

The Regional Impacts of a Completed Central Ohio Greenways in Franklin County

The ROI of Greenways Investments on Franklin County's Economy and Quality of Life

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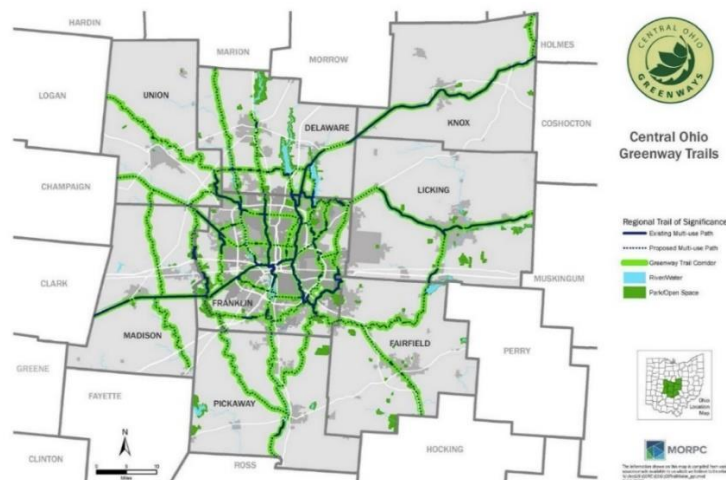
Executive Summary

The Central Ohio Greenways (COG) is an extensive network of 230 miles of trails connecting neighborhoods throughout the Central Ohio region. The COG Board, formed in 2015 as a committee of the Mid-Ohio Regional Planning Commission (MORPC), recently completed a regional trail vision plan which aims to add more than 500 new miles of trails to the network spanning over seven counties. In Franklin County specifically, approximately 173 miles of new trails are anticipated to be developed, adding to its 120 miles of existing trails. This report’s analysis focuses on the economic and societal impacts of Franklin County’s existing and proposed 293-mile trail network.

In addition to their clear transportation, recreation, and health value, trails also deliver multiple economic benefits:

- As an indicator of local reinvestment in a place, trails can serve as a catalyst for additional economic and community development projects.
- As part of a region’s green infrastructure, trail building—if completed in ways that support existing natural resources—can include the creation of a green buffer and tree cover that contribute to sustainable and resilient ecosystems.
- As a mode of active recreation for residents and out-of-town visitors, trails also often serve as a way to encourage “local tourism” as well as attract visitors to spend more time in the region, in turn spending at businesses located nearby.
- Finally, as a critical social infrastructure, trails support mental and physical health.

Figure ES.1: Map of the Central Ohio Greenways Trails Vision



Source: MORPC (2021)

Capital Investment

The completion of Franklin County’s portion of the Central Ohio Greenways (COG) trail system will represent a significant boost to the local and state economies through the upfront capital investments made to complete new trail segments. The County’s anticipated \$203 million investment in the COG network will generate direct construction activity in the region, employing construction workers and professional service providers (e.g. architects, engineers, and environmental services firms) through the project development and implementation period. These direct expenditures are projected to generate \$350 million in total economic impact, supporting 1,890 jobs with \$113 million in earnings in the Franklin County economy.¹

Figure ES.2 Potential Aggregate Economic Impact from Construction of the Proposed Franklin County Central Ohio Greenways Trail Network

Impact Type	Franklin County	Per Mile of Proposed Network
Total Impact (\$M)	\$350	\$2.0
Employment Supported (FTE)	1,890	11
Employee Compensation (\$M)	\$113	\$0.7
Total Tax Revenue Impact (\$M)	\$0.5	\$0.003

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021)

Public Health

The Central Ohio Greenways system supports healthy lifestyles for people in surrounding communities by providing an easily accessible and low-cost option for residents to engage in physical activity. Physically active people typically enjoy a variety of health benefits, including lower incidences of cardiovascular diseases, diabetes, depression, certain cancers, and obesity compared to their sedentary counterparts. It is estimated that the completed trail network will support approximately 48,100 physically active trail users annually. Due to the health benefits associated with physical activity, these users could achieve aggregate annual health care cost savings of nearly \$57 million in Franklin County. Workers who meet recommended physical activity levels using the completed trail network achieve associated benefits in workplace productivity, which could yield total productivity cost savings of \$112.4 million annually.

¹ IMPLAN generates job estimates based on the term “job-years”, or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly “job-years” supported, over two years, that represents 50 annual jobs. Additionally, these can be a mix of a full and part-time employment. Consequently, job creation could feature more part-time jobs than full-time jobs. To account for this, IMPLAN has a multiplier to covert annual jobs to full-time equivalent jobs.

Figure ES.3: Healthcare and Productivity Cost Savings from Active Trail users in Franklin County

	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion	Per Mile of Completed Network
Estimated Regular Trail Users	69,100	33,300	102,400	350
Users Meeting Activity Req. Due to Trails	32,500	15,600	48,100	160
Mean Healthcare Cost Savings Achieved by Active Trail Users	\$38.4 M	\$18.5 M	\$56.9 M	\$194,100
Mean Productivity Cost Savings Achieved by Active Trail Users	\$76.6 M	\$35.7 M	\$112.4 M	\$383,500

Source: CDC (2018), ESRI (2019), Götschia and Lohb (2017), Econsult Solutions, Inc. (2021), Carlson et al. (2013), Chenoweth & Bortz (2005), US Census American Community Survey (2015-2019)

Transportation and Safety

The Central Ohio Greenways system expands mobility options for people that live and work in the region, providing a safe, extensive network for non-motorized transportation that is connected and routed through major destinations. The potential increase in trail users due to the proposed expanded network within Franklin County provides crucial support for the region’s transportation system, including the reduction of Vehicle Miles Traveled [VMT] and safety improvements. It is estimated that users on the completed network who replace automobile trips with trail trips could reduce annual VMT in the region by 24.6 million miles, yielding associated reductions in carbon emissions of 9,710 metric tons and avoided social costs of carbon emissions of over \$525,000.

Figure ES.4: Potential Annual Reductions in VMT, Carbon Emissions, and Social Cost of Carbon

	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion	Per Mile of Completed Network
Estimated Annual Reduction in VMT	16.8 M	7.8 M	24.6 M	83,900
Metric Tons of CO ² Avoided	6,630	3,090	9,710	33
Social Cost of Carbon Avoided	\$358,700	\$167,200	\$525,300	\$1,800

Econsult Solutions (2021), US Census American Community Survey (2015-2019), 2019 Central Ohio Greenways Trail User Survey, Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Environmental Protection Agency (2018)

Spending Due to Trails

Above and beyond impacts generated by the development of the trail network, local spending by trail users will generate additional economic benefits for businesses located near the trail network as well as retailers selling trail-related products. Residents and visitors who access the region’s trails often spend money on both goods and services related to active recreational activity during their trips. Much of this spending is happening at businesses in immediate proximity of the trails. It is estimated that direct spending by trail users on the completed trail network in Franklin County will total over \$74 million annually. These direct expenditures are projected to generate approximately \$136 million in total

economic impact in Franklin County each year, supporting 1,200 jobs in the county with \$41.8 million in earnings annually.

Figure ES.5: Annual Economic and Fiscal Impacts of Trail User Spending in Franklin County

	Existing Trail Network	Proposed Trail Network	Total - Upon Completion	Per Mile of Completed Network
Frequent Trail Users	103,700	49,940	153,640	524
Total Annual Visits	22.8 M	11.0 M	33.8 M	115,400
Total Direct Spending (\$M)	\$49.9	\$24.1	\$74.0	\$0.3
Economic Impact (\$M)	\$92.0	\$44.3	\$136.2	\$0.5
Employment Supported (FTE)	800	400	1200	4
Employee Compensation Supported (\$M)	\$28.2	\$13.6	\$41.8	\$0.1
Tax Revenue Supported	\$0.4	\$0.2	\$0.6	\$1,900

Source: Central Ohio Greenways (2019), US Census American Community Survey (2015-2019), Central Ohio Greenways (2015), Econsult Solutions (2021), IMPLAN (2019), Ohio CAFR (2019)

Environmental Services

Trail networks such as COG in Franklin County provide environmental benefits for the communities they serve by bolstering natural resource management through active environmental conservation efforts. Trail networks help to preserve the surrounding natural environment, which otherwise may be at risk for development or further loss of natural lands. The natural lands adjacent to the trail network provide environment benefits including air pollution removal, the provision of water supply, water quality improvement, flood mitigation, wildlife habitat conservation, and carbon sequestration and storage.

These benefits combined create ecosystem functions that would require costly measures to replicate if lost. In sum, the estimated economic value these ecosystems provide on an annual basis is \$1.2 million. Additionally, the existing tree canopy on the fully completed network is estimated to be valued at \$5.1 million over the lifespan of the tree canopy; in other words, it would cost \$5.1 million to replicate carbon storage if the tree canopy did not exist.

Figure ES.6: Potential Environmental Benefits by Type and Locality upon Full Completion of the Central Ohio Greenways in Franklin County (\$ per Year)²

Ecosystem Service	Existing Trail Network	Proposed Trail Network	Total – Upon Full completion	Per Mile of Completed Network
Total Ecosystem Service Benefits (annual)	\$407,700	\$813,200	\$1,220,900	\$4,167
Carbon Storage (lifetime)	\$1,591,000	\$3,549,600	\$5,140,600	\$17,545

Source: Costanza (2006), Multi-Resolution Land Characteristics Land Cover (2016), MORPC (2021), Econsult Solutions, Inc. (2021)

² Note that not every ecosystem generates an economic benefit, approximately 28 percent of the land cover classifications identified of the ~3,500 acres were used to generate an ecosystem service benefit.

Residential Property Values

Trails are associated with positive impacts on property values proximate to them, and studies show that homeowners are willing to pay a premium to live near recreational outdoor spaces. Basic real estate economics demonstrates that when positive attributes are added to a community, demand for that place as a residential location increases, which produces an increase in housing values. This improves the vitality of the area as a whole: an increase in housing values means more wealth for property owners and more tax revenues for the local jurisdiction.

Across Franklin County, approximately 55,400 housing units are located within a half mile buffer of an existing COG trail, and another 52,000 units are located within a half mile of anticipated portions of the COG trail network.

Upon completion of the entire COG trail network, the total property value premium of the network is \$825 million. To the extent that these house value increases are properly accounted for in assessed values, this property value impact also has the effect of generating additional property tax revenues for jurisdictions and agencies in Franklin County. It is estimated that the completion of the Central Ohio Greenways system will result in additional property tax revenues of about \$2.2 million per year for Franklin County jurisdictions and agencies.

Figure ES.7: Potential Property Value Impacts from the Central Ohio Greenways system in Franklin County upon Completion

	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion
Property Value Premium (\$M)	\$495	\$330	\$825
Per Unit Premium			\$7,700
Estimated Property Taxes (\$M)	\$3.3	\$2.2	\$5.5
Per Mile			\$18,800

Source: ESRI Business Analyst (2021), Econsult Solutions, Inc. (2021), Franklin County (2021)

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1. Introduction

1.1. Purpose of Report

Trail networks provide valuable economic, environmental, and public health benefits to the communities they serve. However, these impacts are often understated or overlooked when considering investment in trail systems within communities. The purpose of this study is to describe the Central Ohio Greenway's "economic footprint" within Franklin County, Ohio to help stakeholders understand the estimated value created by completing the network, including opportunities arising for the community, workers, and local businesses.

Completion of the network within Franklin County will increase economic activity and jobs associated with construction of new segments across the region, will ultimately increase property values for residents located close to completed trails, and will provide environmental service benefits in the form of flood mitigation, carbon sequestration, and other avoided costs due to the trails' presence and their surrounding tree cover. In addition to the benefits afforded to the region by the trail network's presence, the usage of the trails by residents and visitors will also add invaluable benefits and economic activity to the area. The completed network will also expand walking, biking, and other active transportation options for the region and improve connectivity to the public transportation system and other destinations, support healthy lifestyles, and increase foot traffic and economic activity for local businesses located near the trails.

1.2. About the Mid-Ohio Regional Planning Commission and the Central Ohio Greenways

This report was commissioned by the Mid-Ohio Regional Planning Commission (MORPC), Central Ohio's regional council of more than 70 members comprised of counties, cities, villages, townships, and regional organizations.³ As Central Ohio's designated metropolitan planning organization (MPO), MORPC leads the regional transportation planning process and steers transportation infrastructure investments that occur within the region. Working in close collaboration with its members, and in particular the Central Ohio Transit Authority and Delaware County Transit Board, MORPC promotes multimodal transportation options so that Central Ohio residents have a network of roadways, public transit, and bicycling and pedestrian infrastructure to meet their transportation needs.

The Central Ohio Greenways (COG) Board, formed in 2015, is a committee of the Mid-Ohio Regional Planning Commission. The Board developed a five-year strategic plan for the region, envisioning a world-class network of trails that are easily accessible to all residents within Central Ohio. The Board's mission is to "increase greenways trail mileages and use of trails for recreational and transportation needs."⁴ In order to complete their vision and mission, the Board adopted a trail network plan that will extend

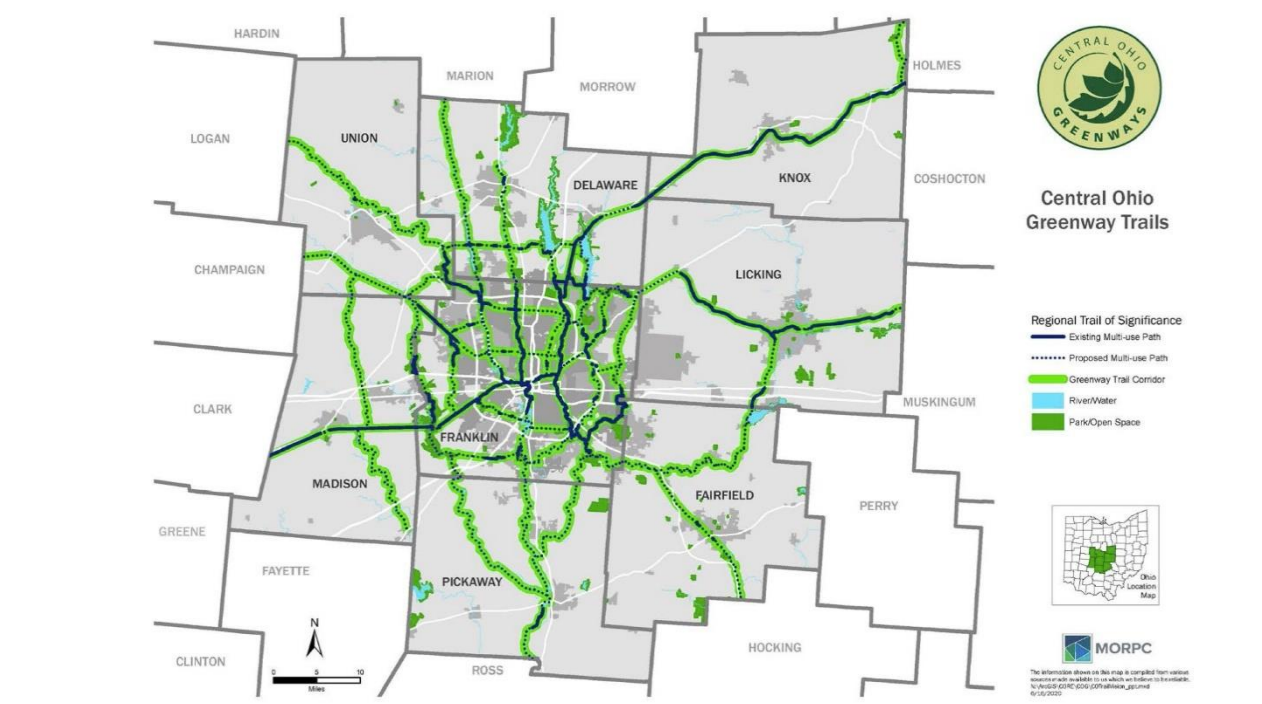
³ www.morpc.org/about-morpc/

⁴ www.centralohiogreenways.com/about/

existing trails, connect gaps in trail corridors, link people to employment areas, and create a “truly interconnected network of trails useful for both transportation and recreation.”⁵

COG is currently an extensive network of 230 miles of trails connecting neighborhoods throughout the Central Ohio region. The Board’s recent regional trail vision plan aims to add more than 500 new miles of trails to the network spanning over seven counties. In Franklin County specifically, approximately 173 new miles of trails are anticipated to be developed, adding to its already 120 miles of existing trails. This report’s analysis focuses on the economic and societal impacts of Franklin County’s existing and proposed 293-mile trail network.

Figure 1.1: Map of the Central Ohio Greenways



Source: MORPC (2021)

Figure 1.2: Central Ohio Greenways by Status of Trail Segments in Miles

	Existing Trails (miles)	Planned Trails (miles)	Total (miles)
Franklin County	120	173	293

Source: MORPC (2021)

⁵ www.centralohiogreenways.com/about/

1.3. Trail Networks as a Driver of Regional Benefits

Research and practice show that greenways and trails are essential infrastructure which improve the economic vitality of communities. Greenways create safe and easy access to a community's natural assets and connect destinations throughout a region. When developed as a network, they support healthy living, provide affordable transportation, and improve the quality of life for residents who live nearby. In addition to providing benefits to residents, investments in greenways and trails increase the attractiveness of a community for businesses and out-of-town visitors. In addition to their clear transportation, recreation, and health value, trails also deliver multiple economic benefits:

- As an indicator of local reinvestment in a place, trails can serve as a catalyst for additional economic and community development projects.
- As part of a region's green infrastructure, trail building—if completed in ways that support existing natural resources—can include the creation of a green buffer and tree cover that contribute to sustainable and resilient ecosystems.
- As a mode of active recreation for residents and out-of-town visitors, trails also often serve as a way to encourage “local tourism” as well as attract visitors to spend more time in the region, in turn spending at businesses located nearby.
- Finally, as a critical social infrastructure, trails support mental and physical health.

1.4. Organization of Report

This report analyzes the potential economic, environmental, and public health impacts of the existing and proposed Central Ohio Greenways trail network within Franklin County, and is organized as follows:

- **Section 2: Impacts from Capital Investments in the Remaining Network:** estimating the potential upfront impacts during construction of the trail;
- **Section 3: Public Health Impacts:** valuing the benefits associated with users increasing their physical activity and fitness due to the presence of the network;
- **Section 4: Transportation and Safety Impacts:** evaluating the ways in which, once complete, the network will enhance safety and connectivity in the region;
- **Section 5: Trail Spending Impacts:** calculating the potential spending generated due to trail users, particularly spending that supports local businesses;
- **Section 6: Environmental Services Benefits:** quantifying the benefits associated with preserving the tree cover and green infrastructure along the network corridors;
- **Section 7: Residential Property Value Impacts:** measuring the incremental property value premium for residential housing located near trails; and
- **Appendix:** providing additional analytical results at more granular level than what is presented in the main body of the report.

1.5. Notes about Data and Terminology

The following lists the data sources and concepts used and discussed throughout the report. For each piece of analysis, ESI obtained the most recently available datasets but it is possible that there many have been other potential datasets that were not used. Impacts for Franklin County are included in each section. When applicable, impacts for the State of Ohio are also calculated.

Multiple data sources are used throughout each section of this report including academic papers, model frameworks, and surveys. The specific methodologies are included in each section. However, there are a few data sources, methodologies, and models that are used throughout the report, which are defined here:

American Community Survey: Data tracking characteristics of the population and region immediately surrounding the trail network and in Franklin County at large are drawn from the latest available complete release of the American Community Survey (ACS) product from the US Census Bureau.

IMPLAN: Impact Analysis for Planning. An industry standard input-output model used to estimate the economic impacts from capital investments and user-trail spending.

Input-output modeling: This economic modeling technique is used to represent the flow of money in an economy. In an inter-connected economy, every dollar spent generates two spill-over impacts: First, some proportion of spending on locally-purchased goods and services is circulated back into an economy. This represents an "indirect effect" and reflects the fact that local purchases of goods and services support local vendors, who in turn create business-to-business transactions when they purchase from their own set of vendors. Second, some proportion of that expenditure that goes toward employee salaries is circulated back into an economy when those employees spend some of their earnings on goods and services. This represents what is called the "induced effect" and reflects that fact that some of those goods and services will be purchase from local vendors, further stimulating a local economy.

MRLC: Multi-Resolution Land Characteristics (MRLC) Consortium. A group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale for a wide variety of environmental, land management, and modeling applications. MRLC manages the land cover and tree canopy data in order to estimate environmental benefits.

In addition to the data sources listed above, the following terms and acronyms are used throughout the report and defined here:

Active transportation: Also referred to as active commuting, refers to transportation by human physical activity or non-motorized means. In this analysis, active transportation refers to transportation modes of walking and biking.

Ecosystem services: Any positive benefit that wildlife or ecosystems provide to people as a result of their natural functions. This report estimates the economic benefits associated with the ecosystem services of provision of water supply, water quality improvement, flood mitigation, wildlife habitat, air

pollution removal, and carbon sequestration and storage that results from the natural environment on natural lands adjacent to the trail network.

Employee absenteeism: In the context of this analysis, employee absenteeism is defined as hours of work lost by employees staying home / missing work due to health issues.

Employee presenteeism: In the context of this analysis, employee presenteeism is defined as hours of work lost by employees being less productive while at work / working due to health issues.

Environmental benefits: The economic benefits derived from ecosystem services.

Geographies: The primary geography of interest in this analysis is Franklin County, Ohio and most metrics throughout the report are developed for Franklin County. It should be noted, however, that the sections that quantify economic and tax revenue impacts from spending in Franklin County present results for the county and statewide.

Hard goods: Also referred to as durable goods, hard goods are goods that yield utility over time rather than being consumed in one or few uses. In the context of this analysis, hard goods refer to trail-related equipment, clothing, and accessories.

Land cover: Patterns of vegetation or man-made features that occur on the earth's surface. Examples of land cover include forest, pasture, wetland, and developed area.

MORPC: Mid-Ohio Regional Planning Commission.

Physically active: In this analysis, "physically active" is defined as meeting the Centers for Disease Control and Prevention recommended level of physical activity: at least 150 minutes per week of moderate-intensity equivalent physical activity. Active trail users in this analysis are defined as those who use the trail network 3 or more times a week and meet recommended levels of physical activity due to trails alone.

Social Cost of Carbon (SCC): The economic cost in terms of the resulting damage to the atmosphere associated with each metric ton of carbon emissions.

Soft goods: Also referred to as non-durable goods, soft goods are goods that are intended to be consumed. In this analysis, soft goods refer to food and beverage consumables.

Value transfer: An estimation method that assigns a monetary value to something non-monetary to gauge how much people value the asset/service and would be willing to pay for it if they had to. This method is used where data collection proves too costly or time consuming. An example of value transfer is asking someone how much they would be willing to pay to remove a ton of carbon from the atmosphere.

2. Impacts from Capital Investments in the Remaining Trail Network

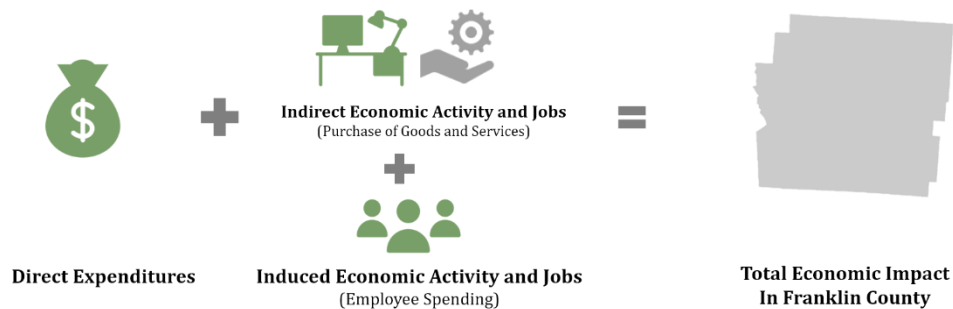
The completion of Franklin County’s portion of the Central Ohio Greenways system will represent a significant boost to the local and state economies through the upfront capital investments made to complete new trail segments of COG. Direct construction activity of the network will employ construction workers and professional service providers (e.g. architects, engineers, and environmental services firms) through the project development period; those workers in turn will spend a portion of their salaries and wages within the local and state economies. This construction activity will also catalyze the procurement of a wide range of goods and services translating into new economic opportunities for local and state vendors.

2.1. Methodology

The impact of this direct investment in the construction of the trails does not end with the initial capital investment but is recirculated through the economy in two ways:

- First, a portion of that direct spending, which goes to the purchase of goods and services, gets circulated back into an economy when those goods and services are purchased from local vendors. This is the “indirect effect,” and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.
- Second, a portion of that direct spending, which goes to labor income, gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This is the “induced effect,” and reflects the fact that some of those goods and services will be purchased from local vendors, further stimulating the local economy.

Figure 2.1: Economic Impact Methodology



Source: Econsult Solutions, Inc. (2021)

By determining linkages across industries, input-output models estimate both the magnitude and composition of spillover impacts to all industries associated with a dollar spent in any one industry. Thus, the total economic impact for the expansion of the Central Ohio Greenways network is the sum of the direct construction investment plus the indirect and induced effects generated by that direct investment (see Figure 2.1). These impacts are only calculated for construction occurring for the proposed network. It does not capture any previous capital investments into the existing network.

2.2. The Central Ohio Greenways' Future Network

A significant investment has been made in COG to date, but a substantial amount of work is still required to establish a connected network of trails within Franklin County and throughout the region. Currently, Franklin County has 120 miles of built regional trails, with an additional 173 miles to be built in the future, including overcoming nearly 50 barriers, such as rivers and highways, to connect urban, suburban, and rural communities. The following estimates are based on the remaining costs to build out the Central Ohio Greenway trails in Franklin County.

Estimates provided by MORPC and evaluated by ESI show that the total cost to construct the remaining segments of the trail network is roughly \$203 million (see Figure 2.2). The average cost of the investment in the new COG segments is \$1.74 million per mile. The cost to construct the trail is categorized by the following:

- **Barriers** include highway and river crossings,
- **Along Open Space** includes any trail segments that will be built in a natural area along a river, field, or other undeveloped area,
- **Along Rail** includes any trail segments that will be built along a railway, and
- **Along Road** includes any trail segment that will be built along a roadway.

Figure 2.2: Estimated Construction Costs of the Proposed Central Ohio Greenway trails in Franklin County (\$M)

Planned Trail Location	Barriers/Miles	Avg Cost per Unit	
		(\$M)	Construction Cost (\$M)
Barriers	49	\$2.0 each	\$98.0
Along Open Space	106	\$0.8/mile	\$79.6
Along Rail	12	\$0.8/mile	\$9.2
Along Road	55	\$0.3/mile	\$16.4
Total	49 barriers/ 173 miles		\$203.2
Average Cost per Planned Mile (\$M)			\$1.74

Source: MORPC (2021)

2.3. Potential Economic Impact of the Central Ohio Greenways' Completion

Direct expenditures attributed to the completion of Franklin County's Central Ohio Greenway segments are estimated to total \$203 million over the next 10 years of construction.⁶ These direct expenditures

On average, each mile of additional trail in the State of Ohio supports:
13 jobs during construction
\$2.4 million in economic output.

are projected to generate \$350 million in total economic impact to Franklin County, supporting 1,890 full-time (FTE) jobs and \$113 million in total earnings (see Figure 2.3). For Ohio, the investment is projected to generate \$423 million in total economic impact, supporting 2,220 jobs with \$130 million in earnings.⁷

Figure 2.3: Potential Aggregate Economic Impact from Construction of the Proposed Central Ohio Greenways system in Franklin County and the State of Ohio

Impact Type	Franklin County	State of Ohio
Direct Output (\$M)	\$203	\$203
Indirect and Induced Output (\$M)	\$147	\$219
Total Impact (\$M)	\$350	\$423
Employment Supported (FTE)	1,890	2,220
Employee Compensation (\$M)	\$113	\$130

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021)

2.4. Completion of Central Ohio Greenways in Franklin County Will Support a Diversity of Jobs

Capital investment in the Central Ohio Greenways network in Franklin County will support jobs in many industries beyond the building trades and engineering. Direct employment in construction of the trails will account for approximately 60 percent of all jobs supported. However, 40 percent of the jobs supported are indirect and induced jobs, including healthcare and social services, professional and technical services, retail sector, food services, administrative services, and finance and insurance. The industry distribution of all employment generated by the proposed construction of the Central Ohio Greenways trails within Franklin County is shown in Figure 2.4.

These indirect and induced jobs are supported through the spillover spending that occurs from the upfront construction of the trail network. For example, the retail industry is supported when a general contractor purchases materials from a local building supply store. Additionally, the accommodations and food sector is supported when construction workers spend their earnings having lunch at a restaurant.

⁶ This analysis does not include any additional spending associated with upkeep or maintenance after the initial capital investment.

⁷ IMPLAN generates job estimates based on the term "job-years", or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly "job-years" supported, over two years, that represents 50 annual jobs. Additionally, these can be a mix of a full and part-time employment. Consequently, job creation could feature more part-time jobs than full-time jobs. To account for this, IMPLAN has a multiplier to covert annual jobs to full-time equivalent jobs.

Figure 2.4: Industry Distribution of Employment Generated from Construction of the Proposed Central Ohio Greenways Network

Industry	Distribution
Health Care and Social Assistance	14.0%
Retail Trade	14.0%
Professional, Scientific, and Technical Services	10.7%
Admin. & Support and Waste Management and Remediation Services	9.0%
Other Services (except Public Administration)	7.7%
Wholesale Trade	7.5%
Accommodation and Food Services	6.7%
Real Estate and Rental and Leasing	6.0%
Transportation and Warehousing	5.7%
Finance and Insurance	5.4%
All Other	13.3%

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021)

2.5. Potential Tax Impacts from the Completion of the Central Ohio Greenways

The cumulative capital investment also generates tax revenue impacts in the respective localities during the period of construction. To estimate these tax revenue impacts, ESI created a custom fiscal impact model to translate total economic impacts into their commensurate tax revenue gains. Output from the IMPLAN model determines its impact on the relevant tax types and tax bases associated with the jurisdictions in which revenue impacts reside. These include income, sales, and business taxes at the state level, which are modeled in this report. There are other relevant taxes for various local jurisdictions, such as municipal income tax, which IMPLAN estimates to be \$1.8 million in personal income tax to cities and municipalities combined in Franklin County. The resulting property tax gains from the trail development are later discussed in Section 7 of this report.

The direct construction activity of the trail network, as well as its indirect and induced economic impacts, is estimated to generate approximately \$6.2 million to the State of Ohio over the next ten years of construction (see Figure 2.5). In Franklin County, it is estimated to generate approximately \$500,000 in sales tax revenue. Tax revenue generated from planned trail construction is approximately \$36,050 per mile for the State of Ohio and \$2,740 per mile for Franklin County over 10 years of construction.

Figure 2.5: Potential Tax Revenue from Construction of Central Ohio Greenways

Tax Type	Franklin County	State of Ohio
Income (\$M)	-	\$1.8
Sales (\$M)	\$0.5	\$3.5
Business (\$M)	-	\$1.0
Total Tax Revenue (\$M)	\$0.5	\$6.2
Tax Revenue Per Mile of Planned Trails (\$)	\$2,740	\$36,050

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021), State of Ohio CAFR (2019)

3. Public Health Impacts

The Central Ohio Greenways supports healthy lifestyles for people in surrounding communities by providing an easily accessible and low-cost option for residents to engage in physical activity. Physically active people typically enjoy a variety of health benefits, including lower incidence of cardiovascular diseases, diabetes, depression, certain cancers, and obesity compared to their sedentary counterparts. Additionally, physically active individuals tend to achieve higher rates of productivity at work. This section estimates health-related cost savings associated with the network's physically active trail users.

3.1. How Trails Contribute to Positive Public Health Outcomes

According to the 2018 *Physical Activity Guidelines for Americans*, individuals who engaged in at least 150 minutes of moderate to strenuous physical activity each week are considered to be physically active.⁸ In order to quantify the health benefits for trail users, this section will measure the impacts of frequent trail users who are healthy and active because of the presence of the Central Ohio Greenways within their community in Franklin County. ESI utilized data from the US Census regarding residents with walking/biking access to the trail network as well as survey data and research from the Journal of Transport and Health to estimate frequent trail users and active adults. Measures from the CDC's report *Inadequate Physical Activity and Health Care Expenditures in the United States* were used to quantify the estimated value of an active lifestyle.⁹ These statistics were used as the basis for estimating the potential savings in the form of health care expenditures that are avoided as a result of increased physical activity on the trail network.

Additionally, the health benefits achieved by physically active individuals are associated with benefits in terms of workplace productivity and employee retention. Physically active workers tend to have lower rates of absenteeism (employees missing work) and presenteeism (employees less productive while at work) than their physically inactive counterparts.¹⁰ Lost productive work hours due to absenteeism and presenteeism represent direct costs associated with physical inactivity. Using the approach established in Chenoweth and Bortz, *Physical Inactivity Cost Calculator*, the productivity cost savings realized by estimated number of workers who will meet recommended levels of physical activity using the Central Ohio Greenways in Franklin County, once completed, are quantified.¹¹

⁸ Centers for Disease Control and Prevention (2021), *Physical Activity Basics*. <https://www.cdc.gov/physicalactivity/basics/adults/index.htm>.

⁹ Carlson et al. (2013), *Inadequate Physical Activity and Health Care Expenditures in the United States*. <https://www.cdc.gov/nccdphp/dnpao/docs/carlson-physical-activity-and-healthcare-expenditures-final-508tagged.pdf>.

¹⁰ Chenoweth and Leutzinger (2006), *The Economic Cost of Physical Inactivity and Excess Weight in American Adults*. https://www.huffinesinstitute.org/Portals/0/Chenoweth_JPAH_3_06.pdf and Chenoweth and Bortz (2005), *Physical Inactivity Cost Calculator: How the Physical Inactivity Cost Calculator Was Developed*.

¹¹ Chenoweth and Bortz (2005), *Physical Inactivity Cost Calculator: How the Physical Inactivity Cost Calculator Was Developed*.

3.2. Estimated Active Users of the Central Ohio Greenways Upon Completion

It is estimated that the completion of the full Central Ohio Greenways will support approximately 48,100 active residents in Franklin County (see Figure 3.1). The following steps were taken to arrive at this count:

- First, ESI estimated the number of local residents who are/will be frequent (three or more times a week) trail users. Data regarding trail usage from the 2019 Central Ohio Greenways Trail User Survey in conjunction with data regarding the number of working age adults with walking/biking access to a COG trail from the US Census were used to develop these estimates. Estimates are developed for the existing trail network, the proposed additions to the trail network, and the total network upon completion.
- Next, the number of frequent trail users who meet recommended physical activity levels established by the CDC due to trail usage is calculated. Research on the physical activity levels of trail users from Götschia and Lohb (2017) is used to estimate the number of frequent trail users who are considered active and are indeed experiencing the health benefits associated with their healthy habits.¹²
- Then, ESI applied a reduction to this estimate based on the proportion of users who would be considered active even without access to the Central Ohio Greenways.¹³ This approach yields a more conservative estimate that accounts only for users that can attribute their increased activity and associated health benefits to the presence of the trails in their community.

Figure 3.1: Estimated Number of Trail Users Located within Walking/Biking Distance and Meeting Physical Activity Requirement Due to the Central Ohio Greenways in Franklin County¹⁴

	Working Age Adults	Estimated Regular Trail Users	Users Meeting Activity Req. Due to Trails
Existing Trail Network	162,200	69,100	32,500
Proposed Trail Network	78,100	33,300	15,600
Total - Upon Completion	240,300	102,400	48,100

Source: CDC (2018), ESRI (2019), Götschia and Lohb (2017), Econsult Solutions, Inc. (2021)

The existing trail network supports an estimated 32,500 Franklin County residents to meet recommended levels of physical activity each year. It is estimated that the completed network will support over 48,000 active residents annually and each mile of trail will support approximately 160 physically active users annually on average.

¹² Götschia and Lohb (2017), *Advancing Project-Scale Health Impact Modeling for Active Transportation: A User Survey and Health Impact Calculation of 14 US Trails*. <https://www.sciencedirect.com/science/article/pii/S2214140516303255>.

¹³ Proportions are drawn from Götschia and Lohb (2017), *Advancing Project-Scale Health Impact*.

¹⁴ Note that columns may not sum due to rounding.

3.3. Potential Public Health Value of the Completed Network

Residents who achieve physically active lifestyles due to the completed Central Ohio Greenways in Franklin County yield a range of personal health benefits as well as broader public health benefits for the region. Physically active lifestyles are linked to positive health outcomes including reduced risk of chronic diseases, improved mental health, and reduced prevalence of rheumatic conditions and injury.¹⁵ These positive individual outcomes yield public health value by reducing strain on the health system and lowering overall health care expenditures.

The economic value of these health benefits can be quantified in terms of the healthcare costs avoided by physically active trail users. ESI developed lower bound, mean, and upper bound estimates of the potential health care expenditure reductions achieved by active users on COG trail network. These estimates were developed by applying potential healthcare expenditure savings per active individual from the CDC study to the number of active trail users supported by COG network.¹⁶ It is estimated that physically active users of the existing trail network could achieve annual healthcare cost savings between \$21 million and \$55 million. It is estimated that the completed Central Ohio Greenways in Franklin County could yield between \$32 million and \$81 million in healthcare cost savings. On average, each mile of the completed network is estimated to support between \$107,800 and \$277,900 in annual healthcare cost savings.

Figure 3.2: Estimated Value of Healthcare Savings from Active Trail Users in Franklin County

	Lower Bound	Mean	Upper Bound
Average Annual Savings per Active Individual (\$)	\$656	\$1,181	\$1,691
Annual Savings - Existing Trail Network (\$M)	\$21.3	\$38.4	\$55.0
Annual Savings - Proposed Trail Network (\$M)	\$10.3	\$18.5	\$26.5
Annual Savings - Total Network Upon Completion (\$M)	\$31.6	\$56.9	\$81.4
Per Mile of Completed Trail Network	\$107,800	\$194,100	\$277,900

Source: Götschia and Lohb (2017), Carlson et al. (2013), ESRI (2019), Econsult Solutions, Inc.(2021)

3.4. Trail Networks’ Impacts on Employee Wellness and Retention

In addition to improving overall health, employer wellness programs can differentiate companies from competitors. In recent years, it takes more than just compensation to incentivize employees to join and stay at a company. In fact, research has shown that companies that invest in their employees’ health and well-being can improve employee loyalty, with 87 percent of employees considering health and

¹⁵ Centers for Disease Control and Prevention (2021), *Benefits of Physical Activity*. <https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>.

¹⁶ Carlson et al. (2013), *Inadequate Physical Activity and Health Care Expenditures in the United States*. <https://www.cdc.gov/nccdphp/dnpao/docs/carlson-physical-activity-and-healthcare-expenditures-final-508tagged.pdf>.

wellness packages when choosing an employer.¹⁷ Beyond attracting employees to choose a certain company over another, trail investments can also increase employee retention.

A study conducted in Northwest Arkansas showed that investment in paved and unpaved trails contributed significantly to the region's well-being and economic performance.¹⁸ Human resource managers and business owners reported that the region's bicycle infrastructure helped retain employees. This study indicates that trail investments can support employee retention.

For example, Schulte Building Systems, a 600-employee metal-building fabrication company in Hockley, Texas, realized benefits associated with increased access to walking and biking trails through improvement in employee wellness and increased retention rates.¹⁹ The company uses personalized wellness programs and walking trails to encourage its employees to be more active. The emphasis on personal health and wellbeing in turn makes the employees feel valued and more inclined to stay with the company.

Additionally, by focusing on wellness programs, companies can increase profits by minimizing the losses associated with high employee turnover. High turnover rates are detrimental to a company's bottom line, since there are monetary and time costs associated with a high turnover rate. Since the recruiting process has costs associated with advertising, interviewing, screening, and onboarding, a high turnover rate can have adverse effects on the company culture and general employee morale. If many employees are leaving, others may ask why and disengage. High employee retention helps to reduce the costs associated with recruiting and training new employees.

A company with reduced costs is able to increase profits, maintain company culture, and perform better in the overall regional economy. Benefits such as wellness programs and access to trails play a large role in employee retention, since employees want benefits personalized to their needs. As will be shown in Section 5.5 below, employees with active lifestyles have also been shown to have greater workplace productivity compared to their non-active counterparts. Walking trails close to employment hubs reduce the barriers to physical activity for employees.

3.5. Productivity Benefits Achieved by Active Trail Users

To quantify the workplace productivity benefits realized by the estimated active users of the Central Ohio Greenways in Franklin County, a series of steps are taken to estimate the number of physically active workers supported by the trail network. The approach to this estimation is consistent with that set forth in Section 3.2, however data from the US Census tracking the number of *workers* with walking/biking access to the trail network are used as the base for this calculation.²⁰ As outlined in

¹⁷ <https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2018/08/27/win-with-wellness-attract-and-retain-talent/?sh=6a90becf1648>

¹⁸ BBC Research and Consulting. 2018. *Economic and Health Benefits of Bicycling in Northwest Arkansas*. Prepared for The Walton Family Foundation and PeopleForBikes. Denver, CO: BBC Research and Consulting. <https://headwaterseconomics.org/trail/136-ar-bicycle-benefits/>

¹⁹ Miller (2018), Employees Are More Likely to Stay If They Like Their Health Plan <https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/health-benefits-foster-retention.aspx>

²⁰ Active workers (rather than working-age residents) are considered in this portion of the analysis because the productivity savings calculated are achieved by employed residents only.

Figure 3.3 below, it is estimated that the existing trail network supports 27,300 physically active workers in Franklin County and the completed network will support approximately 40,000 physically active workers in the region.

Figure 3.3: Estimated Number of Workers Located within Walking/Biking Distance and Meeting Physical Activity Requirement Due to the Central Ohio Greenways in Franklin County ²¹

	Workers Aged 16+ within Buffer	Estimated Regular Trail Users	Estimated Workers Meeting Activity Req. due to Trails
Existing Trail Network	136,100	58,000	27,300
Proposed Trail Network	63,400	27,000	12,700
Total - Upon Completion	199,500	85,000	40,000

Source: CDC (2018), ESRI (2019), Götschia and Lohb (2017), Econsult Solutions, Inc.(2021)

The approach established in Chenoweth and Bortz, *Physical Inactivity Cost Calculator*, presents productivity cost calculations in terms of the annual average costs per worker associated with physical inactivity. The benefits calculated in this section should therefore be thought of as the costs that are avoided by workers utilizing the Central Ohio Greenways in Franklin County to meet recommended levels of physical activity and the associated health and productivity benefits. Lower bound, mean, and upper bound values for the hours lost from absenteeism and presenteeism due to physical inactivity are drawn from the Chenoweth and Bortz study.²² These inputs are used to estimate the corresponding share of a typical employee’s annual workload lost due to absenteeism and presenteeism associated with physical inactivity (see Figure 3.4).²³

Workplace productivity cost savings achieved by active workers are then calculated by combining:

- The estimated number of active workers with walking/biking access to the trail network who meet physical activity guidelines due to trails,
- The percent of an employee’s annual workload lost due to physical inactivity from absenteeism, presenteeism, and in total (combined absenteeism and presenteeism), and
- The median earnings of a worker in the Franklin County (based on data from the US Census Bureau).

It is estimated that, in aggregate, workers who maintain recommended levels of physical activity using the existing COG trail network could achieve between \$65 and \$84 million in annual productivity cost savings, due to reduced levels of absenteeism and presenteeism in physically active workers. Upon completion, it is estimated that the total trail network could support physically active workers to achieve

²¹ Note that columns may not sum due to rounding.

²² Chenoweth and Bortz (2005), *Physical Inactivity Cost Calculator: How the Physical Inactivity Cost Calculator Was Developed*.

²³ A typical employee’s scheduled annual workload is assumed to be 2000 hours.

between \$96 and \$124 million annually in productivity cost savings. On average, potential productivity cost savings achieved per mile of the completed trail network range from \$326,000 to \$422,300.

Figure 3.4: Workplace Productivity Cost Savings Achieved by Active Trail Users in Franklin County (in \$M)

	Lower Bound	Mean	Upper Bound
Absenteeism: Lost Hours / Worker / Year due to Physical Inactivity	3.5	18.08	24.88
Percent of Annual Workload	0.18%	0.90%	1.24%
Presenteeism: Lost Hours / Worker / Year due to Physical Inactivity	131.5	140.75	150
Percent of Annual Workload	6.58%	7.04%	7.50%
Absenteeism Cost Savings Achieved by Active Workers (\$M)			
Existing Trail Network	\$1.7	\$8.7	\$12.0
Proposed Trail Network	\$0.8	\$4.1	\$5.6
Total - Upon Completion	\$2.5	\$12.8	\$17.6
Presenteeism Cost Savings Achieved by Active Workers (\$M)			
Existing Trail Network	\$63.5	\$67.9	\$72.4
Proposed Trail Network	\$29.6	\$31.7	\$33.7
Total - Upon Completion	\$93.0	\$99.6	\$106.1
Total Productivity Cost Savings Achieved by Active Workers (\$M)			
Existing Trail Network	\$65.1	\$76.6	\$84.4
Proposed Trail Network	\$30.4	\$35.7	\$39.3
Total - Upon Completion	\$95.5	\$112.4	\$123.7
Per Mile of Completed Network	\$326,000	\$383,500	\$422,300

Source: Chenoweth & Bortz (2005), US Census American Community Survey (2015-2019), Econsult Solutions, Inc. (2021)

4. Transportation and Safety Impacts

The Central Ohio Greenways expand mobility options for people that live and work in the region, providing a safe, extensive network for non-motorized transportation that is connected and routed through major destinations. The potential increase in trail users due to the proposed expanded network within Franklin County provides crucial support for the region's transportation system (e.g. easing traffic, reducing vehicle miles traveled [VMT], and increasing safety for users). This section highlights how the Central Ohio Greenways' eventual completion within Franklin County will support the region's transportation network.

4.1. Methodology

Many studies have shown that a robust network of pedestrian and bicycle trails encourage more sustainable travel mode choices among residents by creating traffic-separated pathways that are safe, comfortable, and convenient.²⁴ This "mode shift" means residents may choose to shift from driving a single-occupancy vehicle to biking, walking, or taking public transportation.

To estimate the potential impacts of the Central Ohio Greenways on the region's transportation network, ESI estimated the number of miles shifting from motorized to active transportation because of the presence of COG. To do so, ESI estimated the number of active transportation miles attributable to trails by utilizing the 2019 Central Ohio Greenways Trail User Survey. Based on this survey data and the anticipated benefits of a fully connected trail network within Franklin County, ESI then calculated the potential savings in VMT and related costs associated with traffic and congestion.

4.2. Existing Mobility and Transportation Conditions

A recent study ranked Columbus, OH among the top 100 most congested cities nationally, costing each driver an average of \$125 annually in time wasted and additional fuel costs from waiting in traffic.

The completed 293-mile Central Ohio Greenways network within Franklin County is, and will be, a critical component of the region's transportation system, alongside public transit, highways, and roads.²⁵ In densely populated communities within the County, trails work as a transportation corridor for commuters to employment centers and help reduce the region's overall reliance on automobiles.

Figure 4.1 below displays the typical commuting pattern of workers in Franklin County. As shown, the majority (80%) of commuters drive to work alone. Approximately three percent of commuters in the County currently bike or walk to work.²⁶

²⁴ *Active Transportation Transforms America*, Rails to Trails Conservancy, 2019

²⁵ Source for call-out box: *INRIX Scorecard*. <https://inrix.com/scorecard-city/?city=Columbus%20OH&index=473>

²⁶ Note that this data from the American Community Survey is representative of commute-to-work trips for the employed population and does not represent the mode split for all trips in the region. Trips for household errands, childcare, trips to school, etc. are not captured in this data.

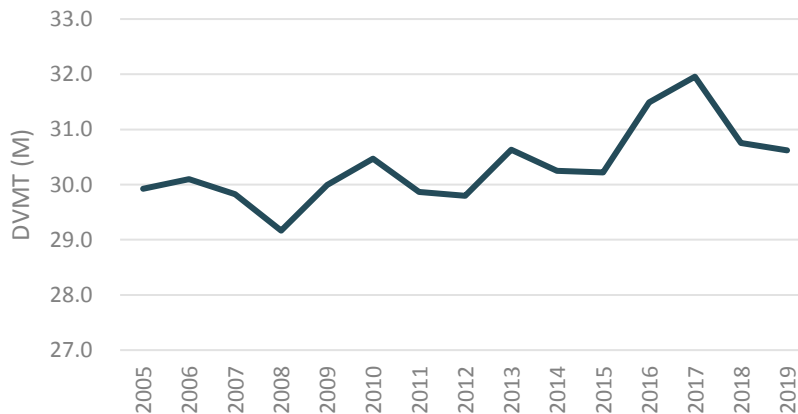
Figure 4.1 Distribution of Commuters in Franklin County

Mode Split by Commuters	
Drove alone	80%
Carpooled	8%
Public transportation (excl. taxicab)	2%
Taxicab, Motorcycle, or Other	1%
Bicycle	0.4%
Walked	3%
Worked at home	5%

Source: US Census American Community Survey (2019)

Despite fluctuations, Franklin County has seen overall growth in daily Vehicle Miles Traveled since 2005, reaching a 15-year high of 32 million in 2017, but dropping to 30.6 million in 2019 (see Figure 4.2).

Figure 4.2: Typical Daily Vehicle Miles Traveled in Franklin County



Source: Ohio Department of Transportation (2021)

Based on assumptions developed by the Environmental Protection Agency (EPA) on average gallons of fuel used per mile, the 2019 daily VMT estimates for Franklin County generated over 12,200 metric tons of CO² emissions a day.²⁷ Transportation is a significant source of carbon emissions in the U.S. (contributing approximately 28 percent of all U.S. greenhouse gas emissions) and light-duty vehicles like cars represent a large portion of that transportation sector.²⁸ To encourage residents to shift their transportation preferences to sustainable modes where possible, a region needs to actively invest in infrastructure that enables residents to safely choose these modes.

²⁷ The EPA emissions calculator estimates an average of 22.5 miles per gallon for a typical vehicle. <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>.

²⁸ US Environmental Protection Agency, *Fast Facts on Transportation Greenhouse Gas Emissions*. <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>.

With residents in Franklin County averaging a commute of 23 minutes each way, providing opportunities to either walk or bike instead, even for a portion of the journey, could have significant impacts on reducing VMT and congestion (see Figure 4.3). Providing safe, comfortable connections to and from transit increases the likelihood that commuters will choose to travel without a car.

Figure 4.3: Average Commute Time for Residents in Franklin County

Travel Time to Work for Commuters	
Less than 15 minutes	23%
15 to 29 minutes	48%
30 to 34 minutes	15%
35 to 59 minutes	10%
60 or more minutes	4%

Source: US Census American Community Survey (2019)

Transportation Expenses by Household

Another indicator of the region’s general reliance on automobiles is the average household spending on automobile-related transportation costs each year. Car ownership and the attendant maintenance expenses cost an average Franklin County household more than \$11,600 a year (see Figure 4.4).²⁹ For a typical household in Franklin County, this cost represents approximately 19% of household income. Increased options to travel using active transportation (walking and biking) can help households to reduce their reliance on, and annual use of, automobiles and achieve associated savings.

Figure 4.4: Average Annual Household Expenditures on Automobile-Related Transportation Costs and Median Household Income in Franklin County

	Average Annual Household Cost
Automobile Ownership	\$8,950
VMT Expenses	\$2,686
Total Automobile-Related Costs	\$11,636
Median Household Income	\$61,305
Share of Household Income on Automobile Costs	19%

Source: US Census American Community Survey (2015-2019), Center for Neighborhood Technology Housing and Affordability Index (2021)

Comparatively, on a per-mile basis, the costs associated with walking and biking are significantly cheaper than automobile travel. Research indicates that the per-mile cost of walking is \$0.00 and the per-mile operating cost of biking is \$0.04.³⁰ Operating costs for a medium sedan (not accounting for

²⁹ Data from the Center for Neighborhood Technology Housing and Affordability Index measured average spending for Franklin County. Expenditures represent average expenditures by a typical household in the county, meaning that costs are averaged across all households.

³⁰ Values are drawn from Victoria Transport Institute (2007), *Transportation Cost and Benefit Analysis II*. <https://www.vtpi.org/tca/tca0501.pdf> Values were presented in 2007\$ and are inflated to 2021\$ for this analysis.

ownership costs) are approximately \$0.18 per mile.³¹ While most households may not forego vehicle ownership entirely due to additional active transportation options, even reduced annual usage of a vehicle can provide savings on operating costs like fuel and maintenance that accrue on a per-mile basis. The ability to use other means of transportation that are low or no expense also improves equitable access to destinations and job opportunities for residents for whom single occupancy vehicle travel is not a viable option.

4.3. Potential Impacts of the Central Ohio Greenways System on Regional Mobility

In order to understand how the Central Ohio Greenways help alleviate the reliance on private vehicle transportation in Franklin County, this analysis seeks to determine the degree to which residents who live in close proximity to the trail network use active forms of transportation in lieu of automobile trips. More residents choosing active modes reduces reliance on private vehicles and alleviates congestion and emission impacts associated with private vehicle travel.

Reductions in Vehicle Miles Traveled

The total number of miles shifted from private vehicle travel to active transportation due to access to the trail network is estimated based on the following steps:

- Data drawn from the US Census Bureau and a shapefile of the existing and potential trail network are used to estimate the number of workers (16 years and older) who will have walkable/bikeable access to the existing trail network, the proposed portion of the trail network, and the total trail network upon completion (up to a mile away from their residence).
- Next, based on data from the 2019 Central Ohio Greenways Trail User Survey, the share of trail users who use trails for commuting and/or errands is estimated. Among those who use trails for commuting/errands, the share who replace automobile trips with trail use is estimated based on the same data source.
- These shares are applied to the estimates of workers who will live within walking/biking distance of the existing, proposed, and completed trail network to estimate the potential number of residents who replace (or would replace) commuting/errand automobile trips with trail trips (see Figure 4.5).

³¹ Data drawn from AAA (2019), *Your Driving Costs*. <https://exchange.aaa.com/wp-content/uploads/2019/09/AAA-Your-Driving-Costs-2019.pdf>

Figure 4.5: Estimated Residents who Replace Commute/Errand Auto Trips with Trail Use³²

	Existing Network	Proposed Network	- Upon Completion
Workers in Walking/Biking Distance of Completed Network	136,100	63,400	199,500
Share who Use Trails for Commuting / Errands	25%	25%	25%
Share of These Users who Replace Auto Trips with Trails	86%	86%	86%
Potential Residents who Replace Commuting/Errand Auto Trips w/ Trails	30,000	14,000	43,900

Source: Econsult Solutions (2021), US Census American Community Survey (2015-2019), 2019 Central Ohio Greenways Trail User Survey

Next, using data from the Ohio Department of Transportation on aggregate daily vehicle miles traveled (DVMT) in Franklin County and population data for Franklin County from the US Census Bureau, DVMT per capita in Franklin County is estimated. Then, using data from the National Household Travel Survey, the portion of DVMT per capita on commuting- and errands-related trips is estimated. These estimates are annualized to yield average annual VMT per capita on commuting/errands (see Figure 4.6).

Figure 4.6: Estimated Annual VMT Per Capita on Commuting/Errands in Franklin County

Aggregate DVMT	30,622,240
Total Population	1,290,360
Per Capita DVMT	23.7
Share of DVMT on Commuting/Errands Trips	35%
Per Capita DVMT on Commuting/Errands Trips	8.4
Annual VMT Per Capita on Commuting/Errands Trips	3,058

Source: Econsult Solutions (2021), Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Census American Community Survey (2015-2019)

Analysis of the 2019 Central Ohio Greenways Trail User Survey data yields minimum, mean, and maximum estimates of the share of automobile trips replaced with trail use among commuting/errands users. The minimum, mean, and maximum shares are applied to the average VMT per capita on commuting/errands trips to yield minimum, mean, and maximum estimates of VMT avoided per trail user on these types of trips. These per-trail-user estimates are then applied to the above detailed estimate of the number of workers who will live within walking/biking distance (up to a mile from their residence) of the existing portion, proposed portion, and completed trail network who will potentially replace commuting/errand automobile trips with trail use. The result of this calculation yields the estimated potential vehicle miles traveled avoided by trail users on the completed trail network.

Figure 4.7 shows results for each portion of the trail network based on the minimum estimated share of automobile trips replaced; the associated supplemental table in the Appendix details the calculation for

³² Note: column totals may not sum due to rounding.

each portion of the trail network based on the minimum, mean, and maximum share of auto trips replaced.³³

Figure 4.7: Potential Vehicle Miles Traveled Avoided by Trail Users in Franklin County³⁴

	Existing Trail Network	Proposed Trail Network	Total - Upon Completion
Annual VMT Per Capita on Commuting/Errands Trips	3,058	3,058	3,058
Share of Auto Trips Replaced by Commute/Errand Users	18%	18%	18%
Potential Residents who Replace Commute/Errand Auto Trips w/ Trail Use	30,000	14,000	43,900
Estimated Annual Reduction in VMT (M)	16.8	7.8	24.6
Per Mile of Trail	136,300	46,000	83,900

Source: Econsult Solutions (2021), Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Census American Community Survey (2015-2019)

On the existing trail network, Franklin County residents achieve an estimated reduction in vehicle miles traveled of approximately 16.8 million annually. Each mile of the proposed network could deliver an additional annual reduction in VMT of approximately 46,000 on top of the VMT avoided by users of the existing network. In total, residents using the completed trail network (including proposed segments) in Franklin County could achieve annual reductions in VMT of 24.6 million, which has important implications in terms of cost savings and reduced greenhouse gas emissions. Overall, the reduction in VMT achieved by users across the completed network could be over 83,000 per mile of trail.

Impacts of Reducing Vehicle Miles Traveled

Reductions in vehicle miles traveled yield associated savings in fuel consumption, carbon dioxide emissions, and congestion. Active transportation associated with the existing Central Ohio Greenways network in Franklin County yields an estimated annual reduction in fuel consumption of over 0.7 million gallons (see Figure 4.8). In addition to the savings delivered by users of the existing network, each mile of the proposed trail network could support an additional reduction in fuel consumption of 2,000 gallons per year. As such, the total network could support an annual reduction in fuel consumption of 1.1 million gallons – a reduction of approximately 3,700 gallons of fuel per mile of trail. Additionally, reduced commute congestion means that workers waste less time sitting in traffic, yielding additional benefits in productivity.

³³ Estimates included in this table and the subsequent tables in this section are based on the minimum range estimate of the share of automobile trips replaced by trail users, as reported in the 2019 Trail User Survey. Minimum estimates are used to account for the likelihood of self-reporting and/or social desirability bias among survey respondents. See: Caputo (2017), *Social desirability bias in self-reported well-being measures: Evidence from an online survey*. <https://psycnet.apa.org/record/2018-19560-023>

³⁴ Impacts shown are based on the minimum estimated share of auto trips replaced; within the supplemental table in the Appendix, the minimum, mean, and maximum share of automobile trips replaced and associated results are shown.

Figure 4.8: Potential Annual Reduction in Fuel Consumption due to Trail Users in Franklin County³⁵

	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion
Estimated Annual Reduction in Gallons of Fuel Consumed (M)	0.7	0.3	1.1
Per Mile of Trail	6,100	2,000	3,700

Source: US Environmental Protection Agency (2018), Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Census American Community Survey (2015-2019), Econsult Solutions (2021)

These impacts to fuel consumption are associated with substantial reductions in greenhouse gas emissions. On the existing trail network, it is estimated that active transportation by local trail users saves the region approximately 6,600 metric tons of CO₂ emissions annually. Each mile of the proposed trail network could support an additional annual reduction in CO₂ emissions of approximately 18 metric tons. As such, active transportation on the completed network could support an annual reduction in CO₂ emissions in Franklin County of approximately 9,700 metric tons each year (see Figure 4.9). To put this quantity of emissions avoided into context, 9,710 metric tons CO₂ is equivalent to the emissions from burning 10.7 million pounds of coal, 2 wind turbines running for a whole year, or the carbon sequestered each year by 11,900 acres of U.S. forest.³⁶ On a per-mile basis, carbon emissions avoided on the completed network could be 33 metric tons.

Furthermore, each ton of carbon emitted generates an economic cost in terms of the resulting damage to the atmosphere, referred to as the “social cost of carbon” (SCC).³⁷ As such, the potential metric tons of carbon emissions avoided by trail users can be expressed in terms of the savings that would result from this reduction in emissions. Active transportation by residents on the existing trail network save the region an estimated \$358,700 in avoided social costs of carbon per year. Each mile of the proposed trail network could support additional savings of approximately \$980. In total, users of the completed trail network could save the region \$525,300 each year in terms of avoided costs of carbon emissions (see Figure 4.9). On average, each mile of the completed trail network could support savings of \$1,800 annually in terms of the social cost of carbon emissions avoided.

³⁵ Impacts shown are based on the minimum estimated share of auto trips replaced; within the corresponding supplemental table in the Appendix, the minimum, mean, and maximum share of automobile trips replaced and associated results are shown.

³⁶ US Environmental Protection Agency (2021), *Greenhouse Gas Equivalencies Calculator*. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

³⁷ US Environmental Protection Agency (2016), *EPA Fact Sheet – Social Cost of Carbon*. https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf

Figure 4.9: Potential Metric Tons of CO₂ and Associated Costs Avoided Annually Due to Trail Users³⁸

	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion
Metric Tons of CO ₂ Avoided	6,630	3,090	9,710
Per Mile of Trail	54	18	33
Social Cost of CO ₂ Emissions Avoided	\$358,700	\$167,200	\$525,300
Per Mile of Trail	\$2,900	\$984	\$1,800

Source: US Census American Community Survey (2014-2018, 2019), INRIX (2018), US Environmental Protection Agency (2017), Econsult Solutions (2021)

4.4. Safety Implications of Trail Networks

Beyond easing congestion and reliance on automobile travel, well-connected trail networks also provide improved safety for pedestrian and bicyclist users. Trails are built in a way that protects pedestrians and bicyclists from automobile traffic, therefore reducing the likelihood of crashes that result in serious injuries or fatalities. Data from the City of Columbus shows that despite representing a very small share (7.5%) of overall commuters, bicyclist and pedestrian commuters are disproportionately likely to be involved in fatal crashes, with bicyclists and pedestrians accounting for 47% of all crash fatalities.³⁹

Beyond the trauma and loss associated with crashes for those involved and their loved ones, crashes come at significant financial costs in terms of medical expenses, emergency services costs, lost quality of life, and other costs. In Franklin County in 2020, there were 475 incidences of injury or fatality due to crashes involving bicyclists or pedestrians. Using estimates from the Federal Highway Administration, the comprehensive costs associated with these injuries of varying severity levels from crashes in Franklin County can be estimated.⁴⁰ In 2020 alone, the financial cost associated with crashes in Franklin County that resulted in evident injury, disabling injury, or fatality total approximately \$215 million.

Figure 4.10: Estimated Comprehensive Costs Associated with Crashes in Franklin County (2020)

Crash Injury Severity Level	Comprehensive Crash Cost	Franklin County Incidence 2020	Total Cost (\$M)
Evident Injury (Non-incapacitating)	\$95,303	339	\$32.3
Disabling Injury	\$256,371	102	\$26.1
Fatality	\$4,612,572	34	\$156.8
Total (\$M)	-	475	\$215.3

Source: GIS Crash Analysis Tool (2021) Ohio Department of Transportation (2021), FHWA (2009)

³⁸ Impacts shown are based on the minimum estimated share of auto trips replaced; within the corresponding supplemental table in the Appendix, the minimum, mean, and maximum share of automobile trips replaced and associated results are shown.

³⁹ Based on data presented in Vision Zero Columbus (2019), *Vision Zero Columbus Action Plan*. <https://vision-zero-columbus.hub.arcgis.com/>

⁴⁰ Comprehensive costs are published by the Federal Highway Administration (FHWA) in 2009\$ and are inflated to 2020\$ for the purposes of this analysis. For comprehensive cost estimates, see: Federal Highway Administration (2009), *Crash Costs by Injury Severity Level*.

<https://safety.fhwa.dot.gov/hisp/resources/fhwasa09029/sec4.cfm>

Comprehensive costs include medical-related costs, emergency services costs, property damage costs, lost productivity costs, and monetized quality-adjusted life years. For details on the derivation of cost estimates, see Federal Highway Administration (2005), *Crash Cost Estimates by Maximum Police-Reported Injury Severity Within Selected Crash Geometries*. <https://www.fhwa.dot.gov/publications/research/safety/05051/>

One of the key challenges for bicyclist and pedestrian safety, as identified by the National Highway Traffic Safety Administration, is inadequate separation between motor vehicle traffic and bicyclists and pedestrians.⁴¹ Trail networks that provide opportunities for pedestrian and bike users to travel on pathways separated from vehicle travel significantly reduce the likelihood of serious collisions. In fact, analysis of national, multi-year data on fatal accidents among pedestrians and bicyclists on different types of transportation infrastructure shows near-zero fatalities for pedestrians (0.0%) and bicyclists (0.1%) on shared-use paths and trails.⁴² As such, expanding the network of well-connected trails that provide protection from vehicle traffic will dramatically improve safe travel options for bicyclists and pedestrians, reducing the likelihood of serious crashes for these users.

⁴¹ National Highway Traffic Safety Administration - US Department of Transportation (2017), *Bicyclist and Pedestrian Safety*. https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/14046-pedestrian_bicyclist_safety_resources_030519_v2_tag.pdf

⁴² National Highway Traffic Safety Administration - US Department of Transportation (2018), *Traffic Safety Facts, Research Note: Pedestrian and Bicyclist Data Analysis*. https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/812502_pedestrian-and-bicyclist-data-analysis-tsf-research-note.pdf

5. Trail Spending Impacts

Above and beyond impacts generated by the development of the trail network, the local spending by trail users will generate additional economic benefits for the businesses located near the Central Ohio Greenways and businesses that sell trail-related products. Residents and visitors who access the region's trails often spend money on both goods and services related to active recreational activity during their trips. Much of this spending is happening at retailers in immediate proximity of the trails.

This section quantifies the impacts realized from local business spending and the resulting tax revenue impacts to local and state governments. While a portion of this spending will be due to visitors using the trail from outside of the network area, the majority of this local business spending will be generated by residents in the area adjusting their spending patterns as part of trail trips. For example, the current and expanded trail network will enable visitors from communities within the network to travel and patronize shops in neighboring communities they may not have otherwise visited.

5.1. Methodology

In order to quantify the local spending from trail users, a spending profile is created based on intercept and online surveys of Central Ohio Greenways users. An estimate of spending by trail users on "soft" goods such as beverages, snacks, and meals is established on a per-visit basis and an estimate of spending on "hard" goods such as bicycles and exercise clothing and accessories is developed on an annual basis. It is estimated, based on survey data, that trail users spend approximately \$11 on "soft" goods when they choose to purchase these types of goods as part of a visit to a trail. It is estimated that frequent trail users spend \$747 on "hard" goods each year such as bikes, bike accessories, and exercise clothing and equipment.

These direct expenditures by trail users support local businesses and generate spillover effects in the local and regional economy. Industry standard input-output modeling software IMPLAN is used to model the economic impacts of this direct trail user spending. Fiscal modeling is undertaken to estimate the additional tax revenues to jurisdictions associated with this economic activity.

5.2. Estimated Annual Spending by Trail Users

Data from the 2019 COG Trail User Survey is matched with data regarding the number of working age adults with walking/biking access to the Central Ohio Greenways network from the US Census to estimate the number of frequent (three or more times a week) trail users. Estimates are developed for the existing trail network, the proposed portion of the trail network, and the total network upon completion. The proportion of frequent trail users who report purchasing "hard" goods in relation to their trail use within the last year is then applied to these estimates of frequent users. Then, these estimates are applied to the average expenditure amount on "hard" goods referenced in the spending profile above to yield the total annual spending on "hard goods" by COG users (see Figure 5.1).

Figure 5.1: Estimated Direct Spending on “Hard” Goods

	Existing Trail Network	Proposed Trail Network	Total - Upon Completion
Working Age Residents with Walking/Biking Access to Trails	162,211	78,119	240,330
Share of Frequent (3+ times a week) Trail Users	64%	\$1	64%
Estimated Frequent Trail Users	103,700	49,940	153,640
Share who Purchased "Hard" Goods in Last Year	60%	60%	60%
Average Amount Spent on "Hard" Goods	\$747	\$747	\$747
Estimated Total Direct Spending on "Hard" Goods (\$M)	\$46.4	\$22.3	\$68.7

Source: Central Ohio Greenways (2019), US Census American Community Survey (2015-2019), Central Ohio Greenways (2015), Econsult Solutions (2021)



The Alum Creek Trail is part of the larger Ohio to Erie Trail, which connects various amenities throughout the Central Ohio area and attracts new visitors and tourists to the region.

To estimate annual spending on “soft” goods (e.g. beverages, snacks, etc.), the number of annual trail visits by local trail users is first estimated using the 2019 COG Trail User Survey and US Census data referenced above. Then, the number of these trail visits during which spending on “soft” goods would occur is estimated based on survey data and assumptions scaled to the frequency of trail use (to avoid frequent trail users skewing up the estimated number of spending visits). The number of annual “soft” goods spending visits are then applied to the spending profile on “soft” goods established by the 2015 survey data to estimate the total annual spending on “soft” goods by COG users (See Figure 5.2).

Figure 5.2: Estimated Direct Spending on “Soft” Goods

Category	Existing Trail Network	Proposed Trail Network	Total - Upon Completion
Working Age Residents with Walking/Biking Access to Trails	162,211	78,119	240,330
Average Number of Visits Per Year per Resident with Walking/Biking Access	141	141	141
Share who Purchased "Soft" Goods During Last Trail Visit	12%	12%	12%
Estimated Number of "Soft" Goods Spending Visits	2,662,144	1,282,059	3,944,203
Average Amount Spent on "Soft" Goods	\$11	\$11	\$11
Estimated Total Direct Spending on "Soft" Goods (\$M)	\$28.4	\$13.7	\$42.1

Source: Central Ohio Greenways (2019), US Census American Community Survey (2015-2019), Central Ohio Greenways (2015), Econsult Solutions (2021)

Local spending by trail users on the Central Ohio Greenways network is estimated to total \$74.8 million annually on the existing network trail network. The completed network is estimated to support approximately \$110.8 million in local trail user spending annually (see Figure 5.3). However, it is important to adjust for the fact that some of this spending immediately leaves the region and therefore

does not have a multiplier effect within the regional economy. For example, a large proportion of retail spending goes to manufacturers and wholesalers, most of which are outside the region, and so the modeling approach used in this analysis includes only the retail margin (the difference between the purchase price for the retailer and the sales price for the customer). Based on this adjustment, the amount of annual local spending modeled in our analysis is \$49.9 million supported by the existing trail network and \$74 million annually supported by the completed network.

Figure 5.3: Potential Annual Local Spending by Trail Users (\$M)

	Existing Trail Network	Proposed Trail Network	Total - Upon Completion
Trail User Spending on "Soft" Goods	\$28.4	\$13.7	\$42.1
Trail User Spending on "Hard" Goods	\$46.4	\$22.3	\$68.7
Total Trail User Spending	\$74.8	\$36.0	\$110.8
<i>Amount of Spending Leaving the Region</i>	<i>-\$24.8</i>	<i>-\$12.0</i>	<i>-\$36.8</i>
Total Modeled Trail User Spending	\$49.9	\$24.1	\$74.0

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021)

5.3. Potential Annual Economic Impact from Trail User Spending

Input-output modeling is used to estimate the potential economic impacts in Franklin County and statewide associated with this local spending by trail users. The modeled local direct expenditures associated with trail user spending on the completed trail network will generate approximately \$136 million in economic impact in Franklin County, supporting 1,200 jobs and approximately \$42 million in wages (see Figure 5.4). Statewide, the total economic impact generated by this spending is over \$152 million, supporting 1,300 jobs and approximately \$46 million in wages. On average, each mile of the completed trail network is estimated to support approximately \$0.5 million in statewide economic impact, 4 jobs, and \$200,000 in wages.

Figure 5.4: Potential Annual Economic Impact from Local Spending by Trail Users

Impact Type	Existing Trail Network		Proposed Trail Network		Total - Upon Completion		Statewide Impacts Per Mile of Completed Network
	Franklin County	State of Ohio	Franklin County	State of Ohio	Franklin County	State of Ohio	
Direct Output (\$M)	\$49.9	\$49.9	\$24.1	\$24.1	\$74.0	\$74.0	\$0.3
Indirect and Induced Output (\$M)	\$42.0	\$53.2	\$20.2	\$25.6	\$62.2	\$78.8	\$0.3
Total Impact (\$M)	\$92.0	\$103.1	\$44.3	\$49.7	\$136.2	\$152.8	\$0.5
Employment Supported (FTE)	800	900	400	400	1200	1300	4
Employee Compensation (\$M)	\$28.2	\$31.0	\$13.58	\$14.93	\$41.8	\$45.9	\$0.2

Source: IMPLAN (2019), Econsult Solutions, Inc. (2021)

5.4. Potential Annual Tax Impact from Spending by Trail Users

On an annual basis, the total economic activity (including direct, indirect, and induced impacts) associated with trail user spending produces increases in various tax bases. To estimate these increases, ESI created a tax revenue impact model to translate total economic impacts into their commensurate tax revenue gains. This analysis estimates the potential increases in income, sales, and business tax revenues to the State of Ohio due to user spending on the Central Ohio Greenways network in Franklin County.

In total, the direct, indirect, and induced economic impacts generated by trail user spending could generate annual tax revenues of \$0.6 million to Franklin County and \$2.3 million to the State of Ohio (see Figure 5.5). On average, each mile of the completed trail network could support up to \$1,930 in tax revenue to Franklin County and \$7,840 to the State of Ohio. Additionally, localities stand to benefit from additional revenues supported by this economic activity. IMPLAN estimates that the economic activity supported by the completed trail network could support additional personal income tax revenues to local jurisdictions (cities and municipalities) in Franklin County of \$0.55 million each year.

Figure 5.5: Potential Fiscal Impact Generated from Economic Impact from Trail User Spending (\$M)

Tax Type	Existing Trail Network		Proposed Trail Network		Total - Upon Completion	
	Franklin County	State of Ohio	Franklin County	State of Ohio	Franklin County	State of Ohio
Income	-	\$0.4	-	\$0.2	-	\$0.6
Sales	\$0.4	\$0.9	\$0.2	\$0.4	\$0.6	\$1.3
Business	-	\$0.2	-	\$0.1	-	\$0.4
Total Tax Revenue (\$M)	\$0.4	\$1.5	\$0.2	\$0.7	\$0.6	\$2.3
Tax Revenue Per Mile of Trail (\$)	\$3,190	\$12,920	\$1,060	\$4,310	\$1,930	\$7,840

Source: Ohio CAFR (2019), IMPLAN (2019), Econsult Solutions, Inc. (2021)

6. Environmental Services Benefits

Trail networks such as COG in Franklin County provide environmental benefits for the communities they serve by bolstering natural resource management through active environmental conservation efforts. Trail networks help to preserve the surrounding natural environment, which otherwise may be at risk for development or further loss of natural lands. The natural lands adjacent to the trail network provide environment benefits including air pollution removal, the provision of water supply, water quality improvement, flood mitigation, wildlife habitat conservation, and carbon sequestration and storage. This section draws upon established research to evaluate the economic benefits in monetary terms of the ecosystem services provided by the network.

These benefits combined create ecosystem functions that would require costly measures to replicate if lost. Trail networks bolster natural resource management by preserving open space and active environmental conservation efforts. If designed in ways that are mindful of existing ecosystems, the upkeep of the trail network will ensure the value of the services from the ecosystems are retained. If these ecosystems were removed, municipalities would incur additional costs to recoup their value. It is important to note that this analysis includes the areas directly surrounding the trail network and does not include any paved surfaces of the trails.

6.1. Methodology

ESI calculates the land cover variation for each trail segment and applies the values associated with each of the ecosystem services to produce total value of the environmental impact of the Central Ohio Greenways, upon full completion of the trail network in Franklin County. Dollar values approximating the economic value of each of these services are based on peer-reviewed estimates of value on a per-acre basis. These total value estimates represent the costs avoided by not having to artificially replicate the ecosystem services currently provided by the Central Ohio Greenways.

First, acreage of ecosystems within the network was determined using the land cover imagery from the Multi-Resolution Land Characteristics (MRLC) 2016 National Land Use Land Cover file.⁴³ The acreage of each ecosystem type is used to calculate environmental services benefits using values from a 2006 study, which estimated the average value of various ecosystem services.⁴⁴ The estimated benefits were derived by determining the acreage type for the ecosystem services and multiplying the acreage by the ecosystem service benefit. Each ecosystem provides different services and has associated value per acre, determined by the Constanza study, and applied to Central Ohio Greenways, upon full completion of the trail network in Franklin County.

The i-Tree model developed by the U.S. Forest Service is used to estimate the air pollution removal and carbon sequestration and storage benefits of the trail network within Franklin County. The resulting

⁴³ The Multi-Resolution Land Characteristics (MRLC) consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale for a wide variety of environmental, land management, and modeling applications. These federal agencies include the Bureau of Land Management, LANDFIRE, National Agricultural Statistic Services, National Oceanic and Atmospheric Administration, US Forest Service, and United States Geological Survey.

⁴⁴ Costanza, Wilson, Tory, Voinov, Liu, and D'Agostino (2006), *The Value of New Jersey's Ecosystem Services and Natural Capital*. New Jersey Department of Environmental Protection, Division of Science, Research, and Technology.

values for air pollution benefits reflect the amount society would have to pay in areas such as healthcare if trees did not remove these pollutants. The model uses National Land Cover Datasets (NLCD) to first estimate the amount of tree canopy and then uses pollution removal rates to estimate the total amount of pollutant removal that results from this canopy coverage. It also estimates the lifetime amount of carbon stored within trees and how much carbon is sequestered by trees on an annual basis. The i-Tree model has the advantage of allowing for the adjustment of the per-acre pollution removal values.

6.2. Analysis of Central Ohio Greenways' Potential Environmental Services Impact Upon Completion

The ecosystem services surrounding a trail include benefits such as air pollution removal, replenishing water supply, water quality improvement, preservation of wildlife habitat, and carbon sequestration and storage. It should be noted that some types of landscapes are more valuable than others for a particular type of benefit: air pollution removal and carbon sequestration are primarily a function of tree cover, while wetlands and riparian forests are major drivers of water supply, water quality, and flood mitigation benefits. Thus, the upkeep of the trail network ensures the ecosystems are protected, providing significant benefits.

Specifically, constructing trails for recreational and transportation uses can be used as a tool to preserve natural lands and hinder further development. Trails can be developed successfully and address the potential concerns of human impact and over usage on natural lands through proper trail management, maintenance, and a robust collaboration among stakeholders with competing interests. Illustrative examples include:

- Coachella Valley: Trail users and agency biologists developed mutual understanding of their competing needs, which allowed the group to develop mindful conservation practices when new trails are developed.⁴⁵
- Haw River Trail in Alamance County, North Carolina: The Haw River Trail includes a planned 80-mile extension of its trail network. The extension includes conservation efforts to improve the water quality as well as the surrounding habitat for the river's wildlife and vegetation.⁴⁶

On average, each mile upon full completion of the trail network in Franklin County will provide annually:
\$4,167 in environmental benefits

Upon full completion of the trail network in Franklin County, the associated ecosystem services will generate significant economic benefits to the extent that these ecosystems within 50 feet of trails and its 880 acres of tree cover are preserved and managed. While the majority of trails are paved, the ecosystems surrounding the trail (within 50 feet) generate ecosystem services benefits, which will be protected by the

existence and upkeep of the trail network.

⁴⁵ California Fish and Wildlife, *Journal for the Conservation and Management of California's Species and Ecosystems*, "Effects of Non-Consumptive Recreation on Wildlife in California," 2020, <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=178943&inline>.

⁴⁶ The Haw River Trail, <https://www.thehaw.org/>.

In sum, the ecosystem services and environmental benefits within 50 feet of the trail network (upon completion) are \$1.2 million in annual benefits from a variety of sources (see Figure 6.1) and \$5.1 million in the lifetime cost savings of carbon storage from tree coverage, where these estimates are based on the lifespan of the tree coverage.⁴⁷

Figure 6.1: Potential Environmental Benefits by Type and Locality of the Central Ohio Greenways in Franklin County (\$ per Year)⁴⁸

Ecosystem Service	Existing Trail Network	Proposed Trail Network	Total – Upon Full Completion
Water Supply	\$184,200	\$455,100	\$639,300
Water Quality	\$34,200	\$50,800	\$85,000
Flood Mitigation	\$52,900	\$79,000	\$131,900
Wildlife Habitat	\$56,200	\$49,400	\$105,600
Air Pollution Removal	\$28,900	\$64,400	\$93,300
Carbon Sequestration	\$51,300	\$114,500	\$165,800
Total Ecosystem Service Benefits (annual)	\$407,700	\$813,200	\$1,220,900
Per Mile of Trail	\$3,398	\$4,701	\$4,167
Carbon Storage (lifetime)	\$1,591,000	\$3,549,600	\$5,140,600
Per Mile of Trail	\$13,258	\$20,518	\$17,545

Source: Costanza (2006), Multi-Resolution Land Characteristics Land Cover (2016), MORPC (2021), Econsult Solutions, Inc. (2021)

The following subsections provide additional detail on the calculations of these ecosystem services and their total cost savings impact on Franklin County, upon full completion of the trail network.⁴⁹

Air Pollution Removal

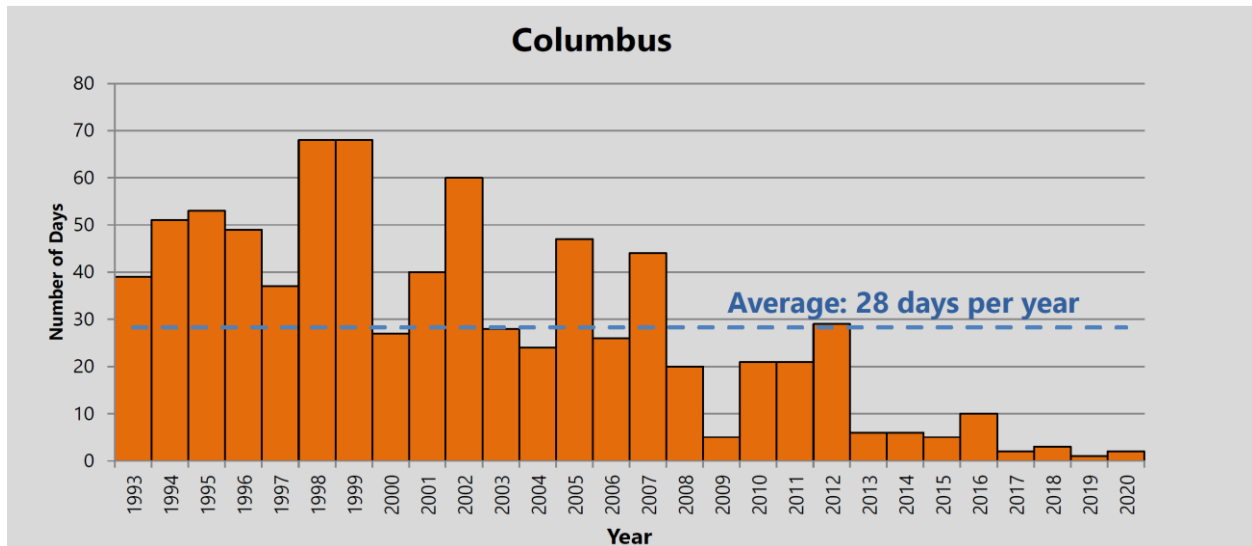
Poor air quality is common in many urban and suburban areas and can lead to a variety of human health problems, including asthma and other respiratory ailments. The pollutants that affect air quality also can damage buildings and plants, give rise to smog, and contribute to climate change. The Central Ohio region generally has experienced improving Air Quality Index (AQI) levels in recent years, with more “good” AQI days and fewer “moderate” AQI days. In addition, the region has seen a downward trends in daily concentrations in pollutants such as ozone and PM2.5 over the last 30 years.

⁴⁷ The lifespan of the trees in the ecosystem depend on the varieties of trees in the ecosystem. Average lifespans can range from 50 years to several hundred years depending on the species of the tree.

⁴⁸ Note that not every ecosystem generates an economic benefit, approximately 28 percent of the land cover classifications identified of the ~3,500 acres were used to generate an ecosystem service benefit.

⁴⁹ The potential environmental services and ecosystem service benefits quantifies and measures only a portion of the benefits ecosystems provide. There are many more functions that ecosystems provide which includes but not limited to water temperature regulation, climate change mitigation, and more.

Figure 6.2: MORPC's 2020 Air Quality Report Shows Reduction in High Ozone Days in Columbus Over Last 30 Years



Source: MORPC (2020)⁵⁰

Emissions reductions are a major contributor to the positive trend in air quality that the region has seen in recent years. Additional investments in the COG will further support this progress by providing alternative transportation options for residents (as discussed in Section 4) and by maintaining tree coverage that further mitigates the ecological damage from pollution. Trees mitigate significant amounts of air pollution through botanic respiration processes that remove pollutants from the air. This naturally occurring air pollution removal process contributes to environmental quality and health.

The analysis of how tree cover can enhance air quality includes benefits derived from the removal of five different pollutants: carbon monoxide (CO), nitrogen dioxide (NO²), ozone (O³), particulate matter (PM₁₀), and sulfur dioxide (SO²). Figure 6.3 below shows the value generated for the removal of each pollutant.

⁵⁰ https://www.morpc.org/wordpress/wp-content/uploads/2021/02/MORPC_EOS_2020.pdf

Figure 6.3: Potential Annual Air Pollution Removal Benefits of the Central Ohio Greenways in Franklin County

	Existing Trail Network		Proposed Trail Network		Total, Upon Full Completion	
	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings
Total	9.8	\$28,800	21.8	\$64,400	31.6	\$93,200
Per Mile		\$240		\$372		\$318

Source: i-Tree (2021), Multi-Resolution Land Characteristics Land Cover (2016), MORPC (2021), Econsult Solutions, Inc. (2021)

Upon completion of the trail network, the Central Ohio Greenways will help to preserve the existing 880 acres of tree canopy within 50 feet of the trail network.⁵¹ Using this total tree canopy acreage and established estimates of the per-ton benefits of removing various airborne pollutants, it is estimated that trees within 50 feet of the Central Ohio Greenways in Franklin County annually will provide \$93,200, approximately \$318 per mile, in air pollution removal services.

Water Supply

The soil of undeveloped land stores water and replenishes streams, reservoirs, and aquifers. This natural system provides the continuous recharge of groundwater and streams. Forests and wetlands are particularly productive land covers for water provision. The larger the land cover, the greater the benefits derived. Were this ecosystem to fail, water would need to be imported from elsewhere or local water would be more extensively treated, both of which are costly. Within 50 feet of the completed Central Ohio Greenways in Franklin County, \$639,300 in annual cost savings, approximately \$2,182 per mile, from natural water supply services will be generated. Trails offer protection to these surrounding ecosystems by lowering the probability of development that would impact the ecosystems.



The Scioto Trail, which runs along the Scioto River in downtown Columbus, provides a green buffer that stores and filters stormwater runoff.

Water Quality

Forests and wetlands provide a natural protective buffer between human activities and water supplies. This service is driven largely by the proportion of forest, wetland, and riparian buffer located along the trail network. This riparian buffer filters and stops several types of waste, including pathogens, excess nutrients, metals, and sediments, from entering the water supply. Without the riparian buffer, residents would be forced to pay for alternative groundwater filtration or water treatment methods. In sum, the

⁵¹ As described in Section 4.2, ESI used land cover spatial files to analyze various uses; this data identified the volume of tree canopy within 50 feet of all Central Ohio Greenway segments.

buffer provided by the Central Ohio Greenways in Franklin County upon full completion of the trail network will generate approximately \$85,000 annually, roughly \$290 per mile, in water quality benefits from the ability to naturally maintain water quality.

Flood Mitigation

Many natural landscapes serve as a buffer protecting people and properties from destructive natural events. The absorptive capacity of protected open space helps to mitigate the risk of flood during storm events by trapping and containing stormwater. If the County were to be deprived of this natural service, residents, and local governments would be forced to undertake costly measures to protect the built environment from further damage as a result of flooding, such as constructing dams or reservoirs. In sum, the buffer provided by the Central Ohio Greenways in Franklin County will generate approximately \$131,900 annually, roughly \$450 per mile, from natural flood mitigation services.

Wildlife Habitat

The trail network serves as habitats for a diverse array of plants and animals. Intact forests and wetlands harbor species that people value for both aesthetic and functional purposes. Values for this ecosystem service estimate the amount of money that people would be willing to pay to preserve wildlife. It is important to note that the value associated with wildlife habitat is of a different nature than the values associated with the other ecosystem services included in this section—it does not represent an avoided cost. To ensure a conservative valuation of the benefit derived from the preservation of wildlife habitat on protected open space, the estimates in this section are based on minimum willingness-to-pay values from the research literature.⁵² In sum, the wildlife habitats located within 50 feet of the Central Ohio Greenways in Franklin County will have an estimated annual value of \$105,600, approximately \$360 per mile.

Carbon Sequestration and Storage

Trees mitigate the impacts of climate change by sequestering and storing atmospheric carbon from carbon dioxide. Carbon storage is an estimate of the total amount of carbon stored in the existing biomass of trees, both above and below ground. In other words, if the carbon currently stored in trees on protected trails were released into the air, it would cause damages that would require a significant cost to mitigate, such as damages to agricultural productivity, human health, and property damages. It is important to note that the estimate of the value of stored carbon is not annual. The storage of carbon in a tree represents a one-time benefit—the carbon is kept out of the atmosphere until the tree dies.

⁵² Costanza, Wilson, Tory, Voinov, Liu, and D'Agostino (2006), *The Value of New Jersey's Ecosystem Services and Natural Capital*. New Jersey Department of Environmental Protection, Division of Science, Research, and Technology.



North Bank Park Trailhead to Scioto Trail

The social cost of carbon, which is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year, is \$171 per ton.⁵³ Using this social cost of carbon, it is estimated that within 50 feet of the completed Central Ohio Greenways in Franklin County, trees will store 30,141 tons of carbon, equating to \$5.1 million within existing biomass. In other words, if carbon currently stored in trees within the trail network were released into the air, it would cause climate change damages that will cost \$5.1 million, or \$17,545 per mile, to mitigate, which is dependent on the lifetime of the tree canopy.

As a tree grows, it pulls carbon from the air. New growth on trees is responsible for carbon sequestration, which is measured on an annual basis. This estimate controls for the yearly release of stored carbon through the death and decay of trees. Like the carbon storage estimate, this estimate measures the monetary damages associated with each ton of carbon that is sequestered. Because this carbon is taken out of the air by trees on the completed Central Ohio Greenways in Franklin County, these damages are avoided, representing savings for communities across the trail network. Every year, new growth on the trees within the trail network will sequester an additional \$165,800, approximately \$566 per mile, in cost savings.

Figure 6.4 shows potential estimates of the tons of carbon annually sequestered and tons stored by trees for their lifetime within fifty feet of the trail network, upon full completion, along with the benefits derived from the storage and sequestration of carbon by these trees. The existing tree canopy within fifty feet of the existing and proposed network were obtained from the National Land Cover Database (NCLD) 2016's Tree Canopy file.⁵⁴

⁵³ I-Tree, USDA Forest Service, <https://www.itreetools.org/>.

⁵⁴ National Land Cover Database, NLCD 2016 USFS Tree Canopy Cover, <https://www.mrlc.gov/data/nlcd-2016-usfs-tree-canopy-cover-conus>.

Figure 6.4: Potential Amounts of Annual Carbon Sequestration and Lifetime Carbon Storage and Associated Benefits from Central Ohio Greenways in Franklin County

Pollutant	Existing Trail Network		Proposed Trail Network		Total	
	Tons	Cost Savings (\$M)	Tons	Cost Savings (\$M)	Total	Cost Savings (\$M)
Carbon Sequestration (annual)	301	\$51,300	671	\$114,500	972	\$165,800
Per Mile	3	\$428	4	\$662	3	\$566
Carbon Storage (lifetime)	9,329	\$1,591,000	20,813	\$3,549,600	30,141	\$5,140,600
Per Mile	78	\$13,258	120	\$20,518	103	\$17,545

Source: i-Tree (2021), Multi-Resolution Land Characteristics Land Cover (2016), MORPC (2021), Econsult Solutions, Inc. (2021)

7. Residential Property Value Impacts

Several studies show that homeowners are willing to pay a premium to live near recreational outdoor space. Trails are viewed as active transportation routes and safe spaces for walking and biking that increase the overall value of housing stock for their neighboring communities. This increased wealth is captured by residents through higher sales values of homes and generates increased government revenues through increased property tax collections and greater transfer taxes at time of sale. This section estimates the increased property values and tax benefits due to a ½ mile walking access and 1 mile biking access buffer of the trail.

7.1. Measuring Property Value Premiums Associated with Trails

Trails are associated with positive impacts on property values proximate to them. Basic real estate economics demonstrate that when positive attributes are added to a community, demand for that place as a residential location increases, which produces an increase in housing values. This is especially true when the features connect communities to one another. This improves the vitality of the area as a whole: an increase in housing values means more wealth for property owners and more tax revenues for the local jurisdiction.

A number of studies have found a significant increase in real estate values associated with trails, landscaping, parks, and green spaces:⁵⁵ Studies have shown that, typically, the property value premium for properties near trails across a metropolitan region ranges from 3.75 percent to 6 percent, depending on the community.

- A study of the Greater Philadelphia region's greenways identified a 5 percent premium for properties within ¼ mile of a trail.⁵⁶
- An economic analysis completed by ESI on the effect of the Ecusta Rail-to-Trail project in North Carolina indicated that home values within a quarter mile of the trail increased by an average of 4 percent.⁵⁷
- A regional study completed by ESI and NV5 of the economic impact of the East Coast Greenway in the Greater Philadelphia region estimated that properties within ¼ mile of the network benefited with an average of 5 percent increase in property value compared to similar properties that do not have access to the trail network.

The analysis in this report relies on the results of previous hedonic regression analyses completed by ESI to measure the existing home value premium associated with proximity to an existing trail and the potential value premium associated with planned trails within the network. Hedonic regression analysis seeks to isolate the explanatory power of a single variable of interest, like proximity to trails, by holding constant other relevant housing characteristics (like square footage, number of bedrooms, year built,

⁵⁵ Wachter, Susan M., and Grace Wong Bucchianeri. "What Is a Tree Worth? Green-City Strategies, Signaling and Housing Prices." May 2008.

⁵⁶ The Potential Economic, Environmental, Health, and Quality of Life Benefits of a Fully Connected Waterfront Greenway in Philadelphia," Econsult Corporation (2010)

⁵⁷ https://www.carolinathreadtrail.org/wp-content/uploads/2018/08/CTT_Economic_Study.pdf

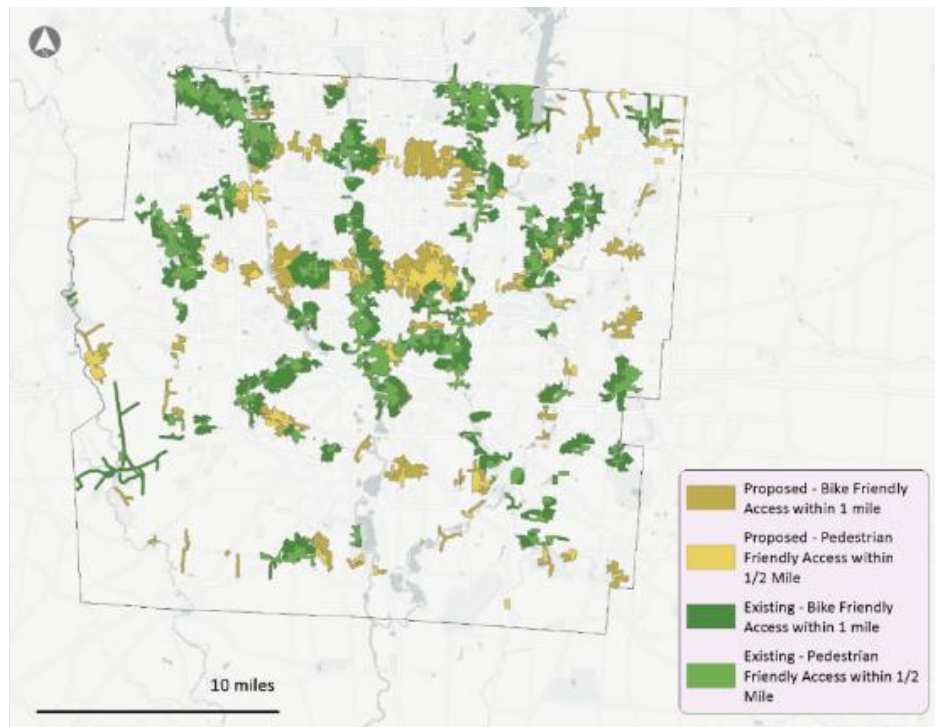
etc.). This technique is commonly applied to housing market transaction data to evaluate the value premium associated with various amenities, services, and infrastructure that support urban communities.

Based on this survey of previous analyses on the premium associated with proximity to trails, ESI estimates that across the region, properties with easy access to a trail (½ mile walking distance/1 mile biking distance) are anticipated to see a value premium of approximately 4 percent.⁵⁸ For the existing trail network, it is assumed that the premium is already inclusive of the existing home prices, while for the planned segments, the property values will increase from the premium.

7.2. The Central Ohio Greenway's Potential Property Value Impacts

Using ESRI Business Analyst, ESI obtained the median house value within a ½ mile walking distance and a 1 mile biking distance of the trail network by its current status of existing or planned segments (see Figure 7.1). The number of properties and median single-family house prices were extracted for Franklin County.

Figure 7.1: Franklin County Central Ohio Greenways –½ Mile Walking Access and 1 Mile Biking Access Buffers by Existing and Proposed Trails



Source: Mid-Ohio Regional Planning Commission (2021), Econsult Solutions, Inc. (2021)

⁵⁸ In analyses that utilize statistical coefficients to predict value changes such as in this study, there is inherently some variation in the specific premia for different geographies and property typologies. However, these models' estimated premia are calculated accounting for variation among various communities, resulting in one multiplier for the region. Examining a more granular geography may result in a higher or lower premium associated with properties' proximity to the trail network.

For the existing trail segments, the 4 percent premiums are backed out from the median house values since it is assumed these houses already have a premium attached to them due to the existing trail network. ESI then attributed a portion of the premium to the total property values from the existing number of housing units within a ½ mile walking or 1 mile biking access of the existing trail segments.

For the planned trail segments, the 4 percent premiums are multiplied to the median house values to estimate the total property value premium impact. This assumes after completion of the planned trail segments, properties in close proximity to the planned trail segments will realize a 4 percent premium.

Figure 7.2: Median House Value of Properties in Close Proximity to Central Ohio Greenways in Franklin County by Status of Trail Network⁵⁹

Status of Network	Median House Value
Existing	\$222,861
Proposed ⁶⁰	\$158,548

Source: ESRI Business Analyst (2021)

Upon completion of the entire trail network, the total property value premium of the existing trail segments within close access of the Central Ohio Greenways in Franklin County is \$495 million with the total property value premium of the proposed trail segments with close access of the trail network upon completion is \$330 million. Combined, the entire network would result in a property value premium of \$825 million (see Figure 7.3).

Figure 7.3: Estimated Property Value Premium for Central Ohio Greenways in Franklin County by Status of Trail Network

Status of Network	Housing		Property Value		Per Unit
	Units	Premium	Premium (\$M)	Property Value	Premium
Existing	55,483	4%	\$495		\$8,900
Proposed	52,096	4%	\$330		\$6,300
Total	107,579	4%	\$825		\$7,700

Source: ESRI Business Analyst (2021), Econsult Solutions, Inc. (2021)

⁵⁹ The median house values were obtained from ESRI Business Analyst, which allows users to obtain specific demographic data through uploading custom geographies.

⁶⁰ In order to avoid double counting of housing units and values, any overlap between the existing and proposed network buffers were removed.

7.3. Potential Property Tax Benefits Resulting from the Central Ohio Greenways

To the extent that these house value increases are properly accounted for in assessed values, this property value impact also has the effect of generating additional property tax revenues for jurisdictions in Franklin County.⁶¹ It is estimated that upon full completion of the Central Ohio Greenways results in additional property tax revenues of about \$2.2 million per year for Franklin County jurisdictions.

Figure 7.4: Potential Property Value Impacts from the Central Ohio Greenways in Franklin County Upon Completion

Status of Network	Franklin County -Estimated Property Taxes (\$M)
Existing (\$M)	\$3.3
Proposed (\$M)	\$2.2
Total Estimated Property Taxes (\$M)	\$5.5
Tax Revenue per Mile of Completed Network (\$)	\$18,800

Source: ESRI Business Analyst (2021), Econsult Solutions, Inc. (2021), Franklin County (2021)

8. Appendix

8.1. About Econsult Solutions, Inc.

This report was produced by Econsult Solutions, Inc. (“ESI”). ESI is a Philadelphia-based economic consulting firm that provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, development, public policy and finance, community and neighborhood development, planning, as well as expert witness services for litigation support. Its principals are nationally recognized experts in urban development, real estate, government and public policy, planning, transportation, non-profit management, business strategy and administration, as well as litigation and commercial damages. Staff members have outstanding professional and academic credentials, including active positions at the university level, wide experience at the highest levels of the public policy process and extensive consulting experience.

8.2. Supplemental Tables

Figure 8.1: Potential Vehicle Miles Traveled Avoided by Trail Users in Franklin County (Supplements Report Figure 4.7)

	EXISTING TRAIL NETWORK			PROPOSED TRAIL NETWORK			TOTAL - UPON COMPLETION		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Annual VMT Per Capita on Commuting/Errands Trips	3,058	3,058	3,058	3,058	3,058	3,058	3,058	3,058	3,058
Share of Auto Trips Replaced by Commute/Errand Users	18%	26%	35%	18%	26%	35%	18%	26%	35%
Potential Residents who Replace Commute/Errand Auto Trips w/ Trail Use	30,000	30,000	30,000	14,000	14,000	14,000	43,900	43,900	43,900
Estimated Annual Reduction in VMT (M)	16.8	24.2	31.7	7.8	11.3	14.8	24.6	35.5	46.5
Per Mile of Trail	136,300	197,100	257,800	6,000	66,500	87,000	83,900	121,300	158,700

Source: Econsult Solutions (2021), Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Census American Community Survey (2015-2019)

Figure 8.2: Potential Annual Reduction in Fuel Consumption due to Trail Users in Franklin County (Supplements Report Figure 4.8)

	EXISTING TRAIL NETWORK			PROPOSED TRAIL NETWORK			TOTAL - UPON COMPLETION		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Estimated Annual Reduction in Fuel Consumption (M)	0.7	1.1	1.4	0.3	0.5	0.7	1.1	1.6	2.1
Per Mile of Trail	6,100	8,800	11,500	2,000	3,000	3,900	3,700	5,400	7,100

Source: US Environmental Protection Agency (2018), Ohio Department of Transportation (2019), National Household Travel Survey (2017), US Census American Community Survey (2015-2019), Econsult Solutions (2021)

Figure 8.3: Potential Metric Tons of CO₂ and Associated Costs Avoided Annually due to Trail Users (Supplements Report Figure 6.9)

	EXISTING TRAIL NETWORK			PROPOSED TRAIL NETWORK			TOTAL - UPON COMPLETION		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Metric Tons of CO ₂ Avoided	6,630	9,580	12,530	3,090	4,470	5,840	9,710	14,040	18,370
Per Mile of Trail	54	78	102	18	26	34	33	48	63
Social Cost of emissions Avoided	\$358,700	\$518,300	\$677,900	\$167,200	\$241,800	\$315,900	\$525,300	\$759,600	\$993,800
Per Mile of Trail	\$2,900	\$4,200	\$5,500	\$984	\$1,422	\$1,858	\$1,800	\$2,600	\$3,400

Source: US Census American Community Survey (2014-2018, 2019), INRIX (2018),
 US Environmental Protection Agency (2017), Econsult Solutions (2021)

Figure 8.4: Potential Annual Air Pollution Removal Benefits of the Central Ohio Greenways in Franklin County

Pollutant	Existing Trail Network		Proposed Trail Network		Total, Upon Full Completion	
	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings
CO	0.1	\$100	0.3	\$300	0.4	\$400
NO ₂	0.3	\$100	0.6	\$300	0.9	\$400
O ₃	5.5	\$13,100	12.4	\$29,200	17.9	\$42,300
PM ₁₀	3.2	\$15,400	7.0	\$34,400	10.2	\$49,800
SO ₂	0.7	\$100	1.5	\$200	2.2	\$300
Total	9.8	\$28,800	21.8	\$64,400	31.6	\$93,200
Per Mile		\$240		\$372		\$318

Source: i-Tree (2021), Multi-Resolution Land Characteristics Land Cover (2016), MORPC (2021), Econsult Solutions, Inc. (2021)

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