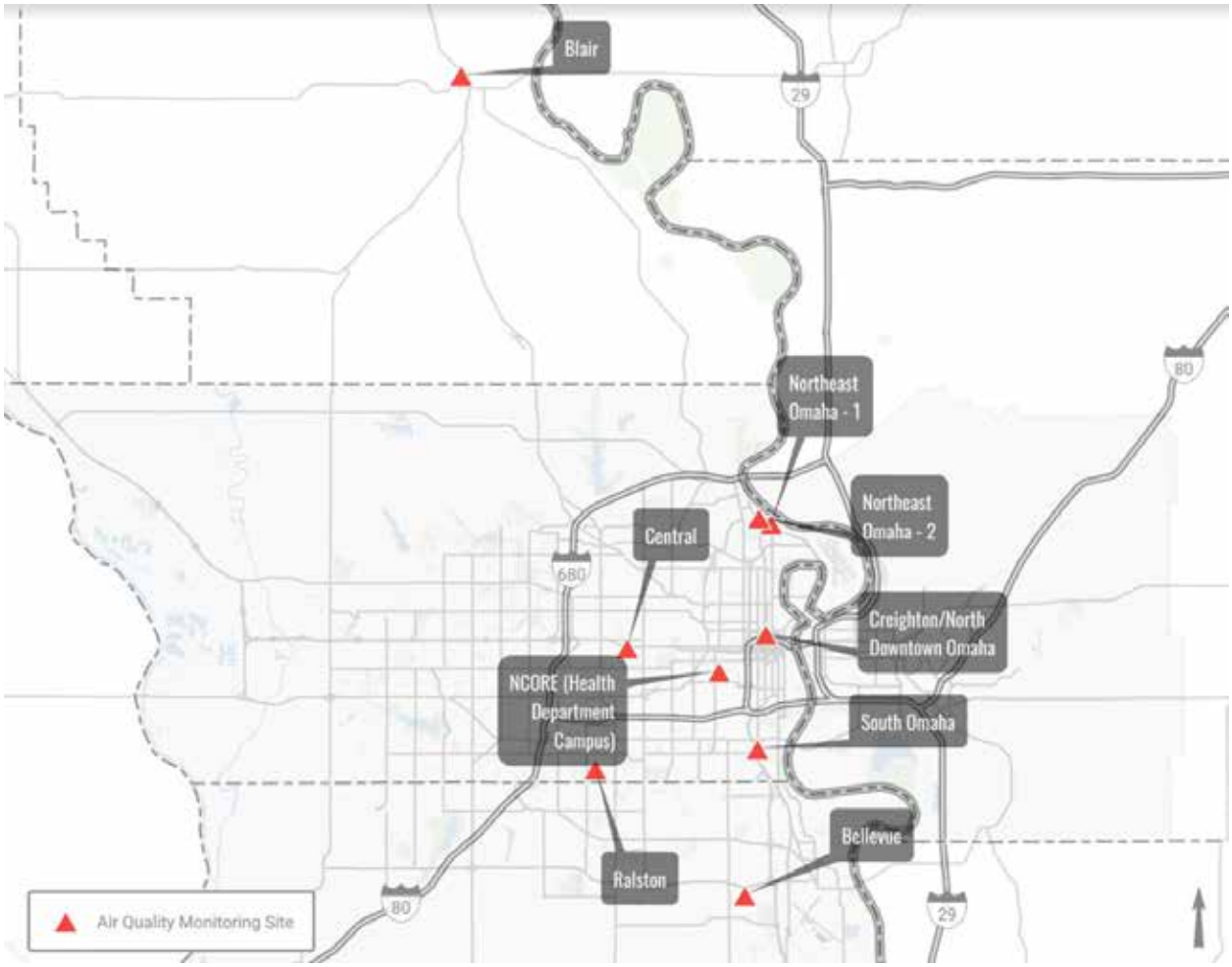


Figure C6: Air Quality Monitoring Locations, Omaha-Council Bluffs Metro

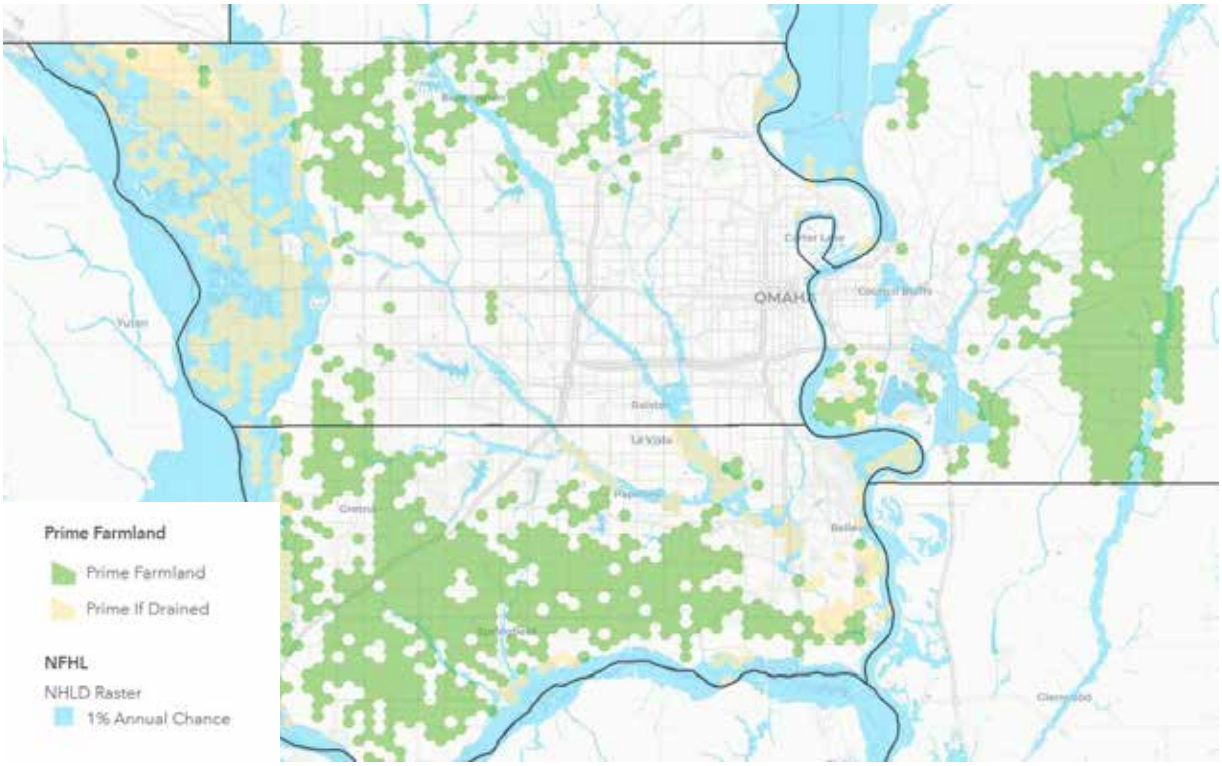


Soil characteristics

The MAPA region is in the Great Plains region of the United States. The soils of the region have developed on the rolling hills of eastern Nebraska and western Iowa and formed in three kinds of parent material: Peoria Loess and younger loess, glacial till, and alluvium. The soils on the bottom land in the valleys of the Elkhorn, Missouri, and Platte rivers formed in alluvium. This alluvium ranges from clay to sand and is commonly stratified. The composition of soils in the MAPA region—and the Midwest in general—is highly conducive to agriculture. The USDA classifies land by soil type through their Natural Resource Conservation Service (NRCS). Using soil composition, slope, and the presence of flooding they rate agricultural acres across the country to identify areas that are highly suitable for farming. These areas are referred to as Prime Farmland. Figure C7 illustrates the intersection of Prime Farmlands and flood zones in the Omaha-Council Bluffs metropolitan area. Much of the metro area once represented some of the most suitable farmland in the country. These conditions still exist in greenfield areas and when drained, in flood prone areas. In developable areas prime farmland conditions exist in:

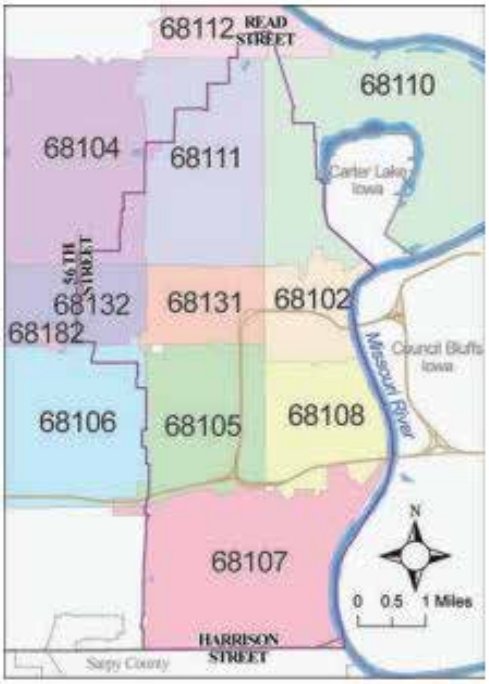
- 49% of Douglas County greenfield acres
- 65% of Sarpy County greenfield acres
- 82% of Pottawattamie County greenfield acres

Figure C7: Prime Farmland in the MAPA Region, MAPA 2020 Regional Development Report



Soil in the urbanized portion of the MAPA region has endured contamination resulting from heavy industry. From the 1870s until the late 1990s, the lead-refining plant Asarco operated on 23 acres along the Missouri River near downtown Omaha. Lead and other heavy metals were emitted into the air and deposited on the ground surface during the plant's operation.

In 1998 the Omaha City Council solicited assistance from EPA to address problems with lead contamination. Soil testing of approximately 22,000 residential properties revealed widespread lead contamination over eastern Omaha. Lead is classified by EPA as a probable human carcinogen and is a cumulative toxicant. The contamination area was added to the National Priorities List by EPA in 2003. The Omaha Lead Site is the area of eastern Omaha where there are many yards that have unsafe levels of lead in them that came from historic industrial air emissions. Lead in yards might have also come from loose and flaking lead-based house paint, auto exhaust and industrial emissions.The lead was blown in many directions by the wind and fell to the ground in the area which was the Omaha Lead Site. Houses, apartments, child care centers, schools, parks and other residential properties are in the site. The impacted area covers approximately 17,921 acres, or 27.0 square miles. Cleanup is still underway and there is currently no fixed end date for remediation. In December 2015, EPA completed the EPA-lead action at the site. Between 1998 and 2015 EPA collected soil samples from 42,047 residential properties.

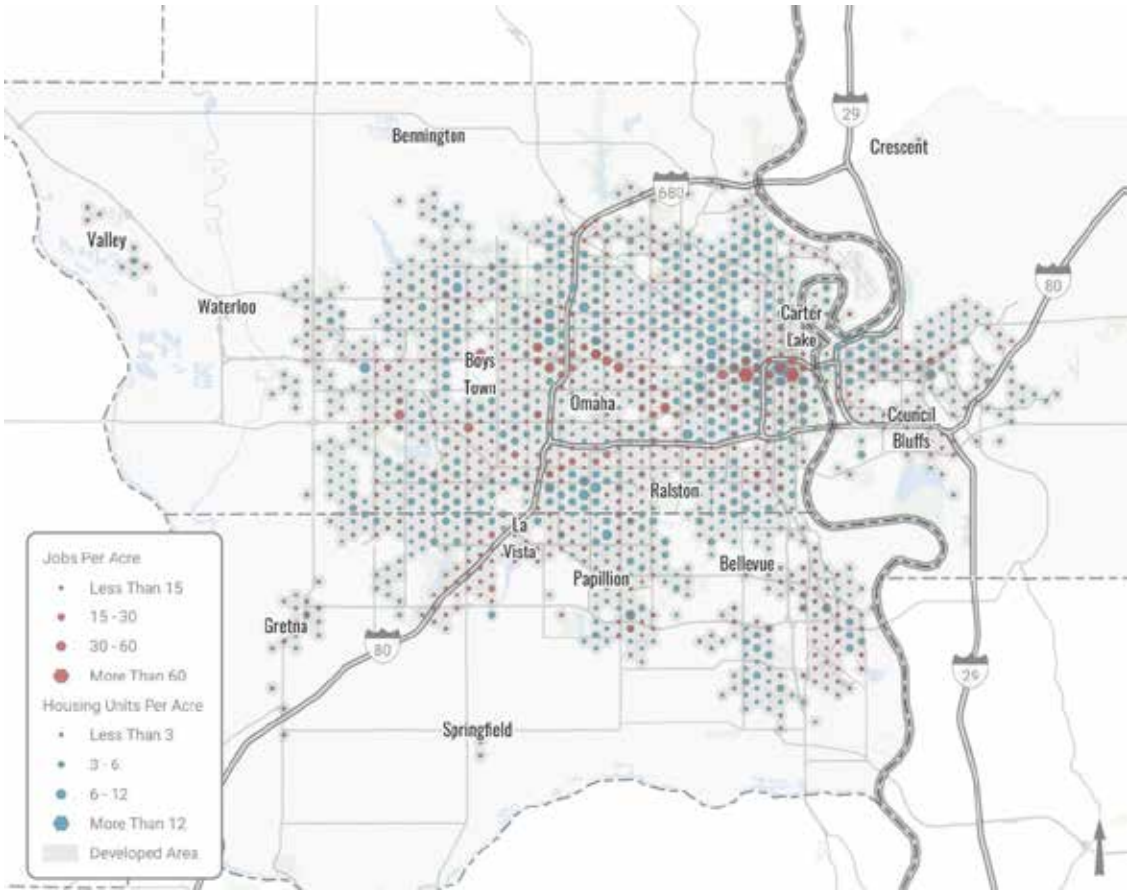


Omaha Lead Site Area

Built Environment

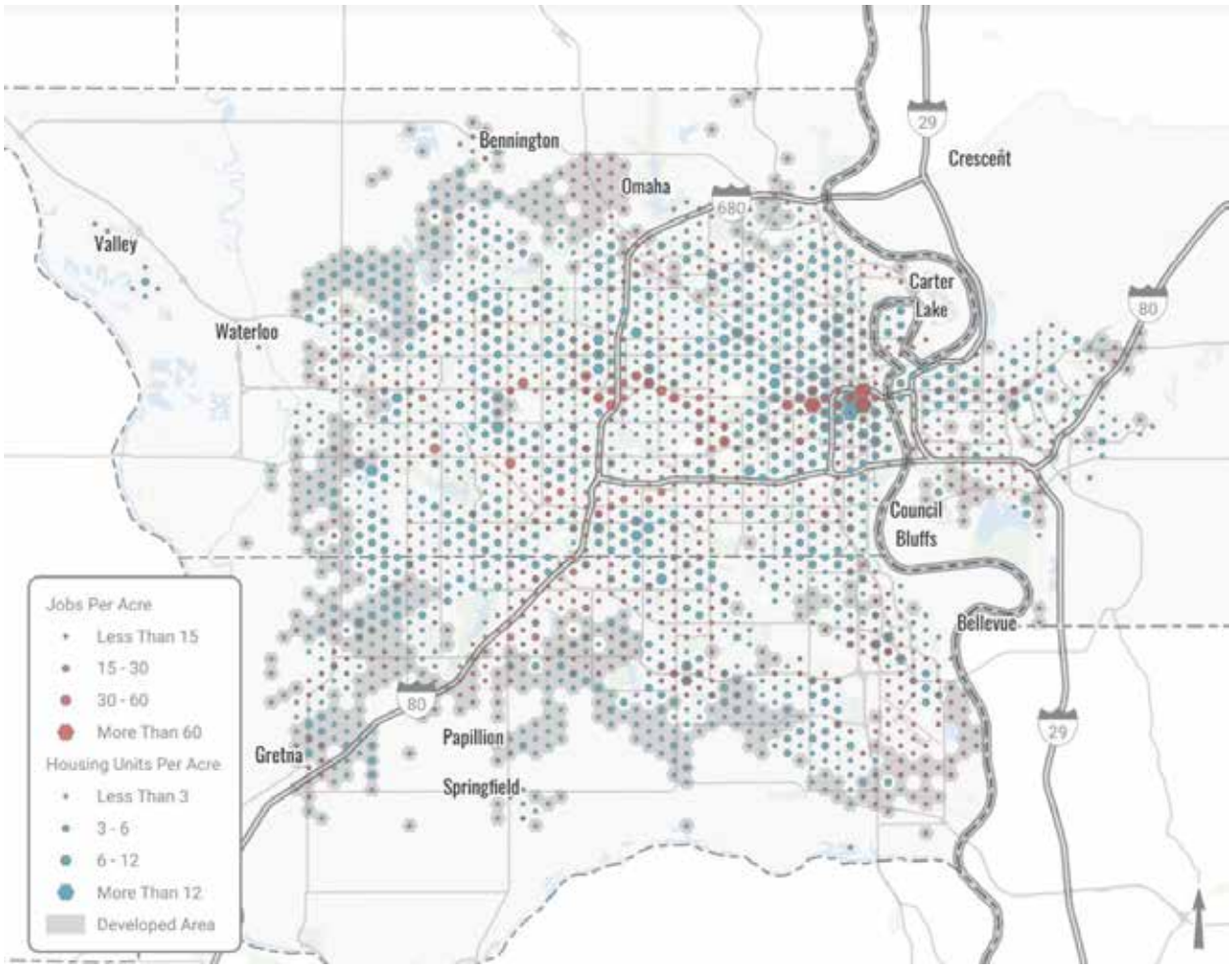
Development of the built environment is a large component of the planning work conducted by MAPA and partnering jurisdictions, agencies and groups. Creating a vibrant and inclusive built environment is paramount to the future vitality of the Omaha-Council Bluffs Metropolitan Area. Planning initiatives like Heartland 2050, Close the Gap, and ConnectGO are designed to promote walkable, dense, multi-modal built environments across the Metropolitan Area, both for the health and well-being of its residents, but for the long term sustainability of the region from a financial standpoint. Current land use and growth patterns show a loss of jobs and housing in the urban core of Omaha, with considerable westward and southward expansion into Douglas and Sarpy County. This current land use direction adds additional strain to the existing transportation network, and creates a loss of farm and industrial land that is turned into housing. Figure C8 illustrates the existing distribution of population and employment in the Omaha-Council Bluffs Region.

Figure C8: Existing Land Use in the MAPA Region



The Heartland 2050 Land Use Scenario projects land use that preserves existing agricultural land and keeps existing urban and suburban centers. Land use strategy is an important factor in reducing the total number of vehicle miles travelled in the region, making transit service more efficient, and supporting non-motorized modes of transportation such as walking and biking.

Figure C9: Heartland 2050 Land Use Scenario Map

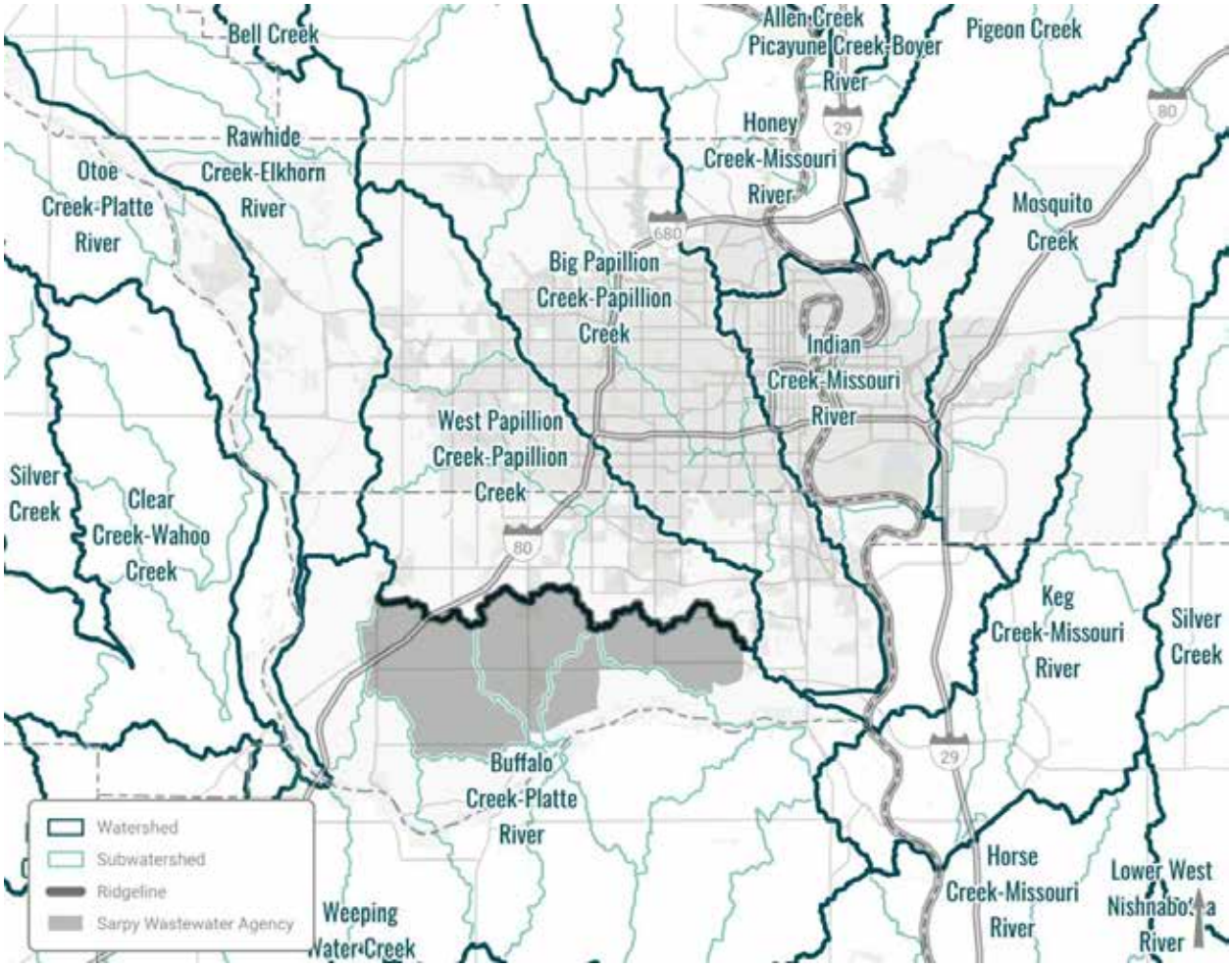


The Heartland 2050 Land Use Scenario prioritizes maintaining existing resources through infill and contiguous suburban and rural development. Through well planned and connected development, housing and employment options will be preserved and expanded upon for the entire region.

In 2018, communities in Sarpy County began a process to develop new sewer system capabilities in the southern portion of the county, often referred to as the “ridge line” separating the Papillion Creek Watershed from the Platte River watershed. The Southern Ridge Wastewater Treatment Study addressed the fact that outside of Springfield, the southern portion of Sarpy County was without sewer service, which was serving as a de facto growth boundary, although

unofficial. This fundamental change to the development pattern of the region took place after the Heartland 2050 Land Use Scenario was created.

Figure C10: Watersheds and Sewer Basins in the MAPA Region



Map depicting the ridgeline between the Papillion Creek and Platte River Watershed districts. Map courtesy of the Southern Ridge Wastewater Treatment Study.

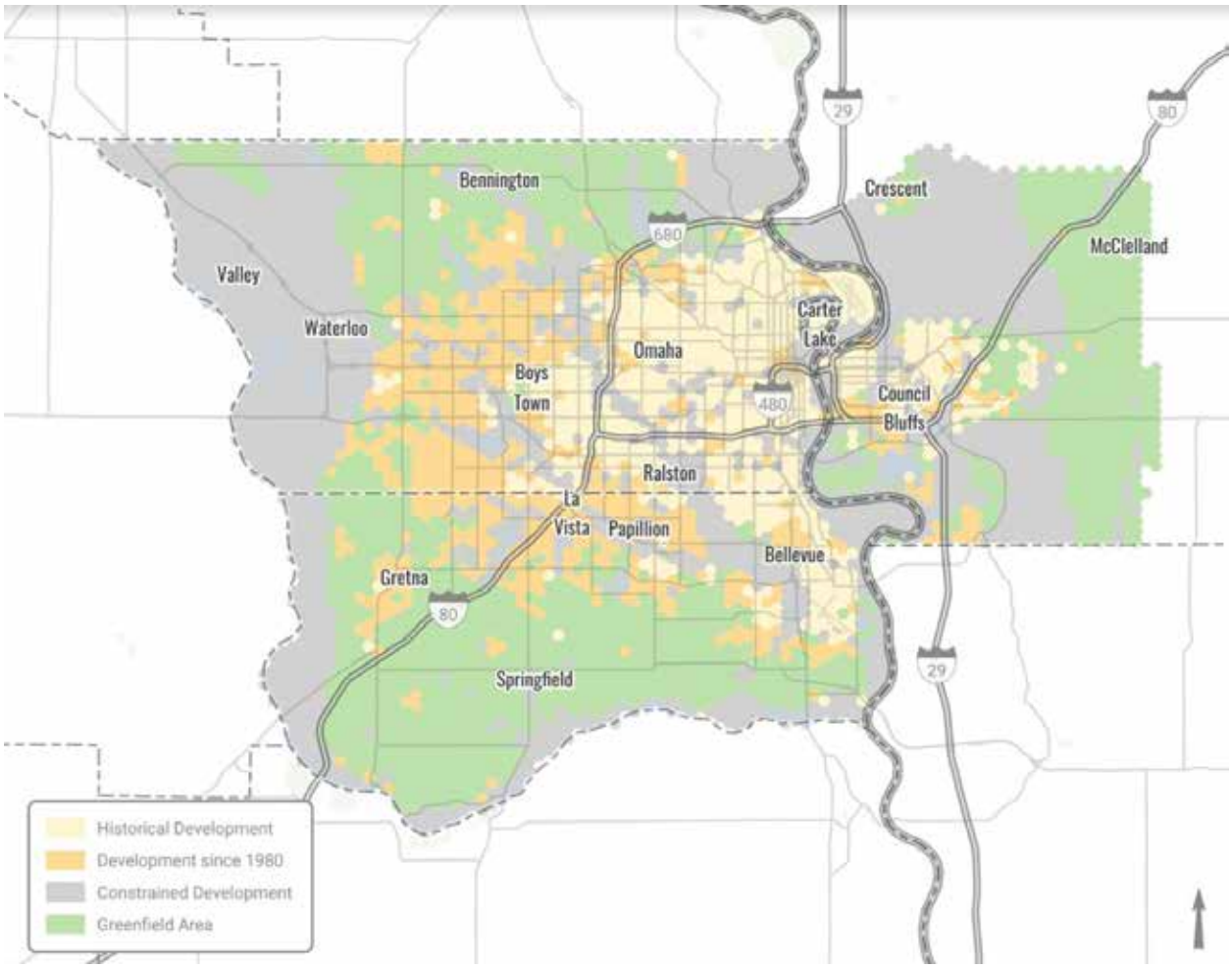
Land Available for Development

Using parcel data, MAPA's Regional Development Report classified the available land area and calculated how it developed over time. As of 2019, the total land consumed by these uses is summarized below:

- Developed Area - 112,988 acres
- Constrained Area - 174,328 acres
- Greenfield Area - 146,094 acres

Figure C11 illustrates the distribution of these areas in the MAPA region as of 2019. The Developed Area includes built structures in the urban and suburban areas of the region. This data is split into historical areas of activity (light orange) and development that has occurred since 1980 (dark orange). The Constrained Area includes land subject to flood risk, cultural resources, and conservation areas such as the Ponca Hills and the Loess Hills. These areas do include some development but the outcome of the analysis is not intended to identify future development in constrained areas. As a result, these areas are excluded from our estimates of future growth. The Greenfield Area includes open space and land that is dedicated currently to agriculture. These areas have future development potential and have comprised a large share of total development activity historically.

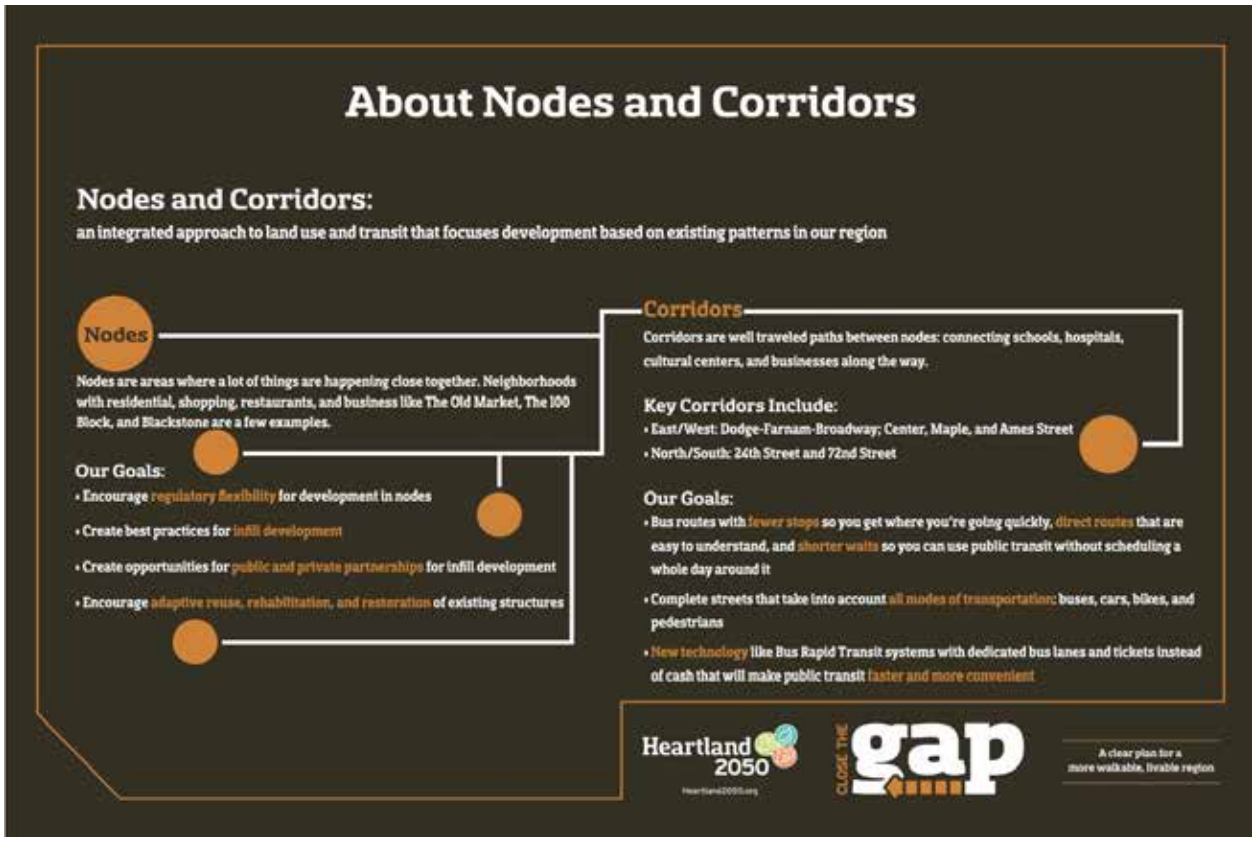
Figure C11: Developed and Greenfield Areas in the MAPA region, 2019



Nodes & Corridors

The land use strategy of Nodes & Corridor development consists of developing and maintaining mixed-use, walkable districts or neighborhoods, connected by strategic corridors which promote

multi-modal transportation for commuting or recreation. The driving force behind the Heartland 2050 Vision is the question: “How and where do we grow?” As part of the Heartland 2050 effort, the Nodes & Corridors Committee identified nodes (current and future mixed-use, high density areas) throughout the region, and the corridors (multi-modal connections) between these areas, in order to focus and coordinate the transportation, housing and economic development investments of regional partners. These investments will increase mobility and access to jobs and strengthen the investments of individual partners through coordination and collaboration. Partners will be able to make effective and strategic decisions about investments with an understanding of broad, regional goals and inter-agency commitments.



Nodes: Nodes are defined areas of development that have a variety of land uses, with concentrations of density, and a concrete sense of place that people can identify.

Corridors: Corridors are major connections between nodes facilitating multiple modes of transportation, often with more intensive transit investment along them.

Regional Nodes & Corridors (Existing and Future), Heartland 2050

Dodge Street Corridor
- Upcoming BRT line (ORBT)
- Major thoroughfare
- Redevelopment along portions

Center Street Corridor
- Road diets
- Bike infrastructure
- Infill development around Aksarben village
- Potential future BRT route

N-370 Corridor
- Major development in Sarpy County
- Infill development potential

24th Street Corridor
- Major N-S corridor connecting North Omaha and South Omaha as well as Bellevue
- Bike infrastructure coming
- Potential future BRT route
- 24th and Lake developments
- MCC South Campus

13th Street Corridor
- Connections to North Downtown, Old Market, Bellevue
- Road diet
- Bike infrastructure

30th Street Corridor
- Connections between Florence, North Omaha, Midtown
- North Omaha Transit Center, 75 North, Fair Deal Village, Midtown Crossing
- MCC North Campus
- Potential future BRT route

72nd Street Corridor
- Potential for redevelopment and infill
- Major East-West divider for the city of Omaha

84th Street Corridor
- Connector between Omaha, Ralston, La Vista, and Papillion
- Downtown districts for Ralston La Vista and Papillion

144th Street Corridor

Suburban infill potential

Provides North-South connections between Omaha and Western Sarpy County

168th Street Corridor

Suburban infill potential

Provides North-South connections between Omaha and Western Sarpy County