7.0 Climate Adaptation Strategy

Adaptation efforts in Santa Cruz County by government and other organizations already exist in the form of emergency preparedness plans, public health programs, water supply contingency plans, flood regulations, sustainable agriculture efforts, and land protection programs. Additional research and planning should build on these existing efforts and amend them to address climate change directly.

7.1 Impediments to Climate Change Adaptation

Despite the substantial economic assets of our nation, our state, and our community, our adaptive capacity to respond to new stresses associated with climate change is limited. As a starting point, it can be argued that our societies are not even well adapted to the existing climate, especially to well-understood natural hazards (earthquakes, hurricanes, floods, and drought) that continue to result in human disasters. Numerous reports and academic research studies describe longstanding impediments to natural hazards mitigation, and these challenges will continue to limit our capacity to adapt to climate change—especially when it involves the intensification of natural hazards (NAS-NRC, 2010).

Adaptation requires both actions to address chronic, gradual, long-term changes such as sea level rise, and actions to address natural hazards that may become more intense or frequent (droughts or floods). Addressing gradual changes is challenging because the eventual extent of such changes is difficult to recognize and measure and costs for initial investments may be considered unaffordable even when they would be cost effective in the long-term.

For several decades, adaptation to climate change has been neglected in the United States, perhaps because it was perceived as secondary in importance to mitigation of climate change (e.g. through greenhouse gas emission reduction), or perhaps more importantly, because it would actually take attention away from mitigation by implying that the country can simply adapt to future changes. In addition, the topic of climate change and the discussion of options for responding have become much more highly politicized in the United States than in some other parts of the world. Arguments in the media over whether climate change is “real” and to what degree it is a problem generated by human activity have confused people about whether action is needed and whether their actions can make any difference. Further, there are frequent suggestions in the media that responding to climate change is “too expensive” or that the options available to limit emissions and adapt to impacts will have a negative impact on the U.S. economy. The emerging reality is that the long-term risks and costs of not responding are likely far greater than the short-term costs of reducing dependence on fossil fuels and transitioning to renewable energy sources. In fact, California has much to gain economically from this transition.

In our society, there are those who see climate change only as a rise in temperature of a few degrees, which they feel is of no concern; those who say that their hands are tied and that they feel powerless to have any impact so why bother; those who are simply tired of hearing about the problems and are suffering issue fatigue; and those who have difficulty dealing with probabilities, and who want perfect information and complete agreement before they are willing to believe in the problem and make change (Moser, 2009).

Adaptations to long-term problems involve long-term investments and also bring considerations of intergenerational equity and other social and economic factors into play that significantly affect the calculation of costs and benefits. The influences of climate change extend well beyond the election cycle of the typical public official in the United States. Therefore, long-term adaptations must hold some promise of short-term reward if they are to be attractive to elected decision-makers.

7.2 Principles for Adaptation

Coastal adaptation strategies fall into three major categories:

- Strategies for existing development, including existing infrastructure and other resources located in potentially vulnerable areas. Strategies for addressing climate change impacts include monitoring of vulnerable property, red-tagging of property in imminent danger, seawalls to protect critical infrastructure, planned retreat, and rebuilding restrictions for vulnerable structures following climate-related disasters.
- Strategies for new development, including mandatory setbacks to restrict development in vulnerable areas, required warning notices to developers and buyers on potential impacts of future climate change, smart growth and clustered development in low-risk areas, designing for climate resiliency, and the development of expendable or movable structures in high-risk areas.
- Strategies to protect and preserve beaches, wetlands, subtidal habitats, and fisheries in the face of climate change include regional sediment management planning to help restore natural sources of coastal sediment, beach nourishment to replace areas lost to sea-level rise or erosion, creation of additional "buffer zones" to allow for wetland migration as the climate changes, creation of new wetlands to replace lost areas, fishery management plans that set catch limits with future climate change in mind, subtidal habitat enhancement, and the creation of Marine Protected Areas.

(Climate Action Team, 2010)

7.3 Adaptive Capacity

For each risk identified for the County, there is typically a set of possible adaptation measures or strategies that could be implemented to reduce the future exposure from the specific risk. For some risks, the County can significantly reduce its vulnerabilities by taking some relatively direct actions; in other words, we have a high adaptive capacity. One good example would be coastal bluff erosion. For other risks, there is very little that can be done to ease or reduce the future impacts, or in other words, we have a low adaptive capacity. Perhaps the best example is the challenge the County will face in dealing with a significant future rise in the ground water table beneath the Rio Del Mar Esplanade. This area of the County was built on flood plain deposits and filled in wetlands of Aptos Creek, which consist primarily of sands and gravels that have a high permeability. As a result the water table is believed to closely reflect the water level in the adjacent creek. As sea level continues to rise, the water level in Aptos Creek will rise at high tides and the ground water table beneath the Rio Del Mar Esplanade/Flats will experience the same rise. This happens now and has for some years but will worsen in the future. There does not appear to be a practical solution or adaptive response; and therefore, the County has a low adaptive capacity.

7.4 County of Santa Cruz Climate Adaptation Goals

Goals are generally guidelines that reflect community values and explain what is to be achieved. They are broad-based, long-term, policy statements that guide future actions and choices as related to achieving the goals. The success of this Climate Adaptation Strategy will be measured by the degree to which the goals are accomplished that yield actual risk reduction. The following goals have been proposed in an effort to guide development of more specific adaptation strategies that would reduce our vulnerability to climate change.

- Protect the unique character, scenic beauty and culture in the natural and built environment from being compromised by climate change impacts.
- Support initiatives, legislation, and actions to respond to climate change.
- Encourage and support actions that reduce risks and vulnerabilities now, while recognizing the importance of identifying, making decisions about, and preparing for impacts and risks that may develop in the future.

- Support the reduction of risks from other environmental hazards, noting the strong interrelationships and benefits between reducing risk from climate change, non-climate change-related disasters, and most other environmental hazards.
- Build resilience into all programs, policies and infrastructure.
- Encourage climate change resilience planning and actions in private companies, institutions, and systems essential to a functioning County of Santa Cruz.
- Encourage community involvement and public-private partnerships to respond to potential climate impacts, particularly for those most vulnerable.
- Ensure that the County of Santa Cruz remains a safe, healthy and attractive place with a high quality of life for its residents, businesses and visitors.

7.5 County of Santa Cruz Local Hazard Mitigation Plan 2010-2015

The purpose of hazard mitigation is to implement and sustain actions that reduce vulnerability and risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions include both short-term and long-term activities which reduce the impacts of hazards, reduce exposure to hazards, or reduce effects of hazards through various means including preparedness, response and recovery measures. Effective mitigation actions also reduce the adverse impacts and cost of future disasters.

The County of Santa Cruz developed the Local Hazard Mitigation Plan (LHMP) to create a safer community. The County of Santa Cruz LHMP represents the County's commitment to reduce risks from natural and other hazards, and serves as a guide for decision-makers as they commit resources to reducing the effects of potential hazards. The County of Santa Cruz LHMP serves as a basis for the California Emergency Management Agency (Cal EMA) to provide technical assistance and to prioritize project funding (Code of Federal Regulations (CFR) §201.6.). Many of the strategies outlined in the following section reference strategies already included in the approved LHMP.

In January 2012, the County received a Community Development Block Grant - Disaster Recovery Initiative grant to complete a number of planning activities identified as priority actions in the County's LHMP. One of the actions is an update of the Safety Element of the County General Plan and Local Coastal Program. The update will add policies and goals to incorporate climate change mitigation strategies and climate adaptation strategies, and specifically will address sea level rise and tsunami events in the sections on coastal bluffs and beaches, erosion, flood hazards, and fire hazards.

7.6 Climate Change Adaptation Strategies for Santa Cruz County

The following table presents a set of possible adaptation actions, or strategies, for each of the vulnerabilities and impacts that have been recognized and evaluated. The strategies include a broad range of approaches for protecting people, infrastructure, and natural resources, with an emphasis on building connections among people and organizations. It is important to note that to some extent this discussion is more about protecting the built environment rather than protecting public health and safety. Public health and safety is not the focus because the local, state, and federal agencies have an increasing ability to predict storm events and to notify and evacuate people in advance of hazardous events related to climate change.

Some strategies emphasize future planning, some focus on avoidance of hazards, and others on more specific engineering approaches. Strategies that build partnerships will yield more specific adaptation actions once the cooperative relationships are operating.

In Table 7-1, strategies are paired with one or two climate change impacts as a means of organizing the strategies, but this is a simplification, as most strategies have multiple benefits across subject areas and could be listed as adaptations to several different impacts.

Table 7-1: Possible Climate Change Adaptation Strategies for Santa Cruz County

Climate Change Process	Impact	Possible Adaptation Strategy
1. Continuing and accelerated sea level rise	Gradual Permanent inundation of low lying shoreline areas	Consider designing and siting all future County projects and infrastructure to account for sea level rise projections, considering projected life span of project.
		Develop a detailed priority list for addressing public infrastructure that has been identified as vulnerable, and consider developing retreat or retrofit plans for high priority infrastructure subject to future inundation.
		Consider developing a plan to elevate E. Cliff Drive at Twin Lakes State Beach, Corcoran Lagoon, and Moran Lake to alleviate frequent coastal flooding and potential inundation.
		Develop a forum for ongoing engagement with coastal private property owners and the California Coastal Commission to discuss frameworks for land use policies that respond to expected future losses. Topics would include post-disaster reconstruction, policies regarding engineered protective structures and legal instruments that would allow property owners to acknowledge and accept responsibility for future losses.
		Consider a program to identify areas where high priority wetlands will be inundated, and evaluate options to allow wetland areas to migrate with the shoreline.
		Consider relocating coastal development away from areas that will be inundated to eliminate the risk of damage and the need for coastal protection. This concept is known as “managed retreat” and may only be technically, financially and legally feasible in limited situations.
	Gradual inundation of beaches where back edge of beach is fixed with a structure (beach loss)	Consider limiting new engineered protection structures to infill in locations where the back beach is currently fixed.
		Consider a program to identify those areas where managed retreat should replace engineered protection structures, based on public benefit.
	Rise in groundwater table and channel surge at Rio Del Mar Esplanade backing up in drainage system	Consider securing federal grant funding for the following drainage improvements within the Rio Del Mar Esplanade necessary to protect against a 10-year storm:
		• Construct pump station to include a new concrete vault at the southeast end of the parking lot centerline equipped with multiple pumps and associated control panels; establish new discharge outfall, provide new piping to connect to the existing storm drain systems and install a water quality treatment unit.
		• Install a closed gravity pipe system along Winfield Way that intercepts runoff along the ramped section of Aptos Beach Drive. Install a closed gravity pipe system near the Esplanade frontage that intercepts runoff flowing down the ramped section of Rio Del mar Boulevard.
		• Replace the undersized 12-inch pipes along Aptos Beach Drive with 24-inch diameter PVC, HDPE or RCP piles. Relocate and replace the Esplanade parking lot storm drain system with 18-inch pipes.
		• Rebuild the 12-inch storm drain lateral from the downstream end of the main storm drain up Venetian Road to Lake Court. Provide several

Table 7-1: Possible Climate Change Adaptation Strategies for Santa Cruz County		
Climate Change Process	**Impact**	**Possible Adaptation Strategy**
		inlet locations and a point of connection at Sand Street.
		• Construct a new seawall within the Esplanade parking lot on County property rather than State Parks property. Alignment would likely divide the parking lot into two halves, with the interior side offering year-round use, and the beach side closed in the storm season only.
	Rise in groundwater table at Neary Lagoon Wastewater Treatment Plant	Continue to improve wastewater collection system to reduce infiltration by groundwater or surface water. Monitor groundwater and increase efforts as necessary.
		Consider coordinating with the City of Santa Cruz on programs to minimize vulnerabilities at the Neary Lagoon plant.
2. Sea level rise in combination with winter storms	Increased impacts to residential development from wave run-up, storm surge and flooding.	Develop a forum for ongoing engagement with coastal private property owners and the California Coastal Commission to discuss frameworks for land use policies that respond to expected future losses. Topics would include post-disaster reconstruction, policies regarding engineered protective structures and legal instruments that would allow property owners to acknowledge and accept responsibility for future losses.
		Work with the engineering community to define a standard increment of additional height that should be added to the FEMA 100 year wave run up, storm surge, and flood levels when analyzing hazards in specific locations.
		In consultation with the California Coastal Commission, consider revising regulations that address rebuilding structures that are repeatedly damaged by sea level rise and coastal storms.
		Consider relocating coastal development away from hazardous areas to eliminate the risk of damage and the need for coastal protection. This concept is known as “managed retreat” and may not be technically, financially or legally feasible in many situations.
		Continue implementing and improve the FEMA flood hazard program. See “changing patterns of precipitation” for detailed recommendations.
	Damage to Public infrastructure from storm surge.	Develop a priority list for addressing public infrastructure that has been identified as vulnerable to storm surge and wave run up associated with 16.5–65.7 inches of sea level rise in 2100, and consider developing retreat or retrofit plans for high priority public infrastructure. This list should be updated periodically to reflect new information about the extent and timing of sea level rise.
		Work with the County Office of Emergency Management to refine FEMA flood hazard mapping to account for climate change, as maps are the basis for evacuation notification in the event of anticipated flooding and/or a tsunami.
	Increase in coastal bluff erosion rates	Consider evaluating unprotected developed coastal bluff areas subject to future erosion, and develop plans and timeline for either armor placement, or retreat and relocation of existing public structures and/or infrastructure.
		Consider evaluating areas that are presently armored to determine whether additional armor or managed retreat is the most practical long-term approach.
	Increase in landslides due to magnitude of storm	Continue to require that the County Geologist review development in areas of suspected landsliding and require engineering geology reports when landsliding is identified or suspected.

Table 7-1: Possible Climate Change Adaptation Strategies for Santa Cruz County		
Climate Change Process	**Impact**	**Possible Adaptation Strategy**
	events	Continue to require that an engineering geologist and/or geotechnical engineer investigate the site of any proposed construction near landsliding and require mitigation of landslide hazards before issuing any building or grading permits.
		Continue to require that an engineering geologist and/or a geotechnical engineer investigate any landslide damage to homes or roadways before repair of the landslide and reuse of the homes or roadways.
3. Changing patterns of seasonality of precipitation	Increased frequency and magnitude of winter flooding in response to more concentrated winter rainfall	Continue to work with the U.S. Army Corps of Engineers, County of Monterey, and City of Watsonville to develop a feasible flood control alternative to reduce the potential overtopping of the Pajaro River levees within both Santa Cruz and Monterey counties, including construction of setback levees to reclaim a portion of the floodplain while increasing the flood capacity.
		Amend the Safety Element of the General Plan and revise implementing regulations to increase the efficacy of the damage prevention and flood protection aspects of the National Flood Insurance Program. This would include revising the method of calculating "Substantial Improvement" in the floodplain, maintaining participation in the Community Rating System to improve floodplain management and reduce insurance costs for residents, and creating an online database of elevation certificates (*LHMP)*.
		Consider increasing the freeboard above the projected 100 year flood level that is required for new development, in order to account for sea level rise and increased winter storms.
		Evaluate the effectiveness of current policies and ordinances designed to limit storm water runoff and flooding and, if needed, recommend revisions to improve the effectiveness of these policies and codes. Specifically, evaluate the effectiveness of current drainage plan requirements for new development to ensure that runoff from impervious surface does not contribute to flooding, and revise development permit conditions of approval if needed (*LHMP)*.
		Prepare a "Storm Water Facilities Master Plan" for Flood Control Districts 5 & 6, which includes portions of Live Oak, Soquel, Aptos, Seacliff and Rio Del Mar. This will include an inventory of existing facilities, development of hydraulic and hydrologic modeling of these facilities, development of a prioritized Capital Improvement Program list, hydromodification analysis and development of generic best management practices and design standards (LHMP).
	Reduced water availability due to more frequent drought	Incorporate findings and recommendations of the integrated Regional Water Management Plan (forthcoming) into County water policy.
		Consider implementing additional water conservation programs, regulations and policies to conserve water supplies in the unincorporated area (See also E-8.1, Strategy for Emissions Reduction).
		Support the Pajaro Valley Water Management Agency in continuing efforts to conserve groundwater supplies and mitigate salt water intrusion in the Pajaro Valley.
		Support the development of additional water supplies that meet environmental standards *(LHMP)*.
		Promote more effective use of groundwater storage through increased

Table 7-1: Possible Climate Change Adaptation Strategies for Santa Cruz County		
Climate Change Process	**Impact**	**Possible Adaptation Strategy**
		groundwater recharge and conjunctive use among agencies *(LHMP)*.
		Water supply plans should incorporate potential increases in water demand and reduced availability of supply that is projected as a result of climate change.
		Promote drought planning by 130 small water systems under County jurisdiction (*LHMP).*
4. Higher temperatures and lower rainfall	More intense heat waves (hotter, longer)	Consider developing or updating existing public health plans that address the health needs of chronically ill people and other vulnerable groups during extreme heat events, including designating emergency cooling centers.
		Consider a system for contacting home-bound or disabled residents and moving them to air conditioned shelters as needed.
		Consider updating emergency response plans for limited term and extended power outages.
		Consider planning for a greater influx of visitors to the County from hotter inland regions during extended and more frequent heat-waves.
		Review site design standards for new development, the Urban Forestry Master Plan, and Parks Department plans for public spaces for opportunities to increase tree canopy in the urban area and for continued emphasis on increasing the number of trees in the built environment.
		Encourage efforts by agricultural organizations such as the Santa Cruz County Farm Bureau and the U.C. Agricultural Extension to assist the agricultural sector to identify and adjust to changes in pest management, cropping patterns, water management and other on farm practices that may be required as precipitation and temperature patterns change.
	Increased frequency and magnitude of wildfire	Establish and maintain cooperative fire protection and fire prevention agreements with other agencies *(LHMP)*.
		Work with State and Federal natural resources agencies to standardize environmentally appropriate fuel reduction practices in sensitive habitats.
		Maintain early notification/warning of residents by technology based applications *(LHMP)*.
		Increase visibility and reduce response times with proper road and address markings *(LHMP)*.
		Enhanced support for interoperability communications systems with local, state and federal emergency services both inside and around the County *(LHMP)*.
		Reduce fire risks in the urban/wildland interface (WUI) through improved building materials and appropriate code enforcement including defensible space programs *(LHMP and Calgreen building code)*.
		Implement additional fire prevention education programs, to include school and commercial business *(LHMP)*.
		Develop fuel reduction approaches in all areas, with special approaches

Table 7-1: Possible Climate Change Adaptation Strategies for Santa Cruz County		
Climate Change Process	**Impact**	**Possible Adaptation Strategy**
		for sensitive habitat areas.
	Increased threat to the County's biotic resources, biodiversity and ecological systems.	Consider protecting, and/or assisting non-profit organizations to protect habitat that is essential to facilitating species adaptation to changing climate. This would include protecting potential refuge areas and large, interconnected habitat patches that achieve multiple conservation benefits. Areas to consider include buffer areas around existing protected habitat, areas that facilitate connectivity between populations, representative areas of the County's diverse local climates, and areas that are more likely to be climatically stable or support species in the predicted hotter and drier climate, including streams, ponds, lakes, wetlands, springs, and north-facing slopes.
		Consider revising the Conservation and Open Space element of the General Plan to address the challenges of climate change and to update conservation policies, working with local scientists, conservation and environmental organizations.
		Support private and non-profit organizations efforts to promote community awareness of Santa Cruz County's rich biological systems and their vulnerability to climate change, as well as their role in mitigating climate change, and to track indicators of the effects of climate change on important biological systems.
5. Countywide strategies that address multiple impacts from climate change.	Many existing County policies and programs do not address climate change.	Consider how climate-related goals and strategies can be incorporated into an amendment of the General Plan. This may be coordinated with policies that flow from the Transit Corridors Plan for Sustainable Communities and the Disaster Recovery Initiative funded update of the Safety Element (underway).
		Consider incorporating the topic of developing resiliency in important sectors of the economy (such as agriculture and tourism) into the County economic vitality strategy that is currently being developed.
		Consider a program to identify the key transportation infrastructure, communication infrastructure, utilities, beaches and other amenities that support tourism, agriculture and commercial activity in general, and prioritize them for protection or retrofit.
		Consider adding adaptation to climate change as a specific component of the next update of the LHMP.
Note: *LHMP* indicates this strategy has been adopted as part of the Local Hazard Mitigation Plan. Source: County of Santa Cruz, 2013.		