Montgomery Planning

CLIMATE ASSESSMENT FOR ZTA 05-04, BETHESDA OVERLAY ZONE

PURPOSE OF CLIMATE ASSESSMENTS

The purpose of the Climate Assessments is to evaluate the anticipated impact of master plans and zoning text amendments (ZTAs) on the county's contribution to addressing climate change. These assessments will provide the County Council with a better understanding of the potential climate impacts and implications of proposed master plans and ZTAs, at the county level. The scope of the Climate Assessments is limited to addressing climate change, specifically the effect of land use recommendations in master plans and ZTAs on greenhouse gas (GHG) emissions and sequestration, and how actions proposed by master plans and ZTAs could improve the county's adaptive capacity to climate change and increase community resilience.

While co-benefits such as health and cost savings may be discussed, the focus is on how proposed master plans and ZTAs may impact GHG emissions and community resilience.

SUMMARY

As ZTA 05-04 is an implementation of the Bethesda Minor Master Plan Amendment (BMMPA), this report summarizes the impacts identified in the Climate Assessment conducted for the BMMPA that are specific to the ZTA, this overarching Climate Assessment is included as Attachment A. ZTA 05-04 will have both negative impacts and positive impacts on the County's goals of addressing greenhouse gas emissions, and slight positive and negative impacts on carbon sequestration. However, key changes contained within ZTA 05-04 will have an overall positive impact on ensuring the resilience and adaptive capacity within the Bethesda Community and providing access to public spaces, community connections, and access to resources.

BACKGROUND AND PURPOSE OF ZTA 25-04

This ZTA would amend the Bethesda Overlay Zone to implement recommendations of the Bethesda Downtown Plan Minor Master Plan by adding incentives for applicants to provide space or funding for a new recreation center, to provide more family sized and deeply affordable Moderately Priced Dwelling Units (MPDUs), and to remove the development cap, along with other small technical updates.

VARIABLES THAT COULD AFFECT THE ASSESSMENT

The following climate-related variables that were considered in this assessment as impacted by the ZTA. Climate related variables include the various greenhouse gas reduction, sequestration, resilience, and adaptive capacity activities in the climate assessment checklists (Tables 1 and 8) contained in the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*.

GREENHOUSE DATA ENTRY-RELATED VARIABLES:

Transportation: Vehicle Miles Traveled (VMT), number of trips, non-vehicle modes of transportation, public transportation use, electric vehicle infrastructure.

Building Embodied Emissions: Building certifications, building square footage, building lifespan, pavement infrastructure, material waste produced, use of green building materials.

Energy-related: Electricity usage, stationary fuel usage, electricity efficiency, stationary fuel efficiency.

RESILIENCE RELATED VARIABLES:

Sensitivity-Related Factors: Changes to forest and non-tree canopy cover, quality of green cover, green roofs, perviousness, stormwater treatments, heat sources (pavements, AC, roofs, etc.), reduced urban heat, and improved air and water quality.

Adaptive Capacity-Related Variables: Changes to accessibility of community and public spaces, access to transportation, accessibility to local food sources, change in economic and financial resources, and change in community connectivity.

ANTICIPATED IMPACTS

Note: The *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County* indicates that carbon sequestration, drawdown, and reduction are generally used interchangeably. The *Recommendations* document uses the term sequestration.

The following section describes the Plan's positive or negative impacts for each climate activity variable associated with GHG emissions, sequestration, community resilience, and adaptive capacity category.

GREENHOUSE GAS EMISSIONS, CARBON SEQUESTRATION, AND DRAWDOWN

Transportation Activities Related to Total Lifetime Transportation GHG Emissions

Due to the increased density allowed by ZTA 05-04, the effects of vehicle miles traveled by type (personal vehicles, commercial trucks, rideshare, school buses, motorcycles) on greenhouse gas

emissions and carbon sequestration will be significant, as residents are projected to grow from 16,179 to 33,499. Furthermore, the overall number of trips per person may increase traffic and congestion in these regions, as the rising vehicle miles traveled both by type and per person represent negative impacts. Conversely, non-vehicle modes of transportation, such as biking and walking, are expected to rise and improve due to new infrastructure. Moreover, public transportation usage is anticipated to rise due to the proximity to Bethesda Metro Station, the future Purple Line Station, and several WMATA and Ride On bus stops. Finally, increased population density will likely enhance access to electric vehicle charging infrastructure, facilitating greater adoption of electric vehicles.

Building Activities Related to Total Lifetime Embodied Building GHG Emissions

Building activities as a result of ZTA 05-04 will have both positive and negative impacts. Building Certifications and use of green building materials will have a positive impact as the Bethesda Overlay Zone will require new development to exceed energy efficiency standards set by the County. There will be negative impacts relating to building square footage, as more density will directly result in more square footage and a shorter building lifespan as a result of redevelopment opportunity.

Energy Activities Related to Total Lifetime Building Energy GHG Emissions

Energy activities as a result of ZTA 05-04 will have both positive and negative impacts. Stationary Fuel Usage will be positively impacted as Montgomery County has moved away from fossil fuel use. While there is an average increase in energy consumption due to density increases, the average embodied energy emissions per residential unit will decline with the increase in density, which is a positive impact in terms of electricity efficiency. However, electricity usage and stationary fuel efficiency (retrofit of existing buildings) will both have negative impacts due to the increase in overall use of electricity and the unlikelihood of retrofitting of existing buildings.

COMMUNITY RESILIENCE AND ADAPTIVE CAPACITY

ZTA 05-04 is anticipated to have no impact to exposure-related related factors and predominantly positive impacts on sensitivity-related factors with the main negative impact being changes to air quality to due increased density. However, it is anticipated the ZTA will have an overall positive impact for factors relating to adaptive capacity.

Sensitivity-Related Factors

ZTA 05-04 is expected to have a negative impact on air quality. While alternative energy sources and fossil fuel combustion are not sourced within the County, increased density and its associated construction impacts contribute to overall emissions. However, it is anticipated that the ZTA will have a positive impact on factors related to the quality of green areas. Additionally, increasing green cover can enhance stormwater treatment capacity by converting impervious surfaces into green areas with

soil and vegetation, which can filter and absorb stormwater. This transformation will also slightly reduce and positively impact the heat island effect caused by impervious surfaces.

Adaptive Capacity Factors

ZTA 05-04 will have positive impacts to adaptive capacity factors. The ZTA expands the ability for development applications to financially contribute to the Bethesda Urban District and increases the Park Impact Payment for projects utilizing Bethesda Overlay Zone Density. Both these changes positively impact accessibility and prevalence of community events, activation of public spaces, funding for new public spaces, and overall changes to community connectivity.

ZTA 05-04 will also incentivize developments that provide deeper levels of affordability and family sized units within their Moderately Priced Dwelling Units (MPDUs) which positively impacts the equitable distribution of resources, including accessibility to local food sources and other goods. Lastly, ZTA 05-04 will incentivize development that will provide space for a new recreation center, which will positively impact availability of resources and support and other goods, including economic and financial resources. These changes within the ZTA will provide an overall positive impact to community connectivity.

RELATIONSHIP TO GREENHOUSE GAS REDUCTION AND SEQUESTRATION ACTIONS CONTAINED IN THE MONTGOMERY COUNTY CLIMATE ACTION PLAN (CAP)

The CAP details the effects of a changing climate on Montgomery County and includes interagency strategies to reduce greenhouse gas emissions and climate-related risks to the county's residents, businesses, and the built and natural environment.

The CAP includes 86 climate actions as a pathway to meet the county's ambitious climate goals while building a healthy, equitable, and resilient community. Each county department has responsibilities for specific climate actions that are relevant to the work of that department. The following section provides a list of the CAP action items relevant to Montgomery Planning Department that are affected by ZTA 05-04. While it is not possible to know the rate or type of development, each action item was rated high, medium, or low for its potential to reduce GHG gasses or sequester carbon.

Building Actions

B-7: Net Zero Energy Building Code for New Construction. **Medium**. All new construction is encouraged to exceed the county's energy standard and reach net zero, net positive, and/or Living Building standards. However, it is not possible to know if these techniques will be applied.

Transportation Actions

T-7: Expand the Electric Vehicle Charging Network. **High.** The number of charging stations is dependent on the number of units per building. Increased density will result in increased charging stations.

Climate Adaptation Actions

A-7: Green Public Spaces. **High**. As noted, the proposed increases in density will increase developer funding to be used for purchasing parks and open space.

A-10: Green Infrastructure. **Medium.** Green infrastructure is not directly recommended but there will be an increase in parks and green roofs with development.

RECOMMENDED AMENDMENTS

The Climate Assessment Act requires the Planning Board to offer appropriate recommendations such as amendments to the proposed ZTA 05-04, or other mitigating measures that could help counter any identified negative impacts through this Climate Assessment. However, given many of the negative impacts are a result of the increased density allowed by ZTA 05-04 due to the removal of the development cap, which is a main recommendation of the Bethesda Minor Master Plan Amendment, there are no recommended amendments.

SOURCES OF INFORMATION, ASSUMPTIONS, AND METHODOLOGIES USED

This Climate Assessment was based on a focused review of the Climate Assessment for the Bethesda Minor Master Plan Amendment, which is the main source of information that is included as Attachment A.

Montgomery Planning

CLIMATE ASSESSMENT FOR BETHESDA DOWNTOWN MINOR MASTER PLAN AMENDMENT PLANNING BOARD DRAFT

PURPOSE OF CLIMATE ASSESSMENTS

The Climate Action Plan (CAP) is Montgomery County's strategic plan to cut greenhouse gas (GHG) emissions 80% by 2027 and 100% by 2035, compared to 2005 levels. To meet this mission, in July 2022, the County Council approved the Climate Assessment Bill (3-22) to better understand the anticipated impacts of proposed legislation and land-use recommendations on the county's GHG emissions. This bill requires planning staff to assess the GHG/climate impacts of each master and sector plan, as well as of zoning text amendments.

In compliance with the Climate Assessment Bill, this Climate Assessment evaluates the anticipated impacts of the Planning Board Draft of the Bethesda Downtown Minor Master Plan Amendment (Amendment) on the county's GHG emissions and reductions. The assessment describes the potential GHG emissions, climate impacts, and the implications of three different density scenario increases compared to the existing Bethesda Master Plan (2017) at full build out for the projected year, 2045. The 3-density increase proposals are Scenario 1 (11 million additional square feet of development, Scenario 2 (16 million additional sq/ft), and Scenario 3 (21 million additional square feet).

This assessment is focused on the GHG emissions and sequestration effects of the 3 scenarios on land-use, transportation, and nature-based climate solutions. While the Amendment recommendations offer many co-benefits, such as economic development, increased housing and office space, and affordable housing, these are not the subjects of this report.

The Climate Assessment was conducted in accordance with the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*, December 1, 2022, prepared by ICF International, Inc. It offers an approach based on national and international available data for conducting a Climate Assessment either for a master plan (quantitative) or for a proposed zoning text amendment (qualitative).

SUMMARY

The Greenhouse Gas Quantification Tool (Quant Tool) used for the assessment is an updated version of a prior model used by Montgomery Planning. The original model was developed by King County, Washington, in 2007. It was revised in 2023 by ICF, using similar methodology with updated building lifetime assumptions (2020), the inclusion of life cycle/upstream emissions associated with fuel combusted production and transportation, and future electric vehicle penetration and fuel mix rates.

The model assesses emissions from four categories: lifetime embodied building emissions, total lifetime building energy emissions, total lifetime building waste emissions, and total lifetime transportation emissions. For each category, the assessment uses the proposed number of buildings or units, the types of buildings, and the total commercial square footage. Sequestration is not an emissions category, rather, it's based on existing and proposed land cover for forests, non-forest tree cover, wetland/meadow, grasslands, and green roofs. The model compares base GHG emissions and sequestration levels for the existing master plan at full build-out with the 3 proposed density increases in the Amendment at full-build out.

The Bethesda Downtown Plan (2017) has a building density cap of 32.4 million square feet, about 1.8 million square feet of which remains. However, some of the objectives of the 2017 Plan for additional parks, certain transportation improvements, and a new recreation center have not been realized. To accomplish these goals, the Planning Department is proposing an increase in density using these 3 different density scenarios. Building density increases will simultaneously require additional developer funding to be used to meet the Bethesda Downtown Plan goals outlined above.

A greenhouse gas carbon assessment has been done for each of the three proposed density increase scenarios determine the level of greenhouse gas increases or decreases for each quantifiable emissions category. The assessment assumes full build out by 2024 for each scenario (every rezoned property is torn down and redeveloped at maximum allowance). The overall GHG emissions increase for Scenario 1 (11 million additional sq/ft) will be approximately 34%.GHG emissions increase for Scenario 2 (16 million additional sq/ft) will be 53.58%. GHG emissions for Scenario 3 (21 million additional sq/ft) will be 73.50%.

The overall increases in total GHG emissions increases are linked to the projected population increase with each scenario from 16,179 people to 24,839 (11 million additional sq/ft), to 29,169 (16 million additional sq/ft), and 33,499 (21 million additional sq/ft). GHG increases in each of the four emissions categories are generated from the following:

1. Lifetime Embodied Building GHG Emissions: Based on building type, residents/daily occupancy of building, square footage, lifespan of building, embodied emissions associated with building pavement, and upstream fuel and end-of-life emissions associated with production, transportation, and disposal of different types of materials used for construction.
2. Total Lifetime Building Energy GHG Emissions: Based on building type, projected floorspace, carbon coefficient, energy consumption, and lifespan to develop a lifespan estimate of energy-related emissions per thousand square feet.
3. Total Lifetime Building Waste: Based on material waste produced, waste management, landfill waste generation, combustion of solid waste, and trash generated within the building type. Includes waste from deconstruction and disposal of materials, the transportation of waste, processing, recycling, and/or disposal of materials.
4. Total Lifetime Transportation: Based on transportation according to building type, occupancy in the unit or building, square footage, building life, Maryland state vehicle related GHG emissions, life cycle/upstream emissions associated with fuel combusted, estimated building residents or

daily occupants, emissions by transportation mode and vehicle type, EV penetration, and fuel mix rates.

Table 1: Results of Greenhouse Gas Assessment for 3 Growth Scenario's (in metric tons of carbon dioxide)

	Existing Master Plan (EMP) 2017	Additional 11 Million Sq/Ft	Percent Increase above EMP	Additional 16 Million Sq/Ft	Percent Increase above EMP	Additional 21 Million Sq/Ft	Percent Increase above EMP
Total Lifetime Embodied Building GHG Emissions	1,179,011	1,501,250	27.33%	1,669,943	41.64%	1,838,642	55.95%
Lifetime Residential Emissions per residential unit	23.6	21.77	**-7.79%**	21.67	**-8.25%**	21.58	**-8.60%**
Lifetime Commercial Emissions per commercial sq/ft	0.05	0.05	0.19%	0.05	0.23%	0.05	0.26%
Total Lifetime Building Energy GHG Emissions	5,947,418	7,926,450	33.28%	9,025,751	51.76%	10,125,056	70.24%
Lifetime Residential Emissions per residential unit	249.39	228.49	**-8.38%**	225.88	**-9.43%**	223.92	**-10.22%**
Lifetime Commercial Emissions per commercial sq/ft	0.23	0.23	0.04%	0.23	0.12%	0.23	0.24%
Total Lifetime Building Waste GHG Emissions	930,370	1,272,218	36.74%	1,478,993	58.97%	1,685,767	81.19%
Annual Total Building Waster Emissions	8,985.31	13,654.23	36.74%	15,873.46	58.97%	18,092.69	81.19%
Lifetime Residential Emissions per residential unit	88.71	86.54	**-2.44%**	86.47	**-2.53%**	86.41	**-2.59%**
Lifetime Commercial Emissions per commercial sq/ft	0	0	**-1.77%**	0	**-2.12%**	0	**-2.40%**
Total Lifetime Transportation GHG Emissions	19,225,523	4,642,287	36.86%	5,410,087	59.50%	6,215,377	83.24%
Land Cover & Management Ecosystems Emissions		-1,414	**N/A**	-1,503	**N/A**	-1,594	**N/A**
Total GHG Emissions	**11,448,774**	15,340,791	**34.00%**	17,583,270	**53.58%**	19,863,249	**73.50%**

At the same time, its noteworthy that while the model projects an overall increase in GHG emissions for each scenario at full build-out, per-capita residential and per-square foot commercial emissions are projected to be reduced in the following four categories: Lifetime Embodied Building Emissions per residential unit; Lifetime Embodied Building Energy Emissions per residential unit; Lifetime Building Waste for Residential Emissions per residential unit; and Lifetime Building Waste for Commercial Emissions per commercial sq/ft.

Table 2: Greenhouse Gas Decrease Emissions Categories

	Percent GHG decrease for additional 11,000 Sq/ft	**Percent GHG decrease for additional 16,000 Sq/ft**	**Percent GHG decrease for additional 21,000 Sq/ft**
Lifetime Embodied Building Emissions per residential unit	**-7.79%**	**-8.25%**	**-8.60%**
Lifetime Embodied Building Energy Emissions per residential unit	**-8.38%**	**-9.43%**	**-10.22%**
Lifetime Building Waste for Residential Emissions per residential unit	**-2.44%**	**-2.53%**	**-2.59%**
Lifetime Building Waste for Commercial Emissions per commercial sq/ft	**-1.77%**	**-2.12%**	**-2.40%**

The Quant Tool is limited and many potential factors could reduce the projected GHG emissions, such as rapid acceleration in electric vehicle adoption that results in market penetration sooner than the model forecasts, expanded use of alternative modes of transportation, less than full redevelopment, building requirements for new buildings to meet net zero or net positive standards, use of waste materials on-site, improvements in composting, and a reduced waste footprint through waste stream reductions.

It's important to outline that all new or changed development leads to additional GHG emissions. Providing increased density in an already dense areas may reduce county sprawl into greenfields, concentrating development where infrastructure such as metro lines, shops, community centers, and schools already exist.

New stormwater management regulations will require stormwater treatment where there presently is none. Cumulatively, will reduce stormwater runoff pollutants and improve water quality. The green cover requirements in the 2017 Master Plan will be applied. If development continues, by 2035 there could be an increased green roof coverage of 10.2 acres. By 2040, an increase in 15.3 acres of green roofs, and by 2045, 20.4 acres. Quantifiably, these roofs could draw down carbon (sequester) approximately 1,594 metric tons of carbon.

Table 3: Metric Tons of Carbon Sequestration for each Growth Scenario

	Percent GHG decrease for additional 11,000 Sq/ft	**Percent GHG decrease for additional 16,000 Sq/ft**	**Percent GHG decrease for additional 21,000 Sq/ft**
Land Cover & Management Ecosystems Emissions	1,414 metric tons	1,503 metric tons	*Land Cover & Management Ecosystems Emissions*

BACKGROUND AND PURPOSE OF DENSITY AMENDMENT

Bethesda's most recent success was made possible by the innovative 2017 *Bethesda Downtown Sector Plan*. Following years of community collaboration, the plan defined a 20-year vision for a truly sustainable urban community by balancing additional building height and density with a new Park Impact Payment to help address the high cost of park development in the downtown, in addition to all the other public amenity, transportation, and school infrastructure improvements paid for by private development.

Beyond the standard measures used all over the county to ensure that public facilities and infrastructure will be in place to serve new development, the plan included several measures to track the implementation of plan recommendations for development, parks, transportation, and more. These included a cap on total development in downtown Bethesda of 32.4 million square feet, including existing and approved new development, based on a transportation analysis conducted at the time the plan was being developed. Once total development came within 2 million square feet (approximately 10 200-unit apartment buildings) of the cap, the plan recommended that the Planning Department and Planning Board check in with the County Council to see if additional recommendations are needed to help implementation of public amenity and infrastructure recommendations like new parks and transportation-related improvements.

In fall 2023, total development in downtown Bethesda reached the 2 million square-foot checkpoint. After public engagement and comment, Planning staff and the Planning Board recommended that the County Council authorize the development of a Minor Master Plan Amendment (MMPA). The amendment includes increasing the density cap. This model measures the greenhouse gas emissions associated with the additional square footage of new construction for the three different building scenarios: 11 million additional square feet; 16 million additional square feet; and 21 million additional square feet.

VARIABLES THAT COULD AFFECT THE ASSESSMENT

The following climate-related variables were used or considered in the assessment of the proposed increases in density. Climate-related variables include GHG reduction, sequestration, resilience, and adaptive capacity activities as outlined in the qualitative checklists (Tables 1 and 8) within the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*.

Greenhouse Data Entry–Related Variables:

Transportation: Vehicle Miles Traveled (VMT), number of trips, non-vehicle modes of transportation, public transportation use, electric vehicle infrastructure.
Building Embodied Emissions: Building certifications, building square footage, building lifespan, pavement infrastructure, material waste produced, use of green building materials.
Energy-related: Electricity usage, stationary fuel usage, electricity efficiency, stationary fuel efficiency.
Land Cover Change & Management: Retention and/or removal of forest, non-forest tree cover, and green space; proposed Nature-Based Solutions.

Resilience-Related Variables:

Exposure-Related Factors: Activity in flood areas and Urban Heat Islands
Sensitivity-Related Factors: Changes to forest and non-tree canopy cover, quality of green cover, green roofs, perviousness, stormwater treatments, heat sources (pavements, AC, roofs, etc.), reduced urban heat, and improved air and water quality.
Adaptive Capacity-Related Variables: Changes to accessibility of community and public spaces, access to transportation, accessibility to local food sources, change in economic and financial resources, and change in community connectivity.

ANTICIPATED IMPACTS

The Master Plan (2017) has strong environmental recommendations to improve Bethesda's climate resiliency, energy consumption through high performance buildings, carbon sequestration capacity, water and air quality. These are also goals set forth within the Climate Action Plan and Thrive Montgomery 2050. The increased density proposed within the Beltway will consolidate populations to reduce sprawl and protect greenfields. New construction will be required to meet today's energy efficiency standards, as well as provide Nature-Based Climate Solutions such as green roofs and tree plantings on each new development project, resulting in an increase in trees, green roofs, and vegetated stormwater management. These features can enhance a community's climate resiliency by reducing runoff and building emissions and improve biodiversity by planting native species. Concurrently, building demolition, construction, and increased transportation demands will increase GHG emissions in all four categories: Lifetime Embodied Building Emissions per residential unit; Lifetime Embodied Building Energy Emissions per residential unit; Lifetime Building Waste for Residential Emissions per residential unit; and Lifetime Building Waste for Commercial Emissions per commercial sq/ft.

The following section describes the Plan's positive or negative impacts for each climate activity variable associated with GHG emissions, sequestration, community resilience, and adaptive capacity category.

GREENHOUSE GAS EMISSIONS, CARBON SEQUESTRATION/DRAWDOWN

Transportation Activities Related to Total Lifetime Transportation GHG Emissions

- Vehicle miles traveled by type (personal vehicles, commercial trucks or vehicles, rideshare, school buses, motorcycles). **Negative Impact**. Transportation Planning staff modeled an overall increase in vehicle miles traveled (VMT) within the transit area due to the projected increase in population from 16,179 to 33,499 people. This increase will result in a greater traffic and

congestion to adjacent neighborhoods, shopping areas, work, and other regional communities which will impact VMT throughout the plan area.

- Number of trips (including single occupancy and carpool trips). **Negative Impact.** The number of trips per person is expected to increase due to population increases. At the same time, Bethesda is a walkable city with access to most daily necessities and services such as work, shopping centers, schools, healthcare, grocery stores, entertainment, restaurants, and more. The proposed vehicle miles travelled per person decreases while the overall number of miles travelled increases due to population increases.
- Non-vehicle modes of transportation (scooters, bikes, walking). **Positive Impact.** It is anticipated that non-vehicle modes of transportation will increase due to the proximity to the Bethesda metro station, bus stops, increased bike-share stations, and improved sidewalks and pedestrian network.
- Public transportation use (public bus and Metrorail). **No Impact.** It is not anticipated that public transit trips will increase with the proposed increases in density.
- Electric vehicle infrastructure access (i.e., charging stations). **Positive Impact.** It is anticipated that electric vehicle use will increase within the next few decades due to national and local incentives, policies, and increased affordability. The number of electric vehicle charging stations is based on the number of units within a building. Therefore, increased density will result in increased charging stations.

Building Activities Related to Total Lifetime Embodied Building GHG Emissions

- Building Certifications. **Positive Impact.** There is a correlation between green building certification and lower emissions. While the master plan cannot dictate actual design and engineering of a building, the recommendations encourage all development to exceed the county's minimum energy standards and strive to meet net zero, net positive, and/or Living Building standards. New buildings will also be required to meet the county's energy standards and codes.
- Building square footage. **Negative Impact.** It is anticipated that there will be an increase in the overall square footage of large buildings. An increase in building square footage will increase material use for building construction (embodied energy), construction activities, and additional energy use in buildings, all of which will increase emissions. While many green building certification standards require materials to be sustainable or sourced within a certain distance, it is not possible to know whether this requirement will apply to new construction projects.
- Building lifespan. **Negative Impact.** A shorter building lifespan results in greater turnover of emissions associated with building demolition and the construction of new buildings. In contrast, a longer building lifetime results in lower overall embodied emissions. The increased density will increase embodied building GHG emissions by approximately 27.33% for **Scenario 1** (11 million additional sq/ft), 41.64% for **Scenario 2** (16 million additional sq/ft), 55.95% for **Scenario 3** (21 million additional sq/ft). To reduce embodied energy emissions, it is recommended to reuse building material during construction.

- Pavement infrastructure. No Impact. The manufacturing and use of pavements to create roadways, walkways, and buildings causes GHG emissions. None of the density scenarios propose additional surface area.
- Use of green building materials. Positive Impact. It is not possible to know what materials will be used for future building; however, the Master Plan (2017) provides incentives for high performance buildings. While not required, the county's green building codes and standards provides benefit points for the use of green construction materials.

Energy Activities Related to Total Lifetime Building Energy GHG Emissions

- Electricity usage. Negative Impact. Due to the density recommendations and the population increases, the overall use of electricity is expected to increase even with the construction of energy efficient, high performing buildings.
- Stationary fuel usage. Positive Impact. Stationary fuel usage refers to combustion equipment for generating steam or providing useful heat or energy. Stationary fuel usage results in direct GHG emissions. Montgomery County has moved from fossil fuel use to alternative energy sources thereby reducing stationary fuel usage. Fossil fuel is anticipated to further decline in the future.
- Electricity efficiency (per square foot). Positive Impact. While there is an average increase in energy consumption due to density and population increases, the average embodied energy emissions per residential unit declines by 8.38%, for Scenario 1 (11 million additional sq/ft), 9.43%, for Scenario 2 (16 million additional sq/ft), 10.22% for Scenario 3 (21 million additional sq/ft).
- Stationary fuel efficiency (BTU per square foot). Negative Impacts. Stationary fuel efficiency capabilities refers to retrofitting existing buildings to improve fuel efficiencies. The proposed density increases will not result in the retrofitting of existing buildings.

Waste Activities Related to Total Lifetime Building Waste GHG Emissions

- Material waste produced. Negative Impact. Material waste is sent to a combination of recycling, landfilling, and waste combusting facilities, which can increase GHG emissions. Although the Plan recommends salvaging building materials during demolition (steel, wood, brick, glass, asphalt, and concrete), most of the property proposed for redevelopment and zoning changes will generate waste material and embodied emissions increasing the overall Building Waste GHG Emissions. However, lifetime residential and commercial building waste per unit for residential and commercial will decrease.

Land Cover Change & Management Activities Related to Land Cover & Management Ecosystems Carbon Stock (Sequestration)

- Area of forest. No Impact. No forests will be affected.
- Area of non-forest tree canopy. Positive Impact. It is intended that no trees will be lost due to increased density. The Master Plan (2017) proposes an increase in street and open space canopy cover.

- Area of green cover. Positive Impact. Green cover in the form of green roofs, trees, shrubs, and/or herbaceous cover can sequester and store carbon as biomass, restore and build soils, and provide food and habitat for coevolved species. Green cover is especially important in urbanized areas with high levels of impervious surfaces, as it helps reduce the heat island effect and cools streetscapes, walkways, roads, and open space. The Master Plan (2017) requires all new development to achieve a minimum of 35% green cover by planting native canopy trees, installing a green roof, or doing both. If growth continues at its current rate, it is anticipated that there may be as much as 20.4 acres of green roofs at full building out in 2024 (21 million additional square feet).
- Implementation of Nature-Based Climate Solutions. No Impact. Nature-Based Climate Solutions are a broad range of actions to restore and mitigate lost natural systems and functions to enhance climate adaptation and sequestration capacities, biodiversity, water and air quality, and human health. Increasing density will not change the implementation of Nature-Based Climate Solutions.

COMMUNITY RESILIENCE AND ADAPTIVE CAPACITY

Urban resilience is the inverse of vulnerability. It is the capacity to function so that people who are living and working in the area, particularly those who are lower income or otherwise vulnerable, can survive and thrive no matter what stresses or shocks they encounter. This section addresses the Plan's Resiliency and Adaptive Capacity for three core vulnerability areas: Exposure (the level of contact that people, systems, and assets have with climate hazards); Sensitivity factors (an increase or decrease in the severity of impacts to people, systems, and assets from a climate hazard); and Adaptive capacity (factors that increase or decrease people or society's ability to cope with adverse impacts). Each vulnerability area has several potential impact factors that increase or decrease resiliency. The worksheet associated with this category requires a broad yes-or-no impact and positive-or-negative determination. Positive impacts will not happen quickly. They are uncertain and dependent on the rate of redevelopment, transportation funding and implementation, and city/county initiatives.

Exposure-Related Factors

- Activity in flood risk areas. No Impact. There are no flood zones or flood plains within the Plan area.
- Activity in urban heat island. No Impact. Any density changes will not affect urban heat island temperatures as its expected buildings will increase in height rather than width.
- Exposure to other hazards (e.g., storms, wind, drought). No Impact. Severe storms and wind can negatively affect public safety and cause damage and disruptions to critical infrastructure (e.g., loss of power, damage to buildings). High winds can discourage sustainable forms of transportation such as biking and walking. The density recommendations will have no impact on exposure to these hazards.

Sensitivity-Related Factors

- Change to forest cover. No Impact. There are no forests within the area where density is proposed to increase.

- Area of non-forest tree canopy. **No Impact.** Non-forest trees, especially in urbanized areas, provide multiple ecological and human benefits, including cooling streetscapes, providing microclimates, reducing urban heat island temperatures, sequestering GHG, reducing energy demand (3 to 30%[1]), and providing wildlife habitat, food, and pollinators. Increasing density should not change non-forest tree canopy cover.
- Change to quality or quantity of other green areas (meadows, green roofs, planting beds, etc.). **Positive Impact.** Adding and mitigating green areas, especially where there are impervious surfaces, will improve community resilience by aiding in temperature reduction and reducing the impacts of extreme heat on human health. Green cover can also add stormwater treatment capacity by converting impervious surfaces into green cover with soils and vegetation to filter and absorb stormwater. Increasing density will facilitate development which in turn, requires funding for the purchasing of additional parks and open space. Green roof construction is anticipated with new development.
- Change impacts of heat (e.g., cool pavements, cool roofs, air conditioning, energy efficiency improvements). **Positive Impact.** Temperatures are expected to increase in Montgomery County, posing a growing threat to human and animal health, natural resources, and infrastructure. The addition of green roofs and trees will slightly reduce heat island effect from impervious surfaces. In turn, this will reduce heat to those directly adjacent to the property.
- Change in perviousness. **No Impact.** Increasing density will not affect pervious surfaces.
- Change in stormwater management system treatments. **No Impact.** Changes in density will not affect stormwater management treatment above what will be anticipated with all new development.
- Change to water quality or quantity. **No Impact.** Changes in density will not affect stormwater management treatment above what will be anticipated with all new development.
- Change to air quality. **Negative Impact.** Increases in density will increase overall GHG emissions which reduce air quality. While alternative energy and the burning of fossil fuels are not sourced within the county, increased density and its construction impacts adds to overall emissions.
- Infrastructure design decisions. **Unknown Impacts.** Infrastructure design can have a bearing on climate resiliency. Increased density does may affect infrastructure design decisions such as culverts or drainage sizing. This is in the purview of other county agencies.

Adaptive Capacity Factors

- Change to accessibility or prevalence of community and public spaces (e.g., libraries, air-conditioned cooling centers). **Positive Impact.** The proposed density increases are anticipated to aid in the funding of additional parks and open space resulting in an increase in community and public open spaces.
- Change to emergency response and recovery capabilities. **No Impact.** Expanding emergency response and recovery capabilities is generally associated with increased community resilience

[1] Climate Assessment Recommendations for Zoning Text Amendments and Master Plans in Montgomery County

and adaptive capacity. For example, if there are more emergency responders available during a flood event or storm, more people can be dispatched to check on vulnerable residents and residents will be more likely to receive the help they need. The Plan does not address this factor.

- Change in access to transportation. No Impact. The increase in density will have no impact on the transportation network, bicycle or pedestrian ways, bus shelters, etc.
- Change to accessibility or prevalence of local food sources and other goods. Positive Impact. Expanding the accessibility and prevalence of local food sources enhances community resilience by reducing reliance on distant travel. It is possible that new development will result in additional food stores and restaurants reducing travel demand for these necessities.
- Change in availability or distribution of economic and financial resources (i.e., to what extent the master plan will influence the accessibility or distribution of economic and financial resources). Potential Impact. Added density could encourages mixed uses which could increase the local labor force, creating jobs and increasing income. This effect is not guaranteed, as mixed use is optional in the master plan and does not guarantee an increase in local jobs.
- Change to community connectivity (e.g., social connections, sense of place, belonging). Positive Impact. Studies show that social cohesion and community connectivity are directly linked with resilience and often help strengthen a community, especially in post-disaster recovery situations. Community connectivity can also reduce mental health challenges and post-traumatic stress for individuals who are impacted by natural disasters. The proposed density increases may improve community connectivity by enhancing public gathering spaces and parks, which provide opportunities to make social connections.
- Change in distribution of resources and support (influencing the equitable distribution of resources and providing policies, institutional knowledge, training, and resources). No Impact. The density changes does not directly make recommendations to provide additional resources and support in this category.

RELATIONSHIP TO GREENHOUSE GAS REDUCTION AND SEQUESTRATION ACTIONS CONTAINED IN THE MONTGOMERY COUNTY CLIMATE ACTION PLAN (CAP)

The CAP details the effects of a changing climate on Montgomery County and includes interagency strategies to reduce greenhouse gas emissions and climate-related risks to the county's residents, businesses, and the built and natural environment.

The CAP includes 86 climate actions as a pathway to meet the county's ambitious climate goals while building a healthy, equitable, and resilient community. Each county department has responsibilities for specific climate actions that are relevant to the work of that department. The following section provides a list of the CAP action items relevant to Montgomery Planning Department. While it is not possible to know the rate or type of development, each action item was rated high, medium, or low for its potential to reduce GHG gasses or sequester carbon.

Clean Energy Actions

- E-3: Promote Private Solar Photovoltaic Systems. Medium. It's possible that developers will incorporate photovoltaics into their development projects, but it is not absolute.

Building Actions

- B-7: Net Zero Energy Building Code for New Construction. Medium. All new construction is encouraged to exceed the county's energy standard and reach net zero, net positive, and/or Living Building standards. However, it is not possible to know if these techniques will be applied.

Transportation Actions

- T-1: Expand Public Transit. Low. There are no transportation recommendations associated with the density increases proposed.
- T-2: Expand Active Transportation and Micro-mobility Network. No. There are no recommendations to construct bicycle lanes, improve sidewalks, and increase access, stations, and frequency of public transit.
- T-4: Constrain Cars in Urban Areas, Limit Major New Road Construction. Low. There are no recommendations to address car constraints.
- T-7: Expand the Electric Vehicle Charging Network. High. The number of charging stations is dependent on the number of units per building. Increased density will result in increased charging stations.
- T-8: Transportation Demand Management. Low. There are no recommendations to address transportation demand management.

Carbon Sequestration Actions

- S-1: Retain and Increase Forests. Low (for forest retention), Low (for increase in forest). There are no forests within the properties proposed for increased density.
- S-2: Retain and Increase Tree Canopy. Low. There are no recommendations for tree canopy changes with the proposed density increases.
- S-5: Restore Soil Fertility, Microbial Activity, and Moisture-Holding Capacity. Low. There are no recommendations for in this category with the proposed density increases.

Climate Adaptation Actions.

- A-18: Expanded Community Gardens. Low. There are no recommendations for in this category with the proposed density increases.
- A-7: Green Public Spaces. High. As noted, the proposed increases in density will increase developer funding to be used for purchasing parks and open space.
- A-10: Green Infrastructure. Medium. Green infrastructure is not directly recommended but there will be an increase in parks and green roofs with development.
- A-13: Ban Stormwater Management Requirement Waivers. Low. There are no recommendations for in this category with the proposed density increases.

SOURCES OF INFORMATION, ASSUMPTIONS, AND METHODOLOGIES USED

The climate assessment for the for the proposed 3 density scenarios was prepared using the methodology for master plans contained within the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*, December 1, 2022.

The approach for modeling greenhouse gas emissions from existing and future (2045) land use and transportation growth was done using a GHG quantification spreadsheet (Quant Tool). The spreadsheet

provides totals emissions by type, including lifetime embodied building GHG emissions, lifetime building energy GHG emissions, lifetime building waste GHG emissions, lifetime transportation GHG emissions, and sequestration rates for land cover and management. The original model was developed in 2007 by King County, Washington, using national averages for transportation, and estimates emissions factors for the lifetime of buildings associated with the master plan's development. The model was revised in 2022 by ICF consultants, using similar methodology with updated building lifetime assumptions (2020), the inclusion of life cycle/upstream emissions associated with fossil fuel production and transportation, and future electric vehicle penetration and fuel mix rates.

Sources of Information

- *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*, December 2022
- *Montgomery County Climate Action Plan*, June 2021
- *Thrive Montgomery 2050*, October 2022
- GHG Quant Tool inputs:
    - Land Use—Master Plan Parcel GIS (land use attributes from county parcel layer); residential units and commercial floor area values adjusted for the Existing Policy and Master Plan scenarios (based on theoretical maximum possible build-out for each scenario's zoning allowances)
    - Pavement/Impervious Surfaces—Montgomery County Planimetric GIS, 2020 (coverage values adjusted for projected Master Plan build-out)
    - Transportation (VMT)—Montgomery County Planning transportation staff modeling program, March 2023
    - Land Cover—Montgomery County Tree, non-forest, turf, and soil cover (Montgomery County GIS, 2015)

GHG Quant Tool Assumptions

- The model calculates the GHG emissions for the maximum build-out by 2045 of land-use development (i.e., residential units and commercial building area) and resulting vehicle miles traveled consistent with the existing allowable development potential for current zoning districts. The model was run for all 3 density increase scenarios.
- The assessment calculates GHG emissions for a theoretical maximum possible build-out by 2045 of land use development (i.e., residential units and commercial building area) and resulting vehicle miles traveled consistent with the theoretical maximum build-out for zoning districts as recommended by the Master Plan.
- The Quant tool assumes an electric vehicle market penetration rate in the GHG Quant Tool of 90% by the year 2035. This estimate is consistent with Montgomery County's goal for transitioning vehicles to 100% electric by 2035, adjusted down by 10% to allow for a possible slower market uptake. However, electric vehicle use could increase at a faster rate than the penetration rate projects.
- The model was run assuming a 35% increase in green cover for all new development based on the proposed requirement. Green cover can be tree canopy cover, green roofs, or both.