

# KERN FAN GROUNDWATER STORAGE PROJECT

## EXECUTIVE SUMMARY

### PROJECT OVERVIEW

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) will recharge and store up to 100,000 acre-feet (AF) of water, primarily during wet periods, in the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin for subsequent recovery and use for public and non-public benefits. Building upon a successful track record of water banking, the Project is co-sponsored by the Irvine Ranch Water District (IRWD) and Rosedale Rio-Bravo Water Storage District (Rosedale). A Project Description was prepared in support of the application submitted by IRWD and Rosedale for Proposition 1 funding under the Water Storage Investment Program (WSIP) administered by the California Water Commission (CWC). This Executive Summary is submitted in fulfillment of **Eligibility and General Project Information Tab, Attachment 1** (Executive Summary) of the WSIP application.

IRWD and Rosedale propose to develop a regional water bank in the Kern Fan area to capture, recharge and store unallocated Article 21 water during wet year conditions and extract water when needed to provide ecosystem, emergency supply, and water supply benefits. The water would be used at a later date through use of groundwater wells and direct or exchange delivery. Operations of the Project will be coordinated with the State Water Project (SWP) through the California Department of Water Resources (DWR).

The Kern Fan Project will cost-effectively recharge and store groundwater for subsequent recovery to address the following project objectives:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to benefit spring and winter-run Chinook salmon;
- Provide water supply during drought conditions;
- Provide water supply for emergency response benefits;
- Establish temporary wetlands through intermittent recharge events that will attract migratory and other water birds in Kern County;
- Benefit the water levels in the Kern County Groundwater Sub-basin;
- Manage water in a resilient and sustainable manner; and
- Be integrated into other water storage projects and storage reservoirs to provide greater statewide benefits.

The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

The Kern Fan Project will provide additional operating flexibility for Rosedale's existing and future programs, and will be a critical element of the IRWD water supply reliability portfolio that supports groundwater recharge and recovery for regional partnerships involving conjunctive use and groundwater banking. The estimated capital cost of the entire Kern Fan Project is approximately \$172 million. In comparison, the economic value of the benefits provided by the Project is estimated at \$177.8 million.

IRWD and Rosedale will partner to implement the Kern Fan Project. As the local co-sponsor, Rosedale will be the Project operator. IRWD and Rosedale share a ten-year history of implementing successful water banking projects. The Project concept, sizing, location, features and operations are based on the experience and knowledge gained from IRWD's and Rosedale's existing water banking projects.

### ***Irvine Ranch Water District***

IRWD was established in 1961 as a California Water District pursuant to the California Water District Law (California Water Code, Division 13). IRWD provides potable and recycled water, sewage collection and treatment, and urban runoff treatment to municipal and industrial and agricultural customers within its 115,531-acre service area in Orange County, California. Since 2007, IRWD has diversified its water supply reliability by developing water banking projects in Kern County. IRWD entered into a long-term water banking partnership with Rosedale to operate IRWD's Strand Ranch and Stockdale West water banking projects. IRWD can store water in the underlying groundwater basin and recover portions of the stored water to supply its demands during critical drought conditions or water supply interruptions. Recovered water is conveyed to IRWD's service area via existing canals, the California Aqueduct, and Metropolitan Water District of Southern California (MWD) facilities. In total, IRWD has developed 126,000 AF of storage capacity, 63,600 AF of recharge capacity, and 35,100 AF of recovery capacity.

IRWD is a landowner in Dudley Ridge Water District (DRWD) and has the rights to the use of SWP Table A water. IRWD has successfully implemented unbalanced exchange agreements, with the approval of MWD and DWR that facilitates the use of portions of this water in IRWD's service area.

### ***Rosedale Rio-Bravo Water Storage District***

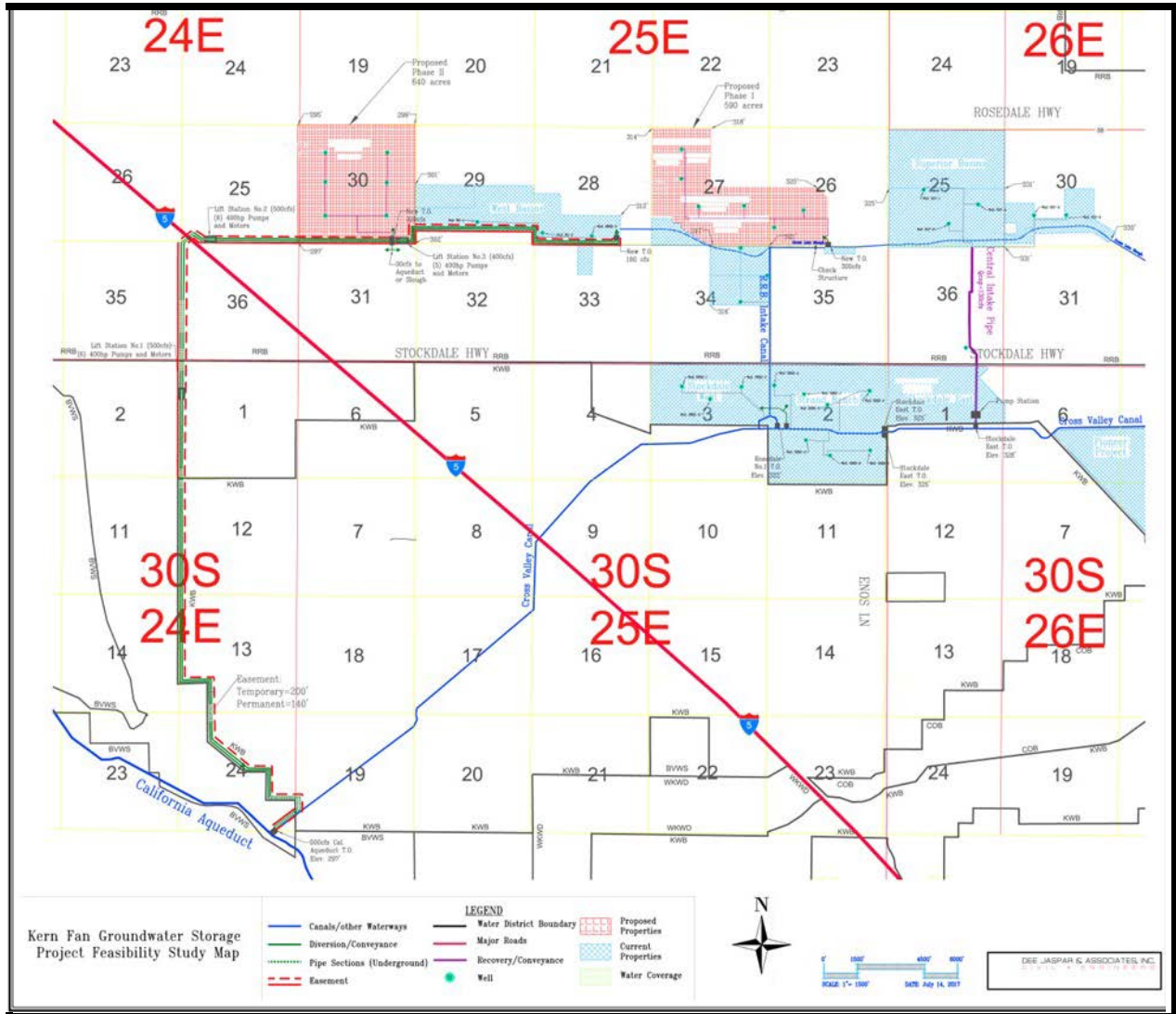
Rosedale was established in 1959 as an independent special district to develop a groundwater recharge program to offset overdraft conditions in the regional Kern County aquifer area. Located west of Bakersfield, the Rosedale service area encompasses 44,150 acres in Kern County, with 27,500 acres developed as irrigated agricultural use and about 7,500 acres developed for urban uses. Rosedale’s service area overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin. For the benefit of its landowners, Rosedale developed a Groundwater Storage, Banking, Exchange, Extraction & Conjunctive Use Program (Conjunctive Use Program) and manages more than 470,000 AF of stored groundwater in the basin, with a total storage capacity in excess of 1.7 million AF. (Sierra Scientific Services, 2009). Operation of the Kern Fan Project will be integrated with Rosedale’s Conjunctive Use Program. **Figure 1** shows the locations of IRWD, Rosedale and the Kern Fan Project.



***Figure 1. Map with IRWD, Rosedale and Kern Fan Groundwater Storage Project Locations***

## Project Implementation

The proposed Kern Fan Project would be located in western Kern County, about six miles west of the City of Bakersfield, as shown in **Figure 2**. Portions of the Kern Fan area are characterized by geologic conditions that are particularly suitable for groundwater recharge operations. Kern County is also strategically located in central California near federal, state, and local water supply conveyance facilities. The Project overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin.



**Figure 2. Kern Fan Groundwater Storage Project Location Map**

The Kern Fan Project would be constructed in two phases. The Phase 1 and 2 project sites would be comprised of 640 acres each and would include construction of conveyance, recharge and recovery facilities as necessary to develop a fully functioning water banking project. The total Project would include approximately 1,200 acres of spreading basins and up to 12 new extraction

wells, each with 5 to 6 cubic feet per second (cfs) of extraction capacity and associated pipelines. Water will be conveyed from the California Aqueduct to and from the Project via a newly proposed turnout at the California Aqueduct and a new conveyance canal with up to 500 cfs conveyance capacity. More detailed information on the project facilities is provided in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix A** of the WSIP funding application.

### *Project Costs*

The estimated capital cost of the Kern Fan Project is approximately \$172 million. **Table 1** shows the breakdown of the estimated project costs.

*Table 1. Estimated Project Costs of the Kern Fan Project*

<b>Description</b>	<b>Estimated Cost (\$)</b>
Aqueduct Turnout	1,185,000
Lift Stations	11,917,500
Phase 1 Recharge & Recovery Facilities	13,861,108
Phase 2 Recharge & Recovery Facilities	14,019,608
Conveyance Facilities	56,195,000
Turnout Facilities	5,582,500
Miscellaneous	2,120,000
Subtotal	104,880,716
20% Contingency	20,976,143
Land, Easements, R/W, habitat credit purchase	36,600,000
<b>Total Field Costs</b>	<b>162,456,859</b>
Non-Contract Costs	
Engineering & Design	5,315,000
Environmental & Permitting	550,000
Construction Management	3,000,000
Subtotal	8,865,000
<b>Total Construction Costs</b>	<b>171,321,859</b>

### *Environmental Compliance*

Environmental compliance, on a program-level, was completed for the Phase 1 recharge and recovery facilities of the Kern Fan Project under the Stockdale Integrated Banking Project Final Environmental Impact Report, approved in 2015. It is expected that a Supplemental EIR would be prepared at a project level for the construction and operation of the Phase 1 and Phase 2 facilities contemplated in the Kern Fan Project. More information about environmental compliance for the Project is located in **Feasibility and Implementation Risk Tab, Attachments 4 and 5** of the WSIP application.

***Allocation of Water to Beneficiaries***

The total storage capacity to be developed from the Project is expected to be 100,000 AF. Deliveries of unallocated Article 21 water would be made on behalf of IRWD as a landowner in DRWD and Rosedale as a member unit of Kern County Water Agency (KCWA). The Article 21 water stored in the Project would be allocated in separate accounts to derive Project benefits as follows:

- 25% would be reserved for public ecosystem benefits
- 37.5% would be reserved for IRWD/DRWD for non-public and public benefits
- 37.5% would be reserved for Rosedale for non-public and public benefits.

Beneficiaries of the Project and their locations are listed in **Table 2**.

***Table 2. Beneficiaries of the Project***

<b>Beneficiary</b>	<b>Location of Benefits</b>	<b>Description of Project Benefit(s)</b>
Public	Delta, Sacramento River, and Feather River	<ul style="list-style-type: none"> <li>• Reduces demands on the Delta by recovering stored groundwater to supply local demands in lieu of exporting water from the Delta</li> <li>• Provides ecosystem benefits in dry and critical years by releasing pulses of water from Lake Oroville for Delta outflow</li> <li>• Decreases water exported from the Delta and increases river flows during critical periods to support fish spawning</li> <li>• Provides an emergency supply in the event of a levee failure in the Delta</li> </ul>
Public	Kern County	<ul style="list-style-type: none"> <li>• Provides temporary wetlands (recharge basins) that attract water birds</li> </ul>
Rosedale	Kern County	<ul style="list-style-type: none"> <li>• Provides greater operational flexibility by utilizing contingency groundwater storage to augment supplies during periods when other water sources may be limited or unavailable (emergency response – extended drought)</li> </ul>
IRWD	Orange County	<ul style="list-style-type: none"> <li>• Augments supplies to IRWD during periods when other supply sources may be limited or unavailable (emergency response – extended drought)</li> </ul>
DRWD	Kings County	<ul style="list-style-type: none"> <li>• Augments supplies during periods when other supply sources may be limited or unavailable (emergency response – extended drought)</li> </ul>

***Project Operations***

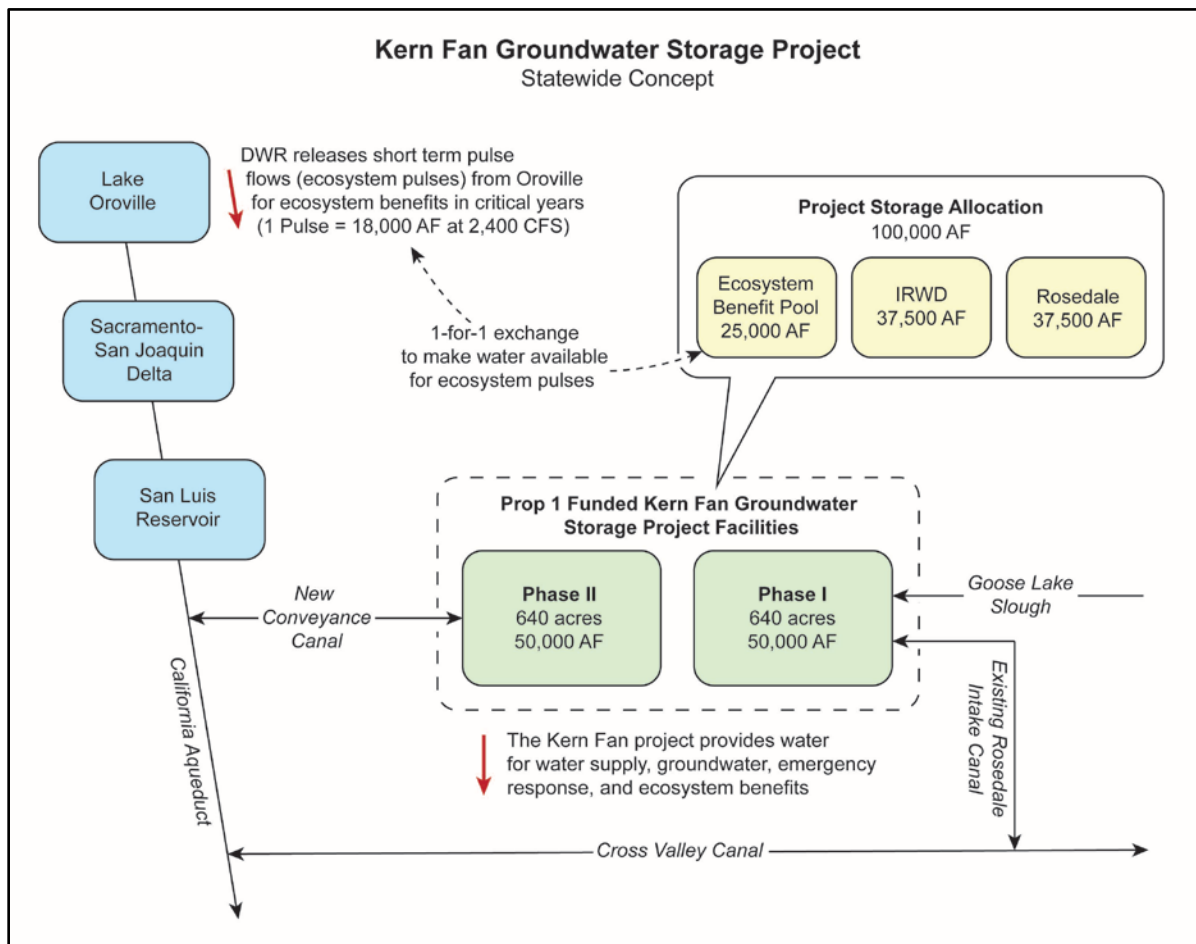
The project would operate such that 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefit purposes. This water would be made available for the ecosystem through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, which is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale’s demands either directly or through operational exchanges. The SWP system water



left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta.

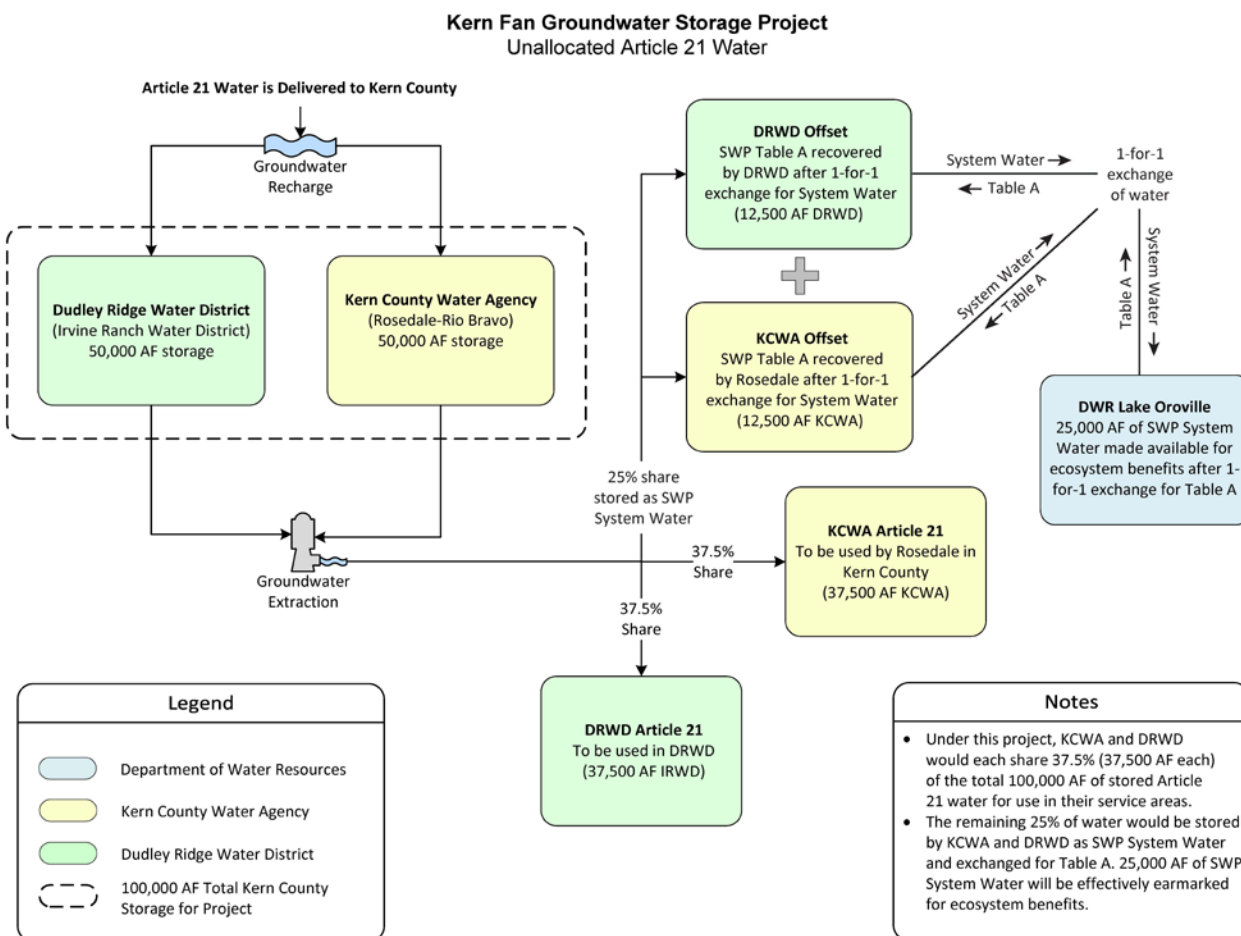
As described in the WSIP funding application, the DWR identified that uncertainties and contractual issues would need to be worked through with respect to the proposed 1-for-1 exchanges. A coordinated operating agreement with DWR would allow the Project to integrate with Oroville operations to provide public benefits. Through the Kern Fan Project, DWR would make releases of pulse flows from Lake Oroville upstream of the Delta which would then physically improve the ecosystem habitat conditions for rearing, downstream migration of spring and winter-run Chinook salmon and other fish species in the Feather River.

**Figure 3** shows a schematic of the statewide perspective of the operations of the Kern Fan Project.



*Figure 3. Kern Fan Groundwater Storage Statewide Operational Schematic*

**Figure 4** presents a schematic of how unallocated Article 21 water will be provided to the Project beneficiaries and how the Project would yield system water for ecosystem benefits through proposed 1-for-1 exchanges.



*Figure 4. Project Preliminary Operations Plan*

### *Project Performance*

MBK Engineers estimated the Project yield and performance using the CalSim II model results that depict the without-Project (Baseline) scenario within a spreadsheet model (MBK Engineers, 2017). The operation of Project was then layered onto the baseline operation of the CalSim II results to simulate the with-Project scenario. Project benefits were then determined and quantified by comparison of the with-Project and without-Project scenarios. MBK Engineers analysis of the Project is included in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix B**. Cramer Fish Sciences prepared an assessment of ecosystem benefits resulting from the Kern Fan Project and this work is included in the **Physical Public Benefits Tab, Attachment 2** of the WSIP funding application.



**Table 3** presents a summary of the Project performance on an average annual basis with the 2030 WISP conditions. Of the 8,000 AF available for the project diversion, approximately 6,100 AF could be conveyed in the Project for recharge on an average annual basis. This water would be stored and then extracted to provide public and non-public benefits. Actual deliveries and recharge in any one year would be substantially greater. Presenting the modeling results on an average annual basis is done for comparison purposes. Actual recharge at the Project would range from 10,000 AF to 70,000 AF per year in years when water is available under 2030 future conditions. Under 2070 conditions, recharge would range from 3,000 AF per year to 70,000 AF per year when water is available. MBK Engineers’ modeling results indicate that 500,000 AF of unallocated Article 21 water would be recharged at the Project over the 82-year modeling period under 2030 conditions. A total of 25 percent of these recharged amounts would be dedicated to an ecosystem account to provide water for ecosystem benefits.

*Table 3. Summary of Project Performance (WSIP 2030) on Average Annual Basis*

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
<b>All Years</b>	<b>6.1</b>	<b>6</b>	<b>1.3</b>	<b>2</b>	<b>2.5</b>

MBK Engineers also simulated project performance under other projected conditions: (1) 2070 climate change, (2) without the California WaterFix (CWF) and (3) with the CWF. While the numbers vary, the conclusions generally remain the same – operation of the Project and coordination with the SWP operation will support ecosystem pulse releases from Oroville Reservoir and will yield a net increase in adult salmon survival benefits.

### *Project Benefits*

Based on analysis the Kern Fan Project, M. Cubed calculated that the Project is anticipated to provide a total benefit value of \$177.8 million (M. Cubed, 2017). A summary of the estimated value of the non-public and public project benefits is provided in **Table 4**.

*Table 4. Estimated Value of Project Benefits*

<b>Benefit Category</b>	<b>Benefit Type</b>	<b>Estimated Value (2015 \$ millions)</b>
Non-public Benefits	Water Supply Benefits	\$47.7
	Groundwater	\$4.3
Public Benefits	Environmental Benefits – Chinook Salmon	\$21.0
	Environmental Benefits – Incidental Wetland Habitat	\$39.8
	Emergency Response – Extended Drought	\$5.1
	Emergency Response – Delta Failure	\$59.9
	<b>Total Benefits</b>	<b>\$177.8</b>

**Conclusion**

The Project will manage available surplus water supplies to serve dry year demands, for emergency response, and ecosystem benefits including improved habit conditions, enhanced access to fish spawning and rearing in the Feather River downstream of Oroville Dam. The Project’s water banking facilities will build upon the success of other groundwater storage/recovery projects, demonstrating that collaboration with DWR can provide ecosystem improvements for habitat and fish at the Delta. Other public benefits from the Project will include temporary wetlands and water supply that will be available during emergency situations such as long-term drought or Delta levee failures. The estimated capital cost of the entire Kern Fan Project is approximately \$172 million. In comparison, the economic value of the benefits provided by the Project is estimated at \$177.8 million.