
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 carbon sequestration, and how actions proposed by master plans and ZTAs could improve the county’s adaptive capacity to climate change and increase community resilience. Climate Assessments are conducted in accordance with the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County, December 1, 2022*.

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

The Montgomery County Planning Board anticipates that The Great Seneca Plan: Connecting Life and Science (Plan) will have moderate negative impacts and slight to moderate positive impacts on the county’s goals of addressing greenhouse gas emissions, and slight positive and negative impacts on carbon sequestration. While the Plan will have both positive and negative impacts on resilience and adaptive capacity, on balance Planning Staff believes that there will be an overall positive impact on ensuring the resilience and adaptive capacity of the Great Seneca communities.

BACKGROUND AND PURPOSE OF THE GREAT SENECA PLAN

The Plan, a comprehensive amendment to the 2010 *Great Seneca Science Corridor Master Plan* (2010 Plan), covers 4,330 acres in the heart of the 1-270 corridor between the cities of Gaithersburg and Rockville and the Town of Washington Grove. The Plan area includes several distinct areas with a variety of contexts, conditions, and opportunities, including the Life Sciences Center (LSC), Quince Orchard, National Institute of Standards and Technology (NIST), Londonderry and Hoyle’s Addition, Rosemont, Oakmont, Walnut Hill, Washingtonian Light Industrial Park, Washingtonian Residential, and Hi Wood.

The Plan focuses predominantly on the Life Sciences Center, a thriving economic hub that is host to a diverse population, as well as growing life sciences, medical, and educational institutions. The 2010 *Great Seneca Science Corridor Master Plan* established a bold vision of transforming the Life Sciences Center into a walkable, vibrant science center with a mixture of uses served by transit, as well as an array of services and amenities for residents, workers, and visitors.

The Plan's overall vision for the future of the Life Sciences Center remains relatively consistent with the vision established in the 2010 Plan. However, the Plan seeks to address barriers that have stymied progress toward achievement of the 2010 Plan vision, as well as to develop recommendations that respond to the many social, environmental, technological, demographic, and economic shifts that have occurred globally and locally since 2010. This Plan focuses on strengthening the economic competitiveness of the Life Sciences Center through mixed-use development, public realm improvements, equitable access, and implementation strategies, as well as enhancing the Life Sciences Center as a complete community, a place that will include a range of land uses, jobs, diverse housing options, services, and amenities to meet the needs of a variety of people within a 15-minute walk, bike ride, roll, or other trip through safe, accessible, and reliable transportation infrastructure.

Beyond the Life Sciences Center, the Plan envisions a thriving residential neighborhood with local serving amenities and services in the Londonderry and Hoyle's Addition area, and offers limited recommendations for the Quince Orchard, Rosemont, Oakmont, Walnut Hill, Washingtonian Light Industrial, Washingtonian Residential, and Hi Wood areas.

The Plan provides the context, vision, and recommendations for each distinct area of the Plan in separate chapters. Recommendations are organized in the themes of the built, social, natural, and economic environments and provide guidance for land use; zoning; urban design; transportation; parks, trails, and public open space; economy; environment; and implementation.

As stated above, the Plan includes several distinct areas with a variety of contexts and conditions separated by the cities of Gaithersburg and Rockville. Given the discontinuous Plan area, Planning staff evaluated the greenhouse gas emissions, carbon sequestration, resilience, and adaptive capacity at three geographies: 1) the Life Sciences Center; 2) the Focus area, which includes the Life Sciences Center, Washingtonian Residential, Washingtonian Light Industrial, Oakmont, Rosemont, and Walnut Hill; and 3) the Plan area, which includes the Focus area as well as NIST, Londonderry and Hoyle's Addition, and Quince Orchard.¹ A consistent approach was applied for the Transportation Analysis completed in support of this Plan. These geographies allowed staff to evaluate climate-related variables at a more granular scale based on context and proximity to existing infrastructure.

VARIABLES THAT COULD AFFECT THE ASSESSMENT

The following section describes the climate-related variables considered in this Assessment as impacted by the Plan. Climate related variables include the various greenhouse gas reduction,

¹ The Hi Wood area, a community of approximately 30 single-family detached units in the Plan area, but surrounded by the City of Rockville, was not included in the analysis due to the limited changes recommended for this area.

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*.

CLIMATE-RELATED VARIABLES

Transportation- Vehicle miles traveled by type, number of trips, non-vehicle modes of transportation, public transportation use, electric vehicle infrastructure access.

Building Embodied Emissions – Building certifications, building square footage, building life span, pavement infrastructure, material waste produced, use of green building materials.

Energy – Electricity usage, electricity efficiency.

Land Cover and Management – Area of forest, area of non-forest tree canopy, area of green cover, Implementation of nature-based solutions.

RESILIENCE-RELATED VARIABLES

Exposure-Related Factors – Activity in flood-risk areas, activity in urban heat island, exposure to other hazards (e.g. storms, wind).

Sensitivity-Related Factors – Change to forest cover, change to non-forest tree canopy, change to quality or quantity of other green areas, change to impacts of heat, change in perviousness, change in stormwater management system treatments, change to water quality or quantity, change to air quality, infrastructure design decisions.

ADAPTIVE CAPACITY-RELATED VARIABLES

Change to accessibility or prevalence of community and public spaces, change to emergency response and recovery capabilities, change in access to transportation, change to accessibility or prevalence of local food sources and other goods, change in availability or distribution of economic and financial resources, change to community connectivity, change in distribution of resources and support.

OTHER VARIABLES

Other variables include the number and frequency of events at each permitted site, transportation options, and where the sites are located.

ANTICIPATED IMPACTS

GREENHOUSE GAS EMISSIONS, CARBON SEQUESTRATION, AND DRAWDOWN

Greenhouse Gas Emissions Quantitative Assessment Summary

The Plan is anticipated to have moderate negative impacts and slight to moderate positive impacts on greenhouse gas emissions. The Quantitative Assessment estimates that total greenhouse gas emissions in the Life Sciences Center will be approximately 26% higher at buildout than the emissions from buildout of the existing GSSC Master Plan. This is because the Plan proposes to replace large areas of surface parking with new development and redevelopment of existing properties. While this is a much more efficient use of land, larger numbers of workers and residents living and working in the Life Sciences Center (LSC) will use more energy for the heating, cooling and lighting of their homes and offices and for transportation to, from and within the LSC. Because emissions are directly associated with energy use, more emissions will result. Larger numbers of people will also generate larger amounts of material waste, and there are emissions associated with the creation, transport, and disposal of those materials.

When including other portions of the Plan area, the difference between estimated emissions under the existing 2010 Plan and the proposed Plan shrinks, as lower intensity development and use types are included in the calculations. When evaluating the emissions from the LSC plus the Focus area (Washingtonian Residential, Washingtonian Light Industrial, Oakmont, Rosemont, and Walnut Hill), the emissions increase drops to just under 22%. The estimated emissions increase for the entire Plan area, including the large Quince Orchard area is just over 20%.

Breaking out the components of the emissions assessments, building energy use constitutes the largest source of greenhouse gas emissions, followed by transportation emissions, then emissions from building embodied energy and building waste. While this same pattern holds true throughout the Plan area, the relative proportions of each component change as the area of the Plan being assessed grows larger. Notably, building energy use constitutes about 40% of the total emissions in the LSC, around 45% for the LSC and Focus area combined, and about 50% for the entire Plan area. This may be due to the increasing number of single-family houses in each of those geographies. Single-family houses are less energy efficient than more compact residential forms.

These greenhouse gas emissions estimates are based on average figures for similar building types, land uses and transportation systems in comparable regions. Emissions estimates include existing buildings, transportation systems, and processes for the creation and disposal of material waste. It should be noted that the LSC contains a concentration of land uses that require high energy inputs, including needs for large computer systems and the high-tech health care systems at the Adventist HealthCare Shady Grove Medical Center. The emissions projections also assume that the energy being consumed continues to be generated through the burning of fossil fuels. Transitioning to clean energy is the key to eliminating greenhouse gas emissions from our buildings and transportation systems.

The Plan includes numerous recommendations to increase the energy efficiency of buildings, generate more renewable energy on site, provide new public transit options, and create high-quality pedestrian and bicycle facilities to shift the predominant transportation modes away from single-occupant petroleum-fueled vehicles. There are additional recommendations to expand the network

of electric vehicle charging stations to encourage people to transition to the use of electric vehicles. In addition, the Plan's recommendations to create a mix of uses within the LSC, including the creation of more housing options, should reduce the number of vehicle trips and distances traveled, and allow more people to get to their desired destinations by non-motorized means. All of these recommendations in the Plan should contribute to reductions in greenhouse gas emissions.

These changes will be taking place within a larger context of new initiatives and policies already being enacted by other county agencies that will result in requirements for greater building energy efficiency, provision of public transit, and transitioning to clean, renewable energy. As these programs are implemented, the emissions associated with energy use throughout the Plan area should decrease.

Carbon Sequestration/Drawdown Quantitative Assessment Summary

The existing forest, non-forest tree cover, and green space areas sequester and store around one percent of the total carbon emissions in the LSC and Focus area. This figure increases to 3.5 to 4 percent in the assessment of the entire Plan area. This is due to the extensive forests and tree cover contained within the Quince Orchard area. While these amounts are a fraction of the total ghg emissions, they are not inconsequential, storing over 117 million metric tons of carbon dioxide equivalents in the LSC, and over 756 million metric tons of CO₂ equivalents in the overall Plan area. Loss of these resources typically results in an emission of CO₂ if the trees being removed are not converted into semi-permanent products, such as wood furniture. Increasing the forest and non-forest tree cover will result in additional sequestration and carbon storage.

The additional contributions of forest, tree cover and green space to climate change mitigation through heat reduction associated with shading, evapotranspirational cooling, and changes in reflectance cannot be quantified with our current tools, although methods of quantifying some of these benefits are being explored. These natural resources have many additional benefits that are considered in the Climate Assessment sections covering Climate Adaptation and Resilience.

Greenhouse Gas Emissions, Carbon Sequestration, and Drawdown Qualitative Discussion

Transportation Emissions

The Great Seneca Plan is anticipated to have both positive and negative impacts on transportation emissions. Since this is an area targeted for growth in the county, the overall square footage of non-residential uses and number of residential units are expected to increase within the Plan area. By far, the greatest growth will occur within the Life Sciences Center area. The additional workers and residents are projected to increase the total number of trips and vehicle miles traveled in the Plan area, with a corresponding increase in transportation emissions. However, the expansion of non-motorized transportation alternatives including additional bicycle lanes and the LSC Loop Trail will increase the number of trips taken by zero emission modes. The Plan's approach to growth, featuring a mix of uses in compact developments created through infill development and redevelopment, will

facilitate reductions in vehicle miles traveled and make non-motorized alternatives more feasible. The expansion of public transit alternatives will provide additional lower-emission options for people commuting to, from, and within the Plan area. Increasing the electric vehicle infrastructure will facilitate a shift away from fossil fuels in the transportation system.

Building Embodied Emissions

Given the planned growth, total building square footage will increase. As long as the energy used to build and operate these buildings is generated by burning fossil fuels, projected greenhouse gas emissions will increase commensurate with the increase in building square footage. Increased numbers of workers and residents are expected to generate increased material waste.

Building lifespan is anticipated to have both positive and negative impacts on greenhouse gas emissions, although the overall impact may be more positive. Some redevelopments may require knocking down existing buildings, shortening their lifespan and increasing building material waste. However, many new buildings with longer life expectancy will be added, and some buildings may be repurposed or retrofitted, increasing their useful life.

Likewise, pavement infrastructure is anticipated to have both positive and negative emissions impacts. Some new pavement will be added for roadways and non-motorized vehicle infrastructure. In other places, infill development will replace surface parking lots with new buildings. The Plan includes recommendations to minimize pavement wherever possible. New green areas are recommended along Key West Avenue and Great Seneca Highway, and these spaces may replace pavement in some areas.

Building certifications indicating conformance with higher standards for energy efficiency, including the use of green building materials and obtaining building materials from nearer sources are both expected to represent a larger percentage of new buildings, and reducing greenhouse gas emissions.

Energy

More residential units, more non-residential square footage, more residents and more workers will all result in the increased use of electricity. Increased on-site generation of clean, renewable energy will help limit the increase in greenhouse gas emissions from building energy use.

The Plan includes recommendations for increasing energy efficient building orientations and designs, including more efficient heating and lighting systems to reduce increases in emissions.

COMMUNITY RESILIENCE AND ADAPTIVE CAPACITY QUALITATIVE DISCUSSION

The Plan is anticipated to have slight negative and slight to moderate positive impacts on community resilience and adaptive capacity.

Community Resilience

The guiding document, *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County* notes that Community Resilience is the inverse of vulnerability (pg. 27), and therefore organizes the Community Resilience and Adaptive Capacity checklist into measures of vulnerability based on Exposure-Related Factors and Sensitivity-Related Factors, as well as identifying additional factors that contribute to Adaptive Capacity.

Exposure-Related Factors

The Plan is not anticipated to increase activity in flood risk areas. Flood risk areas include areas mapped as 100-year or 500-year floodplain or floodways. A very small segment of Clopper Road on the periphery of the Quince Orchard neighborhood is traversed by 100-year floodplains, but the Plan is not anticipated to increase activity in this area. The occurrences of flood risk areas in other portions of the Plan area are small, and not in areas where activity is anticipated to increase as a result of the Plan.

The Plan will increase activity in urban heat island areas because the growth of residences and employment in the area will increase the number of people in the heat islands. Heat mapping completed by Montgomery County has identified heat island areas with the Plan boundaries, and these are typically areas of development with sparse tree canopy. The Plan includes recommendations to reduce heat impacts in these areas.

Increased numbers of people will be exposed to other climate hazards such as storms and wind simply as a result of the growth of the area, but not specifically due to other actions of the Plan.

Sensitivity-Related Factors

Sensitivity-Related Factors include changes to land cover and climate impacts can increase or decrease the effects of hazard exposure.

Most of the Sensitivity-Related Factors could have both positive and negative impacts on adaptation and resilience in the Plan, depending on the outcome of each project that is developed or redeveloped in the Plan area.

Changes to forest cover, non-forest tree canopy, and the quality or quantity of other green areas may occur on a project-by-project basis. Forest, non-forest tree canopy and other green areas may be lost or added to a site through the site design and development process. Specific examples include the proposed addition of linear green spaces along segments of Key West Avenue and Great Seneca Highway, the conversion of current meadow/turf cover on the Belward Farm to areas of development and parkland, and the addition of trees along streets, trails, in parking areas and green spaces as areas are developed to the new standards of the Complete Streets Design Guide and recommendations in the Plan. Increasing tree cover is a goal of the Great Seneca Plan.

Likewise changes in perviousness will occur from project to project. Reducing imperviousness is another recommendation of the Plan. In some cases, impervious areas such as parking lots will be

replaced with buildings and infrastructure needed to accommodate development without substantially increasing imperviousness. In other areas, such as the aforementioned linear green space along Great Seneca Highway, existing impervious areas will become more pervious. Pervious green spaces may also be incorporated into sites that are currently largely impervious. Particular attention will be paid to any proposed development or redevelopment in the Piney Branch Special Protection Area.

Changes to impacts of heat will be both positive and negative and will respond primarily to the changes in green cover, tree canopy cover, and perviousness on a project-by-project basis as noted above. Implementing the Plan recommendations to increase tree cover and green cover and to reduce imperviousness wherever possible during the regulatory review process should result in greater mitigation of heat impacts. Additional positive impacts to heat mitigation will accrue through greater use of more heat reflective surfaces and cool roofs, as well as implementation of street tree recommendations in the Complete Streets Design Guide.

Changes to stormwater management treatments will also occur from project to project. The overall change should be positive, as areas with little or no stormwater treatment systems or with older systems are redeveloped with new stormwater treatment systems.

Staff anticipates that changes to water quality and quantity should be largely positive. While some new developments will add impervious surfaces in some areas, much of the Life Sciences Center and the Focus area north of the LSC contain very large surface parking areas with outmoded stormwater management. When redeveloped, these areas will incorporate new stormwater treatment systems, green areas and tree cover that should intercept, infiltrate, and filter water that is not currently being treated before running off.

Staff also anticipates that changes to air quality should be more positive than negative. While vehicle trips are projected to increase, expanding the electric vehicle charging infrastructure should facilitate the shift away from the internal combustion engine vehicles that are primarily responsible for air pollution in the area. Additionally, the expanded public transit and non-motorized vehicle transportation systems will allow more trips to be taken with little or no air pollution impact, especially given the county's move toward a fleet of electric powered buses. Increasing the mix of uses can help shorten trips. Finally, increasing non-forest tree canopy and other vegetated areas will help filter out some of the air pollutants.

Staff anticipates that Infrastructure Design Decisions will have a slight overall positive impact on resiliency and adaptive capacity. New and enhanced transportation infrastructure will facilitate movement and offer more transportation alternatives within and through the Plan area, especially in the Life Sciences Center. Infrastructure designs will add more street trees, tree canopy and stormwater treatment facilities to reduce heat impact, improve air and water quality, and handle runoff from storms.

Adaptive Capacity Factors

Adaptive Capacity Factors facilitate community connectedness and cohesiveness and improve the accessibility of critical resources including food and monetary resources, making it easier for both the community and individuals to withstand and adapt to climate-related impacts.

Changes to accessibility or prevalence of community and public spaces are anticipated to have a positive impact on adaptive capacity. The Plan proposes a number of new outdoor public spaces where people can gather, interact, and form connections that will foster community cohesiveness.

Changes to emergency response and recovery capabilities should improve somewhat as a finer-grain street grid and additional pedestrian and bicycle connections will improve emergency access within the Plan area.

As noted above, changes in access to transportation should definitely improve through the extension of transit corridor connections, increased bicycle and pedestrian facilities, the LSC Loop Trail and a finer-grain street grid will increase both transportation options and access.

Positive change in accessibility or prevalence of local food sources and other goods is supported by a Plan recommendation to support access to healthy, local foods including through farmers' markets, food stands and community gardens. The recommendation includes a specific reference to the existing Shady Grove Farmers' Market which is currently housed on the Montgomery Medical opportunity site. The Plan notes that, if this farmers' market must be relocated due to redevelopment of the site, alternative sites should be identified to continue to the farmers' market, such as in one or more of the parks and public open spaces recommended by the Plan.

Changes in the availability or distribution of economic and financial resources as opportunities for employment and entrepreneurship at various levels of education and experience grow through the continued development of the Life Sciences uses within the area, expansion of residential areas, and the need for businesses that support the new development.

Staff anticipates that the Plan will enhance and facilitate community connectivity through the provision of attractive new public spaces and programming that will bring people together, promoting civic engagement and the formation of support networks within the community.

Changes in the distribution of resources and support should improve slightly with the recommendation for a potential new school site in the LSC, to be co-located with other community uses such as a childcare facility, health center, or other comparable public use. Additionally, improvements in the transportation infrastructure, including improved non-auto and transit options, should improve access to community facilities.

**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 and addressed within the Plan. While it is not possible to know the rate of implementation, development, funding, or other implications, 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. The Plan promotes the use of on-site alternative energy systems for all development, private and public.
- E-4: Public Facility Solar Photovoltaic Installations and Groundwork. Medium. The Plan promotes the use of on site alternative energy systems for all development, private and public.

BUILDING ACTIONS

- B-7: Net Zero Energy Building Code for New Construction. Medium. The Plan makes recommendations that support and facilitate achieving Net Zero energy emissions.

TRANSPORTATION ACTIONS

- T-1: Expand Public Transit. High. There are recommendations for increasing access, stations, stops, and frequency of public transit.
- T-2: Expand Active Transportation and Micro-mobility Network. High. There are 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 recommendations to reduce the number of lanes previously recommended on major roads in the Life Sciences Center.
- T-7: Expand the Electric Vehicle Charging Network. Medium. There are recommendations to increase charging stations.
- T-8: Transportation Demand Management. High. There are many recommendations intended to influence people's transportation choices and reduce use of single occupancy vehicles.

CARBON SEQUESTRATION ACTIONS

- S-1: Retain and Increase Forests. High (for forest retention), Low (for increase in forest). Retention and expansion of forest and is recommended.
- S-2: Retain and Increase Tree Canopy. Medium. Recommendations include increasing tree canopy cover on open space, within the right-of-way, and on new development.

CLIMATE ADAPTATION ACTIONS

- A-18: Expanded Community Gardens. High. Recommendations support community and rooftop garden expansion.
- A-7: Green Public Spaces. High. All development, public space, and the right-of-way must include native tree and vegetative plantings.
- A-10: Green Infrastructure. High. Green infrastructure is essentially the same as Nature-Based Design Solutions and the terms are used interchangeably. It is recommended for all new development and road retrofits.
- A-15: Water Supply Protection. High. The Plan makes recommendations to protect watersheds that contribute to the County's water supply.

RECOMMENDED AMENDMENTS

The Climate Assessment Act requires the Planning Board to offer appropriate recommendations such as amendments to the proposed Great Seneca Plan or other mitigating measures that could help counter any identified negative impacts through this Climate Assessment.

Based on a review of the results of the Climate Assessment, Staff recommended that the Planning Board incorporate the following additional recommendations into the Great Seneca Plan:

- Support access to healthy, local foods including through farmers' markets, food stands and community gardens. Should the existing Shady Grove Farmers' Market require relocation due to redevelopment of the Montgomery Medical opportunity site, alternative sites should be identified to continue the farmers' market, including the parks and public open spaces recommended by this Plan.
- Use nature-based climate solutions, including soil improvement techniques, in landscaped features wherever possible.

The Planning Board accepted these recommendations through their work sessions, and the recommendations are included in the Planning Board Draft Plan.

SOURCES OF INFORMATION, ASSUMPTIONS, AND METHODOLOGIES USED

The climate assessment for the Great Seneca Plan 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*.