Outcome: Monitoring and Assessment

Goal: Climate Resiliency

Outcome: Continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects.

Management Approach: Assess past and future trends in sea level, precipitation patterns, temperature and ecosystem response

Key Action (Description of work/project)	**Performance Target(s)** (Incremental steps to achieve Key Action)	**Participating Entity**	**Geographic Location**	**Timeline** (completion date: month & year)	**Factors Influencing and/or Gap**
Establish guidance of the application of climate change scenarios, projections and realizations for Chesapeake Bay Program assessments.	Facilitate a workshop to evaluate applicability of international, national, regional and state climate scenarios, projections, forecasts and assessments and to develop process for establishing a recommended set of climate projections for use in Chesapeake Bay Program assessments.	STAC	Watershed	Feb-16	Climate science
Conduct a literature review and synthesis of latest scientific research on past and future climate change impacts on the Chesapeake Bay, as was done in the 2008 Scientific and Technical Advisory Committee report.	Assess international, national, regional and state-level (DE, MD, PA, WV, VA, NY, DC) climate change assessments.	STAC, STAR, Climate Resiliency Workgroup, PA, MD, DE, DC	Watershed	Dec-17	Vulnerability of the watershed
	Report on PA Climate Impacts and Assessment, a report that is required to be updated every 3 year. PSU researchers have been contracted to provide an assessment report to PA DEP. The most current report was updated in August 2015.	PA DEP	Pennsylvania	2016-2017	Vulnerability of the watershed
	Synthesize latest scientific research on sea level and water level trends; precipitation and evapotranspiration; and temperature change in both air and water	STAC, STAR	Watershed	Dec-17	Climate science
	Review USACE regional literature synthesis for the mid-Atlantic region available online at http://www.corpsclimate.us/docs/rccvarreports/USACE_REGION_02_Climate_Change_Report_CWTS-2015-09_Lo.pdf..	USACE	Watershed	Dec-17	Climate science
Assess Chesapeake Bay (CB) climate sensitivity, utilizing CB National Estuarine Research Reserve (NERR), National Weather Service and other data sets. Assessment will be informed by direct engagement with staff from MD and VA CB NERRS staff.	Analyze available climate monitoring and climate sensitive data on extreme events to document past trends and impacts. Analyze climate model projections similarly to predict future. Use CB NERRS data in conjunction with other available data to tell specific stories about climate impacts on NERRS. Develop climate change chapter for Chesapeake Bay Ecosystem Atlas for use in formal and informal education.	MD and VA Chesapeake Bay National Estuarine Research Reserve, Chesapeake Environmental Communications, University of Maryland Center for Environmental Science, NOAA/National Centers for Coastal Ocean Science	Chesapeake Estuary	Oct-16	Climate science
Gain a better understanding of past and future impact of ocean acidification on Chesapeake Bay waters.	Convene federal, state and regional experts along with academic partners to assess current knowledge surrounding ocean acidification trends within the Chesapeake Bay.	Climate Resiliency Workgroup; Fisheries GIT; Maryland Dept. of Natural Resources	Chesapeake Bay	Dec-17	Climate Science
	Use a combination of field, experimental and biogeochemical modeling to delineate contributions of atmospheric and eutrophication drivers to Chesapeake Bay acidification. Identify shellfish restoration areas most and least prone to acidification, and future impacts to long-term oyster restoration goals. Quantify carbonate and nutrient exchange between oyster reefs and surrounding waters and observe the change in those fluxes as a result of reef structures and acidification.	UMCES/CBL (NOAA Ocean Acidification Program)	Chesapeake Bay	Aug-18	Climate science

Management Approach: Develop a research agenda to improve understanding of climate impacts or fill critical data or research gaps

Key Action (Description of work/project)	**Performance Target(s)** (Incremental steps to achieve Key Action)	**Participating Entity**	**Geographic Location**	**Timeline** (completion date: month & year)	**Factors Influencing and/or Gap**
Compile a research agenda to improve understanding of climate impacts or fill critical data or research gaps.	Conduct a cursory review and analysis of 29 individual management strategies to initial climate-related research needs.	Climate Resiliency Workgroup	Watershed	Dec-17	Scientific capabilities
	Conduct an assessment of research needs to support future policy dialog related to the integration of climate change considerations into the Water Quality Management Strategy.	Climate Resiliency Workgroup	Watershed	Jun-16	Scientific capabilities
	Work with regional partners (e.g., LCC, Climate Hubs and Climate Science Centers), academic institutions and other stakeholders to collaboratively define climate related science and research needs at the broader watershed-scale or within a defined geographic area.	Climate Resiliency Workgroup, USFWS, NRCS, USFS, USDA NE Climate Hub, NFW, CBSSC, USGS	Watershed	Dec-17	Scientific capabilities; Lack of collaboration

Undertake targeted research to improve understanding of climate impacts or fill critical data or research gaps.	Simulate the effects of the projected changes on the living resources of the Bay system through application of an integrative ecosystem modeling approach(es) (e.g., CAM).	NCBO	Chesapeake Bay	TBD	Vulnerability of the watershed
	Undertake the NSF Coastal SEES Project: Chesapeake Bay Sustainability: Implications of Changing Climate and Shifting Management Objectives	VIMS, NCBO CAM	Chesapeake Bay	Sep 2013 – August 2016	Vulnerability of the watershed
	Assess effects of climate change on flow, temperature, and water-quality in streams of the Bay watershed. Work will build off USGS analysis examining changes in flow and temperatures in streams. USGS will be working with fish biologists on implications for freshwater populations and will also be looking at potential approaches to assess effects on nutrient and sediment loads.	USGS, CBP Modeling Team	Watershed	2016-2017	Vulnerability of the watershed
	Investigate the risk of flooding and salt water intrusion to state wildlife impoundments and ponds and consider how to support important wetland communities and related species.	State of Delaware	Nanticoke Watershed	Sep-18	Vulnerability of the watershed
	Conduct research on the mechanisms and potential migration path of wetlands and habitat conversion as water levels rise and salt tolerance lines move.	State of Delaware	Nanticoke Watershed	Sep-18	Vulnerability of the watershed
	Analyze available climate monitoring and climate sensitive data on extreme events to document past trends and impacts. Analyze climate model projections similarly to predict future. Use CB NERRS data in conjunction with other available data to tell specific stories about climate impacts on NERRS. Develop climate change chapter for Chesapeake Bay Ecosystem Atlas for use in formal and informal education.	Chesapeake Environmental Communications, MD and VA National Estuarine Research Reserves, University of Maryland Center for Environmental Science	Chesapeake Estuary	16-Oct	Climate science
	Conduct an evaluation of existing data sets, long-term trends, projects and research studies at each Sentinel Site in the Chesapeake Bay Sentinel Site Cooperative (CBSSC), to include (but not limited to): sea level change, surface elevation change and wetland vegetation dynamics.	Chesapeake Bay Sentinel Site Cooperative (CBSSC)	Sentinel Sites included in the Chesapeake Bay Sentinel Site Cooperative (CBSSC)	Dec-16	Climate science
	Conduct shipboard and autonomous sampling to study the diurnal, seasonal, and interannual variability of the CO2 system in the Chesapeake Bay. Use biogeochemical models to distinguish the impacts between eutrophic and global climate change impacts to the bay's carbonate system.	VIMS	Chesapeake Bay	Sept. 2018	Climate science
	Analyze latest scientific data collected at MD CBNERRS sites (i.e., SETs, water quality, vegetation data) to gain a better understanding of what is happening at the reserve level and how that can be applied to the Bay as a whole.	Chesapeake Bay NERRS, CBSSC (Participating)	MD NERRS Sites	Dec-17	Climate science
	Compile and synthesize existing Gulf and Atlantic Coast vulnerability/resilience information on ~30 priority coastal species and models that quantitatively link SLR and increased storm severity and frequency with system response, impacts to habitats and species, and restoration and management alternatives.	USFWS, Landscape Conservation Cooperatives	Watershed	Sep-16	Climate Science
	Provide science on wetlands prioritization by (1) modeling marsh migration due to sea-level rise using monitoring data from near Blackwater National Wildlife Refuge and other coastal wetlands, (2) conducting research on the effects of sea-level rise, salinification, and watershed sediment loading on the resilience and services of tidal freshwater wetlands (along the Pamunkey and Mattaponi rivers), (3) providing forecasts of land development throughout the watershed to help assess potential wetland loss, and (4) better document long-term changes in wetlands due to climate variability.	USGS, CBSSC (Participating)	Watershed	2016-2017	Vulnerability of the watershed
	Develop a vulnerability assessment guidance document for NER parks based on lessons learned from completed and ongoing NER	NPS Northeast Region collaborators at the University of Rhode Island	National Parks	Estimated winter 2016	Vulnerability of the watershed; Lack of capacity
	Undertake a follow up vulnerability assessment building on that guidance for Colonial National Historical Park beginning in 2016.	National Park Service	National Parks	Estimated summer 2017	Vulnerability of the watershed; Lack of capacity

Compile available data, tools and resources that can be used to support Chesapeake Bay watershed vulnerability assessments.	Share USACE Climate Preparedness and Resilience Community of Practice sea level calculator and watershed-level climate vulnerability assessment, as well as a non-stationarity detection tool currenlty in development	USACE Climate Preparedness and Resilience Community of Practice	Watershed	TBD	Vulnerability of the watershed