Fact Sheet

Climate Change Considerations for Appropriative Water Rights Applications

This fact sheet provides information to water rights applicants on how climate change will affect water availability, and highlights resources that may aid with selecting an appropriate season, rate, and quantity of proposed diversions to improve the long-term feasibility of their water right.

Overview

California law requires that every application for an appropriative water right demonstrate a reasonable likelihood that unappropriated water is available to supply the applicant. Generally, water availability for permitting has been based on past hydrological data to estimate unimpaired flow, with subtraction of the demand of all senior diversions and the demand for instream resource needs.

Due to changing climate, past conditions are no longer a reliable guide to future conditions, and changes in hydrology will make it increasingly difficult to reliably estimate water availability based on the observed record. By accounting for projected future conditions, applicants for appropriative water rights can develop projects that can adapt, ensuring that their water right is minimally affected by climate change.

Climate Change and California's Water Resources

Climate change refers to broad changes in overall weather patterns such as temperature and precipitation. California's Fourth Climate Change Assessment, completed in 2018, confirmed the consensus of the climate change science community that climate is changing. While each region of the state is experiencing a unique combination of climate change impacts, the overall statewide trend shows warming temperatures and diminishing snowpack. Annual average air temperatures have risen throughout the state over the last century, and are projected to rise significantly in this century. Projected changes include increased precipitation variability (longer, more-pronounced droughts punctuated by intense storms), more extreme weather, increased wildfire threat, heat waves, rising sea level, and widespread flooding.

The potential hydrologic impacts of climate change will have profound effects on the availability of water for direct diversions, storage, energy generation, reservoir operations, flood management, and ecosystems. The wet season will become wetter, and the dry season longer and drier, affecting both water quality and water availability. Due to warming alone, California will see more of its precipitation fall as rain than as snow, which will result in diminished natural water storage in the form of snowpack, less snow in lower and intermediate elevations, and shifting of the timing and nature of peak streamflows.

When Filing an Application to Appropriate Water

Once a party has submitted a water rights application, the proposed season of diversion, rate of diversion, or annual amount requested cannot be increased. Therefore, prospective applicants are encouraged to consider climate change impacts on their proposed project before filing the application. Below are examples of project components that might be affected by changes in hydrology that are anticipated to occur under climate change:

1. **Diversion Season -** Timing of peak runoff is expected to shift as temperatures increase and snowpack diminishes. The arrival of warmer temperatures earlier in the spring causes snow to melt earlier. In addition, warming causes a greater share of precipitation to fall as rain instead of snow, which contributes to earlier runoff. Applicants should consider the projected runoff patterns at their proposed point of diversion, which may influence the requested season of diversion. Additionally, the timing of some beneficial uses may change, as warming may shift plant growing season. For example, earlier spring dormancy breaks can increase risk of exposure to spring frosts earlier than the traditional frost protection season.

   Runoff patterns have already shifted earlier by nearly a month over the past 100 years in the Sacramento River system.

2. **Diversion Rate -** Climate model projections indicate that California's seasonal Mediterranean precipitation pattern will continue with wet winters and dry summers. However, extreme precipitation and runoff (i.e., flooding) may become more common. Higher intensity precipitation does not necessarily mean the total amount of precipitation at a location will increase, but that the precipitation may be more concentrated over a shorter period when compared to the historical average. Also, higher intensity precipitation does not necessarily mean more frequent precipitation. Changes in precipitation frequency may be region-specific; for example, increase in northern California and decrease in southern California. Therefore, applicants should evaluate if the requested pumping rate is sufficient to handle the greater streamflow rates generated by higher intensity storms to provide the quantity of water needed for the intended beneficial use(s), especially in regions where precipitation frequency decreases.

3. **Diversion Volume/Amount -** The total amount of precipitation is projected to decrease in some regions. At the same time, warming may be associated with increased water demand, e.g. for irrigation or for cooling. For direct diversions and diversions to storage, applicants should evaluate the long-term viability and sustainability of the requested volume/amount of water. Applicants should assess the historical and the projected future water availability of the source stream(s), identify the range of water quantity needed to support the intended beneficial use(s), and consider the hydrologic and environmental impacts of the project diversion(s) to determine if the diversion(s) are sustainable in a changing climate.

4. **Streamflows Required for Protection of Fish and Wildlife Habitat -** Warming trends have already been documented in California's aquatic ecosystems for which long-term temperature data are available. As more precipitation falls as rain instead of snow, the quantity of snowmelt that supplies streams and rivers will decrease, reducing the amount of cold-water habitat available for native fish species, such as Chinook salmon. Increases in water temperature can negatively affect fish metabolism, development, behavior, and distribution. Applicants should be aware that there may be a need for an additional evaluation of the project's instream flow requirements necessary to protect public trust resources, such as fisheries, wildlife, aesthetics, and navigation. For example, in order to continue to protect migration paths, and instream flows needed for spawning and rearing anadromous fish in a changing climate, it may be necessary to modify the instream criteria and metrics to better reflect a changing hydrology.

Climate Change Data and Tools

California has invested in a considerable amount of research to understand how a changing climate will affect water resources, and identify ways to build resilience, and prepare for impacts of climate change. The below resources are in the public domain:

- SGMA Climate Change Resources. California Department of Water Resources (DWR) developed climate change data, water operations modeling, and Delta hydrodynamic modeling, and provides those data, tools, and guidance to support implementation of Sustainable Groundwater Management Act (SGMA). The climatological data include historical detrended precipitation and reference evapotranspiration, along with change factors for projected climate conditions centered around 2030 and 2070. The hydrological data provide projected unimpaired stream inflows for major streams in the Central Valley, and streamflow change factors for areas outside of the Central Valley and smaller ungaged watersheds within the Central Valley.

- Cal-Adapt. Cal-Adapt is an online portal that provides multiple interactive tools for the public to explore how climate change might affect California. The data cover 1950-2005 for the historical period, and 2006-2100 for medium and high emissions scenarios. The data include daily temperature and precipitation over California. Additional variables are relative humidity, wind speed, and surface solar radiation, along with estimates of historical and future daily hydrologically relevant variables, such as snow cover, soil moisture, runoff, water loss from plants, surface moisture and heat fluxes.

Where a better watershed-specific model exists, water rights applicants may use other best available data and science to evaluate potential impacts on the diversion season, diversion rate, and diversion amount for a proposed project. In addition, applicants may want to review if an existing water management planning effort conducted for their area addressed climate change impacts, such as a major water district, groundwater sustainability agency, or an academic organization.

What to Submit

The application form is designed to collect information required in the Water Code as contents of an application for a permit to appropriate water.

If an applicant adapts their project due to climate change considerations, the applicant should also provide information supporting the future water availability analysis. Technical information should include data, and any modeling and assumptions used to complete the water availability analysis with projected climate change.

In a hypothetical example, to demonstrate a reasonable likelihood that unappropriated water is available for appropriation as required by Water Code section 1260(k), Sandy compiles data from multiple sources. Sandy retrieves streamflow records from gages in the source watershed and along the downstream flow path to estimate water supply, and existing water rights demand from eWRIMS to determine if there is unappropriated water. To assess if the unappropriated water is available for appropriation, Sandy obtains information regarding instream needs at the point of diversion and downstream. To support the initial showing of water availability, Sandy submits a summary of streamflow records, minus demands for senior diversions and for instream needs plus the proposed project to show that water is likely available to supply the project based on historical conditions.

Sandy also retrieves data on the projected hydrology in 2070, and evaluates future water availability. Comparison of historical records with projected streamflow indicates that the peak flow rates may increase but occur during a shorter period, ending earlier in the season. Sandy decides to seek a phased permission to move from a diversion rate based on historical records, to a higher diversion rate based on projected future conditions. The requested higher rate is not yet possible but the application indicates a proposed trigger when the higher rate is expected to become feasible, and demonstrates the capability to divert at the requested rate (i.e. a higher rate pump, and sufficient storage capacity to take a larger volume at once). To justify the request based on climate change considerations, Sandy submits projected hydrology data, and information supporting the future water availability analysis as part of the initial water availability showing. The adapted project becomes more climate resilient as Sandy will be able to divert the full amount even when peak flows end earlier in the season.

Additional Resources

More information on climate change considerations for appropriative water right applications can be found on the water rights climate change page.

Information on the water rights permitting process including filing of a new water right application is available on the Permitting and Licensing Program page.

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