Coastal Hazards

Section 309 Enhancement Objective
Prevent or significantly reduce threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level change

Resource Characterization
Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.

1. **Characterize the level of risk in the coastal zone from the following coastal hazards:**

   (Risk is defined as: "the estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." ***Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA 386-2. August 2001*****)**

Type of hazard	**General level of risk** (H,M,L)	**Geographic Scope of Risk (Coast-wide, Sub-region)**
Flooding	H	Coast-wide
Coastal storms, including associated storm surge	H	Coast-wide
Geological hazards (e.g., tsunamis, earthquakes)	L	Coast-wide
Shoreline erosion (including bluff and dune erosion)	H	Coast-wide
Sea level rise and other climate change impacts	H	Coast-wide
Land subsidence	M	Sub-region

2. **For hazards identified as a high level of risk, please explain why it is considered a high level risk. For example, has a risk assessment been conducted, either through the State or Territory Hazard Mitigation Plan or elsewhere?**

Flooding

There is a high risk of flooding in the coastal zone due to generally low elevations and flat topography. These natural conditions are exacerbated by development encroachment on waterways and coastlines, as well as impervious surfaces associated with development. Additional flooding in the coastal zone is associated with riverine flooding and the loss of non-tidal wetlands. Flood risk in Virginia's coastal zone is documented on FEMA Flood Insurance Rate Maps, and has been assessed through the state Hazard Identification and Risk Assessment

planning process as well as through local and regional hazard mitigation plans as required under the Disaster Mitigation Act of 2000.

Coastal storms

Coastal storms such as hurricanes, tropical storms, and nor'easters present a high level of risk in the coastal zone due to Virginia's position on the eastern seaboard. Some areas of the coastal zone will flood in any storm, while the threat to other areas is storm-specific. Vulnerability to coastal storms has been assessed through local and regional mitigation plans.

Shoreline erosion

Shoreline erosion presents a high risk in the coastal zone. Virginia has a large amount of shoreline along both the Chesapeake Bay and Atlantic Ocean, as well as along numerous tidal creeks. Areas with more open fetch are particularly vulnerable to shoreline erosion. Sea level rise and boat traffic are other factors that have led to increased erosion along Virginia's shoreline. Detailed shoreline evolution reports have been prepared for several coastal localities by the Shoreline Studies Program at the Virginia Institute of Marine Science, and reports for several other localities are planned. These evolution reports are developed using historical and current aerial images. Additionally, the Center for Coastal Resources Management at the Virginia Institute of Marine Science has prepared shoreline inventories for some areas. These inventories were conducted through on-the-ground documentation of current conditions.

Sea level rise and other climate change impacts

Sea level rise presents a high risk in Virginia's coastal zone, and is of particular concern locally in part due to post-glacial rebound. During the last glacial maximum, the weight of the ice caused depression of the earth's surface in northern North America, while un-glaciated areas further south experienced some uplift. Since the end of the glacial period, previously glaciated areas in the north have experienced rebound or uplift, while other areas such as Virginia have experienced downward movement and decreasing elevations above sea level. Sea level rise is capable of exacerbating flooding, shoreline erosion, and the effects of coastal storms. Sea level rise has been documented by NOAA tide gauges, which indicate that sea level rise in the Chesapeake Bay is occurring at twice the global average rate.

3. If the level of risk or state of knowledge of risk for any of these hazards has changed since the last assessment, please explain.

The state of knowledge of risk has improved for many of these areas since the last assessment due to the completion and/or updates of state, regional, and local hazard mitigation plans. Scientific data regarding sea level rise and its potential impacts has become more common, and the issue is now more commonly discussed in planning at the state and local level than at the time of the previous assessment. For instance, the issue was addressed in the report from the Governor's Commission on Climate Change, released in December 2008, and has been addressed in some local comprehensive plans and emergency management plans The Virginia

CZM Program has provided three years of funding to three coastal regions to examine these issues and develop local responses to anticipated sea level rise and storm surge. The Northern Virginia, Middle Peninsula and Hampton Roads regions have each assembled advisory workgroups of relevant stakeholders. In addition to various mapping and data gathering initiatives, the groups have each developed a regional framework for local policy to deal with coastal hazards, working in concert with the hazard mitigation planning process. The public's awareness of climate change impacts such as sea level rise and frequency and intensity of storms has also increased, in part because of communication strategies developed through these regional efforts.

Some major insurance companies have reacted to climate change trends as well, and will no longer write new property insurance policies in parts of Virginia's coastal zone. The companies limiting new policies in Virginia's coastal zone represent 55% of the private insurance providers in the mid-Atlantic region of the United States. Other insurers have chosen to increase deductibles for damage caused by coastal storms.

A November 2009 nor'easter caused extensive flooding and damage equivalent to a Category 1 hurricane in the Hampton Roads region of Virginia. Seven homes were destroyed and 166 sustained major damage. Virginia Dominion Power reported that approximately 357,000 customers in Hampton Roads and the Richmond area lost power as a result of the storm. Additionally, six deaths were indirectly attributed to the storm. Preliminary damage estimates suggested over $50 million in individual assistance and more than $18 million in public assistance. President Obama has declared the event a major disaster, making the region eligible for federal disaster aid.

4. Identify any ongoing or planned efforts to develop quantitative measures of risk for these hazards.

In 2008, three planning districts in the coastal zone were awarded grant funds from the Virginia CZM Program to carry out climate change adaptation studies. These assessments are being conducted by the Northern Virginia Regional Commission, Middle Peninsula Planning District Commission, and Hampton Roads Planning District Commission. The Northern Virginia Regional Commission project involves conducting a sea level rise risk assessment for the region and uses LIDAR data to map various sea level rise scenarios. The Middle Peninsula PDC project seeks to quantify and qualify the anthropogenic and ecological impacts of climate change from an economic perspective. The Hampton Roads PDC project involves collection and analysis of information on climate change and associated ramifications, identification of data gaps and areas for future study, presentations and discussions to facilitate prioritization of climate change issues, and development of a framework for mitigating and adapting to climate change within the region.

FEMA is in the process of updating its Flood Insurance Rate Maps, which will provide an updated and more accurate quantitative measure for flooding. Additionally, a few localities are obtaining LIDAR data. This detailed elevation data is useful for accurately identifying flood-prone areas and estimating the impacts of storm surge and sea level rise. However, complete,

consistent, and accurate LIDAR data is needed for the entire coastal zone in order to effectively quantify these risks.

The Virginia Institute of Marine Science, funded through the Virginia CZM Program, has completed detailed shoreline evolution reports for several coastal localities. Similar reports for some other localities are planned or currently being conducted. Additionally, shoreline inventory reports have been conducted for several localities.

The Shoreline Studies Program at the Virginia Institute of Marine Science, funded through a grant from the National Fish and Wildlife Foundation, is currently developing a Shoreline Management Plan for Mathews County, VA. This plan will make specific recommendations for eroding shorelines throughout the county, and will include cost estimates for recommended management strategies.

The Center for Coastal Resources Management at the Virginia Institute of Marine Science conducted a study of tidal wetlands for the Lynnhaven River watershed in southeast Virginia, using a simplistic geospatial elevation model to quantify the potential loss of wetlands under various sea level rise scenarios. The study revealed that using conservative estimates of sea level rise, nearly all tidal wetlands would be lost by the year 2100. This study documents where and how much potential loss of both wetlands and upland land area could be experienced given current and projected rates of sea level rise.

The Center for Coastal Resources Management at the Virginia Institute of Marine Science conducted a study of shallow-water tidal habitats and their vulnerability to climate change. The study used a model that incorporated anticipated sea level rise, water temperature and salinity projections, and coastal development in order to forecast the distribution of key coastal habitats within the next 50 to 100 years. The project was intended to inform management and planning efforts by identifying areas at significant risk for changes to habitat components, as well as areas with significant potential to support critical habitat components in the future. Maps were created that depict the projected threat to shallow-water and tidal wetlands, tidal marshes, estuarine beaches, submerged aquatic vegetation, and vulnerable developed lands. These maps, as well as the final report from the project, can be accessed from the following site: http://ccrm.vims.edu/research/climate_change/index.html.

Under the Disaster Mitigation Act of 2000, localities are required to have hazard mitigation plans in place in order to apply to federal non-emergency disaster funds. These plans are in place in Virginia's coastal localities and are updated in accordance with the Act. Several coastal localities are planning to begin updating these in 2010.

The Virginia Department of Emergency Management (VDEM) has created storm surge hazard maps for more than 20 coastal localities. The maps identify areas which would be inundated during Category 1, 2, 3, and 4 hurricanes. These maps are based on data from the 2008 Hurricane Evacuation Study, a joint effort by VDEM, FEMA, the U.S. Army Corps of Engineers, and coastal localities. These maps, except for those for northern Virginia localities, are available at: http://www.vaemergency.com/threats/hurricane/stormsurge.cfm.

5. **(CM) Use the table below to identify the number of communities in the coastal zone that have a mapped inventory of areas affected by the following coastal hazards. If data is not available to report for this contextual measure, please describe below actions the CMP is taking to develop a mechanism to collect the requested data.**

Type of hazard	**Number of communities that have a mapped inventory**	**Date completed or substantially updated**
Flooding	80	Varies
Storm surge	27	2008-ongoing
Geological hazards (including Earthquakes, tsunamis)	18	Varies
Shoreline erosion (including bluff and dune erosion)	37	Varies
Sea level rise	30	2009-2010
Land subsidence	0	N/A

Management Characterization

Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.

1. **For each of the management categories below, indicate if the approach is employed by the state or territory and if significant changes have occurred since the last assessment:**

Management categories	**Employed by state/territory** (Y or N)	**Significant changes since last assessment** (Y or N)
Building setbacks/ restrictions	Y	N
Methodologies for determining setbacks	Y	N
Repair/rebuilding restrictions	Y	N
Restriction of hard shoreline protection structures	N	N
Promotion of alternative shoreline stabilization methodologies	Y	Y
Renovation of shoreline protection structures	N	N
Beach/dune protection (other than setbacks)	Y	Y
Permit compliance	Y	N
Sediment management plans	Y	Y
Repetitive flood loss policies, (e.g., relocation, buyouts)	Y	N
Local hazards mitigation planning	Y	Y
Local post-disaster redevelopment plans	N	N
Real estate sales disclosure requirements	Y	N

Management categories	**Employed by state/territory** (Y or N)	**Significant changes since last assessment** (Y or N)
Restrictions on publicly funded infrastructure	N	N
Climate change planning and adaptation strategies	Y	Y
Special Area Management Plans	Y	Y
Hazards research and monitoring	Y	Y
Hazards education and outreach	Y	Y

2. **For management categories with significant changes since the last assessment provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference rather than duplicate the information.**
   a) **Characterize significant changes since the last assessment;**
   b) **Specify if it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts; and**
   c) **Characterize the outcomes and effectiveness of the changes.**

Promotion of alternative shoreline stabilization methodologies

The Virginia Institute of Marine Science has promoted living shorelines through shoreline management planning, funded through a variety of sources including the coastal program, Chesapeake Bay Trust, and National Fish and Wildlife Foundation. Living shorelines allow wetlands to migrate inland with rising sea levels. As a result of shoreline management planning efforts, the number of permits issued for living shorelines has increased. In 2008, VIMS received a grant from the Virginia CZM Program to develop a living shoreline design and construction guidance manual.

The Virginia Marine Resources Commission, also with funding assistance from the Virginia CZM Program, has recently revised its Tidal Wetlands Mitigation Policy to ensure that even small impacts to wetlands receive adequate compensation. The Virginia CZM Program has also worked with VIMS to provide better data for individual shoreline management decisions by funding county shoreline inventories and shoreline evolution studies as described above. During the five year period since the previous assessment, the Virginia CZM Program has provided approximately $800,000 in funding for projects related to alternative shoreline stabilization and shoreline management.

Beach/dune protection (other than setbacks)

In February 2008, changes to the Coastal Primary Sand Dunes and Beaches Act (§ 28.2-1400-1420) were approved by the Virginia General Assembly. Under the original Act, nine localities were permitted to enact a primary sand dune zoning ordinance and require permits for activities impacting dunes and beaches. The recent changes expand the number of coastal localities

permitted to do this to more than 45. The legislative changes are result of research funded by the Virginia CZM Program.

Sediment management plans

A shoreline management plan for Mathews County, VA is currently being conducted by the Shoreline Studies Program at the Virginia Institute of Marine Science. This study is funded by the U.S. Army Corps of Engineers.

Repetitive flood loss policies

No significant change. Areas of Gloucester County that experience persistent flooding were recently purchased by the county using FEMA grant funds. The VA Department of Emergency Management also gives grants to communities for buyouts of repetitively flooded properties. Additionally, there has been increased usage of FEMA repetitive loss funds in Virginia's coastal zone in recent years because of major storms such as Hurricane Isabel in 2003 and Hurricane Ernesto in 2006.

Local hazard mitigation planning

Hazard mitigation plans have been prepared for Virginia localities as required by the Disaster Mitigation Act of 2000. Many initial plans were completed after the 2005 coastal assessment, and plans are updated in accordance with the Act. Several Virginia localities are planning to begin updates in 2010. These plans address hazards such as coastal storms, flooding, and shoreline erosion. They assess vulnerability to these hazards and identify mitigation strategies.

Climate change adaptation and strategies

As discussed above, three planning districts in the coastal zone were awarded grants from the Virginia CZM Program to perform climate change adaptation studies. Additionally, the final report of the Governor's Commission on Climate Change, released in December 2008, includes recommendations for adaptation to unavoidable impacts of climate change. Recommendations set forth in the report include incorporating sea level rise and storm surge into planning efforts for coastal zone localities, and promoting living shorelines to increase the adaptability of tidal wetlands to rising sea levels.

Additionally, the Virginia CZM Program has recently funded numerous projects related to living shorelines and promoting alternative shoreline stabilization strategies. These projects are described above (under "promotion of alternative shoreline stabilization methodologies"). These accomplishments have laid the groundwork for further promotion of living shorelines and shoreline management planning during the next five years through a series of projects to be funded under Virginia's Section 309 program.

Special Area Management Plans

Special Area Management Plans (SAMPs) are used in Virginia, but their primary purpose is not hazard management. For more information on the use of SAMPs in Virginia's coastal zone, refer to the SAMP section of this assessment.

Hazards research and monitoring

Several hazards research and monitoring initiatives are described above. Additionally, the Virginia CZM Program funded efforts by the Virginia Institute of Marine Science (VIMS) to measure dune and beach changes. The findings of this study were published in a March 2009 report entitled "Dune Monitoring Data Update Summary, available at: http://web.vims.edu/physical/research/shoreline/docs/Dune_Monitoring_Update.pdf.

Another ongoing project at VIMS has involved using computer modeling to provide street-level predictions of storm surge flooding along the Chesapeake Bay shoreline. Project leaders estimate that street-level predictions will be possible within five years. Emergency managers will then be able to use this information to alert individual neighborhoods about appropriate protective measures and possible evacuation during hurricanes and nor'easters. This project is not funded by the Virginia CZM Program.

Hazards education and outreach

The VA Department of Transportation, VA Department of Emergency Management, and Hampton Roads Emergency Management Committee published a Virginia Hurricane Guide, which includes basic information about hurricanes as well as evacuation procedures, public shelters, an emergency kit checklist, and a list of additional resources. This brochure was released in early 2009 and is available at: http://www.vaemergency.com/threats/hurricane/2010_Va_Hurricane_Evacuation_Guide.pdf.

In September 2009, the Virginia Institute of Marine Science published a brochure called "A Guide to Shoreline Management Planning for Virginia's Coastal Localities" using funds from the Virginia CZM Program. The guide is available at: http://web.vims.edu/physical/research/shoreline/docs/ShoreMan_Brochure.pdf.

The Virginia Department of Environmental Quality (DEQ) received a grant from the Virginia CZM Program in 2009 that will fund climate change education for the general public. DEQ will develop a brochure listing ten things Virginians can do in their everyday lives to help reduce greenhouse gas emissions. This publication was recommended in the report from the Governor's Commission on Climate Change. Additionally, DEQ will develop a climate change-related curriculum for environmental educators, including a PowerPoint, handouts, and speaker notes.

3. **(CM) Use the appropriate table below to report the number of communities in the coastal zone that use setbacks, buffers, or land use policies to direct development away from areas vulnerable to coastal hazards. If data is not available to report for this**

contextual measure, please describe below actions the CMP is taking to develop a mechanism to collect the requested data.

For CMPs that use numerically based setback or buffers to direct development away from hazardous areas report the following:

Contextual measure	Number of communities
Number of communities in the coastal zone required by state law or policy to implement setbacks, buffers, or other land use policies to direct development away from hazardous areas.	All communities in Virginia's coastal zone are required to implement a 100 foot buffer from all perennial waters under the Chesapeake Bay Preservation Act
Number of communities in the coastal zone that have setback, buffer, or other land use policies to direct development away from hazardous areas that are more stringent than state mandated standards or that have policies where no state standards exist.	Four

For CMPs that do not use state-established numerical setbacks or buffers to direct development away from hazardous areas, report the following:

Contextual measure	Number of communities
Number of communities in the coastal zone that are required to develop and implement land use policies to direct development away from hazardous areas that are approved by the state through local comprehensive management plans.	N/A
Number of communities that have approved state comprehensive management plans that contain land use policies to direct development away from hazardous areas.	N/A

<u>Priority Needs and Information Gaps</u>

Using the table below, identify major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy). If necessary, additional narrative can be provided below to describe major gaps or needs.

Gap or need description	**Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach)	**Level of priority** (H,M,L)
LIDAR elevation data and more accurate		

mapping of flood risk areas	Data	H
Shoreline management planning	Policy, Data, Capacity, Communication/outreach	H
State level policy and guidance for integrating climate change adaptation into local planning; Enabling legislation for localities to take action. Action on the part of high risk areas (those with LiDAR) to integrate hazard planning more comprehensively into land use planning and take steps to mitigate the potential impacts of increased hazards from Climate Change and SLR.	Policy, Communication/outreach	H
Outreach and education for general public regarding sea level rise and other climate change impacts	Communication/outreach	M
LIDAR professional at the state level to provide training for other state and local employees	Capacity	M
Collaboration of emergency managers and land use planners on coastal hazards issues	Communication	M
Continued research on climate change impacts for improved planning	Data, Capacity	M
Continued outreach to residents in high risk areas	Communication/outreach	M
Increased staff capacity at the local level to monitor and enforce compliance with building restrictions and other regulations	Capacity	M
Funding for state and/or local purchase of high risk properties to prevent further development	Capacity	M
Elevated priority of coastal hazards issues among the general public	Communication/outreach	M
Continued research and monitoring related to tidal wetlands and living shorelines	Data, Capacity	M

A high priority data gap that exists in Virginia's coastal zone is LIDAR data. There is a need for consistent, high-resolution elevation data across the entire coastal zone in order to better identify areas prone to flooding, storm surge, and sea level rise. Most current hazard maps are based on topographic maps and Digital Elevation Model data, which are course-grained in nature and cannot produce maps that are as detailed and accurate as those produced using high-resolution LIDAR data. Three coastal localities in Virginia – Virginia Beach, Alexandria, and Poquoson – have independently obtained LIDAR data. Additionally, the Northern Virginia Regional

Commission (NVRC) was able to acquire LIDAR data from the U.S. Department of Defense specifically for use in the CZM-funded climate change adaptation project discussed above. However, NVRC is permitted to use this data only for map production and cannot share the data layers with localities. There is a need for state-funded acquisition of LIDAR data for the entire coastal zone. Other coastal states, such as Maryland, have funded coast-wide LIDAR acquisition.

Shoreline management planning is a high priority need as well. The Virginia CZM Program has invested heavily in this area since the last assessment and plans to continue doing so during the next five year period. Major work is needed on shoreline management to reduce shoreline erosion and loss of wetlands through the development of living shorelines. Shoreline management planning includes assessment of underlying geology and morphology, quantifying historic and recent shoreline change, mapping existing structures and current shore conditions, assessing existing marine resources, analyzing general wave climate, analyzing storm surge and sea level rise, and developing site-specific shore management strategies. Before effective shoreline management plans can be developed, shoreline evolution reports and shoreline inventories such as those described above need to be completed for all communities under the plan, in order to recommend the appropriate suite of shore protection strategies. Results of current research on living shorelines will add to the knowledge base for developing shoreline management plans. Shoreline management plans provide a venue to make recommendations geared toward implementation of living shorelines where appropriate.

Another high priority need is state level policy and guidance for localities on integrating climate change adaptation strategies into local planning. Virginia is a Dillon's Rule state, meaning that localities have only powers that are expressly granted to them through state-level enabling legislation. Virginia localities often will not or cannot act independently of the state or go beyond state-mandated minimum requirements. Thus, there is a need for state-level enabling legislation so that localities which desire to go beyond state requirements for climate change-related planning and policy may do so. Some localities have begun to incorporate climate change considerations into their comprehensive plans. All Virginia localities, especially those in the coastal zone, should be required to do this. Additionally, the state should provide guidance to localities for developing locally appropriate policies and programs related to climate change mitigation and adaptation.

When educating local officials and community members about climate change, it is important to do so in a locally appropriate manner. In Virginia, attitudes about climate change may vary greatly among different regions. In the Hampton Roads region, local officials are currently very interested in learning about climate change and how to communicate the issue to citizens. This is largely due to the impacts of the November 2009 nor'easter discussed earlier in this section. Similarly, in northern Virginia, planning for sea level rise is on the radar for local officials and hazard mitigation planning is becoming more common. In the more rural Middle Peninsula region, however, many citizens are still highly skeptical of climate change or believe that it is not an issue that should be dealt with by local governments. Addressing public apathy is an important issue in the Middle Peninsula region.

Enhancement Area Prioritization

1. What level of priority is the enhancement area for the coastal zone (including, but not limited to, CZMA funding)?

High	✓
Medium	_____
Low	_____

Briefly explain the level of priority given for this enhancement area.

The interagency Coastal Policy Team reviewed and ranked this issue at its February 17, 2010 meeting according to the following criteria: feasibility; importance and appropriateness. Up to 5 points were allotted to each of the three criteria so that a maximum score would be 15. Scores from 0-4.99 are considered low priority; 5–9.99 is medium priority and 10-15 is high priority. Coastal Hazards received a score of 12.04.

2. Will the CMP develop one or more strategies for this enhancement area?

Yes	_____
No	✓

Briefly explain why a strategy will or will not be developed for this enhancement area.

The highest priority need identified in the strategy was for high resolution elevation data for the entire coastal zone. LIDAR data for some localities is currently being developed and other localities are likely to acquire this data during the upcoming strategy period. Shoreline management planning was also identified as a high priority, but is being addressed as a Cumulative and Secondary Impacts Strategy. Enabling legislation for localities to address climate change was identified as the third high priority, but in discussion with strategy workgroup members it was decided that this would not be a major impediment to local action. Based on these issues, it was decided that a Coastal Hazards strategy was not necessary.

2000 Assessment		2005 Assessment		This Assessment (2010)	
High	✓	**High**	✓	**High**	✓
Medium	___	Medium	___	Medium	___
Low	___	Low	___	Low	___