Appendix 2-F: Technical Analysis

Summaries of the technical information used in the development of this IRWM Plan are included in this appendix. In order to develop an IRWM Plan, information must be incorporated from many other planning documents, studies, and other sources.

The references list for this IRWM Plan is provided at the end of the Plan. Over 120 sources were consulted during the development of the IRWM Plan, primarily for Section 2, Region Description, and Section 3, Local Land and Water Use Planning. Many of the sources referenced were planning documents, which are described in Section 3, and listed in Appendix 3-A.

F.1 Population and Demographics

Current population data for the Tahoe-Sierra Region, presented in Table 2-2 was obtained from the 2010 Census data for total population by census tract. There were four census tracts that required adjustments to the total population number as the tract is not located entirely within the Region. Both Alpine County and Sierra County have only one census tract, so the population was calculated proportional to the amount of each county located within the Region. Census tract 9 in Nevada County and census tract 220.14 in Placer County also include land outside of the region so the total population was adjusted proportional to the amount of the tract located within the Region. The population within the census tracts in El Dorado County located in the Region was less than the population data included in South Tahoe Public Utility District's (South Tahoe PUD) 2010 Urban Water Management Plan (UWMP). The South Tahoe PUD service area is smaller than the area of El Dorado County within the Region, but the South Tahoe PUD population data estimate is for the 2009 population and may factor in the high percentage of non-full-time residents.

Population growth estimates were obtained from various sources including the Tahoe Regional Planning Authority (TRPA) Strategic Plan, county General Plans, and UWMPs for South Tahoe PUD, Tahoe City Public Utility District (Tahoe City PUD), North Tahoe Public Utility District (North Tahoe PUD), Placer County Water Agency, and Truckee Donner Public Utility District (Truckee Donner PUD). In some cases the available population growth data included areas both within and outside of the Region. Population projections for future water demand were obtained from the UWMPs.

Demographic data presented in Section 2 was based on the 2010 Census data with similar proportional calculations for the four bisected census tracts as was done for the total population data. The disadvantaged community (DAC) populations presented in Table 2-4 were obtained from the Department of Water Resources (DWR) website for IRWM Plans (http://www.water.ca.gov/irwm/grants/resourceslinks.cfm) and was based on the 2010 Census data. The exception was the employment data, which were obtained from the American Community Survey for the period 2007-2011.

F.2 Land Management Agencies and Land Use

Land use is presented in two different ways in Section 2, by land use type and by land management agency. Land management agency data is presented in Figure 2-2 and Table 2-1, which show the areas managed by the US Forest Service, Bureau of Land Management (BLM), California Department of Parks and Recreation, California Department of Fish and Wildlife (CDFW), and the State Lands Commission; and the areas under private ownership, including both urban development and rural plots. This information was derived from GIS data generated by the BLM.

Land use type data is presented in Figure 2-5, which is from GIS data developed by DWR and provides a large scale view of the predominant land use types including urban development, agriculture, and open space (both public and privately owned).

F.3 Climate and Streamflow

The climate summaries in Section 2 used readily accessible data from the Western Regional Climate Center and Cal-Adapt websites (http://www.wrcc.dri.edu/climatedata/climsum/, and http://cal-adapt.org/). Twelve Cooperative Observer Network (COOP) stations were identified that provided both temperature and precipitation summary data within the Region. Of those, six were excluded as the period of record did not include the last decade. The Sagehen Creek station was included despite the period of record ending in 2010 in order to provide a slightly higher elevation dataset, but the Truckee Ranger station was excluded as it is fairly close to the Donner State Park station. The period of record for the five stations selected for Table 2-5 and Figures 2-6 and 2-7 ranged from 45 years (Tahoe Valley FAA Airport) to 110 years (Tahoe City, California). These five stations provide a reasonable geographic distribution in the Lake Tahoe Basin, Truckee River, and Little Truckee River hydrologic units (HUs). There were no current COOP stations in the West Fork or East Fork Carson River HUs. The elevation range represented by these five stations is limited, ranging from 5,580 feet above mean sea level (amsl) at the Boca station to 6,340 feet amsl at the Sagehen Creek station, and does not represent the full range of elevations within the Region.

The potential effects of climate change in the Region were summarized from the model outputs presented in the tools on the Cal-Adapt website. According to the data sources description on the website, the tools use data from four models (Parallel Climate Model PCM1, Community Climate System Model version 3 CCSM3, Geophysical Fluid Dynamics Laboratory GFDL, and Centre National de Recherches Meteorologiques CNRM) for two scenarios (B1 low emission scenario and A2 high emission scenario), which were downscaled to local-scale using bias correction and spatial downscaling. The Temperature: Degrees of Change visualization tool spatially displays the averaged temperature differences from the baseline 1961-1990 to the end of the century 2070-2099. For this IRWM Plan, winter months were assumed to be December through March and summer months were assumed to be June through September. The Snowpack: Decadal Averages Map visualization tool spatially displays the snowpack model results averaged by decade. For this IRWM Plan the average of all four models was used, and the decrease in snowpack was estimated between 1950 and 2090.

Streamflow and runoff data presented in Figure 2-11 and Table 2-7 were obtained from the US Geological Survey National Water Information System web interface for Surface Water Monthly Statistics (http://waterdata.usgs.gov/). Six stations were selected within the Region, with one in each HU except for the Lake Tahoe Basin. In the Lake Tahoe Basin two stations were selected to provide hydrologic data both upstream of the lake (Upper Truckee River at South Lake Tahoe) and at the discharge of the lake (Truckee River at Tahoe City). For the Truckee River and the Little Truckee River the most downstream station was selected. For the East and West Fork Carson Rivers there is only one active station in each river, at Woodfords and Markleeville, respectively. The selected parameter was streamflow, in cubic feet per second (parameter code 00060), which was converted to acre-feet for Table 2-7.

For item 3.3 of the Climate Change Vulnerability checklist, a statistical analysis was performed on the streamflow data obtained from the USGS to determine whether seasonal low flows are decreasing. The minimum flow from each year in the period of record for each of the six gauges was input into ProUCL (USEPA, http://www.epa.gov/osp/hstl/tsc/software.htm) and a Mann-Kendall trend test analysis was performed with a confidence coefficient of 0.9. The test was inconclusive for

the Little Truckee River, Upper Truckee River, and East Fork Carson Rivers. At 90% confidence the Truckee River at Tahoe City shows an increasing trend in minimum streamflow, and the Truckee River at Farad and the West Fork Carson River show decreasing trends in minimum streamflow.

F.4 Water Supply and Demand

Water supply and demand quantities and projections that were incorporated into the IRWM Plan were primarily drawn from planning documents for the major water providers including UWMPs for North Tahoe PUD, South Tahoe PUD, Placer County Water Agency, Tahoe City PUD, and Truckee Donner PUD; and the *Olympic Valley Groundwater Management Plan* (2007 Hydrometrics). Qualitative information such as type of water source was also obtained from the Department of Public Health' http://drinc.ca.gov website, county General Plans, LAFCO Municipal Service Reviews, or websites for individual water providers. While the majority of the population is served by the major water providers, total supply and demand for the Region is estimated as quantified water supply information is not available for the many smaller water purveyors or private water wells. The demand not served by the major water suppliers was estimated using the average of the baseline per capita demand reported by the major water suppliers, multiplied by the estimated population outside of the service areas of the major water suppliers.

F.5 Ecological Resources

The land cover types presented in Figure 2-12 and summarized in Table 2-14 are based on GIS data generated by the California Department of Forestry and Fire Protection Forest and Resource Assessment Program (CDF-FRAP) 2002 assessment. The CDF-FRAP assessment compiled the "best available" land cover data into the California Wildlife Habitat Relationships (CWHR) system classification. This dataset has been aggregated into ten categories of land cover, down from the 77 habitat classifications included in the CWHR.

The special status species listed in Table 2-15 and Appendix 2-C were based on the output from the CDFW's California Natural Diversity Database (CNDDB) Quick Viewer (https://www.dfg.ca.gov/biogeodata/cnddb/), which provides limited access to the full dataset searched by county or 7.5' quadrangle. The database is updated monthly, and the list used for this IRWM Plan was exported in May 2013. For this IRWM Plan, the data was exported by quadrangle including the Dog Valley, Sardine Peak, Webber Peak, Independence Lake, Hobart Mills, Boca, Norden, Truckee, Martis Peak, Tahoe City, Kings Beach, Homewood, Meeks Bay, Rockbound Valley, Emerald Bay, South Lake Tahoe, Echo Lake, Freel Peak, Woodfords, Carson Pass, Markleeville, Heenan Lake, Topaz Lake, Ebbetts Pass, Wolf Creek, Coleville, and Disaster Peak quadrangles. The list was then filtered to eliminate duplicates, sorted into classifications, and filtered to include only those species that are Federally Listed, State Listed, or that have other special status as listed in the CNDDB *Special Animals* list (CDFW 2011) and *Special Vascular Plants, Bryophytes, and Lichens List* (CDFW 2013).

The potential effects of climate change on the wildfire risk in the Region was summarized from the model outputs presented in the tools on the Cal-Adapt website. According to the data sources description on the website, the Wildfire: Fire Risk Map tool uses data from three models (PCM1, GFDL, and CNRM) for two scenarios (B1 low emission scenario and A2 high emission scenario), which were downscaled to local-scale using bias correction and spatial downscaling. The Wildfire: Fire Risk Map visualization tool spatially displays the estimated increase in burned acreage from the baseline 2020 to the end of the century 2085. This projection is based on climate models only, and does not take into account the landscape and fuels on the ground. The models differ in their results. The PCM1 and CNRM models project an increase of up to 2-fold for the low emission

scenario and up to 3-fold for the high emissions scenario; but the GFDL model projects a much larger increase for the high emission scenario of over ten-fold increase.

F.6 Additional Information Needs

The technical information used to develop this IRWM Plan represents the best and most current available data and is generally adequate to provide a description of the water-related setting, concerns, and needs in the Region. In some cases, listed below, the required information was not readily available but rather had to be estimated from other sources.

- The groundwater supply quantities included in this IRWM Plan are based on prior, current, and projected pumping volumes presented in the UWMPs, and the Martis Valley Groundwater Management Plan (GWMP) and Olympic Valley GWMP. There is no evidence that groundwater levels are dropping at current pumping levels, so these pumping rates appear to be sustainable. However, the total quantity of water in each basin has been estimated only for the Tahoe Valley South and Martis Valley Groundwater basins in DWR Bulletin 118 to estimate sustainable pumping yields. Recharge has only been estimated for the Martis Valley groundwater basin.

- Total water production and demand quantities for the Region are estimated as quantified water supply information is only available for the major water suppliers. The supply for the many smaller water purveyors and individual wells is unknown, however as the majority of the population is served by the major water suppliers this is not likely to significantly change the total estimates of water supply in the Region.

- The degree to which water quality is affected by rain events is unknown, and therefore the effect of climate change and possible changes in precipitation on water quality in the Region is not known.