Testimony of Andy Draper

I, Andy Draper, declare:

INTRODUCTION

1. I am a principal engineer with Montgomery Watson Harza (MWH). I have over 30 years experience in water resources engineering, and 10 years experience in system operations modeling of California's water resources. I am a registered Civil Engineer in the State of California, and have been employed at MWH since 2003. Exhibit YCWA-15 is a copy of my resume, which accurately describes my qualifications and work experience.

2. I am providing this expert testimony on the issues pertaining to Yuba County Water Agency (YCWA) and the Yuba River Development Project (Yuba Project) and related facilities that will be discussed during the December 5 and 6, 2007 State Water Resources Control Board (SWRCB) hearing to consider YCWA's petitions to modify YCWA's water-right permits and for long-term transfer of water.

3. My testimony relates to the analyses that were performed for the Lower Yuba River Accord (Yuba Accord) Environmental Impact Report/Environmental Impact Statement (EIR/EIS). The Yuba Accord Draft EIR/EIS is exhibit YCWA-1. The Yuba Accord Final EIR/EIS is exhibit YCWA-2. These analyses include: reservoir operations modeling for the Yuba Project and affected downstream rivers and facilities; temperature modeling for the lower Yuba River downstream from Englebright Dam and Reservoir; and hydrodynamic and water quality modeling for the Sacramento-San Joaquin Delta (Delta). My testimony also discusses analyses of historical data for the groundwater basin underlying Yuba County.

YUBA ACCORD EIR/EIS

Study Area

4. The environmental analysis for the Draft EIR/EIS covers four geographical areas that will be influenced by the Yuba Accord, as follows: (a) the Yuba Region, (b) the Central Valley Project/State Water Project (CVP/SWP) Upstream from the Delta Region, (c) the Delta Region, and (d) the Export Service Area. These regions are described in Section 2.1 of the Draft EIR/EIS, and together represent the Study Area.

Existing Condition and Alternatives

5. The Draft EIR/EIS considers the Existing Condition. These alternatives are described in Chapter 3 of the Draft EIR/EIS, and are summarized in Table 3-1 on page 3-3 of the Draft EIR/EIS. Modeling assumptions for the Existing Condition and each alternative are described in Section 4 of Appendix D of the Draft EIR/EIS.

Impact Analysis Approach

6. A scenario is a computer simulation characterization of the Existing Condition or an alternative. Seven scenarios were analyzed in the Draft EIR/EIS. The impact analyses compared modeling outputs from one scenario with modeling outputs from another

scenario to determine the potential for changes in environmental conditions. Table 2-1 on page D-3 of Appendix D of the Draft EIR/EIS lists the comparisons of scenarios that were evaluated in the Draft EIR/EIS. The evaluations of environmental impacts were performed using a set of impact indicators and significance criteria developed for each of the resource topics analyzed in the Draft EIR/EIS. Table 4-1 on pages D-20 and D-21 of Appendix D of the Draft EIR/EIS summarizes modeling assumptions for each of the scenarios.

7. The remainder of this testimony focuses on the comparison of Scenarios 2 and 3. Scenario 2 represents the CEQA No Project Alternative. Scenario 3 represents the CEQA Yuba Accord Alternative. The principal modeling assumptions that differentiate Scenario 2 from Scenario 3 are as follows:

   Scenario 2: CEQA No Project Alternative

   - SWRCB RD-1644 long-term instream-flow requirements for lower Yuba River
   - New Bullards Bar Reservoir September 30 maximum target storage of 705 TAF
   - No stored water transfers

   Scenario 3: CEQA Yuba Accord Alternative

   - Proposed Yuba Accord flow schedules for lower Yuba River
   - New Bullards Bar Reservoir September 30 maximum target storage of 650 TAF
   - The stored water transfers that will occur with implementation of flow schedules 1-6 and A-B in exhibit 1 of the Yuba Accord Fisheries Agreement and the New Bullards Bar Reservoir storage target line

8. The impact analyses for the Draft EIR/EIS are presented in the resource chapters of the Draft EIR/EIS. My testimony discusses the analyses the CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative for Surface Water Supply and Management (Chapter 5), Groundwater (Chapter 6), and Water Quality (Chapter 9). Surface Water Supply and Management

9. Chapter 5 of the Draft EIR/EIS discusses the potential impacts of the various alternatives on surface water supply and management within the Study Area. Table 5-33 on page 5-52 of the Draft EIR/EIS lists the impact indicators and significance criteria that were used for these analyses. These impact indicators are as follows: (a) surface water allocations to YCWA Member Units, (b) deliveries to south-of-Delta CVP water service contractors and wildlife refuges, (c) Table A deliveries to south-of-Delta SWP contractors, (d) X2 location, (e) Delta excess water conditions, (f) water levels in the south Delta, and (g) San Luis Reservoir storage. Computer-simulated stream flows and reservoir storage levels, generated as part of this surface water supply and management impact assessment, also were used in the evaluations of groundwater, hydropower, flood control, water quality, fisheries, terrestrial, recreation, and cultural resources for the Draft EIR/EIS.

Analytical Approach

10. Computer simulation models of water systems provide a means for evaluating changes in system characteristics such as reservoir storage, stream flows, and diversions, as well as

the effects of these changes on environmental parameters such as water temperature and water quality. The principal surface water models and post-processing tools that were used to simulate conditions with and without implementation of the Yuba Accord Alternative were:

- CALSIM II Model
- Yuba Project Model
- Lower Yuba River outflow routing tool
- Delta Simulation Model 2 (DSM2) Hydro module

11. These models and tools are briefly described below, and are described in more detail in Section 3 of Appendix D of the Draft EIR/EIS.

CALSIM II

12. CALSIM II was jointly developed by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), and California Department of Water Resources (DWR) for planning studies relating to CVP and SWP operations. The primary purpose of CALSIM II is to evaluate the water supply reliability of the CVP and SWP at current and future levels of development, with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the upstream watershed of the Delta, and SWP and CVP deliveries to the San Francisco Bay Area, Central Coast, San Joaquin Valley, Tulare Lake Basin, and Southern California.

13. CALSIM II typically simulates system operations for a 73-year period using a monthly time-step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed level of development. The historical flow record of October 1921 to September 1994, adjusted for the influence of land use changes and upstream flow regulation, is used to represent the possible range of hydrological conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CALSIM II uses a mass balance approach to route water through this network.

Yuba Project Model

14. The spreadsheet-based Yuba Project Model was developed by MWH in association with YCWA for modeling Yuba Project facilities and flows in the lower Yuba River. The Yuba Project Model simulates operations of New Bullards Bar and Englebright Reservoirs, diversions at Daguerre Point Dam, and flows in the lower Yuba River between Englebright Dam and the river's confluence with the Feather River. The model is a volumetric mass balance accounting tool, which simulates reservoir operations according to a set of predefined operating rules to meet downstream water demands and instream flow requirements on the lower Yuba River. The model is described in detail in Attachment A of Appendix D of the Draft EIR/EIS.

Lower Yuba River Outflow Routing Tool

15. The lower Yuba River outflow routing tool is a spreadsheet-based post-processing tool developed by MWH that uses outputs from CALSIM II and the Yuba Project Model to

simulate how changes in Yuba River flows at the Marysville gage affect storage in Lake Oroville, and downstream flows in the Feather River, the lower Sacramento River, and the Delta. This tool is described in Section 3.4 of Appendix D of the Draft EIR/EIS.

Delta Simulation Model 2 – Hydro Module

16. DSM2 is a branched one-dimensional model for simulation of hydrodynamic and water quality in a network of riverine or estuarine channels. The hydrodynamic module (Hydro) can simulate channel stage, flow, and water velocity. The model was developed and is used by DWR to perform operational and planning studies for the Delta. Impact analyses for planning studies for the Delta are typically performed for the 16-year period from 1976 to 1991. Results from CALSIM II and the Yuba River outflow routing tool are used to define Delta boundary inflows for the DSM2 model. DSM2 is described in Section 3 of Appendix D of the Draft EIR/EIS.

Conclusions Regarding Potential Effects of Yuba Accord Alternative on Water Supplies and Management

17. The model results for Surface Water Supply and Management are presented in Appendix F1 and Appendix F4 of the Draft EIR/EIS. Summarized below are key conclusions for the Yuba Accord Alternative (Scenario 3) compared to the No Project Alternative (Scenario 2).

Surface Water Allocations to Member Units

18. YCWA's allocations of surface water to its Member Units will be approximately 0.7 percent, or approximately 3 TAF per year, higher with the implementation of the Yuba Accord Alternative. However, YCWA's actual surface water deliveries to its Member Units under the Yuba Accord Alternative will be lower because of the greater volumes of groundwater-substitution transfers under the Yuba Accord Alternative, which will use some of the surface water that YCWA would allocate to its Member Units.

Deliveries to South-of-Delta CVP contractors

19. Average annual deliveries to CVP south-of-Delta water service contractors and wildlife refuges, excluding the additional water that will be made available through Yuba Accord water transfers, will be approximately 7 TAF per year, or less than 1 percent, lower under the Yuba Accord Alternative, relative to the No Project Alternative. In dry and critical years, average annual deliveries will be approximately 11 TAF and 23 TAF per year lower, respectively. However, these reductions in dry and critical years will be more than offset by the deliveries of Component 2, Component 3 and Component 4 water under the Yuba Accord Water Purchase Agreement.

Deliveries to South-of-Delta SWP contractors

20. Average annual south-of-Delta Table A deliveries, excluding the additional water that will be made available through Yuba Accord water transfers, will be approximately 5 TAF per year, or less than 1 percent, lower than under the Yuba Accord Alternative than under the No Project Alternative. In dry and critical years, the average annual deliveries will be approximately 9 TAF and 19 TAF per year lower, respectively. However, these

reductions in deliveries will be more than offset by the deliveries of Component 2, Component 3, and Component 4 water under the Yuba Accord Water Purchase Agreement.

Water Rights

21. Reclamation and DWR are supporting the Yuba Accord, and therefore are not objecting to any effects of the Yuba Accord on CVP or SWP water rights. Because water will remain in the lower Yuba River, the Feather River, the lower Sacramento River and the Delta with implementation of the Yuba Accord, the Yuba Accord will not affect the ability of any person or entity besides Reclamation or DWR to divert water from any of these water bodies, and therefore will not affect their water rights, except possibly by changing the dates on which the SWRCB's Standard Permit Term 91 will be in effect. Term 91 is discussed in the following paragraphs.

22. Term 91 prohibits certain permittees and licensees from diverting water in the Delta or in the upstream watershed under specified conditions. These conditions are triggered when water (supplemental project water) is being released from CVP and SWP storage, or imported to the basin by the CVP and SWP, to meet water quality standards or in-basin entitlements in the Delta or upstream watersheds. CVP and SWP export diversions and associated carriage water are not in-basin entitlements.

23. Diversion curtailments under Term 91 are managed on a real-time basis by reviewing calculations of the supplemental project water releases that are presented on Reclamation's Web site. Generally, Term 91 is in effect during the months of June through August, although there are significant year-to-year variations. For example, in 1992, Term 91 was in effect from mid-May through mid-November. Nevertheless, the default end-date for Term 91 is August 31.

24. A review of historical data shows that, at the onset of Term 91, changes in the CVP's and SWP's releases of supplemental project water are several hundred cubic feet per second (cfs) per day. For example, on May 31, 2005, supplemental project water had a calculated negative value of 2,992 cfs. On June 15, 2005, supplemental water had a calculated positive value of 5,871 cfs. This represents an average change of almost 600 cfs per day. On the other hand, the decreases in Yuba River outflows under the Yuba Accord Alternative compared to the No Project Alternative during the times when Term 91 is likely to be going into effect will be much smaller, and will not significantly change the timing of when Term 91 goes into effect. The potential impacts of the Yuba Accord Alternative on when Term 91 is in effect are discussed in detail Chapter 4 of the Final EIR/EIS at pages 4-67 to 4-68, under Response to Comment SA3-15.

Groundwater Resources

25. Chapter 6 of the Draft EIR/EIS discusses the potential impacts of the various alternatives on the groundwater basin underlying part of Yuba County. This groundwater basin is divided by the Yuba River into the North Yuba Subbasin and South Yuba Subbasin. The locations of the subbasins are shown in Figure 6-2 on page 6-7 of the Draft EIR/EIS and in Slide 10.

26. Groundwater occurs generally within unconfined conditions throughout most of the Yuba Basin. However, confined conditions probably occur at depths exceeding 300 feet to 400 feet below ground surface (bgs). Semi-confined conditions probably occur at about 300 feet bgs. The general flow of groundwater in the Yuba Basin is from east to the west, beginning in the mountain front recharge regions. The hydraulic gradient is steep in eastern Yuba County and gradually flattens out toward the west. As a result of agricultural pumping, particularly in the South Yuba Subbasin, relatively low groundwater elevations occur in the southwest area of the South Yuba Subbasin, inducing groundwater to flow toward this area, as shown in Figure 6-2 on page 6-7 of the Draft EIR/EIS. The hydrogeology of the Yuba subbasins is discussed in detail in Chapter 6 of the Draft EIR/EIS.

27. Table 6-7 on page 6-69 of the Draft EIR/EIS lists the impact indicators and significance criteria that were used for the analyses of the potential effects of the Yuba Accord on the groundwater resources. These impact indicators are as follows: (a) groundwater levels and storage; (b) groundwater and surface water interactions; (c) groundwater quality; and (d) land subsidence.

Analytical Approach

28. Two methods were applied to assess potential impacts of the various alternatives on Yuba Basin groundwater levels and storage.

    Long-term Impact Analysis: This analysis evaluated the long-term regional trends in groundwater levels and storage within the North Yuba and South Yuba subbasins between 1960 and 2005. Based on a study of historical well data, the long-term recharge rate of the subbasins was estimated.

    Short-term Impact Analysis: This analysis estimated the potential localized short-term impacts that resulted from historical pumping in the North Yuba and South Yuba subbasins during the previous groundwater transfers in 1991, 1994, 2001, and 2002.

29. The Yuba Project Model was used to estimate annual volumes of groundwater pumping under the various alternatives that are discussed in the Draft EIR/EIS. It was assumed that the maximum three-year groundwater pumping volume would be limited to 180 TAF under the Yuba Accord Alternative. The resulting 3-year pattern for maximum annual groundwater-substitution pumping was assumed to be 90 TAF during year 1, 60 TAF during year 2, and 30 TAF during year 3. It was also assumed that groundwater pumping for groundwater-substitution transfers would only occur in dry and critical years, and in below normal years when allocations to the SWP contractors are less than 60 percent of their full Table A amounts. These modeling criteria are described on page A-23 of Attachment A of Appendix D of the Draft EIR/EIS.

30. For the No Project Alternative, it was assumed that the maximum 3-year groundwater pumping volume would be limited to 140 TAF, and that the resulting 3-year pattern for maximum annual groundwater-substitution pumping would be 70 TAF during year 1, 50 TAF during year 2, and 20 TAF during year 3.

Conclusions Regarding Potential Effects of Yuba Accord Alternative on Groundwater

Groundwater Storage and Levels

31. The long-term impact analysis is described in Section 6.2 of the Draft EIR/EIS. For the South Yuba Subbasin, the historical average annual recharge rate is approximately 21 TAF per year. No definitive recharge rate could be established for the North Yuba Subbasin because the basin appears to be in long-term equilibrium. However, following a drawdown in 1976 and 1977, the North Yuba Subbasin recovered at an average recharge rate of 11 TAF per year. Based on the analysis of regional groundwater storage changes, a combined average annual volume of total groundwater pumping for substitution transfers and surface water delivery shortages of 30 TAF per year is considered to be safe and sustainable, and pumping at this rate would not lower long-term groundwater levels and storage within the Yuba Basin.

32. This long-term impact analysis did not account for the beneficial impacts on groundwater storage that will occur as a result of implementation of the Wheatland Project, which will provide up to 40 TAF per year of surface water to the Wheatland Irrigation District. Farmers within this district currently rely on groundwater as their sole source of irrigation water, so provision of this new surface water supply will reduce future groundwater pumping in this area by a corresponding amount, and will reduce the impacts of Yuba Accord groundwater-substitution programs.

33. Figure 6-19 on page 6-43 of the Draft EIR/EIS illustrates the annual groundwater recharge, the maximum annual groundwater pumping, and the cumulative groundwater storage changes that it is assumed could occur over a six-year period under the Yuba Accord Alternative. As shown in this figure, under this maximum potential groundwater pumping, the cumulative decline in groundwater storage over six years would be 180 TAF. This decline would be a result of the maximum 3-year groundwater pumping of 180 TAF (90 TAF for year 1, 60 TAF for year 2, and 30 TAF for year 3), followed by a second, similar three-year sequence imposed on a recharge rate of 30 TAF per year. Figure 6-20 on page 6-44 of the Draft EIR/EIS illustrates the annual groundwater recharge, the maximum annual groundwater pumping, and the cumulative groundwater storage changes that it is assumed could occur over a six-year period under the No Project Alternative. The cumulative decline over six years under the No Project Alternative would be 100 TAF.

34. Figure 6-21 on page 6-46 of the Draft EIR/EIS compares the maximum estimated cumulative change in storage of 180 TAF under the Yuba Accord Alternative and the maximum estimated cumulative change in storage of 100 TAF under the No Project Alternative to the historical changes in groundwater storage in the South Yuba Subbasin that occurred between 1961 and 2005. This figure also is presented in Slide 11. A storage decline of 180 TAF would lower groundwater in the South Yuba Subbasin from its current storage level to approximately to the conditions that occurred in 1991. However, this resulting level still would be approximately 190 TAF above the historical minimum storage levels that occurred in 1982. Moreover, it is anticipated that, under the Yuba Accord Alternative, groundwater levels in the South Yuba Subbasin actually will stay above the 1991 conditions because: (a) groundwater-substitution pumping will occur in both the North and South subbasins, while the historical groundwater pumping was

almost exclusively in the South subbasin; and (b) the Wheatland Project, when fully implemented, will reduce normal groundwater pumping by up to 40 TAF per year. Typically, following groundwater-substitution pumping during a drought cycle, the basin would recover under a cycle of wetter years. Figure 6-22 on page 6-48 of the Draft EIR/EIS shows that for the 73-year period of simulation, simulated groundwater storage would increase at an average rate of 2 TAF per year under the Yuba Accord Alternative.

35. Yuba Project Model results for estimated groundwater pumping under the Yuba Accord Alternative and the No Project Alternative are presented in Table 6-4 on page 6-47 and in Table 6-8 on page 6-70 of the Draft EIR/EIS, and in Table LA2-1 on page 4-96 of the Final EIR/EIS. As shown in Table 6-4, the long-term average annual groundwater pumping under the Yuba Accord Alternative will be 28 TAF per year, compared to the long-term average annual groundwater pumping of 25 TAF per year under the No Project Alternative. In model simulations, two three-year, back-to-back cycles with maximum pumping for groundwater-substitution transfers would occur only once during the 73-year period of simulation, under a repeat of the 1987 to 1992 drought.

Groundwater and Surface Water Interactions

36. Groundwater elevation maps, data for subsurface lithology and well construction data were used for a qualitative analysis of the level of connection between surface water in the rivers and groundwater in the aquifers along the major rivers in the Yuba Basin. This analysis shows that the Yuba River is the primary source of recharge to the North Yuba and South Yuba subbasins. Recharge to the Yuba Basin from the Bear and Feather rivers and Honcut Creek is small, and groundwater levels along the Feather River and Honcut Creek showed very minor changes during past groundwater-substitution transfers.

37. The areas most prone to potential impacts from groundwater/surface water interactions will be the upper portion of the lower Yuba River, upper portion of the lower Bear River, and upper portion of Honcut Creek, where depths to the water table tend to be shallow, and where coarse-grained materials are present at shallow depths. Figure F2-9 on page F2-13 of Appendix F2 of the Draft EIR/EIS illustrates the relationships between stage in the lower Yuba River at Marysville (shown in black), and groundwater elevations at four different depths (70 to 80 feet, 250 to 260 feet, 430 to 450 feet, and 600 to 620 feet, shown by the curves of other colors). This hydrograph shows that most of the pumping occurs at the middle depths and that groundwater elevations in aquifers at these depths are very responsive to groundwater pumping. This hydrograph also shows that groundwater elevations in the shallow aquifer (blue curve) do not respond to groundwater pumping, but rather follow the stream stages.

Groundwater Quality

38. The Yuba Basin is in healthy condition with respect to water quality. During past groundwater-substitution transfers, no long-term significant impacts on groundwater quality have occurred. One potential adverse impact associated with lowering groundwater levels below the range of historical low levels would be the potential mobilization of saline water from deeper zones to shallower zones. However, because anticipated future pumping with implementation of the Yuba Accord Alternative

evaluated in this EIR/EIS will be within historical pumping volumes, this type of impact to groundwater quality will be less than significant.

39. During the implementation of the Yuba Accord groundwater-substitution transfers, YCWA and its Member Units will be obligated to monitor and report on groundwater basin conditions, both before and after the transfers. Using the adaptive management program of the Yuba Accord Alternative, YCWA will identify local impacts and take actions to mitigate any local water quality concerns. As part of this adaptive management program, water quality data collected by DWR from multilevel piezometers will be used to characterize groundwater quality changes at different depths.

Land Subsidence

40. Groundwater elevations in the Yuba Basin would have to drop below historical low levels before land subsidence could occur. In the North Yuba Subbasin, the lowest groundwater levels were experienced in 1977, while in the South Yuba Subbasin, groundwater levels were at historical lows in 1982. Groundwater levels in the North Yuba Subbasin have increased by approximately 30 to 80 feet since the early 1980s. In the South Yuba Subbasin, current groundwater elevations are approximately 30 to 100 feet higher than the historical lows. Groundwater pumping under the Yuba Accord Alternative is not expected to draw groundwater levels below the historical low level of 1991. Although potential land subsidence impacts are expected to be less than significant, YCWA will continue to coordinate with DWR to monitor land subsidence across the Yuba Basin.

Surface Water Quality

41. Chapter 9 of the Draft EIR/EIS discusses the potential impacts of the various alternatives on surface water quality and water temperature. Water bodies that could be affected by these alternatives are New Bullards Bar Reservoir, the lower Yuba River, Oroville Reservoir, lower Feather River, lower Sacramento River, the Delta, and San Luis Reservoir. Table 9-16 on pages 9-44 and 9-45 of the Draft EIR/EIS lists the impact indicators and significance criteria for this resource. These impact indicators are as follows: (a) reservoir storage in New Bullards Bar Reservoir, Oroville Reservoir, and San Luis Reservoir; (b) flow and water temperature in the lower Yuba River; (c) flow and water temperature in the lower Feather River and lower Sacramento River; (d) X2 location; (e) Delta export to inflow (E/I) ratio; (f) electrical conductance (EC) at Delta water quality control stations; (g) chloride at Delta municipal and industrial (M&I) intakes; (h) dissolved organic carbon at Delta M&I intakes; and (i) channel flow in the south Delta.

Analytical Approach

42. Flow and storage results from modeling conducted for Surface Water Supply and Management (Chapter 5) were used to help identify potential surface water quality impacts. In addition to the reservoir operations models and flow routing tools previously described, the following water quality models were used for this impact analysis.

Lower Yuba River Water Temperature Model

43. The lower Yuba River temperature model is a statistical model that was used to evaluate the potential impacts of different New Bullards Bar Reservoir storage regimes and flow releases, and diversions at Daguerre Point Dam, on water temperatures in the lower Yuba River. Details of the statistical relationships that were used in this model are presented in Attachment B of Appendix D, of the Draft EIR/EIS. Independent variables for these relationships are storage in New Bullards Bar Reservoir, releases from New Bullards Bar Reservoir, inflows to Englebright Reservoir from the Middle Yuba and South Yuba rivers, Yuba River flow at the Smartville gage, and Yuba River flow at the Marysville gage.

Reservoir and River Temperature Models

44. Reclamation has developed water temperature models for the Sacramento and Feather rivers. These models have both reservoir and river components and are described in Section 3 of Appendix D of the Draft EIR/EIS.

Delta Simulation Model 2 – Qual Module

45. The water quality module (Qual) of DSM2, which was developed by DWR, is used to simulate the movement of conservative constituents. In model simulations, EC is used as a surrogate for salinity.

Conclusions Regarding Potential Effects of Yuba Accord Alternative on Surface Water Quality

46. Model results for surface water quality are included in the outputs presented in Appendix F4 of the Draft EIR/EIS. Summarized below are key findings for the Yuba Accord Alternative (Scenario 3) compared to the No Project Alternative (Scenario 2).

Water Temperatures in the Lower Yuba River

47. In general, lower Yuba River water temperatures under the Yuba Accord Alternative will be slightly warmer from October to June and slightly colder from July to October compared to those that would occur under the No Project Alternative. Long-term average monthly water temperatures in the lower Yuba River at the Smartville gage under the Yuba Accord Alternative will vary from -0.3 ºF to +0.2 ºF compared to those under the No Project Alternative.. Long-term average monthly water temperatures at the Marysville gage will vary from -2.0 ºF to +0.2 ºF compared to those under the No Project Alternative.

Water Temperatures in the Lower Feather and Lower Sacramento Rivers

48. Differences in long-term average monthly water temperatures, in the Feather River below the Thermalito Afterbay under the Yuba Accord Alternative, relative to the No Project Alternative, are less than 0.2 ºF.

49. Differences in long-term average monthly water temperatures at the mouth of the Feather River between the Yuba Accord Alternative and the No Project Alternative reflect differences in water temperature of Yuba River outflow, but attenuated by the Feather River flows. In general, water temperatures at the mouth of the Feather River under the

Yuba Accord Alternative will be slightly warmer from October to June and slightly colder from July to October compared to those that would occur under the No Project Alternative. Long-term average monthly water temperatures at the mouth of the Feather River under the Yuba Accord Alternative will vary from -0.8 ºF to +0.2 ºF compared to those under the No Project Alternative.

50. Differences in long-term average monthly water temperatures in the lower Sacramento River under the Yuba Accord Alternative, relative to the No Project Alternative, reflect differences in Feather River water temperatures, but attenuated by flows in the Sacramento River. Long-term average monthly water temperatures in the Sacramento River below the Feather River confluence under the Yuba Accord Alternative will vary between -0.3 ºF to +0.1 ºF compared to those under the No Project Alternative.

X2 Location

51. The long-term average location of X2 and average location by water year will remain essentially the same during most months under the Yuba Accord Alternative, relative to the No Project Alternative, over the 73-year simulation period. Increases (i.e. movement upstream) in X2 location under the Yuba Accord Alternative, relative to the No Project Alternative, will not exceed 0.4 kilometers (km).

Delta Salinity

52. Salinity (EC) results from DSM2 for Delta water quality compliance stations and Delta M&I intakes are presented in Appendix F5 of the Draft EIR/EIS. Changes in EC will be generally less than 5 percent. The Yuba Accord alternative will tend to slightly reduce salinity in the south Delta during the summer and fall, and slightly increase salinity in the spring due to New Bullards Bar Reservoir refill effects. These changes will have no significant impacts.

EFFECTS OF *NRDC V. KEMPTHORNE* INTERIM REMEDIES ORDER

53. After the Draft EIR/EIS was issued in June 2007, a draft interim remedies order was issued in August 2007 by the court in *Natural Resources Defense Council (NRDC) et al. v. Kempthorne et al.* (*NRDC v. Kempthorne*). This case concerns the U.S. Fish and Wildlife Service's (USFWS) 2005 Biological Opinion (BO) on the CVP and the SWP Operations Criteria and Plan (OCAP). As discussed in Chapter 3 of the Final EIR/EIS, the draft interim remedies order in *NRDC v. Kempthorne* directs Reclamation and DWR to take several actions, including some substantial curtailments of Delta exports by the CVP and SWP during late December through June of each year.

First Phase of the Yuba Accord

54. As a result of the draft remedies order, Reclamation has decided to delay completion of its Federal Endangered Species Act (ESA) compliance for the Yuba Accord, and to delay completion of its Environmental Impact Statement and Record of Decision (ROD) for the project until the ESA re-consultations for OCAP are completed. As a result of this decision, the Yuba Accord will be implemented in two phases. During the first phase, only YCWA and DWR will be parties to the Water Purchase Agreement. During the first phase, the same amount of Component 1 water will go to the Environmental Water

Account (EWA) Program. For Components 2, 3, and 4 water, DWR will still execute Tier 3 Agreements with SWP contractors, and DWR also will execute water-purchase agreements with interested CVP contractors.

Analytical Approach

55. The phasing of the Yuba Accord will cause two major changes in the analyses presented in the Draft EIR/EIS. First, the proportions of Yuba Accord transfer water pumped at the Banks and Jones pumping plants will change, if Yuba Accord transfer water may not be pumped at the Jones Pumping Plant at the rates analyzed in the Draft EIR/EIS. Second, while the amounts of Yuba Accord transfer water that are delivered to the EWA Program will not change, there may be some changes in the amounts of Yuba Accord transfer water that are delivered to CVP and SWP contractors in drier years. However, it is anticipated that DWR will enter into contracts with interested CVP contractors under which DWR will supply Components 2, 3, and 4 water to these contractors. The range of allocations of Components 2, 3, and 4 water discussed and analyzed in the Draft EIR/EIS therefore probably will not change significantly during the first phase of the Yuba Accord.

56. To quantify the maximum potential effect of phasing of the Yuba Accord on CVP and SWP pumping of Yuba Accord transfer water from the Delta, it was assumed that, under the first phase of the Yuba Accord, all Yuba Accord transfer water will be conveyed only through Banks Pumping Plant, and only when capacity is available at the Banks Pumping Plant for this purpose.

57. The analysis of this scenario for the Final EIR/EIS used the same models, assumptions, and methodologies as were used for analyses presented in the Draft EIR/EIS, but with the restriction that export pumping of Yuba Accord transfer water may occur only at the Banks Pumping Plant.

Conclusions Regarding Effects of Phasing of the Yuba Accord

58. Table 1 of exhibit YCWA-27 shows the differences in simulated Yuba River flows at the Marysville Gage under the first phase of the Yuba Accord and the simulated flows at this same gage under the Draft EIR/EIS Yuba Accord Alternative. The major differences in flows will occur during July through September in dry and critical years, caused by reductions in groundwater-substitution pumping. The reduction in groundwater-substitution pumping will result from reduced available export capacity at Banks Pumping Plant.

59. Table 3-1 on page 3-3 of the Final EIR/EIS shows the changes in pumping rates that will result under the first phase of the Yuba Accord compared to pumping rates presented for the Yuba Accord Alternative in the Draft EIR/EIS. The restriction on moving Yuba Accord water through Jones Pumping Plant will mostly be offset by increases in pumping at Banks Pumping Plant. C1 water will typically be moved through EWA-dedicated capacity at Banks Pumping Plant under either scenario, and thus will not be affected by the phasing of the Yuba Accord. C2 and C3 water is associated with drier hydrological conditions, when typically plenty of pumping capacity is available at Banks Pumping Plant for water transfers. As Table 3-1 shows, there normally will be slightly lower

pumping at Jones Pumping Plant, and slightly higher pumping at Banks Pumping Plant during the first phase of the Yuba Accord, relative to the Yuba Accord Alternative analyzed in the Draft EIR/EIS. Average annual total exports will be 3 TAF lower during the first phase. Average annual exports will be lower under the first phase during all water-year types except below-normal years, during which total exports will be slightly higher.

Yuba Accord with Interim Remedies Order

60. The U.S. District Court issued its draft interim remedies order in *NRDC v. Kempthorne* on August 31, 2007. Although the court has yet not issued its final interim remedies order in this case, it is anticipated that the court's final order will be very similar to the draft order, and therefore will significantly restrict the amounts of water that Reclamation and DWR may pump from the Delta from late December through June of each year.

Analytical Approach

61. Supplemental modeling was undertaken to simulate operations under the Yuba Accord Alternative with the interim remedies order in place. The purpose of this modeling was to determine whether the environmental impacts of the Yuba Accord Alternative with the interim remedies order in place will result in any new significant environmental impacts that are not already identified in the Draft EIR/EIS. The purpose was not to estimate the effects of the interim remedies order on overall CVP and SWP export operations. Given the current uncertainties regarding interpretation of the interim remedies order, modeling assumptions were chosen to be the most restrictive on CVP and SWP operations during the December through June period, because this assumption results in the largest changes in the Yuba Accord operations and model simulations that are presented in the Draft EIR/EIS. Exhibit YCWA-28 contains a summary of the modeling assumptions for the interim remedies order that were used for this supplemental modeling.

62. This supplemental analysis of the interim remedies order used the same models, assumptions and methodologies that were used for analyses presented in the Draft EIR/EIS, but with two changes. First, additional restrictions on CVP and SWP export pumping were imposed from December through June to limit reverse flows in the Old River and Middle River. Second, for the Yuba Accord Alternative, because of anticipated reduction in available pumping capacity at Banks and Jones pumping plants in July, the New Bullards Bar Reservoir target storage was adjusted to move the timing of some transfer water from July to August.

Conclusions Regarding Effects of the Interim Remedies Order on the Yuba Accord

63. Table 3-4 and Table 3-5 on page 3-8 of the Final EIR/EIS present the simulated monthly stored-water and groundwater-substitution transfer volumes for the Yuba Accord Alternative, and the percentages of the total transfers that will occur during each month. These tables show that relatively small percentages of the stored-water transfers, and none of the groundwater-substitution transfers, under the Yuba Accord Alternative are predicted to occur during the December to June period. Also, changes in the rules governing CVP/SWP exports from the Delta will not directly affect New Bullards Bar Reservoir operations, because New Bullards Bar Reservoir still will be operated to meet

monthly target reservoir storage amounts, YCWA Member Unit demands for surface water, and instream flow requirements in the lower Yuba River. Therefore, it is anticipated that the main effect of the court's interim remedies order on the Yuba Accord Alternative will be to reduce exports of Yuba Accord surface water transfers during the December to June period. This reduction may be partially offset by increases in transfers during the July to November period achieved through re-regulation of Yuba River outflows through temporary storage of additional water in Oroville Reservoir.

64. Table 3-4 and Table 3-5 also show that the majority of the stored-water and groundwater-substitution transfers under the Yuba Accord Alternative will occur during July through September, with some additional transfers during October and November. The court's interim remedies order does not directly affect CVP or SWP exports during these months, so it is unlikely that this order will significantly affect exports of Yuba Accord transfer water that are analyzed in the Draft EIR/EIS, during these months. However, CVP and SWP re-operations to reduce surface water delivery impacts of the court's interim remedies order may reduce the availability of export capacity for water transfers during the summer months and thus may reduce exports of Yuba Accord transfer water during these months. Such reductions may lead to slightly higher Delta outflows.

65. Table 2 of exhibit YCWA-27 compares changes in simulated Yuba River flows at the Marysville Gage for the Yuba Accord Alternative with the interim remedies order in place to the simulated flows at this same gage under the Draft EIR/EIS Yuba Accord Alternative. Differences in outflow may occur during July and August if New Bullards Bar Reservoir target storage levels are modified to better match available export pumping capacity in the Delta. In addition, in dry years there will be a reduction in the June to September flows at the Marysville Gage caused by reductions in groundwater-substitution pumping. The reductions in groundwater-substitution pumping will result from reduced available Delta export capacity at Banks Pumping Plant. There also will be corresponding changes in the flows in the Feather River downstream of its confluence with the Yuba River, and in the flows in the Sacramento River downstream of its confluence with the Feather River. However, the percentage changes in these flows will be lower than the percentage changes in lower Yuba River flows, because the base flows in these rivers will not change.

66. The interim remedies order will have a significant effect on CVP and SWP export pumping. Based on the assumptions summarized in exhibit YCWA-28, little or no CVP or SWP Delta export pumping capacity will be available from January through June. In very wet years, high inflows to the Delta from the San Joaquin River will create a positive flow in the Old and Middle rivers, thus reducing the impact of the interim remedies order on allowable pumping rates. In critical years, when CVP and SWP allocations are low, some available pumping capacity for water transfers will still exist. In general, the effects of the interim remedies order on the Yuba Accord will be as follows:

    - to reduce Delta exports of Yuba Accord surface water transfers from January to June because of the order's limits on reverse flows in the Old and Middle rivers;
    - to shift some Delta exports of Yuba Accord surface water transfers during the July to September period from wet years to above normal and below normal years

because of a reduction in available pumping capacity at Banks and Jones pumping plants in wet years and the ability to temporarily store Yuba Accord water in New Bullards Bar Reservoir; and

- to reduce Delta exports of Yuba Accord groundwater transfers from July to September in dry years because of a reduction in available pumping capacity at Banks and Jones pumping plants.

67. For all of these reasons, changes in operations of the Yuba Accord Alternative under the interim remedies order are not anticipated to result in any new, significant environmental impacts on surface water, groundwater or water quality that were not analyzed in the Draft EIR/EIS.

First Phase of the Yuba Accord Alternative with Interim Remedies Order

Analytical Approach

68. The analyses described above were repeated for the combination of both the first phase of the Yuba Accord Alternative and the interim remedies order.

Conclusions Regarding Effects Combination of the Interim Remedies Order and the First Phase of the Yuba Accord Alternative

69. Table 3 of exhibit YCWA-27 shows the differences in Yuba River simulated flows at the Marysville Gage for the combination of the first phase of the Yuba Accord Alternative and the interim remedies order to simulated flows at this same gage presented for the Yuba Accord Alternative in the Draft EIR/EIS. The model results and conclusions for the combination of the first phase of the Yuba Accord Alternative and the interim remedies order are similar to those described above for the Yuba Accord Alternative with the interim remedies order.

Preparation of Exhibits YCWA-22, 23 and 24

70. The new hydrological analyses described above for the first phase of the Yuba Accord, interim remedies order and combination of interim remedies order and first phase of the Yuba Accord also were used to prepare Exhibits YCWA-22 and YCWA-23. Also, MWH personnel under my supervision forwarded the new estimates of SWP and CVP Delta exports under these scenarios to HDR|SWRI, so that HDR|SWRI personnel could use these new estimates of Delta exports to prepare Exhibit YCWA-24. All of these new figures and tables were prepared using the same methods that were used to prepare the corresponding figures and tables in the Draft EIR/EIS, with the addition of the new modeling assumptions described above.

CONCLUSIONS

71. The Yuba Accord Alternative, as described in the Draft EIR/EIS, and in comparison to the No Project Alternative, will not unreasonably affect water supply and management of California's water resources, groundwater conditions within Yuba County, or surface water quality, and will not result in any substantial injury or harm to any legal user of water.

72. As shown by the supplemental modeling and analysis discussed above, the phasing of the Yuba Accord, implementing the Yuba Accord while the court's interim remedies order in *NRDC v. Kempthorne* is in effect, and the combination of phasing the Yuba Accord while the court's interim remedies order is in effect, will not change the conclusions of the environmental impact analysis presented in the Draft EIR/EIS with regard to water supply and management of California's water resources, groundwater conditions within Yuba County, or surface water quality.

I declare under penalty of perjury that the foregoing is true and correct. Executed at Sacramento, California, this 8th day of November, 2007.

Andy Draper

Testimony of Andrew Draper, Ph.D., P.E.

For December 5-6, 2007

State Water Resources Control Board Hearing

On Yuba County Water Agency Petitions

For Lower Yuba River Accord

Surface Water Supply and Management Environmental Impact Analyses

Reference: Chapter 5, Proposed Lower Yuba River Accord, Draft EIR/EIS

Potential Surface-Water Effects of Yuba Accord

- Reservoirs and streams potentially affected by Yuba Accord:
  - New Bullards Bar Reservoir and lower Yuba River
  - Oroville Reservoir and lower Feather River
  - Sacramento River downstream of its confluence with Feather River
  - Sacramento-San Joaquin River Delta
  - San Luis Reservoir
- Water users potentially affected by the Yuba Accord:
  - YCWA Member Units
  - Contra Costa Water District
  - CVP and SWP contractors
  - Water users subject to Term 91

Methodology

- Computer simulation models and post-processing tools were used to assess potential changes in reservoir storage, river flows, diversions and exports relative to the bases of comparison. These tools evaluated monthly operations under 73 years of varying hydrology
- Modeling tools included:
  - Yuba Project Model (YCWA model of Yuba Project)
  - CalSim II (joint DWR-Reclamation model of CVP and SWP)
  - DSM 2 - Hydro (DWR hydrodynamic model of Delta)

Conclusions Regarding Surface Water

- Yuba Accord Alternative compared to No Project Alternative
  - YCWA Member Unit allocations will be approximately 0.7% higher
  - Reductions in CVP and SWP project deliveries will be more than offset by C2, C3, and C4 Accord transfer water
  - Changes in X2 location and Delta excess conditions would affect Contra Costa WD filling of Los Vaqueros during only 1 of 876 months
  - Changes in minimum daily south Delta water levels will be less than 0.01 feet
  - Carryover storage in San Luis Reservoir will average 2 TAF lower

Groundwater Resources Environmental Impact Analysis

Reference: Chapter 6, Proposed Lower Yuba River Accord, Draft EIR/EIS

Potential Effects of Yuba Accord on Yuba Groundwater Basin

- Fisheries Agreement commitment of 30,000 acre-feet of groundwater-substitution pumping in about 4% of years (Schedule 6 years) to supplement storage releases for instream flows
- Groundwater pumping to mitigate YCWA surface water delivery shortages to YCWA Member Units in some years
- Member Units' participation in groundwater-substitution transfers

Methodology

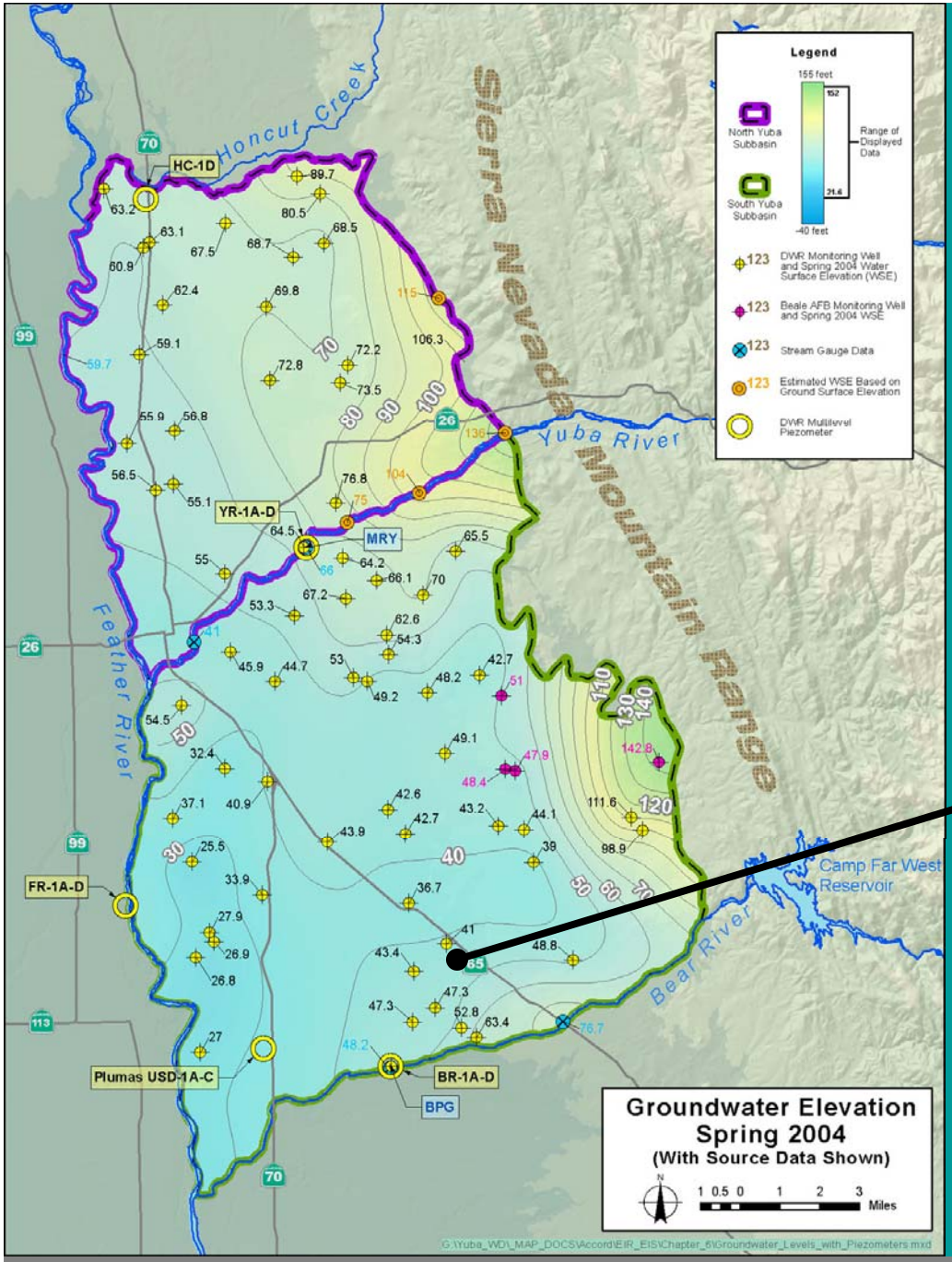
- Empirical field data for Yuba Basin was used to characterize basin responses to historical groundwater stresses and to estimate future stresses resulting from Yuba Accord
- Data used for analysis:
  - Historical groundwater elevations (1960-2005)
  - Historical groundwater-substitution transfer pumping volumes (1960-2005)
  - Historical river gage data (1980-2004)
  - Surface water delivery records (1971-2005)
  - Groundwater-substitution transfer pumping records (1991, 1994, 2001, 2002)
  - Well construction data
  - Subsurface lithology
  - Groundwater elevations from multilevel piezometers
  - Yuba Basin well hydrographs located throughout the Yuba Basin

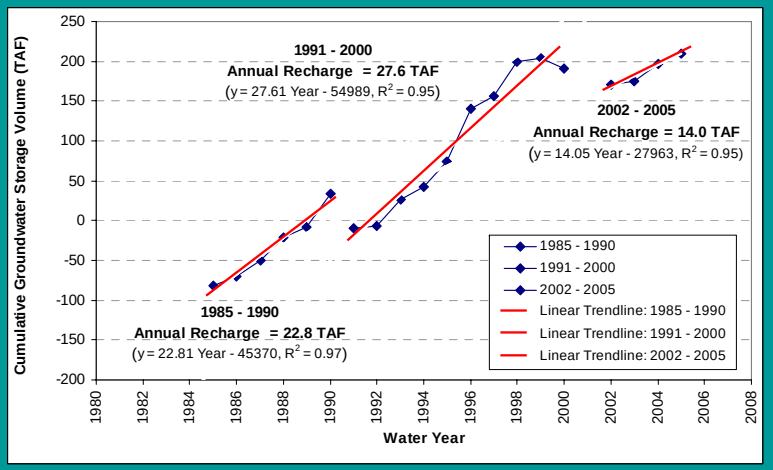
Methodology

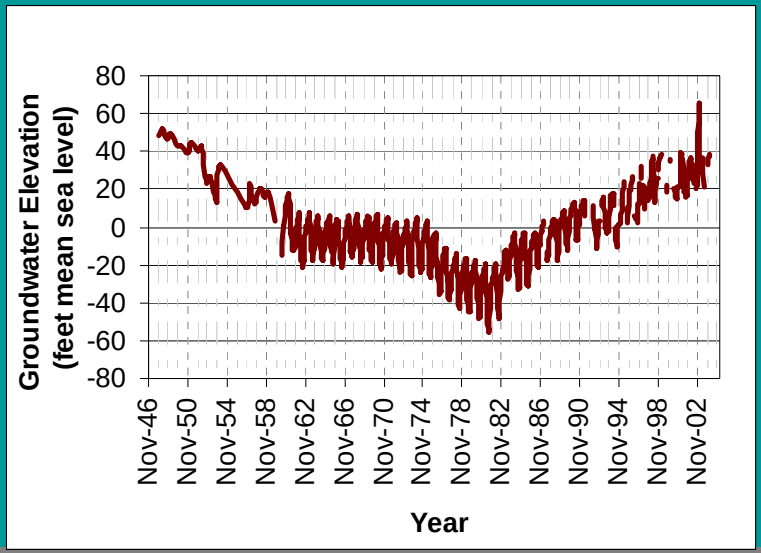
- Long-term regional impact analysis: evaluates long-term trends in groundwater levels
  - Estimate groundwater levels in Yuba Basin between 1960 and 2005
  - Estimate groundwater storage changes from 1960 to 2005
  - Estimate annual groundwater pumping rate that could be sustained without reducing average groundwater levels (equals long-term average annual recharge rate)
  - Formulate rules for simulating groundwater-substitution program
  - Evaluate downstream impacts of groundwater-substitution program operated at maximum capacity

- Short-term local impact analysis: Evaluates potential localized short-term impacts
  - Analysis and review of historical pumping and well hydrographs in Yuba Basin during previous groundwater transfer years 1991, 1994, 2001, and 2002.

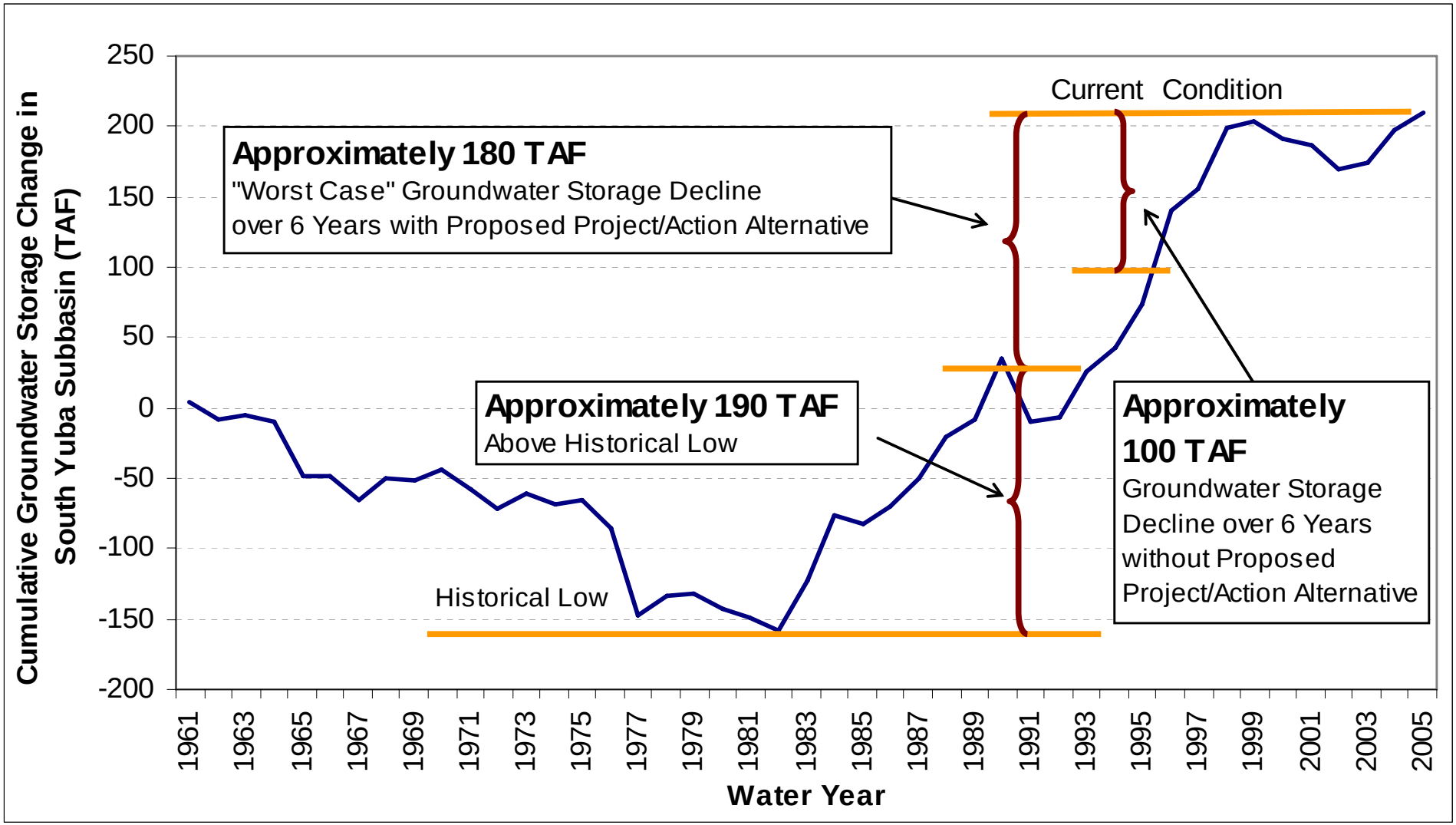
Yuba Groundwater Basin







Historical and Simulated Groundwater Storage



Conclusions Regarding Groundwater

- Average annual groundwater pumping rate will be less than historical average annual recharge rate
  - Groundwater pumping to supply C2, C3 and C4 water will be limited to volumes determined by YCWA and the Member Units that will not adversely impact Yuba groundwater basin
- Short-term changes in groundwater levels and storage will be similar to those experienced during past water transfers
  - If any impacts to local groundwater users occur, then YCWA and participating Member Units will take actions similar to actions taken in 1991, 2001 and 2002 to fully mitigate any such impacts
- No evidence of increased stream losses to groundwater during past transfers
  - Absence of transmissive materials along the Bear River and Honcut Creek.
  - Limited hydraulic connection between Feather River and underlying aquifer
- No anticipated water quality impacts
  - Water quality data collected by DWR from multilevel piezometers will be used to monitor groundwater quality with depth
- No anticipated land subsidence impacts
  - Groundwater levels will substantially exceed historical low levels
  - YCWA will coordinate with DWR to monitor land subsidence across the Yuba Basin

Surface Water Quality Environmental Impact Analysis

Reference: Chapter 9, Proposed Lower Yuba River Accord, Draft EIR/EIS

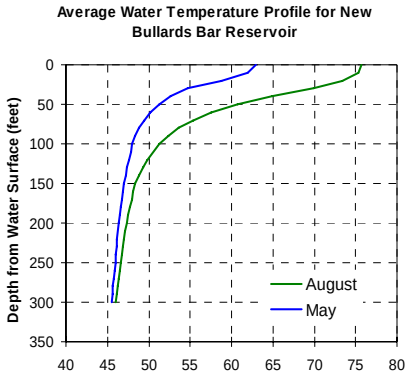
Potentially Effects of Yuba Accord on Surface Water Quality

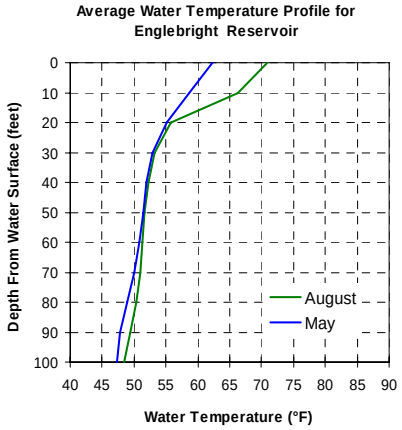
- Water bodies potentially affected by the Yuba Accord include:
  - Lower Yuba River
  - Lower Feather River downstream of Oroville Reservoir
  - Sacramento River downstream of its confluence with Feather River
  - Sacramento-San Joaquin River Delta
  - New Bullards Bar Reservoir
  - Oroville Reservoir
  - San Luis Reservoir

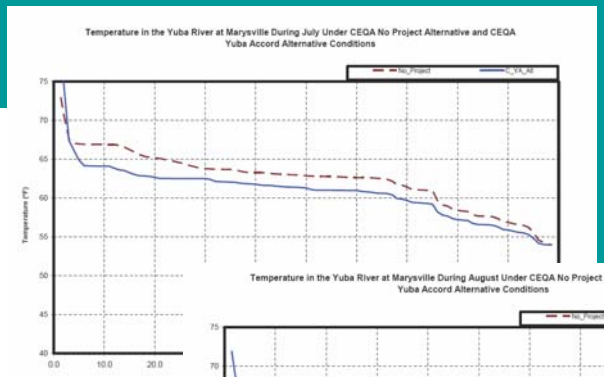
Methodology

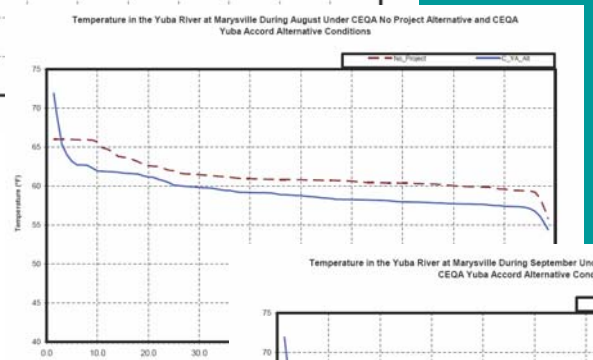
- Modeling tools used:
  - Lower Yuba River temperature model (MWH developed statistical model)
  - Reservoir and river temperature models (developed by Reclamation)
  - DSM 2 - Qual (DWR water quality model of the Delta)

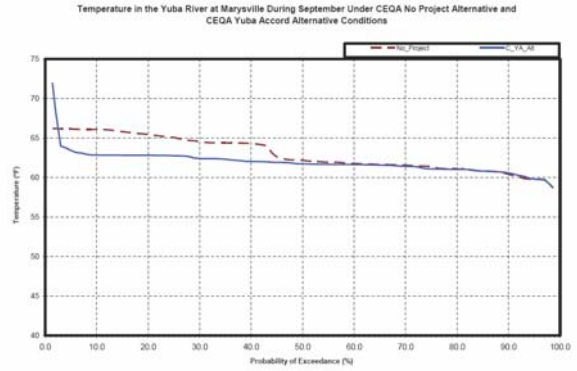
Yuba River Water Temperatures











New Bullards Bar Reservoir

Colgate Powerhouse

Monthly Average Temperatures:
May: 48 °F
August: 49 °F

Englebright Reservoir

Monthly Average Flow:
May: 2,549 cfs
August: 1,958 cfs

Smartville Gage

Narrows II Powerhouse

Monthly Average Temperatures:
May: 53 °F
August: 54 °F

Parks Bar

Monthly Average Temperatures:
May: 55 °F
August: 57 °F

Daguerre Point Dam

Monthly Average Temperatures:
May: 55 °F
August: 58 °F

May: 3,533 cfs
August: 918 cfs

Marysville Gage

Monthly Average Temperatures:
May: 57 °F
August: 60 °F

Conclusions Regarding Surface Water Quality

- Yuba Accord Alternative compared to No Project Alternative:
  - Long-term average monthly water temperatures at Marysville would be similar except for:
    - Warmer temperatures in May (+0.4^{0}F)
    - Colder temperatures in July (-1.6^{0}F), August (-2.0^{0}F), September (-1.1^{0}F), October (-0.6^{0}F)
  - Maximum average monthly increase in X2 location by water year type would be 0.4 km
  - Average monthly changes in Delta salinity (EC) generally would be less than 5%

Interim Remedies Order in *NRDC vs. Kempthorne* and Phasing of Yuba Accord

Supplemental Modeling Analysis

- First phase of Yuba Accord Alternative
  - Export pumping of Yuba Accord transfer water through Banks Pumping Plant only
- Yuba Accord Alternative with interim remedies order
  - Most restrictive interpretation of interim remedies order on CVP/SWP export pumping
- Combined first phase of the Yuba Accord Alternative with interim remedies order

Conclusions Regarding *NRDC v. Kempthorne*

- Yuba Accord
  - C1 water moved through EWA-dedicated capacity at Banks Pumping Plant
  - C2 and C3 water associated with dry hydrological conditions, and low CVP/SWP water allocations, when available export capacity typically exists
  - Reduction in groundwater-substitution pumping in dry water years under first phase and interim remedies
- CVP and SWP operations under interim remedies order
  - Reduced CVP/SWP exports during late December to June
  - Some increased CVP/SWP exports during July through November to make up for lower exports during period affected by interim remedies order
- Lower Yuba River flows
  - Reduction in flow at the Marysville gage during June, July, and August due to reductions in groundwater-substitution transfers in dry and critical years
- Phasing of Yuba Accord or implementing Yuba Accord (with or without phasing) while the court's interim remedies order is in effect will not change the conclusions in Yuba Accord Draft EIR/EIS regarding water supply and management, Yuba County groundwater conditions, or surface water quality

Testimony of Andrew Draper, Ph.D., P.E.

For December 5-6, 2007

State Water Resources Control Board Hearing

On Yuba County Water Agency Petitions

For Lower Yuba River Accord