

Northfield DRAFT Climate Action Plan

June 2019

The logo for the City of Northfield, Minnesota. It features the text "City Of" in a small, sans-serif font above the word "Northfield" in a large, bold, black serif font. Below "Northfield" is a stylized blue and green wave graphic. Underneath the wave is the word "Minnesota" in a smaller, black, sans-serif font.

City Of
Northfield
Minnesota

Letter from Advisory Board – CAPAB co-chairs

To be written by CAPAB co-chairs upon review of draft.

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To be completed for the final draft.

- City of Northfield
- CAPAB co-chairs
- Partners in Energy participants and facilitators
- GPI, LHB, Orange Environmental
- Northfield Community members
- All photos taken by Great Plains Institute

Executive Summary

Northfield is committed to ensuring a resilient and sustainable future. Through this plan, Northfield is embarking on a bold path toward climate action by reducing emissions, building community resiliency, and leading on innovative climate action. The plan provides a clear vision for climate action, including strategies focused on adapting to climate change effects and on mitigating those effects. The city is on the forefront of addressing climate change among Minnesota communities.

Local level change is an integral part of addressing climate change, which demands urgent and audacious action at all levels. A 2018 [report](#) from the Intergovernmental Panel on Climate Change (IPCC) describes the impact of increased greenhouse gas emissions, including climate impacts and the consequential ecological, economic, social, and health impacts; all of which demand pathways toward mitigating emissions and enhancing community resilience. Northfield is experiencing, and will continue to experience, more intense and frequent climate hazards such as precipitation and extreme heat. Enhancing the resilience of Northfield's population, as well as the built and natural infrastructure will better prepare the community recover from these hazards.

Equally important to climate change adaptation is the mitigation of the causes of climate change through greenhouse gas emission reductions. Emissions reductions will occur through a combination of renewable energy generation, electrification, energy conservation and efficiency, mode-shifting of transportation, reducing waste, increasing tree canopy, and a variety of other strategies. Through the development of this Climate Action Plan, Northfield has set a goal to reduce its emissions 50% by 2030 from 2015 levels and become carbon neutral no later than 2050, consistent with recommendations from the IPCC report.

The development of this plan demonstrates Northfield's dedication to building a more resilient, equitable, sustainable future by focusing on challenges and solutions associated with waste, food, transportation, energy, land, and water.

Resilience

Resilience describes the ability of an individual or community to respond, adapt, and be minimally impacted by a changing climate and increased climate hazard events. Resilience of systems and populations can be measured by vulnerabilities and strengths in the face of climate hazards. An assessment of community resilience involves an analysis of population, built infrastructure, and natural systems.

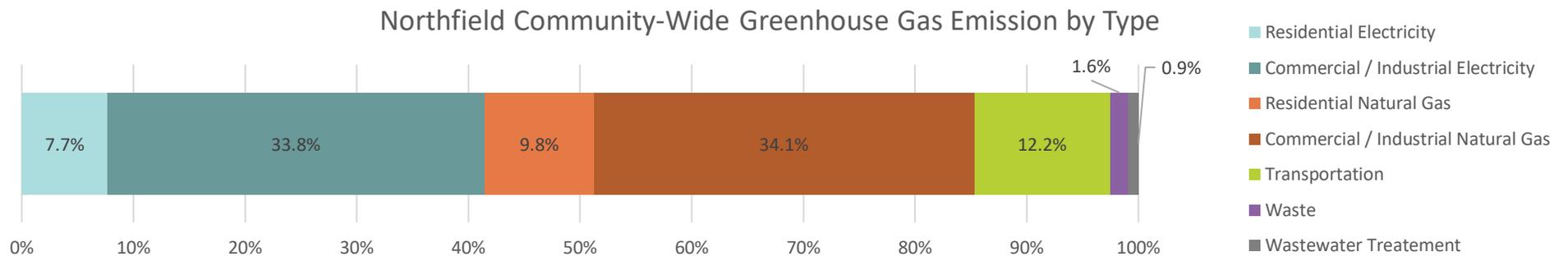
People experience and are impacted by climate-related hazards differently. The impact of climate hazards and the ability to recover from these impacts may depend on a variety of demographic (age, income, race, etc.) and situational factors (mobility, housing, transportation access, etc.). Built infrastructure, like roads, bridges, water and wastewater systems,



transportation networks, and city buildings. This infrastructure may be vulnerable to damage from precipitation events, extreme weather events, and other climate hazards and the resulting impacts can cause stress and disruptions to community members' necessities and quality of life. Natural infrastructure like trees, native plants, surface and groundwater, and agriculture/green spaces can make a community more resilient to climate hazards through carbon sequestration, shading, wastewater filtration, and improving community aesthetics.

Greenhouse Gas Inventory

Northfield's most current community emissions profile is for 2017. Emissions in Northfield come from a variety of sources: residential, commercial, and industrial buildings (electricity and natural gas), emissions from vehicle travel, emissions from solid waste processing and landfill decomposition, and water and wastewater processing.



Similar proportions of emissions in Northfield came from commercial/industrial usage of electricity (33.8%) and natural gas (34.1%). Transportation emissions followed commercial/industrial uses, making up 12.2% of emissions. Residential emissions account for 7.7% from electricity and 9.8% from natural gas. Processing of waste contribute to 1.6% of total emissions, and wastewater processing contributes 0.9%.

Mitigation

Mitigating the causes of climate change is a crucial component to climate action. Mitigation requires changes in energy usage and type of energy used. Actions necessary to mitigate climate impact include reducing the amount of energy used – using less energy through conservation, efficiency, and behavior change will decrease emissions associated with energy use. Mitigation also involves the type of fuel used for energy use. Transitioning to carbon-free energy sources to generate electricity, deliver heat, and power transportation systems will also decrease emissions associated with fossil fuel use. There must also be strategies to reduce material consumption to lower both upstream and downstream emissions that occur outside of the city boundaries, as well as actions to remove carbon from the atmosphere through sequestration. These strategies have many co-benefits, such as improved air quality, safer and more affordable homes, and increased resilience.

Goals and Strategies

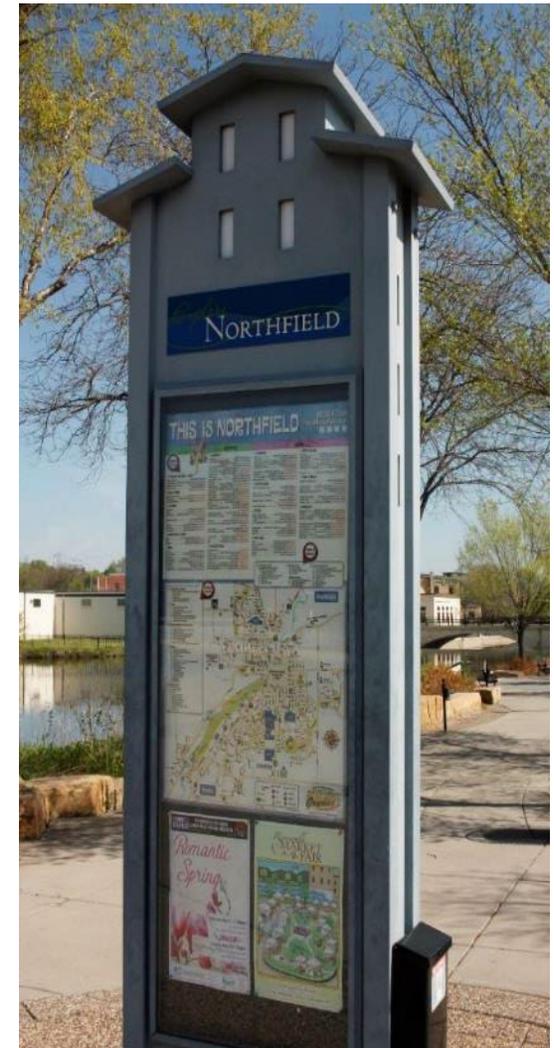
The City of Northfield has a goal to achieve 50% reduction in greenhouse gas emissions by 2030 and carbon neutrality by no later than 2050. Achieving these goals demands accelerated action and thorough planning. As such, Northfield has developed an extensive portfolio of strategies and actions for community and city stakeholders. The City engaged in Xcel Energy's Partners in Energy (PiE) planning process, with the results compiled in the Energy Subcommittee Report. The report focuses on addressing building energy use in the next three years – 2019-2022. This plan incorporates these actions, as well as broader actions for mitigation and resilience. Within the mitigation section, there are four overarching strategy areas: Education and Engagement, Policy and Planning, Innovation and Demonstration; and Supporting the Plan. Each of these sections are further broken into broad umbrella strategies, underneath which are many recommended actions. Below is a high-level summary of strategy areas.

Resilience Strategies

- Enhance **population resilience** through outreach, ensuring food security, expanding safe and affordable housing, and considering vulnerability to climate hazards in emergency preparedness planning
- Ensure long-term viability, reliability, and integrity of **built infrastructure** through maintenance, long-term planning, and infrastructure upgrades
- Protect and enhance **natural infrastructure** through supporting access to local food, increasing urban tree canopy, and adding more green infrastructure elements to city projects and planning

Mitigation Strategies

- Expand **education and engagement** strategies for residents, businesses, and tourists to increase and market sustainable, green projects
- Incorporate emission reductions, climate considerations, and resilience into **policy and planning** processes and decisions
- Demonstrate climate leadership through **innovation and demonstration** of energy and sustainability projects
- Maintain momentum and progress through **continued support** of the Climate Action Plan



Introduction

Northfield residents understand the urgency that is needed to address climate change. Climate action has been stalled for too long and the time has come to bend the trajectory of emissions downward to achieve a 50% reduction in emissions by 2030 and carbon neutrality no later than 2050. In a special report released as follow up to the Paris Climate Agreement, the Intergovernmental Panel on Climate Change warned the global community that we must reduce emissions 45% from 2010 levels by 2030 in order to limit warming to 1.5°C and avoid some of the worst consequences of climate change¹. In Minnesota, we are already seeing the effects of climate change in the form of heavy precipitation events and warmer temperatures. It is evident that Minnesota communities must simultaneously look to mitigate emissions and adapt to a changing environment. Northfield is prepared to be among the leading cities in the state to do so and stresses the importance of accelerating action.

The Climate Action Plan (CAP) provides a comprehensive pathway for addressing climate change in the City of Northfield and has identified priorities, strategies, and actions that will both mitigate the City's contribution to climate change and prepare Northfield for the unavoidable impacts of climate change. There is opportunity to improve the quality of life beyond reducing emissions. Many of the strategies deployed in this plan also have co-benefits that can positively impact the economic, physical, and environmental health of the community. Further, these strategies will be implemented in consideration of equity, elevating the resilience of the city's most vulnerable residents to ensure a more prosperous future for all who live and work in Northfield.

This plan is the culmination of many years of actions and leadership by Northfield residents. In 2008, an energy task force was established to address the challenges of climate change and energy supply. Ultimately, the plan developed by that task force was not adopted but was nonetheless instrumental in catalyzing future efforts to combat climate change. In 2010, Northfield joined the Minnesota GreenStep Cities program and has achieved Step 3. This program provides a framework for cities to improve upon their sustainability goals. The program has since added Steps 4 and 5, which can aid the city in tracking its progress toward fulfilling its climate and sustainability goals. In 2017, the city included "Climate Change Impacts" as a priority in its strategic plan, which led to establishing the Northfield Climate Action Plan Advisory Board (CAPAB) - tasked with leading and engaging the Northfield area community in responding strategically, rapidly, and responsibly to a changing climate by developing a Climate Action Plan.

The CAPAB has developed six core areas and subcommittees that have been identified as having the greatest opportunities for resilience and emissions reductions including: Materials and Waste, Energy, Land, Food, Water and Wastewater, and Transportation. Each core area group was led by a CAPAB member and each group convened subcommittees of community members around these topics and met monthly. Each subcommittee brainstormed background information, researched best practices, and developed strategies for emissions mitigation and resiliency related to the topic area to be incorporated into the CAP.

CAP Development & Community Engagement Process

The CAP was developed in two phases. The first phase included gathering data and information for community-wide emissions, city operations emissions, and the resilience assessment. The community-wide GHG inventory involved collecting three years (2015, 2016, and 2017) of emissions data associated with the consumption of electricity and natural gas in commercial, industrial, and residential buildings, emissions from vehicle travel, and emissions from solid waste. The city operations emissions inventory looked more closely at emissions from public buildings and facilities, streetlights and signals, the city fleet, water

¹ Intergovernmental Panel on Climate Change, *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5C approved by governments*, <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/> (accessed June 2019).
City of Northfield Draft Climate Action Plan, June 2019

distribution, and the treatment of wastewater. The information collected for these inventories was used to establish a baseline and determine a business-as-usual scenario that informs forecasted emissions from which the city seeks to reduce its emissions.

The resilience assessment looked at how hazards associated with climate change are anticipated to impact Northfield and how well prepared the city is to adapt to these changes. The assessment specifically looked at the strengths and vulnerabilities of the population as well as the built and natural infrastructure. This assessment informed the recommended strategies and actions to help improve the overall resilience of the community.

The second phase included public engagement and development of the CAP. This CAP was developed in parallel with the Partners in Energy (PiE) Energy Subcommittee Report, which is incorporated into the related energy elements of this plan. The development process of the Energy Report complemented the efforts of the CAP development through facilitation of energy data-sharing and leveraging the community engagement process. In addition to the PiE process, the CAP included several opportunities for community engagement, soliciting feedback on resilience and mitigations strategies, and gaining insights into additional areas of concern for residents and businesses.

Prior to the first phase, the CAPAB and City staff worked with a community volunteer and a City of Northfield student intern to develop a community-wide survey, available in English and Spanish. The survey asked 13 questions, [linked here](#), and was administered at 14 public events and paper copies were available at several locations throughout the City. An extensive report of the survey [can be found at this link](#). The survey sought to understand community member's understanding and attitudes toward climate change, individual actions being taken to address climate change, priority areas and level of concern, and additional information requested. More than 1,000 people responded to the survey, and their input was incorporated both in the Plan's framing and in the specific targets and strategies.

An educational event was held on February 28, 2019 to introduce community members to the CAP process, provide background on climate change, and set context around national initiatives to address climate change. Northfield's Earth Day celebration took place on April 27, 2019, at which each topic area subcommittee tabled. At this tabling event, community members completed a dot voting exercise to identify priority areas for the subcommittees – 280 Dots total were shared.

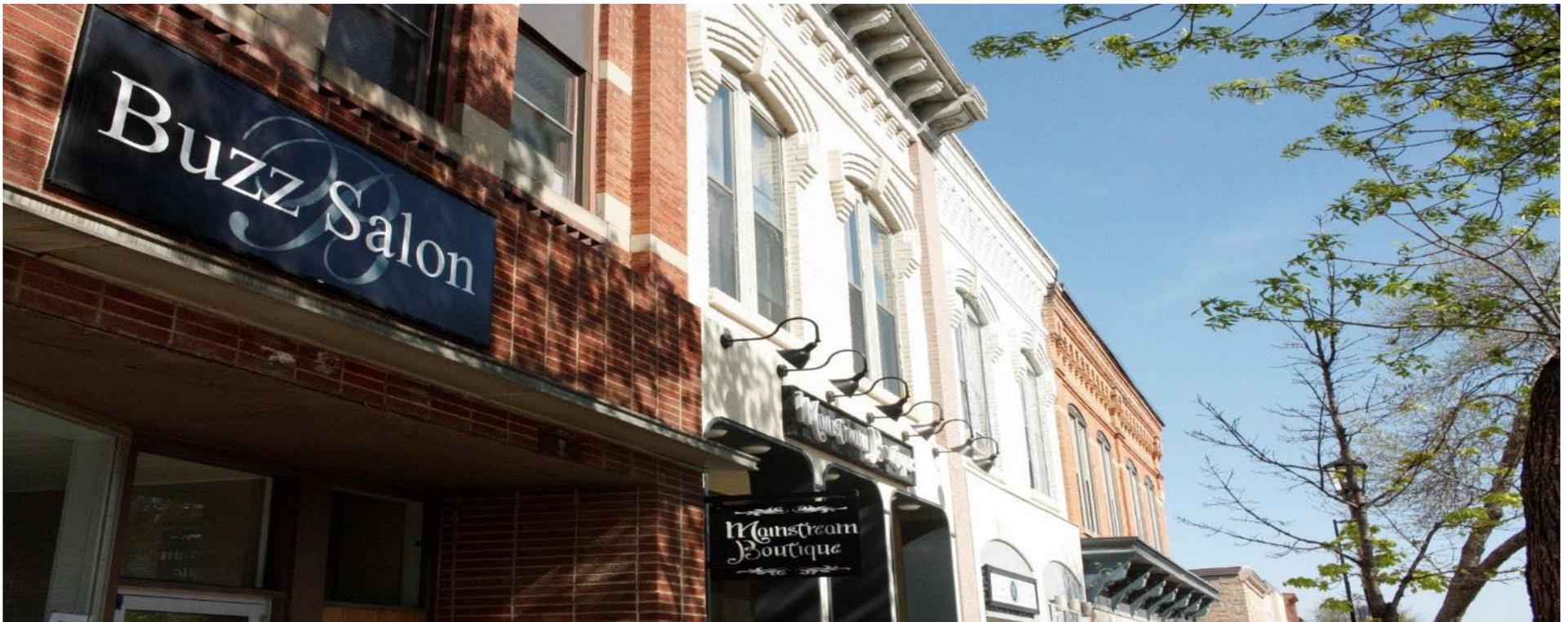
Northfield city staff, CAPAB members, and Great Plains Institute selected four focus groups to discuss community concerns and explore opportunities for inclusion in the CAP. These focus groups prioritized community members who would be most impacted by climate change, key stakeholders in implementing the plan, and those communities who had otherwise not been engaged in the planning process. These focus groups engaged high school students, college students from Carleton College and St. Olaf College, community groups working with and serving the Latinx community, and Northfield business owners and representatives. These focus groups were facilitated and led by Great Plains Institute with assistance in recruitment and outreach provided by the City of Northfield, Carleton College Sustainability Office, Northfield Chamber of Commerce, and high school students at Northfield High School. Each meeting varied in content, but focused on describing the CAP process to date, presenting background data on emissions and resilience, and discussing concerns, opportunities, and ideas surrounding climate change and quality of life. Findings from these focus group meetings were shared with CAPAB members and City staff and have been incorporated throughout the plan.

Although the Climate Action Plan is focused community-wide, the City also recognizes the importance of lowering emissions related to City operations and leading the way on strategies for mitigation and resiliency. As such, Great Plains Institute presented data gathered and analyzed by Orange Environmental LLC to city staff. The group also discussed strategies and initiatives to lower emissions.

City of Northfield Draft Climate Action Plan, June 2019

Public input sessions for the CAP draft are being planned for the summer and fall of 2019. These sessions will allow for feedback on strategies, prioritization of different ideas from residents, and formal commenting on the draft conducted through the City. Sessions will seek to engage a diverse representation of Northfield community members.

The following Climate Action Plan is the result of tremendous effort by community members and city staff. It is intended to guide the city toward achieving its GHG reduction goals and improving the resilience of the community. The CAP is a living document that is to be revisited frequently to help the city meet its targets and adjust to technological, political, and economic changes.



City of Northfield Draft Climate Action Plan, June 2019

Climate Resilience and Adaptation

Climate change is already having demonstrable impact on the Earth's natural systems. Minnesota has begun to see some of the most dramatic effects from a changing climate. Average annual temperatures are rising at a faster rate than most other parts of the country. Our winters are warming faster than average, especially overnight lows. Heavy precipitation events are more common throughout the state with both annual averages on the rise and the occurrence of mega-rain events — Northfield has seen two major flooding events since 2012. This Climate Action Plan includes strategies to reduce GHG emissions to mitigate the city's impact on climate change, but it also recognizes the need to adapt to changes that are already occurring by improving the resilience of all residents, as well as built and natural infrastructure.

Resilience describes the ability of an individual or community to respond, adapt, and be minimally impacted by a changing climate. This section will analyze resilience through two main sections. The first is an overview of anticipated of climate hazards in Northfield. The second is an assessment of Northfield's vulnerabilities, strengths, and opportunities as they relate to various community assets (built and natural infrastructure) and residents. Understanding strengths and vulnerabilities helps to determine the resilience of the community and how to strengthen it in the future. The resulting strategies are directed at addressing opportunities to prepare for, withstand, and adapt to climate-related impacts.

Climate change will have far-reaching effects that will impact communities, infrastructure, resources, and individuals differently. Assessing where and what a city and community's vulnerabilities are as they pertain to an increasingly changing climate will allow for proactive decision-making and intervention so that the safety and resilience of all Northfield residents is ensured.



Local Climate Hazards

As greenhouse gas levels in the atmosphere continue to rise, temperatures will increase and precipitation patterns change. In 2018, the Climate & Health Program of the Minnesota Department of Health conducted a study analyzing current climate trends and examining climate projection data to forecast temperature and precipitation trends through 2075. There are two major climate trends happening and expected to continue in Southeast Minnesota: an increase in winter and summer temperatures, and an increase in average and heavy precipitation events, with longer periods of dry spells in between².

The increase in winter and summer temperatures is well documented: average winter low temperatures are rising and winters are warming nearly 13 times faster than summers. The Minnesota Department of Health projects the average maximum summer temperature to increase by 7.7 degrees Fahrenheit through 2075 compared to 1981. The same projection forecasts a 9.1 degree Fahrenheit increase in average winter minimum temperatures through 2075. Warmer temperatures have direct and indirect effects on climate, ecology, and people.

Warming temperatures also cause more extreme and variable precipitation patterns through an increase in evaporation and the increased capacity for warmer air to hold more water vapor. More moisture in the atmosphere then produces more intense precipitation events. The graphic below provides a visualization of climate change impacts in Minnesota and some human health effects associated with these changes.

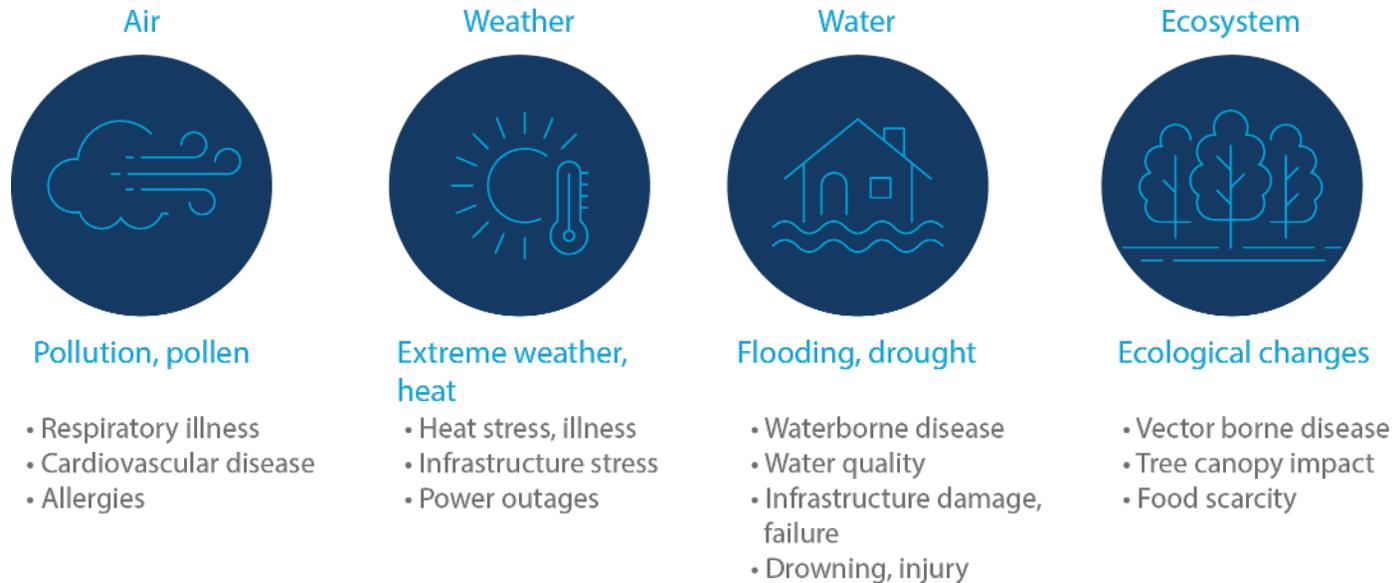


Figure 1. Climate impacts on health and well-being. Adapted from Minnesota Department of Health, "Minnesota Climate and Health Profile Report Summary," 2016.

² Minnesota Climate & Health Program, *Planning for Climate & Health Impacts in Southeast Minnesota*, https://www.health.state.mn.us/communities/environment/climate/docs/hsem_region1.pdf (accessed June 2019).
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In 2014, the Minnesota Department of Health completed a climate change vulnerability assessment for the state. In its analysis, MDH identified five major climate hazards of increasing concern in Minnesota as our climate changes: extreme heat events, air pollution, vector-borne disease, flooding and flash flooding, and drought³. Additionally, the Metropolitan Council identified extreme weather as a separate hazard, encompassing snow events, storms (rain, hail, etc.), and other extreme weather events. These climate hazards provide a lens through which to examine which resources and populations are more vulnerable to climate change, and the geographic vulnerabilities of both. Each of these six events has been ranked as being most likely, moderately likely, and low likelihood of occurring in Northfield when compared to the rest of the state of Minnesota in the MDH Vulnerability Assessment, as listed below.

HAZARD	DESCRIPTION
 Extreme Heat	<p>Extreme heat is measured by number of days of heat advisories and excessive heat warnings. By mid-century, projections indicate 5-15 more days with a maximum temperature above 95 degrees.</p> <p>Extreme heat is moderately likely to occur in Northfield when compared to the rest of Minnesota.</p>
 Air Pollution	<p>Climate change causes temperature and precipitation changes that change air quality in a variety of ways.</p> <ul style="list-style-type: none"> • Particulate Matter: Dust from industry, particulates from fossil fuel combustion, and air stagnation from wildfires in other parts of the country can cause increased particulate matter of various size • Allergens: Lengthening allergy season to create more potent allergens • Ground-level Ozone: The natural emission of VOCs from plants & vegetation increase as temperatures and sunlight increases <p>Air pollution is highly likely to occur in Northfield when compared to the rest of Minnesota.</p>
 Flooding & Flash Flooding	<p>With increasing precipitation events, models predict increasing frequency and intensity of flooding and flash flooding events. Geographies specifically vulnerable to flooding and flash flooding have seen increases in mega-rain events in recent years.</p> <p>Flooding and flash flooding are highly likely to occur in Northfield when compared to the rest of Minnesota.</p>
 Extreme Weather	<p>Extreme weather events such as thunderstorms, tornados, hail, intense precipitation events are less certain to occur because of climate change than warmer temperatures and increased precipitation themselves. Damage caused by these storms may be distinct from damage caused by flooding.</p> <p>Extreme weather is moderately likely to occur in Northfield when compared to the rest of Minnesota.</p>
 Vector-Borne Disease	<p>Climate changes cause ecological changes. Warmer weather facilitates a thriving tick population, which has the potential to carry and transmit diseases.</p> <p>Vector-borne disease is unlikely to occur in Northfield when compared to the rest of Minnesota.</p>
 Drought	<p>Decreases in water can cause drought. Although climate change can cause increased frequency and intensity of rain events, the precipitation events also become less predictable and more variable.</p> <p>Drought is unlikely to occur in Northfield when compared to the rest of Minnesota.</p>

Table 1. Likelihood of climate hazards in Northfield. Source: Minnesota Department of Health, "Minnesota Climate Change Vulnerability Assessment 2014," 2014.

³Minnesota Climate & Health Program, Environmental Impacts Analysis Unit, *Minnesota Climate Change Vulnerability Assessment 2014*, <https://www.health.state.mn.us/communities/environment/climate/docs/mnclimvulnreport.pdf> (accessed June 2019)

Resilience Assessment

Resilience is measured by the strengths and vulnerabilities of a community, including built infrastructure, natural infrastructure, and population. Better understanding of community resilience to climate change requires an analysis of existing community strengths – aspects of infrastructure and community character that make a city more resilient to climate hazards. At the same time, to improve its resilience and to understand priority areas for resilience strategies, a community must know what its vulnerabilities are.

Vulnerabilities to climate change hazards are a result of a confluence of factors including geographic location, inherent or pre-existing characteristics, and situational context. Natural infrastructure, built infrastructure, and community population are three main categories that may be either resilient toward or susceptible to climate hazards.

People are impacted differently by climate-related hazards. The ability to recover from an event may depend on a variety of factors, including demographic characteristics (age, income, race, language, health conditions) and situational factors (mobility, housing, transportation access). Vulnerability in populations can be assessed through these combined inherent and situational factors. Situational factors mean that an individual may only be vulnerable in the wake of a climate hazard, rather than inherently more vulnerable. Vulnerability can also be temporary and dynamic, as is the case with certain health conditions, pregnancy, and homelessness. Some opportunities for increased resiliency focus on individual action, whereas others focus on community-wide strategies to increase resiliency.

Built infrastructure can be vulnerable to climate hazards, and its vulnerability may lead to damage that impacts city operations and the well-being of the community. Built infrastructure includes elements related to transportation infrastructure (roads and bridges, public transportation, and active mobility), water infrastructure (stormwater, drinking water, and wastewater), and critical infrastructure (back-up generation facilities and energy infrastructure).

Natural infrastructure like trees, native plants, water, and ecosystems may be both susceptible to climate change and, at the same time, help improve the resilience of the city more broadly. For example, saplings in a flood zone may be vulnerable to flooding, but increased tree cover community-wide may sequester carbon, increase soil health, and provide shade during heat waves. This analysis focuses on trees and native plants, water supply and quality, and parks and natural spaces.

The following analysis examines strengths, vulnerabilities, and opportunities for increased resilience in the face of the six climate hazards identified previously. The resiliency analysis will focus on three main elements of Northfield: population, built infrastructure, and natural infrastructure.

Resilience Assessment



Population



Built Infrastructure



Natural Infrastructure

Population Resilience

The resiliency of a population depends on individual and community-wide strengths and vulnerabilities; a community is only as resilient as its most vulnerable. Resilience is a measure of how an individual may be impacted by different climate hazards and their ability to recover from these hazards. Population resiliency and vulnerability is dynamic and may change depending on context and time. This population resilience assessment examines a variety of demographic and situational factors, the impact of climate hazards, and opportunities for increased resilience. The below table examines each climate hazard, populations likely to be vulnerable, and the potential impacts of each hazard.

HAZARD	VULNERABLE POPULATIONS	IMPACTS
 Extreme Heat	<ul style="list-style-type: none"> • Older adults – particularly those living alone • Young children and babies • People experiencing homelessness • People living in poverty – particularly those without access to air conditioning • People of color • People with preexisting health conditions • Outdoor workers 	Heat-related illnesses <ul style="list-style-type: none"> • Heat stress • Heat stroke • Dehydration • Cardiovascular health
 Air Pollution	<ul style="list-style-type: none"> • Young children • Older adults • People of color • People with preexisting cardiovascular or respiratory diseases 	<ul style="list-style-type: none"> • Severe allergies • Cardiovascular health • Asthma attacks • Respiratory illness
 Vector-Borne Disease	<ul style="list-style-type: none"> • Older adults • People with weakened immune systems • Environmental justice communities 	<ul style="list-style-type: none"> • Lyme disease • Human anaplasmosis • West Nile Virus
 Flooding & Flash Flooding	<ul style="list-style-type: none"> • Older adults – particularly those living alone • Young children and babies • People with preexisting physical or mental health conditions • People living in poverty • People with limited English proficiency • People with limited mobility options – particularly no access to a vehicle 	<ul style="list-style-type: none"> • Drowning, injury • Mold or waterborne disease • Economic loss • Property damage • Travel limitations
 Drought	<ul style="list-style-type: none"> • Older adults • Young children • People with respiratory diseases • People of color 	<ul style="list-style-type: none"> • Respiratory illness and other illness • Property damage • Economic losses • Food insecurity
 Extreme Weather	<ul style="list-style-type: none"> • Older adults • Residents with limited English proficiency • Residents with mobility limitations • Low-income residents: renter, homeowners, those experiencing homelessness 	<ul style="list-style-type: none"> • Property damage • Injury/death • Travel limitations • Economic losses

Table 2. Climate hazard impact on population. Source: Minnesota Department of Health, "Minnesota Climate Change Vulnerability Assessment 2014," 2014.

Population vulnerability to climate hazards is impacted by where people live, the structures in which they live and work, and demographic factors. To discuss and measure vulnerability and resilience to climate impacts, each demographic and situational category is considered separately and without specific consideration for overlapping non-demographic factors, like geography. However, people will experience climate hazards as a confluence of inherent and situational factors, with some characteristics making them more resilient, and others more vulnerable. Holding many identities that might individually make a resident more vulnerable to climate hazards may together make them even more vulnerable than the sum of the identities would otherwise imply. Vulnerability and resilience are dynamic metrics and should not be taken only individually by demographic categories, but rather considered as indicators for potential impacts from climate hazards.

This assessment is based on literature reviews, quantitative data about Northfield’s population and where they live, as well as qualitative assessments based on community focus group discussions. These priority areas included concerns and opportunities related to housing (quality, access, affordability), mobility (transportation options and access), and health (food security, air quality, asthma and allergies). The following assessment focuses on the social determinants of Northfield’s population vulnerability, including the situational and demographic measures outlined above. Findings from 2017 5-year American Community Survey data and focus group sessions are incorporated in the assessment below.

Demographic Factors

Age

Residents under the age of 5 and over the age of 65 are vulnerable to climate hazards because of physiological differences and potential reliance on others for safety and care. Residents over 65 who live alone are especially vulnerable to climate hazards due to potential social isolation and mobility constraints.

Young children, under the age of 5, are vulnerable to heat-related illnesses and deaths. Children under the age of 5 tend to be more susceptible to air pollution related health impacts and vector-borne illnesses because they spend more time outside, exposed to pollutants and ticks. They might be more susceptible to extreme weather impacts due to reliance on others for evacuation or mobility needs.

Older residents, over the age of 65, have the highest rates of heat-related illnesses and deaths, mostly due to physiological changes that affect the ability to control body temperature. Because of this, they may be more vulnerable to extreme heat events. Older adults are vulnerable to negative

Proportion of population either under the age of 5 or over the age of 65

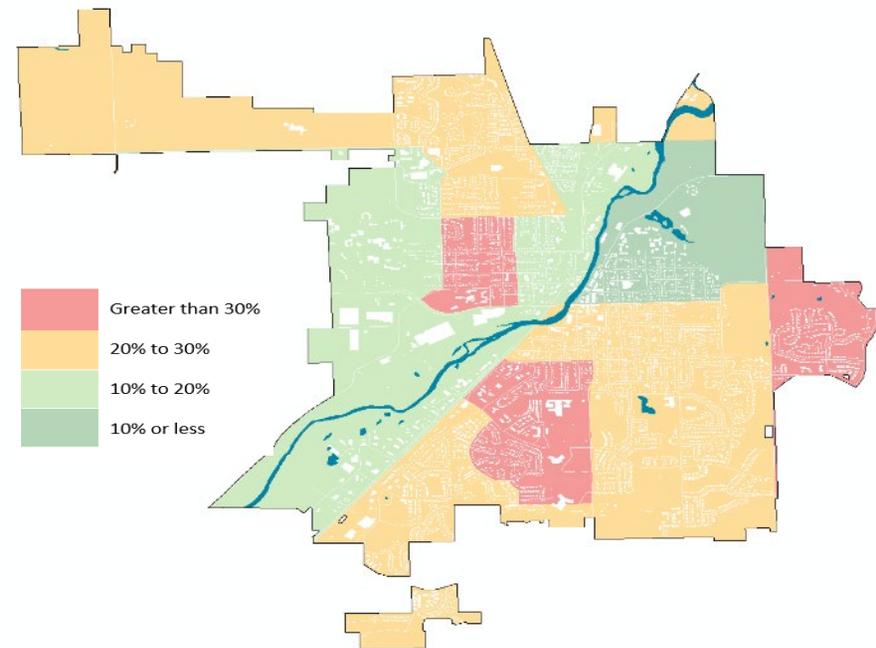


Figure 2. Vulnerable populations by age. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates; generated by Jessi Wyatt.

health effects due primarily to existing cardiovascular or respiratory diseases. Although older adults are not more vulnerable to contracting tick-borne diseases, symptoms may be more severe for them. Older adults are vulnerable to flooding, particularly those living alone and may require assistance to evacuate or receive care throughout the flood event. Older adults may be more vulnerable to extreme weather events for many of the above reasons.

In Northfield, 4.6% of the population is below the age of 5 and 14.2% of the population is above the age of 65. Residents over 65 and living alone account for 4.42% of the total population. The Minnesota Climate & Health Program estimates a 66% increase in the elder population in Rice County by 2050.

Strengths

Northfield has a moderately high livability index score (61) as measured by the AARP⁴, which accounts for a variety of factors such as environment, health, civic engagement, and housing for aging populations. This score indicates that the infrastructure to support older populations in Northfield is generally available and in good condition. Northfield has a similar level of residents over 65 as Rice County and Minnesota. On the other end of the age spectrum, Northfield has a lower percent of residents under the age of 5 than Rice County and Minnesota. These measures indicate that community-wide, Northfield may be more resilient to climate hazards due to the age makeup of the population and infrastructural support to those age groups.

Vulnerabilities

As mentioned above, the Minnesota Climate and Health Program estimates a 66% increase in the population over 65 for Rice County by 2050. In 2017, Northfield was named the best place to retire by Money magazine⁵. With this increase in the older population, Northfield should plan to address the associated increase in vulnerabilities to climate hazards associated with an aging population.

Opportunities

Northfield has many opportunities to increase the resilience of young and old populations in the face of climate hazards. The City can partner with local organizations and schools to develop mobility and evacuation programs for young and old residents in the face of climate hazards, particularly flash floods. Similarly, older populations can increase resilience to climate hazards with increased social cohesion and networks, which the City can lead as well. Educational materials about warming temperatures, increased precipitation events, and potential health impacts may help to make residents more resilient to climate impacts. Other elements outlined later in this section, such as the safety and resilience of roads and public transportation options, will increase community resiliency, particularly for young and old populations with increased mobility considerations.

Percent of population above 65 & living alone

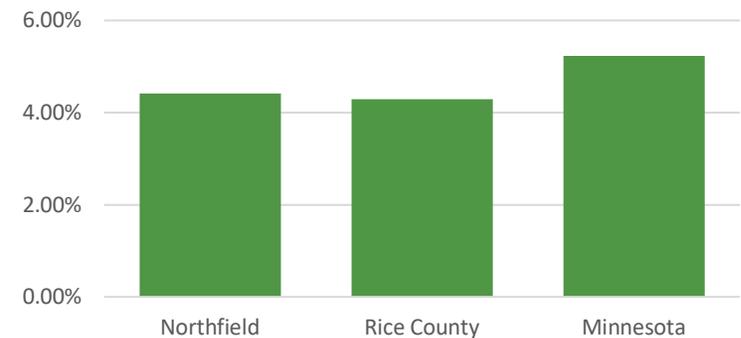


Figure 4. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates.

⁴ AARP, AARP Livability Index for Northfield, MN, <https://livabilityindex.aarp.org/search#Northfield+MN+USA>, (accessed June 2019).

⁵ Visit Northfield, *Northfield Named Best Place to Retire!*, <http://visitingnorthfield.com/northfield-named-best-place-retire/>, (accessed June 2019).

Income

Low-income residents may be more susceptible as they may lack the resources needed to afford adequate housing and may have limited or no access to a vehicle. Poor housing quality can impact both the health of residents and increase financial stress. For example, a home with little insulation and air sealing will result in colder indoor air temperatures in the winter and warmer in the summer. Further, homes in poor condition will cost more to heat and cool, increasing the energy burden of the residents.

Access to insurance is also an indicator for how well people can respond to damaging weather events. Low income residents living in rental or mobile housing may be less likely to recover from extreme weather events and flooding events that cause property damage. Flooding is more likely to negatively impact houses that are more poorly built or built in a floodplain.

As extreme heat events increase, those without access to air conditioning may suffer more heat-related illnesses. Community members experiencing homelessness are particularly susceptible to damage and health effects from these climate hazards as they may lack resources to protect themselves and property from damage.

Another area of concern for low-income community members is the ability to recover from impacts from climate shocks. Lower income community members may not have access to health insurance or quality health care, compounding the negative health impacts and ability to recover from such impacts.

In Northfield, the median household income is \$62,032, with 11.7% of residents living below the poverty line and 31.3% qualify for heating assistance. Of all residents, 5.4% of residents do not have access to a vehicle. During focus group discussions, concern for housing quality of Latinx community was identified as a priority area. Many residents of the Viking Terrace mobile park face challenges to improving housing quality. The design and construction of the homes make difficult to complete the necessary energy and health improvements. For example, water pipes are left exposed beneath the homes making them particularly vulnerable to Minnesota winters and the risk of freezing. In an effort to avoid freezing pipes, residents may leave the water running and turn their heat up in times of extreme cold, resulting in increased water and heating bills. Solutions to these issues require specialized knowledge and access to financing that may not be available to all residents.

Strengths

Northfield has an unemployment rate of 2.75% in 2018, which is lower than the Minnesota and National rate. The poverty level and median household income is similar to the statewide levels, indicating that Northfield's population is not more vulnerable than others in Minnesota because of economic concerns. The Energy Subcommittee Report involves many strategies related to housing, with emphasis on low-income, renter, and Latinx populations in Northfield.

City of Northfield Draft Climate Action Plan, June 2019

Proportion of individuals with income below the poverty threshold

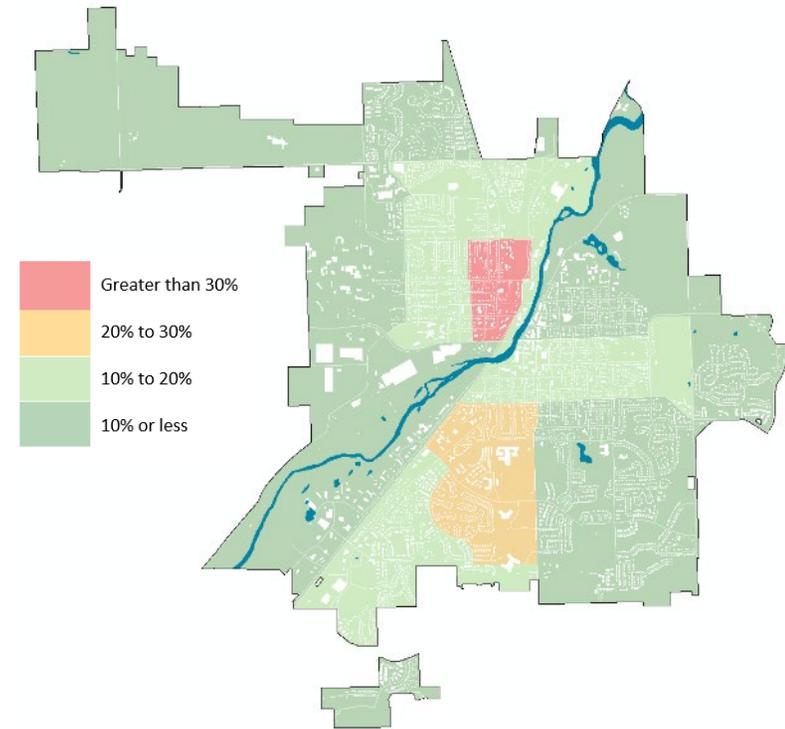


Figure 5. Vulnerable populations by income. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates; generated by Jessi Wyatt.

Vulnerabilities

As seen in the map above, the census tract with the highest poverty levels is close to the Cannon River, a site vulnerable to flash flooding events. Because lower income residents are more vulnerable to impacts from flooding and recovering from flooding, this situational context should be considered in resiliency strategies. Mobility options, housing improvements, and programs for energy efficiency may be less available to lower income individuals, which could increase resiliency.

Opportunities

Focusing city services, outreach materials, and support for community-led initiatives on low-income populations in Northfield can address vulnerabilities and increase resiliency. Programs in support of safe, efficient, affordable housing and increased mobility options accessible to low-income residents can increase community resiliency.

Race

People of color are more vulnerable to climate hazards due to compounding disparities in access to health care and socioeconomic position because of race-based discrimination⁶. Racism and oppression impact preexisting health conditions and geographic location of residences, both of which have direct impacts on vulnerabilities to climate hazards.

Communities of color may be more vulnerable to the effects of extreme heat, primarily due to health disparities. Communities of color have higher prevalence of respiratory illness, which effect vulnerabilities to illnesses in the face of poor air quality days and respiratory illnesses associated with mold development due to excess moisture. Some studies have found that people of color may be disproportionately impacted by the spread of infectious diseases like vector-borne diseases, likely due to differential access to medical access and health insurance.

Of Northfield, residents, 16.4% are people of color. Hispanic or Latinx residents make up 8.7% of Northfield's population, African American or Black individuals 1.9%, Asian or Pacific Islanders 3.5%, and people of two or more races 2%.

Strengths

Northfield has many community groups that serve the Latinx community and that focus on decreasing economic and educational disparities among the Latinx population. In the City's strategic plan, diversity, equity, and inclusion is one of six strategic priorities, with an initiative focused on the creation and implementation of a Racial Equity Action Plan. The City is participating in a cohort of Minnesota cities working to advance racial equity implementation through the Government Alliance on Sustainability. These plans on their own will not solve systemic racial inequities that make people of color more vulnerable to climate hazard impacts, but the commitment of the City to addressing these issues can be built upon to specifically address climate vulnerabilities.

Proportion of non-white population

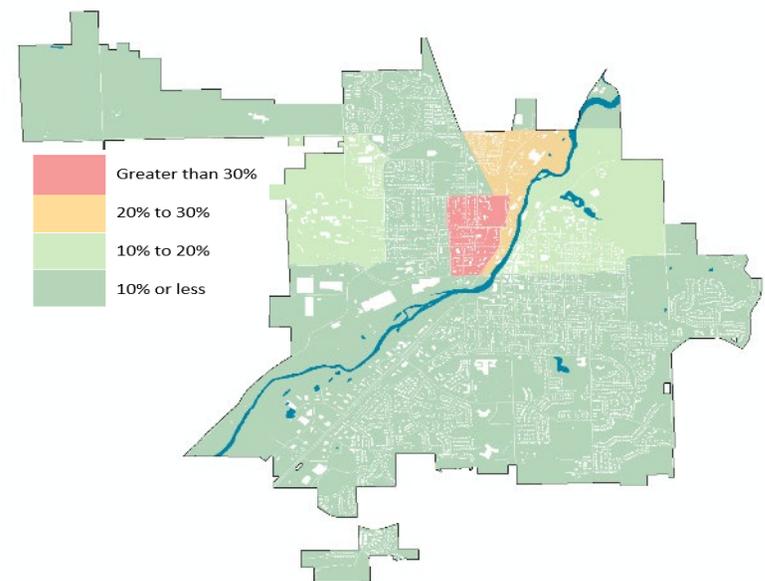


Figure 6. Vulnerable populations by race. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates; generated by Jessi Wyatt.

⁶ Vickie M. Mays et al., "Race, Race-Based Discrimination, and Health Outcomes Among African Americans," *Annual Review of Psychology*, 58, (2007): 201-225. City of Northfield Draft Climate Action Plan, June 2019

Vulnerabilities

Although Northfield has a lower percentage of people of color than the statewide average, communities of color may still be more vulnerable to impacts from climate hazards. As shown in the map above, census tracts with a higher proportion of non-white residents are close to the Cannon River, which is prone to flooding. This is one example of the ways in which the intersection of race and income may make populations more vulnerable to climate hazards. Through focus group conversations focused on the Latinx population in Northfield, housing, health, and transportation concerns related to climate impacts were raised as priority issues. Community members who are not US citizens may not have access to housing opportunities and programs, such as energy efficiency focused programs or loans, that can increase resiliency to climate hazards.

Opportunities

Focusing resources, programs, and outreach materials to communities of color in Northfield in efforts to address racial disparities can improve resiliency to climate hazards. The intersection of non-citizens, community members who do not speak English, and communities of color, particularly the Latinx community, is an important consideration for the development of programs and outreach materials to increase resilience – such as through increasing mobility options, housing quality and affordability, and healthcare access. The City has an opportunity to address many of the impacts of climate change on communities of color in the development of the Racial Equity Action Plan as well.

Language

Residents with limited English proficiency may be more vulnerable to climate hazards, primarily due to barriers in understanding and/or receiving emergency response or evacuation information. Community meetings held in English will not reach community members who do not understand English well. Health and safety warnings and outreach focused on climate resiliency or hazards may not reach these communities, creating an additional element of risk in the face of climate hazards. The most commonly spoken language besides English in Northfield is Spanish. 2.9% of Northfield residents speak English “less than very well,” according to the 2017 5-year American Community Survey.

Strengths

Most community members in Northfield speak some amount of English, indicating an understanding of city updates and alerts to climate hazards. A higher percentage of residents in Northfield speak some English than in Rice County and Minnesota more broadly. Greenvale Community School is a bilingual elementary school serving many of Northfield’s students and families.

Vulnerabilities

Updates from the City of Northfield page are available only in English. This update mechanism is how the City communicates climate risks, hazards, and emergencies, but may not be reaching all residents due to language barriers. Further, community members pointed out that energy efficiency programs to make housing and buildings more resilient to climate hazards are advertised and promoted only in English.

Opportunities

The City can increase community resilience by ensuring that announcements, alerts, and city services are communicated in English and Spanish, rather than only English. There is also opportunity for both the City and residents to improve relationships and social cohesion across cultural lines, building toward a stronger community.

Ability Level and Health

Residents with limited mobility or pre-existing medical conditions may be more vulnerable to climate hazards. Residents with respiratory illnesses are more susceptible to health issues associated with poor air quality days, exposure to allergens from pollen, and exposure to mold. Poor air quality may exacerbate symptoms of COPD and asthma. Outdoor workers may be more susceptible to the onset and exacerbation of symptoms of asthma as air quality worsens. In Rice County, 673 people visited the emergency room for asthma-related illnesses between 2013-2015. The rate of emergency department visits was 34.4 in Rice County, compared to 37.6 statewide for 2013-2015⁷. The rate is a ratio of the number of emergency room visits divided by the number of people at risk in a population. Hospitalization rates for COPD (age-adjusted) are 19.8 in Rice County and 14.6 statewide.

Residents in wheelchairs and with other mobility limitations are vulnerable to health impacts in recovering from hazards including extreme weather and floods, as they may have more difficulty evacuating or avoiding sidewalks that are flooded. Disability status is measured through the American Community Survey and encompasses many forms of disability. Statewide, 11.2% of the population has a disability and in Northfield that rate is 7.5%.

Strengths

Rice County has lower air pollution levels than other geographies due to its distance from heavy-industry metropolitan areas and low likelihood of wildfires. Additionally, the three largest employment sectors in Northfield are primarily indoor professions – educational services (19.2%), health care and social assistance (16.1%), and manufacturing (12.1%). These professions reduce individual exposure to poor air quality compared to outdoor professions. Additionally, the percentage of the population with a disability in Northfield is lower than statewide.

Vulnerabilities

Residents with mobility limitations, pre-existing respiratory diseases, and other disabilities may be more vulnerable to the impacts of climate hazards. In Northfield, although a high percentage of workers primarily work indoors and therefore will have less exposure to air pollution than other industries, preexisting health issues and health impacts from climate hazards disproportionately impact poor people and people of color, as outlined above.

Opportunities

Ensuring connected and well-maintained sidewalks is necessary to ensure mobility and evacuation options for individuals with disabilities, especially those in wheelchairs. Providing safe, affordable housing can address mold issues that can exacerbate or trigger respiratory illnesses. More broadly, as climate hazards impact human health, communities need access to reliable, quality healthcare.

Housing

The condition, location, and cost of housing all impact the vulnerability and resiliency of both the housing structure itself and the people living in it. The condition of housing is an important resiliency consideration for a variety of reasons. First, a more energy efficient home protects inhabitants from extreme weather such as extreme heat, and helps to lower energy use, thereby increasing grid resilience as electricity demand decreases. Focus group members shared that some community members run water consistently in the winter to avoid pipes freezing, a weatherization and efficiency issue that is exacerbated into a water usage issue for community-wide resiliency considerations. Second, an anchored, updated home is more resilient to climate hazards such as increased flooding and intense storms. Finally, houses that are weatherized and inspected regularly prevent mold and water-borne illnesses associated with flooding and stormwater.

⁷ Minnesota Department of Health, *Minnesota Public Health Data Access Asthma query*, https://data.web.health.state.mn.us/asthma_query, (accessed June 2019).
City of Northfield Draft Climate Action Plan, June 2019

Affordability of housing is related to both the condition and location of housing. Renters are more susceptible to impacts from climate hazards as they are generally lower income and have less control over HVAC and weatherization upgrades. Rice County has less than 1% vacancy of housing generally, with almost no vacancy of affordable housing. Residents experiencing homelessness are vulnerable to all impacts of climate change and are the least likely to be able to recover from impacts.

Strengths

The Energy Subcommittee Summary Report involves many strategies related to housing, with focus given to low-income, renter, and Latinx populations in Northfield. Many areas in Northfield have a high-quality housing stock, the structures of which are more resilient to climate hazards.

Vulnerabilities

In focus group conversations, housing was highlighted as a primary concern for Northfield. Viking Terrace was identified as an area vulnerable to climate impacts as many mobile homes are unanchored with dated HVAC systems. As mentioned previously, low-income residents most likely to need weatherization and efficiency upgrades in their homes may also be least likely to afford these programs. Renters are more vulnerable to climate change impacts, but there are barriers to buying homes for first-time buyers, particularly for undocumented community members. Affordable housing in Northfield is exceedingly rare, with almost no affordable housing county-wide. Community members emphasized that many areas where housing upgrades are needed are invisible to much of the community due to isolation from the main downtown district.

Opportunities

City Council is currently considering an Accessory Dwelling Unit ordinance, which would impact affordable housing availability in the city and build resiliency to climate change. Through the Energy Subcommittee Report, Growing Up Healthy is partnering with Center for Energy and Environment to perform Home Energy Squad visits. This trajectory can continue to upgrade efficiency and weatherization equipment through programs with city partnerships. Considering connectivity and access to necessities in community planning to build community resiliency will also address concerns around climate hazards.



Built Infrastructure

The built infrastructure of a city includes facilities constructed for water distribution and treatment, transportation and mobility, and delivery of energy. These features are crucial to the functioning of a city and the safety of its residents. Built infrastructure may be susceptible to climate hazards, especially when not maintained regularly, nor necessarily constructed with consideration of future climate impacts. Built infrastructure can be particularly vulnerable to increased precipitation and freeze/thaw cycles, which can shock and stress pipes, roads, and bridges, leading to structural damage. Aging infrastructure is particularly vulnerable to hazards. This section provides a snapshot of climate hazards of greatest concern for built infrastructure in Northfield, highlighting existing conditions, strengths, vulnerabilities, and opportunities for increased resilience.

Water Infrastructure

Water infrastructure includes drinking water, stormwater infrastructure (gray and green), and wastewater treatment. Access to clean, potable water is central to the safety and vitality of Northfield residents and businesses. Water infrastructure may be susceptible to climate hazards including prolonged heatwaves, heavy precipitation, extreme weather events, and freeze/thaw cycles. Power outages caused by extreme weather can impact the functionality of wastewater and drinking water infrastructure. With increased heavy precipitation events, stormwater infrastructure may be stressed or overwhelmed limiting its ability to effectively convey or allow water to infiltrate as designed. Further, flooding and flash flooding events can increase the likelihood of surface water being contaminated, reducing the water quality. Power outages caused by extreme weather can impact the functionality of wastewater and drinking water infrastructure. The following summarizes the existing conditions, strengths, vulnerabilities, and opportunities of water infrastructure.

Stormwater Infrastructure

Stormwater infrastructure support community resiliency during periods of heavy rainfall. Conveyance systems help to move water quickly to rivers, streams, and lakes and away from the built environment. While this strategy works for most rainfalls, it may have negative impacts in times of heavier than anticipated rain events. Systems that are not designed to handle heavy rains may not have the capacity to intake large volumes of water, leading to back-ups and potential for flash flooding. Further, there may be downstream impacts related to sending too much water, too fast, and sometimes carrying debris or pollutants, into bodies of water.

Supplementing stormwater conveyance systems with green infrastructure can help mitigate some of these challenges. Green infrastructure, like bioretention ponds and rain gardens, can help slow the flow of stormwater and filter contaminants. According to the Northfield's Comprehensive plan, the City's stormwater drainage system consists of detention and quality treatment ponds, creeks, drainage ways, roadway gutters, overflow and yard drainage swales, catch basins, storm sewer lateral and storm sewer trunk main facilities.

Conveyance Systems: In periods of heavy rainfall and extreme weather, conveyance systems such as storm drains and pipes move water to surface water bodies. In Northfield, there are about 40 miles of stormwater lines, including gravity mains and drain tiles. Stormwater pipes generally direct water into the



Cannon River. Most pipes that the City has data on range from 12 to 36 inches in diameter. The City does not have a complete record on the age and condition of storm lines city-wide. As rainfall and precipitation increase, stormwater will increase, raising the concern of burdening the capacity of these conveyance systems.

Green Infrastructure: Northfield’s green stormwater infrastructure includes 57 bioretention ponds and one infiltration basin. The stormwater ponds are an average of 20.5 years old. In 2017, a water quality assessment⁸ was completed for the City of Northfield. The assessment look at stormwater ponds and measured their water quality against the state quality standard. Eight bioretention ponds were identified as high priority to be improved as they have reached or are approaching their sediment accumulation capacity. When stormwater runoff enters impaired ponds, the runoff is not adequately filtered, and therefore is less effective mitigating flooding and improving water quality. The City of Northfield provides incentive programs for residents to install rain gardens, native plantings, and rain barrels. These programs encourage residents to manage stormwater runoff in their own yards and residences, increasing community resilience.

Drinking Water

An updated, well-maintained drinking water system increases community resiliency, particularly as extreme heat events increase. Water demand is forecasted to increase on these days as community members drink more water to cool themselves down and use more water for distressed trees and other vegetation. Potable water in Northfield comes from four ground-water wells originating from the Jordan and Jordan-Prarie-du-Chien aquifers, both of which are stable sources of water. The wells range from 365 to 415 deep. There are three storage facilities for potable water. The water distribution system is made up of water mains ranging from 4 to 24 inches in diameter.

In 2006, Northfield conducted a comprehensive water plan⁹, which identified the water distribution system as effective and serving its purpose well. The Comprehensive Water Plan recommends expansion of the existing storage capacity and recommends a new well to be constructed between 2016 – 2021 for reliability of safe drinking water as development increases. To ensure resilience to climate events, the City must ensure maintenance and expansion of the water system as population trends increase and climate hazards introduce new threats to the system. With the current system, there have been 46 water main pipe bursts, none of which have been directly related to weather issues. As extreme weather is projected to increase, however, the City should be prepared to respond to quality and age issues of wells in the event of a pipe burst.

Wastewater Infrastructure

Wastewater infrastructure is made up of sewage lines and wastewater treatment facilities. This infrastructure may be more vulnerable to climate hazards as it ages and if maintenances is deferred. In Northfield, the sewage system serves 7.66 square miles and was originally constructed in the early 1900s¹⁰. The pipes range from 4 to 52 inches in diameter and the system is primarily a gravity pipe network. About 10% of the sewage lines are older than 50 years old, which is an indicator of system vulnerability to performance issues. Inflow/infiltration is a problem that may occur when clean water enters the sanitary sewer system which

⁸ City of Northfield, *City of Northfield Stormwater Pond Assessment*, <https://www.ci.northfield.mn.us/DocumentCenter/View/6170/Northfield-Pond-Assessment---Final-Report--12212017?bidId=>, (accessed June 2019).

⁹ City of Northfield, *Comprehensive Water Plan*, <https://www.ci.northfield.mn.us/DocumentCenter/View/608/ComprehensiveWaterPlan?bidId=>, (accessed June 2019).

¹⁰ City of Northfield, *Comprehensive Sanitary Sewer Plan for the Northfield/Dundas Area*, <https://www.ci.northfield.mn.us/DocumentCenter/View/607/ComprehensiveStormsewerPlan?bidId=>, (accessed June 2019).

may cause back-up problems and the unnecessary treatment of clean water. In 2008, the Sewage Comprehensive Plan for Northfield indicated no significant infiltration or inflow issues in Northfield.

The City of Northfield operates a wastewater treatment facility to treat wastewater and discharge that water into the Cannon River. In 2016, the city completed a plan¹¹ for Northfield's Wastewater Treatment Facility that included recommendations for improvements, repairs, and replacements. The facility was originally constructed in 1958, with the latest improvements before 2016 occurring in 2002. The facility was designed to meet the needs of the community until 2020. In 2018, the Northfield wastewater treatment facility experienced overflow issues and a fire. Since the summer of 2018, the processing has been running through a temporary system operation with an external partner treating the sludge. This spurred the City to begin the upgrading process with completion of upgrades projected in February 2020. The facility treated 20% more wastewater in 2017 compared to 2015.

Strengths

Northfield has strategically and preemptively sought to mitigate these effects through green stormwater infrastructure policies and incentives for residents to install rain gardens, rain barrels, and native plantings. The City passed an ordinance giving the city engineer authority to require a stormwater management study as part of site plan review¹². The drinking water infrastructure has had no weather-related pipe bursts, suggesting a resilient system. The upgrades to the wastewater treatment facility will include a specific focus on energy efficiency and upgraded safety features, as well as features that will increase the load served. These upgrades will ensure that the facility can operate efficiently and effectively as wastewater loads continue to increase with increased population.

Vulnerabilities

Northfield's water infrastructure may be most vulnerable to stormwater runoff issues due to design capacity in the face of increased climate hazards. As flooding events become more prevalent, stormwater infrastructure may become more strained and reach maximum capacity for high performance. The sanitary sewage lines have 10% older than 50 years: older pipes are more susceptible to leaks and bursts in the face of increased stress. Eight of Northfield's stormwater ponds have sediment levels indicating their ineffectiveness at adequately filtering stormwater before it enters other water bodies. The wastewater treatment facility is also situated in the northern portion of the city, immediately next to a FEMA-designated (Federal Emergency Management Association) area on almost all sides. The proximity of the facility to the river situates the facility surrounded by regulatory floodway, without base flood elevation – both of which are special flood hazard area designations, making it vulnerable to flooding.

Opportunities

Increasing green infrastructure for stormwater management increases filtration of stormwater and eases the capacity pressure of the stormwater management system as flooding and flash flooding will increase. By tracking and monitoring condition and age of the stormwater lines, the City can better perform regular maintenance and monitor for stress and quality. Programs focused on water quality improvements to impaired stormwater ponds will increase capacity for filtration and prevent contamination of surface water bodies. For drinking water infrastructure, the City has an opportunity to address the expanded need for new wells in the coming years, as climate hazards may impact the functionality of current well infrastructure. Wastewater treatment presents several opportunities for increased resilience. Smart sewers help to control wastewater and stormwater flow into waterways through sensors and monitoring. These

¹¹City of Northfield, *Wastewater Treatment Facility Plan*, <https://kymnradio.net/wp-content/uploads/2018/06/Final-Northfield-Facility-Plan-Adopted-2016-02-16.pdf>, (accessed June 2019).

¹²City of Northfield, *Land Development Code* (Section 2.4.4 Public Institution District (PI-S), B), <https://www.ci.northfield.mn.us/DocumentCenter/View/5005/Complete-2017-LDC-3-27-17?bidId=>, (accessed June 2019).

systems can also lessen sewer overflow and backup issues. The wastewater treatment plant updates currently being undertaken by the City include resilience opportunities, such as installing a microgrid for the plant for increased energy resiliency and reliability.

Transportation Infrastructure

Transportation infrastructure – roads, bridges, public transportation routes, bike/pedestrian trails and sidewalks – allows for movement of people and goods. Increased extreme weather events, particularly more frequent and intense precipitation events, have the potential to impose stress on built infrastructure systems.

Roads, bridges, and routes that are older and maintained less frequently are particularly vulnerable to hazards. Not only would such stress be inconvenient and dangerous to residents but may also result in increased infrastructure maintenance costs and damage to private and public property. Alternatively, transportation systems that are built to be resilient also offer opportunity to provide more active mobility choices improving residents' health and enhance stormwater infrastructure with capture and infiltration systems.

This section assesses the existing transportation network – roads and bridge, public transportation, and active mobility – in Northfield, and identifies strengths weaknesses and opportunities to improve its resilience.

Roads and Bridges

Roads and bridges are both vulnerable to climate hazards and provide an opportunity for increased resiliency for Northfield residents. Roads and bridges may be particularly susceptible to damage caused by increased freeze/thaw cycles, extreme heat, and flooding. The biggest risk of these climate hazards on roads and bridges is increased maintenance costs for infrastructure to ensure safety. Northfield contains 74 miles of roads – 18% of which (14.4 miles) are in less than fair condition. According to the Capital Improvement Plan, all roads will be reconstructed by 2021. There are 12 bridges in Northfield, all of which are in good or fair condition.

Road and bridge networks present an opportunity for community resilience through stormwater management and mobility. Safe, reliable mobility options are important for residents, and will continue to be important as residents move away from climate hazards as they occur.

The current age and status of roads in Northfield indicates that the roads and bridges are fairly resilient to hazards, assuming that all roads are updated as planned in Northfield's Capital Improvement Plan.



Public Transportation

Public transportation options not only help to mitigate emissions, but also provide an opportunity for increased community resilience. Northfield has a few public transportation options: Hiawathaland Transit serves the internal Northfield-Dundas region and Dial-a-ride bus services are available within the City. Northfield Lines, which has stops between Northfield and the Twin Cities metropolitan area, stops at Carleton College, Downtown Northfield, and St. Olaf College regularly, at least once daily. Of commuters traveling to and from Northfield, 0.50% of commuters use these bus lines to commute.

In focus group discussions with both the Latinx community and college students, many noted the frustration with the limited options for transit in the community. It was pointed out that the existing services are difficult to navigate, have limited frequency, and are the slowest transportation option for movement throughout the community. Limited transit services can impact residents' abilities to get to work, participate in community events, and move quickly in the event of an emergency.

Active Mobility

Active mobility options include bicycling, walking, scootering, rollerblading, and other forms of movement and rolling. Benefits of active mobility options include increased exercise, physical and mental health benefits, safer mobility¹³, and reduced greenhouse gas emissions.¹⁴ Active mobility trails may be susceptible to similar impacts as roads, streets and bridges: infrastructural damage from flooding, increased freeze/thaw cycles, and extreme heat. A cohesive, safe, well-maintained network of trails can increase population resiliency to climate hazards, particularly for those residents without access to a personal vehicle. Increased mobility options help people avoid, evacuate from, and adapt to climate hazards, such as a flood near their home.

A significant percentage of Northfield residents walk or bike to work – about 41.3%. In aggregate, Northfield has approximately 26.23 miles of trail – a combination of biking, walking, or combined trails. Many trails, mapped in Figure 7, are fragmented – except for the Mill Towns State Trail, which loops around the Cannon River. Most of the biking and walking trails are both located and connected in the southern portion of the community, in the neighborhoods, and along the Cannon going south from downtown.

¹³ Todd Litman, "A New Transit Safety Narrative," *Victoria Transport Policy Institute*, http://www.nctr.usf.edu/wp-content/uploads/2014/12/JPT17.4_Litman.pdf. (Accessed June 2019).

¹⁴ United States Department of Transportation Federal Transit Administration, *Public Transportation's Role in Responding to Climate Change*, <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf>. (Accessed June 2019).

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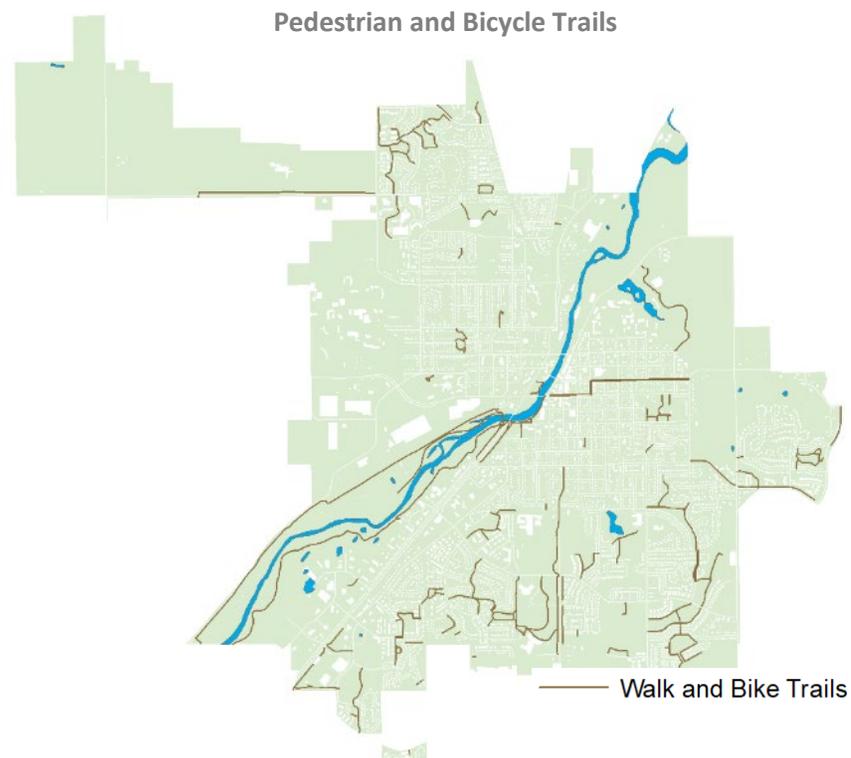


Figure 7. Pedestrian and bicycle trails in Northfield, MN. Source: City of Northfield Public Works Department, 2019; generated by Jessi Wyatt.

In 2012, the City adopted a [Complete Streets policy](#), which aims to balance the needs of all street users and to develop pedestrian and bicycle infrastructure. The policy encompasses resilience to climate hazards, including a goal of managing stormwater by reducing impervious surface and planting street trees. The Complete Streets Policy outlines steps the city can take, and frames the city's commitment, to building resilience through the design of transportation projects, prioritizing bicycle and pedestrian networks.

In April 2019, Toole Engineering conducted an analysis¹⁵ of different plans and policies in Northfield that impact transportation, with the intention of recommending areas to improve upon pedestrian, bicycle, and trail networks. As a part of this study, Toole Design facilitated an online gap analysis performed by Northfield residents. The analysis sought bicycling and walking network gaps in the city. Generally, Toole Design found that pedestrian problem areas are clustered along three major corridors with both limited pedestrian visibility and protection when crossing, fast-moving traffic failing to yield, a lack of pedestrian protection around schools, and a lack of sidewalk. Bicycling problem areas are clustered along similar corridors as pedestrian areas, with common concerns being a lack of safe crossing areas, fast-moving traffic, and poor maintenance and signage of existing routes. This analysis is useful in helping to determine areas that Northfield can prioritize as it expands infrastructure for active mobility.

Strengths

Much of the City road infrastructure is in better than fair condition, with all roads planned for reconstruction by 2021. This maintenance and upgrading of roads will improve the overall resilience of the transportation system that is dedicated to vehicles. Bridges in Northfield are in good condition as well.

Vulnerabilities

Active mobility trails in Northfield are fragmented across the community. Lacking connectivity makes these trail networks more difficult to maintain and for community usage. Public transportation systems in Northfield are limited in availability, accessibility, and convenience. There are no public bicycle shares, electric scooters, bikes, or other active mobility options that build community resiliency through the many benefits of alternative transportation, including increased quality of life.

Opportunities

Streets that are in poor condition are scheduled to be maintained present an opportunity to redesign existing networks to accommodate additional transportation modes and natural stormwater infrastructure to build community resiliency. Further, the community can prioritize completing the bike and pedestrian networks throughout the community, with emphasis on improving connectivity for low-income neighborhoods where residents may have few options for travel.



¹⁵ City of Northfield, *City of Northfield Pedestrian, Bike, and Trail System*, <https://www.ci.northfield.mn.us/DocumentCenter/View/7570/City-of-Northfield-Pedestrian-Bike-and-Trail-System-Final-Report?bidId=>. (Accessed June 2019).

Natural Infrastructure

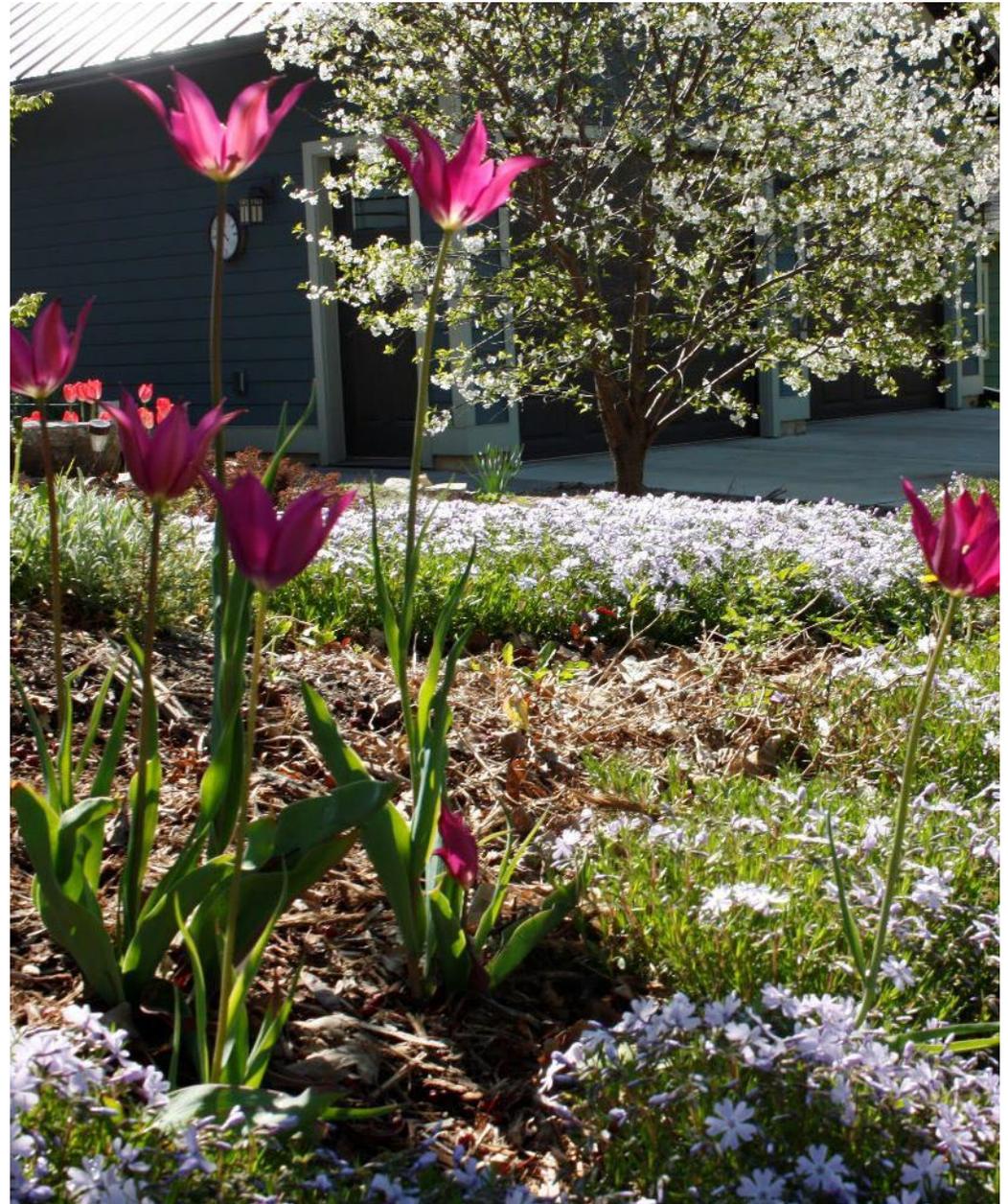
The natural infrastructure of a city includes ecological features that supplement built infrastructure to provide essential services such as water infiltration, air quality improvements, and quality of life enhancement. Natural infrastructure components include trees, rain gardens, native landscaping, and water. These features can be both vulnerable to climate hazards and they can mitigate impacts of climate hazards, making a community more resilient. For example, a healthy and extensive tree canopy sequesters carbon, provides shade on the increased extreme heat days, and filters stormwater.

This section gives a snapshot of climate hazards of distinct concern for trees and native plants and water supply and quality. In addition, each section describes existing conditions, strengths, vulnerabilities, and opportunities for increased resilience for each element in Northfield.

Trees and Native Plants

Trees are an important asset that provide ecological, environmental, social, and economic benefits to communities. Trees improve air quality, support healthy ecosystems and biodiversity, sequester carbon, help to manage stormwater run-off, enhance community aesthetics, and provide shade. Similarly, native plants provide habitat to pollinators, improve surface water quality, and improve aesthetics. These elements of trees and native plants contribute to community resilience in the face of climate hazards. For example, in the face of extreme heat events, shading from trees becomes particularly important. Likewise, infiltration of stormwater runoff from tree root systems is critical as major rain events become more frequent and intense.

The health of a community's tree canopy has broad-reaching implications for climate resilience. Trees uptake and sequester carbon dioxide, removing it from the surrounding atmosphere. Similarly, degradation or conversion of existing vegetation has the potential to release already sequestered carbon from biomass resulting in increased atmospheric emissions, in addition to loss of sequestration capacity. Northfield has a tree canopy coverage of 30.3%, indicating moderately healthy coverage and an opportunity to add more trees.



A significant concern for trees in Northfield is the prevalence of Emerald Ash Borer (EAB), a beetle whose larvae is lethal to ash trees. The invasive insect is increasing in prevalence partially due to warming winters in Minnesota. In Northfield, 20.3% of all trees are Ash, meaning the canopy is particularly susceptible to EAB. Additionally, the highest percent of a single genus is maple, accounting for 27.4%, well above the 10% recommended level of a single genus¹⁶. Northfield has six private and eight public rain gardens, totaling 0.8 acres of coverage across the 14 rain gardens. Rain gardens help to capture stormwater runoff and allow it to slowly infiltrate the ground, alleviating the volume of water that enters the conveyance system of the built stormwater system.

Strengths

The arboretum within Northfield’s city limits has a large tree canopy and extensive land management plan to build climate resiliency. The urban tree canopy coverage is healthy with moderate diversity of tree genera.

Vulnerabilities

Northfield’s most significant vulnerability for natural infrastructure is the high percentage of Ash trees susceptible to the spread of EAB. Northfield has a high percentage of maples. While there is not a significant threat to maples currently, the city should consider increasing the diversity of its trees as more are planted. In addition, some projections for Minnesota’s warming climate predict that different types of trees may be better suited in Minnesota, which could mean that existing coverage in Northfield – despite being healthy – may not be resilient in the long-term, as hardiness zones begin to change.¹⁷ There is also concern that a warming climate will create increasing opportunity for insects and viruses that host in trees to both better survive winters, and experience additional reproduction cycles, adding additional stressors to Northfield’s canopy.

Opportunities

There is opportunity to grow the urban tree canopy and provide multiple benefits to the community. Higher tree canopy coverage can help to sequester more carbon, improve soil and water quality, provide shade to residents, and habitat to many species. The city should look to prioritize tree replacement and planting in areas of low coverage and minimize the impact of Emerald Ash Borer. The city can also commit to long-term consideration of suitable canopy coverage, as Northfield begins to experience the impacts of a changing climate; proactive planting creates opportunity for long-term resilience.

Water Supply and Quality

Consistent water supply and water quality are high priorities for communities, the prioritization of which will only increase with a changing climate. A stable, clean water source provides a resilient asset to the community as temperatures warm and extreme weather events increase. Increased precipitation and changing freeze-thaw cycles may impact stormwater management practices that help to maintain the health of surface water.

¹⁶ City of Northfield Environmental Quality Commission, *Regular Meeting Agenda February 2014*, <https://www.ci.northfield.mn.us/Archive/ViewFile/Item/1100>. (Accessed June 2019).

¹⁷ United States Department of Agriculture, *Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the Northwoods Climate Change Response Framework Project*, https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs133.pdf. (Accessed June 2019).

Ground Water

Potable water in Northfield comes from the Jordan Aquifer and is a stable source of water. The geology of the aquifer is primarily composed sandstone, which has porous characteristics and is prone to fractures. Due to the permeability and the potential for wellheads to be compromised, the aquifer is most vulnerable to contaminations, especially during heavy rain events¹⁸.

Surface Water

There are five major water bodies that convey and store water through Northfield: the Cannon River, Heath Creek, Spring Creek, Rice Creek, and Lymon Lakes. Cannon River and Spring Brook are listed as impaired by the Minnesota Pollution Control Agency. The City's Wastewater Treatment Plant discharges into the Cannon River. As increases in average wet weather flow without increases in mass loading limits to the river occur, this may present problems with the River's capacity and the quality of the water. As such, these water bodies are more susceptible to damage from flooding and extreme water and may impact the city's resilience to these hazards.

Strengths

The Jordan aquifer is at a stable level and quality for drinking water. The Shoreland overlay district protects shoreland areas in Northfield to preserve and enhance surface waters. The shoreland overlay district protects shoreland areas to preserve and enhance surface waters in Northfield.

Vulnerabilities

The Cannon River, a central community feature, is an impaired water designated by the MPCA. In addition, as precipitation events increase, wastewater discharges are expected to increase in average wet weather flow into the Cannon River, without increasing the mass loading limits (according to the Comprehensive Water Plan). Spring Brook is also an impaired water. These water issues will continue to be vulnerable to climate hazards and will compound flooding events. As Northfield continues development with population growth and increased housing needs, impervious surface will likely increase. Higher impervious surface percentage can increase runoff and exacerbate warming temperatures. Tertiary land use and management decisions, like agricultural fertilizer application and winter road salt use, can also compound these challenges. Balancing development needs with natural infrastructure is a challenge, but one with opportunities for community resiliency presented.

Opportunities

Green stormwater infrastructure elements can help ensure the health of surface water systems as water quality levels are managed and runoff is controlled. The stormwater management ordinance in Northfield presents an opportunity to incorporate and stress the importance of green infrastructure elements. With increased development and impervious surface converts, ensuring native plantings, green infrastructure elements, and access to greenspaces for all residents will increase the resiliency of water systems and quality of life.

¹⁸ Metropolitan Council, *Groundwater Digest*, <https://metro council.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Groundwater-Digest,-Twin-Cities-Metropolitan-Area,.aspx>. (Accessed June 2019).

Land Use and Food

Northfield is a thriving, rural community located about an hour south of the Twin Cities metro. The city is predominantly in Rice County, a fraction of its northern section falls in Dakota County. The community is in central Southern Minnesota, just outside of the state's major metropolitan region and has rural and agricultural characteristics.

Land use decisions can impact both the resilience of a community as well as its emissions, especially from transportation. Resilience aspects of land use range from food security to the balance of the built and natural environment. Decisions made through land use regulations can dramatically impact both the climate impact of a community, as well as the way that the community experiences and adapts to a changing climate. Understanding and planning sustainable land use – of both built and natural infrastructures – can help increase community resiliency.

Decisions either enabled or prevented from the zoning code, like building development, also impact how people move around a community. For example, areas where residential housing is close to goods and services may motivate residents to walk, instead of drive, to the grocery store. Facilitating both mixed use zoning, as well as increased density of people and products can reduce the energy necessary to get from one place to another, while also fostering a stronger sense of community and place among residents.

Impervious surface refers to non-vegetated land – typically buildings, roads, parking lots, and other concrete areas. About 40% of land in Northfield is classified as impervious surface. High impervious surface indicates areas with lower vegetative coverage. As previously mentioned, natural infrastructure and vegetation can strengthen a community's resiliency from hazards through carbon sequestration, shading, water filtration, and other functions. In contrast, areas with high impervious cover can exacerbate and contribute to the intensity of climate risks.

Strengths

Northfield is a developed community with rural characteristics. Many of the neighborhoods and edge areas of the community have low impervious surface and greater vegetative cover. The proximity of the agricultural community can support a local food system.

Vulnerabilities

Much of Northfield's downtown and industrial areas have greater than 50% impervious surface coverage, increasing runoff during heavy rain events and contributing to urban heat island effect.

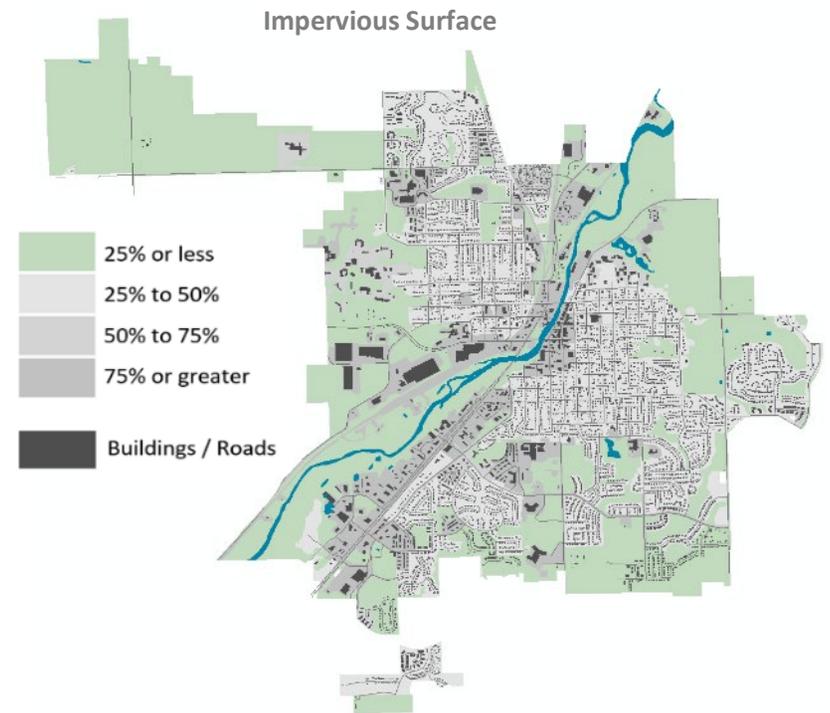


Figure 8. Impervious surfaces in Northfield, MN. Source: City of Northfield Public Works; generated by Jessi Wyatt.

Opportunities

There is opportunity to enable higher density by allowing more mixed uses and permitting accessory dwelling units in the land development code. There is also improve connectivity of trails and greenways to increase active mobility. Impervious surfaces can be reduced by removing parking minimums, narrowing streets, and committing to land cover conversion where appropriate. Northfield's rural characteristics and proximity to agricultural resources create an opportunity to improve food security and support the local agricultural economy. Supporting local food enterprises both reduces emissions from the transportation of food and boosts local businesses, while providing sustenance for residents. Further, available land within the community can also offer opportunity to convert land into food production through community gardens and school programming.

Resilience Strategies

Building community resilience to changes in climate events is crucial to climate action and to ensuring the safety and well-being of the community. Strategies for increasing community resilience and addressing community vulnerabilities to climate hazards are divided into three main categories: improve population resilience, enhance built infrastructure resilience, and enhance natural infrastructure resilience. Improving community resilience presents many other opportunities, including addressing inequities within Northfield's population that can exacerbate climate vulnerabilities.

RS – 1 Improve Population Resilience

Description: Improve community resilience by enabling community members to prepare for and recover from climate-related impacts through education, ensured food security, safe housing conditions, and emergency preparedness.

Recommended Actions

Preparedness and Response

- Lead and support emergency preparedness measures
 - Aid in response to food scarcities due to extreme weather
 - Support local, healthy food shelf
 - Develop and support plans for evacuation measures, particularly for populations vulnerable to hazards and within flood zones and those with limited mobility considerations
 - Ensure that emergency alerts are available in Spanish and through a variety of channels
 - Provide education materials on the health impacts of air pollutions and extreme heat
- Support active living through mobility options that are equitably available and accessible throughout the community, especially in underserved communities
- Establish a food coordinator position to lead local food programming to support locally produced foods and businesses

Equity

- Incorporate climate considerations and resilience strategies into Racial Equity Action Plan and the comprehensive plan update
- Increase affordable housing, emergency and transitional housing in Northfield, and ensure safety of these homes
- Strengthen community connectedness across cultural groups through more inclusive community events and more intentional engagement with underrepresented groups
- Consider climate migrants (unexpected growth in population) in city planning efforts

RS – 2 Enhance the Resilience of Built Infrastructure

Description: Ensure long-term integrity and reliability of built infrastructure systems through maintenance and integration of resilience into long-term planning and projects.

Recommended Actions

Stormwater

- Incorporate resilience into the capital improvement plan to ensure city infrastructure projects consider projected climate impacts
 - Conduct an asset management assessment in consideration of life cycle costs and climate risks
 - Develop and utilize a climate lens for all city infrastructure planning
- Increase community energy resilience during power outages through the development of micro-grids with storage and renewable electricity generation
- Evaluate upstream and downstream impact on the Cannon River of the Ames Mill Dam removal
- Use the higher historical rain events (500 or 1000-year floods) from Atlas 14 or projections as they become available for stormwater system planning and construction
- Incorporate smart sewer systems to monitor flows, overflow potential, and backup issues through sensors
- Increase the utilization of green infrastructure to supplement existing and future stormwater management systems, such as stormwater ponds and infiltration basins

Potable water

- Work with state agencies and other local governments to monitor the stability of the water supply from the Jordan aquifer and support management efforts
- Ensure the drinking water availability is adequate and balanced to meet future demand without risking the supply
- Continue to ensure the wastewater system has capacity to support increase demand

Emergency Response

- Coordinate with Dakota and Rice counties to plan for the management and disposal of waste after extreme weather events
- Ensure the incorporation of resilient elements such as microgrids, solar plus storage, and backup energy infrastructure

Land Use

- Incorporate additional transportation modes (such as bike lanes, wide sidewalks) and green stormwater infrastructure systems (such as rain gardens) into street maintenance and reconstruction projects
- Prioritize community multi-modal connectivity in long-term planning
- Increase bicycle and pedestrian network connectivity through the Complete Streets Policy implementation, with an emphasis on connecting low-income neighborhoods with downtown Northfield
- Include Accessory Dwelling Units as a permitted use in Northfield’s Land Development Code to enable more efficient use of land

RS – 3 Natural Infrastructure

Description: Protect and enhance natural infrastructure to ensure resilience to climate hazards and ability to mitigate impacts from climate hazards

Recommended Actions

Education

- Host workshops to provide opportunities for interested parties to learn about actions they can take to improve resilience including:
 - Soil remediation best practices
 - Increasing tree canopy and caring for existing trees on private property
 - Changing landscaping practices to consider beneficial plantings and practices that provide stormwater benefits, improve soil health, and increase pollinator habitat
 - Water conservation measures to reduce consumption of potable water and treatment of wastewater
- Incorporate food education and farming programs to Northfield school districts

Urban Forest and Vegetation

- Update and adopt Urban Forestry Asset Management Plan
- Incentivize expansion of boulevard gardens on private property; expand boulevard gardens and rain gardens on city-owned lands
- Increase tree canopy through city-sponsored program to plant trees
 - Prioritize tree replacement and plantings in areas of low canopy coverage to reduce the impact of Emerald Ash Borer damage
 - Proactively pursue increased canopy coverage to improve long-term resilience
- Pursue pervious pavement alternatives
- With the development of City parks and green spaces, ensure accessibility for all residents through connected trails, proximity to low-income neighborhoods, and signage in English and Spanish

Soil and Agriculture

- Create Advisory Board that represents agricultural sector in Northfield, supporting best practice models for carbon reduction farming and equal access and affordability of sustainable food
- Enable and encourage more community gardens throughout the city
- Incentivize and reward soil best management practice for urban lawns, gardens, landscaping, parks, open spaces, prairies, environmentally sensitive areas, and agricultural land uses
- Support creation of local compost process facilities and system to deliver organic material
- Increase conversation with agricultural producers to support local food systems and ensure sustainable agricultural land use practices, learn with and from community to better improve and achieve community resilience

Greenhouse Gas Emissions Inventory

The Northfield greenhouse gas (GHG) inventory is made up of two parts: community-wide emissions and city operations emissions. Each set of emissions follows the U.S. GHG Protocols developed by ICLEI and primarily include Scope 1 and Scope 2 emissions. Scope 1 emissions are those that are emitted within the boundary of a community such as gas and diesel vehicles, and the combustion of natural gas for space and water heating as well as industrial processes. Scope 2 emissions refer to those that result from the generation of electricity associated with the consumption of electricity within a community. Scope 3 emissions are often harder to capture as they are the upstream and downstream emissions that result from the production, transportation, and disposal of goods. Apart from waste emissions, Scope 3 is not included in either inventory. The purpose of completing a GHG inventory is to determine a baseline of emissions so that the community can set goals and measure progress against those goals.

This section includes the GHG inventories for community-wide and city operations for a three-year study period from 2015 to 2017. The baseline year for emissions reductions is 2015. Northfield residents and businesses have actively participated in renewable energy and energy efficiency programs and projects; these accomplishments and impact on emissions is included in the following summary.

Community-Wide Greenhouse Gas Emissions

Community-wide GHG emissions were captured for the years 2015, 2016, and 2017. In the most recent year, the inventory shows that commercial and industrial emissions from electricity and natural gas contribute to the largest share of total emissions – two-thirds of all community emissions (68%). This sector is followed by residential emissions (18%), and travel (12%). Waste and wastewater, combined, comprise less than 3% of the City's total emissions profile.

The sections following provide an analysis of current community-wide emissions across all sectors, including building energy, transportation, and waste. Figure 9 provides a break-down of emissions by sector and energy type.

While emissions from city operations are captured in this section, they are not isolated. Those emissions are isolated and described in the next section.

Northfield 2017 Community-wide Emissions (GHG)

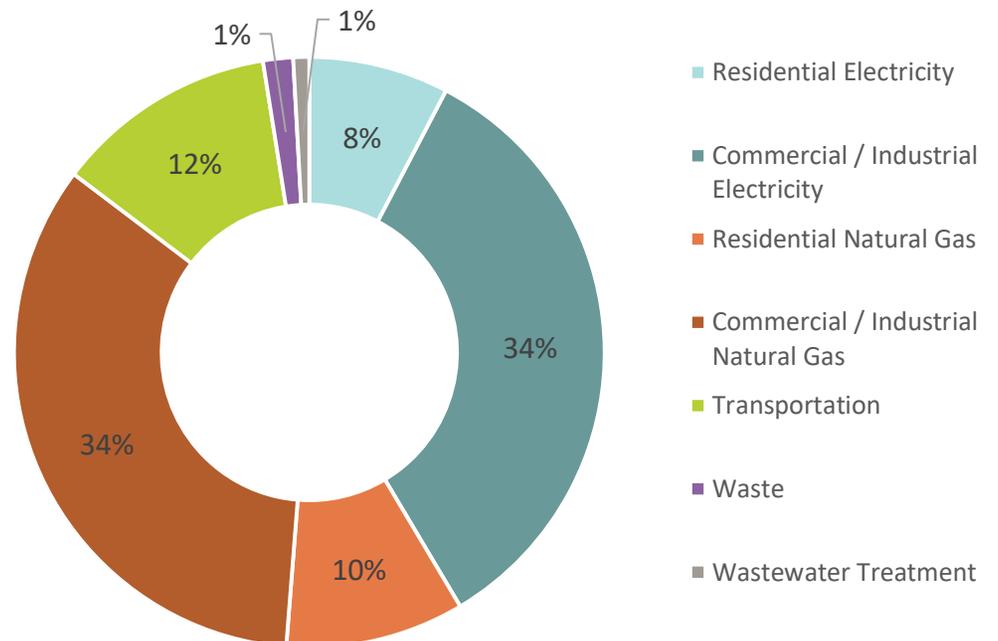


Figure 9. Community-wide greenhouse gas emissions for Northfield, Minnesota by sector. Each wedge represents a different sector and energy use category. Source: Xcel Energy, Minnesota Department of Transportation. Generated by Regional Indicators Initiative.

Building Energy

Building energy emissions include all GHG emissions that come from the consumption of electricity and natural gas used by residents, businesses, and industrial facilities. This includes energy used for space and water heating (typically natural gas), and electricity used for appliances, lighting, as well as some space and water heating. Natural gas is often used in industrial processes as well. Xcel Energy is the electric and natural gas provider for Northfield residents and businesses. Of the premises served, 88% are residential, 11% are commercial/industrial, and 1% are municipal. In 2017, Northfield consumed 2.7 million MMBTU of energy (both electricity and natural gas). About two-thirds of Northfield's 2017 energy consumption is from natural gas (67%), and one-third from electricity (33%). Energy data show that of the 2.7 million MMBTU consumed by Northfield, 21% is consumed by residential premises, 78% is consumed by commercial/industrial premises, and 1% is consumed by municipal premises.

In Northfield, building energy use represents the greatest share of emissions at 85% of the total in 2017. Of all building emissions, 49% came from the consumption of electricity (41% of total emissions). The remaining building emissions come from the use of natural gas, the equivalent of 54% of building emissions (44.% of the community's total emissions). There are three major energy users that, together, make up a substantial amount of the commercial/industrial emissions. These include Carleton and St. Olaf Colleges, and the Malt-O-Meal (Post Consumer Brand) facility. Each of these institutions has already taken significant strides to reduce emissions from their electricity use through the purchase and generation of renewable energy and will make powerful partners to help the city achieve its GHG reduction goals.



Renewable Energy and Conservation

Community-wide building energy emissions are impacted by both energy conservation measures and the utilization of local or purchased renewable energy. Participation in renewable energy and energy conservation programs is summarized in the Energy Subcommittee Report and is incorporated herein.

On-site Renewable Energy

On-site renewable energy, sometimes referred to as “behind-the-meter” includes solar panels and wind turbines installed on-site (either rooftop or ground-mount), to supply some or all of the electricity for a building or campus. In 2017, 76 residential and five commercial/industrial premises had solar panels on their home or facility equaling a total capacity of 554 kW. Two wind turbines — one at Carleton College and one at St. Olaf College — also generated power for each of those institutions totaling just over 6.7 million kWh.

Off-site Renewable Energy

Off-site renewable energy subscriptions offer residents and businesses the opportunity to use renewable energy without having to install any equipment. Two popular examples of utility-sponsored renewable power purchase programs include WindSource® and community solar garden subscriptions. In 2017, 613 Northfield residential premises subscribed to renewable energy, totaling more than 1.8 million kWh of electricity. Sixteen commercial/industrial premises subscribed to renewable energy for a total of 33.6 million kWh of electricity.

Energy Conservation

Northfield residents and businesses have actively participated in Xcel Energy’s energy conservation programs, saving 1.2% of electricity consumed and 0.7% of natural gas consumed between 2015 and 2017. In 2017, 813 total premises participated in Xcel Energy’s programs, including 11% of residential premises and almost 8% of commercial/industrial premises. By participating in energy conservation programs, premises saved a total of 18,710 MMBTU (million British thermal units). The most popular programs for residents include Saver’s Switch and rebates for heating and cooling equipment. For commercial/industrial premises, lighting, heating, and cooling efficiency rebates are the most utilized programs for saving energy.



Transportation and Land Use

Of total community-wide GHG emissions, the transportation sectors makes up 12%. Transportation emissions include all in-boundary emissions that come from mobile sources, like cars, trucks, and motorcycles. In boundary emissions are determined based on the number of miles driven within the city boundary, the assumed breakdown of vehicle type (light vs. heavy duty), and the fuel efficiency of those vehicles. Through Regional Indicators Initiative data, vehicle miles traveled (VMT) and associated emissions have been recorded from 2006 through 2017 and are shown in figure 10. Over this time period, VMT have grown steadily with a decline beginning in 2011 and rising again after 2013, likely due to the economic recession and relatively higher fuel prices at the time.

VMT Trends in Northfield

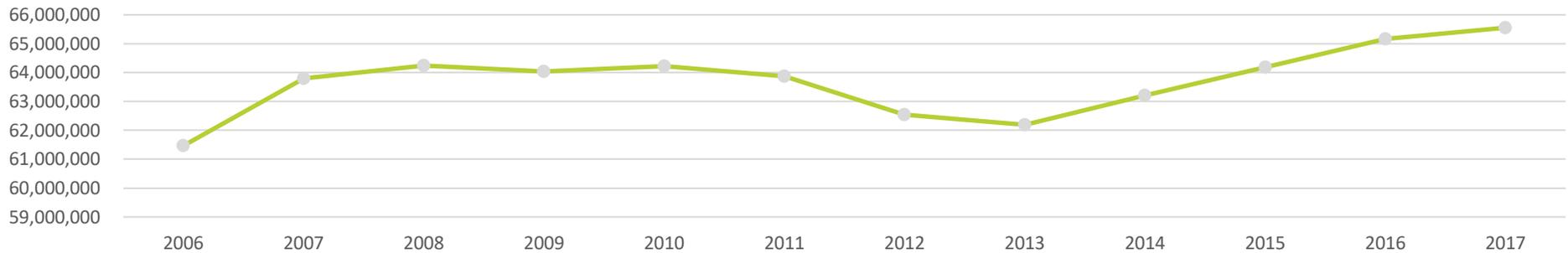


Figure 10. Total Vehicle Miles Traveled by year, 2006 - 2017. Source: Minnesota Department of Transportation. Generated by Regional Indicators Initiative.

According to the 2017 5-year American Community Survey, 52% of Northfield residents drove alone, nearly 11% carpooled, 8% biked or walked, and 32.6% of residents work from home. The percent of residents who drive alone is relatively low compared to the state (78%). This may be reflected in the college-town characteristics of the community as many students and faculty are more likely to walk or bike to campus if they live in close proximity. Further, 32.6% of residents telecommuting is high and may be an opportunity for co-working spaces in Northfield.

Utilization of mobility options – like walking, biking, or public transportation – is largely facilitated by availability of infrastructure and accommodating land use to support and encourage it. In Northfield, there are nearly 26 miles of combined bike and walking trails which cross the city. These trails coupled with on-street route options for bikers offer many options for non-motorized travel. However, as mentioned previously, many of the trails have gaps and would benefit from better connectivity and protection. Currently, the primary transit option available to Northfield residents is through Hiawathaland Transit, operated by Three Rivers Community Action. Only .5% of residents reported using public transit. As highlighted previously, there have been barriers to utilizing the transit system by students and the Latinx community organizations, such as timing, frequency, route efficiency, and accessibility. Increasing the availability of and access to low or no carbon transportation options also improve equity and health options for residents. Walking and biking offer health benefits by allowing people to incorporate exercise into their community. Further, access to multiple mobility options allow all residents improved access to places of employment and involvement in community events.

For trips that must be made by a car, electric vehicles (EVs) are a cleaner alternative to combustion vehicles, both in terms of local air pollutants and GHG emissions. Of passenger vehicles in Northfield in 2016, 99.5% used gasoline¹⁹. The growing availability of EV charging infrastructure is supporting an increase in adoption for these vehicles. As of 2019, there are two public electric vehicle charging station in Northfield, one located at Carleton College and one at St. Olaf College. There are 32 registered electric vehicle owners in city of Northfield and surrounding area, (Department of Motor Vehicle Statewide Registration Data, 2017). Although most charging is done at home, adding EV charging stations in more public spaces will help to enable EV adoption beyond Northfield. There may also be an opportunity to create a network of shared electric vehicles within the community and enable more people to have access to a clean vehicle without owning one.

Waste and Food

Municipal solid waste data is collected by the Minnesota Pollution Control agency at the county scale, and is then estimated for the city using the counties' (Rice and Dakota) per capita rates. Emissions from solid waste are based on the management method used by the local haulers and account for 2% of total community-wide emissions. In Northfield, the city contracts with Dick's Sanitation Services for a single hauler waste pick-up for both garbage and recycling. Each year more than 26,000 tons of solid waste are disposed of in Northfield (Table 3). Roughly half of the waste is recycled and most of the remainder is sent to a landfill, with a small percentage going to a resource recovery facility. Emissions are calculated based on the volume and destination of the solid waste. The majority of emissions (95%) from Northfield solid waste come from waste that is landfilled. Organic materials (food waste) that are sent to a landfill break down and decompose over time, releasing methane, a powerful greenhouse gas. While most of the methane at these landfills is captured, there is opportunity to reduce future methane by reducing the amount organic material that enters the landfill.

Northfield currently offers organics composting opportunities for all food products, available at a single drop-off location near Sechler Park. The drop-off site is only open seasonally (April through October), limiting the ability of Northfield residents to participate in composting year-round. Further the drop-off site is not convenient for everyone, nor are all residents aware of the opportunity and benefits. It is important to address food waste for a number of reasons. According to the Minnesota Pollution Control Agency, in 2013, 31% of all waste in Minnesota was organic material (Figure 11).

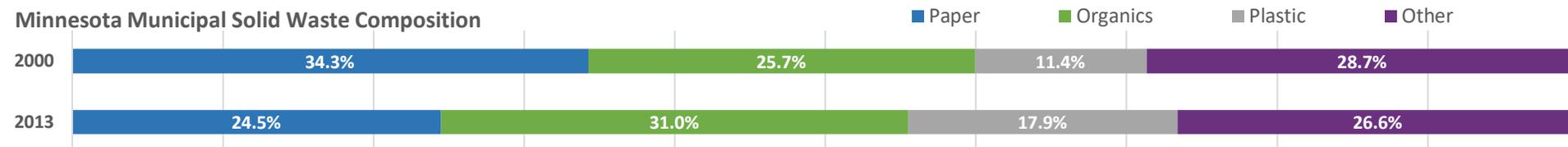


Figure 11. Composition of municipal solid waste in Minnesota in 2000 and 2013. Source: Minnesota Pollution Control Agency, "Minnesota MSW Composition Study," 2013.

Disposal Year	2015	2016	2017
Tons of solid waste	26,361	27,891	27,545
% Recycled	54%	52%	46%
% Landfilled	44%	46%	52%
% Resource recovery	1%	2%	2%
Tonnes of GHG	3,437	3,374	3,737

Table 3. Total solid waste and waste processing proportions from 2015-2017. Source: Generated by Regional Indicators Initiative, from Rice and Dakota County data.

¹⁹ Department of Energy State and Local Energy data (2016), <https://www.eere.energy.gov/sled/#/>, (Accessed June 2019).
City of Northfield Draft Climate Action Plan, June 2019

This means that a large volume of waste could be removed from the waste through better management of the food system. Reducing organic waste can be done by 1) purchasing more intentionally to avoid disposing extra, unconsumed food, 2) making food available to those who may struggle with food insecurity, and 3) composting what remains.

While not included in this GHG inventory, an additional consideration for food-related emissions is the distance the food travels from source to table. There are significant upstream emissions that go into the production and transportation of food. Better management of food and waste is a high priority for Northfield residents. Community members see it as an opportunity to work toward food security and resiliency while reducing emission.

Because Northfield is situated near agricultural land producers it has an opportunity to better connect with local growers to increase the amount of food that is supplied locally. There are also opportunities to increase the amount of food grown within the city limits at community gardens and/or schools. Expanding local food access and production in the Northfield and surrounding area will support all residents — no matter of economic background — and businesses in receiving a wide variety of healthy, affordable, and sustainable food choices to meet the majority of our food needs.

In addition to food, Northfield residents wish to reduce overall waste from going to the landfill. The Environmental Protection Agency (EPA) developed a waste hierarchy to help visualize best management practices to reduce the amount of waste that is generated by households, industry, and all levels of government. The hierarchy prioritizes prevention and reuse of goods. By limiting purchases, particularly for single-use items, people and businesses can reduce the amount of waste that is thrown away. Further purchasing items that can be used more than once allows users to maximize the usefulness of a particular good. For items that that have reached limitation of use, recycling and composting is the next best use for those items. Finally, for items that must be disposed of, resource recovery is recommended, while landfills should be avoided. Through education, policies, and dedicated programming there is opportunity for all Northfield residents to reduce the amount of waste that is thrown away.

Achieving a low or no-waste community is a critical component to eliminating emissions from waste. It will take a cohesive effort from all aspects of the community — residential, commercial, institutional, and governments — to realize this outcome.

CARLETON COLLEGE FOOD RECOVERY NETWORK

In 2014, the Carleton Food Recovery network was found by a student in Collaboration with the Center for Community and Civic Engagement and Bon Appetit. The Network transports uneaten food from the dining hall to community partners in the Northfield area who help people struggling with food insecurity.

During the first two years of operation, Carleton student volunteers have collected over 5,000 pounds of food and redirected it away from the college waste stream to those who could most benefit from it.

City Operations GHG Emissions Inventory

City operations generates emissions associated with municipal buildings and facilities, streetlights, potable water processing, liquid fuels, and wastewater treatment. In 2019, a city operations greenhouse gas (GHG) assessment was completed for the years 2015, 2016, and 2017. This study was completed to support Northfield in its efforts to better understand city operations emissions for reduction measures. The complete study is included as an attachment to this document (see Appendix X).

Emissions from Northfield's city operations represents less than 2% of the community-wide total. The table and chart to the right highlight the sources and changes in emissions from 2015 to 2017. Wastewater treatment was the largest contributor of total emissions during this period, accounting for 51% of total city operations emissions in 2017. Buildings, park facilities, potable water, liquid fuels, and streetlights and signals accounted for 9-12% of the total in 2018. Emissions from waste were the smallest component at 1% of the total. Overall emissions across all areas of city operations were reduced by 11% over the three-year study period.

The reduction in total GHG emissions from 2015 to 2017 can be primarily attributed to Xcel Energy's improved electricity emissions factor, a measure that incorporates the GHGs emitted during the generation of the electricity provided by Xcel. The improved electricity emissions factor accounted for just over half (52%) of the 11% reduction in Northfield's city operations GHG emissions. Emissions reductions from the wastewater treatment plant accounted for 30% of the total reduction between 2015 to 2017.

The following summarizes emissions from each of the categories highlighted in the assessment.

Streetlights and Traffic Signals

In 2017, streetlights and traffic signals accounted for 9% of city operations emissions. Between 2015 and 2017, emissions associated with streetlights and signals in Northfield decreased by 8%. This improvement was largely driven by Xcel's electricity emissions factor improvement. The city owns about half of the streetlights in the community. Those owned by Xcel have largely been replaced with LED; those owned by the city are being replaced with LED as the current lights reach the end of their useful life.

Greenhouse Gas Emissions, 2015 - 2017 (tonnes)				
Category	2015	2016	2017	Change
Streetlights and Signals	377.3	344.2	346.2	-8.2%
Vehicles	383.0	445.8	380.6	-0.6%
Potable water	407.8	362.6	353.8	-13.2%
Park Facilities	473.7	443.8	418.2	-11.7%
Buildings	524.4	471.5	454.9	-13.2%
Wastewater Treatment	2,275.3	2,232.0	1,997.6	-12.2%
Total	4,441.5	4,299.9	3,951.3	-11.0%

Table 4. Breakdown of city operations greenhouse gas emissions by type from 2015 to 2017. Source: Orange Environmental LLC, "City of Northfield Greenhouse Gas Assessment," 2019.

City Operations Greenhouse Gas Emissions by Type

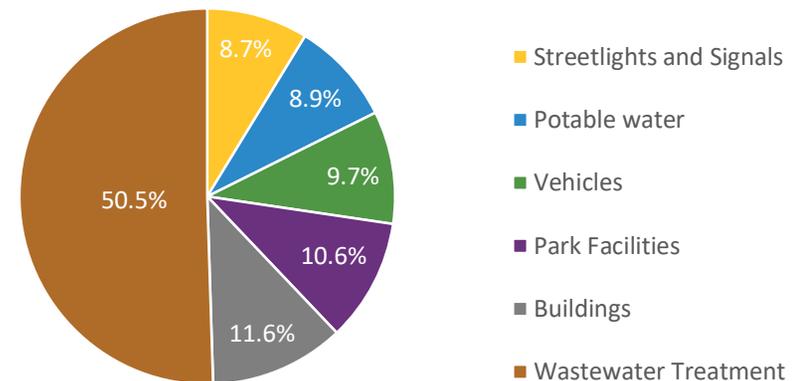


Figure 12. Proportion of Northfield city operations greenhouse gas emissions by type from 2015 - 2017. Source: Orange Environmental LLC, "Northfield Greenhouse Gas Assessment," 2019.

Liquid fuels

In 2017, vehicle emissions constituted 9.7% of total city operations emissions. Between 2015 and 2017, emissions associated with the city's vehicle fleet decreased by 0.6% (the equivalent of 2.4 tonnes CO₂e). During this period, diesel consumption increased by 121% over 2015 levels, though gasoline consumption declined by 20% — it is likely that 2015 was the anomaly year, though there is not an explanation for the discrepancy.

Potable Water

In 2017, potable water represented 8.9% of emissions from city operations. Emissions from potable water are attributed to the electricity used to pump and distribute the water. Between 2015 and 2017, emissions from potable water were reduced by 13.2%. Reductions came both from improved efficiency as well as a cleaner generation mix.

Park Facilities

Northfield has 24 metered park facilities within its operations. In 2017, park facilities were responsible for 10.7% of total city operations emissions. Total emissions from park facilities decreased 11.7% between 2015 and 2017, the equivalent of 55 tonnes co₂e. During that period, electricity consumption in park facilities increased by 1%, but natural gas consumption decreased by 28%.

City Buildings

City buildings were responsible for 11.6% of all city operations emissions in 2017. Emissions from all buildings were reduced 13.2% from 2015 to 2017. Despite a reduction in aggregate emissions, electricity consumption in buildings between 2015 and 2017 increased by 4%, while natural gas consumption decreased by 26%. After aggregate park facilities, City Hall is the largest emitter, though between 2015 and 2017 the building experienced a 35% reduction in emissions. The Northfield public library saw the greatest increase between 2015 and 2017 (60% electricity and 47% natural gas), due to expansion.

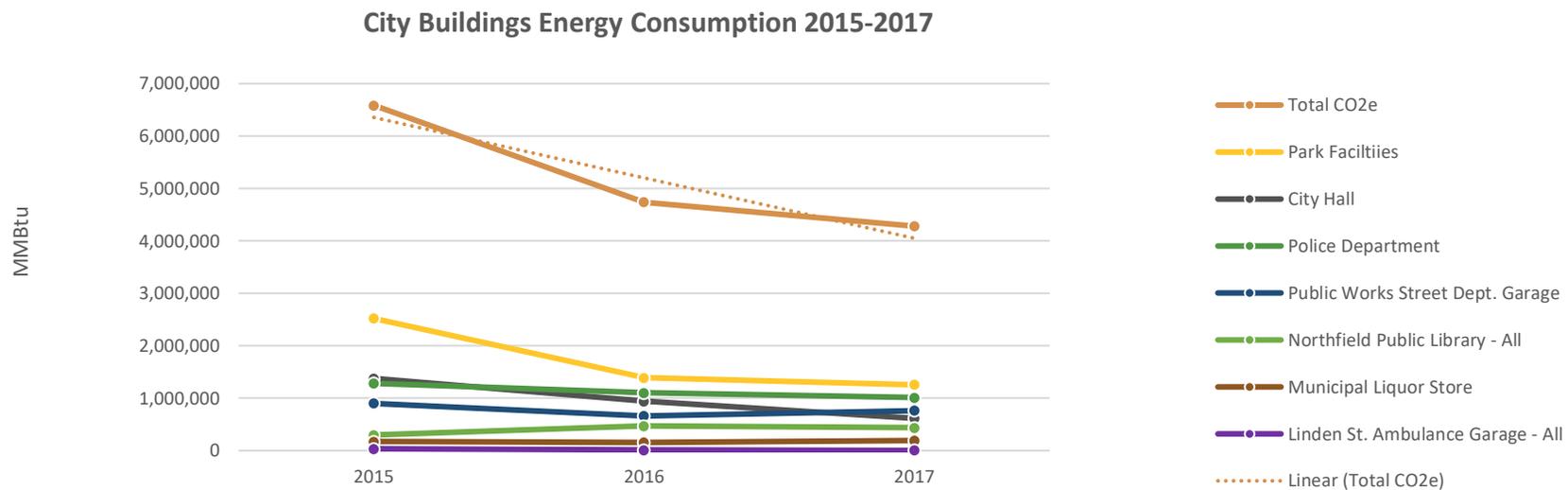


Figure 13. Northfield City Building Energy Consumption trends (2015-2017 Source: Orange Environmental LLC, "Northfield Greenhouse Gas Assessment," 2019.

Wastewater

Emissions from the treatment of wastewater occur from the electricity used to transport water to treatment facilities and treatment operations, as well as the gases that are produced from the breakdown of organic material. Together, water pumping and distribution, as well as wastewater treatment account for about 1% of Northfield’s total community-wide GHG emissions, but 59% of total city operations emissions. The greatest portion of emissions for the treatment of water and wastewater come from electricity: 334 metric tons for potable water and 1,400 tons for the treatment of wastewater each year. Wastewater treatment facilities also use a significant amount of natural gas which results in 411 metric tons of CO2 emitted annually.

Wastewater treatment accounts for the largest proportion of total emissions in the city operations – over 50%, with just under 2,000 tonnes co2e emitted in 2017. Between 2015 and 2017, wastewater treatment emissions decreased by 12.2%. Over the period of 2015 to 2017, electricity consumption decreased by 10%, but natural gas consumption increased by 9%.

In addition to City of Northfield wastewater, the treatment plant also processes wastewater from Carleton College and the City of Dundas, which total about 7% of the total amounts treated. Volumes from all three sources increased from 2015-2017, with the total being 20% higher in 2017 compared to 2015. On a per-capita basis, wastewater just from the City was 21% higher in 2017 than in 2015. However, described in terms of efficiency, the 34% increase in electrical efficiency experienced between 2015 and 2017 had an impact of 62% of the total energy consumption in the facility (in 2017), resulting in an overall increase in efficiency of 26%.

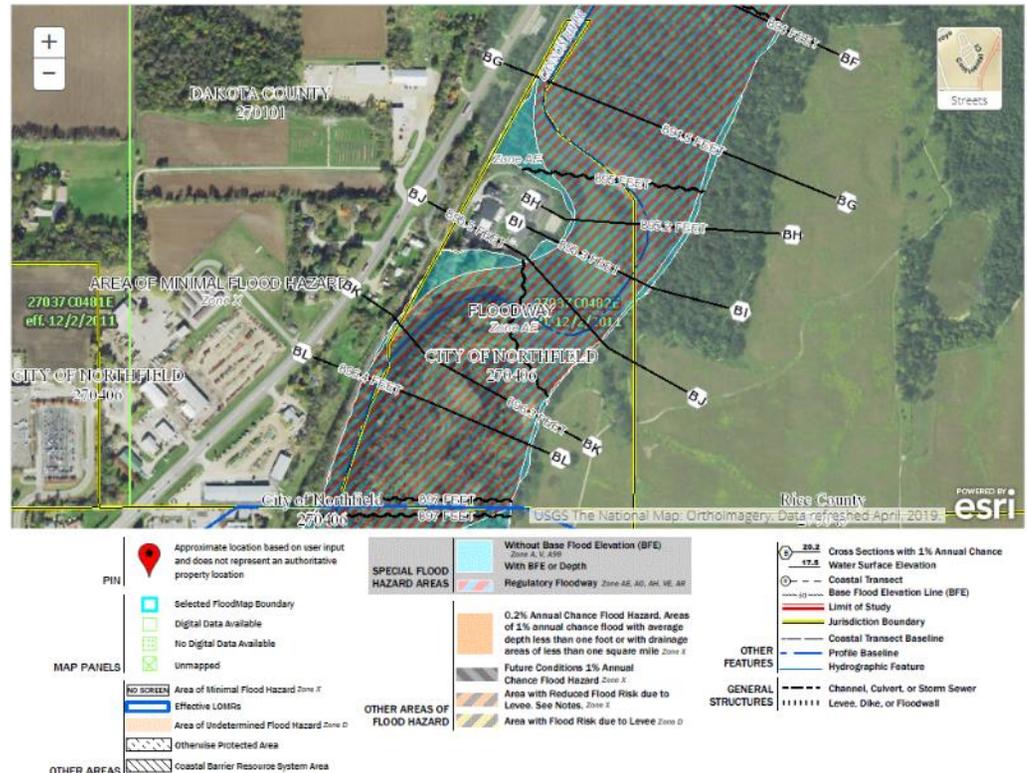


Figure 14. Northfield flood map from the Federal Emergency Management Agency showing likely flood areas. Source: Federal Emergency Management Agency, "Northfield Flood Zones."

Emissions Reduction Targets and Plan Impact

The City of Northfield has set a goal to reduce its emissions 50% by 2030 from 2015 levels and become carbon neutral no later than 2050. Achieving this goal will require aggressive emissions reductions in every sector, with most of the savings achieved through strategies associated with the energy used in buildings. Figure 15 shows planned carbon reductions between now and 2050, broken out by strategy. The strategies and actions outlined in this Climate Action Plan contribute to meeting these reduction rates in the near-term, while additional innovation and policy-level action will be required to achieve the long-term reductions.

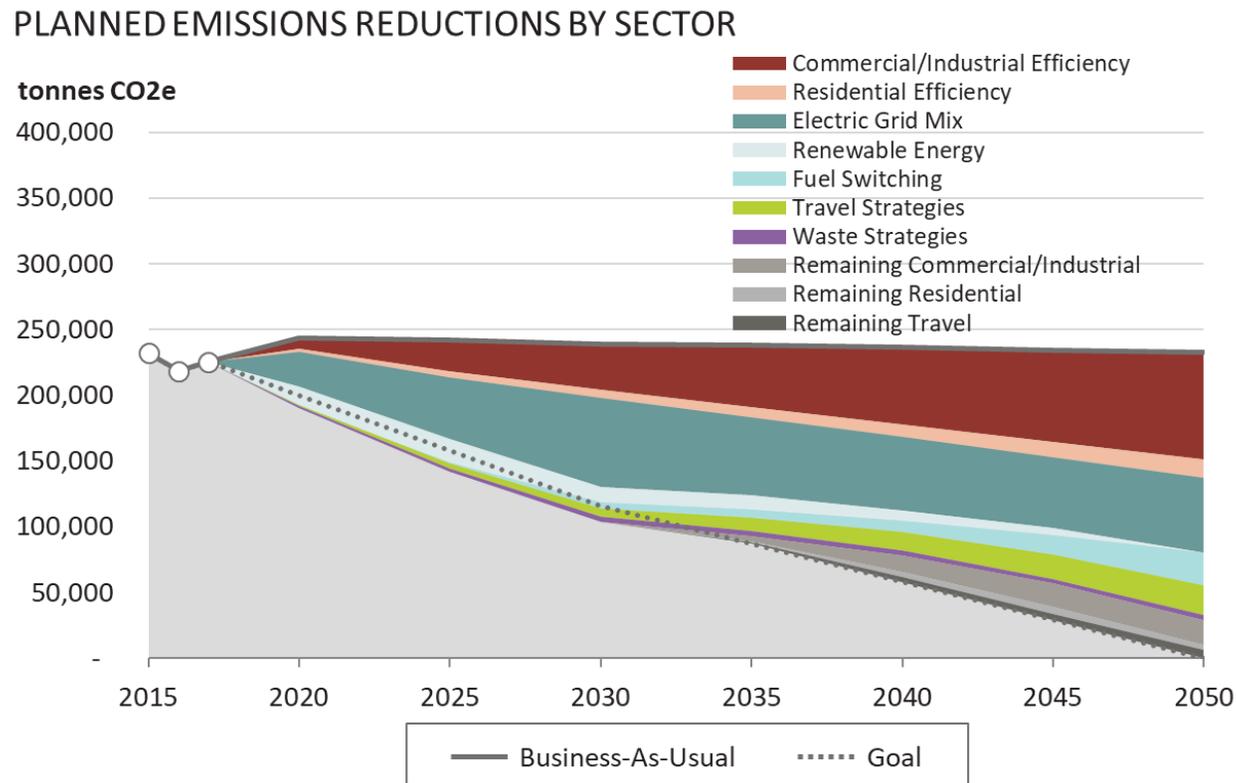


Figure 15. Planned community-wide emissions reductions, including: historic emissions for 2015-2017, a business-as-usual projection through 2050 (top grey line), Northfield's goal (dotted grey line), and the estimated impact of reduction strategies (colored 'wedges') that close the gap between the business-as-usual and the goal. The two orange-shaded wedges represent building energy efficiency strategies, the three teal-shaded wedges represent decarbonizing building energy through an increase in renewable energy sources, and the green and purple wedges represent travel and waste emissions strategies, respectively. Source: LHB, Inc.

Combined, these strategies are estimated to achieve an 87% reduction in total GHG emissions from business-as-usual in 2050, with:

- A 35% reduction in overall emissions through commercial and industrial building efficiency, such as net-zero energy new construction and energy efficiency retrofits
- A 6% reduction through residential building efficiency, such as net-zero energy new construction and energy efficiency retrofits
- A 25% reduction through Xcel’s changing electric grid mix,²⁰ which is supplemented in the near-term through community-supported renewable energy
- An 11% reduction through fuel switching from natural gas to electricity in homes and businesses
- A 10% reduction through travel strategies such as mode shift and electric vehicles
- A 2% reduction through waste strategies that lead to zero waste by 2030²¹

The grey-shaded wedges represent the remaining 13% gap to the goal that will need to be addressed through advanced strategies in the future. Of the remaining emissions, 64% is from natural gas used in commercial buildings and industrial processes, 14% is from natural gas used in residential buildings, and 21% is from vehicle travel (Figure 16). Several initiatives described in this plan begin to address these remaining emissions through strategies such as exploring the potential for thermal grids and sequestering carbon through urban forests.

Note that this analysis only addresses GHGs that are either emitted within the boundary of the city (Scope 1) or are emitted indirectly through the consumption of electricity or other energy sources (Scope 2). While these emissions can be most directly impacted by Northfield’s residents and businesses, they exclude other sources that can also be influenced by community members, such as travel by residents and employees outside city boundaries and emissions from the production and distribution of food and other products (Scope 3). These make up a substantial amount of global emissions and – though not quantified – strategies to reduce these emissions are included throughout this plan.

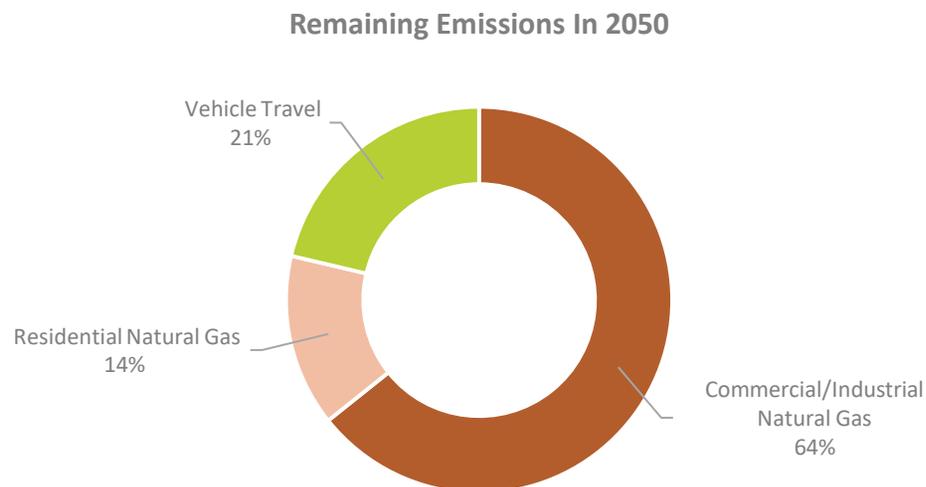


Figure 16. With a projected 87% emissions reduction in 2050; this graph shows the breakdown of the remaining 13% that will need to be addressed through advanced strategies. Source: LHB, Inc.

Emissions reductions were projected using participation rates across specific reduction strategies. These strategies are broken down by sector, including commercial/industrial, residential, travel, and waste. Strategies to reduce emissions are aimed at energy efficiency, renewable energy, fuel switching, and mode shift, as well as achieving zero waste. Most of the strategies are assumed to have increasing participation rates each year impacting overall GHG emissions. A summary of the participation rates across strategies is included on the following page.

²⁰ Based on Xcel’s preliminary projections of their future emissions factors from their draft Preferred Plan.

²¹ Due to rounding, these percentages do not precisely add up to reflect the total reduction.

Participation rates in each reduction strategy

	2020	2030	2040	2050
Commercial/Industrial Efficiency				
Energy Code Enforcement	100%	100%	100%	100%
Net-Zero Energy Buildings	5%	100%	100%	100%
Energy Efficient Retrofits	24%	72%	72%	72%
Residential Energy Efficiency				
Energy Code Enforcement	100%	100%	100%	100%
Net-Zero Energy Buildings	5%	20%	50%	100%
Energy Efficient Retrofits	38%	100%	100%	100%
Electric Grid Mix				
Xcel Plan (% reduction from baseline) ²²	26%	78%	77%	100%
Renewable Energy				
On-Site Renewable Electricity	5%	10%	20%	30%
Green Power Purchase - Residential	10%	30%	20%	0%
Green Power Purchase - Business	15%	50%	24%	0%
Fuel Switching				
Residential	1%	10%	30%	75%
Business	1%	10%	20%	50%
Travel				
Mode shift	2%	7%	20%	30%
Electric Passenger Vehicles	4%	28%	56%	100%
Electric Light Trucks	0%	3%	12%	27%
Electric Heavy Trucks	0%	14%	32%	50%
Waste				
Zero-waste	33%	100%	100%	100%

Table 5. Forecasted participation rates in strategies for emission reduction. Source: LHB, Inc.

²² Xcel's emissions factor reduction for 2020-2034 is based on preliminary results from their draft Preferred Plan. These will be updated after Xcel publishes their Preferred Plan on July 1, 2019. For 2035-2050, it follows a linear trajectory to Xcel's stated goal of carbon-neutral by 2050. City of Northfield Draft Climate Action Plan, June 2019



Priorities, Strategies, and Actions for Climate Mitigation

Meeting the carbon reduction goals established in this plan will require aggressive and collaborative effort on behalf of the city, its residents, and its businesses. Over the next 18 months, the city will implement the energy plan put forth by the Energy Subcommittee, which will help launch many of the actions included in this plan. While that is a good starting point to reduce emissions, it will not be enough to achieve the downward trajectory needed to meet the city's 2030 and 2050 goals. The remainder of this plan lays out priorities, strategies, and actions to achieve those goals. The plan is structured first by four over-arching priorities: Education and Engagement, Policy and Planning, Innovation and Demonstration; and Supporting the Plan. Each of these priority areas has multiple strategies with specific actions to employ.

Education and Engagement

Education and engagement are critical first steps to support the remaining strategies and actions in the plan. The strategies and actions in this section seek to actively engage Northfield residents, businesses, and institutions in implementation of energy conservation measures and renewable energy options to reduce their operating costs, energy consumption, and carbon emissions. Strategies in this category are focused on easy access to information, knowledge-sharing pathways, and outreach efforts that bring solutions to consumers rather than relying on them to actively seek out information.

Impact on Emissions: Education and Engagement strategies and actions will have relatively little direct impact on emissions reductions but are nonetheless critical in supporting other strategies that have greater impact.

Desired Outcome: The primary outcomes for this priority are to increase visibility of Climate Action Plan and climate- and energy-related events, and maintain community support for climate action. Community members who are actively engaged and knowledgeable about issues and available resources are more likely to act. The success of this plan depends on an informed and engaged community.

EE – 1 Climate Information Center

Description: Create a climate information center on the city's website that includes information related actions, events, metrics, and includes a dashboard to demonstrate progress. This is the first strategy to appeal to those who are interested in information and eager for the city to showcase the Climate Action Plan and other successful initiatives. This information would be easily accessible and updated regularly by city staff to ensure the most current information is available. This section includes a mix of electronic, hard copy, social media, events, workshops, and other outreach strategies to the Northfield community.

Recommended Actions

- Use the Climate Information Center to post climate action metrics to demonstrate progress to public
- Keep residents and businesses updated with workshops and events
- House informational resources to help businesses and residents make informed decisions around reducing GHG emissions
 - Ensure material is available in Spanish and/or that translating options are available
- Regularly update and maintain content on the Climate Information Center; ensure that this responsibility delegated to a specific city staff person

EE – 2 Sustainable Tourism and Marketing

Description: This strategy focuses on outward engagement by marketing Northfield’s energy conservation and renewable energy projects and programs in a way that attracts and retains tourists, residents, and local businesses. This strategy takes advantage of existing innovations, such as college wind turbines, community solar gardens, and community sponsored agriculture, while also envisioning future attractions such as net zero energy buildings and green developments.

Recommended Actions

- Work with the Chamber of Commerce to incorporate local energy initiatives into Northfield’s tourism marketing materials
- Create a “sustainability tour” of local energy projects
- Consider strategies for recruiting sustainability and energy-focused businesses to existing Northfield spaces and/or a future green business park or industrial development
- Post highly visible energy information resources throughout the community highlighting clean energy projects
- Develop factsheets and related materials to help promote clean energy projects

EE – 3 Small Consumer Energy Engagement

Description: Give households, small institutions, and small businesses easy access to energy education, energy conservation, and renewable energy programs that are directly applicable to their energy needs. Residents, small institutions, and small businesses represent the highest number of premises in the Northfield, so broad and accessible outreach strategies will be the primary focus for this group. The city should ensure that information will be accessible to all residents, regardless of age, income, or language.

Recommended Actions

- Implement Partners in Energy “18-month Energy Action Plan” for residential consumers
- Develop and distribute education and outreach tools that provide local builders and building owners with information on energy efficiency resources such as Xcel Energy’s Efficient New Home Construction, the US Department of Energy Net Zero Homes certification, or similar programs
- Host workshops focused on home energy efficiency and clean energy opportunities that include case studies and success stories
 - Coordinate with community organizations to provide workshops in Spanish that are in accessible to Latinx residents and address housing concerns
- Use successes and lessons learned from 18-month Energy Action Plan to continue engagement beyond the PiE time frame
- Educate residents and small businesses about the benefits of replacing heating equipment with air-source heat-pumps or other efficient electric heating options
- Promote opportunities for residents and small businesses to replace natural gas appliances with electric alternatives; partner with Xcel to offer thermal storage opportunities
- Engage youth in outreach and engagement efforts
- Identify resources to help residents understand energy efficiency options for specialized homes (e.g. mobile homes)

EE – 4 Large Consumer Energy Engagement

Description: Engage Northfield’s top energy consumers in efforts to achieve community-wide energy reduction targets and encourage them to share or develop their own in-house energy or carbon reduction plans and targets. These consumers use the largest percentage of energy and therefore can implement the highest impact energy reduction and renewable energy projects.

Recommended Actions

- Implement Partners in Energy “18-month Energy Action Plan” for large and small commercial consumers
- Build a stakeholder coalition group among large users to identify shared goals and potential coordinated actions
- Develop and distribute education and outreach tools that provide local builders and building owners with information on energy efficiency resources such as Xcel Energy’s Energy Efficient Buildings and Energy Design Assistance (EDA) evaluations, or similar programs
- Partner with the public schools to create energy educational materials tied to real-world, local projects
- Provide information about financing options such as commercial PACE (Property Assessed Clean Energy), Trillion BTU, and Rev It Up

EE – 5 Travel Engagement

Description: There are increasingly more options available to people to travel within and outside of their community. Often, people rely on travel modes that are most convenient and those they are familiar with. Education around travel helps people to see the different choices that are available to them whether its by foot, bike or rolling, transit, or shifting to an electric vehicle. Making the decision easier for an individual will enable people to make cleaner and healthier choices.

Recommended Actions

- Host workshops to provide opportunities for interested parties to learn about actions they can take related to:
 - Transit
 - Walking, biking, rolling (e.g. scooters)
 - Switching to an electric vehicle
 - Other mode-shift opportunities
 - Emerging technologies
 - Time of day pricing and charging options
- Host ride and drive events where EV owners lend their vehicles for others to experience
- Include information about travel options on the Climate Information Center



EE – 6 Waste Reduction

Description: To achieve zero waste by 2030 Northfield residents and businesses will need to be informed about best practices to implement. This can be done through a series of dedicated outreach campaigns and workshops, providing community members with the tools and information needed to implement best waste management practices.

Recommended Actions

- Host workshops to provide opportunities for interested parties to learn about actions they can take related to:
 - Waste reduction strategies
 - Reducing and managing food waste
 - Composting best practices
 - Recycling best practices
- Develop guidelines to reduce the amount of construction and demolition waste that goes to the landfill
- Conduct a campaign to reduce contamination of recycling and composting to ensure higher quality end products



City of Northfield Draft Climate Action Plan, June 2019

Policy and Planning

Policy and Planning are strategies to ensure that certain initiatives will move along. Many policies are already in place and can be built upon to implement climate-specific actions insofar as they align with the goals of this plan. Relevant policies include but are not limited to: Complete Streets, Safe Routes to Schools, Land Development Code, and the Comprehensive Plan. In some instances, it will be necessary to create new policies to address some of challenges where existing policies are insufficient to meet climate targets.

Impact on Emissions: Policies and planning have the potential to have the greatest impact on emissions. Those that are targeted toward large energy users will have the most impact.

Desired Outcome: To create predictability and transparency around climate policies in the community. By enacting these policies the city will send clear signals to community members about expectations regarding reduction of GHG emissions.

PP – 1 Large Energy Users

Description: Commercial and Industrial energy users represent the greatest share of emissions and therefore the greatest opportunity for reductions. Actions are aimed at addressing both buildings that already exist to maximize their efficiency and at buildings yet to be constructed as they have the potential to meet higher building energy standards.

Recommended Actions

- For existing buildings, adopt a commercial building benchmarking ordinance for buildings larger than 15,000 square feet
 - Encourage ENERGY STAR certification for eligible facilities
- Currently, cities are not allowed to require stricter buildings standards than the current State Building Code. There have been efforts to allow cities to adopt a stretch code that would enable them to enforce higher energy standards. Prepare to adopt the stretch code when it becomes available and support legislation to enable that action
- Until the stretch code is available:
 - Implement a voluntary green building code for new or substantially reconstructed buildings
 - Require any buildings that receive public funding to be constructed to green building standards
- Ensure all new public buildings are designed, constructed, and operated to the highest available green building standards

PP – 2 Small Energy Users

Description: Small businesses and residences make up a smaller share of emissions in the community but represent a greater share of the number of buildings. Policies aimed at these sectors should focus on achieving maximum carbon reductions from a high number of premises without overburdening city staff and volunteer community members.

Recommended Actions

- Research truth in housing and rental policy
- Include energy efficiency, renewable energy, and water conservation best practices in building permit processes
- Increase annual participation in deep energy conservation programs for residences and small businesses
- Work at the state level to support green residential development standards
- Develop policies or programs to incentivize property owners to make energy efficiency improvements for their tenants
- Enable residential PACE when it becomes available; promote commercial PACE to small businesses

PP – 3 Renewable Energy

Description: The city has ample renewable resources in both wind and solar. In order to accelerate its carbon reduction goals, the city can focus on renewable energy procurement options that meet or exceed consumption in the community.

Recommended Actions

- Explore a policy requiring solar-ready and EV-ready homes by 2020
- Establish an in-boundary goal to generate the equivalent of 10% of the city's electricity from solar installations by 2030
- Identify opportunities to expand renewable energy in or near Northfield; coordinate with Carleton, St. Olaf, Malt-O-Meal, and Xcel Energy
- Encourage rooftop solar on commercial buildings with an economically viable solar resource
- Enable solar development on underutilized land, such as parking lots
- Develop policies or programs to increase low-income access to affordable renewable energy
- Promote green power purchase programs for businesses and residents including: WindSource, Renewable Connect, and community solar garden subscriptions



PP – 4 Transportation and Land Use Policy

Description: Emissions from transportation can be reduced through better land use practices and the availability of alternative transportation modes.

Recommended Actions

- Adopt a policy for market-based pricing for parking in commercial areas and funnel funds into transportation for biking, walking, and public transit
- Adopt a policy to subsidize bus passes to increase ridership on existing transit system
- Research a robust, fully electric local and regional transit system
- Implement the current bike/ped plan to improve access and safety of bike and pedestrian infrastructure
- Explore car-sharing opportunities, ensure electric options are available
- Collaborate with St. Olaf and Carleton on a potential bike/scooter share program

PP – 5 Sustainable Products and Waste

Description: Implement policies and actions to support substantial waste reduction.

Recommended Actions

- Establish a zero-waste policy to be achieved by 2030
- Encourage green purchasing practices by city operations and businesses
- Implement and zero waste packaging ordinance
- Coordinate with Dick’s Sanitation to offer curbside compost pick-up for residents and businesses
- Make composting and recycling available in public spaces with appropriate signage
- Encourage businesses to collaborate on sustainable and resilient products, e.g., facilitate a bulk buy of compostable products (cups, straws) and ensure proper disposal is available

PP – 6 CAP Policy Integration

Description: Ensure full implementation of existing city plans that relate to climate to institutionalize the plan across all city operations and actions.

Recommended Actions

- Integrate the Climate Action Plan into existing city policies and documents, including but limited to:
 - Complete streets
 - Safe routes to schools
 - Land Development Code
 - Comprehensive plan
 - 2019 Bike plan
 - Capital Improvement Plan

Innovation and Demonstration

The City of Northfield shall pursue these and other innovative projects that can also serve as demonstrations for Northfield residents and businesses as well as other communities locally, state-wide, and nationally wherever applicable. These projects will require a new approach that will test unfamiliar concepts and prepare to scale up those that demonstrate viability.

Impact on Emissions: These projects have the potential to achieve significant reductions in emissions.

Desired Outcome: The desired outcome of these strategies is to identify where the city can focus its efforts on deep GHG reductions through the successes and lessons learned.

IN – 1 Advanced Building Energy

Description: While many of these technologies are currently available, they are not necessarily widely used for a variety of reasons.

Recommended Actions

- Identify a future development project that can demonstrate a net zero energy building design
- Identify firms qualified to design, develop, or construct net zero energy buildings and encourage them to lead by example through local projects
- Work with the Minnesota Department of Commerce to match heat waste with heat loads to see if there are opportunities for combined heat and power and district heating technologies to be utilized
- Partner with local businesses, institutions, and Xcel Energy to develop a pilot micro-grid with renewable power and battery storage
- Partner with Dakota and Rice Counties to understand opportunities and barriers for an anaerobic digester for food and agricultural waste

IN – 2 Transportation and Land Use

Description: Innovative transportation and land use projects that may take additional research and buy in before they are implemented.

Recommended Actions

- Partner with businesses to catalyze public EV charging
- Update and strengthen the comprehensive plan and Land Development Code to increase residential density within city limits through infill best practices, such as accessory dwelling units and elimination of minimum parking requirements
- Research and promote land management practices to encourage carbon sequestration through trees and soil

IN – 3 City Operations

Description: City operations can lead by example through implementation of best practices for city buildings and facilities, fleet, and water and wastewater operations.

Recommended Actions

- Set annual targets to reduce energy use and emissions among city operations, including facilities, buildings, and fleet
- Utilize an asset management software tool to track and monitor the operations of city buildings and help plan for maintenance
- When making large capital improvement decisions, utilize a life-cycle cost assessment rather than simple payback

- Adopt zero waste goals and procedures for all city led events, provide training and technical assistance
- Host a community solar garden with subscriptions reserved for low to moderate income residents
- Utilize green purchasing cooperatives to buy recyclable or compostable products with all city contracts
- Complete a fleet study to identify opportunities to replace vehicles with electric models and/or right-sized vehicles
- Identify opportunities for on-site renewable installations, particularly paired with storage for back-up power at critical facilities

Supporting the Plan

The development and adoption of this plan is only the beginning. Implementation will require a coordinated, on-going effort that maintains the momentum of the plan, monitors and shares progress, and ensures that the city is on track to meet its targets. Adjustments will need to be made along the way to make sure the plan is in alignment with the technological, political, and economic advancements that will take place in the coming years. Dedicating staff and resources to the plan will help to ensure its success.

SP – 1 Staff and Community Involvement

Description: Successful implementation of the CAP will require a coordinated effort between the city and the community.

Recommended Actions

- Hire a full-time city staff position to focus on coordination and implementation of the plan
- Review and if needed expand the role of the EQC to include oversight and review of CAP and sustainability, volunteer groups as needed to carry out action items, such as an Energy Task Force
- Ensure youth representation and involvement is a part of the coordinated effort
- Engage the Latinx community and supporting organizations throughout implementation
- Provide an annual report card and progress report to the EQC, Council, and public; make it available on the Climate Information Center

SP – 2 Resources and Funding

Description: Develop a plan to establish funding for CAP implementation. While existing funds can be used to an extent, additional funds will be necessary to achieve the goals of the plan.

Recommended Actions

- Utilize community-based crowd-source platforms to create a CAP implementation fund that community members can voluntarily contribute to
- Enter into a franchise agreement with Xcel Energy; establish a volumetric fee and utilize funds for the CAP activities
- Use savings from city solar garden subscriptions to fund CAP activities