Testimony of Steve Macaulay
Muni/Western Ex. 10-1

I. Introduction and Summary

1. I was retained in 2007 by the San Bernardino Valley Municipal Water District (Muni) and the Western Municipal Water District of Riverside County (Western) to prepare testimony in support of their joint water rights application to divert unappropriated water in the Santa Ana River watershed for storage in Seven Oaks Dam and subsequent storage/use within the Muni and Western service areas. The purpose of my testimony is to place the applications and proposed water use in the context of water management programs in the Santa Ana River watershed, other potential sources of water supply, and statewide benefits of developing local supplies and local storage. I emphasize the importance of integrated regional water management, a critical state water policy advanced by the Project and emphasized in the 2005 Update to the California Water Plan.

2. Water utilities within the Santa Ana River watershed, including Muni and Western, have invested for many years in advancing integrated regional water management: groundwater management including artificial recharge, conservation, recycled water, brine management and desalination. Water management projects and programs are both progressive and diverse, and are aimed at improving water supply reliability for the region. Water management actions are taken in the context of both water quantity and water quality, since both are essential components of water supply reliability. The Project before the State Water Resources Control Board in this proceeding advances the implementation of integrated regional water management, a focal point of State policy and modern water management as set forth in the 2005 Update to the California Water Plan. The Project is designed to make greater use of existing facilities, improve regional salinity, and restore groundwater storage and operational characteristics that have been impaired by past industrial activities. It is the next step in the region's long-term water reliability programs.

II. Background and Qualifications

3. I have over 34 years of experience in California water issues, including water rights, water quality, contractual and operational aspects of the California State Water Project, water transfers, water conservation, groundwater/surface water conjunctive use, and a wide range of issues related to the CALFED Bay-Delta Program. I participated as a member of the public advisory committee for both the 1998 and 2005 updates to the California Water Plan. In addition, I have been directly involved in the development and management of a variety of California water policies, both as a long-time member of Department of Water Resources (DWR) management staff and subsequently as DWR's Chief Deputy Director from July 1999 to May 2003. A more detailed description of my qualifications is set forth as Muni/Western Ex. 10-2.

4. I am Vice President of West Yost Associates, a water resources engineering consulting firm headquartered in Davis, California. My specific activities are related to work for water resources clients on integrated regional water management, water rights, drinking water quality, and natural resource management issues and projects. In this capacity I also serve part-time as Executive Director of the California Urban Water Agencies (CUWA). My participation in the current proceeding is not on behalf of CUWA.

III. Nature of Testimony

5. My testimony addresses water management within the Santa Ana River watershed as it relates to the Project, the major water resources challenges facing the region, and the benefits of the Project in the context of both local and statewide water resources. This is put into the context of the California Water Plan, other water policy documents, and future uncertainties.

IV. Water Management within the Santa Ana River Watershed

6. The Santa Ana River watershed is highly urbanized, with a long history of progressive water management programs and actions. Bill Dendy's earlier testimony provided an overview of the long history of successful water management in this watershed. This portion of my testimony describes several programs as they relate to the Project as a next investment in an overall water supply portfolio for the region. I address: (1) historic water management planning and implementation, (2) salinity as a water management driver, (3) water conservation, and (4) continued pursuit of integrated regional water management.

7. Historic Water Management Planning and Implementation. Water sources for urban water utilities within the Santa Ana River watershed, and urban southern California, have become increasingly diversified. The 2005 Water Plan Update provides an overview of the water supply and water quality challenges of the South Coast Hydrologic Region (Muni/Western Ex. 10-3). Drought conditions are a driver for increasing water supply reliability (Muni/Western Ex. 10-4, page 5-12). Local water agencies in southern California, "…have also implemented a variety of resource management strategies to increase the efficiencies of agricultural and urban water uses, utilize recycled water, groundwater conjunctive use, groundwater remediation, brackish water desalination, drinking water treatment, watershed management, ground-water banking, and water transfers from outside the region" (Muni/Western Ex. 10-4, pages 5-12 and 5-18). Brackish groundwater desalting is a substantial new tool being employed in the Santa Ana River watershed, with programs being implemented by the Santa Ana Water Project Authority (SAWPA), Chino Basin Desalting Authority, the City of Corona, Eastern Municipal Water District and Irvine Ranch Water District (Muni/Western Ex. 10-4, page 5-15). The 2005 Water Plan Update indicates that, "…Proposition 13 water bond funding is being utilized to expand desalting capacity in the region…" (Muni/Western Ex. 10-4, page 5-15).

8. These activities have been initiated at the local level. In 2005 SAWPA amended its 2002 Integrated Watershed Plan in the form of an integrated regional water management plan, consistent with emerging new State policy set forth in the 2005 Update to the California Water Plan and the provisions of Proposition 50 which provided funding for IWRMP planning and implementation. Chapter 1 of the 2005 SAWPA IWP Update sets forth the planning context of that integrated plan as the continuance of many coordinated regional water management activities over the past few decades. (Muni/Western Ex. 10-5) Such efforts include various Santa Ana River watershed partnerships, the Santa Ana Watershed nitrogen management and total dissolved solids Task Force, the Santa Ana Watershed Stormwater Quality Task Force, the Perchlorate Impacts Workgroup, the Santa Ana Watershed Basin Monitoring Task Force, the Santa Ana Sucker Conservation Team, the Southern California Wetlands Recovery Program, and a long list of coordinating regional plans and programs aimed at addressing a full range of resource management strategies on a watershed-wide basis.

9. Salinity as a Water Management Driver. Salinity management is key within the watershed to managing overall water supply reliability, and the high value and priority of water supplies (as evidenced by the region's long-standing, large investments in imported and local water supplies) is reinforced by commitments to make the most effective use of water though salinity management programs. SAWPA is a regional joint powers authority in the Santa Ana River watershed, and represents five water agencies in Orange, Riverside and San Bernardino Counties. (Muni/Western Ex. 10-4, page 5-16) those agencies are Eastern Municipal Water District, Inland Empire Utilities Agency, Orange County Water District, San Bernardino Valley Municipal Water District, and Western Municipal Water District of Riverside County. As indicated in the 2005 Water Plan Update (Muni/Western Ex. 10-4, page 5-16), SAWPA has been active in constructing, operating and/or assisting its member agencies with brine disposal lines, groundwater recovery programs, water recycling and other activities. The SAWPA programs are highlighted in the Central Valley Regional Board's 2006

report on salinity issues in the Central Valley, as an example of active and effective salinity management programs elsewhere in California (Muni/Western Ex. 10-6, pages 64-71). That same report describes the objectives and critical issues identified by the Southern California Salinity Coalition, and reflects active engagement by drinking water utilities in managing salinity (Muni/Western Ex. 10-6, pages 61-63). Further, the report describes the Salinity Management Study conducted by The Metropolitan Water District of Southern California (MWD) and the U.S. Bureau of Reclamation, and states, "…that about half the region's salt is contributed by imported water…" (Muni/Western Ex. 10-6, page 72).

10. Muni/Western Ex. 10-3 describes the salinity management challenges within the Santa Ana River watershed. Historic extensive water management investments in response to these challenges, often made at high cost, are evidence of the high value of water to the region. Another is the Groundwater Replenishment System being implemented by the Orange County Water District and the Orange County Sanitation District. "The project will take highly treated wastewater and treat it beyond drinking water standards for groundwater recharge and injection into the seawater barriers along the coast" (Muni/Western Ex. 10-4, page 5-17).

11. The region continues to take an aggressive approach to investing in water supply reliability. As indicated again in the 2005 Water Plan Update, "SAWPA has begun a 10-year integrated program to help, among other things, drought-proof the watershed, so it can roll off imported water for up to three years during drought years." (Muni/Western Ex. 10-4, page 5-16). Investments are not just region-wide. Muni has been actively pursuing elements of the Project for many years, as evidenced by its activities related to management of the local groundwater basin. This is an excerpt from the 2005 California Water Plan Update regarding these efforts (Muni/Western Ex. 10-4, page 5-17):

> *Another future water supply option is management of the San Bernardino Basin as a groundwater storage facility. The basin has a capacity of about 5.5 million acre-feet. Pursuant to the January 1969 settlement for Western Municipal Water District et al. vs. East San Bernardino Valley Municipal*

Water District et al. Superior Court Riverside County Case number 78426, the Western-San Bernardino Watermaster determined that the safe yield of the San Bernardino Basin is about 232,000 acre-feet per year. SBVMWD has been working with the U.S. Geological Survey for many years to develop a groundwater computer model that will enable the agency to determine ways to enhance the safe yield of this basin.

12. In addition, the Project before the SWRCB in this proceeding is described in the 2005 Water Plan Update (Muni/Western Ex. 10-4, pages 5-17 and 5-18) to enhance groundwater recharge and provide limited additional surface storage.

13. Water Conservation. These programs collectively represent a strong commitment within the Santa Ana River watershed to efficient and effective water use. In addition, there are conservation programs within the watershed's individual water utilities. The project partners, Muni and Western, are involved directly and indirectly in a number of water conservation efforts and programs. Western is a signatory to the Urban Water Conservation Memorandum of Understanding and is a member of the California Urban Water Conservation Council. In addition, Western is a member agency of MWD, which has extensive, long-term water conservation programs serving all of its 26 member agencies throughout southern California. Western's water conservation program performance is reflected in their most recent Urban Water Management Plan, submitted to the California Department of Water Resources in December 2005. Pages 19 through 23 of that report (Muni/Western Ex. 10-7) describe a number of successful water conservation elements and programs. Western benefits from MWD's conservation incentive programs for commercial, industrial and institutional water customers. Both Western and MWD have aggressive and successful public information programs to increase the public's awareness of the importance of conservation and what they can do to save water.

14. As indicated in the 2005 California Water Plan Update, water use efficiency (conservation, recycling, desalination, etc,) is expected to have an increasing role in water resource portfolios in the future. Much of this is reflected in MWD's

2003 Integrated Resources Plan Update. Table ES-1 in this report (Muni/Western Ex. 10-8) shows significant planned increases conservation and recycling by the year 2020 as compared to similar projections in MWD's initial Integrated Water Resources Plan in 1996.

15. Muni is not required to prepare an urban water management plan since it is a wholesaler. However, retailers in the Muni service area have submitted such plans. The City of San Bernardino's 2005 Urban Water Management Plan outlines the City's conservation programs and other elements of its water management strategy. That report provides information (Muni/Western Ex. 10-9) on progress in implementing each of the applicable Best Management Practices (BMPs), also described as Demand Management Measures. The City of San Bernardino has implemented successful programs in the areas of water survey and audit programs, leak detection and repair, public information and school education programs and water waste prohibition. In addition, that report notes that changes in plumbing codes and state law regarding toilets and showerheads are guiding the water savings from these devices.

16. Continued Pursuit of Integrated Water Resources Planning and Management. Muni's Master Plan, adopted in 1995 well in advance of the current focus on integrated regional water management, identified a number of strategies as being essential to a coordinated plan for regional water management. Those strategies include the following (Muni/Western Ex. 10-10):

- Water Conservation (Demand reduction)
- Groundwater Management
- Surface Water Management (Including Seven Oaks Dam)
- Imported Water Use
- Reclaimed Water Use
- Spreading Operations and Management
- Flexibility of Supply Sources

17. Twelve years after this Master Plan was adopted, it still covers what is considered today a comprehensive portfolio of water management actions. The conservation and groundwater management elements described in the Master Plan are consistent with the Project that is the subject of this hearing.

18. Recognizing that many water management strategies are not "either/or" choices, leadership within the region is developing new ways of addressing water management challenges. In addition, the various watershed activities mentioned earlier in my testimony address a full range of water-related activities, from directing efforts at recovering the Santa Ana sucker fish species to dealing with specific water quality concerns such as nitrogen, salinity and perchlorate, to addressing the consequences to the watershed from forest fires. (Muni/Western Ex. 10-5)

19. In addition to SAWPA activities and individual urban water management plans, in January 2006 Muni was awarded a $500,000 Proposition 50 grant by DWR to develop an integrated regional water management plan (Muni/Western Ex. 10-11). This program has since been renamed the Integrated Regional Groundwater Management Plan for the Upper Santa Ana River (IRGMP). The IRGMP continues under development, and is scheduled to be adopted in August or September 2007 (personal communication, Robert M. Tincher, Manager of Engineering and Planning, San Bernardino Valley Municipal Water District, March 27, 2007). The IRGMP has two priorities: (1) improve water supply reliability, particularly during drought, and (2) improve surface and groundwater management, specifically including reducing the risk of liquefaction and addressing problems associated with groundwater contaminant plumes (Muni/Western Ex. 10-12). This exhibit indicates that the IRGMP will address operational considerations and limitations related to recycled water opportunities, conservation, and other ground water management components that integrate both quantity and quality.

V. Major Water Resource Challenges Facing the Region

20. The dominant water resources challenges facing the region are: (1) imported water reliability and costs, (2) local storage, (3) increased recycled water use, (4) increased implementation of water conservation, and (5) water quality.

21. Imported Water Reliability and Costs. The 2005 Water Plan Update includes an appendix describing water supplies, demands and challenges for each region in California. The chapter on the South Coast Hydrologic Region, in which the Project is located, includes a statement that the region is challenged by reductions in water supply reliability from several historical sources, including the State Water Project (Muni/Western Ex. 10-4, page 5-9). The reduced SWP delivery reliability is more specifically addressed in "The State Water Project Delivery Reliability Report 2005", DWR, April 2006 (Muni/Western Ex. 10-13).

22. Delivery reliability estimates using a computer simulation model are complex, and are driven by many assumptions regarding assumed facilities, water project operations and hydrology. DWR's evaluation reflects past experience in conducting more than 20 years of SWP delivery reliability evaluations for its water contractors, as well as input from the 2002 report (published in 2003) and comments on an earlier draft of the current report. Delivery reliability is summarized in five year increments on page 23 of Muni/Western Ex. 10-13, reflecting various changes in SWP demands and other constraints over the time frame of 2005 through 2025, and assuming existing facilities. In general, this table shows that delivered SWP contract supplies south of the Delta have an average reliability of about 70-75 percent, meaning that the average delivered amount from simulation models is about 70 to 75 percent of contract supply over the full range of historic hydrology in DWR's models (1922-1994). The average percent reliability does not tell the full picture.

23. The table shows greatly reduced reliability of delivery of full contract supplies during a variety of historical drought periods, ranging from 32 percent to 42

percent. In addition, the table shows that in a recurrence of the single driest year of record, 1977, deliveries could be as low as 4 percent of contract amounts.

24. Consequently, SWP water users need to supplement SWP supplies with other management measures to meet long term needs. This statement is from the foreword to the 2005 report (Muni/Western Ex. 10-13):

> *Although the estimates contained in The SWP Delivery Reliability Report 2005 are the best quantifications available of the delivery ability of the SWP, these estimates are limited because of the uncertainty of future conditions. DWR will continue to use the CalSim II model and its updates as appropriate for analyses, but other information is being developed that will help us analyze, understand, and prepare for our uncertain future. Per the Governor's directive (Executive Order S-3-05), the potential impacts of climate change on the State's resources, including water supply, are being evaluated. Using CalSim II, preliminary estimates have been done of the potential impact upon the SWP 50 to 100 years in the future if no additional conveyance facilities or upstream reservoirs are built. As these estimates become more refined, they will be helpful in guiding strategies for the management and development of the State's water resources, including improvements to the SWP.*

25. The SWP delivery reliability report will be redone every two years (Muni/Western Ex. 10-13, page 2). Work is underway for the 2007 report (personal communication, Kathy Kelly, DWR, March 16, 2007). Since the last report there have been strong indications that water supplies that rely on the Delta may be even less reliable in the long term than earlier thought.

26. Governor Schwarzenegger's Executive Order S-17-06, issued on September 28, 2006, created a new process to develop a long-term strategic plan for the Delta (Muni/Western Ex. 10-14). The Executive Order notes the threats to much of California's developed water supplies from levee failures in the Delta, and that immediate attention is needed, "… because of the potentially catastrophic environmental and economic consequences if timely action is not planned for and undertaken…" (Muni/Western Ex. 10-14). The Governor called for development of a long-term plan for sustainable management of the Delta's many uses, and for development and implementation of a Strategic Plan. The relevance of this effort

to SWP water delivery reliability is that it recognizes in the near term that all uses of the Delta – including SWP water diversions – are at risk more so than earlier thought – until a long-term plan is implemented to reduce the risks identified in the Executive Order and various recent studies.

27. The initial definitive evaluation of the threat of catastrophic Delta levee failures was in the 2005 report, "Mount J, Twiss R. 2005. Subsidence, sea level rise, seismicity in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science.Vol. 3, Issue 1 (March 2005), Article 5. http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art5" (Muni/Western Ex. 10-15). This study was done for the CALFED Independent Science Board (ISB). The co-authors are members of the ISB.

28. Since that report there has been more attention to the potential long-term threats to Delta levees. More recently, a great deal of public attention has been brought to the report, "Envisioning Futures for the Sacramento-San Joaquin Delta", issued by the Public Policy Institute of California in February 2007. The summary of the report (Muni/Western Ex. 10-16) includes the following statement:

> *Over the next 50 years, there is a two-thirds chance of a catastrophic levee failure in the Delta, leading to multiple island floodings and intrusion of seawater. For one such scenario, the Department of Water Resources estimates that a large earthquake near the Delta would cause major interruptions in water supplies for Southern California, the San Joaquin Valley, and the Bay Area, as well as disruptions of power, road, and shipping lines, costing the state's economy as much as $40 billion.*

29. While no water source is free of risk, this puts a further degree of uncertainty to SWP delivery reliability that reinforces the value of supplemental programs in areas served by SWP supplies.

30. Costs for water delivered to the region from the SWP are relatively high. Muni/Western Ex. 10-17 is a page from the most recent annual report, Management of the State Water Project, which shows the forecasted unit rates for

water delivered to various regions served by the SWP. Costs for water delivered to the "Southern California Area" are the highest, reflecting much higher capital and power costs than other regions of the SWP service area.

31. These costs reflect the delivery of untreated water to SWP turnout facilities, from which it is transported to water treatment plants and subsequently distributed to water customers. As indicated in Muni/Western Ex. 10-17, these unit costs assume delivery of full contract amounts. Although the power costs will vary with actual amounts of water delivered, the capital and maintenance costs are fixed regardless of delivered amounts. Thus, water deliveries during dry years will have much higher unit water costs, placing a high value to both Muni and Western on local water sources that can augment dry year supplies. As indicated earlier by the information from *The SWP Delivery Reliability Report 2005* (Muni/Western Ex. 10-13), the value of water in very dry years and multiple-year droughts is very high.

32. Local Storage. Concerns regarding SWP delivery reliability reinforce the value of additional storage at the local level, both to re-regulate SWP supplies when they are available and to store local supplies for times of water shortage. Over the past decade or more, a number of SWP contractors have developed additional storage. Such facilities include Diamond Valley Reservoir developed by MWD (Muni/Western Ex. 10-4, page 5-13), and extensive groundwater banking operations between MWD and water agencies in other parts of California (Muni/Western Ex. 10-4, pages 5-14 and 5-15). Contra Costa Water District constructed Los Vaqueros Reservoir to improve its water supply reliability, particularly with regard to water quality. The San Diego County Water Authority constructed Olivenhain Reservoir for storage of imported water supplies to meet emergency needs (Muni/Western Ex. 10-4, page 5-13). There are many examples in the 2005 Water Plan Update of development of new ground and surface water projects at the local level to improve water supply reliability. They are not repeated here for brevity, but represent a wide range of institutional arrangements

aimed at improving water supply reliability for both the water banking entity and the participants.

33. The 2005 California Water Plan Update addresses the potential for additional statewide as well as regional storage (Muni/Western Ex. 10-20, Chapters 17 and 18). Muni/Western Ex. 10-18, Chapters 17 and 18 outline a number of implementation challenges for surface storage. For local projects such challenges include funding, suitable locations, science related to potential impacts, and identifying beneficiaries. The Project as set forth by Muni and Western has been thoroughly evaluated in the Final EIR. A new dam is not needed, and there are willing partners to share in Project costs and benefits. In addition, the Project includes integration with regional groundwater resources and is a good example of the benefits of integrated regional water management.

34. Increased Recycled Water Use. The 2005 Water Plan Update's report on the South Coast Hydrologic Region (Muni/Western Ex. 10-4) addresses current and potential future uses and opportunities for recycled water. In addition, the Water Plan Update addresses concerns, and includes recommendations, regarding future increases in recycled water use (Muni/Western Ex. 10-18, Chapter 16). Those recommendations were guided by the findings and recommendations of the State Recycled Water Task Force, reproduced in the Water Plan Update (Muni/Western Ex. 10-18, pages 16-3 and 16-4). The future potential for recycled water is substantial, but the Water Plan Update and Recycled Water Task Force recommendations set forth a long-term program that will take time to advance the augmentation of water supplies from this source. Key issues will continue to be public acceptance (Muni/Western Ex. 10-18, page 16-5) and water quality (Muni/Western Ex. 10-18, page 16-4), both very important issues at the local level that will guide implementation.

35. Increased Water Conservation. One of the 25 management tools set forth in the 2005 California Water Plan Update is more aggressive urban water conservation.

The Water Plan indicates that the potential for additional water conservation is in the range of 1.2 to over 3 million acre-feet per year statewide by the year 2030 (Muni/Western Ex. 10-19). This range, although with other promising water management strategies identified by the 2005 Water Plan Update, is shown on the bar graph of this exhibit. In my experience as a member of the Public Advisory Committee participating in the development and critique of these and other estimates, the wide range reflects a great deal of uncertainty in a number of factors, including strategies to move implementation forward in a more aggressive manner. The technical bases for these estimates are a combination of past experience and theoretical estimates of urban water conservation potential assuming existing technology and specific assumptions regarding cost-effectiveness. As a member of the Public Advisory Committee, I would expect this to change over time as more experience and data is developed, and more and more implementation challenges overcome.

36. The graphic on Muni/Western Ex. 10-19, and the accompanying text, does not indicate that California's future water needs can be met by a single management strategy. The overall thrust of the 2005 Update is that multiple sources and management strategies will be needed to assure long-term water supply reliability, with the appropriate mix dependent on programs, demands and hydrology within each region.

37. It is likely, in my opinion that we will continue to see increases in urban water conservation savings through a variety of efforts and programs. Conservation is an essential tool when used in conjunction with other tools, particularly storage. Increased conservation can reduce base demands, which is particularly important in meeting peak demands during the summer. Muni and Western have assumed for the Project that existing and planned conservation actions implemented by retail water suppliers and end users will increase conservation savings over existing levels by ten percent, consistent with the long-term conservation assumptions in the 2002 Santa Ana Integrated Watershed Plan (Muni/Western

Ex. 10-20). Water conservation should not be considered an "either/or" choice, although it is sometimes mischaracterized in this way. In my professional opinion, particularly given a number of future uncertainties including SWP delivery reliability and climate change, the Project's inclusion of additional conservation beyond current levels is appropriate and necessary – from both a supply reliability and water quality standpoint.

38. The Final EIR addresses the general concerns raised in comments regarding water conservation. One of the issues is the challenges to implementing water conservation programs. Conservation is no different than other water management strategies in having implementation challenges. The 2005 Water Plan Update includes a discussion of each water management tool, described as "resource management strategies". Each discussion includes a section on implementation challenges. The 2005 Water Plan Update (Muni/Western Ex. 10-18, pages 22-6 to 22-10) outlines a number of major issues and barriers that need to be addressed to gain additional urban water conservation savings, along with a number of recommendations and suggestions.

39. How to advance urban water conservation is a current ongoing debate, both within the CALFED Bay-Delta Program as it develops recommendations for Stage 2 of program implementation, and in advancing the recommendations of the State Landscape Task Force (many of which address current conservation implementation challenges that have yet to be overcome). The Landscape Task Force report (Muni/Western Ex. 10-21) contains 43 recommendations and many more suggested specific actions. A review of the actions (Muni/Western Ex. 10-21, pages 5-12) indicates that they cover a wide range from increased public education to legislation to technical research.

40. It is prudent to assume greater urban water conservation in the future, just as it may be prudent to assume improvements in water quality and groundwater storage. The key is how to get there. While additional urban water conservation,

even beyond the additional ten percent assumed by Muni and Western, may occur, the pathway for getting there is not clear. The California Urban Water Conservation Council (CUWCC) has undertaken a number of studies to address this issue. Implementation of existing BMPs, consideration of changes to existing BMPs, and prospects for new BMPs is a matter of ongoing debate within the CUWCC.

41. Water Quality. A continuing challenge to the Santa Ana River watershed is the control and management of salinity. This has been addressed in my earlier testimony and the testimony of several others. It is an important water supply reliability component for the watershed, and is affected by the quality of water supplies, the efficiency of water use, the use of recycled water, management of salinity by brine lines, and the development of energy-intensive desalination facilities.

42. The Project provides the opportunity to improve water quality – i.e. reduce salinity – in source waters. The salinity of Santa Ana River water in the vicinity of Seven Oaks Dam is understood to be substantially lower than SWP water based on long-term experience by water purveyors in the region. Accordingly, local water purveyors have not seen a need to monitor salinity on a regular basis, and thus a long-term historical record of salinity at this point is not readily available. However, we were able to get unpublished data collected by SAIC as part of environmental studies leading to the FEIR for the Project, as well as miscellaneous salinity data collected by the City of Redlands and East Valley Water District in recent years. This latter information is important since these two entities divert water directly from the Santa Ana River and treat it for municipal use.

43. Muni/Western Ex. 10-22, Muni/Western Ex. 10-23 and Muni/Western Ex. 10-24 are from unpublished water quality data for the Santa Ana River and the State Water Project. Muni/Western Ex. 10-22 is total dissolved solids (TDS) data for

the SWP at Devil Canyon Afterbay, the point of delivery of SWP water to this region (note that the station name and location changed in 2001). This information was taken from DWR's on-line database available through their web site (http://cdec.water.ca.gov/cgi-progs/selectOMWQ). Muni/Western Ex. 10-23 is unpublished TDS data collected by the City of Redlands and East Valley Water District. Muni/Western Ex. 10-24 is unpublished data collected by SAIC as part of environmental studies leading to the FEIR for the Project. The data was taken as electrical conductivity; Muni/Western Ex. 10-24 includes an additional column that calculates TDS using a rough conversion factor of 0.7 (e.g., an EC value of 300 umhos/cm is calculated to be 210 mg/l TDS). Muni/Western Ex. 10-25 is Table 32 from DWR's "State Water Project Operations Data For the Month of January 1991" available through the DWR SWP Operations Control Office web site (http://wwwoco.water.ca.gov/monthly/monthly.menu.html).

44. These data clearly show that Santa Ana River water is substantially lower in salinity than water imported by the SWP. This should come as no surprise since Seven Oaks Dam is relatively high in the Santa Ana River watershed, upstream of factors that increase salinity. SWP water is also affected at times by ocean salinity, since the point of diversion in the Delta is in a tidal estuary.

45. While Santa Ana River salinity is better (lower) than the SWP for the periods of record shown in these exhibits, the quality difference is likely greater during severe drought periods. For example, SWP water at the Delta (before it is pumped through the California Aqueduct for hundreds of miles throughout the state) was as high as 488 mg/l TDS in 1991, and the TDS at the Santa Ana Pipeline was 396 mg/l that same month (presumably lower due to mixed quality in upstream SWP regulating reservoirs) (Muni/Western Ex. 10-25). This contrasts with a typical average SWP TDS concentration for the region of about 300 mg/l. (Muni/Western Ex. 10-4, page 5-10)

46. Water quality is also an important factor in the sustainability of local groundwater basins. A legacy of earlier industrial development is the contamination of several local groundwater basins that have historically limited their use for local and regional water storage. Dennis Williams earlier provided testimony on the degree of contamination of local groundwater basins, and the opportunity the Project provides to rehabilitate those areas to restore operational storage and supply reliability.

47. The Santa Ana Regional Water Quality Control Board has been actively engaged in the water quality issues of the Santa Ana River watershed for many years. This Board may be familiar with the long history of the Regional Board in working with water resources interests in the watershed on water quality issues of concern. Muni/Western Ex. 10-26 is an overview of Santa Ana Regional Board's water quality challenges from the Regional Board's web site (Muni/Western Ex. 10-26), and highlights some of the current challenges in the watershed. The point of this exhibit is to note that the Regional Board is working actively to deal with salinity and nitrogen as key water quality constituents in the Santa Ana River watershed. More specifically, the exhibit states the following as a current accomplishment, and reinforces the importance of water quality to water supply reliability:

> *Coordinated major stake holders in the watershed to review the total dissolved solids and nitrogen water quality objectives of the Santa Ana Basin, develop a regulatory strategy to protect water quality and optimize water resources development.*

VI. Benefits of the Project in the Context of Local and Statewide Water Resources

48. The Project fits into a continuing integrated regional water management paradigm for the Santa Ana River watershed. This portion of my testimony: (1) describes the value of a diverse water portfolio, and (2) puts the Project into the larger context of a more complete water management portfolio.

49. Value of Diverse Water Portfolio. There are a number of parallels between a balanced financial portfolio and a balanced water supply portfolio. Both are developed around concepts of maximizing value within defined risk limits. Both have investments with different levels of performance, but collectively provide a reliable return – whether it is financial performance or overall water supply reliability.

50. As presented earlier in my testimony, SWP deliveries to the region have specific risks associated with hydrology. There are also unpredictable risks associated with the Delta, at least in the near term. Even so, the SWP is capable of providing a highly reliable level of deliveries in many years, particularly in wetter years in central and northern California.

51. While SWP delivery risks have been quantified, there are other factors that lead to additional uncertainty. These include known hydrologic variability, unknown hydrologic variability due to the effects of climate change, and other unquantified delivery risks due to future earthquakes or man-made disruptions. The first factor is the year-to-year change in rainfall and runoff, a risk factor that is an integral part of water management. The second factor is what appears to be long-term changes in climate associated with global warming. This is a risk factor that has not been well-quantified to date, but enough is known about potential impacts to address climate change in a qualitative manner – perhaps enough to support future water management decisions. Last, there are other unknown or unquantified risks due to natural or man-made disruptions. A reliable water system is robust to both quantified threats — ones with a known risk profile — and unquantified threats.

52. In July 2006 the California Department of Water Resources issued their first report on the potential impacts of climate change on California's water resources (Progress on Incorporating Climate Change into Planning and Management of California's Water Resources, Technical Memorandum Report, July 2006). Muni/Western Ex. 10-27 (Table 2-1, page 2-6 from this report) summarizes the

general potential impacts of climate change on our water resource systems, and some of the expected consequences.

53. New information on climate change has become available frequently during preparation of this testimony. In part this was related to elements of the new information from the United Nations Intergovernmental Panel on Climate Change as set forth in press releases, pieces of technical reports, and the subsequent press coverage with responses from a variety of interests. A reading of any of California's major newspapers this year would reveal widespread opinions on how water management should change in the future to respond to climate-induced changes to both hydrology and water demands. In my opinion there have been many that view management tools as "either/or"; we need more storage, or we need more conservation. Such reactions are inconsistent with the recommendations of the 2005 California Water Plan Update, as described in the following paragraphs. In my opinion, a wide range of water management actions will continue to be needed, tailored specific to each region. The Project before the SWRCB in this proceeding may be even more valuable as future hydrology becomes more variable as has been suggested by many scientists.

54. Project as Part of the Regional Portfolio. As a water resources professional with more than 34 years of experience, this table (Muni/Western Ex. 10-27) and the full measure of the report, indicates that increased threat to water supplies relying on the Delta, as well as future variations in hydrology, speak strongly in support of additional storage and diversity in water supply portfolios. It also indicates that future stresses to our water supplies merit increases in the efficiency of our water use, particularly given the potential of climate change to increase demands over what they might be otherwise. The Project proposed by Muni and Western is the next step in their region's response to a variety of uncertainty factors (including climate change) to improve regional self-sufficiency and water supply reliability. The region as a whole, including the Santa Ana River watershed in which Muni and Western are located, depends on a mix of local and imported water supplies.

Such supplies rely on a combination of surface and ground water storage, operating together in an integrated manner, in order to meet needs throughout the year and the range of years from wet to dry.

55. The 2005 Water Plan Update recommended a number of actions to improve reliability of water supplies, including promoting and practicing integrated regional water management (Muni/Western Ex. 10-28). The Project as developed by Muni and Western is a regional partnership designed to improve water supply reliability – for both supply and quality – for the region. As this portion of the 2005 Water Plan Update states, "*Regional partnerships will enable optimum management of water and other resources within a region. California's regions cannot meet all of their water objectives with a single strategy. Just as the mix of tools will vary depending on the job, the combination of strategies will vary from region to region*" (Muni/Western Ex. 10-28, page 2-12).

56. Development or greater utilization of local storage can be a good complement to imported SWP supplies. As indicated earlier, increased water conservation and expansion of recycled water use can stretch water supplies further. The same is true for desalting. Each of these water management tools has implementation challenges and costs, and each must be implemented within a local institutional framework. The Santa Ana River watershed has taken for many years a coordinated, watershed-wide approach to improving regional water supply reliability. In doing so, the region has a solid track record of recognizing and overcoming water quality limitations to supply reliability.

57. A desirable portfolio of future water resources would place less emphasis on imported supplies of decreasing reliability and poorer quality, and more emphasis on local resources—increased natural infiltration, heightened water recycling, integration with regional salinity management, and improved end use efficiency. These diverse sources complement each other. The Project fits into a

comprehensive water management portfolio, and fulfills several needs that are not being met under current conditions:

- Intermittent diversion of local supplies under wetter conditions adds to the overall supply, and expands the opportunity for local groundwater recharge.
- Santa Ana River water in the vicinity of Seven Oaks Dam is lower in salinity than water imported from the SWP.
- Lower salinity source waters can expand the utility of the region's water supplies, particularly for reuse purposes.
- Increased groundwater recharge will improve the quality of contaminated portions of local basins, adding additional supply and storage capabilities to the overall water supply portfolio.
- Increased water use efficiency (conservation) can permit reduced imports of poorer quality water, thereby improving basin salinity management and providing other water system benefits.

58. This combination of water portfolio elements works together to increase reliability, reduce risk and improve quality. The Project is designed to make greater use of existing facilities including the existing Seven Oaks Dam, to improve regional salinity, and to restore groundwater storage and operational characteristics that have been impaired by past industrial activities. It is the next logical step in advancing the region's progressive water management portfolio.