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Adaptation Option Template Future Built Environment Infrastructure DRAFT

Common Option (FBEI-1): Integrated Planning for Sea Level Rise, Coastal Storms and Coastal Erosion

Option Description

Sea level rise and associated hazards such as storm surge, coastal flooding and erosion pose both short term and long term threats. Drawing on the MD CCC science report, we recommend integrated planning at the local, state and Federal level for all bay and coastal communities within the State of Maryland.

This planning must be flexible in that it must account for a diversity of land uses, different levels and probabilities of water inundation and several planning time horizons that exceed what is currently addressed. The key variable to this option is the establishment of a Maryland estimate of the amount of sea level rise and the time frame for future projected rise. This variable is subject to change so this planning element must reflect that certainty. The planning should include policies and appropriate adaptation responses in this defined geographic area.

The overarching mechanism recommended here is that local government plans, as detailed in Article 66B of the Annotated Code of Maryland, include an element that addresses integrated planning for sea level rise, coastal storms and coastal erosion. This recommendation extends to the plans that underpin the comprehensive master planning, including but not limited to appropriate infrastructure and community facilities plans including (e.g., water and wastewater plans) land use plans, municipal growth elements, sensitive areas and areas of special concern (e.g., floodplain management, Chesapeake Bay Critical Area, forest preservation), and special plans (e.g., marina and boating plans, shoreline plans and emergency management plan). Particular attention should be given to the integration of All Hazards Planning and the Comprehensive Planning Process, including landuse related issues. This recommendation refers only to comprehensive and strategic plans as described and not operational plans or development regulations and guidelines.

The goal of this policy option is to increase coordination and consistency in planning approaches and to create a framework for the integration of other climate adaptation proposals, such as new building and zoning codes. This option includes 2 major components;

- 1) Local coordination of Comprehensive and other plans to reduce risks from SLR and associated coastal hazards.

- 2) State of Maryland coordination of state plans to reduce risks from SLR and associated coastal hazards.

These plans should appropriately apply strategies along the continuum from protection to retreat. At a minimum the plans would address potential threats in affected areas and strategies for a phased implementation response under the following categories:

- land use, zoning, population density regulations to reduce population and investment at risk;
- public and market-based incentives/disincentives to reduce property damage and threats to human health;
- the provision of community infrastructure such as roads, schools; public safety and medical facilities; water and wastewater systems; gas, electrical and communications utilities;
- the maintenance of existing and future natural resource lands and wildlife habitat, and working lands (i.e. agricultural and forest lands);
- adaptive shoreline erosion control (non-structural and “living shorelines” approaches) and buffer management strategies, including the accommodation of future wetland migration corridors where limited or no development is allowed; and,
- public communication and outreach.

Option Design

Targets:

- Identify all public and private land at risk from sea level rise and storm surge. Regular, updated floodplain mapping combined with predictive mapping of storm surge associated with specific weather events should be undertaken by MEMA.
- State, Federal, and local transportation planners will include sea level rise and storm surge vulnerability into short and long range transportation planning to avoid infrastructure expansion into vulnerable areas. Where existing infrastructure is already vulnerable, options should be evaluated to minimize risks, move infrastructure from vulnerable areas, or otherwise reduce vulnerabilities.
- All new development and transportation projects must include advanced “environmental site design” techniques for stormwater such as infiltration, use of natural features, and bioretention over traditional stormwater management techniques. Stormwater management calculations must also take into account anticipated changes in precipitation associated with climate change in the Mid-Atlantic region and seek to accommodate potentially greater volumes of stormwater within the watershed without creating or exacerbating downstream water quality and habitat problems.
- Provide disincentives for development within high vulnerability areas by ensuring that public funds are not spent on infrastructure that supports new development within vulnerable areas.

Parties Involved: Maryland Department of Natural Resources, Maryland Department of Planning, Maryland Department of Environment, Maryland Department of Transportation, Maryland Emergency Management Agency, Local and County Governments

Timing: 2008 prepare proposed administration legislation; 2009 seek passage of legislation; 2010 prepare administrative guidelines, technical assistance materials; 2011 – first year that new local comprehensive plans must incorporate new CHARPE elements.

Other: Maryland Association of County Organizations, Maryland Municipal League, affected local governments in Maryland’s coastal zone; NOAA, USGS, Corps of Engineers

Implementation Mechanisms

Maryland Planning Article 66B

Implementation of these recommendations could include amendments to Annotated Code of Maryland Planning Article 66B to expand sensitive areas, and/or add a section on sea level rise under county comprehensive plans and/or local hazard mitigation plans. These efforts should draw on statewide mapping and monitoring efforts. Additional modifications to the Chesapeake Bay Critical Area Act (Natural Resources Article, §8-1807) and implementing Criteria (COMAR, Title 27) to enhance sea level rise adaptation and response might be required. [From 2-28-08 call- add language to include the suggestion for using visions in 66B to address landuse response to SLR and habitat preservation.]

Planning guidelines would be developed jointly by the Departments of Planning, Natural Resources and the Environment to ensure consistency and clarity and to facilitate the integration of the new plan element with existing comprehensive planning and zoning requirements. Of particular importance is the need for the SLR element to clearly identify, under various scenarios, how the provision of public infrastructure may change, *i.e.* whether or not local governments plan to fortify and/or rebuild damaged infrastructure; reduce the footprint of vulnerable or damaged infrastructure; or abandon or relocate critical public infrastructure components. Local governments should also evaluate the estimated costs and benefits of proposed solutions and associated funding mechanisms. These analyses and decisions are of monumental importance to existing and future property owners, insurers, emergency personnel, local, state and federal government agencies, elected officials, the business community and others.

Capital Planning Component

Capital project planning efforts are to include in the planning process estimations of vulnerability for new or modified infrastructure to sea level rise and storm surge. This process will consider broad floodplain management criteria such that development occurs in areas that best reduce and minimize storm and flood hazards, facilitate natural infiltration, protect/restore riparian buffers, wetlands and forests and allow wetland migration corridors.

Emergency Management and Mitigation Plans

The adverse health consequences of flooding, storms, and storm surges are complex and far-reaching, and include the physical health effects experienced during the event or clean-up process, or from effects brought about by damage to infrastructure, including population

displacement. The physical effects largely manifest themselves within weeks or months following the event, and may be direct (such as injuries) and indirect (such as increased rates of vector-borne and other diseases). Extreme weather events are also associated with mental health effects, such as post-traumatic stress disorder, resulting from the experience of the event or from the recovery process. These psychological effects tend to be much longer lasting and may be worse than the direct physical effects.

To address these risks, in collaboration with appropriate public health agencies and stakeholders, effective approaches will be developed to communicate appropriate responses that protect human health during large-scale floods, storms, and storm surges. Of particular concern are communication systems and plans that address health issues associated with low-income and under-served populations and other vulnerable groups. Plans will be developed for moving critical acute and longer term care facilities if they will need to be closed because sea level rise, storm surges, or flooding will put them at risk. The plans will ensure that climate change concerns are integrated into activities of the Maryland Institute for Emergency Medical Services Systems and other organizations engaged in disaster response. Stakeholders will include managers of hospitals, public buildings, and infrastructure that provide emergency security, communications, and health services, to reduce the vulnerability of critical activities and equipment during an extreme event or other climate-related event.

Local Government Capacity

Current available capacity of local governments to undertake necessary actions to implement these recommended actions is unknown. However, it is expected that the current capacity is insufficient to successfully complete the needed actions in a timely manner. Therefore, the following actions should take place immediately to estimate the capacity. What is recommended is that the DNR, MDE, MDP, MDOT, and MEMA work with MML and MACO to perform and provide:

- A survey of local governments throughout the state to assess the planning measures already in place for sea level rise, what are some perceived barriers, and how best to share information between state, county and local governments;
- A technical review and assessment of planning guidelines used by local communities and municipalities within the coastal zone;
- Guidance to assist local governments with identifying specific measures (e.g., local land use regulations and ordinances) to adapt to sea level rise and increasing coastal hazards.

Based on findings of the capacity assessment, State offerings of technical assistance, academic assistance, grants to local governments, and support for local GIS mapping may be appropriate

Integration Across State and Local Plans

Planning policy adopted at the state level will be integrated with local efforts at three levels of planning. At the broadest level of planning, state and federal-mandated efforts such as the Comprehensive Master Plan (MD), the Critical Area Master Plan (MD), All Hazard Plan (MD, US), Master Water and Sewerage Plan (MD, US) would guide adoption of broad classifications of impacts and policy response.

Local planning requirements would address in detail the design requirements for public and private development in areas at risk from sea level rise and associated hazards. Examples of these plans include Marina, Boating and Water Facility plans, Emergency Response Plan, Erosion Control Plans, Floodplain Management Plans, and Shoreline Master Plans.

Planning for all publicly-funded projects though Capital Plans would require “screening” for possible SLR impacts and establish design standards for mitigating impacts.

Related Policies/Programs in Place

Recommend strengthening of enforcement of the Federal Consistency Review in the coastal management program.

The Maryland Coastal Program Coastal Communities Initiative provides technical and financial assistance to local governments to promote the incorporation of natural resource and/or coastal management (e.g., coastal hazards, public access, water-use activities) issues into local planning and permitting activities. Additionally, a number of state sponsored activities are currently underway that relate to this option including hazard mitigation planning; incentives and technical assistance for soft shoreline erosion control; sea level rise and storm surge mapping; green and blue infrastructure assessments; and an evaluation of growth management tools in coastal areas.

Mapping efforts already underway, such as Maryland Shorelines Online and Maryland’s iMap, as well as the policy option proposal for Integrated Geographic Information Systems: Mapping Modeling and Monitoring will provide local and regional governments access to required spatial information for these planning efforts.

Estimation of Adaptation Benefits and Costs

Capital intensity:

Flexibility:

Adaptive capacity:

Other:

Documentation of Adaptation Benefits and Costs

Data Sources:

Quantification Methods:

Key Assumptions:

Key Uncertainties:

Additional Benefits and Costs

Feasibility Issues

Full benefit of this effort will depend on access to local information on SLR and associated hazards for planning purposes. A policy option designed to address monitoring, data management and quality, geographic information systems, and integration of required modeling efforts is recommended elsewhere in this report.

Status of Group Approval

Barriers to Consensus

FBEI-2. State Agency Reporting on Response to CCC Findings

Formerly titled “Mandate Integration of MD CCC Findings and Recommendations Into All Appropriate State and Local Programs”

This reporting process will consist of 2 major elements. The first element is designed to promote integration of sea level rise and associated coastal hazards into the existing review processes conducted by state agencies. An Executive Order would require that agencies determine how to best modify their planning and project review procedures to assure that the risks of sea level rise and associated hazards are addressed. Agencies would be expected to follow their modified procedures.

The second element of this policy option is to establish a set of performance measures (Stats) that document progress in adaptation to sea level rise and associated hazards. These measures might include topics identified in other policy options, such as progress on mapping infrastructure, integration of sea level rise and associated hazards into state, regional, and local planning,

Option Description

The Executive Order establishing the MD CCC recommended that state agencies incorporate and accommodate CCC findings where applicable. In order to advance action on key recommendations and promote integration of existing programs with recommendations, we recommend that each state agency be asked to report on their review the recommendations of the MD CCC and associated action plan. The report should address opportunities for integration with existing programs, actions initiated, new programmatic efforts, and barriers to response. Particular attention should be given to State and Local program implementation. These reports are to be submitted to the Governor, the Executive Committee, Cabinet members, and Committee Chairs with copies to the Commission on Climate Change. Information from these reports would support ongoing evaluation of MD’s efforts, capacities, and needs in addressing climate change mitigation and adaptation.

Reporting of performance measures (STATs) will be ...

Option Design

Targets: State agencies will each review CCC findings and recommendations and report to the Governor on their efforts to incorporate and accommodate findings.

Timing: Reports will be submitted within a year of publication of CCC Mitigation, Adaptation, and Science Working Group reports.

Parties Involved: All State agencies are expected to report and coordinate with local and regional partners as appropriate.

Other:

Implementation Mechanisms

Provide up to 1 paragraph describing how the option would be implemented. Specify whether implementation would be based on changes to existing rules/regulations, new legislation, provision of incentives, or other mechanisms.

Related Policies/Programs in Place

Provide up to 1 paragraph describing any existing or planned programs or policies that are complementary or reinforcing.

Estimation of Adaptation Benefits and Costs

Capital intensity:

Flexibility:

Adaptive capacity:

Other:

Documentation of Adaptation Benefits and Costs

Data Sources:

Quantification Methods:

Key Assumptions:

Key Uncertainties:

Additional Benefits and Costs

Feasibility Issues

Status of Group Approval

Barriers to Consensus

**FBEI-3. New Design Standards and Codes to Facilitate Retreat,
Avoid Sea Level Rise, and Increase Resilience**

Existing Built Environment is now leading the common option that includes these issues.

FBEI-4. Preserve Undeveloped, Vulnerable Lands

Now integrated with RRI option

FBEI-5. Create a Climate Change and Insurance Advisory Committee

Option Description

Insurance is a central, cross-cutting element to an overall adaptation strategy. It is clear that climate change is likely to affect virtually every segment of the insurance industry, and is also likely to have significant impacts on the financial condition of insurers and reinsurers, the ability to pay future claims, and hence on the availability and affordability of insurance to Maryland's citizens and businesses. The structure of insurance will shape social investments and the distribution of risks through society.

There are a number of approaches being discussed and tested in other states and many changes taking place in the industry, and in some cases the vulnerability of state insurance systems to climate change is becoming clearer. In Florida, for example, where 79% of insured property sits along the coast, homeowner insurance premiums have risen more than in any other state, with the average policy increasing by 88% between 2001 and 2006. Some insurance companies are no longer writing new coverage in the state.¹ In states that are insurers of last resort, the possibility of increasingly expensive or unavailable insurance coverage could pose significant problems for the state's financial and fiscal health as a whole.

Two measures in particular can help Maryland to assess its options for state regulation of insurance in the face of climate change. First, there is a need for information on the risks posed by climate change and how insurers and reinsurers are managing those risks. Second, it is important to have a focused assessment of this issue and a strategy for managing the ramifications of climate change risks and uncertainties. We recommend that the Governor establish an Insurance Advisory Committee to study and report on potential impacts of climate change on insurance in the state, the potential role for insurance in promoting environmental management goals, and address the relationship between changing building and design standards and insurance. We also recommend that the state Insurance Commission consider requiring insurers operating in the State of Maryland to disclose to their investors the risks posed by climate change, and what steps the companies are taking to manage those risks. At a minimum, the Commission could consider requiring disclosure of the steps taken to assess the impact of climate change in the state, the results of the assessment over various time periods (short term to long term), and the degree to which climate risks could affect the company's access to reinsurance, solvency, risks in its own investment portfolio, and possible effects on availability and affordability of coverage.

Option Design

There are two actions in this option:

¹ Environmental Defense, "Blown Away: How Global Warming is Eroding the Availability of Insurance Coverage in America's Coastal States," 2007.

1. Creation of an Independent Advisory Committee to advise the state insurance administration and the Governor of the risks that climate change poses to the availability and affordability of insurance for Maryland citizens and businesses; and
2. Require that the Advisory Committee study and report on the costs and benefits of requiring greater disclosure of the risks posed by climate change to investors on the part of all insurance companies operating in the State of Maryland.

Targets: TWG has begun conversations with insurance specialists in order to identify key issues that should be considered by such as commission.

Timing: The advisory committee should be established and provide an initial report back within a year.

Parties Involved: The Advisory Committee should be broadly representative and include members of the reinsurance industry, private and commercial insurance holders, insurance sector representatives and the Maryland Insurance Administration.

Other: As needed, identify other factors/parties that would need to be engaged for successful implementation of the option in the state.

Implementation Mechanisms

An advisory committee composed of staff from the MD Insurance Administration, MEMA, MDP and representatives from associated industries, such as insurance and reinsurance companies would meet to consider major issues. They would be expected bring in additional outside experts to inform their discussions on topics.

Related Policies/Programs in Place

Provide up to 1 paragraph describing any existing or planned programs or policies that are complementary or reinforcing.

Estimation of Adaptation Benefits and Costs

Capital intensity:

Flexibility:

Adaptive capacity:

Other:

Documentation of Adaptation Benefits and Costs

Data Sources:

Quantification Methods:

Key Assumptions:

Key Uncertainties:

Additional Benefits and Costs

Feasibility Issues

Status of Group Approval

Barriers to Consensus

FBEI-6. Integrated Geographic Information Systems: Mapping, Modeling and Monitoring

Option Description

Maryland's coast is particularly vulnerable to both episodic (i.e., hurricanes and Nor'easters) and chronic hazards associated with shore erosion, coastal flooding, storm surge, and inundation. These hazards are both driven by and exacerbated by climate change and sea level rise, which is occurring in the mid-Atlantic region at a rate nearly double the global average. Sea level rise poses a significant threat to resources and infrastructure in Maryland's coastal zone. As growth and development continues, especially within low-lying Eastern Shore communities, these impacts are likely to escalate.

In recognition of the State's vulnerability to sea level rise and its ensuing coastal hazards, Maryland's State Agencies have been aggressively acquiring and analyzing various data and technological resources (see Related Policies and Programs) to both gain a better understanding of sea level rise vulnerability and to increase the State and local government capacity to adapt and respond. To date, the State of Maryland has amassed a significant amount of data and undertaken state-of-the-art research, making Maryland a national leader in sea level rise modeling, research and response planning. However, more work is still needed.

Adaptation strategies for minimizing current and future risks to sea level rise and associated coastal hazards will depend on a full understanding of the extent of risks and vulnerabilities. To support this, the following additional data collection and modeling efforts are needed:

- Assess the status and capabilities of inundation and storm surge mapping and modeling efforts;
- Develop a strategy, along with financing options, for completing modeling and mapping on a state-wide basis at a scale appropriate for both state and local government needs;
- Adopt a maintenance schedule for updating mapping and modeling including the data necessary for both activities. This schedule should include, if practicable, anticipated costs, data sources, and increasing the accuracy of predicted results;
- Assure easy access to the comprehensive body of information necessary for planning and response activities by state and local governments;
- Develop pertinent data sets and mapping products at a scale relevant to state and local governments;
- Review institutional and organizational data management practices and make recommendations to enhance efficiency and cost effectiveness of data gathering, sharing, maintenance and processing efforts and to minimize duplication of effort and data redundancies;
- Create a digital, spatial inventory of potentially impacted infrastructure from sea level rise, including the identification of public and private systems and facilities and

threatened historical structures. This database should be maintained relative to emerging projected sea level rise findings;

- Undertake modeling and creation of geospatial coverages to reflect changing risks of SLR and associated coastal hazards; and
- Enhance the integration of data, research and technological capacity into State and local sea level rise adaptation and response planning efforts.

Option Design

Targets: The effort will provide comprehensive coverage for the state and assure regular updates of data, models, and maps. These maps will be made broadly accessible to professionals and public to support adaptation planning and understanding of risks and processes of change.

Timing: This effort will support the ongoing efforts of MDP, MDNR, MDE, and MHMH to integrate GIS data and improve data quality standards.

Parties Involved: MDNR, MDE, MDOT, MEMA, MDP and MHMH, MD iMap, MD State Geographic Information Committee (MSGIC), University System of Maryland

Other: As needed, identify other factors/parties that would need to be engaged for successful implementation of the option in the state.

Implementation Mechanisms

This effort will build on ongoing efforts of the MDNR, MDE, MDP, and MDH to improve the integration and data quality standards of their ongoing data acquisition, mapping and modeling efforts.

Work with the *Maryland State Geographic Information Committee (MSGIC)*: The Maryland State Geographic Information Committee (MSGIC) acts to promote coordinated development and efficient use of resources amongst all entities involved in the collection and/or use of spatial data and GIS technologies in Maryland.

Related Policies/Programs in Place

Over the past several years, the State of Maryland has directed substantial efforts toward advancing the State's understanding of sea level rise and coastal hazard vulnerability. The foundation of this understanding has been implementation of an aggressive strategy dedicated toward advanced technology, data and research acquisition and support.

Sea Level Rise Vulnerability: Recent data and research efforts of the Department of Natural Resources include: the completion of historic shoreline position maps; the statewide calculation of historic erosion rates; a comprehensive inventory of shoreline features and conditions for Maryland's coast; and a sea level rise economic cost study. Another major achievement for the State is the acquisition of LIDAR (LIght Detection And Ranging) high-resolution topography. Over a five-year time span, DNR worked with State and local partners to acquire high resolution

topographic data for the majority of the State's coastal counties including all of the Eastern Shore. This data is now being used to develop sea level rise inundation models that demonstrate both the impact of gradual sea level rise inundation over time, as well as impacts associated with increased storm surge from episodic flood events. Sea level rise modeling has been completed for Worcester County (<http://www.dnr.state.md.us/Bay/czm/wcslrreport.html>), Dorchester County, and pilot areas within Anne Arundel and St. Mary's Counties. Recently, *Sea Level Rise Vulnerability Maps* have been created for all coastal counties, depicting lands (i.e., 0-2'; 2 - 5' and 5 - 10') about mean sea level.

Maryland Shorelines Online: To provide ready access to the data and information discussed above, the Maryland Coastal Program, in cooperation with Towson University, developed an Internet portal, titled Maryland Shorelines Online (<http://shorelines.dnr.state.md.us/>). The portal provides information and tools to coastal managers and decision makers, educators, and the public on sea level rise, coastal hazards and shoreline management. This site houses information on Maryland's legal framework, permitting and regulatory guidance, educational materials, assessments, and spatial decision support tools for shore erosion and sea level rise. The tools provided on the website allow for the identification of potential shoreline protection and restoration options throughout the State to mitigate hazards and enhance natural shoreline habitat.

Coastal Bays Hazards Initiative: In February 2004, the Coastal Bays Policy Committee charged the Department of Natural Resources, Coastal Program, with the task of assembling a Work Group to investigate the need and opportunities for better coordination of coastal hazards issues. In particular, recommendations were to be developed on how to promote the use of new tools and developing technologies at the local level to assist in visualizing hazards and local vulnerability.

Recent developments in data gathering, information management, and planning tools have crossed technological thresholds that have greatly enhanced the ability to do desktop planning for hazard response and mitigation. To effectively achieve the efficiencies that the employment of these new technologies and tools offers, a better understanding is needed of local government technology requirements, mechanisms to increase coordination and leverage available resources. This Final Report identifies some of the hurdles to implementation and lays the groundwork for expanding application of the products and tools statewide. Specific recommendations provided in the report focus on: 1) means for incorporating, developing, processing, and formatting data for decision makers, 2) identifying capacity building opportunities and needs, 3) recognizing responsibilities and coordination, 4) technical support, and 5) financial assistance.

Floodplain Map Modernization: The Maryland Department of the Environment (MDE) Business Plan for Map Modernization (2004-2008) outlines the State's vision for modernization of the State's flood studies and maps. Maryland's vision for floodplain management is closely coupled with its vision for map modernization. MDE seeks to reduce costs associated with traditional detailed studies by developing a new set of "live" studies (digital verses paper product), which can be modified as watershed conditions change. Any proposed changes can be modeled to keep the maps current as permits are issued. LIDAR data is being used to develop the more accurate map products. [Note: Need to update – send to MDE.]

Surge Inundation Mapping: LIDAR data has also been used by the U.S. Army Corps of Engineers to develop surge inundation models for Maryland's Eastern Shore Counties. These counties are the lowest areas in the State and some areas are experiencing significant growth pressures. The maps are essential in expanding our knowledge of potential impacts and identifying vulnerable communities and infrastructure. These maps have been provided to local comprehensive planning and emergency management offices. Extension of these mapping efforts into all coastal counties is needed and under consideration. [Note: Need to update – send to MEMA.]

Local Hazard Mitigation Plans. In November 2004, the Maryland Emergency Management Agency (MEMA) completed the Maryland State Hazard Mitigation Plan (SHMP) and associated mapping pursuant to regulations established by the Disaster Mitigation Act (DMA) of 2000. The goal of the SHMP is to reduce the loss of life and property damage associated with hazard events in Maryland. MEMA complied with this priority as considerable effort has been put forth to map state-owned and critical facilities, as well as the hazard areas for eleven other hazards. The most important aspect of this mapping effort was the identification of facilities, total populations at risk, and vulnerable populations at risk within hazard areas. The data sets and mapping effort will continue to evolve and improve as new data and technologies become available. MEMA considered historic shoreline changes data during the development of the SHMP, which was then used by local governments as the baseline/starting point of information for local hazard mitigation planning activities.

HAZUS-Multi Hazard (MH): HAZUS is a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. HAZUS-MH estimates damage before, or after, a disaster occurs and takes into account various social and economic impacts of a hazard event. MDE partnered in {insert year} with Salisbury University to complete a statewide analysis of flood vulnerability estimated through the HAZUS-MH flood module. The Level One analysis completed in June 2005, estimates flood damage from a 100-year coastal or riverine flood event to commercial and residential properties. This study takes the next step from identifying flood vulnerability to understanding the risk to the built environment. The final report, "An Assessment of Maryland's Vulnerability to Flood Damage" is now available. [Note: Need to update – send to MDE and MEMA.]

Emergency Management Mapping Application (EMMA). EMMA was developed by Towson University Center for Geographic Information Science (CGIS) in cooperation with Maryland Emergency Management Agency. EMMA is an incident response tool for the emergency management community to display relevant information before, during, and after an incident occurs. As a web-based mapping application, EMMA enables the emergency responders to identify incident locations from the field, generate location-specific reports, visualize incident locations via a map, perform site-specific analysis, and coordinate response efforts. Using a simple Web browser, such as Internet Explorer, EMMA provides basic and advanced tools for map visualization, location analysis, and report generation.

Sea, Lake and Overland Surges from Hurricanes (SLOSH): SLOSH is a computer program available to the emergency management and planning communities. SLOSH is housed and utilized in the State and local emergency operations centers to identify storm surge impacted

areas and determine evacuation routes. SLOSH, a computerized model developed by the National Hurricane Center (NHC), assists Maryland's emergency management and response communities in estimating storm surge heights and winds resulting from historical, hypothetical, or predicted hurricanes by taking into account a storm's pressure, size, forward speed, track and wind. During tropical Storm Isabel, communication of the surge predictions from SLOSH for the Chesapeake Bay were not accurately translated and transferred to the public.

Hurricane Evacuation Tool (HURREVAC): HURREVAC is a computer program that is available to the emergency management and planning communities through the National Hurricane Center. HURREVAC automatically tracks hurricane related information and displays the results graphically. The program is utilized in the State's Emergency Operation Center (EOC) housed at MEMA to assist in determination of evacuation options and routes. HURREVAC utilizes current and forecast storm data and displays the track of the storm in various formats. The program derives the potential for storm surge and calculates evacuation times based on storm speed and intensity. It can also be used as a "what-if" tool to help decision makers determine courses of action for different storm characteristics.

Maryland State Geographic Information Committee (MSGIC): MSGIC acts to promote coordinated development and efficient use of resources amongst all entities involved in the collection and/or use of spatial data and GIS technologies in Maryland. The Committee is crucial in promoting coordinated development and efficient use of resources amongst all entities involved in the collection and/or use of spatial data and GIS technologies in Maryland. Most recently MSGIC has focused on interoperable practices and standards, which relate to the "capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units" (MSGIC website). The Maryland Mapping Resource Guide lists projects addressing parcel mapping, tax maps, emergency management support, floodplain mapping, and other projects, including several at the county level.

MD iMap: The Maryland Statewide Basemap (Maryland's iMap or MD iMap) is an Internet-based interactive map suitable for use by state agencies, local governments and the public. It will provide access to standardized information (imagery, roads, streams, place names, property information, etc) that will serve as a base that other data can be overlaid, such as the locations of features or resources at risk from SLR or predicted water levels from storm surge modeling. Anticipated deployment of Phase I is Spring 2008.

Estimation of Adaptation Benefits and Costs

Capital intensity:

Flexibility:

Adaptive capacity:

Other:

Documentation of Adaptation Benefits and Costs

Data Sources:

Quantification Methods:

Key Assumptions:

Key Uncertainties:

Additional Benefits and Costs

Feasibility Issues

FBEI-7. Evaluate Shoreline Protection Structures

This option is incorporated into a common option lead by the EBEI TWG.

FBEI-8. Economic Development Initiative

Option Description

As Governor O'Malley stated in testimony before the U.S. Senate Environment and Public Works Committee in September 2007... "We must transition from a carbon-based economy to a green, sustainable economy." As we face the inevitable impacts of climate change in the coming years, adapting to sea level rise and associated coastal hazards with entail considerable costs to our residents and our economy. However, the flip side of these challenges will be the economic opportunities provided by the creation of "green collar" jobs within the new "green" economy. The State of Maryland must take the initiative and adopt a leadership role by facilitating development of both the workforce knowledge, skills and expertise and the business (commercial, industrial, financial) platform that will be necessary to take advantage of these new opportunities.

Option Design

Targets: Establish MD as a leader in the new "green" economy by increasing by 20% by 2015 both: 1) the gross state product of businesses within the State that provide products or services related to sustainability; and 2) the amount of investment within the State in products and services related to sustainability.

Timing: 20% increase by 2015; 50% increase by 2030.

Parties Involved:

MD Department of Business and Economic Development
MD Economic Development Corporation
MD Department of Environment
MD Office for a Sustainable Future (within Department of Natural Resources)
MD Green Building Council (standing commission created by legislature)
MD Sustainability Sub-Cabinet
MD University System
Baltimore Development Corporation
MD Association of Counties
MD Chapter of National Federation of Independent Business (NFIB) – small business advocacy organization
Financial Community – banks, investment firms, pension funds
Clean Energy Partnership – MD-based non-profit that organizes businesses in support of practical solutions to global warming

Other:

Implementation Mechanisms

Develop new sustainability curricula and R&D (research and development) programs within the State University System.

Create business incubator within the State University System to provide technological support and outreach to green businesses.

Provide targeted education and training to prepare the labor force.

Provide tax credits or other tax incentives for green businesses.

Undertake communications campaign to market Maryland as a “green collar state” receptive to new green businesses.

Target state pension plans to in-state investments.

Subsidize the production of cellulosic biomass in the agricultural and forestry industries.

Increase Renewal Portfolio Standard (RPS) requirements for utilities; broaden requirement to include energy efficiency along with renewable.

Emissions brokering, offset credits/allowances, and other economic opportunities generated by MD participation in Regional Greenhouse Gas Initiative (RGGI) cap-and-trade system; provide tradeable credits for green buildings, agricultural sequestration and other GGH mitigation mechanisms under cap-and-trade system.

Incorporate monitoring and improvement of sustainability performance metrics for state agencies under new Department of Information Technology (see Governor’s 2008 Legislative Agenda).

Create sustainability “revitalization and incentive zones” similar to, or incorporated within, new BRAC R&I Zones (see Governor’s 2008 Legislative Agenda).

Related Policies/Programs in Place

Baltimore Development Corporation, MD Dept of Business and Economic Development; MD Energy Administration; MD Economic Development Corporation

Estimation of Adaptation Benefits and Costs

Capital intensity:

Flexibility:

Adaptive capacity:

Other:

Documentation of Adaptation Benefits and Costs

Data Sources:

Quantification Methods:

Key Assumptions:

Key Uncertainties:

Additional Benefits and Costs

Feasibility Issues

Status of Group Approval

Barriers to Consensus