

Chapter 9

PLANNING FOR CLIMATE CHANGE

The Urban Water Management Planning Act does not require water suppliers to address climate change in their Urban Water Management Plans and a full discussion of this subject is beyond the scope of this report. Nevertheless, evidence continues to accumulate that climate change associated with rising global surface temperatures may have significant effects on California's water resources. Furthermore, these effects may be felt locally within the 20-year time frame of this plan, adding uncertainty and hydrologic variability to an already unpredictable and variable future.

9.1 Potential Climate Change Effects Statewide

A summary of the major expected effects of climate change that pose a threat to the state's water resources is provided in Table 9-1 (DWR, 2006).

Table 9-1. Summary of Potential Impacts and Consequences of Climate Change on California's Water Resources

Potential Impact	Expected Consequence
Reduction of the State's average annual snow pack	<ul style="list-style-type: none"> • Potential loss of water storage • Challenges for reservoir management in balancing flood protection and water supply
Changes in the timing, intensity, location, amount, form, and variability of precipitation	<ul style="list-style-type: none"> • Potential increased storm intensity and increased potential for flooding • Possible increased potential for droughts
Long-term changes in watershed vegetation and increased incidence of wildfires	<ul style="list-style-type: none"> • Changes in the intensity and timing of runoff • Possible increased incidence of flooding and increased sedimentation
Sea level rise	<ul style="list-style-type: none"> • Inundation of coastal areas • Increased salinity intrusion into coastal groundwater aquifers
Increased water temperatures	<ul style="list-style-type: none"> • Changes in aquatic ecosystems • Potential adverse changes in water quality • Increased environmental water demand
Changes in evapotranspiration rates	<ul style="list-style-type: none"> • Increased irrigation and domestic water demands (bathing, drinking, recreation)

These changes could have profound effects on both ecological and water resource systems of the state.

Even though the City is not connected to the major water storage and conveyance systems in California such as the State Water Project or the Central Valley Project, it benefits from the same winter weather systems that provide the annual precipitation on which much of the state relies for its water supply. It is also vulnerable to many of the same threats, including rising sea level, storms of increasing intensity, and alternating periods of more severe floods and drought.

As a coastal community, the City of Santa Cruz recognizes the significance of climate change to the City's economic well-being, public health, and environment, and has begun taking steps as a local agency to respond. Activities fall into two general categories. *Mitigation* refers actions that reduce greenhouse gas emissions contributing to climate change and expand the use of clean energy sources. *Adaptation* refers to efforts designed to improve the community's ability to cope with a changing climate. These activities are summarized briefly below:

9.2 Mitigation Response

In 2007, the City of Santa Cruz established a Climate Action Program to create and implement a comprehensive plan to meet the City's community-wide greenhouse gas reduction goals and State land use requirements pertaining to climate change.

Among other steps, the City has prepared a draft [Climate Action Plan](#) as part of the City's General Plan update. This plan quantifies greenhouse gas emissions from various community sources and outlines the actions the City may take in the areas of energy use, transportation, land use, water and wastewater to reduce greenhouse gas emissions 30 percent as compared to 1996 levels by year 2020. In this report, it is estimated that the energy consumed to operate the City water system represents 15 percent of emissions generated by the municipal sector, but less than one percent community-wide emissions. Still, water use efficiency is identified as an important strategy to accomplish greenhouse gas reduction goals. The plan is scheduled to be considered by the Santa Cruz City Council in late 2011.

9.3 Climate Adaptation Planning

The City's current climate adaptation planning effort is an outgrowth of its first Local Hazard Mitigation Plan (LHMP), developed in 2007. The Federal Disaster Mitigation Act

of 2000 requires local governments to develop and submit LHMPs for FEMA approval as a condition of receiving mitigation grant funding. The Climate Adaptation Plan is a continuation of that commitment through an analysis of the steps necessary to reduce the potential impacts of climate change, creating a more climate resilient community.

The City first engaged University of California at Santa Cruz (UCSC) scientists Gary Griggs and Brent Haddad to undertake a vulnerability study to identify risks and recommend potential actions throughout the City to prepare for climate change impacts. The [Vulnerability Study](#) (January 2011) provides an assessment of potential effects of climate change specifically for the City of Santa Cruz with an emphasis on how anticipated climate change may affect the people, infrastructure, property and development, economy, environmental resources, and environmental health. The report provides an analysis, risk assessment, and recommendations relative to the following key impact areas:

- Vulnerability of the Santa Cruz coastline to sea level rise
- Coastal storm damage and cliff erosion
- Changes in precipitation, flood potential and water availability
- Changing temperatures
- Natural resource impacts

Over the next 40 years, the two highest risks to the City identified by the researchers will come from:

1. Water shortages due to the combination of increasing temperatures and changes in precipitation patterns, and
2. Rise in water table on buildings and infrastructure beneath the downtown portion of the City, including the wastewater treatment plant

Based on this study, the City has developed goals, objectives and a range of potential actions that will build adaptive capacity into City policies, programs and infrastructure. These goals and actions along with the Vulnerability Study forms the City's Adaptation Plan that creates a framework for long-range planning decisions.

In all, over 30 action items involving various City departments were identified and prioritized. Those items involving the Water Department include:

- Diversify water portfolio

- Prepare for water emergency supply for climate related events
- Protect watershed land and vegetation
- Monitor open space/watershed
- Protect coastline and water system infrastructure
- Conserve and curtail water usage
- Reduce creek and/or river flooding
- Minimize risks from dam failure
- Prepare for potential changes in water quality due to climate change
- Prepare for climate-change related short-term water shortage

The Vulnerability Study, goals and proposed actions were presented to various City Commissions and will be reviewed by City Council late 2011. After the document has been reviewed by FEMA it will go back to City Council for approval and adoption in winter 2011-12.

9.4 Long-term Average Temperature and Precipitation Change

The National Climatic Data Center maintains temperature and precipitation records for the nation and provides 30-year monthly and annual averages referred to as long-term “normal” figures. These normal temperature and rainfall figures are updated every 10 years.

As shown in Figure 9-1, a recent comparison of 1981-2010 normals with the previous, 1971- 2000 period, for major cities across California suggests that, as temperature rises inland, California's coastal regions appear to be getting slightly cooler by between 0.1 to 1.0 degrees F (Golden Gate Weather Services, 2011). The cooling is attributed to stronger sea breezes. Average rainfall was also seen to increase slightly across the state.

Normal temperature and precipitation for the City of Santa Cruz for three averaging periods is present in Table 9-1. The trend for temperature in Santa Cruz did not track with findings elsewhere along the coast, showing a slight warming trend of 1.1 degrees F between the two averaging periods ending in 2000 and 2010. Average annual rainfall in Santa Cruz does show a slight increase of 0.68 inches, or 2.2 percent, corresponding with observations elsewhere. The analyst cautioned against drawing conclusions about rainfall trends, suggesting that the increase in rainfall may just be the randomness of climate as opposed to signaling a larger scale trend. It was noted that the earlier, 1971-2000 period contained some exceptionally dry years (1976-77) that were dropped off in the succeeding averaging period.

Figure 9-1. Comparison of Mean Annual Temperature and Rainfall for Selected California Cities

Weather changes

Monthly temperature and precipitation averages from 1981 to 2010 were compared with the averages from 1971 to 2000. Here is the change between these two time periods for selected California cities.

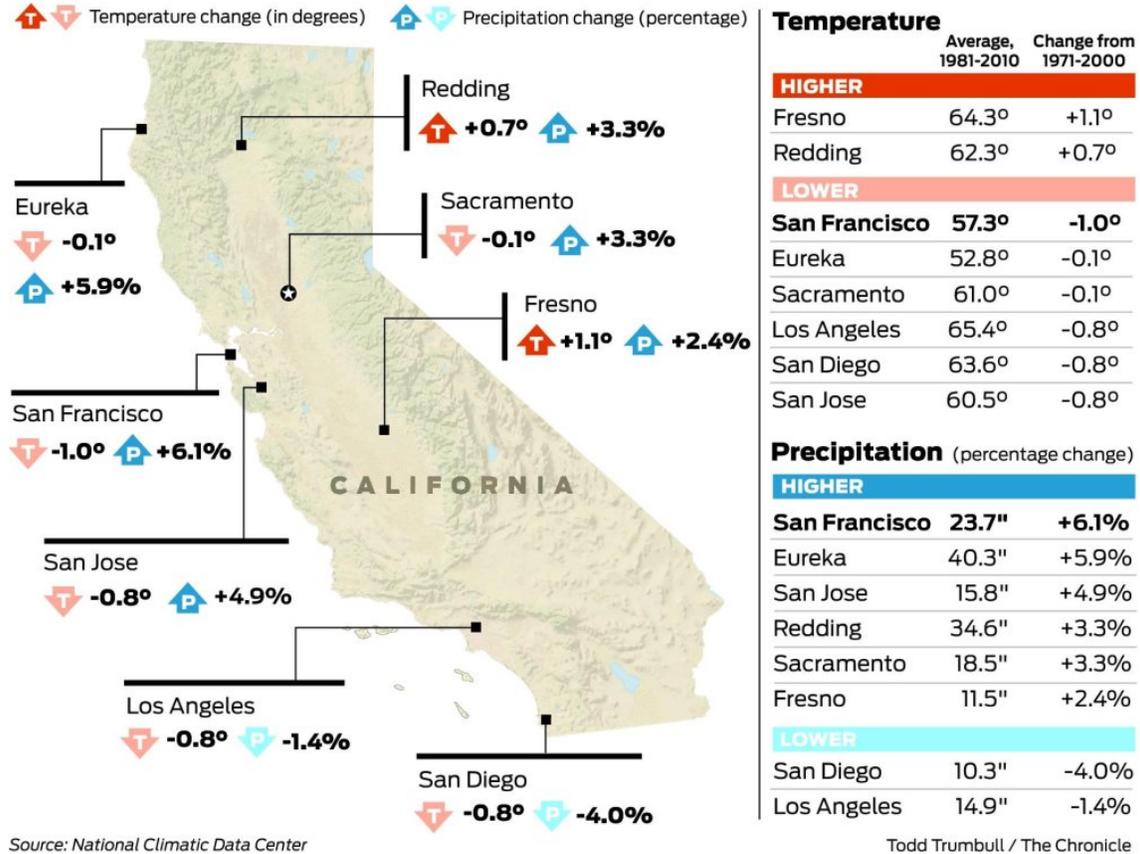


Table 9-1. Comparison of Mean Annual Temperature and Precipitation, Santa Cruz, CA

	1961-1990	1971-2000	1981-2010
Mean Annual Temperature (F)	57.3	57.7	58.8
Precipitation (inches)	28.99	30.67	31.35

The issues identified above regarding the potential effects of climate change are a matter of fundamental concern to the City because of the economic, social, or environmental consequences, particularly when it involves extreme weather events like a flood disaster. Some processes, like sea level rise, will be comparatively gradual, occurring over a long time frame, and could pose a threat to the viability of the City's

groundwater resources. From a water management standpoint, it still remains the short to intermediate-term natural variations of weather, however - which can be impossible to distinguish from the influence of climate change - that present the greater challenge. For a predominantly surface water system like Santa Cruz, these small incremental changes in average temperature and in rainfall do matter, but short-term weather anomalies like persistent high pressure causing back to back dry years, or a damaging flood matter much more. And while the science of ocean and atmospheric dynamics and long-term weather predictions continue to improve, reliable weather forecasts are still good only for a week or two into the future, at best. Thus, there will always be uncertainty about what the weather will be, how much rain the coming year will bring, and whether the City's water supplies will be adequate, irrespective of the longer-term trends.