PHOENIX LAKE IRWM RETROFIT

Attachment 8 - Economic Analysis: Water Supply Costs and Benefits

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1.0 Description of the Water Supply Project and Its Relationship to Other Projects

The Water Supply Project component of the Phoenix Lake IRWM Retrofit consists of raising the spillway crest of Phoenix Lake Dam by 6 ft to elevation 180 ft, filling the lake to a higher elevation during the spring, and producing more water from the lake for municipal supply during the dry season when it is needed most. This Project also includes piping modifications that will eliminate some potential cross connection issues between the potable water and untreated Phoenix Lake water and facilitate use of Phoenix Lake water on a more regular basis. These improvements will provide operational flexibility and new opportunities to use the added yield of the lake via MMWD's existing water pumping, delivery, and treatment capabilities.

Raising the spillway crest will be accomplished by installing a gate within the 11-ft wide by 6-ft high "notch" of the existing concrete spillway. Based on the 30% Concept Design, the spillway gate will be an Obermeyer or similar type of pneumatically operated spillway gate. The 30% Concept Design of the spillway gate installation is shown in Figure 2, section 3.2.2 of Attachment 3, Workplan.

Raising the spillway crest also works synergistically with other component projects comprising the Phoenix Lake IRWM Retrofit to enhance their benefits, as summarized in Table 1 below.

Table 1. Relationship of the Water Supply Project to Other Projects of the Phoenix Lake IRWM Retrofit	
Other Project	**Relationship of Water Supply Project to Other Project**
Flood Damage Reduction Project	Raised spillway crest also adds 120 acre-ft of active storage capacity which enhances flood attenuation and reduces flooding downstream
Water Quality Project	Raised spillway crest also increases overall lake water depth which enlarges the lake hypolimnion which contains better quality water (i.e., less algae, better clarity) available for municipal supply
Ecosystem Restoration Project	Raised spillway crest also enlarges the lake hypolimnion and suitable coldwater habitat in the lake and volume of cool water available for release downstream
Recreation and Public Access Project	Raised spillway crest also enlarges the wetted surface area which enhances the visual appearance of the lake

Phoenix Lake operations for water supply will be coordinated with operations for flood damage reduction, water quality, ecosystem restoration, and public recreation. A coordinated operations plan (COP), establishing rules and criteria for operating Phoenix Lake in a manner that achieves the lake's new multi-use benefits, will be developed that is mutually acceptable to MMWD and FZ9. A preliminary COP is described in Appendix 2 of Attachment 3, Workplan. Under the preliminary COP, operations would follow a general "rule curve" which defines normal operating water levels during the wet (flood) season and the dry (water supply) season. The preliminary COP also defines criteria for drawdown and refilling during the transitional periods.

Raising the spillway crest will enable capture an active storage of up to an additional 120 acre-feet of runoff from the MMWD watershed. The added active storage capacity will increase the long term average annual yield of the lake by 107 acre-feet per year for municipal supply to the MMWD system during the dry season. Long term average annual yield includes all hydrologic year types, including wet, normal, dry, and critical dry (i.e., shortage) years. During shortage years, the project will increase the yield of Phoenix Lake by about 50 afy.[1] Shortage year water supply availability, rather than long term average annual water supply availability, is the basis that MMWD uses to evaluate the reliability of its water supplies and determine whether there is any imbalance (or deficit) between supply and demand. Further long term hydrologic analysis covering an extended period of hydrologic record that includes additional severe shortage periods, e.g., the 1976-77 drought, is needed to confirm these figures.

[1] Based on an assumed minimum instream flow release to Ross Creek of 1 cfs. The final instream flow release will be defined in the future COP.

Table 2. Water Supply Project Increase in Water Yield of Phoenix Lake	
Yield Type	**Quantity (afy)[2]**
Long Term Average Annual Yield[1]	107
Shortage Year Yield	50

1. Based on a range of hydrologic year types, i.e., wet, normal, and dry years.
2. Source: Appendix 5 of Attachment 3, Workplan (Phoenix Lake Hydrology Report, Stetson Engineers, 2011)

Although, as described above, raising the spillway crest enhances the benefits of the other component projects of the Phoenix Lake IRWM Retrofit, it is essential to the Water Supply Project. Without raising the spillway crest the active storage capacity of the lake and, hence, its water supply yield, is not increased and there is no water supply benefit. For this reason, this economic analysis assigns costs associated with raising the spillway crest, excluding costs relating to installing an emergency power supply[2], to the Water Supply Project.

2.0 Description of the Water Supply Project's Economic Costs

The Water Supply Project component of the Phoenix Lake IRWM Retrofit includes installing an Obermeyer or similar type of pneumatically operated spillway gate within the 14-ft wide by 6-ft high "notch" of the existing concrete spillway. The 30% Concept Design of the spillway gate installation has been completed and is shown in Figure 2, section 3.2.2 of Attachment 3, Workplan.

Economic costs associated with the Water Supply Project include initial costs and future operations and maintenance costs. Initial costs relate to installation of the spillway gate and its appurtenances and are detailed in Attachment 4, Budget. Future operations and maintenance costs relate to the spillway gate and its appurtenances. Water production costs to use the added lake yield include pumping, delivering, and treating the additional water yielded by the project. Pumping is accomplished using existing pumping and delivery facilities, consisting of a floating barge pump station at Phoenix Lake, booster pump station, and several thousand feet of raw water pipeline. These facilities pump and deliver water from Phoenix Lake (el. 180 ft) to the Bon Tempe Water Treatment Plant (approximately el. 716). Modifications to the raw water delivery piping would provide the operational flexibility to also pump to Bon Tempe Lake (el. 716 ft) for storage when space is available. Treatment for Phoenix Lake water for municipal supply is accomplished at the existing MMWD Bon Tempe Water Treatment Plant.

These future operational and maintenance costs would be difficult to accurately quantify at this time because they are directly related to the frequency and duration of utilization of the added Phoenix Lake yield. Utilization of the added Phoenix Lake yield has not yet been conclusively determined. Preliminary analysis shows that the long term average

[2] An emergency power supply is needed to ensure that the spillway gate can be raised in case there is a disruption in electrical power service, as might occur during a heavy storm or flood condition. Accordingly, emergency power supply costs are assigned to the Flood Damage Reduction Project component of the Phoenix Lake IRWM Retrofit.

annual yield and shortage-year yield would be 107 afy and 50 afy, respectively, as described above. But further hydrologic analysis of re-operation of Phoenix Lake is needed that considers MMWD's overall storage and delivery system, taking into account the added flexibility of pumping to Bon Tempe Lake for storage, and covers an extended period of hydrologic record that includes severe shortage years (e.g., 1976-77 drought). This further analysis is described in Attachment 3, Workplan.

For the purpose of this analysis, future annual operations and maintenance costs are estimated as a percentage (2%) of the construction cost[3]. Table 3 shows the cost details of the initial capital costs and future operations and maintenance costs. Capital costs for the Water Supply Project amount to about $682,000 (2009 dollars). The capital costs will be incurred in 2011 through 2015 and distributed according to the schedule of Attachment 5. Capital costs that were already expended in the past are considered sunk costs and are not included in this analysis. The incremental costs associated with project administration, operation, maintenance, replacement, and others (i.e., dry season lake water level data collection) amount to a total of about $250,000 (non-discounted 2009 dollars) over the useful lifetime of the project (assumed 50 years).

Together, the present value capital and O&M costs for the Water Supply Project at 6% discount rate amount to about $555,000 through 2065.

[3] Refer to the construction cost estimation table in section 3.2.2 of Attachment 3, Work Plan. The 2% was applied to the construction cost excluding the cost for general requirements.

Table 3 Annual Cost of Water Supply Project (in 2009 Dollars)
Project: Phoenix Lake IRWM Retrofit Project – Water Supply Project

	Initial Costs	Operation and Maintenance Costs [1]							
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Year	Grand Total Costs	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor [2]	Discounted Costs (g) × (h)
2009								1.000	
2010								0.943	
2011	$28,000						$28,000	0.890	$24,920
2012	$75,000						$75,000	0.840	$63,000
2013	$19,000						$19,000	0.792	$15,048
2014	$49,000						$49,000	0.747	$36,603
2015	$511,000						$511,000	0.705	$360,255
2016		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.665	$3,325
2017		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.627	$3,135
2018		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.592	$2,960
2019		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.558	$2,790
2020		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.527	$2,635
2021		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.497	$2,485
2022		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.469	$2,345
2023		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.442	$2,210
2024		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.417	$2,085
2025		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.394	$1,970
2026		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.371	$1,855
2027		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.350	$1,750
2028		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.331	$1,655
2029		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.312	$1,560
2030		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.294	$1,470
2031		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.278	$1,390
2032		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.262	$1,310
2033		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.247	$1,235
2034		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.233	$1,165
2035		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.220	$1,100
2036		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.207	$1,035
2037		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.196	$980
2038		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.185	$925
2039		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.174	$870
2040		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.164	$820
2041		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.155	$775
2042		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.146	$730
2043		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.138	$690
2044		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.130	$650
2045		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.123	$615
2046		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.116	$580
2047		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.109	$545
2048		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.103	$515
2049		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.097	$485
2050		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.092	$460
2051		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.087	$435
2052		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.082	$410
2053		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.077	$385
2054		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.073	$365
2055		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.069	$345
2056		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.065	$325
2057		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.061	$305
2058		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.058	$290
2059		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.054	$270
2060		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.051	$255
2061		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.048	$240
2062		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.046	$230
2063		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.043	$215
2064		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.041	$205
2065		$1,200	$1,200	$1,200	$1,200	$200	$5,000	0.038	$190
Project Life	$682,000	$60,000	$60,000	$60,000	$60,000	$10,000	$932,000		
Total Present Value of Discounted Costs (Sum of Column (i))									**$555,000**

3.0 Description of the Project's Expected Water Supply Benefits

3.1 Background

Describing the Water Supply Project's expected water supply benefits first requires some background on MMWD's overall water supply picture.

MMWD supplies water to about 190,000 people over a 147-square mile area of southern and central Marin County. The primary source of MMWD's raw water supply, on average about 71.5 % of the total water delivered to customers, is runoff from the high-yielding local Marin County watersheds that is captured and stored in seven reservoirs. Additional raw water, on average about 25.5 % of the total water delivered to customers, is imported Russian River water that is purchased and delivered through an interconnected system of the North Marin Water District and Sonoma County Water Agency. The cost to purchase and deliver Russian River water to MMWD is about $850 per acre-foot.[4] Just under 2 % of the water is recycled and 1 % is untreated – certain, limited accounts use untreated water.

After treatment at one of the District's three water treatment plants, the treated water is distributed throughout the MMWD service area by gravity flow or booster pumps. MMWD's recycled water system delivers an average of 650 acre-feet of recycled water per year through 323 service connections. Operation of the District is financed solely by revenue from the sale of water. Large-scale capital improvements have been funded by bond issues and certificates of participation.

For a variety of reasons[5] the current MMWD reliable water supply is close to the current water demand with little if any surplus supply reliability. MMWD has begun to implement an aggressive water conservation program, investing $3.3 million in 2008–09 to support a wide range of conservation program activities. In combination with implementation of the California Plumbing Code, these activities are projected to save enough water to meet the needs of the projected future MMWD customers until 2025. This program is an aggressive program, and its success is not guaranteed, so it does pose a significant risk for MMWD to rely on the projected demand savings. However, MMWD will closely monitor water supply and demand between now and 2025, and will determine whether other alternatives to balance supply and demand will need to be implemented.

Over the past few years, the MMWD Board of Directors has investigated a number of options to ensure a reliable long-term water supply for district customers. Ultimately, the Board decided that no single approach would provide the level of reliability the District needs, but that a combination of options would provide more reliability as well as

[4] Jon LaHaye, MMWD, personal communication, April 4, 2011.
[5] For details, refer to pp. 3-1 – 3-7, Final EIR, Marin Municipal Water District Desalination Project, December 2008 (URS) available at http://www.marinwater.org/controller?action=menuclick&id=446

flexibility. In 2009, the board adopted a long-range water supply plan that includes conservation (as described in the preceding paragraph), improvements to the existing reservoir system, more recycled water, and desalination. Improvements to the existing reservoir system and more recycled water will add some measure of reliability but not all that is needed.

Desalination converts raw bay water into drinking water by removing the salt and other impurities. MMWD first investigated desalination as a potential water source for Marin in 1990. In 2001, the District initiated work on the current environmental impact report and established a temporary pilot desalination plant in 2005. The pilot plant demonstrated that bay water could be purified to levels that exceed state drinking water standards. Desalination costs were found to range from about $2,000 to $3,000 per acre-foot.[6] The environmental impact report was certified by the MMWD Board in February 2009.

In April of 2010, the Board put the desalination option on hold, due primarily to a drop in demand (15 percent in the past three years) resulting from the District's conservation program efforts. Water usage figures for 2009-10 show that MMWD delivered to its customers 25,500 acre-feet of water during the 2009-10 fiscal year, or 8.3 billion gallons. At this level of usage, MMWD is already exceeding its own target for conservation as outlined in the 2007 Water Conservation Master Plan and is also meeting the year 2020 water conservation targets specified in last year's Water Conservation Act (SB X7 7), which requires a statewide reduction in urban water use of 20 percent by 2020. This is the lowest amount of water used since the drought year of 1991, when MMWD last asked customers to ration supplies.

Also figuring into the Board's decision to put desalination on hold is the District's estimate that existing water supplies would currently be adequate to meet customer needs, with 25-percent rationing, if a drought similar to that of 1976-77 were to occur.

MMWD is in the process of updating its Urban Water Management Plan, which will include projection trends in population, water use and water supply for the next 20 years. A draft of the plan will be released for review in spring 2011. That plan will help inform decisions related to all of the district's long-term water supply options.

3.2 General Description of Water Supply Benefits

Potential benefits of the Water Supply Project include greater reliability during periods of shortage in local and imported Russian River water supplies and avoided need to impose further, more severe conservation measures on MMWD customers. Another potential benefit is avoided need for more costly water supplies, such as desalination. According to the San Francisco Bay Area IRWM Region's Proposition 84 Implementation Grant Application (p. 7.1-8) the estimated average cost of water supplies to retail suppliers in

[6] For details, refer to Engineering Report on Desalination Pilot Program, Executive Summary, January 2007 (Kennedy Jenks) available at http://www.marinwater.org/controller?action=menuclick&id=413

the Bay Area is currently $1,500 per acre-foot of treated water. The table below summarizes the costs of various water supplies.

Table 4. Summary of Water Supply Costs

Supply	Cost ($ per acre-foot)
Phoenix Lake water	$510
Imported Russian River water purchased and delivered to MMWD from SCWA	$850
Desalinated seawater	$2,000 to $3,000
Average cost of water supply to Bay Area retailers	$1,500

Another benefit to MMWD provided by the Project would be the avoided cost to MMWD of frequently making the change over from potable to raw water use on a temporary basis. Currently, whenever Phoenix Lake water is pumped to Bon Tempe Lake MMWD must reconfigure the piping and dechlorinate at two locations (see memo from C. Gowan (MMWD) dated March 17, 2011 in Attachment 3, section 3.2.2). The estimated cost for this change over is about $10,000. The piping modification element that is part of the Water Supply Project would avoid the need for this frequent change over, resulting in a savings of to MMWD $10,000 per change over. It would also eliminate some potential cross connection issues between the potable water and untreated Phoenix Lake water and facilitate use of Phoenix Lake water on a more regular basis. Overall, it will provide operational flexibility and new opportunities to use the added yield of the lake via MMWD's existing water pumping, delivery, and treatment capabilities.

Table 5 is a summary of annual water supply benefits. Due to the difficulty to accurately quantify the economic benefits, the benefits of the Water Supply Project are presented in physical terms. Further hydrologic analysis of re-operation of Phoenix Lake is needed to confirm these benefits. The analysis will need to consider MMWD's overall storage and delivery system, taking into account the added flexibility of pumping to Bon Tempe Lake for storage, and will need to cover an extended period of hydrologic record that includes severe shortage years (e.g., 1976-77 drought). This further analysis is described in Attachment 3, Workplan.

Table 5 Annual Water Supply Benefits (in 2009 Dollars)
Projects: Phoenix Lake IRWM Retrofit – Water Supply Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) - (d)	Unit $ Value	Annual $ Value (f) × (g)	Discount Factor	Discounted Benefit ($) (h) × (i)
2009								1.000	
2010								0.943	
2011								0.890	
2012								0.840	
2013								0.792	
2014								0.747	
2015								0.705	
2016	Increased yield	Acre-ft	0	107	107			0.665	
2017	Increased yield	Acre-ft	0	107	107			0.627	
2018	Increased yield	Acre-ft	0	107	107			0.592	
2019	Increased yield	Acre-ft	0	107	107			0.558	
2020	Increased yield	Acre-ft	0	107	107			0.527	
2021	Increased yield	Acre-ft	0	107	107			0.497	
2022	Increased yield	Acre-ft	0	107	107			0.469	
2023	Increased yield	Acre-ft	0	107	107			0.442	
2024	Increased yield	Acre-ft	0	107	107			0.417	
2025	Increased yield	Acre-ft	0	107	107			0.394	
2026	Increased yield	Acre-ft	0	107	107			0.371	
2027	Increased yield	Acre-ft	0	107	107			0.350	
2028	Increased yield	Acre-ft	0	107	107			0.331	
2029	Increased yield	Acre-ft	0	107	107			0.312	
2030	Increased yield	Acre-ft	0	107	107			0.294	
2031	Increased yield	Acre-ft	0	107	107			0.278	
2032	Increased yield	Acre-ft	0	107	107			0.262	
2033	Increased yield	Acre-ft	0	107	107			0.247	
2034	Increased yield	Acre-ft	0	107	107			0.233	
2035	Increased yield	Acre-ft	0	107	107			0.220	
2036	Increased yield	Acre-ft	0	107	107			0.207	
2037	Increased yield	Acre-ft	0	107	107			0.196	
2038	Increased yield	Acre-ft	0	107	107			0.185	
2039	Increased yield	Acre-ft	0	107	107			0.174	
2040	Increased yield	Acre-ft	0	107	107			0.164	
2041	Increased yield	Acre-ft	0	107	107			0.155	
2042	Increased yield	Acre-ft	0	107	107			0.146	
2043	Increased yield	Acre-ft	0	107	107			0.138	
2044	Increased yield	Acre-ft	0	107	107			0.130	
2045	Increased yield	Acre-ft	0	107	107			0.123	
2046	Increased yield	Acre-ft	0	107	107			0.116	
2047	Increased yield	Acre-ft	0	107	107			0.109	
2048	Increased yield	Acre-ft	0	107	107			0.103	
2049	Increased yield	Acre-ft	0	107	107			0.097	
2050	Increased yield	Acre-ft	0	107	107			0.092	
2051	Increased yield	Acre-ft	0	107	107			0.087	
2052	Increased yield	Acre-ft	0	107	107			0.082	
2053	Increased yield	Acre-ft	0	107	107			0.077	
2054	Increased yield	Acre-ft	0	107	107			0.073	
2055	Increased yield	Acre-ft	0	107	107			0.069	
2056	Increased yield	Acre-ft	0	107	107			0.065	
2057	Increased yield	Acre-ft	0	107	107			0.061	
2058	Increased yield	Acre-ft	0	107	107			0.058	
2059	Increased yield	Acre-ft	0	107	107			0.054	
2060	Increased yield	Acre-ft	0	107	107			0.051	
2061	Increased yield	Acre-ft	0	107	107			0.048	
2062	Increased yield	Acre-ft	0	107	107			0.046	
2063	Increased yield	Acre-ft	0	107	107			0.043	
2064	Increased yield	Acre-ft	0	107	107			0.041	
2065	Increased yield	Acre-ft	0	107	107			0.038	
Project Life									
Total Present Value of Discounted Benefits Based on Unit Value (Sum of Column (j))									

3.3 Description of the Distribution of Local, Regional, and State-Wide Benefits

The Water Supply Project will provide local benefits by improving the reliability of MMWD's water supply. The beneficiaries of improved reliability are the customers of MMWD.

The Water Supply Project will provide regional benefits by improving the reliability of MMWD's local water supply sources. To the extent that the reliability of local supplies is improved, and to the extent that the additional local supply created by the Project can replace imported supplies, the Water Supply Project will provide regional benefit to the greater Bay Area region. This benefit results from potentially reducing the need for MMWD to draw from the Russian River during severe shortages, as occurred during the late 1980s and early 1990s when the District drew surplus water through its supply connection with the Sonoma County Water Agency. The regional beneficiaries of reduced reliance on Russian River water during shortages are the water users of the Russian River, including the Sonoma County Water Agency and other users, as well as public resources that depend on adequate flows in the Russian River (e.g., special-status anadromous salmonid species, recreation).

The Water Supply Project can provide statewide benefits by improving the reliability of MMWD's local water supply sources and thereby reducing the potential need to draw from the State Water Project during severe shortages, as occurred during the 1976-77 when State Project Water was transferred to MMWD via an emergency hook up to the EBMUD system. The Statewide beneficiaries of MMWD's reduced reliance on the State Water Project during an emergency are the users of the State Water Project, as well as public resources (e.g., anadromous salmonids, recreation) that depend on adequate flows in the rivers that supply the State Water Project.

3.4 When the Benefits Will be Received

Based on the Water Supply Project Schedule in Attachment 5, the Water Supply project is scheduled to be completed and ready for operation beginning in 2016. Starting in 2016, the project will increase the average annual yield of MMWD's local supplies.

3.5 Uncertainty of the Benefits

The benefits of the Water Supply Project depend on future hydrologic conditions in the Phoenix Lake watershed, which are always subject to a degree of uncertainty. Estimates of the average annual yield over the long term and the annual yield during shortages were derived from analyses using standard hydrologic methods based on historical hydrological data. It is possible that climate change or some other unforeseen factor may cause future hydrologic conditions to significantly differ from the historical conditions

that formed the basis of the estimates of the project yield benefits. However, that possibility cannot be quantified.

3.6 Description of Any Adverse Effects

Potential adverse effects of the Water Supply Project relate to increased use of Phoenix Lake water for water supply. The potential adverse effects will be analyzed in the environmental documentation. Under CEQA, any potential adverse effects must be mitigated to a level of less than significant. Possible mitigation measures include maintaining adequate minimum instream flows below the dam in Ross Creek and achieving these minimum flows by releasing cool water from the lake hypoliminon to Ross Creek to improve fresh coldwater habitat.