Adding Net Emissions Definitions to the Maryland Code

Background

National Net GHG Goal - Article 4 of the Paris Agreement requires countries to develop nationally determined contributions (NDCs) that achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gasses (GHGs). Thus, the U.S. NDC, as supported by the federal government, is to reduce *net* GHG emissions 50-52% below 2005 levels in 2030.

Maryland's Climate Solutions Now Act - The Climate Solutions Now Act of 2022 (CSNA) requires the State to "reduce statewide greenhouse gas emissions by 60% from 2006 levels by 2031." Maryland statute defines "statewide greenhouse gas emissions" as:

> the total annual emissions of greenhouse gasses in the State, measured in metric tons of carbon dioxide equivalents, including all emissions of greenhouse gasses from the generation of electricity delivered to and consumed in the State, and line losses from the transmission and distribution of electricity, whether the electricity is generated in-state or imported.

The current definition does not include carbon sequestration in Maryland's natural and working lands or other forms of GHG removal. As such, one interpretation is that the 2031 goal is a *gross* emissions goal with no consideration of GHG removal from the atmosphere in achieving the State's GHG reduction target. This creates an inconsistency between Maryland's *gross* emissions goal for 2031, the U.S. *net* emissions goal for 2030, and Maryland's *net*-zero emissions goal for 2045. Neither the CSNA nor prior Maryland law provides definitions that direct MDE to treat the 2031 goal as a net emissions goal or fully account for net emissions in the State's GHG Inventory.

Additional reasons to support net emissions goals

- The CSNA says that the State may include carbon storage technologies in its plan to reduce emissions 60% by 2031 if those technologies are proven to achieve verifiable carbon reductions. However, any technologies that remove and store atmospheric carbon could only be accounted for if a definition of net emissions was added to the Maryland Code.

- Accounting for net emissions allows Maryland climate mitigation plans to acknowledge, support, and leverage the carbon sequestration benefits provided by Maryland's land managers who are national leaders in growing and managing forests, implementing climate-friendly practices on agricultural land, and restoring tidal wetlands to support coastal resilience. This level of inclusion directly builds upon the State's investment in utilizing best available science to quantify and monitor changes to Maryland's natural carbon sinks. *Note*: The net impact of GHG emissions and removals from Maryland's 1 natural and working lands are currently tracked within the *Land Use, Land-Use Change, and Forestry* sector of the State GHG inventory following UNFCCC and EPA reporting conventions (see more information below).

- As recently incentivized through Maryland's Tree Solutions Now Act of 2021 and Conservation Finance Act of 2022, net emissions goals would allow the State to directly count statewide tree planting and

broader green and blue infrastructure activities towards its climate mitigation goals.

- Maximizing the relative contribution of carbon removal activities towards Maryland's net-zero 2045 will require targeted investment and accounting in removals over the short and medium terms to effectively "grow" Maryland's carbon sinks. Accounting for net emissions sooner rather than later will encourage earlier investments in natural and technological solutions that can take decades to develop.

- Some GHG removal activities are lower cost and have greater co-benefits than some emissions reduction activities, so shifting to a net emissions approach could reduce costs for the State and taxpayers while creating additional benefits (such as improved stormwater management and reduced urban heat island effect resulting from growing more trees).

Proposed definitions

Including the following definitions in the Maryland Code and clarifying that the 2031 goal is a reduction of net statewide greenhouse gas emissions would provide clarity to MDE on how to account for GHG removals and measure net emissions.

- **Statewide greenhouse gas removals**: The total annual quantity of atmospheric greenhouse gasses, measured in metric tons of carbon dioxide equivalents, captured in-state and stored through biologic, chemical, geologic, or physical processes.

- **Net statewide greenhouse gas emissions**: The difference between statewide greenhouse gas emissions and statewide greenhouse gas removals.

- **Net-zero statewide greenhouse gas emissions**: When the annual quantity of statewide greenhouse emissions is equal to the annual quantity of statewide greenhouse gas removals.

Existing commitments to natural carbon sequestration

Current Natural and Working Lands inclusion in the MD GGRA Plan

The 2030 Greenhouse Gas Reduction Act (GGRA) Plan includes a range of State commitments aimed at growing and maintaining Maryland's natural carbon sinks. The Plan's projections through 2030 are based on the implementation of several state-supported programs designed to engage landowners in growing and managing forests, implementing climate-friendly practices on agricultural land, and restoring tidal wetlands to support coastal resilience. State agencies

are currently tracking progress on program implementation under both the GGRA and reporting towards Chesapeake Bay Program goals and targets. While the State's 2031 GHG goal is not currently based on net accounting, the GGRA Plan reflects a commitment to ambitious emissions reductions with attention to the additional sequestration benefits provided by Maryland's Natural and Working Lands (NWLs).

Connections to the MD GHG Inventory

While climate action plans clarify the ambition needed to reach a particular GHG reduction goal, GHG inventories serve as a mechanism for assessment to determine State progress against the Plan. In this sense, the goal is to have every sector from the GGRA Plan reflected in the State inventory, including Maryland's NWLs. While the inventory should reflect the implementation of planned GGRA activities, a robust methodology will also capture changes in statewide carbon stocks resulting from all natural and human activities, not just GGRA planned activities. Attention to the entire sequestration sector, including the drivers of both carbon gains and losses, can help identify factors that should be considered for further policy intervention and planning.

Quantifying Annual Net Carbon Fluxes

In line with inventory accounting principles established by the Intergovernmental Panel on Climate Change and the US EPA, the Maryland Department of the Environment (MDE) is committed to ensuring we have robust methodologies for quantifying the net change in annual carbon sequestration across all NWLs. Specifically, we seek approaches that capitalize on best available science, including the use of high-resolution and spatially-explicit data in Maryland when available. MDE has already demonstrated leadership in this area through the inclusion of new forest carbon monitoring science, supported by NASA's Carbon Monitoring System, which allows us to quantify and track changes in carbon stocks at very fine spatial scales across the entire state. In line with a recommendation from the Maryland Commission on Climate Change, MDE has also moved to include agricultural soil carbon and blue carbon within State GHG Inventory. To support this work, MDE and its sister agencies have worked with experts to develop methodologies to quantify annual changes to Maryland's blue carbon and agricultural soil carbon stocks and pursued technical assistance from the U.S. Climate Alliance to support additional data analysis and integration into State policy tools.

Commitment to Using Best Available Science

With Maryland's first-in-nation leadership on utilizing new science and technologies to inform our NWL planning and monitoring, we are in an excellent position to quantify and track fine scale changes to our carbon sinks resulting from a range of drivers. While carbon science is always iterating and improving, this commitment to using best available science helps to guard against systematic over- or under-estimation of Maryland's natural carbon sinks and provides ongoing clarity about the contribution of NWLs towards a broader net zero GHG goal.

Current Science Approaches Across NWL Categories

Trees and Forests

Building on research from the NASA Carbon Monitoring System, a U.S. Climate Alliance funded project led to the development of a new method for calculating annual forest carbon fluxes in the State. Led by the University of Maryland, with support from Maryland Department of Natural Resources (DNR) and MDE, this effort combines high-resolution light detection and ranging (LiDAR) data on forest height and structure, a predictive ecosystem model, and annual estimates of forest cover change from Landsat satellite imagery to quantify annual changes to the State's forest carbon stocks. The method improves Maryland's GHG inventory by reducing the uncertainty associated with estimates of forest carbon stock change, increasing the temporal and spatial resolution of those estimates, and providing a consistent methodology to estimate carbon stock change in forests and trees outside of forests. Importantly, this work allows for attribution of annual fluxes to key drivers, including land use change, weather, rising atmospheric CO2 and disturbance. The underlying ecosystem model used to support this forest monitoring work was also used to project forest carbon sequestration potentials

within the GGRA Plan, highlighting the value of plan-inventory integration with a consistent science approach. New forest carbon estimates will be published in the 2020 GHG Inventory.

Agricultural Soil Carbon

Maryland farmers have long demonstrated leadership on implementing climate friendly practices, such as cover cropping, in support of the Chesapeake Bay Program goals. MDA and MDE have already utilized an early version of the U.S. Department of Agriculture (USDA) and Colorado State University's CarbOn Management & Emissions Tool (COMET) Plannertool to provide a GHG sequestration estimate of projected practice implementation for the 2030 GGRA Plan. COMET, and its underlying modeling framework, is a widely accepted tool that has had more than a decade of iteration and support from the USDA. Building from this investment, MDE was awarded a USCA Technical Assistance grant to integrate directly state-specific data within COMET's underlying biogeochemical model to generate historical annual agricultural soil carbon fluxes across all cropland (2006-2021), develop a method to quantify annual fluxes for future state inventories, and consider future fluxes under a range of planning scenarios for ongoing BMP implementation towards future GHG goals. This work will ensure we can accurately capture the additional carbon contributions of Maryland farmers against the broader agricultural soil carbon landscape. New agricultural soil carbon estimates will be included in the 2023 GHG Inventory, replacing the current default estimates provided for Maryland by the USDA via the EPA's State Inventory Tool.

Blue Carbon Ecosystems

The recent incorporation of coastal wetlands into the national GHG inventory has relied on a mix of data sources that still present large uncertainties at higher spatial and temporal scales. Accurate assessment of GHG fluxes are impacted by the range of methane emissions in palustrine wetlands, the depth of soils lost to erosion, extraction, and drainage, and differing soil carbon burial rates and the fraction of carbon lost to the atmosphere. To improve these estimates for the State of Maryland, DNR and MDE have engaged scientific experts to refine the emission reduction estimates associated with the range of wetland classes found within the Chesapeake and Coastal Bays. This work has leveraged spatially-explicit data from NASA's Carbon Monitoring System and the Smithsonian Environmental Research Center (SERC) Coastal Carbon Atlas. The proposed monitoring approach also draws from research across the State to quantify potential impact of salinity on the net GHG benefits of tidal wetlands given the potential for methane release. Assessment of blue carbon stocks changes will continue to be coupled with sea level rise (SLR) modeling and the potential impacts of SLR on future carbon sequestration rates. This will again ensure the State maintains a dynamic understanding of our blue carbon stocks for GHG reduction planning. New carbon estimates for tidal wetlands and submerged aquatic vegetation will be published in the 2020 GHG Inventory.

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