Section IV-E Drought and Climate Change

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Part IV-E Drought and *Climate Change*

A. OVERVIEW

WHAT IS DROUGHT?

Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions, thus it can vary significantly from one region to another. Drought is different than aridity, which is a permanent feature of climate in regions where low precipitation is the norm, as in a desert. Human factors, such as water demand and water management, can exacerbate the impact that drought has on a region. Because of the interplay between a natural drought event and various human factors, drought means different things to different people, depending on its effect.

Drought can often be defined regionally based on its effects:

- **Meteorological** drought is usually defined by a period of below average water supply.
- **Agricultural** drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock.
- **Hydrological** drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.
- **Socioeconomic** drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region

WHY IS DROUGHT IMPORTANT?

The U.S. is vulnerable to the social, economic, and environmental impacts of drought. The over 100-year weather record of the U.S. indicates that there were three or four major drought events during that period. Two of these, the 1930's Dust Bowl drought and the 1950's drought, each lasted five to seven years and covered large areas of the continental U.S. Droughts have been among the most costly weather-related events, in terms of economics and loss of life.

HOW IS DROUGHT MONITORED AND ASSESSED?

The U.S. Drought Monitor provides a general summary of current drought conditions. The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted.

The result is the consensus assessment presented on the USDM map. The image is color-coded for four levels of drought intensity. An additional category, "Abnormally Dry," is used to show areas that might be moving into a drought, as well as those that have recently come out of one.

WHICH AGENCY IS RESPONSIBLE FOR DROUGHT MANAGEMENT?

Federal Government
According to communications with Brian A. Fuchs, Associate Geoscientist/Climatologist, National Drought Mitigation Center University of Nebraska-Lincoln, "The National Drought Mitigation Center has worked in the drought area for the last 20 years and has long been the "go to" source for monitoring, planning, and mitigation related to drought. About 7 years ago, there was an effort to determine a federal lead agency which would combine the drought efforts of many federal agencies who had some interest or past record in dealing with drought. This effort was the National Integrated Drought Information System (NIDIS) and can be found at drought.gov. The National Drought Mitigation Center and NIDIS works closely addressing many issues/topics related to drought. The federal government has long delegated drought response to the states and many states have implemented drought response plans."

Several bills have been introduced into Congress in an effort to mitigate the effects of drought. In 1998, President Clinton signed into law the National Drought Policy Act, which called for the development of a national drought policy or framework that integrates actions and responsibilities among all levels of government. In addition it established the National Drought Policy Commission to provide advice and recommendations on the creation of an integrated federal policy. A more recent bill introduced into Congress was the National Drought Preparedness Act of 2003, which established a comprehensive national drought policy and statutorily authorized a lead federal agency for drought assistance. It established a National Drought Council within the Department of Agriculture, to improve national drought preparedness, mitigation, and response efforts, and for other purposes.

State of California
In California, the State National Resources Agency has appointed its Department of Water Resources as the lead for both flood and drought.

County of Orange
The Sheriff's Department Emergency Management Division is heading up a county-wide comprehensive committee on drought.

B. CALIFORNIA DROUGHT

Drought is a gradual phenomenon. Normally, one dry year does not constitute a drought in California, but rather serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure (reservoirs, groundwater basins and aqueducts, etc.) generally mitigates the effects of short-term dry periods for most water users.

Drought can have secondary impacts. For example, drought is a major determinant of wildfire hazards, in that it creates greater propensity for fire starts and larger, more prolonged conflagrations fueled by excessively dry vegetation, along with reduced water supply for firefighting purposes. Drought is also an economic hazard. Significant economic impacts on

California's agriculture industry can occur as a result of short- and long-term drought conditions. These include hardships to farmers, farm workers, packers and shippers of agricultural products. In some cases, droughts can also cause significant increases in food prices to consumers due to shortages. Drought can also result in lack of water and subsequent feed available to grazing livestock, potentially leading to risk of livestock death and resulting in losses to the state's agricultural economy.

Past experience with California droughts tells us that drought impacts are felt first by those most dependent on or affected by annual rainfall – agencies fighting forest fires, ranchers engaged in dryland grazing, farmers and rural residents. Almond trees in California use 10% of all the state's water to grow almond trees and such practices may not be sustainable. Droughts and floods can occur back to back in California, a state with such extremes that Northern California may receive 90 inches of rain in a year and Death Valley only two inches. The 1861-62 great floods were followed by two severely dry years, which ended the cattle rancho economy in California altering the states future.

Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response unlike droughts which are gradual phenomenon. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends.

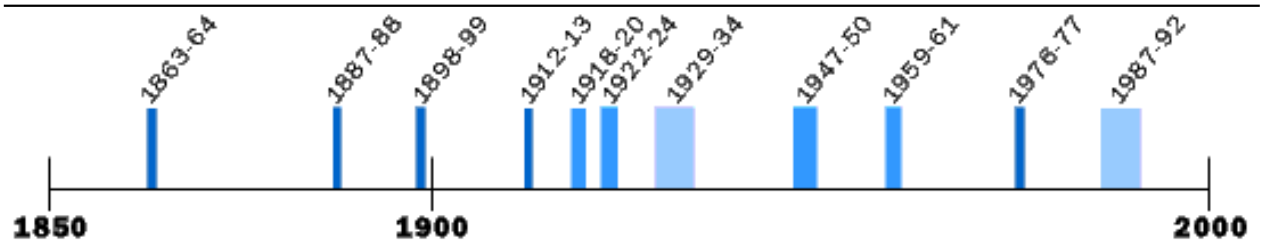
CALIFORNIA DROUGHT HISTORY

Drought has affected virtually every county in California at one time or another, causing more than $2.6 million in damages. Droughts exceeding three years are relative rare in Northern California, the source of much of the state's water supply. The 1929-1934 drought established the criteria commonly used in designing storage capacity and yield for large Northern California reservoirs. The driest single year in California's measured hydrologic history is 1977.

Prior to the current drought, a major drought occurred in 2007-2009. At a regional level, parts of Southern California experienced a series of consecutive dry years in the late 1990s/early 2000s, with water year 2002 setting records for the single driest precipitation year in cities such as Los Angeles and San Diego. The Colorado River Basin, an important source of water supply for Southern California, experienced five consecutive years of drought in water years 2000-2004.

Historically, California has experienced multiple severe droughts. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs. The driest single year of California's measured hydrologic record was 1977. The figure below depicts California's multi-year historical dry periods, 1850-2000.

FIGURE 1: SOUTHERN CALIFORNIA'S MULTI-YEAR HISTORICAL DRY PERIODS, 1850 - 2000



SOURCE: CALIFORNIA DEPARTMENT OF WATER RESOURCES (DWR), WWW.WATER.CA.GOV/
Note: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

The HMPC identified the following droughts as having significant impacts on the planning area:

1947-1950—This drought was in effect for the entire State from 1947- 49. The most extreme drought areas were in the south, affecting Orange County.

1959-1961—This drought was in effect for the entire State from 1959-1962. The most extreme drought conditions existed in the Sierra Nevada and central coast.

1976-77—A federal disaster declaration was declared as a result of a drought affecting Orange County and much of California. This was the driest two years in California history.

1987-1992—Orange County also suffered adverse effects resulting from this statewide drought.

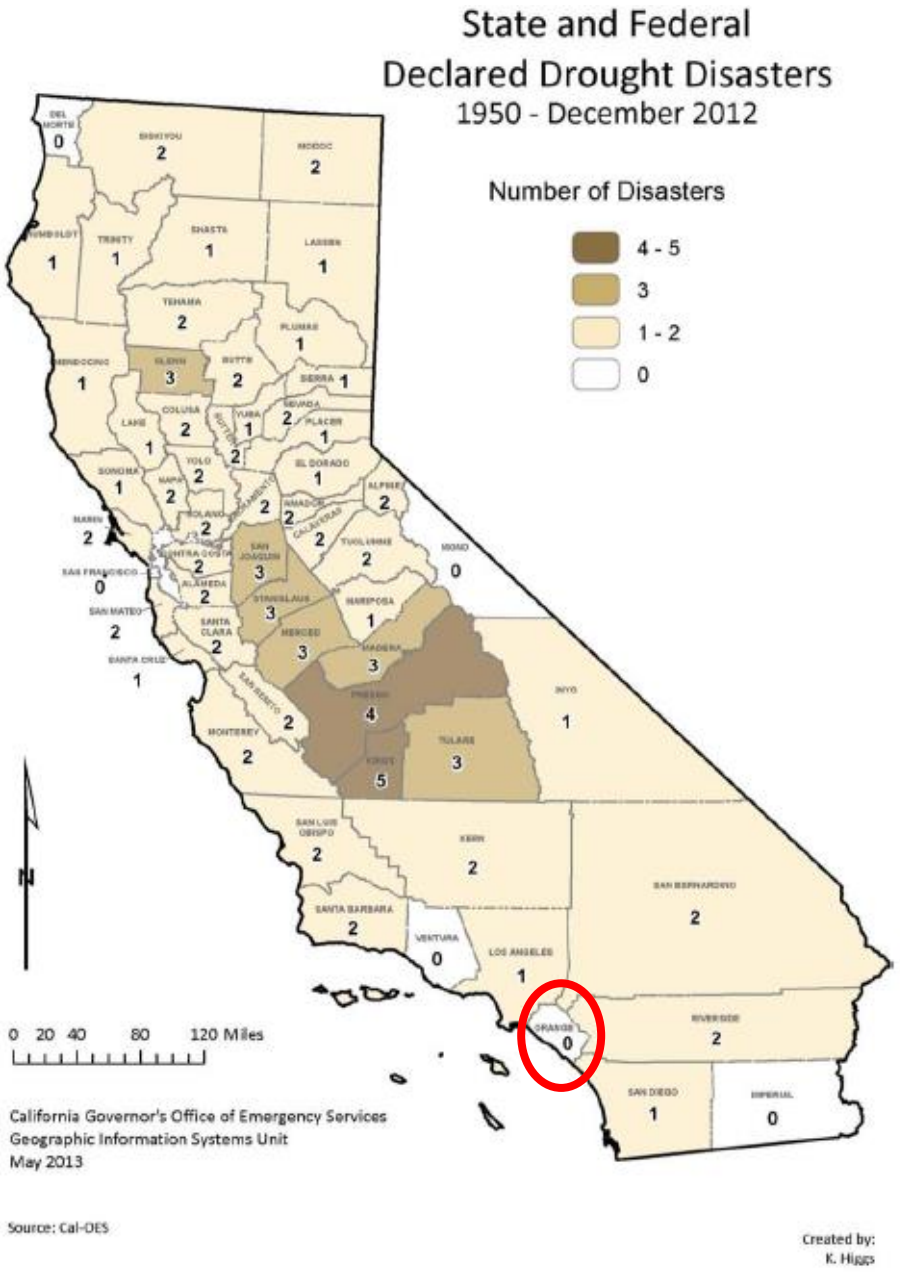
2007-2009—Water year 2007 was unusually dry across much of California. Water year 2006-2007 ended with 53 percent of normal runoff for the State. Winter snow levels in 2007-2008 were about 65 percent of average. Compounding the drought situation was the spring of 2008, which was the driest spring on record for the state. Water year 2007-2008 ended with 60 percent of normal runoff for the State. January of 2009 was the 8th driest January on record for the state and snow sensors indicated water content in the Sierra statewide snowpack at 60 percent of average.

TABLE 1: CALIFORNIA DROUGHT INCIDENTS 1972 - 2009

Year	Number of Incidents	Jurisdictions Affected (Counties, Unless Otherwise Noted)	Crop Damage
1972	1	Glenn, San Benito, Santa Clara	$8 million
1976-1977	1	Alpine, Calaveras, Colusa, Fresno, Glenn, Madera, Merced, San Diego, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne, Alameda, Butte, Contra Costa, Kings, Los Angeles, Riverside, San Luis Obispo, Tulare, Yolo, Amador, Monterey, Napa, Nevada, San Benito, San Bernardino, Tehama, San Mateo, Marin	$2.67 billion
1988	1	Madera County location emergency was ratified every two weeks through 1991.	N/A
1990	2	Santa Barbara(City and County)	0
1991	1	Alameda, Alpine, Colusa, Fresno, City of Orange Cove, Glenn, Kern, Kings, Lake, Madera, Marin, Mendocino, Monterey, Placer, Santa Barbara, City of Santa Barbara, Shasta, Siskiyou, Solano, Sonoma, Sutter, Tehama, Tulare, Tuolumne, and Yuba. Many of these emergencies continued through 1992.	USDA-nationwide: $995 million for 1990-1991 crop loss. Additional $775 million in emergency funds for 1990-92 crop losses.
2001	5	Del Norte, Modoc, Siskiyou, Inyo, Humboldt, Kern, Los Angeles, Ventura, Mono, Lassen, Plumas, San Bernardino, Santa Barbara, Sierra, Shasta, Trinity	N/A
2002	3	Alpine, Amador, Calaveras, Imperial, Modoc, Nevada, Orange, Placer, Riverside, San Bernardino, Sierra, Stanislaus	$12,100
2007	1	Kings, Riverside	(data pending)
2008	1	Fresno, Kern, Kings, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tulare	(data pending)
2009	1	Fresno	(data pending)

Sources: Cal OES Individual Assistance Section, 2001& 2002 SBA Declarations/USDA Designations database; Cal OES Origins and Development- A Chronology 1917- 1999

FIGURE 2: STATE AND FEDERAL DECLARED DROUGHT DISASTERS 1950 TO DECEMBER 2012.



Map 6.J shows the pattern of drought-declared disasters in California over the past 62 years. Heaviest concentrations are in the Central Valley and inland areas.

Figure 2 shows that Orange County has not ever declared a disaster for drought from 1950 to 2012.

ISSUES RELATED TO DROUGHT

Key factors that have an effect on water demands in California have influenced water demands in the past and will continue to do so in the future:

Climate Variability
California's climate is highly variable both spatially (from temperate rain forest conditions on the North Coast to the extreme aridity of Death Valley) and temporally. Records for maximum annual precipitation range from more than 90 inches on the North Coast to a little over 2 inches in Death Valley. Droughts and floods can occur in close proximity. For example, the flooding of 1986 was followed by six years of drought (1987-92). At the beginning of the state's historical record the so-called "Noachian" floods of winter 1861-62 were followed by two severely dry years, a combination became the death knell for much of the cattle rancho economy.

Drought and Precipitation
Most of California's precipitation (rain and snow) comes from storms moving across the Pacific Ocean. The path followed by the storms is determined by the position of an atmospheric high pressure belt that normally shifts southward during the winter months, allowing low pressure zones to move into the state. On average, 75 percent of California's annual precipitation occurs from November through March, with 50 percent occurring from December through February. California's average precipitation is dependent on a relatively small number of storms; a few storms more or less during the winter season can determine if the year will be wet or dry. If a persistent Pacific high pressure zone remains over California in mid-winter, there is a tendency for the year to be dry.

Drought and Groundwater
In an average year, about 30 percent of California's urban and agricultural water supplies come from groundwater. Reliance on groundwater increases during droughts due to reduced availability of surface water. During the six-year 1987-92 drought the total number of well driller reports filed with the Department were in the range of 25,000 wells per year for several years, up from fewer than 15,000 reports per year prior to the drought. Most of the new wells were for private residential use.

California is sinking 2 inches a month because of drought-driven groundwater pumping. Scientists have known California is sinking for years, but new data from NASA show the state is subsiding even faster than previously thought due to relentless pumping of groundwater – largely for agricultural purposes. According to LiveScience, NASA officials say some parts of the state are dropping at a rate of more than 2 inches per month due to groundwater extraction, and if the trend continues, the land could permanently lose its capacity for storing water underground.

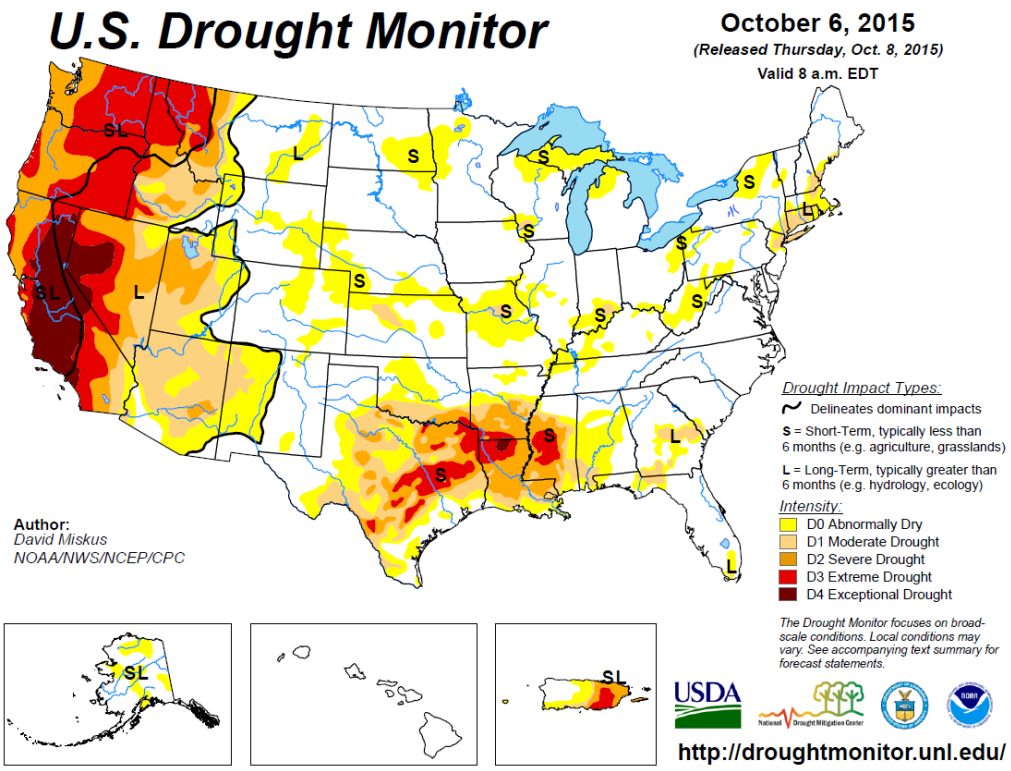
Demographic
Since water use is related to demographics, an accurate description of population and housing stock in the service area can serve as a basis for water planning activities described in the Urban Water Management Plan. California's extreme population growth over the years has placed a tremendous burden on water providers to serve their growing populations especially as the Colorado River provides less and less water to California. Over the past 5 years, Orange County has dramatically increased the density in residential areas. This high density development is placing a tremendous pressure on the decreasing water supply complicated by a four year drought.

Economic
In the early 1990's, the rate of economic growth declined due to the severity and duration of the recession. The recession affected declines in the manufacturing sector, particularly in the defense and aerospace. During the late 1990's and early 2000's, the economy was strong and had an effect on increased water usage. However, even with the stronger economy, industrial demands decreased. This has been partly due to changes in operation such as installation of on-site recycled water system. In addition, several large companies have moved out of the area and have been replaced with different sectors whose water usage is lower.

CALIFORNIA'S CURRENT DROUGHT

California's is currently in the fourth year (2012 - Ongoing) of a major statewide drought. According to the U.S. Drought Monitor, California is in the category "Exceptional" which is the worst level possible.

FIGURE 3: U.S. DROUGHT MONITOR FOR U.S., OCTOBER 2015

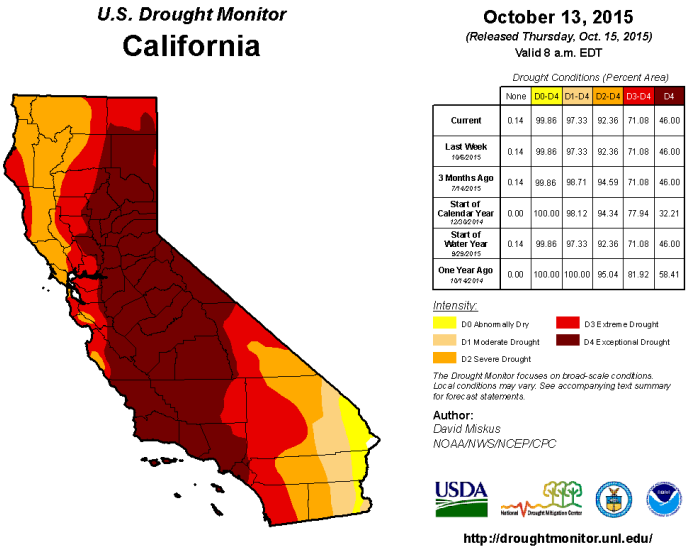


On April 1st, 2014 California Governor Jerry Brown made an executive order that requires cities and towns to cut 25% of water use (excluding agriculture) to save an estimated 1.5 million acre feet of water over the next nine months. The Governor declared a State of Emergency. **RSCCD is currently in a State of Emergency Drought which is part of a 4 year serious drought.**

In response to this issue and other timely issues, the District started the RSCCD Sustainable Committee (RSC) which addresses drought.

The following article entitled, 17 Interesting Facts About the California Drought, written by Seametrics, Technology with a Mission on April 20, 2015 sums up the 2012/2015 California Drought.

FIGURE 4: U.S. DROUGHT MONITOR FOR CALIFORNIA, OCTOBER 2015



1. The drought currently encompasses over 98% of the state of California.

2. More than 44% of California is in "exceptional" drought, the worst level of drought.

3. Some parts of the Sierra Mountains that typically have 66 inches of snow pack are barren.

4. Farmers could sell their water for $700 an acre foot, more than they would earn by using the water to grow crops.

5. Nearly 60 percent of the state's water needs are now met by groundwater, up from 40 percent in years when normal amounts of rain and snow fall.

6. The drought forced California farmers to fallow 500,000 acres of land in 2014. And the number may double by the end of 2015.

7. California-based trade organization Western Growers Association estimated 17,000 farm jobs were lost in 2014 alone.

8. California is the world's fifth-largest supplier of food.

9. California grows 43 percent of the nation's fruits, nuts, and vegetables and more than 90 percent of its almonds, grapes, and broccoli.

10. The current drought cost the (farming) sector an estimated $2.2 billion in 2014.

11. In some areas of the Central Valley, the land is sinking by one foot or more per year.

12. The Sierra Nevada snowpack, which is counted on to provide 30 percent of the state's water supply as it melts through early summer, is at its second-lowest level on record.

13. The diminished hydropower capacity of California's dams cost electricity customers a total of $1.4 billion in the past three years.

14. It will take about 11 trillion gallons of water (42 cubic kilometers) — around 1.5 times the maximum volume of the largest U.S. reservoir — to recover from California's continuing drought, according to a new analysis of NASA satellite data.

15. California's current drought is the driest period in the state's 163 years of recorded rainfall history.

16. NASA scientists predict that there is an 80 percent chance of a mega-drought in the Southwest United States before the end of the century.

17. Rows of almond trees cover nearly 1 million acres in California and consume 1.07 trillion gallons of water annually in the state, one-fifth more than California families use indoors.

The drought issue in California is further compounded by water-rights. Water is a commodity possessed under a variety of legal doctrines. The prioritization of water rights between farming and federally protected fish habitats in California is part of this issue.

The snow that blanketed the Sierra Nevada in California last winter, and that was supposed to serve as an essential source of fresh water for the drought-stricken state, was at its lowest levels in the last 500 years, according to a new study. The paper, published in the journal Nature *Climate Change*, used tree-ring data from centuries-old blue oaks to provide historical context for the mountain range's diminished snowfall. In early 2015 the snowpack levels were just 5 percent of their 50-year historical average.

As California is experiencing the fourth year of our current drought, we are learning about the extensive impacts which are wide-reaching and cause economic, environmental, and/or societal damage. The most significant impacts associated with drought in the planning area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Also, during a drought, allocations go down, which results in reduced water availability. Voluntary conservation measures are typically implemented during extended droughts as was done with Governor Brown's State of Emergency. A reduction of electric power generation and water quality deterioration are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding which often follows a drought. Weather predictions for late 2015 and early 2016 include the prediction of a great El Nino or "Godzilla El Nino" demonstrating once again the great hazard mitigation challenges that California faces. "

The current drought has had an Extremely High impact on Orange County due to the lack of rain and snowfall for the past three to four years in the Sierra water shed. With extremely low snowfall, the reservoirs in Northern California are at their lowest ever as well as Southern California reservoirs being very low. Population growth has been significant across Southern California which requires an even larger demand for water. High density housing is being built all over Orange County and will add to the long term problems. Agriculture water allocations needed in late winter – early spring planting cycle have been cut to zero. Voluntary water restrictions have been implemented for residences. Conservation actions have been and are being taken by, residence, business, agriculture, and government. The RSCCD has formed a Sustainable

RSCCD Committee to lead the district's water conservation efforts among other sustainable issues. Wildland fires will significantly affect all of California (both Northern, Central and Southern) which causes health and medical issues for all residences. Fisheries are also affected. Low to no flows on the Sacramento and American Rivers have had an adverse effect on Smelt, Salmon, Bass, Trout and other species that are native to the rivers.

The major issue directly attributed to the Drought is the economic impacts that will affect everyone. The economics loss crosses drought impacts causing loss in income, jobs, cut back in government revenue, loss of beef cattle, dairy production, vegetables, rice, nuts and other crops. The secondary, impacts of the drought have yet to be seen, reduction in in homes sold, higher unemployment, more people seeking food stamps, higher needs of staple food commodities from local Food Banks. All of this will have a significant impact on California's Economy, which is one of the top 10 Economy's in the World.

CURRENT STATE DROUGHT HAZARD MITIGATION EFFORTS

Mitigation of drought impacts includes short- and long-term water conservation measures for urban areas as called for by the past Governor's Emergency Proclamations. There is ample literature on urban water conservation measures. Agricultural water conservation measures reducing crop damage and losses include but are not limited to:

- Drought Planning
- Water Management Planning
- Land Management Planning
- Crop Management Planning

C. ORANGE COUNTY DROUGHT

Orange County relies on two major water supply sources, which includes imported water from the Metropolitan Water District of Southern California (Metropolitan) and local groundwater from the OCWD. Approximately 75 percent of the water supply is provided by 11 groundwater wells. The groundwater comes from a natural underground reservoir that stretches from the Prado Dam and fans across the northwestern portion of Orange County, excluding the communities of Brea and La Habra, and extending as far south as the El Toro "Y."

ORANGE COUNTY DROUGHT HISTORY

A significant drought, reported by many of the ranchers in Southern California, occurred in 1860. The great drought of the 1930s, coined the "Dust Bowl," was geographically centered in the Great Plains yet ultimately affected water shortages in California. The drought conditions in the plains resulted in a large influx of people to the west coast. Approximately 350,000 people from Arkansas and Oklahoma immigrated to the Great Valley of California. As more people moved into California, including Orange County, increases in intensive agriculture led to overuse of the Santa Ana River watershed and groundwater resulting in regional water shortages.

D. ORANGE COUNTY WATER SOURCES

A special thanks to Kelly Hubbard, Water Emergency Response of Orange County (WEROC) for her assistance on the Orange County Water Sources section. Ms. Hubbard was interviewed for this plan and she reviewed the competed drought section.

North and Central Orange County have a valuable asset, a local groundwater basin managed by the Orange County Water District (OCWD) that provides nearly two-thirds of the water supply for 2.4 million people. Knowing the likely occurrence of droughts in California, OCWD saves reserve funds to prepare for and respond to drought conditions. The OCWD has spent $79.3 million over the past three years purchasing imported water from Metropolitan. The water was recharged into the groundwater basin which helped to partially refill the basin and somewhat offset the impacts of the recent drought. Although groundwater levels have fallen, they are still within normal historic operating range. OCWD recently invested $142 million to expand the Groundwater Replenishment System (GWRS), an award-winning water purification system that takes treated wastewater from the Orange County Sanitation District and purifies it to meet or exceed drinking water standards. The expansion, completed in June 2015, produces an additional 30 million gallons a day (MGD), taking the GWRS total production to 100 MGD. This is enough water to meet the combined water demands of the cities of Anaheim and Huntington Beach.

In addition to being reliable during drought, GWRS water is about half the cost of imported supplies and is controlled locally, saving cities in Orange County millions of dollars annually.

There are 28 retail water utilities and 2 regional water utilities within the County of Orange.

Orange County Water Sources Summary:

48% Groundwater	7% Recycled Water
43% Imported	2% Surface Water

The imported water is 50% from the Colorado River and 50% from the State Water Project.

Single-Family homes account for 43% of all water used in Orange County. Here's how water is utilized:

65% outdoor irrigation	8% Laundry	6% Faucets
9% Toilet	6% Showers	6% Other including leaks

Where does the water come from?

STATE WATER PROJECT

The California State Water Project (SWP) is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. Of the contracted water supply, 70 percent goes to urban users and 30 percent goes to agricultural users.

The Project makes deliveries to two-thirds of California's population. It is maintained and operated by the California Department of Water Resources. The Project is also operated to improve water quality in the Delta, control Feather River flood waters, provide recreation, and enhance fish and wildlife.

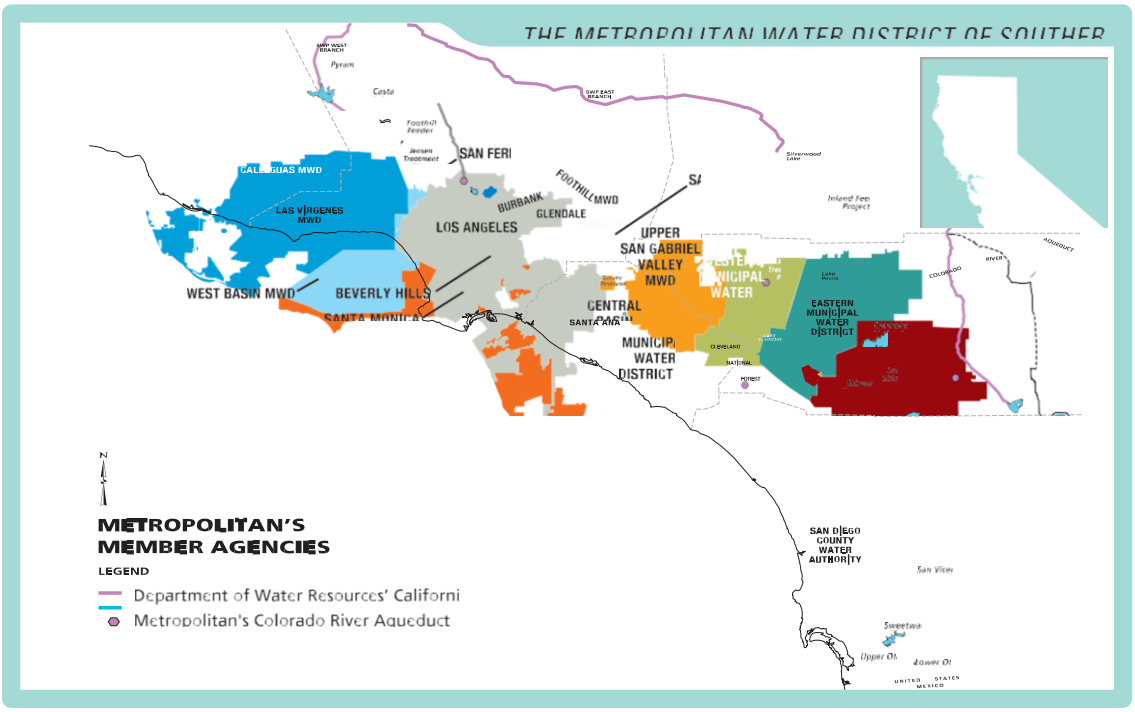
Today, the Project includes 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 701 miles of open canals and pipelines.

The State Water Project provides supplemental water to approximately 25 million Californians and about 750,000 acres of irrigated farmland.

FIGURE 5: CALIFORNIA STATE WATER PROJECT (SWP) FACILITIES

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

FIGURE 6: METROPOLITAN MEMBER AGENCIES



The Metropolitan is the REGIONAL wholesaler that delivers water to 26 member public agencies – 14 cities, 11 municipal water districts, one county water authority which in turn provides water to more than 19 million people in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura Counties. Metropolitan is governed by a 37-member board of directors who represents their respective member agencies ensuring each member agency is part of the governance process.

To supply the more than 300 cities and unincorporated areas in Southern California with reliable and safe water, Metropolitan owns and operates an extensive water system including the Colorado River Aqueduct, 16 hydroelectric facilities, nine reservoirs, 819 miles of large-scale pipes and five water treatments plants. Four of these treatment plants are among the 10 largest plants in the world. In fact, Metropolitan is the largest distributor of treated drinking water in the U.S. The District imports water from the Feather River in Northern California and the Colorado River to supplement local supplies. It also helps its member agencies develop water recycling, storage and other local resource programs to provide additional supplies and conservation programs to reduce regional demands and help with the ongoing threat of drought.

Metropolitan currently delivers an average of 1.7 billion gallons of water per day to a 5,200-square mile service area.

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY (MWDOC)

The Municipal Water District of Orange County (MWDOC) is a wholesale water supplier and resource planning agency. Their efforts focus on sound planning and appropriate investments in water supply development, water use efficiency, public information, legislative advocacy, water education, and emergency preparedness. MWDOC's service area covers all of Orange County, with the exception of the cities of Anaheim, Fullerton, and Santa Ana. They serve Orange County through 28 retail water agencies.

Local water supplies meet nearly half of Orange County's total water demand. To meet the remaining demand, MWDOC purchases imported water from Northern California and the Colorado River through the Metropolitan. MWDOC delivers this water to its 28 client agencies, which provide retail water services to the public.

MWDOC is governed by a seven-member Board of Directors. The MWDOC is the third largest Metropolitan member agency and holds key leadership positions on the Board of Directors that oversee policy development, strategy, and implementation.

ORANGE COUNTY WATER DISTRICT (OCWD)

OCWD was formed in 1933 by a special act of the California State Legislature to protect Orange County's rights to water in the Santa Ana River. OCWD's primary responsibility is managing the vast groundwater basin under northern and central Orange County that supplies water to more than 20 cities and water agencies, serving more than 2.3 million Orange County residents. Since 1933, OCWD has replenished and maintained the groundwater basin at safe levels while more than doubling the basin's annual yield. This important source of water provides local groundwater producers with a reliable supply of high-quality water.

OCWD primarily recharges the basin with water from the Santa Ana River and, to a lesser extent, with imported water purchased from the Metropolitan. OCWD currently holds rights to all Santa Ana River flows reaching Prado Dam. Water enters the groundwater basin via settling or percolation ponds in the cities of Anaheim and Orange. Behind Prado Dam (constructed and owned by the U.S. Army Corps of Engineers for flood prevention), OCWD owns 2,400 acres in Riverside County, which the District uses for water conservation, water quality improvement and environmental enhancement.

OCWD monitors the groundwater taken out each year to ensure that the basin is not overdrawn; refills the basin; and carries out an assessment program to pay for operating expenses and the

cost of imported replenishment water. The groundwater basin holds millions of acre-feet of water (an acre-foot satisfies the needs of two families for one year). The groundwater basin provides more than half of all water used within the District. Protection, safety and enhancement of groundwater are OCWD's highest priorities. With one of the most sophisticated groundwater protection programs in the country, OCWD uses more than 700 wells providing more than 1,400 sampling points—from which OCWD takes more than 18,000 water samples and conducts more than 350,000 analyses every year. OCWD's monitoring program looks for more than 330 contaminants—far more than the 122 required by the regulatory agencies.

OCWD is leading the way in purification of wastewater for reuse to provide a reliable, new, drought-proof high quality source of water. The Groundwater Replenishment System, a joint project of OCWD and the Orange County Sanitation District, went on-line in January 2008 and can produce enough near-distilled quality water for 500,000 people.

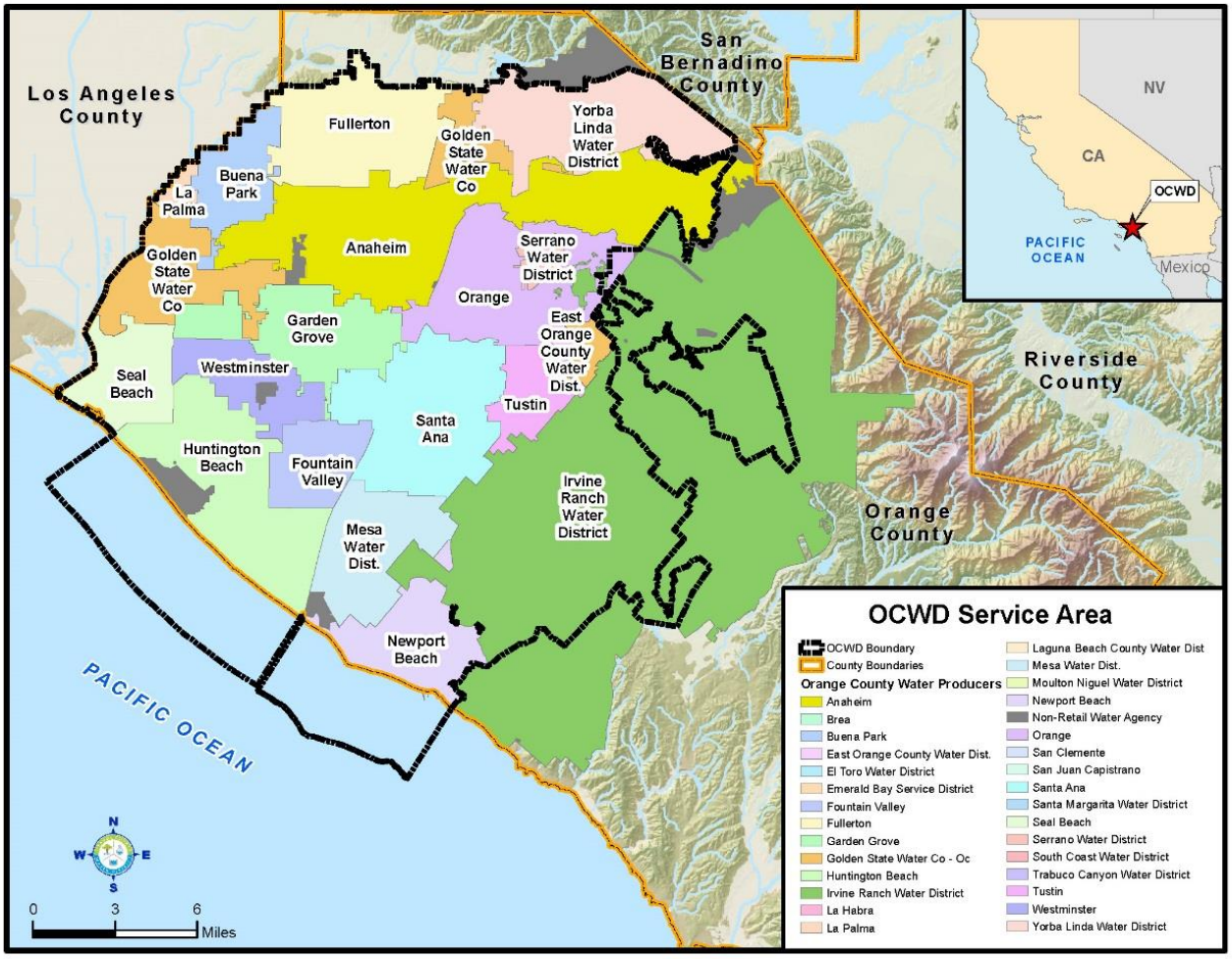
Additional efforts to increase local water supplies include expanding the capacity of the existing percolation facilities, treating poor quality water to make it useable, studying methods to extend the life of filtration membranes, improving advanced purification technologies, using bacteria to remove contaminants, and studying the quality of Santa Ana River water and other water-related issues. Other OCWD groundwater management and water quality activities focus on expanding the Prado wetlands, groundwater treatment at well heads, computer modeling of the groundwater basin and conservation of endangered or threatened species.

About Groundwater
Groundwater is the high-quality water that makes up more than half of all water used in Orange County. The groundwater basin began forming millions of years ago as mountains eroded and ocean sediments filled a deep valley, trapping Santa Ana River water between the layers of accumulated sand and gravel. The deepest aquifers of the groundwater basin still contain pristine water that fell to the earth thousands of years ago. The water Orange County drinks today may have entered the basin one year, 100 years or 1,000 years ago, depending on the location and depth of the well. The groundwater basin holds between 10 million and 40 million acre-feet of water, of which 1.25 million to 1.5 million acre-feet is usable.

Groundwater has always been vital to the lives and livelihoods of Orange County residents. In the 1800s and early 1900s, Orange County's growing agricultural industry thrived because of a reliable, easily obtainable supply of water pumped from the ground below. As farmers continued to pump groundwater and divert water from the Santa Ana River for irrigation, they noticed that groundwater levels were falling. Pumps had to be lowered deeper into the ground to pump out the same amount of water, requiring more energy. The question of seawater being drawn into the groundwater basin also was of serious concern.

Orange County's groundwater basin supplies up to 75% of the water needs for residents and businesses in Anaheim, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Newport Beach, Irvine, La Palma, Los Alamitos, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster and Yorba Linda. (This includes all RSCCD sites and facilities.)

FIGURE 7: ORANGE COUNTY WATER DISTRICT (OCWD) SERVICE AREA



VULNERABILITY ASSESSMENT

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services.

Impacts are commonly referred to as direct or indirect. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of direct impacts. The consequences of these impacts illustrate indirect impacts. For example, a reduction in crop, rangeland, and forest productivity may result in reduced income for farmers and agribusiness, increased prices for food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and businesses, migration, and disaster relief programs. Direct or primary impacts are usually biophysical. Conceptually speaking, the more removed the impact from the cause, the more complex the link to the cause. In fact, the web of impacts becomes so diffuse that it is very difficult to come up with financial estimates of damages. The impacts of drought can be categorized as economic, environmental, or social.

Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and diseases to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.

Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Reduced income for farmers has a ripple effect. Retailers and others who provide goods and services to farmers face reduced business. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue for local, state, and federal government. Less discretionary income affects the recreation and tourism industries. Prices for food, energy, and other products increase as supplies are reduced. In some cases, local shortages of certain goods result in the need to import these goods from outside the stricken region. Hydropower production may also be curtailed significantly. Income loss for water retail agencies often result in the need to increase water rates in order to cover fixed operational costs.

Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

TABLE 2: ORANGE COUNTY AGRICULTURE VALUES (2009)

Crop	Value
Animal Industry	$246,978
Field	$875,688
Nursery	$126,316,686
Tree Fruit & Berry Crops	$51,062,700
Vegetables	$13,598,272
Total	$192,100,324

Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. Many of the impacts specified as economic and environmental have social components as well. Population out-migration is a significant problem in many countries, often stimulated by greater availability of food and water elsewhere. Migration is usually to urban areas within the stressed area or to regions outside the drought area; migration may even be to adjacent countries, creating refugee problems. However, when the drought has abated, these persons seldom return home, depriving rural areas of valuable human resources necessary for economic development. For the urban area to which they have immigrated, they place ever-increasing pressure on the social infrastructure, possibly leading to greater poverty and social unrest.

In terms of calculations of the replacement value of the potential loss of structures due to drought, additional analysis could not be made due to data limitations. Hazus does not have drought data. However, it is not thought that drought would seriously impact structures in the district. The table above shows the value of agriculture that is present in Orange County. The loss of agriculture would impact the RSCCD financially by the loss of tax dollars received by the district.

E. RSCCD AND DROUGHT

RSCCD has been proactive in the area of sustainability for the past several years. The RSCCD Board of Trustees has established policies for District sustainability that have been incorporated in both the District Educational and Facilities Master Plans. The District has been active in recycling efforts, encouraging public transit use for students, faculty, and staff, and implementing energy and water saving projects and efficient new construction of campus facilities. Students have also been very active in this area through various clubs and sustainability events. While the District has made significant progress on the path to sustainability, it is poised to accomplish much more with the implementation of the new Sustainability Plan.

RSCCD WATER SOURCES

RSCCD is dependent on the Cities of Santa Ana, Orange and Tustin for their water service who in turn are dependent on the State Water Project, Metropolitan, MWDOC, and OCWD for water supply.

Fortunately, these agencies have always provided adequate, reliable water supplies to serve the District's needs. The Metropolitan, MWDOC and OCWD and the cities of Santa Ana, Orange and Tustin project that the water supply will be adequate to meet essential water demands for the next 20 years. Of course a deepening and continuing drought and/or extensive population increases could impact those projections. Also continuing conservation measures such as hardware installation, the reduction of industrial consumption, and education programs in conservation have significantly assisted the reduction in water usage within the County and these and additional mitigation measures are necessary to provide a continued sufficient water supply to RSCDD.

The three water suppliers to RSCCD are: Cities of Santa Ana, Orange and Tustin.

CITY OF SANTA ANA WATER

RSCCD has four sites located in Santa Ana: (1) Santa Ana Community College, (2) District Operations Center, (2) Centennial Education Center and the (4) Digital Media Center.

The City of Santa Ana Public Works Department manages the water service for Santa Ana. It depends on two sources for the 12.5 billion gallons of water supplied to its residents each year, 72 percent is groundwater and 28 percent is imported water, purchased from the Metropolitan.

The groundwater accumulates and is stored beneath the surface of the earth and then pumped to the surface by 20 City-owned wells. Metropolitan brings Colorado River water from Lake Havasu and runoff from the snow pack in the Sierra Nevada Range in Northern California. The water is then treated at either the Diemer Filtration Plant in Yorba Linda or the Weymouth Filtration Plant in La Verne before it is delivered to Santa Ana college facilities. There are seven Metropolitan connections located in the city. Most of Santa Ana customers receive a blending of the two sources, groundwater and imported water.

CITY OF ORANGE WATER

RSCCD has two sites located in the City of Orange: (1) Santiago Canyon Community College and (2) Orange Education Center. The City of Oranges water supply comes from several sources: local groundwater basins, Northern California water via the State Water Project, the Colorado River, local watersheds, reclamation, and water reuse projects. The City is a member agency of MWDOC and Metropolitan. Metropolitan supplies imported water to six Southern California counties, including Orange County. As a MWDOC member, it represents the interests of its 29 member agencies at the Metropolitan.

The City of Orange is also a member of the OCWD who manages the vast groundwater basin under north and central Orange County. The Orange County Groundwater Basin is the main source of water supply for the City of Orange. The City obtains approximately 64 to 75 percent of its water from City-owned wells. The City purchases approximately 25 to 36 percent through the MWDOC. In addition, the City purchases approximately 3 to 5 percent from the Serrano Water District. The following four water districts serve the City of Orange:

- Irvine Ranch Water District
- Golden State Water Company
- Serrano Water District
- East Orange County Water District (EOCWD)

CITY OF TUSTIN WATER

RSCCD has one site located in Tustin, the Orange County Sheriff's Regional Training Academy. The City of Tustin's main sources of water supply are: groundwater from the Lower Santa Ana River Groundwater Basin and imported water from Metropolitan through MWDOC. The City relies on 85% groundwater and 15% imported water. It is projected that through 2035 the water supply will remain roughly the same. The City works together with three primary agencies: Metropolitan, MWDOC, and OCWD to insure a safe and high quality water supply. The sources of imported water supplies include the Colorado River and the State Water Project.

RSCCD DROUGHT/CLIMATE CHANGE MITIGATION EFFORTS

Both Santa Ana and Santiago Canyon Colleges have implemented water conservation strategies through various projects on their respective campuses. For example, Santiago Canyon College is currently working with the Irvine Ranch Water District (IRWD) to utilize reclaimed water to irrigate the athletic fields. Although the area is served by the IRWD, the recycled water is provided through a partnership from the City of Orange Water Department.

In addition, the new Humanities and Gymnasium buildings at Santiago Canyon College were designed with low-flush volume toilets with automatic operation resulting in reduced water usage. Low-flush urinals were also installed and plans have been made to install more when funding is available. Synthetic turf has also been installed on the softball field to reduce the need for water, fertilizer, and pesticides. Santa Ana College has installed new efficient, low-flow irrigation systems in all of its new perimeter landscaping as well as efficient irrigation valves to reduce its water use on campus. A new tournament quality artificial turf soccer field was recently installed to reduce the use of water, fertilizer, and pesticides, as well as GHG emissions related to lawn mowers. Finally, the District would like to explore the feasibility of greywater systems, which capture and repurpose used water for flushing toilets or irrigation. It will aim to pilot a greywater system at one of the campuses.

Various sustainable landscaping projects have been implemented on both campuses, such as the Campus Landscape Improvement Program at Santa Ana College and the Coastkeeper Garden at Santiago Canyon College (SCC). The Coastkeeper Garden is a project where Santiago Canyon College leases some of its property to the non-profit Orange County Coastkeepers, who have built a demonstration garden open to the public featuring sustainable landscape techniques. SCC has also undergone campus landscaping projects using native or adaptive plant materials to reduce or eliminate irrigation requirements. Highly water efficient irrigation equipment is employed where irrigation is required. Moving forward, the District will continue to landscape with native plants and employ water-wise landscaping practices. The District will explore the installation of water bottle refilling stations or enhance current water fountains to better accommodate bottle refills. This will encourage the use of reusable bottles, thereby reducing the amount of plastic water bottles purchased and thrown in the waste stream.

The Community College Academic Senate Curriculum Committee indicates that faculty members are currently integrating sustainability in the curriculum in three main ways: by adding a component to an existing course outline of record, creating a new course, or creating a new certificate or degree program. The District employs these strategies as described more fully below, and all strategies will require leadership from faculty for adoption.

Some examples of courses include:

Biology 170/ Environmental Studies 170 – Environmental Challenge of the 21st Century – Examines the environmental impacts of increased human population on food, water and energy resources. Land use policies and environmental effects of pollution will also be analyzed.

Engineering 203 – Sustainable Construction and Facilities Management
This course provides students the means to apply core sustainable principles to each step within the facilities planning, design and management process. It examines best practices for site and building: energy, conservation, reclamation, recycle-ability, air, water, waste, sound, ecological literacy, and management tools.

Environmental Studies 140/ Geology 140 – Environmental Geology – This course focuses on the study of urban geologic hazards: earthquakes, groundwater pollution, flood potential, landslides and creep, soil expansion, coastal erosion, and volcanic hazards.
Santiago Canyon College is the lead college for training field water utility employees throughout Orange County. In addition, the Community College Academic Senate Curriculum Committee is adding new certificate and degree programs on sustainability including:

Water Utility Science Degree & Certificate – The Water Utility Science program and certificate at Santiago Canyon offers a wide range of courses that directly apply to water distribution, treatment, and wastewater management. The program provides a great opportunity for students to be trained in a growing and important field centered on environmental sustainability. With completion of the program, students are prepared for entry-level jobs in the water distribution, treatment and water reclamation industries. The associate of science degree provides coursework and internship experience designed to provide an overview of a wide range of environmental career opportunities.

According to the Director of District Construction, the sites are independently following through on drought mitigation – albeit using similar approaches: signage, reduced irrigation. Where the district has coordinated more closely is through scheduled maintenance. There are projects proposed and approved in the Scheduled Maintenance Program that address irrigation control and replacement of turf with drought tolerant species. Additionally since Santa Ana College is undergoing a significant infrastructure project and hard/soft scape replacement that balances the landscape design in a way that meets water conservation mandates.

RSCCD has been extremely pro-active on water conservation. One of the projects being studied by the committee for the Santa Ana Community College is the feasibility of a rainwater harvesting system, which would use the upper deck of the parking structure as a collection area.

SUSTAINABLE RSCCD COMMITTEE (SRC)

Purpose
The Sustainable RSCCD Committee is a participatory governance committee, working with the campus committees, responsible for raising awareness within the district and making recommendations to the Chancellor concerning the conservation of energy and other resources and the implementation of sustainability practices that impact the district and community.

The District has established water conservation goals in their approved RSCCD Sustainability Plan. The District will perform water use benchmarking studies at both campuses and the District Office to better understand usage as compared to similar facilities and community college peers. Based on the results, the District will establish annual water use reduction goals and plan new appropriate measures to achieve goals.

Responsibilities
Promote and nurture new patterns of thinking about college and district operations, practices, learning programs, support services and the relation to the local community that include consideration of conservation of energy and sustainability.

Develop a comprehensive plan to achieve climate neutrality.

Create institutional structures and identify resources relating to conservation of energy and sustainability to guide and support the implementation of the comprehensive plan.
Complete an inventory of all greenhouse gas emissions and update that inventory at least once every two years.

Encourage the development of curriculum that raises awareness about climate neutrality and sustainability and that offers a career path to employment in "green" technologies.
Review the status of and develop objectives related to improving and maintaining the "green infrastructure" of the district and colleges.
Provide periodic progress reports on the accomplishments of the committee.

Sustainability Plan
The Sustainable RSCCD Committee finalized work on the Rancho Santiago Community College District Sustainability Plan in February 2015. The plan was approved by the Board of Trustees at its meeting of March 9, 2015, Rancho Santiago Community College District Sustainability Plan.

F. LIKELIHOOD OF FUTURE OCCURRENCES

EXTENT/PROBABILITY OF OCCURRENCE AND MAGNITUDE

Of the many varied indexes used to measure drought, the "Palmer Drought Severity Index" (PDSI) is the most commonly used drought index in the United States. Developed by meteorologist Wayne Palmer, the PDSI is used to measure dryness based on recent temperature compared to the amount of precipitation. It utilizes a number range, 0 as normal, drought shown in terms of minus numbers, and wetness shown in positive numbers. The PDSI is most effective at analyzing long-range drought forecasts or predications. Thus, the PDSI is very effective at evaluation trends in the severity and frequency of prolonged periods of drought, and conversely wet weather. The National Oceanic and Atmospheric Administration (NOAA) publish weekly Palmer maps, which are also used by other scientists to analyze the long-term trends associated with global warming and how this has affected drought conditions.

The U.S. Drought Monitor is unique, blending numeric measures of drought and experts' best judgment into a single map every week. It started in 1999 as a federal, state, and academic partnership, growing out of a Western Governors' Association initiative to provide timely and understandable scientific information on water supply and drought for policymakers.

The Monitor is produced by a rotating group of authors from the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration, and the National Drought Mitigation Center. It incorporates review from a group of 250 climatologists, extension agents, and others across the nation. Each week the author revises the previous map based on rain, snow and other events, observers' reports of how drought is affecting crops, wildlife and other indicators. Authors balance conflicting data and reports to come up with a new map every Wednesday afternoon. It is released the following Thursday morning.

Very Likely

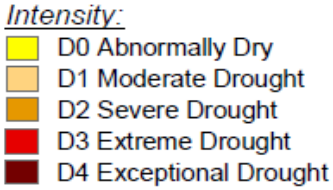
The University of Nebraska-Lincoln has published many of the Palmer Drought Index maps analyzing trends over the past one hundred years (National Drought Mitigation Center). In coastal Southern California, (Orange County is a coastal county) from 1895 to 1995, severe droughts occurred 10 to 15 percent of the time. From 1990 to 1995, severe droughts occurred 10 to 20 percent of the time and as recently as 1989, a severe drought was documented that lasted for six years. More recently, between 1999 and 2004, a six-year drought on the Colorado River basin has resulted in a drawdown of Colorado River water storage by more than 50%. The 2012-15 drought has been severe causing the Governor to declare a State of Emergency and require conservation measures of all Californians.

Based on these trends and *Climate Change*, severe droughts can readily occur in Southern California. According to the California Natural Resources Conservation Service (NRCS), the current and recent droughts in Southern California have caused extensive devastation to forests in the mountains of San Bernardino, San Jacinto and Palomar Mountains. Drought weakens trees which make them susceptible to infestation by bark-beetles. In turn dry vegetation and beetle infested trees are more susceptible to fire than healthy forests.

In addition, droughts are occurring much more often since the 1970's. Drinking water supply for Orange County is approximately 50% local supply and 50% imported supply. With the tremendous population explosion in Southern California and the possibility of *Climate Change*, based on this data, droughts are **Very Likely** to continue to impact the planning area.

Drought Impact Types: Short Term droughts are typically less than 6 months with Long Term droughts typically greater than 6 months.

Drought Intensities are listed to the right. At the writing of this plan, October 2015, California is in level D4, Exceptional Drought emergency and the State of California is in a Drought State of Emergency. .



G. CLIMATE CHANGE AND THE RSCCD

WHAT IS CLIMATE CHANGE?

Climate is usually defined as the "average weather" in a place. It includes patterns of temperature, precipitation (rain or snow), humidity, wind and seasons. Climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. But the climate we've come to expect is not what it used to be, because the past is no longer a reliable predictor of the future. Our climate is rapidly changing with disruptive impacts, and that change is progressing faster than any seen in the last 2,000 years.

According to the report, Preparing for a Changing Climate, rising levels of carbon dioxide and other heat-trapping gases in the atmosphere have warmed the Earth and are causing wide-ranging impacts, including rising sea levels; melting snow and ice; more extreme heat events, fires and drought; and more extreme storms, rainfall and floods. Scientists project that these trends will continue and in some cases accelerate, posing significant risks to human health, our forests, agriculture, freshwater supplies, coastlines, and other natural resources that are vital to the economy, environment, and our quality of life.

Because so many systems are tied to climate, a change in climate can affect many related aspects of where and how people, plants and animals live, such as food production, availability and use of water, and health risks. For example, a change in the usual timing of rains or temperatures can affect when plants bloom and set fruit, when insects hatch or when streams are their fullest. This can affect historically synchronized pollination of crops, food for migrating birds, spawning of fish, water supplies for drinking and irrigation, forest health, and more
.
Some short-term climate variation is normal, but with longer-term trends many scientists believe they indicate a changing climate.

Climate Change/Climate Adaptability
Climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to *Climate Change*. The experiences of California during recent years underscore the need to examine more closely the state's water shortage, distribution management conservation and use policies.

The Climate Adaptation Strategy (CAS) stresses the need for public policy development addressing long-term *Climate Change* impacts on water supplies. The CAS notes that *Climate Change* is likely to significantly diminish California's future water supply, stating that:

"California must change its water management and uses because *Climate Change* will likely create greater competition for limited water supplies needed by the environment, agriculture and the cities." (State of California Multi-Hazard Mitigation Plan, 2013)

In February 2015, California passed SB 379 would, upon the next revision of a local hazard mitigation plan on or after January 1, 2017, or, if the local jurisdiction has not adopted a local hazard mitigation plan, beginning on or before January 1, 2022, require the safety element to be reviewed and updated as necessary to address climate adaptation and resiliency strategies

applicable to that city or county. The bill would require the update to include a set of goals, policies, and objectives based on a vulnerability assessment, identifying the risks that *Climate Change* poses to the local jurisdiction and the geographic areas at risk from *Climate Change* impacts, and specified information from federal, state, regional, and local agencies. Historical evidence and scientific studies have already uncovered distributing trends due to *Climate Change*s. By 2006, scientist projected a loss of at least 25% of the Sierra's snowpack, an important source of urban, agricultural and environmental water.

Weather patterns are becoming more variable, causing more severe winter and spring flooding and longer drier droughts.

Since 1950's, flood flows on many California rivers have been largest on record. Levees, dams, and flood by-passes are forced to manage flows for which they weren't designed.

In the past century, sea levels has risen over one-half foot at the Golden Gate. It is projected, continued sea level rises will threaten many coastal communities as well as the sustainability of the Sacramento – San Joaquin Delta which supplies 25 million Californians with drinking water.

Agencies that provide water to RSCCD (Municipal Water District of Orange County, Orange County Water District, City of Santa Ana, Orange's five water districts and City of Tustin) are monitoring and preparing for *Climate Change*. This has been made a priority for all California water departments.

Rising water temperatures and changes in runoff patterns may adversely impact salmon and other aquatic species.

Based on the *Climate Change* Impacts and Climate Predication Outlooks, it is ***high likely***, that we will see additional Sever to Extremely Sever Droughts over the next 10-20 years requiring:

- Strategies to address impacts of *Climate Change*s
- Increase monitoring of climatological and water resources conditions.
- Improve flood forecasting abilities and *Climate Change*s models to assess future flood protection needs.
- Refined projections of *Climate Change*s consequences on water supply and reliability
- A need to conduct system re-operation studies to improve reliability and maintain sufficient flood reservations
- A need to assess *Climate Change* effects on hydropower production
- A need to reduce greenhouse gas emissions from water management activities
- Updated studies on the combined effects of increased atmospheric carbon dioxide and increased temperature on crop water needs, to predict future water needs
- Analyses on the effects of the sea level rise on the Delta salinity levels
- Adaption statewide of water management systems by incorporating more flexibility
- Improvements in the interaction and coordination with local, state, federal and academic researchers

Integrated Regional Water Management

Integrated regional water management plans are the primary strategy to achieve reliable, high quality water supplies and protect and enhance the environment. Cooperation among communities and stakeholders benefit by resolving conflicts, leveraging existing infrastructure, and building a diversified portfolio of water supply alternatives. This approach will help regions find the best solutions to the effects of Climate Changes in local areas.

Orange County is ahead of the curve on this issue with the Metropolitan District of Southern California, Municipal District of Orange County and the Orange County Water District. Orange County has been working for decades with integrated regional water management plans and policies.

Groundwater and Surface Storage
Climate Change may cause core frequent and more severe winter storms, and longer drier periods of drought. New groundwater and surface and water storage, will ensure a reliable water supply for California's future and provide vital flood protection by managing more variable precipitation and runoff.

Again, Orange County has the Orange County Water District that regionally manages and shares in the ground water. They maintain the groundwater ensuring quality water for Orange County residents.

Water and Energy
Climate Change may reduce hydropower generation production. At the same time, energy use may increase because of higher temperature and greater water demands. These conditions may force greater reliability on fossil fuels that produce greenhouse gases. Future water management activities must consider strategies to conserve energy and reduce greenhouse gases emissions.

The Delta
Rising sea levels will increase pressure on Delta levees, and force more salt water from the San Francisco Bay into the Delta. As currently managed, more fresh water will be needed to repel seawater and maintain water quality standards, especially during drier years. Compounding these impacts from sea level rise, shifting precipitation and runoff patterns will direct more water to the Delta during the dry summer months. Since 43% of Orange County's water is imported, it is critical that we pay close attention to issues such as the Delta.

Drought Mitigation Projects
We have identified the following Drought Mitigation issue that we are currently discussing or assessing the status of these issues to determine if we need to take action to mitigate the effects of the drought on Operational Area. We will be working with Local Water Purveyors, City, County, State and Federal partners to coordinate our response to these issues that have been identified.

Identified mitigation drought issues for future consideration include:
- Assess Vulnerability to Drought Risk
- Plan for Drought
- Monitor Drought Conditions
- Monitor Water Supply
- Require Water Conservation During Drought Conditions
- Retrofit Water Supply Systems
- Enhance Landscaping and Design Measures
- Educate Residents on Water Saving Techniques

The Sustainability RSCCD Committee is already taking the lead on drought issues and will continue to lead the district and its colleges on drought and *Climate Change*.

Orange County already has numerous groups working towards climate adaption. Felicity Figueroa of Orange County for Climate Action stated: “If we let the inevitable consequences of *climate change* proceed undeterred, no other issue will even matter.” Orange County for Climate Action (OCCA) is alliance of OC organizations to address the problem of climate change and how it affects individuals, organizations and our community. (occlimateaction.org).

H. Drought & Climate Change Mitigation Strategies

Hazard	**Drought Activity #1**
Action Item	**Develop a comprehensive approach to mitigating the hazard "Drought."**
Coordinating Organization	Chief Safety & Security and Sustainable RSCCD Committee
Ideas for Implementation	Work through the Sustainable RSCCD Committee (SRC) to do the following Introduce the Hazard Mitigation Plan to the RSCCD Sustainability Planning Committee so efforts can be coordinated by inviting them to the Hazard Mitigation Community Forum. Continue Drought awareness and education (Short Term Activity #2) Monitor and report drought conditions on a monthly basis and display this information on the district's website (Short Term Activity #3)
Time Line	Ongoing
Constraints	Pending Funding and Available Personnel
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	Improved education and planning. Low cost item
Priority	Medium/High

	Plan Goals Addressed
X	**Promote Public/College Community Awareness**
X	**Create Partnerships and Implementation**
	Protect Life and Property
	Protect Natural Systems
X	**Strengthen Emergency Services**

Hazard	DROUGHT ACTIVITY #2
Action Item	**Increase Drought and Climate Change Risk Awareness and Education**
Coordinating Organization	Sustainable RSCCD Committee and Chief District Safety & Security
Ideas for Implementation	▪ Present the RSCCD Hazard Mitigation Drought/Climate Change Section to as many RSCCD staff, faculty, students and the public when possible ▪ Every occasion the districts emergency preparedness program is presented, include information on the RSCCD Hazard Mitigation Drought/Climate Change Section and ask for input into future projects. ▪ Present the U.S. Drought Monitor to RSCCD staff, faculty, students and public to ensure they understand that California is in the Exceptional Drought index and how severe the drought situation is in California. Even when the drought ends, drought education must continue. ▪ Include information on monitoring droughts, conservation actions the district is taking, emergency plans for severe droughts, and educating students, faculty, and staff on water saving techniques for work and home. ▪ Review the California "Local Government Drought Toolkit" to determine if further District actions are necessary. Go to: http://www.opr.ca.gov/docs/Local_Government_Drought_Toolkit_March_10_2014.pdf
Time Line	Ongoing
Constraints	Chief District Safety & Security can only offer the training; attendance is voluntary
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	Sustained mitigation outreach programs have minimal cost and will help build and support district-wide capacity. This type of activity enables the district faculty, students and the public to better prepare for drought. .
Priority	Medium/High

Plan Goals Addressed	
X	Promote Public and College Community Awareness
X	Create Partnerships and Implementation
X	Protect Life and Property
	Protect Natural Systems
X	Strengthen Emergency Services

Hazard	

	DROUGHT ACTIVITY #3
Action Item	**Continue to develop a Drought Conservation Plan for the RSCCD (Implement Water Conservation Strategies SRC 4.7.2)**
Coordinating Organization	Sustainable RSCCD Committee (lead) Chief District Safety & Security will liaison with the committee on Drought
Ideas for Implementation	▪ Utilizing the Sustainable RSCCD Committee (SRC), make list of what conservation efforts that have been completed and are ongoing. ▪ List actions being considered (unfunded projects). The Hazard Mitigation Team Project Manager should work with the SRC providing a list of possible funding sources for these projects from the Hazard Mitigation Plan.
Time Line	5 years
Constraints	Pending Funding and Available Personnel
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	Drought is a long term issue that must be managed every year, not just in drought years. Low cost item
Priority	Medium/High

Plan Goals Addressed	
X	Promote Public/College Community Awareness
X	Create Partnerships and Implementation
	Protect Life and Property
	Protect Natural Systems
X	Strengthen Emergency Services

Hazard	**DROUGHT ACTIVITY #4**
Action Item	**Retrofit Water Supply Systems.**
Coordinating Organization	Director of District Construction
Ideas for Implementation	Improve water supply and delivery systems to save water through actions such as: a. Designing water delivery systems to accommodate drought events b. Developing new or upgrading existing water delivery systems to eliminate breaks and leaks c. Repair all water leaks in a timely manner
Time Line	5 years
Constraints	Pending Funding and Available Personnel
Funding Sources	General Fund
Cost Estimate	$3 – 4 million
Benefits: Losses Avoided	Long term planning item that will result in long term benefits.
Priority	Medium/High

Plan Goals Addressed	
X	Promote Public/College Community Awareness
X	Create Partnerships and Implementation
	Protect Life and Property
	Protect Natural Systems
X	Strengthen Emergency Services

Notes: SAC has a soccer field with AstroTurf
Darryl Taylor is completing a Districtwide Water conservation Efforts Presentation to the Board

Hazard	**DROUGHT ACTIVITY #5**
Action Item	**Enhance Landscaping and Design Measures (Adopt Sustainable Landscaping Practices SRC 4.7.4)**
Coordinating Organization	Director of District Construction
Ideas for Implementation	All future landscaping on the seven RSCCD sites should take into consideration using drought-tolerant landscape design through measures such as: a. Incorporating drought tolerant practices to reduce dependence on irrigation b. Using permeable parking lots and surfaces to reduce runoff and promote groundwater recharge c. Consider synthetic turf in appropriate locations (Test case is the soccer field was converted to AstroTurf) d. SCC needs a reclaimed water system e. Research systems available for reuse of rain water f. Replace faucets, fixtures, toilets with low-flow and waterless fixtures (almost complete) g. Upgrade campus wide irrigation system to smart and water efficient systems. i.e. drip or other system
Time Line	5 years
Constraints	Pending Funding and Available Personnel
Funding Sources	General Fund
Cost Estimate	$2 million
Benefits: Losses Avoided	Long term planning item that will result in long term benefits.
Priority	Medium/High

Plan Goals Addressed	
X	Promote Public/College Community Awareness
X	Create Partnerships and Implementation
	Protect Life and Property
	Protect Natural Systems
X	Strengthen Emergency Services

Note: A districtwide water conservation efforts report will be presented to the Board in 2016.

Hazard	CLIMATE CHANGE ACTIVITY #1
Action Item	**Study the impacts of Climate Change on the RSCCD**
Coordinating Organization	Sustainability RSCCD Committee
Ideas for Implementation	a. Review updated state and county studies on Climate Change as they are released b. Make recommendations to the Board of Trustees on how RSCCD can be pro-active on climate adaption issues c. Take necessary actions d. Educate the students, faculty and staff on Climate Change and Climate Adaption issues
Time Line	5 years
Constraints	Pending Funding and Available Personnel
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	Long term planning item that will result in long term pro-active actions.
Priority	Medium/High

Plan Goals Addressed	
X	Promote Public/College Community Awareness
X	Create Partnerships and Implementation
	Protect Life and Property
X	Protect Natural Systems
	Strengthen Emergency Services