TOGETHER 2045

Bismarck's Comprehensive Plan

LAND USE AND DEVELOPMENT CAPACITY

Growth Projections for 2045

October 29, 2021

Together 2045 - Bismarck's Comprehensive Plan envisions future growth and development of the City of Bismarck between 2020 and 2045. This background technical report uses available data to project future development scenarios that are expected to occur if current trends persist.

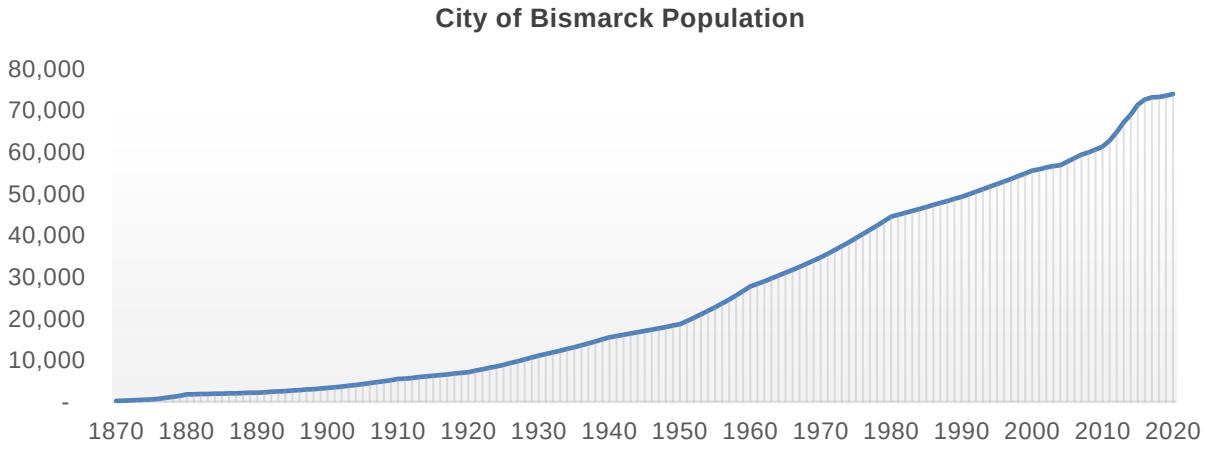
A projection is different from a vision. This report attempts to predict future outcomes based on data representing existing trends. It does not attempt to show what should occur, and the accuracy of any projection is subject to a margin of error and unforeseen future events. Through input from the community and a broad range of stakeholders, the final Together 2045 Plan will include a vision and implementation strategy for the future of land use that will likely affect the results of this report.

Contents

Population Projection

The population projection will function as the primary basis for the future land use estimates in this report. All previous comprehensive plans for Bismarck included future population estimates, and the projections vary widely in accuracy. Although Bismarck has experienced short-term periods of rapid population growth followed by terms of relative stagnation, over the long-term Bismarck's population growth has remained steady.

The plans that were adopted during a period of slower growth were more accurate, but the plans adopted in 1980 and 2014, during periods of high growth, overestimated the future projections by assuming that the short-term trends would continue. Using a longer trend to establish a base growth rate appears to yield more accurate results.



Components of Population Change

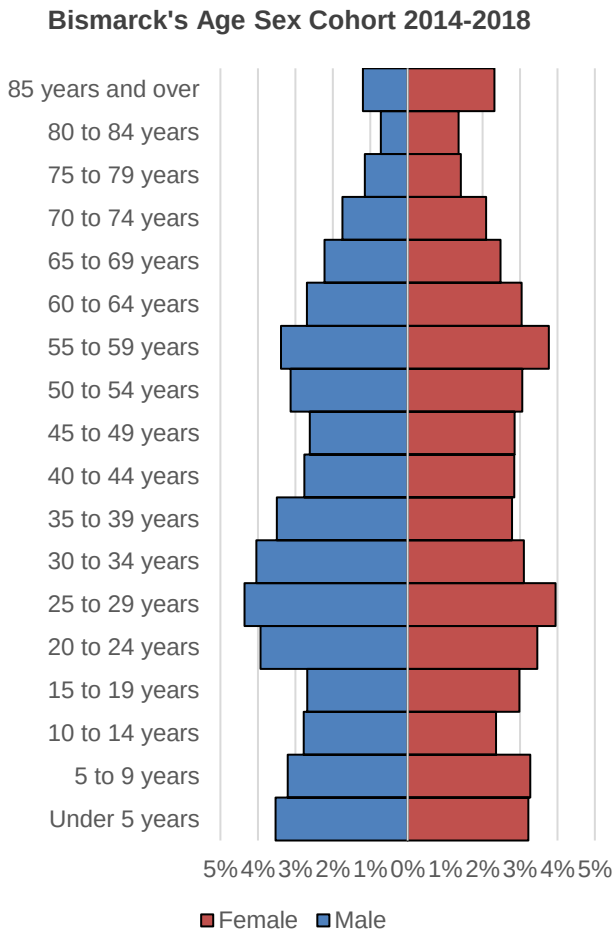
All population growth can be divided into two components: natural increase (total births less total deaths) and net migration (people moving in less people moving out). According to data from the US Census Population Estimates Program, approximately 37% of Bismarck's population growth over the last ten years can be attributed to natural increase, and the other 62% can be attributed to net migration.

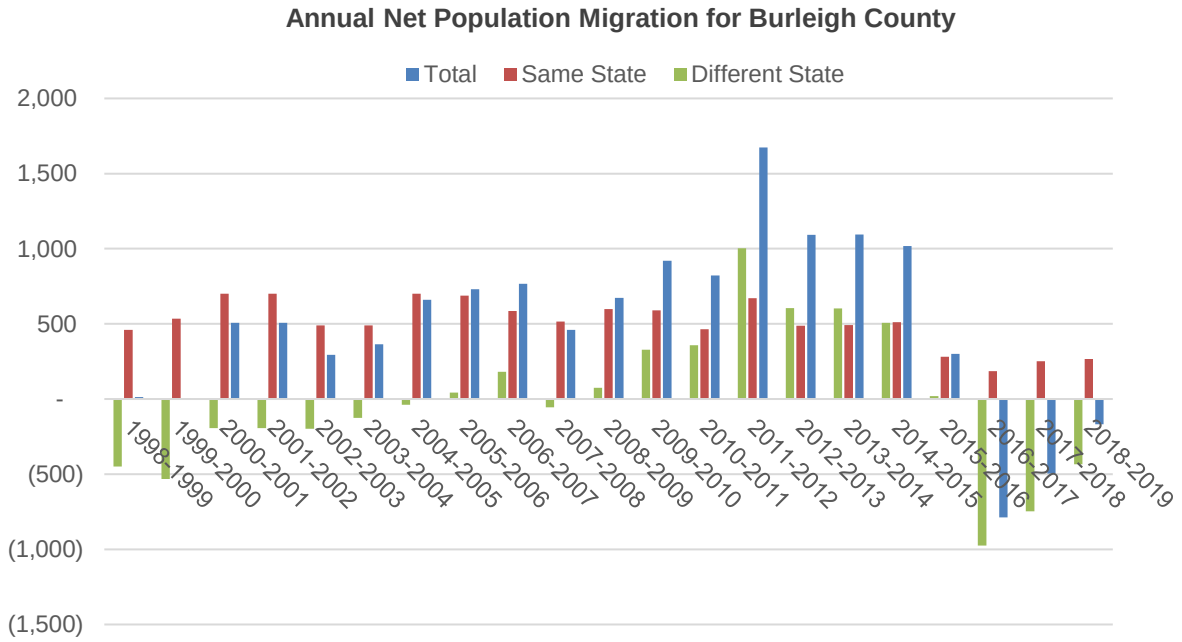
Natural increase has been a stable source of growth over time, although the rate of natural increase has been slowly declining in Bismarck as it is throughout the United States. The decline is typically attributed to an aging population and declining fertility rates. Bismarck's distribution of population by age and sex is close to national averages, although it does skews slightly older and more male.

According to the Centers for Disease Control (CDC), North Dakota and South Dakota have the highest fertility rates in the nation at 70.6 births per woman of child-rearing age. North Dakota was the only state that increased in fertility over the last fifteen years, although this rate has declined since 2016. This increase is likely attributed to the strong economic conditions over the last decade, but over the longer term the declines experienced in all other states can be expected in North Dakota as well.

Net migration shows much more fluctuation based on economic conditions, which makes it more difficult to predict. Data from the Internal Revenue Service (IRS) is available to show county-to-county migration each year. About 12% of the Bismarck population turns over each year.

Historically, Bismarck has gained population from rural counties in North Dakota. Although there is significant movement back and forth between Burleigh, Morton, Cass, Ward, and Grand Forks counties, most of the net increase has been from the other less populated counties. This trend has been relatively consistent but has recently started to decline starting in 2015. This may be a short-term effect from the end of the oil boom cycle, or it could be a more persistent condition if the rural counties are hitting a threshold in which they are too small and aged to supply the same level of migration as they have over the previous century.





Out of state net migration had historically been negative in Bismarck, but it grew considerably and even outpaced in-state migration in the mid-2000s. Notably, this broader in-migration began before the oil boom, but the strong statewide economic conditions greatly accelerated the trend.

However, residents left the state following the boom and the City's net migration is only very recently returning to equilibrium. The steepest drop in outmigration occurred in 2018, when the IRS reported that a net 788 people had left Burleigh County the year before. The overall population never dropped, because enough natural increase occurred, but growth was minimal until the net migration began to improve.

Potential Disrupters

Over the course of the next twenty-five years, a major event or technological innovation could disrupt the existing trends noted above. Although such an effect is, by definition, unpredictable, some potential future disruptions can be considered.

The following could have an impact on future population of the City of Bismarck:

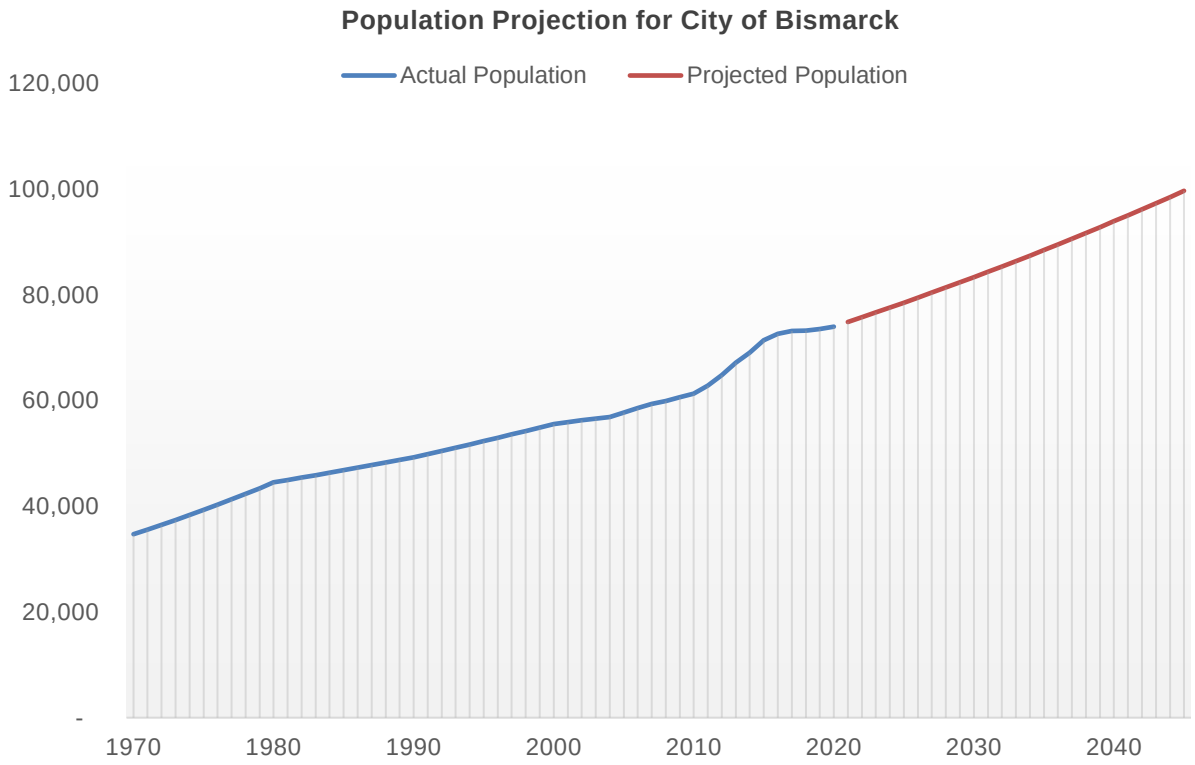
- A major shift in the primary sector economy of North Dakota, particularly the energy sector, would either negatively or positively effect population.
- Technological advancements in remote work increasingly allow employees to choose where to live. Continued adoption may lead to a dispersal from more expensive major metropolitan areas to more affordable mid-sized cities. This could have a positive effect on Bismarck's population if quality of life is preserved and enhanced.
- Global climate change could affect the climate of the Bismarck area relative to other populated areas. This could have a positive effect on future population growth.
- A change in law, policy, or technology that effects the costs of residential development in rural areas would impact the population of the City of Bismarck.
- A major natural hazard or weather event could have an effect. However, major events such as the 2011 flood of the Missouri River have not notably affected population growth in the past.

Growth Rate and Population Projection

A projected population growth rate of 1.2% per year is proposed for the following reasons:

- This reasonably aligns with the long-term population trends for Bismarck, accounting for both boom and bust cycles.
- This represents an exponential pattern of growth, which fits the historic curve better than a linear regression.
- A fixed annual rate of growth is simple to use and apply to any future year.
- This is the population growth rate used for the 2020 Arrive 2045 Metropolitan Transportation Plan, and the travel demand model used to project future transportation needs used this projection. Both plans would be aligned.

Based on this projection, the City of Bismarck will grow by approximately a thousand people per year and have a population of 99,647 by 2045.



Housing Projection

A growing population will inevitably result in the need for new housing construction and rehabilitation of the existing housing stock. Projection of housing growth is relatively straightforward, because it can be measured in discrete housing units, whether in the form of single-family homes or apartments. With the exception of the relatively small portion of the population in group dwellings, such as dorms and jails, and the unsheltered, each household in the community will be associated with one occupied housing unit.

The housing unit projection will assume the 1.2% total population projection to maintain consistency between projections. The following is a discussion of other variables necessary to establish this link:

Group Quarters Population

The population that resides in group quarters count toward the total population but do not generate a projected housing unit. In 2020, a total of 3.8% of the Bismarck population was in group quarters, primarily in nursing homes and the state penitentiary. This proportion has been relatively stable over the years. In 2000, 3.1% of the population lived in group quarters. Without any known plans for new major institutions such as a college or correctional facility, it can be assumed that this proportion will remain consistent into the future.

Housing Vacancy

Housing units that are vacant count toward the total housing unit projection but are not influenced by the total population projection. Housing vacancy occurs either in the short-term, as homes are being marketed for sale or rent, or in the long-term, if disinvestment or major life events lead to a housing unit remaining vacant for several years. Short-term vacancies are relatively consistent and effected the real estate market conditions, especially in the multifamily housing market, but long-term vacancies vary widely between communities and reflect overall economic conditions.

In 2020, 6.8% of all housing units in Bismarck were vacant. This was below the state average of 13% and the national average of 9.7%, which is generally considered a healthy rate to allow the housing market to function well. It is also lower than both Fargo and Grand Forks cities. Bismarck's housing vacancy rate has fluctuated considerably over the last decade. The census recorded a 4.8% rate in 2010, and estimates were showing a rate as low a 1.9% by 2015.

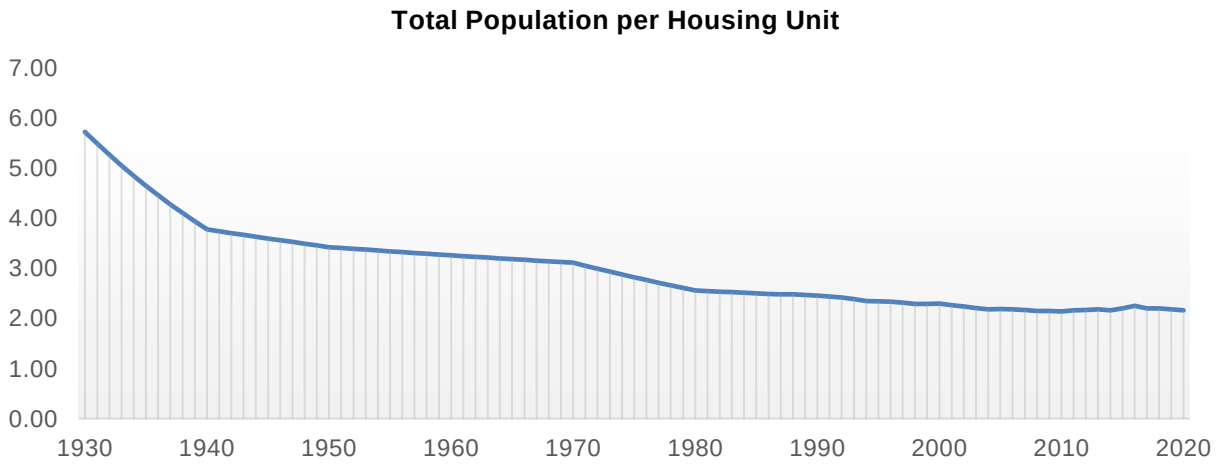
Household Size

The number of members in a households will affect the number of units necessary to house the population. Over the 20th Century, the average household size has declined considerably in Bismarck, as it has throughout the United States. However, starting in 2010 this trend started to stabilize and even reverse. The average Bismarck household size reached a low of 2.18 in 2010 and has increased to an estimated 2.36 by 2019. This inflection point can be attributed to economic growth over last ten years, which has led to family in-migration and also to an increase in non-white households, which tend to be larger, since 2010.

It is unknown whether household size will continue to drop in the future or remain stable and even slightly increase.

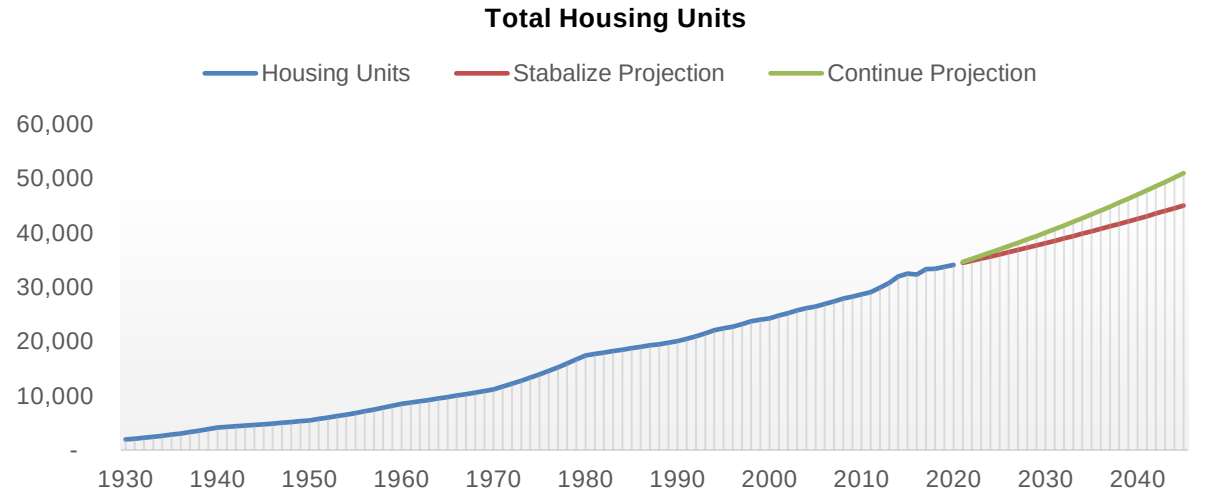
Housing Unit Projection

The three components listed above can be combined into a simple metric of population per housing unit.



Two housing unit projections are made. Continue projection of 1.6% assumes the pop-housing rate will continue to drop at the 40-year average rate. Stabilize projection of 1.1% assumes the pop-housing rate will stabilize and increase slightly as it has since 2010.

2045	Total Housing Units	New Units Needed Since 2020	Average New Units Per Year
Continue Projection	50,938	16,889	676
Stabilize Projection	44,971	10,922	437



Commercial Projections

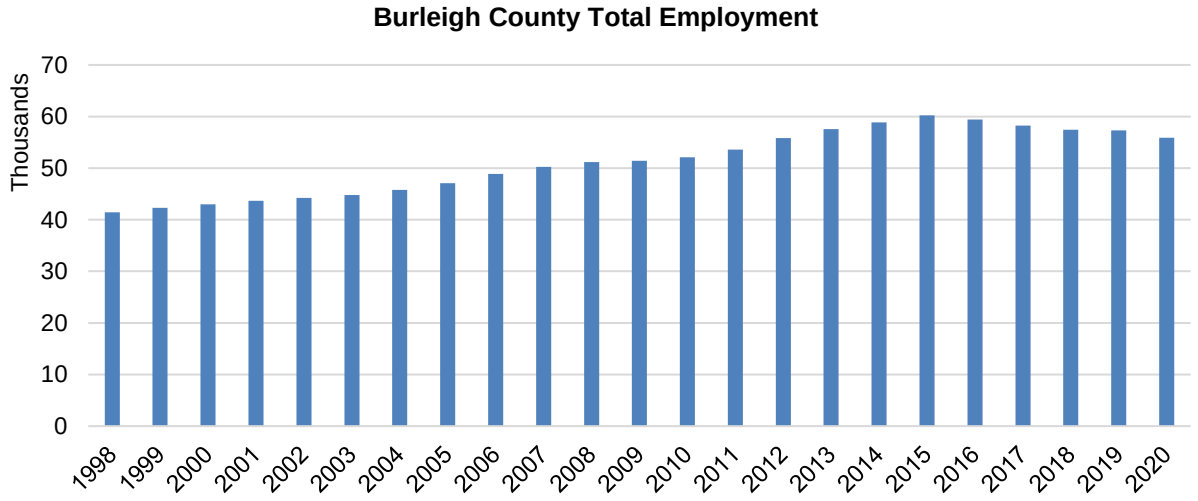
Unlike housing, there is no obvious discrete unit that allows commercial and industrial growth to be easily measured and projected. There is also less historic data available on land use and development of commercial and industrial areas to evaluate long-term trends. Finally, shifts in technology and consumer demands are difficult to predict and can have a major impact on commercial land use needs.

This report will attempt rough projections for general commercial and industrial land use growth, with the acknowledgment that these estimates face a greater degree of uncertainty. Even a poor estimate will provide some understanding of the scale of future land use needs of Bismarck.

Commercial Land Needs

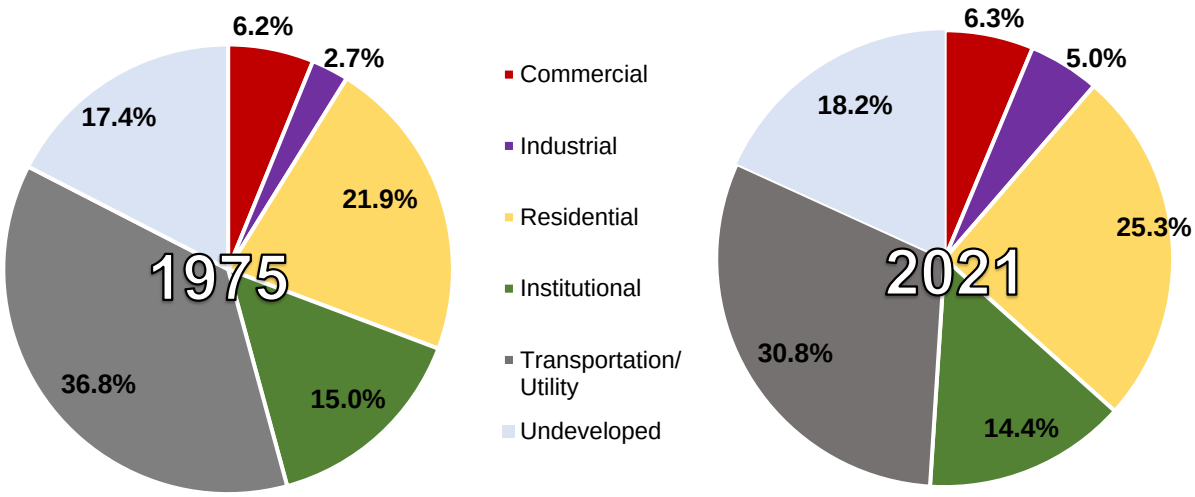
Commercial land uses, as defined here, include retail, offices, and medical uses. The unit of measurement will be commercial square footage of floor area.

Employment data is collected by the Bureau of Labor Statistics for Burleigh County, the vast majority of which applies to the City of Bismarck. Although this has typically trended upward with population, there has been a drop of employment since 2015. This coincided with a period of relative stagnation in population. Although this is expected to reverse as the statewide economy recovers, it does suggest that future commercial uses generated by employment should at least not exceed population growth.



The most comprehensive historic survey of land uses in Bismarck occurred in 1975, when each parcel of the city was surveyed and classified into various land use categories. When these categories are aggregated into general land uses, the overall proportions are very similar to the City's current land use mix.

Mix of Land Uses for the Entire Annexed Area of Bismarck



Somewhat more land was dedicated to transportation and utility infrastructure in 1975, which may be due to the fact that the airport was a larger proportion of the annexed area at that time. Industrial land uses have grown since 1975 but remain a small portion of the total city land area. The proportion of residential areas has also grown. Although the types of commercial and industrial businesses have changed significantly in the time span between surveys, these general categories have not.

An evaluation of the percentage of land zoned for certain land uses that this actually developed reveals current market conditions and the existing capacity. Approximately 10% of all commercially zoned parcels in the city are vacant. The vacancy rate for industrial is slightly higher although has been declining in recent years.

Real estate markets for retail and office space are undergoing a global paradigm shift that makes long-term projections extremely difficult. Major societal changes driven by technology, especially the rise of online retail and a shift of professional work to remote settings, has reduced the demand for commercial/office space in general, and this trend will likely continue. Bismarck residents will continue to need in-person experiences, and commercial markets will adapt. But it is reasonable to assume that the total land area necessary to support commercial uses may be somewhat reduced, as a proportion of population, by 2045.

Bismarck assessment records show 14,918,525 square feet of floor area for commercial uses, including office, medical, and mixed-use in 2021. At a growth rate of 1% per year, the following projection can be made for 2045:

2045	Total Commercial Square Footage	New Commercial Square Footage	Average New per Year
Commercial Projection	18.9 Million	4 Million	168,000 Square Feet

Industrial Land Needs

According to assessing records, approximately 1,100 acres are dedicated to industrial uses in the City of Bismarck with over 7 million square feet of floor area in 2021. Industrial land has the highest vacancy rate of any of the broad land use categories, with 11% of all parcels within industrial zoning districts vacant and developable.

Most industrial land uses in Bismarck function within the local economy, providing services such as storage, contractor yards, and wholesale distribution to businesses and consumers in the Bismarck/Mandan metropolitan area. Although some previous comprehensive plans envisioned widespread manufacturing growth, the industrial primary sector in Bismarck remains small. Only 4.2% of the City's workforce is employed in the manufacturing sector, compared to 10.1% nationally and 6.8% in North Dakota. Other than Helena, MT, no other peer community in the region has a smaller manufacturing base.

Projecting industrial growth depends greatly on the primary sector. If the industrial uses remain predominantly local in nature, it can be assumed that their growth will stay proportionate with that of the overall population. However, even a few new major primary-sector firms choosing to locate within Bismarck could generate significant industrial land needs, especially considering spillover effects on smaller firms. The Bismarck-Mandan Chamber-EDC has targeted primary-sector recruitment toward industries that may provide value-added production to North Dakota's dominant agricultural and energy-sectors.

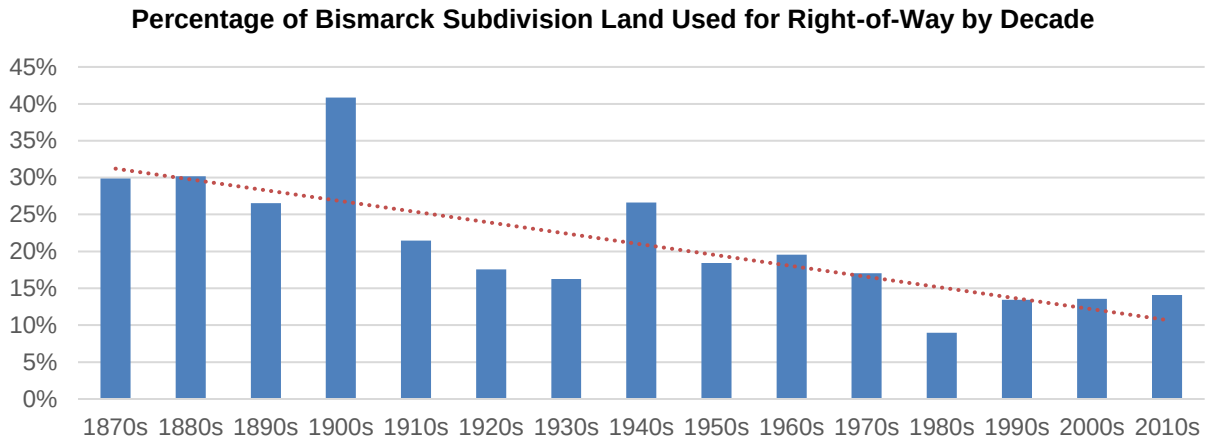
If growth of industrial areas proceeds at 1.3% per year, slightly higher than the population growth rate, the following may be expected by 2045:

2045	Total Industrial Acres	New Industrial Acres	Average New per Year
Industrial Projection	1,500	400	16.66 Acres

Right of Way Land Needs

An important, but often overlooked, land use is public right-of-way. In 2021, public right-of-way in the City of Bismarck constitutes about 6.4 square miles of land area, or 18% of the total area of the city. This area is essential not only for public travel by multiple modes, but for parking, utilities, and street trees.

Over time, the percentage of land dedicated to public right-of-way within subdivisions has declined. While the original 19th Century Bismarck subdivision plats included approximately 30% of all land as public rights-of-way, the average for the last thirty years of plats has been approximately 14% of land. This can be explained by changes in street patterns with reduced connectivity, greater use of private access drives especially in commercial areas, and lesser right-of-way widths for certain streets.



Furthermore, the City of Bismarck amended the subdivision ordinance in 2019 to allow narrower right-of-way widths on local residential streets that have narrower pavement widths. The minimum was reduced from 66 feet to 60 or 54 feet if parking restrictions are imposed. This is likely to lead to a further reduction in right-of-way land use in residential subdivisions.

Cities nationwide have trended toward reduced right-of-way widths in both law and practice for several decades. However, more recent evidence also suggests a nationwide trend toward more interconnected traditional grid-like street networks, which generally require a greater land area for right-of-way than more disconnected patterns utilized in the mid 20th century. If these two forces balance, it may be assumed that the growth in right-of-way land use will remain basically aligned with overall population growth.

The following projections assume a 1.2% annual growth rate:

2045	Total Right-of-Way Acres	New Right-of-Way Acres	Average New per Year
Right-of-Way Projection	5,436	1,353	56

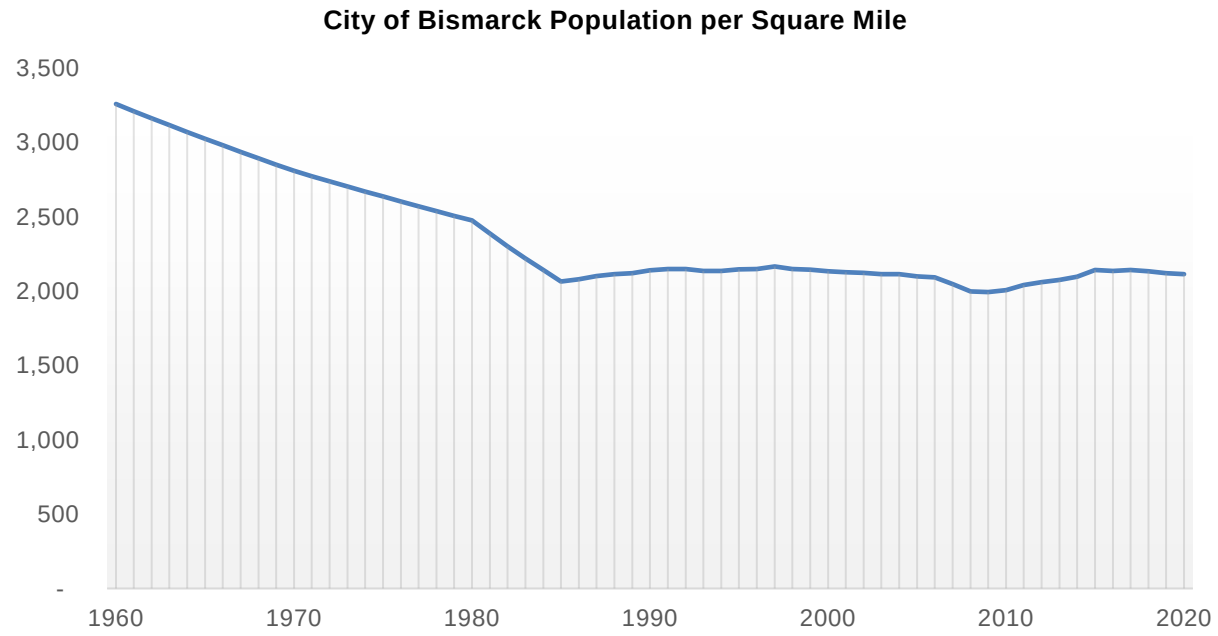
Land Capacity for Growth

The second part of this report evaluates the amount of land available within the City of Bismarck and its extraterritorial area and compares this to the 2045 land use projections for residential, commercial, and industrial growth. Translating future projections into geographic space requires an understanding of density, the inherent constraints of the land, and a contiguous sequence for future development.

The land capacity is evaluated for both inside of city limits, including potential redevelopment of parcels fully or partially in use, and areas outside of city limits but within the extraterritorial area negotiated with Burleigh County.

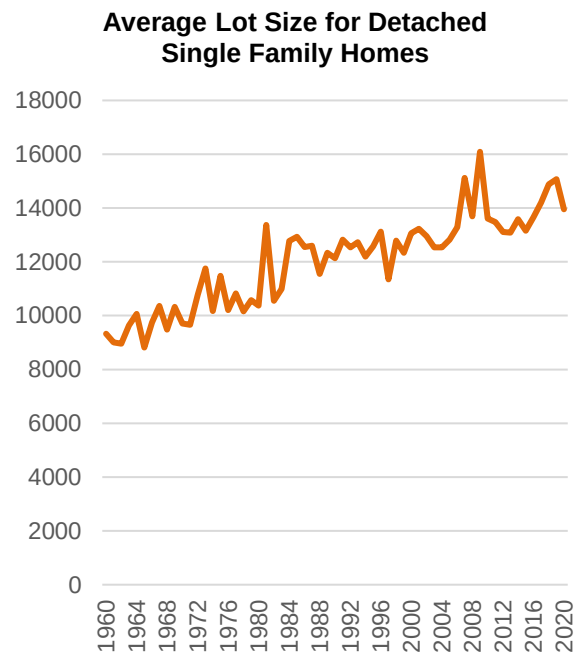
Density of Development

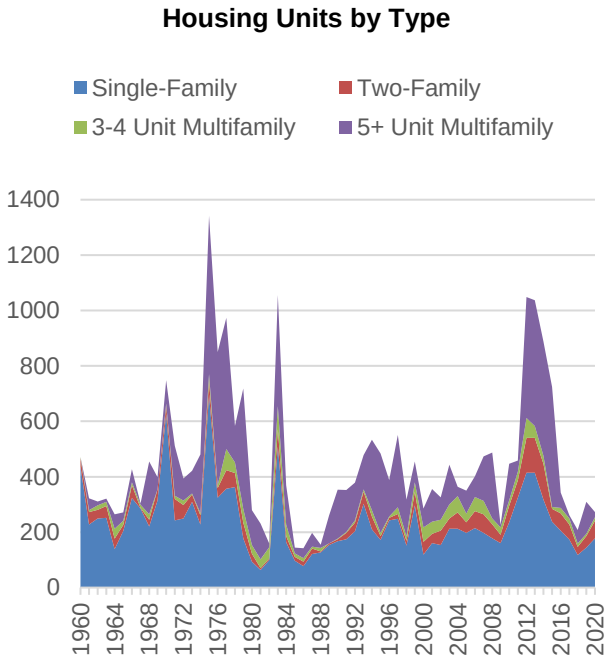
The overall population density of the City of Bismarck has remained fairly steady over the last 40 years at around 2,000 people per square mile, although with a notable decline in the early stages. Although it had reached a high of around 3,500 people per square mile in 1960. The 2020 Bismarck density of 2,212 people per square mile is typical for a mid-sized city in the region, below Fargo (2,530) and Sioux Falls (2,434) but above Rapid City (1,366) and Helena (1,908).



Measuring density with use of corporate limits has some limitations. First, it is highly sensitive to annexation policies. For example, Grand Fork's density dropped from 2,655 to 2,122 over the last ten years because of a large annexation including the airport. The fact that Bismarck's airport and other large undeveloped lands were already annexed by 1980 may have masked a slight increase in density.

Secondly, the same urban population has required more development to support it over time. Bismarck's housing unit density has increased over the last forty years, because of diminishing household sizes as previously discussed. More importantly, the Bismarck trade area is over a hundred miles from city limits, according to City Administration, and the Bismarck-Mandan metropolitan area has grown at a faster rate than the City of Bismarck. While the City of Bismarck was 85% of the total Burleigh County population in 1970, this decreased to 75% in 2010 (although it has increased somewhat since). While rural development in Burleigh County mostly ceased after 2010, the City of Lincoln has continued to grow rapidly over the last ten years. A large share of this metropolitan and surrounding rural growth still works, shops, and regularly visits Bismarck and its commercial or industrial land uses.



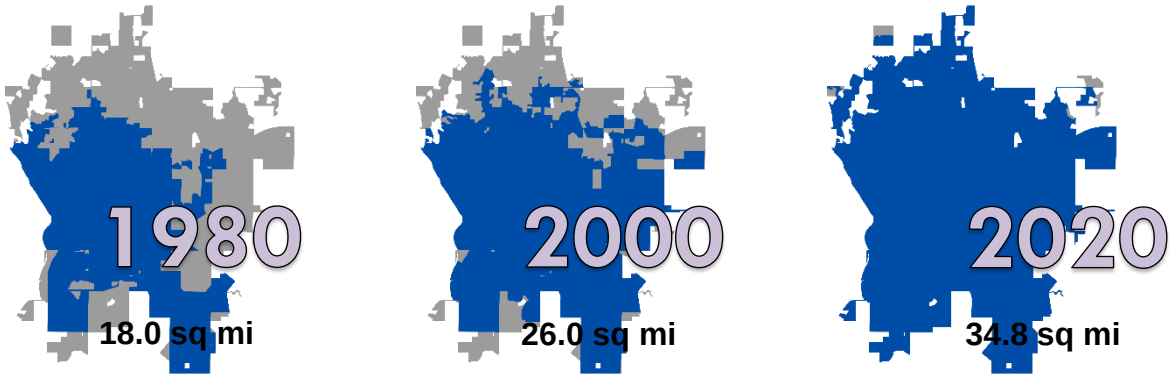


Certain housing market demands, or at least the perception thereof among developers, have affected residential density. The average lot size of a single-family home has increased from about 9,300 in 1960 to about 14,000 in 2020. It should be noted that this change has not been driven by a minimum lot size in zoning regulations, which has been consistently set at 7,000 square feet for single-family residential zoning districts. Private land developers are choosing to create larger lots. A likely driver of larger lots is the prevalence for more garage stalls. The 1-2 stall garages commonly built until the 1960s could easily be accommodated on a 60-foot-wide lot. Since the mid-1990s, the average new home has three garage stalls, and the average lot width has increased to 80 feet. The width has a direct correlation to overall lot size.

Multifamily residential development has occurred in waves since the 1970s, with evident boom and bust cycles. The density of multifamily sites has decreased over Bismarck's history, but has remained stable since 1980. Apartment sites built between 1925 and 1980 average 7 units per acre, but this drops to 3.5 units per acre for sites developed from 1980 to the present.

Annexation Projections

The land area of the city limits has grown consistently over the years. The City of Bismarck has historically annexed upon petition by landowner, with very few city-initiated exceptions. Although the annexation may occur after the land has been platted and zoned into an urban zoning district, it will always precede any physical urban development of the site. Therefore, the annexation can be seen as the front end of a development process that will typically take multiple years between infrastructure improvements, construction, and then final occupation of all uses on the property.



Because property owners opt to annex at different times, Bismarck's city limits have always included some irregularity and areas that have passed over. Although, at certain times efforts have been made to fill in non-annexed areas, to reduce confusion concerning police and fire jurisdiction and promote fairness for paying for services. The overall area of the city has grown from 18 Square Miles in 1980 to 34.8 Square Miles in 2020.

This report presents three potential annexation scenarios, all linked to the overall population projection of 1.2% growth per year. The scenarios reflect the unknown factor of population densities in the future.

Scenario A: The population density of the City of Bismarck remains unchanged. The city limits grow directly in proportion to population growth.

2045 Bismarck Area: 46.9 Square Miles New Area: 12.1 Sq M

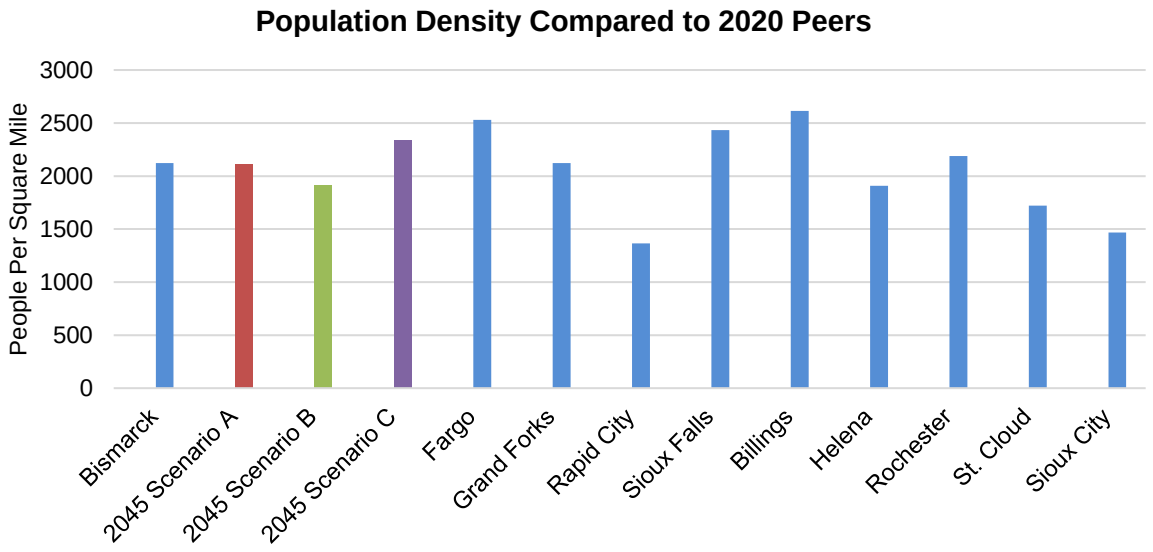
Scenario B: The population density continues along the 40-year trend of declining at a rate of 0.4% per year.

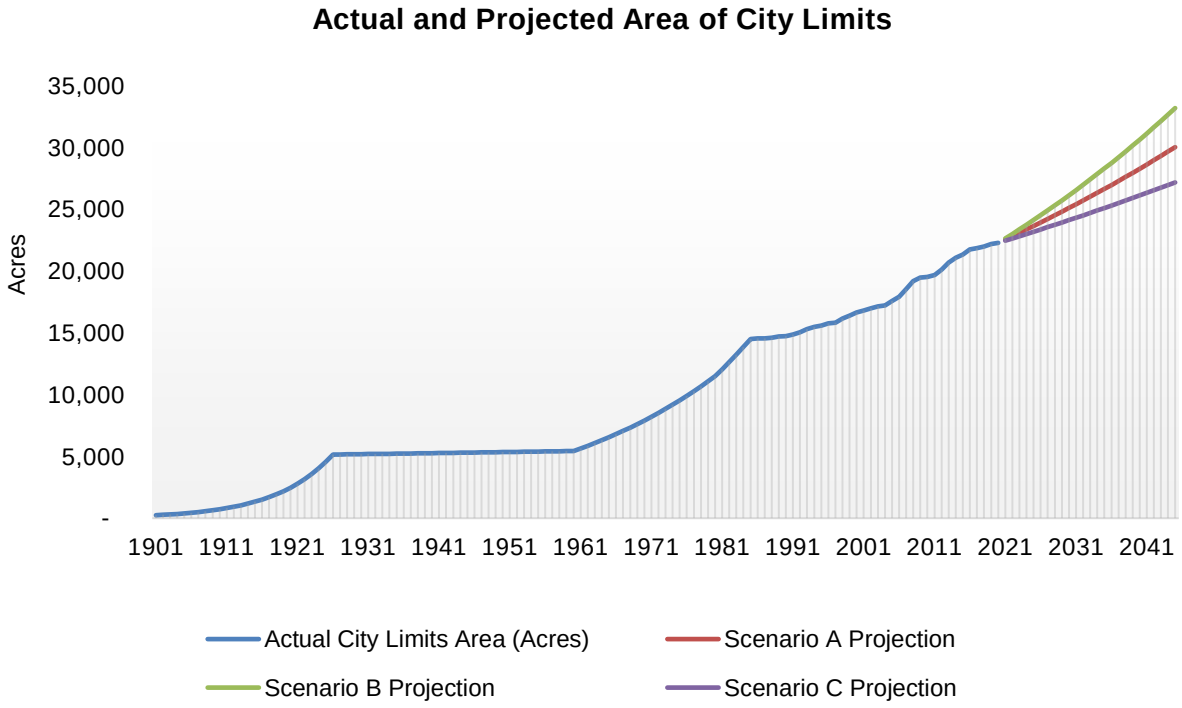
2045 Bismarck Area: 51.7 Square Miles New Area: 17.0 Sq M

Scenario C: The population density increases by 0.4% per year through greater density of new development and infill and redevelopment of the existing city limits. This scenario represents a departure from current trends.

2045 Bismarck Area: 42.5 Square Miles New Area: 7.6 Sq M

All three of the annexation projections would result in a 2045 population density that is within the range of peer communities. As a frame of reference, it is possible for a mid-sized U.S. city to have much high population density. Boulder, Colorado has a 2020 population density of 12,087 people per square mile, which is over five times as dense as even the high-density future scenario for Bismarck.



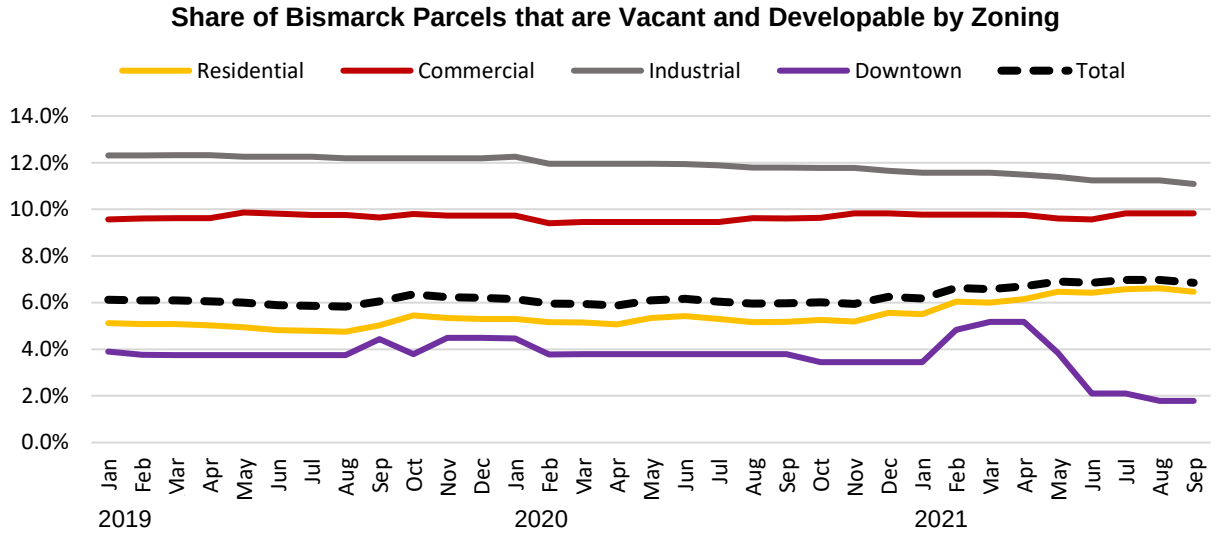


Capacity within Existing City Limits

Capacity within city limits will be divided into two categories: infill and redevelopment. Infill is defined as parcels that are annexed, vacant and developable. Redevelopment is defined as parcels that are already developed to some degree but have potential for intensification.

Infill: Vacant and Developable Parcels

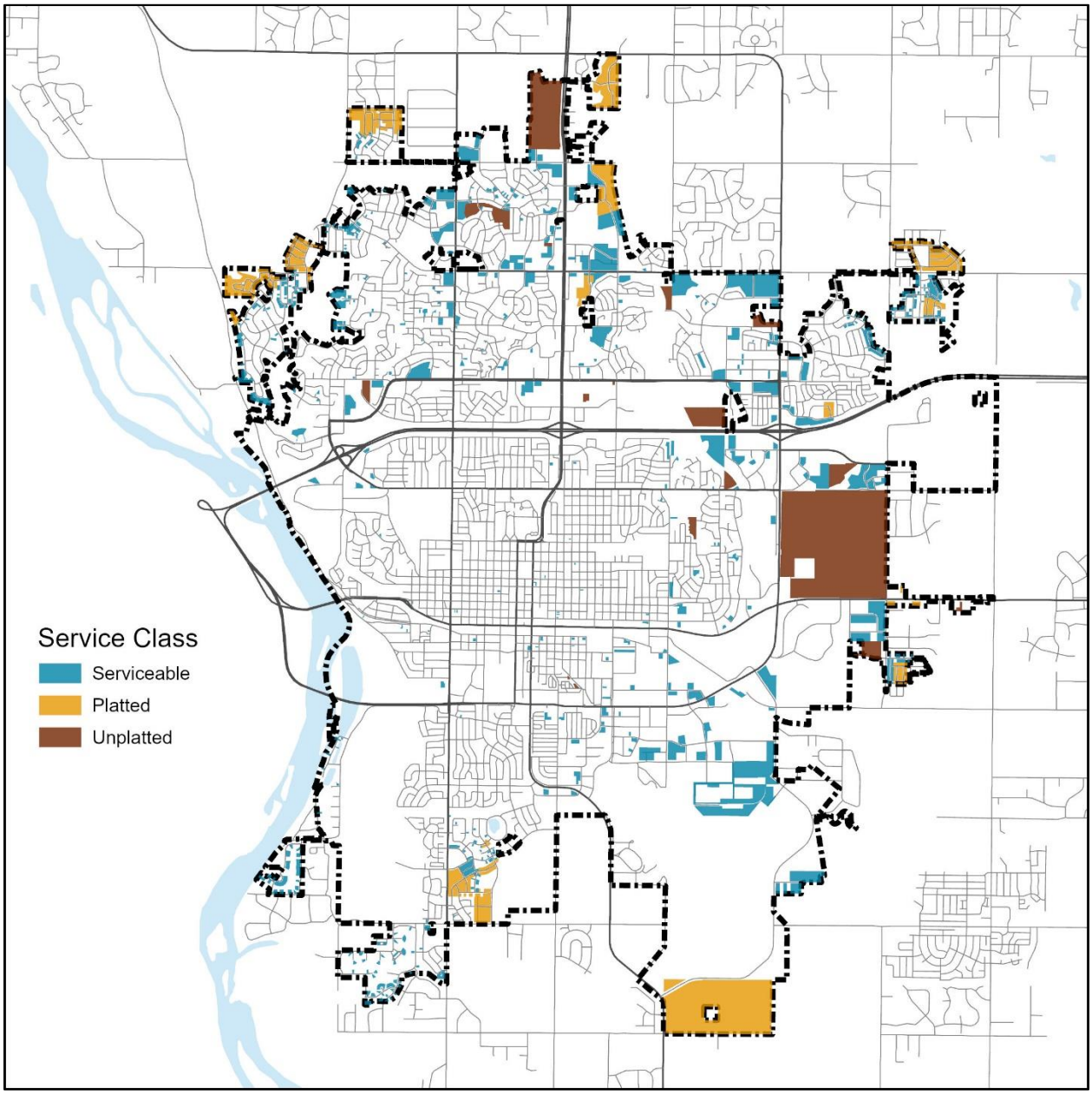
There are currently 1,766 parcels in the City of Bismarck that are vacant and considered to be developable. This means that they are not encumbered by any severe restrictions, such as extreme topography, utility easements, zoning non-conformance, or floodway area that would render them undevelopable, or at least not developable without high cost or legal revisions. These parcels also have no development or current recognized use.



The share of vacant and developable parcels has remained relatively consistent over the span of three years at around 6% of all parcels in the city. Roughly half (47%) of all vacant and developable parcels have been in existence and vacant for at least five years, which might be considered the typical timeframe of a subdivision build-out. These long-term vacant parcels may be hindered by certain natural constraints, lack property owner interest in development, or are simply evidence of a slower market demand for lots in certain locations.

Vacant and developable parcels are further divided based on the readiness for development. Serviceable parcels are platted, zoned into a non-agricultural zoning district, have nearby access to water and sewer service, and have constructed roadway access. The majority, a little over a thousand, of the parcels fit this definition. Parcels that are platted and zoned but not yet provided with city services are categorized as “platted.” Finally, some areas of the City have been annexed in the past, but have never been platted and typically remain in the Agricultural zoning district.

Vacant and Developable Parcels within City Limits



These “infill parcels” have the potential to absorb a significant portion of projected demand for new growth. A model has been developed with density assumptions by zoning, or the current Future Land Use Plan for areas within the city remaining within the Agricultural zoning district. A map of vacant and developable parcels, by serviceability, is shown on the previous page, and the results of this modelled development are as follows:

Available Infill Capacity

Residential	Housing Units	Population	Commercial	Industrial	Other/ Public	Jobs
677 Acres	4,795	10,130	533 Acres	840 Acres	389 Acres	17,599

Comparing this capacity to projected increases in population, a total of **12 years** of population growth and **16 years** of employment growth can be absorbed without any changes to city limits.

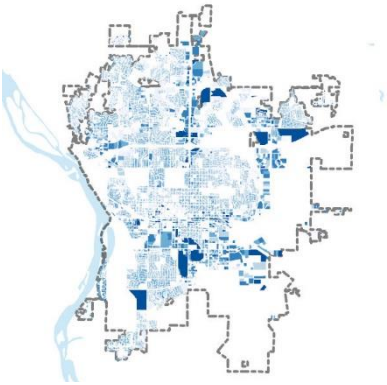
It should be noted that this is an estimate for what is known as full “build-out,” meaning the development densities achieved once all lots have been sold and built upon. In reality, there is a necessary latency period between an initial annexation and actual development completion, which can be five or more years for a typical residential subdivision. And markets require multiple open lots to be available at any time to allow competition.

For these reasons, it’s not reasonable to expect perfectly efficient city growth and a certain number of vacant parcels will remain in a healthy economy. Much like economists consider a certain degree of unemployment to be a natural function of the market, urban developable lot vacancy may be seen the same way. A drop to a 4% rate would still accommodate enough new housing for about 3,000 people.

Redevelopment Potential

Redevelopment is defined here as the intensification in use of parcels in the City of Bismarck that are already developed to some degree. In commercial areas, this could take the form of building additions, further build-out of sites with remaining space, adaptive reuse, or complete demolition and reconstruction of sites. Redevelopment in residential areas could consist of increasing the number of units on a parcel, such as the addition of an accessory dwelling unit, or demolition and reconstruction into a building type with higher densities, including the possibility of mixed uses.

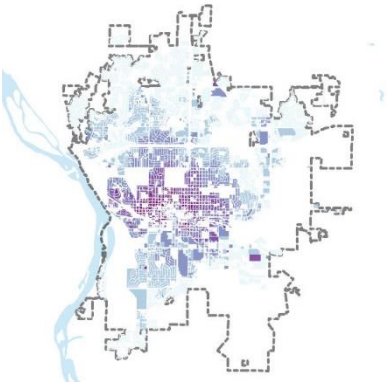
The following variables are included in an index to predict likelihood of redevelopment by parcel:



Land to Improvement Value Ratio

The assessed value of the land only as a percentage of the total value of the property, including all improvements, indicates properties under financial pressure to redevelop. Properties that have high land values and very low improvement values, which could be either related to building condition or size, are assumed to be more likely to redevelop.

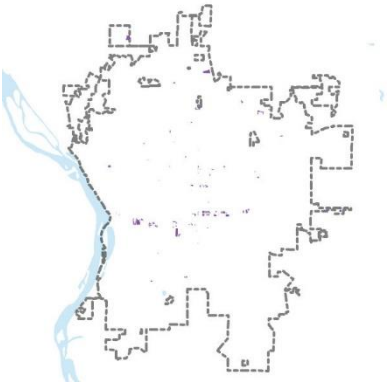
LV = (Land Value / Total Value)



Age of Building

Modern building practices typically assume a lifespan for any structure built. Therefore, it can be assumed that older buildings are more likely to redevelop than newer buildings. However, it's important to note that certain historic buildings may have an increased value due to their age, which is a limitation of this variable. The formula used places all parcels from 0 – 1 from the oldest building at 1876 to 2021. For example, a parcel built in 2021 is assigned a 0 and a parcel built in 1948 is assigned a .5.

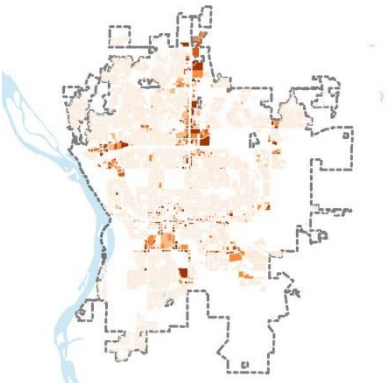
A = 1 – (Year Built – 1876)/145



Zoning Conformance

Parcels that do not conform to the existing zoning district they are within are assumed to be more likely to redevelop. A total of 285 parcels have a use-based non-conformity, which is expressed as a simply binary. Non-conforming use parcels are assigned a 1.

NC = 1 if Nonconforming

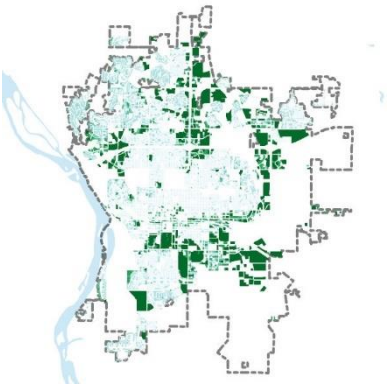


Excess Off-Street Parking

Commercial parcels that have a large area of off-street parking relative to the commercial floor area of the parcel are considered to have a higher likelihood of redevelopment. Parking areas are relatively flat, already impervious (so addition stormwater measures may not be necessary) and have transportation access. The City of Bismarck reduced minimum parking requirements for most uses citywide in 2019, and parcels with excess off-street parking may be permitted to develop additional structures.

On average, commercial parcels in Bismarck have three square feet of parking area for each square foot of floor area. The index assigns a 0 to parcels that have a ratio of 1, that is one square foot of parking area for each square foot of commercial floor areas, on the premise that no excess parking exists. Parcels with higher ratios rank higher, with a maximum cap at 5.

P = (Area of Parking / Commercial Floor Area) / 5 &
P = 0 if (Area of Parking / Commercial Floor Area) <= 1



Size of Lot

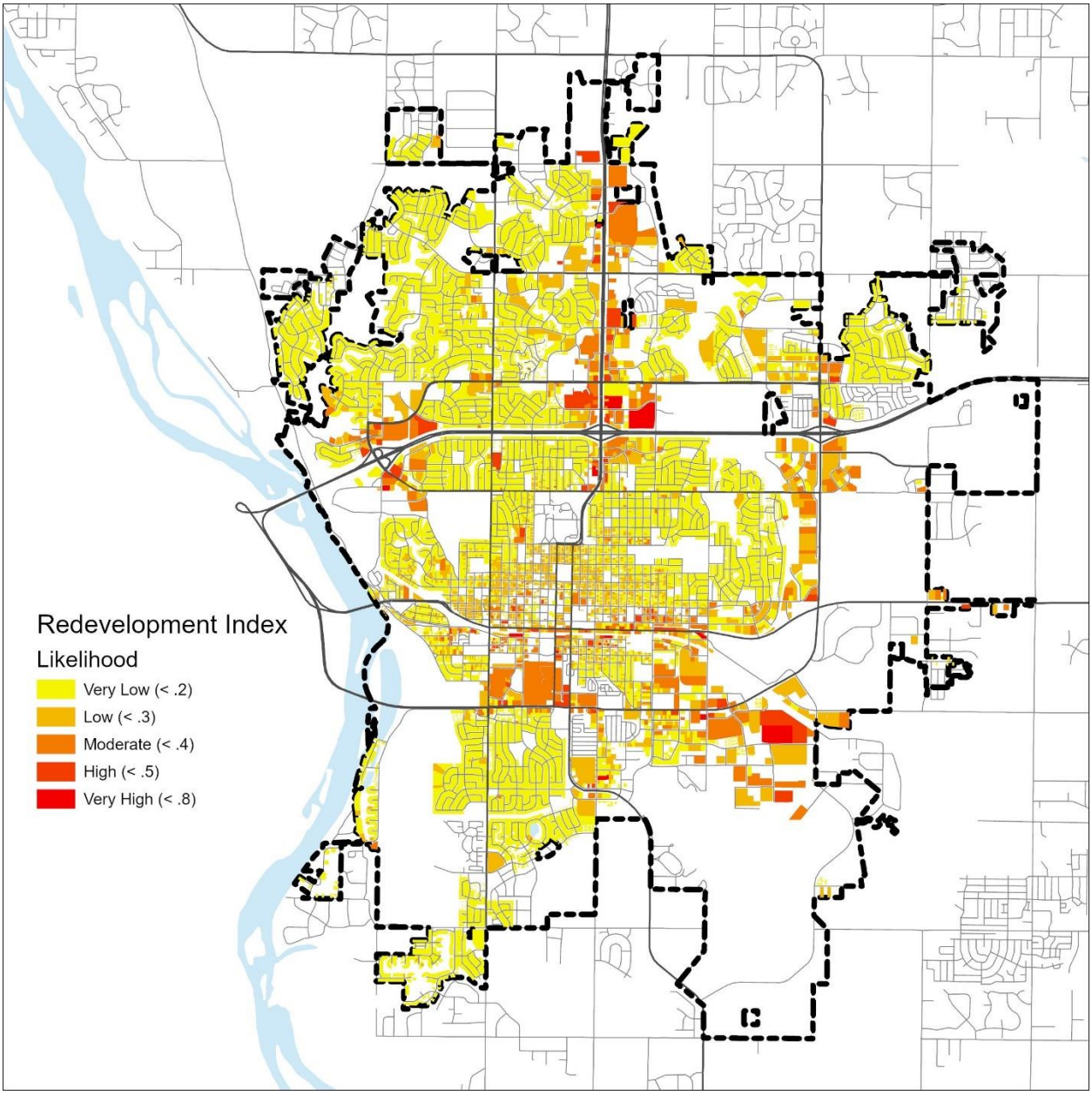
Another factor in redevelopment capacity is the simple size of the lot. Often more intensive uses will require additional land area, and redevelopment of larger lots under control of a single entity may be more efficient than assembling multiple lots and reaching a consensus among multiple property owners. The .99 percentile lot size, approximately 130,000 square feet, is used as the maximum to remove outliers.

P = Parcel Size / .99 Percentile Parcel Size

The redevelopment index does not indicate whether a site *should* be redeveloped, from the perspective of the property owner or the surrounding neighborhood, but only that certain conditions exist that make the redevelopment more likely.

Parcels rated ‘high’ or ‘very high’ redevelopment potential account for 300 acres of land, the vast majority of which is within a commercial zoning district. However, multifamily residential is also permitted within commercial districts, and there would also be a potential for mixed-use development on these parcels.

Redevelopment Index within City Limits



Capacity Outside of City Limits

An evaluation of capacity for growth outside of city limits includes several variables for urbanized land suitability. Most of this land has not been platted, and therefor has not been studied in detail or master planned for infrastructure and lot layout. However, this report will utilize the best available data to determine a contiguous path for future development outside of city limits, given natural and man-made constraints that currently exist, as well as the costs of infrastructure.

The City of Bismarck and Burleigh County negotiated an extraterritorial area in 2014, which has not changed since. This negotiated ETA, which roughly coincides with two miles from the city limits, will use used as the study area for this evaluation. The City of Lincoln and it's extraterritorial area are not including within this study area.

Natural Constraints

The most obvious natural constraint is the Missouri River, which creates a hard growth boundary along the western edge of city limits. This is both a physical and political limit because land across the river lies within Morton County and the extraterritorial area of the City of Mandan.

A number of other constraints existing as shown and described below:

Floodplain/Floodway

The Special Flood Hazard Area (SFHA) is defined through the National Flood Insurance Program run by the federal agency FEMA. This map is periodically updated based on studies of flood risk in riverine corridors. Areas that fall within the SFHA area expected to have a 1% probability of flooding an any given year. Areas designated as "floodway" within the SFHA are at risk of flooding and should remain unrestricted during a flood event to avoid displacement of water onto other properties.

For this report, the general floodplain may be considered a moderate constraint. Development is possible through acquisition of a floodplain development permit or an amendment to the flood map, but the higher initial costs of development as well as the potential for long term insurance costs and property risk diminish the attractiveness of land. The floodway may be considered a hard constraint. Development is strictly prohibited, unless an engineer can certify that flood waters would not rise at all as a result of any improvements.

Areas most affected by the floodplain are west of River Road in the northside of Bismarck, and large portions of the south side of Bismarck. There may be areas susceptible to flooding that have not been mapped by FEMA.

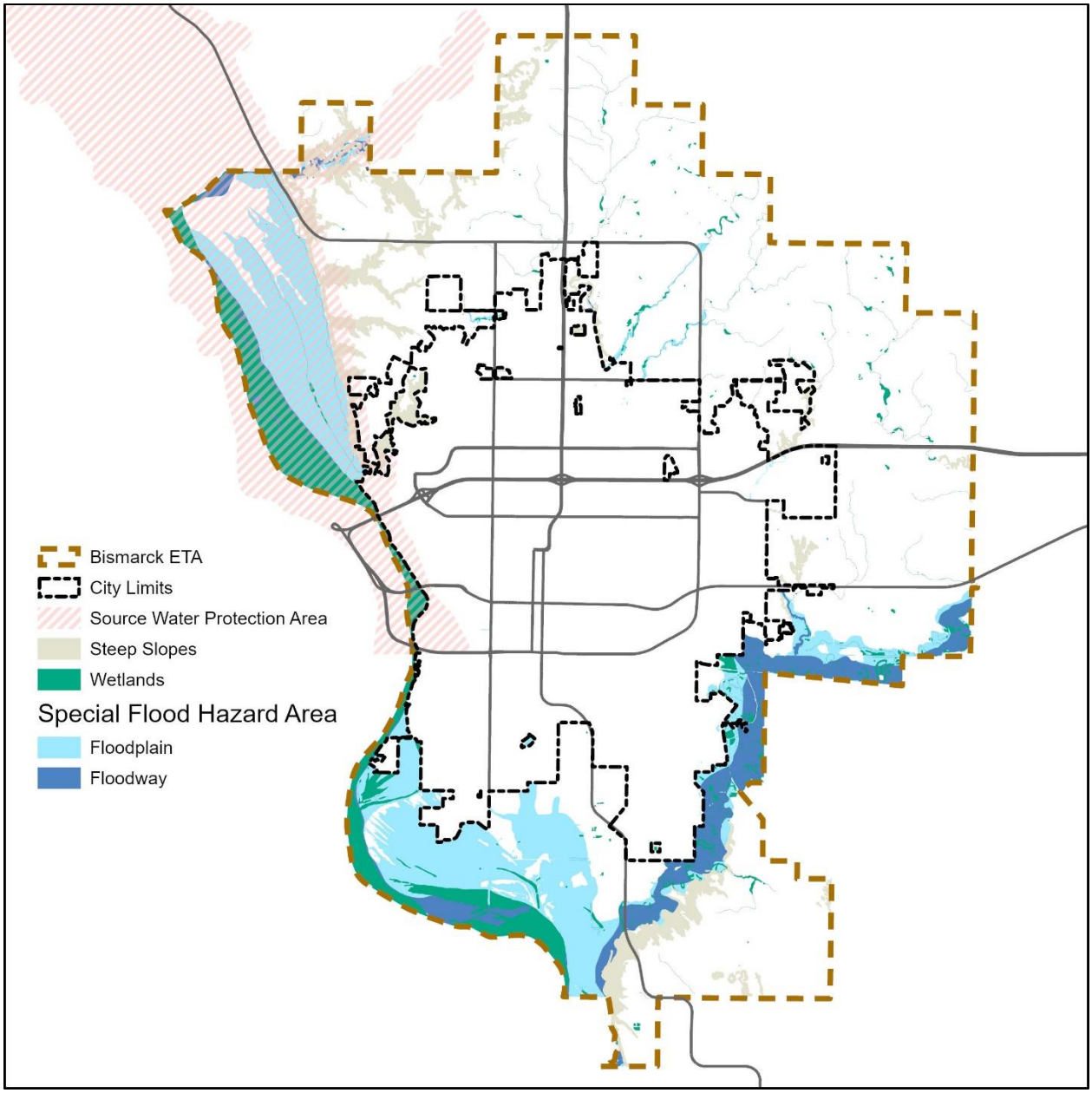
Steep Slopes

Areas of high topographical variation also present challenges for development. Steep slopes are typically defined as areas of at least 20% grade over a run of at least 100 feet. Besides the obvious constraints for roadways, parking, and building construction, slopes in the Bismarck

area also include soil stability and erosions considerations. Landslides have occurred along bluffs, raising safety and property damage concerns. Much like flooding, the soil stability damage may not accrue immediately, but could affect long-term maintenance and operations of facilities.

The majority of steep-sloped areas exist along the bluffs of the Missouri River north of Bismarck, and also south near the University of Mary. However, there are sloped coulees throughout the region at a smaller scale.

Natural Constraints Outside of City Limits



Wetlands

Wetlands are ecologically sensitive areas that provide many social benefits and are covered by the federal Clean Water Act. Due to groundwater saturation, development potential is limited within wetlands without modifications to the land. A National Wetland Inventory (NWI) has been generally mapped, and the boundaries of further delineated locally upon any development proposal. Wetlands that are determined to be “public waters” are federally protected.

Wetland areas present constraints on development in terms of higher land modification costs, risk of environmental damage, and the time and costs to comply with federal law. Wetlands are scattered throughout the Bismarck rural areas, found in low-lying locations and riverine corridors.

Source Water Protection Area

The City of Bismarck draws its drinking water from the Missouri River. The provision of safe drinking water requires not only filtering and cleaning the water before it enters the system, but also protecting the water from upstream contaminates at the source. Certain land uses may have a potential to introduce contaminates into the ground or surface waters that could reach the public water intake. Although this area does not entail a hard constraint on development, it should be considered when evaluating suitability for more intensive land uses. Bismarck’s source water protection area has been delineated as the area northwest of the current city limits, as well as a portion of the Burnt Creek tributary.

Development Constraints

Certain human-created conditions of the land will also affect the ability to develop or redevelop land within Bismarck’s ETA.

Existing Development

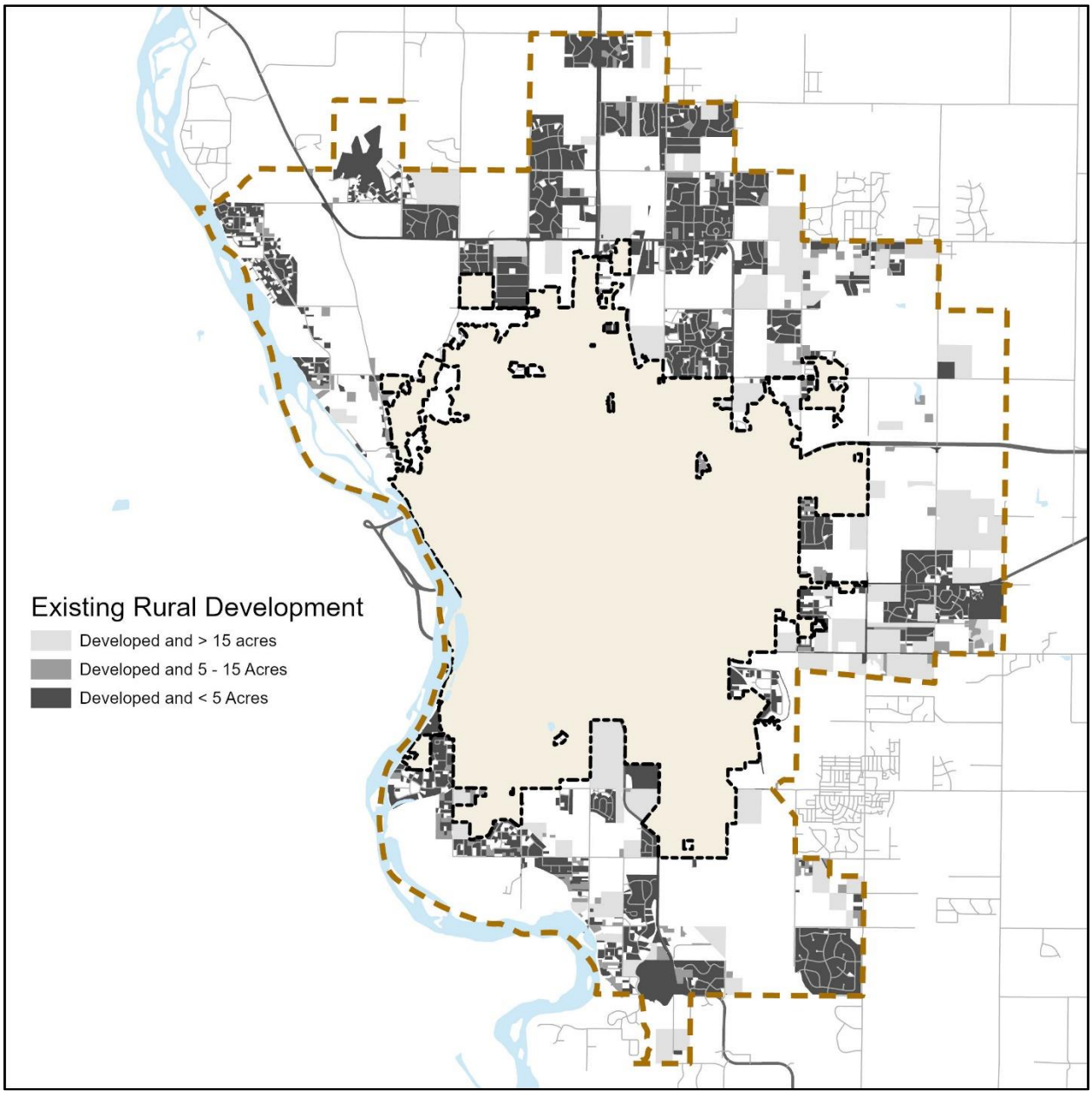
Future urban development of the ETA is impeded by rural development that already exists outside of city limits. With a few exceptions, such as universities and other public facilities, most of the development is residential, with lot sizes ranging from 1 to 5 acres. There are also agricultural properties with residential development at a much less intensive scale.

A few subdivisions developed in the 1970s, such as Grand Prairie Estates and Green Acres, already abut the current city limits, and numerous other rural residential subdivisions were developed between the Mid-1990s and 2010. Most of the subdivisions are served by rural water lines, and homes have individual private septic systems. However, a few developments feature smaller lot sizes supported by a private centralized sewer system.

Although a majority of these subdivision plats include plans for future urbanization, experience indicates that this is unlikely to occur, with the possible exception of subdivisions with very large lot sizes. On the other hand, most unplatted areas with a home on a larger tract of land could more easily be redeveloped, with the home either moved or incorporated into the development.

Therefore, the areas of smaller-lot rural residential development may be seen as a hard constraint on future urban development at least within the 2045 time horizon of this plan.

Development Constraints Outside of City Limits



Airport

The Bismarck Airport occupies approximately 1,500 acres in the southeastern portion of the city. Although the airport is entirely annexed, most of the adjacent and surrounding lands are not. The airport plans to improve facilities as demand grows in the future, but there are no plans for major alterations in the runways that would affect city growth.

One of the objectives of the 2019 Airport Master Plan is to ensure compatibility between airport operations and surrounding land uses. There are three primary ways the airport affects suitability for urban growth. First, noise of aircraft takeoff can create a nuisance for nearby uses, particularly residences or sensitive institutional uses. Second, structures must be limited in height in and near runway approach zones. Third, standing water may attract wildlife that present a hazard to aircraft. Given that low-lying areas often require stormwater detention to manage runoff from developed impervious surfaces, the FAA advises limitations on these water bodies.

The airport constraints range from regulatory to advisory, and at least some of these impacts will have direct market effects even without intervention from the City. Other than areas immediately adjacent to the airport, most of these constraints may be managed especially for industrial uses.

Municipal Utility Serviceability

Another factor in development suitability outside of city limits is the potential to serve with municipal utilities, especially sewer and water. Unlike natural or development constraints, the expansion of city infrastructure does not represent hard constraints that cannot be resolved through engineering. However, development that requires extensive length of pipelines or additional facilities will have greater upfront costs, as well as long-term maintenance liabilities for the City. Bismarck engages in periodic master planning for the water and sewer systems, which are more detailed than necessary for the purpose of evaluating land capacity. This report will offer a high-level review.

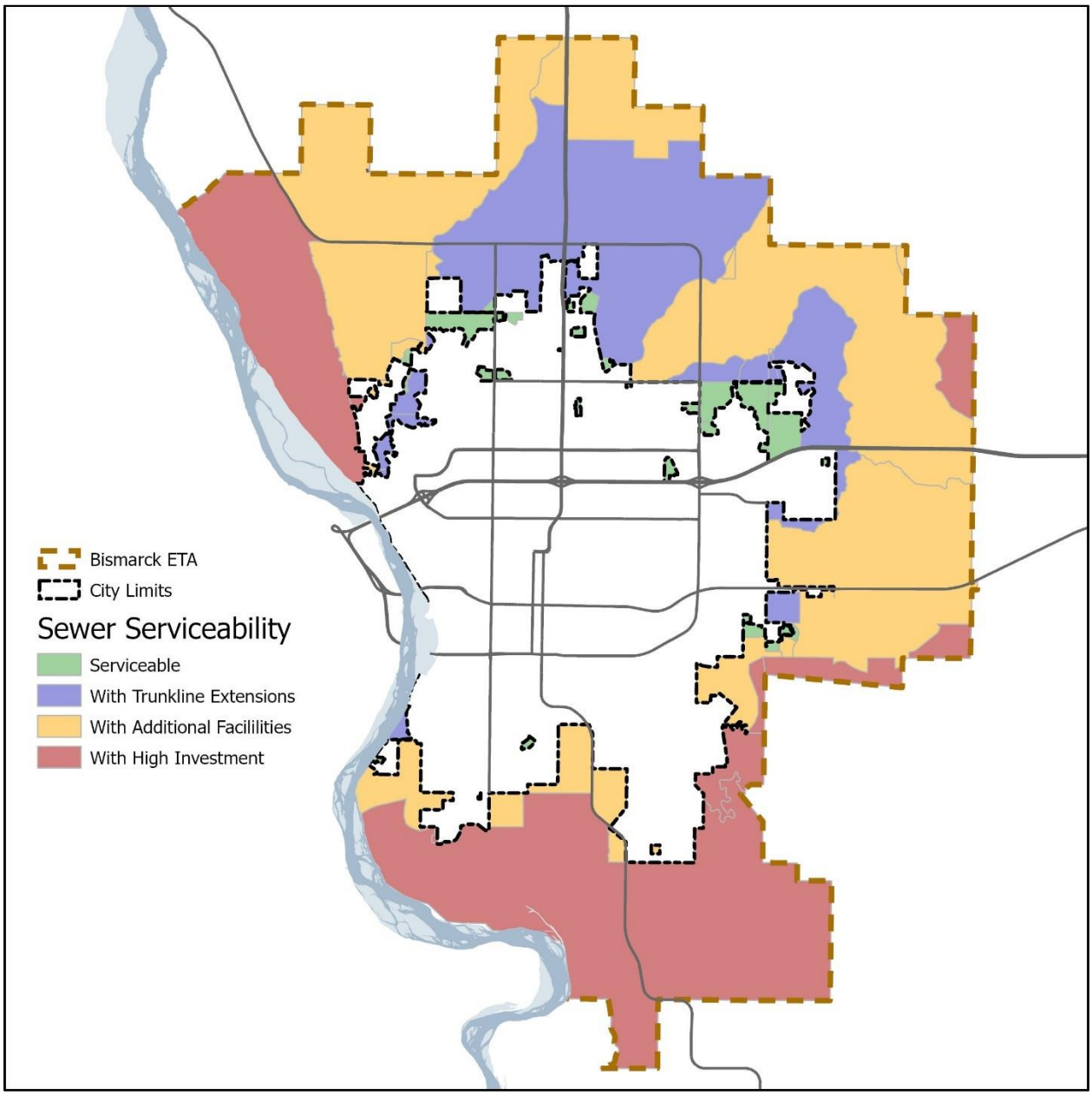
The most important determinant to land suitability is sanitary sewer. Gravity-based systems must be planned to follow the natural contours of the land, so areas uphill from existing interceptors and the treatment plant will necessarily be easier to serve. A gravity system is considered more cost-effective in the long term than a system that uses forced mains and lift stations, which must be maintained and operated by the City in perpetuity (unless replaced by a future gravity system).

The land area outside of city limits can be categorized based on the level of investment required to provide sewer, as shown on the map. Some areas are already serviceable with a connection to an existing city sewer main. These are areas that city growth has bypassed but were not yet annexed at the discretion of the property owner. The second group is property within a sewershed, an area where all wastewater flows toward a single direction, that is already served downstream. Development within these areas would require extensions of sewer mains but could be achieved without significant public investment.

The final two groups would require more significant investment to provide sanitary sewer services. This would be either a temporary or permanent lift station with force mains, or potentially a longer segment of gravity sewer line that would traverse and area with minimal adjacent use. Generally, low-lying areas south of the wastewater treatment plant or below the bluffs of the Missouri River would be the most difficult to provide service to.

The City's water distribution and storage system also affects suitability for development. The City must provide sufficient pressure for fire flows, which varies based on the elevation of the property. The City currently has eighteen different pressure zones, which are each regulated by their own pressure control devices. Capacity for development within each zone is limited by the facilities in place to support it, unless upgrades or replacements are made.

Sewer Serviceability Outside of City Limits



Another potential limitation for providing water service is the ability to reach an area with pipelines of sufficient capacity. A resilient water distribution system requires a degree of

redundancy, in terms of pipeline loops and excess pipe sizes, to protect from systemic failures and maintain water flows. If rights-of-way or easements are not available for logical extensions from an existing water main, then development may be hindered.

There is a history in Bismarck of landowners restricting extension of municipal services through their property in order to maintain a competitive advantage in land development. As a response, the City of Bismarck adopted a policy in 2015 to require extensions of easements or rights-of-way through properties during the subdivision process, which has mitigated this effect at least for plats recently recorded.

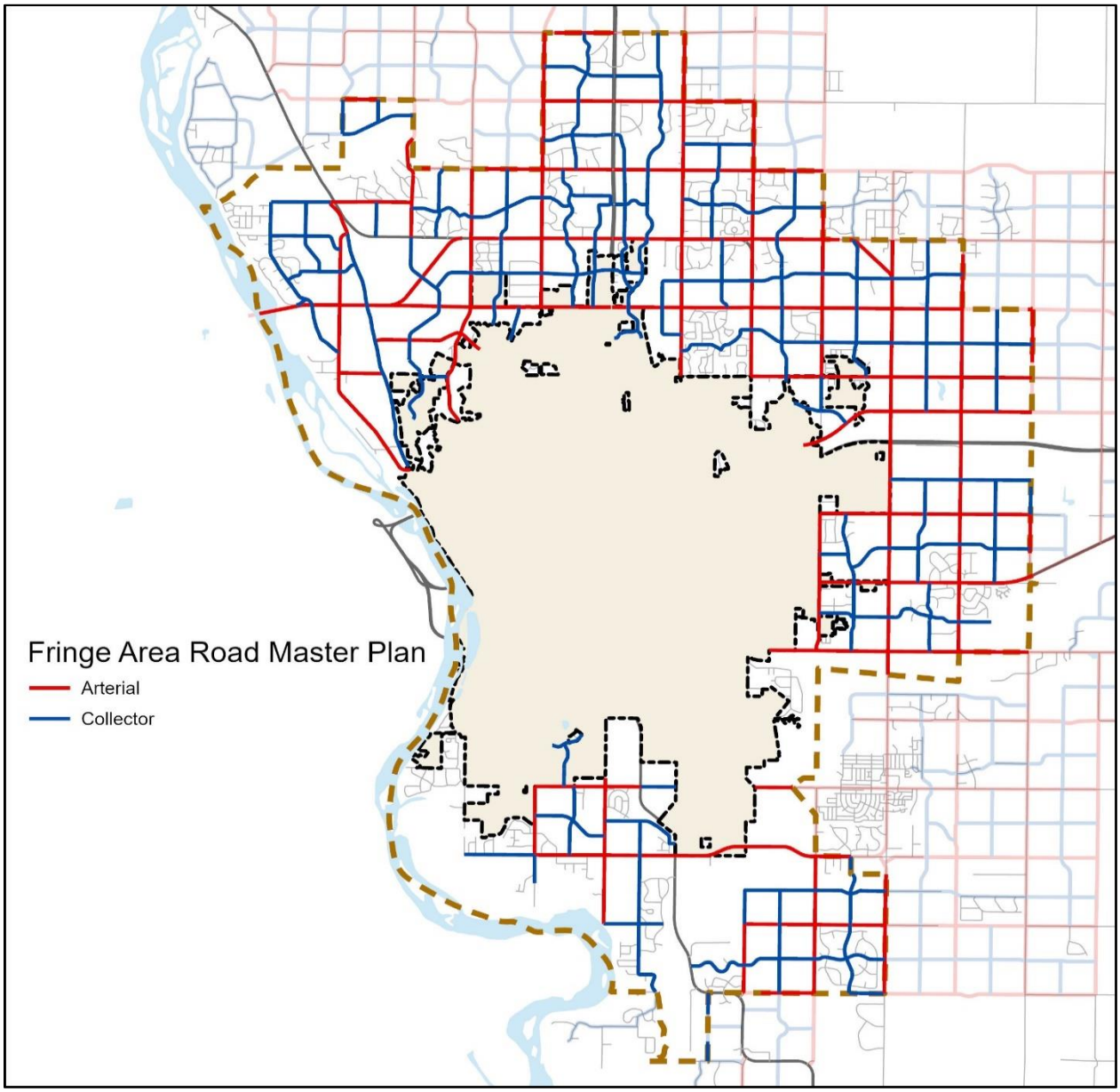
Transportation Access

Adequate roadway capacity must be available, or pending planned improvement projects, to support the traffic that may be anticipated from any new development. The City of Bismarck, in cooperation with Burleigh County and other governments in the region, utilize a Fringe Area Road Master Plan to set general alignments for future arterial and collector roadways. Local roadways are determined through the platting process within the overall planned network. This plan is modified periodically upon request, and it is not anticipated that a major change would occur through this Comprehensive Plan.

From the perspective of the City, the primary concern is the provision of emergency response for police, fire, and ambulances. The street network must also contain a certain degree of interconnectivity. By policy and by fire code, development above a certain intensity must provide multiple means of access to ensure that emergency services can be provided even during a street blockage.

Because of both transportation access and utility servicing, the primary driver for urban land suitability is simple proximity to existing infrastructure. North Dakota Century Code requires annexations to be “contiguous or adjacent to” city limits, which is intended to “encourage natural and well-ordered development.” However, the intent of this law has periodically been circumvented by including rights-of-way, which are under control of Burleigh County, in a petitioned annexation request to reach areas that are not contiguous. For the purposes of this report, land that is directly contiguous and may be readily served by city services is ranked more suitable.

Planned Transportation Access Outside of City Limits



Contiguous Outward Growth Sequence

Given the natural and development constraints and estimated transportation and utility infrastructure serviceability discussed in the previous section, a contiguous sequence of outward growth can be determined. This sequence is presented on the following page for twelve separate tiers, ranked based on these criteria, outside of city limits and within the ETA. Areas not included within a tier are not expected to annex and/or develop as part of Bismarck within the foreseeable future.

Each tier is roughly equivalent in size, ranging from 1,150 to 1,450 acres, although the higher tiers are slightly larger in area to reflect the small exponential characteristic of the growth projection.

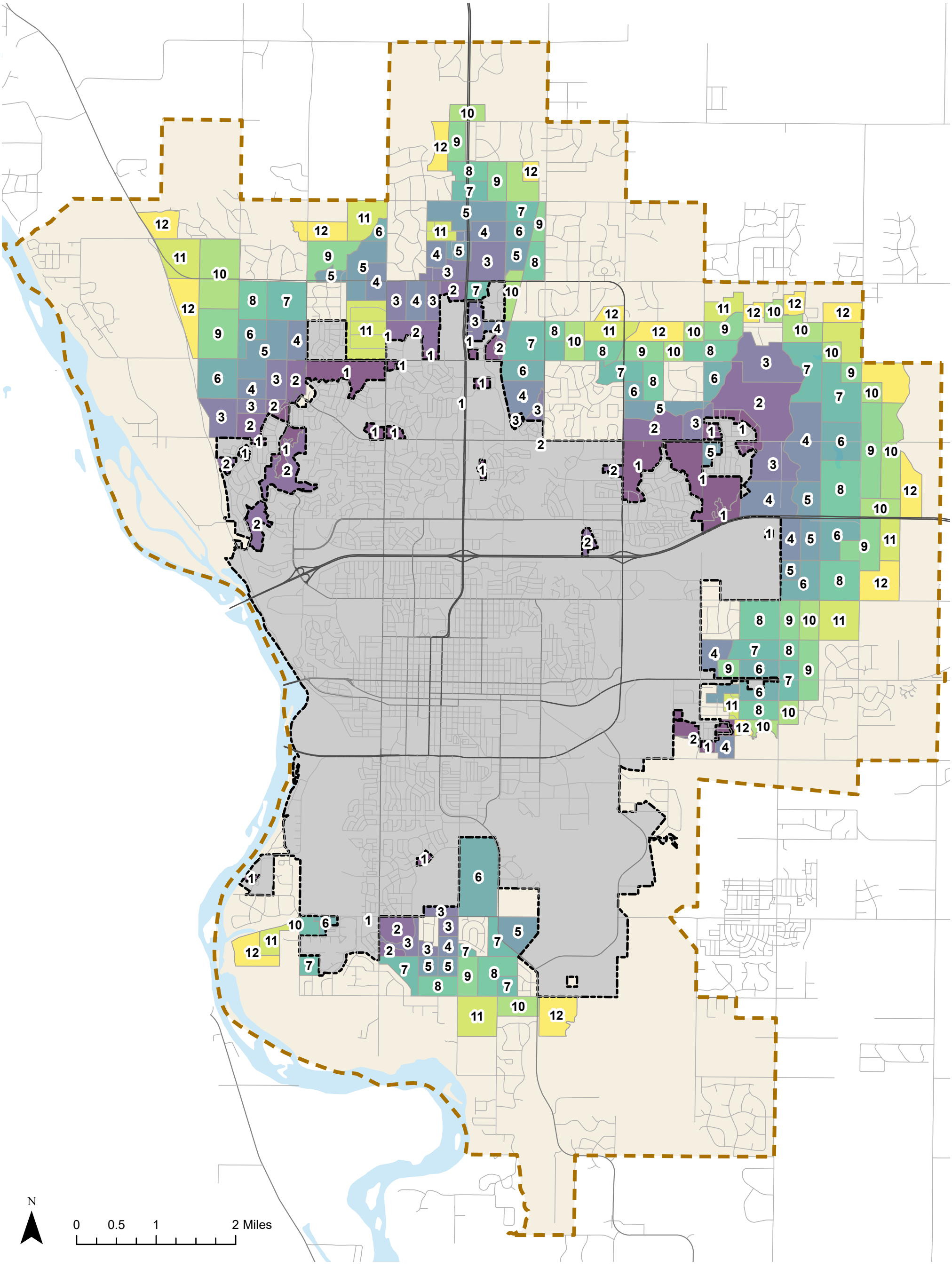
Contiguous Sequence Tiers by Projected Year Annexed

			Year Annexed		
Tier	**Acres**	**Cumulative**	**Scenario A**	**Scenario B**	**Scenario C**
1	1,150	1,150	2024	2023	2026
2	1,262	2,412	2028	2026	2032
3	1,305	3,717	2032	2029	2039
4	1,262	4,979	2036	2032	**2045**
5	1,261	6,241	2040	2035	2051
6	1,410	7,651	**2044**	2038	2057
7	1,444	9,094	**2048**	2041	2063
8	1,439	10,533	2052	**2044**	2069
9	1,407	11,940	2056	**2046**	2074
10	1,412	13,353	2059	2049	2079
11	1,387	14,740	2062	2051	2083
12	1,422	16,162	2065	2054	2089

The cumulative area of the tiers can be compared to the three annexation scenarios discussed in a previous section to determine an approximate year by which that tier would be annexed. Under scenario A (stable density), Tier 6 would be annexed by 2044 and Tier 7 by 2048. Under Scenario B (decreasing density), Tier 8 would be annexed by 2044 and Tier 9 by 2046. Under Scenario C (increasing density), Tier 4 would be annexed by 2045.

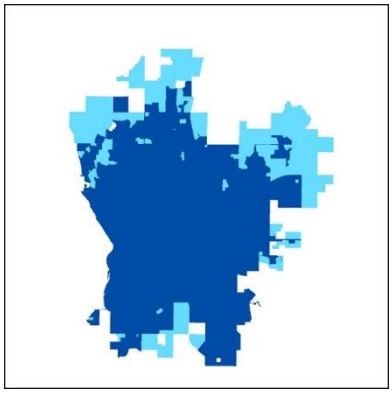
Contiguous Sequence of Growth

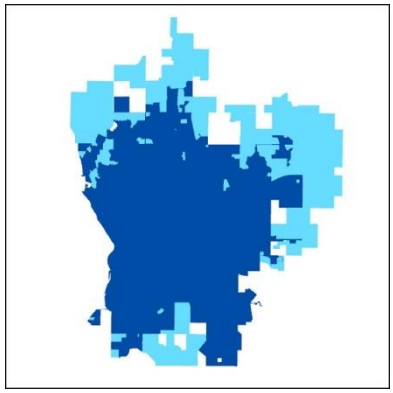
Land Use and Development Capacity

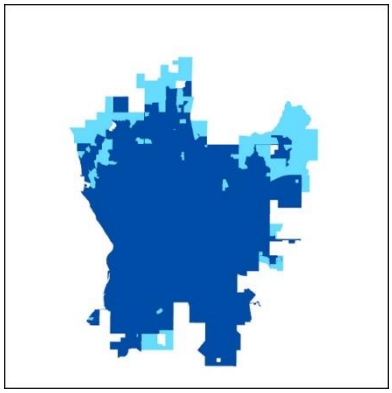


2045 Projected Annexation

Scenario A	Scenario B	Scenario C
Annexation occurs in proportion to population growth	Urban density continues to reduce in density at rate of - 0.4% per year	Urban density increases at a rate of 0.4% per year.
12.1 Sq M (new area)	17.0 Sq M (new area)	7.6 Sq M (new area)







As noted above, the projected year for annexation is when the development process for any given tract of land is expected to begin. Since subdivisions and sites will often take many years to develop to their full planned capacity, the annexed area of the city will always proceed in advance of the development area of projected residential, commercial, and industrial uses.

Comparing Growth Projections

The land use and development capacity in this report may be compared to the socio-economic growth projections made in 2018 for the 2020 Bismarck-Mandan Metropolitan Transportation Plan (MTP), which also considered inward and outward growth of Bismarck out to the year 2045. The purpose of the MTP socio-economic projections is to provide a basis for a travel demand model that is used to evaluate new transportation improvement projects.

The population projections used in both reports are exactly the same, but the MTP report anticipated more employment growth, which is translated into commercial and industrial development, than this report does. There are a few reasons for this difference. First, according to BLS data discussed above, the number of jobs in Burleigh County has actually declined each year since 2015. While this is expected to reverse, this new data may indicate that future employment growth is unlikely to exceed population growth as previously assumed. Secondly, commercial and industrial lands within the city already have higher vacancy rates than residential, which suggests that annexation of new land for these uses is likely to be slower. Thirdly, existing commercially developed land scored higher on redevelopment potential, indicating there may be more available capacity to support new commercial uses within these sites. Finally, this report is influenced by emergent market shifts, including remote work and online retail, that may also reduce commercial and office (but not industrial) development over the next two decades.

Another difference that affects comparability is that the MTP plan projects full build-out of development, and the contiguous growth sequence projects initial annexation. While both are targeted for 2045, this report can be expected to be approximately five-years ahead, when accounting for typical development timelines.

The overall area of the City of Bismarck is similar between both projections. The MTP projected 7.88 square miles of new growth outside of current city limits by 2045, which, given the caveats described above, would place the MTP projection in between Scenario A and Scenario C of this report.