2019 SALTWATER INTRUSION PLAN – TOP RECOMMENDATIONS – APRIL 2020

RESOURCE: AQUIFER - Assess available data - There are many data sets in existing governmental (federal, state, and local) and academic databases that can be obtained and analyzed. Obtaining and assessing the data would help identify knowledge gaps. Compiling the data (both groundwater and surface water) into a single database would be helpful.

RESOURCE: AQUIFER - Assess potential vulnerability - identify vulnerable aquifers by assessing withdrawal by sector, initial estimates of hydraulic gradients, and a study of recharge rates. Identify vulnerable water users of the surficial aquifer by overlaying groundwater appropriation permits and locations of domestic wells with sea level rise inundation areas.

RESOURCE: SURFACE WATERS - Identify currently vulnerable water users - map the locations of intake pipes (surface water appropriation permits) relative to the current freshwater-saltwater transition zone.

RESOURCE: SURFACE WATERS - Identify and catalog ditches - having high-resolution geographic data on the location, depth and extent of ditches (agricultural, wetland, etc.) could help researchers better estimate and understand the upstream movement of saltwater within Maryland surface waters.

RESOURCE: AGRICULTURE - Improve maps of past, current, and future salinization - determining current and forecasting future salinization will help farmers better evaluate what land is of higher value, and land is or will be of lesser value for farming. Assess the vulnerability of Maryland's farms and overall coastal ecosystems to saltwater intrusion via surficial drainage networks by developing a saltwater intrusion vulnerability index.

RESOURCE: AGRICULTURE - Track salinity shifts in wells and streams - track the link between sea level rise and the landward migration of saltwater. Conduct status and trends analyses using this information.

RESOURCE: AGRICULTURE - Create an ability to track real-time sea level rise and identify areas of declining crop health and opportunities for inland migration of coastal wetlands - in other words, determine where it is best to yield to sea level rise and to allow agricultural land to revert to beneficial wetlands.

RESOURCE: AGRICULTURE - Explore transitional crops and land uses, including the development of tidal wetland habitat - this effort would focus in areas greatly affected by saltwater intrusion and unproductive for farming.

RESOURCE: AGRICULTURE - Investigate alternative crops, soil amendments, and farming practices - these alternatives would reduce the economic loss from saltwater intrusion for affected farmers by addressing the impacts on farm profitability, nutrient runoff, and ecosystem benefits. Develop tools for farmers to facilitate decisions on whether and when to plant certain crops, and when to pursue particular adaptation practices.

RESOURCE: COASTAL WETLANDS - Determine how sea level rise and saltwater intrusion will change the types and amounts of wetlands in Maryland - DNR completed an assessment in 2011 of future wetland loss due to sea level rise using the Sea Level Affecting Marshes Model (SLAMM). The total loss and change in type of wetlands due to sea level rise or saltwater intrusion should be reevaluated and the risk assessed. The state could update its 2011 analysis of the loss of wetlands due to sea level rise and could perform a similar and additive analysis on the loss and change in type of wetlands due to saltwater intrusion. Other factors that might not be taken into account sufficiently by the SLAMM model could be considered as well; (e.g., understanding the relationship between saltwater intrusion and saltmarsh elevation change (saltmarsh accretion rate) is important, given that a lower rate of elevation change in tidal freshwater wetlands would mean they may more quickly become inundated due to sea level rise).

RESOURCE: COASTAL WETLANDS - Identify priority existing wetlands at risk and adaptation actions - Once vulnerable wetlands are identified, the state could update its 2009 study that prioritized which of Maryland's coastal wetlands to target for protection or restoration; incorporating new knowledge regarding ecosystem service values of particular areas in Maryland; and which of these wetlands may be able to migrate further inland (if migration corridors exist) or to be lost or transformed to saltmarsh.

RESOURCE: COASTAL WETLANDS - Complete a study to inform the development of a Maryland wetland adaptation plan - develop a Maryland-specific study of how these wetland ecosystem services could change (or not change) as saltwater intrusion increases, and as coastal wetlands migrate, are lost, or are transformed, over time. This type of study can inform policymakers and resource managers regarding the best types and locations for wetland restoration and management projects.

RESOURCE: COASTAL FORESTS - Develop a vulnerability index for forest prone to salinization - building upon the existing land cover and change analyses, develop a vulnerability index to assist property owners in determining management options and opportunities.

RESOURCE: COASTAL FORESTS - Identify and track the effects of salinization on forest health, building upon the Maryland Forest Health Survey - use high resolution imagery combined with cutting-edge automated feature extraction techniques to map tree canopy decline, assign mortality severity value to forest stands, and develop a web mapping decision support tool to provide quick and easy access to the information for resource managers, decision makers, and the public.

RESOURCE: COASTAL FORESTS - Study the resilience of more biodiverse coastal forest stands to saltwater intrusion - determine if modified forest management approaches could reduce the overall vulnerability of coastal forests to saltwater intrusion, examine the consequences and tradeoffs of the different forest adaptation strategies for landowners and ecosystem services; and identify potential barriers to implementation.

RESOURCE: INFRASTRUCTURE – Identify existing underground infrastructure within the coastal plain (i.e. wells, natural gas, energy transmission lines, internet, wastewater, and water systems).

Saltwater Intrusion Plan – Conservation Easement Recommendation

> *"Develop a report that presents specifics for how to establish and implement conservation easements in Maryland that facilitate transitional land uses (e.g., saltmarsh) for salt-impacted farmland."*

Meetings with DNR and MALPF staff – to discuss existing easement programs and opportunities

DNR

Coastal resiliency easement – used once in 2011

- Perpetual easement
- New opportunity in 2020 – easement language is being updated
- Includes coastal resiliency management plan and wetland adaptation buffers that will move inland with changing sea level rise (updated every 5 to 10 years or as needed)

Potential for targeting lands for preservation (easement)

Beginning discussions with MALPF

- How to address the changing conditions on existing easement lands
- How to consider the vulnerability of potential easement lands during the ranking/evaluation process (potential to direct farmlands vulnerable to the effects of saltwater intrusion and/or sea level rise to another easement program)

Other programs that can be used to preserve farmland vulnerable to saltwater intrusion/sea level rise:

- NRCS Wetlands Reserve Program https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1049327
- Conservation Reserve Enhancement Program – CREP https://www.nrcs.usda.gov/wps/portal/nrcs/detail/md/programs/?cid=nrcs144p2_025631

Saltwater Intrusion Plan – Statewide Wetland Adaptation Plan Recommendation

"Develop the first phase of a statewide wetland adaptation plan, which would include marsh migration, and in some cases, measures to protect high priority wetlands in place, in response to sea-level rise inundation and salinization"

Meetings with DNR (Chesapeake and Coastal Service, Forest Service), TNC, MDA (Forest Pest Management), US Climate Alliance

- Future meeting planned with MDE Wetlands and Waterways. Hope to meet with UMCES regarding Blue Carbon Workshop.

- Ongoing and planned grant projects (state government, NGOs) exist involving wetland protection prioritization and forecasting future wetland migration and ecosystem services.

- A variety of completed assessments (MDE, DNR) exist concerning wetland protection prioritization and a completed (although in the process of being updated) forecast of future wetland migration. Need to determine the types of wetland ecosystem services covered by each assessment.

A first phase of a statewide wetland adaptation plan could include:

- Goals and objectives for the plan.
- Possible map-based approach (see Table 1 below) to set priorities.
- Possible policy-based approach to assist with wetland protection.
- Expected management needs.

Goals and objectives – initial ideas

- Maximize protection of wetland (and coastal forest) migration corridors and future wetland (and coastal forest) areas.
- Identify and protect land areas that will have the highest level of wetland ecosystem services (those of highest priority to the state) over the next 50 years.
- Support the development of management tools to facilitate decisions on whether to protect specific wetlands in place.

Map-based approach

If a map-based approach is used, then the state might need a framework for considering different wetland ecosystem services and how they might change over time (e.g., due to increasing salinization, sea-level rise, changes in precipitation, and other climate change impacts) in a particular location. The subset of lands to be assessed would include existing wetlands, likely wetland migration corridors, and wetland adaptation areas (forecasted future wetland areas).

There are a wide variety of potential changes over time for particular locations, for example: (a) currently a salt marsh, in 10 years will be open water; (b) currently a productive farm, in 10 years a salt-impacted farm, in 20 years, a saltmarsh; (c) currently a coastal freshwater wetland, in 10 years a brackish water wetland, in 15 years, a saltmarsh, in 20 years open water. In some cases, there will be no wetland ecosystem service at the particular location currently, but that service might eventually come into being, and then later disappear.

Should the value of protecting the land in a particular location be the average of the value of the wetland ecosystem services at that location over a particular time period?

If the wetland ecosystem services at a particular location will reach a maximum at a certain point during the time period, but then will disappear, should efforts be made to protect that location and prevent its loss?

Table 1.

Wetland Ecosystem Services at a Particular Location	**2020-2025: Score for each Ecosystem Service**	**2025-2030: Score for each Ecosystem Service**	**2030-2035: Score for each Ecosystem Service**	**2035-2040: Score for each Ecosystem Service**	**2040-2045: Score for each Ecosystem Service**
Biodiversity protection					
Coastal community protection					
Nutrient and sediment reduction					
Carbon sequestration					
AVERAGE					

<u>Policy-based approach</u>

If a policy-based approach is used, could consider the following aspects:

- Forecasted wetland migration corridors and future wetland areas could have development restrictions placed upon them to support successful wetland migration.

<u>Expected management needs</u>

- Barriers to wetland migration should be identified and incentives provided to remove them.
- Costs to protect highest value wetlands in place need to be quantified to help government and landowners determine if the cost outweighs the ecosystem services benefits.
- Identify management methods to facilitate coastal forest migration.