



Resilient Muncie Climate Action Plan



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Cover- Walnut Street Historic District 001.JPG, n.d., online image, SHAARD, https://secure.in.gov/apps/dnr/shaard/r/59580/N/Walnut_Street_Historic_District_001.JPG
 Photograph, above- Donati, Jason. “Tree Planting by Muncie Central Students, 2022.”

Acknowledgements

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Dan Ridenour

City Council

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Letter from Councilman Troy Ingram

Since the passing of Muncie’s Climate Resiliency Resolution back in April of 2021, the Planet Muncie Committee has been working hard to gather data, research information, conduct a survey, and put together a plan for our community to do our part in reducing our emissions and becoming better stewards of our environment.

We didn’t do this work alone and Muncie is grateful that we have colleagues at Ball State that have willingly worked beside us to help us create a plan that can converge with the exciting work they have been doing for many years now. We know that working together with all our different community partners, institutions, organizations, businesses, and citizens is the best way to achieve our goals and benefit the collective good. We also know that for others to take the important and necessary steps they all need to take to reduce greenhouse gas emissions, the City of Muncie must first be a leader in this strategy and lead by example.

That is why I am pleased to have participated with a citizen-led group in the writing of Muncie’s first-ever Climate Action Plan, and I am confident that the recommendations and strategies that this plan highlights will help get Muncie headed in the right direction.

I am hopeful when I think about Muncie’s future because of the potential we have to always be a shining example for other cities to follow. At the forefront of this plan is the thought of residents in our community struggling with poverty, rising energy costs, threatened homes, and food insecurity. All of these issues become exacerbated if we don’t take preventative steps to be more resilient, protect our most vulnerable, and mitigate future disasters. We must act now to help protect our community and prepare ourselves for future challenges that can come our way.

We hope that you find this document helpful and user-friendly, and we want to thank everyone that helped us to get to this point after many years of comprehensive planning and discussion. Please join us in taking tangible steps to be better stewards of our resources and years from now we can look back and say that we all took the right steps to make a difference and help our community.

Councilman Troy Ingram

Planet Muncie Committee Member and Chair of the Environmental Review Committee



Photograph- Intersection, An Aerial Photo of the Downtown Muncie Area, n.d., online image, Muncie Journal, <http://www.munciejournal.com/2019/12/muncie-journals-most-viewed-stories-of-2019/>

Executive Summary

A Tribute to Marta Moody

I never thought I would write this as we finalize the last details of a plan that has been in the works for many years, but we knew we needed to give a tribute to Marta Moody, a founding member of the Planet Muncie Committee. Marta passed away in early 2023 at the age of 71 after working over 44 years in our local Planning Commission Office. We all know that we wouldn't be where we are today without Marta's incredible contributions to this plan and our community. She was instrumental in getting this plan started, performing a greenhouse gas inventory for Muncie, and helping us get a Climate Resiliency Resolution passed by the Muncie City Council in April of 2021. She was all about making connections in our community and she was adamant about protecting our environment and making sure that it was represented in the various plans she helped write.

When I moved back to Muncie in 2008, I immediately tried to get plugged into various community organizations and eventually was hired to work for our local government as an environmental educator. I met Marta when my office was in the Delaware County building and immediately discovered that she was someone that you could go to with questions about anything in our community. She was always welcoming, kind, and easy to have a conversation with, and she was always helpful. I had the pleasure of working with Marta in government for many years and we were both members of the Indiana Association for Floodplain and Stormwater Management. I had the privilege and honor to serve on various community non-profit boards with her that included the Muncie Land Bank, the Muncie Action Plan, and the Cardinal Greenway, where she was a Board member for over 20 years. While serving as President of the Cardinal Greenway for many years she played a pivotal role in connecting vibrant community projects like the completion of the White River Greenway and the new Kistelman Trailhead on the east side of Muncie. She was recently recognized with the Fisher Governance Award from the Ball Brothers Foundation in 2022 for her passionate and active leadership on the Greenway board. Most recently she was tasked with leading a 9-member Delaware County Solar Study Committee commissioned by the Delaware County Commissioners made up of 3 neutral, 3 proponents, and 3 opponents to study the recently passed County utility-scale solar ordinance. I had the honor of serving on that committee under Marta's leadership all the way up until the time of her passing. She was a gifted listener, a great compromiser, and could lead a meeting like no other.

I can't overstate how much she meant to our community and how much of her time she poured into Muncie and Delaware County. We all learned an incredible amount of information and skills from her and she was always willing to give honest feedback and let you know when you were not headed in the right direction. She had an incredible ability to guide discussions, dissension, and constructive dialogue in a room full of different personalities that were always about to give up. She was the true definition of a leader and a public servant, and her fingerprints will be eternally left on some of the best qualities we possess in Delaware County.

This Climate Action Plan is dedicated to the life and legacy of Marta Moody and is a reflection of her resiliency, determination, vision, and service to Muncie and Delaware County. We are forever grateful for her efforts and may we all continue to serve as the shining example that she showed us.

In gratitude,

Jason Donati
Chair of the Planet Muncie Committee

Many will ask why the City of Muncie itself is drafting a Climate Action Plan. After all, Muncie is not a large city. The actions of its 70,000 people in relation to climate change may seem inconsequential when compared to those of Indianapolis, Chicago, or New York. Others will say that cities don't even have control over carbon emissions. Large, multinational corporations emit greenhouse gases in such great quantities that the small actions of a city like Muncie won't even be a drop in the bucket. Those people—however well-intentioned—would be missing the point. We cannot wait on larger cities, corporations, or other people to combat the changing climate. Our inaction will not induce them to action. Instead, wherever possible, cities like Muncie should take the lead in developing an actionable plan of emissions reduction and climate resiliency. Whatever can be done, should be done, but not only for the sake of "the environment" (quite a nebulous term). No, this plan should directly benefit the residents of Muncie. As the world edges towards irreversible climate change, Muncie will need to prepare for those changes. Increasingly intense weather events, flooding, and extreme heat days will all directly affect Muncie. So too will the need to accommodate (and promote) E.V. transportation into this new era of global emissions reduction policies. Muncie must get ahead of these climatic and cultural shifts to ensure a prosperous and stable future for its residents. Hence, the drafting of the Resilient Muncie Climate Action Plan. This plan aims to:

1. Describe the current and future state of the climate crisis
2. Describe Muncie's role in that crisis through greenhouse gas emissions
3. Explain what Muncie has accomplished thus far to reduce emissions and bolster climate resiliency
4. Set up realistic strategies for Muncie to reduce its emissions now and into the future

Through these efforts, a more resilient Muncie can be secured.

The Resilient Muncie Climate Action Plan Matrix summarizes the recommended strategies for the City of Muncie to take. Additional information about many of the strategies is provided further in the document.

Resilient Muncie Climate Action Plan Matrix

Key: COM - City of Muncie,
MSD - Muncie Sanitary District,
MCS - Muncie Community Schools,
MPL - Muncie Public Library,
ITOM - Ivy Tech of Muncie,
AEP - American Electric Power,
MITS - Muncie Indiana Transit System,
DC - Delaware County,
IDEM - Indiana Department of Environmental Management,
BSU - Ball State University

Timeframes: S = short-term (1 year or less),
I = intermediate (1-5 years),
L = long-term (5-7 years)

Section 1- Strategies to Reduce GHG Emissions

Strategies for the overall community (including residential, commercial, and industrial sectors) are included in the Education & Outreach section

Chapter 1.1 - ENERGY	Recommended Stakeholders	Recommended Timeframe
Goal: Increase renewable energy generation		
1.1.1 Encourage AEP to decarbonize the electricity provided to Muncie	AEP, COM	I
1.1.2 Place solar PV on all municipal structures and properties that have appropriate installation potential E14, E18, MSD1	COM, MSD, MCS, MPL, ITOM	I
1.1.3 Place ground-mounted "carport" arrays in suitable locations	COM, MITS, MPL	I
1.1.4 Convert suitable brownfields into renewable energy sites E8-10	COM, DC, IDEM	L
1.1.5 Support installation of on-site solar PV	COM, MSD, DC, MCS	L
1.1.6 Complete SolSmart process to streamline permitting for renewable energy installation	COM	S
1.1.7 Explore geothermal heating and cooling for municipal buildings E20	BSU, ITOM, COM	I
1.1.8 Explore and implement capture and use of wastewater energy potential at wastewater treatment plant	MSD	I
1.1.9 Explore and implement biogas opportunities MSD6	MSD	I
1.1.10 Partner with BSU on existing energy initiatives E23	COM, ITOC	S
1.1.11 Use energy grants and funding E6	BSU, COM, DC, MSD, ITOM, Federal	I
Chapter 1.2 - BUILT ENVIRONMENT		
Goal: Increase energy efficiency of City-owned structures and infrastructure.		
1.2.1 Conduct building energy audits E11	COM, MSD, DC	S
1.2.2 Continue conversion of City lights, streetlights, and signals to LED	COM, AEP	I
1.2.3 Work with utilities to incentivize and promote replacement of heating and cooling equipment and facilitate the bulk purchasing of efficient equipment. Goal: 250 households replacing equipment annually*	COM, AEP, CENTERPOINT	I
1.2.4 Replace appliances with energy-efficient appliances E13	COM, MSD, DC	S
Goal: Increase energy efficiency of City-supported structures and infrastructure		
1.2.5 Encourage MITS to add energy-efficient features to facilities T3	COM, MITS	S
Chapter 1.3 - TRANSPORTATION		
Goal: Decrease vehicles miles traveled.		
1.3.1 Establish an employee incentive to promote alternative commuting options	COM, MSD	S

1.3.2 Increase use of public transportation T2	COM, MITS, DC, BSU, ITOM	S
1.3.3 Increase frequency of buses on routes	COM, MITS	S
1.3.4 Provide bus shelters at regular intervals along bus routes	COM, MITS	I
1.3.5 Expedite implementation of the <i>Bicycle Pedestrian Plan</i>	COM, DC	S
1.3.6 Provide and enhance safe routes for pedestrians throughout the city	COM, DC, MCS, BSU, ITOM	S
1.3.7 Provide safe routes for bicyclists throughout the city	COM, DC, BSU, ITOM	S
1.3.8 Encourage carpooling	COM, DC, MSD	S
1.3.9 Replace traditional stoplight intersections with roundabouts at periphery of city	COM, DC	I
Goal: Increase energy efficiency of vehicles and driving habits		
1.3.10 Upgrade vehicles to electric, hybrid, or low-carbon renewable fuels	COM, MSD, DC, BSU, ITOM, MCS, MITS	I
1.3.11 Support and encourage switching vehicles to electric, hybrid, or low-carbon renewable fuels E 17, T4, MSD3	COM, MSD, DC, BSU, ITOM, MCS, MITS	I
1.3.12 Provide electric charging infrastructure	COM, MSD, DC, BSU, ITOM, MPL, MCS	I
1.3.13 Provide electric charging stations in public parking lots E26, T1	COM, MSD, DC, MPL	I
1.3.14 Incentivize commercial properties to provide electric charging stations	COM, DC	S
1.3.15 Educate employees importance of no-idling habits E16, T5	COM, DC, MSD, MCS	S
Chapter 1.4 - WASTE MANAGEMENT		
Goal: Reduce waste going to the landfill		
1.4.1 Support efforts to increase diversion of recyclables MSD9-11	MSD, BSU	S
1.4.2 Partner with MSD to provide more comprehensive recycling program in City facilities E19	COM, MSD, DC	S
1.4.3 Support efforts to increase composting and the diversion of compostable material MSD13	MSD, DC	S
1.4.4 Support efforts to increase diversion of recoverables	MSD	S
Chapter 1.5 - PARK AND GREENSPACE MANAGMENT		
Goal: Increase efficiency of maintenance equipment and the landscape		
1.5.1 Upgrade all maintenance equipment to electric or low-carbon renewable fuels	COM, MSD, DC	S
1.5.2 Replace gas-powered equipment with electric-powered equipment	COM, MSD, DC	I
1.5.3 Reduce area that is mowed	COM, MSD, DC	S
1.5.4 Establish native plants along the banks of White River and throughout underused areas in parks	COM, MSD	S

Section 2 - Strategies to Mitigate and Adapt to Climate Change

Strategies for the overall community (including residential, commercial, and industrial sectors) are included in the Education & Outreach section

Key: COM - City of Muncie
 MSD - Muncie Sanitary District
 MCS - Muncie Community Schools
 MPL - Muncie Public Library
 ITOM - Ivy Tech of Muncie
 AEP - American Electric Power
 MITS - Muncie Indiana Transit System
 DC - Delaware County
 IDEM - Indiana Department of Environmental Management
 BSU - Ball State University

Timeframes: S = short-term (1 year or less)
 I = intermediate (1-5 years)
 L = long-term (5-7 years)

Chapter 2.1 - TRANSPORTATION	Recommended Stakeholders	Recommended Timeframe
Goal: Provide infrastructure to manage effects of climate change		
2.1.1 Ensure all street reconstructions are built as Complete Streets including sidewalks/multi-modal trails, trees, and LID stormwater infrastructure	COM, MSD, DC	I
2.1.2 Establish clear policies that promote the use of bicycles, skateboards, and scooters for commuting	COM, DC	I
2.1.3 Amend City Code to remove ban on skateboards to allow as transportation on City infrastructure	COM	S
2.1.4 Implement the <i>Safe Routes to Schools Plan</i>	COM, DC, MCS	S
2.1.5 Improve street infrastructure to be more resilient to freeze and thaw cycles	COM, DC	I
Chapter 2.2 - LAND USE		
Goal: Increase carbon sequestration		
2.2.1 Protect and preserve large trees	COM, DC	S
2.2.2 Establish carbon sinks by creating additional wooded areas and wetlands	COM, MSD, DC	I
2.2.3 Partner with Red-Tail Land Conservancy to establish more conservation land trusts N7	COM, MSD	I
2.2.4 Establish native plants along the banks of White River and throughout underused areas in parks (*also recommended in P2) N6	COM, MSD	S
Goal: Reduce heat island impacts (these strategies also mitigate stormwater impacts)		
2.2.5 Recognize and include trees as vital infrastructure	COM, DC	S
2.2.6 Increase the city-wide canopy	COM	S
2.2.7 Continue to plant diverse species of trees following completion of the "1000 Trees in 1000 Days" program	COM	S
2.2.8 Include shade trees as a part of all streetscapes	COM, DC	S
2.2.9 Support redevelopment of older parking lots to include trees as established in the <i>Corridor Development Standards</i>	COM, DC	I
2.2.10 Increase the quality and quantity of greenspace within the community	COM, DC	I
2.2.11 Increase use of native vegetation	COM, DC, MSD	S

Goal: Encourage density and increased housing options		
2.2.12 Support development of mixed-use projects that create live/work/play opportunities in walkable areas.	COM, DC	I
2.2.13 Incentivize in-fill development	COM, DC	I
2.2.14 Establish an urban growth boundary	COM, DC	I
Chapter 2.3 - WATER AND WASTEWATER		
Goal: Mitigate flood hazards and impacts		
2.3.1 City should purchase all land in the 100-year floodplain to avoid unnecessary damage to private property	COM, MSD	L
2.3.2 Prohibit construction of structures in the floodplain or increase the required height of structures in the floodplain above BFE from 2' to 3'	COM, DC	I
2.3.3 Expand floodplain management area to reflect a 500-year floodplain	COM, DC, MSD	I
Goal: Support the overall community from the impacts of flooding		
2.3.4 Join FEMA's Community Rating System (CRS) for National Flood Insurance discounts to residents	COM, DC	S
Chapter 2.4 - PUBLIC HEALTH AND SAFETY		
Goal: Provide social infrastructure to manage effects on climate change		
2.4.1 Provide accessible heating/cooling centers during extreme weather events	COM, DC	S
2.4.2 Provide parks with shade and water fountains within 1/4 mile of all residences	COM, DC	I
Chapter 2.5 - ACCOUNTABILITY		
Goal: Create an office of sustainability or a board with representation from applicable departments that will be responsible for:		
2.5.1 Implement portions of the <i>Climate Action Plan</i> (including seeking grants and educational outreach)	COM, MSD, MCS	S
2.5.2 Provide support for implementing the <i>Climate Action Plan</i>	COM, DC, MSD	I
2.5.3 Monitoring and report on the City's progress in reaching goals	COM, MSD	I
2.5.4 Monitoring implementation of all strategies to ensure that they optimize benefits for disadvantaged peoples and groups EQ1	COM	I
Goal: Celebrate Successes		
2.5.5 Establish an annual award to recognize local businesses that make considerable progress toward sustainability E7	COM	S
2.5.6 Recognize businesses that achieve carbon neutrality	COM	I
2.5.7 Recognize businesses that are LEED-certified and/or SITES-certified	COM	I
2.5.8 Promote local environmental efforts through a monthly email newsletter MSD12	COM	S
2.5.9 Promote and support the work of local community leaders who both promote equity and environmental resilience EQ2	COM	S

Section 3 - Education and Outreach – Community-focused strategies

Key: COM - City of Muncie
 MSD - Muncie Sanitary District
 MCS - Muncie Community Schools
 MPL - Muncie Public Library
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 IDEM - Indiana Department of Environmental Management
 BSU - Ball State University

Timeframes: S = short-term (1 year or less)
 I = intermediate (1-5 years)
 L = long-term (5-7 years)

Chapter 3.1 - ENERGY	Recommended Stakeholders	Recommended Timeframe
Goal: Increase renewable energy generation		
3.1.1 Conduct a public information campaign encouraging upgrades to greener alternative energy sources (solar, wind, geothermal)	COM, MSD	S
3.1.2 Promote community-wide solar education	COM	S
3.1.3 Support installation of on-site solar PV	COM	S
3.1.4 Connect residents with solar panel companies	COM	S
3.1.5 Promote identification and pursuit of energy grants and funding	COM, MSD	S
Chapter 3.2 - Built Environment		
Goal: Increase energy efficiency of structures and accessories		
3.2.1 Inform residents about opportunities to conduct energy audits	COM, DC	S
3.2.2 Conduct a public information campaign encouraging upgrading appliances to greener alternatives	COM, DC	S
3.2.3 Connect the public with incentives to promote replacement of heating and cooling equipment.	COM, DC	I
Goal: achieve 250 households replacing equipment annually		
3.2.4 Promote state and federal weatherization programs	COM, DC	I
3.2.5 Encourage BSU to raise its current LEED Silver certification goals to LEED Gold	COM, BSU	S
Chapter 3.3 - TRANSPORTATION		
Goal: Decrease vehicle miles traveled		
3.3.1 Conduct a public information campaign to promote use of public transportation	COM, MITS	S
3.3.2 Conduct a public information campaign to promote alternatives to typical commuting habits including bicycling, walking, and carpooling	COM, DC, MITS	S
Goal: Increase efficiency of vehicles and driving habits		
3.3.3 Conduct a public information campaign to encourage upgrading vehicles to electric, hybrid, or low-carbon renewable fuels	COM, MSD, DC, MITS	S
3.3.4 Conduct a public information campaign to encourage no-idling habits	COM, MSD, DC	S

Chapter 3.4 - WASTE MANAGEMENT		
Goal: Reduce waste going to the landfill		
3.4.1 Conduct a public information campaign to encourage recycling and composting	COM, MSD, DC	S
3.4.2 Encourage BSU and Ivy Tech to engage in campus-wide recycling programs	MSD, BSU, ITOM	S
Chapter 3.5 - GREENSPACE MANAGEMENT		
Goal: Increase efficiency of maintenance equipment		
3.5.1 Conduct public information campaign to encourage upgrades to maintenance equipment to electric	COM, DC	I
Goal: Reduce heat island impacts		
3.5.2 Conduct a public information campaign to protect trees and encourage planting appropriate tree species in sustainable locations	COM	S
Goal: Mitigate flood hazards and impacts		
3.5.3 Conduct a public information campaign concerning flood hazards and impacts	COM, DC, MSD	S
Goal: Reduce stormwater impacts		
3.5.4 Conduct a public information campaign concerning stormwater impacts	COM, MSD	S
3.5.5 Conduct a public information campaign concerning ways to safely slow stormwater runoff with rain gardens and other low impact development options	MSD	S
3.5.6 Reduce areas that are mowed	COM, MSD, DC	S
3.5.7 Conduct a public information campaign to encourage replacing some lawn areas with native plants and rain gardens	COM, MSD	S
Goal: Support the overall community from the impacts of flooding		
3.5.8 Conduct a public information campaign concerning flood insurance	COM, DC, MSD	S
Chapter 3.6 - HEALTH & SAFETY		
Goal: Provide social infrastructure to manage effects of climate change		
3.6.1 Conduct a public information campaign concerning the dangers of extreme weather, locations of heating/cooling centers, and how to recognize and help people in danger from weather-related illness (including heat stroke and frostbite)	COM, DC	S

INTRODUCTION

City Council Resolution

Given considerable public interest in a city-wide climate action plan, the Common Council of the city of Muncie formally approved the creation of a Resilient Muncie Climate Action Plan on April 5th, 2021, with Amended Resolution No.: 9-21. Its introductory statement reads:

A resolution of the common council of the city of Muncie, Indiana, to partner with the Muncie Action Plan, Ball State University, local businesses, and other organizations to reduce carbon emissions, increase energy efficiency and renewable energy use, and to create a Resilient Muncie Climate Action Plan to benefit the economy, promote public health, and protect our environment.¹

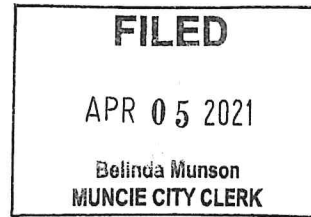
The resolution requires the Resilient Muncie Climate Action Plan be aided by an appointed Common Council member and possibly an appointment by the mayor. Through use of Muncie's 2019 Greenhouse Gas Inventory, the plan necessitates:

1. formulating emissions reduction goals
2. identifying strategies to achieve those goals
3. engaging in education and outreach activities

Once adopted by the Common Council of Muncie within 90 days of being published, the city will review and update the plan every 3 years. The resolution is hereby attached¹:



Photograph- Climate Resiliency Resolution Team in front of City Hall after Amended Resolution NO.: 9-21 was adopted by City Council, April 2021. Photograph provided by Jason Donati.



AMENDED RESOLUTION NO.: 9-21

A RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF MUNCIE, INDIANA, TO PARTNER WITH THE MUNCIE ACTION PLAN, BALL STATE UNIVERSITY, LOCAL BUSINESSES, AND OTHER ORGANIZATIONS TO REDUCE CARBON EMISSIONS, INCREASE ENERGY EFFICIENCY AND RENEWABLE ENERGY USE, AND TO CREATE A RESILIENT MUNCIE CLIMATE ACTION PLAN TO BENEFIT THE ECONOMY, PROMOTE PUBLIC HEALTH, AND PROTECT OUR ENVIRONMENT

WHEREAS, The City of Muncie currently is taking multiple measures to reduce blight, clean up brownfields, enhance public parks, create more green space, protect the White River and other waterways, and improve the quality of life of all citizens; and

WHEREAS, climate action attracts jobs, new residents, and economic development opportunities that will positively contribute to the development of a sustainable, livable city with a strengthened economy and higher quality of living as well as increase energy efficiency activity regarding vehicles, buildings, electricity, and the community of Muncie; and

WHEREAS, Muncie citizens have voiced their support for climate action initiatives, including a formal climate action plan to be written by community constituents and leaders, in public input processes such as the *Vision 2021* economic development plan and three iterations of the Muncie Action Plan; and

WHEREAS, the Delaware-Muncie Metropolitan Plan Commission has already hosted an Indiana Environmental Institute Resilience Cohort to conduct a baseline greenhouse gas inventory for Muncie and Delaware County; and

WHEREAS, Ball State University has implemented significant climate actions, including signing the Talloires Declaration and the Second Nature Climate Leadership Commitment, establishing a Council on the Environment (COTE), developing a Climate Action Plan, installing the nation’s largest ground-source, closed-loop district geothermal energy system, solar energy technologies, obtaining LEED certifications for campus buildings, and making a commitment to reach carbon neutrality by 2030; and

WHEREAS, the Purdue Climate Change Research Center has determined that with continued business-as-usual operations and no attempted reduction in carbon emissions, the Midwest can expect increased risks to public health, infrastructure, and agriculture due to increased heat wave intensity and frequency, more extreme droughts, increased heavy rain events, and flooding that decreases agriculture yield, and degraded air and water quality; and

WHEREAS, Indiana has already warmed 1.2°F since 1895 with data showing it may significantly increase in coming years, Indiana’s average annual precipitation has increased 5.6 inches since 1895 with more of it coming in heavy downpours, and Indiana’s frost-free season has lengthened by nine days per year since 1895 with trends pointing to a dramatic increase in

coming years in the absence of global action to reduce emissions; and

WHEREAS, supplies of non-renewable fossil fuels are finite, and Forbes reported that U.S. electricity generation from renewable energy exceeded coal in 2019 and that Levelized Cost of Energy (LCOE) analysis shows U.S. renewable energy prices fell below the cost of coal in 2018; and

WHEREAS, the effects of a healthier environment will substantially reduce health costs, especially for those suffering from asthma and emphysema or other respiratory issues associated with poor air quality; and

WHEREAS, various economic analyses have shown that the introduction of measures that mitigate climate change impacts is possible at a low cost and that the projected benefits outweigh the associated costs.

NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF MUNCIE, INDIANA as follows:

SECTION 1. The Common Council acknowledges that climate change is a critical public issue that threatens to negatively impact public health and the world’s economy and, therefore, action is necessary to lessen those negative impacts into the future.

SECTION 2. The Common Council intends to partner with the Muncie Action Plan (MAP) to collaborate with its Planet Muncie Committee to create a formal Climate Action Plan utilizing data from the Resilience Cohort’s greenhouse gas inventory completed for the Delaware-Muncie Metropolitan Plan Commission in 2019, and other related information.

SECTION 3. The Common Council will participate in the Planet Muncie Committee by, at a minimum, appointing a committee member who will serve at the pleasure of the Council.

SECTION 4. The Common Council will support and encourage the Mayor of Muncie to also appoint a Planet Muncie Committee member to work toward the creation of a Muncie Climate Action Plan.

SECTION 5. The Common Council, via its Environmental Review Committee, in collaboration with the Planet Muncie Committee, will publish the results of its Resilient Muncie Climate Action Plan (RMCAP) by April 2022 on the City of Muncie’s website with a goal of adoption by the Common Council of the City of Muncie within ninety (90) days of its completion.

SECTION 6. After completion of the RMCAP, the Common Council will work with the City Administration to announce plans for emission reduction goals and create an energy management program based on the RMCAP starting in 2022, and the RMCAP shall be revisited and updated where applicable, every three (3) years thereafter, beginning in 2025.

SECTION 7. The Common Council, via the Planet Muncie committee, will engage in education and outreach activities for community members and support individual lifestyle changes that reduce greenhouse gas emissions.

SECTION 8. The Common Council will encourage and support the Mayor of Muncie, in cooperation with the Planet Muncie Committee, to create an annual recognition awards program to acknowledge and encourage local businesses that demonstrate tangible action steps to be more sustainable and to reduce their carbon footprint.

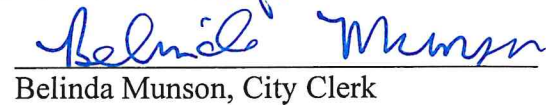
SECTION 9. That this resolution shall be in full force and effect from and after its adoption by the Common Council.

Passed by the Common Council of the City of Muncie, Indiana, this 5th day of April, 2021.


	Yeas	Nays	Abstained	Absent
Ralph Smith	✓	_____	_____	_____
Jeff Robinson	✓	_____	_____	_____
Brandon Garrett	✓	_____	_____	_____
Bradley Polk	✓	_____	_____	_____
Jerry D. Dishman	✓	_____	_____	_____
Anitra Davis	✓	_____	_____	_____
Aaron Clark	✓	_____	_____	_____
Troy A. Ingram	✓	_____	_____	_____
Ro Selvey	✓	_____	_____	_____


 President
 City Council, City of Muncie

Presented by me to the Mayor for his approval this 5 day of April, 2021.


 Belinda Munson, City Clerk

The above resolution is approved/vetoed by me this 5th day of April, 2021.



 Dan Ridenour, Mayor

ATTEST:


 Belinda Munson, City Clerk

This Resolution is proposed by Council Member: _____.

This Resolution is approved in form by Controller: _____.

This Resolution is approved in form by Legal Counsel: 

Sources:

Technology, E. I. P. and. (n.d.). Renewable Energy Prices Hit Record Lows: How Can Utilities Benefit From Unstoppable Solar And Wind? Forbes. Retrieved March 9, 2021, from <https://www.forbes.com/sites/energyinnovation/2020/01/21/renewable-energy-prices-hit-record-lows-how-can-utilities-benefit-from-unstoppable-solar-and-wind/?sh=2e8984742c84>

Widhalm, M., Hamlet, A. Byun, K., Robeson, S., Baldwin, M., Staten, P., Chiu, C., Coleman, J., Hall, B., Hoogewind, K., Huber, M., Kieu, C., Yoo, J., Dukes, J.S. 2018. Indiana's Past & Future Climate: A Report from the Indiana Climate Change Impacts Assessment. Purdue Climate Change Research Center, Purdue University. West Lafayette, Indiana. <https://bit.ly/2KDsaga>

Amended filing

Justification

Because Muncie's climate is intimately connected to both the regional and global climate, we cannot disregard our place in the global climate change phenomenon. This complicated, global process affects people at every scale. The scientific justification this plan accepts relies on three levels: the international level, state level, and local level. But first, we must answer an essential question:

What is "climate change" and how does it occur?

According to NASA, climate change has technically been happening since Earth began². Due to small variations in Earth's orbit around the Sun, our planet periodically experiences episodes of glacial advance and retreat. Seemingly in concurrence with these trends, we currently are experiencing a period of climate warming. Except this time, that change is not due to variations in orbit, but to human activity. 97% of climate scientists agree that this current warming is driven mostly by human activity³. It began in the mid-19th century when the Industrial Revolution employed large-scale fossil fuel burning². Since then, our propensity for using oil, coal, and other dirty fuels has only increased.

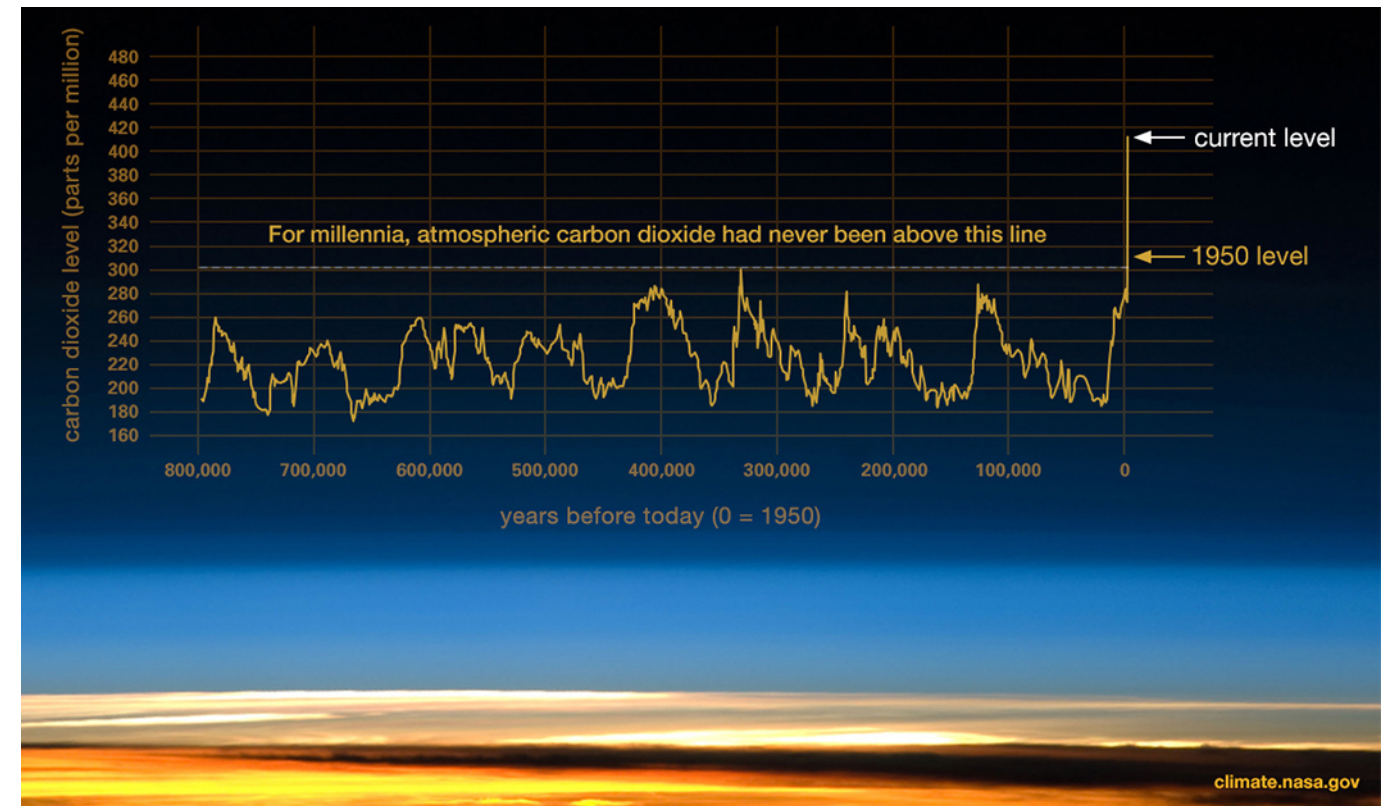


Figure 1: NASA graph of CO₂ increase over 800,000 years⁴

With this came unprecedented amounts of atmospheric greenhouse gas (GHGs) emissions such as carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons³. Not all these gases are harmful in small doses. For example, plants need carbon dioxide to "breathe" and grow. But in the kinds of large doses produced by our recent industrial activity, these gasses contribute to the destabilizing warming of the Earth through what scientists call the "greenhouse effect"⁵.

The greenhouse effect describes the heating of Earth when atmospheric gasses prevent radiation from escaping. Life on Earth depends on this process to regulate global temperatures, but the rapid and long-lasting increase in GHGs have turned the dial up on this process. Over time, this increase in global temperatures will have effects previously unseen under normal atmospheric conditions.

Presented by me to the Mayor for his approval this _____ day of _____, 2021.

Belinda Munson, City Clerk

The above resolution is approved/vetoed by me this 5th day of April, 2021.

Dan Ridenour, Mayor

ATTEST:

Belinda Munson, City Clerk

This Resolution is proposed by Council Member: _____

This Resolution is approved in form by Controller: _____

This Resolution is approved in form by Legal Counsel: _____

Sources:

Technology, E. I. P. and. (n.d.). Renewable Energy Prices Hit Record Lows: How Can Utilities Benefit From Unstoppable Solar And Wind? Forbes. Retrieved March 9, 2021, from <https://www.forbes.com/sites/energyinnovation/2020/01/21/renewable-energy-prices-hit-record-lows-how-can-utilities-benefit-from-unstoppable-solar-and-wind/?sh=2e8984742c84>

Widhalm, M., Hamlet, A. Byun, K., Robeson, S., Baldwin, M., Staten, P., Chiu, C., Coleman, J., Hall, B., Hoogewind, K., Huber, M., Kieu, C., Yoo, J., Dukes, J.S. 2018. Indiana's Past & Future Climate: A Report from the Indiana Climate Change Impacts Assessment. Purdue Climate Change Research Center, Purdue University. West Lafayette, Indiana. <https://bit.ly/2KDsaga>

Original filing

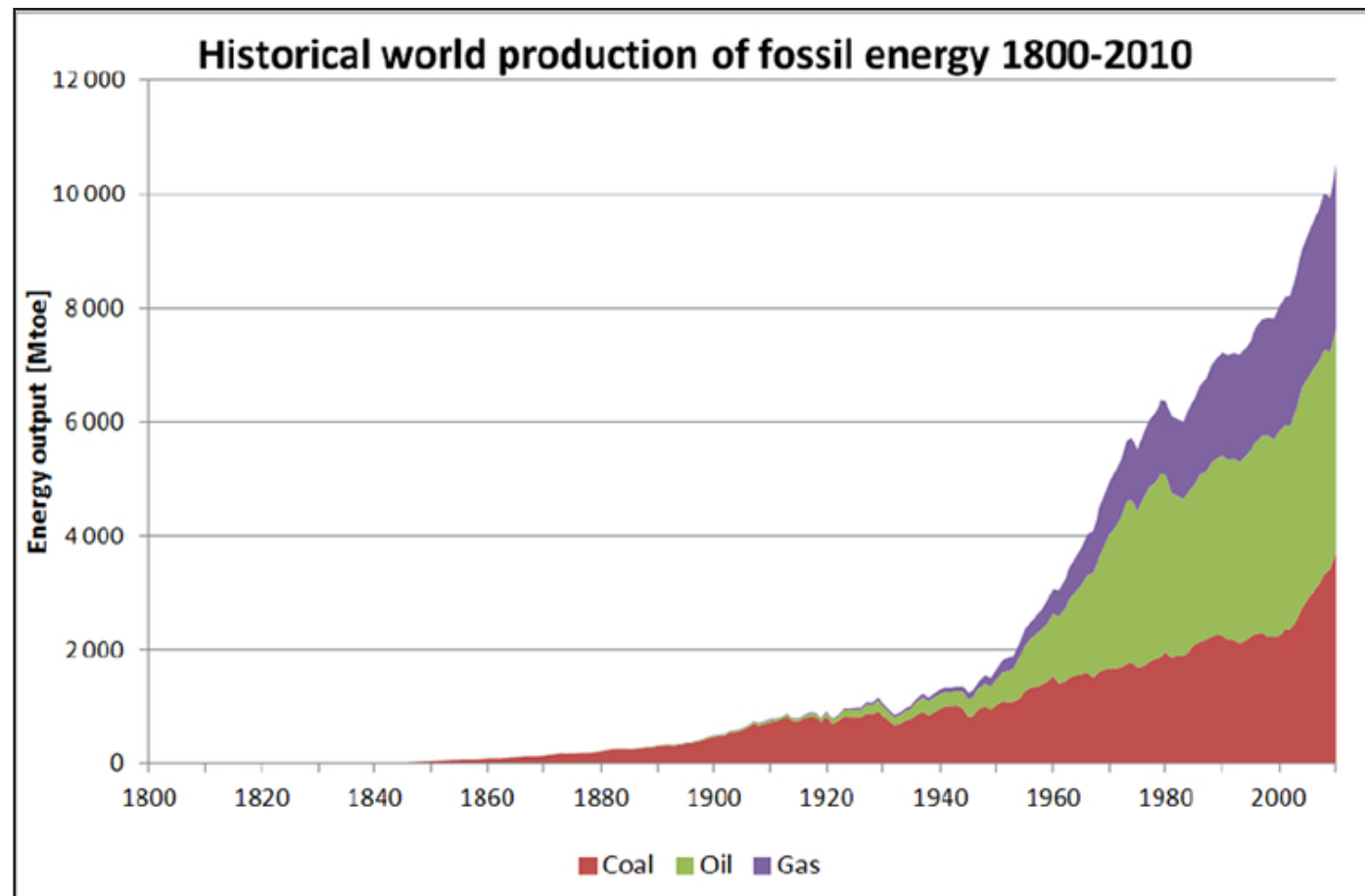


Figure 2: Historical production of fossil energy from 1800 to 2010, divided into coal, oil and gas⁶

International Level

The harmful effects of climate change are already being felt globally². NASA and the UN's Intergovernmental Panel on Climate Change (IPCC) predict a(n):

- Rise in sea levels
- Worsening of heat waves
- Worsening of droughts
- Increases in precipitation
- Worsening of hurricanes
- Losses of biodiversity

Unless we greatly reduce our GHG emissions, the IPCC predicts a global temperature increase between 1.5°C and 2°C (2.7°F to 3.6°F) during the 21st century^{7,8}. And if we don't maintain the emissions reductions advised by the IPCC, we will see further increases in global temperatures beyond 1.5°C-2°C⁹. But how will these changes impact humanity on a global scale? What are the specific impacts of these dangers?

Rise in Sea Levels

Climate-change-induced sea level rise occurs through two major phenomena: ice sheets/glacial melting and sea water warming⁹. The ice sheets/glacial melting is relatively intuitive; when large ice blocks on land are heated, their water flows into the oceans. Because that water was not *in* the oceans before, but instead *on* the land, its melting raises the sea level (much like adding water to a drink). As for the warming sea water, one might recall from science classes that matter expands as it heats up. As global temperatures increase, the water molecules which constitute the oceans begin to take up more space. This means that sea level rise is affected not only by *more* water in the oceans (from the melting ice sheets previously held on land) but also by the *expansion* of current ocean water molecules.

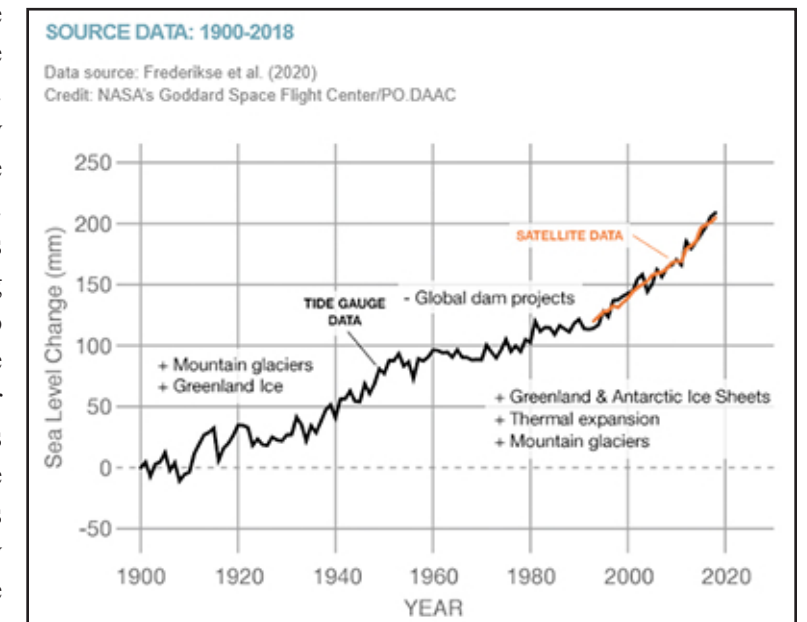


Figure 3: NASA graph of sea level change from 1900-2018¹⁰

So, what does this mean for the world? Why should we care about a little extra water along our beaches? Well, according to NASA, about 30% of the world population lives within 100 kilometers (or 62.14 miles) of a coastal shoreline¹¹. This means that any alteration to that shoreline (in this case, the encroachment of water on land) will greatly affect the many populations and cities located along those shorelines. The major effects and implications of rising sea levels are predicted to be:

- Coastal flooding
 - Increased economic costs
 - Requires the building of levees or relocation of coastal populations
 - Reduced GDP resulting from mass migration or added taxes to fund levees
 - Equity implications
 - The poor and disadvantaged may live along coastlines once their instability becomes undesirable; they are at particular risk from floods.

- Political instability
 - Countries such as the Maldives may be entirely underwater; where do these people go and what becomes of their country?
- Fresh water source contamination
 - Salty seawater may leak into subterranean aquifers as sea levels rise¹²
 - Coastal drinking water may be threatened by advancing salt fronts.
 - Sources of agricultural irrigation may be ruined.

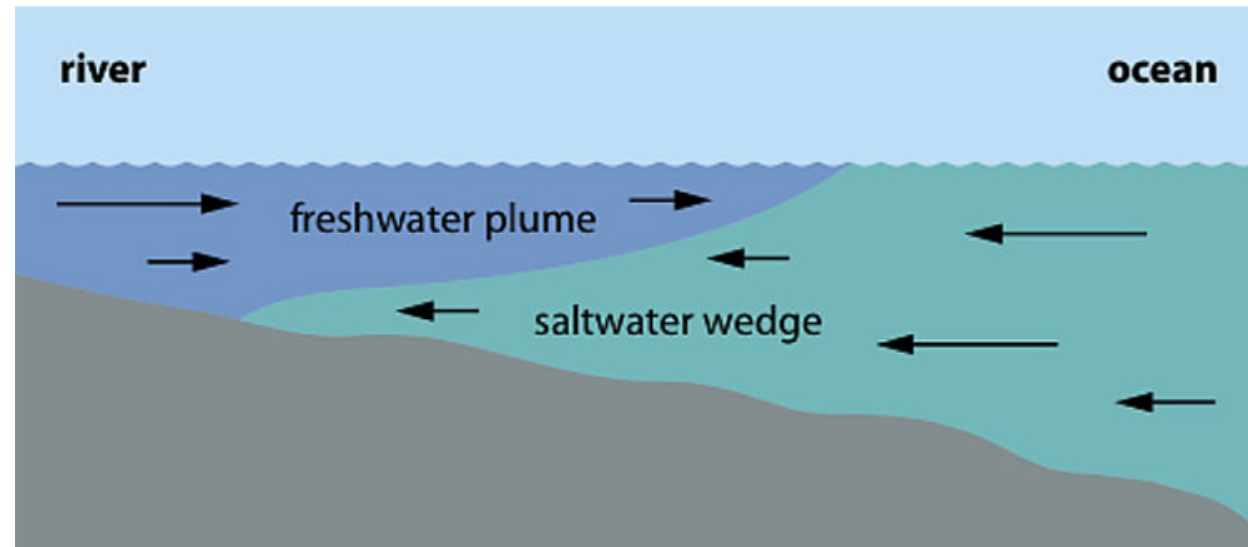


Figure 4: Salt fronts form when freshwater moving downstream meets tidal water moving inland¹³

Worsening of Heat Waves

According to the National Academies of Sciences, Engineering, and Medicine, a “heat wave” is defined as time periods of 2+ days wherein the temperature is hotter than/comparable to the historical averages for that area¹⁴. The Academies assert that heat waves are the leading cause of weather-induced death in the United States. Populations vulnerable to the worst effects of heat waves include:

- Older adults
- Young children
- The chronically diseased
- Those who work outside for prolonged periods of time
- Pregnant women
- Those with mental health issues

Climate change is worsening these heat waves by making them longer, more intense, and happening with greater frequency¹⁴. The major effects of rising sea levels can be summarized as:

- Increased heat-related deaths and injuries
 - Increased economic costs
 - Workers are either permanently removed from the workforce or lose valuable time to heatstroke/heat-related illness¹⁵.
 - Equity implications
 - Migrants and people of color are more likely to work long hours outside in the increasingly intense heat¹⁴, thereby effecting their communities disproportionately¹⁶.

Worsening of Droughts

According to NASA, a drought is defined as an extended period of time wherein the average precipitation is less than the multi-year average for precipitation level¹⁷. Much like the worsening of heat waves due to climate change, droughts are expected to increase in length, intensity, and frequency¹⁶. If droughts increase as expected due to climate change, the major effects can be summarized as:

- Increased economic costs
 - Drinking water will increase in price due to an increase in its scarcity.
 - Food will increase in price because irrigation water will cost more to import from water-plentiful areas.
- Equity implications
 - The poorer/more disadvantaged the group of people, the less likely they will be to have either:
 - 1) the funds to pay for more expensive water/food, or
 - 2) the access to increasingly scarce water/food.
- Political instability
 - Countries with already low access to clean water and affordable food will be pressed with supplying these to their constituents. Especially in authoritarian regimes, these necessities may simply *not* be supplied, and riots/political dissent may result.
 - Developed countries will experience a similar pressure to supply affordable food and water, which will be met with political backlash if taxes must be raised for this purpose.



Figure 5: Tree experiencing drought¹⁸

Increase in Precipitation

NASA asserts that US precipitation has increased overall since 1900, but some areas have had more than others. This information may seem to conflict with the dire drought predictions, but the truth is that some areas will benefit from more precipitation with climate change while others will suffer increased droughts¹⁵. According to the IPCC, the increased global temperatures are all but guaranteed to increase the amount of precipitation the world experiences. It, too, agrees that some areas will see greater changes in precipitation than others¹⁶. An interesting takeaway from the IPCC findings is that the *contrast* between dry and wet seasons will intensify and become more apparent¹⁵. Though it is difficult to say exactly what the impact of increased precipitation will be across the globe, especially because extreme precipitation increases will be localized, effects can be expected to include:

- Crop damage
 - Economic costs
 - When large swaths of crops are damaged¹⁶, supplies decrease, and prices increase; food becomes more scarce and more expensive.
- Soil erosion
 - Where precipitation is increased, highly localized cloud-burst events¹⁹ may drop such great quantities of precipitation that soil erodes too quickly for localities to respond.
- Increased flood risk

- Where precipitation is increased, the risk that water will accumulate past the limits of local infrastructure increases
- Equity implications
 - The aforementioned effects of increased food costs and increased flood risks in particular will affect disadvantaged communities first because: 1) they have less disposable income to pay for increased food costs and 2) they are more likely to live in lower-cost housing, which may be located in high-risk floodways.

Worsening of Hurricanes

According to NASA, climate change will ensure that hurricanes occur with more frequency, more intensity, and for a greater duration¹⁵. All of these factors, including the frequency of Category 4-5 hurricanes, have increased since the 1980s¹⁵. The impacts of such increases can be expected to impact:

- Economics
 - Coastal populations and cities will be damaged with increasing frequency and intensity, thereby costing landlords, homeowners, local governments, and society at large substantial sums of money to repair structures and relocate people.
- Equity
 - It is not uncommon for poor/disadvantaged groups to be located along hurricane corridors when the risk of living there reduces housing prices. Therefore, the direct impacts of worsening hurricanes will disproportionately affect the already disadvantaged.
- Geopolitics
 - Developing countries (such as Haiti) which lie in direct paths of hurricanes may be increasingly decimated by them; this could induce revolutions or political strife when homes and shops are routinely destroyed.
 - Developed countries like the U.S. include regions with frequent hurricanes. These areas may become perennially discontent with the intensity and frequency of destruction and push the government to act.

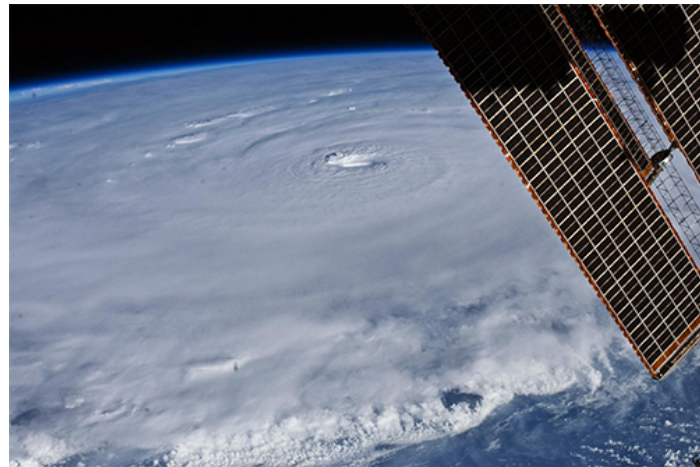


Figure 6: 2010 NASA image of hurricane Earl taken from the International Space Station²⁰

Loss of Biodiversity

According to the IPCC, biodiversity represents the variability among living organisms across marine and terrestrial ecosystems¹⁶. The European Union's Research and Innovation Magazine—Horizon—asserts that climate change is one of the main causes of biodiversity loss²¹. The previous impacts of climate change (such as rise in sea levels, worsening heat waves, worsening droughts, increases in precipitation, and worsening hurricanes) have all alluded to a decrease in global diversity. This section will outline how each facet will negatively impact global biodiversity:

- Rise in sea levels
 - Coastal wetlands and estuaries may be compromised by the introduction of coastal sea water¹⁶, thus permanently altering their ability to sustain biodiverse life.
- Worsening of heat waves

- Regions which previously supported certain animal/plant/other life may now (for even the mere duration of the heat wave) be incompatible with certain life forms due to natural constraints. This means that certain life forms may die in relatively short-duration heat waves, but cannot return in the same numbers (or at all) because the shock of heat waves that have decimated their populations.
- Biodiverse populations in certain regions may rely on stable temperature changes to survive. As the intensity, frequency, and severity of heat waves increase, these populations may be routinely shocked to the point where they cannot reproduce¹⁶. Over time, this will drastically reduce the biodiversity of many regions.
- Worsening of droughts
 - As with heat waves, regions which previously supported certain animal/plant/other life may now (for even the mere duration of the drought) be incompatible with certain life forms due to natural constraints¹⁶. This means that certain life forms may die in relatively short droughts, but cannot return in the same numbers (or at all) because the shock of droughts that have decimated their populations.
- Increase in precipitation
 - Increased localized precipitation may drown certain species and prevent them from repopulating at previous levels. This could negatively affect not only *their* populations, but also the ones that rely on them for sustenance¹⁶.
- Worsening of hurricanes
 - Increased intensity of and frequency of hurricanes has the potential to disrupt coastal biodiversity¹⁶ similar to its disruption of coastal human communities.

State Level + Local Level

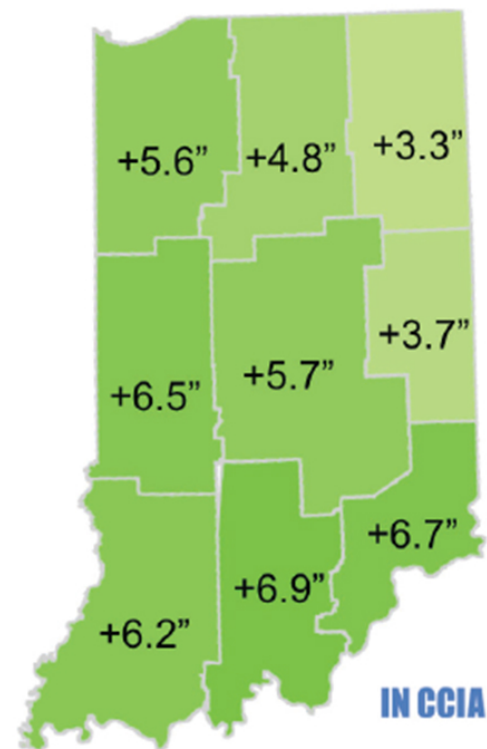
Though climate change is often discussed as a global phenomenon, it is already affecting us in Indiana. Purdue University's 2018 Indiana Climate Change Impacts Assessment found that the Hoosier state has warmed 1.2°F since 1895 and will continue to warm by 5°F to 6°F by 2050²². This increase in regional temperature is likely to result in:

- Increase in extreme heat events
- Decrease in extreme cold events
- Increase in annual precipitation
- Increase in frost-free days
- Reduced water quality
- Reduced air quality
- Decrease in crop productivity (i.e. soybeans and corn)
- Loss of species (i.e. Karner Blue Butterfly)
- Increase in electrical demand on cooling units

This list includes a mixed bag of benefits and drawbacks, but they all ultimately require adaptation. An increase in extreme heat events increases the likelihood for heatstroke and hospitalizations, especially among children and the elderly¹⁶. A decrease in extreme cold events increases the likelihood for disease-carrying insects (such as mosquitoes and ticks) to propagate more and for longer period of time. Increased annual precipitation raises the likelihood for floods, overflow of polluted water from combined sewage-stormwater systems, and added stress on agricultural production if the precipitation comes in bursts^{16, 19}.

An increase in frost-free days can both increase the growing season in Indiana, but also create favorable conditions for pests, invasive species, and undesirable plants such as ragweed²². The five other effects related to water quality, air quality, crop productivity, loss of species, and electrical demand are all clearly burdens on our systems.

Annual Average Precipitation on the Rise



Change in annual average precipitation based on linear trend between 1895 to 2016

Indiana's Growing Season

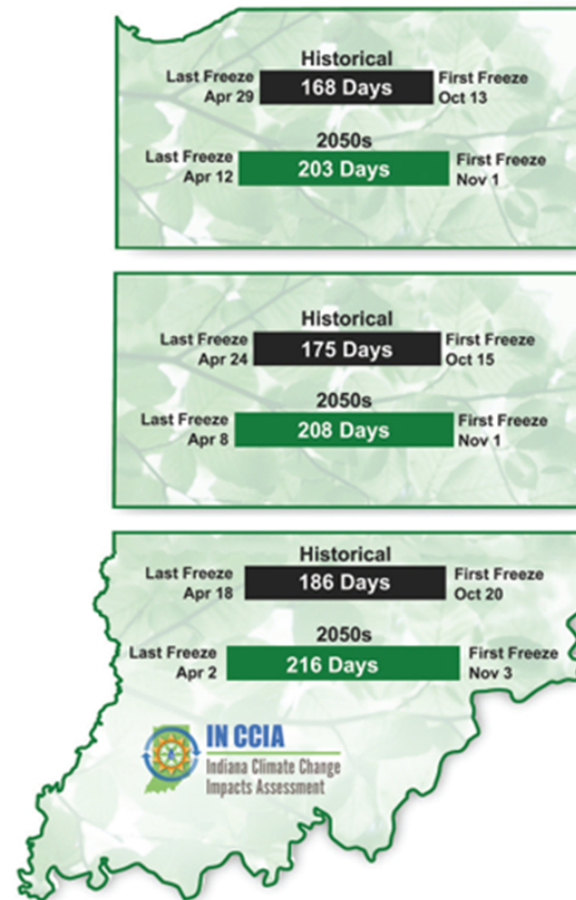


Figure 7: Purdue University precipitation and growing season infographics²²

Overall, the effects of climate change in Indiana will not be the same as the global effects. NASA predicts more frequent and intense droughts worldwide, rising sea levels, and a greater frequency and intensity of hurricanes. All three of these changes are unlikely to significantly change Indiana's climate.

First, the droughts Indiana will experience are more likely to take the form of hotter, drier summers²² than an extreme reduction in overall rainfall which would be experienced elsewhere¹⁵. The Purdue 2018 Indiana Climate Change Impacts Assessment actually predicts an *increase* in annual precipitation in Indiana²². Droughts will likely impact already dry regions in the world, worsening their conditions while Indiana sees the opposite effect¹⁶. Second, because Indiana is not along an ocean, rising sea levels will not directly affect the residents living there (see Figure 8). This doesn't mean that Hoosiers won't see economic hardships if coastal cities are impacted by climate change, but insofar as physical effects go, rising sea levels won't affect them. Finally, similar to rising sea levels, Indiana won't see an increase in hurricane frequency or intensity because it's too far from the coast. Tornadoes or storm systems resulting from coastal hurricanes may make their way to Indiana and cause damage¹⁶, but the hurricanes themselves won't move that far inland.

This is all to say that merely analyzing the global effects of climate change won't adequately explain localized effects. Every region should analyze climate data themselves to develop policies and adaptive strategies tailored to the impacts climate change will have locally. This does not imply, however, that the economic and societal impacts of climate change elsewhere will not impact Indiana residents. The global economy will be strained by increases in droughts, rising sea levels, increases in hurricanes, and the myriad of other negative effects expected. There will require state policies to address these economic and societal impacts, but the physical impacts of climate on Indiana will require entirely separate responses.



Figure 8: NOAA projected results of 1 ft of sea level rise on the east coast of the United States²³

How will climate change effect Muncie?

Taking an even more localized view than Indiana, we can look at the effects of climate change on the city of Muncie. Being in Indiana, Muncie will experience much of the same effects as the rest of the state: increased extreme heat events, decreased extreme cold events, increased precipitation, fewer frost days, etc. But because Muncie is also located along the White River, there is a greater threat of flooding from increased precipitation. This means that, along with other climate change response strategies, stormwater infrastructure and flood planning must be high priorities for Muncie in the coming years.

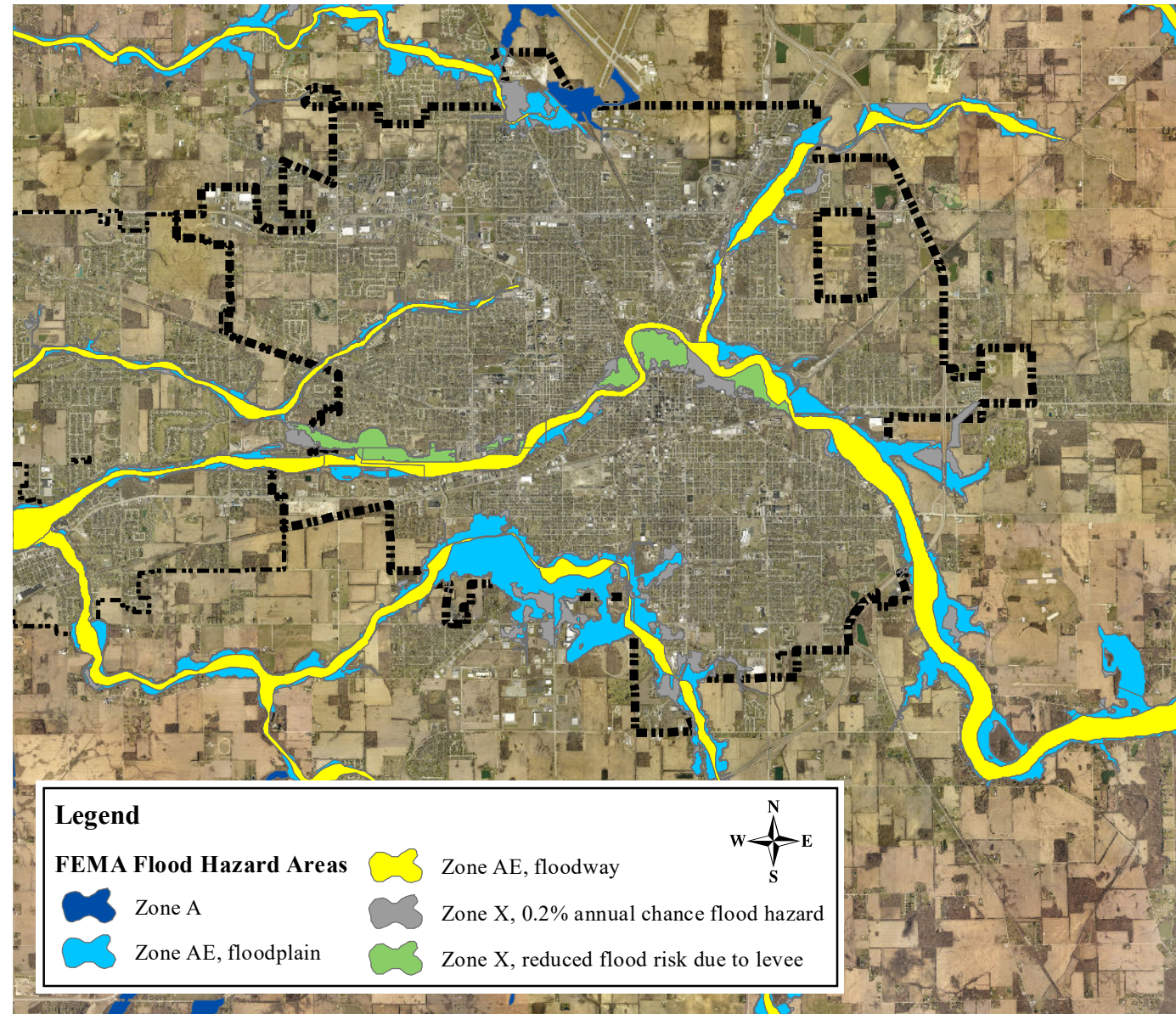


Figure 9: FEMA floodplain data for the City of Muncie²⁴

Existing Efforts

As the Amended Resolution No.: 9-21 briefly mentioned, Muncie and its community have already taken some steps towards climate resiliency.

Ball State University have been a leader in the community by taking the following actions:

- Signing of the Talloires Declaration (1999)
- Signing of the Second Nature Climate Leadership Commitment
- Creating a 2013 Climate Action Plan
- Setting a Carbon-Neutral 2030 Goal
- Establishing a Council on the Environment (COTE)
- Authoring *Resilient Muncie: A Prepared and Responsive City*
- Collaborating with the Indianapolis Airport on a 75-acre solar farm
- Requiring LEED certification for new construction
- Using biodiesel shuttle busses
- Providing six electric charging stations
- Installing the “nation’s largest ground-source, closed-loop district geothermal energy system”²⁵

The Delaware-Muncie Metropolitan Plan Commission has taken steps toward climate resiliency, with initiatives such as:

- 2017 Greenhouse Gas (GHG) Inventories for the city of Muncie and Delaware County
- Bicycle and Pedestrian Plan (2019)

The City of Muncie has also taken steps towards climate resiliency, with initiatives such as:

- *Muncie Action Plan 3: Task Force 5* (goals focusing on the environment)
- Compressed Natural Gas (CNG) police force fleet
- Continual purchasing of land for new parks
- Mayor Dan Ridenour’s “1000 Trees in 1000 Days” project

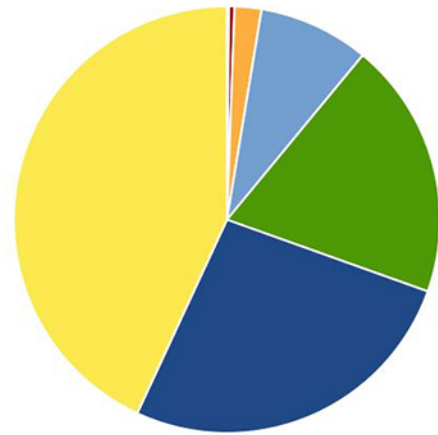
These actions (among others) will be discussed in more detail later. For now, it is important to know that this climate resiliency process has already begun, and that the creation and adoption of the Resilient Muncie Climate Action Plan is but one step in a long process of establishing climate resiliency.

Forecasting and GHG Target

An integral part of any climate action plan is its emissions reduction goals. By first creating a Greenhouse Gas Inventory²⁶ to identify our current emissions, we could then move on to forecasting our future emissions and what our goals should be. In 2019, the DMMPC commissioned an extern from Indiana University’s Environmental Resilience Institute to compile this inventory using ClearPath software made available from ICLEI. Otherwise known as Local Governments for Sustainability, ICLEI is an organization comprised of environmental science experts, software experts, and over 2500 local and regional government members, all committed to developing environmentally sustainable policies²⁷. ClearPath was used to compile data for Muncie’s GHG Inventory and forecast future Muncie emissions for this climate action plan. The drafters of this plan also consulted with ICLEI staff on forecasting, emissions reduction targets, and basic climate action plan questions. We owe much of the direction and content of this plan to ICLEI and its staff members.

The breakdown of CO₂e emissions in Muncie is depicted in Figure 10. Though the inventory was conducted in 2019, emissions data from 2017 was used to compile it²⁶. All figures used in this inventory and in the projections are rough estimates. Our emissions were broken down into seven sectors: residential energy,

CO2e By Category



- Water & Wastewater ● Process & Fugitive Emissions ● Solid Waste
- Industrial Energy ● Commercial Energy ● Residential Energy
- Transportation & Mobile Sources

Figure 10: GHG Inventory emissions breakdown for Muncie, IN in 2017²⁶

commercial energy, industrial energy, transportation & mobile sources, water & wastewater, solid waste, and process & fugitive emissions. Table 1 ranks each sector by its total CO₂e emissions. Muncie's three largest emitting sectors are Transportation & Mobile sources at 224,809 metric tons of CO₂e, followed by Residential Energy at 130,943 metric tons, and then Commercial Energy at 123,572 metric tons²⁶.

Muncie 2017 CO ₂ e	
Sector	CO ₂ e
Transportation & Mobile Sources	224,809 MT CO ₂ e
Residential Energy	130,943 MT CO ₂ e
Commercial Energy	123,572 MT CO ₂ e
Industrial Energy	41,964 MT CO ₂ e
Solid Waste	10,227 MT CO ₂ e
Process & Fugitive Emissions	2,783 MT CO ₂ e
Water & Wastewater	765 MT CO ₂ e
Total	535,063 MT CO ₂ e

Table 1

Using ICLEI's forecasting software, we modeled what these 2017 baseline emissions would look like if no reduction strategies were taken through 2049. These emissions are broken down first by their emissions category (see Figures 11-17) and later compiled into one, encompassing graph (see Figure 20).

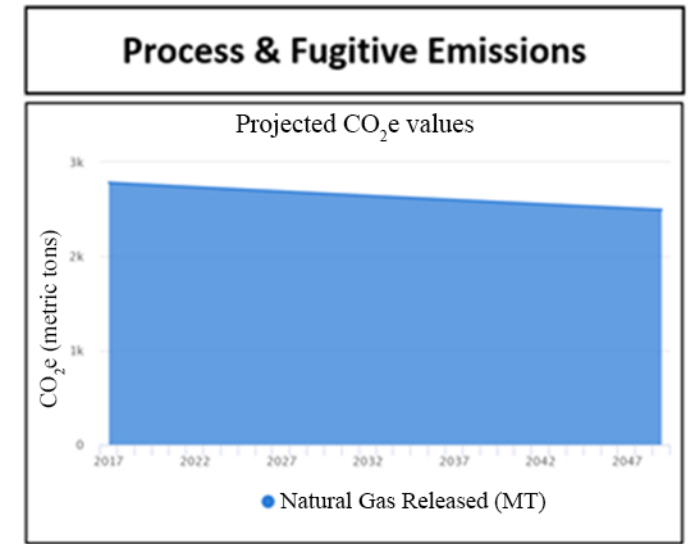


Figure 11

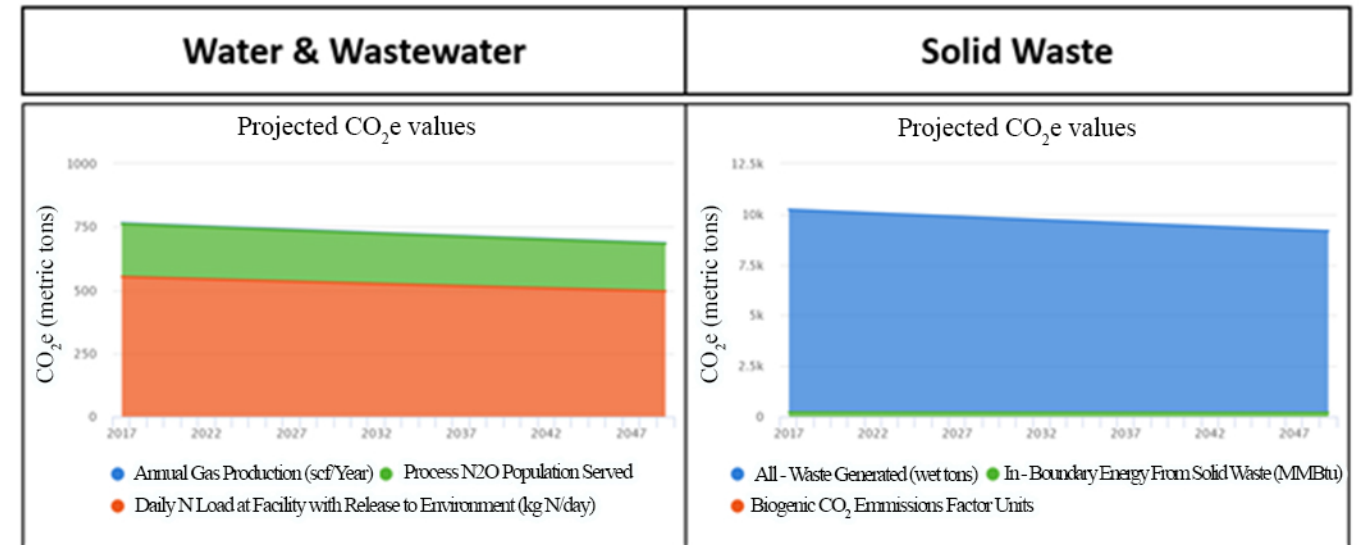


Figure 12

Figure 13

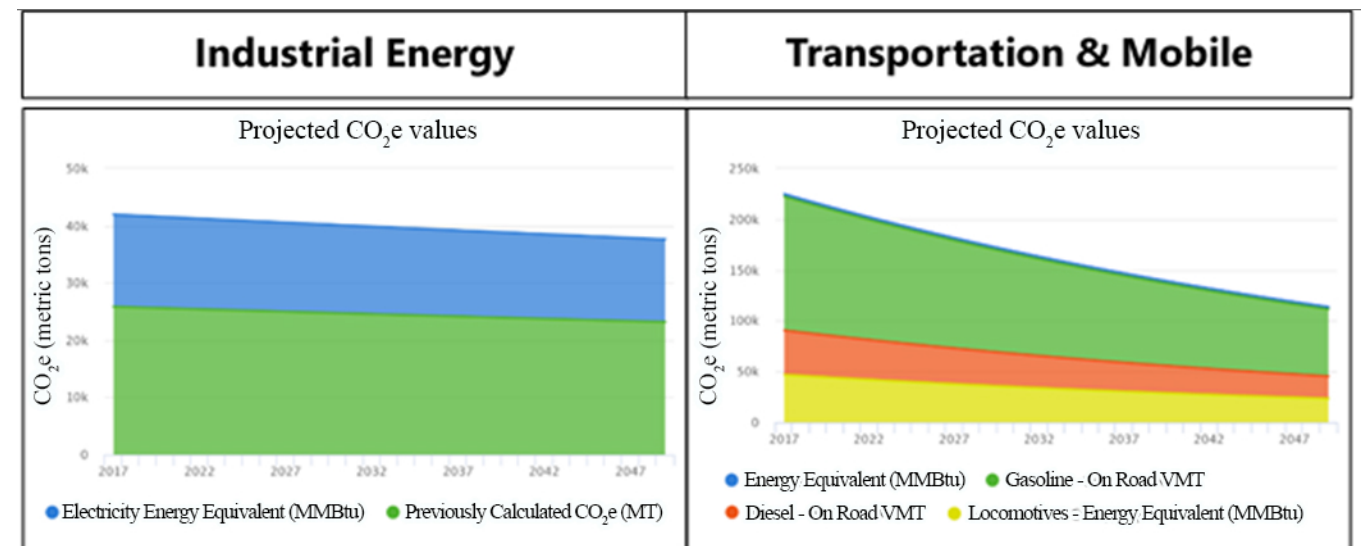


Figure 14

Figure 15

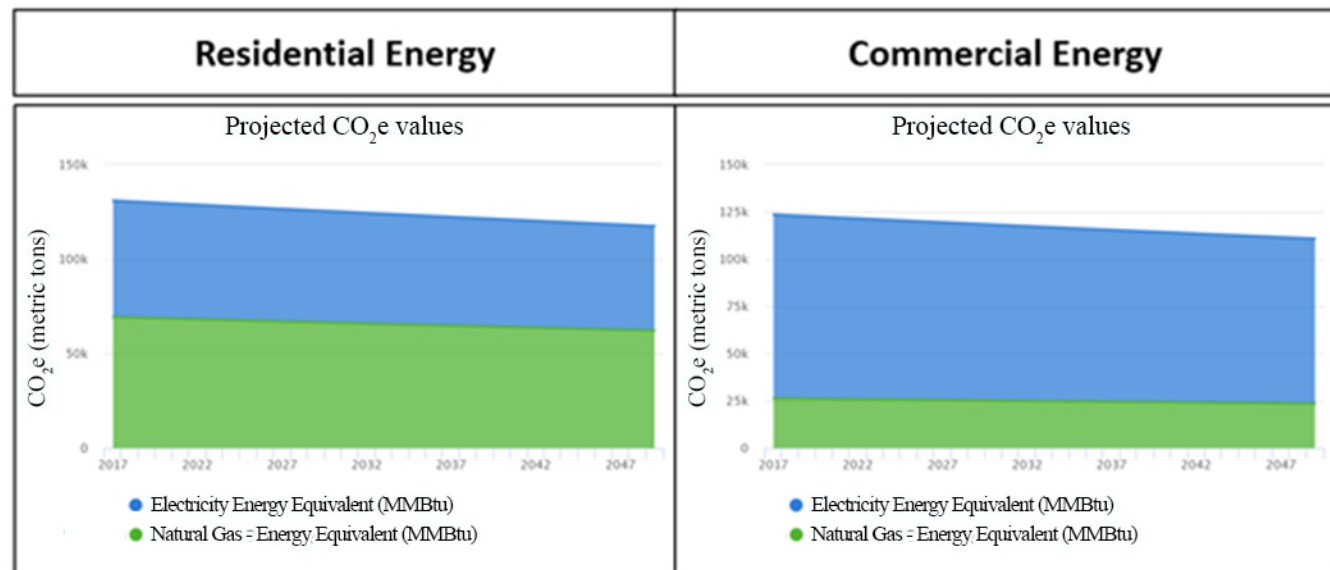


Figure 16

Figure 17

Two factor sets were used to estimate CO₂e emissions over time: 1) Muncie’s rate of population decline (applied to all sectors for the Growth Rate) and 2) the federal Transportation Carbon Intensity Growth Rates (CAFÉ standards) (applied to the Carbon Intensity factor of the transportation sector). The transportation sector used the additional CAFÉ standards for its Carbon Intensity Factor (instead of only applying the Growth Rate based on Muncie’s population growth rate) because transportation vehicles have the added emissions factor of regular, mandatory improvements to federal fuel economy standards. These CAFÉ standards are imposed by the federal government over time which must be reflected in our emissions forecasting. The projected rate of carbon intensity reduction due to CAFÉ standards is -1.8% per year while the rate of Muncie population decline is -0.33984929293% per year. Muncie is losing residents year over year, and for this reason, our annual emissions will naturally reduce by 2050. Still, this decrease in emissions will not significantly reduce the city’s contribution to climate change. For this, more steps must be taken to reduce our emissions.

Race to Zero

One strategy to reduce emissions is to join Race to Zero, a pledge made by 700+ cities across the globe to drastically reduce emissions by 2030 and achieve zero emissions by 2050²⁹. To help Muncie decide whether to make this pledge, ICLEI formulated a High Impact Action (HIA) Analysis Summary Report for our city. The report uses science-based targets used to derive a 2030 emissions reduction goal and strategies to

High Impact Action Analysis Summary Report: Muncie, IN 2017

SBTs and Emission Goals	2030 Per Capita	2030 Absolute	Baseline Scope 1 & 2 (MT CO ₂ e)	2030 Scope 1 & 2 (MT CO ₂ e)
	63.4%	65.0%	524,834	183,916

Growth Rates	Commercial	Residential	Industrial	On-Road Transportation	Grid Decarbonization
	No Growth	Population Growth	No Growth	Population Growth	CES
	0.00%	-4.32%	0.00%	-4.32%	-80.00%

Figure 18: HIAA 2022 emissions reductions for Muncie, IN

reduce our emissions in accordance with the Race to Zero goals. According to this summary report, Muncie should expect to reduce emissions by 65% by 2030 to reach carbon-zero by 2050²⁹. Though Figure 19 only shows the 2030 emissions goal, Race to Zero states its desire for participants to reach carbon-zero by 2050.

The strategies we can use to reach these goals include:

- grid decarbonization,
- reductions in vehicle miles traveled (VMT),
- an increase in electric vehicle adoption,
- increased commercial and residential building energy efficiency, and
- increased commercial and residential building electrification²⁹

As shown in the HIA overview in Figure 19, grid decarbonization will constitute the majority of emissions reductions:

HIA Overview			
Type	Name	Net Reduction (MT CO ₂ e)	Description
Grid Decarbonization	CES	137,950	Clean Energy Standard: 80% Reduction in carbon intensity (kg CO ₂ /MWH) by 2030.
High Level VMT Reduction	Aggressive (10% VMT Reduction)	12,669	10% Reduction in total VMT
On-Road Electric Vehicles Adoption	Moderate (4.5% Annual Growth)	24,005	22.5% of VMT is EV by 2030. This action influences an increase in Residential & Commercial buildings electricity emissions.
Commercial Building Efficiency	IECC 2018	935	All new buildings including 1% of existing Sq FT (renovations and turnover) will meet IECC 2018 (36.95% reduction in building EUI)
Residential Building Efficiency	IECC New + 5% Existing	1,929	All new buildings and 1% of existing Sq FT (renovations and turnover) will meet IECC 2018 (36.95% reduction in building EUI) & 5% Existing Sq FT (renovations and turnover) EUI is reduced by 20%.
Commercial Building Electrification	5% EB Electrified	16,620	5% of existing SF per year is electrified. This action influences an increase in Commercial buildings electricity emissions.
Residential Building Electrification	10% EB Electrified	64,617	10% of existing SF per year is electrified. This action influences an increase in Residential buildings electricity emissions.

Figure 19: HIAA 2022 emissions reductions strategies for Muncie, IN

The following pages show the baseline and projected emissions for the “Business as Usual” scenario (wherein Muncie makes no additional resiliency efforts) compared with the Race to Zero scenario (wherein Muncie enacts the emissions reduction strategies outlined in the HIA).

"Business as Usual"			
Muncie 2017 - Muncie 2049			
Sector	2017 (CO ₂ e)	2049 (CO ₂ e)	% change
Transportation & Mobile Sources	224,809	113,737	-49.41%
Residential Energy	130,943	111,721	-14.68%
Commercial Energy	123,572	110,817	-10.32%
Industrial Energy	41,964	37,633	-10.32%
Solid Waste	10,227	9,172	-10.32%
Process & Fugitive Emissions	2,783	2,496	-10.31%
Water & Wastewater	765	686	-10.33%
Total	535,063	386,262	-27.81%

Table 2

Race 2 Zero			
Muncie 2017 - Muncie 2049			
Sector	2017 (CO ₂ e)	2049 (CO ₂ e)	% change
Transportation & Mobile Sources	224,809	10,870	-95.16%
Residential Energy	130,943	0	-100.00%
Commercial Energy	123,572	0	-100.00%
Industrial Energy	41,964	7,477	-82.18%
Solid Waste	10,227	9,172	-10.32%
Process & Fugitive Emissions	2,783	2,496	-10.31%
Water & Wastewater	765	686	-10.33%
Total	535,063	30,701	-94.26%

Table 3

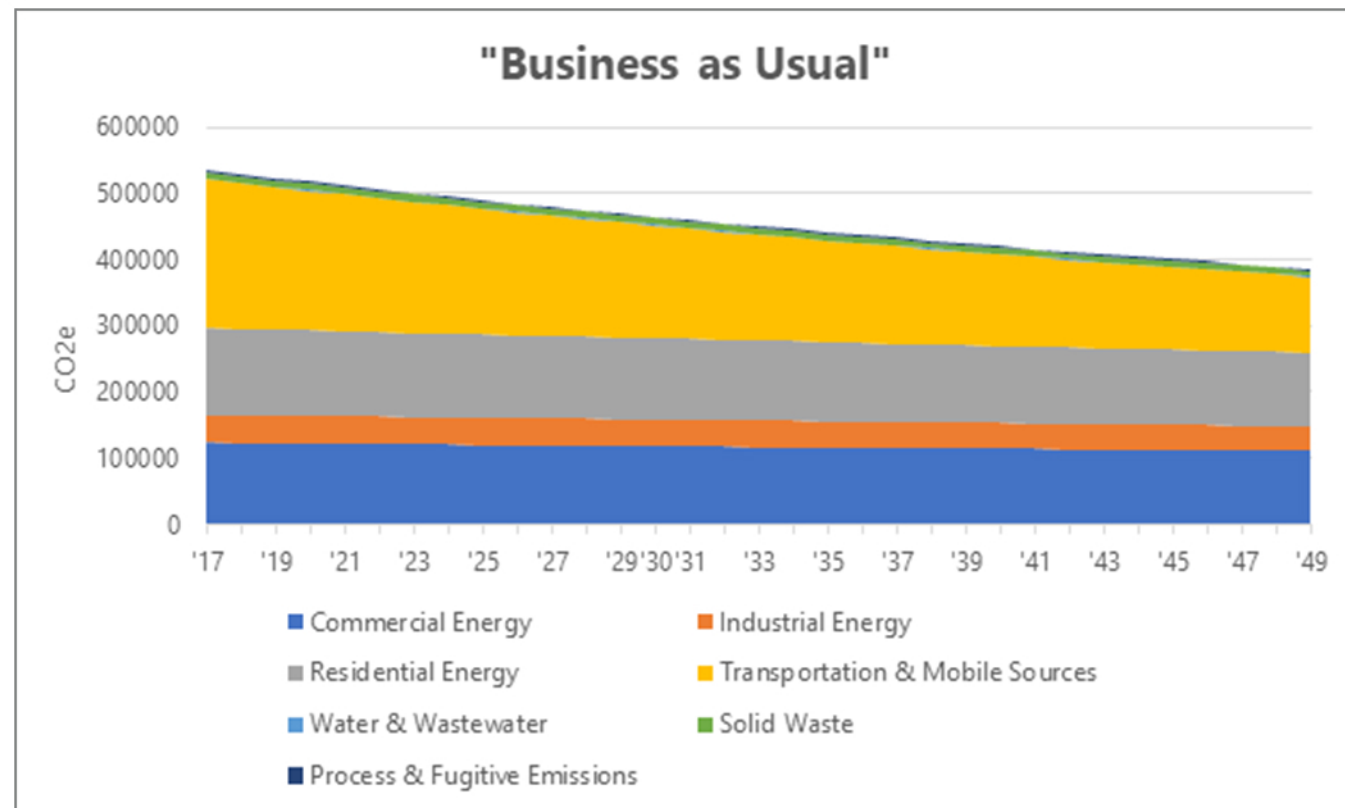


Figure 20: "Business as Usual" emissions forecast

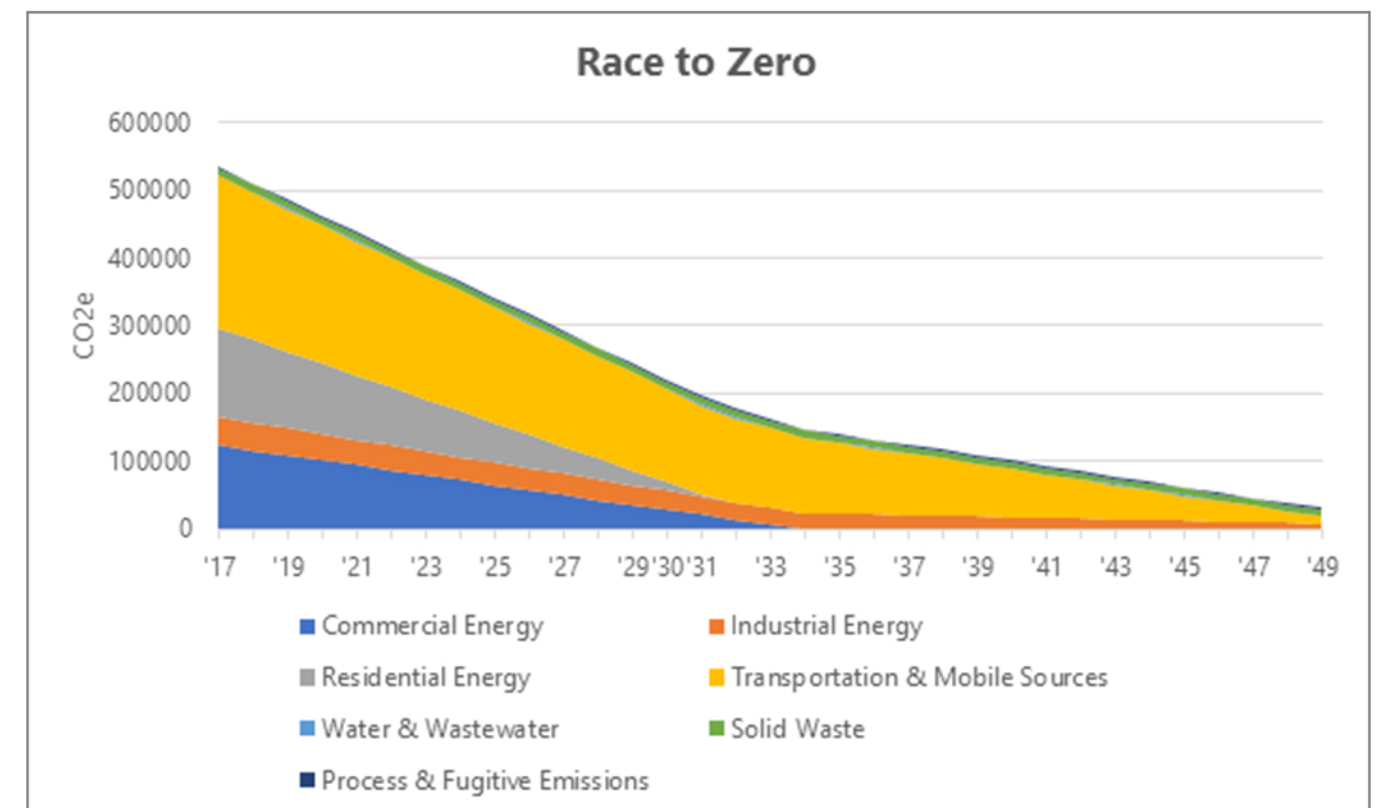


Figure 21: Race to Zero emissions forecast

Community Survey

Emissions Comparison			
Sector	CO ₂ e Emissions by Year 2050		% Change
	Business as Usual	Race 2 Zero	
Transportation & Mobile Sources	113,737	10,870	-90.44%
Residential Energy	111,721	0	-100.00%
Commercial Energy	110,817	0	-100.00%
Industrial Energy	37,633	7,477	-80.13%
Solid Waste	9,172	9,172	0.00%
Process & Fugitive Emissions	2,496	2,496	0.00%
Water & Wastewater	686	686	0.00%
Total	386,262	30,701	-92.05%

Table 4

Figure 20 portrays Muncie’s emissions if no resilient action is taken and our population continues to decline (“Business as Usual”), while Figure 21 portrays Muncie’s emissions if Muncie follows the Race to Zero emissions reduction strategies starting in 2022. If we followed the Race to Zero 2030 emissions strategies through 2050, Muncie would emit only 30,701 MT CO₂e compared with a “Business as Usual” strategy inducing a whopping 386,262 MT CO₂e. Although the graphs and tables project only to 2049, this is essentially 2050 because the 2049 growth covers the entire year, right until 2050 itself. No growth would be projected for 2050 because the deadline is 2050.

Given this great reduction, it seems the obvious choice to take the Race to Zero pledge and adopt its strategies. This approach requires unilateral government action, and a great deal of implied public support.

We can also look at the increased commercial and residential building energy efficiency strategies. Barring a legal mandate, there is no way to guarantee that those residents or businesses will make their buildings more energy efficient.

Finally, as an example, we can look at the strategy of increased electric vehicle adoption. The city could campaign to increase electric vehicle adoption, but there is no guarantee that a public campaign alone would trigger adoption to the degree that 22.5% of vehicles miles traveled (VMT) are traveled by electric vehicles. Furthermore, Muncie’s public electric vehicle charging infrastructure is basically nonexistent, which disincentivizes such adoption.

Because these Race to Zero strategies are unlikely to be implemented in Muncie, a new set of strategies must be adopted. These strategies will draw influence from ICLEI’s suggestions and move in similar directions, but with the added benefit of being actionable. These will be described at the end of each emissions category (i.e. residential energy, commercial energy, etc.). But before the emissions reduction policies are described, it is important to note what the public thinks about this initiative.

Planet Muncie polled the community about what they’d like to see the Resilient Muncie Climate Action Plan accomplish; 100 responses were collected. The survey was conducted through a Google Forms survey conducted from February 2022 to May 2022, which the Planet Muncie committee distributed through word-of-mouth, social media, fliers placed around the Ball State campus, promotion at the March 2022 Muncie neighborhood association IDEA Conference, and inclusion in the April Muncie Action Plan Newsletter. The survey asked 14 multiple choice questions, two short answer questions, and seven demographics questions; see Appendix A for a review of all of the responses.

Although the survey only received a small number of responses, community members that participated heavily favored Muncie having an office of sustainability or a designated sustainability officer and felt that Muncie would be a more attractive place to live/work if it took proactive measures towards climate resiliency. The vast majority of respondents were concerned about higher temperatures and extreme heat. The majority of respondents also were concerned with home or neighborhood flooding. Responses to the short answer questions provided more in-depth feedback for the City.

How would you suggest Muncie become more resilient and reduce its carbon footprint?

Most respondents promoted city use/promotion of alternative sources of energy such as solar, geothermal, and wind. They suggested that the many large brownfields in Muncie could be used for solar energy generation. Others suggested the city take a legal strategy of environmentalism, enforcing such policies as requiring:

- a single-use plastic bag cost/tax
- businesses to recycle
- restaurants to compost
- consideration of multi-mobility access in new developments
- alternative energy solutions for new construction
- internalized city power generation away from the grid; solar and wind energy

Finally, the respondents heavily favored improving existing sidewalk and biking infrastructure, the installation of public E.V. charging infrastructure, and adding more greenspace.

Do you have any other comments or information you’d like to share?

Most of these responses were similar to the previous short-answer question:

- improve sidewalks
- use cleaner energy
- educate the public on reducing carbon emissions
- focus on park improvement
- ensure there are enough workers and resources to plant trees
 - o (this respondent approved of Muncie’s “1000 trees in 1000 days” project but didn’t think the city had the staff to implement it)
- ensure city-wide recycling capability (especially in apartments)
- emphasize biodiversity where possible

Similar to the short answer questions, Table 5’s question “Check all environmental measures you’d like to see Muncie enact” revealed respondents’ preferences for Climate Action Plan strategies. The respondents could choose from 16 different environmental strategies (see Table 5). The top five most voted strategies were:

- 1) Update sidewalk infrastructure 86.9%
- 2) Plant more trees 73.7%
- 3) Connect residents with energy-saving programs 72.7%

- 4) Add solar panels to public facilities 68.7%
- 5) Reduce bus fare for low-income residents 60.6%

Check all environmental measures you'd like to enact:	
100 people responded, % that supported measures:	
1. Add more MITS bus routes and hours of operation	50%
2. Add more MITS buses	31%
3. Add more parks	53%
4. Add more public electric vehicle charging stations	45%
5. Add more solar panels to public facilities	68%
6. Adopt anti-idling campaign	30%
7. Connect residents with energy-saving programs	73%
8. Connect residents with home weatherization programs	58%
9. Convert city vehicles to electric	49%
10. Emphasize more roundabouts and fewer traffic lights	47%
11. Establish a Muncie Conservation Corps to provide experience and training to youth and young adults while improving the urban landscape	55%
12. Offer composting for homeowners	58%
13. Plant more trees	74%
14. Reduce bus fare for low-income residents	60%
15. Remediate existing brownfields	55%
16. Update bike lane infrastructure	59%
17. Update sidewalk infrastructure	87%

Table 5

These results indicate that a focus on making Muncie more livable is paramount. If Muncie can implement emissions reduction strategies which cater to both everyday needs—such as adequate sidewalks, plentiful shade, and reasonable bus prices—while also reducing emissions and increasing climate resiliency, Muncie residents will support this plan. Furthermore, and essential to the long-term success of this plan, Muncie residents overwhelmingly support an office of sustainability or designated sustainability officer. This designation is a flexible one, but would surely entail:

- 1) tracking Muncie emissions over time,
- 2) implementation of emissions reduction strategies, and
- 3) assessing current resiliency progress and planning to increase city-wide climate resiliency.

Climate Action Strategies

Section 1- Strategies to Reduce GHG Emissions

Strategies for the overall community (including residential, commercial, and industrial sectors) are included in the Education & Outreach section

Section 1.1- ENERGY

Goal: Increase renewable energy generation

1.1.1 Encourage AEP to decarbonize the electricity provided to Muncie

1.1.2 Place solar PV on all municipal structures and properties that have appropriate installation potential

Wherever possible, Muncie should continue to search for suitable government buildings to fix solar panels to and prioritize their funding. Electrification requires the replacement of gas used to heat/cool buildings with a direct connection to the electrical grid³⁰. This assumes a long-term shift in Muncie's energy grid away from fossil fuels and to a reliance on renewable energy. By electrifying the grid now, before this transition has taken place, Muncie will ensure that it can take advantage of emissions reductions as soon as the electrical grid updates its energy portfolio.

While compressed natural gas is still not a renewable resource, it pollutes markedly less than traditional diesel³¹. Therefore, the Sanitary District should continue its use and looks to offset its future emissions through solar system installations.

1.1.3 Place ground-mounted Photovoltaic (PV) "carport" arrays in suitable locations

1.1.4 Convert suitable brownfields into renewable energy sites

Capitalizing on the brownfield site list from "Brownfields to Brightfields."

Brownfield remediation grants often require that the city own the brownfield site before they are awarded funding for cleanup. By drawing from the current list of brownfield sites³² (which includes the size of the plots and their potential solar energy output) and adding to the list their contamination characteristics and what means are necessary to acquire them, Muncie can more quickly purchase sites and apply for the relevant cleanup grants.

Partner with local institutions, government agencies, and nonprofits to provide both manpower and funding to remediate these sites

The remediation of brownfield sites is often a serious undertaking. Some sites will be very large and their precise degree of contamination may have been inadequately monitored. The City of Muncie needs to partner with as many institutions as possible to aid in the remediation of their local brownfields. Nearby colleges such as Ball State University and Ivy Tech would likely have a vested interest in cleaning up Muncie's most contaminated sites, as would state agencies and local nonprofits. If Muncie makes it clear that funding and resources raised from these groups would directly improve the state of Muncie's economy and image, they may find institutional backing.

Continue to purchase brownfield sites to convert into renewable energy sites

The outcome of the City of Muncie's potential Build, Operate, and Transfer agreement with GM Development for solar farm development of the former Chevrolet site³³ will largely determine the prospective future of similar projects. If neighbors, community leaders, and the city as a whole approve the implementation of this \$17 million solar farm, Muncie may look to replicate the project across its many brownfield sites. This strategy would benefit from the previously mentioned strategy of keeping a detailed record of all existing brownfields in Muncie.

1.1.5 Support installation of on-site solar PV

1.1.6 Complete SolSmart process to streamline permitting for renewable energy installation

1.1.7 Explore geothermal heating and cooling for municipal buildings

Ball State University's extensive geothermal heating/cooling network has proved to be a successful long-term investment in reducing energy costs and emissions. If the City of Muncie can develop its own geothermal system, it could see the same long term dividends.

1.1.8 Explore and implement capture and use of wastewater energy potential at wastewater treatment plant

1.1.9 Explore and implement biogas opportunities

In a typical wastewater treatment system, sewage undergoes a primary treatment and a secondary treatment³⁴. The primary process first screens out larger particles and sediment. The secondary process removes most organic matter using bacteria, and treats the remaining materials with chlorine before releasing the wastewater back to nature (see Figure 22).

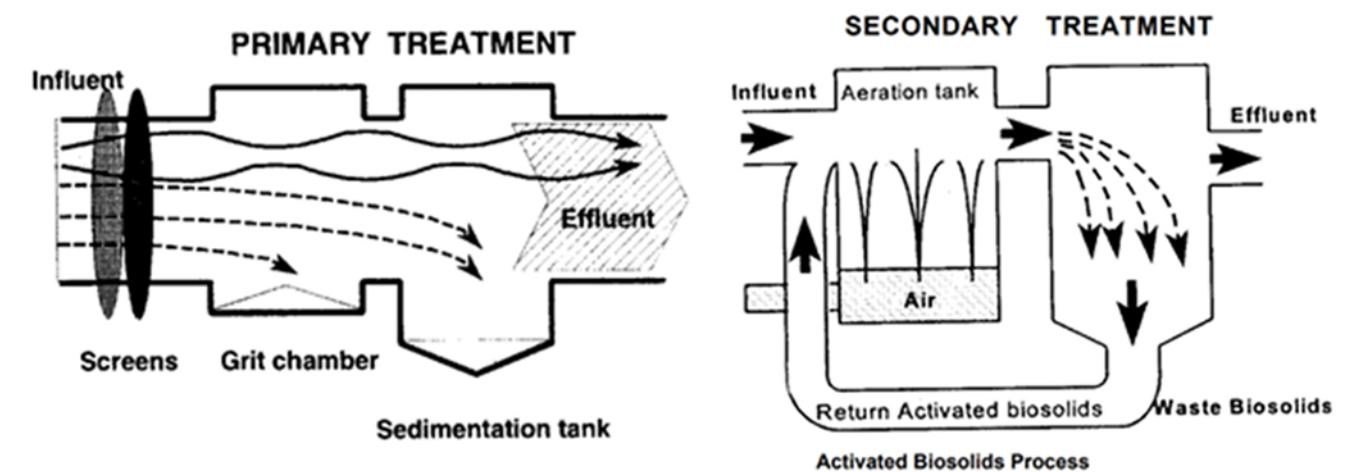


Figure 22: Typical primary and secondary sewage treatment processes³⁴

Though effective at removing contamination from wastewater, this treatment process can have side-effect of emitting harmful methane gas. Methane accounts for 30% of climate change since the industrial revolution and, over a 20-year period, is 80 times more impactful than carbon dioxide as a greenhouse gas³⁵. Therefore, it would be prudent for the Sanitary District to look for alternative wastewater treatment options which capture or eliminate methane emissions.

One way to achieve this could be installing an anaerobic sludge digestion system. These systems add an additional pretreatment process called thermal hydrolysis, which exposes the sewage to high temperatures and pressures to maximize the amount of methane produced³⁶. An anaerobic digester then breaks down the sewage particles further, a product of which is useable methane gas³⁶. A visual representation of this process and subsequent methane uses is shown in Figure 23 on the following page.

Potential uses for the resulting methane gas include³⁶:

- On-site heat production
- On-site electricity production
- On-site alternative fuel source that can be sold to the utilities

The net cost of this upgrade will depend on the capacity of the treatment plant and whether the District will sell the resulting methane for a profit.

Wastewater-to-Energy System

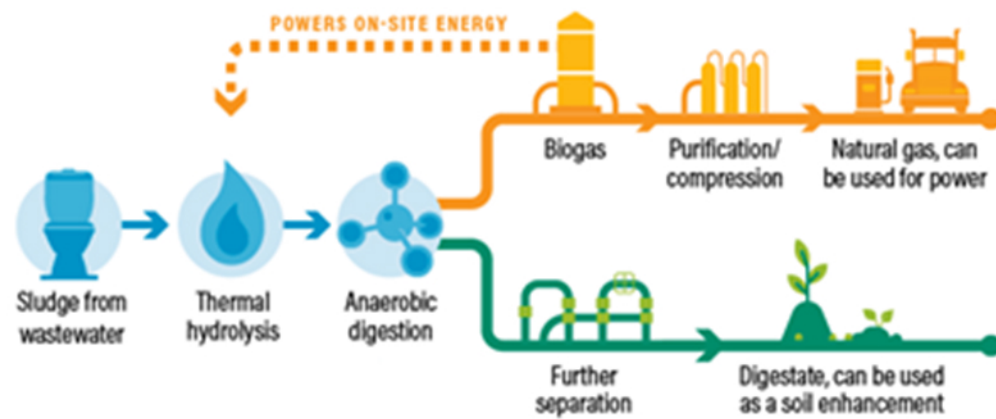


Figure 23: Potential sludge digestion system diagram³⁶

1.1.10 Partner with BSU on existing energy initiatives

Ivy Tech could join BSU in its LEED certification system commitment. Though the Muncie Ivy Tech campus has very few buildings (and likely can't expand much more), the college could commit to Gold or Silver certification when updating its buildings. Ivy Tech also could join BSU in investing in renewable energy sources, especially if Ball State purchases noncontiguous land to develop solar or wind farms. In such a case, Ivy Tech could pay a portion of the land and development costs in exchange for a percentage of the renewable energy generated.

1.1.11 Use energy grants and funding

A list of some potential grant and funding opportunities is provided in the Conclusion. Additional opportunities may be available.

Section 1.2- BUILT ENVIRONMENT

Goal: Increase energy efficiency of City-owned structures and infrastructure.

1.2.1 Conduct building energy audits

Before Muncie can decide which of its government buildings need updating and/or changing (in order to reduce emissions and improve energy efficiency), it needs to conduct energy audits³⁷ on all of its buildings. Once these audits are completed, it will be clearer which parts of its buildings/appliances/practices need to be updated and/or changed first.

These audits:

- Locate air leaks
- Insure proper ventilation
- Check insulation levels
- Inspect heating and cooling equipment
- Examine light bulbs for replacement or upgrade to LEDs
- Estimate energy use of appliances

1.2.2 Continue conversion of City lights, streetlights, and signals to LED

There are many environmental reasons to switch to LED light bulbs, which are 80% more energy efficient than traditional light bulbs, require less energy for a comparable light level, contain fewer chemicals than other light bulbs, and last up to six times longer³⁸. If Muncie converts all city-owned lights to LEDs, the

local government can save on its energy bill while reducing its overall emissions.

1.2.3 Work with utilities to incentivize and promote replacement of heating and cooling equipment and facilitate the bulk purchasing of efficient equipment.

The City should consider setting a goal to help at least 250 households replace their home's equipment annually. This goal should be reviewed annually in order to ensure that the goal is realistic and assists as many households as possible.

1.2.4 Replace appliances with energy-efficient appliances

Appliances such as dishwashers, water heaters, and thermostats can be upgraded to improve energy efficiency³⁹. The federal government-backed and EPA-partnered Energy Star rating system can be used to identify energy-saving appliances that meet its strict energy efficiency criteria³⁹. Energy Star labels adorn independently certified appliances proven to deliver the same (or better) quality of service at a greater energy efficiency. Though Energy Star does not certify bathroom fixtures, Muncie should consider switching faucets, toilets, and other sources of in-building water to low flow alternatives.

Goal: Increase energy efficiency of City-supported structures and infrastructure

1.2.5 Encourage MITS to add energy-efficient features to facilities

Muncie's MITS Bus system has already transitioned portions of its facilities to LEDs and installed a solar panel system⁴⁰. They should continue to convert facility lights to LEDs, install more solar panels, and look for inventive ways to increase energy efficiency and reduce emissions through the use of energy efficient facility features.

Section 1.3- TRANSPORTATION

Goal: Decrease vehicles miles traveled.

1.3.1 Establish an employee incentive to promote alternative commuting options

1.3.2 Increase use of public transportation

MITS Bus should continue to expand and improve bus access where possible to incentive residents to drive less and use public transportation more.

1.3.3 Increase frequency of buses on routes

1.3.4 Provide bus shelters at regular intervals along bus routes

1.3.5 Expedite implementation of the Bicycle Pedestrian Plan

1.3.6 Provide and enhance safe routes for pedestrians throughout the city

1.3.7 Provide safe routes for bicyclists throughout the city

1.3.8 Encourage carpooling

1.3.9 Replace traditional stoplight intersections with roundabouts at periphery of city

Goal: Increase energy efficiency of vehicles and driving habits

1.3.10 Upgrade vehicles to electric, hybrid, or low-carbon renewable fuels

1.3.11 Support and encourage switching vehicles to electric, hybrid, or low-carbon renewable fuels

Though CNG and hybrid vehicles are commendable strategies to reduce government vehicle emissions, and extend alternative fuel use should be pursued, the ultimate goal should be to convert all government vehicles to electric. The current conversion of police fleets to CNG is a good short-term emissions reduction strategy. But, electric vehicles provide both a short-term emissions reduction benefit and a long-term one. In the short term, Muncie will be less polluted from government vehicle exhaust. In the long term, once the electrical grid transfers its energy portfolio to renewable energy sources, emissions at the site of energy production will be reduced.

Muncie's MITS Bus system should continue transitioning its fleet to hybrid and/or electric vehicles, taking advantage of grant funding whenever possible. One MITS vehicle which should be transitioned to renewables in the immediate future is their forklifts. Though this may seem a negligible vehicle to focus on, MITS Bus staff have mentioned that the exhaust fumes from their forklifts are particularly problematic. While the transition of larger-scale diesel-powered and propane-powered public transportation fleets are being arranged, MITS Bus forklifts should be switched to alternative fuel models. Consider use of modulated all electric Danner equipment.

Whenever economically feasible, the Sanitary District's fleet of vehicles should be transitioned to CNG, hybrid, or electric vehicles to reduce emissions. Grants may be helpful in this endeavor.

1.3.12 Provide electric charging infrastructure

1.3.13 Provide electric charging stations in public parking lots

Research indicates that there are currently only eight charging stations within Muncie city limits. Ball State University owns six of those stations⁴¹ and the remaining two are in a hotel parking lot and Cadillac dealership⁴². The locations of these two other charging stations imply the need for an explicit reason to be on the premises; they are probably not truly public. Therefore, Muncie has no public E.V. charging stations. If the city wants electric vehicle ownership to grow in the city, it must install public charging stations or incentivize new developments to install public charging stations. This will reduce emissions in the city and support climate resiliency into the future.

Both Ball State University and Ivy Tech should add electric vehicle charging stations whenever financially possible, and in locations critical to cross-city movement.

1.3.14 Incentivize commercial properties to provide electric charging stations

1.3.15 Educate employees importance of no-idling habits

Government vehicles such as police and maintenance fleets may spend unnecessary amounts of time with the engine running. If a government employee is not actively using a vehicle to transport themselves, others, or materials, the vehicle should be turned off. Idling increases the total emissions from government vehicles. Because these emissions are indeed unnecessary, it would be prudent to discourage idling of government vehicles. One mechanism to do so might be a city-wide no-idling order, approved by both City Council and the Mayor, which would set up a series of minimal fines and/or write-ups for employees caught idling their vehicles.

If such an order is unsavory to the City of Muncie, a less aggressive anti-idling strategy can be taken. The city could run an anti-idling campaign for government vehicles which could involve a long-term component and a short-term component.

Long-term component:

- Bi-yearly emails defining idling, giving examples of it, discouraging it, and providing alternative solutions to idling (i.e. eating one's lunch inside instead of in a running government vehicle)

Short-term component:

- Six-month long intensive campaign (also seen in the Transportation section)

- Metal signs are posted in the parking lots of government buildings discouraging idling
- Government organizations/affiliates share an approved social media post discouraging idling, with detailed reasons why idling increases emissions and explaining what idling is
- No-idling fliers are made visible and available in all government offices, government meetings, and permit-required social events for the duration of the campaign
- An email is sent out at the beginning and end of the campaign to all government employees discouraging them to idle their vehicles, and with an email attachment with anti-idling educational materials
- Materials and promotions posted to the Muncie Climate Action Plan Facebook page

Section 1.4- WASTE MANAGEMENT

Goal: Reduce waste going to the landfill

1.4.1 Support efforts to increase diversion of recyclables

The Muncie Sanitary District is currently looking into a shift away from blue recycling bags and towards an additional all-recycling tote. This strategy would reduce waste from the blue bags themselves, but still needs resolution (logistically and financially). If feasible, this opportunity to reduce waste should be capitalized upon.

Out of the 21 locations which currently offer blue bags, only four are on the south side of Muncie. For south side residents without a personal vehicle, this makes it very difficult for them to access recycling resources. Efforts should be made to expand blue bag access to underserved areas of Muncie, such as the south and east sides.

The Sanitary District should consider offering financial incentives such as small discounts on wastewater services to residents who utilize blue bags. This discount might only take a portion of a percent off every month's bill if residents prove they took blue bags from pickup locations. This could be proved by scanning a QR code on blue bags, which would change every month. To alert patrons of blue bag locations to recycling opportunities, promotional posters could be distributed to each participating location for hanging above the blue bags. Furthermore, the Sanitary District should look into further educating its customers on the benefits of recycling and how to recycle properly. Proper recycling may increase if Sanitary District customers are emailed monthly with information concerning:

- Why recycling is beneficial for the environment and for the taxpayer
- How to properly recycle (do's and don'ts)

1.4.2 Partner with MSD to provide more comprehensive recycling program in City facilities

Muncie's government buildings do not currently recycle anything but shredded paper. This leaves all of the cardboard in city buildings unrecycled. If Muncie wants to lead by example and reduce unnecessary waste, it should partner with either the local Sanitary District (if it has the capacity) or a private recycling company to get recycling bins into government buildings. Bin should be clearly labeled as "recycling" with a uniform bag color, and instructional images should either be etched into the bins themselves or displayed on posters nearby; cardboard recycling should also be offered.

1.4.3 Support efforts to increase composting and the diversion of compostable material

If economically feasible, the Sanitary District should look into offering its own composting service to Muncie residents. A survey could be sent out to current customers polling about various aspects of the service, such as whether they would use a leaf/organic matter composting service and how much they would be willing to pay for the service. If feedback is promising, a small parcel of land could be purchased/rented to provide a pilot composting program for a select number of residents. This beta program could be run for six months to one year to test the program's effectiveness, profitability, and appeal. Over time, the operation's scope can be widened and eventually cover all of Muncie.

1.4.4 Support efforts to increase diversion of recoverables

Section 1.5- PARK AND GREENSPACE MANAGMENT

Goal: Increase efficiency of maintenance equipment and the landscape

1.5.1 Upgrade all maintenance equipment to electric or low-carbon renewable fuels

1.5.2 Replace gas-powered equipment with electric-powered equipment

1.5.3 Reduce acreage that is mowed

1.5.4 Establish native plants along the banks of White River and throughout underused areas in parks

Section 2 - Strategies to Mitigate and Adapt to Climate Change

Strategies for the overall community (including residential, commercial, and industrial sectors) are included in the Education & Outreach section

Section 2.1- TRANSPORTATION

Goal: Provide infrastructure to manage effects of climate change

2.1.1 Ensure all street reconstructions are built as Complete Streets including sidewalks/multi-modal trails, trees, and LID stormwater infrastructure

2.1.2 Establish clear policies that promote the use of bicycles, skateboards, and scooters for commuting

2.1.3 Amend City Code to remove ban on skateboards to allow as transportation on City infrastructure

2.1.4 Implement the Safe Routes to Schools Plan

2.1.5 Improve street infrastructure to be more resilient to freeze and thaw cycles

Section 2.2- LAND USE

Goal: Increase carbon sequestration

2.2.1 Protect and preserve large trees

2.2.2 Establish carbon sinks by creating additional wooded areas and wetlands

2.2.3 Partner with Red-Tail Land Conservancy to expand more conservation land trusts acquisitions

By partnering with the Red-Tail Land Conservancy on park acquisition and maintenance, the city can ensure that the natural areas are maximized, and vacant land is quickly appropriated by either the City of Muncie or the Land Conservancy itself. Their expertise is invaluable in: 1) determining the sorts of sites viable for natural areas or public parks, 2) successful implementation of years-long maintenance, and 3) legal success in retaining these properties throughout multiple sales (if an easement is purchased instead of the land deed itself).

2.2.4 Establish native plants along the banks of White River and throughout underused areas in parks

Muncie has a great number of vacant lots owned by the city or county which are currently covered by overgrown grass. This type of unattended weed growth does very little for Muncie's climate resiliency, but its replacement presents an opportunity; native and perennial plants could take its place. Native and perennial plants offer numerous environmental advantages over basic grass. Firstly, native habitats for

animals, other plants, and various other creatures can be partially restored by foregoing typical grass and planting their native grasses and plants⁴³. This might be most naturally (and simply) achieved in Muncie's vacant lands by planting biodiverse prairie grasses. The natural variety of long-rooted, short-rooted, tall, and short plants allows a wide range of other living species to support and live off the prairie⁴³. Secondly, native plants have the capacity to store carbon emissions. One acre of natural prairie grass can sequester one ton of carbon in its system (roots and soil) per year⁴³. Furthermore, the city would reduce its emissions by not having to mow the prairie grass. If aesthetics or some other factor rules out prairie establishment in Muncie, the replacement of regular grass with clover (as referenced in another strategy) would be a simple way to reduce mowing emissions.

Goal: Reduce heat island impacts (these strategies also mitigate stormwater impacts)

2.2.5 Recognize and include trees as vital infrastructure

2.2.6 Increase the city-wide canopy

2.2.7 Continue to plant diverse species of trees following completion of the "1000 Trees in 1000 Days" program

2.2.8 Include shade trees as a part of all streetscapes

2.2.9 Support redevelopment of older parking lots to include trees as established in the Corridor Development Standards

2.2.10 Increase the quality and quantity of greenspace within the community

2.2.11 Increase use of native vegetation

Goal: Encourage density and increased housing options

2.2.12 Support development of mixed-use projects that create live/work/play opportunities in walkable areas.

2.2.13 Incentivize in-fill development

2.2.14 Establish an urban growth boundary

Section 2.3- WATER AND WASTEWATER

Goal: Mitigate flood hazards and impacts

2.3.1 City should purchase all land in the 100-year floodplain to avoid unnecessary damage to private property

2.3.2 Prohibit construction of structures in the floodplain or increase the required height of structures in the floodplain above BFE from 2' to 3'

2.3.3 Expand floodplain management area to reflect a 500-year floodplain

Goal: Support the overall community from the impacts of flooding

2.3.4 Join FEMA's Community Rating System (CRS) for National Flood Insurance discounts to residents

Section 2.4- PUBLIC HEALTH AND SAFETY

Goal: Provide social infrastructure to manage effects on climate change

2.4.1 Provide accessible heating/cooling centers during extreme weather events

2.4.2 Provide parks with shade and water fountains within 1/4 mile of all residences

Section 2.5- ACCOUNTABILITY

An Environmental Sustainability Commission is not a universally defined term, but in Muncie’s case, it could represent either a committee (much like Planet Muncie) or single staff member whose main responsibilities would be the: monitoring of the plan’s progress, assessment of Muncie’s emissions (not daily, but on a regular basis), eventual updating of the plan, and answering of the public’s or government’s questions concerning Muncie’s climate resiliency. If the city wants to ensure that this plan makes a valuable impact in the community, there should be at least one staff member dedicated to its implementation.

Goal: Create an office of sustainability or a board with representation from applicable departments that will be responsible for:

2.5.1 Implement portions of the Climate Action Plan (including seeking grants and educational outreach)

2.5.2 Provide support for implementing the Climate Action Plan

2.5.3 Monitor and report on the City’s progress in reaching goals

2.5.4 Monitoring implementation of all strategies to ensure that they optimize benefits for disadvantaged peoples and groups

Muncie should ensure that all emissions reductions strategies specifically address underserved communities, or at least do not additionally burden them. It is understandable, for example, that increasing the number of charging stations at Ball State University may not specifically help underserved communities on the south side of Muncie. But because this strategy would not disadvantage those communities, it is an acceptable strategy. Over time, as the plan’s strategies are implemented and the plan itself is updated, it will be necessary to ensure the equity of all emissions reduction strategies.

Goal: Celebrate Successes

2.5.5 Establish an annual award to recognize local businesses that make considerable progress toward sustainability

The resolution which approved the development of this plan (Amended Resolution No.: 9-21) also authorized the creation of an “annual recognition awards program to acknowledge and encourage local businesses that demonstrate tangible action steps to be more sustainable and reduce their carbon footprint.”⁴¹ As of the writing of this plan, no formal awards program has been designed. In the formulation of this award and its standards, the City of Muncie could look to the research and publishing company Environmental Business International for guidance.⁴⁴ This organization has been operating for 32 years to provide CEOs, investors, lawmakers, policymakers, management firms, and businesses up-to-date information on new technologies, resources, and opportunities in the environmental and climate change industry.⁴⁴ Environmental Business International holds yearly Business Achievement Awards to award businesses which excel in climate change mitigation and environmental sustainability.⁴⁵ The organization prioritizes these qualities when choosing awards recipients:

- Conducts initiatives in climate change adaptation and resilience
- Conducts initiatives to reduce greenhouse gas emissions
- Invests in renewable or alternative energy sources

- Invests in renewable or alternative fuel sources
- Invests in “green buildings” or resource-efficient building structures and functions
- Supports carbon sequestering through the planting of trees
- Actively supports legislation which enables funding to climate change mitigation efforts, environmentally conscious governmental policies, and environmental education

2.5.6 Recognize businesses that achieve carbon neutrality

2.5.7 Recognize businesses whose facilities are LEED-certified and/or SITES-certified

2.5.8 Promote local environmental efforts through a monthly email newsletter

The Sanitary District should highlight local sustainability efforts in a monthly email newsletter. A deep analysis of organizations such as ScrapCycle—which offers and empties composting buckets to local residents free of cost⁴⁶—could be conducted every month, wherein one environmentally-focused organization could be highlighted monthly. This would provide exposure to local sustainability efforts and promote the expansion of these efforts.

2.5.9 Promote and support the work of local community leaders who both promote equity and environmental resilience

Wherever possible, community members’ work in both equity and environmental resilience should be promoted and supported. This should be done without favoritism and, if the City of Muncie is the supporting agency, with complete transparency to the public.

Section 3 - Education and Outreach – Community-focused strategies

Section 3.1- ENERGY

Goal: Increase renewable energy generation

3.1.1 Conduct a public information campaign encouraging upgrades to greener alternative energy sources (solar, wind, geothermal)

3.1.2 Promote community-wide solar education

Solarize ECI is a part of the state-wide nonprofit Solarize Indiana. The East Central chapter is comprised of a volunteer team that includes John and Carolyn Vann, Sheryl Swingley, and others. According to the nonprofit, they “provide interested individuals, businesses and non-profits with simple information about getting solar installations at a discounted price” and have access to a vetted solar panel installer⁴⁷. The company specifically focuses on explaining to residents:

- Personal and societal reasons to install solar panels
- How solar panels work
- How much energy they produce
- What kind of roofs can support solar panels
- How much it would cost Muncie residents to install solar panels, considering:
 - How long the panels need to “pay for themselves”
 - Net Metering
 - Federal Tax Credits

3.1.3 Support installation of on-site solar PV

3.1.4 Connect residents with solar panel companies

The City of Muncie could add a page to their website where local solar panel companies are encouraged to apply for participation. Once applications are approved, they would be able to link their own websites and contact information, as well as provide a blurb of information about their services. This could also be promoted on the Muncie Climate Action Plan Facebook page.

3.1.5 Promote identification and pursuit of energy grants and funding

Section 3.2- Built Environment

Goal: Increase energy efficiency of structures and accessories

3.2.1 Inform residents about opportunities to conduct energy audits

Energy audits are multi-step process best done by a professional³⁷, but basic analyses can be conducted by residents. By starting the energy audit process, residents can increase their understanding of energy inefficiencies and may be able to fix blatant inefficiencies without calling a professional. The basic process of an energy audit includes:

- Locating air leaks
- Insuring proper ventilation
- Checking insulation levels
- Inspecting heating and cooling equipment
- Examining light bulbs for replacement or upgrade to LEDs
- Estimating energy use of appliances

As previously mentioned in the other public information campaign strategy, this information could be disseminated through mass-emails, mailed pamphlets, city council meetings, public meetings, and through the newly created Muncie Climate Action Plan Facebook page.

3.2.2 Conduct a public information campaign encouraging upgrading appliances to greener alternatives

Such appliance alternatives could include Energy Star appliances. An appliance is qualified as Energy Star if it meets the EPA's or USDOE's strict energy efficient criteria³⁹. This information could be disseminated through mass-emails, mailed pamphlets, city council meetings, public meetings, and through the newly created Muncie Climate Action Plan Facebook page.

3.2.3 Connect the public with incentives to promote replacement of heating and cooling equipment.

Goal: achieve 250 households replacing equipment annually

3.2.4 Promote state and federal weatherization programs

Weatherization programs typically fund the assessment and partial updating of low-income homes' energy efficiency⁴⁸. For more information on the specifics and for who qualifies, see the Funding Sources section of this plan.

3.2.5 Encourage BSU to raise its current LEED Silver certification goals to at least LEED Gold

Section 3.3- TRANSPORTATION

Goal: Decrease vehicle miles traveled

3.3.1 Conduct a public information campaign to promote use of public transportation

3.3.2 Conduct a public information campaign to promote alternatives to typical commuting habits including bicycling, walking, and carpooling

Goal: Increase efficiency of vehicles and driving habits

3.3.3 Conduct a public information campaign to encourage upgrading vehicles to electric, hybrid, or low-carbon renewable fuels

3.3.4 Conduct a public information campaign to encourage no-idling habits

Muncie is home to many personal and business vehicles which may unnecessarily idle. While police enforcement of a no-idling order on residents would likely be impossible (and very likely not accepted by the public), a public campaign discouraging idling may work as a tactic. This no-idling campaign would concern educational outreach to residents. It is recommended to replicate the campaign outlined in 1.3.15 with the focus on the public instead of government employees.

Section 3.4- WASTE MANAGEMENT

Goal: Reduce waste going to the landfill

3.4.1 Conduct a public information campaign to encourage recycling and composting

3.4.2 Encourage BSU and Ivy Tech to engage in campus-wide recycling programs

While Ball State already has a recycling network across campus, it is not well labeled or marketed; Ivy Tech has no paper recycling program. The two institutions could collaborate on a joint recycling system which uses the same recycling-pickup company. Because Ball State is a large institution, it may have the resources to partially finance Ivy Tech's portion of the recycling program. Together, the colleges could commit to:

- Uniform bag colors
- Bins clearly labeled as "recycling"
- Images on/above the bins explaining exactly what can/cannot be recycled

Section 3.5- GREENSPACE MANAGEMENT

Goal: Increase efficiency of maintenance equipment

3.5.1 Conduct public information campaign to encourage upgrades to maintenance equipment to electric

Goal: Reduce heat island impacts

3.5.2 Conduct a public information campaign to protect trees and encourage planting appropriate tree species in sustainable locations

Goal: Mitigate flood hazards and impacts

3.5.3 Conduct a public information campaign concerning flood hazards and impacts

Goal: Reduce stormwater impacts

3.5.4 Conduct a public information campaign concerning stormwater impacts

3.5.5 Conduct a public information campaign concerning ways to safely slow stormwater runoff with rain gardens and other low impact development options

3.5.6 Reduce areas that are mowed

3.5.7 Conduct a public information campaign to encourage replacing some lawn areas with native plants and rain gardens

Goal: Support the overall community from the impacts of flooding

3.5.8 Conduct a public information campaign concerning flood insurance

Section 3.6- HEALTH & SAFETY

Goal: Provide social infrastructure to manage effects of climate change

3.6.1 Conduct a public information campaign concerning the dangers of extreme weather, locations of heating/cooling centers, and how to recognize and help people in danger from weather-related illness (including heat stroke and frostbite)



Photographs, above- Williams, Heather. "Riverside-Normal City Neighborhood Tree Planting, 2021."

Conclusion

Grants and Funding

Bipartisan Infrastructure Bill

Alternative Fuels Data Center Rates and Rebates

Biodiesel Price Preference

The Community Recycling Grant Program

Community & Urban Forestry Assistance (CUFA) Grant

Community Rating System

Brownfields Multipurpose Grants

Brownfields Assessment Grants

Brownfields Cleanup Grants

Brownfields Revolving Loan Fund (RFL) Grants

Brownfields Job Training (JT) Grants

Energy Savings Tax Credit (Corporate)

Renewable Energy Tax Credits

Indiana's Solar Rebates and Incentives

Interlocal Community Action Program (ICAP)

Bipartisan Infrastructure Bill

How the bill funds climate change adaptation⁴⁹:

- Federal Grant:
 - Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT) Program: \$8.7 billion

PROJECT Program

The new PROTECT Program will allocate \$7.3 billion in funding to states and \$1.4 billion in grants for funding of more resilient infrastructure, including the movement of infrastructure away from high-risk areas (i.e. along waterways which may flood).

How the bill funds environmentally friendly, and equitable transportation⁴⁹:

- Federal Grant:
 - Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants: \$15 billion for local/regional transportation projects which specifically target areas historically disadvantaged and in persistent poverty

How this bill funds environmentally-friendly transportation⁴⁹:

Over five years, this bill will give Indiana:

- \$673 million to fund public transportation
- \$156 million to reduce emissions from transportation
- \$100 million to fund E.V. charging stations
- Federal Grants:
 - Charging and fueling infrastructure discretionary grants: \$2.5 billion for E.V. charging infrastructure
 - FTA Grants for Buses and Bus Facilities Program⁵⁰: \$375 million for the purchase/rehabilitation of buses and related equipment and facilities, including zero/low-emission vehicles/facilities
 - FTA Low and No Emissions Bus Programs⁵¹: \$1.1 billion for acquisition of zero/low-emission transit buses and the necessary facilities to support them

Charging and fueling infrastructure discretionary grants

Charging and fueling infrastructure discretionary grants⁵² fund the strategic placement/purchasing of “electric vehicle charging infrastructure and other alternative fueling infrastructure along designated alternative fuel corridors”⁵². A minimum of 50% of the funding must prioritize access to this infrastructure for low-to-moderate-income residents, places with few private parking spaces, and rural areas.

FTA Grants for Buses and Bus Facilities Program

The Federal Transit Authority (FTA) Grants for Buses and Bus Facilities Program⁵⁰ is part of a federal grant program for Fiscal Year 2022 aimed at establishing and improving bus transit fleets across the country. This particular grant program draws from \$375 million in funding to support the replacement of, rehabilitation of, or purchase of zero-to-low-emission buses and their necessary equipment and facilities. Eligible applicants include states, local governments, Indian tribes, private nonprofit organizations, and certain other applicants, all of whom must run a fixed-route bus operation. Up to 0.5% of a funding request can cover workforce training for the applicable buses and equipment, while an additional 0.5% may fund training at the National Transit Institute. If part or all of the requested funding is for zero-emission vehicles, the applicant must spend 5% of the funding on workforce development and training and the applicant must create a Zero-Emission Transition Plan. This grant will fund 80-90% of the project's cost, which must be completed within four years.

FTA Low and No Emissions Bus Programs

The Low or No Emission Vehicle Program⁵¹ is a \$1.1 billion federal grant program for Fiscal Year 2022 aimed at establishing and improving bus transit fleets across the country. This particular funding program offers financial support to state and local governments for the purchase and/or lease of zero-to-low-emission buses and the creation/acquisition of facilities to support them. Specifically, according to the Federal Transit Administration's website, this program funds:

- “purchasing or leasing low- or no-emission buses
- acquiring low- or no-emission buses with a leased power source
- constructing or leasing facilities and related equipment (including intelligent technology and software) for low- or no-emission buses
- constructing new public transportation facilities to accommodate low- or no-emission buses
- rehabilitating or improving existing public transportation facilities to accommodate low- or no-emission buses”

This grant will fund 85-90% of the project's cost. Just as with the Grants for Buses and Bus Facilities Program, up to 0.5% of a funding request can cover workforce training for the applicable buses and equipment, while an additional 0.5% may fund training at the National Transit Institute. If part or all of the requested funding is for zero-emission vehicles, the applicant must spend 5% of the funding on workforce development and training and the applicant must create a Zero-Emission Transition Plan. The project must be completed within four years. Eligible applicants include states, local governments, Indian tribes, and certain other applicants.

How the bill will fund nature initiatives⁴⁹:

- Federal Grant:
 - Reconnecting Communities Pilot Programs: \$1 billion

Reconnecting Communities Pilot Programs

The new Reconnecting Communities Pilot Programs will fund local and state governments', metropolitan planning organizations', and tribal governments' efforts to establish and maintain parks. This program also funds other improvements not directly related to nature (i.e. city planning, city design, demolitions, and other infrastructure projects).

Alternative Fuels Data Center Rates and Rebates

- Diesel Vehicle Retrofit and Improvement Grants
- Compressed Natural Gas (CNG) Tax Credit
- Medium and Heavy-Duty Grant Program
- Alternative Fuel Vehicle (AFV) Inspection and Maintenance Exemption
- Electric Vehicle Supply Equipment (EVSE) Rebate - Indiana Michigan Power
- Plug-In Electric Vehicle (PEV) Time-Of-Use (TOU) Rate - Indiana Michigan Power

Diesel Vehicle Retrofit and Improvement Grants

Diesel Vehicle Retrofit and Improvement Grants⁵³ are administered by the Indiana Department of Environmental Management (IDEM). The program offers grants between \$50,000 to \$750,000 for Indiana projects which reduce diesel emissions. Applicants can be private or public entities, so long as the equipment being funded serves the public (including private buses and sanitation buses). Potential projects include, but are not limited to:

- Replacing or transferring a current diesel-running bus or component with one that runs on alternative fuels
- Installing exhaust retrofits
- Installing idle reduction technologies
- Installing aerodynamic technologies

- Installing low rolling resistance tires

Compressed Natural Gas (CNG) Tax Credit

According to the US Department of Energy website, the Compressed Natural Gas (CNG) Tax Credit⁵⁴ stipulates that a “carrier operating a commercial CNG vehicle on any Indiana highway may claim a credit equal to 12% of the road taxes imposed on its CNG consumption in the previous calendar quarter. The credit is refundable. (Reference Indiana Code 6-6-4.1-1 and 6-6-12).”

Medium and Heavy-Duty Grant Program

The Medium and Heavy-Duty Grant Program⁵⁵ is administered by the Indiana Department of Environmental Management (IDEM). The program dedicates part of the Volkswagen (VW) Environmental Mitigation Trust funds to the replacement or refurbishment of certain on-road and off-road vehicles and equipment. While this fund does not specifically apply to alternative fuel vehicles, it does permit their funding so long as the necessary fueling infrastructure is identified. The EPA must certify all the following vehicles and equipment which are eligible for funding:

- Class 4-8 trucks
- Class 4-8 school, shuttle, and public transit buses
- Airport ground support equipment
- Ferries
- Forklifts
- Port cargo handling equipment
- Freight-switcher locomotives.

Alternative Fuel Vehicle (AFV) Inspection and Maintenance Exemption

According to the US Department of Energy website, the Alternative Fuel Vehicle (AFV) Inspection and Maintenance Exemption⁵⁶ stipulates that “dedicated AFVs are exempt from inspection and maintenance requirements if they operate exclusively on natural gas, propane, ethanol, hydrogen, or methanol. (Reference 326 Indiana Administrative Code 13-1.1).”

Electric Vehicle Supply Equipment (EVSE) Rebate - Indiana Michigan Power

According to the US Department of Energy, the Electric Vehicle Supply Equipment (EVSE) Rebate from Indiana Michigan Power (the power supplier for Muncie, IN) offers “commercial, fleet, and multi-unit dwelling customers a rebate of \$250 per Level 2 EVSE port installed or five years' worth of revenue credits to apply against construction costs of new business facilities to serve newly installed EVSE”⁵⁷. After the limited supply of incentives are claimed, this rebate will not accept further applications.

Plug-In Electric Vehicle (PEV) Time-Of-Use (TOU) Rate - Indiana Michigan Power

The Plug-In Electric Vehicle (PEV) Time-Of-Use (TOU) Rate from Indiana Michigan Power applies to customers who own an electric vehicle⁵⁸. Owning a qualified PEV permits a customer to charge their vehicle using more expensive energy during peak energy use periods and less expensive energy during low energy use periods. This may require that a customer install a metering system which can track building energy use and PEV energy use separately.

Biodiesel Price Preference

According to the US Department of Energy website, educational institutions (and other select entities) are entitled to a 10% price preference on transportation fuels which are either⁵⁹:

- 20% biodiesel by volume, or
- Primarily derived from biological materials

The Community Recycling Grant Program

The Community Recycling Grant Program funds educational institutions’, government entities’, and nonprofits’ efforts to increase recycling and waste reduction up to \$100,000 (with a 25% cash cost-share)⁶⁰. Applicants’ projects must complete one or more of the following goals:

- Establish or increase a recycling, composting, or other type of waste-reduction program
- Establish a new permanent waste-reduction service which either:
 - o Collects a new waste material, or
 - o Services a new area
- Increase efficiency of existing waste-reduction services

Community & Urban Forestry Assistance (CUFA) Grant

The CUFA grant funds the following urban forestry projects in Indiana⁶¹:

- Tree Inventory or Urban Tree Canopy Assessment.....\$1,000 - \$20,000
- Management/Response Plan.....\$1,000 - \$8,000
- Education/Training.....\$1,000 - \$5,000
- New Tree Planting.....\$1,000 - \$10,000
- Community Education/Awareness Events.....\$1,000 - \$5,000

The funding must be matched 1:1 by the applicant using cash, in-kind donations, or a mix of both. Eligible applicants include local governments and 501(c)(3) non-profit organizations, but only one applicant per community may be awarded this grant in a given year. Once accepted, the applicant must agree to arrange the implementation of every aspect of the grant themselves.

Community Rating System

This FEMA program⁶² provides discounts on National Flood Insurance premium rates to participating communities. Municipalities that wish to participate earn points towards flood insurance discounted rates based on a 10-class rating system. Communities can earn points in 19 different activities, which can be organized into the following categories:

- Public Information
- Mapping and Regulations
- Flood Damage Reduction
- Warning and Response

Examples of activities and their possible points include:

- Hazard Disclosure 14-80 points
 - o Wherein real estate agents disclose the flood hazard status of the property to potential buyers
- Flood Data Maintenance.....115-222 points
 - o Food and property-related flood data is kept meticulously
 - o Base maps are kept up to date
 - o Elevation reference marks are monitored and updated
- Acquisition and Relocation.....195-2,250 points
 - o Buildings prone to floods are acquired by the government to be removed from the floodplain
- Flood Warning and Response.....254-395 points
 - o Flood warnings are made early to the public
 - o Government flood response is detailed and pre-planned

Currently, residents of a CRS-rated community will receive greater discounts if they are within a Special Flood Hazard Area (SFHA). This area is defined as the likely region impacted by a once-in-100-year flood

and appears on FEMA floodway maps. Changes are currently being made to the program to eliminate the differences in discounted rates between the SFHA area and non-SFHA area. Figure 94 shows the current CRS classes, the credit points to qualify for that class, SFHA discounted rates, and non-SFHA discounted rates.

CRS Credit Points, Classes and Premium Discounts			
Credit Points	Class	Premium Reduction SFHA*	Premium Reduction Non-SFHA**
4,500+	1	45%	10%
4,000 - 4,499	2	40%	10%
3,500 - 3,999	3	35%	10%
3,000 - 3,499	4	30%	10%
2,500 - 2,999	5	25%	10%
2,000 - 2,499	6	20%	10%
1,500 - 1,999	7	15%	5%
1,000 - 1,499	8	10%	5%
500 - 999	9	5%	5%
0 - 499	10	0%	0%

Figure 24: National Flood Insurance premium cost reductions by credit points earned

This yearly program offers Indiana homeowners up to 75% off the price of constructing/installing a FEMA-approved tornado safe room or shelter⁶³. The 2022 fund has a total of \$115,000 to offer homeowners. Some of the stipulations include:

- Applicant must own the home where the safe room/shelter is being constructed
- It must not be built in a floodplain
- Reimbursements are capped at \$5,000
- Applicants must pay a minimum of 25% of the cost of the project

FEMA Building Resilient Infrastructure and Communities Gran Program

This yearly program offers Indiana homeowners up to 75% off the price of constructing/installing a FEMA-approved tornado safe room or shelter⁶³. The 2022 fund has a total of \$115,000 to offer homeowners. Some of the stipulations include:

- Applicant must own the home where the safe room/shelter is being constructed
- It must not be built in a floodplain
- Reimbursements are capped at \$5,000
- Applicants must pay a minimum of 25% of the cost of the project

Brownfields Multipurpose Grants

Multipurpose (MP) Grants provide funding for the assessment and cleanup of a specific CERCLA § 101(39) defined brownfield site⁶⁴. Up to \$800,000 can be applied for, though applicants must pay a \$40,000 cost share (similar to an insurance premium). This does not need to be paid directly, but could come in the form of services, labor, or materials. Applicants must have the ability to perform all the necessary assessment activities and/or cleanup activities required for said site; this grant does not provide access to labor or expertise, only the funds to pay said labor and experts. Once an applicant knows they can complete these tasks, their application

must outline how the grant funds will—according to the EPA—result in at least:

- “one Phase II environmental site assessment;
- one brownfield site cleanup; and
- an overall plan for revitalization of one or more brownfield sites, if there is not already a plan in place”⁶⁴

Finally, it is important to note that the assessment and/or cleanup must be carried out within five years of the project’s start.

Brownfields Assessment Grants

Assessment Grants provide funding for the assessment of a specific CERCLA § 101(39) defined brownfield site⁶⁵. According to the EPA, these grants fund the following activities related to brownfield sites:

- Inventorying
- Characterizing
- Assessing
- Conducting of planning activities
- Developing site-specific cleanup plans
- Conducting community involvement

Two different types of assessment grants may apply to Muncie: community-wide assessment grants and site-specific assessment grants. Community-wide grants allot up to \$500,000 for use on more than one brownfield site in the community. Site-specific grants allot up to \$200,000 for use on only one brownfield site in the community, though a request can be made for this limit to be raised to \$350,000. The project completion time limit for both of these grants is three years.

Brownfields Cleanup Grants

Cleanup Grants provide funding for the cleanup of specific CERCLA § 101(39) defined brownfield sites⁶⁶. The applicant must own these sites. Up to \$500,000 is allotted for cleanup activities, though on an extremely limited basis, this limit can be raised to \$650,000 if there is only one site being applied for. The cost-share of the grant is 20% and can be paid with finances or the equivalent cost of labor, materials, or services. Only one application can be submitted per competition cycle and the project must be completed within three years.

Brownfields Revolving Loan Fund (RFL) Grants

Revolving Loan Fund (RLF) Grants enable communities to borrow funds for the cleanup of local brownfield sites so long as those communities lend out to other loan applicants⁶⁶. An applicant comprised of one or more entities may apply for up to \$1,000,000 to address local brownfield sites. But there are stipulations to this offer:

- Only applications who do not have an open Brownfields RLF cooperative agreement can apply for funding
- The applicant must be able to commit finances to the Revolving Loan Fund for many years, and possibly decades. This enables the program to truly work as a “revolving” fund, instead of a one-time fund
- Applicants must be willing and able to follow program reporting requirements even past the date of the RFL closure
- Applicants must understand how loan processes function legally and how to conduct credit analysis
- Applicants must be able to market the RFL program during their use of the program and after it has closed
- All monies within the applicant’s RFL fund (assuming they join the program) must be returned to the EPA once the program is finished, and this termination of their involvement must be initiated by the applicants themselves

Brownfields Job Training (JT) Grants

Formerly called the Environmental Workforce Development and Job Training Program, the Brownfield Job Training Grant Program funds nonprofits, local governments, and other organizations up to \$200,000 per project to train and employ low-income/unemployed residents affected by brownfield sites⁶⁷. The end goal is to prepare these residents for full-time employment in the environmental field, and potentially the brownfield remediation sub-field.

Energy Savings Tax Credit (Corporate)

Indiana Code § 6-3.1-31.5 sets up the Energy Savings Corporate Tax Credit Program⁶⁸. This program applies to business entities which install Energy Star certified appliances such as water heaters, programmable thermostats, furnaces, central air conditioners, and room air conditioners. Businesses can be awarded up to \$100 per year for the installation of these appliances.

Renewable Energy Tax Credits

The Consolidated Appropriations Act of 2021 permitted the acquisition of tax credits for geothermal heat pumps, small residential wind turbines, solar energy systems, fuel cells (residential fuel cells and microturbine systems), and biomass fuel stoves⁶⁹. The exact specifications and capacities of these renewable energy sources vary, but they all share the same step-down tax credit categories:

- 30% for systems placed in service by 12/31/2019
- 26% for systems placed in service after 12/31/2019 and before 01/01/2023
- 22% for systems placed in service after 12/31/2022 and before 01/01/2024

Indiana’s Solar Rebates and Incentives

- Net metering in Indiana
- Renewable energy property tax exemption
- Indiana sales tax exemption
- The federal solar tax credit
- Investment Tax Credit

Net metering in Indiana

Net metering⁷⁰ in Indiana applies to solar energy systems producing less than one megawatt (MW) of energy. The solar incentive works by sending any excess electricity produced by one’s solar unit (that is, any energy produced that not already used to power their business) back into the grid. In return for this energy, the “grid” gives the resident financial credits on their energy bill.

Renewable energy property tax exemption

The renewable energy property tax exemption⁷⁰ applies to the added value to one’s property from a solar PV system. It is assumed that a solar PV system will increase one’s property value, but including the expected increase in property taxes resulting from the higher assessed home value would dissuade residents from adding solar units to their properties. Therefore, to incentives solar adoption, any solar PV system’s assessed value will not be included in the value of one’s property for property tax purposes.

Indiana sale tax exemption

The Indiana sales tax exemption⁷⁰ permits a purchaser of a solar energy system to not pay sales tax for the solar modules, racking, or inverters of said system.

Investment Tax Credit

The Investment Tax Credit⁷⁰ (otherwise known as the federal solar tax credit) allows an Indiana resident to

pay 26% less on their PV solar energy system if they 1) buy their system outright and 2) have a certain level of income. This percentage reduces to 22% in 2023 and is not available after that year. As a special perk to businesses, accelerated depreciation can also be applied to their solar panels (along with the federal solar tax credit).

Interlocal Community Action Program (ICAP)

- Energy Assistance Program
- Weatherization Program

Energy Assistance Program

The ICAP Energy Assistance Program⁴⁸ is a federal program which pays a portion of a low-income household's heating bill during the expensive winter months. In order to apply, household income may not exceed the amounts shown in Figure 25. If the applicant is accepted, this program prevents utility disconnection until March 15th of that program year. The funding is available from November-May of each year (or until funding is depleted). This only applies to regulated utilities.

Household Size	Last 3 Months Household Income Must NOT EXCEED
1	\$6,489
2	\$8,457
3	\$10,482
4	\$12,480
5	\$14,478
6	\$16,473
7	\$16,848
8	\$17,223

Figure 25: Eligible household income limits (ICAP)

Weatherization Program

The ICAP Weatherization Program⁴⁸ serves low-income residents in six Indiana counties: Delaware, Henry, Hancock, Rush, Johnson, and Shelby. Once accepted, Community Action Agency (CAA) crews and contractors will evaluate the applicant's home on the basis of its energy efficiency. The hopeful result of this program is to reduce energy costs in low-income homes. To qualify, your household must:

- Have a gross annual income of (max.) 200% of the federal poverty level
- Have at least one member belonging to one of the following groups:
 - o 60+ years old
 - o 18 years or younger
 - o Disabled (SSI income)

It is important for applicants to note that this is not a quick process and does not fund repairs to roofs, floors, mold removal, or other rehab items. The Weatherization Program evaluates a home's energy efficiency based on numerous factors, some of which being:

- Indoor air quality
- Carbon monoxide
- Combustion safety
- Mold infestations

Monitoring and Reporting

In accordance with city Resolution No.: 9-21, which enabled the drafting of this first Resilient Muncie Climate Action Plan, this document must be updated every three years. These regular updates will serve to both monitor and report the plan's progress. It is advisable that either a dedicated government planning staff member or local university student studying an affiliated field be commissioned with this report every three years. Under the Government Energy section of this plan, a strategy suggested creating a sustainability commission or officer which might be useful for this purpose. This entity or person would be tasked with including the following in the updated report:

1. An updated Greenhouse Gas Inventory to note our progress (or lack thereof)
2. An inventory and analyzation report detailing the city's emissions reduction progress and city-wide resiliency status. This information could be gathered by meeting with local government agency representatives (i.e. from the Sanitary District, MITS Bus, and the planning department)
3. An assessment of what must be done in the future

Closing Statement

Through the adoption and implementation of this Resilient Muncie Climate Action Plan, the City of Muncie can ensure a stable and prosperous future for its residents. The plan's strategies will address the changing environment head-on and reinforce the notion that climate change is not out of our control. It is not the sole purview of large government or corporate entities to save this planet. The acceptance of and reaction to climate change is the responsibility of all people because it effects all people. Make no mistake, this transition will not be easy. The implementation of these emissions reduction strategies will take time and continued dedication. But, considering the costs of inaction, they will surely be worth it.

Notes

- 1: City of Muncie Amended Resolution NO.: 9-21, April 5, 2021, https://www.cityofmuncie.com/egov/documents/1617736482_70842.pdf
- 2: “Climate Change Evidence: How Do We Know?”, NASA, updated April 18, 2022, <https://climate.nasa.gov/evidence/>
- 3: “Scientific Consensus: Earth’s Climate Is Warming”, NASA, updated April 18, 2022, <https://climate.nasa.gov/scientific-consensus/>
- 4: Graph Showing That CO2 Has Increased Dramatically since the Industrial Revolution Compared to Paleoclimatologic (Past Climate) Measurements over the Past 800,000 Years, n.d., online image, NASA Climate, <https://climate.nasa.gov/evidence/>
- 5: “The Causes of Climate Change”, NASA, updated April 18, 2022, <https://climate.nasa.gov/causes/>
- 6: [Historical production of fossil energy from 1800 to 2010, divided into coal, oil and gas], n.d., online image, Research Gate, https://www.researchgate.net/figure/Historical-production-of-fossil-energy-from-1800-to-2010-divided-into-coal-oil-and-th_fig1_231240674
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Community Survey

Planet Muncie polled 100 community members about what they'd like to see the Resilient Muncie Climate Action Plan accomplish. This was conducted through a Google Forms survey ran from February 2022 to May 2022, which the Planet Muncie committee distributed through word-of-mouth, fliers placed around the Ball State campus, promotion at the March 2022 Muncie neighborhood association IDEA Conference, and inclusion in the April Muncie Action Plan Newsletter.

The survey asked 14 multiple choice questions, two short answer questions, and seven demographics questions (see Figures 1-19). One question titled "Please check only the top five measures you'd like to see enacted, ranked one (lowest priority) to five (highest priority)" is not included in this analysis because the Google Forms question structure chosen was inadequate to gather correct data. Instead, see Table 1 for a better representation of the desired data. The responses to the two short-answer questions are summarized below:

How would you suggest Muncie become more resilient and reduce its carbon footprint?

Most respondents promoted city use/promotion of alternative sources of energy such as solar, geothermal, and wind. They suggested that the many large brownfields in Muncie could be used for solar energy generation. Others suggested the city take a legal strategy of environmentalism, enforcing such policies as requiring:

- a single-use plastic bag cost/tax
- businesses to recycle
- restaurants to compost
- consideration of multi-mobility access in new developments
- alternative energy solutions for new construction
- internalized city power generation away from the grid; solar and wind energy

Finally, the respondents heavily favored improving existing sidewalk and biking infrastructure, the installation of public E.V. charging infrastructure, and adding more greenspace.

Do you have any other comments or information you'd like to share?

Most of these responses were similar to the previous short-answer question:

- improve sidewalks
- use cleaner energy
- educate the public on reducing carbon emissions
- focus on park improvement
- ensure there are enough workers and resources to plant Muncie trees
 - (this respondent approved of Muncie's "1000 trees in 1000 days" project but didn't think the city had the staff to implement it)
- ensure city-wide recycling capability (especially in apartments)
- emphasize biodiversity where possible

Similar to the short answer questions, Table 5's question "Check all environmental measures you'd like to see Muncie enact" revealed respondents' preferences for Climate Action Plan strategies. The respondents could choose from 16 different environmental strategies (see Table 5). The top five most voted strategies were:

1) Update sidewalk infrastructure	86.9%
2) Plant more trees	73.7%
3) Connect residents with energy-saving programs	72.7%
4) Add solar panels to public facilities	68.7%
5) Reduce bus fare for low-income residents	60.6%

These results indicate that a focus on making Muncie more livable is paramount. If Muncie can implement emissions reduction strategies which cater to both everyday needs—such as adequate sidewalks, plentiful shade, and reasonable bus prices—while also reducing emissions and increasing climate resiliency, Muncie residents will be supportive of this plan. Furthermore, and essential to the long-term success of this plan, Muncie residents overwhelmingly support an office of sustainability or designated sustainability officer (see Figure 1). This designation is a flexible one, but would surely entail: 1) tracking Muncie emissions over time, 2) implementation of emissions reduction strategies, and 3) assessing current resiliency progress and planning to increase city-wide climate resiliency.

Check all environmental measures you'd like to enact:	
100 people responded, % that supported measures:	
1. Add more MITS bus routes and hours of operation	50%
2. Add more MITS buses	31%
3. Add more parks	53%
4. Add more public electric vehicle charging stations	45%
5. Add more solar panels to public facilities	68%
6. Adopt anti-idling campaign	30%
7. Connect residents with energy-saving programs	73%
8. Connect residents with home weatherization programs	58%
9. Convert city vehicles to electric	49%
10. Emphasize more roundabouts and fewer traffic lights	47%
11. Establish a Muncie Conservation Corps to provide experience and training to youth and young adults while improving the urban landscape	55%
12. Offer composting for homeowners	58%
13. Plant more trees	74%
14. Reduce bus fare for low-income residents	60%
15. Remediate existing brownfields	55%
16. Update bike lane infrastructure	59%
17. Update sidewalk infrastructure	87%

Table 1

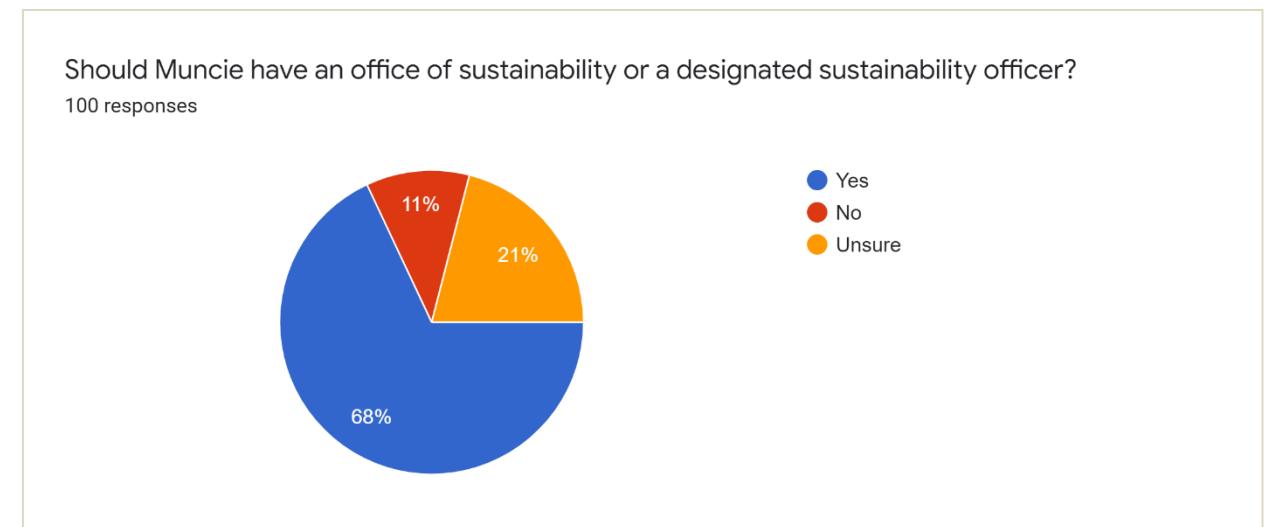


Figure 1

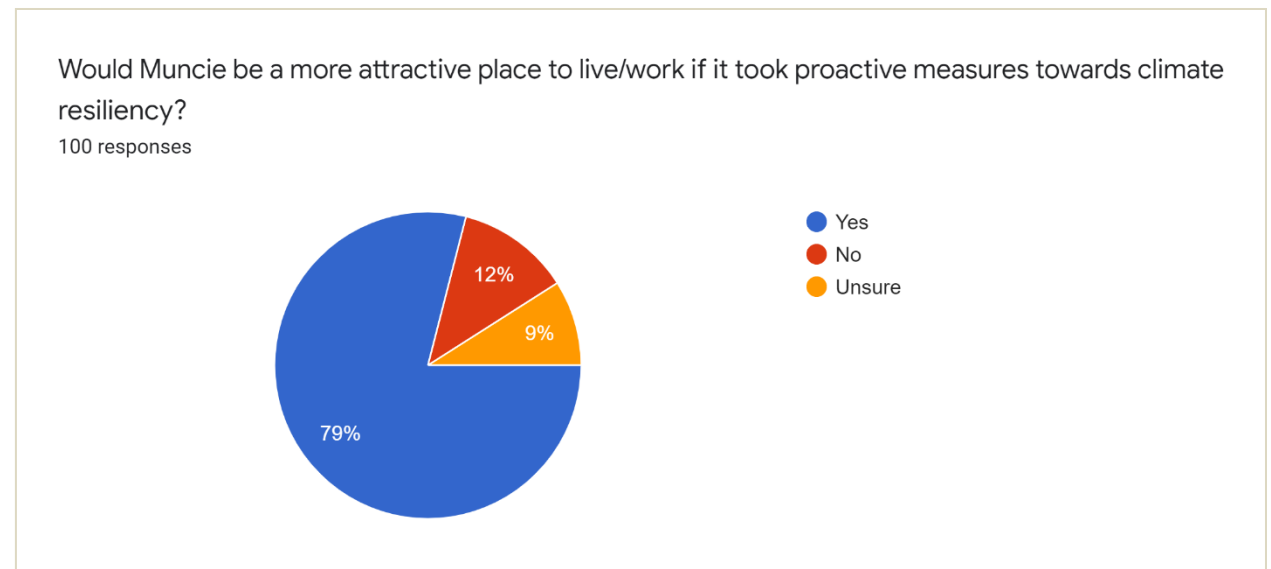


Figure 2

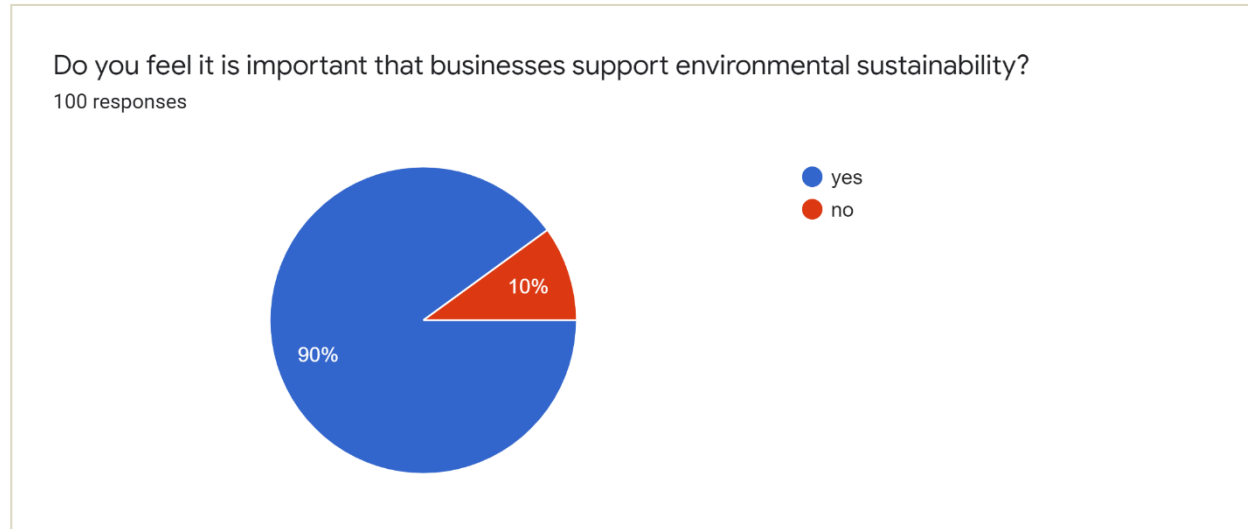


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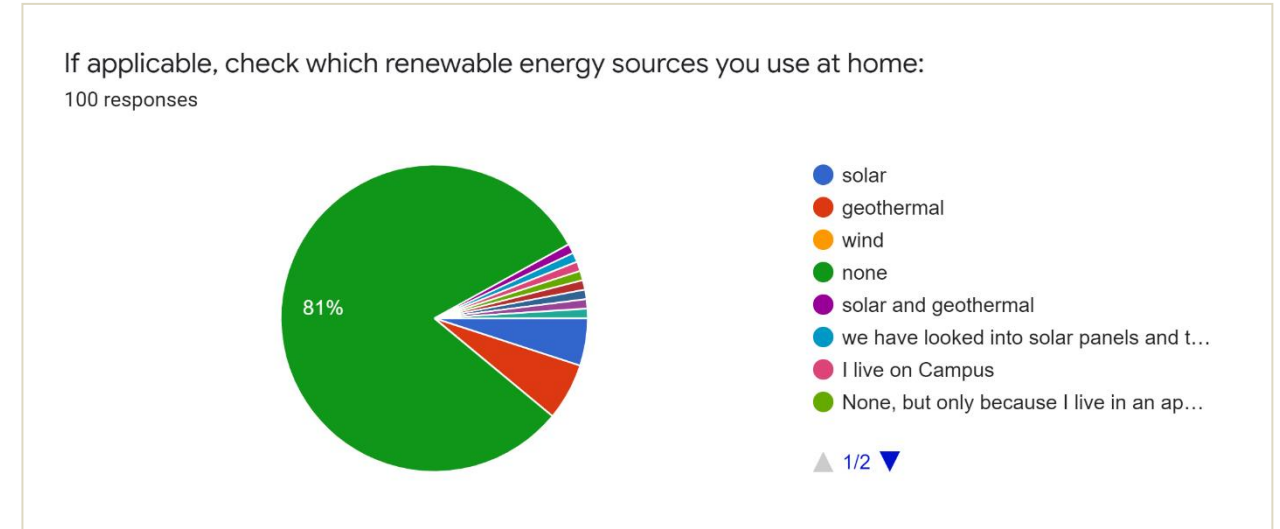


Figure 6

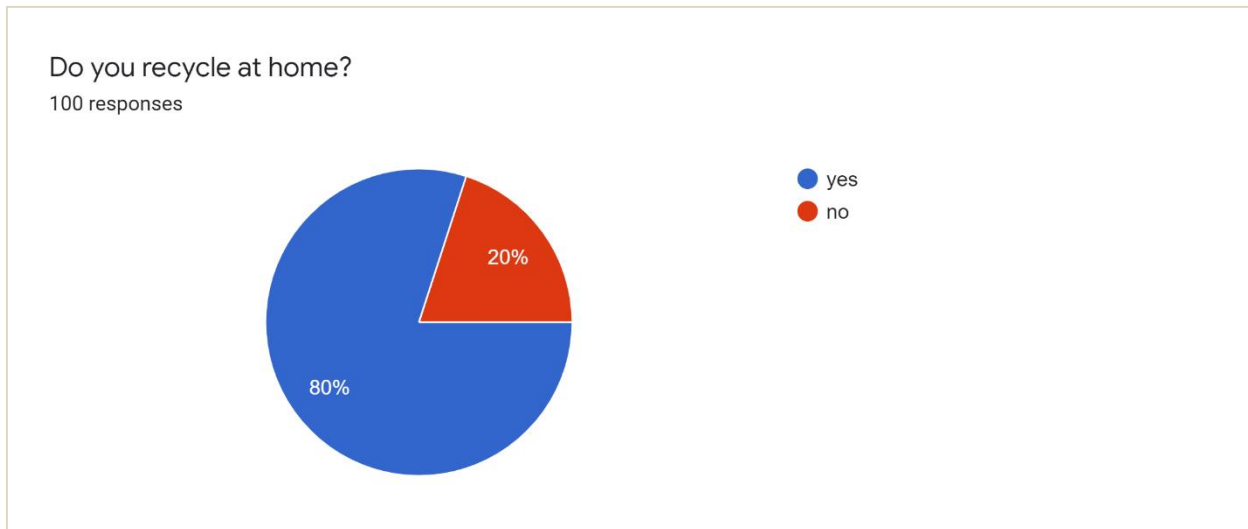


Figure 4

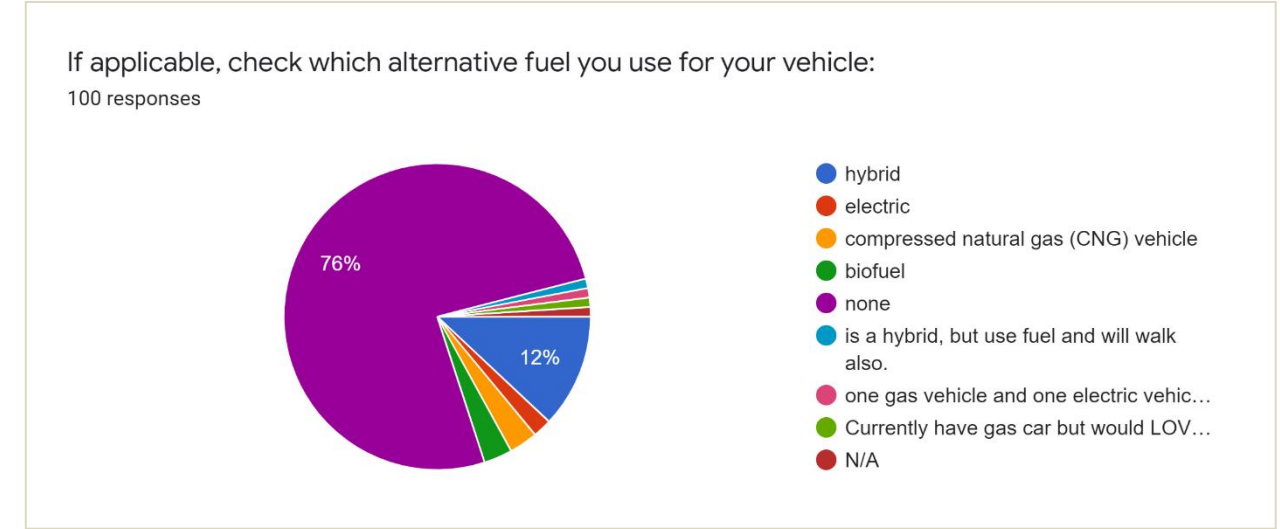


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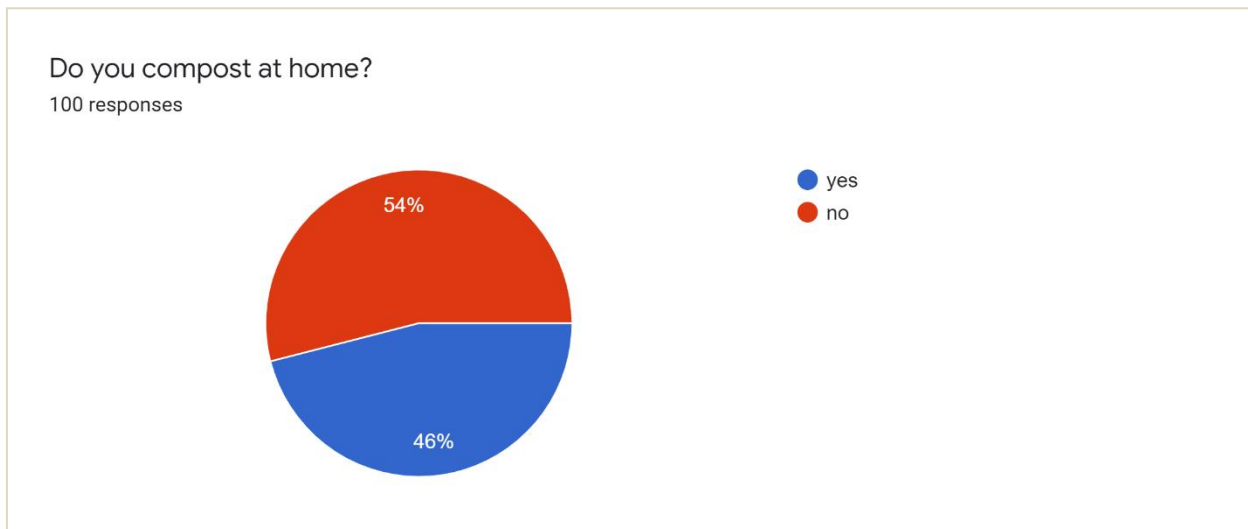


Figure 5

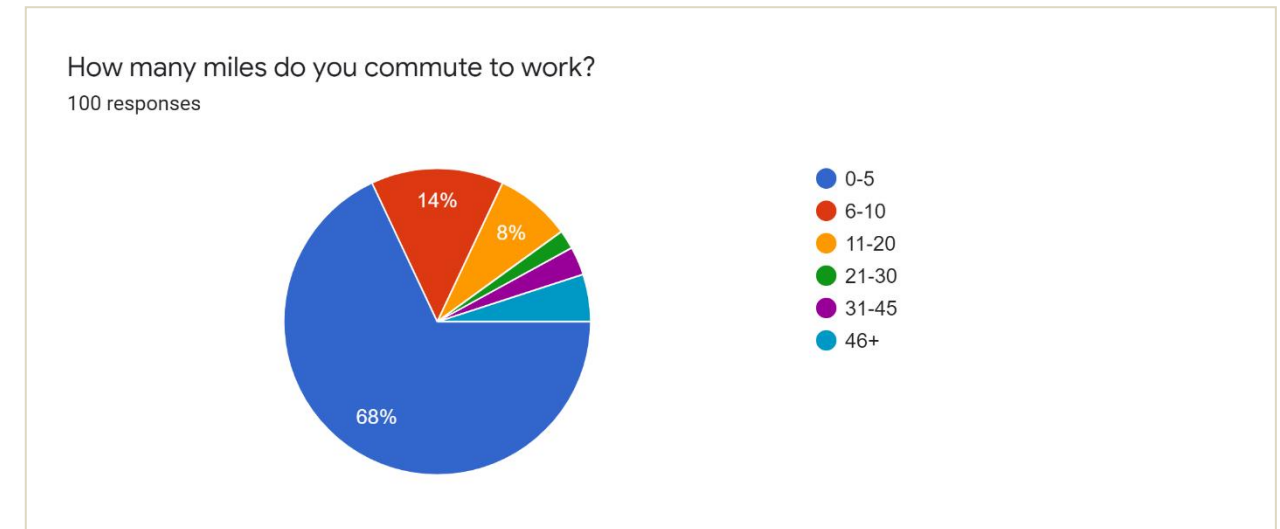


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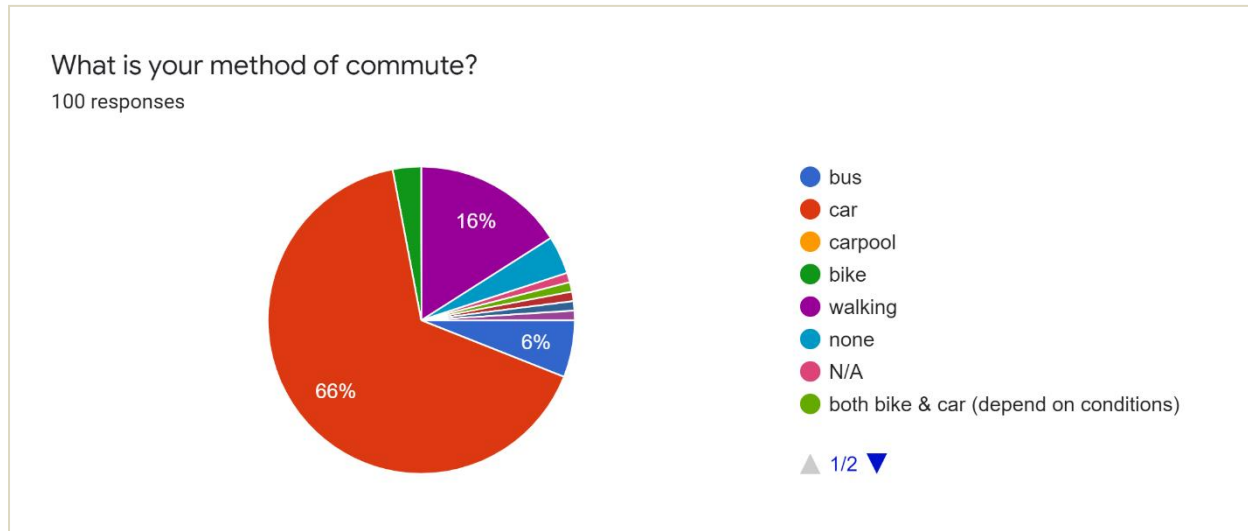


Figure 9

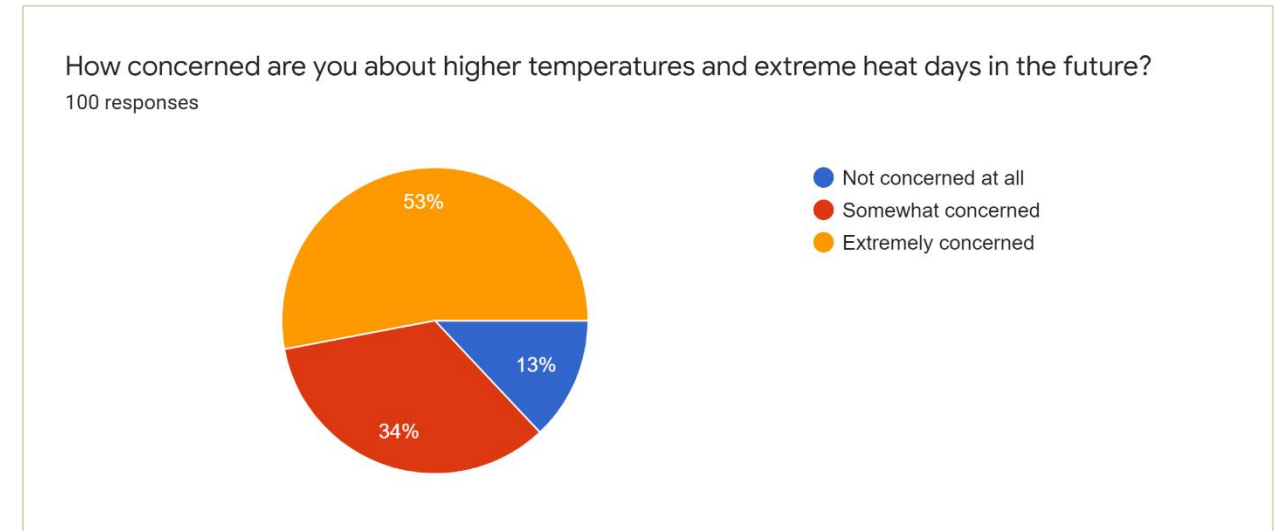


Figure 12

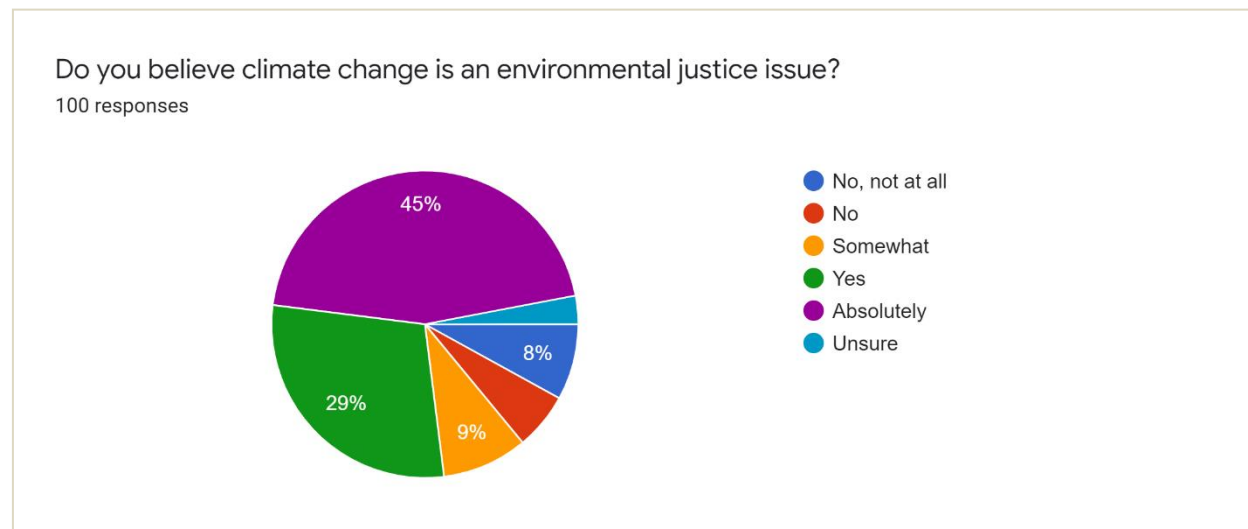


Figure 10

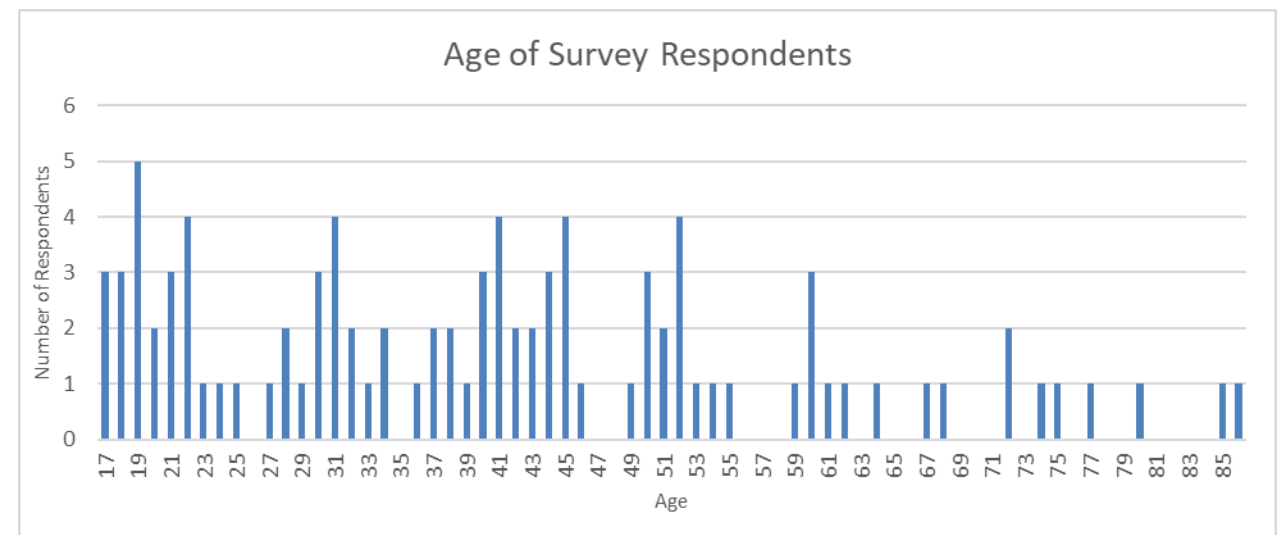


Figure 13

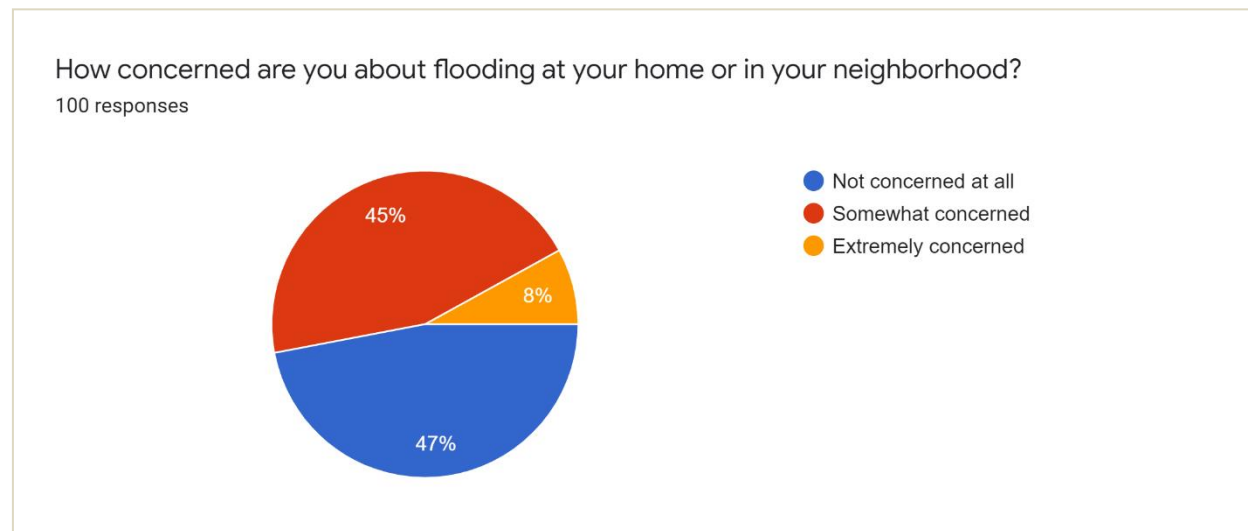


Figure 11

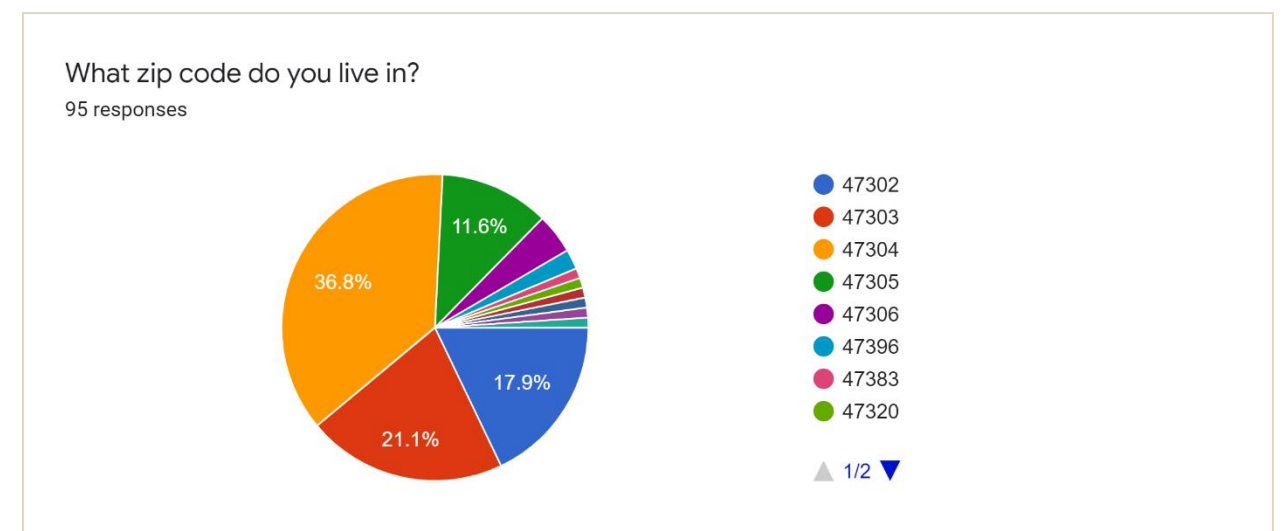


Figure 14

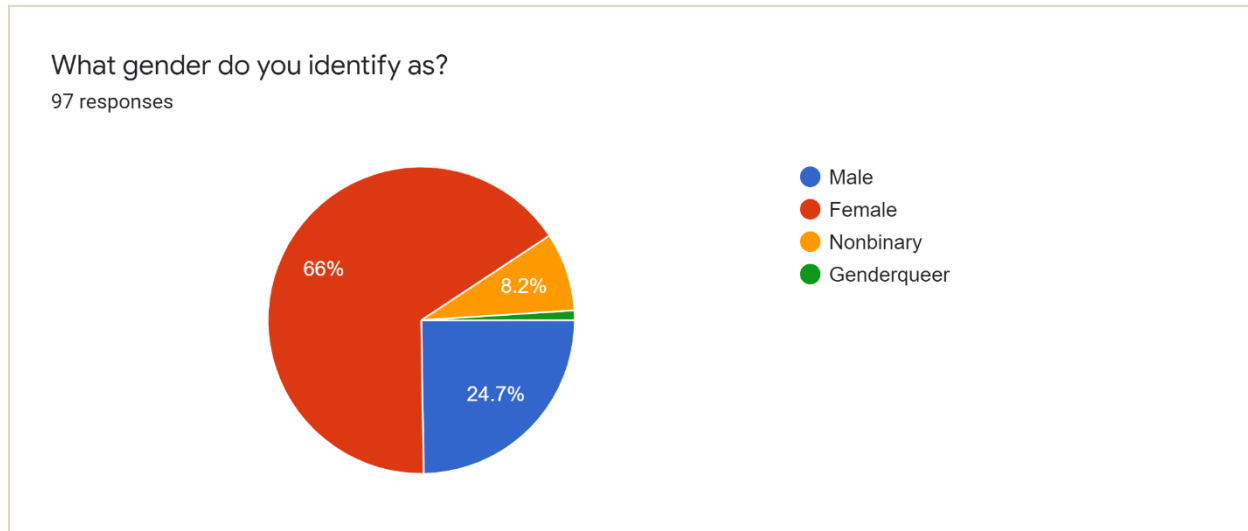


Figure 15

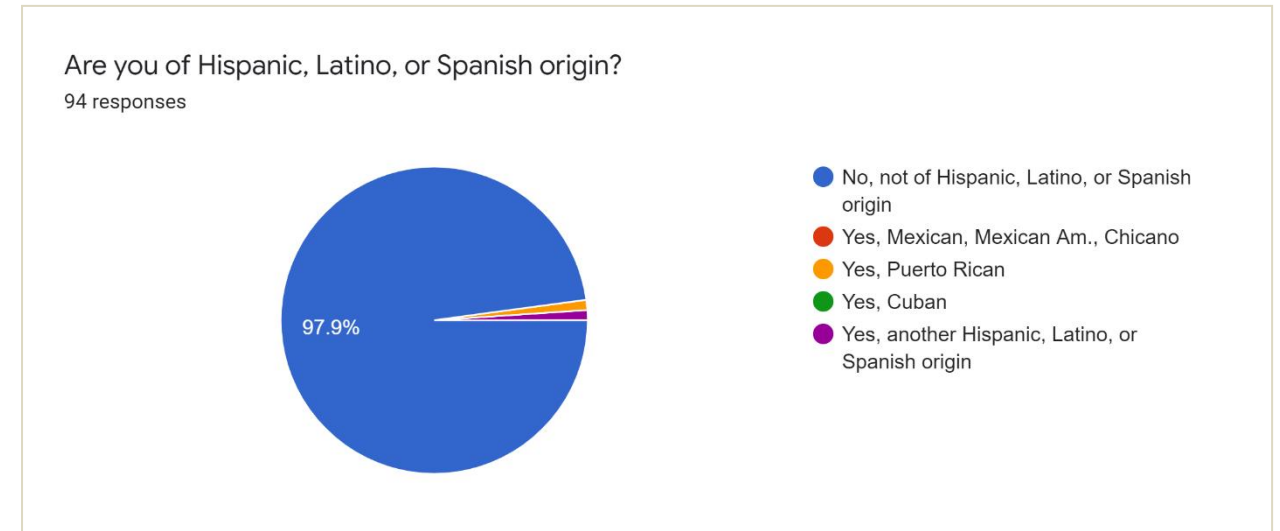


Figure 18

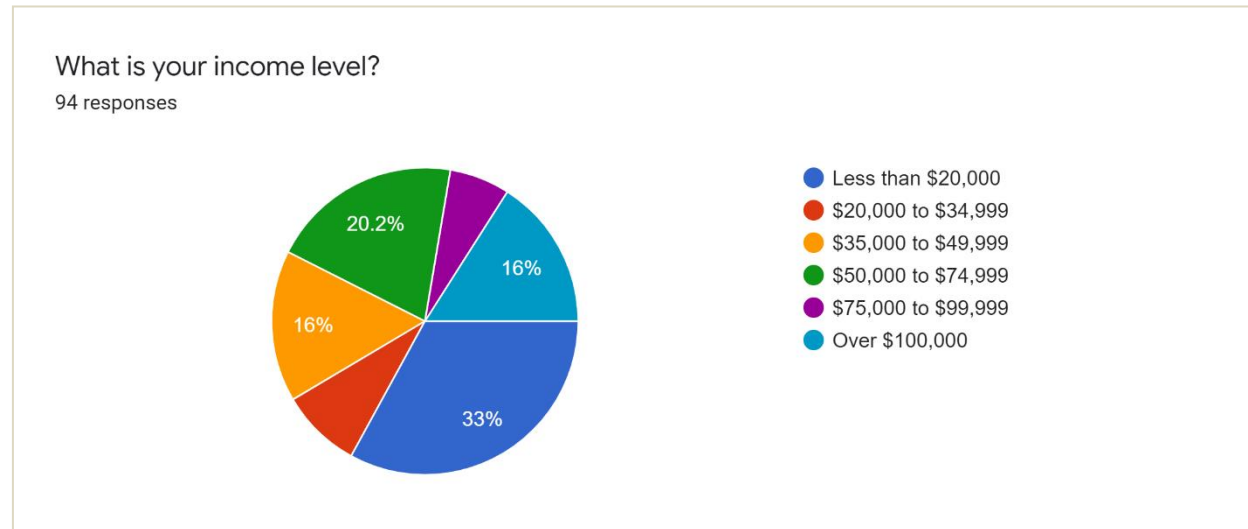


Figure 16

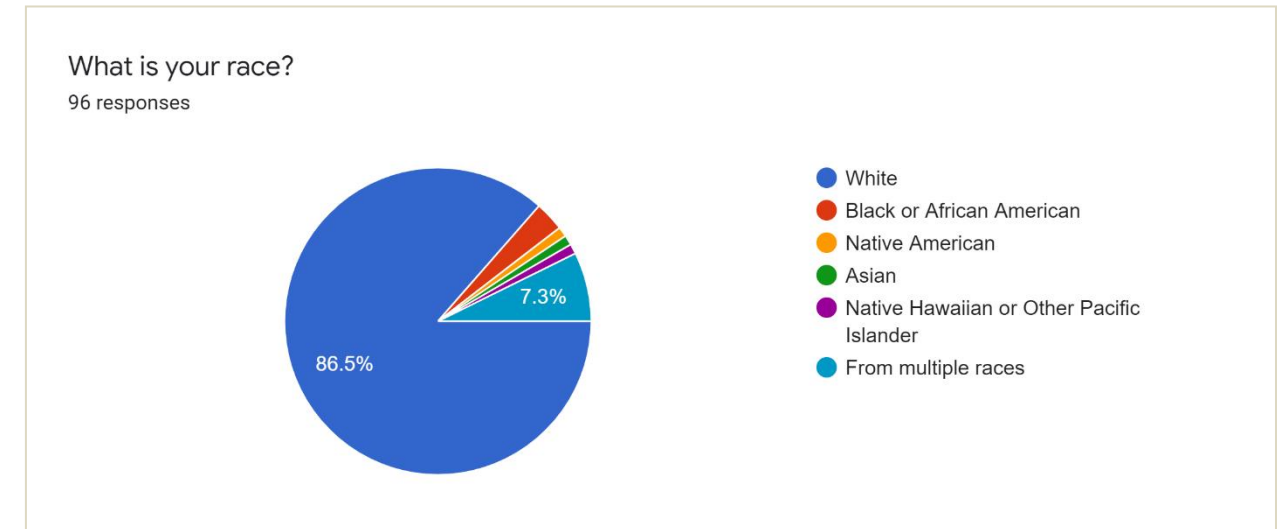


Figure 19

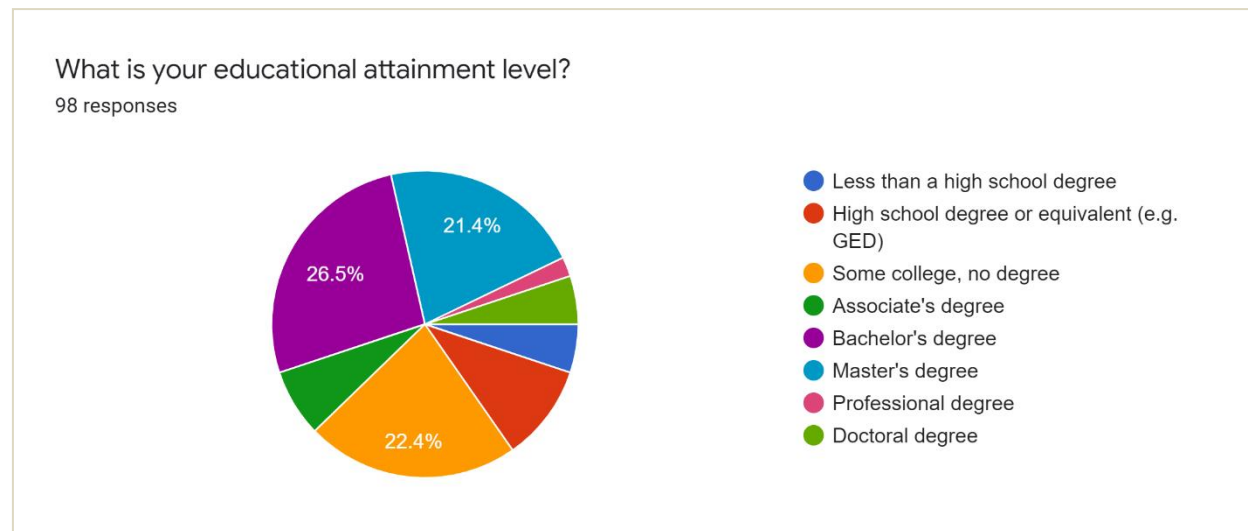


Figure 17

Residential Background

Muncie has an estimated 32,500 total housing units for the years 2015-2019, but only an estimated 27,363 occupied housing units for the same years¹. These properties vary across price points, occupancy (rental vs. owner), and age. This housing data comes from the U.S. Census Bureau’s American Community Survey (ACS), a yearly survey conducted with a smaller sample size than the decennial census². These files are useful for estimating population characteristics within specific locations (i.e. cities) and between larger census data releases². Reliability ratings are sometimes included in these estimates. Where neither ACS files nor U.S. Census data are available, ESRI estimates based on census data will be used.

Housing Units By Year Structure Built		
(2015-2019 ACS Estimate)		
Year Built	# of Houses Built	Percentage of Total
1939 - earlier	7,453	22.9%
1950 - 1959	5,470	16.8%
1960 - 1969	4,349	13.4%
1970 - 1979	3,867	11.9%
1940 - 1949	3,540	10.9%
1990 - 1999	2,794	8.6%
1980 - 1989	2,523	7.8%
2000 - 2009	1,872	5.8%
2014 - later	475	1.5%
2010 - 2013	157	0.5%

Table 1: Ranked by percentage of total housing units

The ACS estimates that a plurality of homes in Muncie were built before 1940 (22.9%), followed by those built between 1950 and 1959 (16.8%); the median built year is 1960 (see Table 1)¹. Due to the somewhat old age of the city, Muncie has identified 12 historic districts and over 175 historic landmarks. Figure 1³ shows these districts:

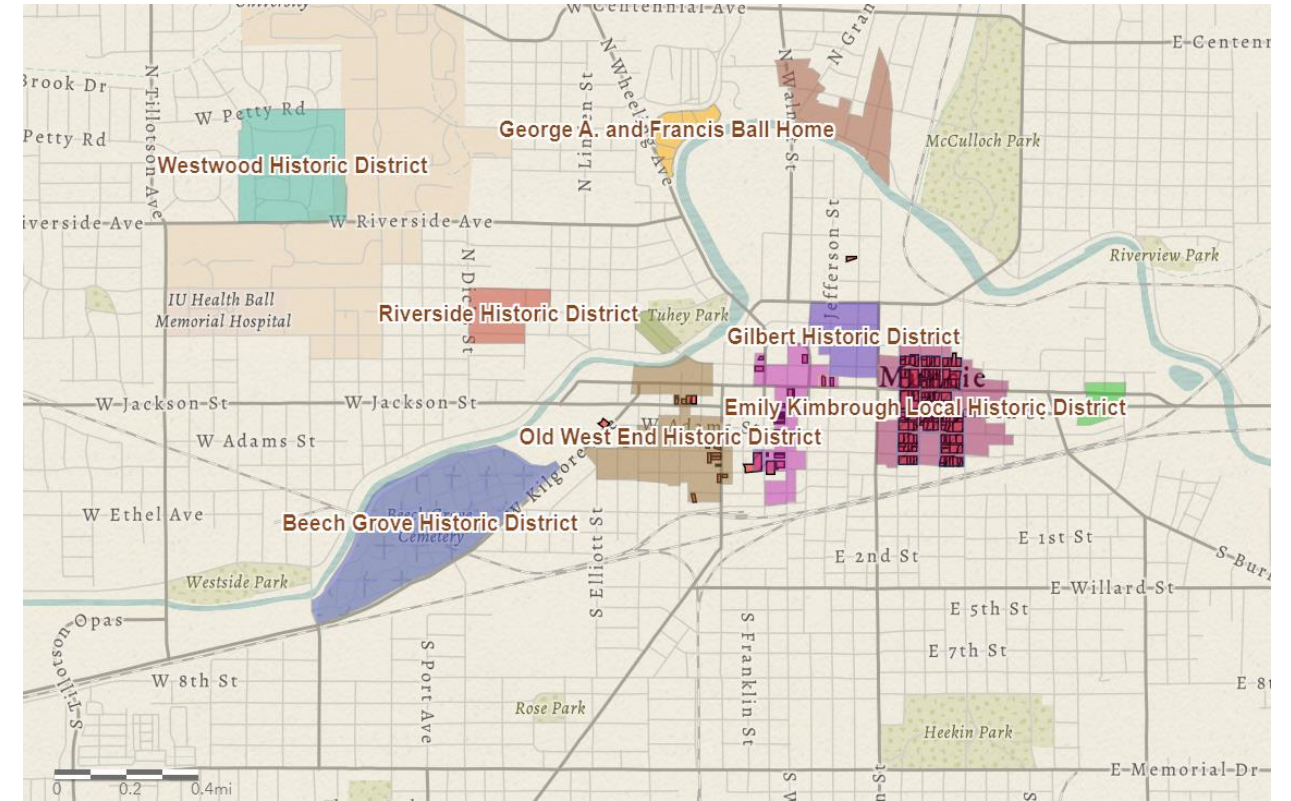


Figure 1: Map of Historic Districts in Muncie; Source: City of Muncie GIS³

Occupied Housing Units By House Heating Fuel			
(2015-2019 ACS Estimate)			
Type of Fuel	# of Houses	Percentage of Total	Reliability (1=low, 3=high)
Utility gas	18,545	67.8%	3
Electricity	8,187	29.9%	3
Bottled, tank, or LP gas	246	0.9%	2
Wood	140	0.5%	2
Fuel oil, kerosene, etc.	105	0.4%	2
Other fuel	70	0.3%	1

No fuel used	51	0.2%	2
Coal or coke	19	0.1%	1
Solar energy	0	0.0%	--

Table 2

Table 2 shows that the estimated most prevalent type of residential fuel is utility gas (67.8%) followed by electricity (29.9%)¹. This is important to keep in mind if we are to emphasize more resilient residential energy source in the future.⁴

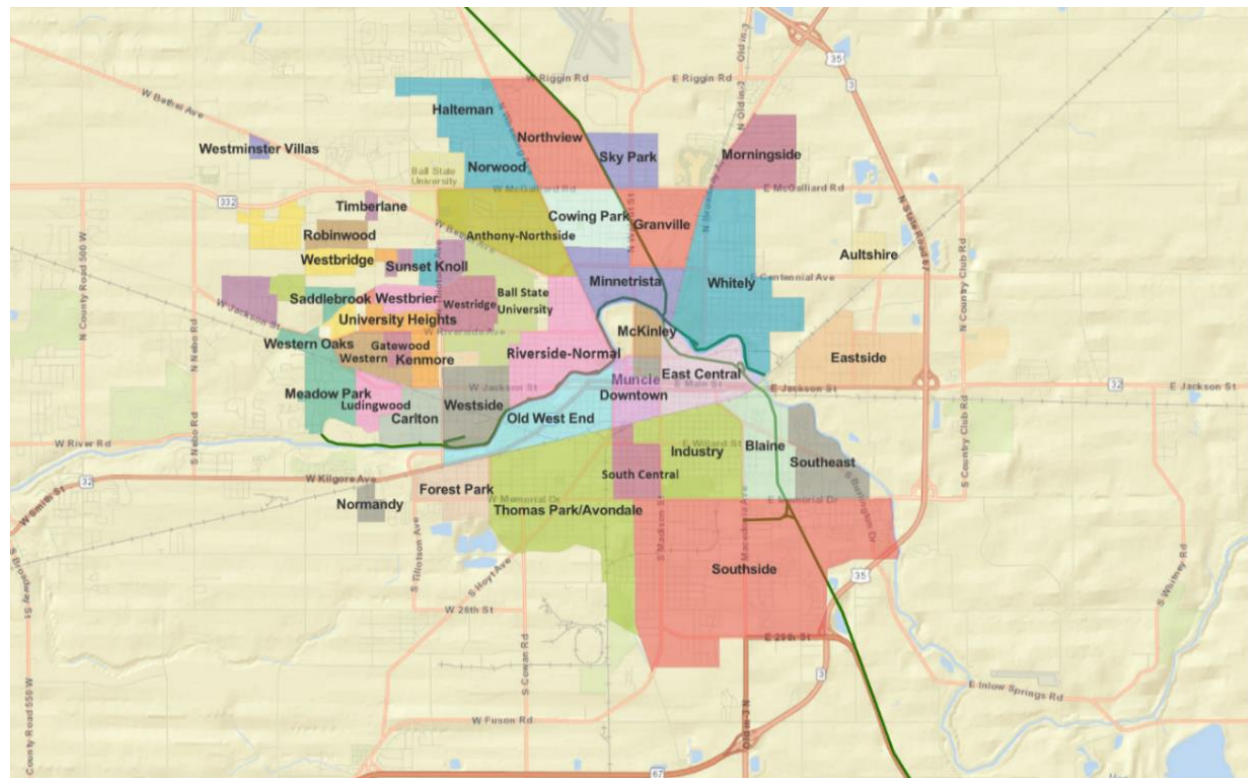


Figure 2: Muncie Neighborhood Map⁴

Current Efforts

The Riverside-Normal neighborhood association has accepted trees from the Muncie forester to plant within their neighborhood. In fall of 2021, 20 association volunteers received and planted 12 trees along the tree belt⁵.

Commercial Background

Muncie Indiana houses a variety of commercial businesses, from restaurants to clothing stores to auto shops. ACS estimates for 2021 show that 2,621 businesses were in Muncie for that year. Using the North American Industry Classification System (NAICS), the ACS survey determined that the five most represented business sectors by number of businesses were⁶:

- | | |
|--|-------|
| 1. Retail Trade | 16.8% |
| 2. Other Services (except Public Administration) | 14.3% |
| 3. Health Care & Social Assistance | 11.7% |
| 4. Accommodation & Food Services | 8.1% |
| 5. Professional, Scientific & Tech Services | 7.4% |

Businesses by Sector		
(2021 ACS Forecasts)		
Sector	# of Businesses	Percentage of Total
Retail Trade	440	16.8%
Other Services (except Public Administration)	376	14.3%
Health Care & Social Assistance	307	11.7%
Accommodation & Food Services	212	8.1%
Professional, Scientific & Tech Services	193	7.4%
Finance & Insurance	158	6.0%
Real Estate, Rental & Leasing	146	5.6%
Unclassified Establishments	120	4.6%
Construction	113	4.3%
Public Administration	100	3.8%
Manufacturing	89	3.4%
Administrative & Support & Waste Management & Remediation	77	2.9%
Educational Services	77	2.9%

Wholesale Trade	63	2.4%
Arts, Entertainment & Recreation	56	2.1%
Information	46	1.8%
Transportation & Warehousing	37	1.4%
Mining	2	0.1%
Utilities	3	0.1%
Management of Companies & Enterprises	3	0.1%
Agriculture, Forestry, Fishing & Hunting	3	0.1%
Total	2,621	≈100%

Table 3

Many of these businesses are concentrated along a few key roadways, such as:

Tillotson Avenue⁷

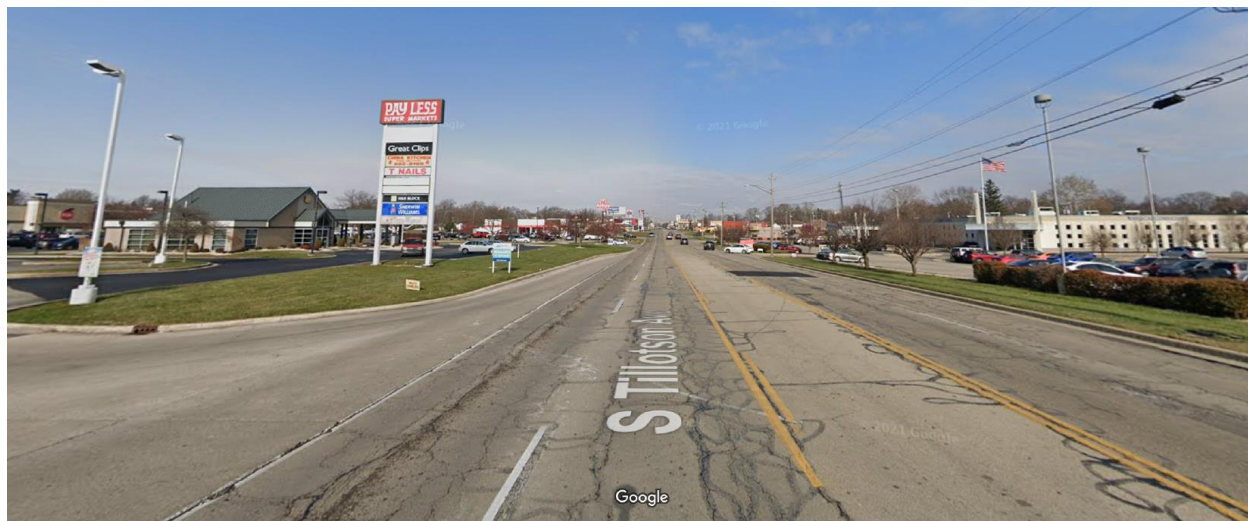


Figure 3: Looking north on Tillotson Ave

McGalliard Road^{8,9}

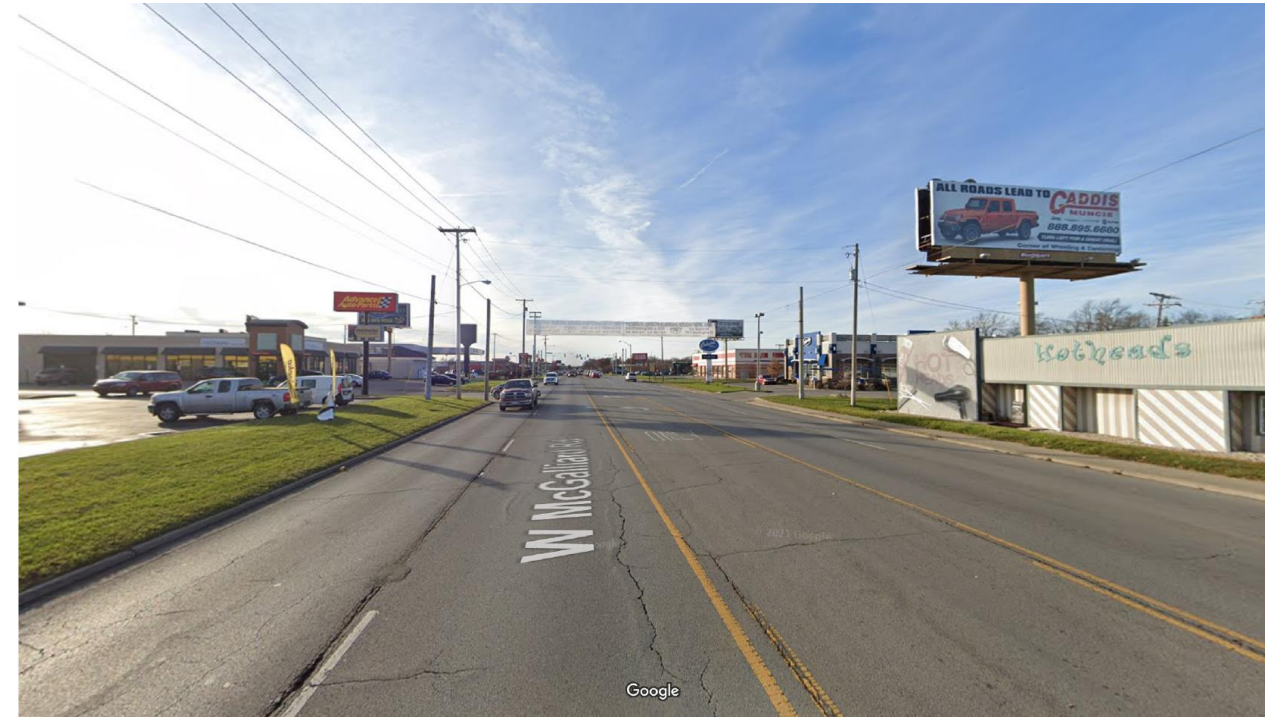


Figure 4: Looking west on McGalliard Rd. near Wheeling Ave.⁸



Figure 5: Looking west on McGalliard Rd. near Bethel Ave.⁹

Industrial Background

Muncie has a rich history of industrial development. The manufacturing industry had constituted the economic base of the city since the late 1800s¹⁰. Early industrial activities included the Ball Corporation, BorgWarner, General Motors (New Venture Gear), Westinghouse, Indiana Steel and Wire, and numerous others¹⁰. From the 1970s through 2010s, many of these companies—including the Ball Corporation—closed their Muncie factories¹⁰. The city has never quite recovered from the jobs lost during this period, though it has attracted new industry in the form of Brevini Wind and Progress Rail Services¹⁰. As of 2021, the manufacturing sector of Muncie only constituted 9.1% of employed population (16 + years old)¹¹.

2021 Employed Population 16+ by Industry	
Industry	Percentage of Total
Services	59.2%
Retail Trade	12.9%
Manufacturing	9.1%
Construction	5.0%
Finance/Insurance/Real Estate	4.6%
Transportation/Utilities	3.1%
Public Administration	2.9%
Wholesale Trade	2.1%
Information	0.9%
Agriculture/Mining	0.2%

Table 4

Compounding the joblessness problem caused by the flight of these companies is the brownfield sites they’ve left behind. The EPA defines a brownfield as “a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant”¹². Though other types of brownfields exist, the abandoned industrial factories, manufacturing plants, and other such facilities of Muncie will this plan’s focus. There are many former industrial sites

in the city whose parent companies merely abandoned them, rarely cleaning up toxic materials or looking for potential issues. This means that debris, foundations, and sometimes entire buildings are left to the elements and to leak their pollutants into the ground. As of August 2020, some of the sites in need of remediation include¹³:

- Former Borg Warner Site
- Former American Lawnmower Site
- Former Twoson Site
- 418 W. Powers Street, Delaware Trucking
- 1724 E. 29th Street
- 600 Blk. E. Fuson Rd.



Figure 5: Former Borg Warner Site¹³



Figure 6: Former American Lawnmower Site¹³



Figure 8: 418 W. Powers Street, Delaware Trucking¹³



Figure 7: Former Twoson Site¹³



Figure 9: 1724 E. 29th Street¹³



Figure 10: 600 Blk. E. Fuson Rd.¹³

Current Efforts

The map in Figure 11 shows all the active and inactive brownfield sites in Muncie as defined by the Indiana Department of Environmental Management¹⁴. While many of these have sat for years without remediation, a group of Ball State University students (under the tutelage of Dr. Sanglim Yoo) developed a report titled "Brownfield to Brightfields" to identify five brownfield sites (and four other sites) for solar farm use¹⁴. To determine the kind of solar capabilities of these sites, they categorized solar energy output into these three subsets:

Utility-Scale Photovoltaic (PV):

- Direct normal solar resource availability $\geq 5 \text{ kWh/m}^2/\text{day}$
- Acreage ≥ 40 acres
- Distance to transmission lines ≤ 10 miles
- Distance to graded roads ≤ 10 miles

- Appropriate Sites:
 - Delaware Advancement Corporation North/South (4500 S Delaware Dr., Muncie, IN)
 - Middlefield Industrial Complex (5401 W Kilgore Ave., Muncie, IN)
 - Utility Scale: Motors Liquidation Company (1200 W 8th St., Muncie, IN)

Large scale PV:

- Direct normal solar resource availability $\geq 3.5 \text{ kWh/m}^2/\text{day}$
- Acreage ≥ 2 acres
- Distance to transmission lines ≤ 1 mile
- Distance to graded roads ≤ 1 mile
- Appropriate Sites:
 - CR3 of IN (2501 W Mt. Pleasant Blvd., Muncie, IN)
 - Muncie King Indiana Forge (1800 E Jackson St., Muncie, IN)

(Remaining non-brownfield sites; rooftop solar):

- Muncie Sanitary District, Water Treatment Plant (5130 W Kilgore Ave., Muncie, IN)
- Muncie Sanitary District, Jake's Creek Lift Station (Cypress Dr. & Everett Rd., Muncie, IN)
- Muncie Fire Station 3 (1200 S Hoyt Ave., Muncie, IN)
- Muncie Fire Station 1 (421 E Jackson St., Muncie, IN)

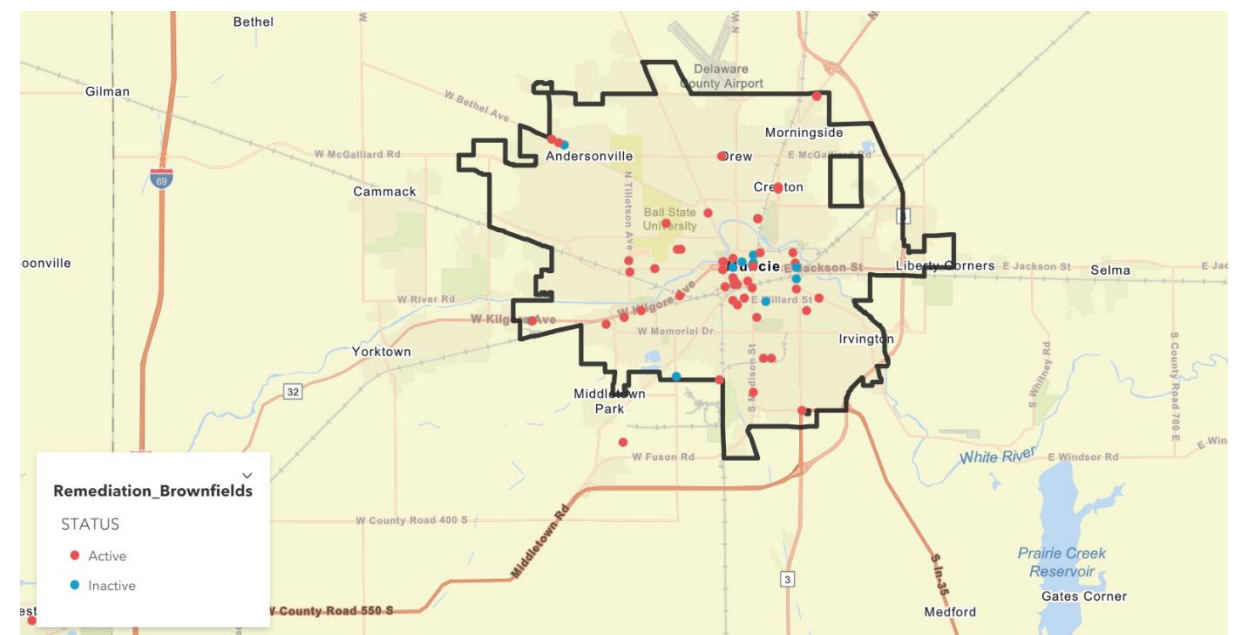


Figure 11: Muncie sites with IDEM Brownfield Status as of 2018¹⁴

This analysis is extremely useful in moving forward with brownfield site remediations because it offers working list of plausible solar field locations. Outside of this list, some progress has been made concerning remediation of local brownfield sites. In 2011, the nonprofit government entity Energize-ECI Regional Planning District, Inc. was awarded \$609,000 in grants from the EPA to assess brownfield sites in four counties, including Delaware county¹⁵. In 2012, the engineering and consulting firm SME secured \$591,600 from the EPA to conduct these steps in Muncie:

- "Quality Assurance Project Plan (QAPP)
- Brownfields Inventories for the City of Muncie, the Town of Yorktown, and Delaware County Coalition
- Community Outreach: Coalition members, city/towns in Delaware County, property owners and developers
- 28 Phase I Environmental Site Assessments (ESAs) - several sites had multiple Phase I assessments for prospective purchaser use
- 12 Phase II ESAs
- 5 Asbestos/Lead Paint Surveys
- 2 Cleanup Plans
- 5 Requests for Indiana Brownfields Program Comfort Letters through the Indiana Department of Environmental Management¹⁶

Some brownfields have already been remediated and are ready for new construction, such as the 70-acre site of the old Indiana Steel & Wire factory¹⁷ (site plans pictured in Figure 54). In June of 2017, the real estate development company M. Peters Group was granted an Industrial Recovery Tax Credit (which was the largest state TIF at that time) to redevelop the site into the Kitzelman Pure Energy Park¹⁷. The site's exact use is still in development, but it has been proposed to hold a 128-unit affordable multi-family housing, public greenspace, and (perhaps most promising for environmental resiliency) a five-megawatt solar power plant¹⁸. Site remediation included the demolishing of the factory in 2017, the replacement of 160,000 cubic yards of soil, and the raising of the site above the floodplain¹⁸.



Figure 12: Kitzelman Pure Energy Park¹⁸

Another brownfield that's been remediated is as a former auto salvage yard 0.62 miles southeast of downtown Muncie¹⁹. Active from 1934 to 2002, the site was used to store oil and gas, as a refinery, and (most recently) an auto salvage yard, among other uses. The site was contaminated from a 2003 substance spill and had large debris littered on the property. To address this, Ball State's Immersive Learning program recruited students to remediate the site from 2012-2017. The students removed the debris, replaced the ailing fence, replaced poor soil, and planted new vegetation.

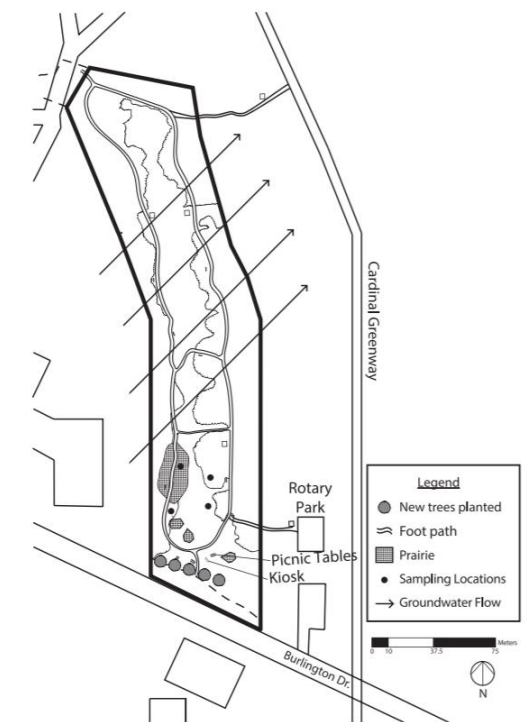


Figure 13: Remediated brownfield map¹⁹

To aid with brownfield redevelopment, the Muncie-Delaware County Economic Development Alliance compiles an up-to-date list of leasing/for-sale properties in the county, including many brownfield sites²⁰. As of February 2022, the site lists 50 leasable or for-sale buildings/properties²⁰.

One final brownfield site is the former General Motor Chevrolet plant located at 1200 W. Eighth St. The Star Press announced on January 26th, 2021 that the City of Muncie and RACER Trust had reached an agreement with a General Motors-linked trust to purchase the 53-acre site²¹. Later, on February 4th, 2022, the industrial sourcing platform Thomasnet reported that talks are still ongoing between the city and trust to purchase the land and develop a solar farm costing \$17 million²². The agreement would likely constitute a Build, Operate, and Transfer agreement, which would permit GM Development (which is not General Motors itself) to develop the land and earn profits from the solar farm for a predetermined period of time. Once that time expires, the City of Muncie would own and manage the farm's operations and electricity outputs. Experts claim the solar farm could produce enough energy to power 27,000 homes for a month²². A recent May 3rd, 2022 city council meeting with a representative for the developer, Ryan Stout, revealed that this solar project would provide \$10.7 million dollars in revenue over 40 years. It is important to note, however, that part of this will go towards the 30-year debt Muncie will incur for the project. A final city council vote has yet to be made.



Figure 56: Former Muncie Chevrolet site²¹

Governmental Background

Formulated in December of 2018 for the City of Muncie, the *Muncie Action Plan 3* includes Task Force Five: Managing Community Resources²³. Some of these task force actions directly relate to environmental resiliency²³:

- **Action 2:**
 - Support the implementation of the *Prairie Creek Master Plan*
 - Community members are unaware that Prairie Creek has amenities (such as bike trails, shelters, etc.), and this should be promoted to the community
- **Action 4:**
 - **4.1:** Encourage and promote models of sustainable design in Muncie
 - Increase the number of parks in Muncie
 - Educate residents on water quality and stormwater run-off, eco-balance, and climate-appropriate/native plant selection
 - Establish an urban tree-planting program
 - Promote urban gardens that include:
 - Bioswales
 - Rain gardens
 - Native plants and trees
 - Promote eco-programs such as Solarize Indiana, which helps residents install rooftop solar panels
 - **4.2:** Adopt carbon footprint reduction goal
 - **4.3:** Create a Muncie Sustainability Office
- **Action 6:** Support a Brownfields Redevelopment Program
- **Action 7:** Support bike-friendly community programs

Current Efforts



Figure 15: Muncie city hall²⁴

The city is undertaking numerous resiliency projects in conjunction with the action goals from the *Muncie Action Plan*:²⁴

- 2021:
 - 53-acres of the former Muncie Chevrolet factory (1200 W. Eighth St.) is being purchased for development of a \$17 million solar farm (ongoing)²²
Financing failed passage by City Council
- 2022
 - Plans to update city firehouses and install solar panels on facilities (ongoing)²⁵
 - Considerations of installing solar panels on various other city-owned buildings (ongoing)²⁵
 - At least 95% of city police vehicles transferred to CNG (ongoing)²⁵
 - New roundabout at River Rd. and Nebo Rd. (approved)²⁵

Aside from these actions, the city has already transferred all the lights in city hall to LEDs—which last longer and are more durable than other lighting options—and is in the process of replacing the city's traffic lights with LEDs²⁵.

Institutional Background

Muncie has various centers of higher learning, but the two principal institutions are Ivy Tech Community College and Ball State University. According to Ivy Tech's website, the college is the state's "largest public postsecondary institution and the nation's largest singly accredited statewide community college system serving nearly 200,000 students annually"²⁶. Ball State University offers 120 majors and 100 graduate degrees. The list of sustainable and/or environmental degrees for both schools is provided in Table 10.^{27,28}

Ball State University Environmental Degrees				
Bachelors		Masters	Certificate	Doctorate
Minors	Majors			
Emergency Management and Homeland Security	Earth/Space Science Education	Geology and Natural Resources	Graduate Certificate in Sustainability	Environmental Science
Geology	Geology			
Environmental Geology	Environmental Geoscience			
Sustainability		Environmental Geoscience		
Natural Resources	Natural Resources and Environmental Management			
Environmental Management				
Ivy Tech Environmental Degrees				
Associate of Applied Science		Technical Certificate		
Environmental Design				

Table 5

Other than these degree programs, both institutions are making strides towards climate resiliency. The Ivy Tech branch in Muncie is promoting environmental resiliency through "Get Your Green On" posters, retrofitting light fixtures, an increase in cardboard recycling, and by generally emphasizing less paper usage²⁶. Ball State has a broader recycling program for students and faculty, though it has been criticized for its lack of clear labeling and mixed-matched use of different colored bags.

Beyond its recycling program, Ball State University has displayed a strong interest in environmental resiliency. The university has already taken numerous steps towards this goal, including:

- Signatory of the Talloires Declaration (1999)
- Signatory of the Second Nature Climate Leadership Commitment
- 2013 Climate Action Plan
- Carbon-Neutral 2030 Goal
- Establishment of a Council on the Environment (COTE)
- *Resilient Muncie: A Prepared and Responsive City*
- Collaboration with the Indianapolis Airport on 75-acre solar farm
- LEED certifying campus buildings
- Biodiesel shuttle busses
- Six electric charging stations
- Installation of the "nation's largest ground-source, closed-loop district geothermal energy system"²⁹

Ball State's efforts date back to 1999 with their signing of the Talloires Declaration, a French document created in 1990 to publicly announce universities' concerns with environmental degradation³⁰. The document specifically asserts, among other things, that: "WE THE PRESIDENTS, RECTORS, AND VICE CHANCELLORS OF UNIVERSITIES FROM ALL REGIONS OF THE WORLD are deeply concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources"³⁰. The university has also signed onto the Second Nature Climate Leadership Commitment Program in 2015³¹, which asserts that the university will adhere to at least one of three commitments (see Figure 16³¹).

THE CLIMATE COMMITMENT

Integrates a goal of carbon neutrality with climate resilience and provides a systems approach to mitigating and adapting to a changing climate. Designed to blend these two critical components of climate leadership.

THE CARBON COMMITMENT

Focused on reducing the emissions of harmful greenhouse gases to zero and mitigating campuses' contribution to climate change.

THE RESILIENCE COMMITMENT

Focused on climate adaptation-specific goals, as well as building community capacity to deal with a constantly changing climate and resulting extremes.

Figure 16 ³¹

The program offers ways to track and graph Ball State's CO₂ emissions (see Figure 17³²).

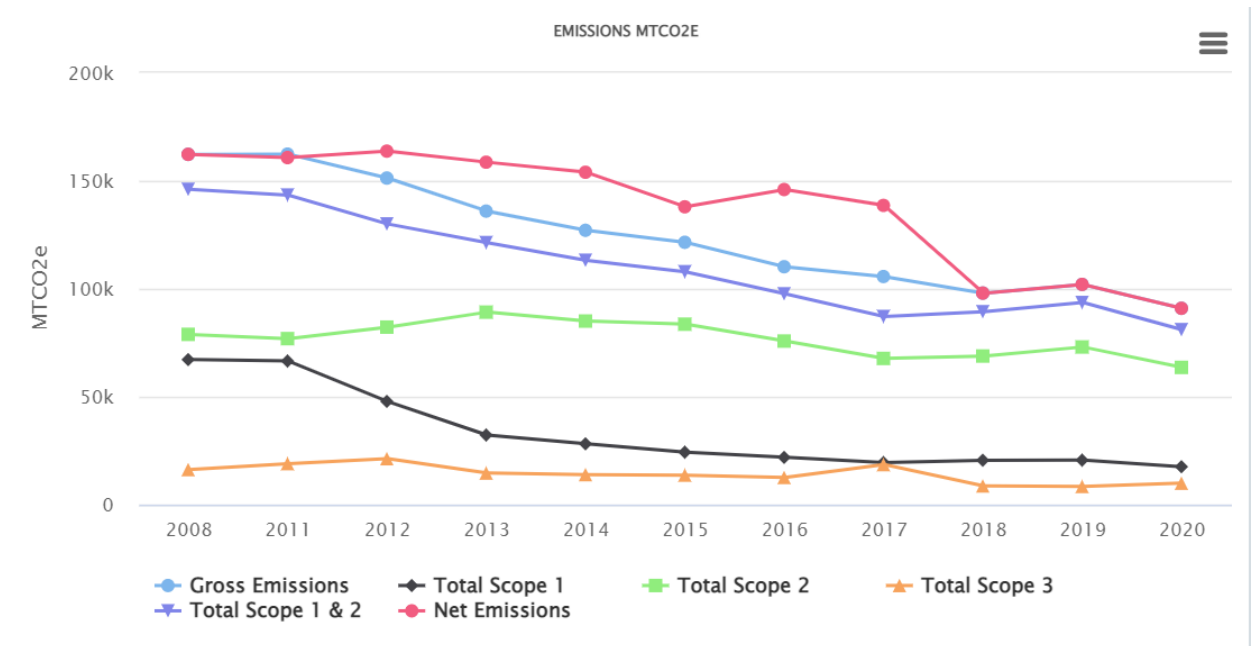


Figure 17: Graph of Ball State CO₂ emissions from 2008 to 2020³²

Three similar leadership steps were taken through BSU's 2013 Climate Action Plan³³, its 2030 Carbon-Neutral Goal³⁴, and its creation of the Council on the Environment (COTE)³⁵, the latter of which promotes communicative of and furthering of sustainable initiatives in the region.

Though not explicitly addressing climate resiliency, BSU released the *Resilient Muncie: A Prepared and Responsive City* in 2019. This document analyzed Muncie's ability to recover from various shocks such as tornadoes or floods, as well as stressors, which the

report defines as "chronic issue[s] such as rising sea levels, housing blight, slowing economic growth, food insecurity, drugs, or poverty [which have] a debilitating impact on the community". Though the report does not chiefly focus on environmental hazards caused by climate change, it offers relevant solutions in the categories of disaster readiness and climate adaptation³⁶:

- Enact a "minimum of 5% street tree coverage in all census tracts"
- "Revise the Comprehensive Zoning Ordinance to require:
 - minimum landscaping of 10% in new development areas across Muncie
 - ... require a minimum of 50% permeable surface coverage in new developed or redeveloped sites located in all flood plains"
- "Modify the Comprehensive Zoning Ordinance to eliminate minimum parking requirements in some land uses, consider eliminating single family zoning, incorporate mixed use zoning (or equivalent) and include density bonus for property owners that use sustainable infrastructure such as bioswales, tree cover, and solar panels"
- "Adapt and improve the combined sewer systems into separate waste and rainwater through the Muncie Sanitary District Long Term Control Plan" (*already in progress*)
- "Create development standards in the Comprehensive Zoning Ordinance to introduce:
 - permeable pavements
 - bioswales (which are vegetative streetside open drainage basins)
 - increase vegetation along the affected areas
 - incorporate green infrastructure throughout the city/streetscape as well as existing infrastructure"
- "Contain sprawl to decrease the cost of extending municipal infrastructure and services"
- "Consider creating a brownfield redevelopment plan to address locations, economic/social potential, cleanup progress, and funding (state/federal) for development of these sites"



Figure 18: Indianapolis Airport solar farm³⁷

Alongside these political actions, BSU continues to adopt tech-heavy resiliency improvements. For example, the university is collaborating with the Indianapolis Airport on its 75-acre solar farm, a 12-megawatt solar photovoltaic system that produces 17,000 megawatt hours per year, enough to power 1,800 homes³⁷ (see Figure 18).

Ball State's commitment to clean energy extends to its own campus, as well, wherein all the university's shuttle buses are all fueled by biodiesel and six electric vehicle charging stations are available. Concerning the charging stations: the university offers Bosch Power Max and Power Max 2 chargers, which both take about four hours to fully charge a vehicle³⁸ (see Figures 19 and 20). At the time of purchasing, the units cost \$800 each³⁸.



Figure 19: Power Max 1³⁸



Figure 20: Power Max 2³⁸

Perhaps the most innovative initiative undertaken by Ball State University is its geothermal energy system, which is the nation's largest of its kind²⁹. The project was pitched after the Indiana General Assembly dedicated \$44.8 million for the replacement/upgrading of its coal-fired boilers in 2005, and it was approved in 2009²⁹. The system is comprised of 3,600 boreholes and 1,100 miles of piping that circulates water to and from two district energy stations. The system also interfaces with nearby buildings to replace their steam-powered heating with geothermal water heating (see Figure 21).

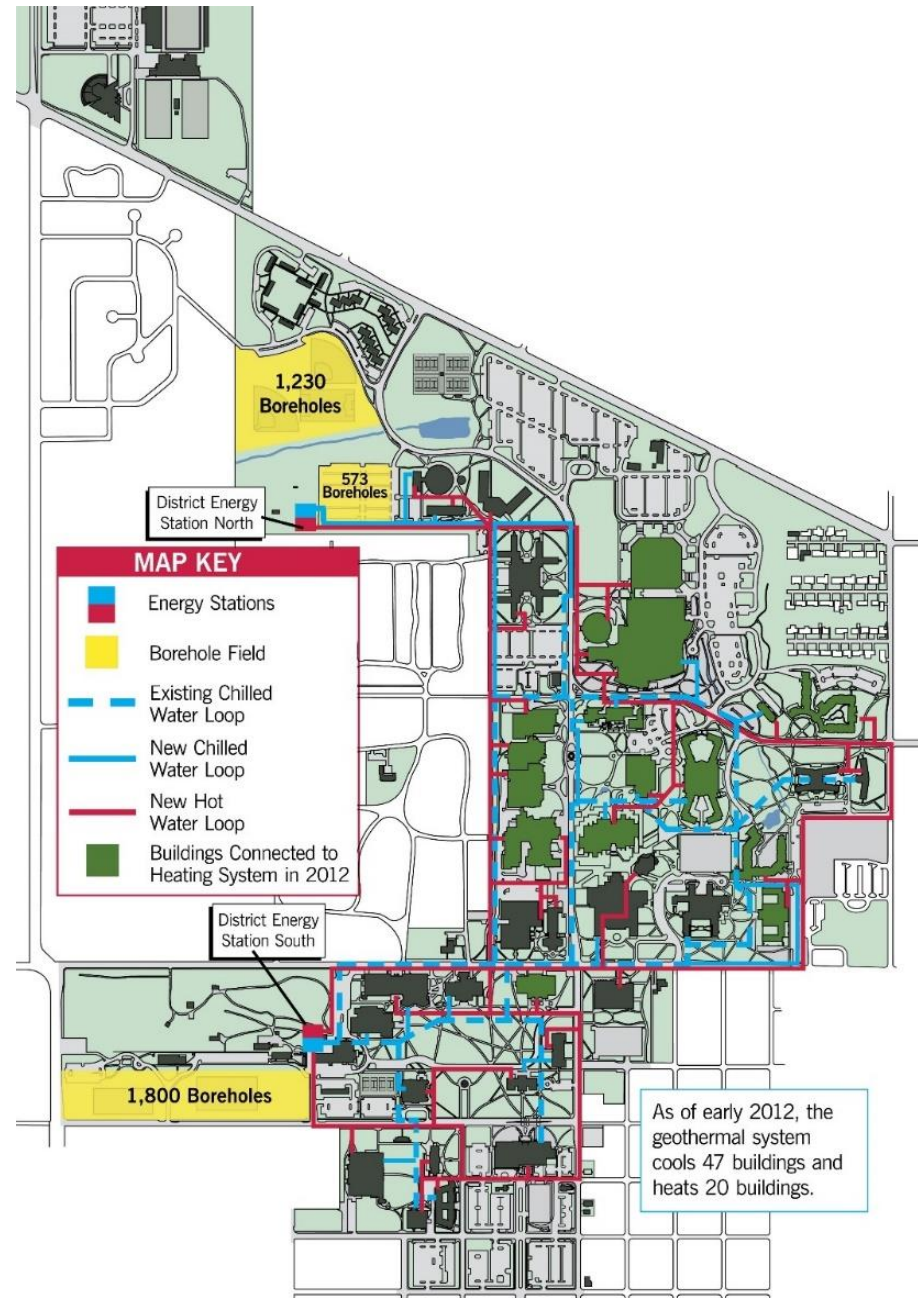


Figure 21: Map of geothermal system across Ball State University²⁹

And finally, to wrap up Ball State's current efforts, the school has begun requiring a minimum of Silver LEED certification for its new and renovated buildings³⁹. Leadership in Energy and Environmental Design (LEED) certification standards were created by the U.S. Green Building Council (USGBC)³⁹. They certify a building design as "LEED certified" if it pays extra attention to energy efficiency, site selection, building materials used, and other environmental categories³⁹. There are four levels of LEED certification, depending on the number of credits a building/project earns⁴⁰:



The various types of credits a building/project can earn include, among others⁴¹:

- High Priority Site and Equitable Development(max. 2 points)
 - Project is developed in underserved areas with few resources, keeping in mind the needs and goals of the community around it
- Surrounding Density and Diverse Uses(max. 5 points)
 - Project is developed in areas with existing infrastructure to preserve existing agricultural land and natural areas
- Access to Quality Transit(max. 5 points)
 - Project is developed in public transportation-heavy areas and expands public transportation where possible
- Bicycle Facilities(1 point)
 - Increases bicycle infrastructure and public storage facilities
- Protect or Restore Habitat(max. 2 points)
 - Preserves and restores local natural areas
- Renewable Energy(max. 5 points)
 - Includes significant percentage of renewable energy in energy portfolio

Figure 22 offers the full list of ongoing and completed BSU LEED certified buildings:

LEED certified projects at Ball State University to-date:

LEED BD+C: NEW CONSTRUCTION OR MAJOR RENOVATIONS, CERTIFIED LEVEL

- Glick Center for Glass, September 2012
- Teachers College, April 2016

LEED BD+C: NEW CONSTRUCTION OR MAJOR RENOVATIONS, SILVER LEVEL

- DeHority Hall, February 2010
- Park Hall, January 2011
- David Letterman Communication and Media Building, August 2011
- Jo Ann Gora Student Recreation and Wellness Center, June 2012
- Kinghorn Hall, November 2014
- North Dining Hall, May 2021

LEED BD+C: NEW CONSTRUCTION OR MAJOR RENOVATIONS, GOLD LEVEL

- Studebaker Hall East, March 2013
- District Energy Station North, June 2013
- Applied Technology Building, August 2016
- Johnson Hall A (East), May 2016
- Johnson Hall B (West), February 2018
- District Energy Station South, March 2018
- Dr. Don Shondell Practice Center, October 2018
- Health Professions Building, September 2020

LEED O+M: EXISTING BUILDINGS, CERTIFIED LEVEL

- David Letterman Communication and Media Building, July 2019

LEED O+M: EXISTING BUILDINGS, SILVER LEVEL

- The Glick Center for Glass, December 2020

Figure 22: List of LEED certified buildings at Ball State University⁷⁴

Transportation Background

Muncie's first railroad, the Indianapolis and Bellefontaine, was created in 1853, two years before Muncie was incorporated as a town⁴². The rails were used for materials transportation and passenger travel until the passenger option was dropped⁴³. Within Muncie itself, prior to its industrialization in the late 1800s, the city was mostly walkable⁴⁴. A trolley system was built in 1887 for those who couldn't afford horses or were too far to walk, and in 1899 this system was combined to add the Union Traction Interurban car alongside the trolley⁴⁴ (see Figure 23).

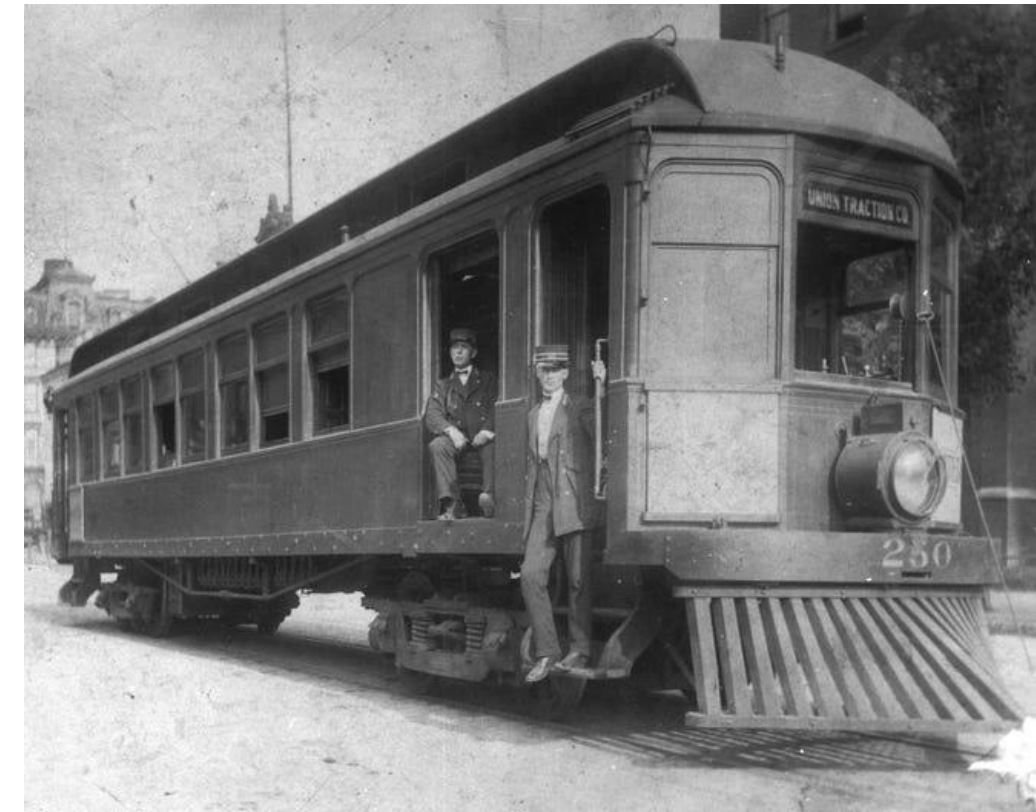


Figure 23: Union Traction streetcar in Muncie, IN⁴⁴

Muncie's first mass-transit-like buses (Jitneys) were used in the 1920s to transport even more people. Figure 24 shows a 1939 Denny or Hines Jitney bus stopped on Main Street in Muncie⁴⁴.



Figure 24: A Denny or Hines bus in 1938 on Main Street, Muncie, IN⁴⁴

From there, more public transit was added while some forms fell to the wayside. An intra-city bus services called Muncie City Lines, Inc., for example, was bought by the city in 1980, reorganized, and renamed the Muncie Indiana Transit System (MITS)⁴⁴. MITS has been serving the community ever since, currently offering 17 different routes⁴⁵.

Current Efforts: *Public Transportation*

MITS Bus is currently taking major steps towards environmental resiliency⁴⁶. Out of 33 total buses, 14 are hybrid, with plans for more hybrid buses in the future. Their hybrid buses use geofencing to determine the best spots to use electric power vs. diesel fuel to power the buses. This means that the maximum fuel economy can be achieved, thus reducing emissions further. Aside from the main buses, 15 MITS Vans run on propane and all staff cars are hybrids (averaging 50 mpg). The MITS facilities which house the vehicles have also made strides towards resiliency. Recently, 36 36,400-Watt light bulbs were replaced with 150 Watt LEDs, a new roof was put on one of the facilities, and solar panels were placed on 41,435 ft² of roofing on one facility.

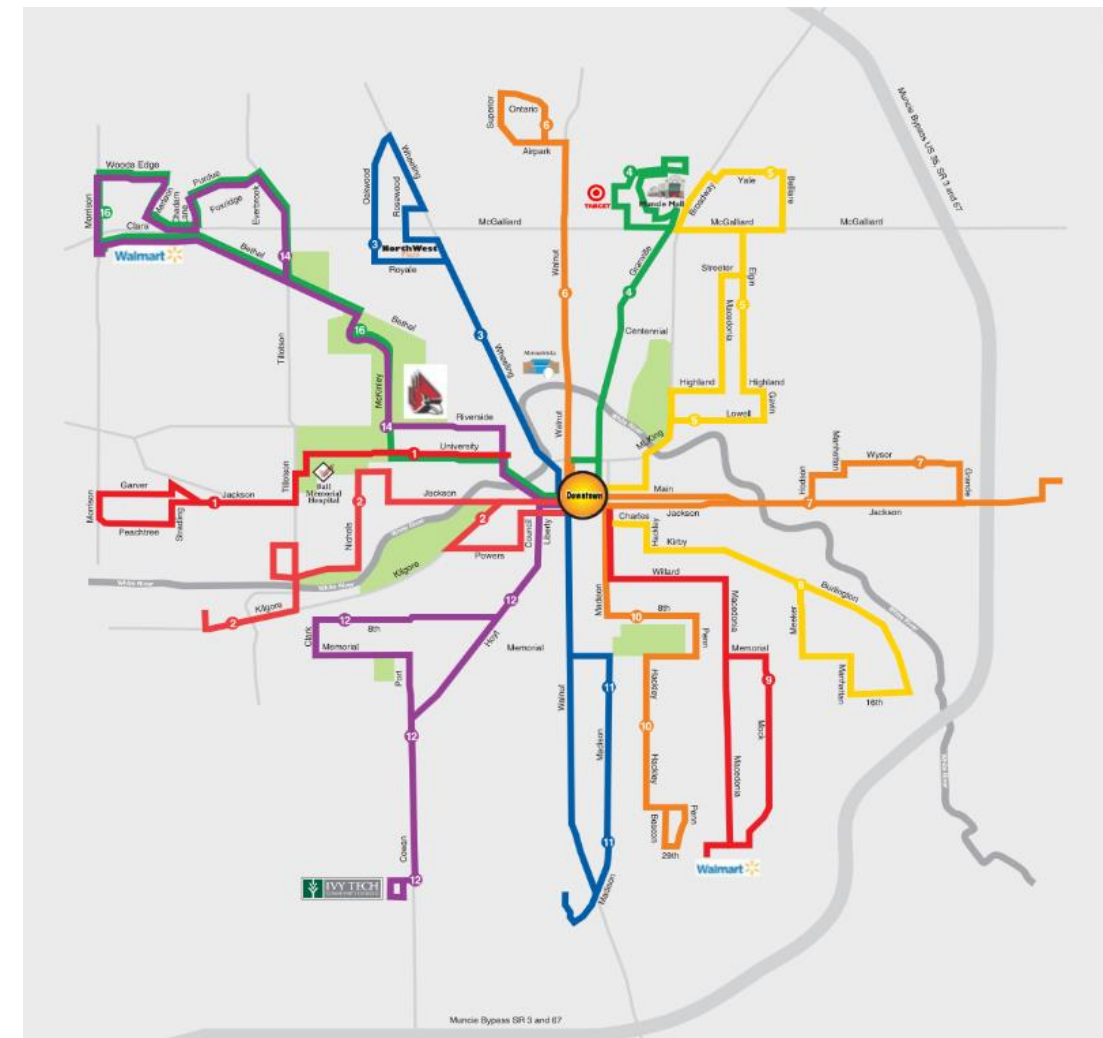


Figure 25: MITS Bus route map⁴⁵

Current Efforts: Walking + Biking

The 2019 *Delaware – Muncie Bicycle And Pedestrian Plan* notes five different categories of non-motorized transportation routes, but for this plan's purposes, we will only focus on four: sidewalks, mixed-use trails, bike paths, and bike-friendly roads. According to Muncie's GIS office, the city has⁴⁷:

- Sidewalks: **210 miles**
- Bike Lanes⁴⁸: **6.26 miles**
 - N. Granville Ave
 - N. Walnut St
 - High St (one-way south)
 - Mulberry St (one-way north)
 - Oakwood St
 - Neely Ave
 - North St (one-way west)
 - Alameda Ave (one-way south)
- Mixed-Use Trails: **21.83 miles**
 - White River Greenway: **5.76 miles**
 - Cardinal Greenway: **6.4 miles**
 - Other Multi-Use Trails: **9.67 miles**

White River Greenway

Muncie has two major trails: the Cardinal Greenway and the White River Greenway. The White River Greenway is a paved mixed-use trail running about 5.76 miles along the White River. The trail connects to Westside Park, Tuhey Park, and McCulloch Park and runs through Minnetrista Center⁴⁹.



Figure 26: Map of White River Greenway⁵⁰

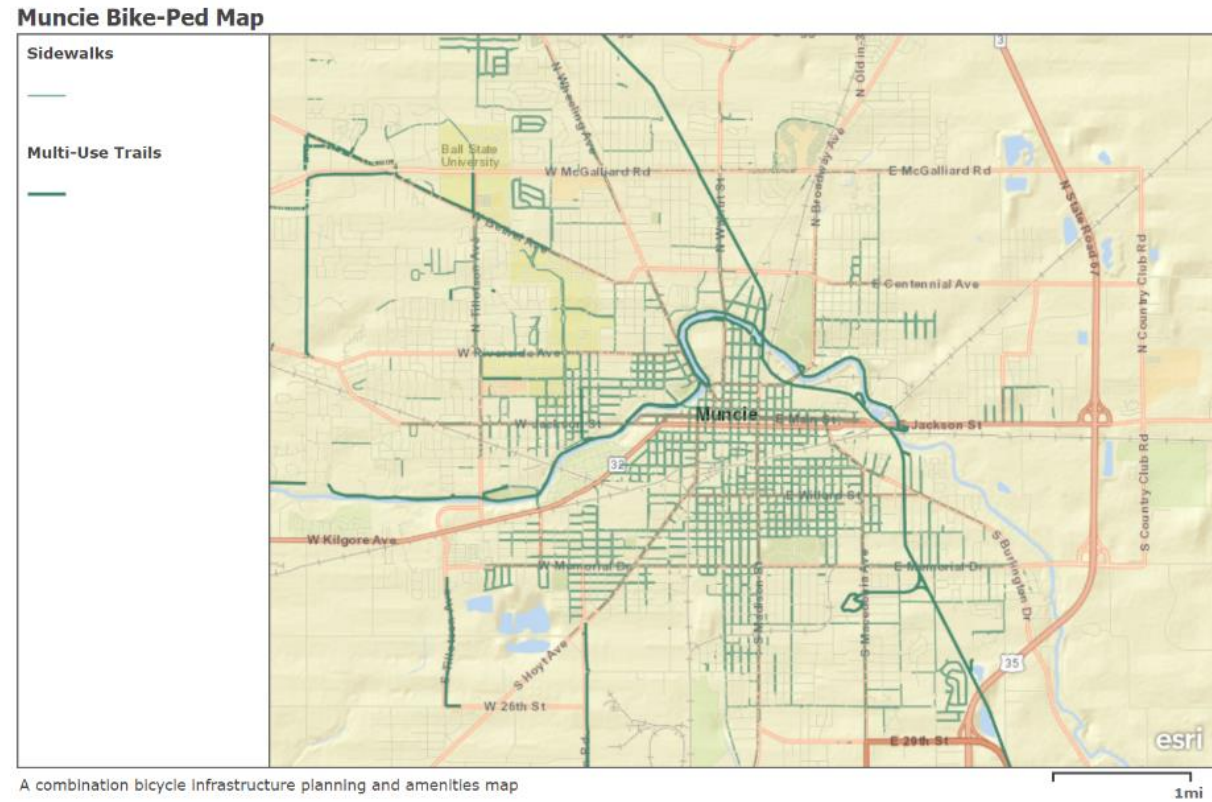


Figure 27: Current sidewalk and multi-use trail map for Muncie, IN⁵¹

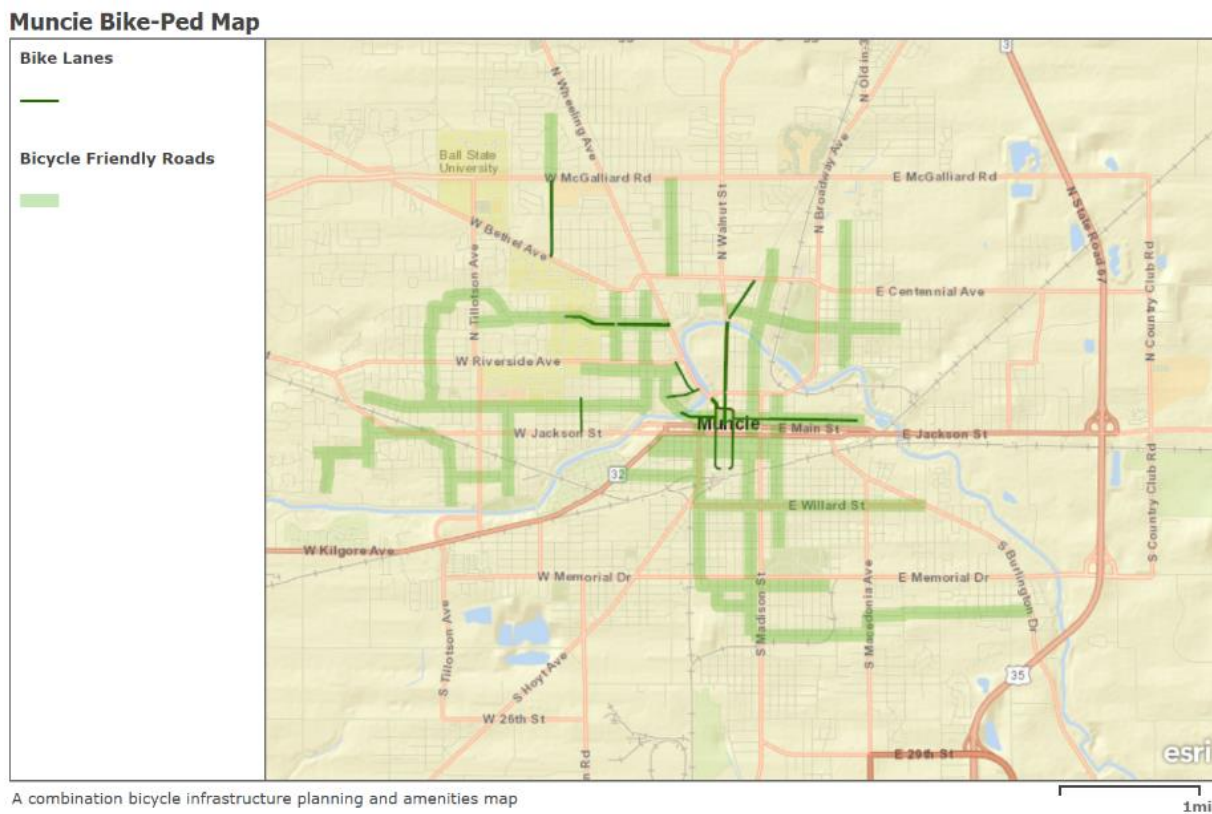


Figure 28: Current bike lanes and bike friendly road map for Muncie, IN⁵¹

The other major trail is the Cardinal Greenway, Indiana's largest former rail trail⁵². After rail service was rerouted from the Cardinal in 1985, Cardinal Greenway, Inc. (a new nonprofit) purchased 60 miles of the rail line to convert it into paved, mixed-use trails in 1993⁵³. The current greenway covers 62 miles (6.4 of which are in Muncie) across five Indiana counties⁵².

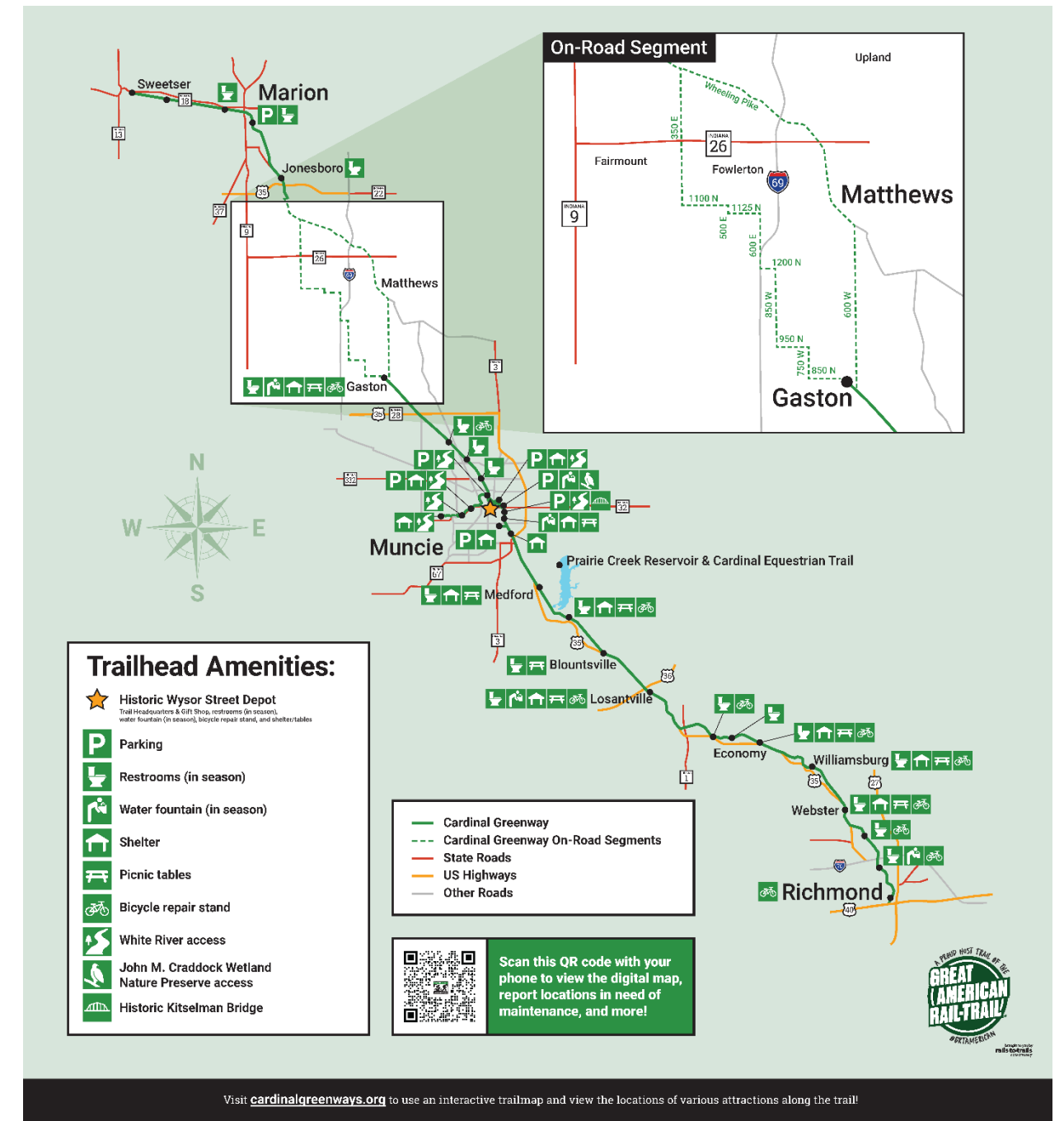


Figure 29: Map of Cardinal Greenway⁵⁴



Figure 30: Photograph of the Kitzelman Bridge⁵⁵

Connecting the Cardinal Greenway to the White River Greenway is the new Kitzelman bridge,⁵⁵ opened in November 2020⁵⁶. Once used by cars to cross the Mississinewa River in Albany, IN, the steel bridge will now be used by bikers and pedestrians to cross the White River on the east side of Muncie⁵⁶.

How necessary are these sidewalks, bike paths, and mixed-use trails to Muncie resident transportation? According to ACS estimates, only 18.6% of owner-occupied homes have one vehicle available; 1.7% have no vehicle¹. For renter-occupied housing, 23.7% of homes have access to one vehicle while 9.2% have no access¹. In total, 2,983 Muncie households do not have a vehicle¹. This means that, while a large majority of Muncie residents have access to a personal car, a certain percentage may need alternative transportation routes if another member of their household is using the vehicle (or if they never had one in the first place). Non-motorized transportation routes may be a crucial backup plan for these Muncie residents. Furthermore, if Muncie wants to promote non-motorized travel as a way to reduce transportation emissions, these routes will become important focal points in that promotion.

Occupied Housing Units By Vehicles Available			
(2015-2019 ACS Estimate) ¹			
	Vehicles Available	Percentage of Total	Reliability (1=low, 3=high)
Owner-Occupied	2	20.2%	3
	1	18.6%	3
	3	6.3%	3
	4	2.0%	2
	No vehicle available	1.7%	2
	5+	0.6%	2
Renter-Occupied	1	23.7%	3
	2	11.3%	3
	No vehicle available	9.2%	3
	3	4.1%	2
	4	1.6%	2
	5+	0.6%	2

Table 6

A number of pedestrian/bike trails are planned for Muncie. One incoming trail is the Riverside-Jackson Trail project. The project's installation of a pedestrian trail, repaving of Riverside Avenue, and reconstruction the Riverside-Jackson Street Intersection will begin in 2022⁵⁷.



RIVERSIDE-JACKSON TRAIL & RIVERSIDE AVE IMPROVEMENTS

Figure 31 ⁵⁷

Another proposed trail is the Muncie Arts and Culture Trail, which would include a separate but parallel biking/walking trail which connects with Ball State University, IU Health Ball Memorial Hospital, downtown Muncie, the south Muncie neighborhoods, Heekin Park, the White River Greenway, and the Cardinal Greenway⁴⁸.

Muncie Art and Culture Trail Plan

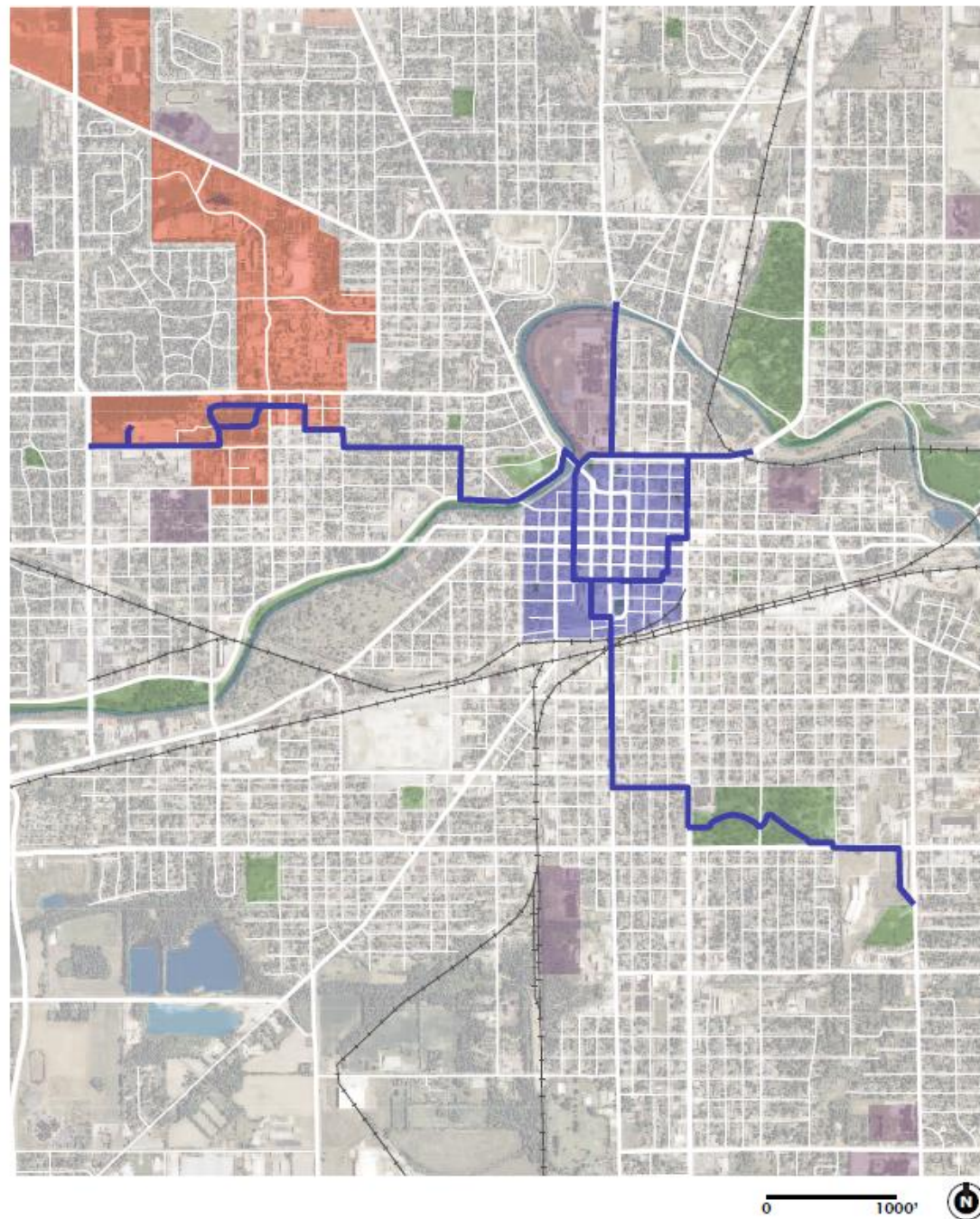


Figure 32: Map of proposed Muncie Art and Culture Trail⁴⁸

Aside from this Culture trail, the *Delaware – Muncie Bicycle And Pedestrian Plan* offers two other proposed Muncie trails and notes the trail proposals for nearby towns (proposed trails represented by the dotted lines; see Figure 33)⁴⁸:

County-Wide Greenway System

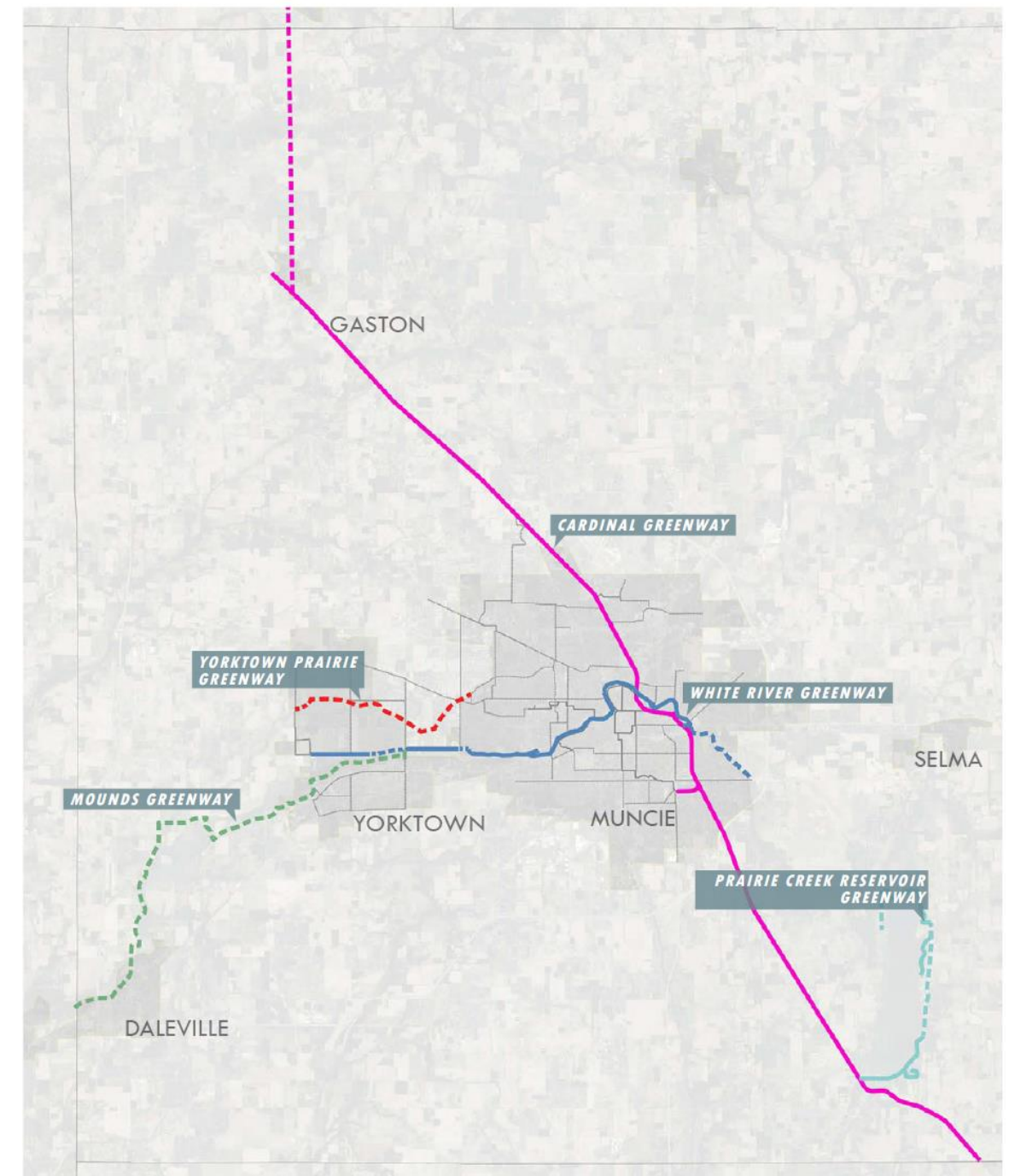


Figure 33: County-wide greenway map⁴⁸

The plan proposes that the White River Greenway be extended 1.5 miles east along the river and that the Prairie Creek Reservoir Greenway be established to connect the two miles between the Cardinal Greenway and existing trails. Though not in Muncie, the proposed addition of the Yorktown Prairie Greenway and Mounds Greenway are of note because they would offer more recreation and commuting options to Muncie's bikers/pedestrians. Along with the expansion of trails and creation of new trails already planned by the City.

MSD Background



Figure 34: Image of Greenline CNG-powered trucks⁵⁸

The Muncie Sanitary District is the entity responsible for collecting stormwater and wastewater for cleaning and release, along with residential garbage pickup and disposal and residential recycling pickup. The District has nine departments: recycling, sanitation, utility billing, Greenline, Bureau of Water Quality, engineering, sewer maintenance, stormwater management, and water pollution control⁵⁹. Aside from environmental measures undertaken during its solid waste and stormwater/sewage waste activities, the District also promotes use of compressed natural gas (CNG)⁵⁹. All the sanitation fleet (staff member trucks, garbage trucks) are powered by CNG, which is more cost effective and better for the environment than either gasoline or diesel⁵⁸. The District has a total of 24 CNG vehicles and has committed to only buying alternative fuel vehicles

in the future²⁵. For fill up by its own fleet and by the public, the Muncie Sanitary District has built the first compressed natural gas station in East Central Indiana⁵⁸.

The Muncie Sanitary District's process to treat wastewater takes environmental resiliency into account. It's ultraviolet (UV) treatment system uses fewer chemicals than traditional methods (chlorine), which benefits the local water system when that wastewater is released back into the environment²⁵. While UV can't be operated in the winter, meaning a seasonal return to traditional treatment methods takes place, this warmer-weather option still reduces chemical use when it's operational.

The District is still in the process of separating its sewage and stormwater pipes, which (when complete) will greatly reduce sewage overflow into the water system after large rains²⁵. In a combined system, high stormwaters will cause overflows of not only stormwater but toxic wastewater, too. The process is about 50% complete.

The Muncie Sanitary District collects both garbage and recycling that residents place in bags in residential totes. Any commercially produced garbage bag will suffice for regular waste, but special blue bags must be used to designate recyclable waste. These bags are offered free of charge with a coupon mailed out bi-yearly, but pickup locations are limited. A mix of 21 businesses and organizations currently offer blue bags⁶⁰.

Once these blue bags are filled with recyclable materials and put in the toter for pickup, the District trucks pick up both garbage and recycling bags. At the Material Recovery Facility, the blue bags are separated from everything else and sent to the recycling line where the items are sorted, baled, and sent to manufacturers for the creation of new products. In 2022 MSD was able to divert 32% of the material being picked up and dropped off by Muncie residents from going to the landfill.

In October of 2022, MSD received a Recycling Market and Development Board Grant from the Indiana Department of Environmental Management for \$468,789.00. This grant will help offset the startup costs of a new residential curbside recycling program where residents can opt-in for a free 96-gallon blue recycling toter. This new program will help eliminate all blue bag waste, help increase Muncie's recycling rate, and reduce contamination in the recycling stream. The new program will start in the early summer of 2023.

Equity Background

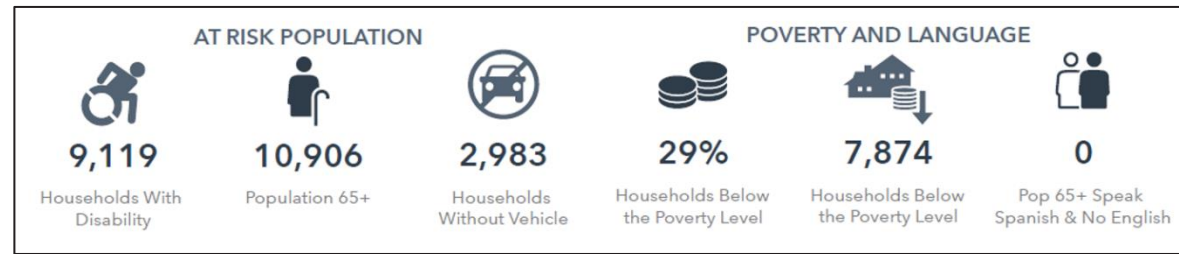


Figure 35: ACS At Risk Population Profile infographic (2015-2019 data)⁶²

According to 2015-2019 ACS estimates, 29% of Muncie households live below the poverty line, there are 2,983 households without a vehicle, and there are 9,119 households that have someone living with a disability (see Figure 35)⁶². These are important factors to keep in mind when drafting climate resiliency/emissions reduction strategies. For those living in poverty, the cost of these policies must be limited (or reduced specifically for low-income residents). Conversely, climate policies could aim to specifically increase the finances of low-income residents through tax rebates or grant funding. For those residents without vehicles, resiliency strategies should increase their access to public transportation routes or make pedestrian/bike travel easier. All forms of transportation and infrastructure should be made ADA (Americans with a Disability Act) accessible. The city is actively working on these issues. For example, Muncie recently altered a sidewalk whose walk signal button was too far from the sidewalk for a wheelchair-bound person to reach. Equity-based environmental planning must be prioritized when planning for climate resiliency.

Language Spoken (ACS)	Age 5-17	18-64	Age 65+	Total
English Only	7,720	45,671	9,336	62,727
Spanish	252	918	54	1,224
Indo-European	49	518	78	645
Asian-Pacific Island	91	582	73	746
Other Language	0	63	8	71

Figure 36: ACS At Risk Population Profile infographic (2015-2019 data)⁶²

Current Efforts

Organizations and community leaders in disadvantaged neighborhoods are attempting to improve their local economy while working with the environment. One such community leader is Troy Malone. He works in low-income neighborhoods of Muncie with his two partners, hiring local youth to mow lawns for money⁶¹. Every summer, the Urban Light Community Church's "Adopt-a-Lot" program supplies Mr. Malone with these lawns to mow in exchange for a bit of money, which he passes on to the youth according to the number of lawns they mow. The adolescents who sign up for the program meet at Mr. Malone's shed at 8am to collect their tools and receive instructions; then they're off to work. Mr. Malone began the program last year to give local at-risk youth a chance to put their energy to good use. It appears to be a productive way of teaching at-risk youth about hard work and first-hand experience with a portion of the natural world.



Figure 37: Urban Light CDC's South Central Community Garden⁶⁴

The Urban Light Community Church not only aims to provide low-income residents with summer labor; it also runs a community garden⁶³. Their South Central Community Garden provides anyone able to work the chance to grow their own healthy, sustainable produce. As a special treat, the Community Gardens sometimes host events like easter egg hunts and fall cookouts.

Keeping in line with the food topic, the Muncie Food Hub is working to further equitable environmental resiliency. Formed in 2016 with about \$300,000 of funding from Ball State University, the Muncie Food Hub Partnership aggregates, distributes, and markets local food products from a collection of local farmers and artisan food producers⁶⁴. They sell food products to local consumers through a mobile market that targets different areas of the Muncie community that are low-income and without immediate access to fresh food. The idea of a mobile food market is to connect people to healthy food and add value to the existing food chain. The benefits of food hubs and mobile markets include⁶⁵:

- Keeping our food dollars local
- Meeting local needs of farmers and consumers
- Shortening supply (value) chain
- Strengthening rural-urban education
- Social benefit
- Environmental stewardship
- Producer capacity
- Rural economic development
- Local employment
- Increasing volume of locally grown foods
- Allowing unused food to be donated



Figure 38: Muncie Food Hub Partnership Farmer's Market in 2018⁶⁸

Greenspace Background

As of October 2021, the Muncie Parks Department was charged with maintaining 2,178.25 acres of park space spread across 21+ parks⁶⁷. Here is the list of all the completed parks under the Parks Department⁶⁸:

Major Parks

- Canan Commons
- Cooley Park
- Cowing Park
- Heekin Park
- Mansfield Park
- McCulloch Park
- Prairie Creek Reservoir
- Thomas Park
- Tuhey Park
- Westside Park

Dog Parks

- Heekin Park
- Emerson Memorial Park

Neighborhood Parks

- Aultshire Park
- Ball Community Park
- Chambers Park
- Clifton-Wallace Park
- Cornerstone Park
- Gilbert Park
- Guthrie Park
- Jacks Park
- Jerry L. Thornburg Memorial Park
- Matthews Park
- Morningside Park
- Muncie Cantilevered Walkway
- Muncie Fireman's Park
- Riverbend Park
- Riverview Park
- Washington Park
- White River Park

The budget for the Muncie Parks Department has been steadily growing over the years. In 2021, the parks budget was increased 16% over that of 2020⁶⁹. The 2022 parks budget was increased a further \$211,466 over the 2021 budget, totaling \$2.8 million⁷¹. Some of this money will be dedicated to hiring a full-time assistant forester to help maintain the health and quality of local park amenities⁷¹.

This doesn't mean that park spending is necessarily sufficient, however. According to the recently released *TogetherDM* Delaware-Muncie Comprehensive Plan, Muncie's park systems are chronically underfunded⁷⁰. In 2021, the median per capita parks spending for U.S. cities of similar sizes (50,000 – 99,000 people) was \$88 while the per capita spending by Muncie was \$24⁷². The plan asserts that many Muncie parks lack amenities, need updating, and are overall sub-par to what they could be.

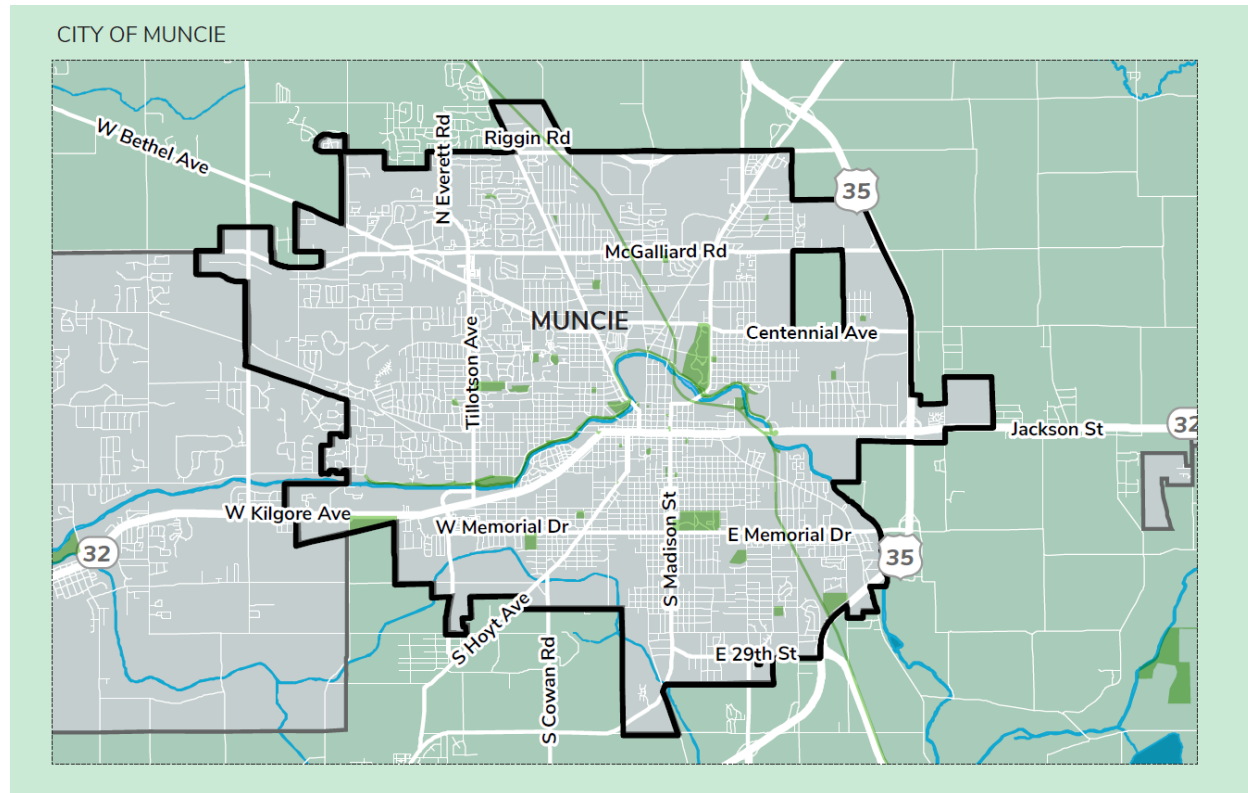


Figure 39: TogetherDM 2022 Muncie parks map⁷²

Aside from governmental parks and natural areas, the Red-Tail Conservancy offers two nonprofit-run public parks in Muncie: Hughs Nature Preserve and Dutro-Ernst Woods⁷¹ (see Figure 40 and Figure 41). Formed over 20 years ago by concerned East Central Indiana residents, the Red-Tail Land Conservancy has grown to protect some 2,800 acres from development and offer 10 public nature preserves⁷². The Conservancy is a conservation land trust, or a legal entity which takes over the maintenance-of and/or ecological protection-of a property⁷³. This form of land trust functions by allowing a property owner to transfer some of their property rights to the trust through a conservation easement⁷⁵. The landowner retains ownership and usage rights, but usage is restricted against certain environmentally-harmful actions⁷⁵. This easement can be made to “follow the land” even after its ownership changes hands. When enacted, this easement ensures that the Conservancy retains easement rights throughout time (unless otherwise stipulated)⁷⁵.

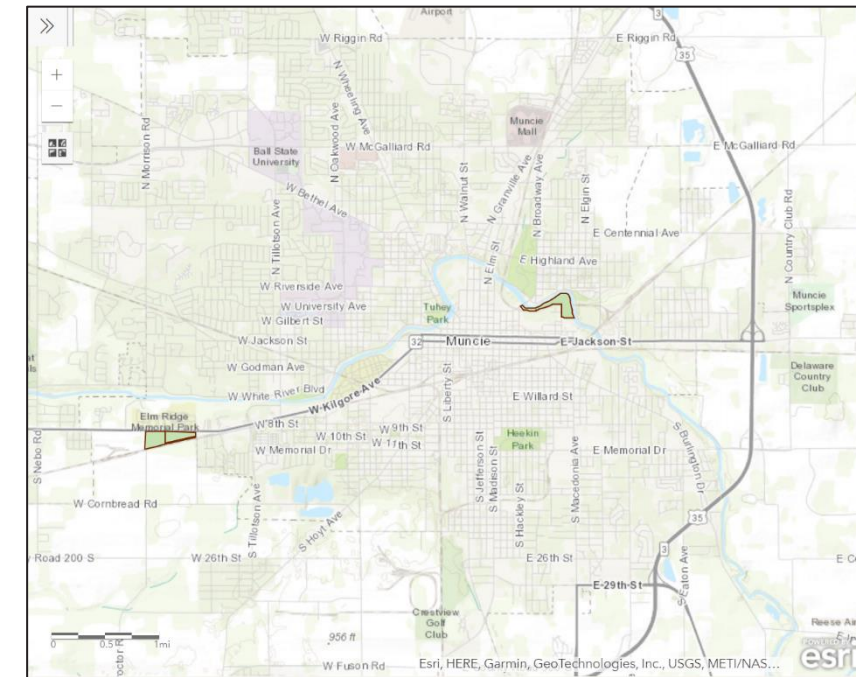


Figure 40: Map of Muncie Red-Tail Conservancy Parks (2022)⁷⁶

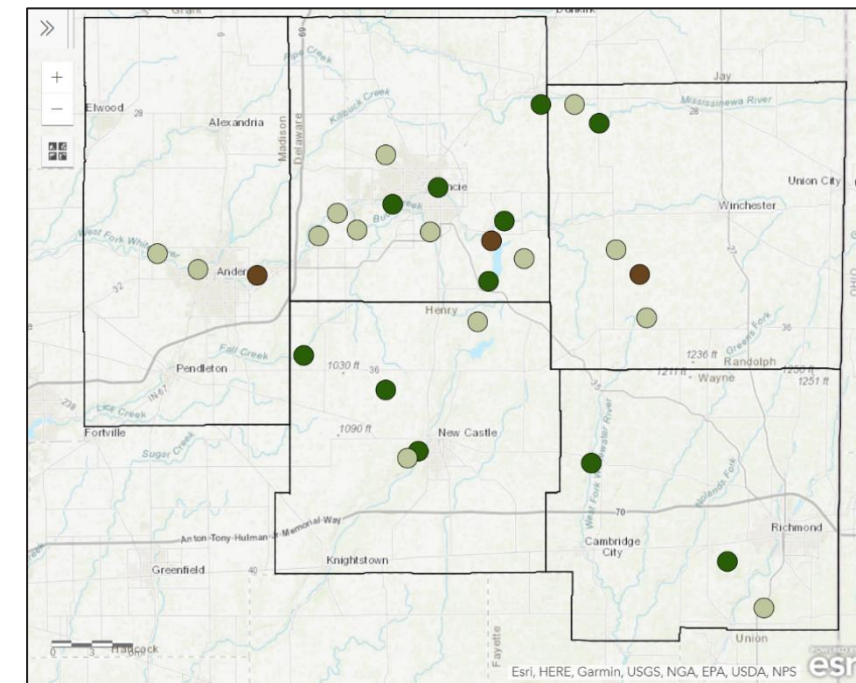


Figure 41: Map of All Red-Tail Conservancy Parks (2022)⁷⁷

Every year, volunteers come together to participate in Muncie's White River Cleanup. Sometimes as many as 500 volunteers search almost 12 miles of the White River to remove visible debris and garbage^{25,76}. Throughout its 13-year runtime, the event has resulted in an estimated 130,300 lbs (65.17 tons) of debris and 799 tires being removed from the White River⁷⁸.

Recently, Muncie has expressed an interest in planting many more trees across the city. One development comes in the form of Mayor Dan Ridenour's goal of planting "1000 trees in 1000 days"⁷⁷. Through the 1) partnering with local nonprofits and government agencies, 2) site selection process, long-term maintenance plan development, and tree species selection, and 3) planting 333 trees per year, the Mayor's goal of revitalizing Muncie's treescape can be achieved⁷⁹. The second development comes from American Electric Power, which already donates 60 trees per year to the Urban Forestry⁵. These trees are planted in spring or fall in neighborhoods interested in local beautification. As stated in the Residential Energy section, the Riverside-Normal neighborhood association has already capitalized on this program. The fall of 2021 saw 20 association volunteers receive and plant 12 of these utility-provided trees along their neighborhood tree belts⁵.



Figure 42: Riverside-Normal tree planting in 2021⁸⁰

Adaptation Background

As climate change continues to alter the frequency and intensity of weather events, it is important for Muncie to understand the natural risks posed to the city by the future. Two natural events often seen in the Midwest are tornados and floods. To assess the risk climate change poses to localized increases in these events, the National Oceanic and Atmospheric Administration can provide guidance. According to NOAA's Storm Prediction Center, neither Delaware county nor Muncie have seen a clear increase in tornado activity since 1980⁷⁹ (see Figure 43). Even the national tornado count hasn't markedly jumped since 1980⁸¹ (see Figure 44).

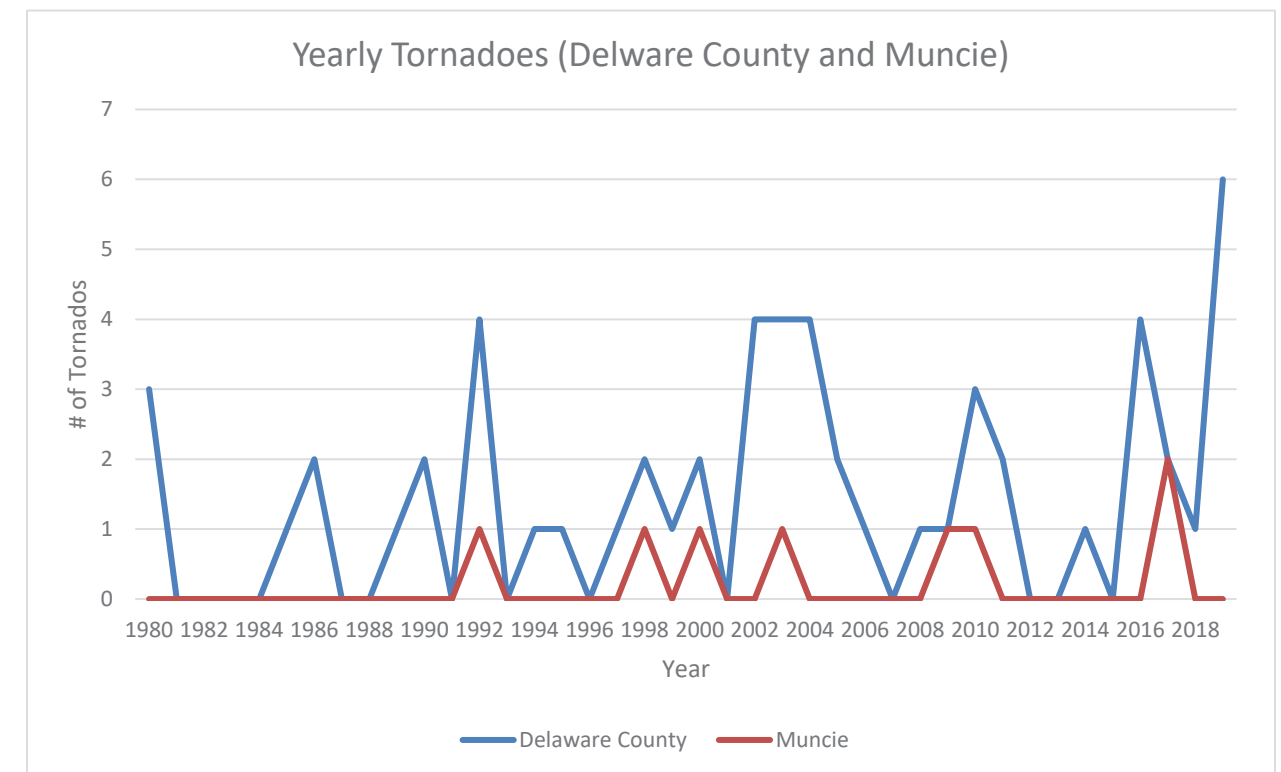


Figure 43: NOAA's Storm Graph depicting tornado counts from 1980-2018 for Delaware County, IN and Muncie, IN⁸¹

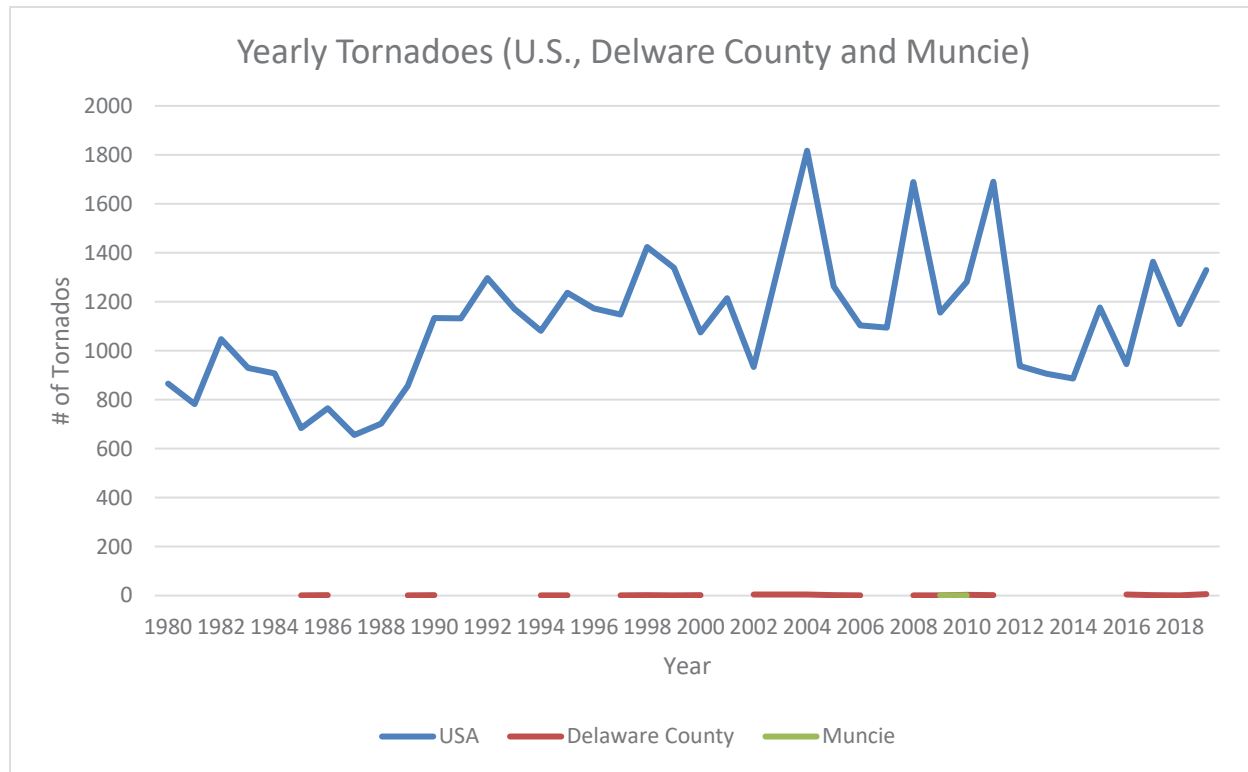


Figure 44: Graph depicting tornado counts from 1980-2018 for the U.S., Delaware County, IN, and Muncie, IN⁸¹

Given this information, it would seem that other environmental stressors could take precedent over tornadoes in Muncie's list of concerns. Flooding is one natural event which is particularly salient because the White River runs directly through the City of Muncie. According to BSU's 2019 *Resilient Muncie* report, (which is itself based off 2017 census data), a 500-year flood has the potential to affect 2,429 people in the city, as well as 99 businesses and 1,146 employees (see Table 7)³⁶.

Resilient Muncie Flooding Potential Assessment

Assessment of Flooding Potential			
Floodplain Class	Population	Businesses	Employees
Floodway	453 (0.66%)	20 (0.74%)	200 (0.53%)
100 Year Flood	1,275 (1.86%)	62 (2.28%)	792 (2.12%)
500 Year Flood	2,429 (3.55%)	99 (3.64%)	1,146 (3.06%)
Flood Risk Reduced by Levee	1,288 (1.88%)	47 (1.73%)	585 (1.56%)
All Floodplain Classes	5,445 (7.95%)	228 (8.39%)	2,723 (7.28%)

Table 7

Floodplains - Flood Rate Insurance Maps (FIRM) (2020)

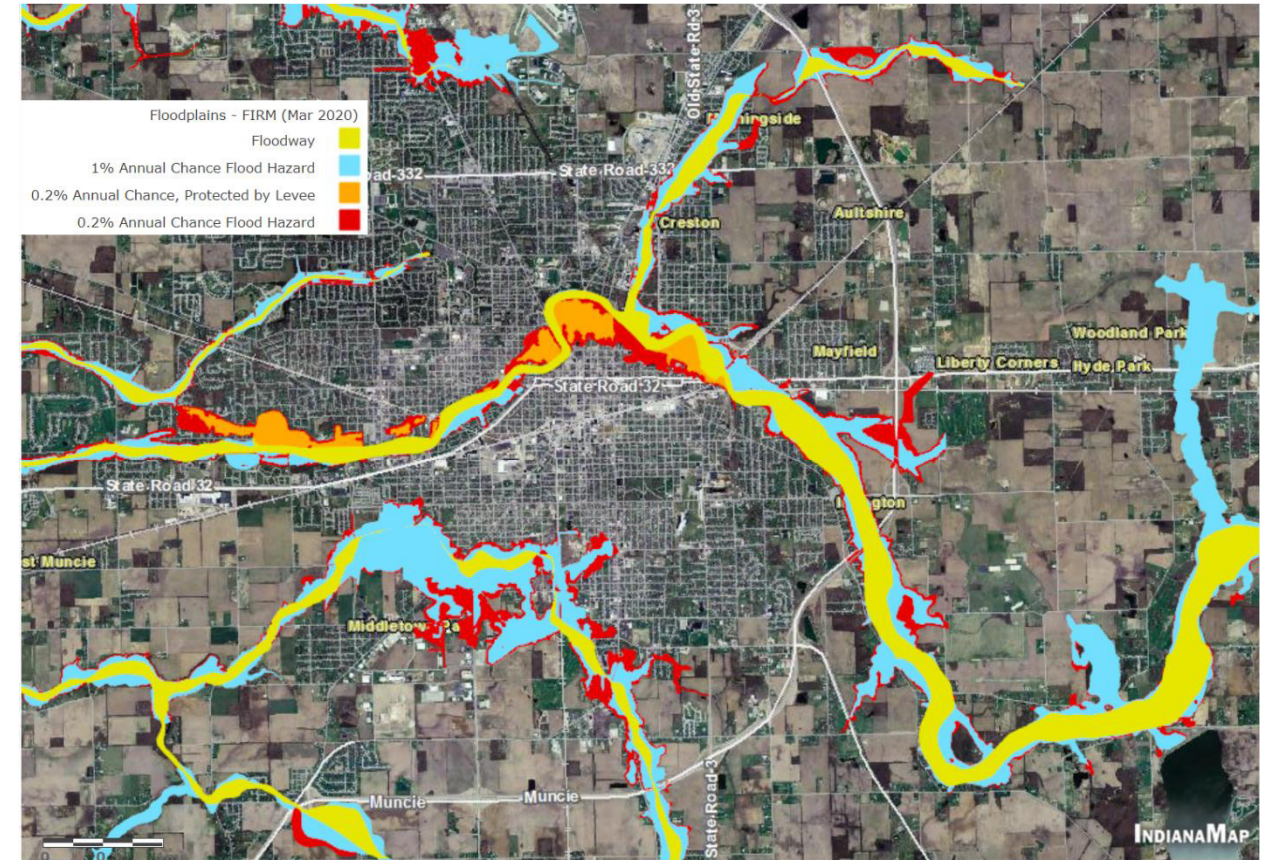


Figure 45: Map of floodways for 100 year flood, reduced risk due to levee, and 500 year flood⁸²

For the purposes of this map, the following legend labels also have these meanings:

- 1% Annual Chance Flood Hazard 100 Year Floodplain
- 0.2% Annual Chance, Protected by Levee Reduced Food Risk Due to Levee
- 0.2% Annual Chance Flood Hazard 500 Year Floodplain

Though the frequency and intensity of tornadoes should continually be monitored, flooding is certainly a more salient risk for a city along the White River.

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