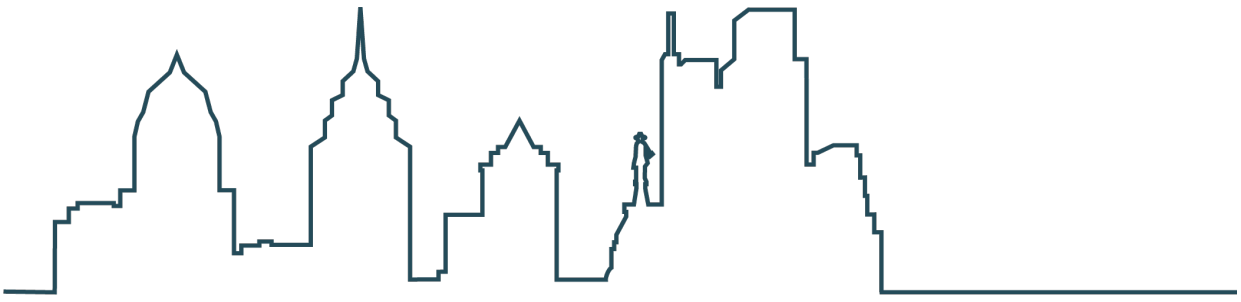
The Economic, Health, and Environmental Benefits of Completing the Capital Trails Network



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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.

1. Introduction

1.1. Purpose of Report

Trail networks provide valuable economic, environmental, and public health benefits to the communities they serve. However, these valuable impacts are often understated or overlooked when considering investment in active transportation networks within communities. This report evaluates the impacts of the Capital Trails Network across the Washington, DC metropolitan region, which is defined in this report as the District of Columbia; City of Alexandria, Arlington County, and Fairfax County in Virginia; and Prince George's County and Montgomery County in Maryland. Further analysis on the impacts of the trail network was also completed at the state and county/city level. The figures, analysis, and mapping in this report examine both the current, existing network as well as the entire network upon completion of proposed trails. The Capital Trails Coalition commissioned Econsult Solutions Inc. (ESI) to quantify these impacts and describe their economic and societal value to the Washington, DC metropolitan region.

This study describes the network's "economic footprint" to help stakeholders understand the estimated value created by completing the network, including opportunities arising for the community, workers, and local businesses and the flowthrough effects (supply chain and household consumption). Completion of the network will increase economic activity and jobs associated with construction of new segments across the DC metropolitan region and will ultimately increase property values for residents located close to completed trails. The presence of trails and their surrounding tree cover/plantings provide environmental service benefits in the forms of flood mitigation, carbon sequestration, and other avoided costs. Local businesses located near the trails will also benefit from spending that occurs from trails users. The completed network will also expand walking, biking, and other active transportation options for the DC region and improve potential connectivity to the public transportation system, supporting healthy lifestyles.

1.2. About the Capital Trails Coalition

The Capital Trails Coalition is a collaboration of public and private organizations, agencies, and community member volunteers working to advance completion of a network of multi-use trails for the Washington, DC metropolitan region. The Coalition coordinates stakeholders across the metropolitan region to achieve a vision of a world-class interconnected network that is equitably distributed across the region.

The Coalition advocates for a trail network with the following characteristics:

- Accessible to people of all ages and abilities
- Healthy and safe to promote wellbeing
- Equitably distributed to provide access across all communities
- Reliable for affordable, sustainable transportation
- World-class built to the highest design standards

The Capital Trails Coalition includes the following members:

- Washington Area Bicyclist Association
- Rails-to-Trails Conservancy
- Maryland Milestones/ATHA Inc.
- Latin American Youth Center
- The Trust for Public Land
- Virginia Bicycling Federation
- Friends of Oxon Run Park
- AARP Maryland
- Georgetown Business Improvement District
- NoMA Business Improvement District
- District of Columbia Recreational Trails Advisory Committee
- Montgomery County Planning Department
- BeechTree Pedalers
- Trust for the National Mall
- Urban Land Institute Washington
- City of Alexandria Department of Transportation and Environmental Services
- Medical Society of the District of Columbia
- Anacostia Watershed Society
- East Coast Greenway Alliance
- Black Girls Do Bike
- BikeArlington
- Visit Alexandria
- University of Maryland Department of Transportation Services
- Friends of Kenilworth Aquatic Gardens
- DC Sustainable Transportation
- Mid-Atlantic Off Road Enthusiasts
- DC Department of Parks and Recreation
- September 11th National Memorial Trail
- District Department of Energy and Environment
- Washington Rowing School
- Northern Virginia Regional Commission
- National Landing BID
- Washington Parks and People
- Fairfax Alliance for Better Bicycling
- Sierra Club-DC Chapter
- Coalition for Smarter Growth
- Bike Maryland
- C&O Canal Trust
- DC Cycling Concierge
- Black Women Bike DC
- The American Discovery Trail Society
- Washington Women Outdoors
- Adventure Cycling Association
- Sierra Club Virginia Chapter
- Gearin' Up Bicycles, Potomac Heritage Trail Association
- Public Health Impact, LLC
- Friends of the Mount Vernon Trail
- DC Bicycle Advisory Council
- DowntownDC BID
- Potomac Pedalers Touring Club
- Netwalking
- Federal City Council
- Green Spaces for DC
- Park Rx America
- The Coalition for the Capital Crescent Trail
- Appalachian Mountain Club Potomac Chapter
- Bowie Multimodal Access and Public Spaces
- Sustainable Mobility for Arlington County
- Coburn & Greenbaum PLLC
- Potomac & Chesapeake Cycling
- Proteus Bicycles
- Prince George's County Department of Parks and Recreation
- Montgomery County Parks

Also engaged with the Coalition are representatives from Metropolitan Washington Council of Governments, The National Park Service, Metropolitan Washington Metro Area Transit Authority, and the District Department of Transportation.

1.3. About the Capital Trails Network

The Capital Trails Network totals more than 881 miles of existing and planned trail infrastructure throughout Washington DC, Maryland, and Virginia, connecting communities, workplaces, and amenities throughout the region. The expansion of the Capital Trails Network has been approved and endorsed by the Transportation Planning Board of the Metropolitan Washington Council of Governments. As a network of multi-use trails that provide active transportation options for residents and visitors to the region, the system also offers access to open space and recreational opportunities to the diverse communities that call the Washington, DC region home.

Currently, the Capital Trails Network offers 479 miles of completed trails throughout the region. However, the trail network is not yet completed – the construction of additional segments will both extend the network into new communities and connect segments of trails that exist in different communities. The network has 152 planned projects, totaling 402 miles of still-to-be built trail segments or connectors (see Figure 1.1). These remaining projects, upon completion, will provide the region with a comprehensive active transportation network that supports increased mobility around the region, provides more communities with green infrastructure and recreational assets, and improves the quality of life and attractiveness of the region.

Figure 1.2: Capital Trails Network by Locality and Status of Trail Segments in Miles

State	County	Existing Trails (miles)	Planned Trails (miles)
DC	DC	68.2	43.2
VA	Alexandria	17.3	6.3
VA	Arlington*	35.0	7.7
VA	Fairfax**	155.2	60.6
MD	Montgomery	113.3	42.5
MD	Prince George's	89.6	242.0
		478.7	**402.3**

Source: Capital Trails Network (2021)
**Falls Church trail segments are included in the Arlington totals.*
***Fairfax City trail segments are included in the Fairfax County totals.*

1.4. Trail Networks as a Driver of Regional Benefits

Research and practice show that trails are essential infrastructure which improve the economic vitality of communities. Trails create safe and easy access to open space, support healthy living, provide affordable transportation, and altogether improve the quality of life for residents who live nearby, as well as increase the attractiveness of the location for businesses that choose to locate there. As an

economic development tool, trails serve multiple purposes, which means that the return on investment of a network can be viewed through a number of perspectives:

- As an indicator of local reinvestment in a place, trails can serve as a catalyst for economic and community development projects.
- As part of a region's green infrastructure, trails contribute to a region's overall competitiveness.
- As a mode of active recreation for residents and out-of-town visitors, trails also often serve as a way to encourage "local tourism" and spending at businesses located nearby.
- As a well-connected and safe means for active transportation, trails strengthen a region's transportation network and increase mobility for residents.

1.5. Organization of Report

This report analyzes the potential economic, environmental, and public health impacts of the Capital Trails Network, and is organized as follows:

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

2. Completion of the Remaining Trail Network

The completion of the Capital Trails Network will represent a significant boost to the local and state economies through the upfront spending on trail construction of new segments. Direct construction activity 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 this direct spending but is recirculated and multiplied 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 Capital Trails Network is the sum of the direct construction investment plus the indirect and induced effects generated by that direct investment.

2.2. The Capital Trail Network's Existing and Future Network

A significant investment has been made within the Capital Trails Network to date, but a substantial amount of work is still required to establish a connected network of trails throughout the Washington, DC region. Currently, the region has 479 miles of built trails, with an additional 402 miles to be built across the region's urban, suburban, and rural communities.

Estimates provided by Capital Trails Coalition show that the total cost to construct the remaining segments of the trail network is roughly $1.09 billion. Approximately 71 percent of the remaining segments are in Maryland, 19 percent in Virginia and the remaining 10 percent in Washington, DC (see Figure 2.2).

Figure 2.2: Estimated Construction Costs of the Remaining Capital Trail Network by Locality

State	County	Miles to be Completed	Construction Cost ($M)
DC	DC	43.2	$282
VA	Alexandria	6.3	$61
VA	Arlington	7.7	$82
VA	Fairfax County	60.6	$183
MD	Montgomery	42.5	$161
MD	Prince George's	242.0	$321
		402.3	**$1,090**

Source: Capital Trails Network (2021)

2.3. Potential Economic Impact of the Capital Trails Network's Completion

On average, each mile of additional trail supports:
40 jobs during construction
$5 million in economic output

Direct expenditures attributed to the completion of the Capital Trails Network are estimated to total $1.09 billion over the next 25 years of construction (see Figure 2.2). Across the Washington, DC region, these direct expenditures are projected to generate $2 billion in total economic impact, supporting 16,100 jobs and $966 million in total earnings (see Figure 2.3). Annually, this equates to an economic impact of approximately $81.8 million and 644 job-years per year over the course of the construction.[1]

[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.

The creation of direct jobs generated from the completion of the trail network may also have a larger effect on job creation compared to other transportation projects. A study conducted by the American Association of State Highway and Transportation Officials determined that construction of multi-use trails generate approximately 17 direct jobs per $1 million in output, more than any type of transportation project (e.g., pavement widening, highway construction, bridge construction, etc.).[2]

Figure 2.3: Potential Aggregate Economic Impact from Construction of the Capital Trail Network

Impact Type	DC	Maryland	Virginia	DC Metro Area (Total)
Direct Output ($M)	$282	$482	$326	$1,090
Indirect and Induced Output ($M)	$128	$506	$322	$955
Total Impact ($M)	**$410**	**$988**	**$647**	**$2,045**
Employment Supported (FTE)	**3,400**	**7,800**	**4,900**	**16,100**
Employee Compensation ($M)	**$273**	**$435**	**$257**	**$966**

Source: Capital Trails Network Coalition (2021), IMPLAN (2019), Econsult Solutions, Inc. (2021)

2.4. Industry Distribution of Jobs Impacted by Trail Completion

Capital investment in the Capital Trails Network will support jobs in many industries beyond the building trades and engineering. Direct employment in construction of the network will account for approximately 70 percent of all jobs supported. However, 30 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 construction of the Capital Trail Network 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.

[2] American Association of State Highway and Transportation Officials, "Mining Recovery Act Data for Opportunities to Improve the State of Practice for Overall Economic Impact Analysis of Transportation Investments," http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(103)_FR.pdf.

Figure 2.4: Industry Distribution of Employment Generated from Construction of the Capital Trail Network in the DC Metropolitan Area

Industry	Distribution
Health Care and Social Assistance	14%
Retail Trade	13%
Professional, Scientific, and Technical Services	11%
Admin. and Support and Waste Mgmt. and Remediation Services	10%
Other Services (except Public Administration)	9%
Accommodation and Food Services	8%
Real Estate and Rental and Leasing	6%
Finance and Insurance	5%
Wholesale Trade	5%
Transportation and Warehousing	4%
All Other	15%

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

2.5. Potential Tax Impacts from the Completion of the Capital Trail Network

The cumulative capital investments also generate tax revenue impacts in the respective localities during the period of construction. 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 Washington, DC, the State of Maryland, and the Commonwealth of Virginia due to spending on constructing the remaining trail segments. There are additional localities that stand to benefit from additional revenue; however, they are significantly smaller in order of magnitude.

The direct construction activity of the trail network, as well as its indirect and induced economic impacts, is estimated to generate approximately $18.3 million to Washington, DC, $37.4 million to the State of Maryland, and $9.6 million to the Commonwealth of Virginia over the next 25 years of construction (see Figure 2.5). Tax revenue generated per mile of planned trail construction in each jurisdiction ranges from approximately $0.4 million per mile of planned trails in Washington, DC to $0.1 million per mile of planned trails in Maryland and Virginia.[3]

[3] Differences in the amount of tax revenue generated per mile of planned trails arise from different tax structures across jurisdictions.

Figure 2.5: Potential Tax Revenue from Construction of Capital Trail Network by Locality[4] ($M)

Tax Type	DC	Maryland	Virginia
Income	$14.4	$17.6	$6.6
Sales	$2.4	$5.9	$2.4
Business	$1.5	$13.9	$0.6
Total Tax Revenue	**$18.3**	**$37.4**	**$9.6**
Tax Revenue Per Mile of Planned Trails	**$0.4**	**$0.1**	**$0.1**

Source: DC CAFR (2019), Maryland CAFR (2019), Virginia CAFR (2019), IMPLAN (2019), Econsult Solutions, Inc. (2021), Capital Trails Network (2021)

[4] Throughout this report, tax revenue impacts are calculated differently since there are three separate taxing jurisdictions.

3. Transportation and Safety

The Capital Trails Network will expand mobility options for people that live and work in the DC region, providing a safe, extensive network for non-motorized transportation that is connected and routed through major destinations.[5] The potential increase in trail users due to the network 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 Capital Trails Network's eventual completion will support the DC region as demand on its transportation system continues to grow.

3.1. 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. [6] 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 Capital Trails Network on the region's transportation network, ESI evaluated the dynamics of commuter patterns within a 2-mile buffer of the existing and proposed trail network. By evaluating mode use patterns in the areas immediately surrounding the trails to those of the broader region, ESI estimated the number of active transportation trips attributable to trails. Based on these existing dynamics and the anticipated benefits of a fully connected trail network, ESI then calculated the potential savings in VMT and related costs associated with traffic and congestion.

3.2. Existing Mobility and Transportation Conditions

A recent study ranked the DC Region 5th nationally for congestion, costing $4.1 billion, an average of $1,835 per driver, in time wasted and additional fuel costs from waiting in traffic.

The 881 miles of Capital Trails Network trails are, and will be, a critical component of the region's transportation system, alongside public transit services, highways, and roads.[7] In densely populated communities within the region, trails are a transportation corridor for commuters to employment centers and help reduce the region's overall reliance on automobiles. Figure 3.1 below displays the typical commuting pattern of residents working within the DC region. As shown, the majority of commuters drive to work alone (see Figure 3.1). Approximately 5 percent of commuters in the region bike or walk to work.[8]

[5] Nonmotorized transportation on trails includes not only biking and walking, but also people using wheelchairs, scooters, e-bikes, skateboards, and various other micro-mobility devices.
[6] *Active Transportation Transforms America,* Rails to Trails Conservancy, 2019
[7] Source for call-out box: *INRIX Scorecard*. https://inrix.com/scorecard-city/?city=Washington%2C%20DC&index=21.

[8] 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.

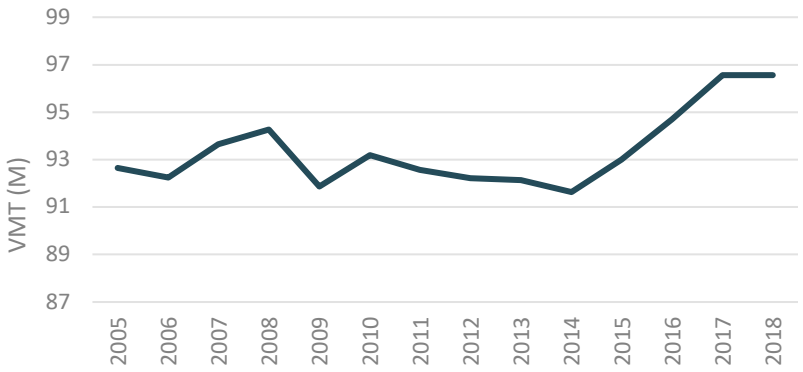
Figure 3.1 Distribution of Commuters in the DC Region by Mode[9]

	Mode Split by Commuters
Drove alone	61%
Carpooled	9%
Public transportation (excl.taxicab)	18%
Taxicab	0%
Motorcycle	0%
Bicycle	1%
Walked	4%
Other means	1%
Worked at home	6%

Source: US Census American Community Survey (2014-2018)

With recovery from the Great Recession and a growing population, the Washington, DC region has seen a substantial increase in the daily VMT, reaching approximately 96.5 million commuter miles in 2018 (see Figure 3.2).[10]

Figure 3.2: Typical Weekday Vehicle Miles Traveled within the DC Region[11]



Source: Metropolitan Washington Council of Governments (2021)

Based on assumptions developed by the Environmental Protection Agency (EPA) on average gallons of gas used per mile, the 2018 VMT estimates for the DC region generated nearly 38,500 metric tons of CO^2

[9] Data collected for DC, Arlington County, City of Alexandria, Montgomery County, Prince George's County, Fairfax County, Fairfax City, Falls Church.
[10] Data on VMT for 2019 and 2020 are not yet available; it is likely that the region experienced a decrease in VMT in 2020 due to temporary COVID-19 stay-at-home orders, but with return to work and a growing population, it is likely that VMT will grow without providing other transportation infrastructure (trails, transit) to support travel around the region.
[11] Annual VMT for DC, Arlington County, City of Alexandria, Montgomery County, Prince George's County, Fairfax County, Fairfax City, Falls Church.

emissions a day.[12,13] 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.[14] 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.

With residents in the DC region averaging a commute of 33 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 3.3). Connecting walking and biking infrastructure with transit stations encourages commuters to use sustainable, multi-modal transportation options. Currently, 51 of the 91 Metrorail stations have entrances within a half mile walk or bike ride of existing trails, and upon completion of the trail network, the number of trail accessible stations will rise to 59.[15] Providing safe, comfortable connections to and from transit increases the likelihood that commuters will choose to travel without a car. For commuters without access to personal vehicles, extending the reach of the transit network through safe walking and biking infrastructure increases mobility options.

Figure 3.3: Average Commute Time for Residents in the DC Region

	Travel Time to Work for Commuters
Less than 15 minutes	13%
15 to 29 minutes	31%
30 to 34 minutes	17%
35 to 59 minutes	36%
60 or more minutes	14%

Source: US Census American Community Survey (2014-2018)

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 DC region household more than $12,500 a year (see Figure 3.4).[16] The ability to use other means of transportation that are low or no expenses is an issue of equitable access to destinations and job opportunities.

[12] The EPA emissions calculator estimates an average of 22.3 miles per gallon for a typical vehicle. https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.
[13] VMT estimates based on the region containing Washington DC, Arlington County, Alexandria, Montgomery County, Prince George's County, Fairfax County, Fairfax City, and Falls Church.
[14] US Environmental Protection Agency, *Fast Facts on Transportation Greenhouse Gas Emissions*. https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.
[15] Georgetown University Urban and Regional Planning Program, "The 6 Spokes: Making DC a World Class Bike Region." https://storymaps.arcgis.com/stories/a5f14c0cd98d43109fe693adc9bab69c?org=1836&lvl=100&ite=1359&lea=2026197&ctr=0&par=1&trk=a105x000006YZi2AAG.
[16] Data from the Center for Neighborhood Technology Housing and Affordability Index measured average spending for the National Capital Region, identified as the Metropolitan Washington Council of Governments (MWCOG) jurisdiction. Expenditures represent average expenditures by a typical household in the region, meaning that costs are averaged across all households.

Figure 3.4: Average Annual Household Expenditures on Automobile-Related Transportation Costs

	Average Annual Household Cost
Automobile Ownership	$9,845
VMT Expenses	$2,732
Total Transportation Cost	**$12,577**

Source: Center for Neighborhood Technology Housing and Affordability Index (2021)

3.3. Potential Impacts of the Capital Trails Network on Regional Mobility

In order to understand how the Capital Trails Network helps alleviate the reliance on private vehicle transportation in the Washington, DC region, this analysis sought to determine whether commuters who live in close proximity to the trail network are more likely to use active forms of commuting. More commuters choosing active modes reduces reliance on private vehicles and alleviates congestion and emission impacts associated with private vehicle travel.

The commuting patterns of workers within a two-mile radius of the trail network were compared with the commuting patterns of that county/city at large to see if active forms of commuting are more prevalent among workers who live near to a trail.[17,18] These calculations were initially conducted at the locality level for each county or city where trails are or will be located (see Technical Appendix 8.3). Locality-level estimates were then aggregated to show results at the state level which are summarized in Figure 3.5. The series of steps undertaken to yield these estimates, based US Census data, is as follows:

- First, the total number of commuters within a two-mile radius of the completed Capital Trails Network is estimated for each county/city where trails are or will be located. These estimates are then aggregated to the state level.
- Next, the number of commuters who use active forms of commuting (walking or biking) in each county/city is estimated; these results are then summed to yield state-level estimates. The total number of commuters in each county/city is also estimated and aggregated to the state level. The share of commuters who walk or bike in these jurisdictions at large is estimated based on these two state-level estimates – the number of active commuters divided by the number of total commuters. These shares represent the average share of active commuters for the jurisdictions in each state where trails are located.
- Then, the number of active commuters who live within a two-mile radius of the completed trail network in each county/city is estimated; these estimates are then summed to yield state-level estimates. The share of active commuters within a two-mile radius of the trail network in each

[17] A two-mile buffer is used for analyzing walk and bike commute patterns in the area surrounding the trail based on the average of two metrics: the midpoint of the average walk and bike commute distance, and the weighted average walk and bike commute trip lengths and the corresponding share of walk and bike commute trips according to National Household Travel Survey data as presented in Kuzmyak and Dill, "Walking and Bicycling in the United States." https://onlinepubs.trb.org/onlinepubs/trnews/trnews280www.pdf

[18] The impacts represented in this section are for the completed Capital Trails Network. Because of extensive overlap between a 2-mile buffer of existing segments of the network and planned segments, it is not possible to isolate impacts of the current trail network and extrapolate them to a completed trail network.

state is then calculated by dividing these state-level estimates by the estimated total number of commuters within a two-mile radius of the trail network calculated in step one.

- The differential in active commuters within a two-mile radius of the trail network is then estimated for each state by calculating the difference between the percent of commuters who walk/bike within a two-mile radius of the trails and the percent of commuters who walk/bike in the jurisdictions at large. This differential is then applied to the total number of commuters within a two-mile radius of trails to estimate the number of additional active commuters within a two-mile radius of the trail network.

Figure 3.5: Increase in Active Transportation due to Trail Proximity

	DC	Maryland	Virginia	Total
Total Commuters within 2-mile radius of Capital Trails Network	343,760	818,060	806,540	1,968,360
Percent of Commuters who Walk/Bike: Localities (County/City) At Large	17.4%	2.3%	3.0%	103,520
Percent of Commuters who Walk/Bike: 2-mile Radius of Trails	18.7%	2.9%	3.6%	117,040
Additional Active (Walk/Bike) Commuters within 2-mile Radius of Trails	**4,580**	**4,190**	**4,750**	**13,520**

Source: US Census American Community Survey (2014-2018), Econsult Solutions (2021)

The results show that for the region overall, the number of residents who actively commute to work is 13.1% higher among residents who live in close proximity to the completed trail network, as compared to those who actively commute in the region overall.

Reductions in VMT

Based on the differential use of active modes by commuters near to trails calculated above, it is possible to calculate how much the DC region stands to benefit from lower daily VMT and resulting greenhouse gas emissions that would have been produced if these commuters traveled by automobile.

To estimate the potential reduction in VMT associated with active commuting, the number of additional active transportation commuters who live in close proximity to trails (summarized in Figure 3.5) was used as the starting point for the calculation. If these active commuters instead traveled by automobile, some would travel by carpool and not necessarily represent another unique vehicle commuting. Data on vehicle commute trends (driving alone versus carpooling) from the US Census Bureau is used to estimate the number of active commuters in lieu of unique vehicle commuters – these estimates are summarized at the state level in Figure 3.6. Next, data on the average commute time from the US Census for each locality (county/city) is applied to data from INRIX on average gallons of fuel wasted per hour wasted, and data from the Environmental Protection Agency on average miles per gallon of fuel to yield an estimate of the average vehicle miles traveled per commute trip in each locality. The estimated VMT per commute trip in each locality is then multiplied by the average annual commute trips per person to yield average annual VMT estimates per vehicle commuter in that locality.[19] These estimates are then calculated at the state level by combining jurisdiction-level data. The number of active commuters in lieu of unique vehicle commuters is then applied to the average annual VMT per vehicle commuter in

[19] The average annual number of commute trips per person is assumed to be 520.

each location to yield the potential annual reduction in VMT associated with the additional active commuting near trails.

Figure 3.6: Annual Reduction in Vehicle Miles Traveled (Millions) due to Additional Active Transportation Commuters

	Active Commuters in Lieu of Unique Vehicle Commuters	Average Annual VMT per Vehicle Commuter	Annual Reduction in VMT (M)
Washington, DC	4,274	4,105	**17.5**
Maryland	3,911	3,375	**13.2**
Virginia	5,210	3,527	**18.4**
Total	**13,395**	**-**	**49.1**

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

Active transportation by commuters who live near the completed trail network could reduce VMT in the region by 49 million miles when compared to surrounding county/city commute trends (see Figure 3.6). It is important to note that these savings in VMT are from commute travel alone, and substantial benefits in terms of VMT reductions are also achieved by residents who walk or bike for short, non-commute trips.[20] The reductions in VMT and associated impacts to fuel consumption and emissions could be much more substantial, as additional residents shift to active modes for short non-commute trips due to improved walking and biking infrastructure. Additionally, as the trail network becomes increasingly connected to public transportation infrastructure in the region, even more trips could be converted from automobile travel if residents combine walking/biking with public transit to complete their commute.

Reductions in vehicle miles traveled yield associated savings in fuel consumption, carbon dioxide emissions, and congestion. Active transportation associated with the Capital Trails Network would yield an estimated annual reduction in fuel consumption of 2.2 million gallons (see Figure 3.7). Reduced commute congestion means that workers waste less time sitting in traffic, yielding additional benefits in productivity.

Figure 3.7: Annual Reduction in Fuel Consumption (Gallons) due to Active Transportation Commuters

	Annual Fuel Reduction
Washington, DC	786,700
Maryland	592,000
Virginia	824,000
Total	**2,202,700**

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

[20] Non-commute trips for shopping, errands, travel to school, and for social and recreational purposes represent much higher shares of walk and biking trips than commuting – implying additional benefits in VMT reductions from non-work-related active forms of travel. See Kuzmyak and Dill, "Walking and Bicycling in the United States."

These impacts to fuel consumption are associated with substantial reductions in greenhouse gas emissions in the region. The region stands to benefit from a reduction in CO_2 emissions of approximately 19,580 metric tons due to active commuting by residents who live in close proximity to the Capital Trails Network (see Figure 3.8). To put this quantity of emissions avoided into context, 19,580 metric tons of CO_2 is equivalent to the emissions from burning 21.5 million pounds of coal, 4 wind turbines running for a whole year, or the carbon sequestered each year by 25,000 acres of U.S. forest.[21]

Figure 3.8: Metric Tons of CO_2 Avoided Annually due to Active Transportation Commuters

	Annual CO_2 Emissions Avoided
Washington, DC	6,990
Maryland	5,260
Virginia	7,330
Total	**19,580**

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

Household Transportation Costs

Mode shift has an impact on individual residents (i.e. users of the trail network) as well. Primarily, residents who are able to walk, bike, or take public transit to work are able to reduce their annual transportation expenses. Residents may have lower operating expenses for their vehicles or may not need a car at all. Based on the number of additional active commuters attributable to the Capital Trails Network (see Figure 3.5) and average automobile-related household expenditures (see Figure 3.4), it is possible to quantify the potential savings yielded by active commuters in the region. Households in the DC region stand to benefit up to $170 million each year in savings on automobile-related expenditures due to active commuting associated with the trail network. These residents will also experience health benefits from a more active transportation mode; those benefits are calculated in Chapter 5 of this report.

Safety from Vehicle Traffic

Trails are built in a way that protect pedestrians and bicyclists from automobile traffic and reduce crashes that result in serious injuries and fatalities by providing a space for walking and biking. According to the Metropolitan Washington Council of Governments (MWCOG), each year in the region, more than 2,600 people walking or biking are injured and approximately 70 people die from traffic fatalities.[22]

According to a study from the Association for the Advancement of Automotive Medicine, the average lifetime cost of pedestrian-motor vehicle crashes for the pedestrian is approximately $205,000 and the

[21] US Environmental Protection Agency (2020), *Greenhouse Gas Equivalencies Calculator.* https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.
[22] Bicycle and Pedestrian Plan for the National Capital Region, 2014.

average lifetime costs to people biking from bike-motor vehicle crashes is approximately $88,000.[23] These costs and the medical services required to attend to crash-related injuries represent a strain on both individuals and the health system. In total, annual traffic injuries result in more than $400 million in estimated lifetime costs in the form of medical costs, reduced productivity, and lost quality of life.

Figure 3.9: Estimated Cost from Crashes Involving Pedestrians and Bicyclists in the DC Region Annually

	Pedestrians	Bicyclists
Average annual injuries	1,900	700
Average cost per injury	$205,000	$88,000
Total annual cost ($M)	**$389.5**	**$61.6**

Source: Bicycle and Pedestrian Plan for the National Capital Region (2015), Association for the Advancement of Automotive Medicine (2004), Econsult Solutions, Inc(2021)

[23] Miller, Zaloshnja, and Lawrence, *Pedestrian and Pedalcyclist Injury Costs in the United States by Age and Injury Severity* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217422/#:~:text=The%20estimated%20lifetime%20cost%20of,as%20motor%20vehicle%20occupant%20injuries. Values from the study were in 2000$ and inflated to 2021$.

4. Environmental Services

Trail networks such as the Capital Trails Network provide enumerable environmental benefits for the communities they serve. This section draws upon established research to evaluate the economic benefits in monetary terms of several types of ecosystem services provided by the network 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. The upkeep of the trail network will ensure the value of the services if 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.

4.1. 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 Capital Trails Network. 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 Capital Trails Network.

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. The acreage of each ecosystem type is used to calculate environmental services benefits using values from a 2006 study conducted by Costanza, which estimated the average value of various ecosystem services. 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 ecosystem services and has associated value per acre, determined by the Constanza study, and applied to Capital Trails Network.[24]

The i-Tree Vue 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. The resulting 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 Vue model has the advantage of allowing for the adjustment of the per-acre pollution removal values.

[24] 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.

4.2. Analysis of Capital Trails Network's 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, and 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 economic benefits.

Upon full completion of the trail network, the ecosystem services provided by the Capital Trail Network's approximately 138,052 acres of the trails will generate significant economic benefits to the extent that the ecosystems within a quarter mile of trails protect existing ecosystems services and the nearly 74,000 acres of tree cover to the region. While the majority of trails are paved, the ecosystems surrounding the trail (within a quarter mile) generate ecosystem services benefits, which will be protected by the existence and upkeep of the trail network.

In sum, the ecosystem services and environmental benefits within a quarter mile of the trail network (upon completion) are $100.5 million in annual benefits from a variety of sources (see Figure 4.1) and $433.1 million in the lifetime cost savings of carbon storage from tree coverage.

Figure 4.1: Potential Environmental Benefits by Type and Locality upon Full Completion of the Capital Trails Network ($M per Year)[25]

Ecosystem Service	DC	Maryland	Virginia	Total
Water Supply	$4.0	$18.0	$40.0	$62.0
Water Quality	$0.6	$2.6	$0.1	$3.2
Flood Mitigation	$1.9	$8.4	$2.1	$12.4
Wildlife Habitat	$0.1	$0.4	$0.1	$0.6
Air Pollution Removal	$1.0	$2.4	$1.3	$4.6
Carbon Sequestration	$1.0	$11.9	$4.8	$17.7
Carbon Storage (lifetime)	$23.0	$283.2	$126.8	$433.1

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

The following subsections provide additional detail on the calculations of these ecosystem services, how they were calculated, and their total cost savings impact on the region.

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. Trees mitigate

[25] Note that not every ecosystem generates an economic benefit , approximately 34 percent of the land cover classifications identified of the 138,052 acres were used to generate an ecosystem service benefit.

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.

Figure 4.2: Potential Annual Air Pollution Removal Benefits by Locality from Capital Trails Network

	DC		Maryland		Virginia		Total	
Pollutant	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings
CO	6	$7,636	49	$45,724	4	$4,498	59	$57,858
NO2	18	$24,240	252	$61,823	78	$48,801	348	$134,864
O3	83	$793,450	1183	$1,514,692	352	$661,309	1618	$2,969,452
PM10	21	$130,309	269	$744,920	109	$537,840	398	$1,413,069
SO2	9	$3,459	73	$5,118	29	$4,525	111	$13,102
Total	**138**	**$959,094**	**1825**	**$2,372,278**	**571**	**$1,256,973**	**2534**	**$4,588,345**

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

Upon completion of the trail network, the Capital Trails Network will provide 74,000 acres of tree canopy within a quarter mile of the trail network.[26] 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 a quarter mile of the Capital Trails Network annually provide $4.6 million in air pollution removal services.

This analysis includes benefits derived from the removal of five different pollutants: carbon monoxide (CO), nitrogen dioxide (NO^2), ozone (O^3), particulate matter (PM10), and sulfur dioxide (SO^2). Figure 4.2 above shows the value generated for the removal of each pollutant.

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 have to be imported from elsewhere or local water would to be more extensively treated, both of which are costly. Within a quarter mile of the completed Capital Trails Network, $62 million in annual cost savings from natural water supply services would be generated. Trails offer protection to these surrounding ecosystems by lowering the probability of development that would impact the ecosystems.

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

[26] 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 a quarter mile of all Capital Trails Network segments.

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 buffer provided by the Capital Trails Network generates approximately $3.2 million annually 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 region 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 Capital Trails Network generates approximately $12.4 million annually 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.[27] In sum, the wildlife habitats located within a quarter mile of the Capital Trails Network has an estimated annual value of $600,000.

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 open space 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.

The social cost of carbon is the value of carbon sequestration and storage is $171 per ton.[28] Using this social cost of carbon, it estimated that within a quarter mile of the completed Capital Trail Network, trees store 2,539,308 tons of carbon, equating to $433.1 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 would cost $433.1 million to mitigate.

[27] Ibid.
[28] I-Tree, *USDA Forest Service,* https://www.itreetools.org/.

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 Capital Trails Network, these damages are avoided, representing savings for communities across the trail network. Every year, new growth on the trees within the trail network sequesters an additional $17.7 million in carbon.

Figure 4.3 shows estimates of the tons of carbon annually sequestered and tons stored by trees for their lifetime within the trail network, along with the benefits derived from the storage and sequestration of carbon by these trees.

Figure 4.3: Potential Amounts of Annual Carbon Sequestration and Lifetime Carbon Storage and Associated Benefits from Capital Trails Network upon Completion of the Trail Network

	DC		Maryland		Virginia		Total	
Pollutant	**Tons**	**Cost Savings ($M)**	**Tons**	**Cost Savings ($M)**	**Tons**	**Cost Savings ($M)**	**Total**	**Cost Savings ($M)**
Carbon Sequestration	5,852	$1.0	69,801	$11.9	28,351	$4.8	104,005	$17.7
Carbon Storage	135,137	$23.0	1,660,556	$283.2	743,616	$126.8	2,539,308	$433.1

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

5. Public Health

The Capital Trails Network supports healthy lifestyles for people in surrounding communities by providing an easily accessible and low-cost option for residents to recreate and 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.

5.1. 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.[29] 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 Capital Trails Network within their community. ESI utilized data from the US Census regarding residents within two miles of the trail as well as survey data and research from the Rails to Trail Conservancy (RTC) 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.[30] 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. 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.[31] 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 workers who meet recommended levels of physical activity using the Capital Trails Network are quantified.[32]

5.2. Estimated Active Users of Capital Trails Network Upon Completion

It is estimated that the completion of the full Capital Trails Network will support approximately 438,000 active residents in the region (see Figure 5.1). The following steps were taken to arrive at this count:

- First, ESI estimated the number of local residents who are frequent (three or more times a week) trail users. Data regarding trail usage from the RTC *DC Region Trail Usage Survey* and data

[29] Centers for Disease Control and Prevention (2021), *Physical Activity Basics*. https://www.cdc.gov/physicalactivity/basics/adults/index.htm.
[30] 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.
[31] 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*.
[32] Chenoweth and Bortz (2005), *Physical Inactivity Cost Calculator: How the Physical Inactivity Cost Calculator Was Developed*.

regarding the number of working age adults within a two-mile radius of a trail from the US Census were used to develop this estimate.

- 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.[33]
- Then, ESI applied a reduction to this estimate based on the proportion of users who would be considered active even without access to the Capital Trails Network.[34] 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 5.1: Estimated Number of Trail Users Located within Two-Mile Radius and Meeting Physical Activity Requirement Due to the Capital Trails Network [35]

	Working Age Adults	Estimated Regular Trail Users	Users Meeting Activity Req. Due to Trails
Washington, DC	466,030	180,430	84,800
Maryland	972,950	376,690	177,040
Virginia	967,570	374,600	176,060
Total	**2,406,560**	**931,720**	**437,910**

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

5.3. Potential Public Health Value of the Completed Network

Residents who achieve physically active lifestyles due to the completed Capital Trails Network 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.[36] 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, average, and upper bound estimates of the potential health care expenditure reductions achieved by active users on the completed 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 in each jurisdiction.[37] It is estimated

[33] 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.
[34] Proportions are drawn from Götschia and Lohb (2017), *Advancing Project-Scale Health Impact.*
[35] Note that columns may not sum due to rounding.
[36] Centers for Disease Control and Prevention (2021), *Benefits of Physical Activity*. https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm.
[37] 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.

that the completed Capital Trails Network could yield between $287 million and $741 million in healthcare cost savings in the DC region.

Figure 5.2: Estimated Value of Healthcare Savings from Active Trail Users

	Lower Bound	Mean	Upper Bound
Average Annual Savings per Active Individual ($)	$656	$1,181	$1,691
Total Annual Savings due to Active Trail Users ($M)			
Washington, DC	$56	$100	$143
Maryland	$116	$209	$299
Virginia	$115	$208	$298
Total	**$287**	**$517**	**$741**

Source: Rails to Trails Conservancy (2019), CDC (2018), ESRI (2019), Econsult Solutions, Inc. (2021)

5.4. Productivity Benefits Achieved by Active Trail Users

To quantify the workplace productivity benefits realized by active users of the Capital Trails Network, a series of steps are taken to first 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 5.2, however data from the US Census tracking the number of *workers* residing within a two-mile radius of the trail network are used as the base for this calculation.[38] As outlined in Figure 5.3, it is estimated that a completed Capital Trails Network will support approximately 379,500 physically active workers in the region.

Figure 5.3: Estimated Number of Workers Located within Two-Mile Radius and Meeting Physical Activity Requirement Due to the Capital Trail Network [39]

	Workers Aged 16+ within 2-mile Radius	Estimated Regular Trail Users	Estimated Workers Meeting Activity Req. due to Trails
Washington, DC	366,170	141,770	66,630
Maryland	857,610	332,030	156,050
Virginia	861,740	333,630	156,810
Total	**2,085,520**	**807,430**	**379,490**

Source: Rails to Trails Conservancy (2019), 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 Capital Trails Network 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

[38] 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.
[39] Note that columns may not sum due to rounding.

Chenoweth and Bortz study.[40] 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 5.4).[41]

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

- The estimated number of active workers in each locality (county/city) in a two-mile radius of 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 corresponding locality (based on data from the US Census Bureau).

Locality-level results are then aggregated to yield the results summarized in Figure 5.4. It is estimated that in aggregate, workers who maintain recommended levels of physical activity due to the Capital Trails Network achieve between $1.4 and $1.8 billion dollars annually in productivity cost savings.

Figure 5.4: Workplace Productivity Cost Savings Achieved by Active Trail Users (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)			
Washington, DC	$6	$34	$46
Maryland	$13	$65	$90
Virginia	$16	$84	$115
Presenteeism Cost Savings Achieved by Active Workers ($M)			
Washington, DC	$244	$261	$278
Maryland	$475	$509	$542
Virginia	$609	$651	$694
Total Productivity Cost Savings Achieved by Active Workers ($M)			
Washington, DC	$251	$295	$325
Maryland	$488	$574	$632
Virginia	$625	$735	$809
Total	**$1,363**	**$1,604**	**$1,766**

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

[40] Chenoweth and Bortz (2005), *Physical Inactivity Cost Calculator: How the Physical Inactivity Cost Calculator Was Developed*.
[41] A typical employee's scheduled annual workload is assumed to be 2000 hours.

6. Spending by Trail Users

Above and beyond impacts generated by the development of the trail network, the local spending by trail users by residents and visitors will generate additional economic benefits for the businesses located near the Capital Trails Network. 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 that may have been previously less accessible.

6.1. Methodology

In order to quantify the local spending from trail users, a spending profile is created based on research and survey data from similar trail networks.[42] 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 a per year 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 $490 on "hard" goods each year such as bikes, bike accessories, and exercise clothing and equipment.

Data from the RTC *DC Region Trail Usage Survey* is matched with data tracking the number of working age adults within a two-mile radius of a trail from the US Census to estimate the frequency of trail use by local residents and the annual visits to trails by local residents. Spending profiles on "hard" and "soft" goods are then applied to trail users of different types (frequency of trail use) based on observed spending patterns of trail users drawn from research and survey data.

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.

6.2. Estimated Annual Spending by Trail Users

Data from the RTC *DC Region Trail Usage Survey* is matched with data regarding the number of working age adults within a two-mile radius of the completed Capital Trails Network from the US Census to estimate the number of frequent (three or more times a week) trail users. For these very frequent trail

[42] Rails to Trails Conservancy, *Schuylkill River Trail 2009 User Survey and Economic Impact Analysis* (2009). https://www.chesco.org/DocumentCenter/View/5691/SRT-Economic-Impact?bidId=.

users in each jurisdiction, an estimate of annual spending on "hard" goods is developed using the spending profile referenced above.

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 RTC *DC Region Trail Usage Survey* and US Census data referenced above. Then, the number of these trail visits during which spending on "soft" goods would occur is estimated using the established spending pattern assumptions. The number of annual "soft" goods spending visits are then applied to the spending profile on "soft" goods to estimate the total annual spending on "soft" goods by trail users in each jurisdiction.

Local spending by trail users on the completed Capital Trails Network is estimated to total $786 million annually (see Figure 6.1). The modeling approach conservatively 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 for spending which occurs outside of the region, the amount of local spending modeled in our analysis is $538 million annually.

Figure 6.1: Potential Annual Local Spending by Trail Users in the DC Region ($M) Upon Completion of the Capital Trails Network

	DC	Maryland	Virginia	DC Metro Area (Total)
Trail User Spending on "Soft" Goods	$64	$133	$132	$329
Trail User Spending on "Hard" Goods	$88	$185	$184	$457
Total Trail User Spending	$152	$318	$316	$786
Amount of Spending Outside of Region	*$48*	*$100*	*$100*	*$248*
Total Modeled Trail User Spending	**$104**	**$218**	**$216**	**$538**

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

6.3. Potential Annual Economic Impact from Trail User Spending

Input-output modeling is undertaken to estimate the potential economic impacts associated with this local spending by trail users. The modeled local expenditures generate approximately $941 million in economic impact in the DC region, supporting 8,200 jobs and $298 million in wages.

Figure 6.2: Potential Annual Economic Impact from Local Spending by Trail Users, Upon Completion of the Capital Trails Network

Impact Type	DC	Maryland	Virginia	DC Metro Area (Total)
Direct Output ($M)	$104	$218	$216	$538
Indirect and Induced Output ($M)	$40	$175	$187	$402
Total Impact ($M)	**$145**	**$393**	**$403**	**$941**
Employment Supported (FTE)	**1,100**	**3,400**	**3,700**	**8,200**
Employee Compensation ($M)	**$61**	**$119**	**$118**	**$298**

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

6.4. 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 one-time or ongoing 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 Washington, DC, the State of Maryland, and the Commonwealth of Virginia due to user spending on the completed Capital Trails Network. There are additional localities that stand to benefit from additional revenue; however, they are significantly smaller in order of magnitude.

In total, the direct, indirect, and induced economic impacts generated by trail user spending could generate annual tax revenues of $4.9 million to Washington, DC, $13.3 million to the State of Maryland, and $4.9 million to the Commonwealth of Virginia.

Figure 6.3: Fiscal Impact Generated from Economic Impact from Trail User Spending ($M)

Tax Type	DC	Maryland	Virginia
Income	$3.2	$4.8	$3.0
Sales	$1.1	$2.6	$1.5
Business	$0.6	$6.0	$0.4
Total Tax Revenue Impact ($M)	**$4.9**	**$13.3**	**$4.9**

Source: DC CAFR (2019), Maryland CAFR (2019), Virginia CAFR (2019), IMPLAN (2019), Econsult Solutions, Inc. (2021)

7. Residential Property Value

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 also generates increased government revenues through increased property tax collections and greater transfer taxes at time of sale. This section estimates the increased property values due to a ¼ and ½ mile buffer of the trail and the resulting tax benefits.

An important consideration in ensuring this change is beneficial and not detrimental to existing residents is engaging and empowering those residents from the very beginning of the planning process. It is crucial to evaluate the equity considerations when planning new trails, and trail planners must actively seek out historically underrepresented voices, in particular Black, Indigenous, and People of Color and low-income communities, early on and throughout the process

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. Concerns about rising property values causing displacement and gentrification are further discussed in Section 7.4.

A number of studies have found a significant increase in real estate values associated with trails, landscaping, parks, and green spaces.[43] 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.[44,45,46]

ESI has also performed significant research on the economic impact of open space as well as trail networks:

- In a study for GreenSpace Alliance and Delaware Valley Regional Planning Commission (DVRPC), properties in close proximity to open space in the Greater Philadelphia region saw an added value of $10,000 per household (around $16 billion in total house value). Since this study, ESI has completed follow up studies for localized impacts of each county's open space assets.

43 Wachter, Susan M., and Grace Wong Bucchianeri. "What Is a Tree Worth? Green-City Strategies, Signaling and Housing Prices." May 2008.
44 "The Economic Impact of the Catawba Regional Trail," Campbell and Monroe (2004)
45 "A Dynamic Approach to Estimating Hedonic Prices for Environmental Goods: An Application to Open Space Purchase," Riddel (2001)
46 The Potential Economic, Environmental, Health, and Quality of Life Benefits of a Fully Connected Waterfront Greenway in Philadelphia," Econsult Corporation (2010)

- An economic analysis 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.
- A regional study 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 values.

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, 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 within a ¼ mile of a trail gained a 5 percent premium in their value; the premium for properties between ¼ mile and ½ mile of a trail is estimated at approximately 2 percent.[47, 48]

7.2. The Capital Trails Network's Potential Property Value Impacts

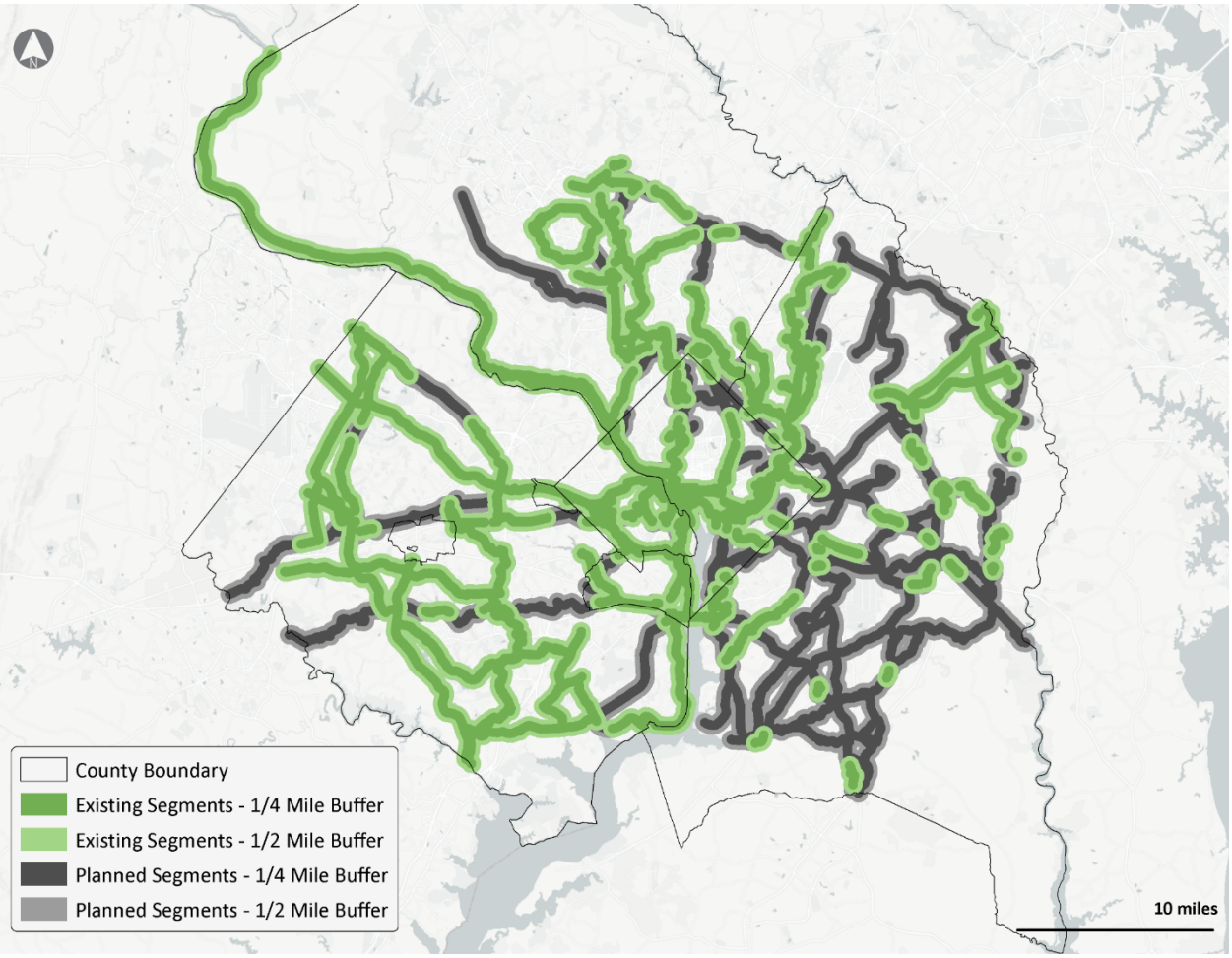
ESI analyzed the potential property value increases of the Capital Trails Network at two distances: within ¼ mile of the existing and future trails and between ¼ mile and ½ mile of the existing and future trails. As described in the prior section, a 5 percent and 2 percent property value premium is applied to properties within a ¼ mile and ½ mile of the trail network, respectively. 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.

A 2020 study by the National Association of Realtors found that people who had more walkable amenities near their homes were most satisfied with the quality of life in their neighborhood.

[47] *The Potential Economic Impacts of the Completed Expansion of Schuylkill Banks*. https://www.schuylkillbanks.org/sites/default/files/attachments/Economic%20Impact%20of%20Schuylkill%20Banks%202017.pdf

[48] 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.

Figure 7.1: Capital Trails Network – ¼ and ½ Mile Buffers by Status



Source: Capital Trails Coalition (2021), Econsult Solutions, Inc. (2021)

Using ESRI Business Analyst, ESI obtained the median house value within a ¼ and ½ mile of the trail network by its current status of existing or planned segments. The number of properties and median single-family house prices were extracted by county and then aggregated by state.

For the existing trail segments, the 5 and 2 percent premiums are backed out from the median house values to each county 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 ¼ and ½ mile of the existing trail segments.

For the planned trail segments, the 5 and 2 percent premiums are multiplied to the median house values to each county to estimate the total property value premium impact. This assumes after completion of the planned trail segments; it will experience a 5 and 2 percent premium within a ¼ and ½ mile of the planned trail segments. The total impacts from each county are then added up to the respective states.

Figure 7.2: Median House Value by County and Status of Capital Trails Network

		Existing Segments: Median House Value		Planned Segments: Median House Value	
State	County	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer[49]	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer
DC	DC	$590,856	$603,761	$461,823	$505,589
MD	Montgomery	$554,506	$540,661	$695,803	$585,270
MD	Prince George's	$329,980	$320,141	$297,805	$301,850
VA	Alexandria	$610,365	$585,496	$260,000	$262,617
VA	Arlington	$618,264	$631,749	-*	$735,294
VA	Fairfax City	$538,571	$564,276	$572,398	$527,090
VA	Fairfax County	$566,487	$556,118	$444,306	$465,477
VA	Falls Church	$805,921	$785,897	$875,000	$882,212

Source: ESRI Business Analyst (2021)
**No data available due to overlap with the existing trail segments in Arlington. Therefore, the results are excluded to avoid double counting of properties.*

Upon completion of the entire trail network, the total property value premium of the existing and planned trail segments within a ¼ mile of the Capital Trails Network is $5.7 billion, and the total property value premium within a ½ mile of the trail network upon completion is $4.2 billion.

Figure 7.3: Estimated Property Value Premium for Capital Trails Network Upon Completion by Locality

	Within a 1/4 Mile Buffer			Within a 1/2 Mile Buffer		
	Housing Units	Premium	Total Property Value Premium ($M)	Housing Units	Premium	Total Property Value Premium ($M)
DC	31,085	5%	$862	59,357	2%	$696
Maryland	94,992	5%	$2,016	164,033	2%	$1,400
Virginia	100,006	5%	$2,823	189,531	2%	$2,136
Total	**226,083**		**$5,701**	**412,921**		**$4,232**

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

7.3. Potential Property Tax Benefits Resulting from the Capital Trails

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 each respective county. [50] It is estimated that upon full completion of the Capital Trails Network results in additional property tax revenues of about $57 million per year in aggregate for counties across the

[49] This excludes value that are accounted for in the ¼ mile buffer, so these estimates are shown between the ¼ and ½ mile buffer.
[50] ESI did not calculate any additional property related taxes for special districts within counties; their comparable impact are minimal compared to the county-level tax revenues.

region within a ¼ mile of the trail network. Within a ½ mile of the trail network, this results in additional $42 million in additional property tax revenues.

Figure 7.4: Potential Property Value Impacts from the Capital Trails Network Upon Completion by Locality

	Property Taxes from Trail Premium	
	Within a 1/4 Mile Buffer ($M)	**Within a 1/2 Mile Buffer ($M)**
DC	$7	$6
Maryland	$21	$14
Virginia	$29	$22
Total	**$57**	**$42**

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

7.4. Potential Implications from Property Value Increases

As described above, rising property values can be a benefit to neighborhoods, as they increase demand for and vitality of the community by creating wealth for property owners and generating more tax revenue for jurisdictions. However, there are also challenges associated with rising property values for residents who have concerns about affordability, potential displacement, and gentrification. Communities and their policymakers can mitigate the challenges associated with increased home values, such as rising rental rates and increasing costs for homeowners, so that trails can serve as an asset and not a threat to current residents' ability to remain in their homes.

Some potential opportunities to prevent displacement in communities within the region most at risk include the following programs and examples of projects that have incorporated community and stakeholder engagement:

- Expand or target Washington DC's local rent supplement program to ensure residents that need housing assistance receive it.[51]
- Provide property tax relief for long-term homeowners so that future tax bills do not result in a cost burden for residents with fixed income. Examples include exemptions as well as Anti-Displacement Tax Fund programs; the latter was launched in Atlanta in 2018.[52]
- Expand Washington DC's inclusionary zoning policy requires that new residential developments include some portion of affordable units. As trails are viewed as an amenity that makes locations nearby more attractive to new development (and may help induce a neighborhood's growth), broader adoption of this policy would be complimentary to a community's trail expansions.[53]

[51] DC Fiscal Policy Institute (2016), *The Local Rent Supplement Program*. www.dcfpi.org/wp-content/uploads/2016/04/16-04-LRSP-Brief.pdf
[52] *Westside Future Fund, City of Atlanta Announce Anti-Displacement Tax Fund Program*. https://www.westsidefuturefund.org/news/tax-fund/
[53] DC Department of Housing and Community Development, *Inclusionary Zoning (IZ) Affordable Housing Program.* https://dhcd.dc.gov/service/inclusionary-zoning-iz-affordable-housing-program

- The region's cities and counties could introduce a Community Land Trust which would allow homeowners to ground-lease their property, resulting in an affordable monthly lease fee. The Atlanta Land Trust has been viewed as a model for best practices.[54]
- To protect existing homeowners and the potential wealth building of rising property values, place restrictions on predatory wholesale home buyers to ensure owners are receiving fair market value for their property.[55]
- Examine the feasibility of offering tax abatements to multifamily property owners who agree to maintain a certain portion of units at affordable rents (60 percent of Area Median Income).[56]
- The Moderately Priced Housing (MPH) law, passed in 1974 in Montgomery County requires between 12.5 to 15 percent of new houses in housing complexes of more than 20 units to be moderately priced (Moderately Priced Dwelling Unit). The Moderately Priced Dwelling Unit (MPDU) program is considered to be one of the nation's first, mandatory, inclusionary zoning laws that specified a density bonus allowance to builders for providing affordable housing. [57]

The following examples are green space projects that demonstrate community and stakeholder engagement.

- The 11th Street Bridge Park, a 1.45-mile-long recreational park, will span the Anacostia River along a former Interstate Highway bridge. Over the past six years, the project was under extensive community planning to ensure the design of the 11th Bridge Park was designed for the residents of Southeast Washington, DC. Residents of the community were able to actively shape the overall design of the park, as well as provide input to the specific programs and features. This resulted in the culmination of the 11th Street Bridge Park's Equitable Development Plan, which outlines the community-driven process of planning for the park, as well as a number of programs to address workforce development, housing, small businesses, and arts and cultural programming. In 2017, more than two dozen community residents in Ward 7 and 8 formed an Advisory Committee to turn the community land trust idea into a community-driven nonprofit reality. Now, as an independent 501(c)(3) nonprofit, the Douglas CLT has developed a pipeline of 252 housing and commercial units and acquired 65 rental units in Ward 8 (preserving affordability). Additionally, in partnership with Manna, the 11th Street Bridge Park team developed a Ward 8 Homebuyers Club. The free club, offered monthly, provides residents with resources about buying a home, peer support, and financial education. The club will also provide a window into new and forthcoming Ward 8 housing developments. To date, 85 low- and moderate-income Ward 7 & 8 residents, who participated in the club, purchased homes.[58]

[54] *Fannie Mae and Community Land Trusts: An Overview for Lenders.* https://atlantalandtrust.org/wp-content/uploads/2018/12/Fannie-Mae-and-Community-Land-Trusts-For-Lenders_FINAL-SEP13.pdf
[55] City Council Philadelphia, *Councilmember Domb Introduces Bill to Protect Homeowners from 'Cash for Homes' Solicitations*. https://phlcouncil.com/councilmember-domb-introduces-bill-to-protect-homeowners-from-cash-for-homes-solicitations/
[56] *Minneapolis 4d Affordable Housing Incentive Program*. http://www2.minneapolismn.gov/cped/housing/WCMSP-214366
[57] Montgomery County Planning Department. https://www.montgomeryplanning.org/community/housing/frequently_asked_questions.shtm
[58] *11th Street Bridge Park Equitable Development Plan*. https://bbardc.org/wp-content/uploads/2018/10/Equitable-Development-Plan_09.04.18.pdf

- The Central Avenue Connector Trail, will serve as a major trail within Prince George's County, which will begin west of the Capitol Heights Metro Station, running through a number of neighborhood streets, and existing and planned segments before ending at the Largo Town Center Metro Station. The trail is currently in the design phase, which includes substantial stakeholder and community engagement. Community engagement for this trial began at the very beginning of the planning process and was done in a way that attempts to mitigate harm to marginalized communities. Two community meetings were held in 2015 to review the potential alignment and gather community feedback. Over 200 community members attended the first meeting which was held at the St. Margaret's Church. Evening meetings often conflict with dinner time, especially for community members with young families, so food was provided. Impact on the neighboring property was a concern for many residents and they asked the project team to engage with private property owners directly affected by the proposed trail as part of the implementation process. Four more community meetings were again held to present the 30% design plans and a separate meeting was organized to meet with property owners. The project is moving forward with the support of the community.[59]

[59] Prince George's County's Department of Parks and Recreation. http://pgparks.com/4475/Central-Avenue-Connector-Trail-CACT

8. Technical Appendix

8.1. Overview of Locality-Level Results

The following subsections include locality-level (county or independent city) results for the impact calculations summarized at the state level in the main body of the report. Although a different level of geography is considered in these calculations, a consistent approach is taken to that detailed for the state-level calculations included in the report. For calculations of economic impact, the aggregate of locality-level results does not sum to the state-level results because less spillover impacts are captured in the locality-level analysis than in state-level analysis.

8.2. Completion of the Remaining Trail Network

Figure 8.1: Potential Aggregate Economic Impact from Construction of the Capital Trail Network by County

Impact Type	Alexandria	Arlington	DC	Fairfax County	Montgomery	Prince George's
Direct Output ($M)	$61	$82	$282	$183	$161	$196
Indirect and Induced Output ($M)	$24	$27	$128	$98	$101	$51
Total Impact ($M)	**$86**	**$109**	**$410**	**$281**	**$262**	**$248**
Employment Supported (FTE)	**680**	**830**	**3,400**	**1,960**	**2,150**	**4,520**
Employee Compensation ($M)	**$43**	**$55**	**$273**	**$124**	**$119**	**$248**

Source: Capital Trails Network Coalition (2021), IMPLAN (2019), Econsult Solutions, Inc. (2021)

8.3. Transportation and Safety

Figure 8.2: Increase in Active Transportation due to Trail Proximity by Locality

	Alexandria	Arlington	DC	Fairfax City	Fairfax County	Falls Church	Montgomery	Prince George's
Commuters within 2-mile radius	92,450	136,650	343,760	11,670	58,790	6,980	367,910	450,150
% Active Transportation Commuters: County/City	6.3%	5.7%	17.4%	3.5%	1.8%	5.8%	2.9%	1.9%
% Active Transportation Commuters: Within 2-mi radius	5.5%	7.2%	18.7%	4.4%	2.4%	6.5%	3.5%	2.3%
Active Transportation Commuters due to the Capital Trails Network: Compared to County/City Averages	-	2,110	4,580	110	3,260	50	2,210	1,980

Source: US Census American Community Survey (2014-2018), Econsult Solutions (2021)

Figure 8.3: Annual Reduction in VMT (Millions) due to Active Transportation Commuters by Locality

	Reduction vs. County/City Trends
Alexandria, VA	-
Arlington, VA	7.2
District of Columbia, DC	7.5
Fairfax City, VA	0.4
Fairfax County, VA	10.6
Falls Church, VA	0.2
Montgomery, MD	6.9
Prince George, MD	6.3

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

Figure 8.4: Annual Reduction in Fuel Consumption (Gallons) due to Active Transportation Commuters by Locality

	Reduction vs. County/City Trends
Alexandria, VA	-
Arlington, VA	324,800
District of Columbia, DC	786,700
Fairfax City, VA	15,900
Fairfax County, VA	476,300
Falls Church, VA	7,000
Montgomery, MD	309,400
Prince George, MD	282,600

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

Figure 8.5: Metric Tons of CO_2 Avoided Annually due to Active Transportation Commuters

	Reduction vs. County/City Trends
Alexandria, VA	-
Arlington, VA	2,890
District of Columbia, DC	6,990
Fairfax City, VA	140
Fairfax County, VA	4,230
Falls Church, VA	60
Montgomery, MD	2,750
Prince George, MD	2,510

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

8.4. Environmental Services

Figure 8.6: Potential Environmental Benefits by Type and County upon Full Completion of the Capital Trails Network ($M per year)

Ecosystem Service	Alexandria	Arlington	DC	Fairfax City	Fairfax County	Falls Church	Montgomery	Prince George's
Water Supply	$0.55	$1.30	$4.03	$0.08	$37.80	$0.22	$15.23	$2.78
Water Quality	$0.08	$0.00	$0.56	$0.00	$0.03	$0.00	$2.55	$0.00
Flood Mitigation	$0.33	$0.06	$1.88	$0.00	$1.71	$0.01	$8.23	$0.13
Wildlife Habitat	$0.02	$0.02	$0.14	$0.00	$0.03	$0.00	$0.36	$0.00
Air Pollution Removal	$0.07	$0.07	$0.96	$0.01	$0.95	$0.08	$0.56	$1.82
Carbon Sequestration	$0.10	$0.31	$1.00	$0.02	$4.38	$0.04	$3.88	$8.03
Carbon Storage (lifetime)	$2.56	$8.09	$23.05	$0.44	$114.78	$0.95	$92.19	$191.02

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

Figure 8.7: Potential Annual Air Pollution Removal Benefits by County in DC upon Full Completion of the Capital Trails Network

Pollutant	Tons	Cost Savings
CO	5.7	$7,636
NO2	18.3	$24,240
O3	83.4	$793,450
PM10	20.8	$130,309
SO2	9.3	$3,459
Total	**137.5**	**$959,094**

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

Figure 8.8: Potential Annual Air Pollution Removal Benefits by County in Virginia upon Full Completion of the Capital Trails Network

	Alexandria		Arlington		Fairfax City		Fairfax County		Falls Church	
Pollutant	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings	Tons	Cost Savings
CO	0.1	$150	0.3	$390	0.0	$20	3.9	$3,890	0.0	$40
NO2	2.3	$2,470	5.3	$5,710	0.3	$200	71.4	$39,550	0.8	$880
O3	9.7	$56,180	30.8	$142,400	0.7	$3,110	316.6	$438,250	3.5	$21,370
PM10	1.7	$10,670	8.2	$51,280	0.3	$1,920	99.4	$469,230	0.8	$59,440
SO2	0.6	$240	1.9	$600	0.1	$20	26.1	$3,570	0.3	$100
Total	**14.4**	**$69,710**	**46.4**	**$200,380**	**1.4**	**$5,270**	**517.4**	**$954,490**	**5.3**	**$81,830**

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

Figure 8.9: Potential Annual Air Pollution Removal Benefits by County in Maryland upon Full Completion of the Capital Trails Network

	Montgomery		Prince George's	
Pollutant	**Tons**	**Cost Savings**	**Tons**	**Cost Savings**
CO	20.8	$14,970	28.1	$30,760
NO2	53.4	$14,900	198.7	$46,920
O3	388.1	$485,430	794.5	$1,029,270
PM10	104.6	$39,110	163.9	$705,810
SO2	12.2	$650	60.9	$4,460
Total	**579.1**	**$555,060**	**1246.2**	**$1,817,220**

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

Figure 8.10: Potential Amounts of Annual Carbon Sequestration and Lifetime Carbon Storage and Associated Benefits from Capital Trails Network by County in Virginia upon Completion of the Trail Network

	Tons	**Cost Savings ($M)**
Carbon Sequestration (annual)	5,852	$1.0
Carbon Storage (lifetime)	135,137	$23.0

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

Figure 8.11: Potential Amounts of Annual Carbon Sequestration and Lifetime Carbon Storage and Associated Benefits from Capital Trails Network by County in Virginia upon Completion of the Trail Network

	Alexandria		**Arlington**		**Fairfax City**		**Fairfax County**		**Falls Church**	
	Tons	**Cost Savings ($M)**	**Tons**	**Cost Savings ($M)**	**Tons**	**Cost Savings ($M)**	**Total**	**Cost Savings ($M)**	**Total**	**Cost Savings ($M)**
Carbon Sequestration (annual)	573	$0.10	1,808	$0.31	99	$0.02	25,659	$4.38	213	$0.04
Carbon Storage (lifetime)	15,017	$2.56	47,427	$8.09	2,605	$0.44	672,991	$114.78	5,575	$0.95

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

Figure 8.12: Potential Amounts of Annual Carbon Sequestration and Lifetime Carbon Storage and Associated Benefits from Capital Trails Network by County in Maryland upon Completion of the Trail Network

	Montgomery		Prince George's	
	Tons	Cost Savings ($M)	Tons	Cost Savings ($M)
Carbon Sequestration (annual)	22,721	$3.9	47,080	$8.0
Carbon Storage (lifetime)	540,528	$92.2	1,120,028	$191.0

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

8.5. Public Health

Figure 8.13: Estimated Number of Trail Users Located within 2 Mile Radius and Meeting Physical Activity Requirement Due to the Capital Trail Network by Locality [60]

	Working Age Adults within 2-mile Radius	Estimated Regular Trail Users	Trail Users Meeting Phys. Activity Req. Due to Trails Alone
Alexandria, VA	105,560	40,870	19,210
Arlington, VA	163,560	63,320	29,760
District of Columbia, DC	466,030	180,430	84,800
Fairfax City, VA	14,920	5,780	2,710
Fairfax County, VA	674,410	261,110	122,720
Falls Church, VA	9,110	3,530	1,660
Montgomery, MD	432,870	167,590	78,770
Prince George, MD	540,080	209,100	98,280
Total	2,406,560	931,720	437,910

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

Figure 8.14: Estimated Value of Healthcare Savings from Active Trail Users by Locality

	Lower Bound	Mean	Upper Bound
Average Annual Savings per Active Individual ($)	$656	$1,181	$1,691
Total Annual Savings due to Active Trail Users ($M)			
Alexandria, VA	$13	$23	$32
Arlington, VA	$20	$35	$50
District of Columbia, DC	$56	$100	$143
Fairfax City, VA	$2	$3	$5
Fairfax County, VA	$80	$145	$208
Falls Church, VA	$1	$2	$3
Montgomery, MD	$52	$93	$133
Prince George, MD	$64	$116	$166
Total	$287	$517	$741

Source: Rails to Trails Conservancy (2019), CDC (2018), ESRI (2019), Econsult Solutions, Inc. (2021)

[60] Note that columns may not sum due to rounding.

Figure 8.15: Estimated Number of Workers Located within 2 Mile Radius and Meeting Physical Activity Requirement Due to the Capital Trail Network[61]

	Workers Aged 16+ within 2-mile Radius	Estimated Regular Trail Users	Est. Workers Meeting Physical Activity Levels due to Trails
Alexandria, VA	97,680	37,820	17,770
Arlington, VA	146,940	56,890	26,740
District of Columbia, DC	366,170	141,770	66,630
Fairfax City, VA	12,500	4,840	2,270
Fairfax County, VA	597,060	231,160	108,640
Falls Church, VA	7,570	2,930	1,380
Montgomery, MD	393,280	152,260	71,560
Prince George, MD	464,330	179,770	84,490
Total	2,085,520	807,430	379,490

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

Figure 8.16: Workplace Productivity Cost Savings Achieved by Active Trail Users by Locality

	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%
Total Productivity Cost Savings Achieved by Active Workers ($M)			
Alexandria, VA	$72	$85	$94
Arlington, VA	$130	$153	$168
District of Columbia, DC	$251	$295	$325
Fairfax City, VA	$8	$10	$11
Fairfax County, VA	$407	$479	$527
Falls Church, VA	$7	$8	$9
Montgomery, MD	$249	$293	$323
Prince George, MD	$239	$281	$309
Total	**$1,363**	**$1,604**	**$1,766**

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

[61] Note that columns may not sum due to rounding.

8.6. Spending by Trail Users

Figure 8.17: Potential Annual Local Spending by Trail Users by Locality ($M) Upon Completion of the Capital Trails Network

	City of Alexandria	Arlington	DC	Fairfax City	Fairfax County	Falls Church	Mont-gomery	Prince George
Trail User Spending ("Soft" Goods)	$14	$22	$64	$2	$92	$1	$59	$74
Trail User Spending ("Hard" Goods)	$20	$31	$88	$3	$128	$2	$82	$102
Total Trail User Spending	$34	$53	$152	$5	$220	$3	$141	$176
Amount of Spending Outside of Region	*$11*	*$17*	*$47*	*$2*	*$69*	*$1*	*$44*	*$55*
Total Modeled Trail User Spending	$24	$37	$105	$3	$152	$2	$97	$121

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

Figure 8.18: Potential Annual Economic Impact from Local Spending by Trail Users by Locality, Upon Completion of the Capital Trails Network

Impact Type	City of Alexandria	Arlington	DC	Fairfax City	Fairfax County	Falls Church	Mont-gomery	Prince George
Direct Output ($M)	$24	$37	$105	$3	$152	$2	$97	$121
Indirect and Induced Output ($M)	$10	$15	$41	$1	$83	$1	$58	$48
Total Impact ($M)	**$34**	**$52**	**$146**	**$4**	**$235**	**$3**	**$156**	**$170**
Employment Supported (FTE)	**280**	**430**	**1050**	**50**	**2020**	**30**	**1240**	**1710**
Employee Compensation ($M)	**$12**	**$19**	**$61**	**$1**	**$78**	**$1**	**$47**	**$52**

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

8.7. Residential Property Value

Figure 8.19: Property Value Premium for the Existing Capital Trail Network Segments by Locality (in $M)

	Within a 1/4 Mile Buffer			Within a 1/2 Mile Buffer		
	Housing Units	Premium	Total Property Value Premium ($M)	Housing Units	Premium	Total Property Value Premium ($M)
DC	22,283	5%	$658	48,976	2%	$591
Maryland	56,162	5%	$1,285	123,504	2%	$1,098
Virginia	85,320	5%	$2,500	171,324	2%	$1,972
Total	**163,765**		**$4,444**	**343,804**		**$3,662**

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

Figure 8.20: Property Value Premium for the Planned Capital Trail Network Segments by Locality (in $M)

	Within a 1/4 Mile Buffer			Within a 1/2 Mile Buffer		
	Housing Units	Premium	Total Property Value Premium ($M)	Housing Units	Premium	Total Property Value Premium ($M)
DC	8,802	5%	$203	10,381	2%	$105
Maryland	38,830	5%	$731	40,529	2%	$302
Virginia	14,686	5%	$323	18,207	2%	$164
Total	**62,318**		**$1,257**	**69,117**		**$571**

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

Figure 8.21: Property Value Premium for the Existing Capital Trails Network Segments by County (in $M)

	Within a 1/4 Mile Buffer			Within a 1/2 Mile Buffer		
	Housing Units	Premium	Total Property Value Premium ($M)	Housing Units	Premium	Total Property Value Premium ($M)
Alexandria	10,394	5%	$317	19,651	2%	$230
Arlington	19,045	5%	$589	30,178	2%	$381
Fairfax City	328	5%	$9	791	2%	$9
Fairfax County	54,573	5%	$1,546	118,665	2%	$1,320
Falls Church	980	5%	$39	2,039	2%	$32
Montgomery	31,951	5%	$886	69,673	2%	$753
Prince George's	24,211	5%	$399	53,831	2%	$345

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

Figure 8.22: Property Value Premium for the Planned Capital Trails Network Segments by County (in $M)

	Within a 1/4 Mile Buffer			Within a 1/2 Mile Buffer		
	Housing Units	Premium	Total Property Value Premium ($M)	Housing Units	Premium	Total Property Value Premium ($M)
Alexandria	557	5%	$7	1,886	2%	$10
Arlington	0	5%	$0	78	2%	$1
Fairfax City	349	5%	$10	630	2%	$7
Fairfax County	13,776	5%	$306	15,484	2%	$144
Falls Church	4	5%	$0	129	2%	$2
Montgomery	7,655	5%	$266	10,036	2%	$117
Prince George's	31,175	5%	$464	30,493	2%	$184

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

Figure 8.23: Potential Property Value Impacts from the Existing Capital Trails Network Segments by Locality (in $M)

	Property Taxes from Trail Premium	
	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer
DC	$5	$5
Maryland	$13	$11
Virginia	$25	$20
	$44	**$36**

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

Figure 8.24: Potential Property Value Impacts from the Planned Capital Trails Network Segments by Locality (in $M)

	Property Taxes from Trail Premium	
	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer
DC	$2	$1
Maryland	$8	$3
Virginia	$3	$2
	$13	**$6**

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

Figure 8.25: Potential Property Value Impacts from the Existing Capital Trails Network Segments by County (in $M)

	Property Taxes from Trail Premium	
	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer
Alexandria	$3.3	$2.4
Arlington	$5.3	$3.4
Fairfax City	$0.1	$0.1
Fairfax County	$16.2	$13.8
Falls Church	$0.5	$0.4
Montgomery	$7.9	$6.7
Prince George's	$4.9	$4.3

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

Figure 8.26: Potential Property Value Impacts from the Planned Capital Trails Network Segments by County (in $M)

	Property Taxes from Trail Premium	
	Within a 1/4 Mile Buffer	Within a 1/2 Mile Buffer
Alexandria	$0.1	$0.1
Arlington	$0.0	$0.0
Fairfax City	$0.1	$0.1
Fairfax County	$3.2	$1.5
Falls Church	$0.0	$0.0
Montgomery	$2.4	$1.1
Prince George's	$5.7	$2.3

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

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