



**Governor’s Action Team on Energy and Climate Change**  
*State of Florida*

**Adaptation Technical Working Group**  
**ADP Policy Options**

**Summary List of Draft Policy Options**

	ADP Policy Option	GHG Reductions (MMtCO <sub>2</sub> e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO <sub>2</sub> e)	Level of Support
		2015	2025	Total 2009–2025			
ADP-1	Advancing Climate Change Science Data and Analysis	<i>Not Quantified</i>					Pending
ADP-2	Comprehensive Land Use Planning	<i>Not Quantified</i>					Pending
2.1	Local Government Level	<i>Not Quantified</i>					Pending
2.2	State Government Level	<i>Not Quantified</i>					Pending
ADP-3	Protection of Ecosystems and Biodiversity	<i>Not Quantified</i>					Pending
ADP-4	Water Resource Management	<i>Not Quantified</i>					Pending
ADP-5	Built Environment, Infrastructure and Community Protection	<i>Not Quantified</i>					Pending
5.1	Building Codes and Regulation	<i>Not Quantified</i>					Pending
5.2	Flood Protection	<i>Not Quantified</i>					Pending
ADP-6	Transportation and Other Infrastructure	<i>Not Quantified</i>					Pending
ADP-7	Economic Development	<i>Not Quantified</i>					Pending
7.1	Tourism	<i>Not Quantified</i>					Pending
7.2	Resource-based Industries	<i>Not Quantified</i>					Pending
ADP-8	Insurance (Property and Casualty)	<i>Not Quantified</i>					Pending
ADP-9	Emergency Preparedness and Response (Extreme Events)	<i>Not Quantified</i>					Pending
ADP-10	Human Health Concerns	<i>Not Quantified</i>					Pending
ADP-11	Social Effects	<i>Not Quantified</i>					Pending
11.1	Intersection of Climate Change and Human Behavior	<i>Not Quantified</i>					Pending
ADP-12	Organizing State Government for the Long Haul	<i>Not Quantified</i>					Pending

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		2015	2025	Total 2009–2025			
ADP-13	State Funding and Financing	<i>Not Quantified</i>					Pending
ADP-14	Coordinating with Other Regulatory and Standards Entities	<i>Not Quantified</i>					Pending
14.1	Federal Government	<i>Not Quantified</i>					Pending
14.2	Professional Societies	<i>Not Quantified</i>					Pending
ADP-15	Public Education and Outreach	<i>Not Quantified</i>					Pending

Note: The numbering used to denote the above pending priority policy options is for reference purposes only; it does not reflect prioritization among these important draft policy options.

## ADP.1 Advancing Climate Change Science Data and Analysis

Hilary Swain is drafting ADP-1.

**Description of Issue:**

**Objectives:**

**What is at Risk:**

**Existing Actions:**

TBD

**Goals and Strategies:**

**Priority For Further Research And Analysis:**

TBD

**Other Remaining Issues:**

TBD

## ADP 2. Comprehensive Land Use Planning

**\*\*\*Note from Jim: We may want to recommend that the overall ADP be reworded to be “Comprehensive Planning”, using land use may unintentionally limit the scope to include other required LGCP elements, e.g. coastal zone management. Also we could add a 2.\_ for Regional Government Level.**

### **Description of Issue:**

Florida has an integrated planning process for state, (regional) and local governments to prepare comprehensive plans that address future growth for the entire state. Florida’s State Comprehensive Plan (SCP) (Chapter 187, F.S.) contains goals, objectives and policies that address energy, land use and other issue relevant to future adaptation to climate change. The 2008 Florida Legislature amended the SCP to address green house gas (GHG) reduction strategies and also amended the Local Government Comprehensive Planning Act (LGCPA) to require that local governments address GHG reductions in their future land use, housing and transportation elements.

The state’s eleven regional planning Councils and five water management districts also produce plans that will need to contemplate specific strategies for reducing GHG and anticipating adaptation planning and actions.

**Objectives:** Florida’s state, regional and local comprehensive plans should be amended, based on best available date, to include goals, objectives and policies that will prepare the state for adapting to the future impacts of climate change, e.g. sea level rise.

### **What is at Risk:**

Based on data from various studies and models Florida may be one of the most at risk states due to the fact it is surrounded by water on three side and the relatively flat terrain will mean its coastal areas and some interior area will experience significant impacts due to climate change.

Natural areas along the coasts, including estuaries and mangrove forests will require areas that allow them to move inland due to sea level rise. Urban areas will need to be assessed to determine appropriate strategies. Between now and 2030 Florida will need to develop residential, commercial and retail areas to serve twice our current population.

### **Existing Actions:**

TBD at later date by TWG

## Goals and Strategies:

### 2.1 Local Government Level

**Goal 1:** Ensure that all relevant elements of local government comprehensive plans, e.g., future land use, coastal zone management and capital facilities, are updated to reflect the best available data and strategies for adapting to future climate change impacts.

**Strategy:**

**Goal 2:** State and regional agencies should provide financial and technical assistance to local governments to ensure timely updates of local plans.

**Strategy:**

### 2.2 Regional Government Level

**Goal 1:** Regional Planning Councils should update their Strategic Regional Policy Plans to reflect important regional issues concerning adaptation to the impacts of climate change.

**Strategy:**

**Goal 2:** Water Management Districts should modify regional water supply plans and other regional water management activities to include adaptation measures addressing impacts from climate change.

**Strategy:**

### 2.3 State Government Level

**Goal 1:** The State Comprehensive Plan and relevant state agency strategic plans should be updated to reflect future actions to promote adaptation measures addressing the impacts from climate change.

**Strategy:**

**Goal 2:** The Florida Energy and Climate Change Commission should encourage intergovernmental cooperation at all levels of government and recommend additional goals and strategies to ensure adequate measure are taken to adapt to future impacts from climate change.

**Strategy:**

**Priority For Further Research And Analysis:**

TBD

**Other remaining issues:**

TBD (who will pay for plan updates?)

### ADP-3. Protection of Ecosystems and Biodiversity

**Note: Gary and Eric both submitted text for ADP-3. Gary's text which focused on beaches is in light blue.**

#### Definition of Issues:

Most of the information in this definitions section is excerpted from the Australian action plan on Biodiversity and Climate Change (NRMMC, 2004).

Temperature, rainfall, sea level and ocean chemistry play major roles in determining where individual species of plants and animals can live, grow and reproduce. The effects of climate change on species and ecosystems can be both direct and indirect as discussed below:

Changes in the structure and composition of ecosystems and communities: Environmental changes leading to changes in distribution, phenology (lifecycles), physiology, habitat use and extinction rates of individual species will lead to changes in the structure and composition of communities and ecosystems as we know them today.

Changes in coastal and estuarine habitat due to rising sea levels: Distribution of mangroves, coastal wetlands, and seagrass communities will be affected in various ways, depending on erosion, depositional processes, proximate development, coastline relief, shoreline hardening and underlying substrate.

Changes in ocean chemistry due to increased atmospheric carbon: Lower pH levels in the ocean (aka ocean acidification) are likely to result from higher concentration of CO<sub>2</sub> in the atmosphere. As a consequence, all sea life that relies on shells or exoskeletons formed from calcium carbonate (e.g., corals, shellfish, some algae) will be adversely affected.

Changes in the geographic range of species: Restricted species may be very vulnerable to even modest changes in climate. Because of dependence on environmental conditions that are now shifting, many species will tend to move north or upward in elevation (if suitable habitats exist) in order to keep pace with shifting climate zones

Changes to the timing of species' lifecycles: There is mounting evidence, for example, that species are breeding earlier in many parts of the world and are out of sequence with other species on which they depend (pollinators, prey, etc.). These shifts will change species population dynamics and survival. Alterations in interactions between species (e.g. competition and predation), will result in changes in the structure and composition of communities and ecosystems.

Increases in the risk of extinction for species that are already vulnerable: Species with limited climatic ranges, limited dispersal ability, specialized habitat requirements, small populations and/or low genetic diversity, or obligate dependence on another species with these characteristics

are typically the most vulnerable to extinction. These species include endemic species biota restricted to islands, peninsulas, small reserves or coastal areas. Species with extensive, nonpatchy ranges, long-range dispersal mechanisms, large populations and high genetic diversity are likely to be at less risk of extinction.

Increased opportunity for range expansion of invasive species: Many weedy and pest species already possess characteristics that will allow them to take advantage of climatic changes (highly mobile, opportunistic breeding, wide climatic tolerance). Native communities under stress from climatic changes may be more susceptible to invasion and other disturbances.

In addition to climatic changes, the associated increase of the carbon dioxide concentration in the atmosphere will lead to changes in plant growth, nutrient composition, plant–animal interactions and ecosystem nutrient cycles. This will interact with temperature and rainfall changes. Climate change is also expected to exert an indirect effect by influencing the intensity and magnitude of existing stresses, such as invasive species and fire regimes, on biodiversity and ecosystem structures, functions and processes. For example, changes in climate can influence fire regimes by altering the frequency, intensity and extent of fire events. Scientific evidence is rapidly mounting that many of the changes listed above are already occurring, consistent with the warming trends over the past century (reviewed in Hughes 2000, 2003; Parmesan and Yohe 2003; Root et al 2003). These changes are expected to accelerate and become more obvious over the next few decades, though the precise nature and rate of change for individual species and ecosystems is uncertain.

### **Description of Issues: (for Beaches)**

The sandy beaches that surround most of our state are an integral part of the quality of life for many Floridians. Currently over half of Florida's 825 miles of sandy beaches are experiencing chronic erosion and about 42% are designated as critically eroding, meaning they need long term maintenance in order to ensure protection of vulnerable upland properties, recreational interests, wildlife habitat or important cultural resources. Sea level rise and other predicted impacts of climate change, such as increases in frequency and intensity of coastal storms and higher storm surges, will increase beach erosion, shoreline recession, and barrier migration and have a profound impact on Florida's beaches, the beach using public, and the tourism industry. Gary}

### **Objectives:**

Describe the policy objectives for the ADP, e.g., protect communities from the 100 year event; protect threatened habitats.

- Maximize the resilience of species and habitats to climate change impacts by minimizing other human induced threats. Traditional conservation actions (e.g., land and water protection, prescribed fire, invasives management and restoration) will comprise the most important elements of a strategic response to climate change
- Maintain/facilitate the persistence of coastal ecosystems and the ecological and human services they provide;

- Increase understanding of how Florida’s marine and coastal ecosystems may morph into new states.
- Identify areas, natural communities and species of particular ecological vulnerability
- Protect natural communities vulnerable to sea level rise from loss resulting from shoreline hardening and other actions that prevent/inhibit natural upslope migration.

Managing ecosystems for resilience enhances their ability to naturally adapt to the stresses of climate change and other pervasive threats. Characteristics of resilient ecosystems include high native biological and genetic diversity, complex and redundant ecological interactions, the ability and room to expand and migrate, a high degree of connectivity, the presence of refugia and threats that are well managed. By focusing our planning and management on these characteristics we protect the ability of species, communities, and systems to adapt to stressors, even when the direction (e.g., increased or decreased rainfall) or magnitude of impacts is uncertain.

### **Objectives: (for Beaches)**

Ensure the long term protection of the beach/dune system and preserve its ecological functions. (State laws are very clear on legislative intent placing a high priority on beach and dune protection. FS 161.053: The Legislature finds that the beaches and the coastal barrier dunes...are subject to frequent and severe fluctuations and represent one of the most valuable natural resources of Florida and that it is in the public interest to preserve and protect them from imprudent construction which can jeopardize the stability of the beach-dune system, accelerate erosion, provide inadequate protection to upland structures, and interfere with public access.” )

1. Currently, Florida’s beach management and protection program has few policies in place specifically designed to mitigate for or adapt to climate change and its associated coastal impacts. Consideration of climate change could be incorporated into all aspects of the beach management and coastal construction regulatory programs. Data modeling could consider different predicted sea level rise scenarios.
2. In areas at increasing risk from sea level rise, shoreline erosion, and storm surge property owners will often choose bulkheading to protect their investments in structures and infrastructure. This activity can prohibit beach migration and accretion, impact ecosystem functions, may accelerate beach loss, and can limit public access to public trust lands. Policies to discourage development adjacent to eroding shorelines and encourage the placement of structures and infrastructure away from retreating shorelines may reduce future reliance on coastal bulkheading. Such policies, often referred to as “retreat” or “relocation”, could be market-based, non-confrontational, fair, and generational in scope. In many areas development densities and land values are so high that that these strategies may not be applicable.
3. If we are to retain substantial amounts of natural shorelines and their associated values in an era of rising seas, then ultimately people in many of these areas will have to be persuaded to give up their land to the public or to the sea. In order to provide buffers for retreating shorelines, to preserve and protect habitats and ecosystem function, and to increase the resiliency of the

shoreline to recover from storm events private lands will have to be purchased and placed in the public domain. The development of a strategically targeted coastal land acquisition program would facilitate this objective.

4. Land use planning will be an integral component of any effort to develop adaptation policies to ensure the long term protection and sustainability of shorelines in an era of rising seas. Incorporating projections of climate change and sea level rise in all relevant aspects of comprehensive planning can assist local governments in reducing the risks for the built environment, in planning for impacts, and in ensuring protection of coastal resources.

5. Several state regulatory agencies have oversight of activities that can affect the long term protection of coastal resources. Enhanced communication on coastal resource protection between and within these agencies can ensure more efficient use of resources and expertise in developing adaptation responses and strategies. (Should be worded better, but you get the idea. Currently DCA and DEP have very limited communication on coastal/beach protection issues. There may be a need to develop a Coastal Commission - see Sarasota County for a good model on how this can be accomplished.)

**Assets at Risk:**

Florida’s terrestrial, freshwater and marine systems extend from temperate north Florida to sub-tropical south Florida. Many tropical species are at their northern range limits in Florida, many temperate species are at their southern limits. The result is a highly diverse, unique assemblage of species, and in terrestrial and freshwater systems, high levels of endemism. Florida has a 1,350-mile coast that is home to a diverse array of marine and coastal natural communities and associated species including the world’s third largest fringing barrier reef and most morphologically diverse barrier island system.

Many of Florida’s natural resources are at risk of loss in the face of the above described climate change impacts.

Non-market values

A lot of Florida’s recreation is based on these resources

New report on coastal economy

**Assets at Risk: (Beaches)**

Beaches are one of the state’s most important economic engines, generating tens of billions of dollars in annual revenues through jobs, tourism, recreation, and tax dollars. A healthy beach/dune system provides protection for upland property and infrastructure and increases a beach’s resiliency, its ability to recover from storm events. Florida’s beach/dune system also provides important habitat for marine turtles, shorebirds, beach mice, invertebrates and other species. As beaches erode and recede all these values and benefits are threatened. In addition, public access to lands held in trust for the public, including both the wet sand beach and near

shore submerged lands, is greatly diminished. Conflicts over public usage and private property rights will likely increase as beaches recede and the area of dry sand beach decreases.

**Goals and Strategies:**

**ADP 3.1 – Uplands, Freshwater and Marine Systems**

**Goal 1:** By 2015, a representative portfolio of Florida terrestrial, freshwater and marine natural communities with redundant representation (of habitats and species) and connecting corridors (aka Florida’s Biodiversity Blueprint) has been protected and is being well managed.

**Strategies:**

**Goal 2:** By 2010, all publicly funded land acquisition programs are taking into consideration future anticipated sea level rise (for example, lands that will become the new shore areas around existing estuaries are rated as high priority), increased tropical storm frequency and intensity, coastal flooding and other climate change impacts as part of the process to prioritize acquisition projects.

Beginning with the fiscal year 2008-2009, the Department of Environmental Protection shall include in its annual Florida Forever workplan, a list of lands on the Florida Forever list that provide opportunities to sequester carbon, provide habitat, protect coastal lands or barrier islands, and otherwise mitigate and help adapt to the effects of sea-level rise.

**Strategies:**

**Goal 3:** By 2015, important natural communities vulnerable to sea level rise (e.g., intertidal and coastal habitats) are buffered/protected (from shoreline stabilization and hardening) to maximize the probability of their persistence into the future. For example, the ecologically valuable estuaries identified under Goal 1 above would be protected from development, shoreline hardening and stabilization measures to minimize their disappearance and to reduce/eliminate their capacity to provide critical nursery habitat for fish, foraging habitat for shorebirds, etc.

**Strategies:**

**Goal 4:** By 2015, the acquisition of lands needed to complete critical south to north migration corridors to accommodate climate change driven range changes in species and natural communities has been completed and these corridors are being appropriately managed.

**Strategies:**

**Goal 5:** By 2015, the economic value and services provided by Florida’s natural communities and associated species have been calculated to inform decisions regarding state budget and policy requirements and the resulting information broadly disseminated.

**Strategies:**

**Goal 6:** By 2015, likely new “states” of Florida ecological systems have been described to inform decisions regarding state budget and policy requirements and the resulting information has been broadly distributed.

**Strategies:**

**Goal 7:** By 2015, areas that may serve as refuges for at risk species are identified, prioritized, protected and managed in a manner that maximizes the persistence of at risk species.

**Strategies:**

**Goal 8:** By 2015, the portfolio of sites identified under Goal 1 above are managed in a manner that maximizes the health of these systems and confers the greatest resilience to climate change impacts (for example, prescribed fire, invasive species control, appropriate stream flows, management of waste water, and commercial and recreational extractive activities, etc.).

**Strategies:**

**Goal 9:** By 2010, climate change impacts on sea level, precipitation and wildfire patterns, storm frequency and intensity, ocean chemistry (pH levels), ambient temperature, etc. and how these changes will affect Florida’s natural communities have been estimated with uncertainties articulated so that the state can prioritize adaptation strategies and the resulting information is widely distributed..

**Strategies:**

**Goal 10:** By 2010, state law has been enacted that defines newly submerged lands contiguous to existing state aquatic preserves, parks, etc. as part of the contiguous state managed areas.

**Strategies:**

**Goal 11:** By 2010, hardening/stabilization of estuarine shorelines is no longer permitted under state and local law.

**Strategies:**

**ADP 3.2 – Beaches and Beach Management**

**Goal 1:** Beaches are not constrained from natural upslope migration as sea level rises. (This is a subset of Goal 3 above).

**Strategies:**

**Goal 2:** Prioritize the ecological value of beach resources around the state and select some subset of these (30%?) in each geographic region to aggressively protect. (This is a subset of Goal 1

above).(For example, in the face of limited sand for renourishment, renourishment activities might focus on the highest value sea turtle nesting beaches that are experiencing high erosion rates. If beach/dune continues to erode, it may be necessary to remove existing structures to accommodate upslope migration of this habitat.)

**Strategies:**

**Goal 3:** By 2015, conditions inhibiting natural long shore sand movement (e.g., the presence of inlets) are minimized so as to minimize the need for beach renourishment.

**Strategies:**

**Goal 4:** The value of ecologic and economic services provided by Florida’s beaches is well understood by all interested stakeholders. (This is a subset of Goal 5 above).

**Strategies:**

**Goal 5:** Beaches are managed in a manner that maximizes the long term health of this natural community and all its components with special attention to rare and imperiled species (includes invasive non-native species control, public access management, etc.) (This is a subset of Goal 8).

**Strategies:**

**Goal 6:** By 2009, state and local governments implement a public information campaign that informs owners of coastal shoreline property that in the face of sea level rise, they may lose their property and may have to abandon structures damaged by rising seas and increased storm intensity/frequency.

**Strategies:**

**Goal 7:** By 2009, state and local governments establish policies and regulations that clearly define when, how, where and under what circumstances emergency beach stabilization is allowed.

**Strategies:**

**Goal 8:** By 2009, state and local governments establish policies and regulations addressing coastal retreat and at what point vulnerable structures will have to be abandoned.

**Strategies:**

**Second Goals and Strategies:**

**Goal 1:** Ensure that the beach management program can accomplish its intended goals in an era of climate change and rising seas.

**Goal 2:** Provide incentives to encourage public and local governments to site structures and infrastructure away from areas at high risk from the impacts of climate change and sea level rise.

**Goal 3:** Ensure the long term sustainability and resiliency of the beach/dune system.

**Goal 4:** Preserve ecosystem functions.

**Goal 5:** Reduce future reliance on bulkheading to protect structures and infrastructure. (An ancillary goal would also be to reduce reliance on beach re-nourishment and ideally increase the times between re-nourishment.)

**Goal 6:** Increase and expand the toolbox of adaptation strategies (Currently the beach protection program relies on one leg; beach nourishment.)

**Goal 7:** Enhance communication and planning between state and local governments and between and within regulatory agencies.

### Goal 3.3 Species Protection

**Goal 1:** By 2010, the vulnerability of Florida's fish and wildlife to climate change impacts (temperature, sea level, precipitation, ocean pH, etc) has been assessed, the most vulnerable species have been identified and plans have been prepared to enhance their chances of persistence where there is a greater than X% probability that the species will persist over the next 50 years. (related to goals 8 & 9 above).

#### Strategies:

**Goal 2:** By 2011, a system for monitoring how Florida's natural communities and associated species are responding to climate change impacts is in place and the results of this monitoring is widely distributed/available to all interested stakeholders.

#### Strategies:

#### Priorities for Further Research and Analysis:

Narrative describing critical gaps in knowledge to be addressed by the research community or further analysis among state agencies.

Priorities for further research may include:

- Estimating the absolute and relative vulnerability of species and habitats to climate change impacts;
- Determining the anticipated new states of natural communities in the face of climate change impacts; and

- Assessing the potential economic costs and benefits of climate change impacts on biodiversity, ecosystem processes, functions and services.

Some of these priorities for research can be found in Florida's Comprehensive Wildlife Conservation Strategy (FWC, 2005) and Florida Ocean and Coastal Council's 2008-2009 Scientific Research Plan (FOCC, 2008).

### **Second set of priorities for Analysis:**

1. Determine future costs (including environmental mitigation costs) of beach nourishment under different sea level rise scenarios. Will these costs be different in areas where adequate buffers have been established and where the shoreline is lined with high density development?
2. Does the state need an Open Beaches Act. (This is a very complicated issue and gets more complicated and confrontational as the beaches recede. Who owns the beach and what are the public's rights of access? On eroded shorelines with bulkheads, what happens to the public's common law right of access and customary use? The need to address these issues will increase as seas rise and erosion increases.)
3. How or does the Burt Harris Act (takings law) impact the ability to adequately address coastal protection in an era of rising seas? Is it having a dampening effect on adequate regulatory policies? Will it increase the cost of implementing adaptation strategies?
4. How will beach access be impacted.
5. Determine offshore sand availability for renourishment under differing scenarios and for different regions of the coast.
6. Model shoreline recession and erosion rates under different sea level rise scenarios.
7. Model need for bulkheading under different scenarios (The last time the state did this type of analysis was under Governor Childers in 1990).
8. Inventory coastal public lands susceptible to impacts and assess those impacts. Determine need for buffers to allow habitat migration. (TNC folks on TWG should really flush this out.)

### **Other Remaining Issues:**

Brief overview of issues not addressed by the TWG, but recommended for further consideration in the future.

### **References**

Florida Fish and Wildlife Conservation Commission. 2005. Florida's Wildlife Legacy Initiative. Florida's Comprehensive Wildlife Conservation Strategy. Tallahassee, Florida, USA. <http://myfwc.com/wildlifelegacy/StrategyDownload.html>

Florida Oceans and Coastal Council. 2008. 2008-2009 Scientific Research Plan. Florida Department of Environmental Protection, 14 pp.  
[http://www.floridaoceanscouncil.org/meetings/files/ResearchPlan\\_FY08-09.pdf](http://www.floridaoceanscouncil.org/meetings/files/ResearchPlan_FY08-09.pdf)

Natural Resource Management Ministerial Council (2004), National Biodiversity and Climate Change Action Plan 2004–2007, Australian Government, Department of the Environment and Heritage, Canberra, ACT. <http://www.environment.gov.au/biodiversity/publications/nbccap/>

## ADP-4. Water Resources Management

### **Description of issue:**

The State of Florida is currently facing many water resource management challenges including shortages due to drought, salt water intrusion or deterioration in quality and limits on the availability of its groundwater sources. Continued pressures from population growth and potential new challenges resulting from climate change stress the system even further. There may be shifts in water demands for agricultural and municipal supply, increased energy consumption for advanced water treatment, transmission and disposal as well as for changing environmental needs. Additionally, climate change may bring precipitation shifts and potential reductions of groundwater recharge, less (or more) surface water flows into watersheds, and degradation of groundwater quality and existing wellfields as sea level rises.

Both water supply sources and the essential infrastructure to capture, store, treat, distribute, reuse of water supplies and the disposal of waste for municipal and industrial users throughout the state may be affected. Incorporating methods to quantify and plan for uncertainties and risks related to population growth, climate change and environmental regulations will be critical to maintain the quality of life, economic vitality and environmental sustainability for the state. This is particularly true as our population continues to grow along the coast, where public water and wastewater facilities are located to serve those populations.

### **Objectives:**

Local, regional and statewide policies to protect groundwater and other water resources are designed to ensure adequate supplies to meet needs for man and the environment. Policies and measures to encourage conservation, protect existing supplies, identify and develop new supplies, and invest in innovative technologies to treat water will be needed.

- Incorporating consideration of climate change into water resource planning and project development can increase Florida's ability to adapt to changing climate conditions that affect water availability, treatment requirements and alternatives and water demands for essential uses.
- Incorporating robust analytical methods to drive holistic planning and management of the built and natural water cycle is essential to plan for the future. Such planning should address energy requirements for water supply development, treatment and distribution and wastewater management.
- Involving citizens, business and industry, environmental groups and public agencies in planning processes will provide a foundation for implementable plans that balance needs and risks among a variety of water users.

- Apply “risk assessment” and “scenario planning” methodologies to assess risk under different climatic futures so that risks to existing assets can be understood, mitigation approaches evaluated and future assets be developed within an anticipated risk framework.

**Assets at Risk:**

The majority of Florida’s population, and the water infrastructure to serve them, reside within 50 miles of the coast. The Florida population is also projected to increase by an additional 50% by 2030 according to the Census Bureau (U.S. Census Bureau. “Interim Projection: Ranking of Census 2000 and Projected 2030 State Population and Change: 2000-2030”. In addition to new infrastructure required to develop and distribute water supplies to meet the needs of a growing population (ADP-5), existing coastal and groundwater resources may be at risk due to salt water intrusion and sea level rise. Inland surface and ground water sources and treatment facilities could be affected by changes in rainfall patterns. Additionally, as interior groundwater sources become constrained, there is great emphasis on developing surface water and coastal desalination facilities. While an integrated water resource strategy is desirable, the full energy cost, as well as risk of climate change and associated resource impacts should be considered in long range plans.

Further, well fields, surface or sub-surface storage facilities and water treatment plants may be vulnerable to changes resulting from climate change. This suggests that siting such facilities should be closely examined and, if necessary, plans developed to mitigate impacts or relocate them or reduce the risk of flooding.

**Existing Actions:**

[ To be completed by DEP]

**Goals and Strategies:**

Strategies will be developed by the TWG later in the process, however a few have been inserted here.

**Goal 1:** Identify and quantify the vulnerabilities and reliability of existing water supplies to potential effects of differing climate change scenarios with particular emphasis on source water availability and quality.

Strategy A:

Strategy B:

**Goal 2:** Identify and quantify the risks associated with siting and/or constructing desalination plants due to sea level rise and coastal flooding.

Strategy A:

Strategy B:

**Goal 3:** Develop regional and statewide water demand projection scenarios that account for potential changes in 1) agricultural demand due to changes in growing season or impacts on crop production; 2) municipal and industrial demand as temperatures increase, drought (seasonal or intra-annual) persists; and 3) in water demand for energy generation due to possible changes in fuel source (e.g., fossil fuel generation capacity replaced by nuclear generation or solar) over a 100-year planning horizon.

Strategy A: Develop conservation programs that address and incentivize both water and energy usage efficiencies

Strategy B:

**Goal 4:** Implement local, regional and statewide water supply planning processes that quantify potential changes in existing water supplies and identify potential new water sources including synergies between flood management structures and water supply. Incorporate methodologies that use not only historic hydrologic data but also consider changes that may result from climate change.

Strategy A: Provide for stakeholder involvement in regional and statewide water supply planning processes

Strategy B:

**Goal 5:** Integrate land use considerations, flood management, stormwater best management practices designed to protect water quality and water demand/supply management in watershed planning and design standards.

Strategy A:

Strategy B:

**Goal 6:** Incorporate methods that consider energy, environmental, and economic sustainability when evaluating potential water management strategies.

Strategy A:

Strategy B:

**Priorities for Further Research and Analysis:**

- Conduct regional downscaling on a watershed basis to quantify potential implications of climate change on existing and potential water supplies.

**Other Remaining Issues:**

TBD

## ADP-5. Built Environment, Infrastructure and Community Protection.

Drafted by Ricardo A. Alvarez

### Definition of Issues:

The built environment can be defined as the aggregate of all buildings, facilities and structures designed and built to provide shelter or to house the full breadth of human activity, as well as the infrastructure designed and built to supports or protect such human activity.

The built environment includes buildings, facilities, structures and infrastructure for purposes such as: residential, commercial, industrial, governance, health-services, educational, research, recreational, transportation, communication, water management, waste management, power generation and distribution and others.

Several factors have over time influenced and shaped the amount, location, distribution, concentration and type of built environment throughout Florida. These built environment shaping factors include the shape of Florida as a peninsula, geographic location, climate zones, geology, some 1,400 miles of coastline and barrier islands, environmental features and ecosystems, as well as a development model that has emphasized tourism, agriculture, international commerce and service industries.

The conjugation of these factors have resulted in more than 75% of the population living in coastal counties and perhaps close to 85% of the built environment, on the basis of total area of construction, located in coastal counties with a high concentration in large urban areas such as the tri-county [Pam Beach, Broward and Miami-Dade] corridor in Southeast Florida, the west-central region around Hillsborough and Pinellas counties, and the Jacksonville-St. Augustine region.

U.S. Census Bureau projections and other studies estimate Florida's population will reach close to 29 million by 2030, which means an increase of some 10 million people over the estimated 2007 state population and 7 to 8 million more residents in coastal counties. Should these projected trends continue it can be concluded that the concentration of built environment will continue along the same parameters that are currently in place.

Consider the vulnerability of Florida. The state is vulnerable to a wide range of natural hazards including hurricanes, coastal storms, floods, tornadoes, wildfire, drought, extreme heat, winter storms and freezes, erosion, sinkholes, landslides and tsunami.

Natural hazards must be considered as sources of potential damage, which have the capability of causing damage when impacting the built environment. Direct damage is caused by damage components in hazards. Some examples of damage components are: wind velocity pressure from hurricanes and tornadoes, hydrodynamic pressure and wave impact from storm surge, hydrostatic

pressure from flooding, flying debris impact, water-borne debris impact, extreme precipitation, extreme temperature and others.

Damage components apply loads [external forces] and create stresses in buildings while these interact with given natural hazards. When these loads and stresses exceed the design criteria of the buildings and its components damage results. Depending on the magnitude and combination of loads damage may range from light to destructive, and could lead to eventual structural failure.

With regard to the built environment its interaction with natural hazards and the resulting potential for damage, it is important to analyze how building design criteria are established and used in the design and construction of buildings, facilities and structures.

Studies of the effects of various types of loads acting on buildings, and historical data and annual probability of exceedance for parameters such as precipitation, temperature, flood levels, storm surge, wind speed, acceleration of gravity from seismic waves and others, are used today to establish design standards for the construction of buildings and structures. A well known example of these design standards is the American Society of Civil Engineers' ASCE-7 that establishes Minimum Design Loads for Buildings and Other Structures.

Such design criteria are part of building codes used to design buildings that we expect will have a minimum service life of 75 – 100 years. In Florida the Florida Building Code, which incorporates ASCE-7, became the single state building code as of March 1, 2002. The expressed intent of the Florida Building Code is “.....to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment...”

Before the adoption of the Florida Building Code, counties and municipalities throughout Florida were allowed to choose among four model codes, and as a result buildings were designed on the basis of diverse minimum design criteria, which in many cases proved inadequate when subjected to the test of an actual impact by a hurricane or other hazard. Before then, going back to the 1950s, 1960s and even the early 1970s buildings were designed using a range of standards that in some cases did not even address the issue of lateral loads such as those exerted by hurricane winds.

From the above it can be summarized that the existing built environment includes a large stock of buildings, facilities and structures that have been designed and built using a wide range of minimum design criteria, which in a large number of cases may not meet the minimum requirements of the current Florida Building Code.

Against this background it is important to consider that climate change will modify and/or exacerbate most of the factors mentioned before, which were used to establish design criteria, during the remaining service life of existing buildings and new buildings just now being built.

Take for example the damage components of a hurricane. While considerable differences remain in the scientific community regarding any linkage between climate change and hurricane formation, it is clear however that certain aspects of climate change specifically global warming and sea level rise have the capacity to exacerbate specific damage components of a hurricane.

For example: global warming has led to sea level rise that is conservatively projected to range from 3.3 ft to 5 ft above current levels by the year 2100, although recent studies suggest a much higher rate of rise based on the rate of melting of the Greenland ice cap. Sea level rise will have a direct impact on storm surge, perhaps the most damaging damage component of hurricanes as they impact the built environment in the coastal region.

Higher sea level leads to higher, fastest flowing, storm surge from hurricanes. The deeper water leads to higher waves. Higher waves result in much higher wave impact upon buildings hit by storm surge. Faster flowing surge means faster flowing water-borne debris and much higher debris impact. Faster flowing surge increases the hydrodynamic pressure [load] acting on a coastal building, which combined with the higher depth of water results in a much greater total load acting on the building.

Another example has to do with how global warming has increased the capacity of the atmosphere to hold moisture, and this in turn has led to a higher threshold for precipitation to occur, which results in a higher incidence of extreme rain events. An extreme rain event may overwhelm the drainage capacity of most roofs, which may lead to higher loads acting on roofs from water accumulation eventually resulting in roof damage and water penetration.

This means that a building designed on the basis of current design criteria and the minimum requirements of the Florida Building Code may be subjected to much higher loads, from storm surge, wave impact and precipitation during hurricanes than what it was designed for, during its remaining service life. It is likely and perhaps highly probable that a building under such conditions will suffer severe damage and even structural failure. Those buildings built before the Florida Building Code came into effect, or even earlier, are clearly at much higher risk of suffering catastrophic damage under the impact of climate change exacerbated hazards.

With regard to the built environment then, the critical issue that Florida confronts is how to enhance or change the way new buildings are designed in order to make them resistant to future climate change exacerbated loads that they may encounter during their service lives. An even more critical issue is what to do with the existing stock of built environment to adapt it, as much as possible, to future impacts from climate change exacerbated natural hazards.

Beyond the potential for damage to the built environment, on an individual building basis, an equally critical issue results from the fact that sea level rise, and more frequent extreme precipitation events, will lead to higher rates of beach erosion, increased coastal flooding, and other adverse impacts on a community and even regional basis throughout Florida. It is clear that adaptation of the built environment to the impacts of climate change will also require adaptation alternatives that are regional in scope if the objective is to preserve the Florida built environment

as it now exists and as it will need to develop to meet the needs associated with the projected increases in population.

**Objectives:**

1. Reducing the potential for damage to the built environment from the impact of natural hazards, especially from those hazards caused or exacerbated by climate change, must become a high priority of all levels of government and the private sector in Florida.
2. Make the practice of adaptation of the built environment to the impact of climate change an integral component of comprehensive planning, building codes, life-safety codes, emergency management, land development and zoning regulations, water management, flood control, coastal management and community development.
3. Make the practice of adaptation of the built environment to the impact of climate change a preferred objective of building design and construction research funded by public monies in Florida.
4. Foster an environment of communication and shared knowledge about adaptation to climate change and the protection of the built environment among the scientific community, lawmakers, various professional sectors [practitioners], and the general public.
5. Promote an environment to connect science with decision-making regarding climate change and the need to adapt the built environment to its impacts.
6. Promote an environment to connect scientific research with practical applications that will contribute to the adaptation of the built environment to the impact of climate change.
7. Encourage the search for practical and effective solutions to ensure that existing and future built environment in Florida will remain inhabitable, providing a viable shelter for the full range of human activity and ensuring continuity of critical and essential functions in the aftermath of impact by climate change exacerbated hazards.
8. Establish educational and professional licensing requirements to ensure that key professional sectors become practitioners of adaptation in support of planning, building design and construction activities.
9. Require the State, county and municipal governments throughout Florida to develop and maintain a Local Climate Change Adaptation Plan, to provide a framework for assessing vulnerability, identifying risks, defining and quantifying the value of the built environment that is at risk, and for identifying and implementing effective adaptation measures at each jurisdictional level [state, county, municipality, individual facility].
10. Exercise fiscal responsibility in recognizing not only the magnitude of the problem to be confronted by future generations, but also the need to start implementing and paying for

solutions now while also creating reserves to pay for future measures, especially those that may be community-wide or regional in scope.

### **Value at Risk:**

In order to assess the vulnerability of the built environment to hazards driven or exacerbated by climate change, it is essential to define and quantify the value at risk. In this specific case this refers to the value of the built environment and associated infrastructure.

The value at risk provides a baseline to assess the potential for damage from the impact of climate-driven or exacerbated hazards over a given time period, and to identify and evaluate the cost effectiveness of adaptation alternatives.

### Defining the Value at Risk

Before quantifying the value of the built environment that is or may be at risk it is necessary to first define what is meant by value at risk. In defining the value at risk of the built environment the following criteria must be considered:

- The value of the built environment is dynamic, meaning that it changes over time in response to a range of factors, such as total population, density of population, demographics, land use and zoning, the mix of occupancies in a given community or region, importance or criticality of the functions sheltered by given buildings or structures, total area of constructed space and others.
- The value of the built environment is not limited to the cost of construction of the physical buildings, facilities and structures, but it is directly affected by the value of the human activity or function sheltered or supported by components of the built environment in a given community or region.
- The value of the built environment is interlinked with the value of the land on which it is located. To the degree that buildings change the character of land from vacant to developed, they also change the value of the land. In this sense the value of the built environment and the value of property become synonymous.
- The value of the built environment is a function of the vulnerability of the location on a regional and/or a site-specific basis.

Given the above criteria it is clear that there are several factors to be taken into account to define the value of the built environment that is at risk of being damaged by the impact of hazards caused or exacerbated by climate change. With respect to the built environment it is also clear that defining and quantifying the value at risk can at best be achieved through a series of snapshots that represent either current conditions or projected conditions based on future scenarios.

Given the variability of these factors from region to region, or from one community to the next, it should be noted that the value at risk must be defined by community or regional basis. The

aggregate of all the regionally defined values at risk constitute the value at risk for the whole state of Florida.

In essence this means that the definition and quantification of the value at risk, of the built environment, must be a continuous exercise requiring the establishment of a baseline for a given region, community or site and periodic updates at specific time intervals.

**Quantifying the Value at Risk**

Once the value at risk has been defined on the basis of region or community-specific criteria and factors the value at risk can be quantified at the community or regional scale.

Quantifying the value at risk provides an essential foundation for the following:

1. The potential for damage to the built environment, from the impact of climate change caused or exacerbated hazards can be estimated as a percentage of the value at risk.
2. The effectiveness and benefits of adaptation measures can be quantified on the basis of their damage reduction capabilities.
3. The cost-effectiveness of adaptation measures can be assessed on the basis of their respective benefit-to-cost ratio.

Quantification of the value at risk [of the built environment] can be based, at a minimum, on the following parameters:

- a) Replacement Value of Building[s]
- b) Replacement Value of Contents
- c) Criticality Factor: a multiplier reflecting the type of function housed in the building

Use of these parameters is represented by the equation below:

$$V_r = (C + N) \times F_c$$

Where:  $V_r$  = Value at Risk in current U.S. Dollars  
 $C$  = Replacement value of building in current \$  
 $N$  = Replacement value of contents in current \$  
 $F_c$  = Criticality factor

Quantification of the value at risk for the built environment can be simplified at the local level, by quantifying the value on the basis of the type of function sheltered by various buildings, facilities and structures. For example, all residential use buildings can be grouped together, the same as all educational facilities, or health-care facilities, or government buildings etc. In the end

the aggregate of all the values at risk by type of function will constitute the total value at risk at the municipal level for example.

**Existing Actions:**

(To be completed by DEP staff)

**Goals and Strategies:**

**Goals:**

**GOAL 1:** Require that the Florida Building Code incorporates design criteria for buildings to resist future loads that may result from the impact of climate change exacerbated hazards during a minimum service life of fifty years.

**Strategies:**

**GOAL 2:** Require the State Building Commission to establish a technical committee focusing of vulnerability to climate change, which will recommend updates to the building code as evidence of new trends of risk factors from climate change, arise.

**Strategies:**

**GOAL 3:** Require public universities in Florida to develop and deliver required educational programs for building design and construction professionals, planners and other pertinent fields, focusing on vulnerability to climate change and adaptation methodologies.

**Strategies:**

**GOAL 4:** Develop a required training program to educate existing professionals, in relevant fields such as architecture, engineering, construction management etc., on the need to incorporate adaptation to climate change as a basis for establishing design criteria for new buildings. Completion of such required training to be a condition for relicensing.

**Strategies:**

**GOAL 5:** Empower the Department of Professional Regulation and the various professional licensing boards to incorporate sections on climate change vulnerability and built environment adaptation methodologies in all licensing examinations.

**Strategies:**

**GOAL 6:** Create and fund a State Climate Change Adaptation Plan Advisory Team charged with drafting a periodically revising a State Climate Change Adaptation Plan to be officially adopted by the state subject to legislative approval.

**Strategies:**

**GOAL 7:** Have a pertinent agency of the state of Florida provide guidance, technical assistance and funding to counties in support of efforts to create and manage a Local Climate Change Adaptation Working Group, which will be charged with drafting a Local Climate Change Adaptation Plan to be adopted by resolution of the county governing authority, and with involving all municipalities and county agencies in such an effort.

**Strategies:**

**GOAL 8:** Require Comprehensive Plans, at all jurisdictional levels in Florida, to incorporate cost-effective climate change adaptation measures or plans for the built environment as a requirement for approval of any new development or redevelopment projects in Florida.

**Strategies:**

**GOAL 9:** Create and fund a Built Environment Climate Change Adaptation Program as a state research initiative charged with engaging the scientific and research community, by way of competitive research projects and annual announcements of funds availability, in the assessment of vulnerability and risk of the built environment to the impact of climate change with a focus on the development of adaptation methodologies based on new design criteria, methods and materials of construction and similar initiatives.

**Strategies:**

**GOAL 10:** Require the Water Management Districts to support the adaptation of the built environment to climate change impacts on a community-wide or regional basis through the implementation of flood control and other civil works projects and the adoption of related policy.

**Strategies:**

**GOAL 11:** Request and engage the support of pertinent federal agencies such as the USGS, FEMA, USACE, that can provide technological and logistical support and work with Regional Planning Councils and other state, county and local planning bodies, in the creation and maintenance of a cartographic depiction of vulnerability to climate change based on current levels of risk and on future scenarios.

**Strategies:**

**GOAL 12:** Create and fund a State Climate Adaptation Commission charged with identifying engineering and technical solutions, developing design concepts for preferred solutions, and with conducting initial feasibility studies relative to the scope, budgets, regulatory compliance and timelines for the implementation of specific proposed adaptation solutions on regional scales.

**Strategies:**

**GOAL 13:** Revise the state Sunshine Standards for K12 education so that vulnerability to climate change and the practice of adaptation become require subject matter in the curricula of public schools in Florida.

**Strategies:**

(to be developed by the TWG following future discussion and meetings)

**Priorities for Further Research and Analysis:**

**Storm Surge:**

Storm surge is the most destructive damage component of hurricanes and coastal storms. Through a combination of loads caused by hydrodynamic pressure, hydrostatic pressure, wave impact, the impact of water-borne debris, and other damaging effects such as erosion, scouring, undermining and translational loads, storm surge has the capacity to inflict severe and even catastrophic damage to the built environment in coastal locations.

Although ASCE-7 and the Florida Building Code prescribe methodology to quantify the main loads resulting from storm surge, the reality of the matter is that there is very little region or site-specific information regarding the behavior of storm surge at specific locations and under the influence of local impact modifiers. Information such as: the angle of attack of storm surge at a given coastal location as a function of the direction of travel of a tropical cyclone, the velocity of flow of storm surge as it approaches a coastal location and the factors that influence such velocity of flow, and other related information are not readily available or not available at all for building design professionals to use in establishing design criteria for a specific building.

Research to identify such storm surge behavioral parameters on a basin-specific basis throughout the state could provide invaluable information to design professionals. The state needs to fund such research and engage the national and international scientific community in tackling the same.

**Other Remaining Issues:**

## ADP-6. Transportation and Other Infrastructure

### Definition of issues:

Potential impacts of climate change to Florida include rising temperatures, increases in more intense heavy rainfalls and hurricanes and rising sea levels. Because of this, transportation and other infrastructure along the coast and in low lying areas are susceptible to damage from sea-level rise, storm surge, erosion, flooding and higher temperatures. However, adaptation, particularly related to transportation, has not yet received as much attention or research compared to climate change mitigation.

### Objectives:

Protect and reduce the impact on transportation and other infrastructure from climate change.

### Assets at Risk:

Roads, airports, rail, pipelines, ports, beaches and other infrastructure along and close to Florida's coastline are potentially vulnerable to climate change impacts. Unfortunately, a comprehensive listing of transportation infrastructure at risk in the United States has not been prepared. Improved information about projected climate change impacts and timing of such events will be needed to identify specifically transportation and other infrastructure at risk.

### Existing Actions:

[Note: DEP staff will complete the Existing Actions section.]

### Goals and Strategies:

Goal 1: Ensure that tools and models are developed to project climate changes at smaller scales to better forecast state and local impacts and to pinpoint infrastructure at risk.

Strategy A\*:

Goal 2: Inventory critical infrastructure at risk; determine whether, when, and where projected impacts from climate change might be significant; and evaluate the costs and benefits of alternatives of needed actions.

Strategy A\*:

Goal 3: Ensure the coordination of adaptation efforts across jurisdictional boundaries and the exchange of information, resources, and best practices among government, the private sector and other stakeholders.

Strategy A\*:

Goal 4: Ensure that the long range planning process addresses adaptation and the protection of critical infrastructure.

Strategy A\*:

**Priorities for Further Research and Analysis:**

[To be added later.]

**Other Remaining Issues:**

[Brief overview of issues not addressed by the TWG, but recommended for further consideration in the future.]

\* Strategies section blank pending further discussion.

## ADP-7. Economic Development

**Description of issue:** Steve Adams to draft overall ADP-7 template.

Note: We have Description of Issue at a the next level i.e. 7.2.

### 7.1 Tourism

Steve Adams to draft.

### 7.2 Resource-Based Industries (7.2.3 Marine)

#### **Description of issue:**

Florida's industries based on living marine resources include commercial and recreational fishing, marine ecotourism including coastal parks and conservation areas, marine pharmaceuticals, and marine research and education. The direct 2006-2007 value of these industries to Florida's economy was \$ 4.4 billion (NOEP, 2008) and the indirect value of related infrastructure and support was many times larger. Adaptive responses to protect the core living resources upon which these industries rely are addressed in ADP-3, "Protection of Ecosystems and Biodiversity." This section addresses threats to the usability and human uses of the resources, beyond considerations made in other adaptation response actions.

#### **Objective:**

The adaptive management of Florida's marine resources and their sustainable use in a changing climate will be designed to protect the living resources and the social, economic, and cultural systems that form our industries.

#### **What is at Risk?**

- The geographic ranges and abundances of living marine resources are likely to change as climate, ocean temperatures and currents, water quality, and related controlling factors change.
- Likewise, the ranges, abundances, and impacts of marine diseases, invasive species, parasites, and harmful algal blooms could change
  - As direct responses to climate change, and
  - As unintended results of the industries, themselves.
- One consequence of these changes is that future fisheries, principal fishing grounds, ecotourism destinations, and the land-based operations and facilities that support the industries may "migrate" from their present locations to different areas of the state. Such

changes have the potential to affect the economic viability of industries dependent on living marine resources.

- The same changes can also have negative effects on the health and safety of industry workers and consumers of industry products and service.
- Public and private investments in land acquisition for future parks and conservation areas, future working waterfronts for fishing and ecotourism, and future marine research and education facilities will be affected by climate change, and the effects could be significant.

What might be gained? The same processes that may diminish Florida’s existing marine industries may lead to new opportunities for fisheries, ecotourism, and allied economies. Truly adaptive management will require an ability to detect and exploit such possibilities.

**Existing Actions:**

The Department of Environmental Protection...

The Fish and Wildlife Conservation Commission...

The Department of Agriculture and Consumer Services...

**Goals and Strategies:**

**ADP- 7.2.3: Industries Based on Living Marine Resources**

**Goal 1:** Provide an integrated tracking and reporting system for the ranges, abundances and condition of species valued for their roles in fisheries, ecotourism, aquaculture, pharmaceuticals, and research.

**Goal 2:** Develop and implement an integrated screening and tracking program for species die-offs, marine diseases, invasive species, and parasites, modeled after the state’s harmful algal bloom programs.

**Goal 3:** Implement educational programs to reduce vessel-based conveyances of unwanted species in Florida waters, and to protect industry workers and consumers from novel health and safety challenges.

**Goal 4:** Develop conceptual plans for the co-location of new working waterfronts for fishing, ecotourism, marine research, etc. that employ green infrastructure adapted to emerging challenges of climate change.

Strategies: Goals 1 and 2 will be met through the use and expansion of existing state and federal programs and platforms for monitoring, event responses, data management, and public reporting.

Goal 3 will be met through collaboration with the Florida Sea Grant Extension Service. University planning, engineering, and architectural schools will be engaged to address Goal 4.

**Priorities for Further Research and Analysis:**

1. Couple IPCC outputs, regional climate and oceans data, and ocean circulation models to forecast areas and rates of coastal water temperature changes under several scenarios.
2. Expand existing state programs and platforms for monitoring, event responses, data management, and public reporting to include range extensions, shifts in population centers of valued species, dispersion patterns of non-native marine and coastal species, marine diseases, and biological threats to industry workers and consumers.
3. Couple future land use plans, sea level projections, hurricane risk models, energy-efficiency standards for marine ops, and land-based transportation systems to co-locate new parks, conservation areas, and working waterfronts for fishing, ecotourism, and marine research.

Respectfully submitted by  
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## **ADP-8. Insurance (Property and Casualty)**

Kathy Baughman-McCleod has agreed to draft this.

## **ADP-9. Emergency Preparedness and Response (Extreme Events)**

Steve to reach out to Division of Emergency Management.

## ADP-10. Human Health Concerns

### **Description of issue:**

Climate change is expected to have a wide range of impacts on Florida's health systems. The historical range of mosquito- and vector-borne diseases may shift with a changing climate. More intense extreme weather events such as hurricanes, heat waves, flooding, and wildfires, will directly impact human health in Florida. Successful research in this area will identify the increasing risks to human health, which segments of the population are most vulnerable, and how risks to their health can be reduced.

As our climate experiences change, many potential stressors to human health change as well. Enhancing the frequency of floods and droughts, for example, impacts the life cycle of water-borne vectors of diseases. Further, these alterations have the potential effect to the healthfulness of the place, now challenged by the prospect of increased tropical pests and diseases.

Equally important are alterations in the moisture content of the air and wind patterns which will likely affect the concentration of air-borne particulates in a given location. Florida is also home to several large cities, such as, Miami, Jacksonville, Orlando and Tampa, and changes in climate in these areas have the potential to affect air quality and, by extension, human health within the state. Understanding how climate change will impact human health in the future requires the cooperation of scientists in many disciplines, including climatology, biology, and environmental science.

**Objectives:** Human health is rather intimately connected with climate and the environment on local and regional scales. The health and well-being of the citizens of the state of Florida is of prime importance to the health of our state. Incorporating considerations of climate change into the state's health plan to protect the citizens is as important as designing water treatment infrastructure to reduce harm to human health.

### **What is at Risk?**

Climate change may increase the risk of some infectious diseases, particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects. These "vector-borne" diseases include malaria, dengue fever, yellow fever, and encephalitis. Also, algal blooms could occur more frequently as temperatures warm — particularly in areas with polluted waters — in which case diseases (such as cholera) that tend to accompany algal blooms could become more frequent.

### **Existing Actions:**

[Note that DEP staff will complete the Existing Actions section.] State building codes are updated every three years. Upon each renewal going forward, climate risks should be incorporated.

**Goals and Strategies:**

**ADP- 10.1: Health Care**

**Goal 1:** Ensure that health codes and policies are adequate to protect against known risks from observed climate and appropriately incorporate potential changes in risk from climate change.

**Goal 2:** Regularly revisit health codes and regulations as new evidence of new or altered risks from climate change arises.

**Goal 3:** Strengthen vaccine campaigns.

**ADP – 10.2 Air Quality**

**Goal 1:** Ensure that air quality polices provide an adequate level of safety to protect against known risks from current climate.

**Goal 2:** Ensure that new air quality policies incorporate potential changes in risks from climate change to ensure appropriate design and mitigation factors.

**ADP – 10.3 Waste Water Treatment**

**Goal 1:** Ensure that waste water infrastructure provides an adequate level of safety to protect against known risks from current climate.

**Goal 2:** Ensure that new waste water infrastructure incorporates potential changes in risks from climate change to ensure appropriate design and capacity over the lifetime of projects.

**ADP – 10.4 Disaster Response**

**Goal 1:** Establish communication mechanism to coordinate efforts between disaster relief and public health agencies.

**Goal 2:** Communication systems and plans that address health issues associated with low-income and under-served populations and other vulnerable groups.

**Goal 3:** Adequate training for first responder and emergency responder personnel.

**ADP – 10.5 Medical Treatment and Biomedicine Development**

**Goal 1:** Increase state universities medical schools focus to include diseases that can be attributed to climate change.

**Goal 2:** Promote the research and development of biopharmaceuticals that can treat the diseases that can be attributed to climate change.

**Strategies:**

[Following the July 8-9 Action Team meeting, the TWG will identify strategies to meet the goals. In particular the TWGs will identify early action items.]

**Priorities for Further Research and Analysis:**

- Improved projections of potential public health risk from the interaction of increasingly intense and long heat waves with existing air-quality problems in major urban areas.
- Projects on the potential in Florida for increases in the transmission of vector-borne infectious diseases (e.g., malaria, dengue, yellow fever, and some viral encephalitis) resulting from immigration from other climate change affected areas.
- Analysis of the relationship between heavy rainfall and biological contamination of water supplies, the influence of climate variability and extremes on notified illnesses, and quantification of the burden of water-related illnesses (including conditions such as gastroenteritis and skin infections).

**Other Remaining Issues:**

[Brief overview of issues not addressed by the TWG, but recommended for further consideration in the future.]

## ADP-11. Social Effects

### **Description of issue:**

Currently Florida's population is around 18M, and its projected growth is 28.5M by 2025. Additionally, Florida's coasts are home to an estimated 70% of the population. The coastal environment also provides diverse habitats for countless marine and terrestrial species. For centuries, humans have lived, worked, and played along the coasts, and the ocean has long been an important component of the economy from fishing to tourism.

Sea levels are expected to rise in the foreseeable future as the earth's climate warms, which makes Florida's coastlines particularly vulnerable. Climate change will likely impact not only the physical coastline, but also the billions of people who live and work in Florida. Understanding the impacts of climate change on our coasts and also our inland areas therefore requires the perspectives of sociologists, economists, and scientists alike.

Society can deal with slow trends in climate, occurring over the many thousands of years that are characteristic of ice age cycles. But decade-to-century changes, i.e., those that occur on the time scales of a human lifetime and the ability of societies to evolve, are potentially catastrophic.

### **Objectives:**

Climate change has the potential to play a major role on human behavior over the next century. Even if all human activities that contribute to global change were stopped today, change would continue as the present surplus of greenhouse gases in the atmosphere will remain for centuries. As of yet, the climate system is not well enough understood to "reverse-engineer" the climate to a state that best suits humanity. Therefore, today Floridians must decide what changes that they must make in their present behaviors in order to live in the changing climate.

### **What is at Risk?**

Increased development to accommodate Florida's projected population growth will most likely increase climate exposure and risks to Florida's citizens and their current way of life. Florida must recognize that all regions of the state will encounter socio-economic changes including:

- Increased housing and insurance costs, especially related to storm events and sea level rise;
- Increased charges for energy consumption and transportation changes; and
- Increased cost of infrastructure improvements including roads, sewer systems, waste-water treatment facilities, water control structures and property protection.

**Existing Actions:**

[Note that DEP staff will complete the Existing Actions section.] State building codes are updated every three years. Upon each renewal going forward, climate risks should be incorporated.

**Goals and Strategies:**

Goals [TWG should identify the goals for the ADP that are relevant for climate change. The goals below are examples drafted by CCS staff and should be rewritten by the TWG.]

**ADP- 11.1: Social Justice Issues**

**Goal 1:** Promote social and economic equity, reduce poverty, increase consumption efficiencies, decrease the discharges of wastes, environmental management, and increase the quality of life of vulnerable.

**Strategies:**

**Goal 2:** Assess potential social impacts of climate change on incomes, and other measures of wellbeing in vulnerable communities.

**Strategies:**

**ADP – 11.2 Food and Water Security**

**Goal 1:** Ensure basic access to safe food supply and water.

**Strategies:**

**ADP – 11.3 Housing Security**

**Goal 1:** Ensure basic access to shelter.

**Strategies:**

**Strategies**

[Following the July 8-9 Action Team meeting, the TWG will identify strategies to meet the goals. In particular the TWGs will identify early action items.]

**Priorities for Further Research and Analysis:**

TBD.

**Other Remaining Issues:**

[Brief overview of issues not addressed by the TWG, but recommended for further consideration in the future.]

**ADP-12. Organizing State Government for the Long Haul**

Steve Adams to draft.

## ADP-13. State Funding and Financing

Division of State Lands to draft?

## ADP-14. Coordinating with Other Regulatory and Standards Entities

### 14.1 Federal Government

### 14.2 Professional Societies

#### Description of issue:

The federal government is participating in a wide range of climate activities nationwide. They also fund state and regional entities that provide climate services. Activities include data collection, interpretation and product dissemination. Primary agencies involved include the National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS) and U.S. Department of Agriculture (USDA). Several products produced by federal agencies, such as drought severity categories and river flood forecasts that trigger a variety of Florida emergency and economic relief activities. Additional Federal entities to be considered include: U.S. Energy Information Administration (EIA), Dept. of Energy including the Energy Star Program, National Science Foundation, and others.

In addition, a number of professional societies are actively involved in climate change activities to better understand the potential impacts of climate change on the members they serve. Additionally, these societies often represent fundamental public service providers (e.g. water utilities) and need early involvement in decision-making, require sufficient data to make informed decisions regarding risk and reliability, public health and safety and financial management. Collectively, they represent a broad base of the population, possess unmatched knowledge of the industry they represent and offer tremendous opportunities for technology transfer, public education and widespread reach.

The following list includes the name and summarizes the function of key Federal agencies (by category) and professional societies involved with or who have a stake in climate change.

#### Drought Preparedness

- National Drought Mitigation Center (NDMC)

This site hosts the Drought Monitor and The Drought Impact Reporter. NDMC helps people and institutions develop and implement measures to reduce societal vulnerability to drought. <http://www.drought.unl.edu/dm/index.html>, <http://droughtreporter.unl.edu/>

- National Integrated Drought Information System (NIDIS)

This National Oceanic and Atmospheric Administration (NOAA) site hosts the federal drought monitoring system. NIDIS provides a complete summary of drought information at national, regional, state and local scales.

- Climate Prediction Center (CPC-NOAA)

CPC provides a variety of climate analysis and prediction products, including the Drought Outlook, which projects drought category tendencies for a 3-month period.

<http://www.cpc.ncep.noaa.gov/>

### **Climate Information**

- National Climatic Data Center (NCDC)

NCDC is the national archive for climate data and products.

<http://www.ncdc.noaa.gov/oa/ncdc.html>

- Applied Climate Information System (ACIS)

ACIS is supported by the National Climatic Data Center (NCDC) under the National Virtual Data System and operated by the six Regional Climate Centers. ACIS provides both real-time and historical climate data from a variety of networks. ACIS also allows execution of user adjustable programs to support drought risk analysis. <http://rcc-acis.org/>

- Florida State Climatologist

The Florida Climate Center is part of three-tiered system that serves to provide climate data, information, and services for the United States.

[http://www.coaps.fsu.edu/climate\\_center/nav.php](http://www.coaps.fsu.edu/climate_center/nav.php)

- Southeast Climate Consortium

The mission of the Southeast Climate Consortium is to use advances in climate sciences, including improved capabilities to forecast seasonal climate, to provide scientifically sound information and decision support tools for agriculture, forestry, and water resources management in the Southeastern USA. <http://secc.coaps.fsu.edu/>

### **Water Information**

- National Water Information System (NWIS)

NWIS is operated by the United States Geologic Survey (USGS) and provides both real-time and historical surface streamflow, reservoir and groundwater information.

<http://water.usgs.gov/waterwatch/>

- U.S. Water Monitor

This site provides a summary of water information at national, regional, state and basin scales.

<http://watermonitor.gov/>

- National Weather Service – Hydrology

The River Forecast Centers provide streamflow and flood forecasts for the U.S.  
<http://www.nws.noaa.gov/oh/index.html>

- U.S. Army Corps of Engineers

In support of Nation’s interests, build broad-based relationships and alliances to collaboratively provide comprehensive, systems-based, sustainable and integrated solutions to water resources national and international challenges. <http://www.usace.army.mil/>

The majority of Florida is served by the Jacksonville District Office (<http://www.saj.usace.army.mil/>) and the Panhandle is served by the Mobile, Alabama office (<http://www.sam.usace.army.mil/>)

### **Agriculture**

- Joint Agricultural Weather Facility (JAWF)

This joint USDA/Department of Commerce operation provides production agriculture predictions for the U.S. and the world. <http://www.usda.gov/oce/commodity/index.htm>

- Natural Resources Conservation Service (NRCS)

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. <http://www.nrcs.usda.gov/programs/>

### **Ecosystems**

- The Mission of the U.S. Fish & Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people .

The challenge of climate change to the U.S. Fish and Wildlife Service is two-fold. The scientific challenge is one of translating projections of climate change into transparent predictions of trust resource response that can guide management decisions. The resource conservation challenge is one of articulating and directing a conservation response that is strategic, adaptive, and collaborative.

- The mission of the Environmental Protection Agency is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people. <http://www.epa.gov/>

### **Professional Societies**

- American Water Works Association (AWWA) and the Florida Section AWWA (FSAWWA)
- AWWA Research Foundation (AWWARF)
- Water Environment Foundation (WEF) and Florida Water Environment Association (FWEA)

- Water Environmental Research Foundation (WERF)
- American Water Resource Association (AWRA)
- WateReuse Foundation
- Southeast Desalting Association (SDA)
- Florida Stormwater Association (FSA)
- American Society of Highway Engineers (ASHE)
- Florida Engineering Society (FES)
- Association of Public Works Administrators (APWA)
- Others as identified

**Objectives:**

There is considerable research, data, potentially impacted end-users and other interested parties directly involved with climate change, directly affected by climate change and/or have the ability to directly impact funding, research priorities, communications or other aspects of the climate change community.

- Develop functional relationships between selected federal government agencies/departments/entities, the State of Florida and key professional societies to collaborate on climate change issues of mutual interest
- Develop a research agenda to address shared interests priorities
- Identify and align with funding sources and allocation decisions essential to Florida’s future as it relates to climate change

**What is at Risk?**

The Federal Government has the lead and is central to most of the significant climate change and related programs, research, funding and information dissemination. Failing to actively engage with the various agencies will result in missed opportunities to ensure that Florida needs are expressed, understood and addressed. Additionally, working in a vacuum will result in waste and inefficient use of our limited financial, intellectual and physical resources and will under leverage the vast pool of resources that have been working on climate change and related issues for years. Lastly, we must actively engage with the Federal process and work as a cohesive unit (a state with numerous needs, challenges and sometimes competing objectives) to ensure that we are not competing among each other for limited dollars and research priorities.

**Existing Actions:**

To be completed by DEP

**Goals and Strategies:**

**GOAL 1:** Develop a clear understanding of the functions and information available (needed) of key federal agencies and professional societies.

**GOAL 2:** Identify data gaps and prioritize research needs to establish an agreed-upon research agenda representing Florida’s collective needs.

**GOAL 3:** Prioritize funding needs, develop a strategy to secure federal and federal flow-down funding to meet strategic needs in Florida.

**GOAL 4:** Engage professional societies to establish industry priorities for research and funding; to work with state and Federal officials to promote priorities.

**GOAL 5:** Develop training and technology transfer tools and engage professional societies to reach members.

**GOAL 6:** Establish a “cross functional” professional society task force responsible for coordinating climate change issues within their respective industries.

**Priorities for Further Research and Analysis:**

Identify targeted Federal agencies based on Florida needs and issues addressed.

**Other Remaining Issues:**

## ADP 15. Public Education and Outreach

**Note that there were two submitters: Prof. Meg Lowman and Alex Score from WWF. Alex's text will be in light blue.**

### **Description of the issues:**

As a state surrounded by water on three sides, with a relatively low elevation, situated in the eye of hurricane alley, and with easy access for infectious disease vectors and tropical invasive species, Florida has an enormous challenge to educate its constituents about climate change. Public understanding of complex, non linear problems, like climate change, is not always easy to convey since much of the jargon and information exchange has been limited to technical journals accessible to and read by only a small minority of professionals. Over the next few decades, political and civic leaders will face difficult choices. Few will have sufficient access to dependable scientific assessments. Designing a dynamic program that marries current climate change findings with business insight to educate a wide array of constituents about adaptation to environmental changes is a critical next-step.

Public education and outreach about climate change in Florida is needed to support necessary mitigation and adaptation actions. Florida is “ground zero” for climate change impacts in the US with its low lying and densely populated coastal zones, susceptibility to hurricanes, and vulnerable natural resources. It seems that few people realize Florida's vulnerability, but these few are crying out for detailed and accurate information and solutions. A focused and comprehensive stakeholder education and outreach program is a key component in building support for the mitigation and adaptation policy changes that will become critical issues in Florida.

### **Objectives:**

Florida can become a national and international leader in the dissemination of climate change information, educating a broad diversity of constituents with a cutting-edge and successful public education program. Other states are currently implementing adaptation and mitigation strategies, but relatively few have implemented broad, comprehensive public education programs at any level. There are myriad grass-roots organizations attempting to educate the public about climate change, but in actual fact some of this effort can actually communicate and disseminate knowledge that may not be accurate or up-to-date. The success of any climate change adaptation demands full participation of the stakeholders (i.e. citizens of Florida). The objectives of a successful public education outreach program would be three fold –

1. To educate all of the stakeholders including state leadership, state and regional government who implement adaptations, citizens of Florida (including retirees, families, work force, and students K-16), and the broader business community both within and outside of Florida but who are important stakeholders in Florida's adaptation actions;

2. To design an over-arching program that could be quickly and effectively disseminated to the stakeholders listed above (a kind of Earthwatch “blitz” of sound science presented in clear, concise and simple terms so that all Floridians can embrace the knowledge); and
  3. To link the public education outreach programs to the best climate change science, so that issues relating to adaptation and risk management create positive solutions to the environmental challenges of the near future.
- Educate and engage a wide audience about climate change in Florida. Share not only current knowledge of the impacts already occurring and expected in Florida, but also short and long term solutions. An informed population will better understand, become involved in local and state issues, and support needed policy changes.
  - Train, engage and coordinate climate change adaptation practitioners, and needed technical support, to help Florida plan for climate change. Climate change adaptation science and related policy improvements are developing fields requiring specific conceptual and technical skills which independently exist in the expert community but require facilitation and training to bring together in an adaptation experts support group.

**Assets at Risk:**

The best climate change adaptation programs will be at risk if they are not embraced by the stakeholders. The best policies might be approved in Tallahassee, but the full understanding and education of citizens will insure their timely implementation and endorsement. A good example is Sarasota County, which has excellent sustainability policies in force with local leadership, but very little comprehension of the issues or “buy-in” by the constituents as witnessed by the fact that Sarasota County was recently “awarded” last place in a statewide carbon footprint audit.

In summary, all assets are at risk without a careful and comprehensive program of education throughout the state at all levels – leadership, regional government, citizens, students K-16, and businesses who deal with Florida.

Second: Principal risks include misunderstood and failed policy actions resulting in political stalemate and inaction. Additionally, adaptation only “buys time.” Rapid and significant greenhouse gas mitigation is the only long term solution. Understanding that the two must go hand-in-hand is crucial.

**Goals:**

Two tiers of immediate training could be implemented:

- a. short (2 day) executive seminars for CEOs and State Legislators, designed for policy makers, conducted by scientists trained in public education outreach (e.g. graduates of the Aldo Leopold Leadership Program from Stanford University); and
- b. A follow-up series of comprehensive workshops (4-6 days) mixing business and civic leaders from public and private sectors. Local teachers should be included in all sessions. The

curricula would be akin to executive business seminars conducted at Harvard Business School, Stanford, and Wharton but tailored to Florida's emergent issues in water management, coastal adaptation, renewable energy production, agricultural strategies, evolving transportation and construction standards for smart growth, public health, and the economics of sustainable development. Initially, participation in Florida Future executive seminars will be at the governor's invitation, with each team designed to be interdisciplinary, matching industry executives from different sectors with key policy makers and scientists to foster cross sector thinking.

Over a two year development period, different types of education programs aimed at other stakeholders (excluding the leadership who are earmarked for a and b above) would be developed and piloted by a Public Education Outreach taskforce, including (but not limited) to school curricula, television segments, government fact sheets, signage, business incentives, and other creative learning pedagogy.

### Goals and Strategies:

1. Initiate major public education campaign (15.1, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9)
  - a. Use high profile media and other appropriate outlets to raise general awareness on climate change in Florida.
  - b. Make connections between mitigation and adaptation solutions and policy changes.
  - c. Educate about the expected costs of inaction and delayed action compared to the costs of acting proactively.
  - d. Focal topics can include: Heat waves and associated health risks, sea level rise and associated infrastructure and property risks, wildfire risks, species disturbances and habitat loss/change and associated ecosystem services losses (impacts to valuable and highly visible resources such as coral bleaching), risks to water supplies, etc..
  - e. Focus groups can include: the public, policymakers, media, business leaders, developers, landowners/buyers/sellers, etc..
2. Create adaptation training and collaboration opportunities (15.2, 15.3)
  - a. Create opportunities for government agencies to work together and with climate change adaptation experts to develop needed skills in applying adaptation concepts in their every day management and planning.
  - b. Build an interacting and idea sharing community that includes members which can
  - c. Bring together experts in climate change adaptation, environmental scientists, economists, social scientists, human health experts, political scientists, and policy makers to combine the needed expertise that can guide Florida.
  - d. Adaptation focus areas: Natural resources and ecosystem services, infrastructure and development, financial markets, job markets, human health and welfare,

- e. [Technical expert focus groups: Florida’s policy makers, research institutions, NGOs, water boards, state agencies, media, etc..](#)

### **Strategies**

In brief, a program should be dedicated to building strategic consensus and civic leadership to address the uncertainties of climate change and its probable impacts on Florida’s 18 million residents. A 10 year education plan should design and establish a ‘think and do’ tank to create a Florida climate change curricula to train 10,000 civic leaders, to educate K-16 teachers and their students, and to mobilize top scientists to advise Florida’s business leadership and counsel Florida’s Climate Action Plans. The full participation of relevant State agencies and NGOs, public and private, is envisioned. When formed, a Florida Leadership Institute (working title) would leverage the intellectual resources of Florida’s state and private universities to train civic leaders through a series of climate change impact seminars hosted by participating institutions across the state, simple sound-bytes translated in a variety of venues, simulated gaming that engage the youth, incentives linking education with business, critical partnerships (such as with Sierra Club, home-owners associations, AARP, NEON, and other groups representing broad constituents) and strategically defined levels of education programs to service all of the diverse constituents in the state.

The mission of the Florida Leadership Institute is to build a generation of progressive thinkers who are conversant with the metrics of climate change; its potential impacts on natural, civic, government, and business systems that support the quality of life in Florida; and who can create adaptation plans based on their education of environmental changes.

Given the urgency of mobilizing civic support, the speed of delivery will be critical to program success. Scientists need to be convened to establish models for Florida adaptation and thresholds for State actions. Training venues need to be identified. Accommodations should be reserved at universities and at field stations in state parks, marine preserves, estuaries, and vulnerable coastal sites. Field-based training could be stewarded by Florida’s best scientists and educators, but should include experts in public science education outreach (not just academics trained in professional communication to peers).

### **Existing Actions:**

(To be filled out by DEP staff)

### **Priorities for Further Research and Analysis:**

Florida can learn from other successful outreach and education strategies for climate change in other states and countries which are farther along in these areas. Just as we are learning about managing coral reefs in a changing climate from Australia, Florida can learn how to engage stakeholders from similar efforts.

**Other Remaining Issues:**

Successful outreach and education requires considerable investment in capacity and operating support. It also requires full understanding of audiences through market research, etc.. The TWG should be ready to support allocation of the necessary resources.

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