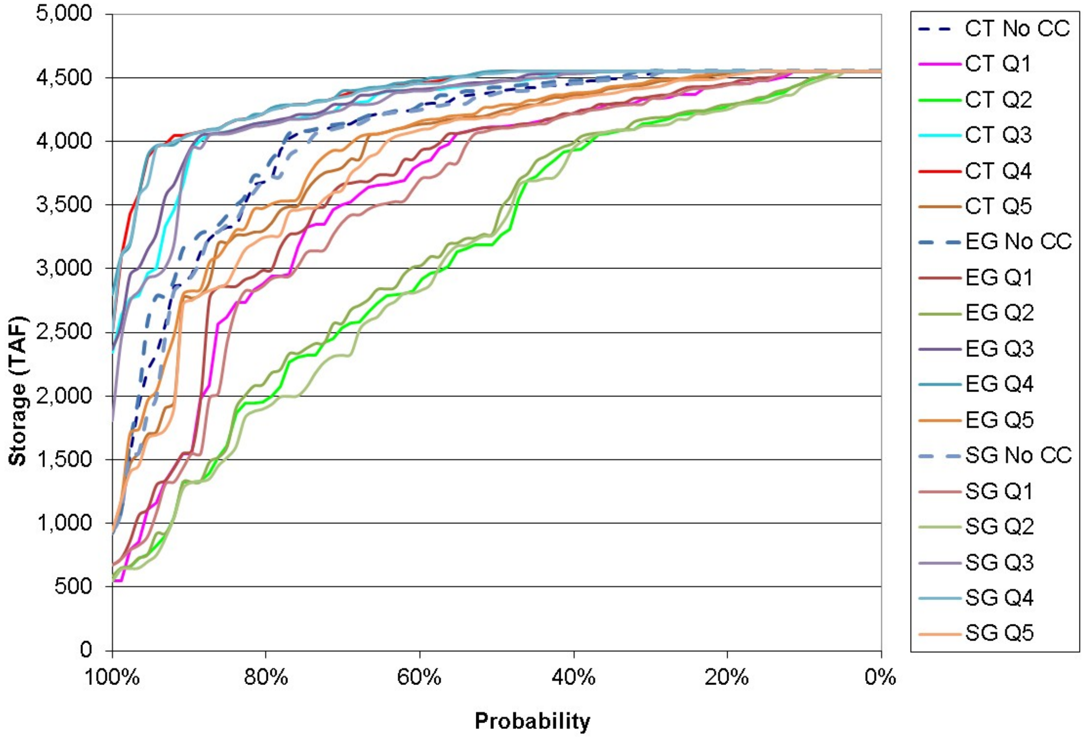
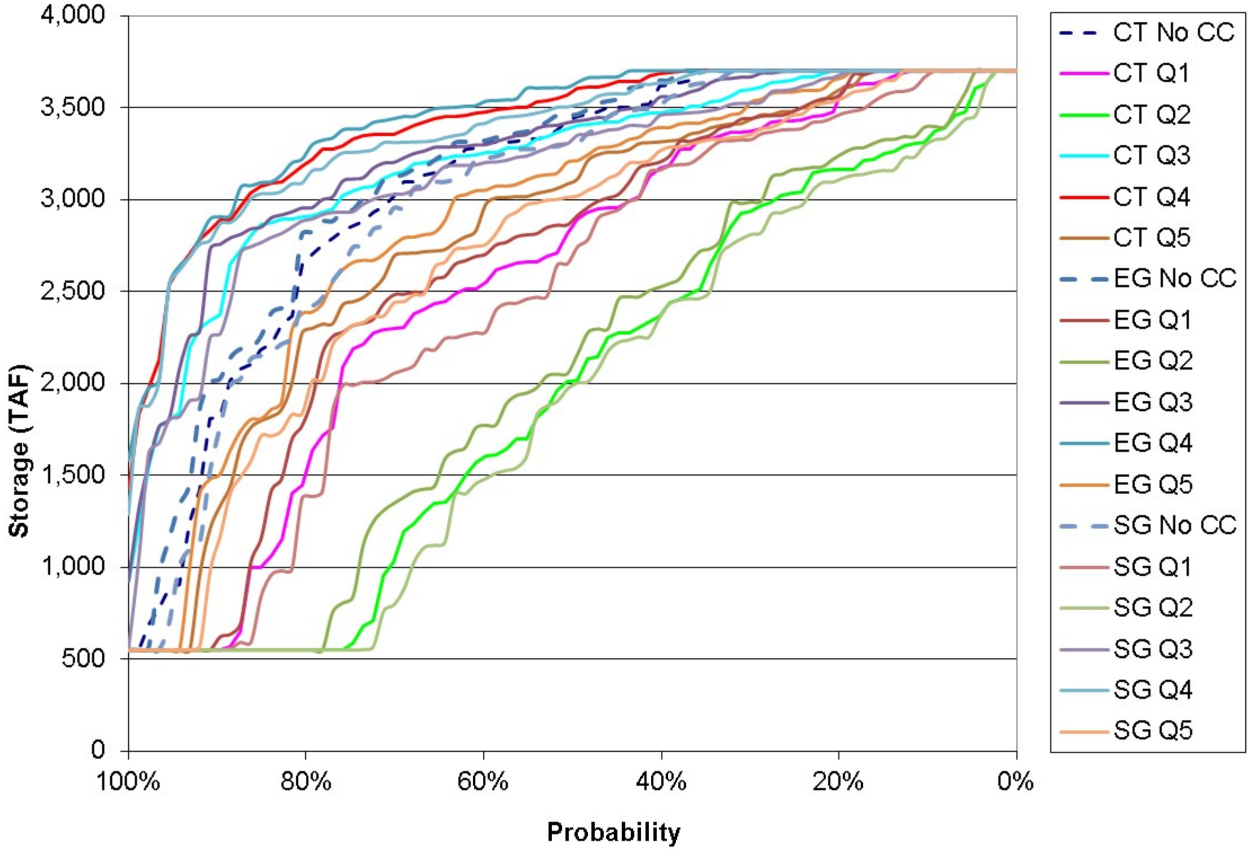
have greater amounts of storage than the no climate change projections.



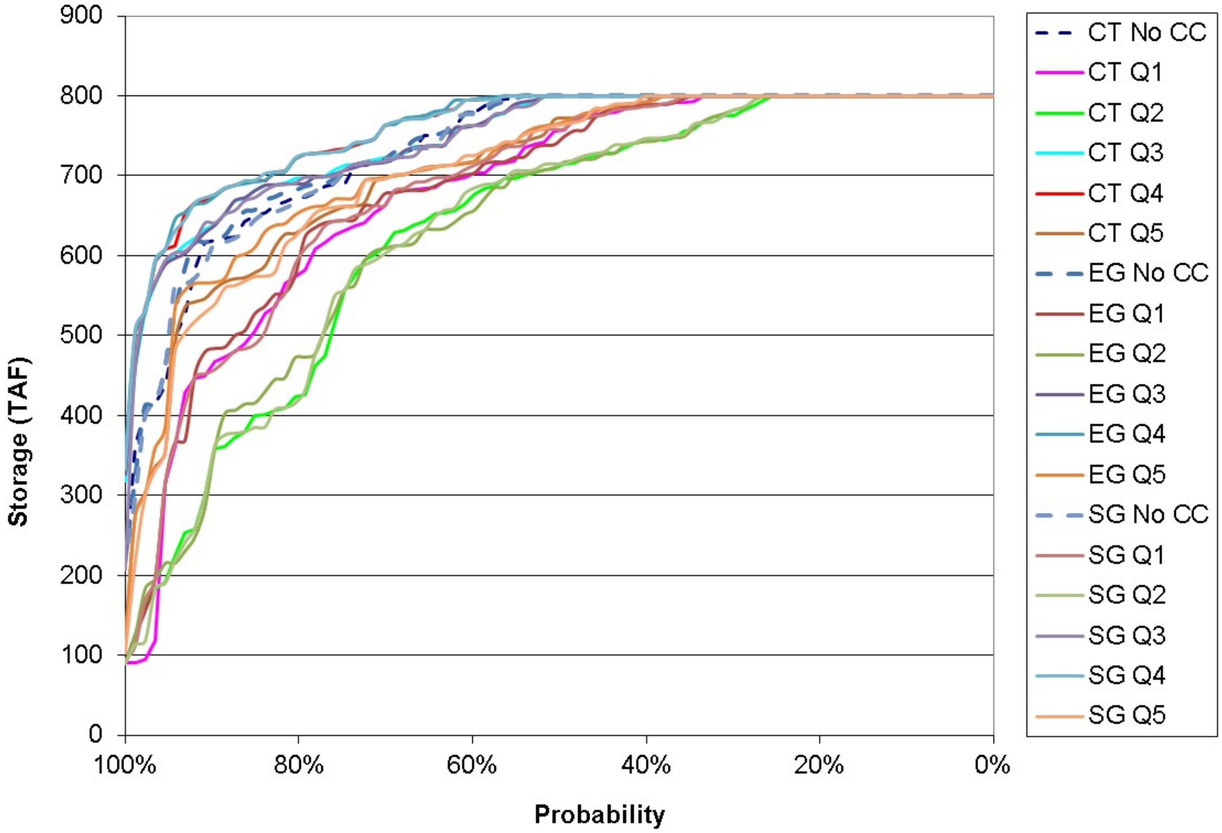
Key:
TAF = thousand acre feet

Figure 3-56. Exceedence of Shasta Lake End-of-May Storage (TAF) in each Scenario



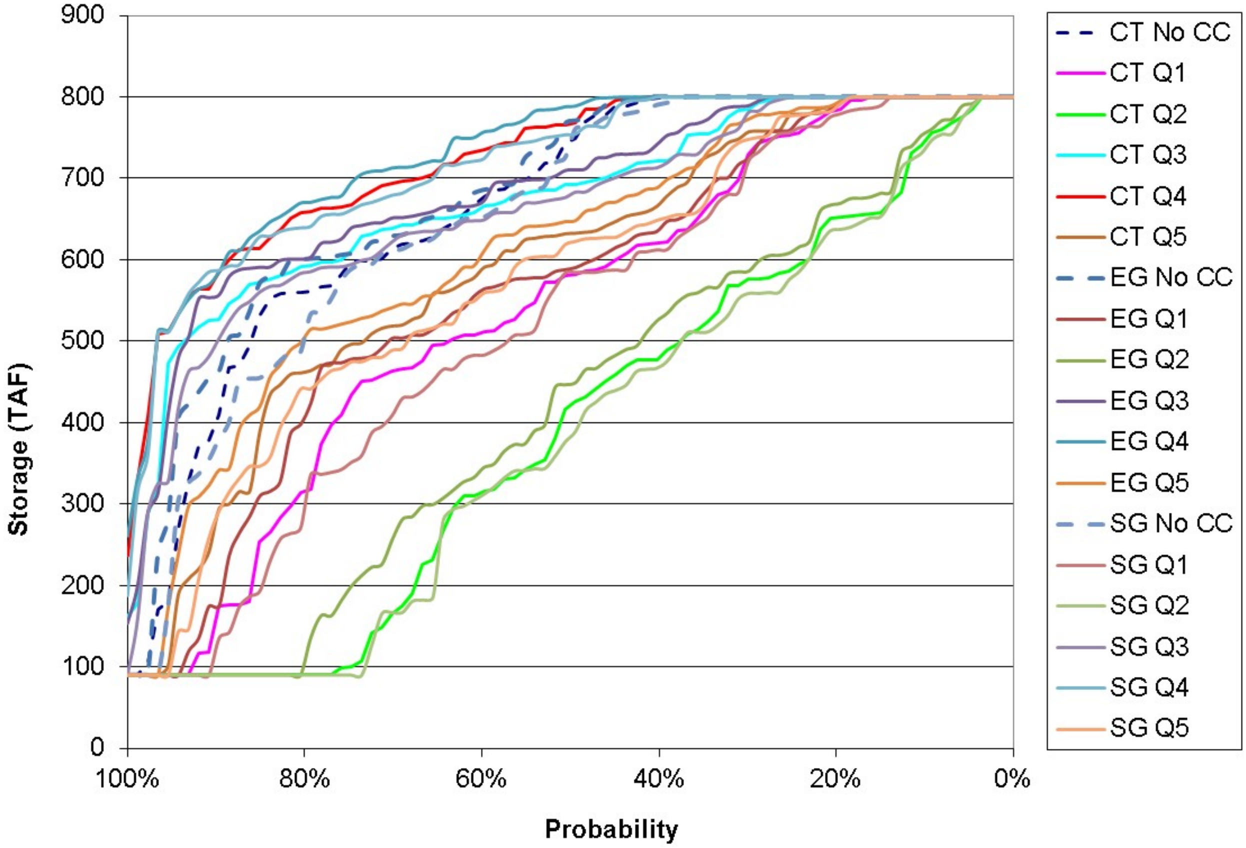
Key:
TAF = thousand acre feet

Figure 3-57. Exceedence of Shasta Lake End-of-September Storage (TAF) in each Scenario



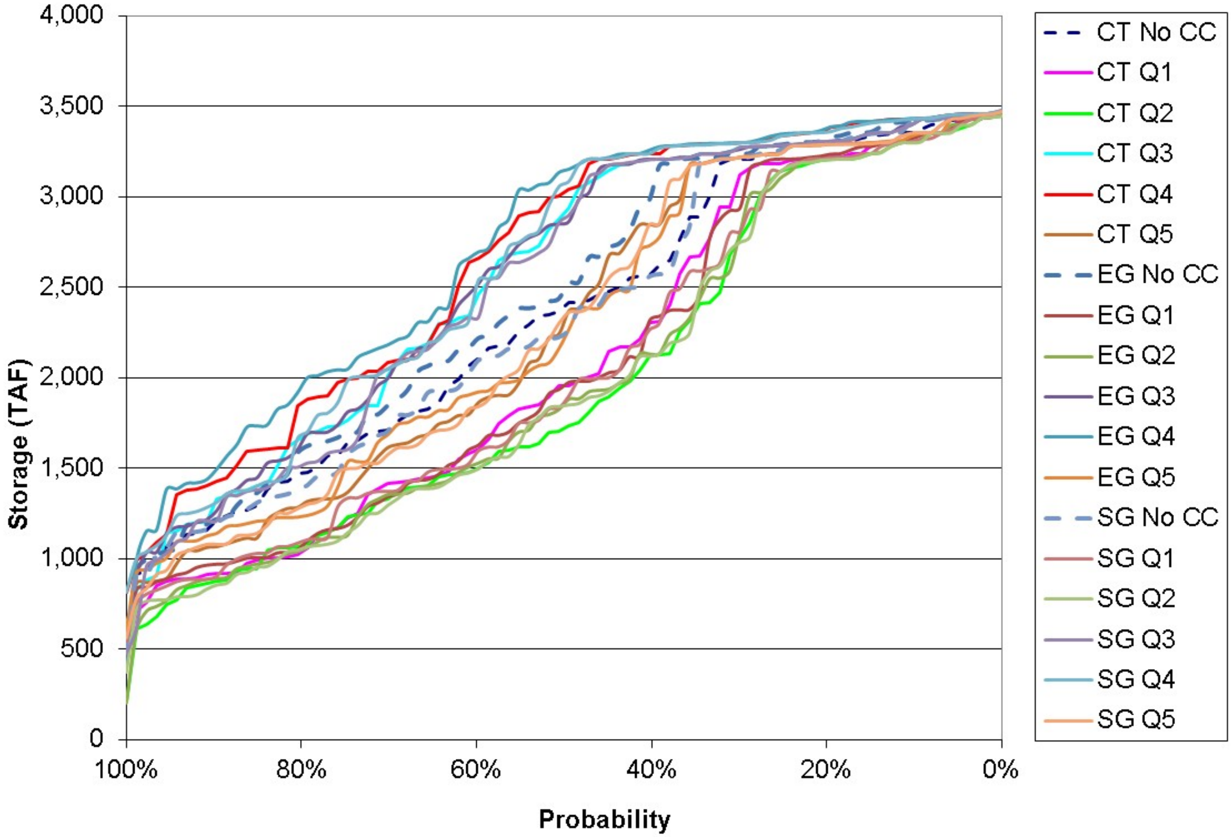
Key:
TAF = thousand acre feet

Figure 3-58. Exceedence of Folsom Lake End-of-May Storage (TAF) in each Scenario



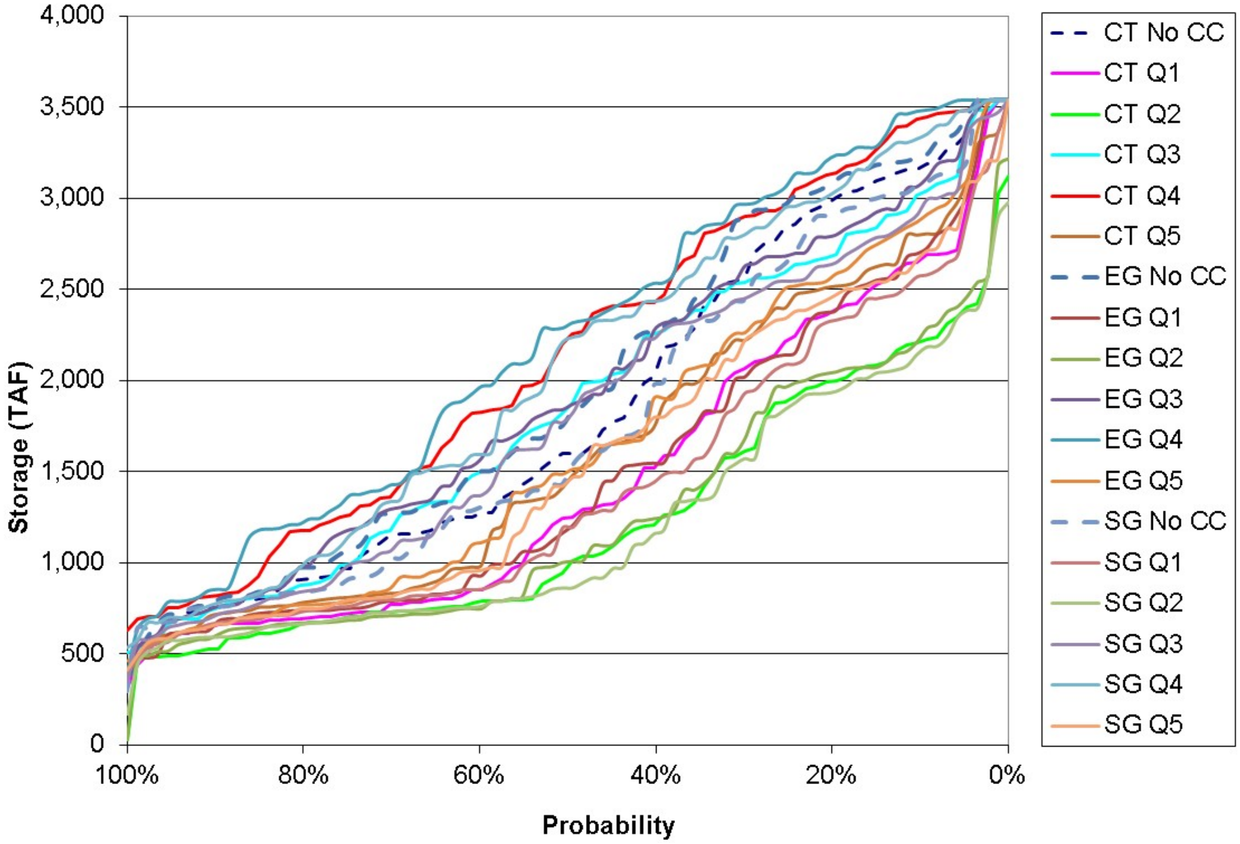
Key:
TAF = thousand acre feet

Figure 3-59. Exceedence of Folsom Lake End-of-September Storage (TAF) in each Scenario



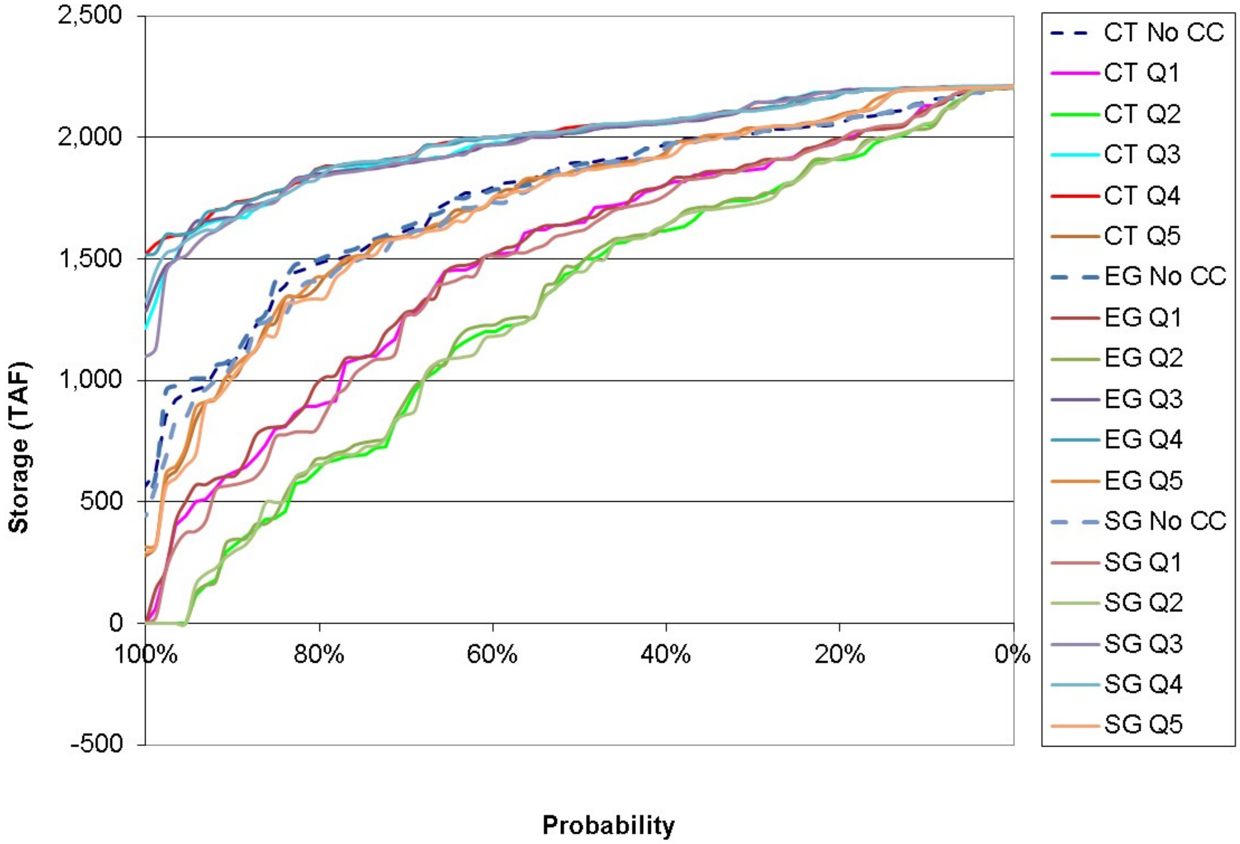
Key:
TAF = thousand acre feet

Figure 3-60. Exceedence of Lake Oroville End-of-May Storage (TAF) in each Scenario



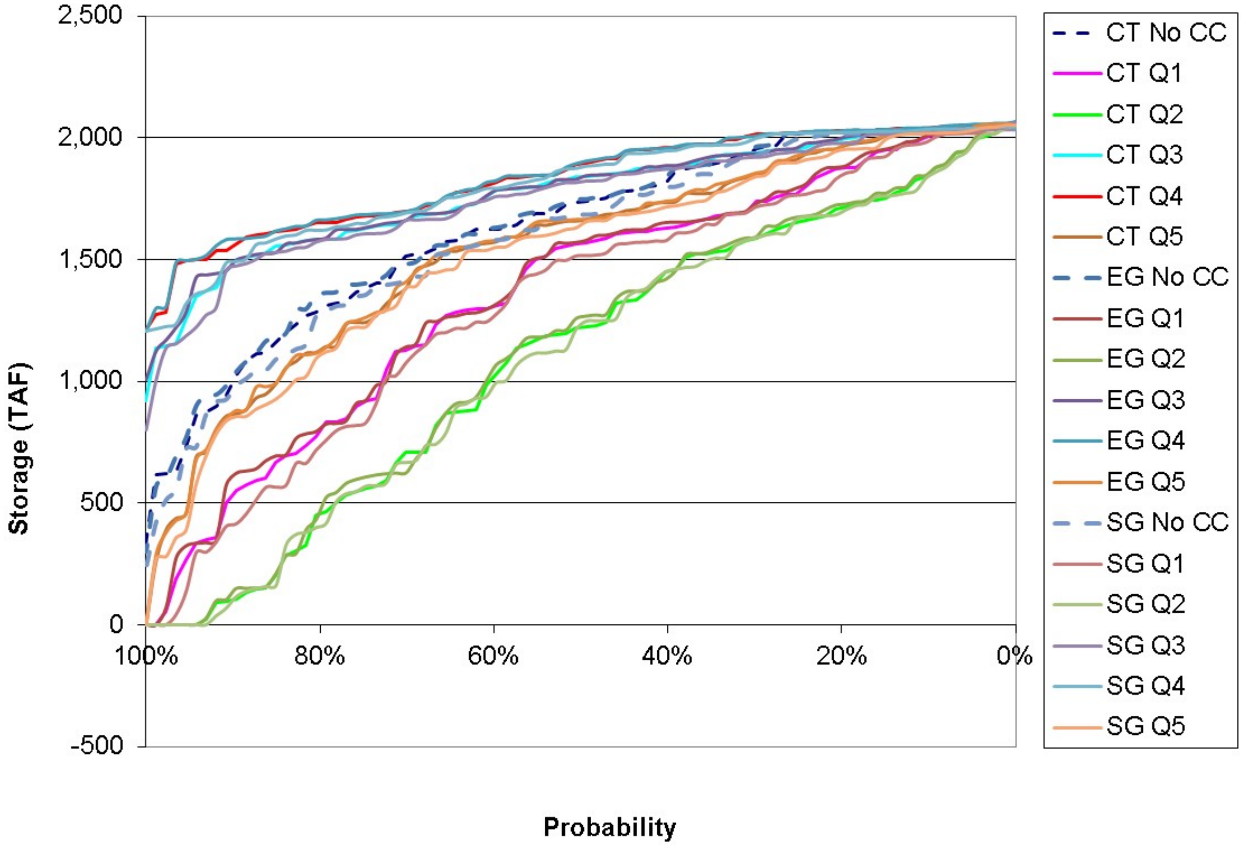
Key:
TAF = thousand acre feet

Figure 3-61. Exceedence of Lake Oroville End-of-September Storage (TAF) in each Scenario



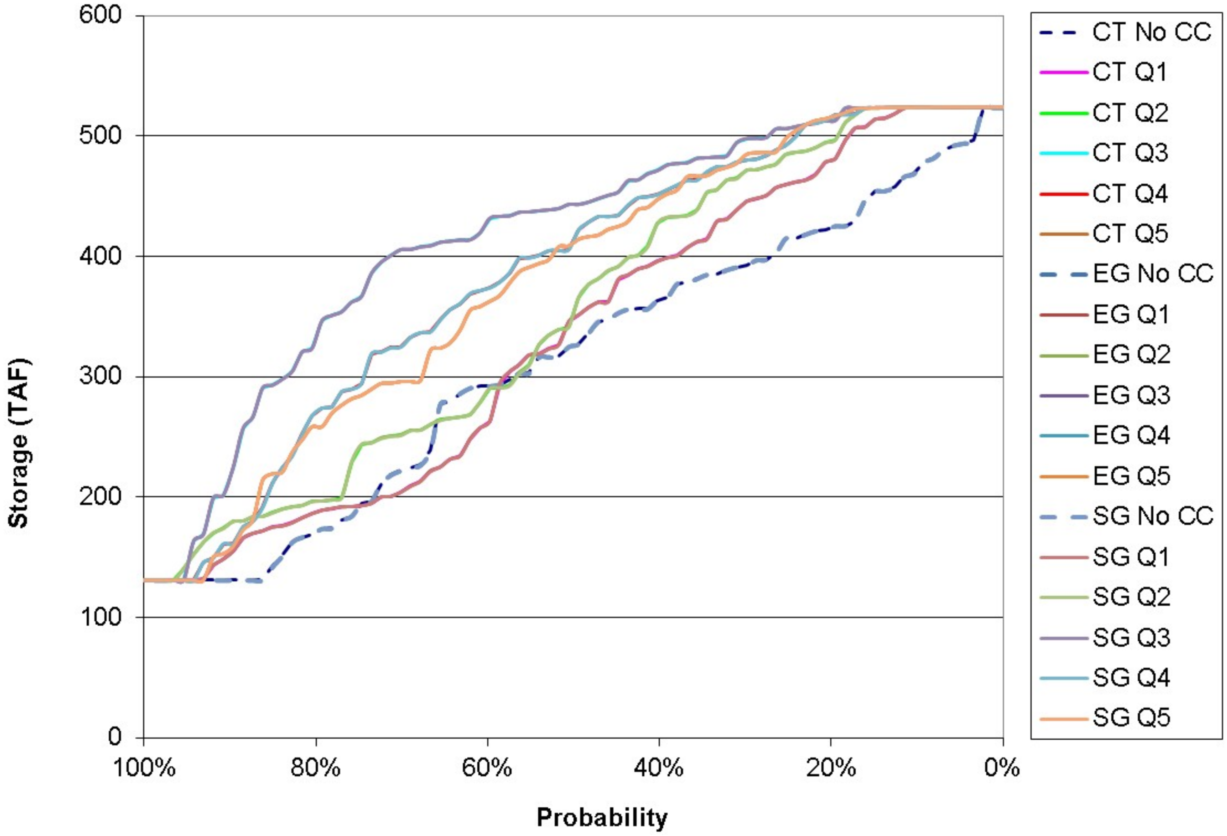
Key:
TAF = thousand acre feet

Figure 3-62. Exceedence of New Melones End-of-May Storage (TAF) in each Scenario



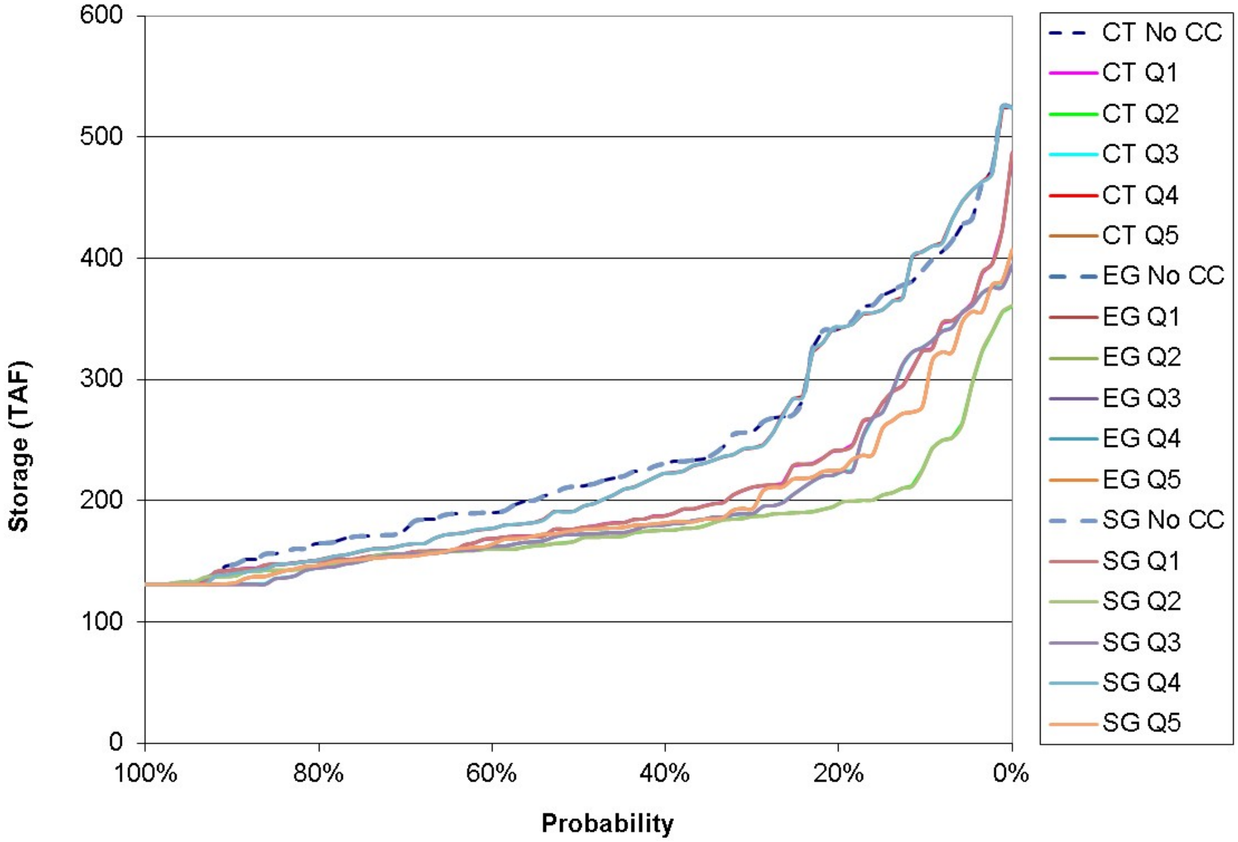
Key:
TAF = thousand acre feet

Figure 3-63. Exceedence of New Melones End-of-Sept Storage (TAF) in each Scenario



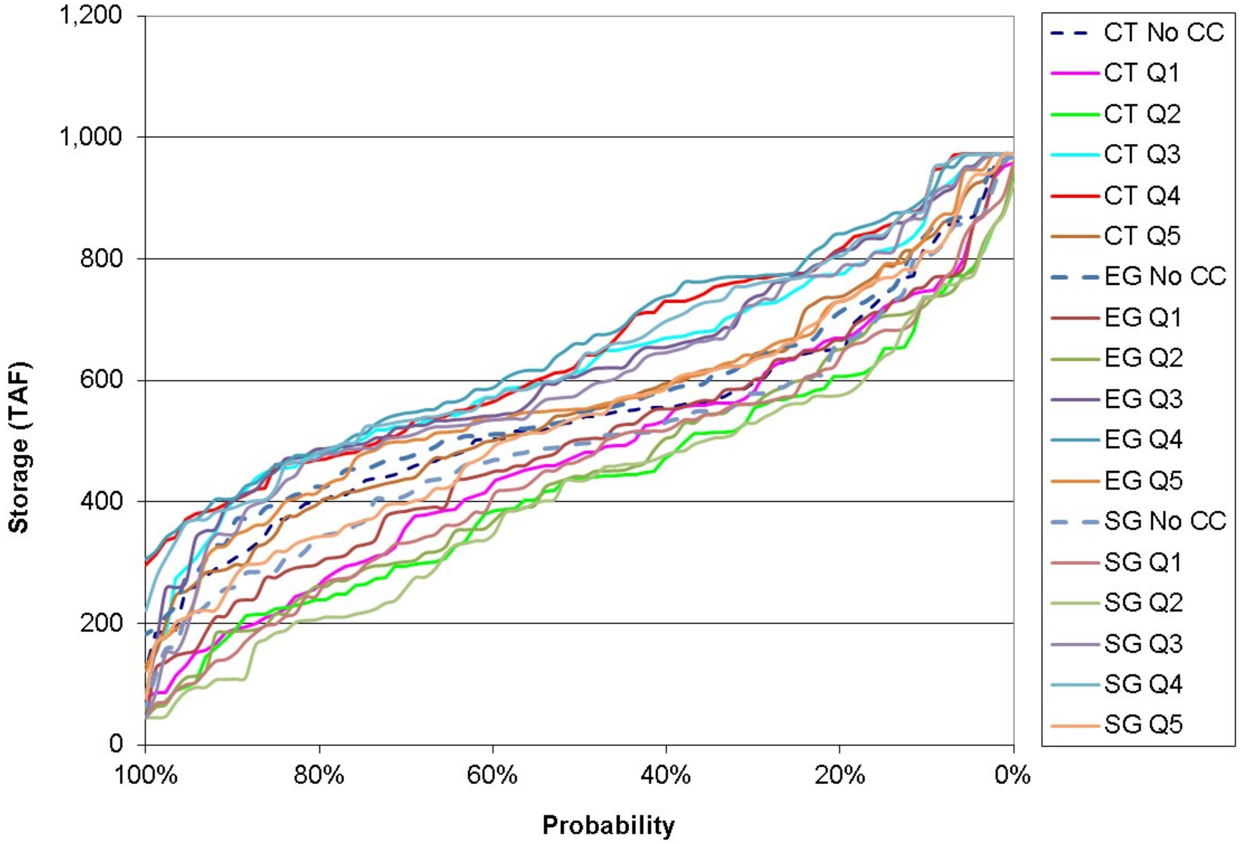
Key:
TAF = thousand acre feet

Figure 3-64. Exceedence of Millerton End-of-May Storage (TAF) in each Scenario



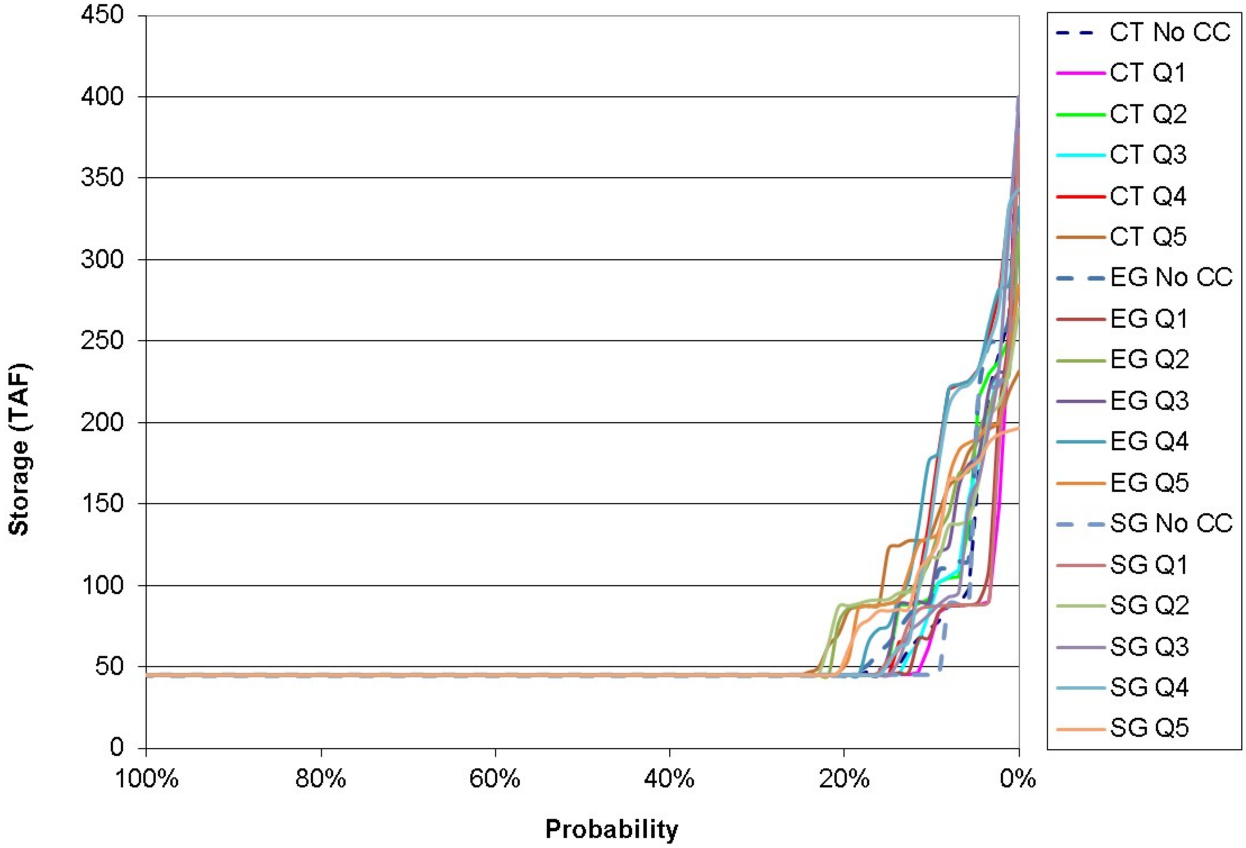
Key:
TAF = thousand acre feet

Figure 3-65. Exceedence of Millerton End-of-September Storage (TAF) in each Scenario



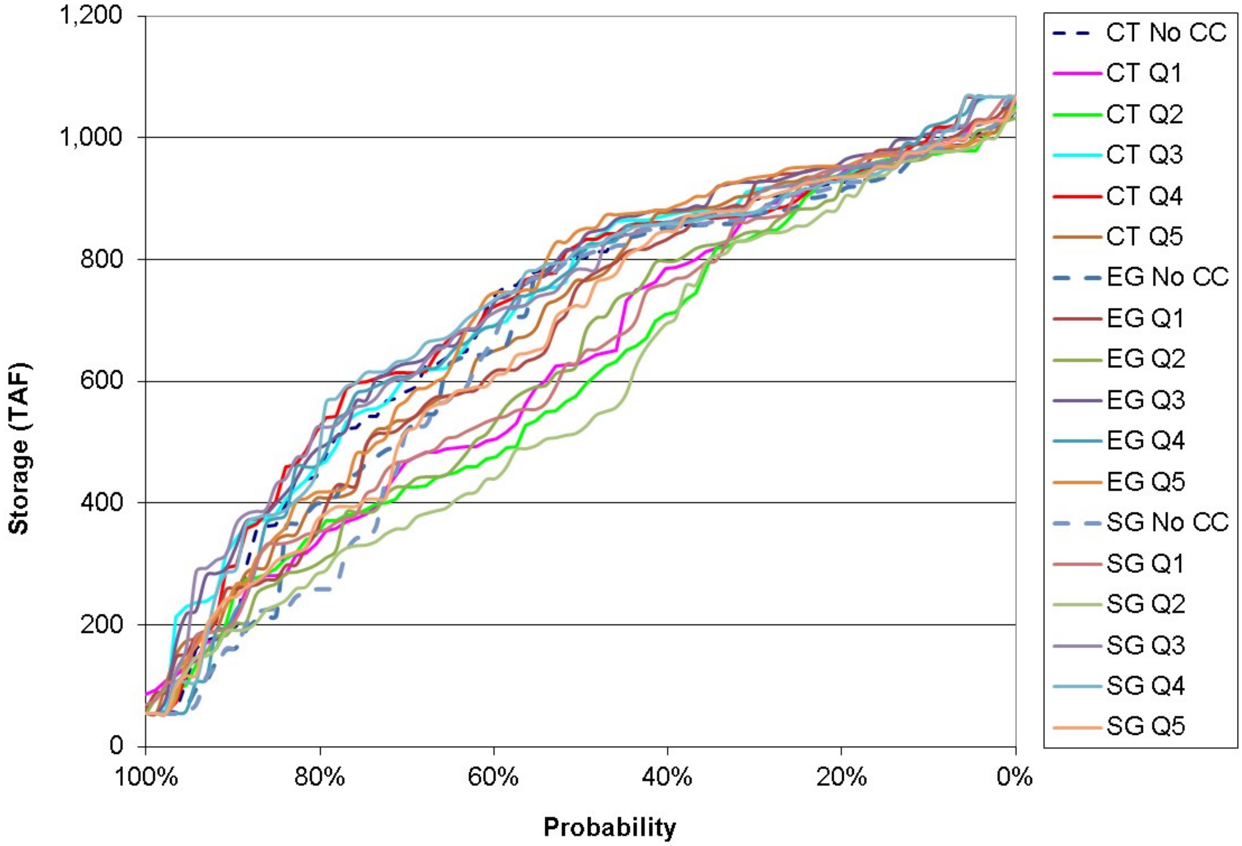
Key:
CVP = Central Valley Project
TAF = thousand acre feet

Figure 3-66. Exceedence of CVP San Luis End-of-May Storage (TAF) in each Scenario



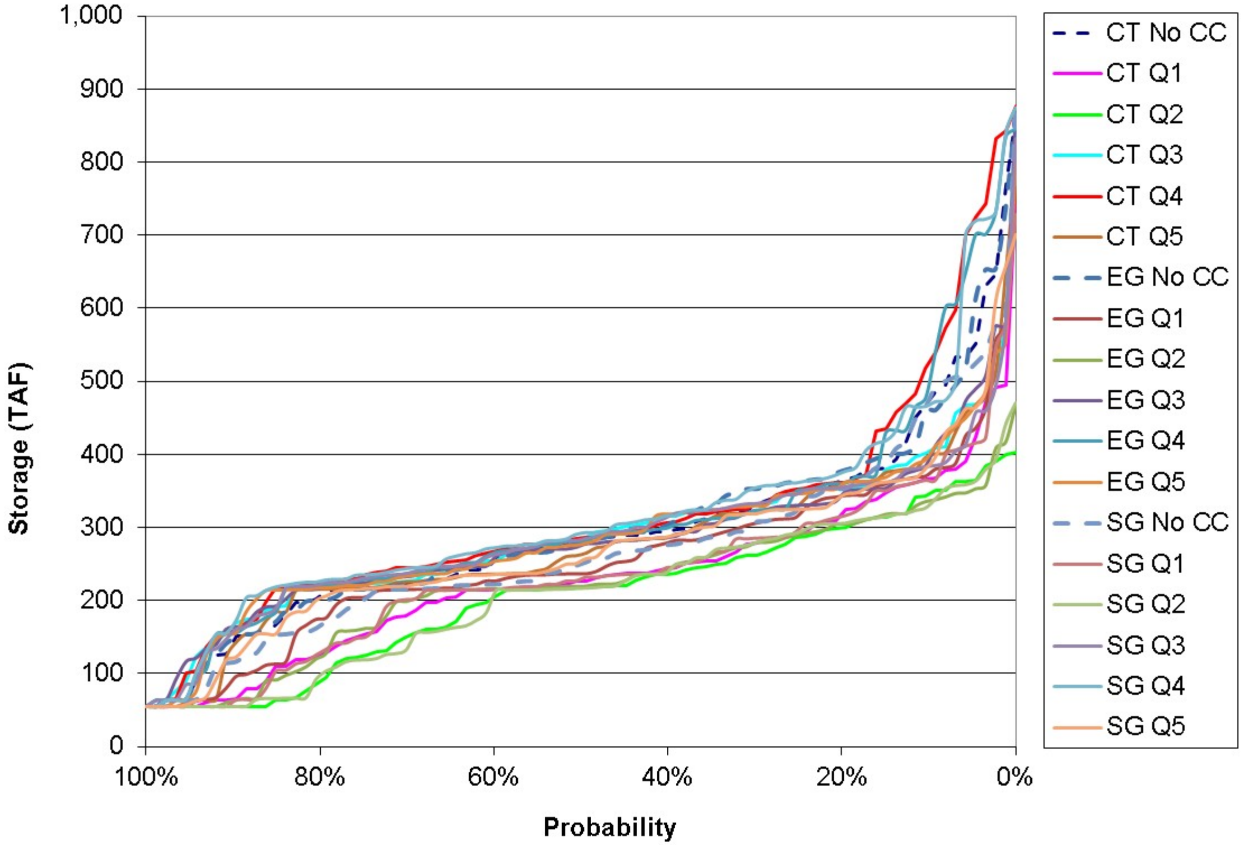
Key:
CVP = Central Valley Project
TAF = thousand acre feet

Figure 3-67. Exceedence of CVP San Luis End-of-September Storage (TAF) in each Scenario



Key:
SWP = State Water Project
TAF = thousand acre feet

Figure 3-68. Exceedence of SWP San Luis End-of-May Storage (TAF) in each Scenario

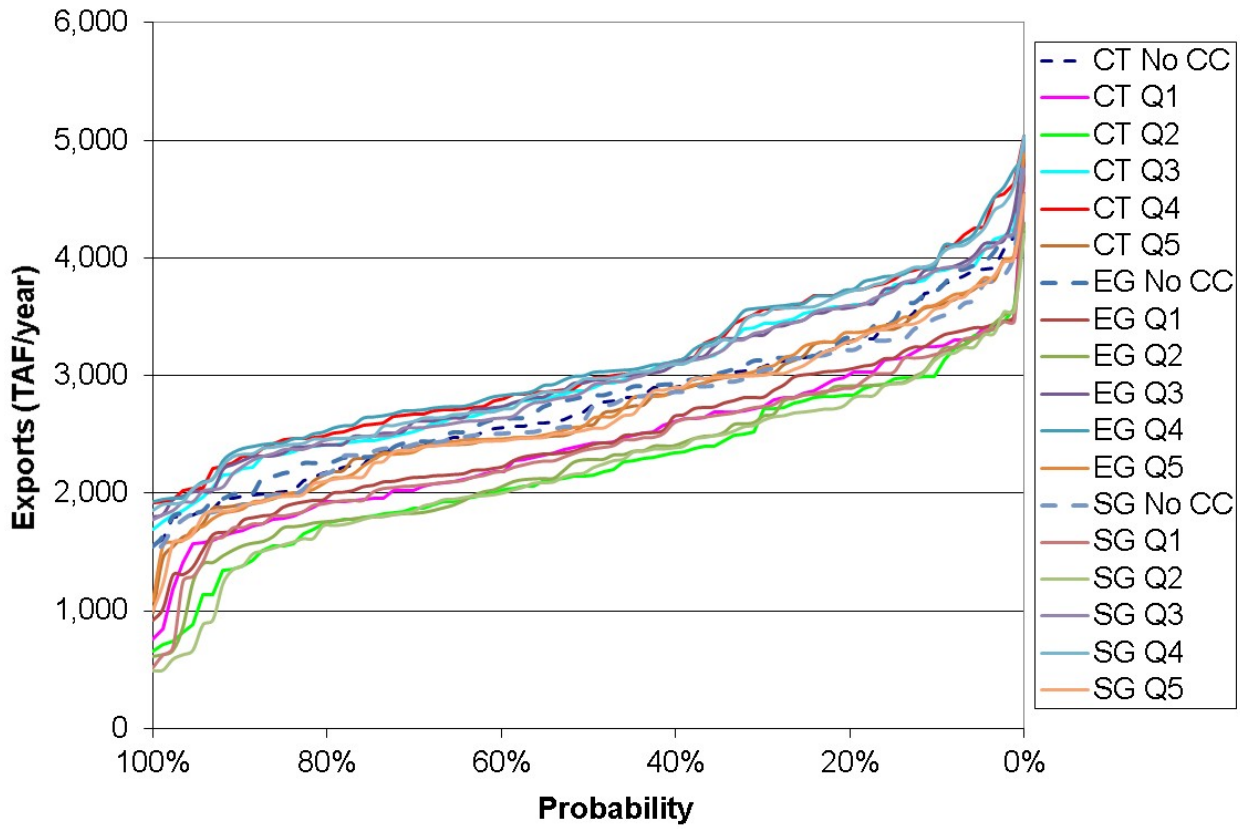


Key:
SWP = State Water Project
TAF = thousand acre feet

Figure 3-69. Exceedence of SWP San Luis End-of-September Storage (TAF) in each Scenario

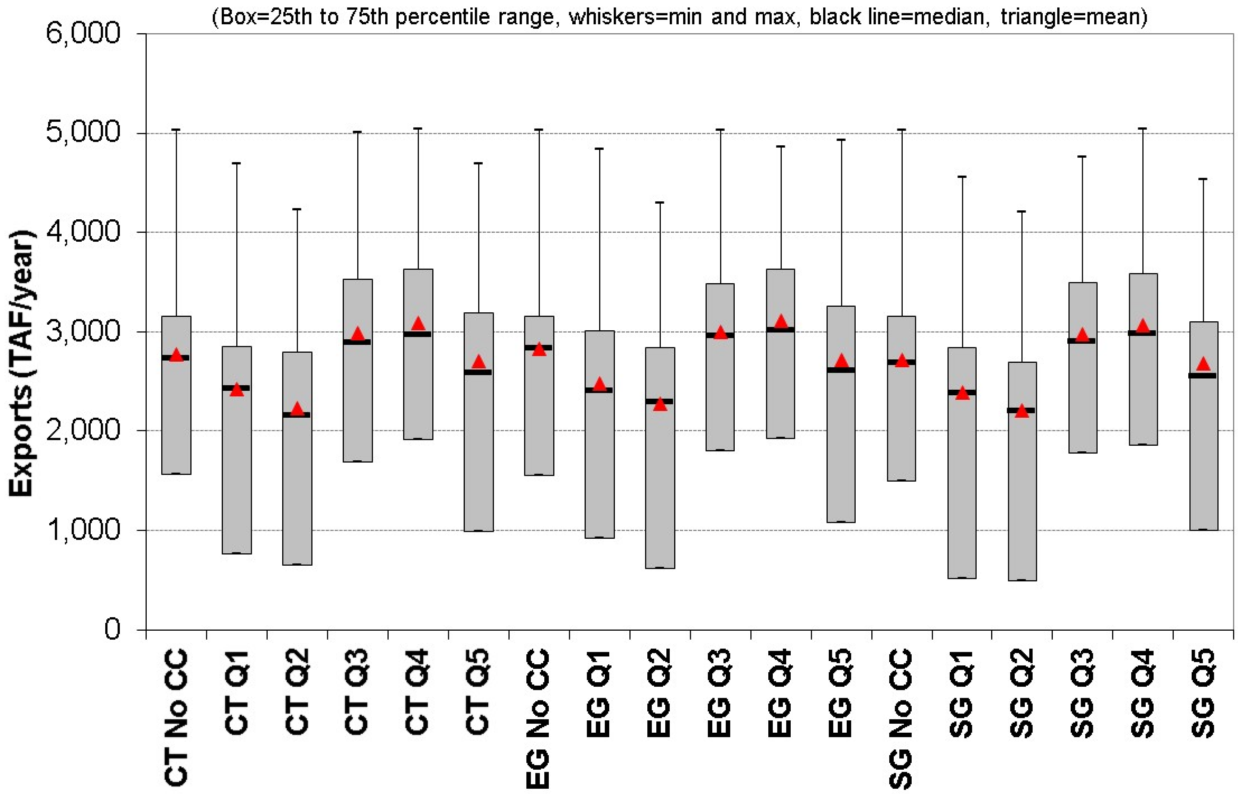
CVP and SWP Delta Exports and Delta Outflow Figure 3-70 through Figure 3-77 are annual exceedence plots and box plots of CVP and SWP exports at H.O. Banks and C.W. Jones pumping plants, Delta Exports and Outflow. The box plots depict the median (black bar), mean (red triangle), 25th and 75th percentile (gray rectangle), minimum and maximum values (line tip) for the annual flows at these same locations in each of the socioeconomic-climate scenarios. For both facilities, the socioeconomic scenarios exert only small influences on the Delta pumping and outflow whereas in both cases the drier climate projections (Q1 and Q2) result in exports below the No CC simulations. The central tendency projections (Q5) are slightly less than their corresponding No CC projections reflecting the fact that Q5 is slightly drier.

Delta exports and outflows are lower under climate scenarios Q5, Q1, and Q2 than under the corresponding No CC scenarios, with the lowest flows occurring in the warmer-drier Q2 scenario. Conversely, the annual flows at all three locations are greater under climate scenarios Q3 and Q4 than under their corresponding no climate change scenarios, with the highest flows occurring in the less warm-wetter Q4 scenario. The drier climate scenarios (Q1 and Q2) show a greater difference in Delta exports relative to their corresponding no climate change scenarios than do the wetter climate scenarios (Q3 and Q4) because exports in the wetter climate scenarios are frequently limited by Delta conveyance capacities and Delta regulatory requirements. Total Delta exports are about 0.2 MAF/year and outflows 0.6 MAF/year lower for the central tendency Q5 than without climate change. For the warmer, drier Q2 projection, Delta exports is approximately 1.2 MAF/year lower and outflow ranges from 4.2 to 5.0 MAF/year lower under Q2 than under their corresponding no climate change scenarios. Conversely, total exports are about 0.5 MAF/year higher and Delta outflow is ranges from 6.0 to 6.2 MAF/year higher under the wetter Q4 projections than under the no climate change scenarios.



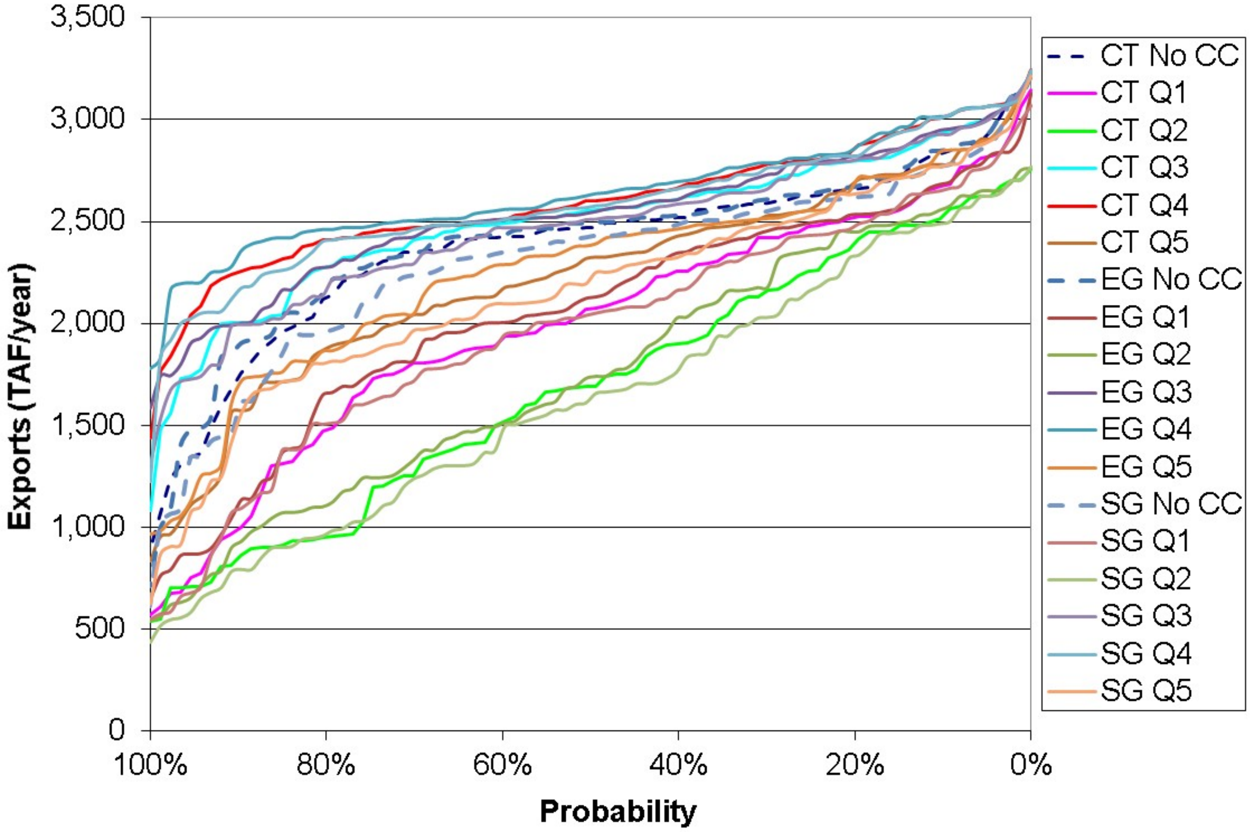
Key:
TAF = thousand acre feet

Figure 3-70. Annual Exceedence of Banks Pumping (TAF/year) in each Scenario



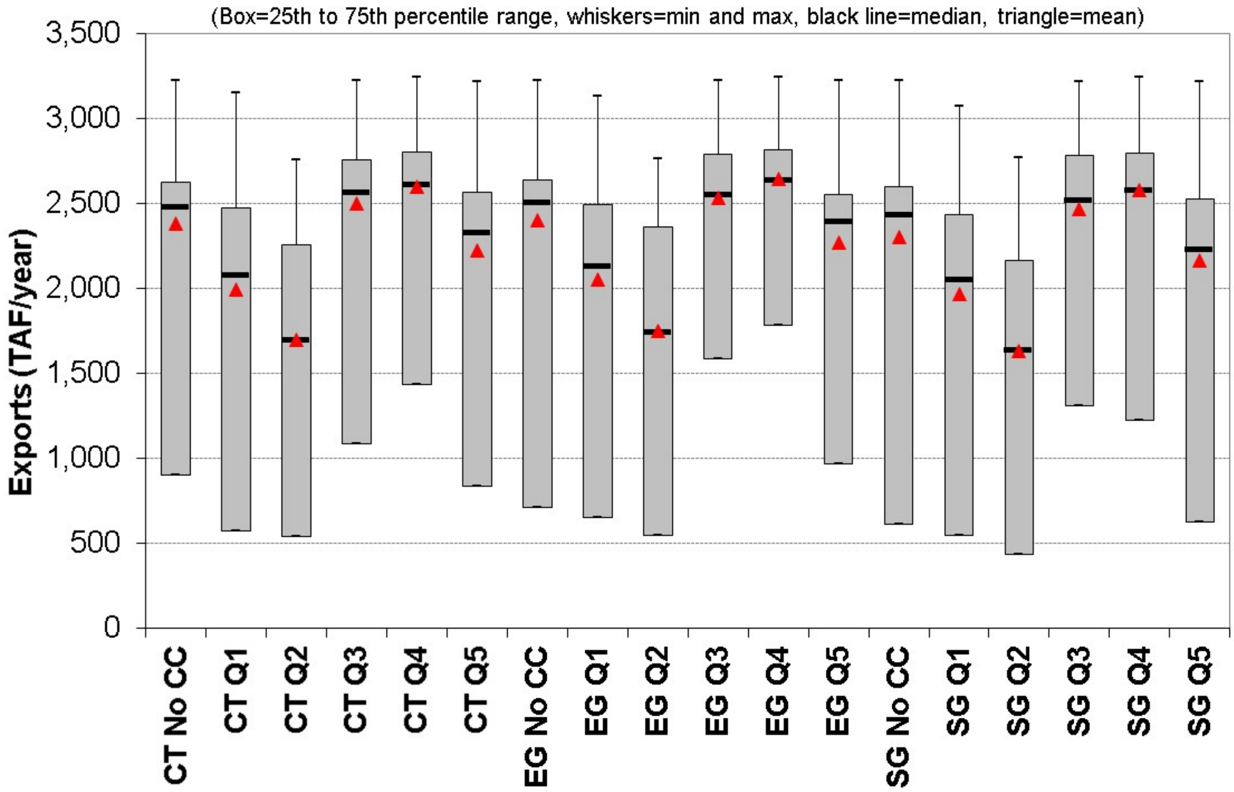
Key:
TAF = thousand acre feet

Figure 3-71. Box Plot of Annual Banks Pumping (TAF/year) in each Scenario



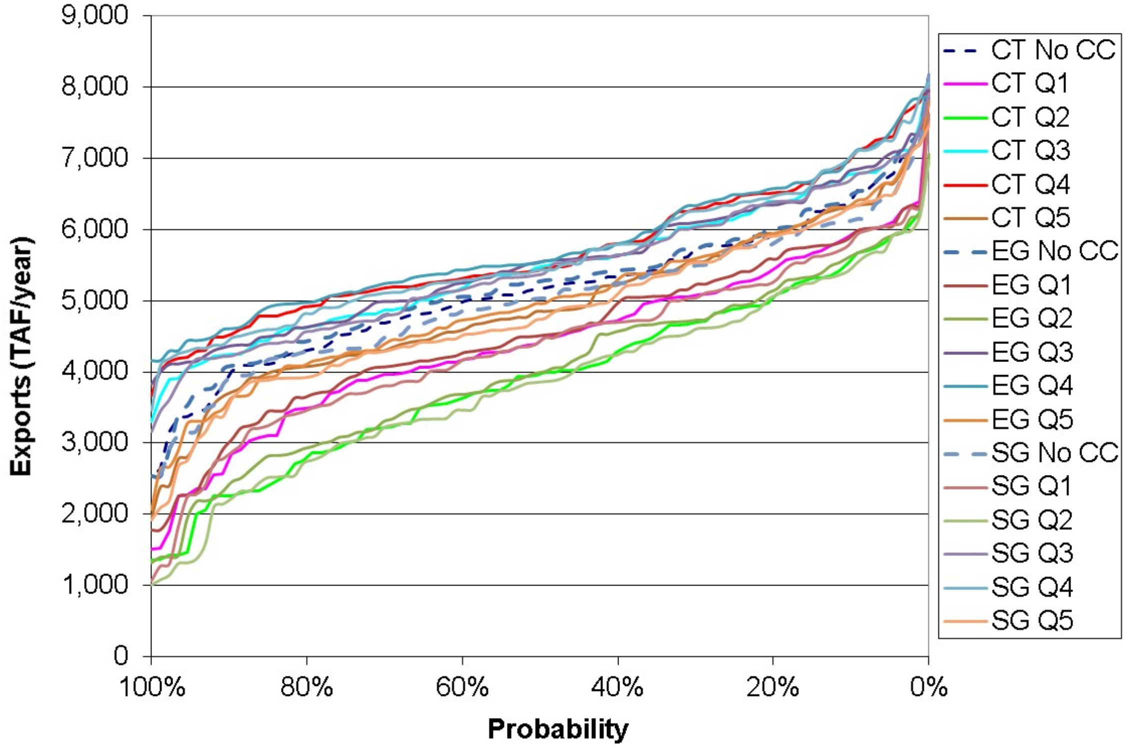
Key:
TAF = thousand acre feet

Figure 3-72. Annual Exceedence of Jones Pumping (TAF/year) in each Scenario



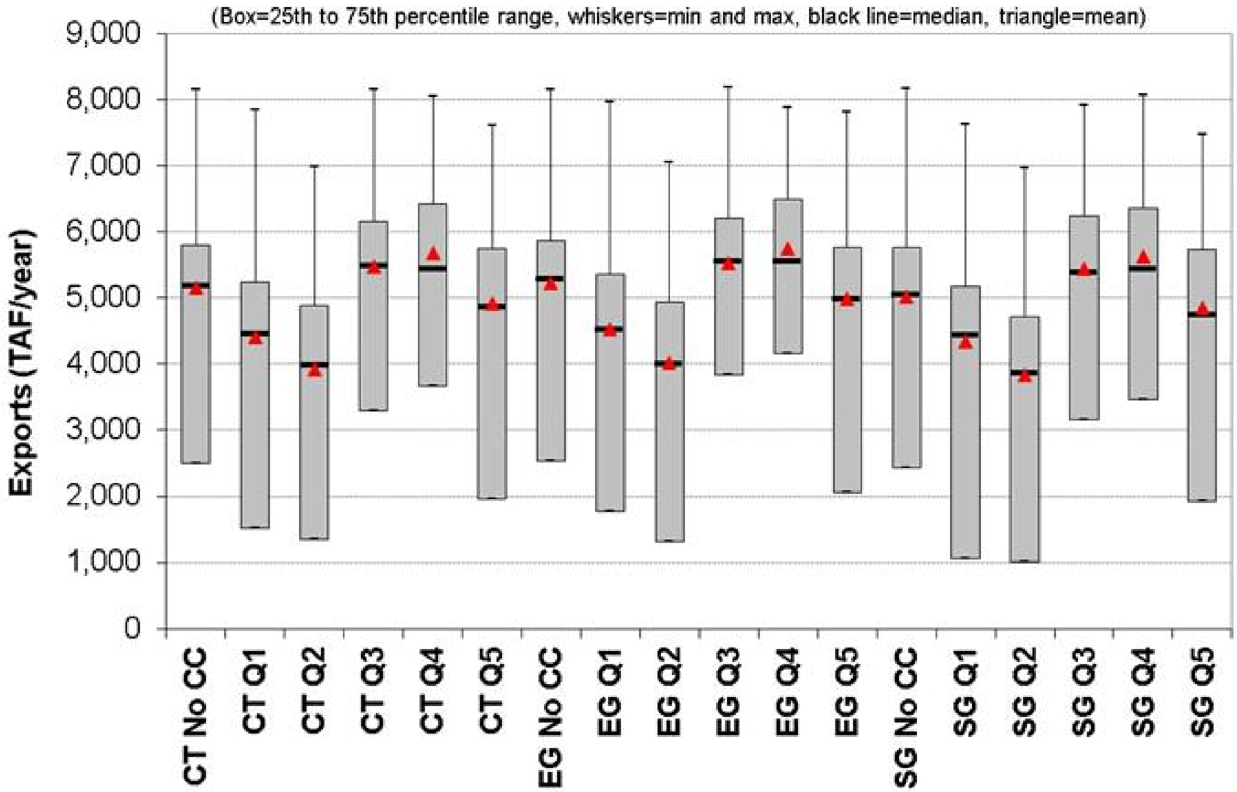
Key:
TAF = thousand acre feet

Figure 3-73. Box Plot of Annual Jones Pumping (TAF/year) in each Scenario



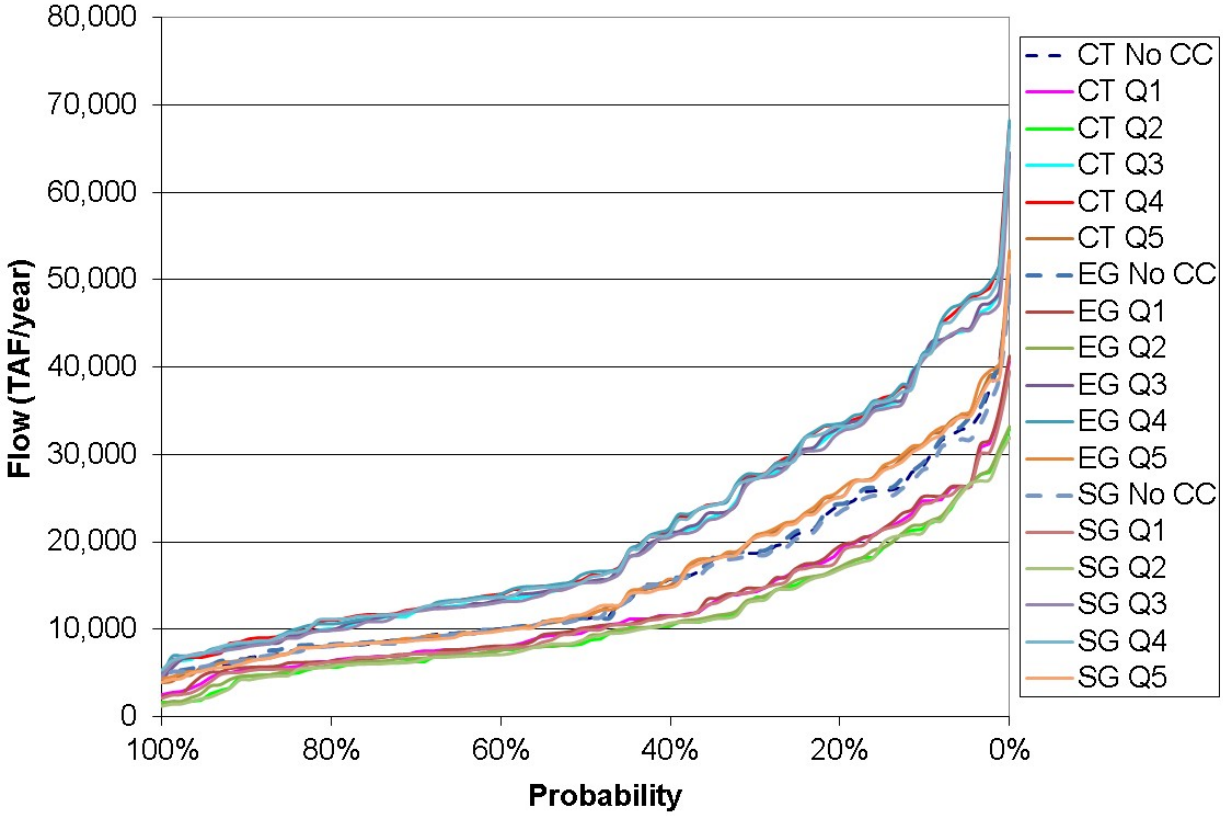
Key:
TAF = thousand acre feet

Figure 3-74. Exceedence of Total Annual Delta Exports Pumping (TAF/year) in each Scenario



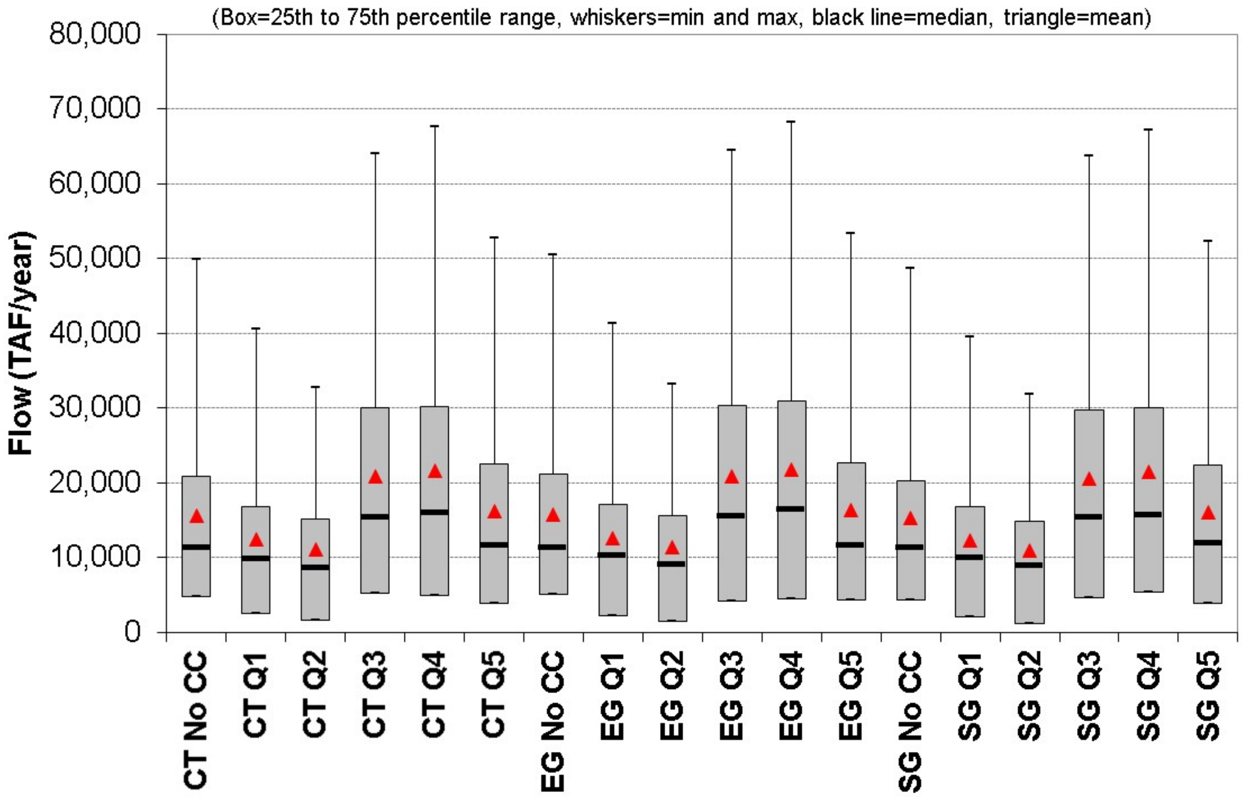
Key:
TAF = thousand acre feet

Figure 3-75. Box Plot of Total Annual Delta Exports (TAF/year) in each Scenario



Key:
TAF = thousand acre feet

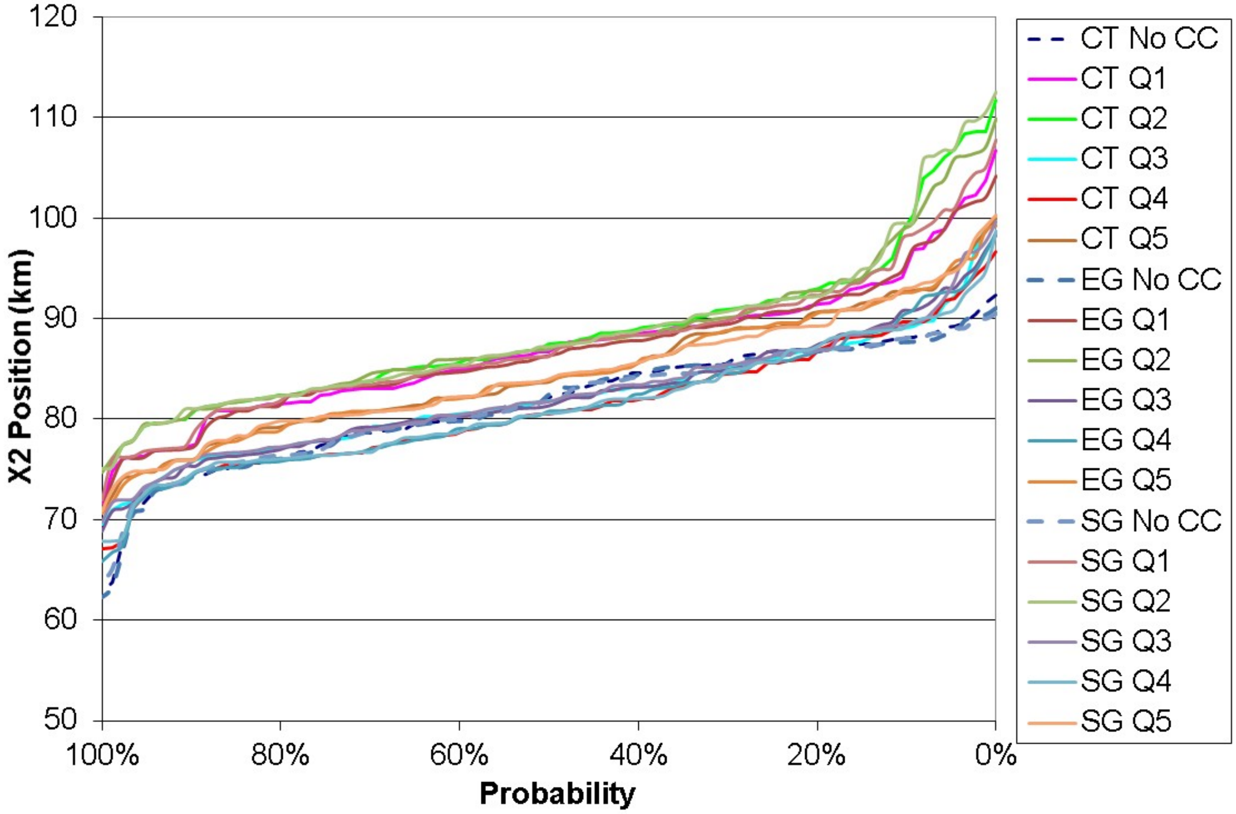
Figure 3-76. Annual Exceedence of Total Annual Delta Outflow (TAF/year) in each Scenario



Key:
TAF = thousand acre feet

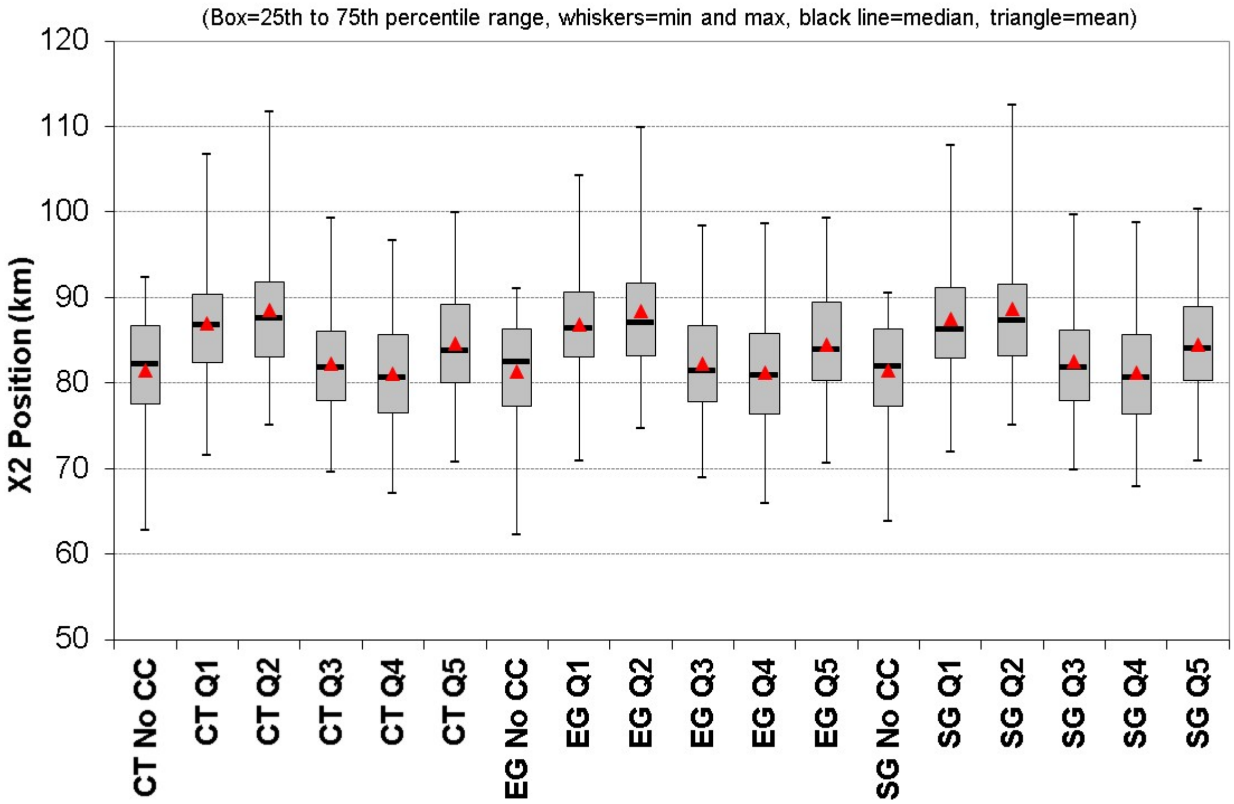
Figure 3-77. Box Plot of Total Annual Delta Outflow (TAF/year) in each Scenario

Delta Salinity Figure 3-76 and Figure 3-77 show exceedence and box plots of the average distance measured from the Golden Gate Bridge of the X2 (2 parts per thousand salinity concentration) position from February through June for each of the socioeconomic-climate scenarios. Greater X2 positions indicate that salinity has moved further eastward into the Delta. The period from February through June is when CVP and SWP reservoirs are operated to maintain certain regulatory requirements concerning the location of X2 within the Delta. As with the other system metrics, the X2 results are very similar between the different socioeconomic scenarios but differ significantly relative to the different climate scenarios. The X2 position results under the wetter climate scenarios (Q3 and Q4) are similar to those of their corresponding no climate change scenarios because the increased flows into the Delta in those wetter scenarios compensate for the increased sea level rise. The average X2 distance in the wetter Q4 climate is about 0.4 kilometer (km) further to the east than without climate change. However, the X2 location is greater under the central tendency Q5 than the no climate change scenario by approximately 3 km eastward. The largest changes occur under the warmer-drier Q2 scenario in which the average X2 distance from February through June is about 7 km further east with respect to the no climate change scenarios.



Key:
km = kilometer

Figure 3-76. Exceedence of Average February-to-June X2 Position (km) in each Scenario



Key:
km = kilometer

Figure 3-77. Box Plot of Average February-to-June X2 Position (km) in each Scenario

Supplies and Demands in CVP Divisions

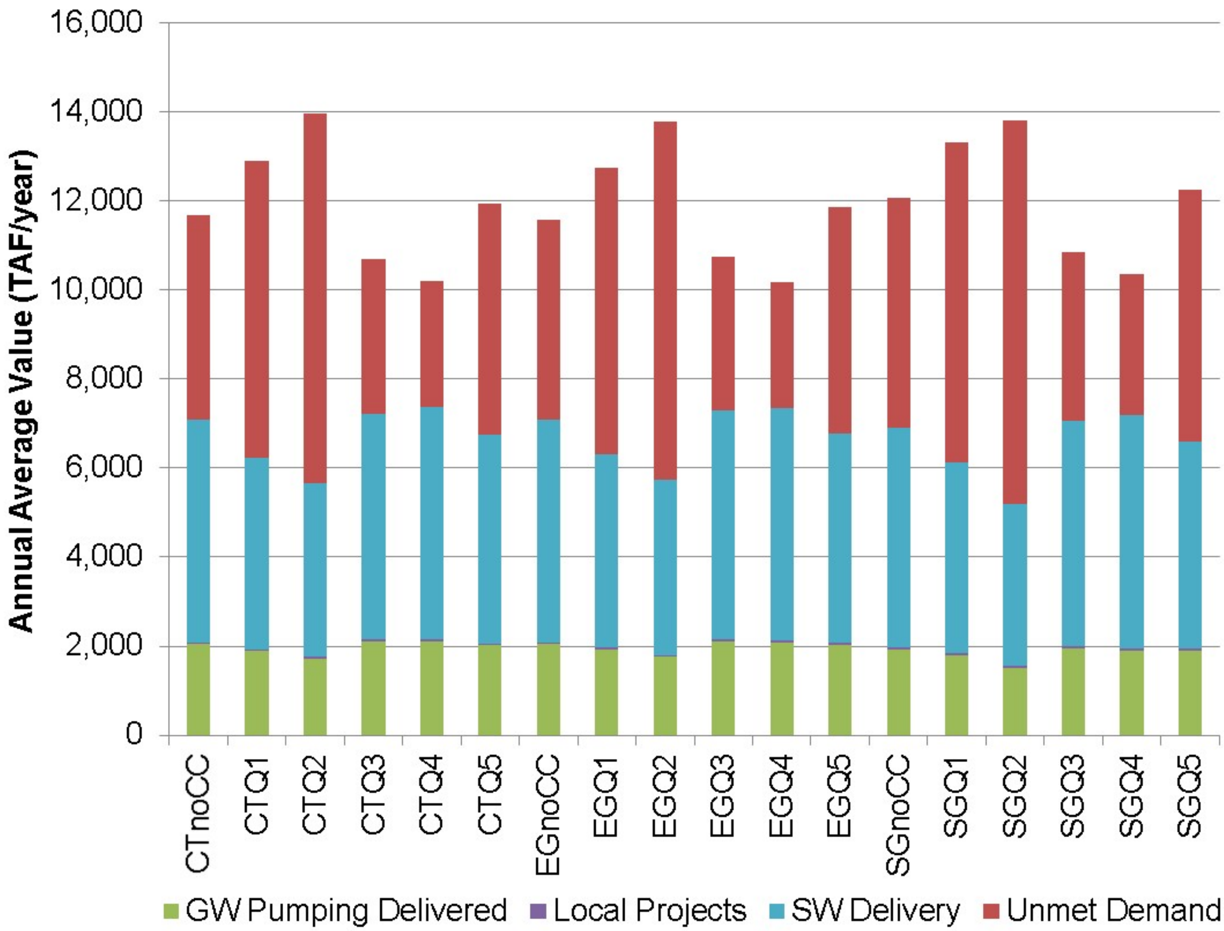
Figure 3-78 shows the average annual total CVP Service Area water supplies from various sources during the 21st century including surface water, groundwater and local supply projects. Also shown on the figure is the average annual unmet demand (defined as total demands minus surface water deliveries, groundwater pumping and the effects of any local supply enhancement actions) for the CVP Service Area under each socioeconomic-climate scenario. The effects of differences in climate are more significant than the socioeconomic scenarios. Local project supplies are relatively small compared to other sources in all the scenarios.

Over the 21st century, the average unmet demands in the CVP Service area range from 2.8 – 8.6 MAF/year. The central tendency Q5 unmet demands are approximately 0.6 MAF/ year greater than their corresponding no climate change scenarios. The largest unmet demands ranging from increases of 3.4 to

3.7 MAF/year occur in the warmer-drier Q2 scenarios while unmet demands decreases ranging from 1.6 to 1.9 MAF/year occur in less warming-wetter Q4 climate scenarios.

Average annual surface water deliveries in the CVP Service area range from a minimum of 3.7 to a maximum of 5.1 MAF/year. The central tendency Q5 surface water deliveries are approximately 0.3 MAF/ year less than without climate change. The surface water deliveries in the warmer-drier Q2 scenarios range from 1.0 to 1.3 MAF/year less than the without climate change scenarios while increases in surface water deliveries relative to no climate change ranging from 0.2 to 0.3 MAF/year occur in less warming-wetter Q4 climate scenarios.

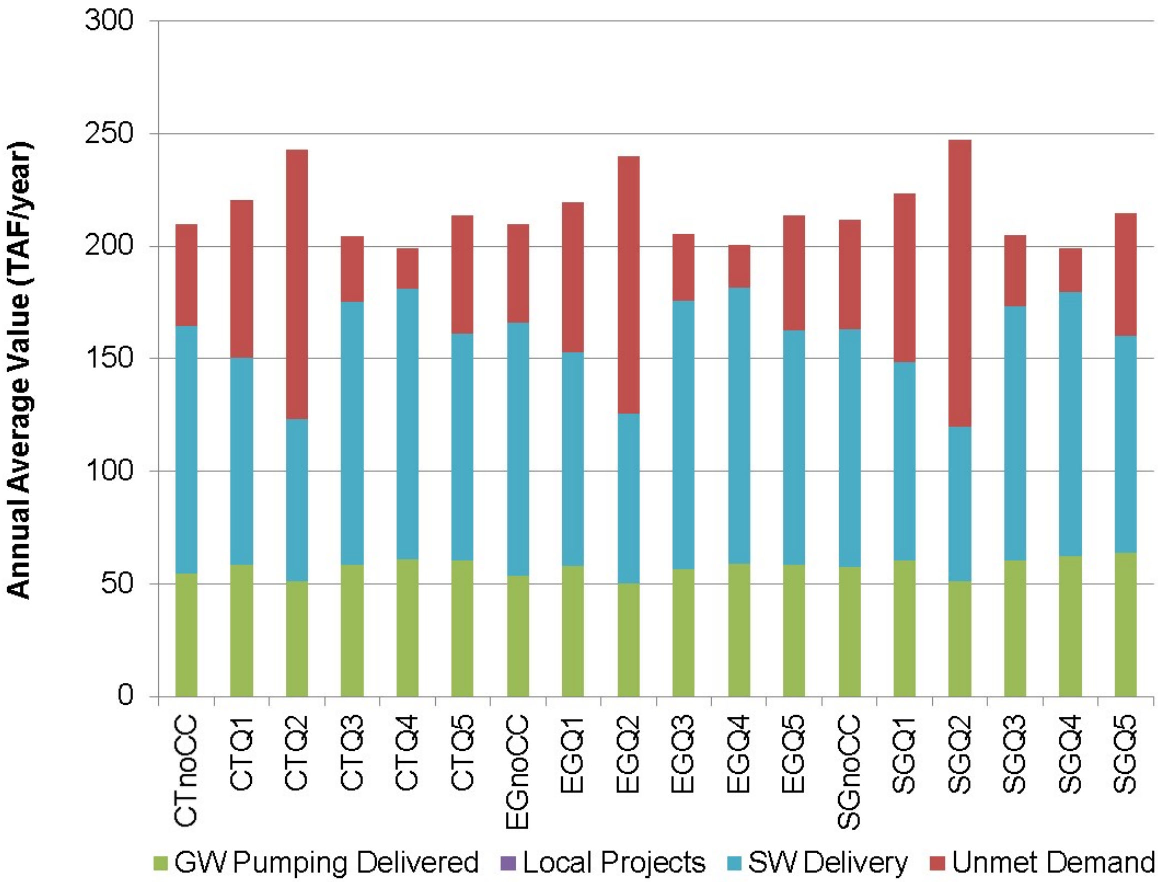
Overall average CVP Service area groundwater pumping ranges from 1.5 to 2.1 MAF/year. The greatest groundwater usage occurs in the wetter Q3 and Q4 scenarios because under these conditions increased aquifer recharge maintains groundwater levels sufficiently high that pumping is not as constrained as in the drier Q1 and Q2 scenarios. The use of groundwater as a source of supply in the CVP IRP CalLite model was constrained to not exceeding historic minimum groundwater levels. The central tendency Q5 groundwater usage is approximately 0.03 MAF/ year less than without climate change. Groundwater extraction in the warmer-drier Q2 scenarios range from 0.3 to 0.4 MAF/year less than the without climate change scenarios while in less warming-wetter Q4 climate scenarios groundwater usage relative to no climate change ranges from a slight increase 0.04 MAF/year to slight decrease 0.02 MAF/year.



Key:
CVP = Central Valley Project
GW = groundwater
SW = surface water
TAF = thousand acre feet

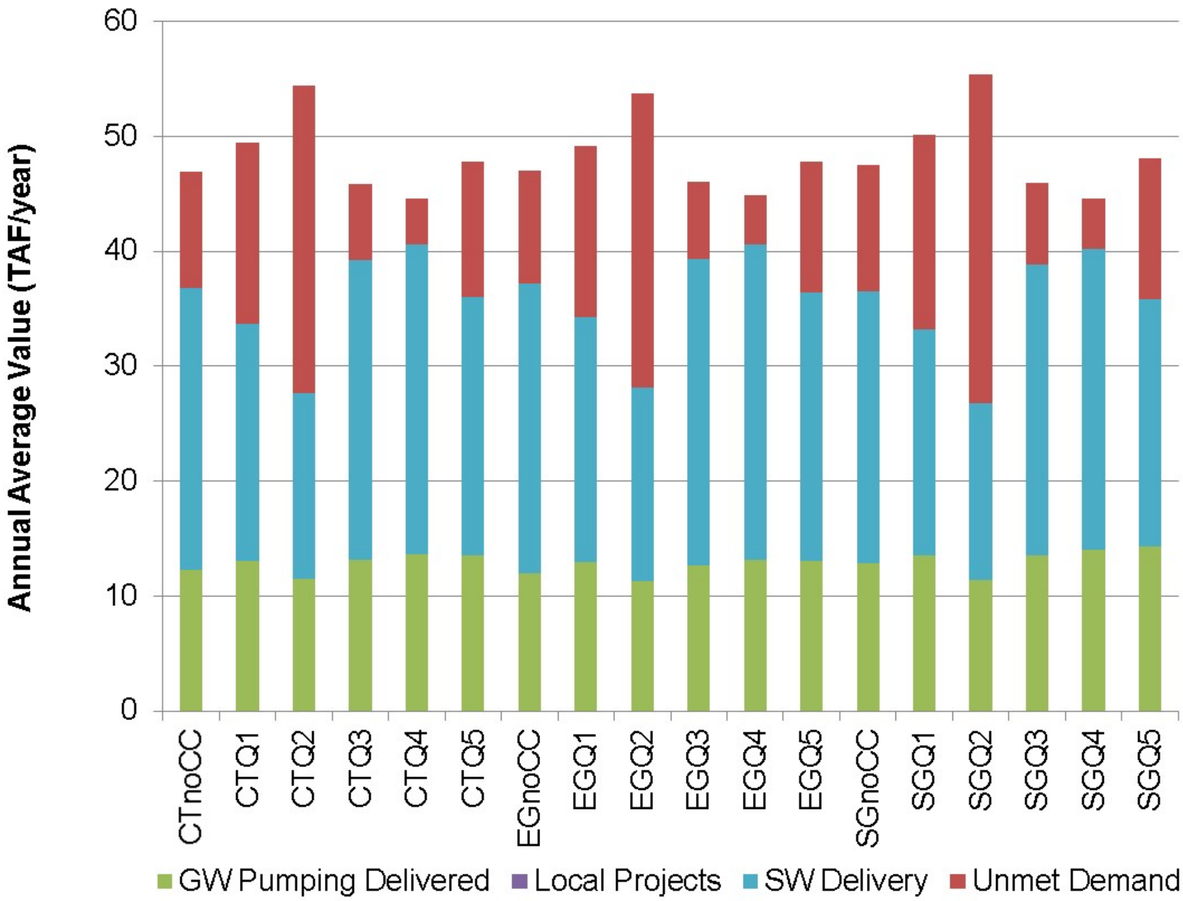
Figure 3-78. Average Annual Supplies and Unmet Demand (TAF/year) in the CVP Service Area in each Scenario

Figure 3-79 through Figure 3-87 present similar information for each of the CVP Divisions. Simulated unmet demands exist in all CVP Divisions with the exception of the American River Division. The largest unmet demands occur in the Friant Division. In general, the magnitude of unmet demands primarily reflects the amount of agricultural demand in the service area. In most of the Divisions, the differences between socioeconomic-climate scenarios exhibit the same relationships as described above for the overall CVP Service Area. In the San Felipe Division there is more differentiation in total demand between the socioeconomic scenarios as compared to the other Divisions because increases in urban demands are not offset by reductions in agricultural demand. In addition, the San Felipe Division demands do not differ between different climate scenarios because they were not simulated in WEAP-CV. Because of this, in the Slow Growth scenario, the San Felipe Division does not fully use all of its potential groundwater supplies because demands are low enough that not all potential groundwater pumping is required to fully meet demands in most years.



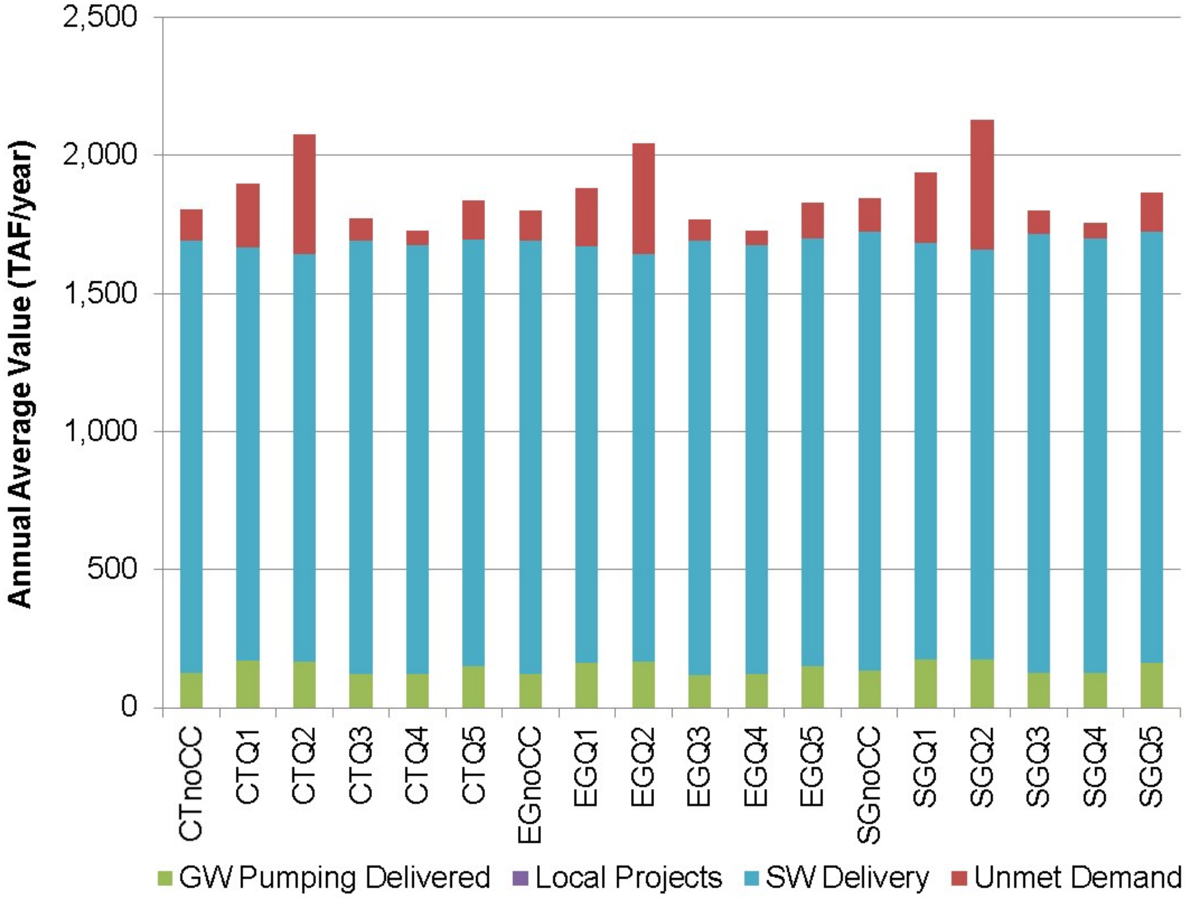
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-79. Average Annual Supplies and Unmet Demand (TAF/year) in the Shasta Division in each Scenario



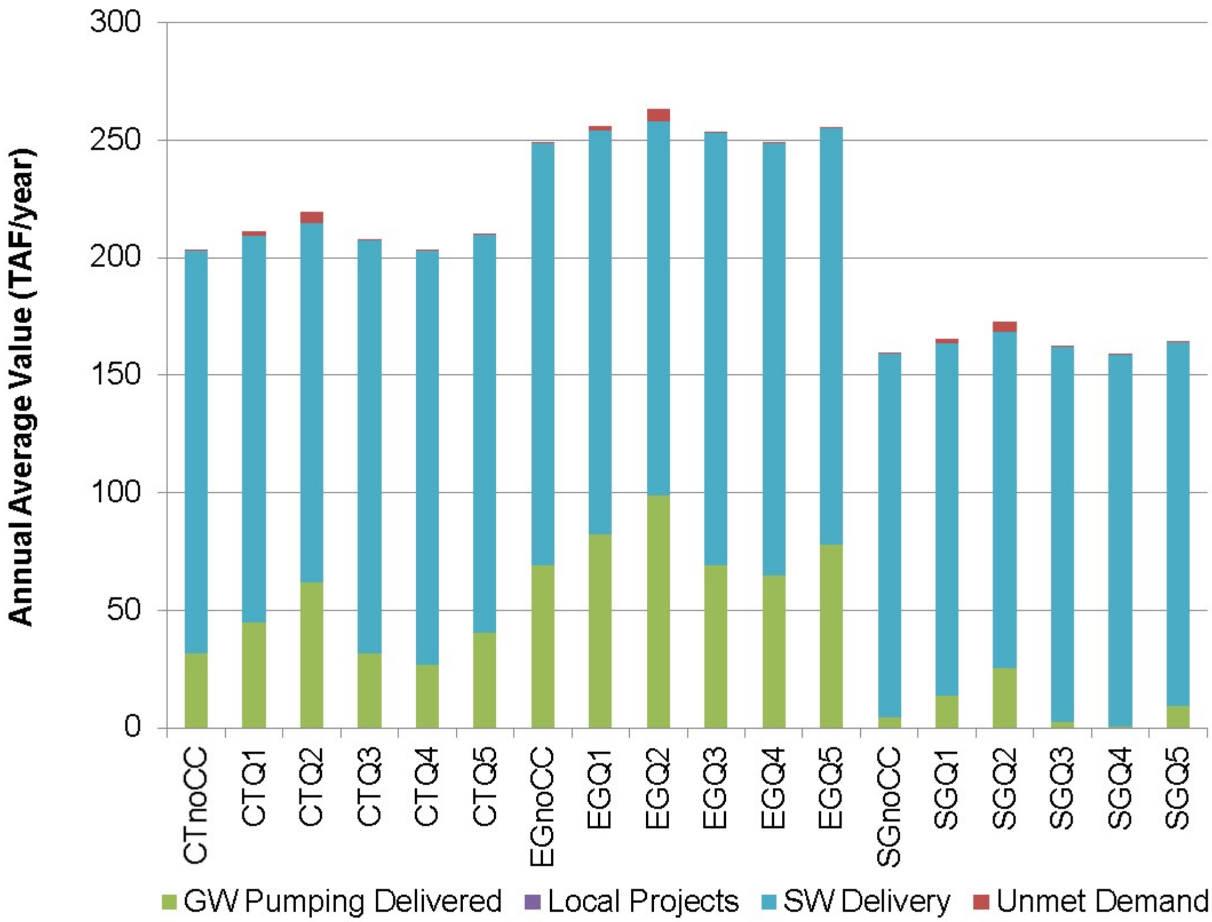
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-80. Average Annual Supplies and Unmet Demand in the Trinity River Division (TAF/year) in each Scenario



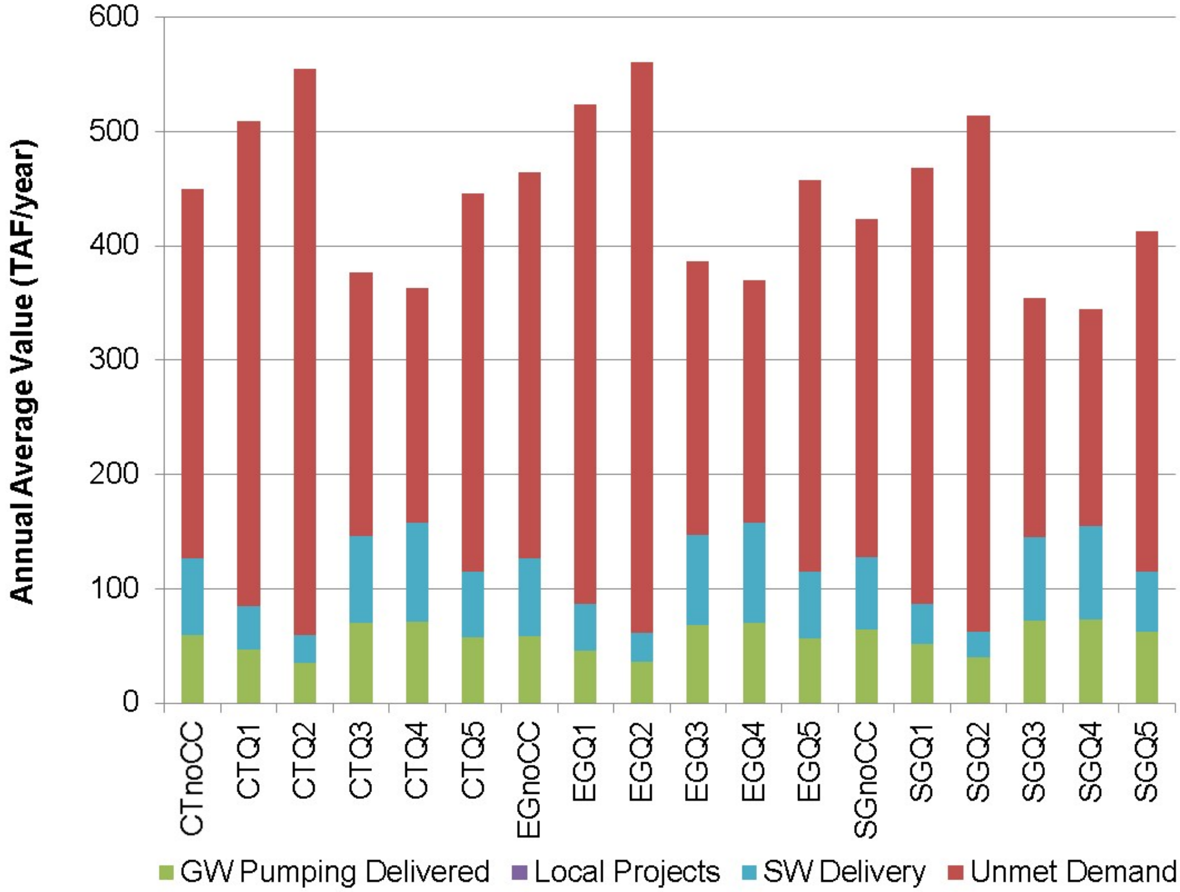
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-81. Average Annual Supplies and Unmet Demand (TAF/year) in the Sacramento River Division in each Scenario



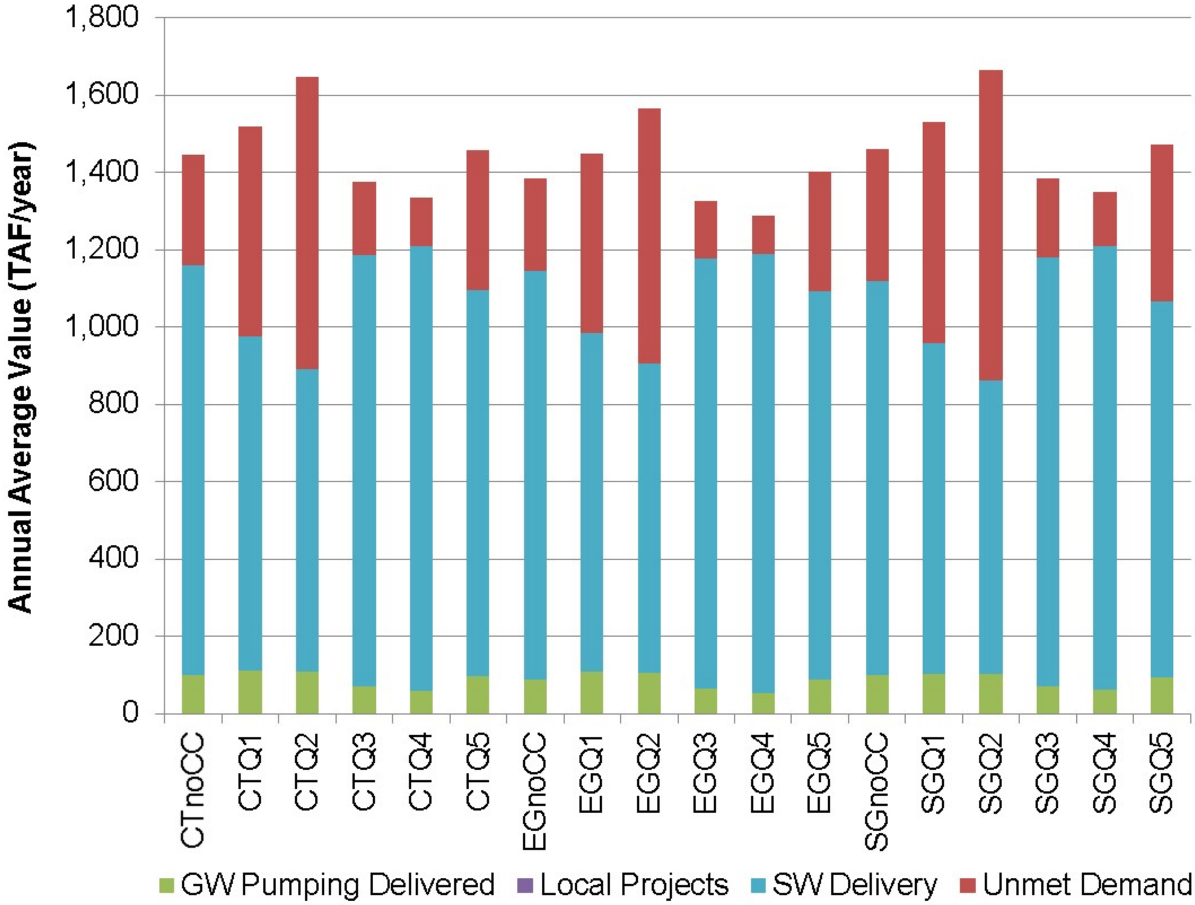
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-82. Average Annual Supplies and Unmet Demand (TAF/year) in the American River Division in each Scenario



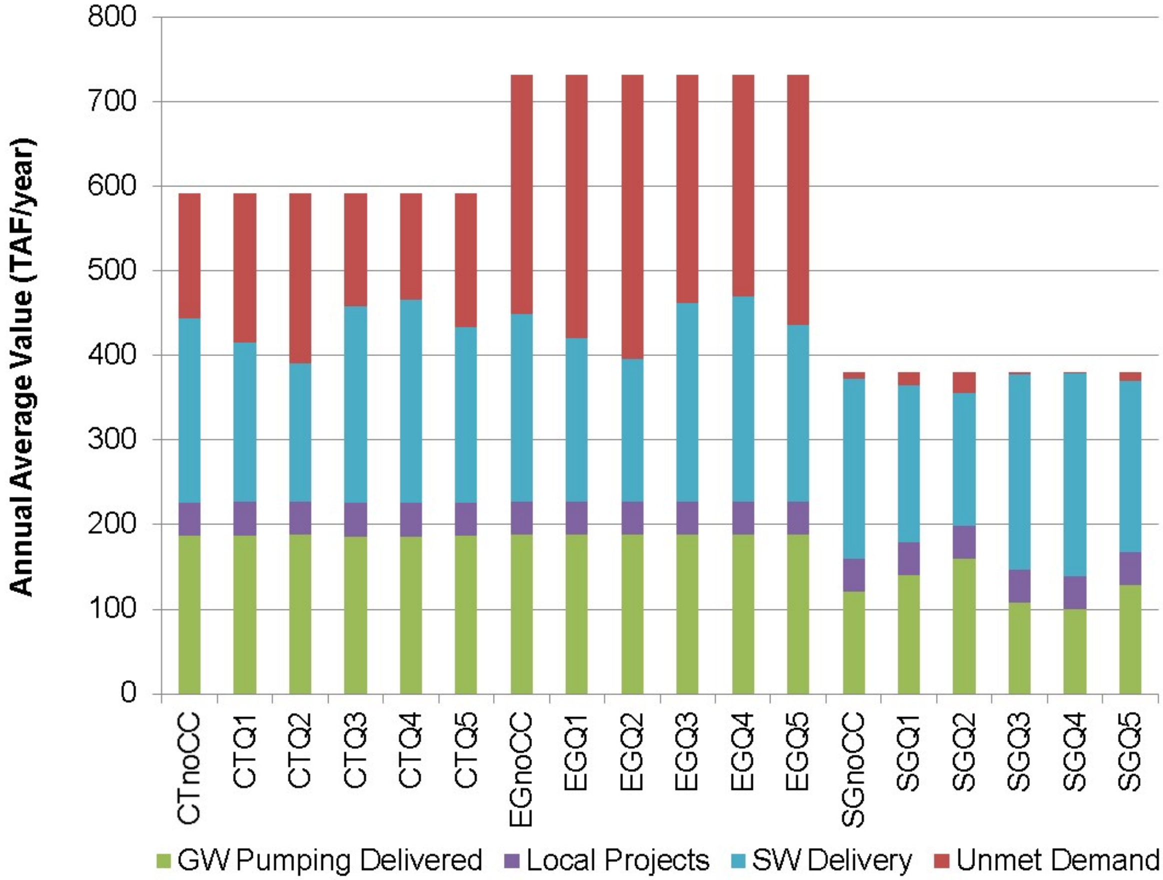
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-83. Average Annual Supplies and Unmet Demand (TAF/year) in the Eastside Division in each Scenario



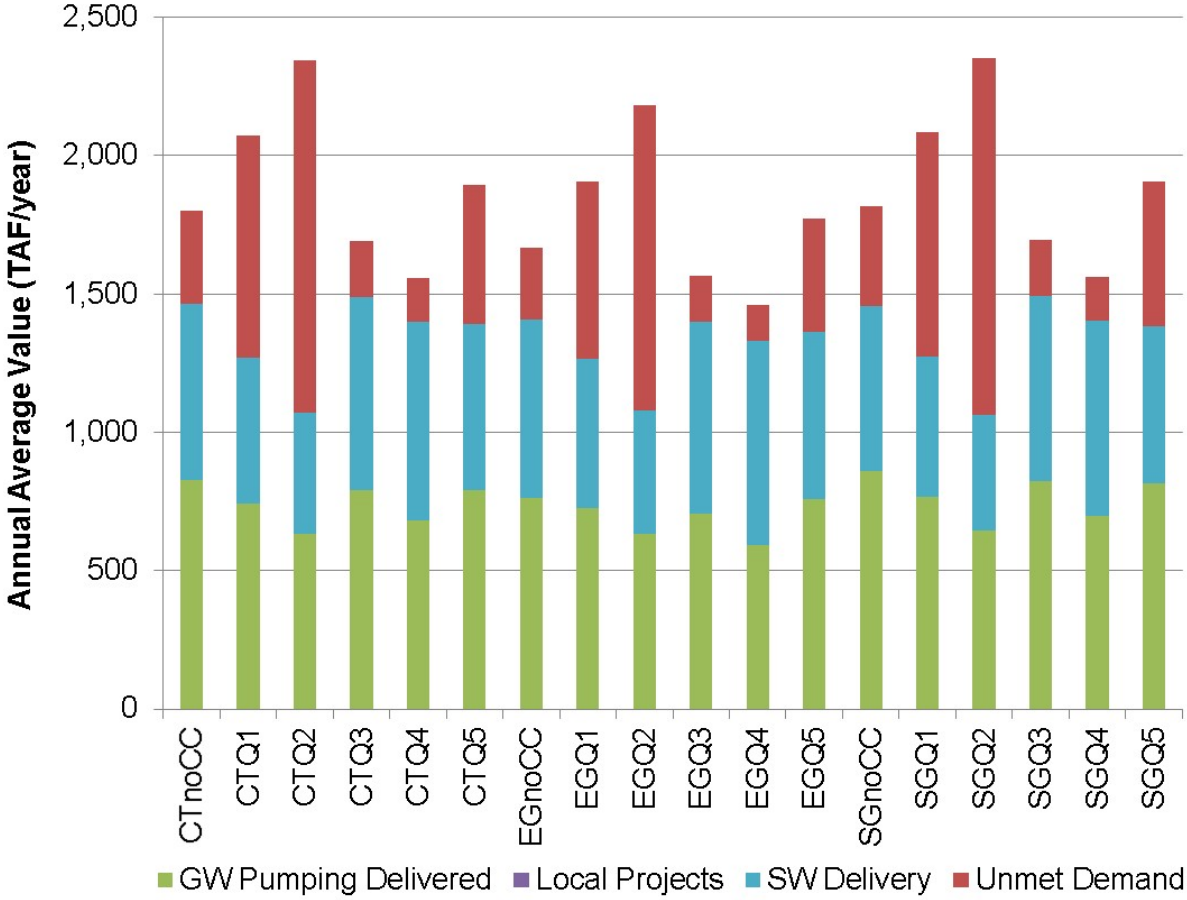
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-84. Average Annual Supplies and Unmet Demand (TAF/year) in the Delta Division in each Scenario



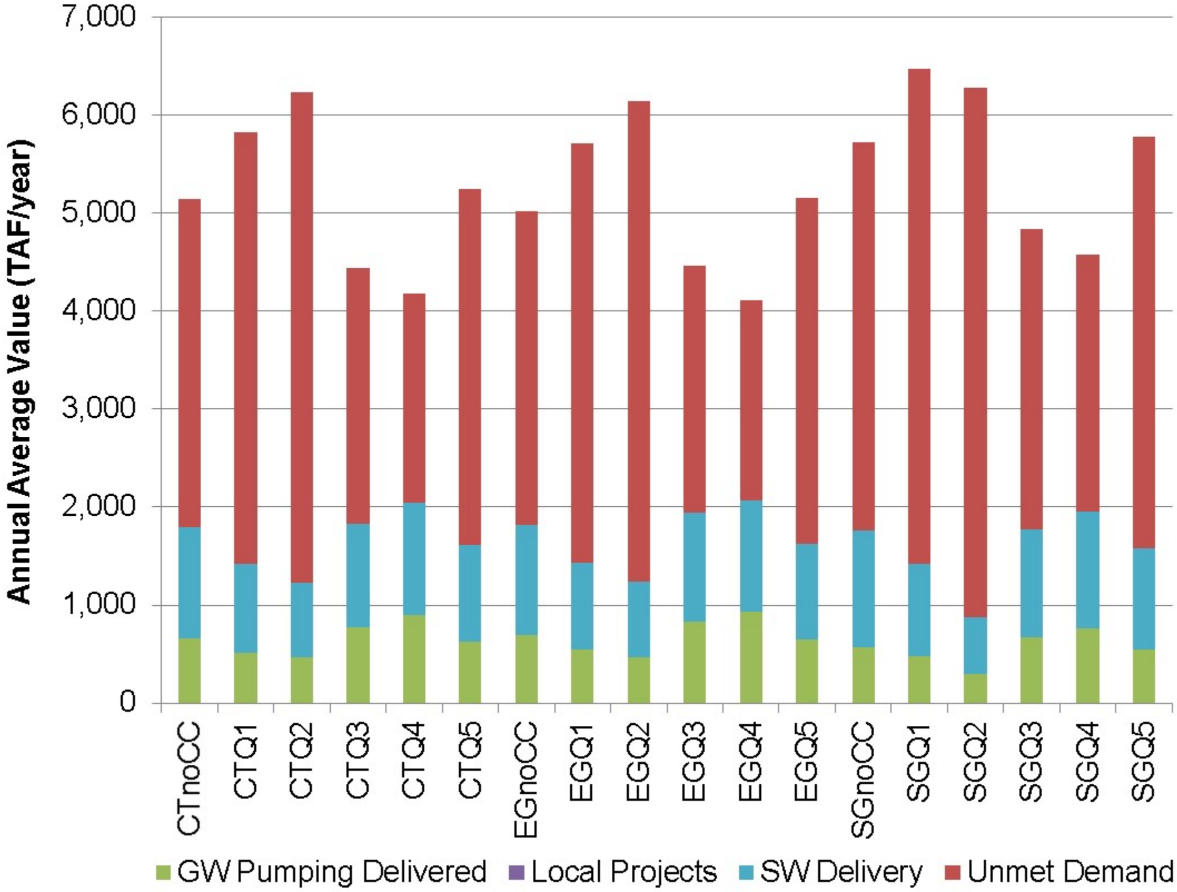
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-85. Average Annual Supplies and Unmet Demand in the San Felipe Division (TAF/year) in each Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-86. Average Annual Supplies and Unmet Demand in the West San Joaquin Division (TAF/year) in each Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

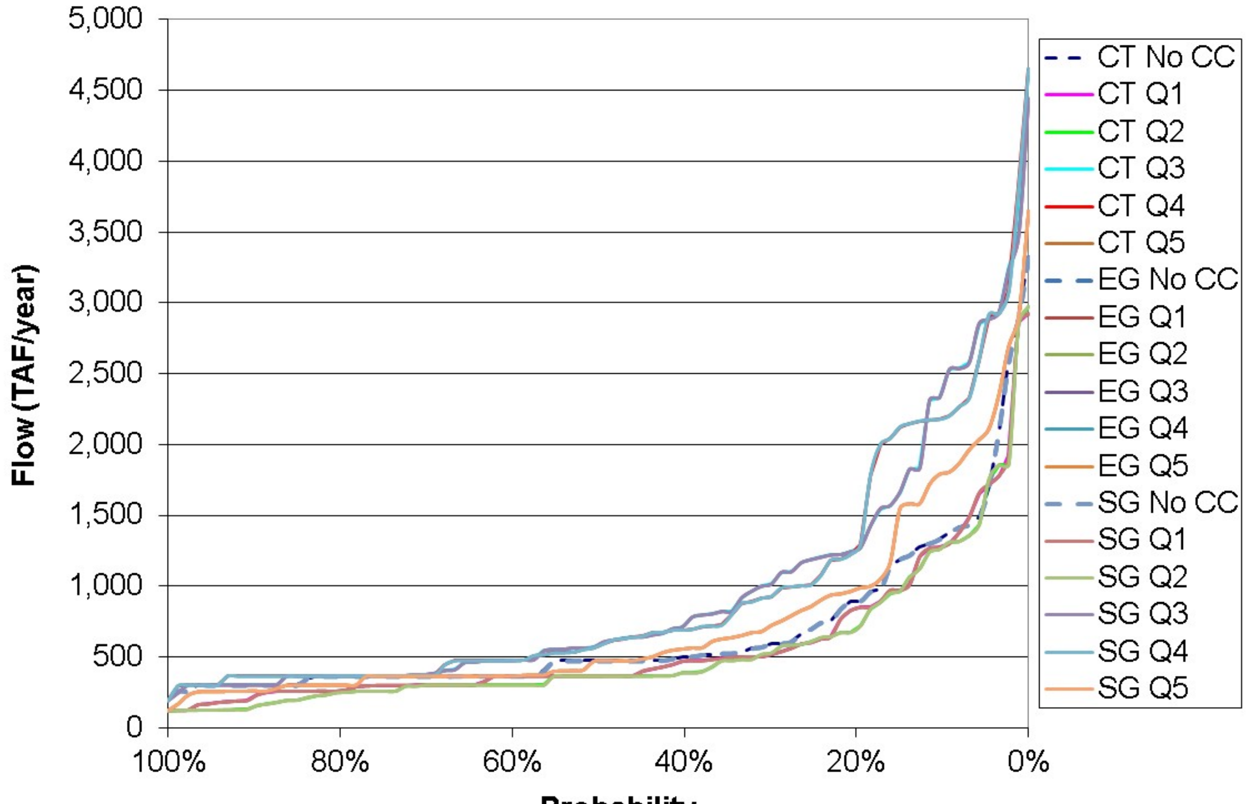
Figure 3-87. Average Annual Supplies and Unmet Demand in the Friant Division (TAF/year) in each Scenario

Figure 88 through Figure 93 provide additional information about the effects of potential climate changes on supply and deliveries in the Friant Division.

Overall 21st century mean annual Millerton releases into the San Joaquin River range from 560 to 960 TAF/year. The central tendency Q5 releases are approximately 70 TAF/ year greater than without climate change. In the warmer-drier Q2 scenarios Millerton releases are approximately 100 TAF/year less than without climate change while Millerton releases increase by approximately 285 TAF/year relative to no climate change in less warming-wetter Q4 climate projections.

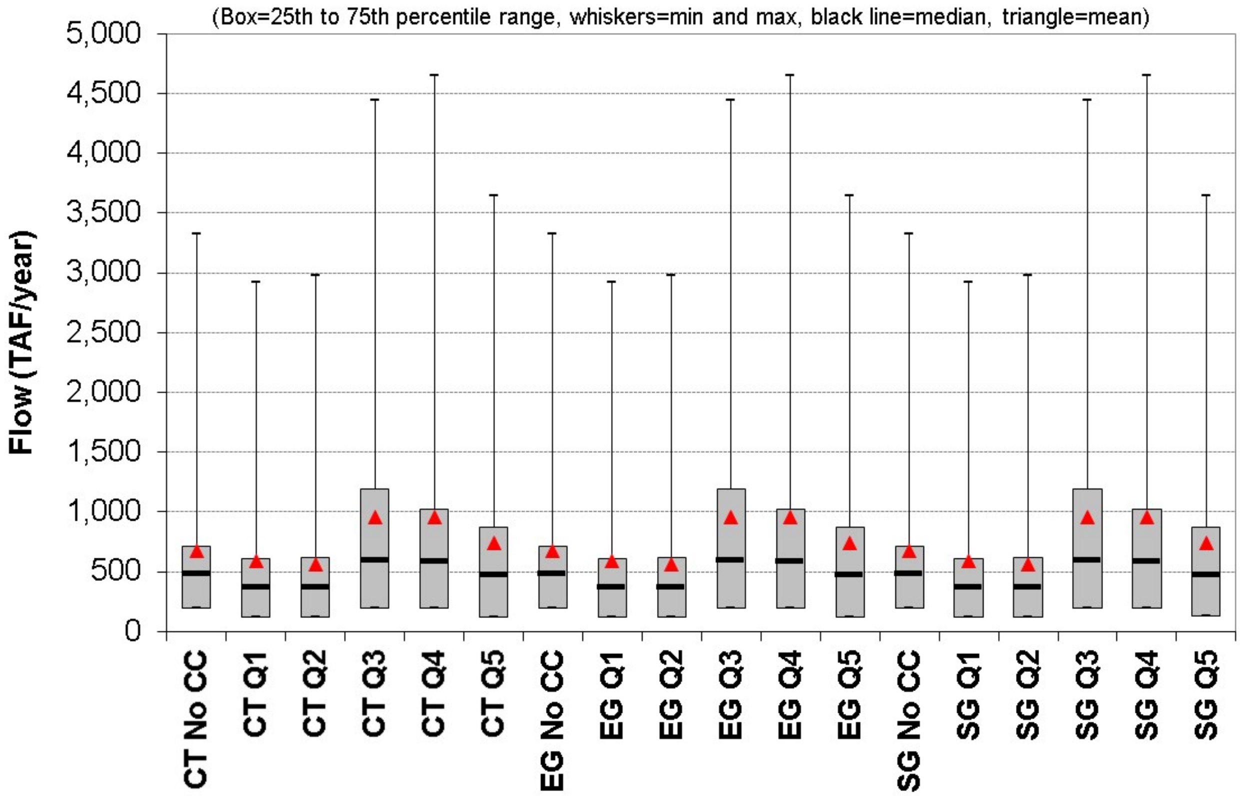
Mean annual Friant-Kern Canal deliveries range from approximately 600 TAF/year to 1 MAF/year. The central tendency Q5 Friant-Kern Canal deliveries are approximately 150 TAF/ year less than without climate change. In the warmer-drier Q2 scenarios Friant-Kern Canal deliveries are approximately 340 TAF/year less than without climate change while Friant-Kern Canal deliveries increase by approximately 70 TAF/year relative to without climate change in less warming-wetter Q4 climate projections.

Over the 21st century mean annual Madera Canal deliveries range from approximately 190 TAF/year to 260 TAF/year. The central tendency Q5 Madera Canal deliveries are approximately 35 TAF/ year less than without climate change. In the warmer-drier Q2 scenarios Friant-Kern Canal deliveries are approximately 90 TAF/year less than without climate change while Friant-Kern Canal deliveries increase by approximately 20 TAF/year relative to without climate change in less warming-wetter Q4 climate projections.



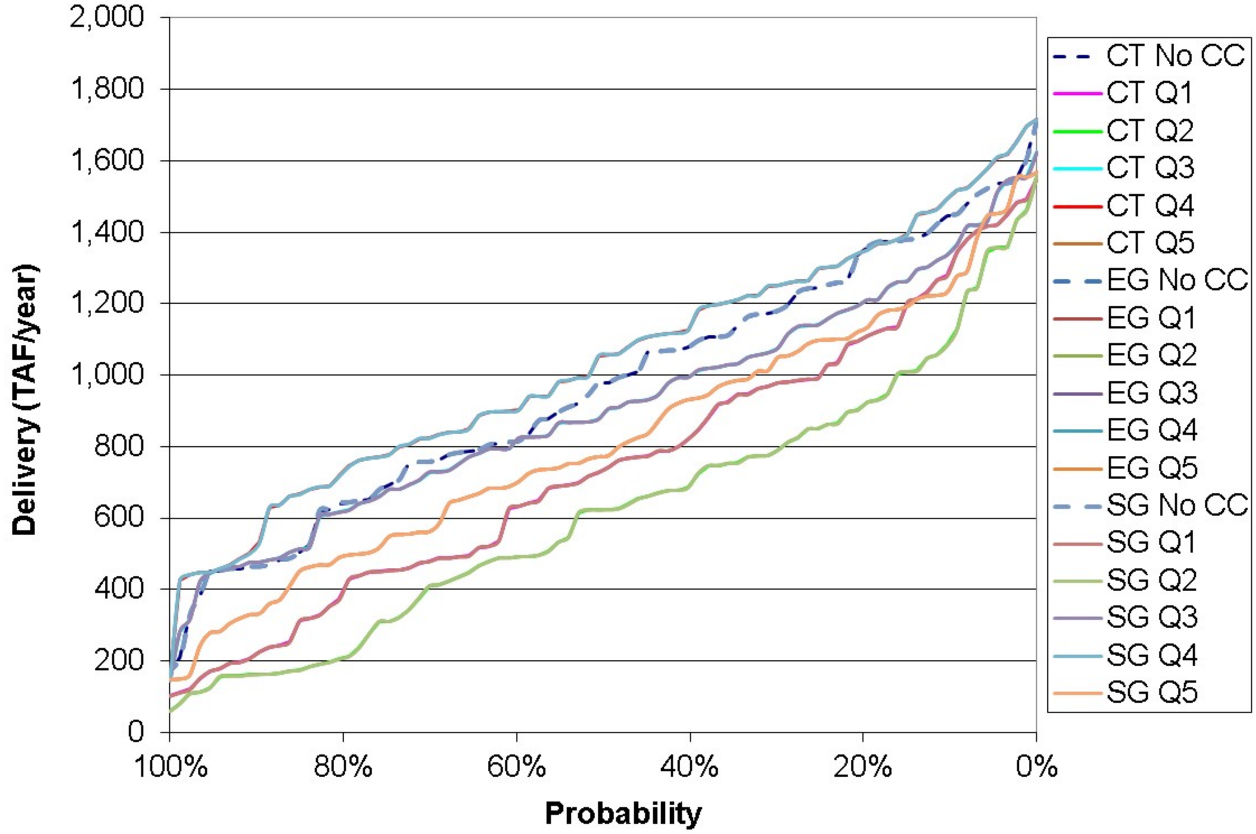
Key:
TAF = thousand acre feet

Figure 88. Annual Exceedence of Millerton Release (TAF/year) in each Scenario



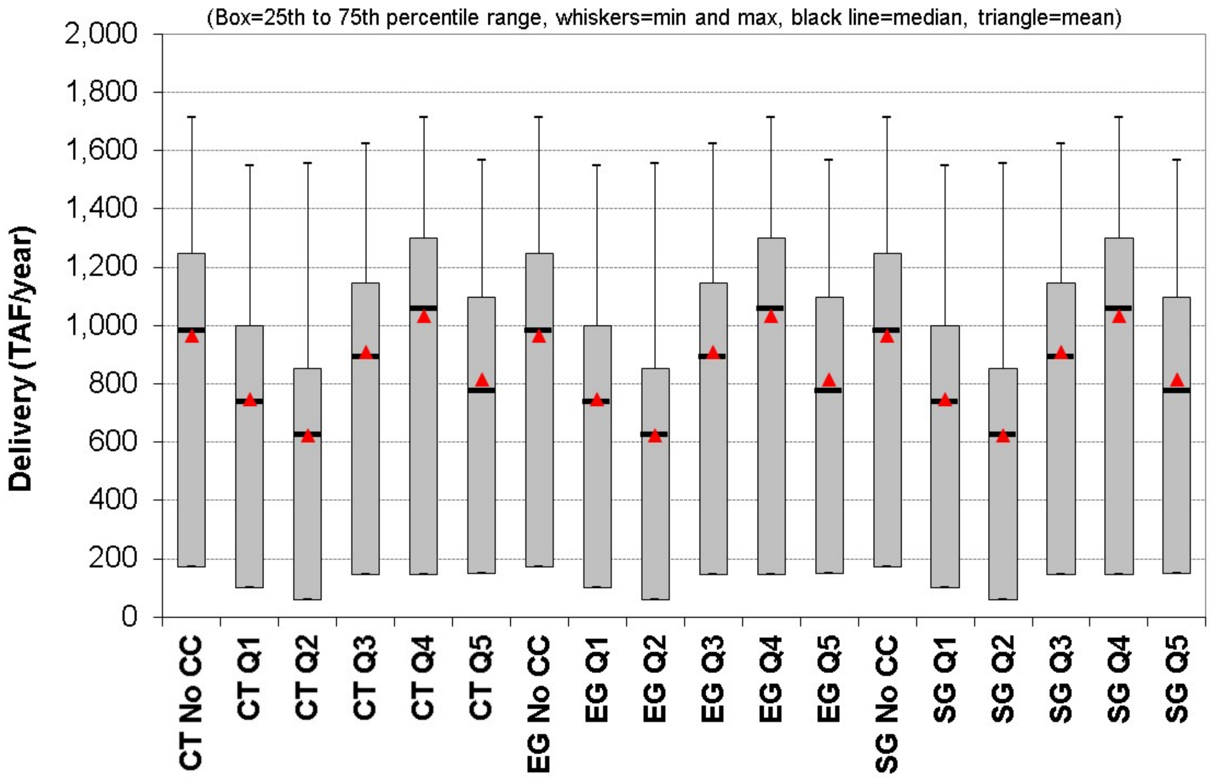
Key:
CT No CC = central tendency-no climate change
TAF = thousand acre feet

Figure 89. Box Plot of Millerton Release (TAF/year) in each Scenario



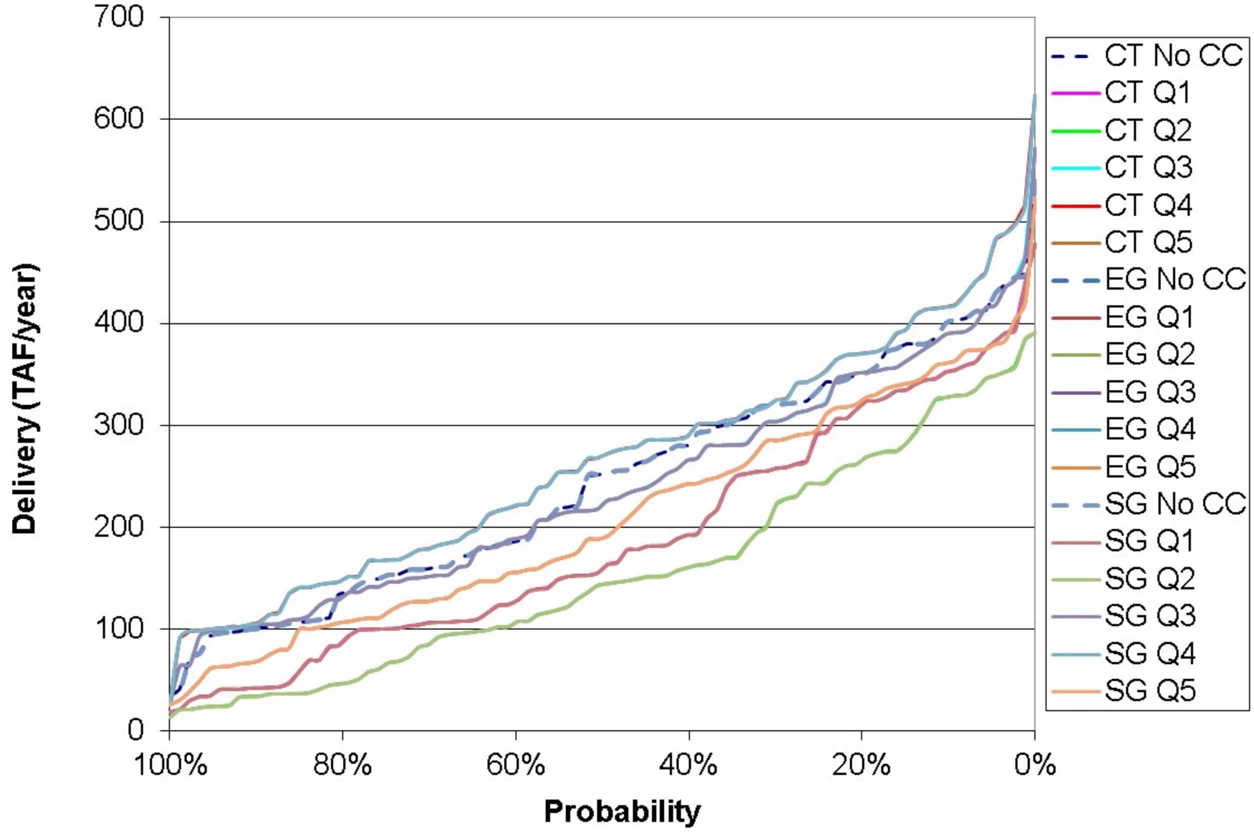
Key:
TAF = thousand acre feet

Figure 90. Annual Exceedence of Friant-Kern Canal Deliveries (TAF/year) in each Scenario



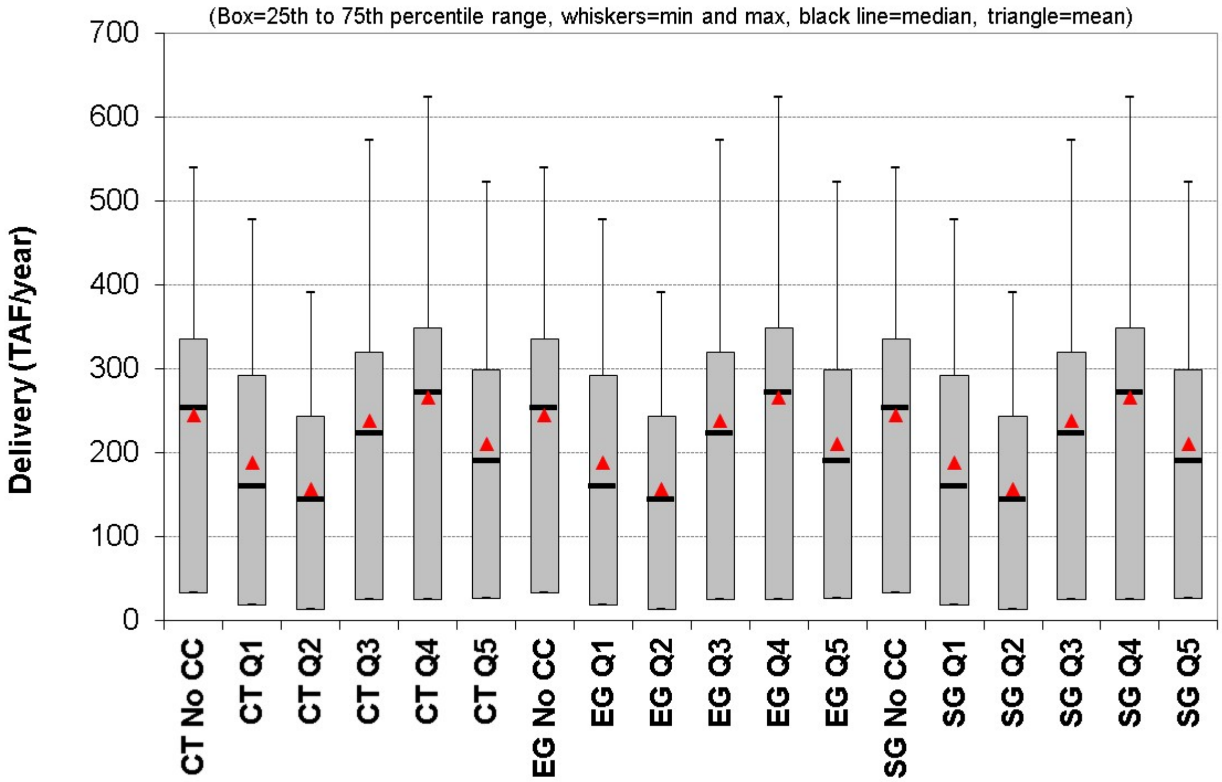
Key:
TAF = thousand acre feet

Figure 91. Box Plot of Friant-Kern Canal Deliveries (TAF/year) in each Scenario



Key:
TAF = thousand acre feet

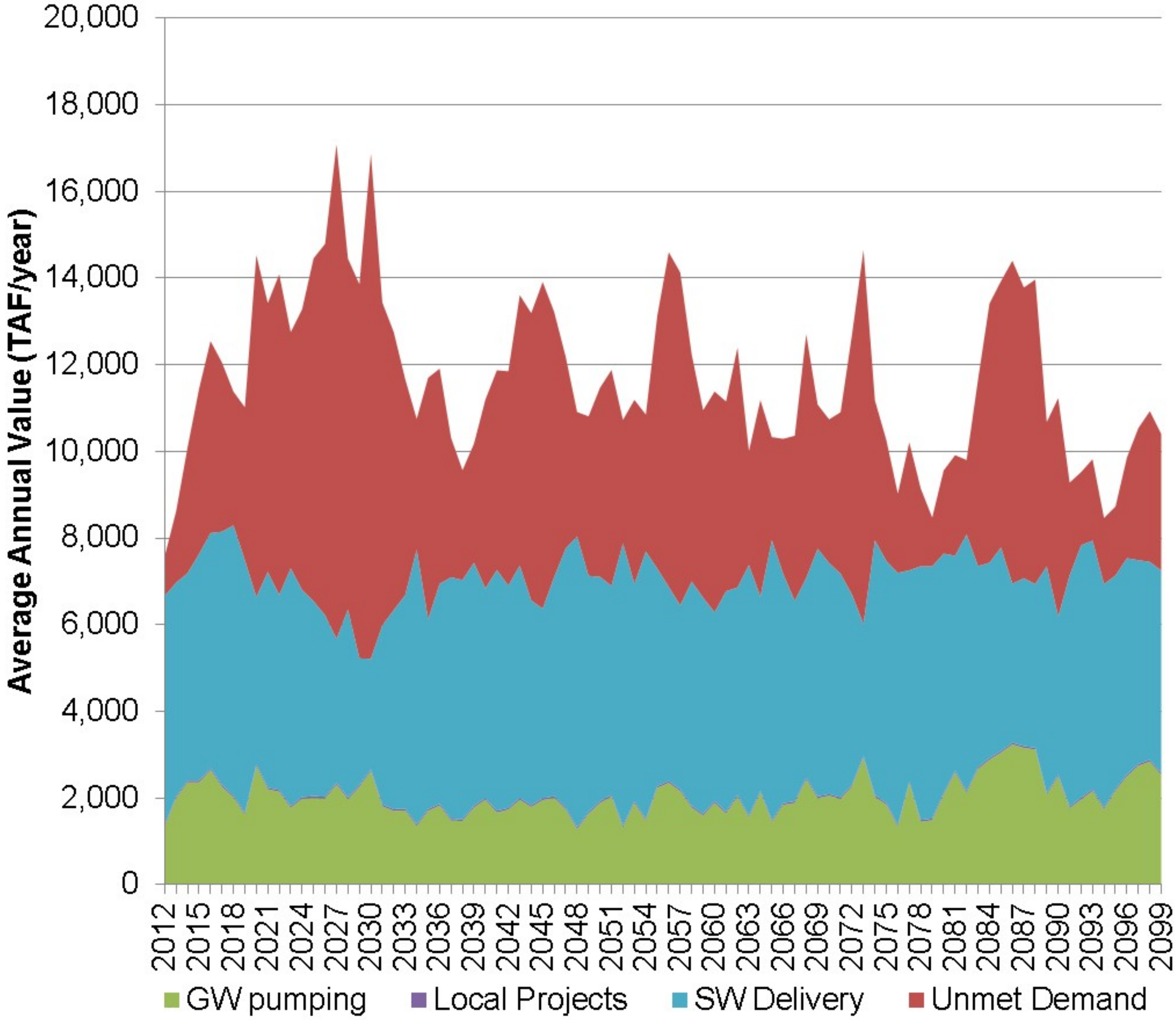
Figure 92. Annual Exceedence of Madera Canal Deliveries (TAF/year) in each Scenario



Key:
CT No CC = central tendency-no climate change
TAF = thousand acre feet

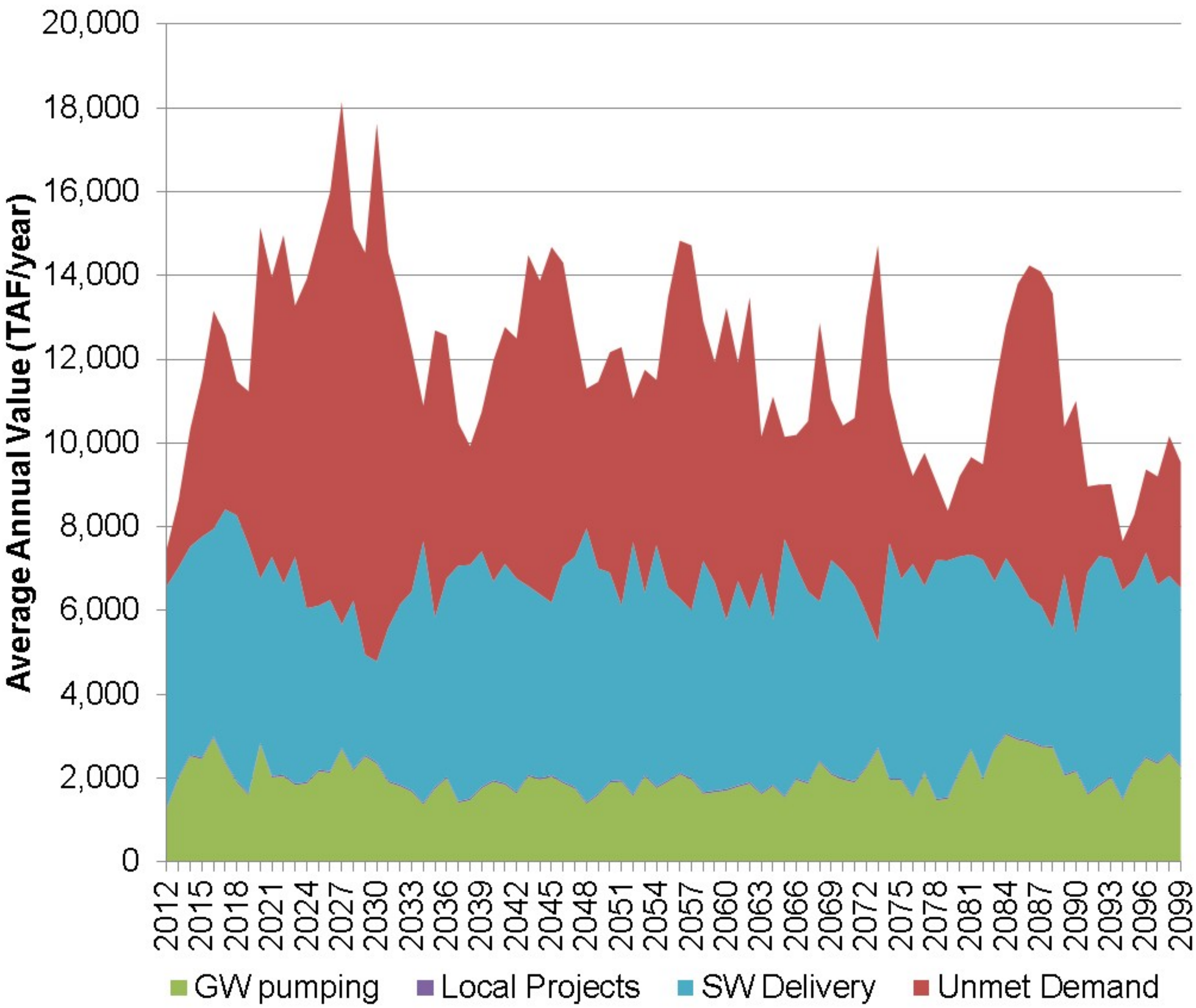
Figure 93. Box Plot of Madera Canal Deliveries (TAF/year) in each Scenario

Figure 3-94 through 3-97 present annual time series of groundwater, surface water and local project supplies and unmet demand for the entire CVP Service Area. All 4 scenarios show similar year-to-year variability, with total demands increasing and surface water supplies decreasing during dry periods and the opposite occurring during wetter years. The Current Trends-NoCC time series figure is presented for comparison with the other future climate projections using the same current trends socioeconomic scenario. Over the 21st century, in the Current Trends–Median climate projection (CT-Q5) total supplies range from a minimum of 4.8 to a maximum of 8.4 MAF/year while unmet demands range from a minimum of 0.9 to a maximum of 12.8 MAF/year. For the Expansive Growth-warmer-drier (EG-Q2) total supplies range from a minimum of 3.2 to a maximum of 8.3 MAF/year while unmet demands range from a minimum of 0.9 to a maximum of 16.2 MAF/year. In the Slow Growth-less warming-wetter (SG- Q4) scenario total supplies range from a minimum of 5.9 to a maximum of 8.2 MAF/year while unmet demands range from a minimum of 0.7 to a maximum of 8.4 MAF/year.



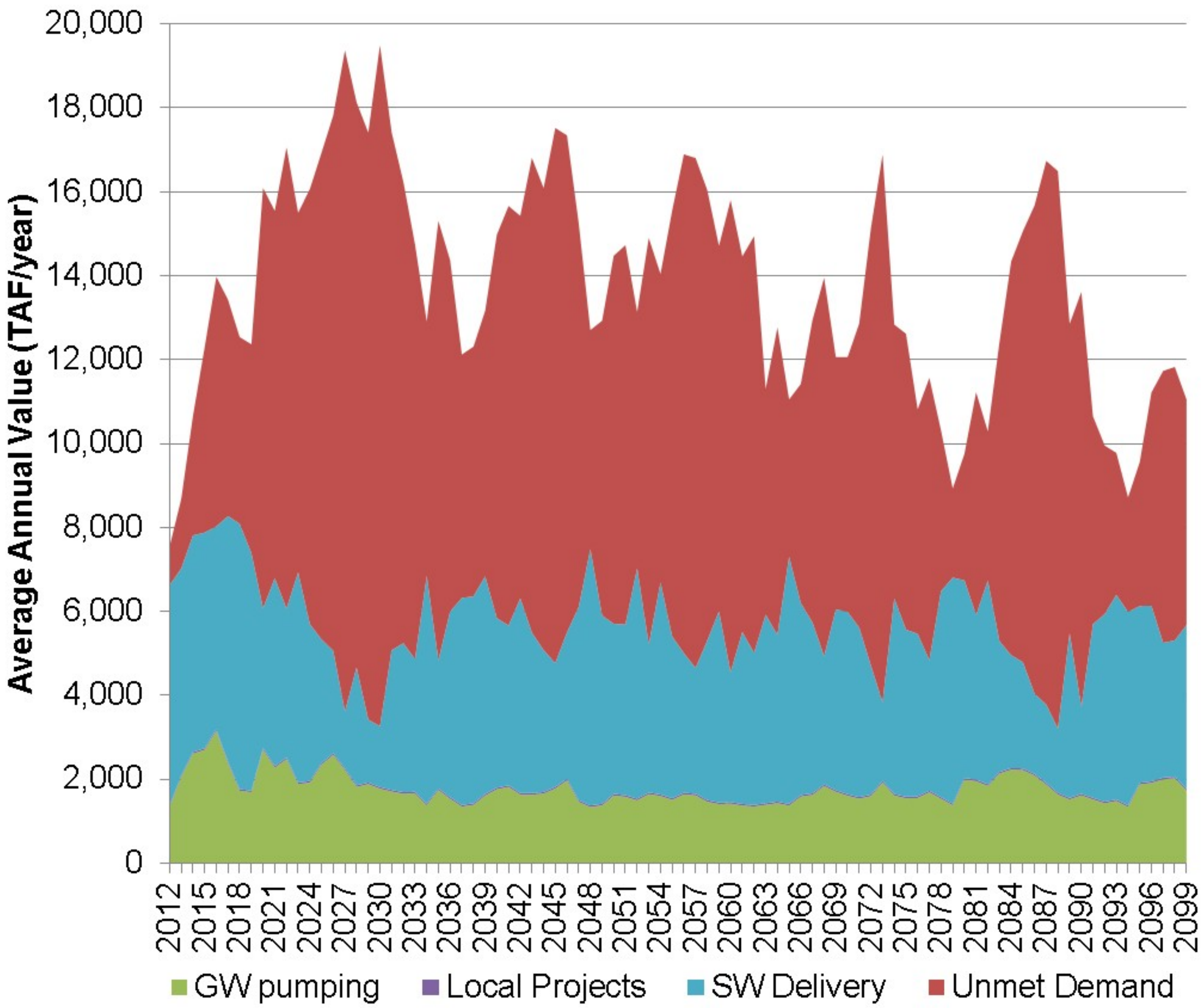
Key:
CT – NoCC = central tendency-no climate change
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-94. Annual Time Series of Supplies and Unmet Demand (TAF/year) in CVP Service Area in the CT – NoCC Scenario



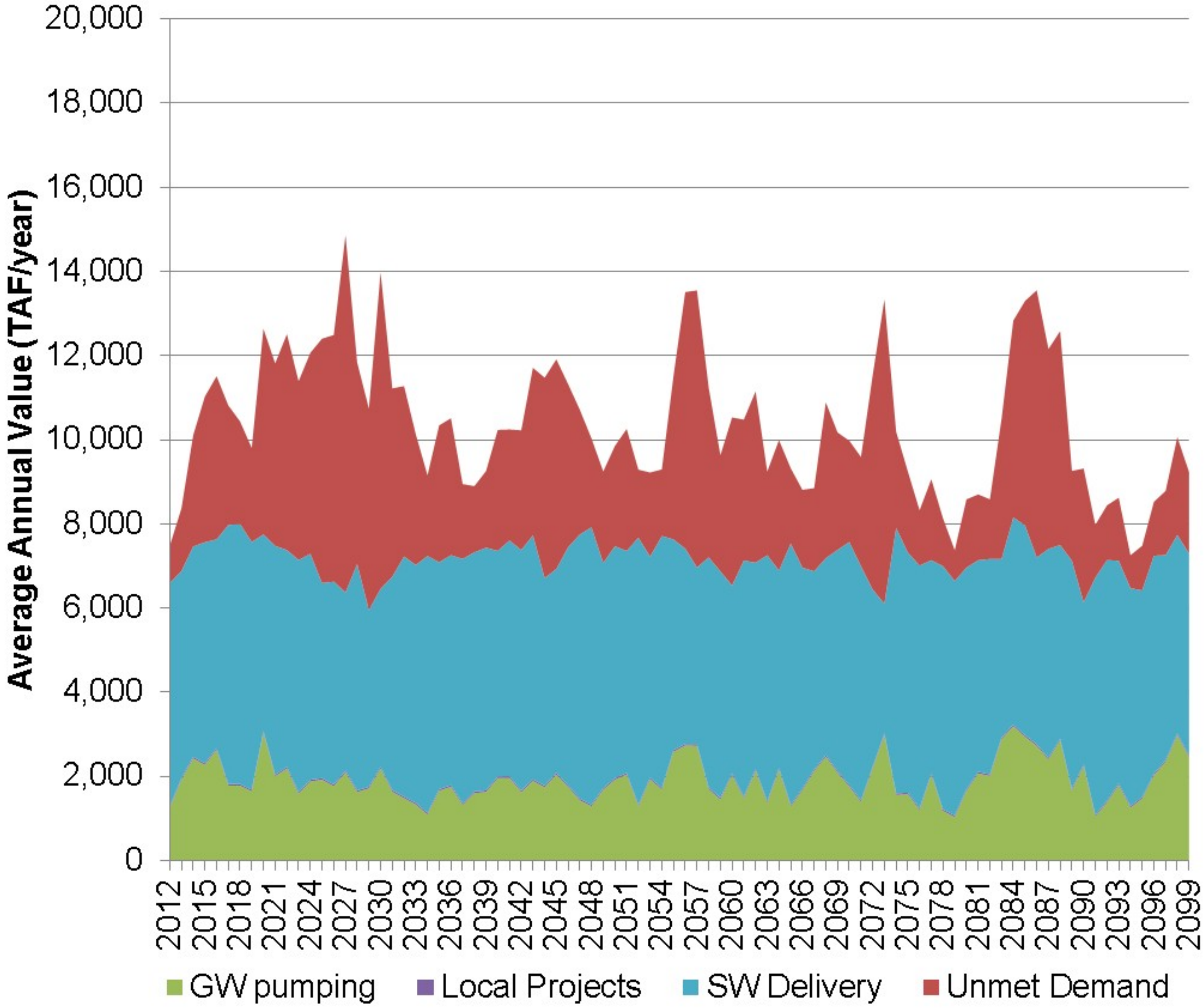
Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-95. Annual Time Series of Supplies and Unmet Demand (TAF/year) in CVP Service Area in the CT – Q5 Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-96. Annual Time Series of Supplies and Unmet Demand (TAF/year) in CVP Service Area in the EG – Q2 Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre feet

Figure 3-97. Annual Time Series of Supplies and Unmet Demand (TAF/year) in CVP Service Area in the SG – Q4 Scenario

Results of Other Performance Assessment Tools

The following sections describe the results of the other performance assessment tools for the Baseline condition. The socioeconomic-climate scenarios analyzed under Baseline conditions include the Current Trends–Median climate projection (CT-Q5), to represent a midrange projection of socioeconomic-climate effects; Expansive Growth-warmer-drier (EG-Q2), to represent the upper range of socioeconomic-climate effects and Slow Growth-less warming-wetter (SG-Q4) to represent the lower range of socioeconomic-climate effects. Because of the sensitivity of the economic and temperature models to climate inputs, additional scenarios were simulated for the economic and temperature models without climate change to better understand the effects of climate change on the results. The results of these simulations are described below. More detailed descriptions of the models are provided in the preceding Section entitled Application of Additional Performance Assessment Tools.

Economics The results from four economically based water management models are presented in this section. These models provide the following capabilities:

- LCPSIM provides economic results for the South San Francisco Bay-South Region
- OMWEM provides economic results for urban regions in Central Valley
- SBWQM estimates salinity costs for deliveries to the South San Francisco Bay Region
- SWAP provides economic results for agricultural regions in the Central Valley.

Because these economic models are designed to analyze differences between two different scenarios rather than the absolute values of a single scenario, the results are summarized in terms of differences in average annual net benefit between the different socioeconomic-climate scenarios described above. In addition, the results from these economic models are presented at three future levels of development (LOD). The three LODs were selected to represent early (2025), mid (2050) and late (2085) 21st century socioeconomic and climate conditions. This approach allows for a clearer understanding of how the changes in socioeconomic and climate factors affect the net economic benefits in the CVP Service area over different timeframes during the 21st century.

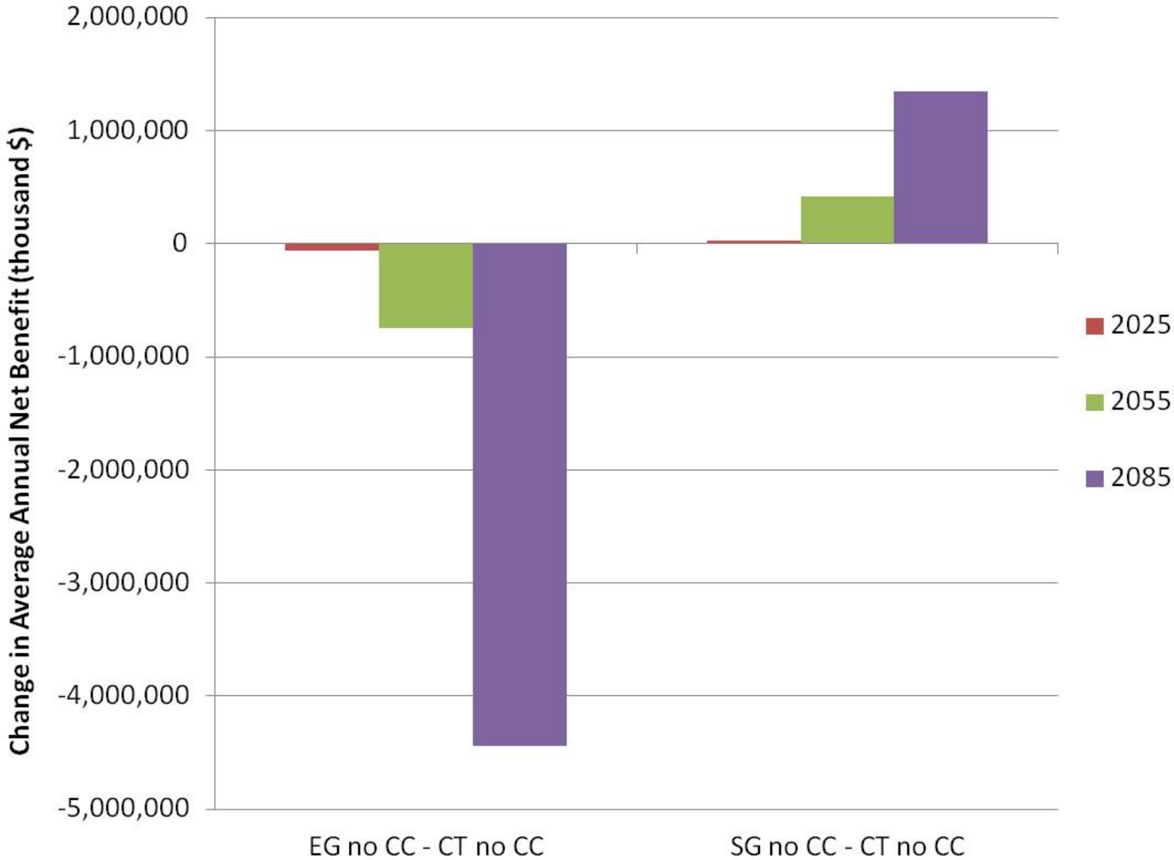
The following discussion presents the results in two steps because the model inputs differ significantly both between different socioeconomic scenarios and different climate scenarios:

1. Comparisons of the three socioeconomic scenarios without climate change, to understand the effect of socioeconomic changes

2. Comparisons of CT-Q5, EG-Q2, and SG-Q4 scenarios with their corresponding no climate change scenario to understand the effects of climate changes

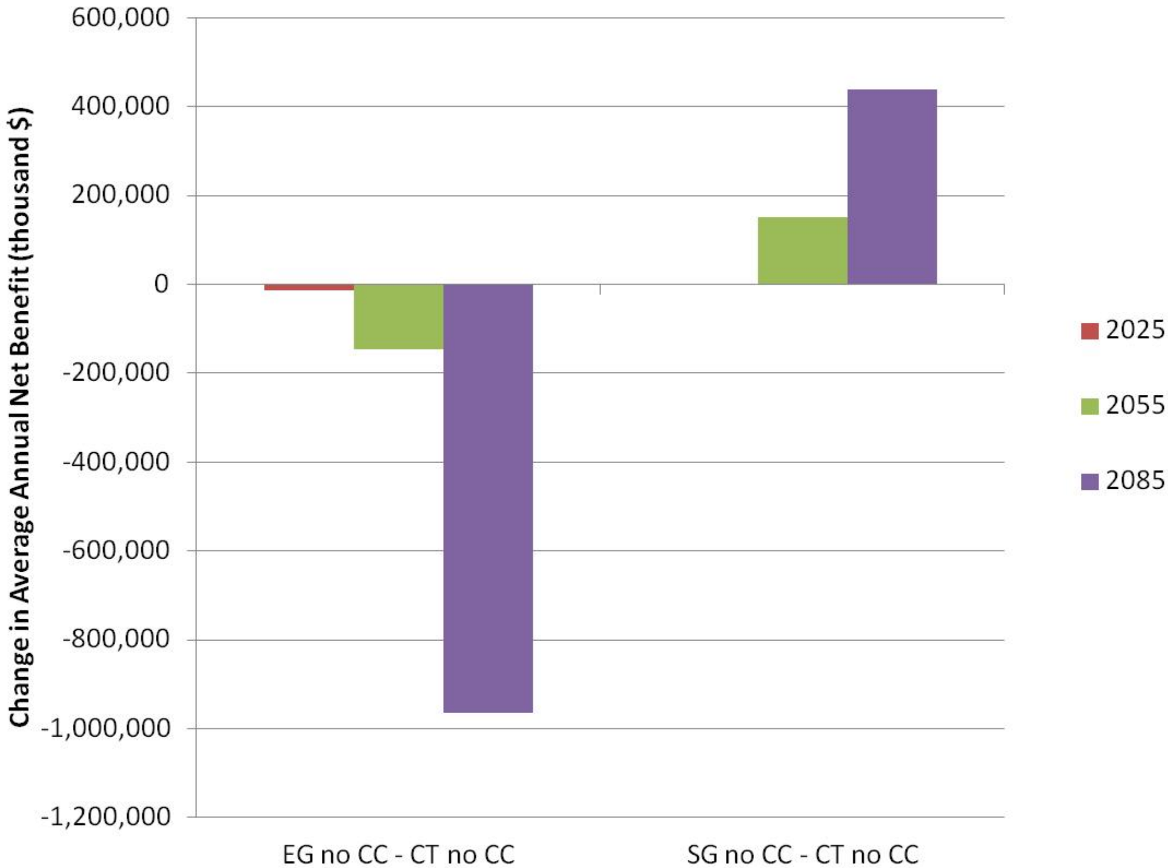
To evaluate the effects of changes in socioeconomic conditions, simulations of all three growth scenarios without climate change were compared. Figure 3-98 through Figure 3-100 show the changes in net water supply system costs in LCPSIM and OMWEM and in net revenue in SWAP for the EG and SG scenarios relative to the CTs at the 3 LODs. (The SBWQM is not capable of producing comparisons between simulations at different socioeconomic conditions and is therefore not included in this comparison.)

All three models indicate that there are significantly less net water supply system costs and significantly more net revenue in the SG scenario than in the CTs scenario, and significantly more net water supply system costs and significantly less net revenue in EG than in the CTs scenario. Furthermore, these differences continue to increase during the 21st century. Figures 3-98 through 3-104 show economic benefits and costs computed by the model. The primary factors accounting for these differences are the changes in population and corresponding changes in land use from agricultural to urban use that occur in each socioeconomic scenario. The EG scenario represents the greatest increase in population and in conversion of agricultural land to urban and consequently has more water supply system costs in the urban models and the lowest net revenue in the agricultural model as compared to the CTs scenario. Conversely, SG has lowest increase in population and the smallest conversion of agricultural land to urban, which results in lower water supply system costs in the urban models and greater net revenue in the agricultural model relative to CTs.



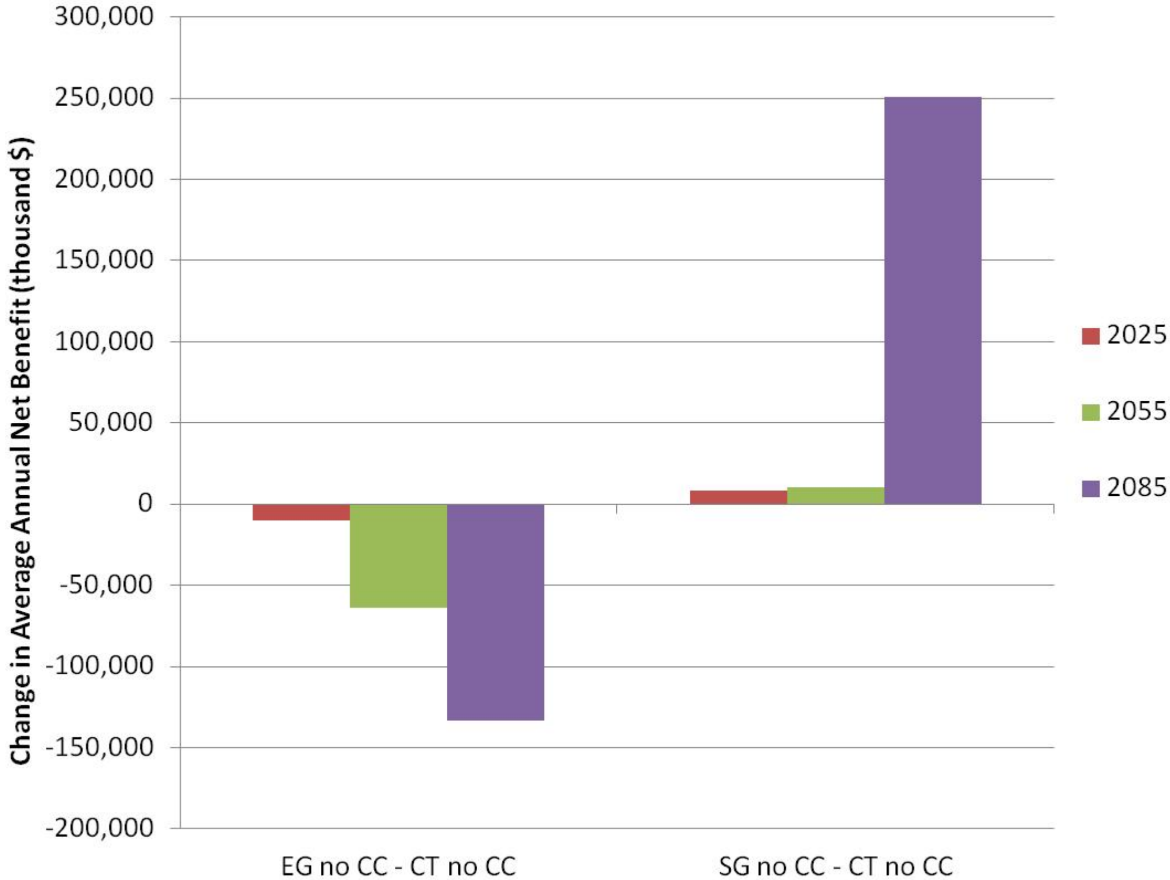
Key:
CT no CC = Central tendency-no climate change
EG = Expansive Growth
SG = Slow Growth

Figure 3-98. Change in Average Annual Net Benefit in South San Francisco Bay Region from LCPSIM



Key:
CT no CC = Central tendency-no climate change
EG = Expansive Growth
SG = Slow Growth

Figure 3-99. Change in Average Annual Net Benefit in Central Valley Urban Areas from OMWEM

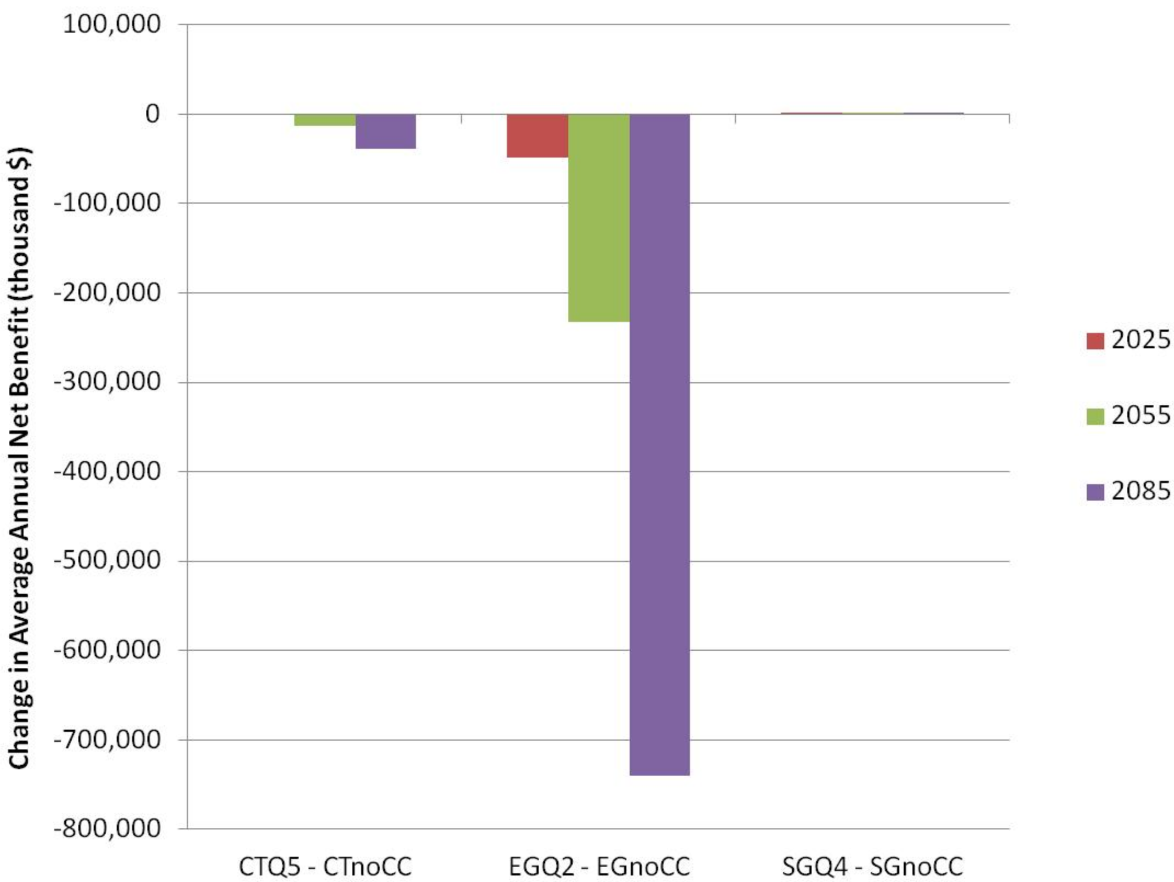


Key:
CT no CC = Central tendency-no climate change
EG = Expansive Growth
SG = Slow Growth

Figure 3-100. Change in Average Annual Net Benefit in Central Valley Agricultural Areas from SWAP

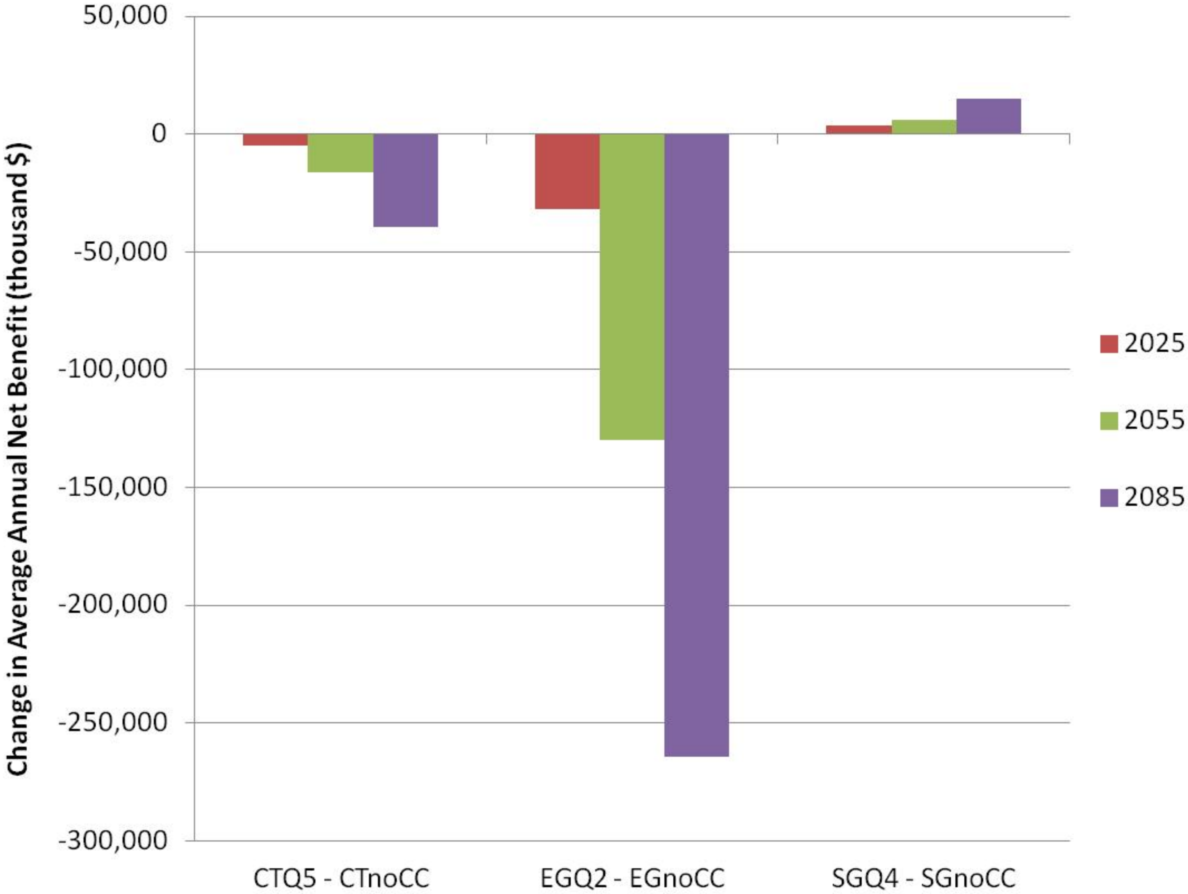
To evaluate the effects of changes in climate changes conditions, simulations of all three climate scenarios are compared with their corresponding no climate change socioeconomic scenarios. Figure 3-101 through Figure 3-104 show the changes in net economic benefits for scenarios CT-Q5 relative to CT-noCC, EG-Q2 relative to EG-noCC, and SG-Q4 relative to SG-noCC, at the 3 LODs from LCPSIM, OMWEM, SBWQM and SWAP. The urban economic models (LCPSIM, OMWEM and SBWQM) show decreases in net economic benefits in CT-Q5 and EG-Q2 due to decreased Delta exports and increased salinity at the Delta pumping locations. OMWEM shows increases in net benefit in SG-Q4 due to increased surface water deliveries in the Central Valley, but LCPSIM has almost no change in benefits because Delta exports in SG-Q4 are almost the same as in SG-noCC. SBWQM shows a net benefit in SG-Q4 relative to SG-noCC because of improved salinity conditions at the Delta exporting locations reduce the salinity costs to the South Bay export regions.

SWAP has similar changes in deliveries as OMWEM, but shows increases in net benefits in all three scenarios because improvements in agricultural production due to climate changes such as increasing CO_2 override the negative effects of reduced SWP and CVP deliveries due to reductions in water supplies in CT-Q5 and EG-Q2.



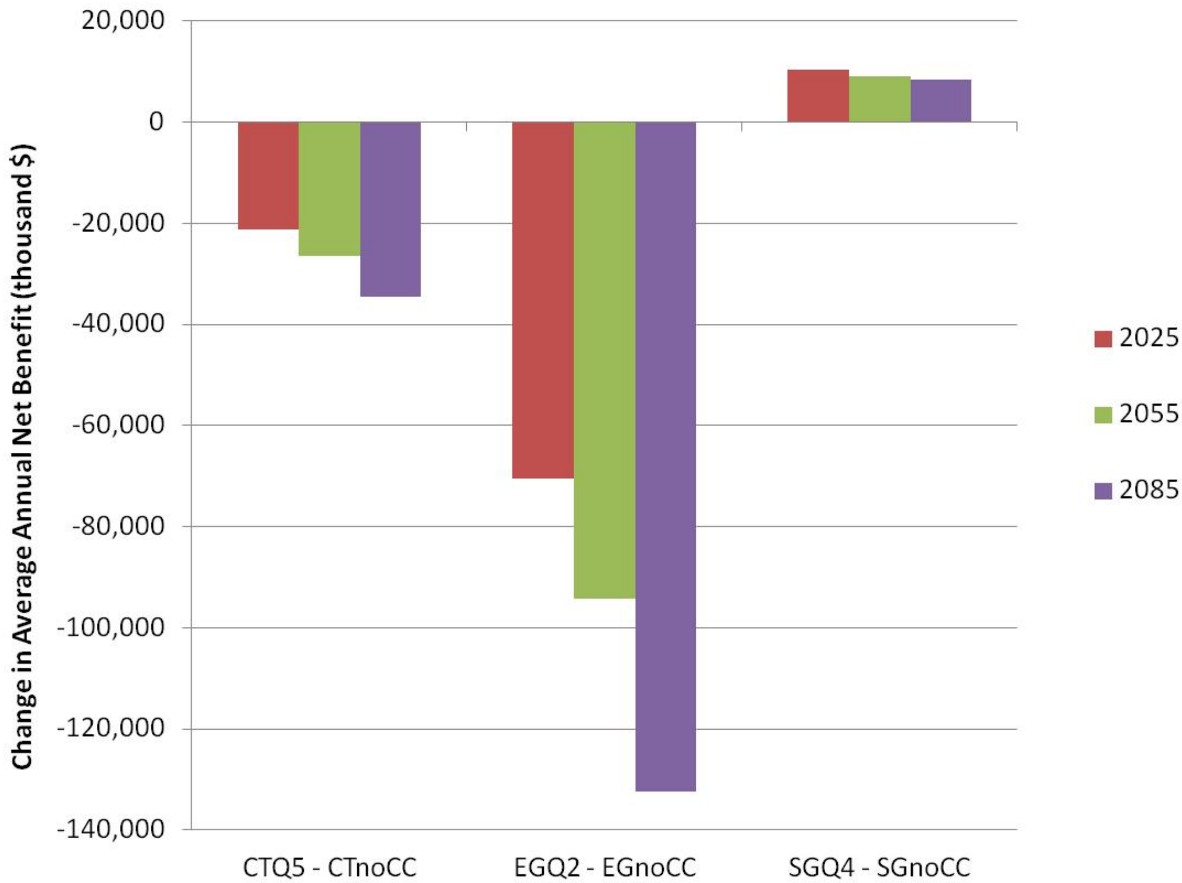
Key:
LCPSIM = Least Cost Planning Simulation Model

Figure 3-101. Change in Average Annual Net Benefit in South San Francisco Bay Region from LCPSIM



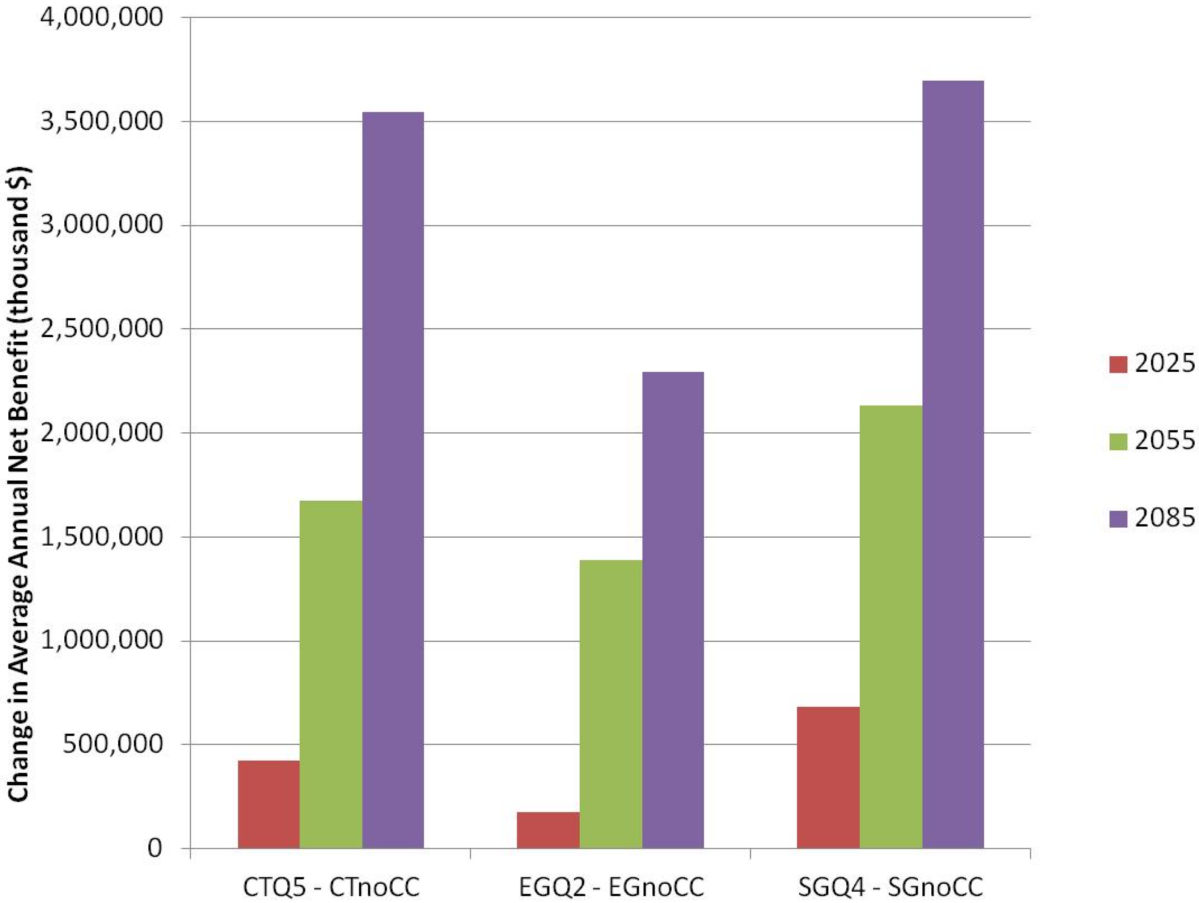
Key:
OMWEM = Other Municipal Water Economics Model

Figure 3-102. Change in Average Annual Net Benefit in Central Valley Urban Areas from OMWEM



Key:
SBWQM = South Bay Water Quality Model

Figure 3-103. Change in Average Annual Net Benefit in South San Francisco Bay Region Salinity Costs from SBWQM



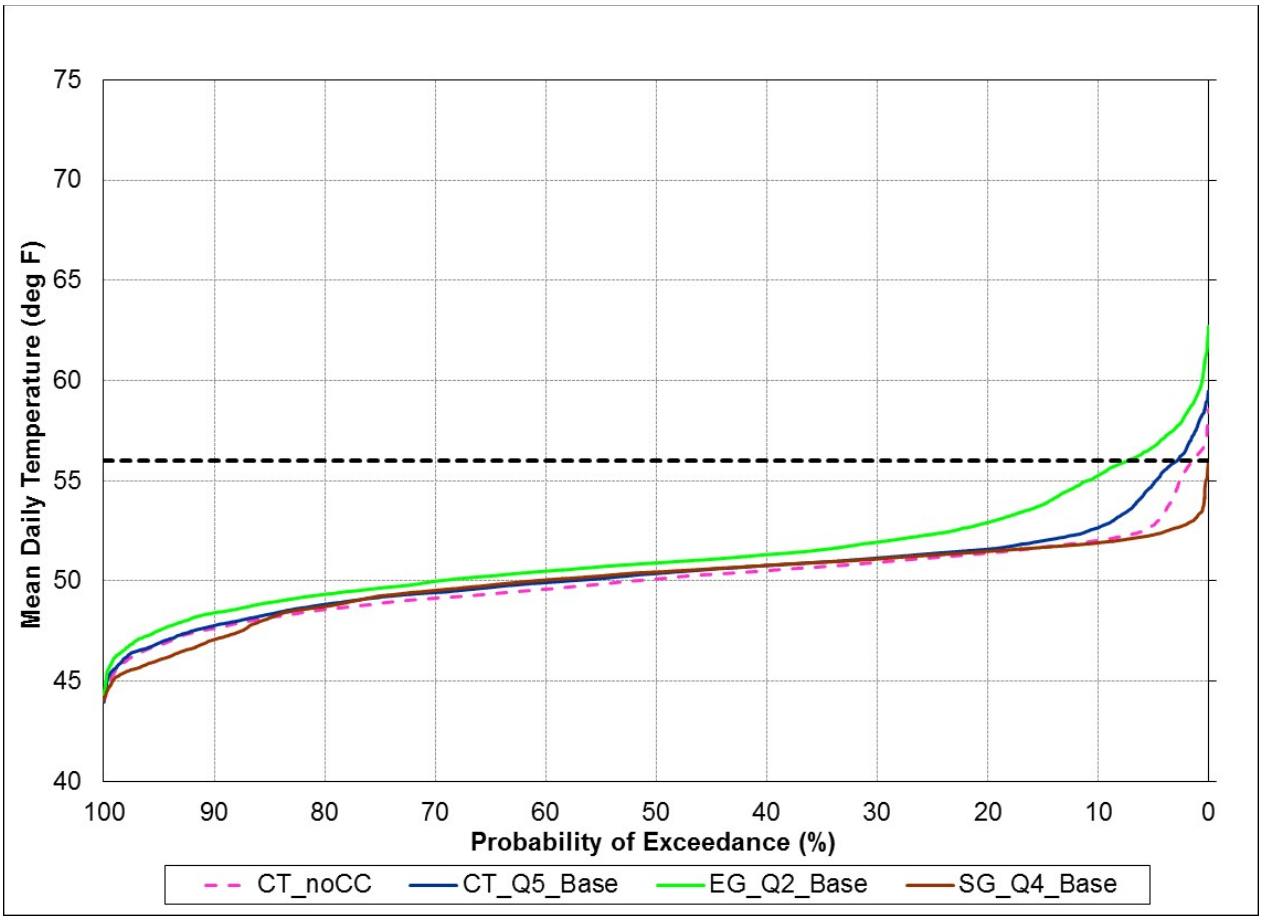
Key:
SWAP = Statewide Agricultural Production Model

Figure 3-104. Change in Average Annual Net Benefit in Central Valley Agricultural Areas from SWAP

Water Temperature To understand the effects of climate change on river temperatures, the Sacramento (USRWQM) and San Joaquin temperature (SJRWQM) models were simulated for the CT-NoCC scenario as well as the CT-Q5, EG-Q2, and SG-Q4 scenarios.

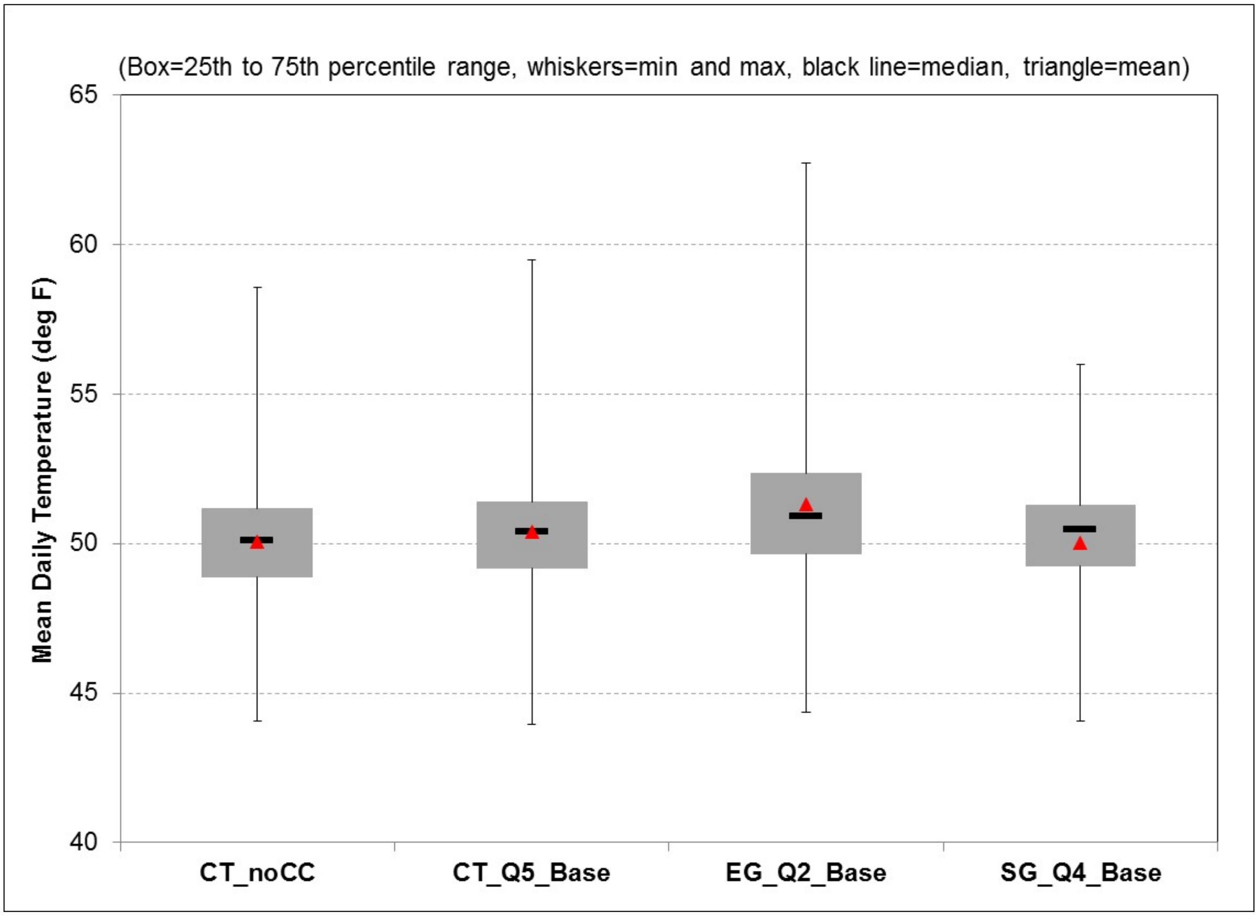
Figure 3-105 through Figure 3-108 show exceedence plots and box plots of daily temperatures from July through September for these four scenarios in the Sacramento River at Keswick and at Jellys Ferry. The box plots depict the median (black bar), mean (red triangle), 25th and 75th percentile (gray rectangle), minimum and maximum values (line tip) of water temperature at these locations. The bold, dashed horizontal lines on the exceedence plots represent desired water temperatures during the period.

At both locations the temperatures in SG-Q4 scenario are a modest amount lower than those in CT-NoCC, reflecting the effects of increased Shasta cold water pool, and greater flows in the river in the wetter Q4 climate. Conversely, the temperatures in CT-Q5 are a modest amount higher and the temperatures in EG-Q2 are higher than those in CT-NoCC at both locations, also reflecting the changes in the storage and flow levels at each location The mean July-September temperatures in EG-Q2 are 51.3°F at Keswick and 55.0°F at Jellys Ferry, as compared to 50.0°F at Keswick and 53.3°F at Jellys Ferry in SG-Q4. These reflect a range of about 1-2 degrees on average between the two most extreme climate conditions and also a difference of about 3-4 degrees between the two locations representing the majority of the spawning and rearing habitat in the upper Sacramento River.



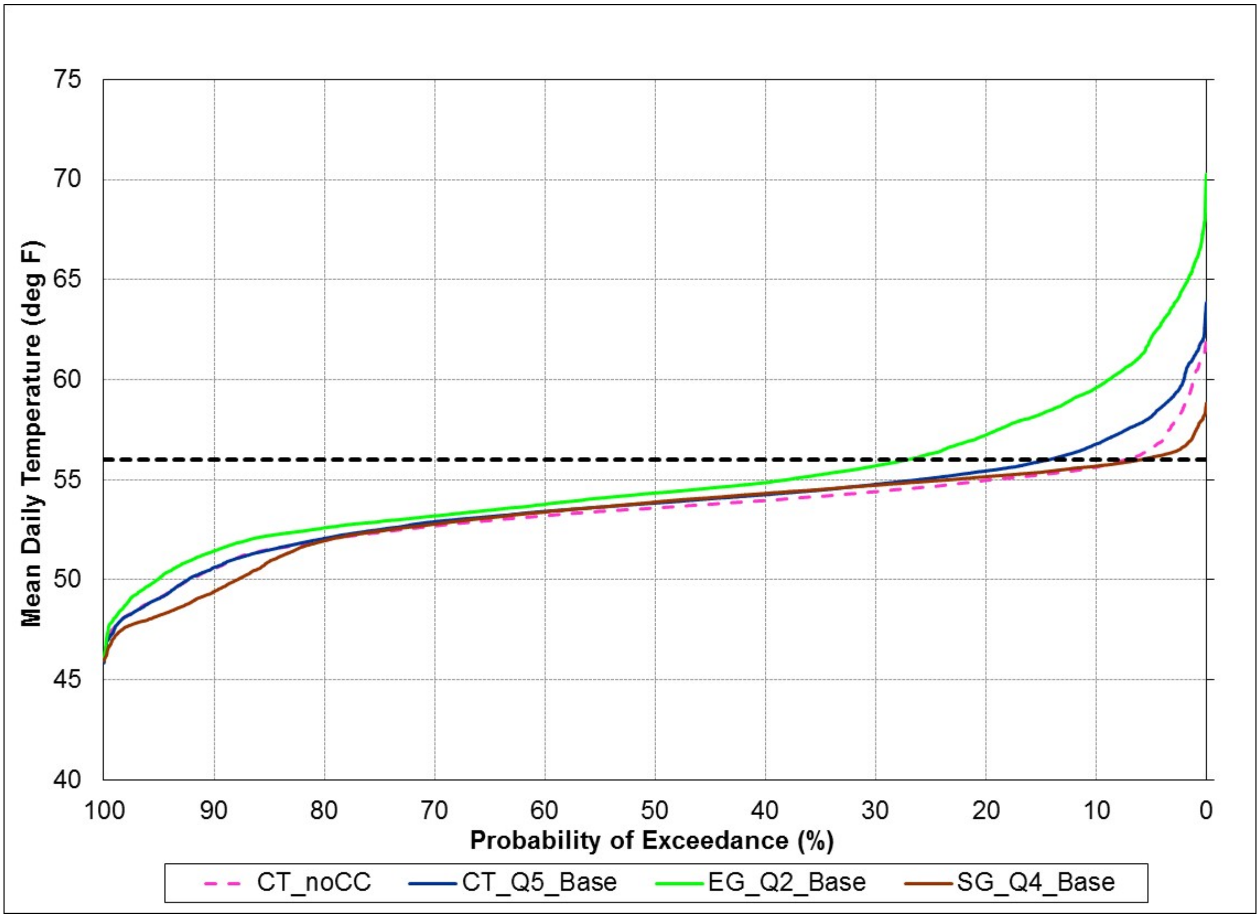
Key:
°F = Fahrenheit
CT_noCC = central tendency-no climate change

Figure 3-105. Exceedence of Average Daily Water Temperature (°F) on Sacramento River at Keswick from July-to-September in each Scenario



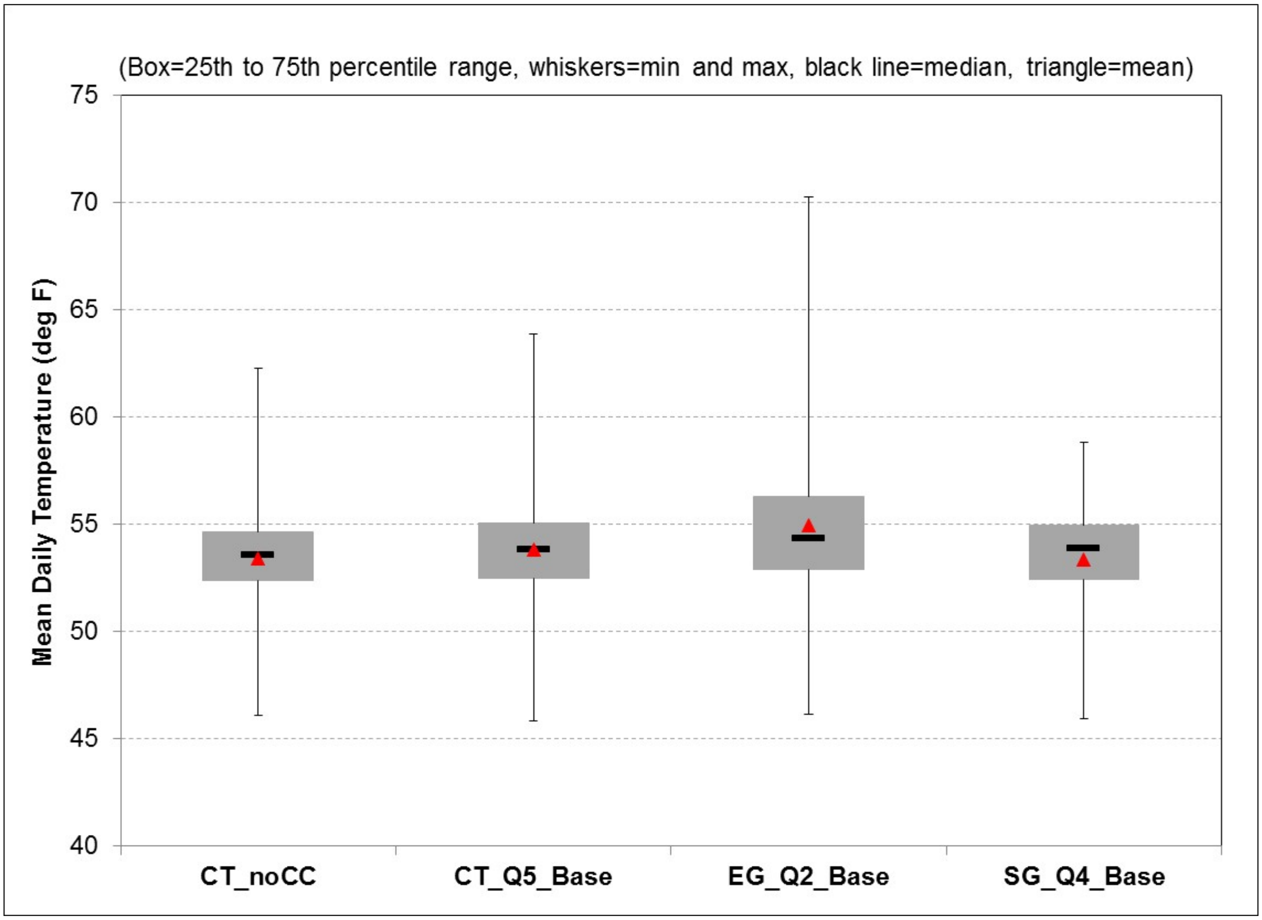
Key:
°F = Fahrenheit
CT_noCC = central tendency-no climate change

Figure 3-106. Box Plot of Average Daily Water Temperature (°F) on Sacramento River at Keswick from July-to-September in each Scenario



Key:
°F = Fahrenheit
CT_noCC = central tendency-no climate change

Figure 3-107. Exceedence of Average Daily Water Temperature (°F) on Sacramento River at Jellys Ferry from July-to-September in each Scenario



Key:
°F = Fahrenheit
CT_noCC = central tendency-no climate change

Figure 3-108. Box Plot of Average Daily Water Temperature (°F) on Sacramento River at Jellys Ferry from July-to-September in each Scenario

Figure 3-109 through Figure 3-114 show exceedence plots and box plots of daily temperatures for the same four socioeconomic-climate scenarios in the San Joaquin River at Lost Lake, at Gravelly Ford and at Vernalis locations from August through November. The mean daily temperatures at Lost Lake (just downstream from Millerton Lake) during these months range from 55.3 to 55.8°F across the four scenarios. With respect to CT-NoCC scenario, scenarios CT-Q5, EG-Q2, and SG-Q4 show reduced temperatures at this location. The lowest temperatures are in the SG-Q4 scenario, with the largest temperatures occurring in the CT-Q5 and EG-Q2 scenarios. There is only minor cooling under wetter SG-Q4 despite the wetter hydrology because Millerton Lake has limited capacity to hold high flows, so when there are higher inflows to Millerton (as occurs more frequently in climate scenario Q4) the thermocline in the lake is disturbed as the high flows flush out any cold water stored in the Lake. Similarly, when there are lower inflows into Millerton (as occurs frequently in climate scenario Q2) the thermocline in the Lake is maintained more frequently and the water released from Millerton is colder, resulting in cooler temperatures at Lost Lake, as observed in the EG-Q2 scenario.

Further downstream on the San Joaquin River at Gravelly Ford, the mean daily temperatures increase under all climate scenarios due to the effects of distance downstream and lower elevation. The warming is greatest in more warming Q2 and only minimal in less warming Q4. At Gravelly Ford, the mean daily temperature in these scenarios during these months range from a low of 67.7°F in CT-NoCC and SG-Q4 to a high of 69.7°F in EG-Q2.

At Vernalis, the temperature results show warming under all climate scenarios reflecting the effects of all operations in the San Joaquin River system including the upstream tributaries. The mean daily average temperature at Vernalis in the CT-NoCC scenario is 66.3°F. For the three climate scenarios, the mean daily temperatures at Vernalis range from 66.6°F to 67.6°F, with lowest in the SG-Q4 scenario, and highest in the EG-Q2 scenario.