Appendix J – Climate Change

This appendix includes the Vulnerability Assessment memorandum, the Adaptation and Mitigation Memorandum, which includes results of the Climate Change Vulnerability Assessment (see **Section 14** and **Appendix C.1.2**) and details regarding Climate Change, prioritized vulnerabilities, IRWM Plan Goals, Objectives and RMS. Additional Climate Change update outreach materials are included as well.

Much of the information in Appendix J was developed by or with Water Systems Consulting, Inc. (WSC).

Appendix Number	Title
J.1	Climate Change Vulnerability Assessment Memorandum
J.2	Climate Change Adaptation and Mitigation Memorandum
J.3	Notice of Public Meeting
J.4	Outreach Materials
J.5	2018 Climate Change Workshop Attendees

J.1 Climate Change Vulnerability Assessment Memorandum

This draft technical memo was prepared by County of San Luis Obispo Public Works staff in collaboration with Water Systems Consulting, Inc (WSC) to develop the climate change vulnerability assessment for the 2018 IRWM Plan update. The Department of Water Resources (DWR) awarded grant funding from Proposition 1 to support this planning effort.

CLIMATE CHANGE VULNERABILITY ASSESSMENT

1 PURPOSE

The purpose of this document is to provide information relevant to the San Luis Obispo (SLO) County Climate Change Vulnerability Assessment as part of the SLO County Integrated Regional Water Management (IRWM) Plan (IRWMP) climate change update. The existing 2014 IRWMP Climate Change Vulnerability Assessment described in Section P.10 will be updated with input from IRWM stakeholders in order to: 1) characterize regional water resources vulnerable to climate change; 2) identify climate change impacts that could affect the planning region; and 3) assess the potential vulnerabilities for each of the IRWM's subregions. These three tasks will be completed to satisfy the requirements of the California Department of Water Resources' (DWR's) 2016 IRWM Grant Program Guidelines (1) and the Climate Change Handbook for Regional Water Planning (Climate Change Handbook), Section 4 and Appendix B (2).

2 CLIMATE CHANGE VULNERABILITY ASSESSMENT

2.1 Identifying Climate Change Impacts

Climate change impacts and vulnerabilities will be identified through an iterative and collaborative process of literature review and stakeholder input. Prior to stakeholder input being solicited via the IRWM Climate Change Workshop, WSC in collaboration with SLO County has identified appropriate literature sources and summarized regional climate change impacts (Section 2.1.1).

Regional Climate Change Impacts

The 2014 IRWMP includes a climate change analysis based on various models, which concludes that local climate change projections suggest longer and drier summers, an increased frequency and severity of droughts, increased evapotranspiration rates, increased temperatures, increased winter runoff, increased storm severity, more frequent wildfires, sea level rise, and reduced groundwater recharge. Impacts on regional water resources from these projected changes can be identified and analyzed to determine prioritized vulnerabilities. DWR's Climate Change Handbook recommends assessing seven vulnerability categories impacted by climate change. Climate change impacts affecting those seven vulnerability categories in the region may include, but are not limited to, those described below.

1. Water Demand
    a. Seasonal agricultural water demands are expected to increase (California Department of Water Resources, 2008). Non-irrigated agriculture and rangeland will be especially vulnerable to reduced surface flows and soil moisture (California Department of Water Resources, 2008), (California Natural Resources Agency, 2009).
    b. Evapotranspiration rates are expected to increase (California Natural Resources Agency, 2009), which will increase agricultural water demands.
    c. A longer growing season will also increase agricultural water demands (California Natural Resources Agency, 2009).

d. Landscaping and other domestic seasonal use, such as cooling processes, is expected to increase (California Department of Water Resources, 2008), (California Natural Resources Agency, 2009).
e. As average air and surface water temperatures increase, cooling water needs may also increase (California Department of Water Resources, 2011). Industries, such as energy production, may see increases in demand or production in response to climate change that in turn increase process water usage.
f. As average temperatures increase and droughts become more frequent, seasonal water use, which is primarily outdoor use, could increase. Seasonal use impacts peak demands that often coincide with low flow summer periods. Increasing seasonal demands puts the region at risk of water shortages (GEOS Institute, 2010).
g. A variety of crops are grown in the region and many are seasonally variable and are sensitive to changes in growing season and heat patterns (GEOS Institute, 2010).
h. Curtailments are challenging especially for small and isolated communities without access to other water sources. If drought conditions continue or worsen, it is unclear how curtailments can be achieved in economically distressed communities with diminishing water supplies and no access to alternative supplies. Lack of drinking water access can lead to poor health, disease spreading, and death (California Natural Resources Agency, 2009). A local drought emergency was enacted in SLO County from 2014 through 2017 that restricted water usage and required acquiring alternate water sources while reservoir levels were allowed to recover.

2. Water Supply
   a. While precipitation projections are less definitive than other climate variables, there is general consensus that precipitation in the Southwestern US will decline over the second half of the 21st Century (US Global Change Research Program, Climate Change Science Program, 2009).
   b. Water supply shortages are expected to worsen (GEOS Institute, 2010).
   c. Groundwater recharge is expected to decrease (GEOS Institute, 2010).
   d. Coastal aquifers will be subject to seawater intrusion, especially in aquifers with high pumping rates (California Department of Water Resources, 2008).
   e. Droughts are expected to be more severe and potentially more frequent (California Department of Water Resources, 2008), (California Natural Resources Agency, 2009).
   f. In sustained drought conditions, use of surface waters may be curtailed, requiring more consumption of groundwater and thus increasing vulnerability to water shortage (California Natural Resources Agency, 2009). Groundwater utilization is expected to increase based on projections to 2035 (2014 IRWMP, Section D). The region may see more severe storm events that result in quick pulses of heavy runoff. Infrastructure does not exist to capture the momentary surplus of water, and poor land use practices prevent much of the rain from infiltrating into the ground (GEOS Institute, 2010).
   g. The State Water Project (SWP) supply has been limited due to pumping restrictions on the Delta and may continue to require restrictions in the future (Carollo Engineers, 2012). A sustained drought may increase hardships on the water rights holders in the region (California Department of Water Resources, 2011).
   h. Changes in surface water supply, snowmelt patterns that affect SWP supply, and increasing demands may make it difficult to balance water needs. Vulnerabilities for ecosystems and municipal/agricultural water needs may be exacerbated by instream flow requirements that are not quantified, not accurate for ecosystem needs under multiple environmental

conditions including droughts, and not met by regional water managers (California Department of Water Resources, 2011).

i. Aquatic species that are already vulnerable to periods of low flow may become increasingly more vulnerable as hydrologic patterns change. The shift in hydrologic flow patterns can disrupt necessary flows and cause biodiversity shifts, loss of habitat, and barriers to species migration (California Natural Resources Agency, 2009). Groundwater pumping leads to lowering of the water table, causing low flows and dry periods in rivers and streams, contraction of riparian areas and wetlands, and stress to aquatic organisms (GEOS Institute, 2010). Steelhead are very sensitive to weather events, sediment, and stream flow. With worsening conditions, steelhead in San Luis Obispo County could follow the pattern seen in other areas, where spawning no longer occurs (GEOS Institute, 2010). The region contains multiple fisheries and habitat for sensitive species that depend on stream flows. The Watershed Management Planning Project Report analyzed instream flow conditions, however, the need for further monitoring and data collection was identified to determine if flow has been insufficient for aquatic life (2014 IRWMP).

3. Water Quality
    a. Eutrophication is expected to occur more often in surface waters as water temperatures increase (California Department of Water Resources, 2008).
    b. Longer low-flow conditions may lead to higher contaminant concentrations (California Natural Resources Agency, 2009).
    c. High turbidity is expected to become more of a concern as storm severity increases and wildfires become more frequent (California Department of Water Resources, 2008).
    d. Increased sedimentation in rivers and streams is expected (GEOS Institute, 2010).
    e. Other water quality issues that typically accompany severe storms (such as spikes in *E. coli* or *cryptosporidium*) are expected to become more frequent (Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008).
    f. Pollutant loads may increase with more intense storms (California Department of Water Resources, 2008).
    g. Increased salinity intrusion into estuaries and brackish environments as seasonal freshwater flows decrease and sea levels rise (California Department of Water Resources, 2008).
    h. Warming temperatures will result in lower dissolved oxygen levels in water bodies which also contributes to algal blooms and eutrophication (California Natural Resources Agency, 2009). Changes in streamflows and increased storm intensity that causes heavy runoff may alter pollutant concentrations in water bodies reducing water quality (California Natural Resources Agency, 2009).
    i. While it is unclear how average precipitation will change with temperature, it is generally agreed that storm severity will probably increase. More intense, severe storms may lead to increased erosion, which will increase turbidity in surface waters. Areas that already observe water quality responses to rainstorm intensity may be especially vulnerable (California Department of Water Resources, 2011).
4. Sea Level Rise
    a. Saltwater intrusion to coastal aquifers with shallow water tables will worsen with sea levels rise (GEOS Institute, 2010).
    b. Coastal erosion is expected to increase in severity in many locations (U.S. Environmental Protection Agency, 2009). Coastal erosion can cause severe damage to coastal developments and facilities (GEOS Institute, 2010). Beach erosion is expected to increase and may require more frequent sand replenishment (GEOS Institute, 2010).

c. Coastal structures, especially earthen levees, are placed under additional stress and are more likely to fail as sea level rises (California Department of Water Resources, 2008), (California Natural Resources Agency, 2009).
d. Coastal flooding is more likely to inundate coastal infrastructure as base sea levels increase (California Department of Water Resources, 2008). Areas within the tidal reach may also be more susceptible to flooding. Tourism infrastructure including roads, buildings, harbors, and piers may be damaged by higher sea levels (GEOS Institute, 2010).
e. Low-lying coastal habitats that are particularly vulnerable to climate change include estuaries and coastal wetlands that rely on a delicate balance of freshwater and salt water (California Department of Water Resources, 2011).

5. Flooding
    a. Potential damage to agriculture systems (GEOS Institute, 2010).
    b. Storms are expected to increase in intensity. The 2009 California Water Plan recommends that no new critical facilities (e.g., fire stations, hospitals, schools, emergency shelters) be built within a 200-year flood plain (California Department of Water Resources, 2008), (California Natural Resources Agency, 2009).
    c. Higher volumes of floodwater are anticipated as more precipitation falls as rain (California Department of Water Resources, 2008).
    d. Flooding is expected to cause beach erosion (GEOS Institute, 2010).
    e. Reservoirs and other facilities with impoundment capacity may be insufficient for severe storms in the future. Facilities that have been insufficient in the past may be particularly vulnerable (California Department of Water Resources, 2011).
    f. Wildfires alter the landscape and soil conditions, increasing the risk of flooding within the burn and downstream areas. Some areas are expected to become more vulnerable to wildfires over time.
6. Ecosystem and Habitat Vulnerability
    a. Sedimentation is likely to increase in marshes, estuaries and coastal streams (GEOS Institute, 2010).
    b. Coastal birds may decline (GEOS Institute, 2010).
    c. Saltwater is likely to intrude estuaries, creeks and wells along the coast (GEOS Institute, 2010).
    d. Rare habitats could decline (GEOS Institute, 2010).
    e. Marine and nearshore marine species are threatened by acidification of ocean water and changes in ocean currents (GEOS Institute, 2010).
    f. Changes in fog could lead to loss of elfin forests (coastal oak forests) (GEOS Institute, 2010).
    g. Sensitive species are at risk (GEOS Institute, 2010).
    h. Lower average rainfall, higher evaporation and increased sedimentation are expected to have negative impacts on vernal pools, wetlands and riparian areas (GEOS Institute, 2010).
    i. Changes in migration patterns and species distribution are anticipated (U.S. Environmental Protection Agency, 2009), (National Academy of Sciences, 2010).
    j. Aquatic and terrestrial invasive species may spread in some areas (National Academy of Sciences, 2010).
    k. Erosion is expected to increase with climate change, and sedimentation is expected to shift. Habitats sensitive to these events may be particularly vulnerable to climate change (California Department of Water Resources, 2011).
    l. Some specific species are more sensitive to climate variations than others and may be especially vulnerable to climate change impacts (California Department of Water Resources, 2011). Saltbush (Atriplex) and other native shrubs are expected to decline with

climate change. Model projections show loss of appropriate conditions for temperate shrubland by mid-century. Shrubs could be impacted by increased drought and spread of fire with non-native grasses. Other species that may be affected include San Joaquin kit fox, LeConte's thrasher, giant kangaroo rats, blunt-nosed leopard lizards, and California condor. Pronghorn and Tule elk might decline with decreased productivity of grasslands. Populations of these species are isolated and the topography of the Carrizo Plain and surrounding areas, making it difficult for them to move to new areas. The future climate may not be suitable for coniferous (pine) forests and woodlands (GEOS Institute, 2010).

m. Species that are already threatened or endangered may have a lowered capacity to adapt to climate change (California Department of Water Resources, 2011).

7. Hydropower
    a. Changing volumes of total snowpack and changing seasonal melting patterns of snow may require changes in reservoir management strategies. Depending on other reservoir release constraints (such as environmental flow release requirements), this could negatively impact hydropower generation (California Department of Water Resources, 2008).
    b. Increasing temperatures will also increase energy demands, especially during peak demand times (California Department of Water Resources, 2008).

2.2 Climate Change Vulnerability Assessment Checklist

Regional climate change impacts from Section 2.1.1 are considered at the subregional level in this section of the memo to establish a preliminary vulnerability assessment for seven water and climate change related categories recommended in the Climate Change Handbook. The 2014 IRWMP discusses prioritized vulnerabilities, but lacks a description of the decision-making process implemented to determine the prioritization of the vulnerabilities. A preliminary list of questions and considerations, or a "Checklist", from the Climate Change Handbook Section 4.3 and Appendix B, is shown below with initial attempts to describe relevant impacts and considerations for each issue relevant to each subregion. These initial considerations are provided to encourage input from stakeholders about relevant key indicators of potential vulnerabilities in each subregion. Once these vulnerabilities are identified, a system will be applied to prioritize them.

Water Demand

1. Are there major industries that require cooling/process water in your planning region?

Several prominent industries in San Luis Obispo County require water for their operations. Notable industries include wineries, breweries, hospitals, energy production, hotels, and education. Additionally, agriculture is a major industry throughout the County and has a significant water demand for irrigation and other processes.

North Coast Subregion

Cuesta College requires water to maintain operations and serve its students and staff. Similarly, the California Men's Colony requires water to serve its residents and maintain operations. Wineries along the North Coast also contribute to the industrial water demand in the subregion.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

Wineries and vineyards throughout the North County have large water demands for growing and wine production. Another major industrial water use in the subregion is process water required by breweries. The Atascadero State Hospital and other hospitals are notable industrial water users in the subregion.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
The Diablo Canyon Power Plant requires cooling and process water for its operations. The Santa Maria Refinery in Nipomo is a major industrial water user. Cal Poly San Luis Obispo has a significant water demand to maintain operations and serve its students and staff. There are also several breweries throughout the South County Subregion that require water for the brewing process. Hospitals, including Sierra Vista Regional Medical Center and French Hospital Medical Center, are another prominent industry in the subregion that requires process water. The Arroyo Grande Oil Field uses large amounts of water during oil pumping.

South County Subregion ☒Yes ☐No ☐Uncertain

2. Does water use vary by more than 50% seasonally in parts of your region?
North Coast Subregion
Seasonal water use is affected by tourism and agriculture in the North Coast Subregion. San Simeon CSD and Cambria CSD both have a noticeably higher water demand from June to October. Los Osos CSD has a significant difference in seasonal water demand, but it is not more than 50%.

North Coast Subregion ☐Yes ☐No ☒Uncertain

North County Subregion
Seasonal water use is affected by agriculture in the North County Subregion. Templeton CSD, Atascadero MWC, and the City of Paso Robles all have significantly lower water demands during winter months.

North County Subregion ☐Yes ☐No ☒Uncertain

South County Subregion
Seasonal water use is affected by agriculture and tourism in the South County Subregion. The City of Pismo Beach, Nipomo CSD, and Oceano CSD all have significantly lower water demands during winter months. During the summer, the City of San Luis Obispo experiences an increase in irrigation water use but a decrease in domestic water use with the absence of Cal Poly students. Overall, seasonal water use does not vary by more than 50%.

South County Subregion ☐Yes ☐No ☒Uncertain

3. ***Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?***
The highest ranked crops by dollar amount are grapes/wine, vegetables, strawberries, avocados, broccoli, and cattle/calves, all which are climate sensitive. The total value of agricultural production in 2016 was over $900 million (County of SLO 6). A report by the USDA determined San Luis Obispo County had a high crop vulnerability ranking.

- While grapes are relatively drought tolerant crops, they are sensitive to temperature, frost, and other climate-related factors. The quality of wine grapes is especially sensitive to climate, so

increased temperatures could significantly reduce the quality and economic value of wine grapes ("Grapes" 1-2).

- Cattle production decreased 36% from 2015 to 2016 due largely to the decrease in rangeland caused by the drought (County of SLO 8). Changes in air temperature and decreased humidity can cause respiratory problems for cattle.
- Strawberries are extremely sensitive to soil salinity. Increasing salt levels in soil would decrease growth rate and fruit yield of strawberries as well as increase irrigation demands for soil leaching. Additionally, strawberries are sensitive to fungal diseases and unusually warm temperatures ("Strawberries" 1-2).
- Broccoli is moderately climate sensitive. Broccoli has a narrow temperature range of 60 to 65˚F and is harmed by temperatures exceeding 80˚F. The vegetable is also sensitive to invertebrate pests and bacterial and fungal diseases, which are likely to pose a greater risk with increased temperatures ("Broccoli" 1-2).
- Avocados are a highly climate sensitive crop requiring wet conditions. Avocados need large amounts of water and frequent irrigation, and their sensitivity to soil salinity could increase this already high water demand. The fruit is sensitive to cold weather and can die during a freeze, but increased fall temperatures could also decrease avocado yields ("Avocados" 1-2).

North Coast Subregion
Avocados, grapes, and berries are all grown in the North Coast Subregion.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
The primary crop in the North County Subregion is wine grapes. The cattle industry is also prominent in this subregion.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
Strawberries, avocados, and grapes are some of the major crops grown in the South County Subregion.

South County Subregion ☒Yes ☐No ☐Uncertain

4. ***Do groundwater supplies in your region lack resiliency after drought events?***

North Coast Subregion
Multiple groundwater basins in the subregion (some of the largest/highest yield and storage capacity basins) have a Level I (2 basins) or Level III (2 basins) severity rating as assigned by the SLO County Planning Department. These basins experience reduced recharge and ability to meet demand during drought conditions. About 50% of the North Coast's urban water supply is from groundwater (SLO 2014 IRWMP D-18). Drought conditions make groundwater basins more susceptible to salt water intrusion and often result in increased chloride levels. This has been witnessed in groundwater wells in Los Osos. San Simeon CSD is dependent on a single creek basin, which is susceptible to adverse effects of drought events.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

The Paso Robles Basin, the largest and highest yielding basin in the subregion, is a critically over-drafted basin (DWR). The groundwater basins in this subregion have low storage and difficulty meeting demands especially during drought events (SLO 2014 IRWMP C-13). About 70% of the North County water supply is from groundwater (SLO 2014 IRWMP D-18).

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

The Cuyama Valley Basin is a critically over-drafted basin, and the Santa Maria Valley Basin is a high priority basin (DWR). Droughts reduce basin recharging and the ability of the basin to meet demand. About 30% of the South County water demand is supplied by groundwater (SLO 2014 IRWMP D-18). However, Nipomo CSD is unique in that it obtains 50-100% of its water supply from groundwater.

South County Subregion ☒Yes ☐No ☐Uncertain

5. ***Are water use curtailment measures effective in your region?***

A local drought emergency was enacted in SLO County from 2014 through 2017 that restricted water usage and required acquiring alternate water sources while reservoir levels were allowed to recover.

North Coast Subregion

Los Osos CSD implemented a Water Shortage Contingency Plan during the recent drought, and water usage dropped to 50 gallons per day per capita.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

Efforts in the City of Paso Robles during the recent drought were effective in reducing per capita water use. The US-LT RCD developed the Agricultural Water Offset program, which limited the establishment of new irrigated lands in Paso Robles Groundwater Basin, but this did not necessarily prevent new groundwater pumping operations outside of the basin boundary.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

While curtailment measures in Nipomo were successful in reducing groundwater pumping by 50%, they did not result in a significant increase in the groundwater level. Restrictions on outdoor water use in the City of San Luis Obispo have been effective at reducing the city's water consumption. The City of Arroyo Grande successfully curtailed water use by 35% from 2013 to 2016.

South County Subregion ☒Yes ☐No ☐Uncertain

6. ***Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?***

A study completed by Stillwater Sciences in 2014 determined the minimum instream seasonal flow requirements needed to sustain basic aquatic systems for stream systems throughout the County. Central coast steelhead trout were used as the indicator species for this study. Based on a 2017 report by the Central Coast Salmon Enhancement, there are streams within all three subregions that did not meet these minimum flow requirements in the past two years. In 2016, only 14 percent of the sites

measured met spring flow requirements, and only 17 percent of measured sites met summer flow requirements (CCSE).

North Coast Subregion

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

Water Supply

1. Does a portion of the water supply in your region come from snowmelt?

North Coast Subregion

The City of Morro Bay, California Men's Colony, Cuesta College, and County Operations Center all receive water from the State Water Project (SWP).

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

Shandon has a water service amount of 100 AFY from the SWP.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

The City of Pismo Beach, Oceano CSD, Avila Beach CSD, Avila Valley MWC, San Miguelito MWC, and San Luis Coastal USD all receive water from the SWP.

South County Subregion ☒Yes ☐No ☐Uncertain

2. Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

See Question 1 above.

North Coast Subregion

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

3. Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

North Coast Subregion

The Pico Creek Valley, San Simeon Valley, Chorro Valley, Morro Valley, and Los Osos Valley Basins have all encountered sea water intrusion and are water supply sources for the subregion (SLO 2014 IRWMP).

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

There are no coastal aquifers in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

The Avila Valley Sub-basin and Santa Maria Valley Basin have both experienced sea water intrusion and serve as water supply sources for the subregion (SLO 2014 IRWMP).

South County Subregion ☒Yes ☐No ☐Uncertain

4. Would your region have difficulty storing carryover supply surpluses from year to year?

Surplus supplies of State Water can be stored via San Luis Reservoir, which is operated by DWR and the Central Valley Project. State water contracts limit the quantity of water allowed to be stored by each contractor, and stored water is subject to spills based on the amount of water in the SWP system.

North Coast Subregion

San Simeon has no way of carrying over supply surpluses.

North Coast Subregion ☐Yes ☐No ☒Uncertain

North County Subregion

The Salinas Reservoir, overseen by the City of San Luis Obispo, is limited in its ability to store new inflow due to criteria set forth by the SWRCB which only allow for new inflow to be stored when there is a live steam in the Salinas River. Monterey County operates and maintains the Nacimiento Reservoir. The District and the contractors of Nacimiento Water have contracts for water but no rights to storage. Supply surpluses in Shandon are stored in San Luis Reservoir and experience significant losses through evaporation.

North County Subregion ☐Yes ☐No ☒Uncertain

South County Subregion

It is possible to store carryover supplies in Lopez Reservoir but only when the water level reaches 40.5% capacity (20,000 AF). The Low Reservoir Response Plan (LRRP) allows agencies to carryover any of their unused annual entitlement for future use when reservoir levels are low. The LRRP allows for reduced entitlement deliveries as well as reduced downstream releases to preserve or stretch out supplies for up

to 2-3 years. When the LRRP is not in effect, agencies occasionally have access to surplus water but can only use it in that same year; they cannot store it for use in future years.

South County Subregion ☒Yes ☐No ☐Uncertain

5. Has your region faced a drought in the past during which it failed to meet local water demands?
During water years 2014 and 2015, due to statewide drought conditions, the State Water Resources Control Board (SWRCB) curtailed post-1914 tributary water rights to the Sacramento-San Joaquin Delta. A local drought emergency was in effect from 2014-2017 during which time alternate water sources were needed.

North Coast Subregion
State Water Project water has experienced increased salt levels during drought conditions, which resulted in violation of water quality standards in the Chorro Valley Water System.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
To ensure water demand could be met during drought conditions, the City of San Luis Obispo added water supply sources and long-standing water conservation programs. In Nipomo, recent drought conditions have contributed to groundwater levels at record lows.

South County Subregion ☒Yes ☐No ☐Uncertain

6. Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?
The 2014 San Luis Obispo County Watersheds Management Plan determined that invasive species identification and assessment as a county-wide priority data gap. The California Invasive Plant Council has recognized areas of spreading invasive species in all three of the County's subregions, and there has already been a significant increase in the overall size of acres covered by invasive species in local watersheds. Yellow star thistle, veldt grass, and arundo are three invasive species with notable management issues in San Luis Obispo County. Additionally, invasive mussels in reservoirs and water management facilities are a concern. Mitigation sites are especially vulnerable to invasive species management issues.

North Coast Subregion
Cape Ivy in the Morro Bay watershed has been an invasive species of special concern.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

Water Quality

1. Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?
According to the Cal-Adapt Wildfire: Fire Risk Map, the SLO County IRWM Planning Region may experience a slight increase in annual mean hectares burned by wildfire (Cal Fire).

North Coast Subregion
The risk of wildfires near Whale Rock Reservoir are a significant contamination risk to the water supply ("Whale Rock" 18). The major source of contamination for the water body is sedimentation from erosion, which would be exacerbated by wildfires in the nearby area ("Whale Rock" 1). Dead trees and large areas of dry bush create a wildfire threat to water bodies throughout the North Coast Subregion – not just Whale Rock Reservoir.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
The Nacimiento Reservoir is in an area with a high risk of wildfires, and possible wildfires pose a threat to the water quality in the reservoir ("Nacimiento Reservoir" 1). Similarly, wildfires are a risk in the nearby areas of the Salinas Reservoir and threaten water quality (Cal Fire).

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
Large amounts of dry brush have been noted throughout the Lopez Lake watershed and contribute to the significant risk of potential contamination due to wildfires ("Lopez Lake" 2). Wildfires would lead to increased sedimentation and add stress to other water quality concerns within the reservoir.

South County Subregion ☒Yes ☐No ☐Uncertain

2. Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?
North Coast Subregion
The San Simeon, Cayucos Creek, and Morro Bay Watersheds all have low dissolved oxygen, among other water quality issues (SLO 2014 IRWMP). Bacteria impairment can be exacerbated by warm temperatures, which accelerates the growth of bacteria. Water bodies with bacteria impairment include Morro bay estuary, Chorro Creek, Los Osos Creek and Warden Creek. Cattle grazing in the Whale Rock Reservoir watershed has been linked to increased turbidity and nutrient levels in the area's water bodies ("Whale Rock" 1). These conditions encourage algal blooms and are worsened in times of drought and high temperatures.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
Middle Salinas-Atascadero and Cholame Creek Watersheds have low dissolved oxygen (SLO 2014 IRWMP). The Nacimiento Reservoir has a recent trend of high algal levels in summer months. Increased erosion, drought conditions, and high temperatures all contribute to harmful levels of algae growth in the reservoir ("Nacimiento Reservoir" 27-28). Similarly, the recent drought conditions resulted in record high levels of nutrients in the Salinas Reservoir, which has contributed to a trend of high algae levels in warm summer and fall months ("Salinas Reservoir" 12).

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
San Luis Obispo Creek and Pismo Creek Watersheds have low dissolved oxygen. San Luis Obispo Creek and Santa Maria River have chlorpyrifos and other water quality issues (SLO 2014 IRWMP). The Lopez Lake Reservoir experienced harmful algal blooms during the recent drought conditions and has a recorded trend of algae spikes during warm summer months ("Lopez Lake" 14).

South County Subregion ☒Yes ☐No ☐Uncertain

3. Are seasonal low flows decreasing for some waterbodies in your region? If so, are the reduced low flows limiting the waterbodies' assimilative capacity?
A 2017 report by Central Coast Salmon Enhancement showed that stream systems throughout the County have recently experienced decreased seasonal low flows. During these low flow periods, water quality and ecosystem processes are highly sensitive to minor alterations and contamination.

North Coast Subregion

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

4. Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?
Beneficial uses are identified by the Watershed Management Planning Project Report for all but one of the watersheds in the region.

North Coast Subregion
Swimming and oyster harvesting in the Morro Bay watershed have been limited in the past due to bacteria levels.

North Coast Subregion ☐Yes ☐No ☒Uncertain

North County Subregion

North County Subregion ☐Yes ☐No ☒Uncertain

South County Subregion

South County Subregion ☐Yes ☐No ☒Uncertain

5. Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Runoff into Whale Rock Reservoir (Cayucos Water Treatment Plant) and Lopez Lake (Lopez Water Treatment Plant) brings sediment into the reservoirs causing turbidity levels to rise. This can dramatically affect the treatability of the water source and increase the risk of exposure to water borne illnesses due to Cryptosporidium, Giardia, and E. Coli as chlorine and filtration demands are elevated during these times. It typically takes several big storms to see such a result in water quality at the water treatment plants, and it can take days for the turbid water to reach the end of the reservoir where water is distributed to the water treatment plants. Fortunately, County facilities can handle these changes to the water source and have not had a violation because of turbidity breakthrough or low chlorine after such rain events.

Storm runoff similarly affects Nacimiento Lake and Salinas Reservoir and treatment facilities in the City of Paso Robles and City of San Luis Obispo, respectively, must respond to the water quality shifts.

North Coast Subregion

Heavy rains in San Simeon forced the community to add a well filtration system to handle increased contamination.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

Sea Level Rise

1. Has coastal erosion already been observed in your region?

North Coast Subregion

Coastal erosion has been observed within the North Coast Subregion; however, the shoreline trends vary across the region and over time. A USGS study found that in the short-term over 80% of the subregion is experiencing net erosion (Hapke 50). San Simeon has been forced to add armoring to the shoreline to protect beach access and the waste water treatment plant.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion
The South County Subregion has experienced notable coastal erosion. Coastal bluffs in Pismo Beach are experiencing erosion rates of six to eight inches per year, which resulted in the construction of a sea wall in 2017 (LA District US Army Corps of Engineers 17). Avila Beach is also using a sea wall to protect roads and infrastructure from coastal erosion (Wallace Group).

South County Subregion ☒Yes ☐No ☐Uncertain

2. Are there coastal structures, such as levees or breakwaters, in your region?
North Coast Subregion
Coastal structures along the North Coast include the San Simeon Pier, Cayucos Pier, and Morro Bay breakwaters.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion
The Arroyo Grande Creek Channel Levee located in the South County Subregion is intended to mitigate flooding. Other notable coastal structures along the South Coast include the Port San Luis breakwater, Harford Pier, Unocal Pier, Avila Beach Pier, and Pismo Beach Pier.

South County Subregion ☒Yes ☐No ☐Uncertain

3. Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level in your region?
San Luis Obispo County Planning Department is currently working on a study that will provide information about specific infrastructure at risk from sea level rise.

North Coast Subregion
Based off the NOAA Sea Level Rise Viewer, roads and infrastructure within areas of San Simeon, San Simeon Ranch, Morro Bay, Morro Bay State Park, and Los Osos would be impacted by six feet of sea level rise.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion
Based off the NOAA Sea Level Rise Viewer, roads and infrastructure near Pismo State Beach and in Oceano would be impacted by six feet of sea level rise. Specifically, the South SLO County Wastewater Treatment Plant is at risk of sea level rise impacts.

South County Subregion ☒Yes ☐No ☐Uncertain

4. Are there climate-sensitive low-lying coastal habitats in your region?
North Coast Subregion
The US Fish and Wildlife Service has designated several Critical Habitats throughout the North Coast Subregion; these federally recognized areas are considered essential for the survival of an endangered or threatened species. Critical Habitats along the North Coast have been recognized for the following species: Steelhead, California red-legged frog, Banded dune snail, Western snowy plover, Morro Bay kangaroo rat, and Tidewater goby. Morro Bay Estuary, in particular, is home to multiple fully protected species and is one of 28 areas protected through the EPA's National Estuary Program.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
There are no coastal habitats in this region.

North County Subregion ☐Yes ☒No ☐ Uncertain

South County Subregion
The coastal area of the South County Subregion also contains several Critical Habitats. Endangered and threatened species dependent on coastal habitats along the South Coast include Tidewater goby, Steelhead, La Graciosa thistle, and Western snowy plover ("ECOS"). Pismo Beach is also home to a Monarch Butterfly Grove – a species which is currently under review for protection under the Endangered Species Act ("Monarch butterfly").

South County Subregion ☒Yes ☐No ☐Uncertain

5. Are there areas in your region that currently flood during extreme high tides or storm surges?
North Coast Subregion
During king tides, the water level in Morro Bay is just inches below docks and waterfront restaurants. Many popular coastal areas in Morro Bay State Park are completely underwater during king tides. Communities in Los Osos have also experienced flooding during king tides. During previous storm surges, Pico Creek lagoon has experienced salt water intrusion.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

Pismo Beach experienced flooding during storm surges in 2016 that resulted in closing the pier (KSBY). During king tides, beaches and coastal habitats in Pismo Beach experience flooding. In the past, storm events have caused flooding of the Oceano Lagoon and Highway 1 in Oceano.

South County Subregion ☒Yes ☐No ☐Uncertain

6. Is there land subsidence in the coastal areas of your region?

The only land subsidence that has been observed in the coastal areas of San Luis Obispo County occurred in and around Oceano due to the December 2003 San Simeon Earthquake. The land subsidence was a result of liquefaction during shaking by the earthquake.

North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

South County Subregion ☐Yes ☒No ☐Uncertain

7. Do tidal gauges along the coastal parts of your region show an increase over the past several decades?

North County Subregion

It can be assumed that sea level trends in the North County Subregion are similar to those studied at Port San Luis and other surrounding areas. Nearby studies indicate the mean sea level is increasing along California's central coast ("Sea Level Trends").

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

According to NOAA's Tides and Currents Sea Level Trends gauge for Port San Luis, the change in mean sea level is 0.84 mm/year with a 95% confidence interval. This calculation is based off data from 1945 to 2016 and is equivalent to a change of 0.28 feet in 100 years ("Sea Level Trends").

South County Subregion ☒Yes ☐No ☐Uncertain

Flooding

1. Does critical infrastructure in your region lie within the 200-year floodplain? DWR's best available floodplain maps are available at:
http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/best_available_maps/.
No areas in the region are within the 200-year floodplain.

North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

South County Subregion ☐Yes ☒No ☐Uncertain

2. Does part of your region lie within the Sacramento-San Joaquin Drainage District (SSJDD)?
No areas in the region are within the SSJDD.

North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

South County Subregion ☐Yes ☒No ☐Uncertain

3. Does aging critical flood protection infrastructure exist in your region?
North Coast Subregion
Two 1940-era Chorro Creek bridges within the California Men's Colony (CMC) are susceptible to collapse and/or obstruction from high water flows and flood debris leading to flooding and restricted access to the West Facility of CMC. Additionally, the Chorro Dam and spillway are aging.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
Old and damaged drainage projects and flood protection infrastructure are present throughout the North County Subregion leaving the area vulnerable to flooding.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
Much of the City of San Luis Obispo's downtown corridor has creeks and waterways with aging infrastructure. The Arroyo Grande Creek Channel Levee was constructed in 1961 to reduce flooding in the area (SLO Flood Control District). The Diablo Canyon Nuclear Power Plant located along the coast has critical flood protection infrastructure. The flood control gates on Oceano Lagoon are aging.

South County Subregion ☒Yes ☐No ☐Uncertain

4. Have flood control facilities (such as impoundment structures) been insufficient in the past?
North Coast Subregion
Flood control and drainage studies were completed by RMC, Inc. for several communities in the North Coast Subregion in 2004. The study in Cambria revealed there were insufficient underground drainage facilities and improved organization and maintenance of the area's flood control facilities was necessary ("Cambria" i). In Cayucos, a lack of initial drainage infrastructure when development began was identified as a major reason for the lack of necessary drainage facilities and frequent street flooding ("Cayucos" i). Another study done in 1997 determined that development in Los Osos without rerouting of drainage facilities had led to poor flood control in the area (Engineering Development Associates ES-1). San Simeon lacks an adequate storm drainage system; private storm drains currently provide most of the flood protection.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
A study by RMC, Inc. showed that the railroad in San Miguel was preventing runoff to the Salinas River and causing flooding ("San Miguel" ii). Additionally, a lack of curbs and gutter systems were contributing to road flooding ("San Miguel" i). In Santa Margarita, inadequate culverts and drainage structures blocked by sedimentation and debris resulted in flood risks ("Santa Margarita" i). The Templeton Drainage and Flood Control Study completed in 2014 identified several insufficient flood control facilities, including culverts along Highway 101, Main Street, and Arizona Crossing as well as restricted conveyance capacity in the Toad Creek Channel due to vegetation and sedimentation (13-16).

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
RMC, Inc. performed flood control and drainage studies in 2004 for several communities in the South County Subregion. The Nipomo study revealed Mesa area flooding was due to development locking existing runoff flow paths and flooding in Olde Towne was the result of insufficient culverts ("Nipomo" i-ii). In Oceano, the study found stormwater was not considered during the community's initial development and that resulted in insufficient drainage facilities and frequent flooding of roads ("Oceano" i). Additionally, the Arroyo Grande Creek Channel Levee was breached in 2001 and hundreds of acres were flooded (SLO Flood Control District).

South County Subregion ☒Yes ☐No ☐Uncertain

5. Are wildfires a concern in parts of your region?
There are areas within all three subregions determined as Very High Fire Hazard Severity Zones by Cal Fire. Additionally, the Region does not have an adequate system for clearing dead trees, snags, piles of limbs, wood chips, etc.

North Coast Subregion
San Simeon lacks adequate fire protection for homes and businesses. There is not enough water storage nor fire flow to protect structures. The West Facility of the California Men's Colony is a 1940-era Army Hospital composed of highly flammable wooden materials and is located adjacent to areas susceptible to wildfire.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

Ecosystem and Habitat Vulnerability

1. Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?
Increased sedimentation has been witnessed throughout the County and can cause shallower and warmer water, and in some cases, loss of estuaries.

North Coast Subregion
The Morro Bay estuary salt marsh is a critical habitat that has already been impacted by sedimentation and effects will likely be complicated by sea level rise. Morro Bay shorebird habitats and eelgrass beds have been identified as at-risk of these disrupting effects. Many species including snowy plovers, least terns, brown pelicans, and brant are expected to lose habitat and resources (Koopman 31). Additionally, Steelhead, California red-legged frog, Morro shoulderband snail, and Morro kangaroo rat Critical Habitats in the North Coast are vulnerable to the effects of erosion and sedimentation ("ECOS").

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
The Salinas River has already been impacted by increased sedimentation (Koopman 31). This sedimentation has degraded riparian habitats including areas designated as a Critical Habitat for Steelhead and California red-legged frog and supports numerous other special status species ("ECOS").

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
Increased sedimentation and coastal erosion could disrupt Critical Habitats for Steelhead, California red-legged frogs, Western snowy plover, and La Graciosa thistle in the South County (Koopman 31). The Pismo Beach area is especially at risk of coastal erosion and flooding.

South County Subregion ☒Yes ☐No ☐Uncertain

2. Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

North Coast Subregion

Morro Bay Estuary is an important coastal habitat supporting a diverse community of species, many of which have special species status, and is dependent on seasonal flow patterns (US-LT RCD). Morro Bay estuary is impacted by changes in freshwater flow. Understanding of specific impacts is limited, but the Morro Bay National Estuary Program is currently researching and monitoring impacts on eelgrass. Several other river and stream mouths along the North Coast are dependent on seasonal flow patterns.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek all form estuarine habitats dependent on seasonal flows and that support federally protected species (US-LT RCD).

South County Subregion ☒Yes ☐No ☐Uncertain

3. Do climate-sensitive fauna or flora populations live in your region?

North Coast Subregion

The elfin forests and estuary in Morro Bay are sensitive to climate change impacts, such as changes in fog, sea level rise, sedimentation, and drought (Koopman 31). These areas support various special status species that are at great risk of climate change impacts. Pine forests and woodlands along the North Coast are at risk of changing conditions that could make current habitats unsuitable, and their isolation from other suitable areas makes them especially vulnerable (Koopman 35). Steelhead trout are sensitive to increased sedimentation and declining stream flows.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

Carrizo Plain supports several climate-sensitive species, such as Pronghorn and Tule elk, which are at risk of declining grassland productivity and isolation from other suitable habitats (Koopman 37). The North County Subregion is also home to various endangered and threatened species that are at high risk of climate change impacts; these species include Steelhead, California tiger salamander, California red-legged frog, Longhorn fairy shrimp, Vernal pool fairy shrimp, Purple amole, and California condor ("ECOS").

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

Steelhead and other protected species found in the coastal areas of the subregion are at risk of various climate change impacts that threaten the conditions required for suitable habitat ("ECOS"). Additionally, climate change effects could put new species at risk. For instance, higher temperatures and poor water quality could cause sea lions to be more susceptible to diseases (Koopman 31).

South County Subregion ☒Yes ☐No ☐Uncertain

4. Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

North Coast Subregion

Endangered Species: Smith's butterfly, Chorro Creek bog thistle, California clapper rail, Morro Bay kangaroo rat, Morro shoulderband snail, Tidewater goby, California seablite, Indian Knob mountain-balm, Marsh sandwort, Salt marsh bird's-beak, Southern Steelhead (US-LT RCD).

Threatened Species: Steelhead, California red-legged frog, Monterey spineflower, California black rail (CA), Beach spectaclepod (CA), Morro manzanita, Western snowy plover, Southern sea otter (US-LT RCD).

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

Endangered Species: Blunt-nosed leopard lizard, Giant kangaroo rat, San Joaquin kit fox, Camatta Canyon amole, Kern mallow, Least Bell's vireo, California condor, California jewel-flower, San Joaquin wollythreads, Longhorn fairy shrimp, Tipton kangaroo rat, Bald Eagle (CA), Santa Lucia mint (CA) (US-LT RCD).

Threatened Species: Bank swallow (CA), Swainson's hawk (CA), California red-legged frog, Vernal pool fairy shrimp, Spreading navarretia, Nelson's antelope squirrel (CA), California tiger salamander, Kern primrose sphinx moth, Camatta Canyon amole, Santa Lucia purple amole (CA), Steelhead (US-LT RCD).

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

Endangered Species: California least tern, Tidewater goby, Gambel's water cress, La Graciosa thistle, Marsh sandwort, Nipomo Mesa lupine, Pismo clarkia, California condor, Blunt-nosed leopard lizard, Giant kangaroo rat, Longhorn fairy shrimp, San Joaquin kit fox, California jewel-flower, Kern mallow, San Joaquin woollythreads, Chorro Creek bog thistle, Indian Knob mountain-balm, Pismo clarkia (US-LT RCD).

Threatened Species: California black rail (CA), California red-legged frog, California tiger salamander, Steelhead, Western snowy plover, Beach spectaclepod (CA), Surf thistle, Kern primrose sphinx moth, Nelson's antelope squirrel (CA), Swainson's hawk (CA), Vernal pool fairy shrimp, Western snowy plover, Morro manzanita, Surf thistle (US-LT RCD).

South County Subregion ☒Yes ☐No ☐Uncertain

5. Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

In 2015, the commercial fishing industry in San Luis Obispo County had a total revenue of $10 million (County of SLO).

North Coast Subregion

Morro Bay State Park, Montana de Oro State Park, San Simeon Beach, and other coastal areas attract tourists, support water-related recreation, and are threatened by sea level rise. Morro Bay economic

activities include oyster farming (2 oyster farms), recreational and commercial fishing, fishing-related, fish markets and restaurants that sell local fish. There are two shops in Morro Bay dedicated to stand-up paddling, as well as numerous kayak rentals shops and three bay tour boat operators. There is a growing number of charter boats that do private sailing and fishing charters. Wildlife viewing also generates economic activity, such as the Morro Bay Winter Bird Festival. Whale Rock and Chorro Reservoirs also support fishing and other recreation activities.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
Santa Margarita Lake supports water recreation activities. The Salinas River and other riparian habitats also support tourism and water recreation.

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion
Avila Beach, Pismo Beach, Oceano Dunes, and other coastal regions in the South County have a strong tourism industry. Whale Rock Reservoir also supports water-related recreation.

South County Subregion ☒Yes ☐No ☐Uncertain

6. Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?
Stillwater Sciences completed an evaluation in 2014 of minimum instream seasonal flows required to sustain aquatic habitats for steelhead. This study determined minimum seasonal flow values required to support Steelhead habitats at 63 different analysis points across the Region (Stillwater Sciences 23-24).

North Coast Subregion

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

North County Subregion ☒Yes ☐No ☐Uncertain

South County Subregion

South County Subregion ☒Yes ☐No ☐Uncertain

7. Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?
Coastal storms bringing storm surges, waterspouts, and flooding are all possible and occur somewhat regularly along the San Luis Obispo County coastline. These events are often linked to atmospheric rivers.

North Coast Subregion

Areas at risk: Estero Bluffs State Park, Morro Bay National Estuary, Morro Bay State Park, William Randolph Hearst Memorial State Beach, San Simeon State Beach, Moonstone Beach, Cayucos Beach, Cayucos State Beach, Morro Strand State Beach, Harmony Headlands State Beach (SLO 2014 IRWMP).

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion
There are no coastal areas in this subregion.

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion
Areas at risk: Montana de Oro State Park, Port San Luis Pier and Beach, Avila State Beach, Pismo State Beach, Oceano Dunes State Vehicles Recreation Area, Guadalupe-Nipomo Dunes wetland complex (SLO 2014 IRWMP).

South County Subregion ☒Yes ☐No ☐Uncertain

8. Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change (https://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/ThreatsForestHealth/Climate/CI-Endangered%20Species%20Coalition%20Top%20Ten.pdf
The Region does not include any of the Top 10 Places from this article.

North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

South County Subregion ☐Yes ☒No ☐Uncertain

9. Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?
North Coast Subregion
Santa Rosa Creek experiences fish passage barriers due to infrastructure changes (SLO 2014 IRWMP). There are many fish passage barriers in the Morro Bay watershed, including the South Bay Boulevard bridge. The Chorro Reservoir Dam is a fish passage barrier impacting steelhead. Additionally, other infrastructure throughout Chorro Creek creates barriers to fish passage.

North Coast Subregion ☒Yes ☐No ☐Uncertain

North County Subregion

The Salinas and Estrella Rivers are important corridors for aquatic and riparian species movement but can be disrupted by declining seasonal low flows.

North County Subregion ☐Yes ☐No ☒Uncertain

South County Subregion
Arroyo Grande Creek experiences fish passage barriers, and Nipomo-Suey Creeks have habitat fragmentation due to development (SLO 2014 IRWMP).

South County Subregion ☒Yes ☐No ☐Uncertain

Hydropower

1. Is hydropower a source of electricity in your region?
Hydropower is not a source of electricity for San Luis Obispo County.

North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion

South County Subregion ☐Yes ☒No ☐Uncertain

2. Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?
North Coast Subregion

North Coast Subregion ☐Yes ☒No ☐Uncertain

North County Subregion

North County Subregion ☐Yes ☒No ☐Uncertain

South County Subregion
The City of San Luis Obispo is exploring options for hydropower.

South County Subregion ☐Yes ☐No ☒Uncertain

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J.2 Climate Change Adaptation and Mitigation Memorandum

San Luis Obispo County IRWMP Climate Change Update – Adaptation and Mitigation Memorandum

This draft technical memo was prepared by County of San Luis Obispo Public Works staff in collaboration with Water Systems Consulting, Inc (WSC) to develop the climate change vulnerability assessment for the 2018 IRWM Plan update. The Department of Water Resources (DWR) awarded grant funding from Proposition 1 to support this planning effort.

1 Purpose

The purpose of this memorandum (memo) is to provide information relevant to climate change adaptation and mitigation as part of the San Luis Obispo County (County) Integrated Regional Water Management (IRWM) Plan (IRWMP) climate change update. Water Systems Consulting, Inc. (WSC) worked with the County and the IRWM Regional Water Management Group (RWMG) to identify data and recommended strategies to satisfy the requirements of the California Department of Water Resources' (DWR's) 2016 IRWM Grant Program Guidelines (1) and the Climate Change Handbook for Regional Water Planning (Climate Change Handbook), Section 4 and Appendix B (2). This memo builds on the Climate Change Vulnerability Assessment document developed by WSC and the County. This document was distributed on January 4, 2018 as a companion document to both the vulnerability assessment survey and the workshop materials for the January 31, 2018 RWMG meeting. Furthermore, this memo builds on the prioritized vulnerabilities (Table A-1) established by the RWMG in the January 31, 2018 and March 7, 2018 workshops.

Table A-1. Prioritized Climate Change Vulnerabilities

Category	Identified Vulnerability	Priority
Water Demand 1	Water-dependent industries	High
Water Demand 2	Seasonal water demand	Medium
Water Demand 3	Climate-sensitive crops	Medium
Water Demand 4	Drought-sensitive groundwater basins	Very High
Water Demand 5	Communities with water curtailment efforts	Medium
Water Demand 6	Insufficient instream flows	Very High
Water Supply 1	Water supply from snowmelt	Low
Water Supply 2	Water supply from coastal aquifers	Very High
Water Supply 3	Inability to store carryover supply surpluses	High
Water Supply 4	Drought-sensitive water systems	Very High
Water Supply 5	Invasive species management issues	Medium
Water Quality 1	Water bodies in areas at risk of wildfire	High
Water Quality 2	Water bodies impacted by eutrophication	High
Water Quality 3	Declining seasonal low flows	Very High
Water Quality 4	Water bodies with restricted beneficial uses	Medium
Water Quality 5	Water quality impacted by rain events	High
Sea Level Rise 1	Coastal erosion	Medium
Sea Level Rise 2	Coastal structures	Low
Sea Level Rise 3	Coastal infrastructure in low-lying areas	Medium
Sea Level Rise 4	Low-lying coastal habitats	Medium
Sea Level Rise 5	Flooding due to high tides and storm surges	Medium
Sea Level Rise 6	Coastal land subsidence	Low

Category	Identified Vulnerability	Priority
Sea Level Rise 7	Rising sea levels	Medium
Flooding 1	Aging flood protection infrastructure	High
Flooding 2	Insufficient flood control facilities	High
Flooding 3	Increased flood risk due to wildfires	Very High
Ecosystem and Habitat 1	Aquatic habitats at risk of erosion and sedimentation	Medium
Ecosystem and Habitat 2	Estuarine habitats dependent on freshwater flow patterns	High
Ecosystem and Habitat 3	Climate-sensitive fauna and flora	Medium
Ecosystem and Habitat 4	Changes in species distributions	High
Ecosystem and Habitat 5	Aquatic habitats used for economic activities & recreation	Low
Ecosystem and Habitat 6	Environmental flow requirements	High
Ecosystem and Habitat 7	Exposed coastal ecosystems	Low
Ecosystem and Habitat 8	Fragmented aquatic habitats	Medium
Hydropower 1	Future hydropower plans	Low

It is anticipated that the County and RWMG will use this memo to inform updates to various sections of the IRWMP including, but not limited to: Section E Goals and Objectives, Section F Resource Management Strategies, and Section G Project Solicitation and Prioritization.

2 Adaptation and Mitigation Strategies

2.1 Objectives to Address Climate Change

As required by the Prop 1 IRWM Program Guidelines, the IRWM Plan must include consideration of objectives and performance measures that address the potential effects of climate change. The following five (5) climate change adaptation and mitigation requirements are addressed by plan objectives and corresponding performance measures as shown in

Table A-2 and Table A-3.

1. Address adaptation to changes in the amount, intensity, timing, quality, and variability of runoff and recharge.
2. Consider the effects of sea level rise (SLR) on water supply conditions and identify suitable adaptation measures.
3. Reduce energy consumption, especially the energy embedded in water use, and ultimately reducing greenhouse gases (GHG) emissions.
4. Consider, where practical, the strategies adopted by California Air Resources Board (CARB) in its AB 32 Scoping Plan, when evaluating different ways to meet IRWM plan objectives.
5. Consider options for carbon sequestration and using renewable energy where such options are integrally tied to supporting IRWM Plan objectives.

The objectives must be measurable by some practical means so achievement can be monitored. Quantitative and qualitative measurements for the IRWM Plan objectives are discussed in IRWMP Section E Goals and Objectives. The plan objectives and corresponding measures shown in

Table A-2 directly address climate change.

Table A-2. Climate Change Objectives and Measures[1]

OBJECTIVES	QUALITATIVE MEASUREMENT	QUANTITATIVE MEASUREMENT
Water Supply Objective #8: Plan for potential regional impacts of greenhouse gas emissions, climate change and droughts on water quantity and quality.		Existence of County-wide planning studies that identify greenhouse gas emission sources and regional vulnerabilities, and forecast the required changes in water supplies and water supply infrastructure as a result of climate change.
Ecosystem and Watershed Objective #7: Increase monitoring and promote research programs to obtain a greater understanding of the long-term effects of climate change and greenhouse gas emissions on the region's watersheds and ecosystems.	Existence of monitoring and research programs that identify the long-term effects of climate change and greenhouse gas emissions on the Region's watersheds and ecosystems.	

1

Table A-2 is adapted from 2014 IRWMP Tables E-6 and E-7

In addition to the two direct climate change objectives above, the five (5) climate change adaptation and mitigation requirements are addressed by plan objectives described in Table A-3 below. Qualitative and quantitative measurements for each plan objective are described in IRWMP Section E.4 Goals and Objectives Metrics.

Table A-3. Plan Objectives Related to Climate Change Requirements

IRWM Plan Objectives[2] \ Climate Change Adaptations and Mitigation Requirements[1]		Adapting to changes in runoff and recharge	Consider the effects of sea level rise on water supply conditions	Reduce energy consumption	Strategies of CARB Scoping Plan[3]	Options for carbon sequestration and renewable energy
Water Supply	Maximize accessibility of water			●		●
	Adequate water supply		●	●		●
	Sustainable potable water for rural	●	●		●	
	Sustainable water for agriculture	●	●		●	
	Water system WQ improvements		●			
	Implement water management Plans	●	●	●	●	●

IRWM Plan Objectives[2] \ Climate Change Adaptations and Mitigation Requirements[1]		Adapting to changes in runoff and recharge	Consider the effects of sea level rise on water supply conditions	Reduce energy consumption	Strategies of CARB Scoping Plan[3]	Options for carbon sequestration and renewable energy
	Conservation/water use efficiency	●	●	●	●	●
	Plan for vulnerabilities of water supply	●	●	●	●	●
	Diverse supply (recycled, desalination)	●	●	●	●	
	Support Watershed Enhancement	●	●			
Ecosystem and Watersheds	Understand watershed needs	●	●			●
	Conserve balance of ecosystem	●	●			●
	Reduce contaminants	●	●			
	Public involvement and stewardship					
	Protect endangered species		●			●
	Reduce impacts of invasive species	●	●			●
	Climate change in ecosystems	●	●	●	●	●
Groundwater	Understand GW issues and conditions	●	●		●	
	Support local GW management	●	●	●	●	●
	Further local basin management objectives	●	●		●	●
	CASGEM Program	●	●			
	Groundwater recharge/banking	●	●			
	Protect and improve GW quality	●	●			
Flood Management	Understand flood management needs	●	●			
	Promote low impact development	●		●	●	●
	Enhance natural recharge	●		●	●	●
	Improve infrastructure and operations	●	●	●	●	
	Implement multiple-benefit projects	●	●	●	●	●
	Restore streams, rivers and floodplains	●	●			●
	Support DAC flood protection	●	●			
Water Resources Management	Public outreach on IRWM implementation		●	●	●	
	Funding for IRWM implementation	●	●	●	●	
	Support local control			●	●	
	Consider property owner rights					
	Agency alignment on water resource efforts	●	●	●	●	●
	Collaboration between urban, rural, and ag	●	●	●	●	●
	DAC support and education		●	●	●	
	Promote public education programs	●		●	●	

Notes: 1. Abbreviated requirements from Prop 1 IRWM Guidelines are described above.
2. Each row represents an abbreviated Objective.
3. The Global Warming Solutions Act of 2006 (Assembly Bill 32) authorized the CARB to develop a plan that includes 18 strategies for reducing carbon emissions statewide. The Scoping Plan addresses water management activities that require energy use and GHG emissions. The goals of the Scoping Plan include developing more reliable water supplies provided by a sustainably managed water system with GHG reductions, water conservation, energy efficiency, and increasing renewable energy.

The County has prioritized vulnerabilities through stakeholder surveys, summarized in Table A-1. The County identified objectives that address vulnerabilities ranked “Very High” in

Table A-4.

Table A-4. Plan Objectives Related to Climate Change Requirements

IRWM Plan Objectives[2] / Top Prioritized Vulnerabilities[1]		Drought-sensitive groundwater basins	Insufficient instream flows	Water supply from coastal aquifers	Drought-sensitive water systems	Declining seasonal low flows	Increased flood risk due to wildfires
Water Supply	Maximize accessibility of water	●	●	●	●	●	
	Adequate water supply	●	●	●	●	●	
	Sustainable potable water for rural	●	●	●	●	●	
	Sustainable water for agriculture	●	●		●	●	
	Water system WQ improvements	●	●	●			
	Implement water management Plans	●	●	●	●	●	
	Conservation/water use efficiency	●	●	●	●	●	
	Plan for vulnerabilities of water supply	●	●	●	●	●	●
	Diverse supply (recycled, desalination)	●	●	●	●	●	
	Support Watershed Enhancement	●	●	●	●	●	●
Ecosystem and Watersheds	Understand watershed needs	●	●	●	●	●	●
	Conserve balance of ecosystem	●	●	●	●	●	●
	Reduce contaminants	●	●	●	●		
	Public involvement and stewardship				●		●
	Protect endangered species		●	●			●
	Reduce impacts of invasive species						●
	Climate change in ecosystems	●	●	●	●	●	●
Groundwater	Understand GW issues and conditions	●	●	●	●	●	
	Support local GW management	●	●	●	●	●	
	Further local basin management objectives	●	●	●	●	●	●
	CASGEM Program	●	●	●	●	●	
	Groundwater recharge/banking	●	●	●	●	●	
	Protect and improve GW quality	●	●	●	●	●	
Flood Management	Understand flood management needs		●				●
	Promote low impact development	●		●	●	●	●
	Enhance natural recharge	●		●	●	●	
	Improve infrastructure and operations	●	●	●	●	●	●
	Implement multiple-benefit projects	●	●	●	●	●	●
	Restore streams, rivers and floodplains	●	●	●	●	●	●
	Support DAC flood protection						●
Water Resources Management	Public outreach on IRWM implementation	●	●	●	●	●	●
	Funding for IRWM implementation	●	●	●	●	●	●
	Support local control				●		●
	Consider property owner rights	●	●	●			●
	Agency alignment on water resource efforts	●	●	●	●	●	●
	Collaboration between urban, rural, and ag	●	●	●	●	●	●
	DAC support and education	●	●	●	●	●	
	Promote public education programs	●	●	●	●	●	●

Notes: 1. Prioritized vulnerabilities ranked "Very High" by stakeholder surveys shown in Table A-1.
2. Each row represents an abbreviated Objective.

3 Resource Management Strategies

The Prop 1 IRWM guidelines require consideration of the California DWR resource management strategies (RMS) in selecting water management projects. RMS are defined by the California Water Plan (CWP) as a project, program, or policy that local agencies can implement to manage water and related resources to meet integrated plan objectives. RMS that meet the region's objectives have been selected and aligned with a list of IRWM Plan Water Management Strategies (WMS) as part of the IRWMP Section F. Because the WMS and RMS are aligned, they are collectively referred to as RMS in the remainder of this memo. Section F of the IRWMP describes how each RMS, addresses the plan objectives. As shown in IRWMP Table F-2, many of the RMS that were included in the County's IRWMP apply to various objectives, shown in Table A-3, addressing climate change vulnerability adaptation and mitigation.

3.1 Additional RMS

The California Water Plan (CWP) 2013 Update includes three additional RMS that will be considered for climate change adaptation and mitigation strategies. The additional RMS are discussed below as they relate to climate change vulnerabilities. Further information and guidance for implementing these strategies can be found in the CWP 2013 Update Volume 3 (3).

Sedimentation Management

Sedimentation management is expected to become increasingly challenging as climate change causes shifts in storm events, vegetative species, soil exposure, and flooding. Sea level rise will cause increased erosion and coastal flooding. Sediment management can improve resiliency and protect the regions vulnerable resources. Recommended project elements include: floodplain restoration, replenishing soil for eroding beaches, marshes, and agricultural lands, storm surge protection, landscape and vegetation management (3).

Sedimentation management can result in high GHG emissions and provides an opportunity to use renewable energy in sediment management operations to mitigate GHG emissions. There is also potential for sequestrations in the reuse of dredged sediment in habitat restoration (3).

Outreach and Engagement

Climate change can be a polarizing and confusing topic for communities. Communicating about climate change is necessary for making informed local water and land use planning decisions to protect the community's vulnerable resources. Outreach and engagement can improve communication with the public, governmental agencies, industry, businesses, and nonprofit organizations about the vulnerability of the County's resources to climate change. The goal of this strategy is to educate and build community commitment to decisions that address climate change. Recommended project elements include: an outreach and education program, building community relationships, solicit community input, improve accessibility of information, and improve monitoring.

Mitigation is supported by educating the public on mitigation strategies for climate change and the importance of reducing their community's carbon footprint. Education has a central role in mitigating climate change. Public awareness, exchange of information, and education will foster empowerment and ownership among the public and convey the importance of their role in mitigating climate change. Developing K-12 outreach programs to educate local youth to form lasting behaviors and awareness can also play a key role in mitigation (3).

Water and Culture

Climate change impacts are expected to affect water-dependent resources that currently support cultural activities. Changes to water resources and ecosystems will affect recreation and spiritual practices associated with water as well as historic preservation, with important cultural sites at greatest risk. Cultural practices, including historic concepts of water rights, dependence on fossil fuels, and other lifestyle practices have an impact on water management and the ability to adapt and mitigate climate change. Healthy and resilient ecosystems can reduce impacts of climate change. Recommended project elements include: high-elevation meadow restoration, managing stormwater, groundwater management, and floodplain restoration. Projects should consider the values and needs of tribal and cultural groups that rely on water resources for their cultural and spiritual practices.

Mitigation can be improved by providing outreach, financial and technical assistance to protect cultural resources and by increasing understanding of carbon sequestration, water conservation and water use efficiency. Other items that could be considered include ways to:

- Reduce GHG emissions related to water project impacts on cultural resources.
- Identify tribal opportunities for water recycling and renewable energy and promote understanding of cultural practices.
- Provide benefits and incentives for tribal water and energy-use efficiency projects (3).

3.2 Adaptation Strategies

Table A-5 summarizes the ability of WMS to address climate change vulnerabilities from Table A-1. The WMS that are applicable to climate change adaptation are described fully in IRWMP Section F.

Table A-5. Applicability of RMS to Climate Change Adaptation to Vulnerabilities

	Vulnerabilities						
2014 IRWM Resource Management Strategies	Water Demand	Water Supply	Water Quality	Sea Level Rise	Flooding	Ecosystem and Habitat	Hydropower
Ecosystem restoration			●	●	●	●	
Drinking water treatment and distribution	●	●	●	●		●	
Improve flood management				●	●	●	
Conjunctive management and groundwater storage	●	●	●	●			
Pollution prevention		●	●		●	●	
Agricultural water use efficiency	●	●				●	
Urban water use efficiency	●	●				●	
Matching water quality to use			●	●	●	●	
Salt and salinity management			●	●		●	
Recycle municipal water		●					
Desalination		●		●			
Water transfers		●					

Land use planning and management	●		●	●	●	●	
Surface storage – CALFED/State	●	●					
Surface storage – Regional/Local	●	●					
Watershed management	●	●	●	●	●	●	
Water transfers		●					
Conveyance – Regional/Local	●	●					
System reoperation	●	●	●	●	●	●	●
Resource Management Strategies Excluded from 2014 IRWM	Water Demand	Water Supply	Water Quality	Sea Level Rise	Flooding	Ecosystem and Habitat	Hydropower
Conveyance – Delta		●					
Precipitation enhancement		●					
Groundwater remediation/aquifer remediation		●	●	●			
Urban stormwater runoff management		●	●		●	●	
Agricultural lands stewardship	●		●		●	●	
Forest management		●	●		●	●	
Recharge area protection		●	●		●		
Economic incentives	●	●				●	
Water-dependent recreation		●	●		●	●	
Crop idling for water transfers	●	●	●				
Irrigated land retirement		●	●				
California Water Plan 2013 Update RMS	Water Demand	Water Supply	Water Quality	Sea Level Rise	Flooding	Ecosystem and Habitat	Hydropower
Sediment management		●	●	●	●	●	
Outreach and engagement	●		●			●	●
Water and culture	●		●			●	

3.3 Mitigation Strategies

Table A-6 summarizes the ability of WMS to address mitigation of GHG. The WMS that are applicable to climate change mitigation are described fully in IRWMP Section F. The major components of climate change mitigation strategies are improving energy efficiency, reducing emissions and carbon sequestration.

Table A-6. Applicability of RMS to GHG Mitigation

	GHG Mitigation		
2014 IRWM Resource Management Strategies	Energy Efficiency	Emissions Reduction	Carbon Sequestration
Ecosystem restoration			●
Drinking water treatment and distribution	●	●	●
Improve flood management			●
Conjunctive management and groundwater storage			
Pollution prevention		●	●
Agricultural water use efficiency	●	●	
Urban water use efficiency	●	●	
Matching water quality to use	●		●
Salt and salinity management		●	
Recycle municipal water	●	●	
Desalination			
Water transfers	●	●	
Land use planning and management	●	●	●
Surface storage – CALFED/State		●	
Surface storage – Regional/Local		●	
Watershed management	●	●	●
Drinking water treatment and distribution	●	●	●
Water transfers			
Conveyance – Regional/Local	●	●	
System reoperation	●	●	
Resource Management Strategies Excluded from 2014 IRWM	Energy Efficiency	Emissions Reduction	Carbon Sequestration
Conveyance – Delta	●	●	
Precipitation enhancement		●	
Groundwater remediation/aquifer remediation			
Urban stormwater runoff management	●	●	
Agricultural lands stewardship	●	●	●
Forest management			●
Recharge area protection			●
Economic incentives	●	●	●
Water-dependent recreation		●	
Crop idling for water transfers		●	
Irrigated land retirement			
California Water Plan 2013 Update RMS	Energy Efficiency	Emissions Reduction	Carbon Sequestration
Sediment management		●	●
Outreach and engagement		●	
Water and culture	●	●	●

4 Project Review Process

4.1 Climate Change Adaptation and Mitigation as Part of the Project Review Process

The requirements of the 2016 IRWM Guidelines include consideration of projects' contribution to climate change adaptation and mitigation, through reducing GHGs, compared to project alternatives as detailed below.

Consider a project's contribution to climate change adaptation.

- *Include potential effects of Climate Change on the region and consider if adaptations to the water management system are necessary.*
- *Consider the contribution of the project to adapting to identified system vulnerabilities to climate change effects on the region.*
- *Consider changes in the amount, intensity, timing, quality and variability of runoff and recharge.*
- *Consider the effects of sea level rise on water supply conditions and identify suitable adaptation measures.*

Contribution of project in reducing GHGs compared to project alternatives.

- *Consider the contribution of the project in reducing GHG emissions as compared to project alternatives*
- *Consider a project's ability to help the IRWM region reduce GHG emissions as new projects are implemented over the 20-year planning horizon.*
- *Reducing energy consumption, especially the energy embedded in water use, and ultimately reducing GHG emissions.*

It is anticipated that the IRWMP project review process described in IRWMP Section G will be amended to describe how the climate change vulnerabilities (Table A-1) as well as adaptation and mitigation strategies discussed in Section 0 will be considered when reviewing projects. WSC proposes updating the 2014 IRWMP climate change adaptation and mitigation ranking methodology by clarifying scoring criteria and addressing 2016 IRWM Guideline requirements as described in the remainder of Section 0. The consideration of a project's contribution to climate change adaptation can be quasi-quantitatively evaluated (Section 0) by assigning weighted points for the project's potential to adapt to vulnerabilities identified in Table A-1. The contribution of projects to climate change mitigation, specifically in reducing GHGs compared to project alternatives, can be quasi-quantitatively evaluated (Section 0) by assigning weighted points for projects' potential to have a positive, neutral, or negative impact on climate change mitigation. As shown in Figure A-1, the scores for adaptation and mitigation could contribute to an overall climate change ranking for projects, which can then be incorporated into the overall scoring criteria for ranking projects (e.g., technical feasibility, ability to meet IRWMP goals and objectives, readiness to proceed, etc.).

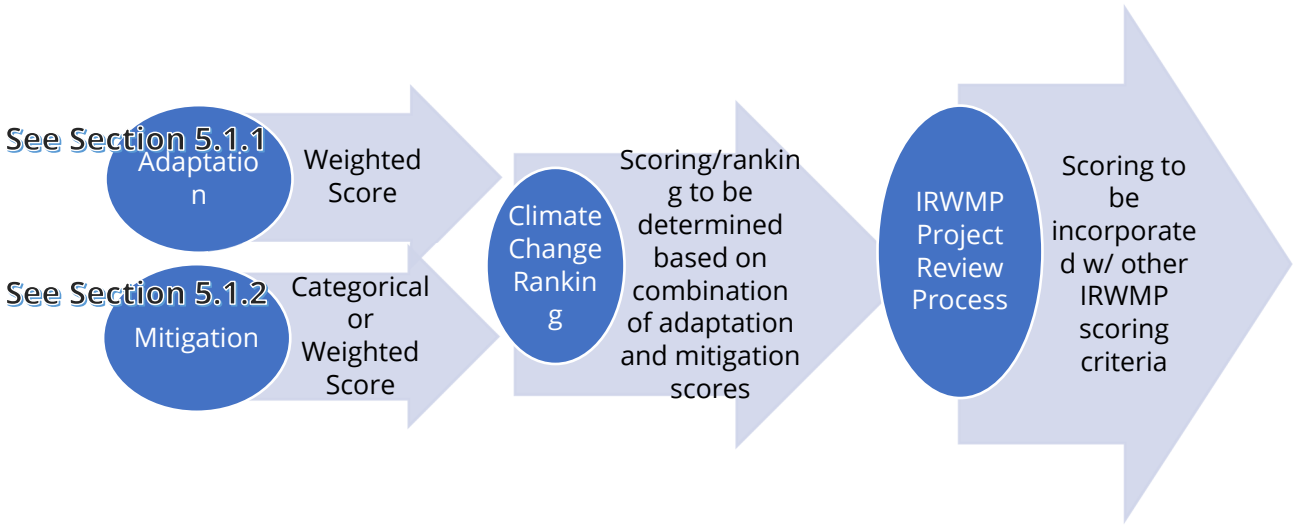

Figure A-1. Climate Change Ranking in Project Review Process

Potential Climate Change Adaptation Scoring Framework

WSC proposes the following methodology framework for the County to develop a flexible questionnaire and form as well as a revised project scoring process to meet the climate change adaptation requirements described in Section 0.

A potential climate change scoring framework could be developed by adapting the 2014 IRWMP process. For example, the "adaptation potential" could be assessed by assigning weighted points for each prioritized vulnerability. Each vulnerability could have its own weight (e.g., Very High[4], High[3], Medium[2], Low[1]), and the project could be assigned an adaptation potential score for each vulnerability (High[3 pt], Medium [2pt], Low[1 pt]). Then, the vulnerability weighting would be multiplied by the adaptation potential score to yield potential adaptation points. The scores for all projects could then be compared and ranked based on percentile placement. The points or ranking placement could be weighted and combined with a score from the mitigation scoring framework (Section 0) to establish an overall climate change ranking or score that could be weighted and incorporated with the other IRWMP project review process scoring criteria. See Figure A-2 for an illustration of this process.

Vulnerability Priority	Vulnerabilites Point Weighting
Very High*	5
High	3
Medium	2
Low	1

Adaptation Potential Ranking	Adaptation Potential Score
High	3
Medium	2
Low	1

Vulnerability Weighting X Adaptation Potential Score = Adaptation Potential Points

Category	Identified Vulnerability	Priority	Check vulnerabilities applicable to your project.	Rank potential to adapt to vulnerability (High, Medium, Low)?	Adaptation Potential Points	Reference or explanation
Water Demand 1	Water-dependent industries	High	X	High	9	Project EIR page 38.
Water Demand 2	Seasonal water demand	Medium				
Water Demand 3	Climate-sensitive crops	Medium	X	Low	2	Project EIR page 56.
Water Demand 4	Drought-sensitive groundwater basins	Very High*				
Water Demand 5	Communities with water curtailment efforts	Medium*	X	Medium	2	Project EIR page 73.
Water Demand 6	Insufficient instream flows	Very High*				
Water Supply 1	Water supply from snowmelt	Low*				

Climate Change Ranking

Potential Ranking	Points Range	Project Score
High	>75th precentile	12-16
Medium	50th-75th percentile	8-12
Low	25ht-50th percentile	4-8
None	0-25th percentile	0-4

Figure A-2. Potential Methodology for Rating Climate Change Adaptation Scores for Projects

Potential Climate Change Mitigation Scoring Framework

The 2014 IRWMP qualitatively considered GHG emissions mitigation potential through categorical assignments of "neutral", "positive" and "negative" scores for mitigation. It is unclear how these categorizations contributed to a point score for the "Climate Change Rank" in IRWMP Table P-9. A potential climate change scoring framework could be developed by adapting the 2014 IRWMP process. The revised methodology should allow for the following:

1. Project proponents with little or no quantitative data can provide qualitative answers to questions.
2. Project proponents with some water usage data, but without energy intensity data, can use default energy intensity values for applicable steps of the water cycle.
3. Project proponents with agency-specific energy intensity data will be able to input their data to estimate GHG impacts. This is further described in the following sections.

WSC proposes the following methodology framework for the County to develop a flexible questionnaire and form as well as a revised project scoring process to meet the climate change mitigation requirements described in Section 0 and identified below in ***bold italic font***.

2016 IRWM Requirement: *Consider the contribution of the project in reducing GHG emissions as compared to project alternatives*

WSC recommends addressing the project alternatives consideration by asking project applicants to consider alternatives when they are filling in project information. Additionally, applicants could provide information about a "baseline", or no project, scenario. Comparison between projects within the region is inherent in the project review process already, but could be improved with a quantitative methodology as shown below in Section 0.

IRWM Requirement: ***Consider a project's ability to help the IRWM region reduce GHG emissions as new projects are implemented over the 20-year planning horizon.***

WSC recommends addressing the 20-year requirement by asking project applicants to consider a 20-year planning horizon when filling in GHG information. Additionally, applicants could indicate if they anticipate GHGs emissions to differ over the 20-year period. If so, they could provide qualitative or quantitative descriptions of anticipated changes or use default tools and data. A potential framework to obtain this information is shown below.

1. County would add a narrative descriptor to the project solicitation form asking project proponents to consider a 20-year planning horizon when filling in GHG information.
2. Qualitative Assessment Questions/Actions for Applicants
    a. Do you anticipate increases or decreases to GHGs within 20 years or beyond 20 years?
        i. (Y/N)
        ii. (Option Box for description)
3. Quantitative Assessment Questions/Actions for Applicants
    a. Please provide quantified changes to GHGs if available from own sources or using default values (See Section 0)
    b. other
4. Other Option for Applicants
    a. Please provide additional relevant information (e.g. renewable energy, wetlands, reforestation, LID project reduction to peak stormwater flows to pumping station, thereby reducing embedded energy, etc.).

IRWM Requirement: ***Reducing energy consumption, especially the energy embedded in water use, and ultimately reducing GHG emissions.***

WSC recommends addressing the embedded energy requirement by asking project applicants to consider changes to embedded energy when entering information. Additionally, applicants could indicate if water use, energy efficiency, and/or GHG emissions are increased or decreased by the project. Applicants could indicate project increases or decreases groundwater production, local surface water, or SWP water from a "baseline" or "status quo" in order to determine some estimated increase or decrease in embedded energy/GHGs with standardized metrics like those provided in Section 0. Applicants could also indicate information about renewable energy generation and any other GHG mitigation that is included in the project. A potential framework to obtain this information is shown below.

1. County would add a narrative descriptor to project solicitation form asking project proponents to consider changes to embedded energy when entering information
2. Qualitative Assessment Questions/Actions for Applicants
    a. Do you anticipate increases or decreases to embedded energy due to your project as compared to the status quo?
        i. (Y/N)
        ii. (Option Box for description)
3. Quantitative Assessment Questions/Actions for Applicants
    a. Please provide quantified changes to embedded energy if available from own sources or using default values (See Section 0)
4. Other option

a. If previous do not apply or there are additional project components that will increase or decrease GHGs, please provide additional relevant information (e.g. renewable energy, wetlands, reforestation, LID project reduction to peak stormwater flows to pumping station, thereby reducing embedded energy, etc.).

Energy Intensity and Embedded Energy Overview

As mentioned in Section 0, project proponents could estimate changes to embedded energy and resulting GHG emissions using agency-specific data or default values. An overview of how embedded energy interacts with the water cycle is provided in the remainder of this section. A methodology to use agency or default data to assess energy intensity and GHG emissions is provided in Section 0.

The 2016 IRWM Guidelines include consideration of energy efficiency and reduction of GHG emissions, especially the energy embedded in water use. Reducing water usage and/or utilizing less energy-intensive water supplies will reduce embedded energy use, which can have a significant impact on reducing GHG emissions.

Figure A-3 provides an overview of the water cycle. Energy is used throughout the water cycle to extract, convey, treat and distribute water. Energy is also used to collect and treat wastewater, and to produce and distribute recycled water. The amount of energy required to accomplish each of the steps on a per-unit basis is called energy intensity. Energy use in the water sector is predominantly in the form of electricity; thus this discussion and subsequent analysis is focused on electrical energy intensity (e.g. kilowatt-hours per acre-ft [kWh/AF]). Energy intensity is calculated for each facility but can be aggregated to estimate the total energy intensity of water and wastewater services. Energy intensity can vary significantly from agency to agency, and even within an agency; thus utilizing appropriate facility-specific and/or agency-specific energy intensity values will provide the most accurate estimate of embedded energy use.

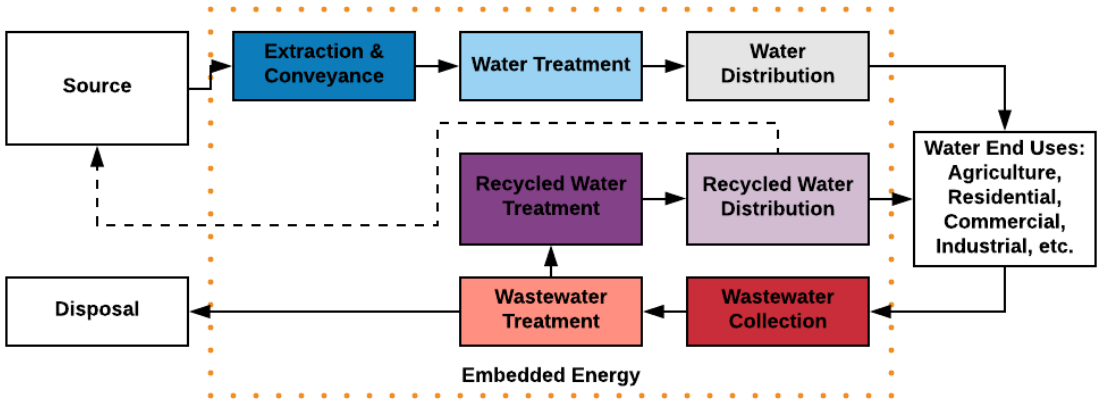

Figure A-3. California Water Cycle and Embedded Energy

Reducing water usage results in embedded energy savings in the water and wastewater systems. By using less water, less energy needs to be expended throughout the water cycle from extraction through wastewater treatment. There is also typically a reduction in end-use energy (defined as energy used on the customer's side of the meter), but this is not typically included in the embedded energy analysis conducted by water and wastewater agencies.

In addition to embedded energy savings through reduced water usage, energy savings can also be achieved by reducing energy intensity through energy efficiency, renewable generation, and/or change in water supplies.

Embedded Energy GHG Calculation Methodology

WSC has developed a draft methodology to support project proponents with quantifying GHG emissions associated with embedded energy. This allows the GHG emissions of the baseline and project to be compared, and also allows any additional project components that increase or decrease GHGs to be incorporated. Figure A-4 provides an overview of the methodology. A draft worksheet for data collection and analysis is provided as Figure A-5 includes default energy intensity values for each step of the water cycle based on statewide and Central Coast average energy intensity data (4) (5).

Incorporated within the worksheet are GHG emissions factors which convert energy intensity (kWh/AF) to associated GHG emissions (lbsCO_2e/AF). For State Water, a GHG emissions factor of 0.437 MTCO_2e/MWh (equivalent to 0.963 lbsCO_2e/kWh) is recommended for use; this is based on the wholesale power purchases for the State Water Project as described in DWR's Climate Action Plan (6). For all other sources and steps of the water cycle, electricity is assumed to be provided by Pacific Gas and Electric Company (PG&E). The most recent emissions factor for PG&E of 0.196 MTCO_2e/MWh (equivalent to 0.432 lbsCO_2e/kWh) is recommended for use; this corresponds to the electricity provided by PG&E in 2015 and aligns with the emissions factors used in the County's EnergyWise Plan.

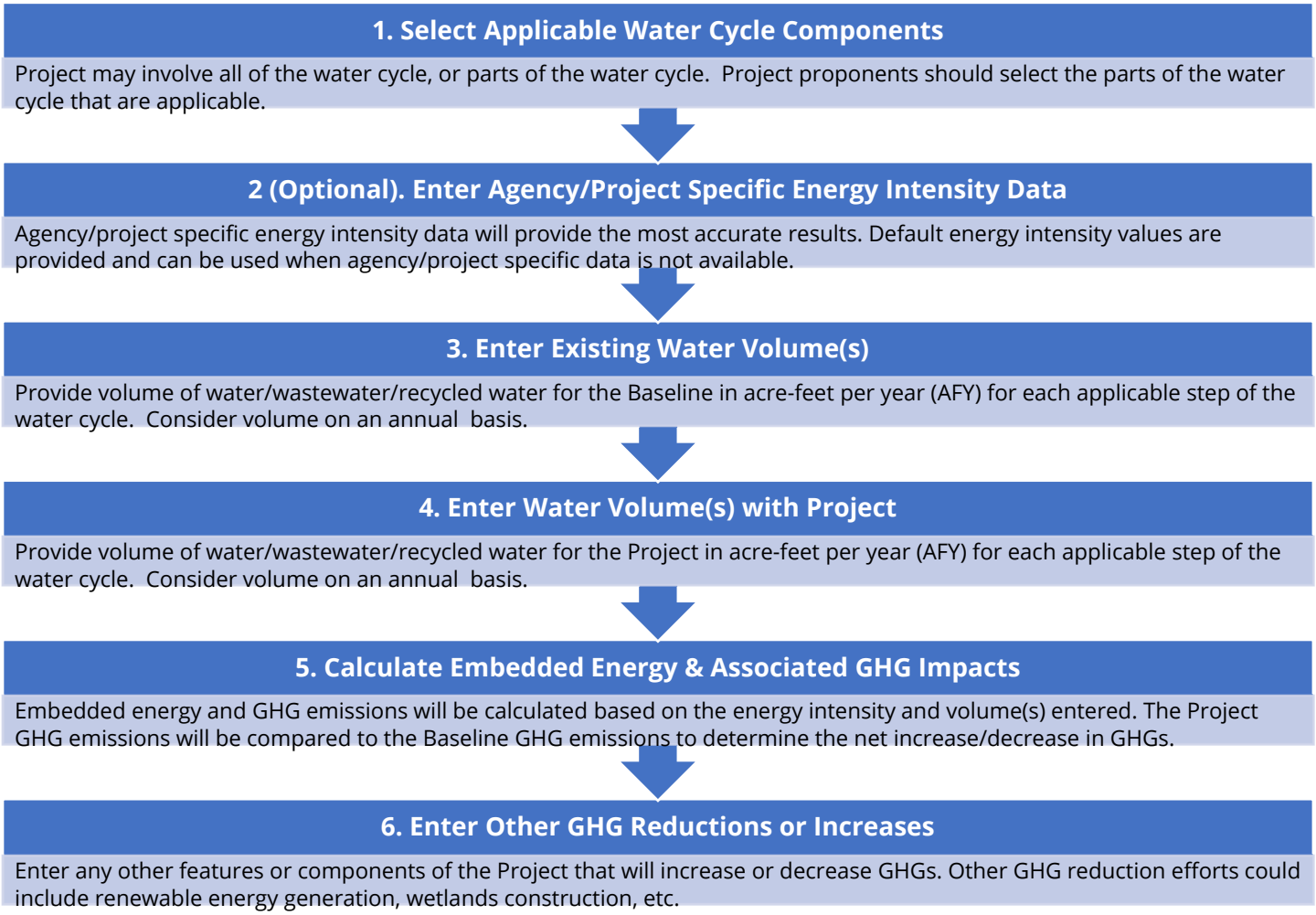

Figure A-4. Overview of Quantitative Approach for Calculating GHGs Associated with Embedded Energy

1. Select Applicable Water Cycle Components

2(Optional). Enter Agency/Project Specific Energy Intensity Data

3. Enter Existing Water Volume(s)

4. Enter Water Volume(s) with Project

5. Calculate Embedded Energy & Associated GHG Impacts

	Reference Intensity Factors			Baseline Data		Project Data		Project Mitigation
Optional Input Cells / Calculated Cells / Reference Cells	Default Energy Intensity (kWh/AF)	Optional Agency /Project Specific Energy Intensity (kWh/AF)	Associated GHG Emissions (lbs CO2e/AF)	Existing Volume(s) per Year (AFY)	Existing GHG (lbs CO2e)	Volume(s) with Project per Year (AFY)	GHG with Project (lbs CO2e)	GHG Change with Project (lbs CO2e)
Extraction and Conveyance								
Groundwater	471							
State Water	2,155							
Local Deliveries	10							
Brackish Desalination	461							
Ocean Desalination	342							
Water Treatment								
Conventional Potable Treatment	144							
Chlorination	3							
Brackish Desalination	2715							
Ocean Desalination	4546							
Water Distribution								
Flat	18							
Moderate	163							
Hilly	318							
Wastewater Collection								
Wastewater Collection	74							
Wastewater Treatment								
Primary + Secondary	344							
Primary + Secondary + Tertiary	915							
Recycled Water Treatment								
Tertiary Treatment + Disinfection	521							
Membrane Treatment	1,303							
Recycled Water Distribution								
Flat	18							
Moderate	163							
Hilly	318							
Total								
Total								

Total Change in GHG Emissions Associated with Embedded Energy	
Other GHG Reductions or Increases (e.g., renewable energy, wetlands, trees, etc.) - Please List	
1	
2	
3	
4	
5	
Net Change in GHG Emissions with Project (lbs CO2e)	

6. Enter Other GHG Reductions or Increases Below Table

Figure A-5. Steps to Estimate Embedded Energy and GHG Emissions

As described in Section 0, the contribution of projects to climate change mitigation, specifically in reducing GHGs compared to project alternatives, can be quasi-quantitatively evaluated by assigning weighted points for projects' potential to have a positive, neutral, or negative impact on climate change mitigation as shown in Figure A-6. As shown in Figure A-1, the scores for adaptation and mitigation could contribute to an overall climate change ranking for projects that could be incorporated into the overall scoring criteria for ranking projects (e.g., technical feasibility, ability to meet IRWMP goals and objectives, readiness to proceed, etc.).

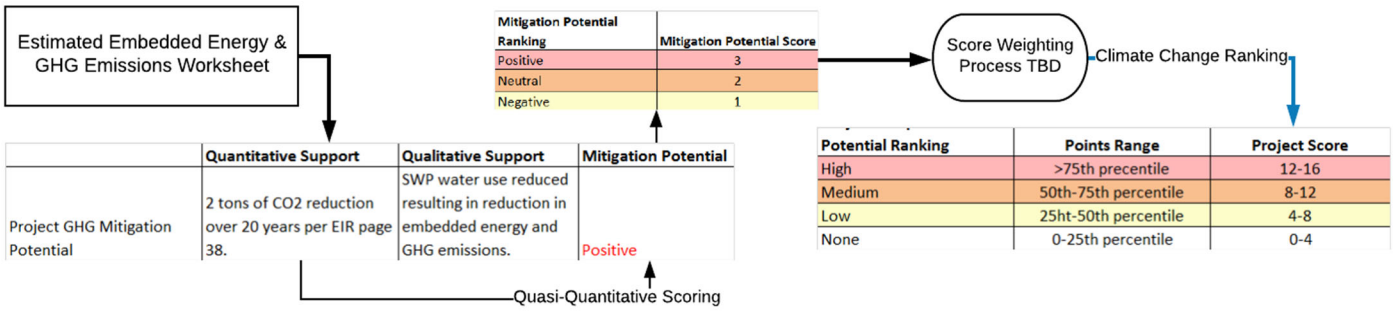

Figure A-6. Potential Methodology for Rating Climate Change Mitigation Scores for Projects

5 References

1. California Department of Water Resources. 2016 Integrated Regional Water Management Grant Program Guidelines Volume 1 - Grant Program Processes. July 2016.

2. CDM. Climate Change Handbook for Regional Water Planning. November 2011.

3. Resources, California Department of Water. California Water Plan Update. 2013.

4. Navigant Consulting, Inc. Navigant 2015 Water/Energy Cost-Effectiveness Analysis: Revised Final Report Prepared for the California Public Utilities Commission. Sacramento, CA : s.n., 2015.

5. —. Navigant 2015 Water/Energy Cost-Effectiveness Analysis: Errata to the Revised Final Report Prepared for the California Public Utilities Commission. Sacramento, CA: : s.n., 2015.

6. California Department of Water Resources. California Department of Water Resources 2012 Climate Action Plan Phase 1: Greenhouse Gas Emissions Reduction Plan. Sacramento, CA: : s.n., 2012.

J.3 Notice of Public Meeting

SAN LUIS OBISPO COUNTY
INTEGRATED REGIONAL WATER MANAGEMENT (IRWM)

Creating a united framework among San Luis Obispo County Stakeholders for sustainable water resource management

IRWM CLIMATE CHANGE WORKSHOP

Wednesday Jan. 31, 2018
9 am to 12 pm
San Luis Obispo Library
Community Room
995 Palm St, San Luis Obispo

WHY IS THE WORKSHOP BEING HELD?

SLO County is updating the climate change section of the IRWM Plan to comply with new state guidelines.

WHO SHOULD COME?

Regional Water Management Group (RWMG) agencies & organizations; city & county planners; utility managers; water purveyors; conservation organizations; stakeholders with agricultural, development, & environmental interests

WORKSHOP OVERVIEW

- Review of IRWM guidelines and adaptive management
- Presentation on survey results and climate vulnerabilities in SLO County
- Stakeholder involvement in vulnerability prioritization
- Evaluate feasibility of our Region to address identified vulnerabilities

TOPICS

Water demand, water supply, water quality, flooding; sea level rise, ecosystem and habitat vulnerability

STAKEHOLDER CLIMATE VULNERABILITY SURVEY

Survey will be sent out Jan. 5th.
Subscribe to IRWM stakeholder email mailing list to receive survey:
slocountywater.org/irwm

Jan. 5 - Jan. 19	Online survey is live
Jan. 24	Survey results sent out to RWMG

Can't come to the workshop?
Be sure to fill out the survey!

COUNTY OF SAN LUIS OBISPO

Please RSVP for the workshop:

Mladen Bandov, County of SLO Public Works
mbandov@co.slo.ca.us
(805) 781-5116

SAN LUIS OBISPO COUNTY 2014 IRWM PLAN

J.4 Outreach Materials

San Luis Obispo County Region
Integrated Regional Water Management (IRWM)

IRWM Climate Change Workshop
AGENDA

Date: January 31, 2018
Time: 9:00 AM – 12:00 PM
Location: San Luis Obispo Library Community Room
995 Palm Street, San Luis Obispo, CA 93401

1. Introductions and Overview of Workshop (*20 minutes*)

2. IRWM Guidelines (*25 minutes*)
    a. Presentation on new IRWM Plan Standards and update process
    b. Review of survey results

--- Break (*10 minutes*) ---

3. Vulnerability Prioritization – Part I (*45 minutes)*
    Part I: Water Demand, Water Supply, and Water Quality
    a. Presentation on vulnerability indicator questions and discussion of the priority designation for each vulnerability
    b. Activity: Vulnerability Prioritization Worksheet

--- Break (*10 minutes*) ---

4. Vulnerability Prioritization – Part II (*45 minutes*)
    Part II: Sea Level Rise, Flooding, Ecosystems and Habitats, and Hydropower
    a. Presentation on vulnerability indicator questions and discussion of the priority designation for each vulnerability
    b. Activity: Vulnerability Prioritization Worksheet

5. IRWM Plan Update and Next Actions (20 *minutes*)
    a. Review of climate change objectives, mitigation and adaptation strategies, project review process, and policies and procedures for adaptive management

6. Wrap-up (*5 minutes*)

For more information, please contact
Mladen Bandov, County of San Luis Obispo Public Works
mbandov@co.slo.ca.us
(805) 781-5116
www.slocountywater.org/irwm

Next RWMG Meetings:
February 7, 2018
March 7, 2018

REMINDER: Please return completed worksheet by the end of the workshop.

IRWM Climate Change Workshop
Vulnerability Prioritization Worksheet

Name: _____

Organization/Affiliation: _____

City/Town: _____

County Public Works staff held an online survey (January 4-19, 2018) about the regional water resources that are vulnerable to the effects of climate change. Twenty-two (22) RWMG members and stakeholders responded to the vulnerability assessment. Thirty-five (35) vulnerabilities were identified within these categories: **water demand (WD)**, **water supply (WS)**, **water quality (WQ)**, **sea level rise (SLR)**, **flooding (FL)**, **ecosystem and habitat vulnerability (EH)**, and **hydropower (HP)**.

The following three characteristics were used to help prioritize the vulnerabilities:

Exposure – the extent (e.g., percentage) that a resource/asset/system could be subject to climate change effects

Sensitivity – the degree to which small variations of climate change effects could impact a resource/asset/system

Likelihood – the probability that a resource/asset/system could be impacted *due to lack of adaptive capacity*

Each vulnerability was evaluated using the following scale and averaged for all survey responses.

	1	2	3	4	5
Exposure	Not Exposed	Somewhat Exposed	Exposed	Very Exposed	Completely Exposed
Sensitivity	Not Sensitive	Somewhat Sensitive	Sensitive	Very Sensitive	Extremely Sensitive
Likelihood	Unlikely	Somewhat Likely	Likely	Very Likely	Extremely Likely

Each vulnerability was scored using the following equation:
Exposure x Sensitivity x Likelihood = Score

Scores were assigned a high, medium, or low priority based on this table (to the right)

Priority	Score
High	> 27.0
Medium	20.8 - 27.0
Low	< 20.8

RWMG Members: **Please write yes or no** if you agree or disagree with the recommended priority. If you disagree, please suggest otherwise (**High**, **Medium**, or **Low**).

ID	Vulnerability	Exposure	Sensitivity	Likelihood	Score	Priority	Agree? Y/N If no, High/Med/Low
WD 1	Water-dependent industries	3.11	2.81	3.24	28.31	High	
WD 2	Seasonal water demand	3.17	2.50	3.00	23.78	Medium	
WD 3	Climate-sensitive crops	3.18	2.82	2.73	24.48	Medium	
WD 4	Drought-sensitive groundwater basins	3.81	3.47	3.67	48.52	High	
WD 5	Communities with water curtailment efforts	2.85	2.54	2.75	19.91	Low	
WD 6	Insufficient instream flows	3.77	3.54	3.62	48.31	High	
WS 1	Water supply from snowmelt	3.00	2.83	2.83	24.03	Medium	
WS 2	Water supply from coastal aquifers	3.54	3.23	3.42	39.10	High	

ID	Vulnerability	Exposure	Sensitivity	Likelihood	Score	Priority	Agree? Y/N If no, High/Med/Low
WS 3	Inability to store carryover supply surpluses	3.00	2.82	2.80	23.69	Medium	
WS 4	Drought-sensitive water systems	3.91	3.45	3.55	47.89	High	
WS 5	Invasive species management issues	2.90	2.67	2.60	20.13	Low	
WQ 1	Water bodies in areas at risk of wildfire	3.09	3.00	3.00	27.81	High	
WQ 2	Water bodies impacted by eutrophication	3.09	3.00	3.00	27.81	High	
WQ 3	Declining seasonal low flows	3.63	3.50	3.38	42.94	High	
WQ 4	Water bodies with restricted beneficial uses	2.89	2.67	2.78	21.45	Medium	
WQ 5	Water quality impacted by rain events	2.92	2.67	2.67	20.82	Medium	
SLR 1	Coastal erosion	3.00	2.70	2.80	22.68	Medium	
SLR 2	Coastal structures	2.40	2.20	2.30	12.14	Low	
SLR 3	Coastal infrastructure in low-lying areas	2.60	2.50	2.60	16.90	Low	
SLR 4	Low-lying coastal habitats	2.50	2.40	2.60	15.60	Low	
SLR 5	Flooding due to high tides and storm surges	2.60	2.50	2.40	15.60	Low	
SLR 6	Coastal land subsidence	1.63	1.50	1.50	3.67	Low	
SLR 7	Rising sea levels	2.13	2.00	2.13	9.07	Low	
FL 1	Aging flood protection infrastructure	3.44	3.11	3.11	33.27	High	
FL 2	Insufficient flood control facilities	3.30	3.10	3.20	32.74	High	
FL 3	Increased flood risk due to wildfires	3.55	3.36	3.36	40.08	High	
EH 1	Aquatic habitats at risk of erosion and sedimentation	2.90	3.00	2.80	24.36	Medium	
EH 2	Estuarine habitats dependent on freshwater flow patterns	3.00	3.09	3.09	28.64	High	
EH 3	Climate-sensitive fauna and flora	3.00	2.90	3.00	26.10	Medium	
EH 4	Changes in species distributions	3.18	3.09	3.09	30.36	High	
EH 5	Aquatic habitats used for economic activities & recreation	2.82	2.55	2.64	18.98	Low	
EH 6	Environmental flow requirements	3.36	3.27	3.09	33.95	High	
EH 7	Exposed coastal ecosystems	2.64	2.64	2.64	18.40	Low	
EH 8	Fragmented aquatic habitats	3.00	2.70	2.80	22.68	Medium	
HP 1	Future hydropower plans	1.78	1.67	1.89	5.62	Low	

<u>REMINDER</u>: Please return completed worksheet by the end of the workshop.

IRWM Climate Change Workshop
Climate Change Vulnerability Assessment Worksheet

Name: _____

Organization/Affiliation: _____

City/Town: _____

The draft answers in this handout come from a draft technical memo prepared by County of San Luis Obispo Public Works staff in collaboration with Water Systems Consulting, Inc (WSC) to develop the climate change vulnerability assessment for the 2018 IRWM Plan update.

This document is designed for the IRWM Climate Change Workshop to collect comments/responses from stakeholders. Copies of this handout will be available at the workshop.

Water Demand

1. Are there major industries that require cooling/process water in your planning region?

Several prominent industries in San Luis Obispo County require water for their operations. Notable industries include wineries, breweries, hospitals, energy production, and education. Additionally, agriculture is a major industry throughout the County and has a significant water demand for irrigation and other processes.

<u>North Coast Subregion</u>

Cuesta College requires water to maintain operations and serve its students and staff. Similarly, the California Men's Colony requires water to serve its residents and maintain operations. Wineries along the North Coast also contribute to the industrial water demand in the subregion.

<u>North County Subregion</u>

Wineries and vineyards throughout the North County have large water demands for growing and wine production. Another major industrial water use in the subregion is process water required by breweries. The Atascadero State Hospital and other hospitals are notable industrial water users in the subregion.

<u>South County Subregion</u>

The Diablo Canyon Power Plant requires cooling and process water for its operations. The Santa Maria Refinery in Nipomo is a major industrial water user. Cal Poly San Luis Obispo has a significant water demand to maintain operations and serve its students and staff. There are also several breweries throughout the South County Subregion that require water for the brewing process. Hospitals, including Sierra Vista Regional Medical Center and French Hospital Medical Center, are another prominent industry in the subregion that requires process water.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you agree think should be included in the final responses to the indicator questions.

- ☐ The hotel industry is major water user requiring water for laundry facilities.
- ☐ The Arroyo Grande Oil Field uses large amounts of water during oil pumping.
- ☐ Details about the agricultural water use in each subregion should be added.
- ☐ Mission Linen, Culligan, and Casa de Flores are notable industrial water users in Morro Bay.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does water use vary by more than 50% seasonally in parts of your region?

North Coast Subregion

Seasonal water use is affected by tourism and agriculture in the North Coast Subregion. San Simeon CSD and Cambria CSD both have a noticeably higher water demand from June to October.

North County Subregion

Seasonal water use is affected by agriculture in the North County Subregion. Templeton CSD, Atascadero MWC, and the City of Paso Robles all have significantly lower water demands during winter months.

South County Subregion

Seasonal water use is affected by agriculture and tourism in the South County Subregion. The City of Pismo Beach, City of Arroyo Grande, and Oceano CSD all have significantly lower water demands during winter months. In the City of San Luis Obispo, seasonal water demand is impacted by the fluctuating student population at Cal Poly.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Nipomo CSD has a significantly lower water demand in winter months.
- ☐ Arroyo Grande has less than a 15% difference in water use between summer and winter.
- ☐ San Simeon CSD water usage varies by 50% or more seasonally due to tourism.
- ☐ Los Osos CSD has a significant difference in seasonal water demand, but it is not more than 50%.
- ☐ During the summer, the City of San Luis Obispo experiences an increase in irrigation water use but a decrease in domestic water use with the absence of Cal Poly students. Overall, seasonal water use does not vary by more than 50%.
- ☐ As a whole, water use in the North County Subregion is significantly lower during the winter season.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

The highest ranked crops by dollar amount are grapes/wine, vegetables, strawberries, avocados, broccoli, and cattle/calves, all which are climate sensitive. The total value of agricultural production in 2016 was over $900 million. A report by the USDA determined San Luis Obispo County had a high crop vulnerability ranking.

- While grapes are relatively drought tolerant crops, they are sensitive to temperature and other climate-related factors. The quality of wine grapes is especially sensitive to climate, and increased temperatures could significantly reduce the quality and economic value of wine grapes.
- Cattle production decreased 36% from 2015 to 2016 due largely to the decrease in rangeland caused by the drought.
- Strawberries are extremely sensitive to soil salinity. Increasing salt levels in soil would decrease growth rate and fruit yield of strawberries as well as increase irrigation demands for soil leaching. Additionally, strawberries are sensitive to fungal diseases and unusually warm temperatures.
- Broccoli is moderately climate sensitive. Broccoli has a narrow temperature range of 60 to 65˚F and is harmed by temperatures exceeding 80˚F. The vegetable is also sensitive to invertebrate pests and bacterial and fungal diseases, which are likely to pose a greater risk with increased temperatures.
- Avocados are a highly climate sensitive crop requiring wet conditions. Avocados need large amounts of water and frequent irrigation, and their sensitivity to soil salinity could increase this already high water demand. The fruit is sensitive to cold weather and can die during a freeze, but increased fall temperatures could also decrease avocado yields.

<u>North Coast Subregion</u>
Avocados, grapes, and berries are all grown in the North Coast Subregion.

<u>North County Subregion</u>
The primary crop in the North Coast Subregion is wine grapes. The cattle industry is also prominent in this subregion.

<u>South County Subregion</u>
Strawberries and grapes are some of the major crops grown in the South County Subregion.

Note: Some members of the San Luis Obispo County Farm Bureau reviewed this draft answer and generally considered it to be sufficient, including some of the comments below.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Grapes are extremely sensitive to frost and cold temperatures.
- ☐ Changes in air temperature and decreased humidity can cause respiratory problems for cattle.
- ☐ Avocados should be included as a prominent crop in the South County Subregion.
- ☐ While other changes could be stressful, increased air temperature could be beneficial for avocados.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Do groundwater supplies in your region lack resiliency after drought events?

North Coast Subregion

Multiple groundwater basins in the subregion (some of the largest/highest yield and storage capacity basins) have a Level I (2 basins) or Level III (2 basins) severity rating as assigned by the SLO County Planning Department. These basins experience reduced recharge and ability to meet demand during drought conditions. About 50% of the North Coast's urban water supply is from groundwater (2014 IRWMP).

North County Subregion

The Paso Robles Basin, the largest and highest yielding basin in the subregion, is a critically over-drafted basin. The groundwater basins in this subregion have low storage and difficulty meeting demands especially during drought events (2014 IRWMP). About 70% of the North County water supply is from groundwater (2014 IRWMP).

South County Subregion

The Cuyama Valley Basin is a critically over-drafted basin, and the Santa Maria Valley Basin is a high priority basin (DWR). Droughts reduce basin recharging and the ability of the basin to meet demand. About 30% of the South County water demand is supplied by groundwater (2014 IRWMP).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Drought conditions make groundwater basins more susceptible to salt water intrusion and often result in increased chloride levels. This has been witnessed in groundwater wells in Los Osos.
- ☐ Nipomo CSD is unique in that it obtains 50-100% of its water supply from groundwater.
- ☐ San Simeon CSD is dependent on a single creek basin, which is susceptible to adverse effects of drought events.
- ☐ The City of San Luis Obispo does not rely heavily upon groundwater to meet water demand.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Are water curtailment measures effective in your region?

A local drought emergency was enacted in SLO County from 2014 through 2017 that restricted water usage and required acquiring alternate water sources while reservoir levels were allowed to recover. *More information is needed about curtailment measures and their results.*

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ While curtailment measures in Nipomo were successful in reducing groundwater pumping by 50%, they did not result in a significant increase in the groundwater level.
- ☐ The US-LT RCD developed the Agricultural Water Offset program, which limited the establishment of new irrigated lands in Paso Robles Groundwater Basin, but this did not necessarily prevent new groundwater pumping operations outside of the basin boundary.
- ☐ Efforts in the City of Paso Robles during the recent drought were effective in reducing per capita water use.
- ☐ Los Osos CSD implemented a Water Shortage Contingency Plan during the recent drought, and water usage dropped to 50 gallons per day per capita.
- ☐ Restrictions on outdoor water use in the City of San Luis Obispo have been effective at reducing the city's water consumption.
- ☐ The City of Arroyo Grande successfully curtailed water use by 35% from 2013 to 2016.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

A study completed by Stillwater Sciences in 2014 determined the minimum instream seasonal flow requirements needed to sustain basic aquatic systems for stream systems throughout the County. Central coast steelhead trout were used as the indicator species for this study. Based on a 2017 report by the Central Coast Salmon Enhancement, there are streams within all three subregions that did not meet these minimum flow requirements in the past two years. In 2016, only 14 percent of the sites measured met spring flow requirements, and only 17 percent of measured sites met summer flow requirements (CCSE).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Some river and stream systems experience extended periods of no surface flow making steelhead swimming and spawning impossible. An alternate method for determining instream flow requirements may need to be developed for these water bodies.
- ☐ Instream flow conditions could be doubly impacted by climate change as streamflow is affected by changes in precipitation patterns as well as by changes in water use.

Please provide any additional suggestions to revise, add to, or update the draft response:

Water Supply

1. Does a portion of the water supply in your region come from snowmelt? Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

North Coast Subregion

The City of Morro Bay, California Men's Colony, Cuesta College, and County Operations Center all receive water from the State Water Project (SWP).

North County Subregion

Shandon has a water service amount of 100 AFY from the SWP.

South County Subregion

The City of Pismo Beach, Oceano CSD, Avila Beach CSD, Avila Valley MWC, San Miguelito MWC, and San Luis Coastal USD all receive water from the SWP.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

North Coast Subregion

The Pico Creek Valley, San Simeon Valley, Chorro Valley, Morro Valley, and Los Osos Valley Basins have all encountered sea water intrusion and are water supply sources for the subregion (SLO 2014 IRWMP).

North County Subregion

There are no coastal aquifers in this subregion.

South County Subregion

The Avila Valley Sub-basin and Santa Maria Valley Basin have both experienced sea water intrusion and serve as water supply sources for the subregion (SLO 2014 IRWMP).

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Would your region have difficulty storing carryover supply surpluses from year to year?

Surplus supplies of State Water can be stored via San Luis Reservoir, which is operated by DWR and the Central Valley Project. State water contracts limit the quantity of water allowed to be stored by each contractor, and stored water is subject to spills based on the amount of water in the SWP system.

North County Subregion

The Salinas Reservoir, overseen by the City of San Luis Obispo, is limited in its ability to store new inflow due to criteria set forth by the SWRCB which only allow for new inflow to be stored when there is a live steam in the Salinas River. Monterey County operates and maintains the Nacimiento Reservoir. The District and the contractors of Nacimiento Water have contracts for water but no rights to storage.

South County Subregion

It is possible to store carryover supplies in Lopez Reservoir but only when the water level reaches 40.5% capacity (20,000 AF). The Low Reservoir Response Plan (LRRP) allows agencies to carryover any of their unused annual entitlement for future use when reservoir levels are low. The LRRP allows for reduced entitlement deliveries as well as reduced downstream releases to preserve or stretch out supplies for up to 2-3 years. When the LRRP is not in effect, agencies occasionally have access to surplus water but can only use it in that same year; they cannot store it for use in future years.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ San Simeon has no way of carrying over supply surpluses.
- ☐ Supply surpluses in Shandon are stored in San Luis Reservoir and experience significant losses through evaporation.
- ☐ Groundwater storage is the only possible storage option in Nipomo.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Has your region faced a drought in the past during which it failed to meet local water demands?

During water years 2014 and 2015, due to statewide drought conditions, the State Water Resources Control Board (SWRCB) curtailed post-1914 tributary water rights to the Sacramento-San Joaquin Delta. A local drought emergency was in effect from 2014-2017 during which time alternate water sources were needed.

More information is needed about sub-regional drought impacts.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Even during droughts, San Simeon has never exceeded 70% of our available Pico Creek Basin capacity.
- ☐ In Nipomo, recent drought conditions have contributed to groundwater levels at record lows.
- ☐ State Water Project water has experienced increased salt levels during drought conditions, which resulted in violation of water quality standards in the Chorro Valley Water System.
- ☐ To ensure water demand could be met during drought conditions, the City of San Luis Obispo has added water sources and long-standing water conservation programs.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

The 2014 San Luis Obispo County Watersheds Management Plan determined that invasive species identification and assessment as a county-wide priority data gap. The California Invasive Plant Council has recognized areas of spreading invasive species in all three of the County's subregions. Yellow star thistle, veldt grass, and arundo are three invasive species with notable management issues in San Luis Obispo County. Mitigation sites are especially vulnerable to invasive species management issues.

More information about invasive species management is currently being obtained from the County of SLO Environmental Division.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ There has been a significant increase in the overall size of acres covered by invasive species in local watersheds.
- ☐ Chorro Reservoir is at risk of arundo management issues.
- ☐ Invasive mussels in reservoirs are a concern.
- ☐ Cape Ivy in the Morro Bay watershed has been an invasive species of special concern.

Please provide any additional suggestions to revise, add to, or update the draft response:

Water Quality

1. Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

According to the Cal-Adapt Wildfire: Fire Risk Map, the SLO County IRWM Planning Region may experience a slight increase in annual mean hectares burned by wildfire (Cal Fire).

North Coast Subregion

The risk of wildfires near Whale Rock Reservoir are a significant contamination risk to the water supply ("Whale Rock" 18). The major source of contamination for the water body is sedimentation from erosion, which would be exacerbated by wildfires in the nearby area ("Whale Rock" 1).

North County Subregion

The Nacimiento Reservoir is in an area with a high risk of wildfires, and possible wildfires pose a threat to the water quality in the reservoir ("Nacimiento Reservoir" 1). Similarly, wildfires are a risk in the nearby areas of the Salinas Reservoir and threaten water quality (Cal Fire).

South County Subregion

Large amounts of dry brush have been noted throughout the Lopez Lake watershed and contribute to the significant risk of potential contamination due to wildfires ("Lopez Lake" 2). Wildfires would lead to increased sedimentation and add stress to other water quality concerns within the reservoir.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Dead trees and large areas of dry bush create a wildfire threat to water bodies throughout the North Coast Subregion – not just Whale Rock Reservoir.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

North Coast Subregion

The San Simeon, Cayucos Creek, and Morro Bay Watersheds all have low dissolved oxygen, among other water quality issues (SLO 2014 IRWMP). Cattle grazing in the Whale Rock Reservoir watershed has been linked to increased turbidity and nutrient levels in the area's water bodies ("Whale Rock" 1). These conditions encourage algal blooms and are worsened in times of drought and high temperatures.

North County Subregion

Middle Salinas-Atascadero and Cholame Creek Watersheds have low dissolved oxygen (SLO 2014 IRWMP). The Nacimiento Reservoir has a recent trend of high algal levels in summer months. Increased erosion, drought conditions, and high temperatures all contribute to harmful levels of algae growth in the reservoir ("Nacimiento Reservoir" 27-28). Similarly, the recent drought conditions resulted in record high levels of nutrients in the Salinas Reservoir, which has contributed to a trend of high algae levels in warm summer and fall months ("Salinas Reservoir" 12).

South County Subregion

San Luis Obispo Creek and Pismo Creek Watersheds have low dissolved oxygen. San Luis Obispo Creek and Santa Maria River have chlorpyrifos and other water quality issues (SLO 2014 IRWMP). The Lopez Lake Reservoir experienced harmful algal blooms during the recent drought conditions and has a recorded trend of algae spikes during warm summer months ("Lopez Lake" 14).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Bacteria impairment can be exacerbated by warm temperatures, which accelerates the growth of bacteria. Water bodies with bacteria impairment include Morro bay estuary, Chorro Creek, Los Osos Creek and Warden Creek.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are seasonal low flows decreasing for some water bodies in your region? If so, are the reduced low flows limiting the water bodies' assimilative capacity?

More information is needed about assimilative capacity.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ There is a declining trend in seasonal low flows throughout the County. During these low flow periods, water quality and ecosystem processes are highly sensitive to minor alterations.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?

Beneficial uses are identified by the Watershed Management Planning Project Report for all but one of the watersheds in the region. It is unclear if these beneficial uses are unable to be met due to water quality issues (SLO 2014 IRWMP).

More information is needed about any disruptions to beneficial uses.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Swimming and oyster harvesting in the back bay of the Morro Bay watershed have been limited in the past due to bacteria levels.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Runoff into Whale Rock Reservoir (Cayucos Water Treatment Plant) and Lopez Lake (Lopez Water Treatment Plant) brings sediment into the reservoirs causing turbidity levels to rise. This can dramatically affect the treatability of the water source and increase the risk of exposure to water borne illnesses due to Cryptosporidium, Giardia, and E. Coli as chlorine and filtration demands are elevated during these times. It typically takes several big storms to see such a result in water quality at the water treatment plants, and it can take days for the turbid water to reach the end of the reservoir where

water is distributed to the water treatment plants. Fortunately, County facilities can handle these changes to the water source and have not had a violation because of turbidity breakthrough or low chlorine after such rain events.

Storm runoff similarly affects Nacimiento Lake and Salinas Reservoir and treatment facilities in the City of Paso Robles and City of San Luis Obispo, respectively, must respond to the water quality shifts.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Heavy rains in San Simeon led to the addition of a filtration system to handle increased contamination.

Please provide any additional suggestions to revise, add to, or update the draft response:

Sea Level Rise

1. Has coastal erosion already been observed in your region?

North Coast Subregion

Coastal erosion has been observed within the North Coast Subregion; however, the shoreline trends vary across the region and over time. A USGS study found that in the short-term over 80% of the subregion is experiencing net erosion (Hapke 50).

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

The South County Subregion has experienced notable coastal erosion. Coastal bluffs in Pismo Beach are experiencing erosion rates of six to eight inches per year, which resulted in the construction of a sea wall in 2017 (LA District US Army Corps of Engineers 17). Avila Beach is also using a sea wall to protect roads and infrastructure from coastal erosion (Wallace Group).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ San Simeon has been forced to add armoring to the shoreline to protect beach access and the waste water treatment plant.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Are there coastal structures, such as levees or breakwaters, in your region?

North Coast Subregion

Coastal structures along the North Coast include the San Simeon Pier, Cayucos Pier, and Morro Bay breakwaters.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

The Arroyo Grande Creek Channel Levee located in the South County Subregion is intended to mitigate flooding. Other notable coastal structures along the South Coast include the Port San Luis breakwater, Harford Pier, Unocal Pier, Avila Beach Pier, and Pismo Beach Pier.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level?

San Luis Obispo County Planning Department is currently working on a study that will provide information about specific infrastructure at risk from sea level rise.

North Coast Subregion

Based off the NOAA Sea Level Rise Viewer, roads and infrastructure within areas of San Simeon, San Simeon Ranch, and Los Osos would be impacted by six feet of sea level rise.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

Based off the NOAA Sea Level Rise Viewer, roads and infrastructure near Pismo State Beach would be impacted by six feet of sea level rise.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Morro Bay harbor and Embarcadero area and Morro Bay State Park should be added to the North Coast Subregion description.
- ☐ The South SLO County Wastewater Treatment Plant and the railroad should be added to the South County Subregion description.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Are there climate-sensitive low-lying coastal habitats in your region?

North Coast Subregion

The US Fish and Wildlife Service has designated several Critical Habitats throughout the North Coast Subregion; these federally recognized areas are considered essential for the survival of an endangered or threatened species. Critical Habitats along the North Coast have been recognized for the following species: Steelhead, California red-legged frog, Banded dune snail, Western snowy plover, Morro Bay kangaroo rat, and Tidewater goby. Morro Bay Estuary, in particular, is home to multiple fully protected species and is one of 28 areas protected through the EPA's National Estuary Program.

North County Subregion

There are no coastal habitats in this region.

South County Subregion

The coastal area of the South County Subregion also contains several Critical Habitats. Endangered and threatened species dependent on coastal habitats along the South Coast include Tidewater goby, Steelhead, La Graciosa thistle, and Western snowy plover ("ECOS"). Pismo Beach is also home to a Monarch Butterfly Grove – a species which is currently under review for protection under the Endangered Species Act ("Monarch butterfly").

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Are there areas in your region that currently flood during extreme high tides or storm surges?

More information is needed about sub-regional historic flooding.

South County Subregion

Pismo Beach experienced flooding during storm surges in 2016 that resulted in closing the pier (KSBY).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ During previous storm surges, Pico Creek lagoon has experienced salt water intrusion.
- ☐ In the past, storm events have caused flooding of the Oceano Lagoon and Highway 1 in Oceano.
- ☐ During king tides, the water level in Morro Bay is just inches below docks and waterfront restaurants. Additionally, many popular coastal areas in Morro Bay State Park are completely underwater.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Is there land subsidence in the coastal areas of your region?

The only land subsidence that has been observed in the coastal areas of San Luis Obispo County occurred in and around Oceano due to the December 2003 San Simeon Earthquake. The land subsidence was a result of liquefaction during shaking by the earthquake.

Please provide any additional suggestions to revise, add to, or update the draft response:

7. Do tidal gauges along the coastal parts of your region show an increase over the past several decades?

North County Subregion

It can be assumed that sea level trends in the North County Subregion are similar to those studied at Port San Luis and other surrounding areas. Nearby studies indicate the mean sea level is increasing along California's central coast ("Sea Level Trends").

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

According to NOAA's Tides and Currents Sea Level Trends gauge for Port San Luis, the change in mean sea level is 0.84 mm/year with a 95% confidence interval. This calculation is based off data from 1945 to 2016 and is equivalent to a change of 0.28 feet in 100 years ("Sea Level Trends").

Please provide any additional suggestions to revise, add to, or update the draft response:

Flooding

1. Does aging critical flood protection infrastructure exist in your region?

More information is needed about aging flood protection infrastructure.

South County Subregion

The Arroyo Grande Creek Channel Levee was constructed in 1961 to reduce flooding in the area (SLO Flood Control District). The Diablo Canyon Nuclear Power Plant located along the coast has critical flood protection infrastructure.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ The flood control gates on Oceano Lagoon are aging.
- ☐ Old and damaged drainage projects and flood protection infrastructure are present throughout the North County Subregion leaving the area vulnerable to flooding.
- ☐ Much of the City of San Luis Obispo's downtown corridor has creeks and waterways with aging infrastructure.
- ☐ The Chorro Dam and spillway should be added to the North Coast Subregion description.
- ☐ Two 1940-era Chorro Creek bridges within the California Men's Colony (CMC) are susceptible to collapse and/or obstruction from high water flows and flood debris leading to flooding and restricted access to the West Facility of CMC.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Have flood control facilities (such as impoundment structures) been insufficient in the past?

North Coast Subregion

Flood control and drainage studies were completed by RMC, Inc. for several communities in the North Coast Subregion in 2004. The study in Cambria revealed there were insufficient underground drainage facilities and improved organization and maintenance of the area's flood control facilities was necessary ("Cambria" i). In Cayucos, a lack of initial drainage infrastructure when development began was identified as a major reason for the lack of necessary drainage facilities and frequent street flooding

("Cayucos" i). The study showed that the railroad in San Miguel was preventing runoff to the Salinas River and causing flooding ("San Miguel" ii). Additionally, a lack of curbs and gutter systems were contributing to road flooding ("San Miguel" i). In Santa Margarita, inadequate culverts and drainage structures blocked by sedimentation and debris resulted in flood risks ("Santa Margarita" i). Another study done in 1997 determined that development in Los Osos without rerouting of drainage facilities had led to poor flood control in the area (Engineering Development Associates ES-1).

North County Subregion

The Templeton Drainage and Flood Control Study completed in 2014 identified several insufficient flood control facilities, including culverts along Highway 101, Main Street, and Arizona Crossing as well as restricted conveyance capacity in the Toad Creek Channel due to vegetation and sedimentation (13-16).

South County Subregion

RMC, Inc. performed flood control and drainage studies in 2004 for several communities in the South County Subregion. The Nipomo study revealed Mesa area flooding was due to development locking existing runoff flow paths and flooding in Olde Towne was the result of insufficient culverts ("Nipomo" i-ii). In Oceano, the study found stormwater was not considered during the community's initial development and that resulted in insufficient drainage facilities and frequent flooding of roads ("Oceano" i). Additionally, the Arroyo Grande Creek Channel Levee was breached in 2001 and hundreds of acres were flooded (SLO Flood Control District).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Floodplains throughout the County lack protective infrastructure and have a history of flooding.
- ☐ San Simeon lacks an adequate storm drainage system. Private storm drains currently provide most of the flood protection.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are wildfires a concern in parts of your region?

There are areas within all three subregions determined as Very High Fire Hazard Severity Zones by Cal Fire.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ San Simeon lacks adequate fire protection for homes and businesses. There is not enough water storage nor fire flow to protect structures.

- ☐ Our community does not do a good job clearing dead trees, snags, piles of limbs, wood chips, etc.
- ☐ The West Facility of the California Men's Colony is a 1940-era Army Hospital composed of highly flammable wooden materials and is located adjacent to areas susceptible to wildfire.

Please provide any additional suggestions to revise, add to, or update the draft response:

Ecosystems and Habitats

1. Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

North Coast Subregion

Increased sedimentation can cause shallower and warmer water, and in some cases, loss of estuaries. Morro Bay shorebird habitats have been identified as at-risk of these disrupting effects. Many species including snowy plovers, least terns, brown pelicans, and brant are expected to lose habitat and resources (Koopman 31). Additionally, Steelhead, California red-legged frog, Morro shoulderband snail, and Morro kangaroo rat Critical Habitats in the North Coast are vulnerable to the effects of erosion and sedimentation ("ECOS").

North County Subregion

The Salinas River has already been impacted by increased sedimentation (Koopman 31). This sedimentation has degraded riparian habitats including areas designated as a Critical Habitat for Steelhead and California red-legged frog and supports numerous other special status species ("ECOS").

South County Subregion

Increased sedimentation and coastal erosion could disrupt Critical Habitats for Steelhead, California red-legged frogs, Western snowy plover, and La Graciosa thistle in the South County (Koopman 31). The Pismo Beach area is especially at risk of coastal erosion and flooding.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ The Morro Bay estuary salt marsh is a critical habitat that has already been impacted by sedimentation and effects will likely be complicated by sea level rise.
- ☐ Eelgrass beds are another Morro Bay habitat that can be adversely impacted by increased sedimentation. Eelgrass beds are critical fish habitats and contribute to cleaner, clearer water in the bay.
- ☐ Chorro Reservoir's sedimentation has impacted habitats in and near the reservoir, including the Morro Bay Estuary.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

North Coast Subregion

Morro Bay Estuary is an important coastal habitat supporting a diverse community of species, many of which have special species status, and is dependent on seasonal flow patterns (US-LT RCD). Several other river and stream mouths along the North Coast are dependent on seasonal flow patterns.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek all form estuarine habitats dependent on seasonal flows and that support federally protected species (US-LT RCD).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ Non-point and point sources of watershed pollution result in fecal coliform and other forms of contamination in estuaries.
- ☐ Morro Bay estuary is impacted by changes in freshwater flow. Understanding of specific impacts is limited, but the Morro Bay National Estuary Program is currently researching and monitoring impacts on eelgrass.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Do climate-sensitive fauna or flora populations live in your region?

North Coast Subregion

The elfin forests and estuary in Morro Bay are sensitive to climate change impacts, such as changes in fog, sea level rise, sedimentation, and drought (Koopman 31). These areas support various special status species that at great risk of climate change impacts. Pine forests and woodlands along the North Coast are at risk of changing conditions that could make current habitats unsuitable, and their isolation from other suitable areas makes them especially vulnerable (Koopman 35).

North County Subregion
Carrizo Plain supports several climate-sensitive species, such as Pronghorn and Tule elk, which are at risk of declining grassland productivity and isolation from other suitable habitats (Koopman 37). The North County Subregion is also home to various endangered and threatened species that are at great risk of climate change impacts; these species include Steelhead, California tiger salamander, California red-legged frog, Longhorn fairy shrimp, Vernal pool fairy shrimp, Purple amole, and California condor ("ECOS").

South County Subregion
Steelhead and other protected species found in the coastal areas of the subregion are at risk of various climate change impacts that threaten the conditions required for suitable habitat ("ECOS"). Additionally, climate change effects could put new species at risk. For instance, higher temperatures and poor water quality could cause sea lions to be more susceptible to diseases (Koopman 31).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

☐ Steelhead should be added as climate-sensitive fauna in the North Coast Subregion.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

North Coast Subregion
Endangered Species: Smith's butterfly, Chorro Creek bog thistle, California clapper rail, Morro Bay kangaroo rat, Morro shoulderband snail, Tidewater goby, California seablite, Indian Knob mountain-balm, Marsh sandwort, Salt marsh bird's-beak, Southern Steelhead (US-LT RCD).
Threatened Species: Steelhead, California red-legged frog, Monterey spineflower, California black rail (CA), Beach spectaclepod (CA), Morro manzanita, Western snowy plover (US-LT RCD).

North County Subregion
Endangered Species: Blunt-nosed leopard lizard, Giant kangaroo rat, San Joaquin kit fox, Camatta Canyon amole, Kern mallow, Least Bell's vireo, California condor, California jewel-flower, San Joaquin wollythreads, Longhorn fairy shrimp, Tipton kangaroo rat, Bald Eagle (CA), Santa Lucia mint (CA) (US-LT RCD).
Threatened Species: Bank swallow (CA), Swainson's hawk (CA), California red-legged frog, Vernal pool fairy shrimp, Spreading navarretia, Nelson's antelope squirrel (CA), California tiger salamander, Kern primrose sphinx moth, Camatta Canyon amole, Santa Lucia purple amole (CA), Steelhead (US-LT RCD).

South County Subregion

Endangered Species: California least tern, Tidewater goby, Gambel's water cress, La Graciosa thistle, Marsh sandwort, Nipomo Mesa lupine, Pismo clarkia, California condor, Blunt-nosed leopard lizard, Giant kangaroo rat, Longhorn fairy shrimp, San Joaquin kit fox, California jewel-flower, Kern mallow, San Joaquin woollythreads, Chorro Creek bog thistle, Indian Knob mountain-balm, Pismo clarkia (US-LT RCD). Threatened Species: California black rail (CA), California red-legged frog, California tiger salamander, Steelhead, Western snowy plover, Beach spectaclepod (CA), Surf thistle, Kern primrose sphinx moth, Nelson's antelope squirrel (CA), Swainson's hawk (CA), Vernal pool fairy shrimp, Western snowy plover, Morro manzanita, Surf thistle (US-LT RCD).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ California red-legged frog and Southern sea otter should be added to the North Coast Subregion description.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

In 2015, the commercial fishing industry in San Luis Obispo County had a total revenue of $10 million (County of SLO).
More information is needed about the economic activities that depend on aquatic habitats.

North Coast Subregion
Morro Bay and Montana de Oro State Parks and other coastal areas attract tourists and support water-related recreation. Similarly, Whale Rock Reservoir supports fishing and other recreation activities.

North County Subregion
Santa Margarita Lake supports water recreation activities. The Salinas River and other riparian habitats also support tourism and water recreation.

South County Subregion
Avila Beach, Pismo Beach, Oceano Dunes, and other coastal regions in the South County have a strong tourism industry. Whale Rock Reservoir also supports water-related recreation.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ The beach access stairway in San Simeon could be impacted by rising sea levels.

- ☐ Morro Bay economic activities include oyster farming (2 oyster farms), recreational and commercial fishing, fishing-related, fish markets and restaurants that sell local fish. There are now two shops in Morro Bay dedicated to stand-up paddling, as well as numerous kayak rentals shops and three bay tour boat operators. There is a growing number charter boats that do private sailing and fishing charters. Wildlife viewing also generates economic activity, such as the Morro Bay Winter Bird Festival.
- ☐ Chorro Reservoir supports recreation and other economic activities.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

Stillwater Sciences completed an evaluation in 2014 of minimum instream seasonal flows required to sustain aquatic habitats for steelhead. This study determined minimum seasonal flow values required to support Steelhead habitats at 63 different analysis points across the Region (Stillwater Sciences 23-24).

Please provide any additional suggestions to revise, add to, or update the draft response:

7. Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

Coastal storms bringing storm surges, waterspouts, and flooding are all possible and occur somewhat regularly along the San Luis Obispo County coastline. These events are often linked to atmospheric rivers.

<u>North Coast Subregion</u>

Areas at risk: Estero Bluffs State Park, Morro Bay National Estuary, Morro Bay State Park, William Randolph Hearst Memorial State Beach, San Simeon State Beach, Moonstone Beach, Cayucos Beach, Cayucos State Beach, Morro Strand State Beach, Harmony Headlands State Beach (SLO 2014 IRWMP).

<u>North County Subregion</u>

There are no coastal areas in this subregion.

South County Subregion

Areas at risk: Montana de Oro State Park, Port San Luis Pier and Beach, Avila State Beach, Pismo State Beach, Oceano Dunes State Vehicles Recreation Area, Guadalupe-Nipomo Dunes wetland complex (SLO 2014 IRWMP).

Please provide any additional suggestions to revise, add to, or update the draft response:

8. Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

More information is needed about the fragmentation of aquatic habitats.

North Coast Subregion

Santa Rosa Creek experiences fish passage barriers due to infrastructure changes (SLO 2014 IRWMP).

South County Subregion

Arroyo Grande Creek experiences fish passage barriers, and Nipomo-Suey Creeks have habitat fragmentation due to development (SLO 2014 IRWMP).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ The Salinas and Estrella Rivers are important corridors for aquatic and riparian species movement.
- ☐ There are many fish passage barriers in the Morro Bay watershed, including the South Bay Boulevard bridge.
- ☐ The Chorro Reservoir Dam is a fish passage barrier impacting steelhead. There is other infrastructure throughout Chorro Creek that creates barriers to fish passage.

Please provide any additional suggestions to revise, add to, or update the draft response:

Hydropower

1. Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in you region?

More information is needed about sub-regional future energy plans.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- ☐ The City of San Luis Obispo is examining options for hydropower facilities.

Please provide any additional suggestions to revise, add to, or update the draft response:

San Luis Obispo County IRWM
Climate Change Vulnerability Prioritization – DRAFT 2/7/2018

RWMG members and stakeholders provided input from the January 4-19, 2018 online survey (22 responded) and January 31, 2018 public workshop (34 participated) about the regional water resources that are vulnerable to the effects of climate change. For the survey, the vulnerabilities were evaluated using exposure, sensitivity, and likelihood of impact to climate change effects, resulting in a prioritization score. During the workshop, participants discussed the assigned priority and provided input on a worksheet. The following table includes the results of those two efforts to prioritize the identified regional climate change vulnerabilities:

Category	Identified Vulnerability	Priority
Water Demand 1	Water-dependent industries	High
Water Demand 2	Seasonal water demand	Medium
Water Demand 3	Climate-sensitive crops	Medium
Water Demand 4	Drought-sensitive groundwater basins	Very High*
Water Demand 5	Communities with water curtailment efforts	Medium*
Water Demand 6	Insufficient instream flows	Very High*
Water Supply 1	Water supply from snowmelt	Low*
Water Supply 2	Water supply from coastal aquifers	Very High*
Water Supply 3	Inability to store carryover supply surpluses	High*
Water Supply 4	Drought-sensitive water systems	Very High*
Water Supply 5	Invasive species management issues	Medium*
Water Quality 1	Water bodies in areas at risk of wildfire	High
Water Quality 2	Water bodies impacted by eutrophication	High
Water Quality 3	Declining seasonal low flows	Very High*
Water Quality 4	Water bodies with restricted beneficial uses	Medium
Water Quality 5	Water quality impacted by rain events	High*
Sea Level Rise 1	Coastal erosion	Medium
Sea Level Rise 2	Coastal structures	Low
Sea Level Rise 3	Coastal infrastructure in low-lying areas	Medium*
Sea Level Rise 4	Low-lying coastal habitats	Medium*
Sea Level Rise 5	Flooding due to high tides and storm surges	Medium*
Sea Level Rise 6	Coastal land subsidence	Low
Sea Level Rise 7	Rising sea levels	Medium*
Flooding 1	Aging flood protection infrastructure	High
Flooding 2	Insufficient flood control facilities	High
Flooding 3	Increased flood risk due to wildfires	Very High*
Ecosystem and Habitat 1	Aquatic habitats at risk of erosion and sedimentation	Medium
Ecosystem and Habitat 2	Estuarine habitats dependent on freshwater flow patterns	High
Ecosystem and Habitat 3	Climate-sensitive fauna and flora	Medium
Ecosystem and Habitat 4	Changes in species distributions	High
Ecosystem and Habitat 5	Aquatic habitats used for economic activities & recreation	Low
Ecosystem and Habitat 6	Environmental flow requirements	High
Ecosystem and Habitat 7	Exposed coastal ecosystems	Low
Ecosystem and Habitat 8	Fragmented aquatic habitats	Medium
Hydropower 1	Future hydropower plans	Low

* indicates that the priority was changed from the worksheet used during the workshop

J.5 2018 Climate Change Workshop Attendees

San Luis Obispo County
Integrated Regional Water Management (IRWM) Program

Climate Change Workshop – January 31, 2018

Signing-in is voluntary. You may attend the meeting regardless of whether you sign-in.

NAME	COMMUNITY/AGENCY	EMAIL
HENRY KRZSICK	SAN SIMEON - RESIDENT	[illegible]
WILLIAM GARFINTEL	S&T	
Jennifer Metz	City of SLO	jmetz@slocity.org
Mychal Boerman	City of SLO	mboerman@slocity.org
Ed Eby	NCSD	eeby@ncscd.gov
Lia Spring	DUDEK	LSPRING@DUDEK.COM
JANE KIM	COUNTY OF SLO	JKIM@CO.SLO.CA.US
Laxie Bell	Morro Bay National Estuary Program	lbell@mbnep.org
Andrew Johnson	USITRCD	Andrew@US-ltrcd.org
Larissa Clarke	CSLRCD	lclarke@[illegible]coastalrcd.org
PATRICK VOWELL	SPR	pvowell@santinelpeakresources.com
Kelly Heffernan	AG	kheffernan@arroyogrande.org
BRENDAN CLARK	SLO COUNTY	BCLARK@CO.SLO.CA.US
[illegible]	SLO Cnty	CMACKENZIE " "
Joey Steil	SLO COUNTY	JSteil@CO.SLO.CA.US

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NAME	COMMUNITY/AGENCY	EMAIL
LINDA CHIMENTI	CoPROSLOCo	LK CHIMENTI@GMAIL.COM
DAN ALLEN GADDIS	NIPOMO C.S.D.	
LPOZZEBON	SLO-EHS	Lpozzebon@co.slo.ca.us
Jan Gray	Dudek	jgray@dudek.com
HERNAN CORTEZ	RICK ENGINEERING	Hcortez@rickengineering.com
Jennifer Morales	DWR	Jennifer.Morales@water.ca.gov
Jacqueline Protsman	County Planning/Building	jprotsman@co.slo.ca.us
Devin Best	USLTRCD	devin@us-ltrcd.org
James Green	SLO Co. Farm Bureau	Jgreen@slofarmbureau.org
Pecco Ogan	Oceano CSD	ocsdgm@oceanocsd.org
DOMINIC ROQUES	RWQCB	dominic.roques@waterboards.ca.gov

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NAME	COMMUNITY/AGENCY	EMAIL
JON GRIESSER	COUNTY OF SLO ENERGY/WATCH	jgriesser@co.slo.ca.us
Dick Tzou	County of SLO	dtzou@co.slo.ca.us
Mary Giesinski	ECOSLO	mary@ecoslo.org
Andy Pease	SLO City Council	apease@slocity.org
Megan Martin	SLO County	mamartin@co.slo.ca.us
Patricia Wilmore	Paso Robles Wine Country Alliance	pwilmore@pasowine.com
AARON FLOYD	CITY OF SLO	afloyd@slocity.org