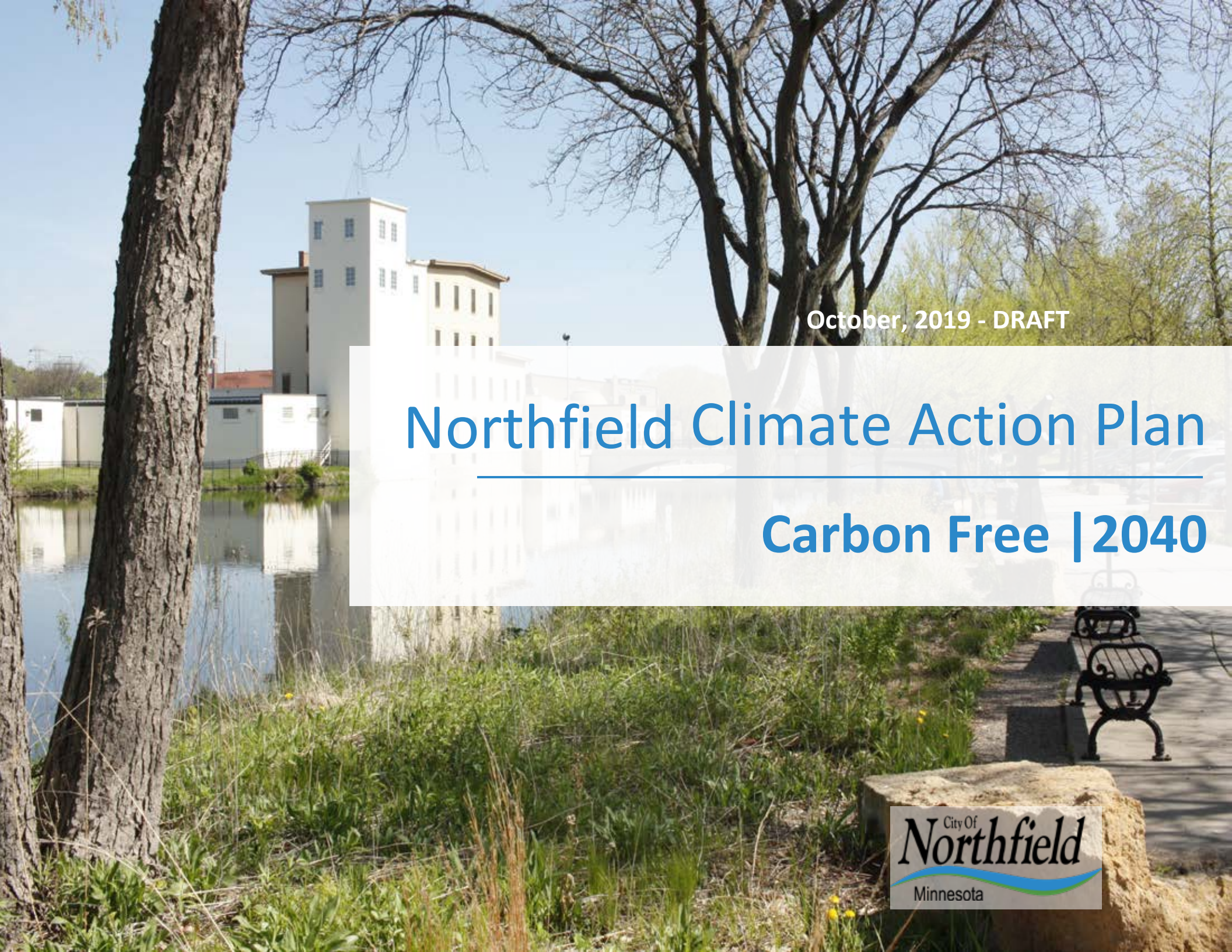

October, 2019 - DRAFT

Northfield Climate Action Plan

Carbon Free |2040

City Of Northfield Minnesota

Letter from Advisory Board

Climate change stories are increasingly in the news. Just as climate scientists have predicted, Minnesota temperatures have been more extreme, lakes are warming, allergy season is lengthening, forests are stressed and shifting north, we have experienced three 500-year floods in the last decade, all of these costing millions of dollars in repairs, medical bills, and emergency expenditures.

Climate change is defined by the National Network for Ocean and Climate Change Interpretation, NNOCCI, as the following: "The atmosphere is like a blanket that surrounds the earth. When we burn fossil fuels like coal and gas, we pump more and more carbon dioxide and other greenhouse gasses into the atmosphere, and this build-up creates a blanket effect, trapping in heat around the world. If nothing is done to halt this process, the planet we leave our children will be hotter with more violent weather, fewer species, and disrupted systems."

The projections are that the more greenhouse gasses we emit into the atmosphere, the warmer the planet - and Northfield - will become, further increasing the negative consequences listed above.

Recognizing this, the Northfield City Council added "Climate Change Impacts" to one of its six strategic priorities in its 2018-2020 Strategic Plan. This established a Climate Action Plan Advisory Board to help the city prepare a climate action plan for the future well-being of the town and its people.

The plan has two main components:

1. Decreasing our greenhouse gas emissions through mitigation strategies.
2. Becoming more resilient to prepare for a changing climate.

This plan has been developed over the last 18 months with input from over 50 citizens serving on six subcommittees.

Inaction is no longer an option on climate change. We Northfielders have been leading the charge on climate action for decades. This plan is a culmination of past work and puts us on a path for a sustainable community. The Climate Action Plan Advisory Board enthusiastically presents this plan to the City of Northfield with hopes of swift action of collaboration and innovation to do our part in lessening our negative impact on Earth.

Sincerely,

The Northfield Climate Action Plan Advisory Board

Photo Credit: Great Plains Institute

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Photo Credit: Great Plains Institute

Acknowledgements

The City of Northfield Climate Action Plan is the culmination of extensive energy, effort, and passion on the part of the the Climate Action Planning Advisory Board, composed of volunteer citizens and local experts, as well as representation and insight from the public, private, and nonprofit sectors. The City of Northfield offers sincere gratitude to each individual who contributed to this effort in any capacity, without whom there would not be a Climate Action Plan.

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Special thank you to all CAPAB members, subcommittee members and volunteers, and focus group participants who helped make this plan a reality.

Photo Credit: Great Plains Institute

Glossary

Active Mobility: Any form of transportation or movement that involves human physical activity. The most common forms include walking or cycling.

Adaptation: Regarding climate change, adaptation is any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or maximizes benefits.

Built Infrastructure: All the systems, buildings, construction, and technology created to help shape and power society. This includes buildings, homes, roads, bridges, telecommunications networks, as well as things like sewers, pipelines, and water treatment facilities.

Carbon Free: For the purpose of this plan and the 2040 goal, carbon free refers to a carbon neutral scenario where carbon dioxide emissions from human activity (i.e. burning fossil fuels) are eliminated and/or offset by removing emissions from the atmosphere through sequestration in trees and soil, as well as using energy sources that are considered carbon neutral (e.g., bio-based sources).

Carbon Sequestration: The capture and long-term storage of carbon dioxide from the atmosphere. This occurs naturally in vegetation and soil.

City Emissions: All GHG emissions associated with city operations, including municipal buildings and facilities, water and wastewater treatment, services like police and fire, as well as streetlights.

Community Emissions: All GHG emissions that occur within the city boundaries but not by the city; residential and commercial energy usage, transportation, and waste all fall under community.

Climate Change: Significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer. Climate change threatens the ability to sustain the Earth's living systems.

Conveyance Systems: Systems designed to collect and move (convey) stormwater away from where it falls. This can include roads with drainage systems, municipal streets, man-made channels, and stormwater pipes that allow stormwater to flow.

Equity: Regarding climate change, equity is primarily concerned with mitigation of disproportionate impacts of changing climate to historically or currently disadvantaged or marginalized community members.

Electric Vehicle (EV): A vehicle powered by electricity that is stored in the vehicle's battery.

Food Insecurity: Experienced when people lack secure access – be it from economic, geographic, situational, or individual barriers - to enough safe and nutritious food for normal growth and development and an active and healthy life.

Greenhouse Gas (GHG) Emissions: Gases that trap heat in the atmosphere are called greenhouse gases. The most prevalent are carbon dioxide, methane, nitrous oxide (N2O), and fluorinated gases.

Greenhouse Gas (GHG) Emissions Inventory: Categorizes all the emissions for a given geographic scope. For a city like Northfield, a GHG inventory outlines total emissions by sector (residential energy, commercial energy, water, waste, wastewater, and transportation). The purpose is often to provide a baseline understanding of emissions to help set targets and opportunities for reductions.

GreenStep Cities (GSC): GreenStep Cities is a statewide program in Minnesota that challenges cities to voluntarily commit to implementing various practices that aim to advance sustainability and quality-of-life goals for the city.

Large Consumers: Businesses or industry that use the largest volumes of energy (electricity and natural gas).

Mitigation: Anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases, and works to reduce the likelihood, severity, and impacts of events associated with a changing climate.

Natural Infrastructure: Forests and wetlands, working landscapes, and other open spaces that conserves or enhances ecosystem values and functions and provides associated benefits to human populations. Natural infrastructure can substitute or complement built infrastructure, providing carbon sequestration, air filtration, soil nutrient organic carbon enhancement, among other benefits.

Potable Water: Potable water is water that is safe for drinking or cooking.

Resource Recovery: In this document, resource recovery refers to a facility that uses waste to generate electricity through combustion.

Resilience: The ability of an individual or community to respond, adapt, and be minimally impacted by conditions of a changing climate.

Small Consumers: Residential homes, dwellings, and small businesses or buildings that consistently utilize low energy or water volumes as part of their routine operations. Examples of small consumers in the City of Northfield include most residences, gas stations, and local stores.

Solar Garden: Centrally-located solar photovoltaic (PV) systems connected to the utility grid to which Xcel Energy customers may subscribe.

Storm Water: Water (precipitation) runoff from rain, snow melt, and surface runoff and drainage.

Sustainability: Avoidance of the depletion of natural resources in order to maintain an ecological balance and meeting the needs of today without compromising the ability of future generations to meet their own needs, inclusive of natural resources, as well as social and economic resources.

Tree Canopy: The layer of tree leaves, branches, and stems that provide tree coverage of the ground when viewed from above.

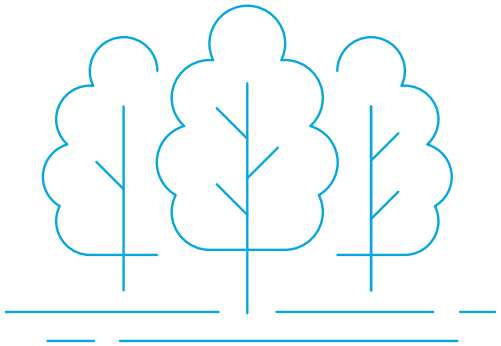
Urban Forest: Urban forests include urban parks, street trees, landscaped boulevards, gardens, river and coastal promenades, greenways, river corridors, wetlands, nature preserves, shelter belts of trees, and working trees.

Vector-Borne Diseases: Human illnesses caused by parasites, viruses, and bacteria.

Vulnerability: The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

Wastewater: All water that has been used in a home, in a business, or as part of an industrial process. Wastewater contains any range of organic matter, microorganisms (occasionally pathogenic), and inorganic compounds that need to be treated at a wastewater treatment facility.

Waterborne Diseases: Waterborne illness is caused by contaminated recreational or drinking water. The water may contaminated by bacteria or other toxins.



Executive Summary

A Changing Climate

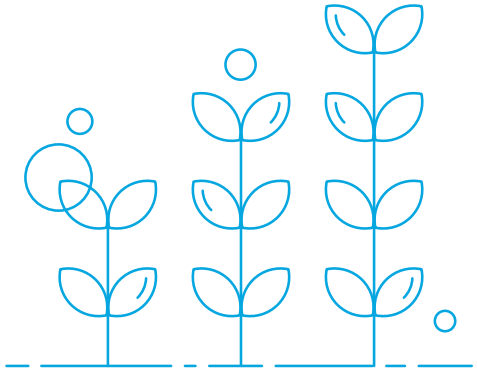
Climate change has wide-reaching causes and consequences, demanding a multi-faceted response from all levels of government and across all sectors. Local action is crucial to addressing climate change and local governments around the world are increasingly motivated to create a more sustainable, resilient future. Northfield has a long history of demonstrated commitment to sustainability, with residents taking action to increase solar and wind energy, conserve land and water, and support locally-supplied food, among other initiatives. Northfield's commitment to sustainability and resilience provides an opportunity to continue taking audacious, innovative action on climate change. This Climate Action Plan (CAP) lays out a path forward to support both the community's ongoing efforts and new initiatives that mitigate the cause of and adapt to the impacts of climate change, ensuring that the community remains a safe, healthy home for all Northfield residents.

Our Goal

The City of Northfield is committed to **100% carbon-free electricity by 2030** and being a **100% carbon-free community by 2040**. This plan also includes strategies to enhance the resilience of the community through cultivating and supporting a resilient population, forward-looking stormwater management and infrastructure planning, 21st century electric grid updates, and supporting local food efforts.

How we will get there

This CAP is built around six core areas: **Materials and Waste, Energy, Land, Food, Water and Wastewater, and Transportation**. Actions are aimed at both mitigating greenhouse gas emissions as well as enhancing resilience across each of these core areas. The majority of the City's emissions come from building energy use (85%), primarily from commercial and industrial uses. Travel accounts for 12% of total community-wide emissions. To achieve the goals laid out in this plan, the City must implement ambitious actions, prioritizing those with the greatest impact, while ensuring all residents benefit equitably.



Actions identified in this plan that will substantially reduce greenhouse gas emissions include deep energy efficiency and clean energy initiatives for both commercial/industrial buildings as well as homes. Broadly, the actions that will have the greatest impact on emissions reductions include:

- Deep energy efficiency retrofits for nearly all buildings and facilities
- Cleaning the generation of electricity in cooperation with the electric utility, Xcel Energy
- Switching energy sources from fossil fuel use to clean electricity in both buildings and travel
- Reducing the amount that people drive through mode shift opportunities like public transit, biking, and walking
- Eliminating waste that enters a landfill or resource recovery facility
- Sequestering carbon through accelerated tree plantings and sustainable land and agricultural practices

Full implementation of these actions would result in an 75% reduction in emissions by 2040, as highlighted in the graph below (figure 1). These reductions can be met with existing and commercially available technologies. The remaining 25% (primarily natural gas and transportation fuels), will need to be met through advanced strategies, particularly for heavy-duty vehicles and industrial processes.

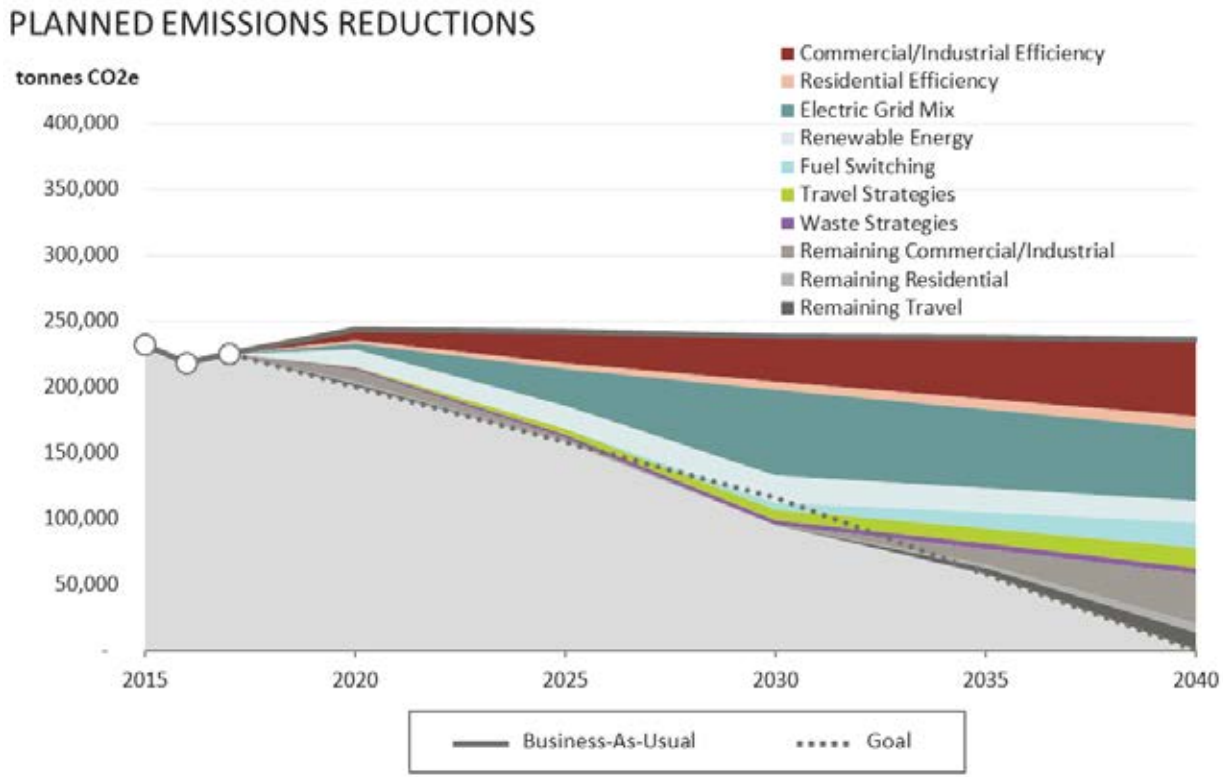


Figure 1. Planned community-wide emissions reductions, including: historic emissions for 2015-2017. More details in Figure 15. Source: LHB, Inc.

The actions are organized under four umbrella strategies to help guide implementation of the plan, including:

1. Expand **Education and Engagement** strategies for residents, businesses, industries, and tourists to increase and market sustainable, green projects
2. Incorporate emissions reductions, climate considerations, and resilience into **Policy and Planning** processes and decisions
3. Demonstrate climate leadership through **Innovation and Demonstration** of energy and sustainability projects
4. Maintain momentum and progress through continued **Support of the Plan**

Resilience

Climate change is already occurring, and Minnesotans are feeling the effects. In addition to mitigating the cause, Northfield is also looking to become more resilient to the anticipated effects of climate change. Building community resilience to climate change involves addressing vulnerabilities and capitalizing on opportunities to strengthen community connections and assets. In a changing climate, resilience is exemplified by individuals or communities with systems in place to respond to unexpected events. Increasing community resilience to climate change involves an analysis of people, built infrastructure, and natural systems. This plan includes strategies to improve the resilience of the community by 1) enhancing population resilience, 2) ensuring long-term viability, reliability, and integrity of built infrastructure, and 3) protecting and enhancing natural infrastructure by supporting access to local food, increasing urban tree canopy, and adding more green infrastructure elements to City projects, planning, and events.

Plan Implementation

Successful implementation of the CAP requires establishing roles (both internally and externally) to lead efforts, identifying funding, and determining priorities to help launch the plan and ensure it is on track. This includes full integration of the CAP into City operations, functions, and services; commitment and actions on behalf of residents and the business community; and a robust volunteer network to help shape and drive action to benefit everyone in the community. Implementation of the plan is centered around specific three-year action items that focus on the targets included in the graphic below.

- Assessment of City assets completed and a plan in place to reduce emissions from city operations
- Commitment from large energy users to meet city climate goals
- Building benchmarking program established

- City fleet assessment completed and purchasing policy updated
- Additional public EV infrastructure available in the community

- 1 MW of additional renewable energy
- 8% of businesses and 19% of residences have made deep energy efficiency improvements
- PiE Jump Start goals have been achieved

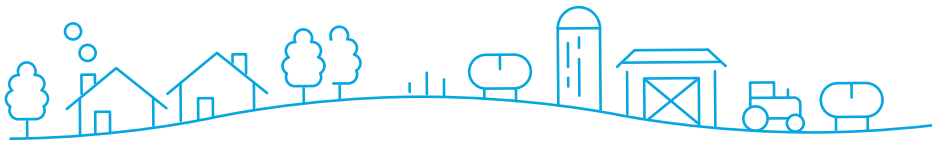
- 10 miles of additional bike and pedstrian infrastructure (trails, paths, sidewalks)
- Community-wide mobility-sharing program in place

- Urban forestry program established that includes robust tree planting, soil restoration, and other sustainable practices
- Resilience is incorporated into city planning and budget processes

- Zero-waste plan developed and adopted; including a plan for a waste processing facility
- Zero-waste packaging ordinance adopted
- Farm to school program in place

Introduction

Northfield is a rural community with agricultural and historical characteristics, approximately one hour south of the Twin Cities. At the heart of the City are two colleges, St. Olaf and Carleton, that are essential to the identity of the community. Northfield is home to 20,000 residents of various economic and cultural backgrounds, all contributing to the richness, creativity, and vibrancy of the community. Northfield has been a leader among cities working toward a more sustainable future. The energy and passion of Northfield residents have contributed to many of the efforts to boost local renewable energy production, improve mobility options, recover food waste, and support the local farming community. The threat of climate change puts a more urgent focus on these sustainability efforts and makes it clear that without concrete goals and a plan to achieve them, Northfield will not be able to reduce its emissions at the pace needed to help reverse the course of climate change.



Northfield residents understand it is imperative 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 100% carbon-free electricity by 2030 and to be carbon-free community-wide by 2040. In a special report released as a 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 (2.7°F) and avoid some of the worst consequences of climate change.[1,2] In Minnesota, we are already seeing the effects of climate change in the form of heavy precipitation events and more extreme temperatures. It is evident that Minnesota communities must simultaneously look to mitigate emissions and adapt to a changing environment. Northfield is among the leading cities in the state to accelerate climate action, motivating others to join in a collective effort to reduce global emissions.

The Climate Action Plan (CAP) provides a comprehensive pathway for addressing climate change in the City of Northfield and in the surrounding communities of Dundas, Waterford, and other contiguous townships within the urban expansion area. The plan has identified priorities, strategies, and actions that will both mitigate the City's contribution to climate change and prepare Northfield for unavoidable impacts. There is opportunity to improve the quality of life beyond reducing emissions. Many of the strategies outlined 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 to ensure a more prosperous future for all who live and work in Northfield.

Background

This plan is the culmination of many years of action and leadership by Northfield residents. The Northfield Environmental Quality Commission (EQC) was established in the mid-1970s to advise the City on environmental quality, natural resources, and the implementation of environmental policy. 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.[3]

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).

2 Northfield Code1986, § 245:05(4)

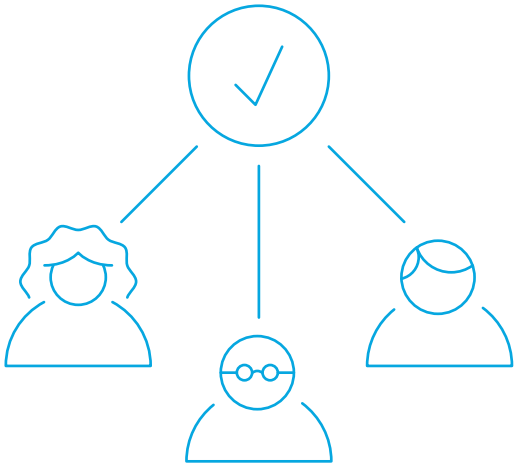
3 City of Northfield, Energy Task Force Report Summary (2008), https://www.ci.northfield.mn.us/DocumentCenter/View/7201/2008-Northfield-Energy-Task-Force-Report-Summary

In 2010, Northfield joined the Minnesota GreenStep Cities (GSC) program, which provides a framework for cities to improve upon their sustainability goals. Northfield has achieved Step 3, which recognizes communities that have implemented several best practices and high-impact actions.[4] In recent years the program 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 2018-2020 strategic plan, which led to the City Council's establishment of the Northfield Climate Action Plan Advisory Board (CAPAB).[5] The CAPAB was 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 (CAP).

The CAPAB led the development of this plan with widespread participation and input from citizens and community stakeholders during 2018 and 2019. The Board is made up of appointed citizens with a wide range of climate-related expertise. The CAPAB focused on six core areas with the greatest opportunities for impact: Materials and Waste, Energy, Land, Food, Water and Wastewater, and Transportation. CAPAB members led and coordinated subcommittees focused on each core area that met monthly throughout the process, generating ideas and content to be included in the CAP.

CAP Development & Community Engagement Process

The development of the CAP took place 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 - 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 (Appendix A) looked specifically at emissions associated with public buildings and facilities, streetlights and signals, City fleet vehicles, water 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. The Resilience Assessment (Appendix B) assessed how hazards associated with climate change are anticipated to impact Northfield and how well the City is prepared to adapt to these changes, informing 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 Xcel Energy Partners in Energy (PiE) Sustainable Energy for All Energy Subcommittee Report (Appendix C), which is incorporated into the related energy elements of this plan. The development process of the Energy Subcommittee Report complemented the efforts of the CAP development through facilitation of energy data-sharing and leveraging the information gathered in 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 survey expert and a City of Northfield student intern to develop a community-wide survey, available in English and Spanish.[6] It was administered at 14 public events and paper copies were available at several locations throughout the City. The survey sought to understand community members' understanding and attitudes toward climate change, individual actions being taken to

4 Minnesota Pollution Control Agency, GreenStep Cities, https://greenstep.pca.state.mn.us/city-detail/12323?ctu_code=2395265
5 City of Northfield Strategic Plan (2018), https://www.ci.northfield.mn.us/DocumentCenter/View/5833/Northfield-Strategic-Plan-2018---2020?bidId=
6 https://www.ci.northfield.mn.us/DocumentCenter/View/7312/CAPAB-CAP-Community-Survey-Questions

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 CAP's framing and in the strategies (see Appendix D for a full survey report).

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, sharing a total of 280 Dots (see Appendix E for results of the exercise).

Northfield City staff, CAPAB members, and Great Plains Institute selected five focus groups to discuss community concerns and explore additional strategies 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 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, Northfield business owners and representatives, and City of Northfield staff. 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 Northfield High School students. Each meeting varied in content, but all 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 in Northfield. Findings from these focus group meetings were shared with CAPAB members and City staff and have been incorporated throughout the plan (see Appendix F for the focus group summary report).

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 adjust to technological, political, and economic changes in order to help the City meet its targets as soon and effectively as possible.

Photo Credit: Great Plains Institute

Northfield Emissions: Where are we today?

We use various forms of energy in our daily lives. Historically, most of our energy has come from the combustion of fossil fuels that include oil, coal, and natural gas. These fuels are used for the generation of electricity, space and water heating, industrial processes, and to run most vehicles. While there has been tremendous innovation and economic growth from the production of energy, it is overwhelmingly evident that the combustion of these fuels has been at a great cost. Greenhouse gases (GHG) are emitted when fuel is burned for energy. GHGs, most commonly carbon dioxide (CO_2), have heat trapping properties that absorb heat from the sun that is reflected off the Earth's surface. Over the past 140 years, humans have come to rely on fossil fuels to meet our growing energy needs, causing the atmospheric concentration of GHGs to rise, trapping more heat and raising the global average temperature. As the temperature rises, we have begun to see the consequences of a changing climate. If left unchecked, climate change will dramatically alter life as we know it. Fortunately, there are viable forms of carbon-free energy-producing technologies that can meet our energy needs and improve our overall quality of life.

In response to climate change, Northfield residents have set goals to **receive 100% carbon free electricity by 2030** and be **carbon free by 2040**. In order to prioritize actions, the City first completed a GHG inventory to measure where emissions are generated in the community. Measuring emissions helps to determine where the community can have the most impact by reducing energy consumption, increasing clean energy production, improving land use and agricultural practices, and changing behavior in ways that equitably impact all residents. A GHG inventory is an assessment of emissions that can be attributed to Northfield residences, businesses, and visitors. A GHG assessment has been completed for both community-wide emissions and City operations. Each of these inventories follow the U.S. GHG Protocols developed by ICLEI - Local Governments for Sustainability.

Using the U.S. GHG protocol, emissions sources are categorized into three Scopes. Scope 1 emissions are those that are emitted within the boundary of a community such as gas and diesel vehicles, the combustion of natural gas for space and water heating, and industrial processes. Scope 2 emissions refer to those that result from the generation of electricity that is usually produced elsewhere but consumed within a community. Scope 3 emissions capture the upstream and downstream emissions that result from the production, transportation, and disposal of goods. Because accurately capturing upstream and downstream emissions poses many accounting challenges, they are often excluded from community inventories. Apart from downstream waste emissions, Scope 3 is not included in Northfield's City or community inventories. This plan does include actions that would reduce emissions from Scope 3 sources, like those from waste. Other sources of emissions that are important to consider but are not quantified in these inventories are those that result from land use, such as agricultural practices where GHGs are emitted from disturbed soil or fertilizer products. Accounting for those emissions are beyond the scope of this plan, however strategies that reduce emissions from those sources are included.

This following section summarizes the GHG inventories for the community and City operations for a three-year study period from 2015 to 2017, including a snapshot of current participation in energy efficiency and renewable energy programs, as well as local solar and wind energy systems.

Community-Wide Greenhouse Gas Emissions

Community-wide GHG emissions were captured for the years 2015, 2016, and 2017. In 2017, the inventory shows that commercial and industrial emissions from electricity and natural gas contribute to the largest share of total emissions – about two-thirds of all community emissions (68%). This sector is followed by residential (17%), and travel (12%). Combined emissions from waste and wastewater comprise less than 3% of the City's total emissions profile. It should be noted that emissions from waste include downstream emissions that result from methane released at landfill sites, not the emissions that went into producing materials and goods consumed in Northfield, which are significant. Figure 2 provides a breakdown of emissions by sector and energy type.

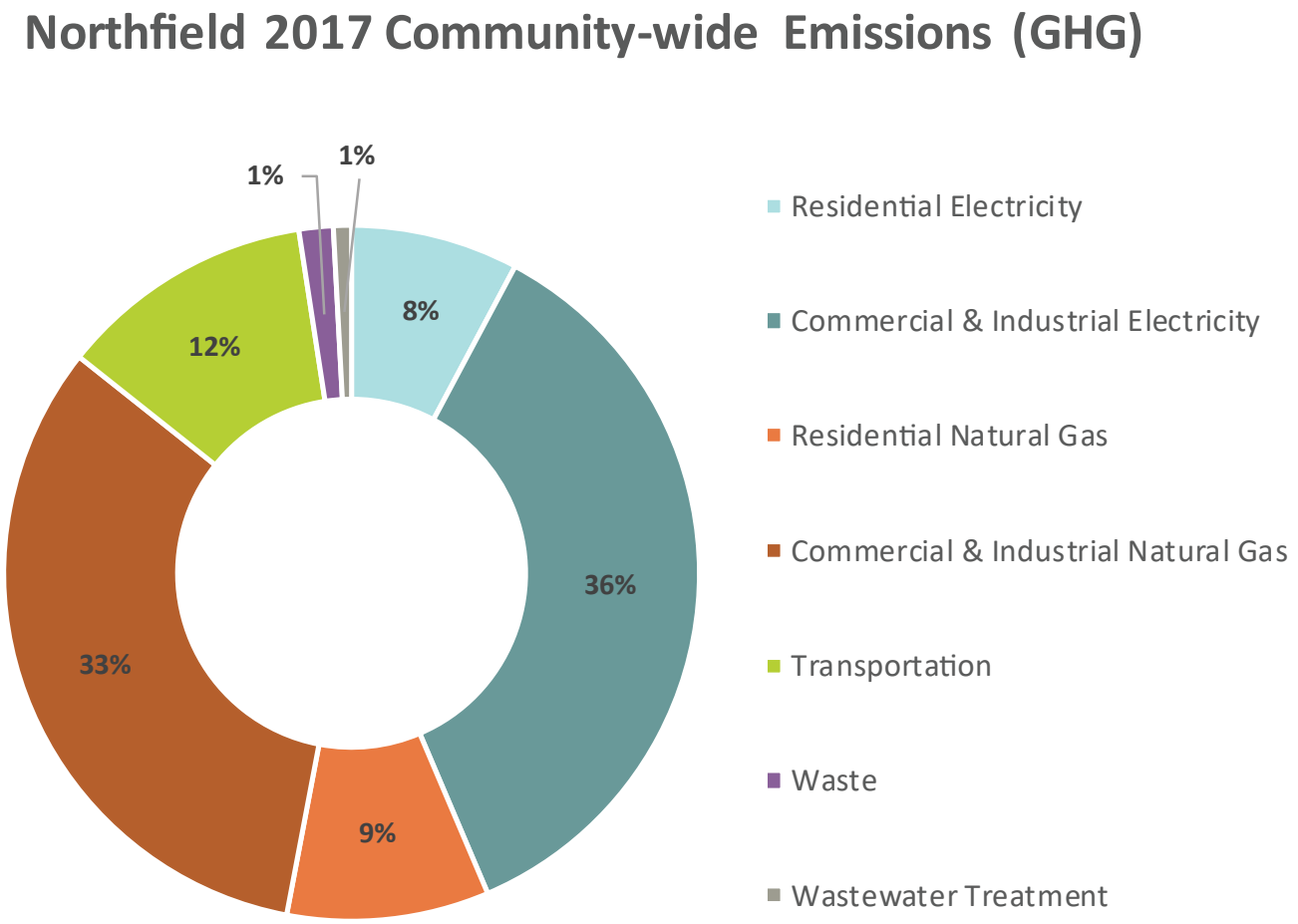


Figure 2. Community-wide greenhouse gas emissions for Northfield, Minnesota by sector. Each wedge represents a different sector and energy use category. Source: Xcel Energy (2017), Minnesota Department of Transportation (2017). Generated by Regional Indicators Initiative.

Building Energy Emissions

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 (million metric British thermal units) of energy, encompassing both electricity and natural gas. About two-thirds of Northfield's 2017 building energy consumption is from natural gas (67%), and one-third from electricity (33%). The bulk of building energy consumption occurs from use of natural gas in commercial and industrial facilities, accounting for 52% of total building energy consumption.

In Northfield, building energy use represented the greatest share of emissions at 85% of the total in 2017. Emissions associated with building energy use are nearly evenly divided between natural gas (49%) and electricity (51%). The commercial/industrial sector emits 80% of total building emissions or 68% of community-wide 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 Post Consumer Brands (formerly Malt-O-Meal) facility. Each of these entities has already taken significant strides to reduce emissions from their electricity use through the purchase and generation of renewable energy and will be critical partners to help the City achieve its GHG reduction goals.

Xcel Energy has set goals to reduce carbon emissions from its electricity generation by 80% by 2030 and 100% by 2050. As part of this CAP, the City of Northfield set a goal to receive 100% of its electricity from carbon free sources by 2030.

Much of the City's electricity goal will be supported by Xcel Energy's efforts, helping to make it more achievable and allowing the City to focus on renewable energy that will provide additional co-benefits to the community through in-boundary installations and community solar garden subscriptions.

Because of Xcel Energy's carbon reduction goals that will help Northfield address its electricity emissions reductions, the City will be able to focus its efforts on reducing emissions from natural gas through deep energy efficiency and innovative technologies.

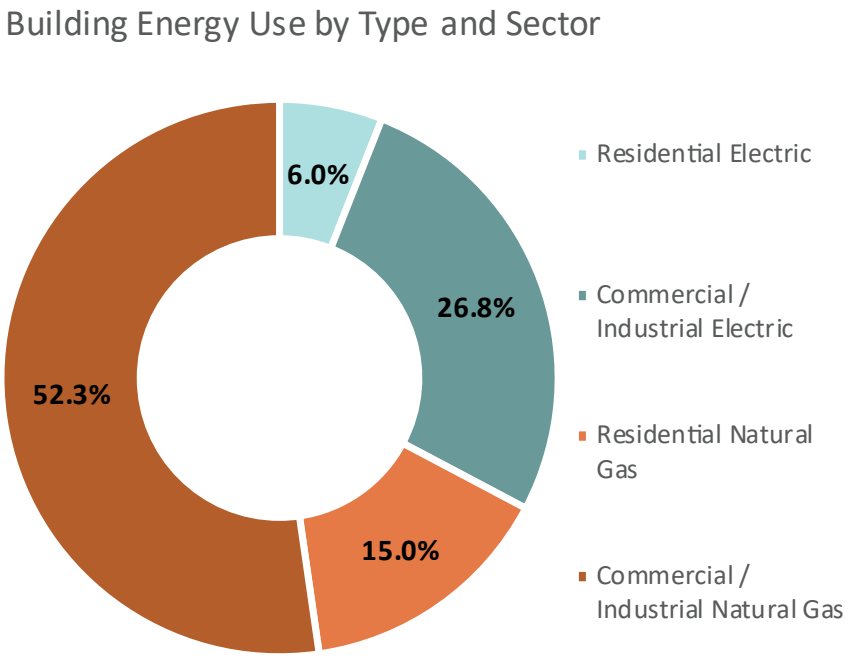


Figure 3. Building Energy Use by Type and Sector. Source: Xcel Energy Community Energy Reports (2017). Generated by Regional Indicators Initiative.

Renewable Energy and Conservation

Community-wide building energy emissions are impacted by both energy conservation measures and the utilization of locally generated or purchased renewable energy. Participation in renewable energy and energy conservation programs is summarized in the Energy Subcommittee Report (Appendix C) and is incorporated below.

Energy Conservation

Some Northfield residents and businesses currently participate 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, consumers saved a total of 18,710 MMBtu. The most popular programs for residents include Saver's Switch and rebates for heating and cooling equipment. For commercial/industrial customers, lighting, heating, and cooling efficiency rebates are the most utilized programs for saving energy.

Photo Credit: Growing Up Healthy

Photo Credit: Great Plains Institute

On-site Renewable

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 5 commercial/industrial premises had solar panels on their home or facility with a total capacity of 554 kW. Three wind turbines — two at Carleton College and one at St. Olaf College — also generated power for each of those institutions totaling just over 6.7 million kWh each year.

Off-site Renewable Energy

Off-site renewable energy subscriptions offer residents and business owners the opportunity to support renewable energy without installing any equipment. Two popular examples of utility-offered renewable power purchase programs include WindSource® and Renewable*Connect. Community solar garden subscriptions are also available to customers as part of an Xcel Energy program. In 2017, 613 Northfield residential customers purchased or subscribed to renewable energy, totaling more than 1.8 million kWh of electricity. Sixteen commercial/industrial premises purchased or subscribed to renewable energy for a total of 33.6 million kWh of electricity.

The graph at right (figure 4) shows the breakdown of renewable energy production and program participation by source for both residential and commercial as it compares to total electricity consumption. For residential consumers, 4.5% of all consumption is sourced through renewable energy; that number increases to 18.5% for commercial. Northfield was an early participant in Xcel Energy's community solar garden program. A 6.63 MW solar garden was commissioned near the community in 2018 and produces enough power for more than 1,000 homes.

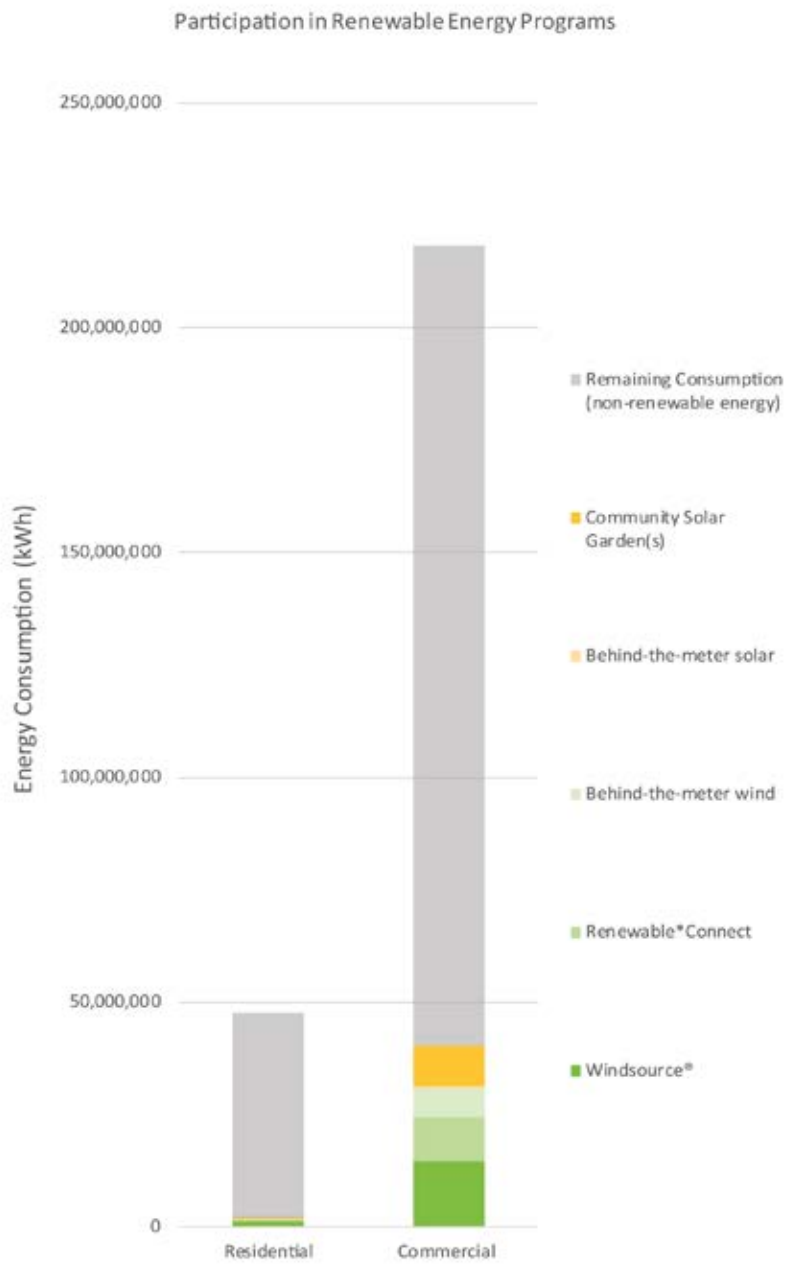


Figure 4. Participation in renewable energy by sector. Source: Northfield Energy Data (2017)

Transportation Emissions

Of total community-wide GHG emissions, the transportation sector 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 5. VMT data comes from the Minnesota Department of Transportation (MNDOT), which collects on-road vehicle counts on an annual basis. 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.

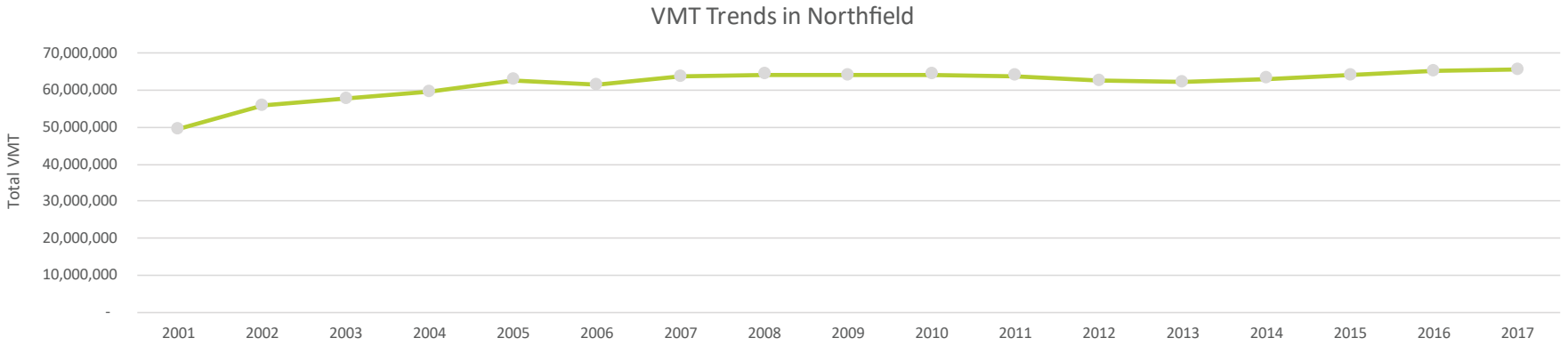


Figure 5. Total Vehicle Miles Traveled by year, 2006 - 2017. Source: Minnesota Department of Transportation. Generated by Regoinal Indicators Initiative.

According to the U.S. Census Bureau 5-year American Community Survey conducted in 2017, 52% of Northfield residents drove alone to work, nearly 11% carpooled, 8% biked or walked, and 32.6% of residents worked 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. Further, 32.6% of residents telecommute, which is relatively high compared to the state and may merit deeper analysis.

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 that cross the City. These trails, coupled with on-street routes for cyclists, offer many options for non-motorized travel. However, 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. Approximately 0.5% of residents reported using public transit through the American Community Survey.

Photo Credit: Great Plains Institute

In conversations with students and community organizations serving Latinx community members, people identified barriers to using the transit system, such as timing, frequency, route efficiency, and accessibility. Increasing the availability of and access to low- or no-carbon transportation options provides co-benefits that improve community-wide equity and health. Walking and biking offer health benefits by allowing people to incorporate exercise into their commute or recreation. Further, improved access to multiple mobility options allows all residents more choices to get to work, provides access to more employment opportunities, and facilitates involvement in community events.

For trips that must be made by a car, electric vehicles (EVs) are a cleaner alternative to internal combustion vehicles, both in terms of local air pollutants and GHG emissions. Of passenger vehicles in Northfield in 2016, 99.5% used gasoline.[7] The growing availability of EV charging infrastructure supports increased adoption for electric vehicles. As of 2019, there are three public Level 2, dual-head electric vehicle charging stations in Northfield, one located at Carleton College, one at St. Olaf College, and one on Water Street and Hwy 19. There are 32 registered electric vehicle owners in the City of Northfield and the surrounding area.[8] 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.

Land Use Emissions

Although not included in the community-wide inventory, emissions from how land is used and maintained is an important consideration for the Northfield community. The development patterns of land can dictate transportation and building density, creating barriers and opportunities for where people live and how they travel. More compact land use with adequate options for non-motorized travel or transit can help reduce emissions from transportation. Conversely, low-density land use patterns that are designed for the movement of vehicles will create an auto-centric community that results in higher emissions. GHGs can also be stored or emitted depending on specific land use and cover. Land cover is the physical material on Earth's surface, like trees, grass, pavement, or buildings. Undeveloped land, natural areas, and wetlands all provide important carbon benefits by capturing and storing the gas in plant matter and soils. Disturbing natural areas through land conversion (e.g., development, agricultural practices) releases the stored carbon, resulting in GHG emissions.

In Northfield, much of the natural land cover has been converted for development or agricultural use. Emissions that come from developed land are captured in Scope 1 and Scope 2 building and transportation emissions. Emissions that can be attributed to agricultural practices in Northfield are not included in this plan. Fertilizer application, soil tillage, and farm animals significantly contribute to global emissions (9% of U.S. emissions).[9] By modifying practices, local farmers can not only reduce emissions associated with agriculture but can also provide carbon benefits to the community. For example, conservation tillage and grazing can reduce emissions and provide opportunities for additional sequestration.

As part of this plan, the City should continue to consider its approach to land use and land cover change as it pertains to emissions – particularly with respect to growth and urban boundary expansion opportunities to store and sequester carbon through wetlands and soil, as well as goals outlined to ensure preservation of agricultural and rural character. Further, the City can look to its natural areas and underutilized spaces to store additional carbon through tree planting and converting turf to native plantings.

7 Department of Energy State and Local Energy data (2016), https://www.eere.energy.gov/sled/#/, (Accessed June 2019).
8 Minnesota Department of Motor Vehicles, Statewide Vehicle Registration Data (2017).
9 Environmental Protection Agency, sources of Greenhouse Gas Emissions, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

Material Waste and Food Emissions

Municipal solid waste data is collected by the Minnesota Pollution Control Agency at the county scale. Rice and Dakota Counties' per capita waste rates were used to estimate City-wide usage. 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 single-hauler waste pick-up service for both garbage and recycling. Each year, more than 26,000 tons of solid waste are disposed of in Northfield (Table 1). Roughly half of the waste is recycled and most of the remainder of the non-recycled waste is sent to a landfill, with a small percentage going to a resource recovery (waste to energy) facility. Emissions are calculated based on the volume and destination of the solid waste. Most emissions (95%) from Northfield solid waste come from waste that is landfilled. Organic materials, such as food waste, that are sent to a landfill break down and decompose over time, releasing methane, a powerful greenhouse gas. This methane could be captured and used either as compressed natural gas for heavy-duty vehicles or as renewable natural gas that is refined and added to an existing natural gas pipeline. In addition to capture, there is opportunity to reduce future methane by preventing organic material from entering the landfill.

Northfield currently offers organics composting opportunities for all food products, available at a single drop-off location near Sechler Park and through Northfield Curbside Compost. The drop-off compost site is operated through the City waste contractors and open seasonally (April through October). Community members may also sign up for Northfield Curbside Compost, a local Northfield business offering weekly curbside compost pick-up for a monthly or yearly fee. It is important to address food waste for many reasons. According to the Minnesota Pollution Control Agency, in 2013, 31% of all waste in Minnesota was organic material (Figure 6).

Breakdown of waste disposal in Northfield, 2015 to 2017			
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%
% Composted	<1%	<1%	<1%
Tonnes of GHG	3,437	3,374	3,737

Table 1. Total solid waste and waste processing proportions from 2015-2017. Source: Generated by Regional Indicators Initiative, from Rice and Dakota County data.

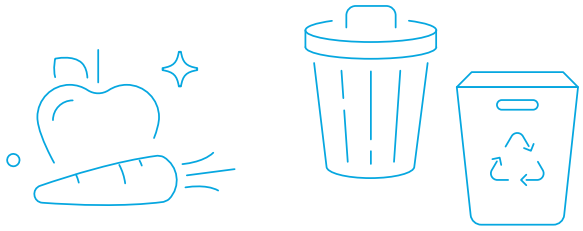
Figure 6. Composition of municipal solid waste in Minnesota in 2000 and 2013. Source: Minnesota Pollution Control Agency, "Minnesota MSW Composition Study," 2013.

A large volume of waste could be removed from the waste stream through better management of the food system. Reducing organic waste can be done by 1) purchasing more intentionally to avoid disposing of extra, unconsumed food, 2) making food available to those who may struggle with food insecurity, such as through the St. Olaf College Food Recovery Network and Carleton College Food Recovery Network,[10, 11] 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. 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 schools, such as the Greenvale Park Community Garden. Expanding local food access and production in Northfield and surrounding areas will support residents of all economic backgrounds and businesses in receiving a wide variety of healthy, affordable, and sustainable food choices.

In addition to food waste, Northfield residents aim to divert waste from 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.[12] 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. For items that have reached limitation of use, recycling and composting are the next best uses for those items. Finally, for items that must be disposed of, resource recovery is recommended, while landfills should be avoided. There may be additional economic and environmental benefits available through the establishment of a waste processing facilities, such as composting. Such a facility could provide economic benefits through an increased tax base and/or through revenue generation from sales. It would also provide additional environmental benefits such as improving soil health, cutting landfill emissions, and reducing stormwater runoff.

Achieving a low or no-waste community is a critical component to eliminating emissions from waste. It will take a coordinated effort from all areas 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 founded by a student in collaboration with the Center for Community and Civic Engagement and Bon Appetit. The network redirects food from the waste stream to those who could most benefit from it.

Six days a week, the Network transports uneaten food from the dining halls to community partners who help people experiencing food insecurity. Students also provide retail recovery, redirecting uneaten food from retailers to the Northfield Food Shelf.

In 2018, Carleton student volunteers collected over 10,000 pounds of food from the dining halls and over 100,000 pounds from retailers for the food shelf.

10 St. Olaf Food Recovery Network, https://www.foodrecoverynetwork.org/chapters-1#St.olafcollege
11 Carleton College Food Recovery Network. https://apps.carleton.edu/ccce/programs/food-recovery-network/
12 United States EPA, Waste Management Hierarchy, https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials- and-waste-management-hierarchy

City Operations GHG Emissions Inventory

City operations generate emissions associated with municipal buildings and facilities, streetlights, potable water processing, liquid fuels from the City fleet, and wastewater treatment. In 2019, a City operations greenhouse gas (GHG) assessment was completed for the years 2015, 2016, and 2017 to support Northfield in its efforts to better understand the distribution of emissions and strategies for emission reductions. The complete study is included in Appendix A.

Emissions from City operations make up less than 2% of the community-wide total emissions. Table 2 and Figure 7 highlight the sources and changes in City operations 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 each accounted for 8-12% of the total City operations emissions. Emissions from waste made up the smallest contribution with 1% of the total. Total 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 accounts for the GHGs emitted during the generation of the electricity. The improved electricity emissions factor accounted for just over half (52%) of the 11% reduction in Northfield's City operations GHG emissions over the same period. Emissions reductions from the wastewater treatment plant accounted for an additional 30% of the total reduction between 2015 to 2017. While the 11% reduction in emissions from 2015 to 2017 is substantial, there is still significant opportunity for the City to further reduce its emissions. The City recently subscribed to 1.9 MW of community solar gardens for the electricity use of several buildings, streetlights, and water wells. The following summarizes emissions from each of the categories highlighted in the assessment.

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

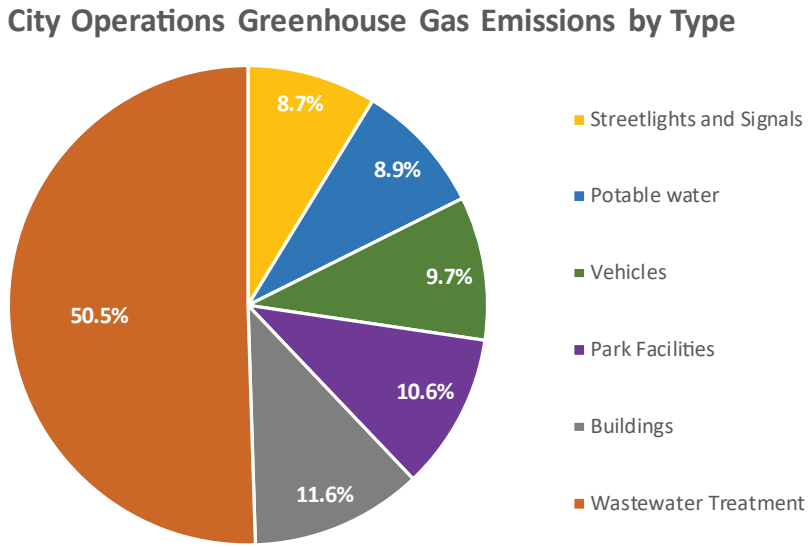


Figure 7. Proportion of Northfield City operations greenhouse gas emissions by type from 2015 - 2017. Source: Orange Environmental LLC, "Northfield Greenhouse Gas Assessment," 2019.

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 Energy's electricity emissions factor improvement. The City owns about half of the streetlights in the community. Those owned by Xcel Energy have largely been replaced with LED bulbs; City-owned lights are being replaced with LED as current lights reach the end of their useful life.

Greenhouse Gas Emissions, 2015 - 2017 (tonnes)				
Fuel (in gallons)	**2015**	**2016**	**2017**	**Change**
Diesel	5,157	11,476	11,407	121%
Gasoline	37,630	37,431	30,082	-20%
Total Liquid Fuel Consumption	42,787	48,907	41,489	-3%

Table 3. City operations liquid fuel consumption from 2015 to 2017. Source: Orange Environmental LLC, "City of Northfield Greenhouse Gas Assessment," 2019.

Liquid Fuels

In 2017, vehicle emissions represented 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% — the result was a 16% increase in emissions from liquid fuels between 2015 and 2017. Table 3 provides a breakdown of gallons of fuels consumed by type during the years assessed.

Park Facilities

There are 25 park facilities (of a total 37) included in the City operations emissions inventory. 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%.

Photo Credit: Great Plains Institute

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 from 2015-2017, building electricity consumption increased by 4%, while natural gas consumption decreased by 26%. After aggregate park facilities, City Hall is the largest single City building 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.

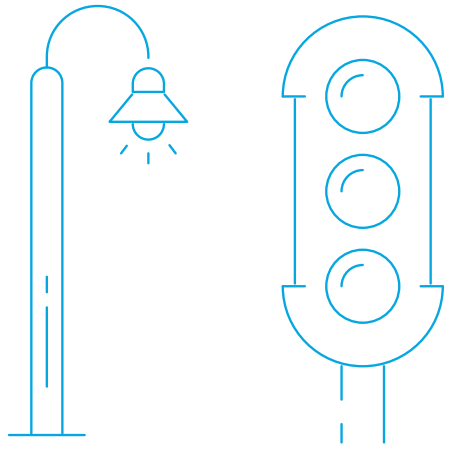
Potable Water

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 associated with potable water decreased by 13.2%. Reductions came both from improved efficiency and cleaner generation mix.

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, distribution, and wastewater treatment account for about 1% of Northfield's total community-wide GHG emissions and 50% of total City operations emissions. The greatest portion of emissions for the treatment of water and wastewater come from electricity: 334 tonnes for potable water and 1,400 tonnes for the treatment of wastewater each year. Wastewater treatment facilities also use a significant amount of natural gas, resulting in 411 tonnes of CO_2 emitted annually.

In addition to City of Northfield wastewater, the treatment plant also processes wastewater from Carleton College and the City of Dundas, which draw from their own wells and account for approximately 7% of the total amounts treated. Volumes from both sources increased from 2015-2017, with 2017 levels 20% higher than 2015. On a per-capita basis, wastewater associated with the City was 21% higher in 2017 than in 2015. 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% despite the increase in amount of wastewater treatment.



Emissions Reduction Targets and Plan Impact

The City of Northfield has set a goal to achieve carbon-free electricity by 2030 and to be carbon-free community-wide by 2040. Achieving these goals will require aggressive emissions reductions in every sector, with most of the savings achieved through strategies associated with the energy used in buildings. Figure 8 shows planned carbon reductions between now and 2040, 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. The planned emissions reductions are based on a business-as-usual (BAU) scenario that considers population and job growth for the community. The BAU uses growth projections based on Dakota and Rice Counties' anticipated employment and population growth, which were downscaled to Northfield based on their relative percentage of the population.

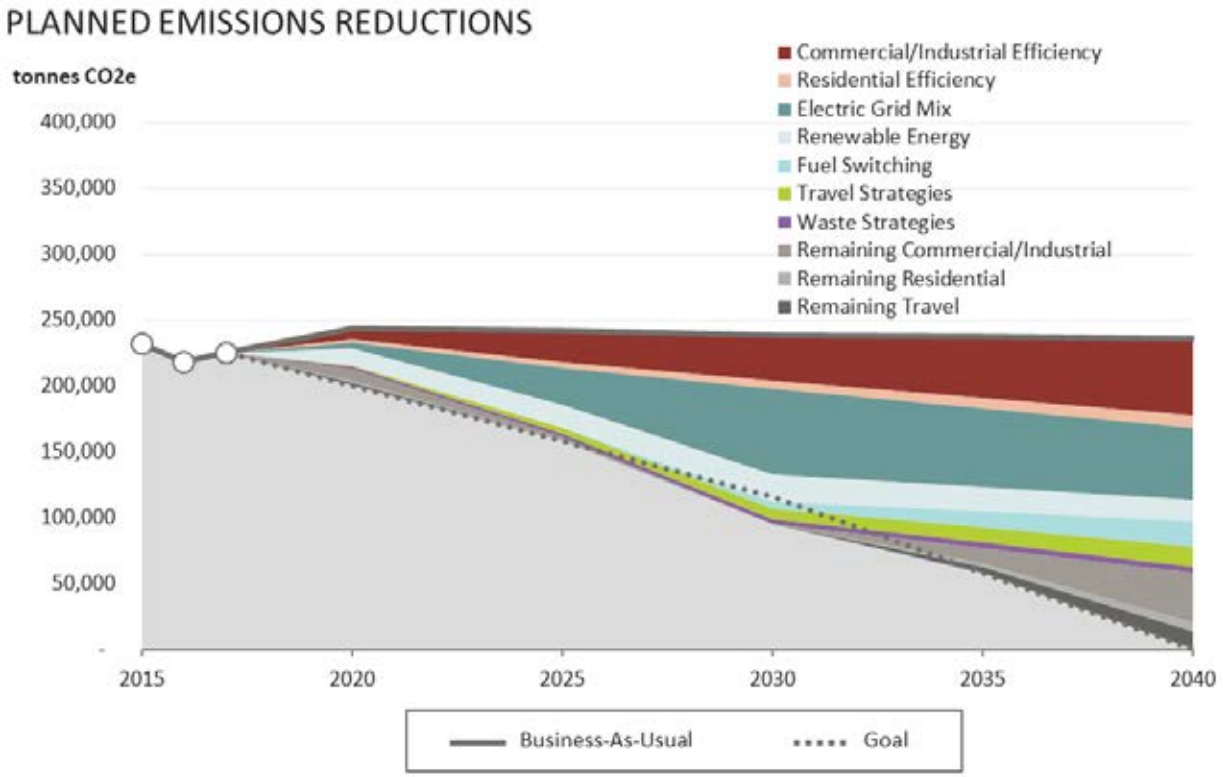


Figure 8. Planned community-wide emissions reductions, including: historic emissions for 2015-2017, a business-as-usual projection through 2040 (top gray line), Northfield's goal (dotted gray line), and the estimated impact of reduction strategies (colored 'wedges') that close the gap between the business-as-usual 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 75% reduction in total GHG emissions from business-as-usual in 2040, with:

- A **25% reduction in overall emissions** through commercial and industrial building efficiency, such as net-zero energy new construction and energy efficiency retrofits
- A **4% reduction in overall** emissions through residential building efficiency, such as net-zero energy new construction and energy efficiency retrofits
- A **23% reduction in overall emissions** through Xcel's changing electric grid mix
- A **7% reduction in overall emissions** through community-supported renewable energy
- An **8% reduction in overall emissions** through fuel switching from natural gas to electricity in homes and businesses
- A **6% reduction in overall emissions** through travel strategies such as mode shift and electric vehicles
- A **2% reduction in overall emissions** through strategies that eliminate waste emissions by 2030

A description of each strategy and the participation rates used to estimate the community-wide emissions reductions are included in Table 4, on the following pages.

The grey-shaded wedges represent the remaining 25% gap to the goal that will need to be addressed through advanced strategies in the future. Of the remaining emissions, 65% is from natural gas used in commercial buildings and industrial processes, 12% is from natural gas used in residential buildings, and 23% is from vehicle travel (Figure 9). 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.

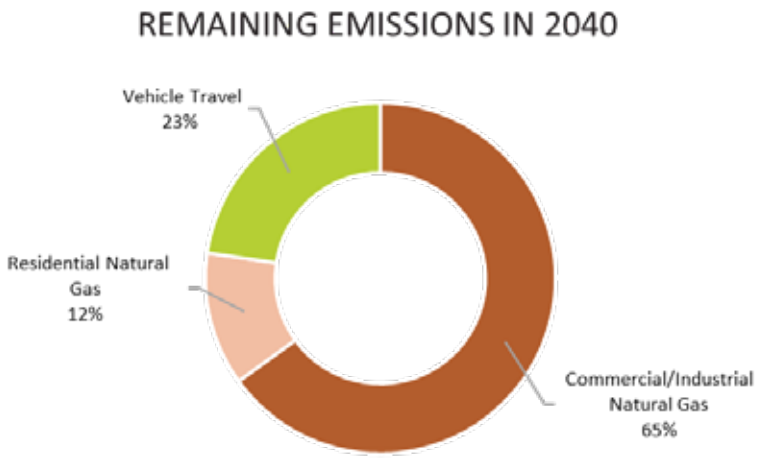


Figure 9. With a projected 75% emissions reduction in 2040; this graph shows the breakdown of the remaining 25% that will need to be addressed through advanced strategies. Source: LHB, Inc.

The table below highlights the forecasted participation rates across different carbon reducing strategies. The participation rates are what will be required to achieve the emissions reductions illustrated in the wedge diagram (Figure 8), resulting in a 75% decrease in emissions by 2040 from Business-As-Usual.

Forecasted Participations Rates

Commercial/ Industrial Efficiency		2020	2030	2040
Energy Code Enforcement	Percentage of new commercial/industrial building area (in the specified year) that complies with the Minnesota Energy Code	100%	100%	100%
Net-Zero Energy Buildings	Percentage of new commercial/industrial building area (in the specified year) that produces as much energy on-site as it uses	5%	100%	100%
Energy Efficient Retrofits	Percentage of businesses that have participated in energy efficiency programs for their existing buildings by the specified year	8%	24%	40%
Residential Efficiency		2020	2030	2040
Energy Code Enforcement	Percentage of new residential building area (in the specified year) that complies with the Minnesota Energy Code	100%	100%	100%
Net-Zero Energy Buildings	Percentage of new residential building area (in the specified year) that produces as much energy on-site as it uses	5%	20%	50%
Energy Efficient Retrofits	Percentage of existing homes that have participated in energy efficiency programs by the specified year	19%	50%	65%
Electric Grid Mix		2020	2030	2040
Xcel Planned Emissions Reduction	Percentage reduction in CO2e emissions per kWh of electricity from baseline year	5%	73%	79%
Xcel Carbon-Free Percentage	Percentage of Xcel's total electricity generation that comes from carbon-free sources in the specified year	60%	75%	84%
Renewable Energy		2020	2030	2040
On-Site Renewable Electricity	Percentage of total community electricity use met by on-site renewable electricity generation in the specified year	5%	10%	20%
Green Power Purchase (Business)	Percentage of commercial/industrial electricity use met through participation in renewable energy purchasing programs (e.g. Xcel's Renewable*Connect) in the specified year	10%	15%	7%
Green Power Purchase (Residential)	Percentage of residential electricity use met through participation in renewable energy purchasing programs (e.g. Xcel's Renewable*Connect) in the specified year	10%	15%	9%

Fuel Switching[13]		2020	2030	2040
Business Electrification	Percentage of commercial buildings served by natural gas for space and water heating that have switched to electricity by the specified year	0%	15%	64%
Residential Electrification	Percentage of homes served by natural gas for space and water heating that have switched to electricity by the specified year	0%	15%	61%
Travel		2020	2030	2040
Mode Shift	Percentage reduction from baseline vehicle miles traveled due to increased walking, biking, rolling, transit ridership, ride-sharing, and trip efficiency	2%	7%	20%
Electric Passenger Vehicles	Percentage of passenger vehicles that drive within City boundaries that are electric by the specified year	4%	28%	56%
Electric Light Trucks	Percentage of light trucks that drive within City boundaries that are electric by the specified year	0%	10%	25%
Electric Heavy Trucks	Percentage of heavy trucks that drive within City boundaries that are electric by the specified year	0%	14%	32%
Waste		2020	2030	2040
Zero-Waste	Percentage reduction in emissions from the management of municipal solid waste by the specified year	33%	100%	100%
Remaining Emissions				
Advanced Strategies	With all strategies deployed, the City will reduce its emissions 75% by 2040. The remaining emissions will result from transportation fuels and natural gas used in buildings and industrial processes. Eliminating or offsetting these emissions will require advanced strategies that may include, but are not limited to, thermal technologies (e.g., district heating, ground-source or air-source heat-pumps), renewable natural gas, other bio-based solutions, and emerging technologies.			

Table 4. Forecasted participation rates in strategies for emission reduction. Source: LHB, Inc.

13 Electrification rates were derived from the "High Electrification" scenario used in the energy modeling analysis for Xcel Energy's Upper Midwest Integrated Resource Plan 2020-2034.

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 also implement an energy plan put forth by the Energy Subcommittee, which will help launch many of the actions included in this plan. While the 18-month Energy Action Plan is a good starting point to reduce emissions, it will not be enough to achieve the reductions needed to meet the City's 2030 and 2040 goals. The following section lays out priorities, strategies, and actions to achieve those goals. The CAP 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 an inventory of specific actions the City can choose to employ.

Under each strategy, the relative carbon impact is denoted by:  The CO_2 marker is used on a scale where 1 is the lowest impact and 5 represents the greatest.

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 the 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.

Impact on Emissions: Education and Engagement strategies and actions will have relatively low direct impact on emissions reductions but are nonetheless critical in supporting and catalyzing more impactful strategies and actions.

Desired Outcome: The primary outcomes for this priority area 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: One-Stop Shop		
Description: Create a One-Stop Shop on the City's website that serves as a climate information center and provides information related to actions, events, metrics, and includes a dashboard to demonstrate progress. This information will be easily accessible and updated regularly by City staff to ensure the most current information is available.		
Recommended Actions		
	General	GHG Impact
EE 1.1	Use the One-Stop Shop to post climate action metrics to demonstrate progress to public *GSC best practice 24*	
EE 1.2	Regularly update and maintain content of the One-Stop Shop; ensure that this responsibility delegated to a specific City staff person *GSC best practice 24*	

EE 1.3	House informational resources to help businesses and residents make informed decisions around reducing GHG emissions *GSC best practice 24* • Ensure material is available in Spanish and/or that translating options are available	CO_2
EE 1.4	Keep residents and businesses updated about workshops and events through various communication channels *GSC best practice 24*	CO_2
EE 1.5	Host workshops and utilize City communication channels to share the climate mitigation benefits of natural resources such as trees, healthy soil, and natural vegetation.	CO_2

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 businesses. This strategy takes advantage of existing innovations, such as the 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

	General	GHG Impact
EE 2.1	Work with the Chamber of Commerce to incorporate local energy initiatives into Northfield's tourism marketing materials *GSC best practice 25*	CO_2
EE 2.2	Create a "sustainability tour" of local energy projects *GSC best practice 25*	CO_2
EE 2.3	Recruit sustainability, waste processing (recycling and composting), and energy-focused businesses to existing Northfield spaces and/or a future green business park or industrial development *GSC best practice 25*	CO_2
EE 2.4	Post highly visible energy information resources throughout the community highlighting clean energy projects and tips to cultivate an energy-aware culture *GSC best practice 25*	CO_2

Photo Credit: Great Plains Institute

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		
	General	GHG Impact
EE 3.1	Implement Xcel Energy Partners in Energy "18-month Energy Action Plan" for residential consumers *GSC best practice 2*	CO_2 CO_2
EE 3.2	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 *GSC best practice 2*	CO_2 CO_2
EE 3.3	Host workshops focused on home energy efficiency and clean energy opportunities that include case studies and success stories, connecting participants with actionable resources *GSC best practice 2*	CO_2 CO_2
EE 3.4	Coordinate with community organizations to provide workshops in Spanish that are in accessible to Latinx residents and address housing concerns	CO_2 CO_2
EE 3.5	Use successes and lessons learned from 18-month Energy Action Plan to continue engagement beyond the PiE time frame	CO_2 CO_2
EE 3.6	Educate residents and small businesses about the benefits of replacing heating equipment with air-source heat-pumps or other efficient electric heating options *GSC best practice 2*	CO_2 CO_2
EE 3.7	Promote opportunities for residents and small businesses to replace natural gas appliances with electric alternatives; partner with Xcel to offer thermal storage opportunities *GSC best practice 2*	CO_2 CO_2
EE 3.8	Engage youth in outreach and engagement efforts	CO_2 CO_2

Photo Credit: Great Plains Institute

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		
	General	GHG Impact
EE 4.1	Implement Xcel Energy Partners in Energy "18-month Energy Action Plan" for large and small commercial consumers *GSC best practice 2*	CO_2 CO_2 CO_2
EE 4.2	Build a stakeholder coalition group among large users to identify shared goals and potential coordinated actions *GSC best practice 2*	CO_2 CO_2 CO_2
EE 4.3	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	CO_2 CO_2
EE 4.4	Partner with the public schools to create energy educational materials tied to real-world, local projects	CO_2 CO_2

EE – 5 Travel Engagement		
Description: There are increasingly more options available for travel within and outside a community. Often, people rely on travel modes that are most convenient and those they find most familiar. Education around travel helps people to see the different choices that are available to them whether it's 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		
	General	GHG Impact
EE 5.1	Host workshops to provide opportunities for interested parties to learn about actions they can take: • Using and improving the Hiawatha Land transit system • Walking, biking, rolling (e.g., scooters), including plans for future trails and street designs • Switching to an electric vehicle through ride and drive events • Emerging technologies or programs, like car-share programs • Time of day pricing and charging options available from Xcel Energy for electric vehicles	CO_2 CO_2
EE 5.2	Host ride and drive events where EV owners lend their vehicles for others to experience, or in cooperation with local dealerships	CO_2 CO_2
EE 5.3	Include information about travel options on the One-Stop-Shop site	CO_2 CO_2
EE 5.4	Provide information about the benefits of electric vehicles at public charging stations	CO_2 CO_2

Photo Credit: Carleton College

EE – 6 Materials and Waste Reduction

Description: While the City does not currently have a policy for zero waste, it is both critical to achieve as part of this plan and it is important to note the impact on upstream emissions. Zero waste requires that consumed materials do not impact land, water, or air that threaten the environment or human health. This means avoiding disposing of materials in landfills or resource recovery facilities. For the purpose of this plan, GHGs result from methane emissions at landfills and emissions from the resource recovery facility (i.e, waste to energy). If all household and business organic material (food, spoiled paper products, etc.) were to be composted rather than landfilled, most future emissions from landfilled waste would be avoided. While it is important to achieve maximum reuse, recycling, and compost rates, there will still be waste materials that will be challenging to eliminate from resource recovery or landfills without major changes in production of consumables. Setting a goal to be zero waste by 2030 helps to accommodate some of the structural challenges. Removing organic material from the waste stream and increasing recycling rates can be accomplished much sooner. This effort will require a massive education campaign that 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

	General	GHG Impact
EE 6.1	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, and recycling best practices *GSC best practice 22*	CO_2 CO_2
EE 6.2	Develop guidelines to reduce the amount of construction and demolition waste that goes to the landfill *GSC best practice 22*	CO_2 CO_2
EE 6.3	Conduct a campaign to reduce contamination of recycling and composting to ensure higher quality end products *GSC best practice 22*	CO_2 CO_2
EE 6.4	Engage businesses in a zero waste certification program; promote efforts and success	CO_2 CO_2
EE 6.5	Require that public events are zero-waste and use events as educational opportunities	CO_2 CO_2

EE – 7 Expanding Local Food Access		
Description: Increasing food access, production, and security in Northfield and surrounding communities to provide all residents — no matter their economic background — and businesses with a wide variety of healthy, affordable, and sustainable food choices will help improve local resilience while supporting local farms, community gardens, grocers, and restaurants.		
Recommended Actions		
	General	GHG Impact
EE 7.1	Utilize the food map created by St. Olaf students to help inform residents about where they can get local food; post on the One-Stop-Shop site	CO_2
EE 7.2	Provide educational materials to residents about growing food in their yards, including food-bearing trees, vegetable gardens, and fruit	CO_2
EE 7.3	Partner with schools to create afterschool programming and curriculum that includes growing your own food	CO_2

Photo Credit: Growing Up Healthy

Policy and Planning

Policy and Planning strategies include actions that are supported by City rules and procedures. Many policies and programs that are already in place can be built upon to implement climate-specific actions insofar as they align with the goals of this plan. Relevant policies and planning functions 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 the 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 polices, 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		
	General	GHG Impact
PP 1.1	For existing buildings, adopt a commercial building benchmarking ordinance for buildings larger than 15,000 square feet. There are 100 buildings at this size threshold, which is 2% of all buildings, but more than half of all building energy consumption *GSC best practice 2* • Encourage ENERGY STAR certification for eligible facilities; require energy audit for low performing buildings	
PP 1.2	Currently, cities are not allowed to require stricter buildings standards than the state building code. However, the goals of this plan cannot be achieved if new buildings are not constructed to be net zero carbon by 2030. There have been efforts to allow cities to adopt a stretch code that would enable them to enforce higher energy standards. • Collaborate with other Minnesota cities to support legislation or state policy that would enable local jurisdictions to enforce stricter energy standards • Evaluate, plan, and prepare to adopt a stretch code if it becomes available *GSC best practice 1,2*	
PP 1.3	Implement a voluntary green building code for new or substantially reconstructed buildings • Consider incentives to encourage local builders and contractors to attend green building workshops available in Minnesota • Require any new building that receives public fuding or incentives to be constructed to green building standards *GSC best practice 3*	

PP 1.4	Ensure all new public buildings are designed, constructed, and operated to the highest available green building standards *GSC best practice 3*	CO_2 CO_2 CO_2 CO_2 CO_2
PP 1.5	Consider purchasing policies for the City that incorporate best practices in waste reduction, lower product consumption, lower energy use, and considers the origin and energy demand to get product from origin to the City	CO_2 CO_2 CO_2 CO_2 CO_2

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

	General	GHG Impact
PP 2.1	Research truth in housing and rental policy as a tool to allow for energy consumption disclosure at the time of sale or rental, in consideration with on-going staff efforts	CO_2 CO_2
PP 2.2	Provide energy efficiency, renewable energy, and water conservation best practice resources on the City website and at promotional events	CO_2 CO_2
PP 2.3	Through the PiE Energy Action Plan, increase annual participation in deep energy conservation programs for residences and small businesses *GSC best practice 2*	CO_2 CO_2 CO_2
PP 2.4	Collaborate with other cities to support state level legislation to enable green residential development standards *GSC best practice 3*	CO_2 CO_2 CO_2
PP 2.5	Enable residential Property Assessed Clean Energy (PACE) financing when it becomes available; promote commercial PACE to small businesses	CO_2 CO_2 CO_2

PP – 3 Renewable Energy

Description: The City has abundant renewable resources available 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

	General	GHG Impact
PP 3.1	Explore a policy options to incentivize solar-ready and EV-ready homes by 2020 *GSC best practice 2*	CO_2 CO_2
PP 3.2	Establish an in-boundary goal to generate the equivalent of 10% of the City's electricity from rooftop and ground-mount solar installations by 2030 *GSC best practice 26*	CO_2 CO_2 CO_2 CO_2 CO_2
PP 3.3	Identify opportunities to expand renewable energy in or near Northfield; coordinate with Carleton, St. Olaf, Post Consumer Brands (formerly Malt-O-Meal), and Xcel Energy *GSC best practice 26*	CO_2 CO_2 CO_2 CO_2 CO_2

PP 3.4	Encourage rooftop solar on commercial buildings where there is an economically viable solar resource (i.e. available space with adequate sunlight, and a structurally sound roof) *GSC best practice 26*	CO_2 CO_2 CO_2 CO_2 CO_2
PP 3.5	Promote Renewable*Connect or other green power purchase programs for businesses and residences	CO_2 CO_2 CO_2
PP 3.6	Promote community solar garden subscriptions; identify opportunities for low-income access to subscriptions	CO_2 CO_2 CO_2 CO_2

PP – 4 Transportation and Land Use Policy		
Description: The built environment, development patterns, and transportation systems influence energy consumption and emissions.		
Recommended Actions		
	General	GHG Impact
PP 4.1	Adopt a policy for market-based pricing for parking in commercial areas and dedicate funds to go toward transportation for biking, walking, and public transit *GSC best practice 12*	CO_2 CO_2 CO_2
PP 4.2	Work with Hiawathaland transit and other partners to explore a subsidized bus pass program and/or simplify the payment method to increase ridership on the existing transit system *GSC best practice 12*	CO_2 CO_2
PP 4.3	Work with Hiawatha Land Transit and other partners to move toward a fully electric local and regional transit system *GSC best practice 12*	CO_2 CO_2
PP 4.4	Collaborate with community partners, particularly St. Olaf and Carleton, to explore bike, scooter, car-sharing or other mobility options; ensure motorized options are electric and accessible to all residents	CO_2 CO_2 CO_2
PP 4.5	Continue to implement the current bike/ped plan to improve access and safety of bike and pedestrian infrastructure *GSC best practice 12*	CO_2 CO_2 CO_2
PP 4.6	Provide adequate public charging spaces that can accommodate multiple charging ports for additional mobility options; connect to solar energy systems when possible	CO_2 CO_2 CO_2
PP 4.7	Partner with local businesses to catalyze EV charging infrastructure	CO_2 CO_2 CO_2
PP 4.8	Engage landowners and surrounding communities to implement the Greater Northfield Area Greenway System (2007) *GSC best practice 12*	CO_2 CO_2 CO_2

PP – 5 Sustainable Products and Waste		
Description: Implement policies and actions to support substantial waste reduction.		
Recommended Actions		
	General	GHG Impact
PP 5.1	Develop a green purchasing policy for City operations and public events *GSC best practice 15*	CO_2 CO_2

PP 5.2	Establish a zero-waste policy to be achieved by 2030 and eliminate 100% of organic materials from the waste stream by 2025 through a robust composting program *GSC best practice 22*	CO_2 CO_2
PP 5.3	Develop a zero-waste packaging ordinance and support local businesses to transition *GSC best practice 22*	CO_2 CO_2 CO_2
PP 5.4	Coordinate with local waste and recycling haulers to offer curbside compost pick-up for residents and businesses that will be delivered to a local waste processing facility (EE 2.3 and IN 3.11)	CO_2 CO_2 CO_2
PP 5.5	Make composting and recycling available in public spaces with appropriate signage *GSC best practice 22*	CO_2 CO_2 CO_2
PP 5.6	Encourage businesses to collaborate on sustainable and resilient products, e.g., facilitate a bulk buy of compostable products (cups, straws) and ensure proper recovery is available *GSC best practice 22*	CO_2 CO_2 CO_2

PP – 6 Increasing local food production		
Description: Expand opportunities for more local food production in and around the community. This can be led by a volunteer entity in partnership with City staff.		
Recommended Actions		
	General	GHG Impact
PP 6.1	Create an urban forage program that encourages people to share excess food grown in their yards with people willing to collect that food	CO_2
PP 6.2	Partner with local schools and farmers to create a farm-to-school program where students can learn more about where food comes from	CO_2

PP – 7 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		
	General	GHG Impact
PP 7.1	Integrate the Climate Action Plan into policy and plan updates including, but not limited to, the comprehensive plan, Land Development Code, complete streets policies, and others	CO_2 CO_2
PP 7.2	Integrate the Climate Action Plan into budgetary decisions including, but not limited to, the City operating budget, capital improvement plan, and the purchasing policy	CO_2 CO_2
PP 7.3	Update the Urban Forestry Asset Management Plan to include climate mitigation best practices for carbon sequestration in vegetation and soil. Include incentives for tree planting and soil enhancements throughout the community	CO_2 CO_2
PP 7.4	Engage decision-makers, including local members of boards and commissions, county officials, as well as state and national representatives, around elements of the climate action plan.	CO_2 CO_2

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		
	General	GHG Impact
IN 1.1	Seek opportunities to partner in our encourage development projects that can demonstrate a net zero energy building design *GSC best practice 2*	CO_2 CO_2 CO_2
IN 1.2	Explore opportunities to be a test/demonstration community for alternative building design, materials, and land management with promise to reduce energy use, incorporate recycled materials, enhance natural assets, or educate others on innovative solutions not presently permitted by codes/policies	CO_2 CO_2 CO_2
IN 1.3	Work with the Minnesota Department of Commerce to map heat waste with heat loads to see if there are opportunities for combined heat and power and district heating technologies to be utilized *GSC best practice 2*	CO_2 CO_2 CO_2 CO_2
IN 1.4	Partner with local businesses, institutions, and Xcel Energy to explore pilot micro-grid with renewable power and batter storage project *GSC best practice 26*	CO_2 CO_2 CO_2 CO_2
IN 1.5	Partner with Dakota and Rice Counties and surrounding communities to understand opportunities and barriers for an anaerobic digester for food and agricultural waste *GSC best practice 22*	CO_2 CO_2 CO_2 CO_2

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		
	General	GHG Impact
IN 2.1	Partner with businesses to catalyze public EV charging	CO_2 CO_2 CO_2

IN 2.2	Update and strengthen the comprehensive plan and Land Development Code to increase residential density within City limits through infill best practices, such as the elimination of minimum parking requirements *GSC best practice 6*	
IN 2.3	Research and promote land management practices to encourage carbon sequestration through trees and soil *GSC best practice 16*	

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, as well as forestry and land managment.		
Recommended Actions		
	General	GHG Impact
IN 3.1	Set annual targets to reduce energy use and emissions among City operations, including facilities, buildings, and fleet *GSC best practice 24*	
IN 3.2	Utilize an asset management software tool to track and monitor the operations of City buildings and help plan for maintenance *GSC best practice 1*	
IN 3.3	When making large capital improvement decisions, utilize a life-cycle cost assessment rather than simple payback	
IN 3.4	Adopt zero waste goals and procedures for all City led events, provide training and technical assistance *GSC best practice 22*	
IN 3.5	Explore options to host a community a solar garden with subscriptions reserved for low to moderate income residents *GSC best practice 26*	
IN 3.6	Evaluate the feasibility of developing and utilizing green bulk purchases for recyclable or compostable products with all City contracts *GSC best practice 26*	
IN 3.7	Complete a fleet study to identify opportunities to reduce GHGs from the City fleet, including the potential to replace vehicles with electric models and/or right-sized vehicles *GSC best practice 13*	
IN 3.8	Identify opportunities for on-site renewable installations, particularly paired with storage for back-up power at critical facilities *GSC best practice 26*	
IN 3.9	Increase carbon sequestration through reforestation and enhancement of soil health on public lands through conversion of turf to native plantings and plant species that can tolerate a changing climate	
IN 3.10	Accelerate replacement of City-owned outdoor lights with efficient prodcuts	
IN 3.11	Encourage and facilitate the creation of businesses to support a zero-waste community such as those that could manage the processing of waste products into usable materials and increase the tax base	

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		
	General	GHG Impact
SP 1.1	Hire a full-time City staff position to focus on coordination and implementation of the plan	CO_2
SP 1.2	Ensure public engagement and implementation initiatives to promote diversity, inclusion and equity	CO_2
SP 1.3	Ensure youth representation and involvement is a part of the coordinated effort - *GSC best practice 24*	CO_2
SP 1.4	Engage the Latinx community and supporting organizations throughout implementation	CO_2
SP 1.5	Engage the aging community throughout implementation	CO_2
SP 1.6	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	CO_2
SP 1.7	Provide an annual report to the EQC, Council, and public; make it available on the One-Stop-Shop	CO_2

SP – 2 Resources and Funding		
Description: Develop a plan to establish funding for CAP implementation.		
Recommended Actions		
	General	GHG Impact
SP 2.1	Explore multiple means of securing funds for CAP implementation, including establishing a non-profit fund, grant programs, foundation funding, investment, financing, and fundraising events	CO_2 CO_2
SP 2.2	Enter into a franchise agreement with Xcel Energy that includes volumetric fee and utilize funds	CO_2 CO_2
SP 2.3	Use savings from City solar garden subscriptions to leverage City operations energy initiatives and/or other CAP activities	CO_2 CO_2
SP 2.4	Consider using a portion of cost savings from energy improvements in public buildings to support a CAP position and/or implementation strategies	CO_2 CO_2

Climate Adaptation and Resilience

The previous section addressed the causes of climate change and Northfield's role in reducing its impact through GHG emissions mitigation. But climate change is already having demonstrable impact on the Earth's natural systems and Northfield must prepare for and adjust to these changes. 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 precipitation level averages and the occurrence of mega-rain events on the rise — 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 the City's built and natural infrastructure.

Resilience describes the ability of an individual or community to respond, adapt, and be minimally impacted by a changing climate. To address climate resilience, a vulnerability analysis has been completed. The complete analysis can be found in Appendix B. This section includes a summary of the assessment and recommended actions to improve community resilience. The summary contains an overview of anticipated climate hazards in Northfield, and the community's capacity to adapt, react, and be resilient to these climate hazards.

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 to climate hazards are will allow for proactive decision-making and intervention to enhance the safety and resilience of all Northfield residents.

Photo Credit: Carleton College

Local Climate Hazards

As greenhouse gas levels in the atmosphere continue to rise, temperatures will increase, ecological functions will be altered, and precipitation and weather patterns will 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. The study found two major climate trends happening now and expected to continue in Southeast Minnesota: an increase in winter and summer temperatures, and an increase in heavy precipitation events, with longer periods of dry spells between.[14]

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°F (4.2°C) through 2075 compared to 1981 under a business-as-usual scenario. The same projection forecasts a 9.1°F (5° C) increase in average winter minimum temperatures through 2075. Warmer temperatures have direct and indirect effects on climate, ecology, and people, further outlined below.

Warming temperatures also cause more extreme and variable precipitation patterns through an increase in evaporation and the increased capacity for warmer air to hold 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. This graphic does not represent all impacts associated with climate change, but rather a summary of major impacts associated with climate change.

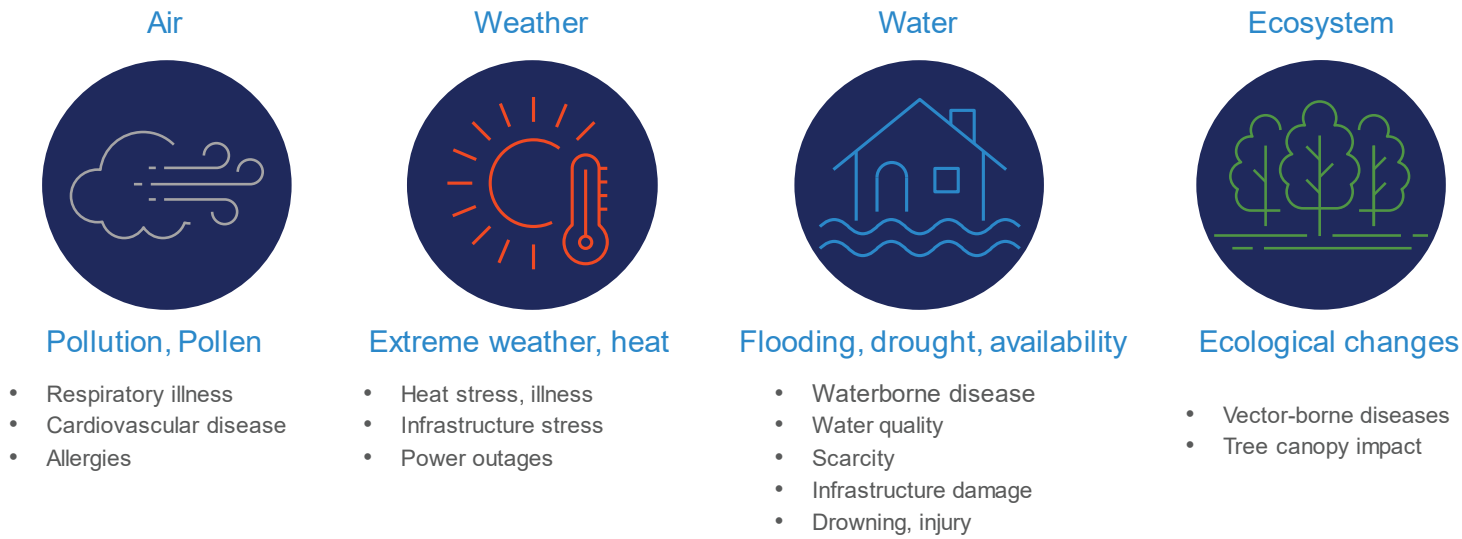


Figure 10. Climate impacts on health and well-being. Adapted from Minnesota Department of Health, "Minnesota Climate and Health Profile Report Summary," 2016.

14 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).

Resilience Assessment

Resilience is measured by the strengths and vulnerabilities of a community, including population, built infrastructure, and natural infrastructure. Understanding a community's resilience to climate change requires an analysis of existing community strengths: aspects of infrastructure and community character that make a City more able to swiftly and safely adapt to a changing climate. At the same time, to improve its resilience, a community must know what its vulnerabilities are.

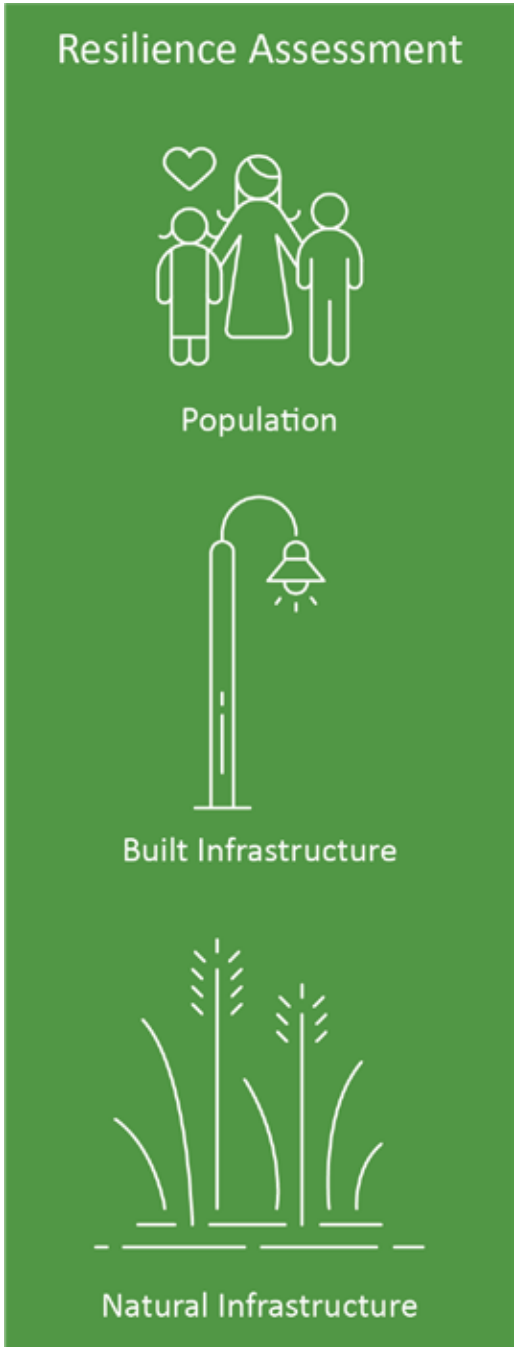
Vulnerabilities to climate hazards are a result of a confluence of factors including geographic location, pre-existing characteristics, and situational context. The full assessment in Appendix B analyzes the strengths, vulnerabilities, and opportunities of natural infrastructure, built infrastructure, and community population.

People are impacted differently by climate hazards. The ability to recover from a climate event like a major flood may depend on a variety factors. Vulnerability in populations can be assessed through inherent and situational factors. Situational factors mean that an individual may only be vulnerable at the moment of a climate hazard, rather than inherently more vulnerable to impacts from climate events. For example, preexisting health conditions are likely to make an individual more inherently vulnerable to certain climate hazards, whereas vulnerability can also be temporary and dynamic, as is the case with certain health conditions, pregnancy, and homelessness. Some opportunities for increased population resilience focus on individual action, while others focus on community-wide strategies to increase resilience.

Built infrastructure can also be vulnerable to climate hazards. Its vulnerability may damage the built environment like City assets, private buildings, and the well-being of the community. Built infrastructure includes buildings, 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 are simultaneously susceptible to climate hazards and crucial to help improve the resiliency of the City. For example, saplings in a flood zone may be vulnerable to damage from flooding, but increased tree cover community wide will 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 in Northfield.

The resilience assessment in Appendix B examines vulnerabilities, strengths, and opportunities for increased resilience in the face of the six climate hazards identified previously. The following section includes a summary of the assessment and recommended actions to improve community resilience.



Population

Population vulnerability to climate hazards is impacted by where people live, the buildings in which they live and work, and demographic factors. 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. Understanding residents' needs can help the City to better direct its resources to both help prepare vulnerable residents for climate hazards and to provide support in the aftermath of a major event.

This analysis is based on a vulnerability assessment completed at the county-level by the Minnesota Department of Health, the corresponding demographic data provided by the U.S. Census American Community Survey, and county-level data regarding individual health related to disabilities and hospital visits for asthma. Further information was provided through focus group discussions with community organizations working with the Latinx residents of Northfield. Priority areas identified through those focus group discussions 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 section describes existing demographic data. An analysis of strengths, vulnerabilities, and opportunities is further analyzed in Appendix B.

Age

The age of resident is an indicator of potential vulnerability to climate hazards. Those under the age of 5 (4.6% of population) and over the age of 65 (14.2% of population) are more likely to be vulnerable to various climate hazards largely due to physiological differences and potential reliance on others for safety and care. These age cohorts may also be more susceptible to extreme weather impacts due to reliance on others for evacuation or mobility needs.

Young children, under the age of 5, are particularly vulnerable to heat-related illnesses and deaths, as well as more susceptible to air pollution related health impacts and vector-borne illnesses. Young children tend to spend more time outdoors engaging in activities that increase their breathing rate.

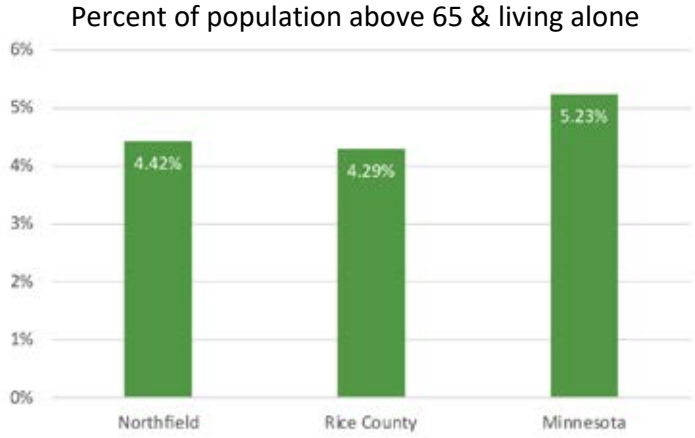


Figure 11. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates.

Income & Housing

Low-income residents may be more susceptible to climate hazards as they may lack the resources needed to afford adequate housing and may have limited or no access to a vehicle. In Northfield, the median household income is $62,032, with 11.7% of residents living below the poverty line and 31.3% qualifying for heating assistance. In addition, 5.4% of residents do not have access to a vehicle.

Poor housing quality can impact resident health 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; poor ventilation or water infiltration can cause mold spores to form, leading to respiratory illness. Often, homes in poor condition will cost more to heat and cool, increasing the energy burden of residents. A more energy efficient home protects inhabitants from extreme weather such as extreme heat, and helps to lower energy use, increasing grid resilience as electricity demand decreases.

Access to health or home insurance is an indicator for how well people can respond to damage from climate hazards. 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 poorly built. Community members experiencing homelessness or transitional housing are particularly susceptible to damage and health effects from these climate hazards as they may lack resources to protect themselves and their property from damage.

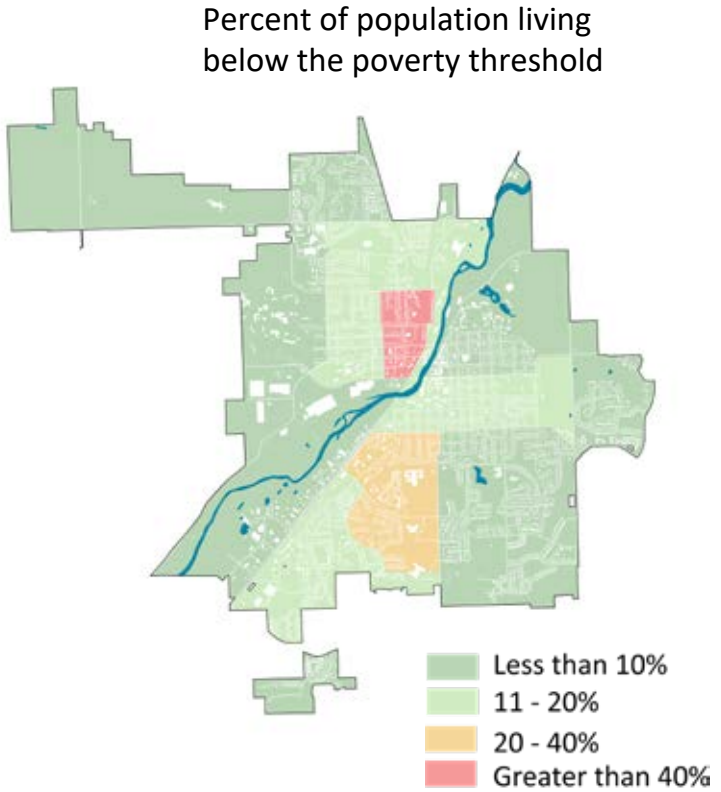


Figure 12. Vulnerable populations by income. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates; all estimates are normalized by census block population. Map generated by Jessi Wyatt.

Through focus group discussions, it was revealed that some Northfield community members are forced to run water continuously during the coldest days of winter to avoid freezing pipes — a weatherization and efficiency issue that has a noticeable impact community-wide water consumption, as well as an added cost burden to those residents, demonstrated in the Local Water Supply Plan.

Housing location can also increase or decrease vulnerability. There are 29 homes in Northfield that have flood insurance through the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP). Between 1998 and 2016, $2.32 million have been paid out in claims for damage to structures and belongings from flooding in Northfield.

Language & Race

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. 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.

Race can be an indicator of vulnerability to climate hazards. In Minnesota, not all residents have benefitted equally from environmental improvements. The routing of roadways, siting polluting industries near communities of color, and limiting access to resources have created inequities that impact health and economic mobility. The Minnesota Pollution Control Agency found that people of color are more likely to be exposed to more pollution than middle and upper income white residents; are more vulnerable to health impacts from pollution and experience greater incidences of disease and death, often due to underlying health disparities; and that climate change disproportionately threatens vulnerable groups, amplifying existing economic and health challenges.

According to the U.S. Census, 88.5% of Northfield residents identify as white, with Latinx-identified population as the next largest at 8.7%. Figure 13 at right shows Northfield's population by race. The areas of the community where 30% or more of the population is non-white overlaps with the map in Figure 12 (previous page) that shows that the highest concentration of poverty in the same area, indicating that residents in those neighborhoods may be more vulnerable to climate hazards as compared to other areas of the community.

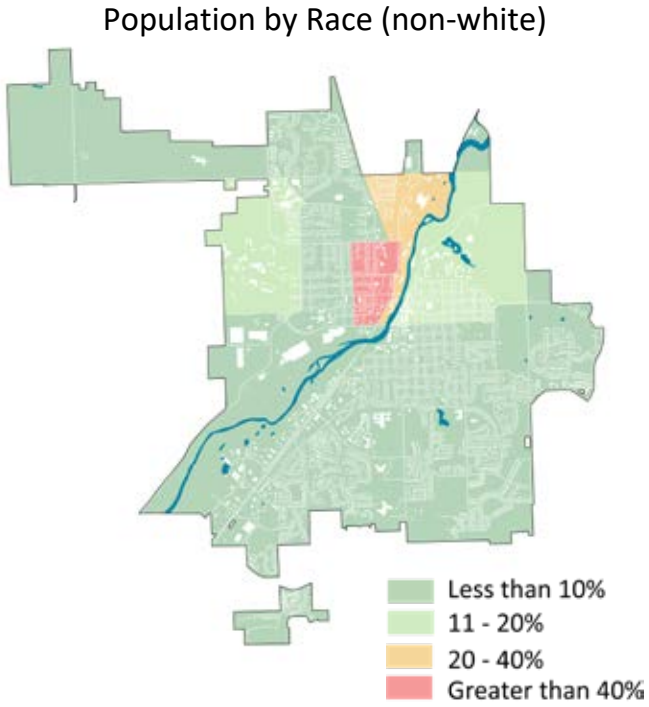


Figure 13. Vulnerable populations by race. Source: U.S. Census Bureau; American Community Survey, 2013 - 2017 5-Year Estimates; all estimates are normalized by census block population. Map generated by Jessi Wyatt.

Food Security

Access to healthy and affordable food is a critical issue for low- and moderate-income families. Food security measures the availability and ability to access food. Food secure households have both the ability to afford healthy food and live in close proximity, or can travel further, to buy local food. Food insecure homes may not have access to healthy food due to an inability to afford it or complicated by how far they may need to travel to access it. In Rice County, 9% of the population are considered food insecure. While there are more healthy food options available within Northfield compared to surrounding communities, those options are not always affordable to all residents.

Ability Level & 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.

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 2013-2015. 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 pulmonary disease (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%.

Photo Credit: Carleton College

Built Infrastructure

The built infrastructure of a City includes facilities constructed for water distribution and treatment, transportation and mobility, buildings, and critical infrastructure such as the 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 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. This section provides a snapshot of climate hazards of greatest concern for built infrastructure in Northfield. Information for this section was gathered from City staff, existing reports, plans available on the City website, and data from State agencies.

Water Infrastructure

Water infrastructure includes drinking water, stormwater infrastructure, 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 functioning 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 contamination, reducing water quality. Power outages caused by extreme weather can impact the functionality of wastewater and drinking water infrastructure.

Stormwater Infrastructure

Stormwater infrastructure supports community resiliency during periods of heavy rainfall. Conveyance systems help to move water quickly to rivers, streams, and lakes - 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, as well as other infrastructure changes like permeable paving surfaces, can help slow the flow of stormwater and filter contaminants. According to 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.

Photo Credit: Great Plains Institute

Conveyance Systems: In Northfield, there are about 40 miles of stormwater pipes, including gravity mains and drain tiles. Stormwater pipes primarily 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 assessment was completed for the City of Northfield.[15] The assessment examines 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 at mitigating flooding and improving water quality because the ponds can no longer hold water at their designed capacity. When ponds reach or exceed their design capacity, more polluted water enters the river. 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.

Drinking Water

Water demand is forecasted to increase as summer days become warmer: community members will drink more water to cool themselves down and use more water for distressed trees and other vegetation. Potable water in Northfield comes from five ground-water wells originating from the Jordan-St. Lawrence, Jordan and Jordan-Prairie-du-Chien aquifers.[16] 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 plan, which identified the water distribution system as effective and serving its purpose well.[17] 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. 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 1900s.[18] 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, potentially causing 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.

15 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).
16 https://ci.northfield.mn.us/DocumentCenter/View/7825/2018-Northfield-CCR
17 City of Northfield, Comprehensive Water Plan, https://www.ci.northfield.mn.us/DocumentCenter/View/608/ComprehensiveWaterPlan?bidId= , (accessed June 2019).
18 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).

The City of Northfield operates a wastewater treatment facility that discharges into the Cannon River. In 2016, the City completed a plan for Northfield's Wastewater Treatment Facility that included recommendations for improvements, repairs, and replacements.[19] 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. This City is currently updating the facility; upgrades are projected to be complete in February 2020.

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, put stress on built infrastructure systems. Roads, bridges, and routes that are older and maintained less frequently are particularly vulnerable to hazards and potentially increasing overall maintenance costs and inhibit travel. Resilient transportation systems can facilitate active mobility choices, improving public health and enhancing 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, vulnerabilities, 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 under normal conditions and will be especially important as residents move away from potential climate hazards.

Photo Credit: Great Plains Institute

Public Transportation

Public transportation options not only help to mitigate emissions, but also provide an opportunity for increased community resilience. 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 according to the 2017 American Community Survey estimates.

19 City 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).

In focus group discussions with both the Latinx community and college students, many community members noted the frustration with the limited options for transit in the community. In these conversations, it was expressed that the existing services are difficult to navigate, have limited frequency, and are the slowest transportation option for movement throughout the community.

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 mobility, and reduced emissions. A cohesive, safe, well-maintained network of trails can enhance 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.

About 8% of Northfield residents walk or bike to work. Northfield has approximately 26.23 miles of trail – a combination of biking, walking, or combined trails. Many trails, mapped in Figure 14, are fragmented – a notable exception is 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 and along the Cannon going south from downtown.

In April 2019, Toole Engineering conducted an analysis of different plans and policies in Northfield that impact transportation, with the intention of improving pedestrian, bicycle, and trail networks.[20] As a part of this study, Toole Design facilitated an online gap analysis performed by Northfield residents. The analysis identified 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 arounds 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.

Figure 14. Pedestrian and bicycle trails in Northfield, MN. Source: City of Northfield Public Works Department, 2019; generated by Jessi Wyatt.

20 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).

Buildings and Critical Infrastructure

Protecting buildings and critical infrastructure from extreme weather and heavy precipitation events can help minimize damage, sustain function, reduce costs, and keep people safe. Buildings most vulnerable are those with deferred maintenance, structures in flood plains or in areas prone to flash flooding, or those with poor construction material. Both public and private buildings should be considered. The City owns seven buildings and 25 park facilities, there are 130 industrial buildings, 546 commercial buildings, and more than 5,000 residential buildings in Northfield.

Critical infrastructure can include hospitals, schools, emergency services, and community centers. It also includes telecommunication and energy services, and modes of travel. Such entities and systems are vulnerable to electric power outages, which can increase in frequency with extreme weather and prolonged heatwaves. Damage to critical infrastructure can disrupt emergency response, reduce access to necessary power or communication, and impact the health of those in need of emergency and other health services. Protecting and reinforcing these assets to withstand extreme weather will help the City better prepare for extreme events.

Xcel Energy provides electricity and natural gas to Northfield. Reliability and safety are among the company's top priorities. Any event impacting the distribution system that leads to power failure must be addressed as quickly as possible. Xcel Energy owns the distribution system and is responsible for ensuring it delivers power. Extreme weather events and ice storms pose threats to distribution infrastructure that could lead to power outages. This is especially critical in times of extreme temperatures when people have heating and cooling needs; it also impacts those who depend on medical devices and businesses that rely on electricity. Building a resilient grid — burying power lines where feasible, incorporating micro-grids, and having back-up power — can help minimize risk.

Photo Credit: Great Plains Institute

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, carbon sequestration, and quality of life enhancement. Natural infrastructure includes trees, rain gardens, native landscaping, as well as wetlands and water bodies. These features can be both vulnerable to climate hazards and help mitigate impacts of climate hazards. For example, a healthy and extensive tree canopy sequesters carbon, provides shade on the increased extreme heat days, and filters stormwater. This section provides a snapshot of climate hazards that threaten natural infrastructure, describing existing conditions, strengths, vulnerabilities, and opportunities.

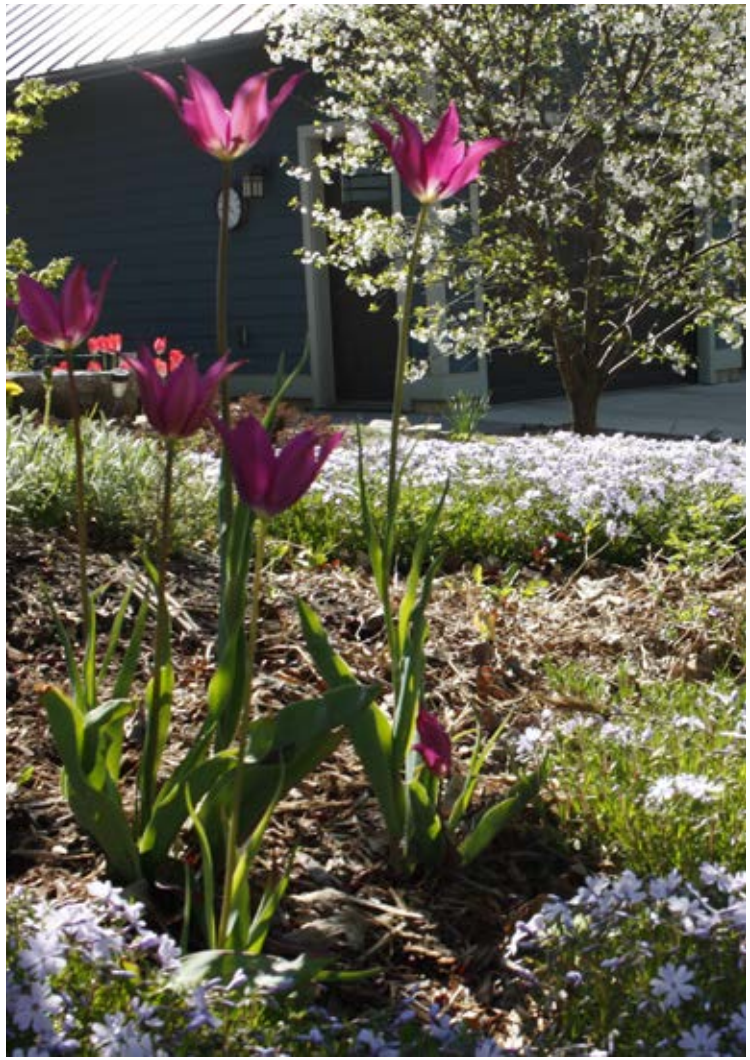


Photo Credit: Great Plains Institute

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 enhance aesthetics. During times of extreme heat events, shading from trees becomes particularly important. Likewise, improved infiltration of stormwater runoff provided by tree and plant 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 and mitigation. 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 genus. 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.

Soil health is also critical for a healthy urban forest. The establishment of a local waste processing facility could provide compost material that can be used for soil restoration and enhancement.

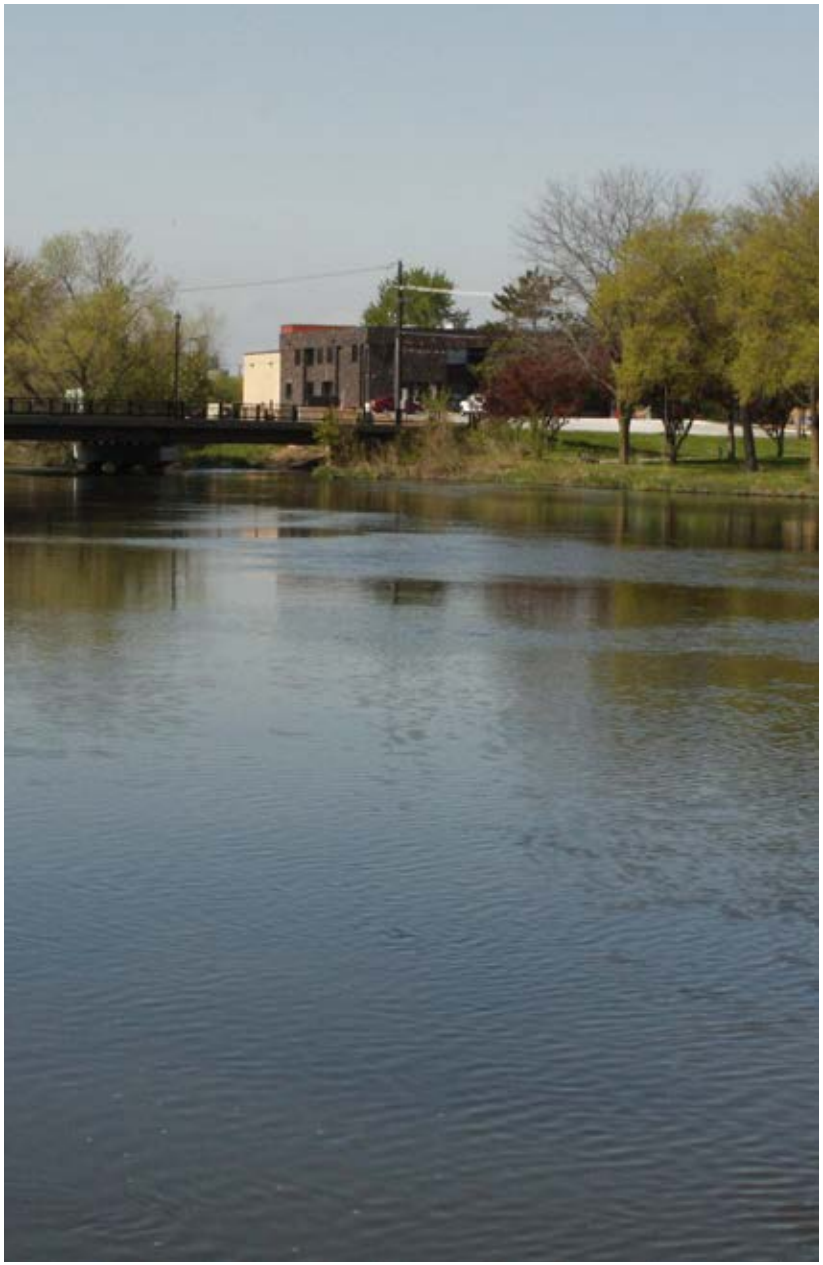


Photo Credit: Great Plains Institute

Water Supply and Quality

Stable water supply and good water quality are high priorities for communities. 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.

Groundwater

Potable water in Northfield is drawn from a series of wells throughout the City. According to the City's website, all municipal wells draw from the Jordan bedrock aquifers. The geology of the aquifer is primarily composed of 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 to nitrates. Well surveys have already identified elevated nitrate levels in some of the supply wells. Risk of contamination is further exacerbated during heavy rain events.[21] Many Northfield residents also have private wells.

Surface Water

There are five major water bodies that convey and store water through Northfield: The Cannon River, Heath Creek, Spring Creek, Rice Creek (also called Spring Brook), and Lyman Lakes (wide spots of Spring Creek located at Carleton College). The Cannon River, Heath Creek, and Rice Creek/Spring Brook are listed as impaired by the Minnesota Pollution Control Agency.[22] The Cannon River is designated as impaired for aquatic life, aquatic consumption, and aquatic recreation due to Escherichia coli (E. coli). Heath Creek is designated as impaired for aquatic life and aquatic recreation due to the presence of E. coli. Rice Creek/Spring Brook is designated as impaired for aquatic life, aquatic recreation also due to E. coli, and drinking water due to nitrate contamination.

21 Metropolitan Council, Groundwater Digest, https://metrocouncil.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Groundwater-Digest,-Twin-Cities-Metropolitan-Area,.aspx. (Accessed June 2019).

22 Inventory of All Impaired Waters, Minnesota Pollution Control Agency (2018). https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list. (Accessed June 2019).

Wetlands

Wetlands encourage water infiltration, filtering out toxins and pollutants from runoff or fertilizers, and providing habitat and carbon sequestration. Wetlands also provide erosion and flood control and habitat for plants and vegetation, as well as facilitating groundwater recharge and discharge and creating recreation opportunities and economic value for communities

According to the National Wetland Inventory in collaboration with the Minnesota Department of Natural Resources, there are an estimated 1,695.8 acres of wetlands in Northfield, inclusive of the Riverine designations (e.g. the Cannon River). The most prominent wetland type by area after Riverine is Freshwater Emergent Wetland. This wetland type is characterized by its temporal nature, which may make it seem like there is not wetland during parts of the dry season.

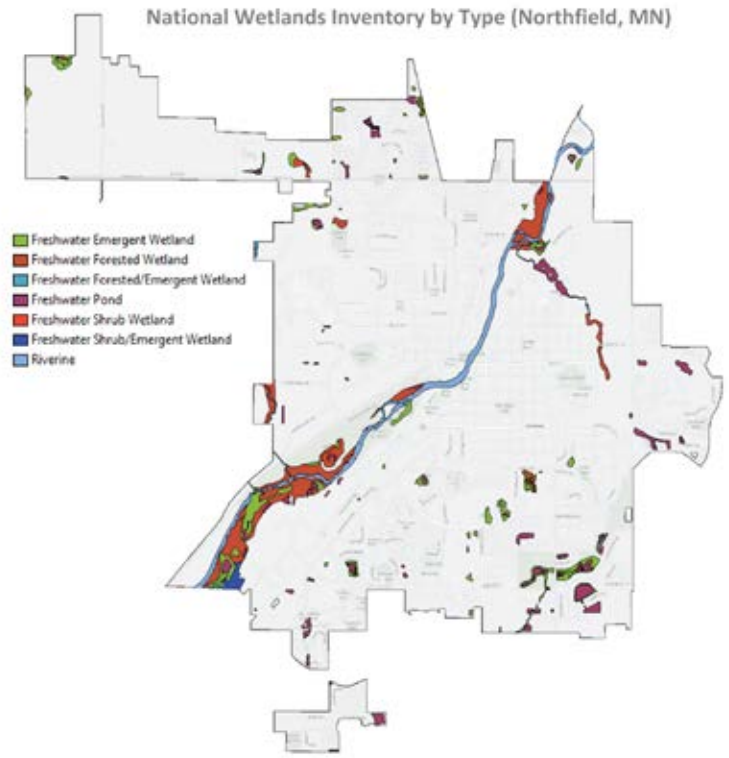


Figure 15. Inventory of all wetlands in Northfield. Source: Statewide Wetland Inventory (Minnesota DNR, 2018); map generated by Jessi Wyatt.

Land Use and Agriculture

Northfield is a thriving, rural community with agricultural characteristics located about an hour south of the Twin Cities metro. It was mentioned previously that there are numerous land uses and practices that contribute to climate change, but there are also many climate and resilience benefits that can be realized through sustainable land use and agricultural practices. Specifically, land use decisions can help mitigate effects of rainfall, reduce urban heat island effect, store carbon, and support local food production.

In consideration of the increasing likelihood of heavy precipitation events, land cover practices that incorporate stormwater management best practices will help improve the City's ability to withstand such events. 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 cover can exacerbate and contribute to climate hazards like heavy precipitation events and urban heat island effect. Increasing vegetative cover and pervious surface, on the other hand, helps to minimize the impact of those hazards in addition to other benefits like storing carbon.

The agricultural nature of the community presents an opportunity to expand local food options. The Inter-Governmental Panel on Climate Change (IPCC) recently released a report highlighting sustainable land management and food security. The report points to declines in crop yields and global instability around food access, suggesting major shifts to the food system. Northfield has opportunity to leverage its local agricultural resources to expand food production and increase access to healthy food. Rice County conducted a survey in 2016 as part of its comprehensive plan update. One question asked about the importance of local food production in the county — 55.8% of respondents strongly agreed and 36.8% agreed, underscoring its importance to community members. Encouraging edible urban tree canopies, community gardens, and partnerships with local farms and community-supported agriculture can help minimize large climate hazards that risk interruption of traditional food supply chains to Northfield residents.

Climate 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: *GSC best practice 29*
  - Aid in response to food scarcities due to extreme weather
  - Support a local, healthy food shelf *GSC best practice 27*
  - 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 can be received through a variety of channels
  - Provide education materials on the health impacts of air pollutions and extreme heat *GSC best practice 24*
  - Partner with community organizations to reach vulnerable populations
- Support active living through mobility options that are equitably available and accessible throughout the community, especially in underserved communities *GSC best practice 12*
- Establish a food coordinator position to lead local food programming to support locally produced foods and businesses *GSC best practice 27*

Education and Resources

- Develop educational materials about warming temperatures, increased precipitation events, and potential health impacts to help residents become more resilient to climate impacts

Equity

- Incorporate climate considerations and resilience strategies into Racial Equity Action Plan; ensure climate and equity are integrated into the comprehensive plan update *GSC best practice 6*
- Increase affordable housing, emergency and transitional housing in Northfield, and ensure safety of these homes *GSC best practice 7*
- Strengthen community connectedness across cultural groups through more inclusive community events and more intentional engagement with underrepresented groups *GSC best practice 29*
- Consider climate migrants (unexpected growth in population) in City planning efforts *GSC best practice 29*
- Ensure access to local, healthy food to all residents through partnerships to improve food security
- Ensure sidewalks are well-maintained and accessible for those who have difficulty walking or use wheelchairs

Housing

- Explore opportunities to require energy improvements for quality affordable housing that is safe and energy efficient

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 *GSC best practice 17*
  - o Conduct an asset management assessment in consideration of life cycle costs and climate risks
  - o 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 *GSC best practice 20*
- Evaluate upstream and downstream impact on the Cannon River of the Ames Mill Dam removal *GSC best practice 17*
- 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 *GSC best practice 17*
- Incorporate smart sewer systems to monitor flows, overflow potential, and backup issues through sensors *GSC best practice 20*
- Increase the utilization of green infrastructure to supplement existing and future stormwater management systems, such as stormwater ponds and infiltration basins *GSC best practice 29*
- Work with upstream jurisdictions to mitigate flooding

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 *GSC best practice 20*
- Ensure the drinking water availability is adequate and balanced to meet future demand without risking the supply *GSC best practice 20*
- Continue to ensure the wastewater system has capacity to support increase demand *GSC best practice 20*

Emergency Response

- Coordinate with Dakota and Rice counties to plan for the management and recovery of waste after extreme weather events *GSC best practice 22*
- Ensure the incorporation of resilient elements such as microgrids, solar plus storage, and backup energy infrastructure *GSC best practice 2*

Land Use

- Incorporate additional transportation modes (such as bike infrastructure, wide sidewalks) and green stormwater infrastructure systems (such as rain gardens) into street maintenance and reconstruction projects *GSC best practice 12*
- Prioritize community multi-modal connectivity in long-term planning *GSC best practice 12*
- Increase bicycle and pedestrian network connectivity through the Complete Streets Policy implementation and implementation of the “Pedestrian, Bike and Trail System Final Report" (April 2019), with an emphasis on connecting low-income neighborhoods with downtown Northfield *GSC best practice 12*
- Continue to include Accessory Dwelling Units as a permitted use in Northfield’s Land Development Code to enable more efficient use of land *GSC best practice 14*

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: *GSC best practice 24*
  - 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 into Northfield school districts *GSC best practice 27*

Urban Forest and Vegetation

- Update and adopt the Urban Forestry Asset Management Plan *GSC best practice 16*
- Incentivize expansion of boulevard gardens on private property; expand boulevard gardens and rain gardens on City-owned lands, and incorporate pollinator gardens in all parks and encourage / incentivize them on private property *GSC best practice 11*
  - Increase tree canopy through City-sponsored program to plant trees *GSC best practice 16*
  - 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
  - Encourage the planting of fruit-bearing trees; support programs that harvest fruit
- 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, Agriculture, and Food

- 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 *GSC best practice 16*
- Enable and encourage more community gardens throughout the City *GSC best practice 16*
- Incentivize and reward soil best management practice for urban lawns, gardens, landscaping, parks, open spaces, prairies, environmentally sensitive areas, and agricultural land uses *GSC best practice 16*
- Support creation of local compost process facilities and system to deliver organic material *GSC best practice 22*
- 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 *GSC best practice 27*

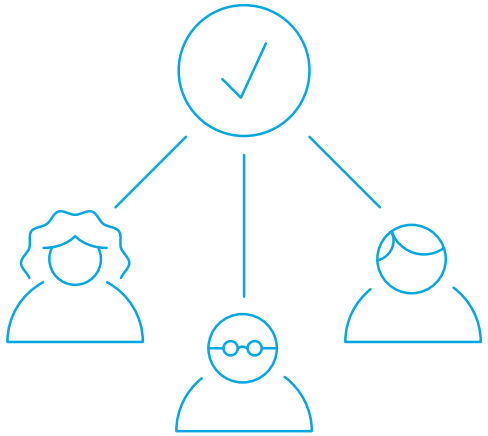
Plan Implementation

The first few years after plan adoption is critical to its success. Establishing roles, both internal and external, identifying funding, and determining priorities will help launch the plan and ensure it is on track. This plan includes aggressive goals to have carbon free electricity by 2030 and be zero carbon by 2040. This will require integration of the CAP into City operations, functions, and services; commitment and actions on behalf of residents and the business community; and a robust volunteer network to help shape and drive action. This section is intended to guide the City as it gets started deploying the CAP.

Building Internal Capacity

Building internal capacity will be important to help establish the CAP as a priority for internal operations as well as fostering connections to the broader community through project building and service delivery.

1. **Fund and hire 1 full-time, permanent staff who will be responsible for actions related to:**
    - Facilitating discussion among large users to reduce emissions through business and industrial strategies
    - Participating in technical resource programs as they are available through the GreenStep Cities Program, such as:
        - The Efficient Buildings Collaborative offered by Hennepin County
        - The renewable energy procurement network offered by CERTs and GPI
    - Working with developers and builders on net zero energy buildings
    - Leading the Energy Task Force and implementing the residential strategies in the Energy Plan
    - Convening an internal City climate working group that meets regularly and provides updates on progress and success, and discusses strategies for more complex challenges, like advanced strategies and zero waste
    - Ensuring the One-Stop Shop webpage is maintained and regularly updated
    - Coordinating and organize volunteer groups and events
    - Engaging city boards and commissions (e.g., the Planning Commission or Economic Development Authority) to ensure the CAP is integrated into their work plans



2. **Develop internal targets and implement actions:**
    - Complete an assessment of all City assets and prioritize actions based on life cycle costs and emissions impact
    - Set annual reduction targets across City departments
    - Consider how existing City funds can be utilized to deliver City services and operations through a climate lens

External Support

City staff and elected officials will not be able to implement this plan without robust support from community members and coordination with jurisdictional, institutional, and organizational partners.

1. **Establish the Environmental Quality Commission as the main citizen-body to support the implementation of the CAP**
   - Form subcommittees that focus on particular areas of the CAP
   - Coordinate with City staff to receive updates on City projects and progress
2. **Establish jurisdictional partnerships that advance CAP strategies to advance and accelerate action.** This can include, but is not limited to Rice and Dakota counties, the State of Minnesota, the Cannon River watershed, Xcel Energy, institutions like St. Olaf and Carleton, and neighboring communities.
3. **Leverage partnerships with existing entities including, but not limited to:**
   - Northfield Healthy Community Initiative
   - Greater Northfield Sustainability Collaborative

Funding

Funding the implementation of the CAP will require reallocation/reconsideration of existing City funds, raising new City funds, and identifying outside resources and funding opportunities. Some funds will need to be dedicated toward long-term support like staffing, while other funding will be on a project-by-project basis. The cost estimates included in the tables below are intended to give a sense of what implementation might cost, not actual dollar amounts. These estimates will include a mix of public and private funding and many of these initiatives will result in a financial payback.

1. **Determine a budget and identify funding sources for staff dedicated to the implementation of the CAP**
2. **Identify a budget necessary to support projects on an annual basis:**
   - For City operations projects, establish an internal fund to pay for energy improvements, direct any savings back to the fund
   - For community-based projects, identify funding opportunities including, but not limited to, foundation funding, crowd-sourcing, private investments, and Property Assessed Clean Energy (PACE)
   - Identify opportunities to increase tax base or production incentives through demonstration projects like large renewable energy systems or a waste (recycling and composting) processing facility
   - Create a Sequestration Fund which individuals can contribute into and the City use for projects such as tree planting, native plantings, etc.
3. **Utilize no-cost technical assistance offerings:**
   - Participate in program offerings that help to establish a building energy benchmarking program, like the Efficient Buildings Collaborative
   - Participate in GreenStep Cities program offerings to network and share resources with peer cities, and access technical assistance from program partners and advisors

1-3 Year Priority Projects:

The following are projects were identified by the CAPAB and are intended to jump start the plan. These projects span climate resilience and mitigation, reaching all sectors of the community. The cost estimates provided are relative costs from least ($) to most ($$$$). It should be noted that costs include a mix of public and private investments and that many of these actions will result in cost savings as well, noted by $.

Internal Projects	Leaders	Cost Estimate
1. Build the One-Stop-Shop webpage on the City's website. This will be a site dedicated to the CAP, providing resources for residents and business leaders to take action, sign-up opportunities for volunteers, event registration, as well as CAP progress and success updates	City staff	$
2. Complete an assessment of City assets for carbon reducing opportunities, including: a. Fleet assessment of all City-owned vehicles b. Building benchmarking and asset management study c. Solar site analysis for rooftop and ground-mount opportunities	City staff	$$$
3. A carbon-free City will need to plan for the elimination of fossil fuels in the community, including how to work with community members on fuel switching strategies, how to think strategically about future infrastructure changes for natural gas and transportation fuels (e.g., gasoline), and how to move toward zero waste. The City's internal climate team should begin think about long-term strategies to transition to clean energy.	City staff	$$

Community-wide Projects	Leaders	Cost Estimate
1. Identifying opportunities for on-site renewables to the achieve the 10% in-boundary generation goal • Complete a solar and wind analysis to determine how much renewable energy could be generated locally • Determine the amount of community solar garden subscriptions and green power purchases (Renewable*Connect) needed to support the goal • Add at least 1 MW of renewable energy by 2021	City staff, EQC, Energy Task Force	$$$$
2. There is enormous potential to store carbon in trees, plants, and soils. This plan identified tree planting as a priority for the community to not only store carbon, but to provide additional co-benefits that come with increased canopy coverage. • Establish annual tree planting goals and identify priority areas in the community for accelerated tree planting and replacement • Create a community-wide tree planting event • Work with volunteers to enhance the existing volunteer tree planting program • Dedicate at least $2/per resident to the City's annual forestry program	City staff, EQC, Park board, Northfield in Bloom	$$$
3. Collaborate with PiE staff, the Energy Task Force, and EQC to execute shared building energy action items, particularly those that address large energy consumers and low-income households.	City staff, EQC, Energy Task Force	$

Reduction Targets:

To meet the goals of this plan, the City will need to steeply reduce its emissions over the next 20 years. This plan includes strategies that will reduce emissions 75% from anticipated, business-as-usual, 2040 emissions. Some of the emissions reductions, about 23%, will be met by Xcel Energy. The remaining 52% will be met through commercial/industrial efficiency (25%), residential efficiency (4%), local renewable energy (7%), fuel switching (8%), travel reductions (6%), and waste strategies (2%). The City will need to achieve, on average, an annual reduction of 2.6% of its baseline emissions to reach the planned 75% reduction, or a 3.75% annual reduction of its baseline to meet is goal to be carbon free by 2040. The three-year targets below are intended to get the City started across the various sectors and positioned to meet or exceed annual targets.

2025: -13%

2030: -26%

2035: -39%

2040: -52%

Three-year targets:

- Assessment of City assets completed and a plan in place to reduce emissions from city operations
- Commitment from large energy users to meet city climate goals
- Building benchmarking program established

- City fleet assessment completed and purchasing policy updated
- Additional public EV infrastructure available in the community

- 1 MW of additional renewable energy
- 8% of businesses and 19% of residences have made deep energy efficiency improvements
- PiE Jump Start goals have been achieved

- 10 miles of additional bike and pedstrian infrastructure (trails, paths, sidewalks)
- Community-wide mobility-sharing program in place

- Urban forestry program established that includes robust tree planting, soil restoration, and other sustainable practices
- Resilience is incorporated into city planning and budget processes

- Zero-waste plan developed and adopted; including a plan for a waste processing facility
- Zero-waste packaging ordinance adopted
- Farm to school program in place

Looking Ahead

Northfield is a welcoming community, recognized for its world-class colleges and historic riverfront downtown, dedicated to sustainably enhancing and preserving its vibrant culture, celebrated arts, strong economy, and an excellent quality of life where all can thrive. Equipped with years of experience in implementing resilience and sustainability initiatives – ranging from food waste reduction and locally-sourced food systems, to on-site renewable energy generation – the City will need to leverage this momentum to sustain, as well as to accelerate, the implementation steps outlined in this plan. Northfield cannot act in isolation. To achieve the goals set forth, strong, collaborative partnerships – continued and new – are essential. These are partnerships with community members, other levels of government, institutions, businesses, and utilities, across sectors, as well as with other peer cities.

This plan will help get the community started on its way toward achieving long-term goals, but it is intended to serve as a living document to be revisited and revised regularly to ensure the community is always pushing ahead and successfully working toward its goals.

The City has set goals to receive 100% carbon free electricity by 2030 and be 100% carbon free by 2040 while continuing to build a more resilient community for all. Fueled by the passion of Northfield residents along with City and institutional leaders, Northfield is well-equipped to take on the challenges of transitioning to a carbon free community, while setting an example that other communities can follow.

Photo Credit: Great Plains Institute