Temperance Flat Reservoir Summary of Project Evaluations for MOU Group

Draft Final Technical Memorandum

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EXECUTIVE SUMMARY

This Technical Memorandum (TM) summarizes the results of an evaluation of the potential benefits of the Temperance Flat Reservoir (TFR) Project performed for the TFR Memorandum of Understanding (MOU) Group. The MOU Group consists of public agency water districts, irrigation districts, and representative joint powers authorities reflecting a broad set of water user interests in the San Joaquin Valley. The MOU group was established to guide technical analyses of the TFR Project to support decision making regarding participation in further project development. TFR Project benefits evaluated included additional water supply through the capture of San Joaquin River inflow and management of Central Valley Project (CVP) and local water supplies. These benefits were evaluated under a range of future operating conditions including new regulatory conditions and new conveyance facilities (i.e., Delta conveyance and trans-valley conveyance).

TFR Storage Account Operation

The TFR Project operation plan is based on preserving the existing operational capacity of Millerton Reservoir with the addition of investor storage accounts in TFR. MOU Group participants used a modeling tool, referred to as the MOU Group gaming tool, that allows each user to evaluate various account storage sizes and operating objectives to meet their own unique requirements and develop storage account operations. The TFR storage accounts have two different operation strategies: capture of San Joaquin River inflow and management of CVP and local water supply.

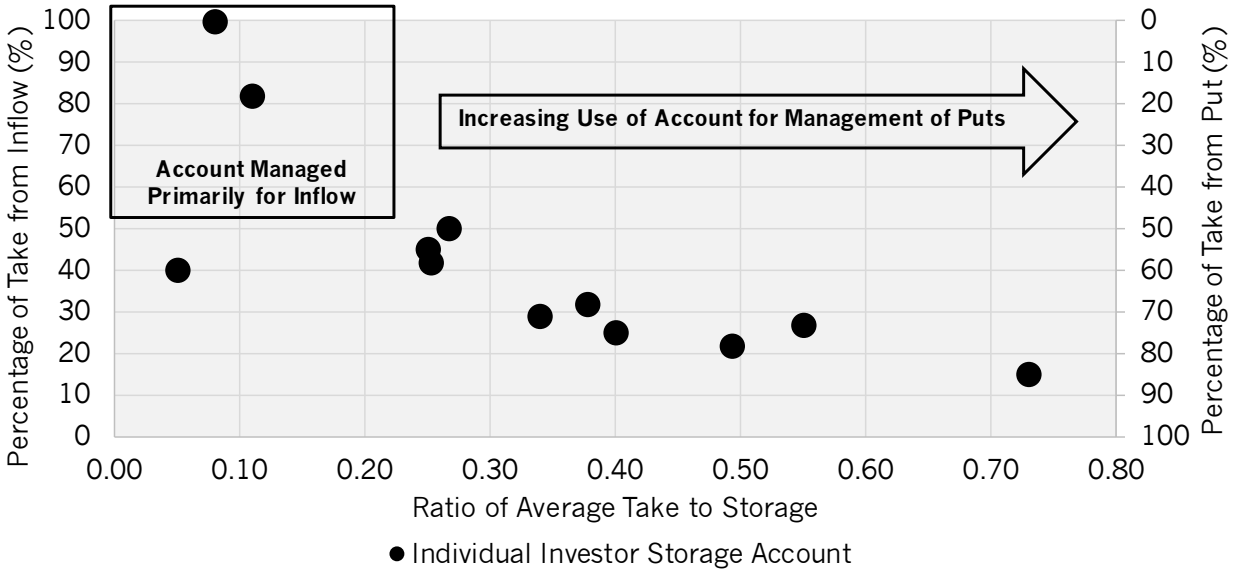
Individual Investor Storage Account Operations

TFR storage accounts were evaluated under the following conditions, which generally reflect existing conditions at the time the analyses were performed:

- Preserve the existing operation capacity of Millerton Reservoir
- Regulatory conditions are simulated under the 2018 Coordinated Operations Agreement (COA) Amendment CalSim II baseline
- Historical delivery to CVP Friant Division
- No access to Delta surplus supply – Delta surplus supply is the quantity of surplus Delta outflow under current regulatory conditions, as limited by the available physical capacity each month at Banks and Jones pumping plants
- Trans-valley conveyance capacity of 250 cfs

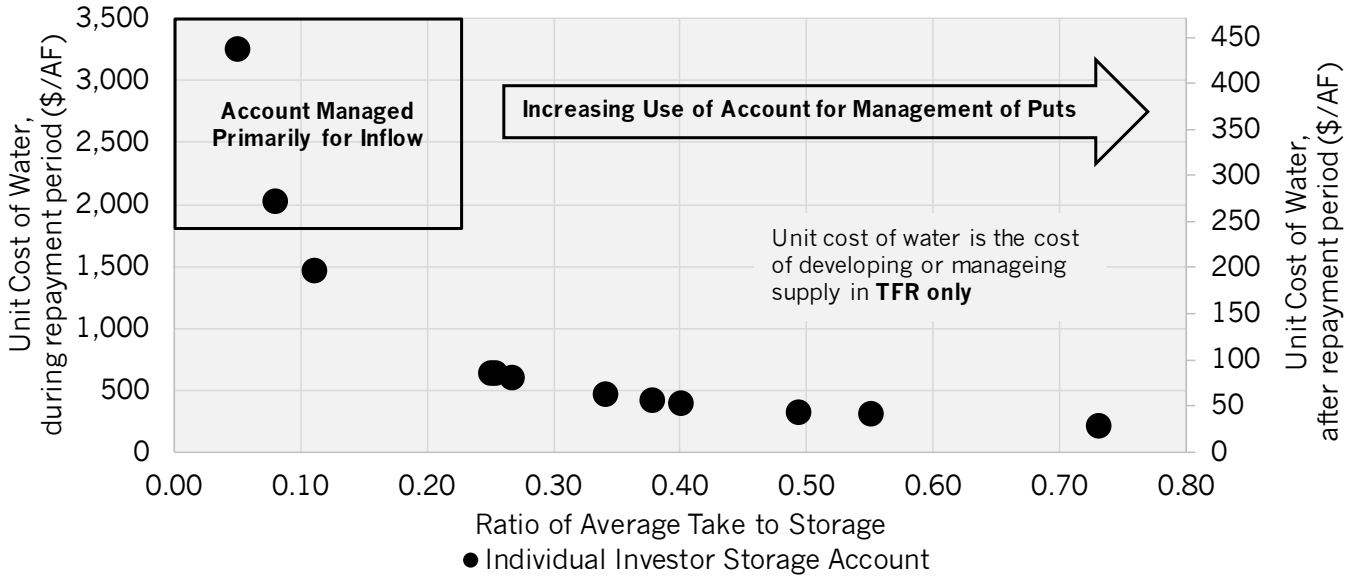
Individual storage account operations were developed for 12 potential investor groups. Figure ES-1 shows the ratio of average take from TFR storage accounts to storage acount size. The ratio of average take to storage is a measure of the average annual delivery as a percentage of the total storage account size. For example, an account with a 0.4 average take per storage represents an account that delivers on average 40 percent of total storage volume per year. The relative percentages of inflow and put indicate how the storage is used to manage water supply. Accounts with a higher percentage of put were operated to manage existing CVP and local water supply; whereas accounts with higher percentage of inflow were operated primarily to develop a new source of water from San Joaquin River inflow.

A cost analysis tool was developed for use by the MOU Group to evaluate the potential project costs and financing requirements associated with the performance of individual storage accounts. For this analysis, 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed at 50 years with an annual interest rate of 2.875 percent, no upfront cash, and repayment period beginning after completion of construction. Figure ES-2 shows the average annual take from storage and the unit cost of water, during and after the repayment period. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only in 2024 dollars and does not include acquisition and conveyance costs for rescheduled or exchanged water supplies.



Key: % =Percentage

Figure ES-1. Individual Investor Storage Account Ratio of Average Take to Storage and Percentage of Take from Inflow and Put



Key: $/AF = dollar per acre-foot TFR = Temprance Flat Reservoir

Figure ES-2. Individual Investor Storage Account Ratio of Average Take to Storage and Unit Cost of Water per Acre-Foot, During and After, Repayment Period

Findings from Individual Investor Storage Account Operations

Review of individual investor storage account operations revealed the following findings:

- Accounts that operate for the management of CVP and local water supply have a higher proportion of take to storage compared to accounts operated primarily to capture inflow
- TFR is more cost-effective when used to manage CVP and local water supply compared to accounts used primarily to capture San Joaquin River inflow as a new source of supply

Combined Account Operation Scenarios

At the conclusion of the individual investor storage account operation analysis, the 12 account operations were combined to identify potential water management conflicts. Two conflicts were identified: total storage account requests, and trans-valley conveyance capacity. The combined account only allocated 875 thousand acre-feet (TAF) of the 1,150 TAF storage available in TFR. It was also found that the 250 cubic feet per second (cfs) trans-valley conveyance capacity limits opportunities for management of CVP supply outside the Friant Division. These conflicts, combined with uncertainty regarding future regulatory actions and potential access to additional Delta water supplies, led to development of several sensitivity analyses to evaluate TFR benefits under a range of future conditions, including:

- CVP delivery under new regulatory conditions
- Increased CVP Friant demand
- Use of unassigned 275 TAF storage
- Access to Delta surplus supply
- Increased trans-valley conveyance capacity

Table ES-1 summarizes presents a selected set of sensitivity scenarios that demonstrate how benefits of TFR Project would vary if the operating objectives for the combined individual accounts were applied to different future operating conditions. A complete list of all sensitivity analyses performed is described in the main report. For all scenarios, the existing operating capacity of Millerton Reservoir is preserved, and the individual investor storage account operations are maintained. This approach was selected to determine the sensitivity of the TFR Project to future conditions, and therefore results in a conservative estimate of the benefits. It is expected that project benefits would increase if individual investor storage account operations were optimized under each scenario. The selected scenarios in Table ES-1 are described below.

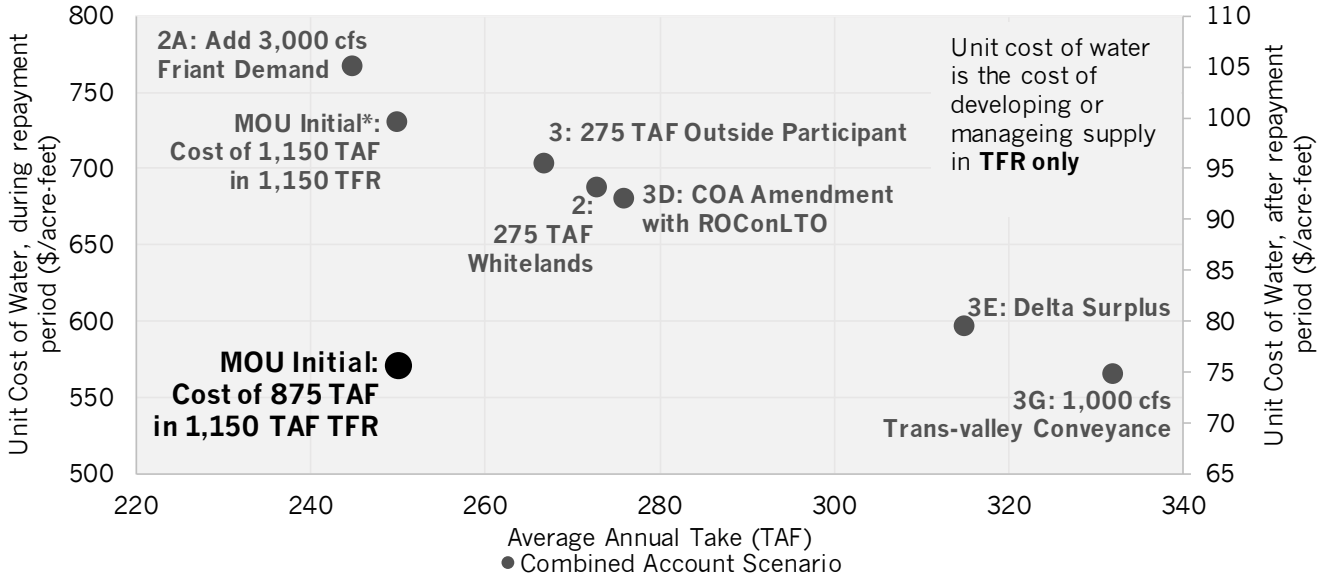
- MOU Initial scenario represents the individual investor storage account operations. The unassigned 275 TAF storage is not simulated.
- Scenario 2 operates unassigned 275 TAF storage as a Whitelands account to simulate a large agricultural water user with neighboring lands to CVP Friant Division lands not located within CVP Friant Division agencies. The water demand pattern is based on historical Friant Division Class 2 deliveries.
- Scenario 2A assumes historical Friant Division deliveries with an additional 3,000 cfs demand to CVP Friant Division to evaluate how decreased availability of inflow to TFR storage accounts changes the management of CVP and local water supply.
- Scenario 3 also assumes 3,000 cfs additional demand in the Friant Division and operates the unassigned 275 TAF storage as an Outside Participant account to simulate a large municipal and industrial (M&I) user outside the San Joaquin Valley.
- Scenario 3D adds the anticipated Re-initiation of Consultation on Long-Term Operations (ROConLTO) of the CVP and State Water Project (SWP) CalSim II baseline to evaluate how the management of CVP supply changes under new regulatory conditions as understood in May 2019. The simulated operations may not be identical to operational requirements that form the basis of Biological Opinions (BO) released in October 2019.
- Scenario 3E adds Delta surplus supply that could be managed with increased storage capacity.
- Scenario 3G adds 1,000 cfs trans-valley conveyance capacity.

Table ES-1. Summary of Combined Account Operation Scenarios

Operating Conditions	Scenario						
	MOU Initial	2	2A	3	3D	3E	3G
Existing Millerton Operations	Included						
Individual Investor Operations	Included						
Regulatory Conditions	COA Amendment				COA Amendment with ROConLTO		
Friant Physical Facilities	Historical Delivery		Historical Delivery with Additional 3,000 cfs Demand				
Unassigned Storage (275 TAF)	Not Simulated	Whitelands		Outside Participant			
Delta Surplus Supply	Not Used					Used	
Trans-Valley Conveyance Capacity	250 cfs						1,000 cfs
	MOU Initial	2	2A	3	3D	3E	3G
	Scenario						

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
MOU = Memorandum of Understanding
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet
Whitelands = The storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies
Note: Highlighted operating conditions represent the different future operating conditions evaluated in the scenarios

Figure ES-3 shows average annual take and the unit cost of water (during and after repayment) for the selected sensitivity scenarios. The MOU Initial* scenario represents the cost of 1,150 TAF storage in TFR with the same operating conditions as the MOU Initial scenario if no other users participated.



Key: $/acre-feet = dollar per acre-feet
cfs = cubic feet per second
COA = Coordinated Operations Agreement
MOU = Memorandum of Understanding
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet
TFR = Temperance Flat Reservoir
Note: MOU Initial* scenario represents the cost of 1,150 TAF storage in TFR with the same operating conditions as the MOU Initial scenario

Figure ES-3. Combined Account Scenario Average Annual Take and Unit Cost of Water per Acre-Foot, During and After, Repayment Period

Findings from Combined Account Operation Scenarios

The following findings are based on review and comparison of combined account operation scenario results

- The reduced availability of inflow under a condition with an additional 3,000 cfs demand to CVP Friant Division Contractors reduces availability of San Joaquin River inflow to TFR storage accounts and increases available storage capacity for management of CVP and local water supply.
- Development of additional CVP Friant delivery capability would not significantly reduce project benefits if additional Delta supply is available and TFR is operated to support management of that supply.
- Operating 275 TAF of unassigned storage to manage CVP and local water supply increases the combined account take compared to managing the storage for the capture of San Joaquin River inflow.
- Use of TFR to manage CVP supply could increase under future regulatory conditions that increase delivery of CVP SOD water supplies.
- TFR could provide greater operational flexibility to store Delta surplus supply with increased trans-valley conveyance capacity.
- Increased access to Delta supply and additional trans-valley conveyance capacity would increase TFR cost-effectiveness
- Committed project participants must be willing to accept responsibility of project costs before construction commences
- Project unit costs could be reduced if Federal or State funding were allocated to project costs

Future Considerations

The MOU Group evaluation of the TFR Project benefits included analyzing various operating scenarios for agricultural water supply and project cost analysis to assist MOU Group members in evaluating their interest in TFR. The operating conditions were based on water supply availability assumptions that could be considered minimum possible conditions. Account operations would likely change under future conditions.

Continued development of TFR with Reclamation and other project partners will be required before the project can be implemented. These requirements include:

- Determine participants, storage account sizes, and operating objectives for the TFR Project
- Develop a detailed Operating Plan in coordination with Reclamation
- Confirm TFR Project benefits and impacts in coordination with Reclamation
- Develop a project financing plan, including agreements for Federal and State cost-sharing
- Coordinate with Reclamation for determination of and compliance with water right requirements
- Complete federal, state, and local permitting requirements, including Endangered Species Act compliance and Section 106 Cultural and Tribal consultation

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ACRONYMS

Ag	agriculture
BO	Biological Opinions
cfs	cubic feet per second
CALFED	CALFED Bay-Delta Program
CM	construction management
COA	Coordinated Operations Agreement
CVP	Central Valley Project
CWC	California Water Commission
DEIS	Draft Environmental Impact Statement
DFR	Draft Feasibility Report
DWR	California Department of Water Resources
ESA	Endangered Species Act
FR	Feasibility Report
FWA	Friant Water Authority
ID	Irrigation District
IDC	Interest During Construction
LTO	Long-Term Operation
MAF	million acre-feet
MOU	Memorandum of Understanding
MUD	Municipal Utility District
M&I	Municipal and Industrial
NCC	non-contract cost
NMFS	National Marine Fisheries Services
n/a	not applicable
OM&R	operations, maintenance, and replacement
RCC	roller-compacted concrete
Reclamation	U.S. Bureau of Reclamation
ROConLTO	Reinitiation of Consultation on Coordinated Long-Term Operations
RM	river mile
SJR	San Joaquin River
SJRECWA	San Joaquin River Exchange Contractor Water Authority
SLDMWA	San Luis & Delta-Mendota Canal Water Authority
SOD	South of Delta

SWP	State Water Project
TAF	thousand acre-feet
TM	technical memorandum
TFR	Temperance Flat Reservoir
TFRA	Temperance Flat Reservoir Authority
USFWS	United States Fish and Wildlife Service
USJRBSI	Upper San Joaquin River Basin Storage Investigation
WCD	Water Conservation District
WD	Water District
WSD	Water Storage District
WSIP	Water Storage Investment Program
$	dollar
$/acre-feet	dollar per acre-feet
$/acres	dollar per acres
%	percentage
<	less than

BACKGROUND

The proposed TFR Project would be a new reservoir, formed by constructing a new dam within the footprint of the existing Millerton Lake. The Millerton Lake-Temperance Flat complex will have a new net storage capacity of about 1.26 million acre-feet (MAF), after accounting for reductions in existing Millerton Lake storage and dead storage in TFR. The proposed TFR Project has been under evaluation for several years as part of the Upper San Joaquin River Basin Storage Investigation (USJRBSI), a CALFED storage project feasibility study jointly led by the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR). The USJBRSI Draft Feasibility Report (DFR) released in 2014 identified the TFR at River Mile 274 as the preferred storage alternative. A Draft Environmental Impact Statement (DEIS) issued in 2014 discloses the effects of its construction and assumed operation. The operating plan included in the DFR and DEIS treated TFR as a virtual expansion of Friant Dam.

In 2017, a coalition of regional water users, including the Friant Water Authority (FWA), the San Joaquin River Exchange Contractor Water Authority (SJRECWA) and the San Luis & Delta-Mendota Canal Water Authority (SLDMWA) developed a Preliminary Operating Plan to evaluate the potential benefits that could be provided by the TFR Project while preserving the capability of Friant Dam to meet contractual obligations to CVP Friant Division Contractors, San Joaquin River (SJR) Exchange Contractors, and the San Joaquin River Restoration Program. The Preliminary Operating Plan is based on the management of storage accounts in TFR to provide water supply, as well as a variety of public benefits, including ecosystem improvements. Under the Preliminary Operating Plan, the TFR Project would be used to manage water supply stored from inflow that exceed the operational capabilities of Friant Dam, and water supply resulting from water transfers and exchanges with CVP Friant Division Contractors. The combined operation of Friant Dam and TFR would preserve the existing requirements and delivery capabilities of Friant Dam for San Joaquin River Restoration releases, water deliveries to CVP Friant Division Contractors, reserved water demands for SJR Exchange Contractors, and flood protection.

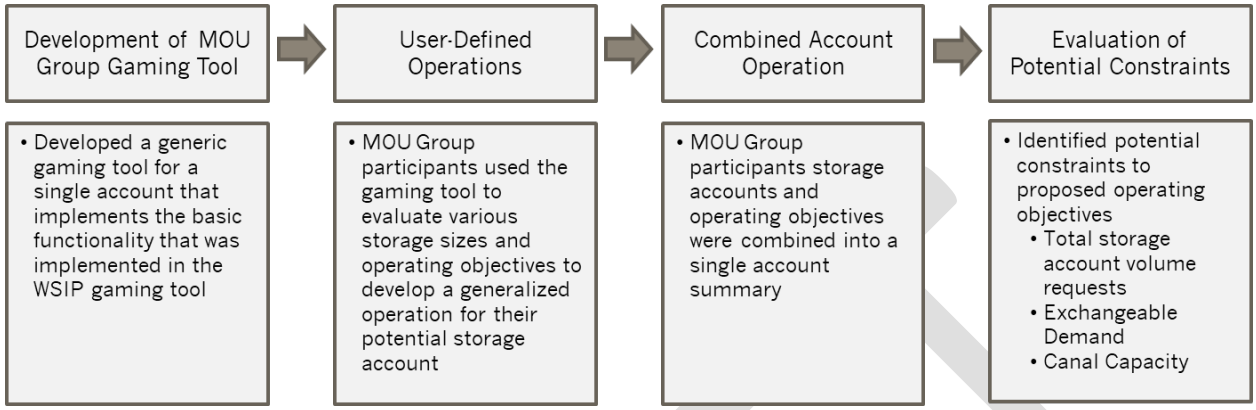
The Preliminary Operating Plan was used to prepare an application for funds available for the public benefits of storage projects under the Water Storage Investment Program (WSIP), administered by the California Water Commission (CWC). The Preliminary Operating Plan includes many generalized assumptions regarding the potential management of TFR storage accounts. The WSIP application demonstrates that the TFR Project is feasible under technical, environmental, economic, and financial criteria. In July 2018, the CWC made a conditional determination of maximum eligible funding for the TFR Project of $171.33 million, based on quantified and approved public benefits.

Concurrent with CWC review of the WSIP application, the MOU Group was formed as a group of public agency water districts, irrigation districts, and representative joint powers authorities that reflects a broad set of water user interests in the San Joaquin Valley. The MOU group was established by potential public agency investors to guide technical analyses of potential benefits of the TFR Project to support decision making regarding continued participation in project development.

MOU Group participants evaluated their potential interest in the TFR Project through application of a refined version of the modeling tool, referred to as the WSIP gaming tool, used to develop the Preliminary Operating Plan during preparation of the WSIP application. The MOU Group gaming tool includes individual user-defined accounts and greater detail regarding account management. Development of the MOU Group gaming tool included coordination with potential project investors and development of technical tools to allow individual investors to evaluate the management of potential water storage accounts in TFR. In addition to the MOU Group gaming tool, a cost analysis tool was prepared for use by MOU Group participants in their evaluation of cost and financing requirements associated with individual storage accounts.

MOU GROUP GAMING TOOL DEVELOPMENT

The MOU Group gaming tool was developed and applied through a sequential process, as illustrated in Figure 1 and described below.



Key: MOU = Memorandum of Understanding WSIP = Water Storage Investment Program

Figure 1. Memorandum of Understanding Gaming Tool Development Process

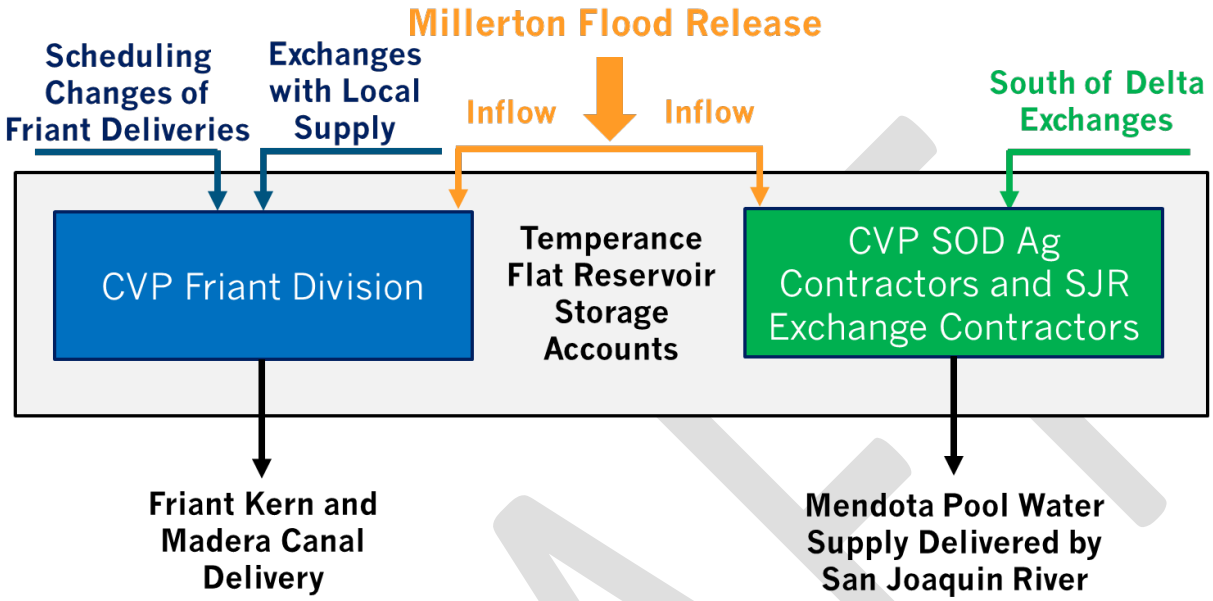
The WSIP application gaming tool implemented the basic functionality to maintain Millerton Lake operational and delivery priorities and the management of flood spills. The WSIP application gaming tool included single storage accounts for general Eastside (i.e., CVP Friant Division Contractors) and Westside (i.e., CVP SOD Agriculture (Ag) Contractors and SJR Exchange Contractors) operations. The MOU Group gaming tool includes individual user-defined accounts and allows the user to evaluate various account storage sizes and operating objectives to meet their own unique requirements and develop their storage account operations.

The MOU Group gaming tool was used to support discussions and identify additional functionality requirements to meet the needs of user-specific evaluations. During 18 monthly MOU Group meetings and 18 individual and group gaming tool workshops, participants provided feedback on the use of the tool to support their analytical needs, requested refinements in tool input and result display features, and received results from previously conducted evaluations and modifications. Additional meetings were held with MOU Group participants to assist in representing operating objectives in the MOU Group gaming tool.

MOU Group individual investor storage account operations were combined into a single account summary to identify potential water management conflicts. Some of the conflicts identified included the total volume of requested storage accounts and trans-valley conveyance capacity limit to managing CVP supply outside the Friant Division. These conflicts and uncertainty in future regulatory actions led to the development of several sensitivity analyses of the combined account to evaluate TFR benefits under a range of future conditions.

STORAGE ACCOUNT OPERATION

In the MOU Group gaming tool, the potential project investors select the size of their storage account to simulate their operations. Figure 2 shows the operational logic for managing water supply for CVP Friant Division Contractors, CVP SOD Ag Contractors, and SJR Exchange Contractors accounts.



Key: Ag = Agriculture CVP = Central Valley Project SOD = South of Delta SJR = San Joaquin River

Figure 2. Memorandum of Understanding Group Temperance Flat Reservoir Storage Account Operations

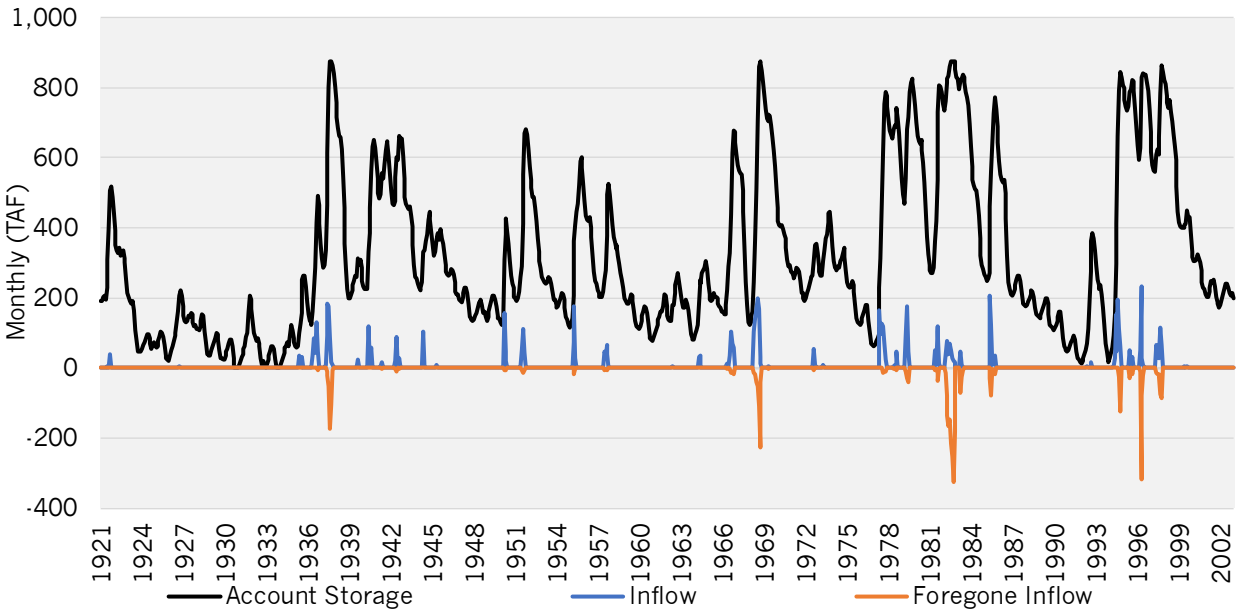
Common terms used in the storage account operations:

- Inflow refers to the capture of San Joaquin River inflow from Millerton Reservoir flood release
- Put refers to the rescheduling of CVP Friant Division water supply (i.e., Class 1 and Class 2) by Friant Division long-term contractors in coordination with local management actions and/or in support of exchanges with non-Friant CVP contractors
- Take refers to the delivery of water from the storage account via the Friant-Kern and Madera canals or delivery via the San Joaquin River to Mendota Pool

MILLERTON FLOOD RELEASE

The San Joaquin River inflow to the TFR storage accounts is the Millerton flood release. In the MOU Group gaming tool, the total inflow into the storage account is allocated based on the size of the individual account to the total size of TFR (i.e., 100 TAF account in a 1,150 TAF TFR would be allocated about nine percent of the Millerton flood release).

The capture of inflow is limited by available storage in individual accounts. If an individual account is full, any allocated inflow not captured is classified as foregone inflow and released to the San Joaquin River. In the combined account analysis, the foregone inflow from the individual accounts was not reallocated to the other accounts. This is because during the development of the individual account operations, the total volume of foregone inflow from all accounts and the availability of storage in other accounts was unknown. As a result, the cumulative estimated capture of inflow may be understated in the analysis. Figure 3 shows the monthly operations trace of the combined account in TFR. In the figure, inflow is the volume of Millerton flood release captured in storage accounts, account storage is the total volume of water in storage accounts, and foregone inflow is the volume of Millerton flood release not captured in storage accounts. The monthly operations trace shows that foregone inflow occurs when the storage accounts are full.

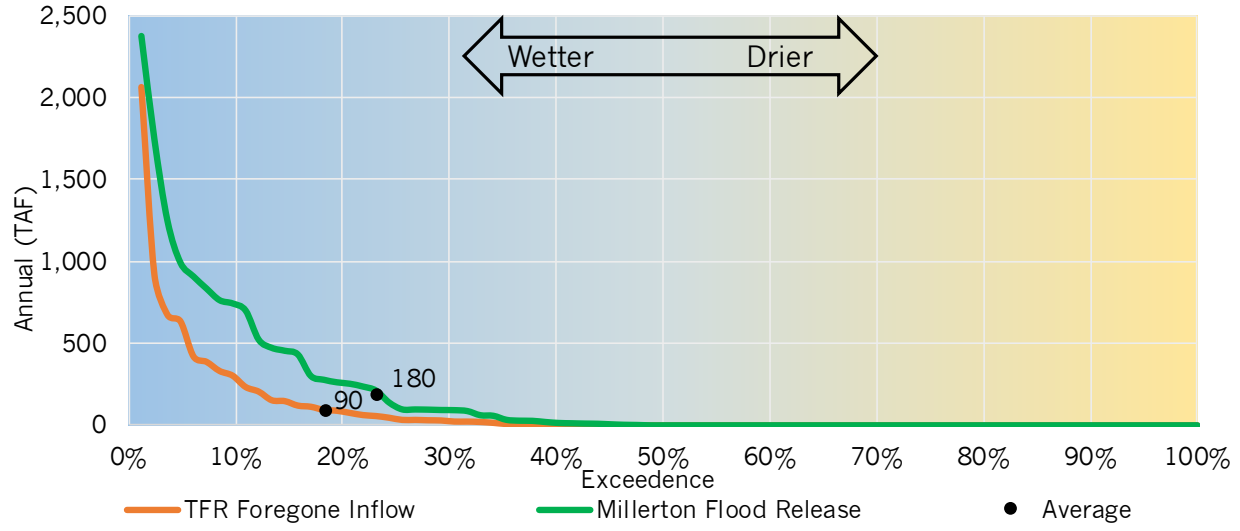


Key: TAF = thousand acre feet

Figure 3. Monthly Operations Trace of the Temperance Flat Reservoir Combined Account

In this TM, several figures show the long-term average amount and its corresponding exceedence frequency. The exceedence describes the chance that a value will be met or exceeded in the simulation period. It should be noted that a 50 percent exceedence corresponds to the median amount, (i.e., the value separating the higher half from the lower half in the simulation period) and is not the average or mean amount. The average amount is indicated in the figure as a black point on the exceedence frequency curve.

Figure 4 shows the Millerton flood release and the foregone inflow from the TFR combined account operation. Millerton flood release are generally available during wetter periods. The results show that TFR has the potential to capture an average of 90 TAF per year of Millerton flood release and reduce the frequency of spills to the San Joaquin River. If foregone inflow were reallocated to available capacity in any individual storage account, the potential to capture inflow could increase up to an additional average 44 TAF per year. However, reallocation of foregone inflow was not simulated and, therefore, it is not known if this full amount could be realized without reducing other operational objectives of individual storage accounts.



Key: TAF = thousand acre feet TFR = Temperance Flat Reservoir

Figure 4. Exceedence of Annual Millerton Flood Release and Temperance Flat Reservoir Combined Account Foregone Inflow

SCHEDULING CHANGES OF FRIANT DELIVERIES

The CVP Friant Division Contractors can operate their storage account by specifying an amount of Class 1, Class 2, and 215/Other delivery that would be stored in their account in-lieu of being directly delivered. This put is a change in scheduled deliveries of Class 1, Class 2, and 215/Other supply.

EXCHANGES WITH LOCAL SUPPLY

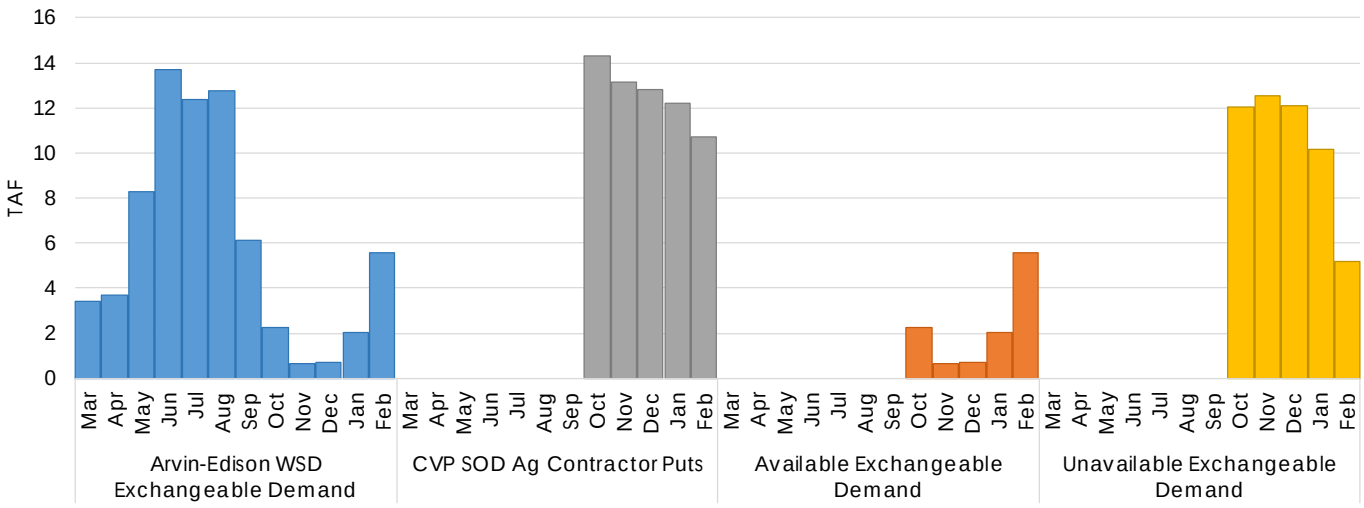
The CVP Friant Division Contractors can specify puts from exchanges with local supply. There is no limit on this as there is no information on the amount, location, and magnitude of what might be available. Exchanges with local supply is only limited by user selected canal capacity limit and available storage space in the account.

SOUTH OF DELTA EXCHANGES

In addition to capturing an allocation of Millerton flood release, the CVP SOD Ag Contractors and SJR Exchange Contractors can specify the amount of their supply that would be put into their account in-lieu of being delivered directly. This is a way to secure their water supply in TFR to protect from potential spills in CVP San Luis Reservoir. This supply would be delivered to their storage account through exchanges with CVP Friant Division Contractors.

After the individual account operations were submitted, the CVP SOD Ag Contractors puts were compared to Arvin-Edison Water Storage District (WSD) take to determine available exchangeable demand, as shown in Figure 5. This analysis assumes exchanges with CVP Friant Division Contractors under a without-pump back condition. The available exchangeable demand is the amount of Arvin-Edison WSD take available to meet CVP SOD Ag Contractor desired put. The unavailable exchangeable demand is the remaining CVP SOD Ag Contractor desired put not met by exchangeable demand with Arvin-Edison WSD.

In the combined account analysis, the MOU Group gaming tool limits puts by 250 cfs trans-valley conveyance capacity and does not limit puts by available exchangeable demand with CVP Friant Division Contractors. The combined account operation does not apply an exchangeable demand limit because the total desired exchanges between CVP SOD Ag Contractors and CVP Friant Division Contractors for all individual accounts was not known. An analysis of CVP SOD Ag Contractor puts was applied in the combined account analysis with an increased trans-valley conveyance capacity, discussed later in this TM.



Key: Ag = Agriculture CVP = Central Valley Project SOD = South of Delta TAF = thousand acre feet WSD = Water Storage District

Figure 5. Example of Average Monthly South of Delta Exchanges with Arvin-Edison Water Storage District in the Combined Account Analysis

TAKE

The CVP Friant Division Contractors take delivery of their account supply by the Friant-Kern Canal and the Madera Canal. The CVP SOD Ag Contractors and SJR Exchange Contractors take delivery of their account supply via Mendota Pool from releases to the San Joaquin River. The take amounts reported in this document represent net differences in delivery of water from the San Joaquin River at Mendota Pool. While the infrastructure exists to directly deliver TFR supply to the California Aqueduct via Friant-Kern Canal and Cross Valley Canal, that potential operation was not included in this analysis.

INDIVIDUAL INVESTOR STORAGE ACCOUNT OPERATIONS

Individual investors and investor groups used the MOU Group gaming tool to evaluate various storage sizes and operating objectives to develop ideas on how they might jointly use the account and develop a generalized operation for their account. The TFR storage accounts were evaluated under the following operating conditions:

- Existing operation capacity of Millerton Reservoir is preserved
- Regulatory conditions are simulated under the 2018 Coordinated Operations Agreement (COA) Amendment CalSim II baseline
- Assumes historical delivery to CVP Friant Division
- Assumes no access to Delta surplus supply
    - Delta surplus supply is the quantity of surplus Delta outflow under current regulatory conditions limited by the available physical capacity each month at Banks and Jones pumping plants
- Trans-valley conveyance capacity is 250 cfs

INDIVIDUAL INVESTOR STORAGE ACCOUNT REQUESTS

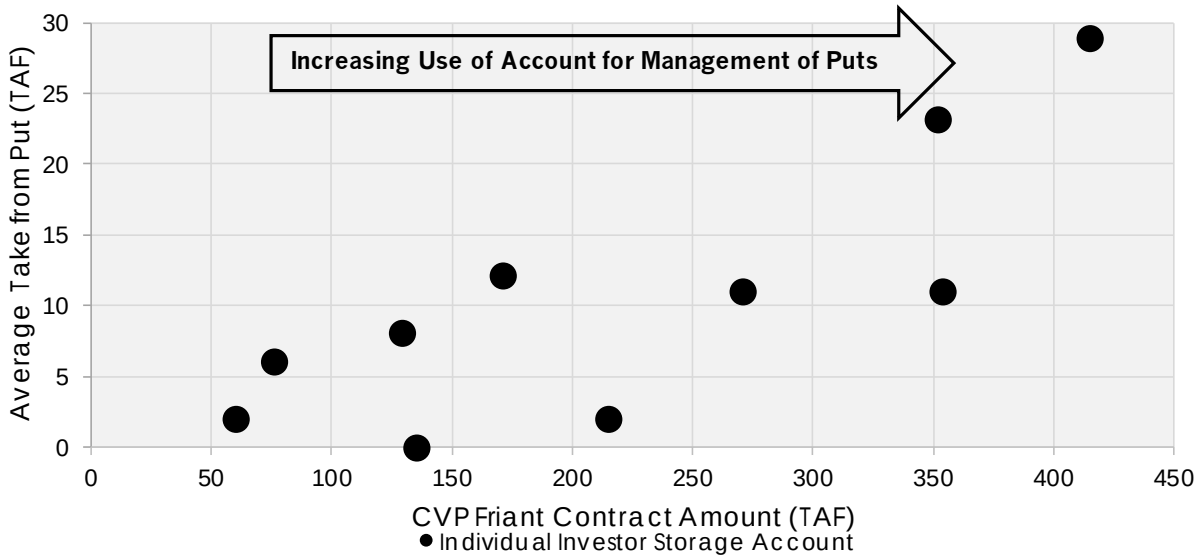
Table 1 shows the MOU Group gaming tool storage accounts for 12 potential investor groups (includes 31 agencies). Seven of the storage accounts were submitted by investor groups that specified account sizes and account operations. Five of the storage accounts were developed based on coordination with the investor group to determine the size of storage account and the account operation was developed based on the investor group participants baseline average delivery pattern. The five assumed operation accounts are highlighted in Table 1. Appendix A summarizes the results of the 12 individual investor group storage account operations.

Table 1. Memorandum of Understanding Group Gaming Tool Individual Investor Storage Account Requests

Potential Investor Group[1]	Storage Account (TAF)
Arvin-Edison WSD	90
Chowchilla WD	100
City of Fresno[2]	150
Delano-Earlimart ID[3]	75
Hills Valley ID[4]	20
Kern-Tulare WD[5]	15
Lower Tule River ID[6]	75
Madera ID	80
Terra Bella ID[7]	20
Tulare ID	50
SJR Exchange Contractors[8]	100
CVP SOD Ag Contractors[9]	100
Total Simulated	**875**

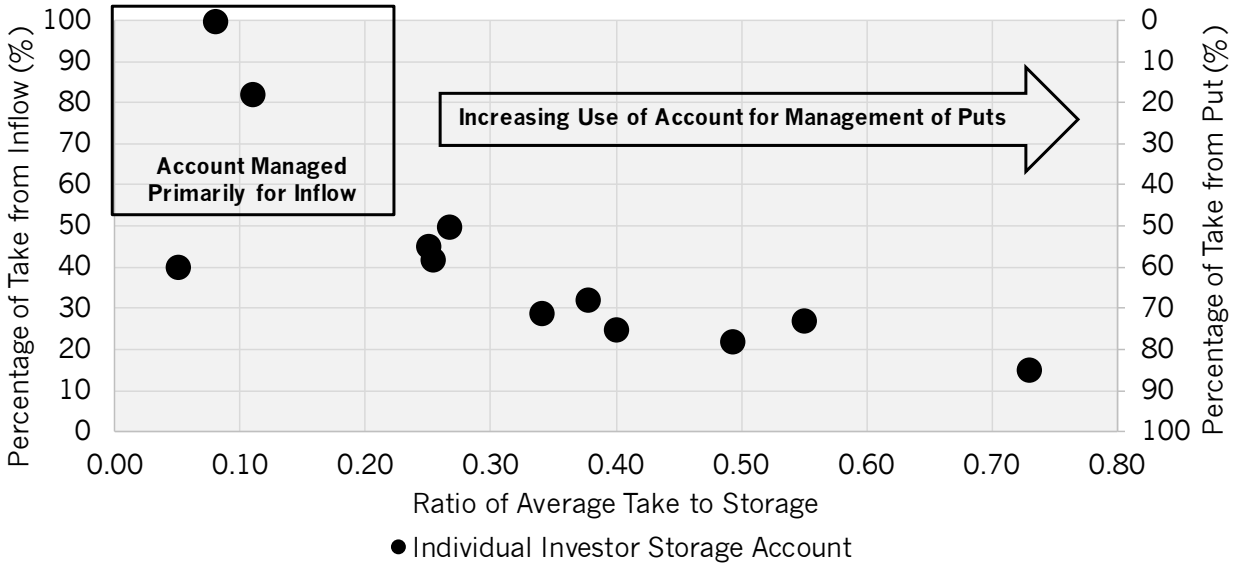
Notes:
[1] Highlighted investor group indicates an assumed account operation was developed based on the investor group participants baseline average delivery pattern
[2]Investor group includes City of Fresno and Fresno ID
[3]Investor group includes Delano-Earlimart ID, Shafter-Wasco ID, and Southern San Joaquin MUD
[4]Investor group includes Hills Valley ID, Kaweah Delta WCD, Lindsay-Strathmore ID, and Orange Cove ID
[5]Investor group includes Kern-Tulare WD and Lindmore ID
[6]Investor group includes Exeter ID, Ivanhoe ID, Lower Tule River ID, Pixley ID, Stone Corral ID, and Tea Pot Dome WD
[7]Investor group includes Porterville ID, Saucelito ID, and Terra Bella ID
[8]Investor group includes Central California ID and SJR Exchange Contractor Water Authority
[9]Investor group includes Del Puerto WD, Panoche WD , San Luis WD, Tanquility ID, and Westlands WD
Key: Ag = Agriculture CVP = Central Valley Project ID = Irrigation District MUD = Municipal Utility District
SJR = San Joaquin River SOD = South of Delta TAF = thousand acre-feet WCD = Water Conservation District
WD = Water District WSD = Water Storage District

10 individual investor groups represent CVP Friant Division Contractors. In Figure 6, the average take from put refers to delivery of managed CVP and local water supply from storage. The average annual take from the management of puts increases with increasing CVP Friant Contract amounts (total Class 1 and Class 2).



Key: CVP = Central Valley Project TAF = thousand acre-feet
Figure 6. Average Annual Take from Put for the Central Valley Project Friant Division Individual Investor Storage Account Operations

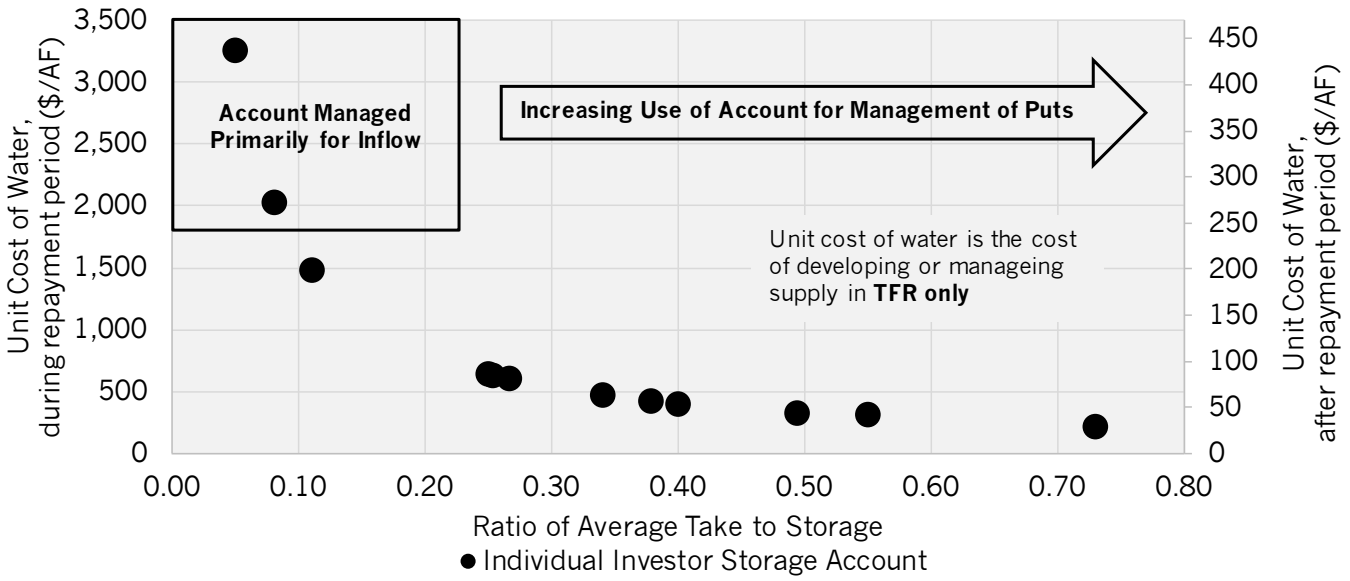
Figure 7 shows the ratio of the average take to storage and the management goals of the individual investor storage accounts. The ratio of average take to storage is a measure of the average annual delivery as a percentage of the total storage account size. For example, an account with a 0.4 average take per storage represents an account that delivers on average 40 percent of total storage volume per year. The relative percentages of inflow and put indicate how the storage is being utilized to manage water supply. Accounts with higher percentage of put operated to manage CVP and local water supply compared to accounts with higher percentage of inflow that operated to develop new source of water from San Joaquin River inflow. Accounts operating for the management of CVP and local water supply have a higher proportion of take to storage compared to accounts that operated primarily to capture inflow.



Key: % = percentage

Figure 7. Individual Investor Storage Account Operation Ratio of Average Take to Storage and Percentage of Take from Inflow and Put

A cost analysis tool was developed for use by the MOU Group to evaluate the potential project costs and financing requirements associated with the performance of individual storage accounts. For cost estimates, 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed 50 years with annual interest rate of 2.875 percent, $0 upfront cash, and repayment period beginning after completion of construction. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only in 2024 dollars. For example, acquisition and conveyance costs for rescheduled or exchanged water supplies are not included. Appendix C describes in further detail the cost analysis tool estimates and the cost analysis for combined account scenarios. Figure 8 shows the average annual take from storage and the unit cost of water per acre-foot, during and after, the repayment period. Accounts are more cost-effective when used to manage CVP and local water supply compared to accounts used primarily to capture San Joaquin River inflow as a new source of supply.



Key: $/AF = dollar per acre-feet TFR = Temperance Flat Reservoir

Figure 8. Individual Investor Storage Account Ratio of Average Take to Storage and Unit Cost of Water per Acre-Foot, During and After, Repayment Period

Findings from Individual Investor Storage Account Operations

Review of individual investor storage account operations revealed the following findings:

- In general, accounts associated with larger CVP Friant Contract amounts made greater use of accounts to manage puts
- Accounts that operate for the management of CVP and local water supply have a higher proportion of take to storage compared to accounts operated primarily to capture inflow
- TFR is more cost-effective when used to manage CVP and local water supply compared to accounts used primarily to capture San Joaquin River inflow as a new source of supply

COMBINED ACCOUNT

At the conclusion of the individual investor storage account operation analysis, the 12 account operations were combined to identify potential water management conflicts. Two conflicts were identified: total storage account requests, and trans-valley conveyance capacity.

Figure 9 shows that only 875 TAF of the 1,150 TAF available storage in TFR was simulated through individual account operations. CVP Friant Division Contractors simulated 675 TAF (59 percent) of storage, CVP SOD Ag Contractors and SJR Exchange Contractors simulated a combined 200 TAF (17 percent) of storage, and 275 TAF (24 percent) remains as unassigned storage. It was also found that the 250 cubic feet per second (cfs) trans-valley conveyance capacity limits opportunities for management of CVP supply outside the Friant Division.

Key: Ag = Agriculture CVP = Central Valley Project SJR = San Joaquin River SOD = South of Delta TAF = thousand acre feet
Figure 9. Temperance Flat Reservoir Combined Account

COMBINED ACCOUNT OPERATING CONDITIONS

These conflicts described above, combined with uncertainty regarding future regulatory actions and potential access to additional Delta water supplies, led to development of several sensitivity analyses to evaluate TFR benefits under a range of future conditions, including:

- CVP delivery under new regulatory conditions
- Increased CVP Friant demand
- Use of unassigned 275 TAF storage
- Access to Delta surplus supply
- Increased trans-valley conveyance capacity

Regulatory Conditions

The MOU Group gaming tool evaluated CVP delivery under the COA Amendment and COA Amendment with ROConLTO CalSim II baselines.

COA Amendment

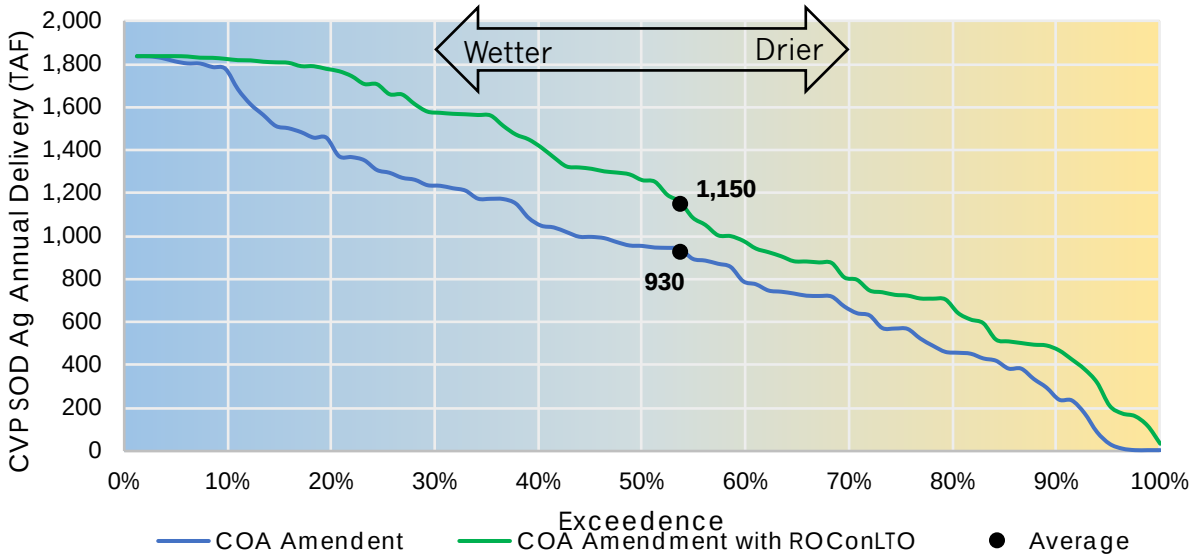
Implementation of the COA Agreement has continuously evolved since it was first established in 1986. The COA is used to monitor and adjust the operation of CVP and SWP facilities to meet fluctuating conditions, additional regulatory responsibilities, and the overall physical and regulatory environment in which the coordination of CVP and SWP operations take place. Since 1986, new facilities have been incorporated into the CVP and SWP that did not exist when the COA Agreement was signed. In 2018, Reclamation and DWR developed a proposal for amending the agreement to reflect the evolved manner in which the CVP and SWP projects have been operated since the COA Agreement was originally signed. The 2018 COA Amendment stipulates a change in responsibility for releases from storage to meet in-basin use and a change in export capacity when exports are constrained.

COA Amendment with Anticipated Re-initiation of Consultation on Long-Term Operations

In August of 2016, Reclamation requested reinitiation of Endangered Species Act (ESA) Section 7 consultation with the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Services (NMFS) on the Coordinated Long-Term Operation (LTO) of the CVP and SWP. Several factors resulted in Reclamation requesting reinitiation of consultation under the ESA, including the apparent decline in the status of several listed species, new information related to recent multiple years of drought, and the evolution of best available science. Reclamation proposes to maximize water deliveries and optimize marketable power generation consistent with applicable laws, contractual obligations, and agreements, and to augment operational flexibility by addressing the status of listed species. The COA Amendment with ROConLTO baseline used in this analysis are simulations based on the proposal as understood as of May 2019 and these

simulations may not be identical to operational requirements that form the basis of BO released in October 2019.

The CVP Friant Division Contractor delivery and the SJR Exchange Contractor delivery is the same in both COA Amendment and COA Amendment with ROConLTO baselines. The CVP SOD Ag delivery is increased under the COA Amendment with ROConLTO baseline compared to the COA Amendment baseline, as shown in Figure 10. Increased CVP SOD Ag delivery could result in increased management of puts in TFR storage accounts through exchanges with CVP Friant Division Contractors via trans-valley conveyance facilities.



Key: Ag = agriculture COA = Coordinated Operations Agreement CVP = Central Valley Project
ROConLTO = Re-initiation of Consultation on Long-Term Operations SOD = South of Delta TAF = thousand acre-feet

Figure 10. Exceedence of Central Valley Project South of Delta Annual Agriculture Delivery Under Coordinated Operations Agreement Amendment and Coordinated Operations Agreement Amendment with Anticipated Re-initiation of Consultation on Long-Term Operations

Friant Physical Facilities

The MOU Group gaming tool includes two baselines for evaluation of CVP Friant Division Contractor delivery. One baseline represents historical delivery and the other represents historical delivery with an additional 3,000 cfs of demand. Simulations of historical delivery was based on COA Amendment and COA Amendment with ROConLTO CalSim II baselines.

Historical Delivery

CVP Friant Division water supply is delivered through two class systems of water supply contracts. Class 1 contracts are for the first 800 TAF of water developed and, at the time contracts were initiated, was considered a dependable water supply that would be available in most years. Class 2 contracts are for the next 1.4 MAF of water developed and is considered an undependable supply that can only be delivered if and when it is declared available by Reclamation. Section 215 of the Reclamation Reform Act of 1982 authorizes the delivery of water that is a result of an unusually large water supply not otherwise storable for project purposes, or infrequent and otherwise unmanaged flood flows of short duration in Reclamation reservoirs to entities that can put the water to beneficial use. This created what is now referred to as "Section 215 water supplies" that have been delivered to CVP Friant Division Contractors, and others, when declared available.

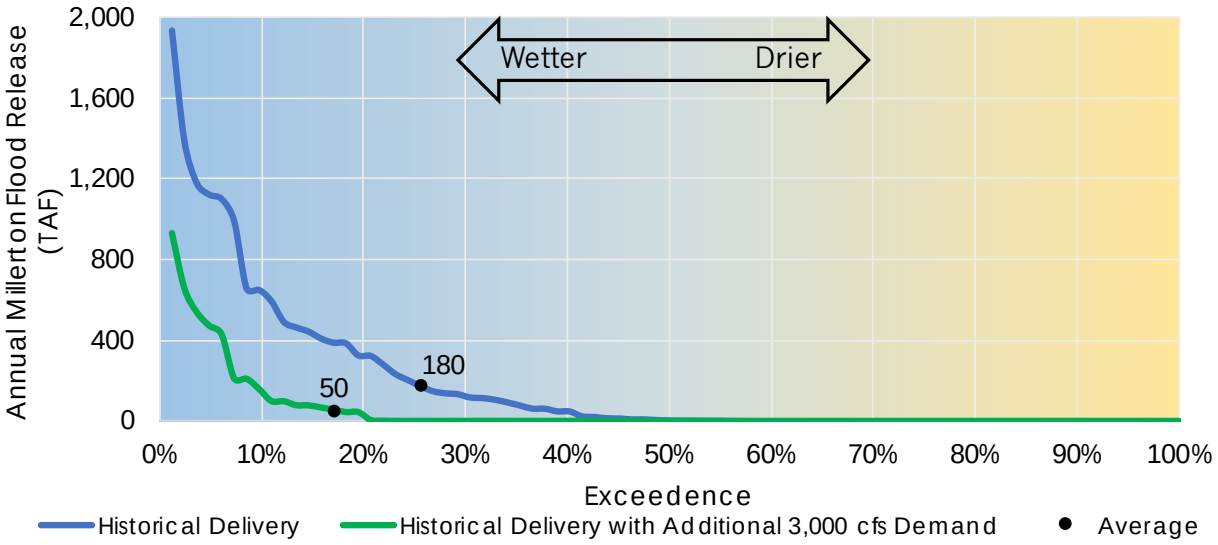
Historical Delivery with Additional 3,000 cfs Demand

The MOU Group analysis assumes historical delivery with additional 3,000 cfs demand to CVP Friant Division Contractors. The use of the water could be to offset groundwater pumping in a CVP Friant Division Contractor's service area, be recharged to groundwater through recharge facilities, or delivered to lands

adjacent to CVP Friant Division Contractor districts, all of which will be important management tools under the Sustainable Groundwater Management Act.

The Millerton flood release were first assumed to meet the historical delivery with additional 3,000 cfs CVP Friant Division Contractor demand prior to the Millerton flood release becoming available as inflow to TFR storage accounts. The Millerton flood release were split between the Friant-Kern and Madera Canals based on the historical delivery pattern and available canal capacity. In this analysis, the available canal capacity was based on the headworks 5,300 cfs capacity for Friant-Kern Canal and 1,250 cfs capacity for Madera Canal. The headworks capacity was used as the limit because it was not known where along the canal new deliveries would be made and the potential constraints along the canals could not be identified.

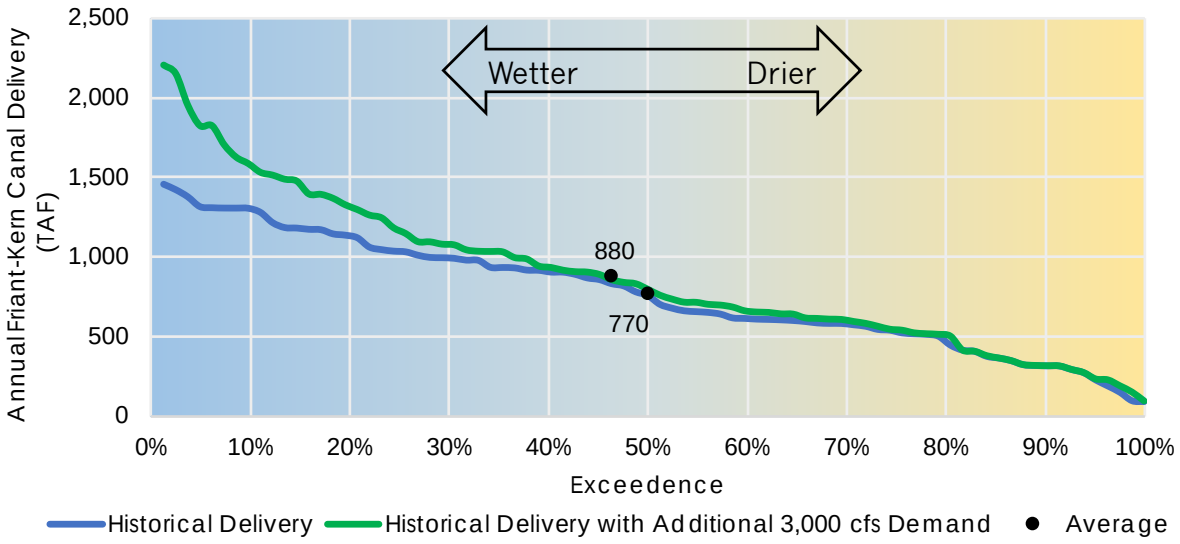
Figure 11 shows that increasing the total delivery capability of the Friant-Kern and Madera canals up to the headworks capacity with an additional 3,000 cfs demand could results in a 130 TAF decrease in average annual inflow to TFR storage accounts. The reduced inflow to TFR storage accounts could allow for increased storage capacity to manage puts of CVP and local water supply.



Key: cfs = cubic feet per second TAF = thousand acre-feet

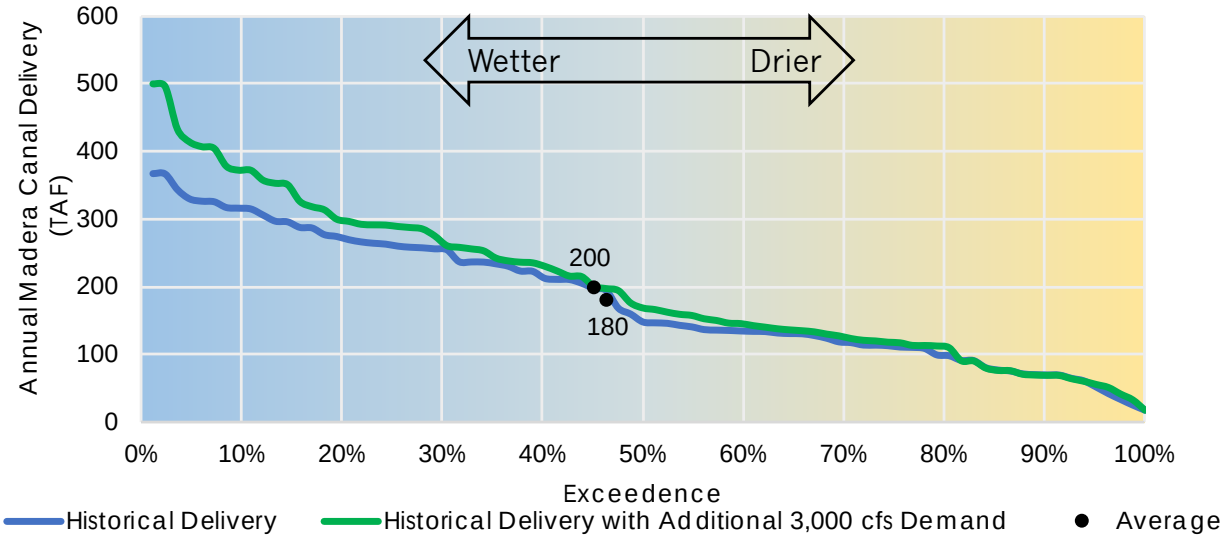
Figure 11. Exceedence of Annual Millerton Flood Release to Temperance Flat Reservoir Under Historical Delivery and Historical Delivery with Additional 3,000 cfs Friant Demand

The exceedence for annual Friant-Kern and Madera canal deliveries under historical delivery and historical delivery with additional 3,000 cfs demand are shown in Figures 12 and 13, respectively. Increasing the total delivery capability of the Friant-Kern Canal up to the headworks capacity could increase the long-term average annual delivery by 110 TAF (from 770 TAF to 880 TAF). Increase in Friant-Kern Canal delivery could increase the opportunity of SOD exchanges with CVP SOD Ag Contractors. Increasing the total delivery capability of the Madera Canal up to the headworks capacity could increase the long-term average annual delivery by 20 TAF (from 180 TAF to 200 TAF).



Key: cfs = cubic feet per second TAF = thousand acre-feet

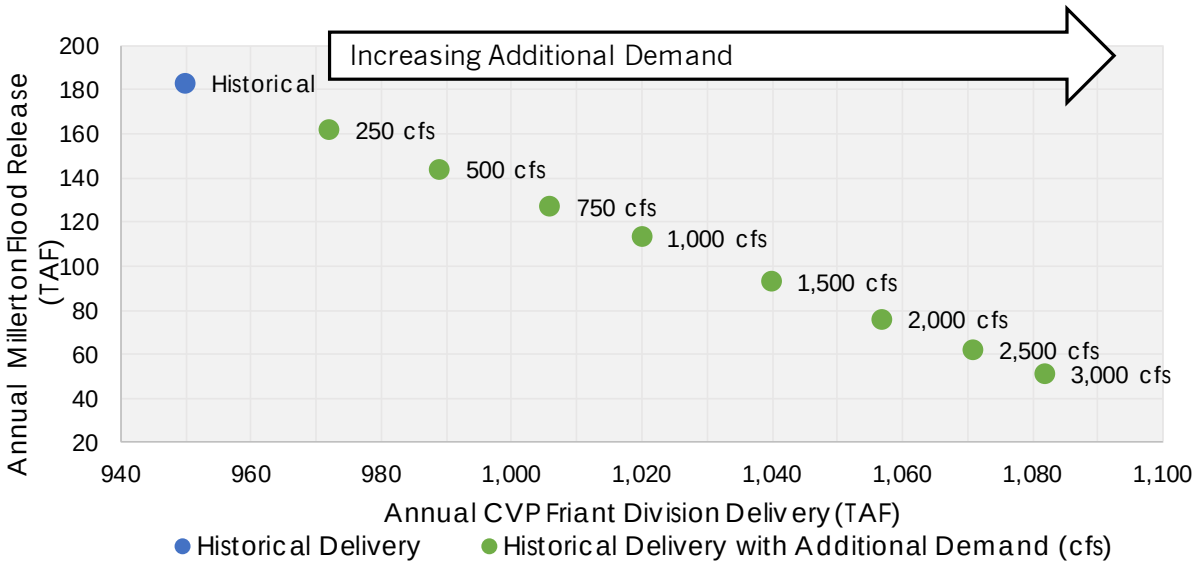
Figure 12. Exceedence of Annual Friant-Kern Canal Delivery Under Historical Delivery and Historical Delivery with Additional 3,000 cfs Friant Demand



Key: cfs = cubic feet per second TAF = thousand acre-feet

Figure 13. Exceedence of Annual Madera Canal Delivery Under Historical Delivery and Historical Delivery with Additional 3,000 cfs Friant Demand

As shown in Figure 14, adding TFR to a condition with the Friant-Kern and Madera canals increased to the headworks capacity and an additional demand to CVP Friant Division Contractors could result in reduced available inflow for storage in TFR and increase the available storage capacity for management of puts into TFR storage accounts. The additional delivery of water is not a no-cost opportunity. Additional delivery could require modifications to surface water delivery systems and additional groundwater recharge facilities, which would require an additional groundwater pumping cost.



Key: cfs = cubic feet per second CVP = Central Valley Project TAF = thousand acre-feet

Figure 14. Exceedence of Annual Millerton Flood Release to Temperance Flat Reservoir Under Historical Delivery and Historical Delivery with Increasing Additional Friant Demand

Unassigned Storage

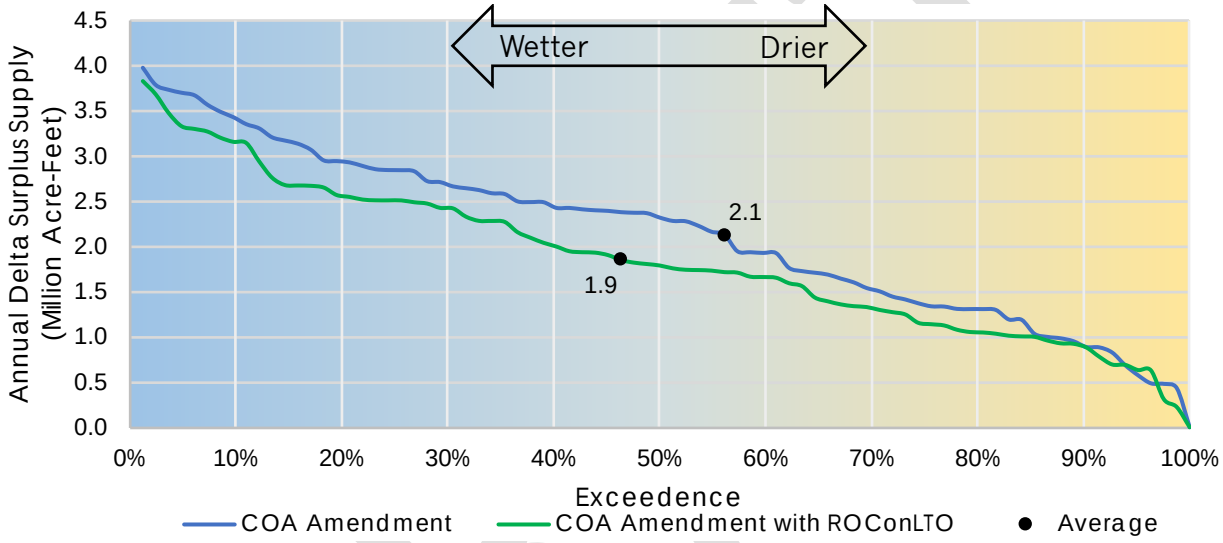
The 275 TAF of unassigned storage in TFR was simulated under the following three conditions:

- Not Used – the 275 TAF of available TFR storage was unassigned in the combined account analysis. The available inflow (Millerton flood release) to this account was treated as foregone inflow and released to the San Joaquin River. The foregone inflow was not reallocated to the other storage accounts because the total volume of foregone inflow from all individual accounts was not known. The inflow allocated to individual accounts was preserved in the combined account analysis.
- Whitelands – The 275 TAF of unassigned storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies, referred to as Whitelands. The account would only capture allocated inflow from Millerton flood release and have no other puts into the account. The delivery pattern is based on a large agricultural user with a CVP Friant Class 2 delivery pattern. The Whitelands account was operated to have a consistent average take for every hydrologic condition. The Whitelands delivery was split between the Friant-Kern and Madera canals based on the historical CVP Friant Division Contractor delivery pattern and available canal capacity (average delivery split was 82 percent Friant-Kern canal and 18 percent Madera canal). The Whitelands delivery does not displace any CVP Friant Division Contractor delivery in the canals.
- Outside Participant – The 275 TAF of unassigned storage was simulated as an account to represent a participant outside of the San Joaquin Valley (i.e., a large SWP M&I water user). The account would not capture inflow and would only have puts from exchanges into the account. The demand pattern is based on a M&I pattern. The Outside Participant account was operated to have a consistent average take for every hydrologic condition. The foregone inflow was not reallocated to other storage accounts because the total volume of foregone inflow from all individual accounts was not known. The inflow allocated to individual accounts was preserved in the combined account analysis.

Delta Surplus

The majority of Delta surplus supply cannot be captured and managed with existing infrastructure. An analysis was performed to quantify the amount of surplus Delta outflow under current regulatory conditions (represented by COA Amendment baseline) limited by the available physical capacity in each month at Banks and Jones pumping plants (10,300 cfs + 4,600 cfs – current exports). The analysis shows that the long-term average available Delta surplus limited by existing Delta conveyance capacity is approximately 2.1 MAF per year, shown in Figure 15, however over 90 percent of the surplus is available during the months of December through May.

The potential effect of COA Amendment with ROConLTO baseline on Delta surplus was also estimated. Figure 15 shows the long-term average annual Delta surplus decreased by around 200 TAF (from 2.1 MAF to 1.9 MAF) under COA Amendment with ROConLTO baseline, which is less than the increase in Delta exports under COA Amendment with ROConLTO (about 800 TAF) because the required Delta outflow is reduced during the fall.



Key: COA = Coordinated Operations Agreement ROConLTO = Re-initiation of Consultation on Long-Term Operations

Figure 15. Exceedence of Annual Delta Surplus Supply Under Coordinated Operations Agreement Amendment and Coordinated Operations Agreement Amendment with Anticipated Re-initiation of Consultation on Long-Term Operations

Table 2 summarizes the average delivery to CVP SOD Ag Contractors, SJR Exchange Contractors, and SWP with and without access to Delta surplus supply under the COA Amendment and COA Amendment with ROConLTO baselines. In this analysis, the Delta surplus was split 50 percent to SWP and 50 percent to CVP SOD Ag Contractors and SJR Exchange Contractors. Between the CVP SOD Ag Contractors and SJR Exchange Contractors, Delta surplus supply was first delivered to the SJR Exchange Contractors up to 100 percent allocation and then was available to the CVP SOD Ag Contractors. Unused Delta surplus supply from either the SWP, CVP SOD Ag Contractors, or SJR Exchange Contractors becomes available to the others up to 100 percent allocation. In the combined account scenarios, the remaining Delta surplus is accessible to CVP Friant Division, CVP SOD Ag Contractors, SJR Exchange Contractors, and Outside Participant accounts proportional to their TFR storage account. Access to Delta surplus supply could results in increased management of puts through SOD exchanges with CVP Friant Division Contractors.

Table 2. Simulated Average Delivery Under Coordinated Operations Agreement and Anticipated Re-initiation of Consultation on Long-Term Operations

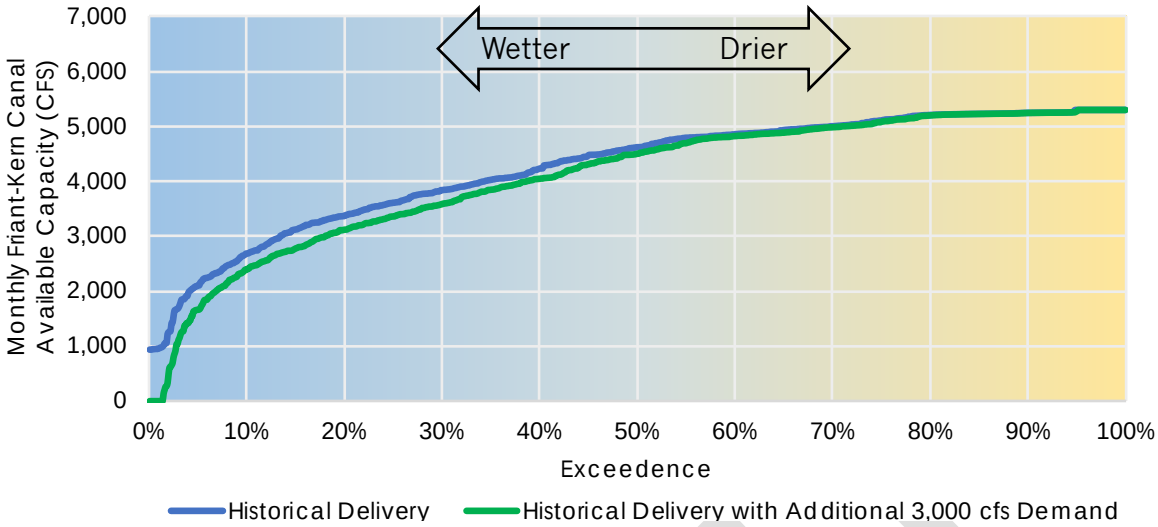
	AVERAGE ANNUAL DELIVERY (TAF)		
	WITHOUT ACCESS TO DELTA SURPLUS	WITH ACCESS TO DELTA SURPLUS	INCREASE AND PERCENTAGE INCREASE (%)
COA Amendment			
CVP SOD Ag Contractors	920	1,170	250 (27%)
SJR Exchange Contractors	840	843	3 (<1%)
SWP	3,320	3,640	330 (10%)
Total	5,080	5,653	573 (11%)
COA Amendment with ROConLTO			
CVP SOD Ag Contractors	1,130	1,300	170 (15%)
SJR Exchange Contractors	840	842	2 (<1%)
SWP	3,650	3,830	180 (5%)
Total	5,620	5,972	352 (6%)

Key:
Ag = Agriculture
COA = Coordinated Operations Agreement
CVP = Central Valley Project
ROConLTO = Reiniation of Consultation on Coordinated Long-Term Operations
SJR = San Joaquin River
SOD = South of Delta
SWP = State Water Project
TAF = thousand acre-feet
< = less than
% = percentage

Conveyance Capacity

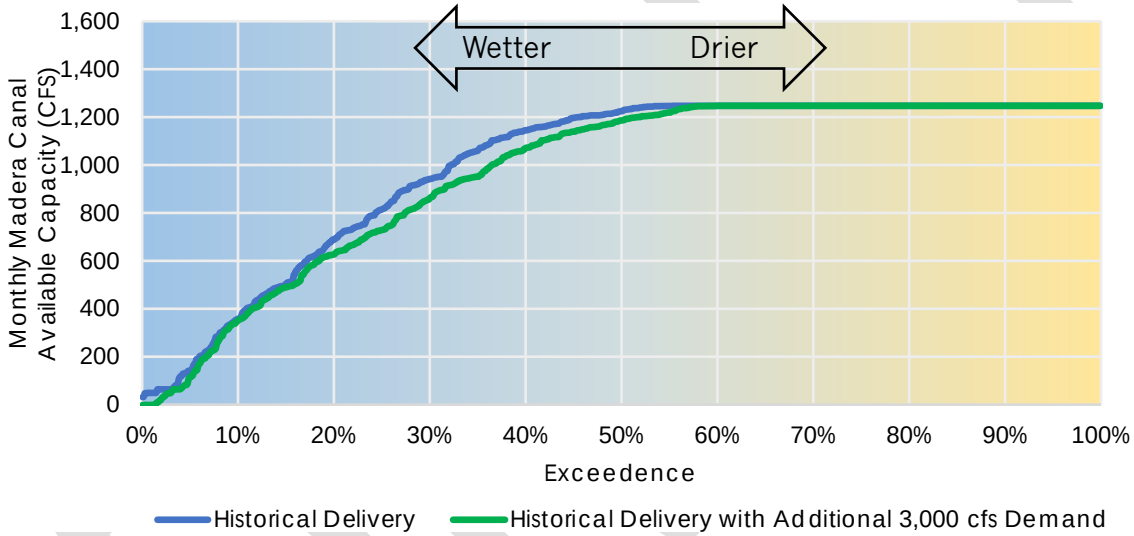
The CVP SOD Ag Contractors and SJR Exchange Contractors were evaluated under a 250 cfs and 1,000 cfs trans-valley conveyance capacity.

CVP Friant Division operations assumed the available canal capacity was based on the headworks capacity of 5,300 cfs for Friant-Kern Canal and 1,250 cfs for Madera Canal. The headworks capacity was used as the limit because it is not known where along the canal a new delivery would be made so it was not possible to identify to potential constraints along the canals. This analysis does not consider reduced capacity of the Friant-Kern or Madera canals resulting from the original design deficiency or recent, ongoing, and potential future subsidence. The exceedence of monthly Friant-Kern and Madera available canal capacity under historical delivery and historical delivery with additional 3,000 cfs demand are shown in Figures 16 and 17, respectively. The available canal capacity decreases because of increased delivery to the CVP Friant Division Contactors, as shown in Figures 12 and 13.



Key: cfs = cubic feet per second

Figure 16. Exceedence of Monthly Friant-Kern Canal Available Capacity Under Historical Delivery and Historical Delivery with Additional 3,000 cfs Friant Demand



Key: cfs = cubic feet per second

Figure 17. Exceedence of Monthly Madera Canal Available Canal Capacity Under Historical Delivery and Historical Delivery with Additional 3,000 cfs Friant Demand

COMBINED ACCOUNT OPERATION SCENARIOS

The MOU Group combined account operation was evaluated under a range of operating conditions to test the sensitivity of the accounts' management under different regulatory conditions and conveyance facilities. For all scenarios, the existing operating capacity of Millerton Reservoir is preserved, and the individual investor storage account operations are maintained. This gives a conservative estimate of the benefits, which would likely increase if individual investor storage account operations were optimized under each scenario. The operating scenarios are listed below and summarized in Table 3.

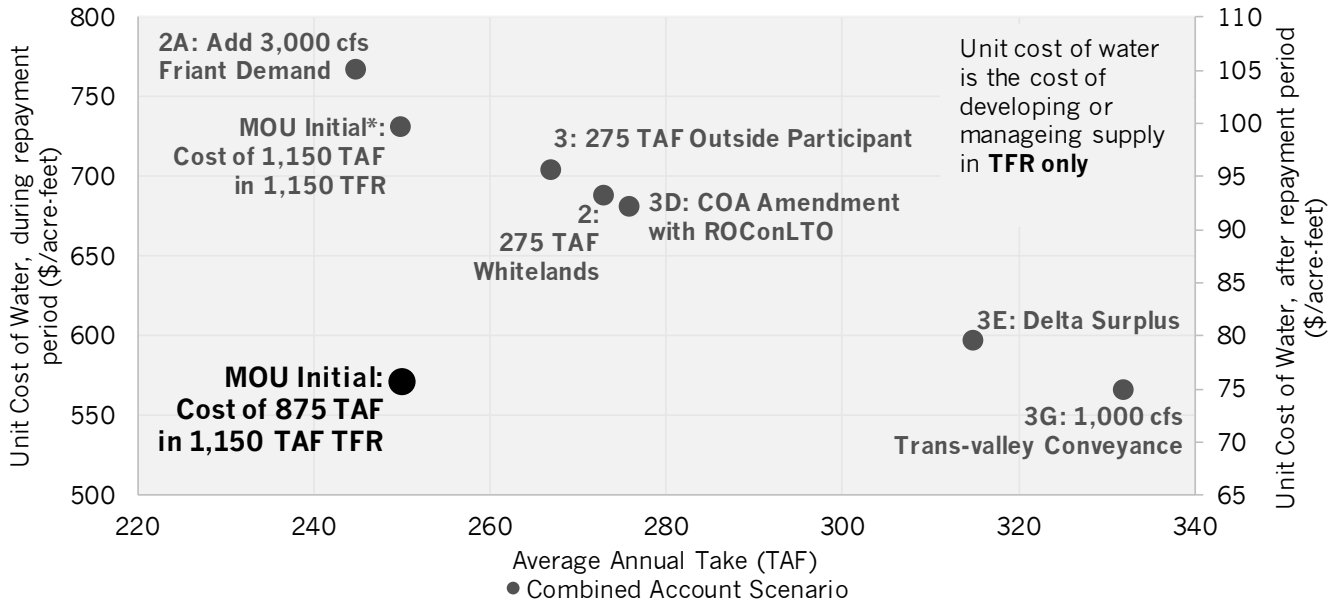
- MOU Initial scenario is the operating conditions used to develop the individual investor storage account operations, as previously described. The unassigned 275 TAF storage is not simulated.
- Scenario 2 operates unassigned 275 TAF storage as a Whitelands account
  - Whitelands represents the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies. This was done to simulate a large agricultural water user with a CVP Friant Class 2 delivery pattern.
- Scenario 2A assumes historical delivery with an additional 3,000 cfs demand to CVP Friant Division
  - The Friant physical facilities were increased to the headworks capacity with an additional 3,000 cfs demand to CVP Friant Division Contractors. The San Joaquin River inflow was operated to first meet the Friant demand before becoming available to TFR storage accounts. This scenario evaluates how decreased availability of inflow changes the management of CVP and local water supply in TFR.
- Scenario 3 operates unassigned 275 TAF storage as an Outside Participant account
  - Outside Participant represents a participant outside the San Joaquin Valley. This was done to simulate a large user with a M&I delivery pattern.
- Scenario 3A the accounts have access to Delta surplus supply
  - This evaluates Delta surplus supply that could be managed with increased storage capacity
- Scenario 3B assumes a 1,000 cfs trans-valley conveyance capacity
  - This evaluates management of CVP supply with increased conveyance capacity
- Scenario 3C assumes access to Delta surplus supply and a 1,000 cfs trans-valley conveyance capacity
  - This evaluates Delta surplus supply that could be managed with increased storage and conveyance capacity
- Scenario 3D regulatory conditions are simulated under the COA Amendment with ROConLTO CalSim II baseline
  - This evaluates how the management of CVP supply changes under new regulatory conditions. (Note: this baseline is based on the proposal as understood as of May 2019 and may not be identical to operational requirements that form the basis of BO released in October 2019).
- Scenario 3E the accounts have access to Delta surplus supply
  - This evaluates Delta surplus supply that could be managed with increased storage capacity
- Scenario 3F assumes a 1,000 cfs trans-valley conveyance capacity
  - This evaluates management of CVP supply with increased conveyance capacity
- Scenario 3G assumes access to Delta surplus supply and a 1,000 cfs trans-valley conveyance capacity
  - This evaluates Delta surplus supply that could be managed with increased storage and conveyance capacity

Figure 18 shows select sensitivity scenarios average annual take and unit cost of water, during and after, the repayment period. These scenarios were selected as the best representation of the benefits of TFR under different future operating conditions, as highlighted in Table 3 (the evaluations of all combined account operation scenarios are summarized in Appendix B). For cost estimates, 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed 50 years with annual interest rate of 2.875 percent, $0 upfront cash, and repayment period beginning after completion of construction. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only in 2024 dollars. For example, acquisition and conveyance costs for rescheduled or exchanged water supplies are not included. The MOU Initial* scenario represents the cost of 1,150 TAF storage in TFR with the same operating conditions as the MOU Initial scenario.

Table 3. Summary of Combined Account Operation Scenarios

Operating Conditions	Scenario										
	MOU Initial	2	2A	3	3A	3B	3C	3D	3E	3F	3G
Existing Millerton Operations	Included										
Individual Investor Operation	Included										
Regulatory Conditions	COA Amendment							COA Amendment with ROConLTO			
Friant Physical Facilities	Historical Demands	Historical Demands with Additional 3,000 cfs Demand									
Unassigned Storage (275 TAF)	Not Used	Whitelands	Outside Participant								
Delta Surplus Supply	Not Used				Used	Not Used	Used	Not Used	Used	Not used	Used
Trans-Valley Conveyance Capacity	250 cfs					1,000 cfs		250 cfs		1,000 cfs	
	MOU Initial	2	2A	3	3A	3B	3C	3D	3E	3F	3G
	Scenario										

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
MOU = Memorandum of Understanding
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet
Whitelands = The storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies
Note: Highlighted operating conditions represent the different future operating conditions evaluated in the scenarios



Key: $/acre-feet = dollar per acre-feet
cfs = cubic feet per second
COA = Coordinated Operations Agreement
MOU = Memorandum of Understanding
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet
TFR = Temperance Flat Reservoir
Note: MOU Initial* scenario represents the cost of 1,150 TAF storage in TFR with the same operating conditions as the MOU Initial scenario

Figure 18. Combined Account Scenario Average Annual Take and Unit Cost of Water per Acre-Foot, During and After, Repayment Period

FINDINGS FROM COMBINED ACOUNT OPERATION SCENARIOS

The following findings are based on review and comparison of combined account operation scenario results

- The reduced availability of inflow under a condition with an additional 3,000 cfs demand to CVP Friant Division Contractors reduces availability of San Joaquin River inflow to TFR storage accounts and increases available storage capacity for management of CVP and local water supply.
- Development of additional CVP Friant delivery capability would not significantly reduce project benefits if additional Delta supply is available and TFR is operated to support management of that supply.
- Operating 275 TAF of unassigned storage to manage CVP and local water supply increases the combined account take compared to managing the storage for the capture of San Joaquin River inflow.
- Use of TFR to manage CVP supply could increase under future regulatory conditions that increase delivery of CVP SOD water supplies.
- TFR could provide greater operational flexibility to store Delta surplus supply with increased trans-valley conveyance capacity.
- Increased access to Delta supply and additional trans-valley conveyance capacity would increase TFR cost-effectiveness
- Committed project participants must be willing to accept responsibility of project costs before construction commences
- Project unit costs could be reduced if Federal or State funding were allocated to project costs

FUTURE CONSIDERATIONS

This TM summarizes the development and outcome of the MOU Group evaluations of the TFR Project, limited to analyzing various operations scenarios for agricultural water supply and project cost analysis to assist MOU Group members in evaluating interest in TFR. The operating conditions were based on water supply availability assumptions that should be considered minimum possible conditions and account operations would likely change under future conditions. Continued development of TFR with Reclamation and other project partners will be required before the project can be implemented. These requirements include:

- Determine participants, storage account sizes, and operating objectives for the TFR Project
- Develop a detailed Operating Plan in coordination with Reclamation. Based on comments provided by Reclamation, the operating plan would need to address several CVP operational and contractual requirements and define coordination processes with the SJRRP.
- Confirm TFR Project benefits and impacts in coordination with Reclamation
- Develop a project financing plan, including agreements for Federal and State cost-sharing
- Coordinate with Reclamation for the determination of and compliance with water right requirements. The State Water Board has indicated that Reclamation would be required to license existing water rights based on historical and current use; perform a water availability study to determine if water supply is available for a new permit after existing permits are licensed; and file an application for a new water right for the project.
- Complete federal, state, and local permitting requirements, including Endangered Species Act compliance and Section 106 Cultural and Tribal consultation

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APPENDIX A – INDIVIDUAL INVESTOR STORAGE ACCOUNT OPERATIONS

Individual investors and investor groups used the MOU Group gaming tool to evaluate various storage sizes and operating objectives to develop ideas on how they might jointly use the account and what the generalized operation could be for their storage account. The following sections summarize the results of 12 individual investor storage account operations. A storage account cost analysis is included for two TFR sizes: 875 TAF and 1,150 TAF. For cost estimates, 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed 50 years with annual interest rate of 2.875 percent, $0 upfront cash, and repayment period beginning after completion of construction. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only. Appendix C summarizes the development and assumptions of the cost analysis tool.

The individual investor storage account is simulated under the following operating conditions:

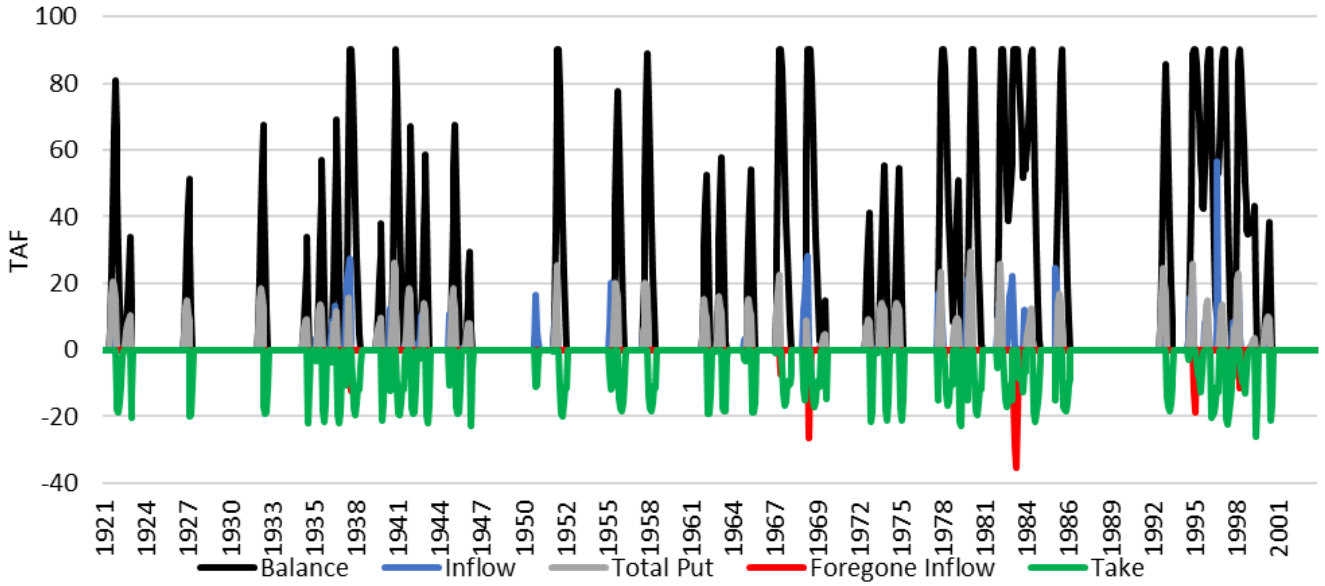
- Existing operation capacity of Millerton Reservoir is preserved
- Regulatory conditions are simulated under the COA Amendment CalSim II baseline
- Assumes historical delivery to CVP Friant Division
- Assumes no access to Delta surplus supply
    - Delta surplus supply is the quantity of surplus Delta outflow under current regulatory conditions limited by the available physical capacity each month at Banks and Jones pumping plants)
- Trans-valley conveyance capacity is 250 cfs

Common terms used in the individual investor storage account operation results:

- Balance – refers to the total volume of water stored in the account
- Inflow – refers to the capture of San Joaquin River inflow from Millerton Reservoir flood release
- Put – refers to the rescheduling of CVP Friant Division water supply (i.e., Class 1 and Class 2) by Friant Division long-term contractors in coordination with local management actions and/or in support of exchanges with non-Friant CVP contractors
- Foregone Inflow – refers to the Millerton Reservoir flood release not captured in storage
- Take – refers to the delivery of water from the storage account via the Friant-Kern and Madera canals or Mendota Pool water supply delivered via the San Joaquin River
- Take from Put – refers to the delivery of water stored in the account from the management of puts
- Take from Inflow – refers to the delivery of water stored in the account from the capture of inflow

ARVIN-EDISON WATER STORAGE DISTRICT

Investor Group: Arvin-Edison Water Storage District
Investor Storage Account: 90 TAF



Key: TAF = thousand acre feet
Figure A.1 Arvin-Edison Water Storage District Monthly Operations Trace

Table A.1 Arvin-Edison Water Storage District Operations Water Year Type Summary

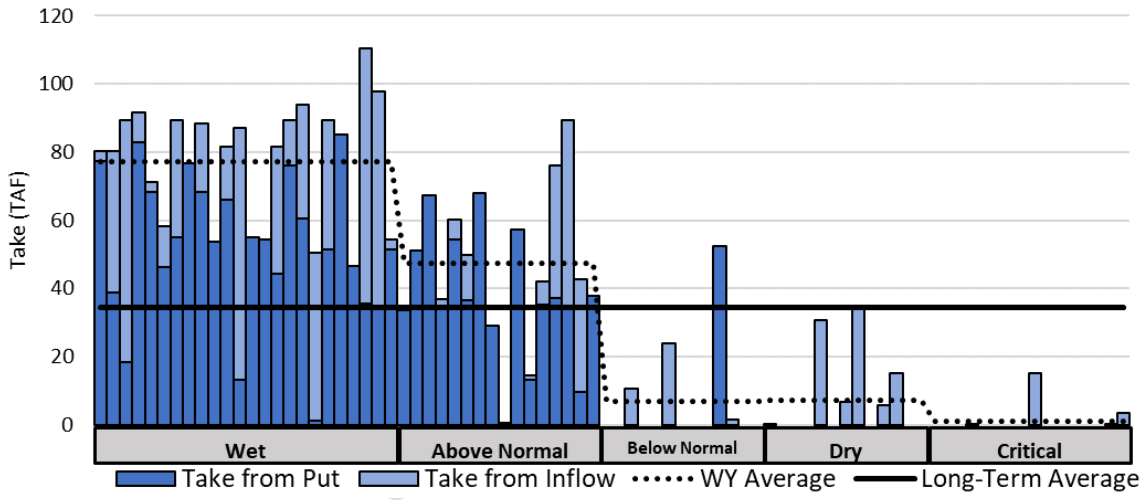
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	30	53	77	53	25	8
Above Normal	5	38	47	37	10	0
Below Normal	3	4	7	4	3	0
Dry	7	0	7	0	7	0
Critical	1	0	1	0	1	0
Long-Term Average	12	24	34	23	11	2

Key:
TAF = thousand acre-feet
WY = water year

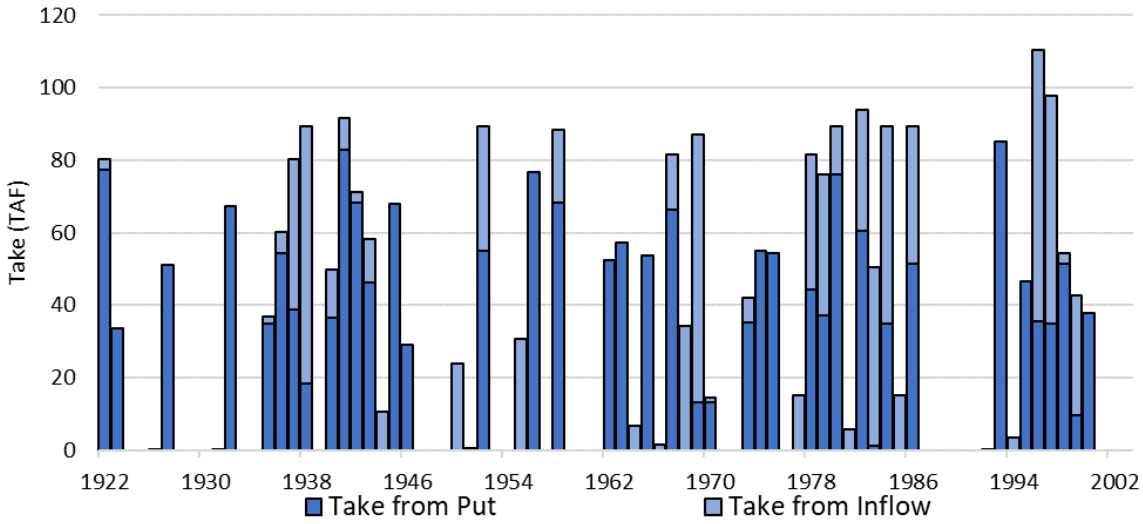
Table A.2 Arvin-Edison Water Storage District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	90	
Investor Portion of Construction cost to repay ($M)	$351	$279
Investor Details		
Investor Annual Water Yield (TAF)	34	
Investor Costs		
Total Investment ($M)	$805	$635
Annualized Cost ($M)	$19	$15
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$552	$432
Unit cost of water, after repayment period ($/AF)	$77	$58

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

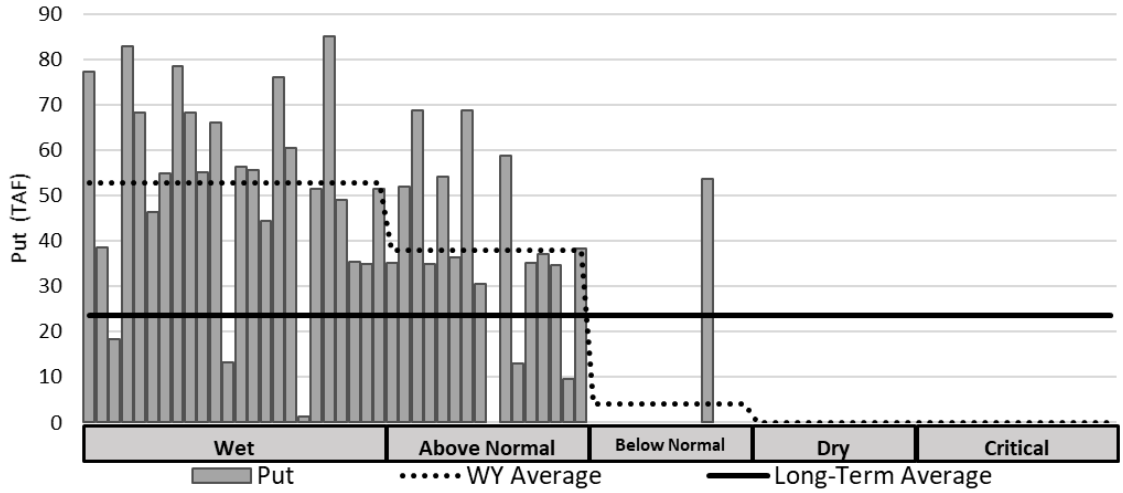


Key: TAF = thousand acre feet
Figure A.2 Arvin-Edison Water Storage District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



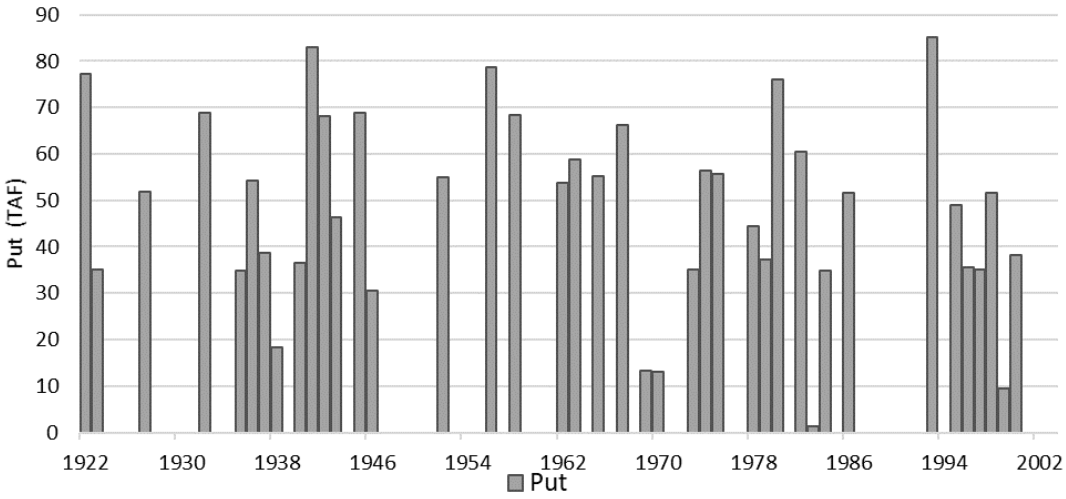
Key: TAF = thousand acre feet

Figure A.3 Arvin-Edison Water Storage District Annual Take



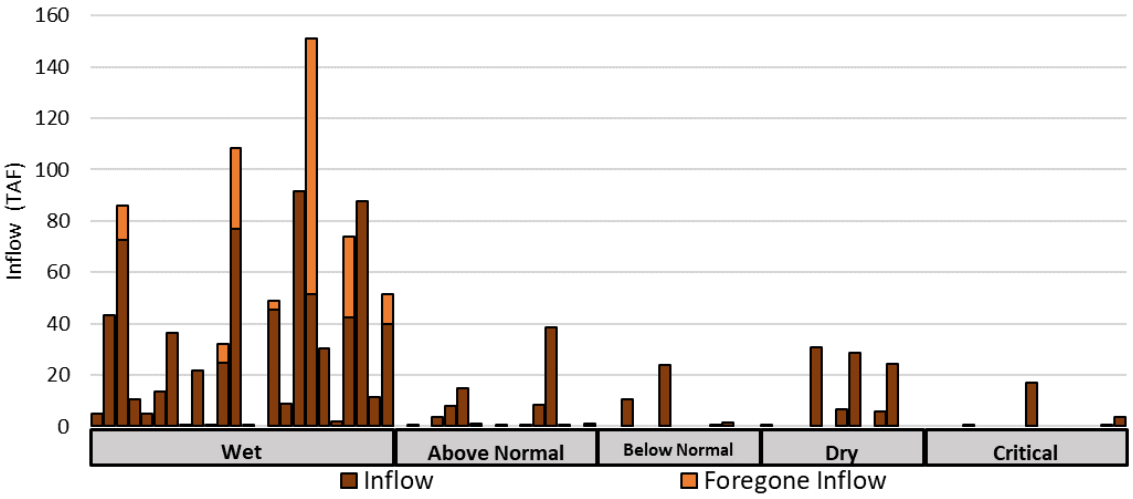
Key: TAF = thousand acre feet

Figure A.4 Arvin-Edison Water Storage District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



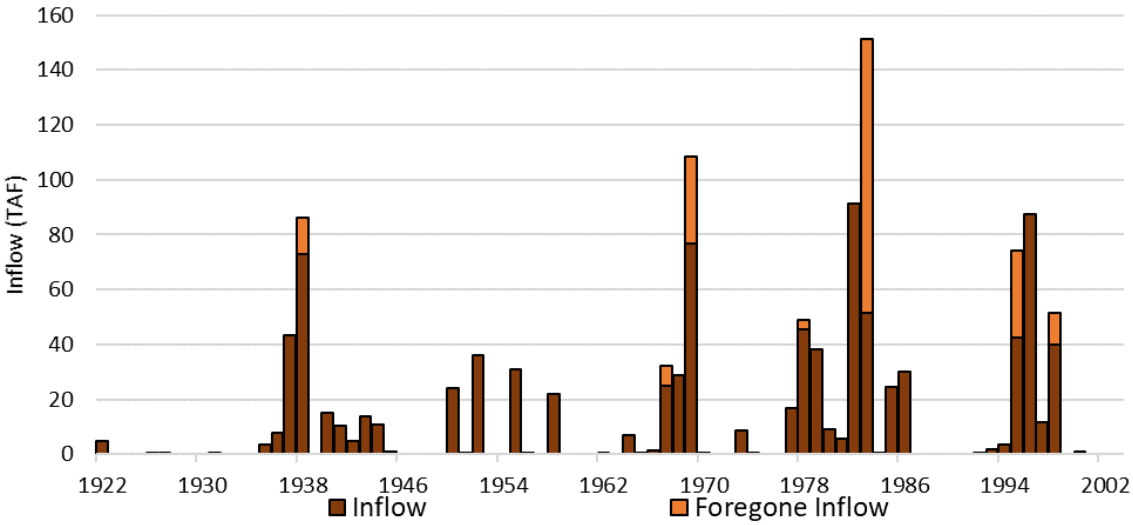
Key: TAF = thousand acre feet

Figure A.5 Arvin-Edison Water Storage District Annual Put



Key: TAF = thousand acre feet

Figure A.6 Arvin-Edison Water Storage District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type

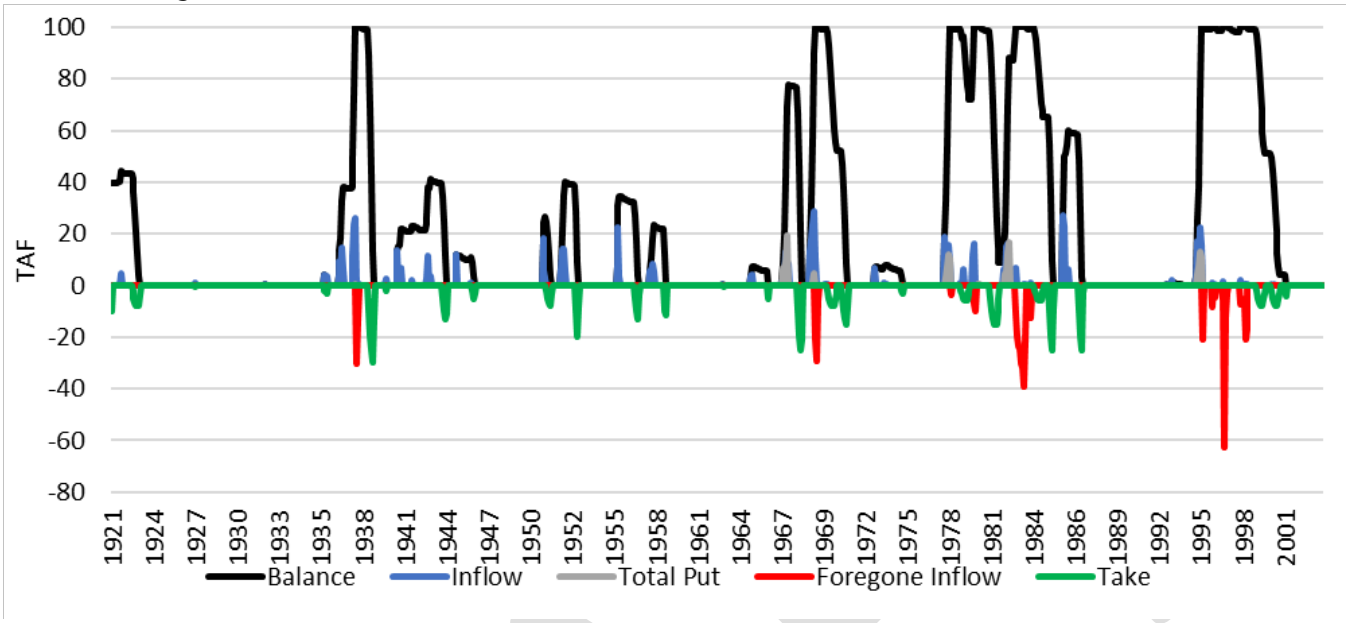


Key: TAF = thousand acre feet

Figure A.7 Arvin-Edison Water Storage District Annual Inflow and Foregone Inflow

CHOWCHILLA WATER DISTRICT

Investor Group: Chowchilla Water District
Investor Storage Account: 100 TAF



Key: TAF = thousand acre feet
Figure A.8 Chowchilla Water District Monthly Operations Trace

Table A.3 Chowchilla Water District Operations Water Year Type Summary

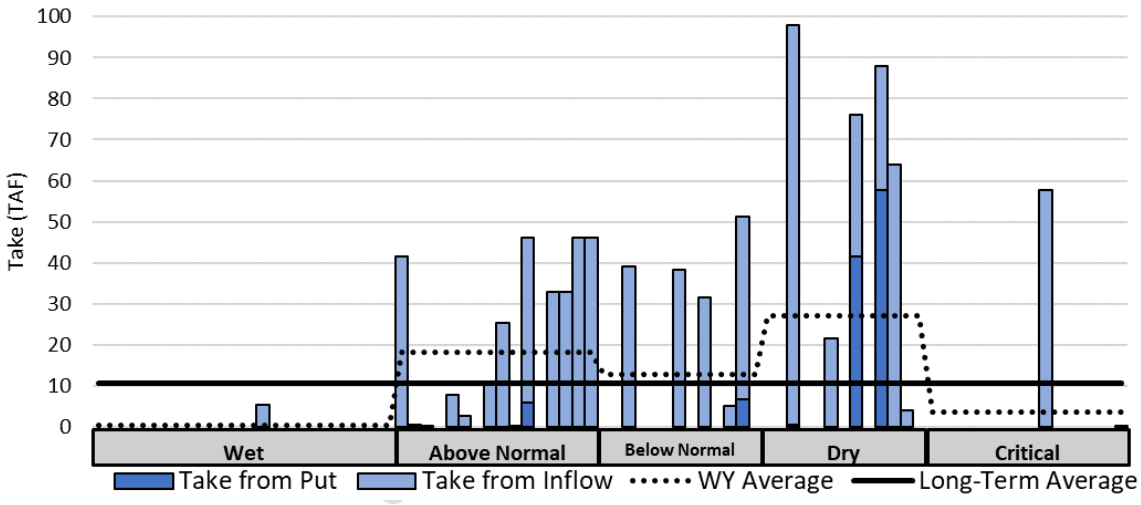
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	21	7	0	0	0	22
Above Normal	5	0	18	0	18	0
Below Normal	3	0	13	1	12	0
Dry	8	0	27	8	19	0
Critical	1	0	4	0	4	0
Long-Term Average	9	2	11	2	9	6

Key:
TAF = thousand acre-feet
WY = water year

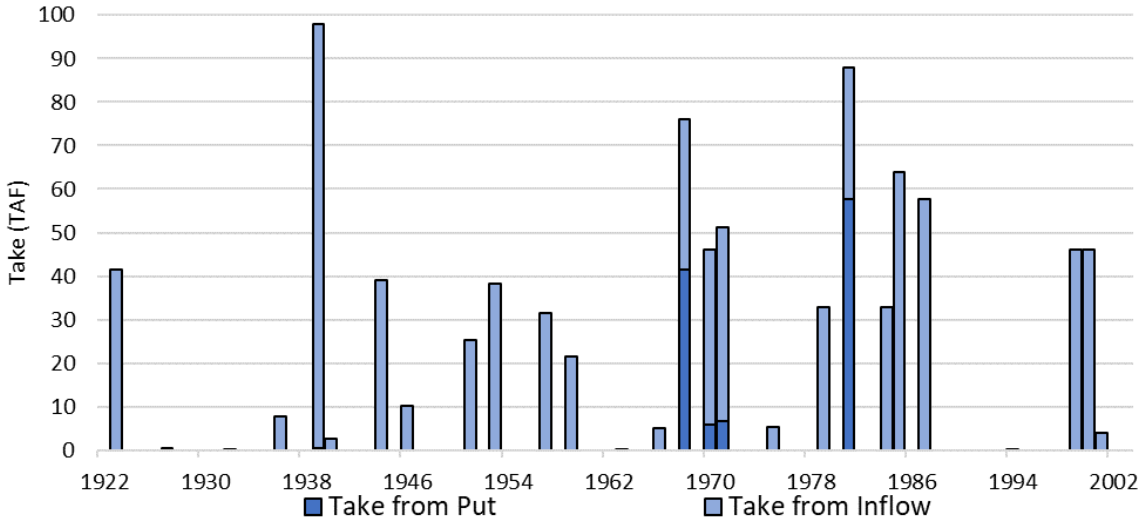
Table A.4 Chowchilla Water District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	100	
Investor Portion of Construction cost to repay ($M)	$390	$310
Investor Details		
Investor Annual Water Yield (TAF)	11	
Investor Costs		
Total Investment ($M)	$894	$705
Annualized Cost ($M)	$21	$16
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$1,896	$1,483
Unit cost of water, after repayment period ($/AF)	$263	$200

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

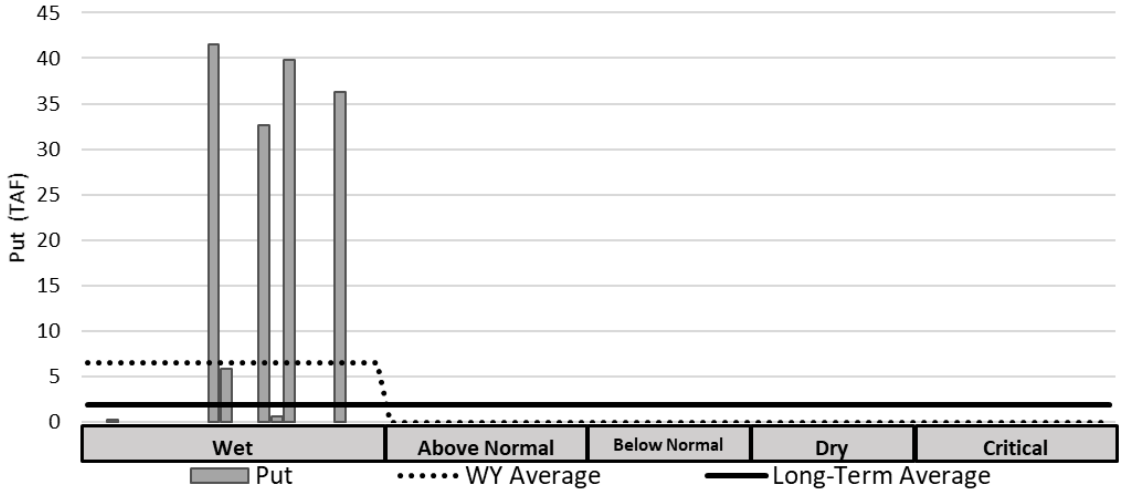


Key: TAF = thousand acre feet
Figure A.9 Chowchilla Water District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure A.10 Chowchilla Water District Annual Take

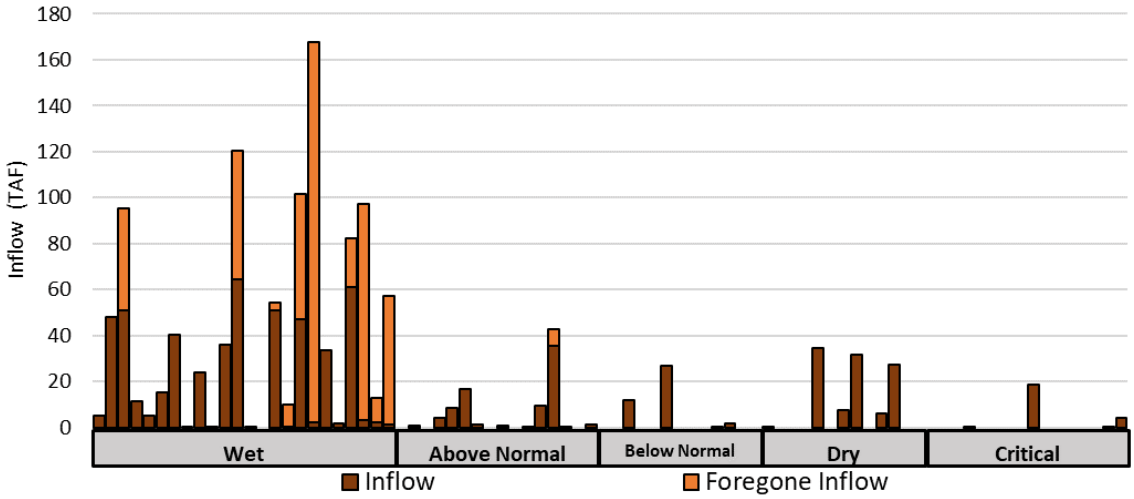


Key: TAF = thousand acre feet

Figure A.11 Chowchilla Water District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type

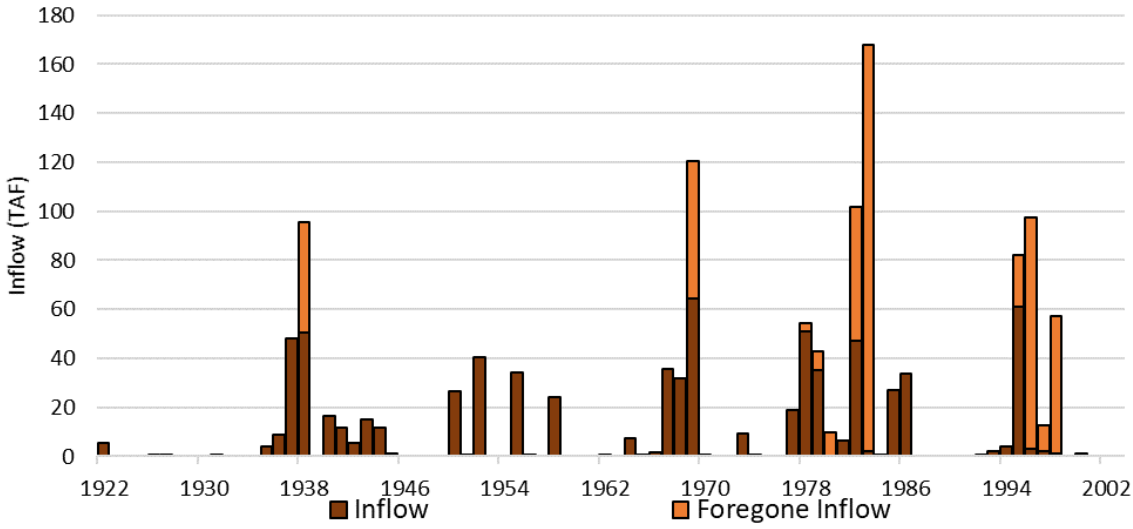
Key: TAF = thousand acre feet

Figure A.12 Chowchilla Water District Annual Put



Key: TAF = thousand acre feet

Figure A.13 Chowchilla Water District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type

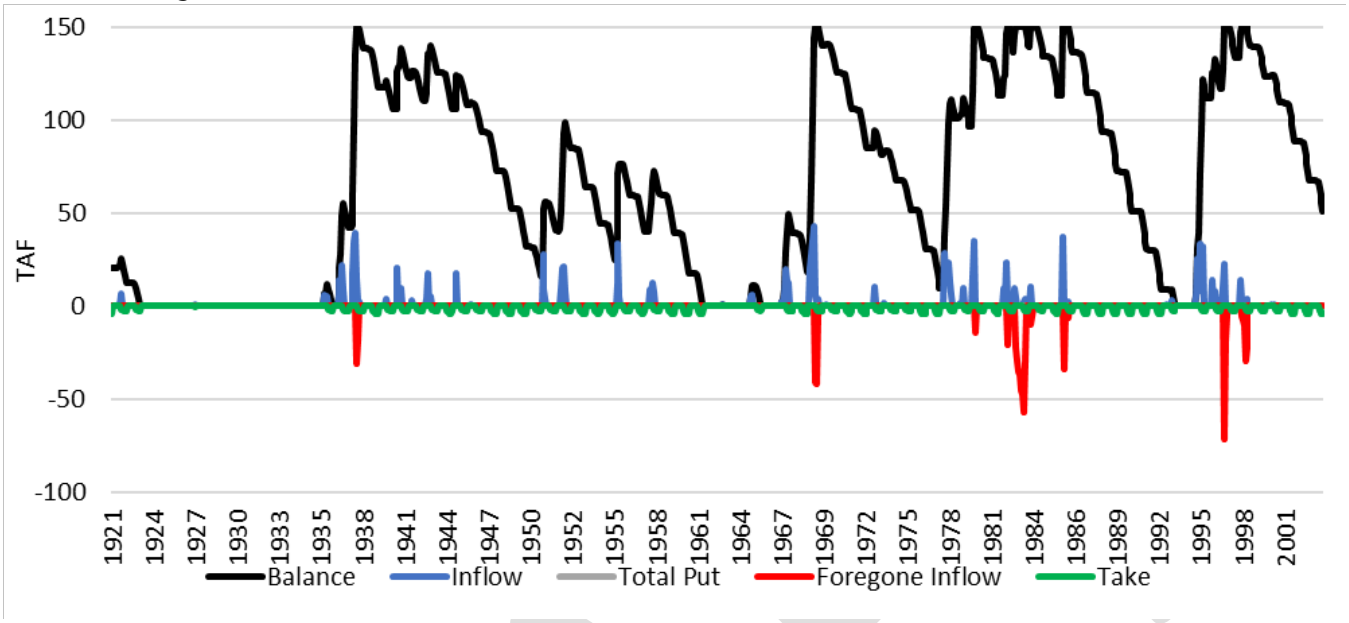


Key: TAF = thousand acre feet

Figure A.14 Chowchilla Water District Annual Inflow and Foregone Inflow

CITY OF FRESNO

Investor Group: City of Fresno and Fresno Irrigation District
Investor Storage Account: 150 TAF



Key: TAF = thousand acre feet
Figure A.15 City of Fresno Monthly Operations Trace

Table A.5 City of Fresno Operations Water Year Type Summary

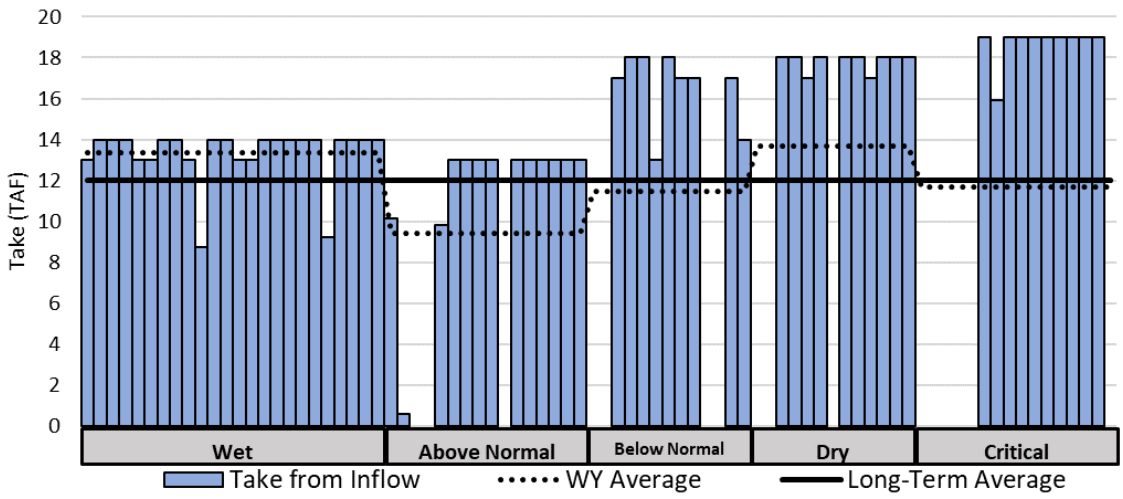
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	34	0	13	0	13	30
Above Normal	8	0	9	0	9	0
Below Normal	5	0	11	0	11	0
Dry	12	0	14	0	14	0
Critical	2	0	12	0	12	0
Long-Term Average	15	0	12	0	12	9

Key:
TAF = thousand acre-feet
WY = water year

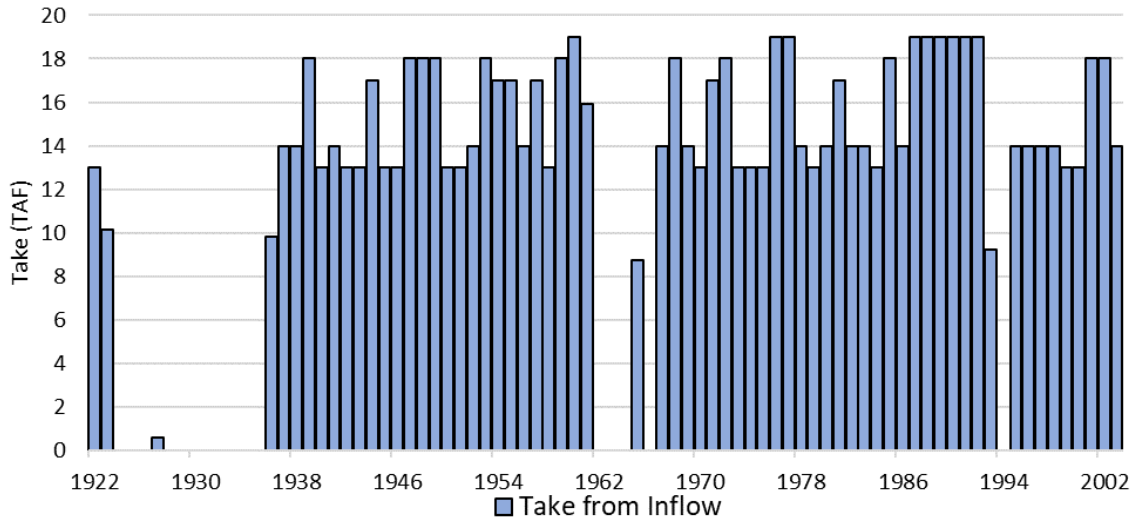
Table A.6 City of Fresno Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	150	
Investor Portion of Construction cost to repay ($M)	$585	$465
Investor Details		
Investor Annual Water Yield (TAF)	12	
Investor Costs		
Total Investment ($M)	$1,341	$1,058
Annualized Cost ($M)	$31	$24
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$2,608	$2,039
Unit cost of water, after repayment period ($/AF)	$362	$275

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

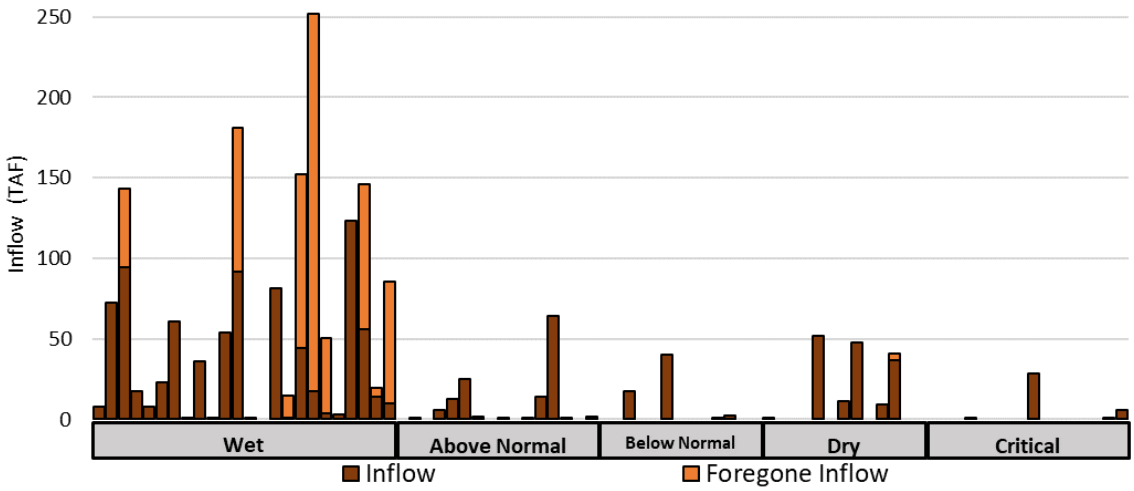


Key: TAF = thousand acre feet
Figure A.16 City of Fresno Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



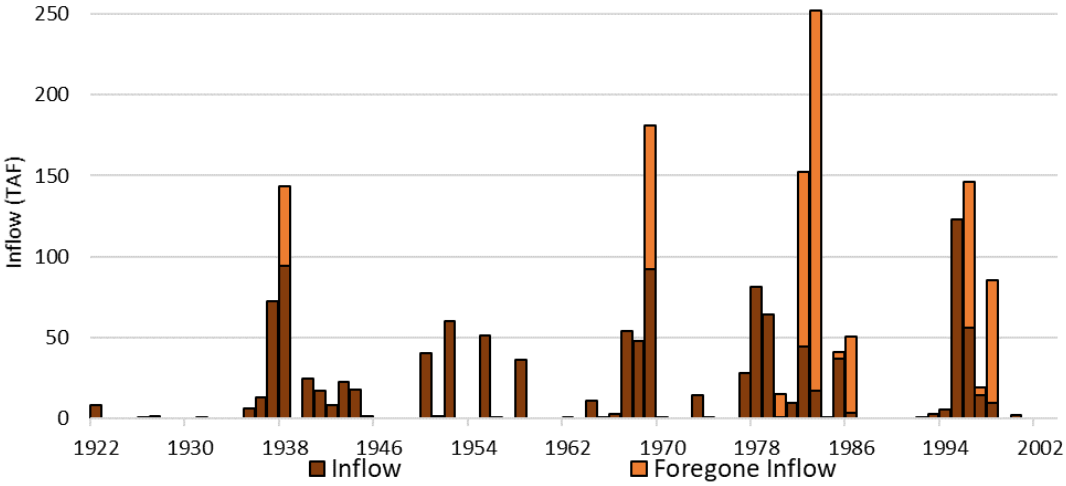
Key: TAF = thousand acre feet

Figure A.17 City of Fresno Annual Take



Key: TAF = thousand acre feet

Figure A.18 City of Fresno Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



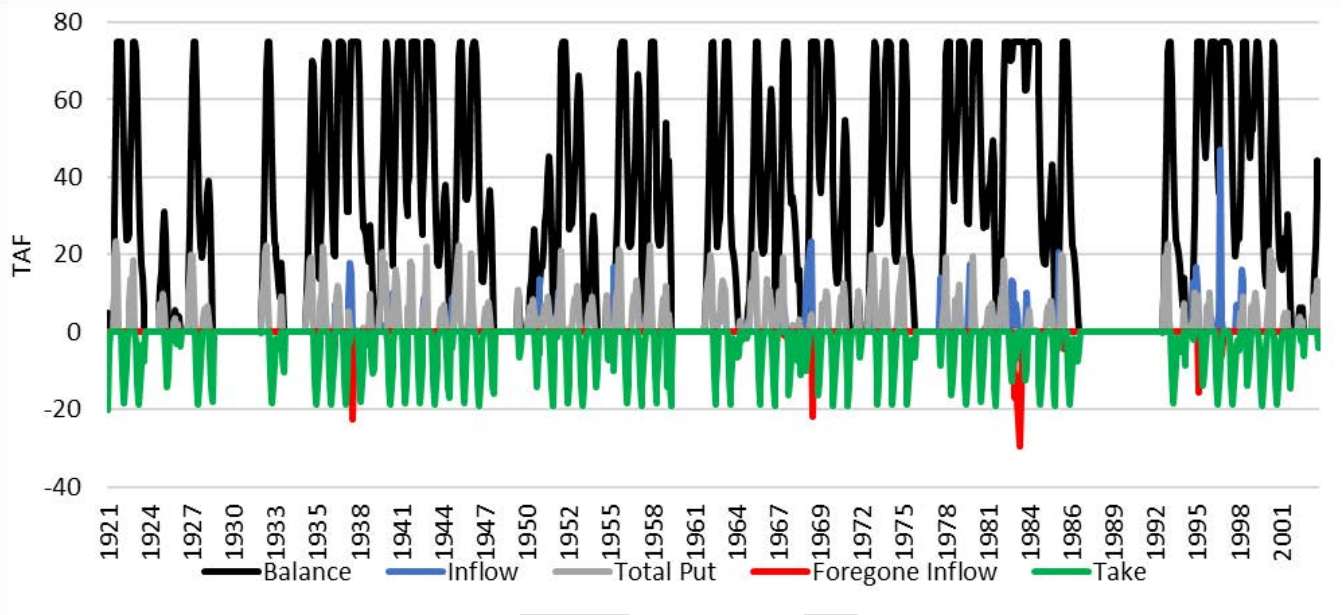
Key: TAF = thousand acre feet

Figure A.19 City of Fresno Annual Inflow and Foregone Inflow

DELANO-EARLIMART IRRIGATION DISTRICT

Investor Group: Delano-Earlimart Irrigation District, Shafter-Wasco Irrigation District, and Southern San Joaquin Municipal Utility District

Investor Storage Account: 75 TAF



Key: TAF = thousand acre feet

Figure A.20 Delano-Earlimart Irrigation District Monthly Operations Trace

Table A.7 Delano-Earlimart Irrigation District Operations Water Year Type Summary

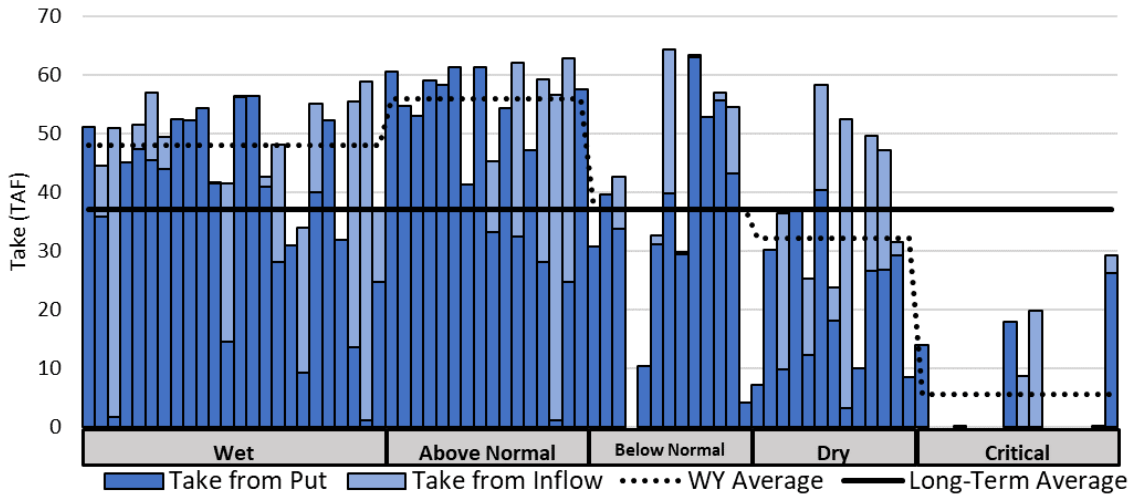
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	23	39	48	36	12	9
Above Normal	4	52	56	46	10	0
Below Normal	2	35	37	33	4	0
Dry	6	15	32	20	12	0
Critical	1	1	6	4	2	0
Long-Term Average	9	30	37	29	8	3

Key:
TAF = thousand acre-feet
WY = water year

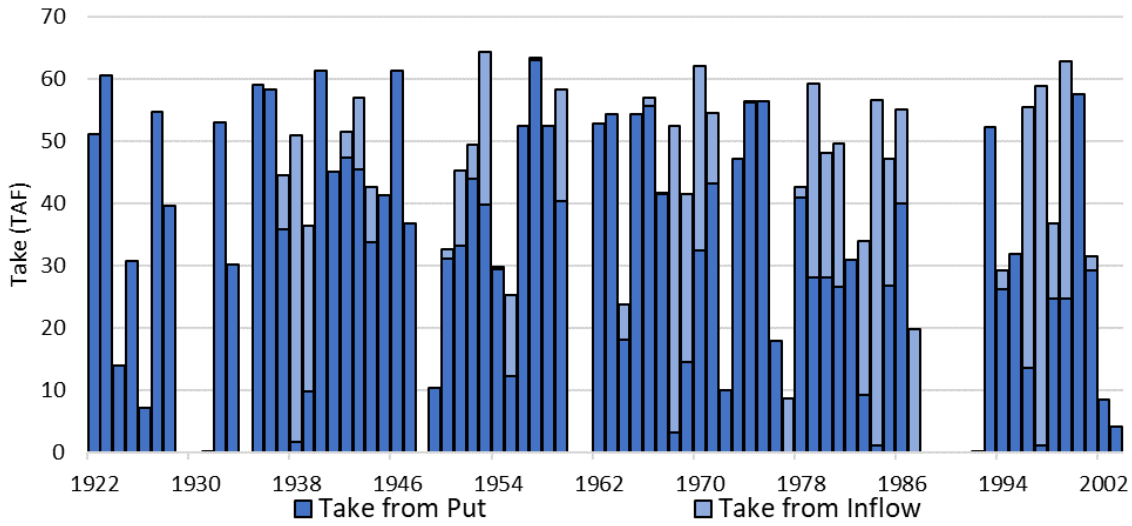
Table A.8 Delano-Earlimart Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	75	
Investor Portion of Construction cost to repay ($M)	$292	$233
Investor Details		
Investor Annual Water Yield (TAF)	37	
Investor Costs		
Total Investment ($M)	$670	$529
Annualized Cost ($M)	$16	$12
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$423	$331
Unit cost of water, after repayment period ($/AF)	$59	$45

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

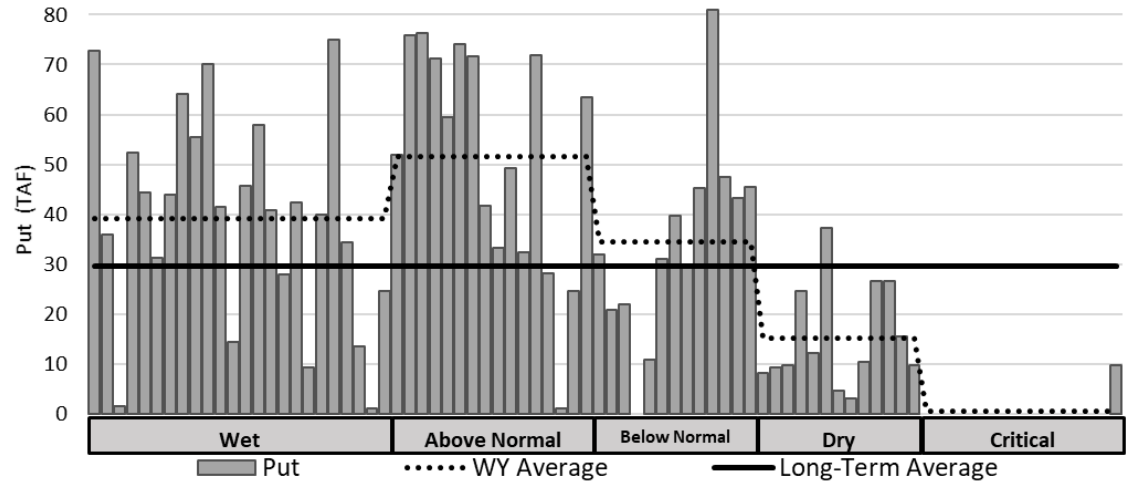


Key: TAF = thousand acre feet
Figure A.21 Delano-Earlimart Irrigation District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



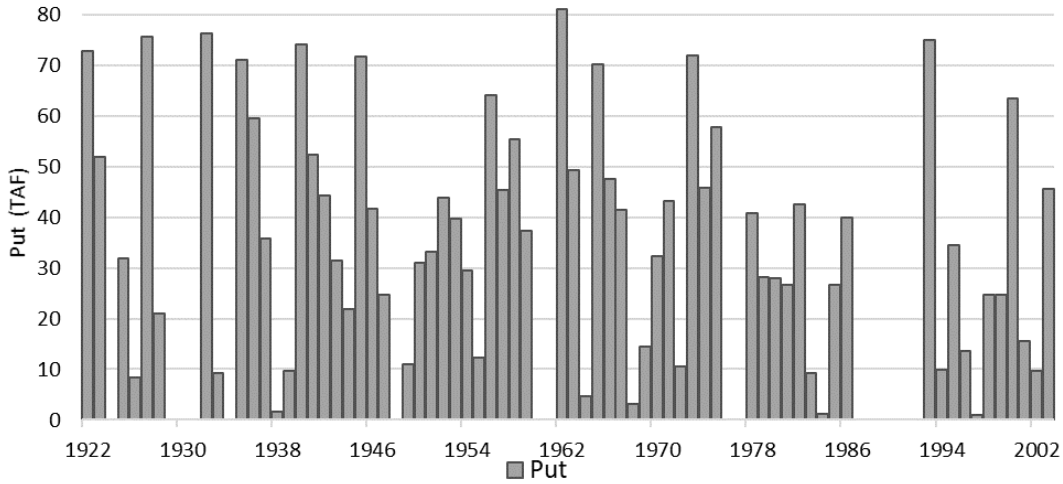
Key: TAF = thousand acre feet

Figure A.22 Delano-Earlimart Irrigation District Annual Take



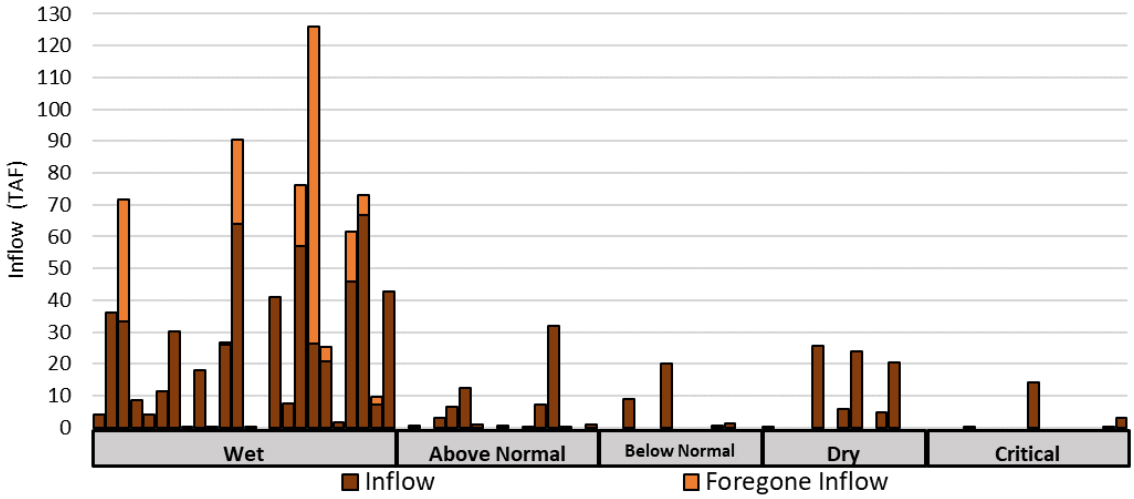
Key: TAF = thousand acre feet

Figure A.23 Delano-Earlimart Irrigation District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



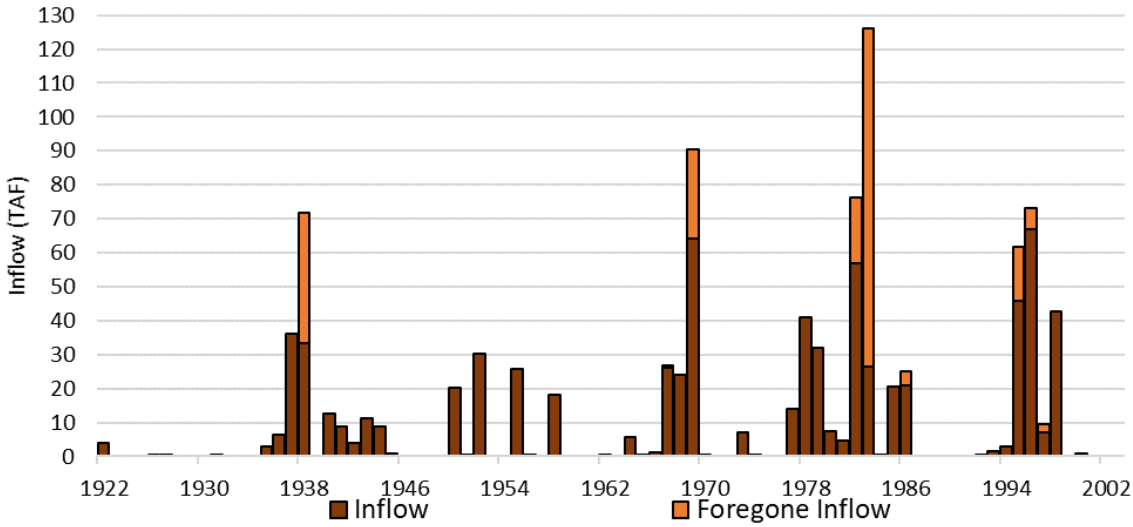
Key: TAF = thousand acre feet

Figure A.24 Delano-Earlimart Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.25 Delano-Earlimart Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



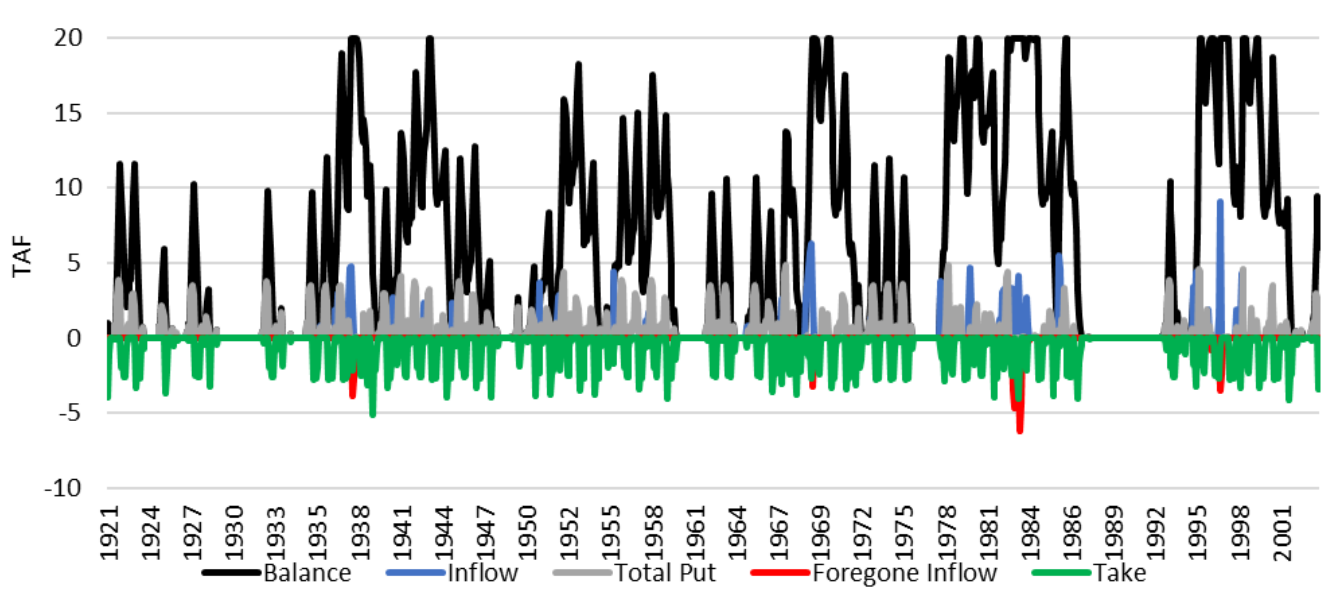
Key: TAF = thousand acre feet

Figure A.26 Delano-Earlimart Irrigation District Annual Inflow and Foregone Inflow

HILLS VALLEY IRRIGATION DISTRICT

Investor Group: Hills Valley Irrigation District, Kaweah Delta Water Conservation District, Lindsay-Strathmore Irrigation District, and Orange Cove Irrigation District

Investor Storage Account: 20 TAF



Key: TAF = thousand acre feet

Figure A.27 Hills Valley Irrigation District Monthly Operations Trace

Table A.9 Hills Valley Irrigation District Operations Water Year Type Summary

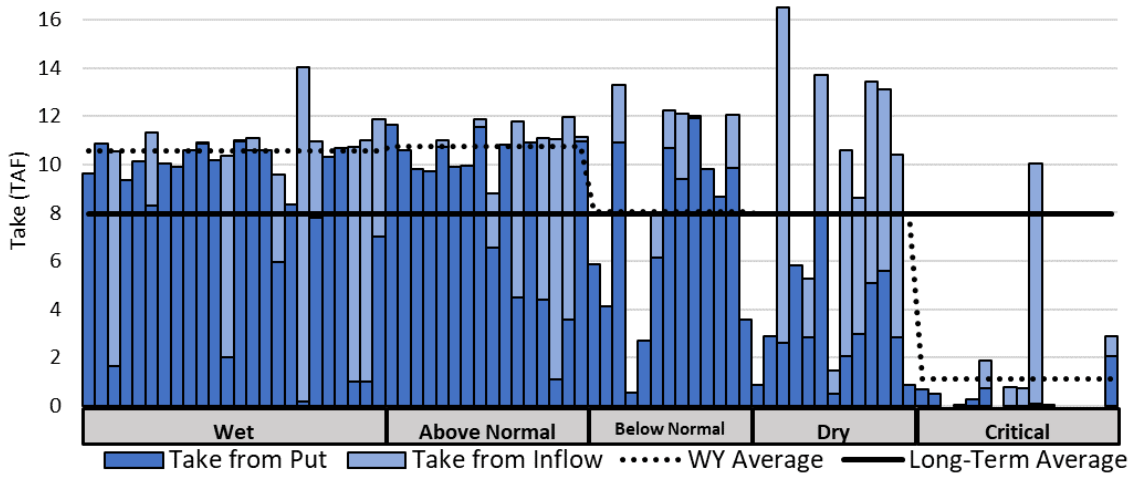
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	7	9	11	8	3	2
Above Normal	1	9	11	9	2	0
Below Normal	1	7	8	7	1	0
Dry	2	3	8	3	5	0
Critical	0	0	1	0	1	0
Long-Term Average	3	6	8	6	2	1

Key:
TAF = thousand acre-feet
WY = water year

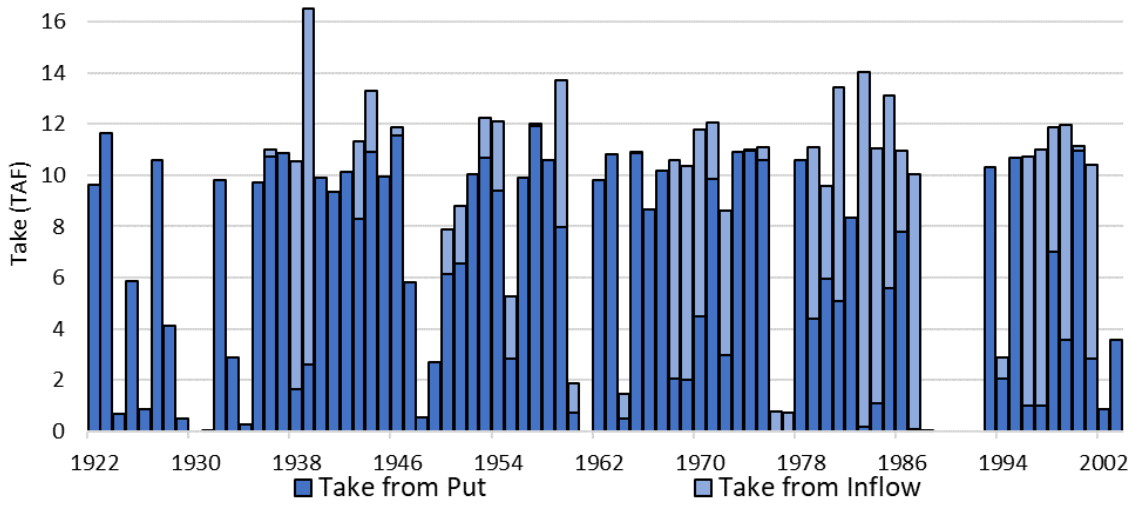
Table A.10 Hills Valley Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	20	
Investor Portion of Construction cost to repay ($M)	$78	$62
Investor Details		
Investor Annual Water Yield (TAF)	8	
Investor Costs		
Total Investment ($M)	$179	$141
Annualized Cost ($M)	$4	$3
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$522	$408
Unit cost of water, after repayment period ($/AF)	$72	$55

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

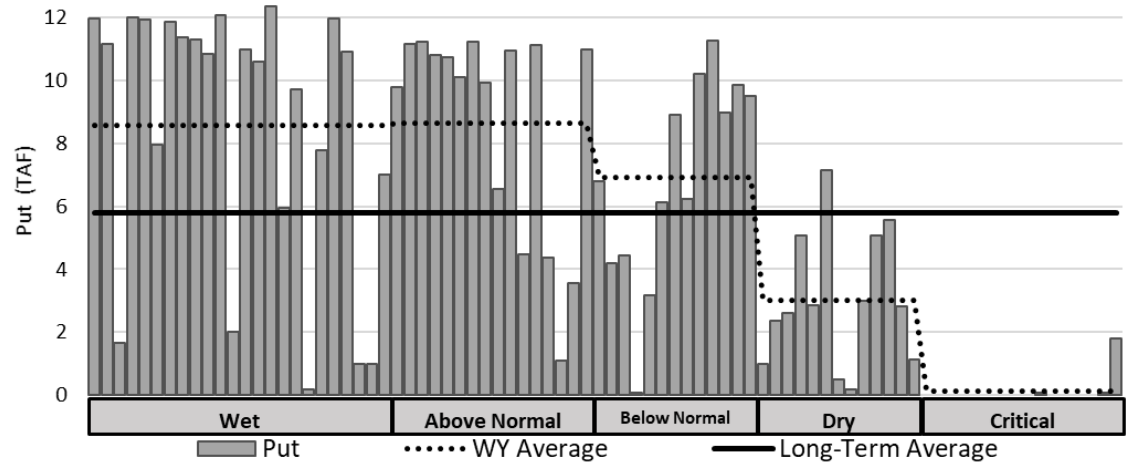


Key: TAF = thousand acre feet
Figure A.28 Hills Valley Irrigation District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



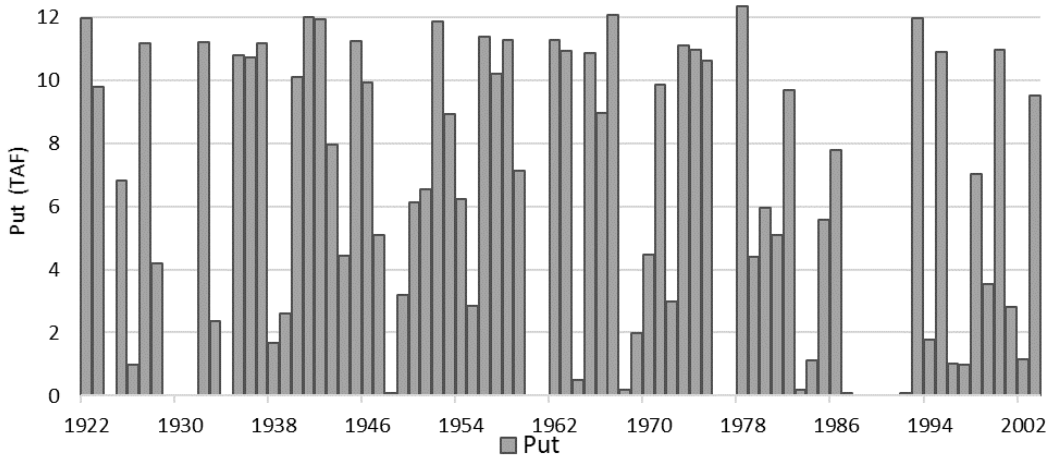
Key: TAF = thousand acre feet

Figure A.29 Hills Valley Irrigation District Annual Take



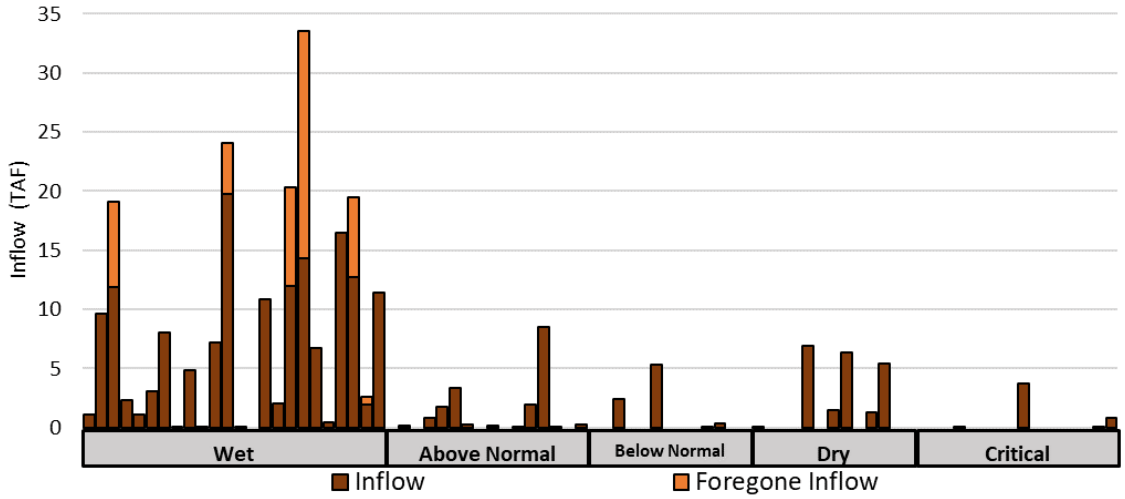
Key: TAF = thousand acre feet

Figure A.30 Hills Valley Irrigation District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



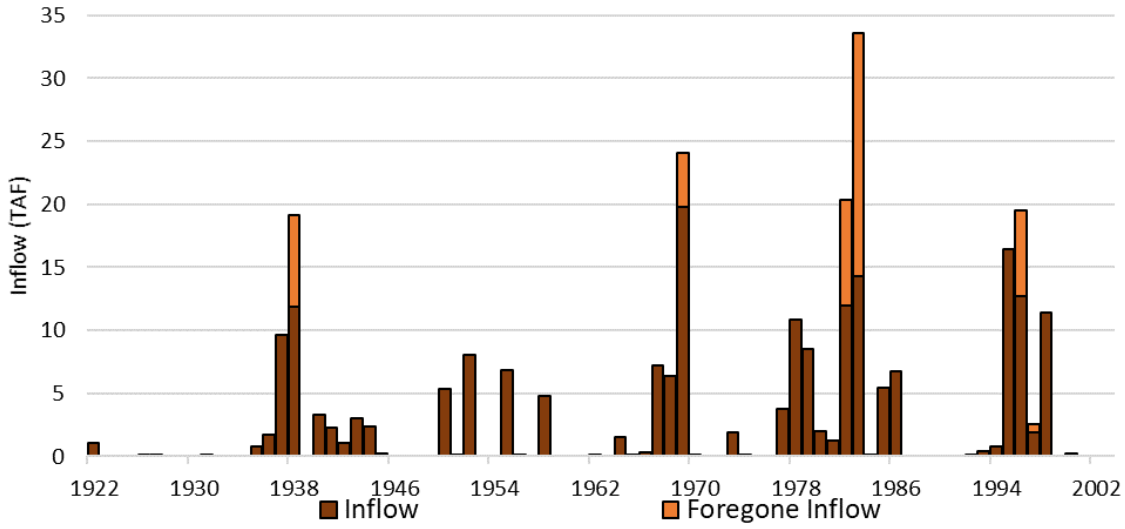
Key: TAF = thousand acre feet

Figure A.31 Hills Valley Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.32 Hills Valley Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type

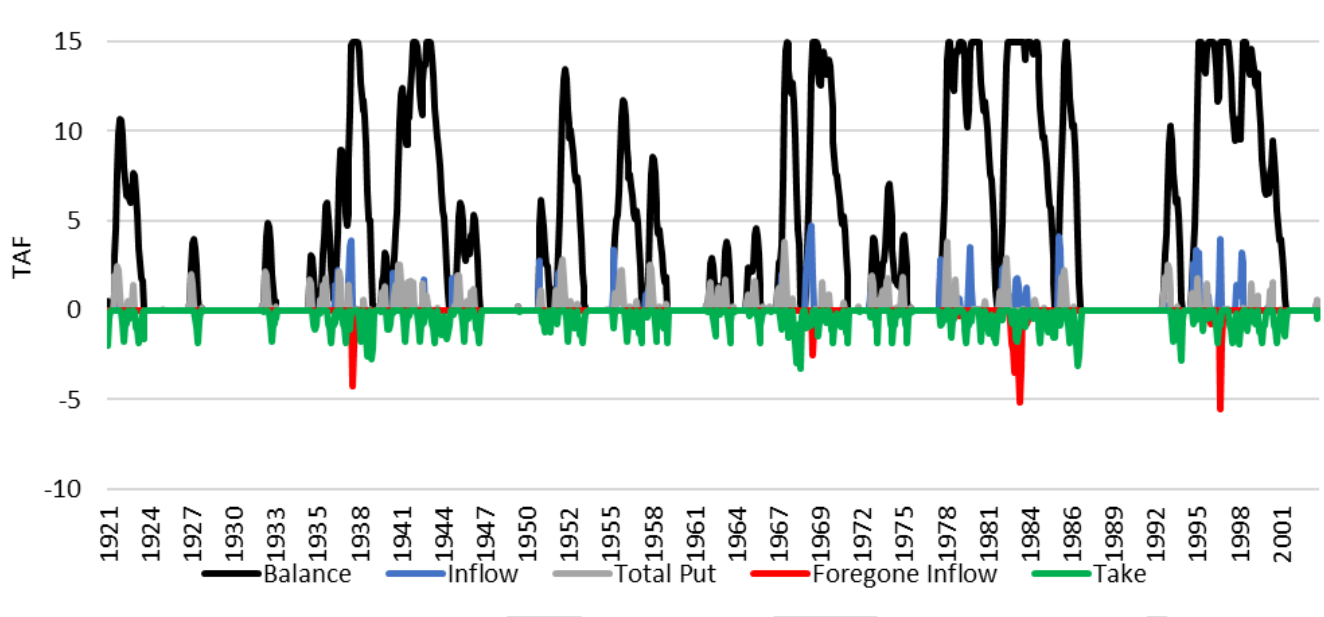


Key: TAF = thousand acre feet

Figure A.33 Hills Valley Irrigation District Annual Inflow and Foregone Inflow

KERN-TULARE WATER DISTRICT

Investor Group: Kern-Tulare Water District and Lindmore Irrigation District
Investor Storage Account: 15 TAF



Key: TAF = thousand acre feet
Figure A.34 Kern-Tulare Water District Monthly Operations Trace

Table A.11 Kern-Tulare Water District Operations Water Year Type Summary

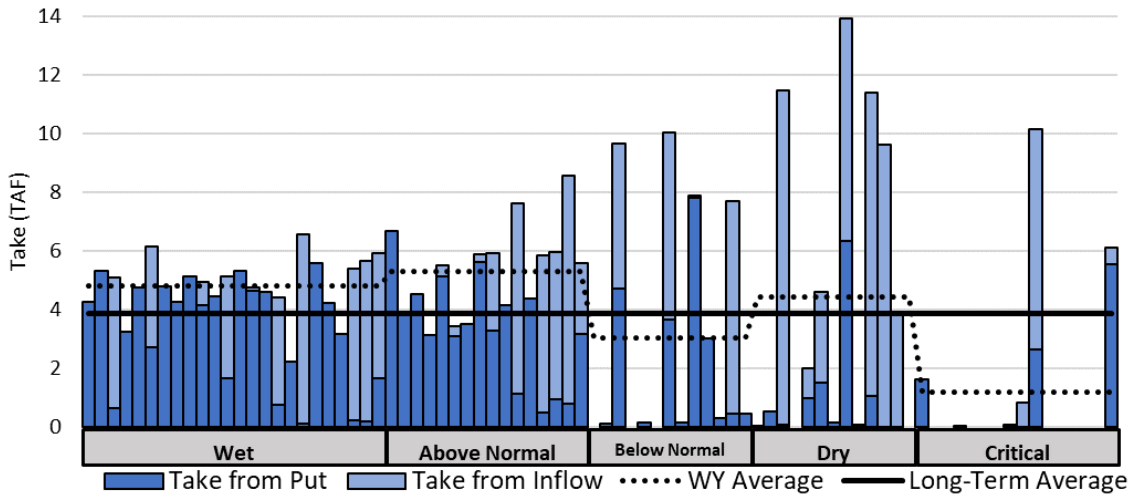
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	4	5	5	3	2	2
Above Normal	1	3	5	3	2	0
Below Normal	0	1	3	2	1	0
Dry	1	0	4	1	4	0
Critical	0	0	1	1	1	0
Long-Term Average	2	2	4	2	2	1

Key:
TAF = thousand acre-feet
WY = water year

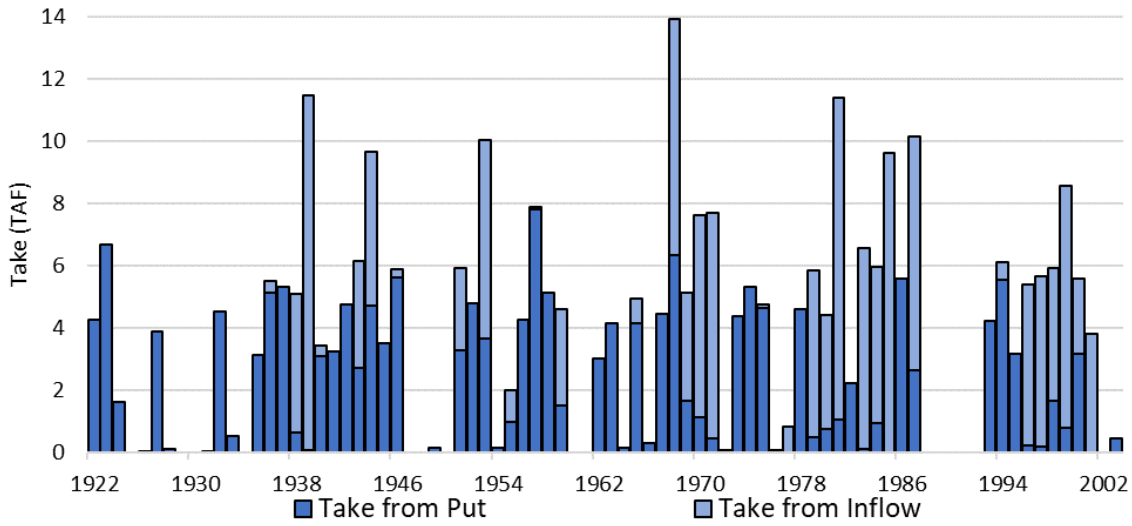
Table A.12 Kern-Tulare Water District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	15	
Investor Portion of Construction cost to repay ($M)	$58	$47
Investor Details		
Investor Annual Water Yield (TAF)	4	
Investor Costs		
Total Investment ($M)	$134	$106
Annualized Cost ($M)	$3	$2
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$782	$612
Unit cost of water, after repayment period ($/AF)	$109	$83

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

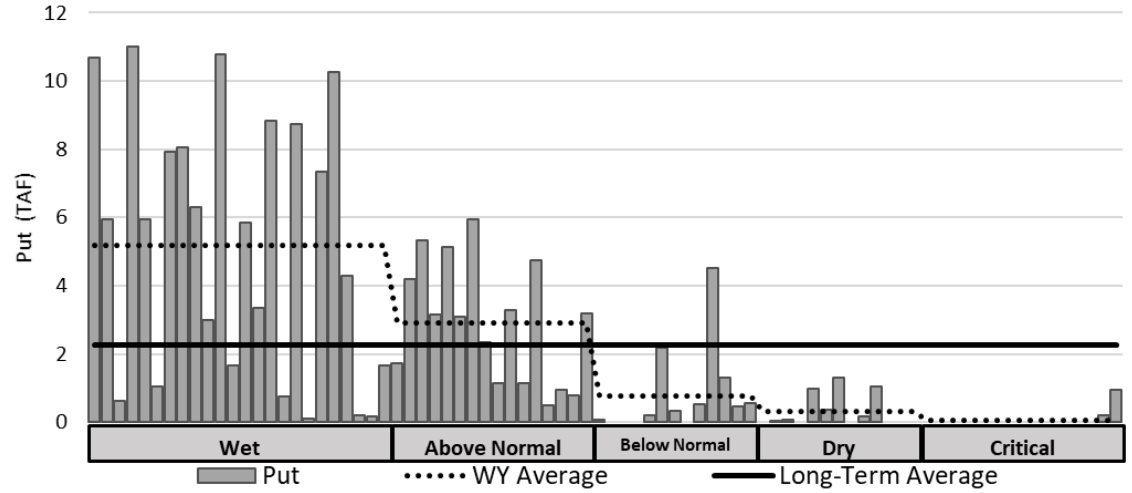


Key: TAF = thousand acre feet
Figure A.35 Kern-Tulare Water District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



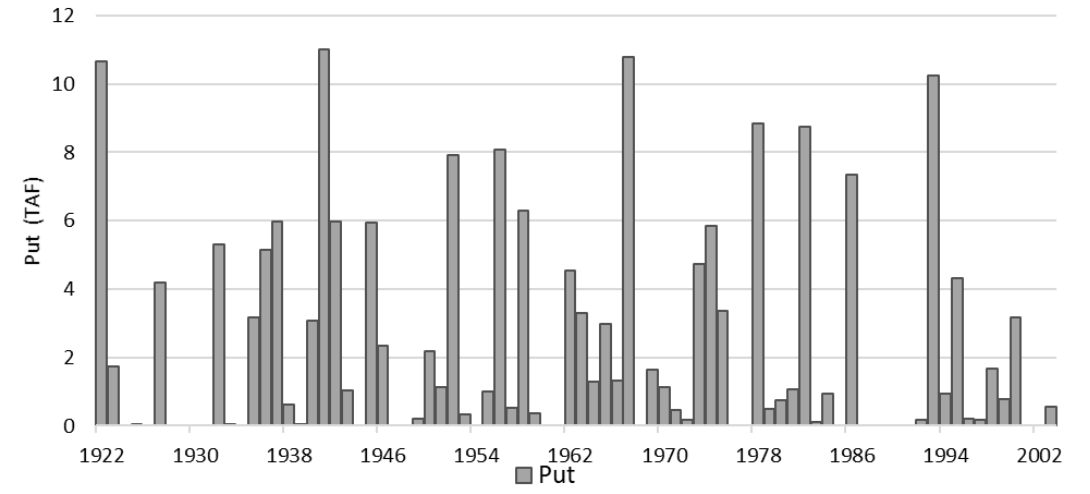
Key: TAF = thousand acre feet

Figure A.36 Kern-Tulare Water District Annual Take



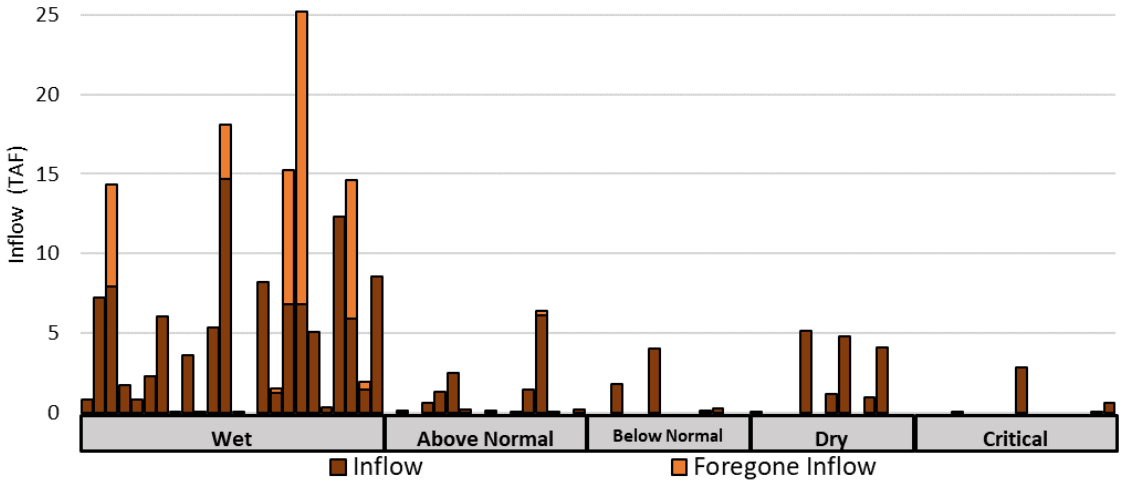
Key: TAF = thousand acre feet

Figure A.37 Kern-Tulare Water District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



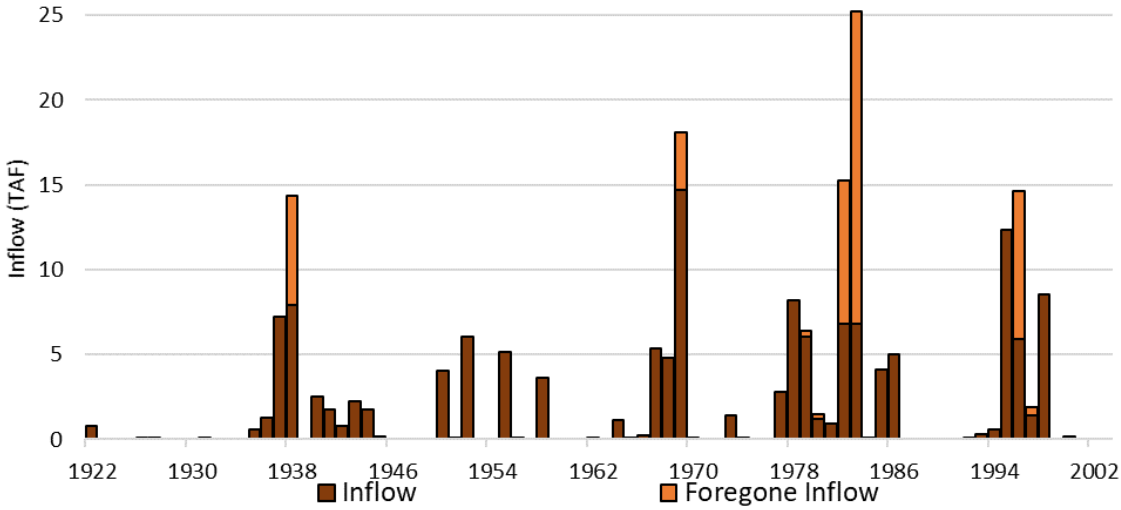
Key: TAF = thousand acre feet

Figure A.38 Kern-Tulare Water District Annual Put



Key: TAF = thousand acre feet

Figure A.39 Kern-Tulare Water District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



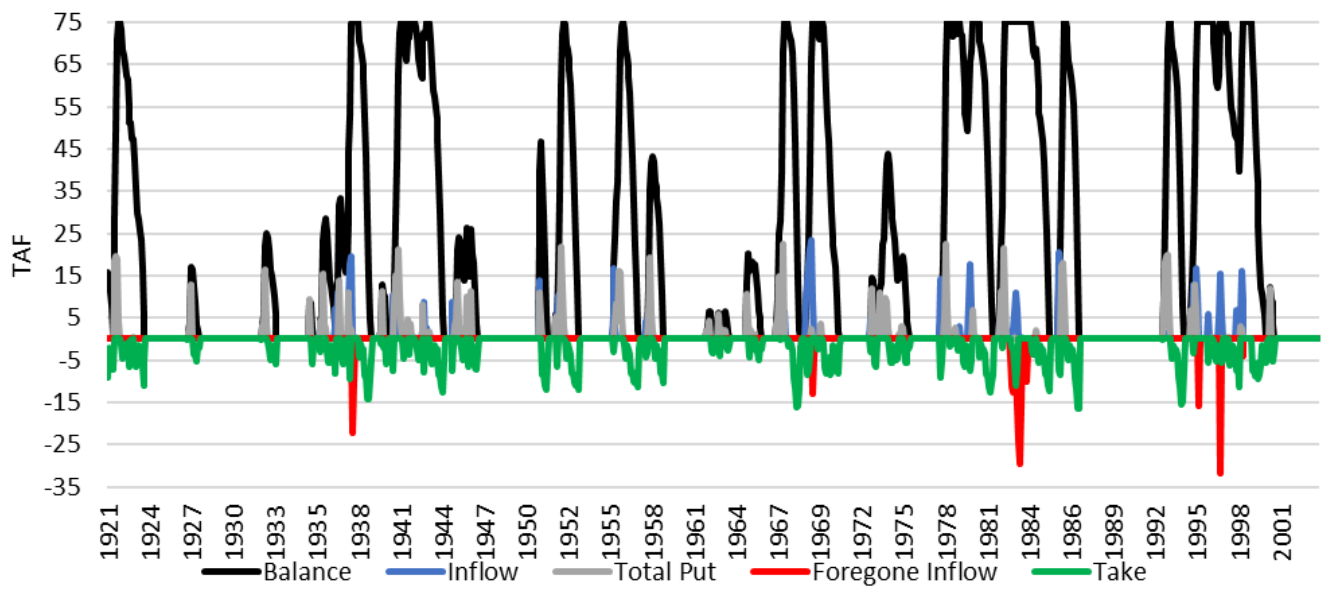
Key: TAF = thousand acre feet

Figure A.40 Kern-Tulare Water District Annual Inflow and Foregone Inflow

LOWER TULE RIVER IRRIGATION DISTRICT

Investor Group: Exeter Irrigation District, Ivanhoe Irrigation District, Lower Tule River Irrigation District, Pixley Irrigation District, Stone Corral Irrigation District, and Tea Pot Dome Water District

Investor Storage Account: 75 TAF



Key: TAF = thousand acre feet

Figure A.41 Lower Tule River Irrigation District Monthly Operations Trace

Table A.13 Lower Tule River Irrigation District Operations Water Year Type Summary

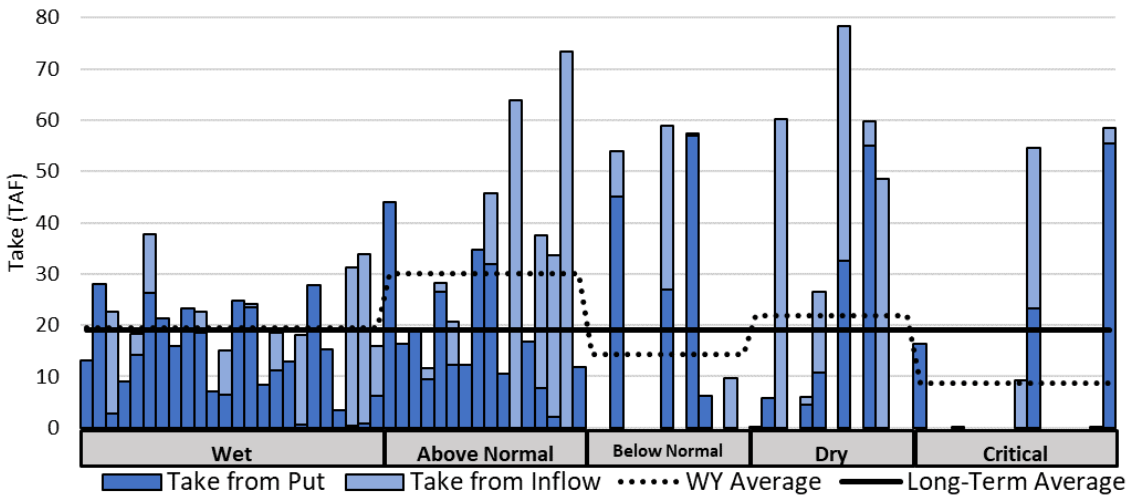
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	21	28	20	13	6	11
Above Normal	4	12	30	16	14	0
Below Normal	2	4	14	10	4	0
Dry	6	2	22	8	14	0
Critical	1	1	9	6	3	0
Long-Term Average	8	11	19	11	8	3

Key:
TAF = thousand acre-feet
WY = water year

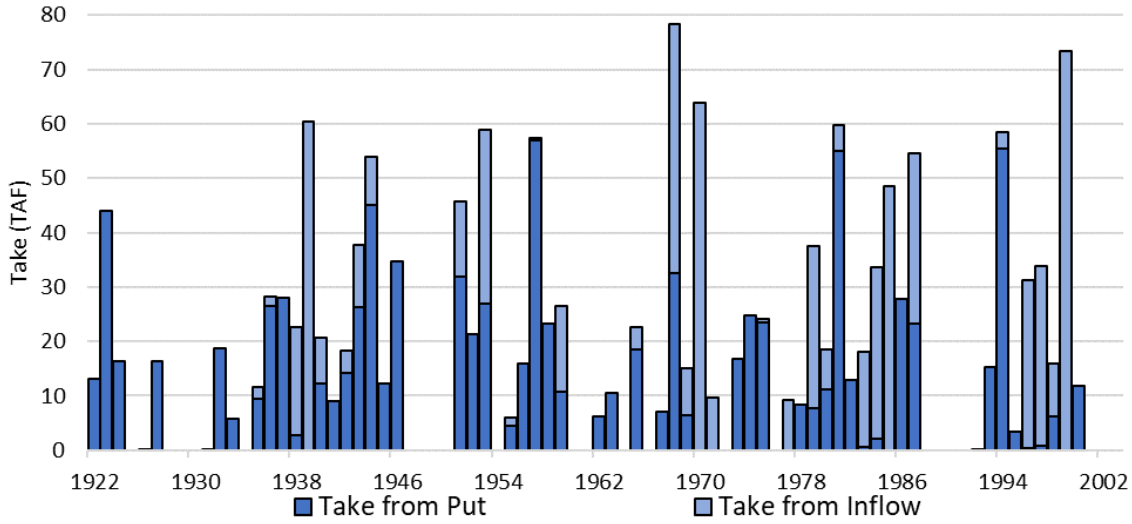
Table A.14 Lower Tule River Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	75	
Investor Portion of Construction cost to repay ($M)	$292	$233
Investor Details		
Investor Annual Water Yield (TAF)	19	
Investor Costs		
Total Investment ($M)	$670	$529
Annualized Cost ($M)	$16	$12
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$823	$644
Unit cost of water, after repayment period ($/AF)	$114	$87

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

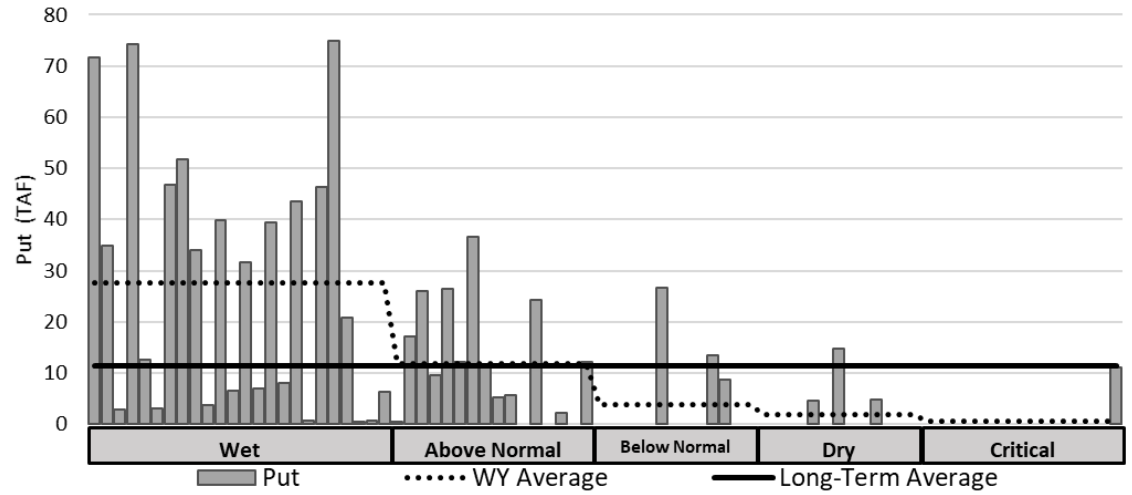


Key: TAF = thousand acre feet
Figure A.42 Lower Tule River Irrigation District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



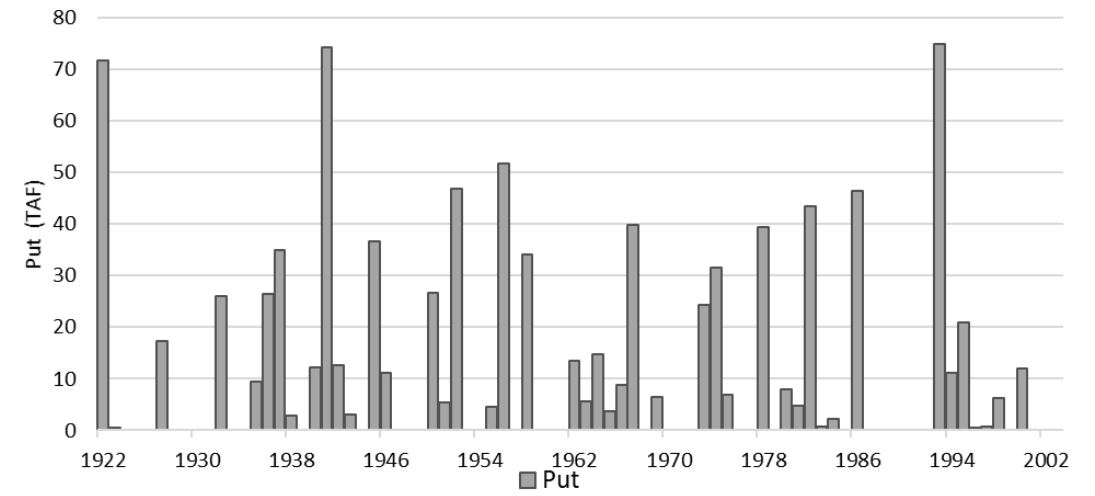
Key: TAF = thousand acre feet

Figure A.43 Lower Tule River Irrigation District Annual Take



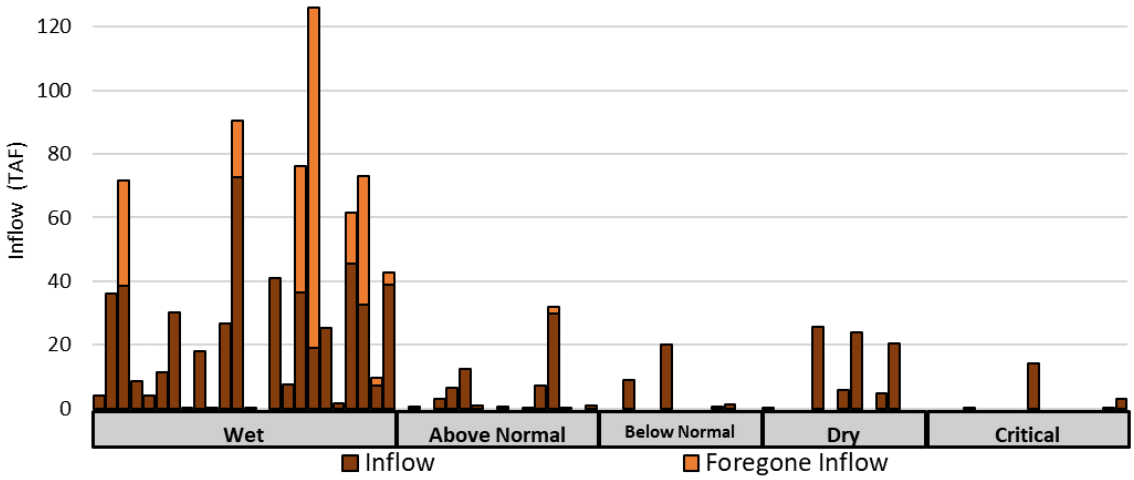
Key: TAF = thousand acre feet

Figure A.44 Lower Tule River Irrigation District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



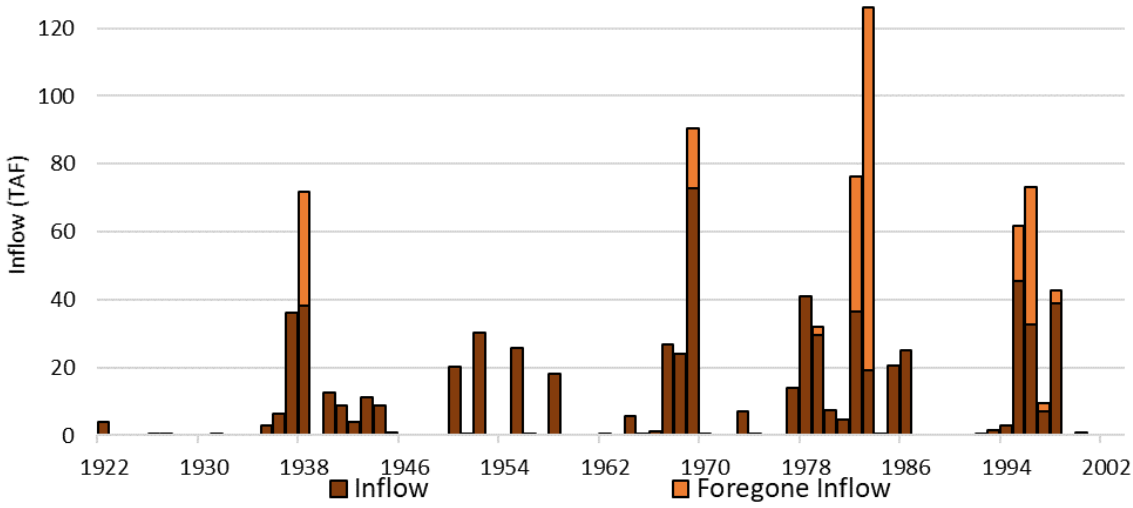
Key: TAF = thousand acre feet

Figure A.45 Lower Tule River Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.46 Lower Tule River Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type

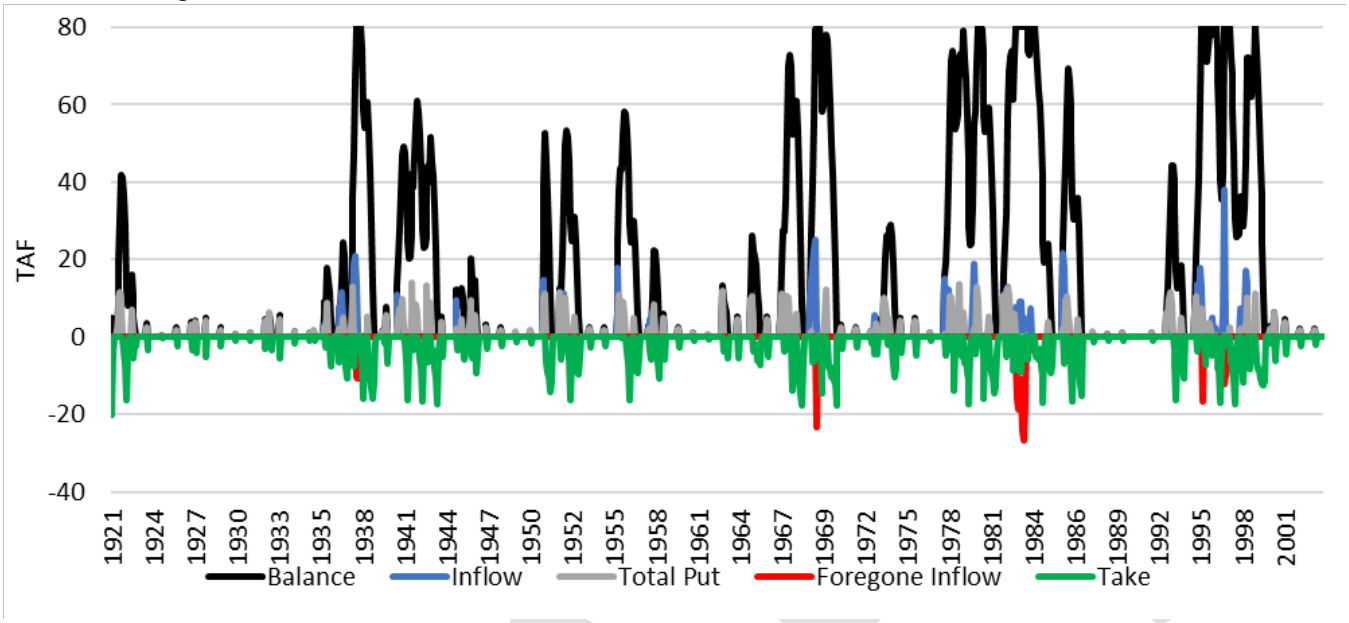


Key: TAF = thousand acre feet

Figure A.47 Lower Tule River Irrigation District Annual Inflow and Foregone Inflow

MADERA IRRIGATION DISTRICT

Investor Group: Madera Irrigation District
Investor Storage Account: 80 TAF



Key: TAF = thousand acre feet
Figure A.48 Madera Irrigation District Monthly Operations Trace

Table A.15 Madera Irrigation District Operations Water Year Type Summary

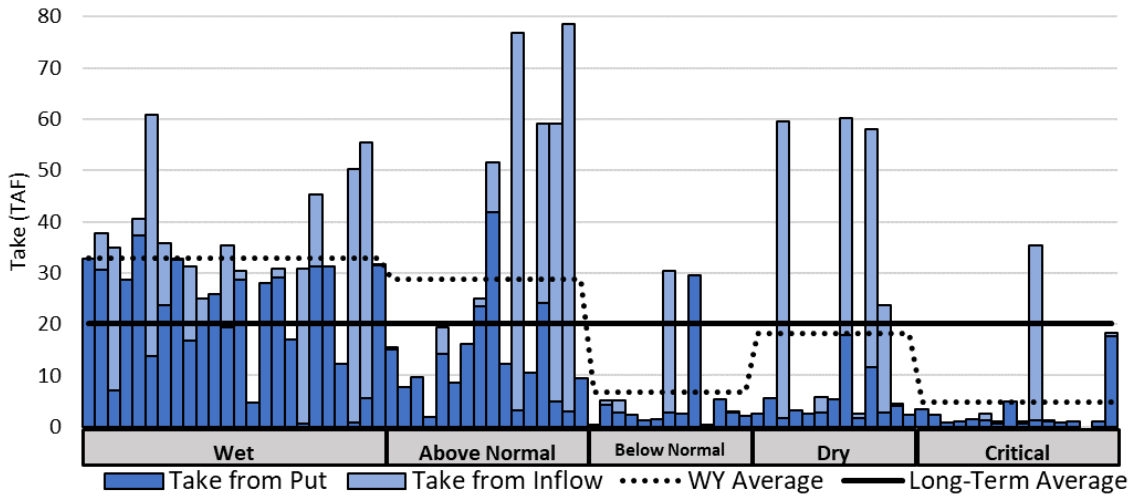
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	24	25	33	21	12	10
Above Normal	4	10	29	13	16	0
Below Normal	3	6	7	4	2	0
Dry	7	5	18	5	13	0
Critical	1	2	5	2	2	0
Long-Term Average	10	11	20	11	9	3

Key:
TAF = thousand acre-feet
WY = water year

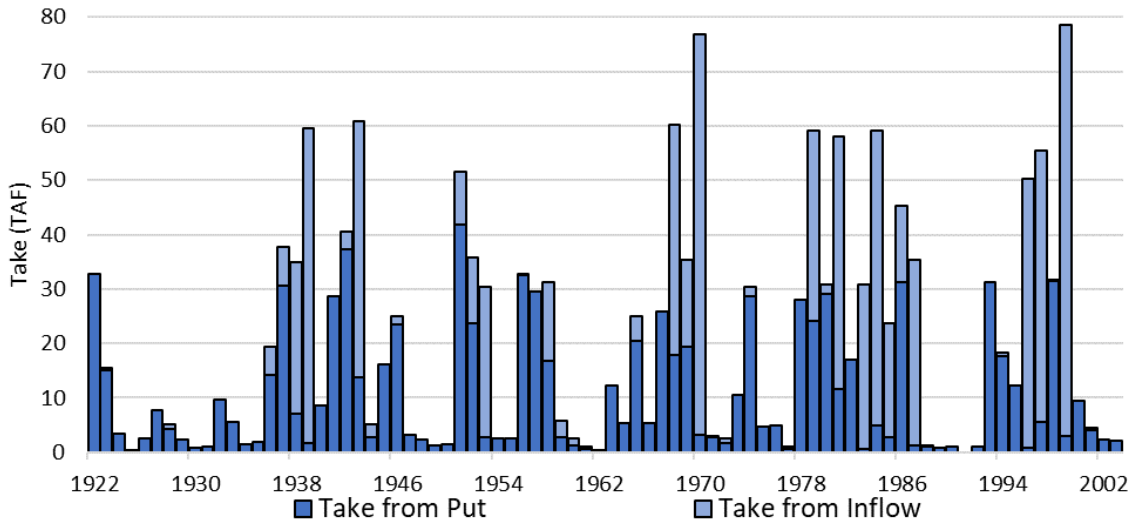
Table A.16 Madera Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	80	
Investor Portion of Construction cost to repay ($M)	$312	$248
Investor Details		
Investor Annual Water Yield (TAF)	20	
Investor Costs		
Total Investment ($M)	$715	$564
Annualized Cost ($M)	$17	$13
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$834	$652
Unit cost of water, after repayment period ($/AF)	$116	$88

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

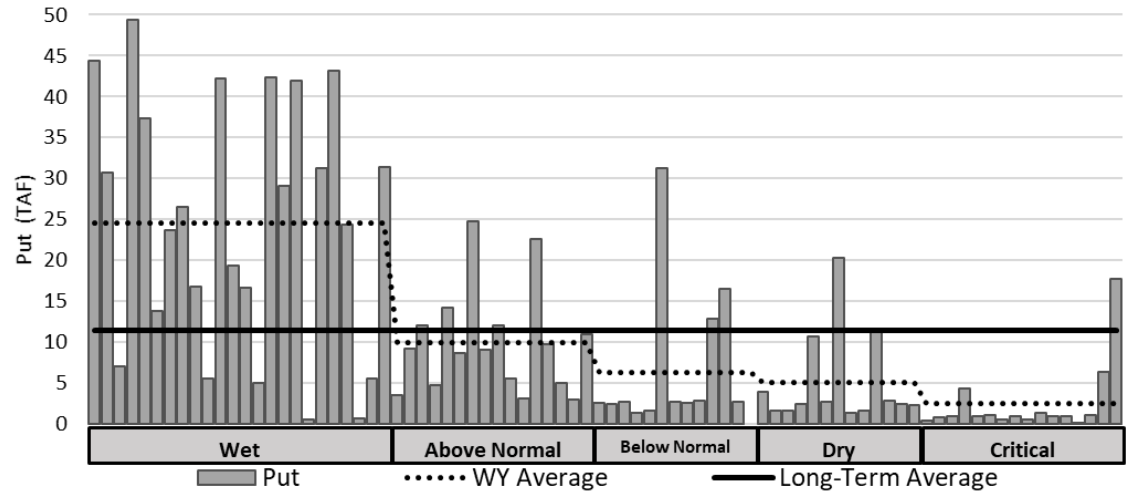


Key: TAF = thousand acre feet
Figure A.49 Madera Irrigation District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



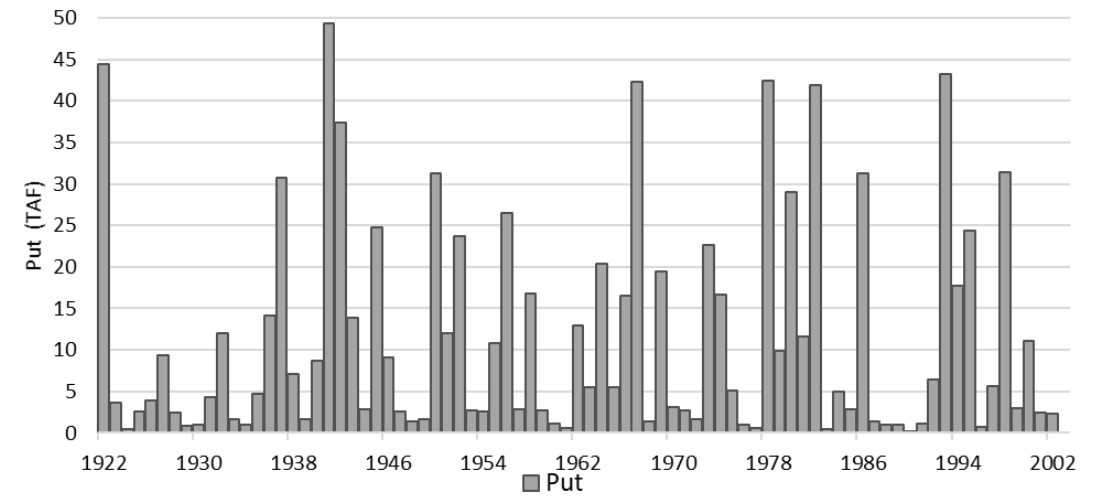
Key: TAF = thousand acre feet

Figure A.50 Madera Irrigation District Annual Take



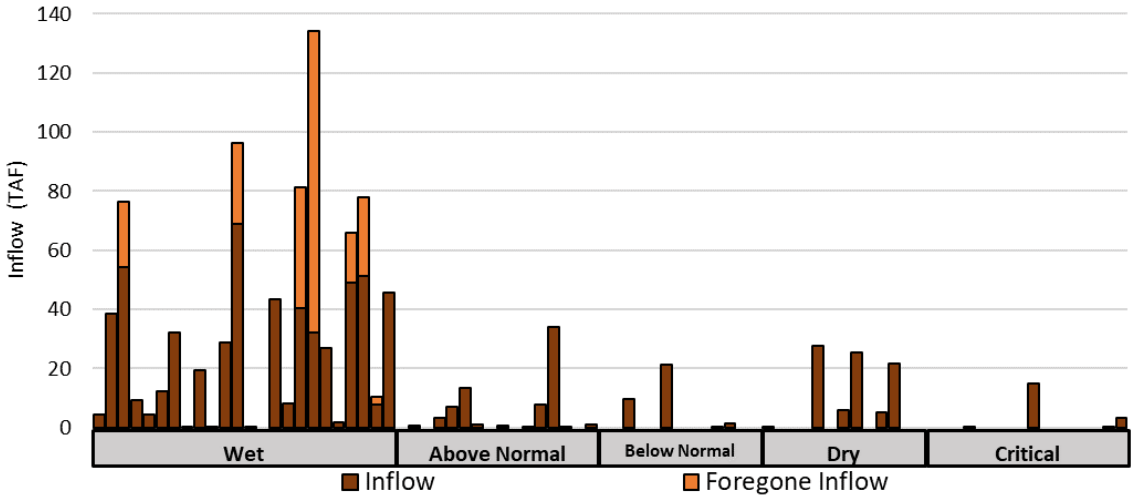
Key: TAF = thousand acre feet

Figure A.51 Madera Irrigation District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



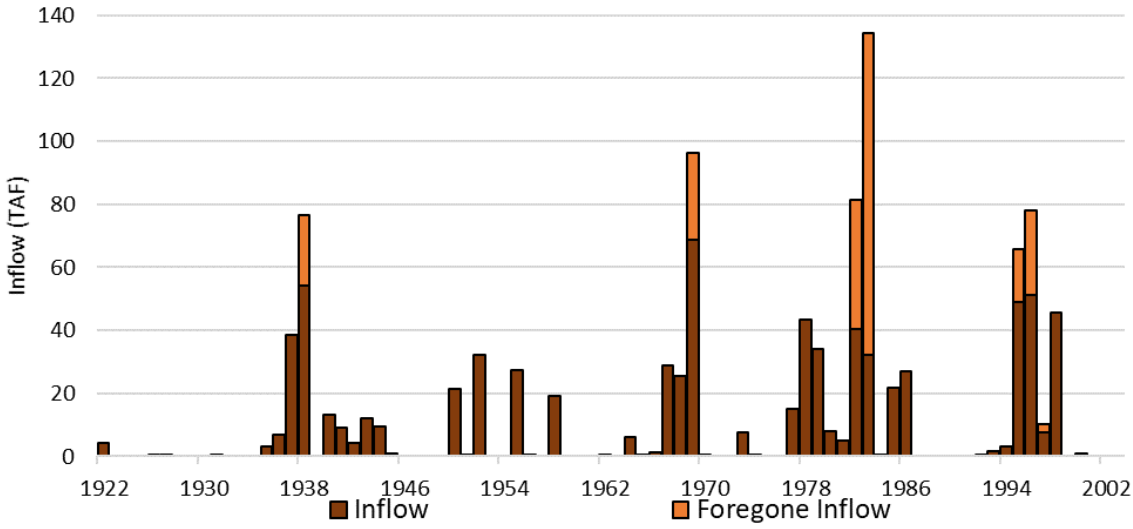
Key: TAF = thousand acre feet

Figure A.52 Madera Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.53 Madera Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



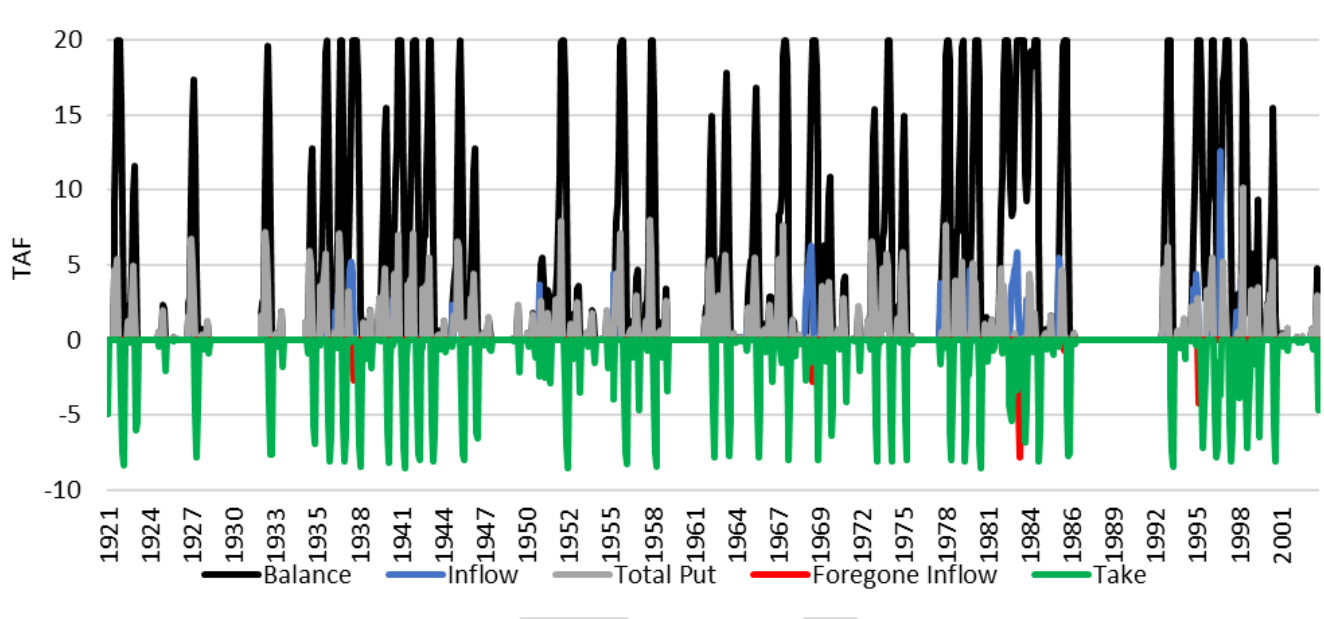
Key: TAF = thousand acre feet

Figure A.54 Madera Irrigation District Annual Inflow and Foregone Inflow

TERRA BELLA IRRIGATION DISTRICT

Investor Group: Porterville Irrigation District, Saucelito Irrigation District, and Terra Bella Irrigation District

Investor Storage Account: 20 TAF



Key: TAF = thousand acre feet

Figure A.55 Terra Bella Irrigation District Monthly Operations Trace

Table A.17 Terra Bella Irrigation District Operations Water Year Type Summary

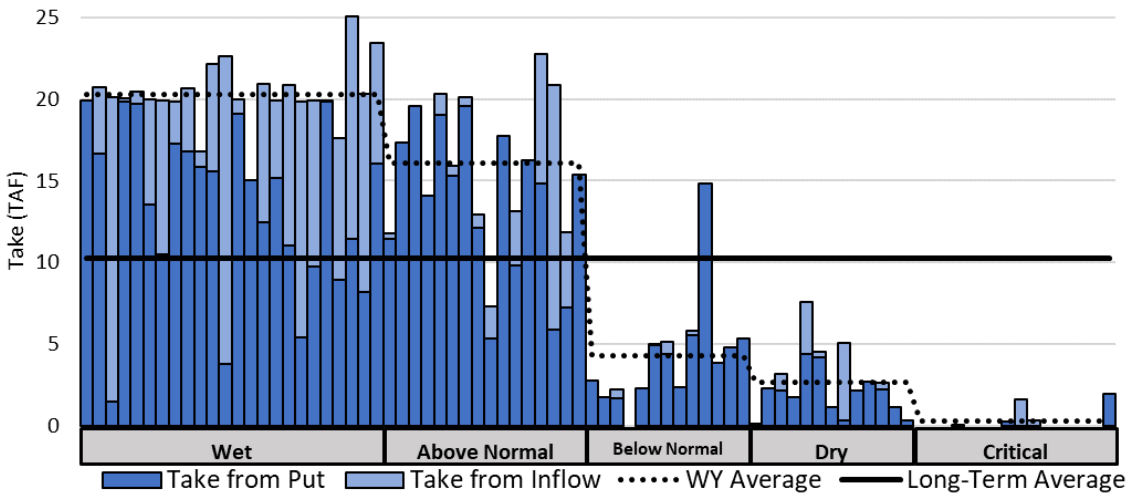
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	7	13	20	13	7	1
Above Normal	1	14	16	14	2	0
Below Normal	1	5	4	4	0	0
Dry	2	2	3	2	1	0
Critical	0	0	0	0	0	0
Long-Term Average	3	8	11	8	3	0

Key:
TAF = thousand acre-feet
WY = water year

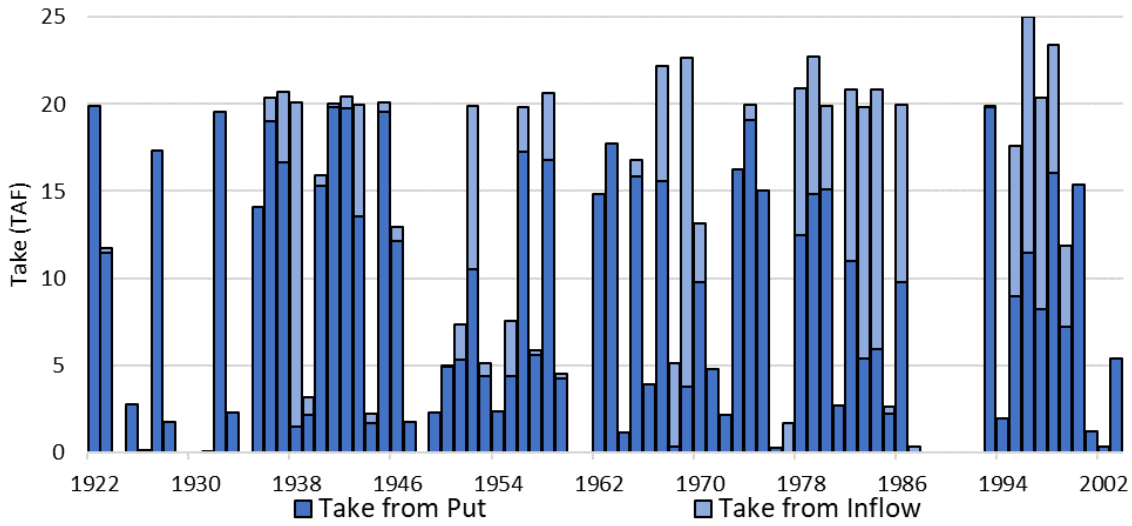
Table A.18 Terra Bella Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	20	
Investor Portion of Construction cost to repay ($M)	$78	$62
Investor Details		
Investor Annual Water Yield (TAF)	10	
Investor Costs		
Total Investment ($M)	$179	$141
Annualized Cost ($M)	$4	$3
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$417	$326
Unit cost of water, after repayment period ($/AF)	$58	$44

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

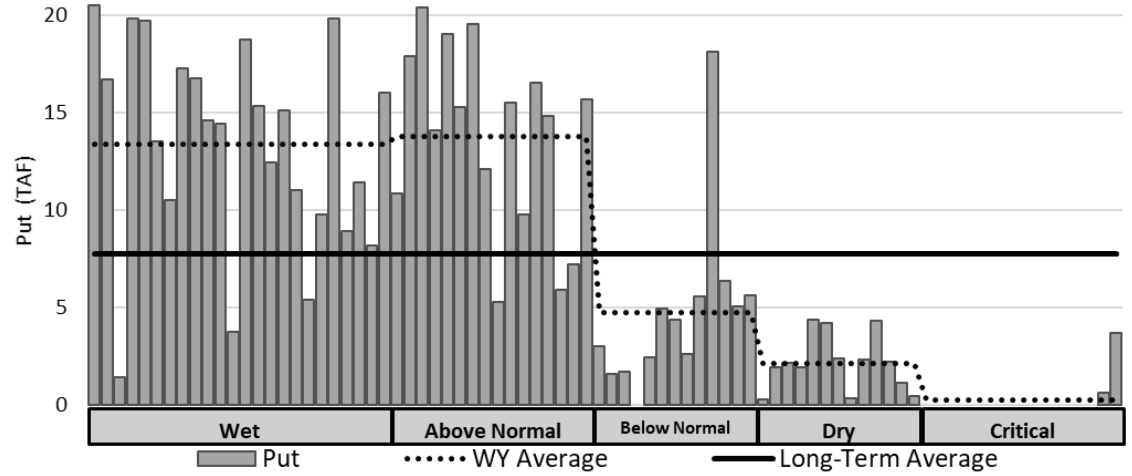


Key: TAF = thousand acre feet
Figure A.56 Terra Bella Irrigation District Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year



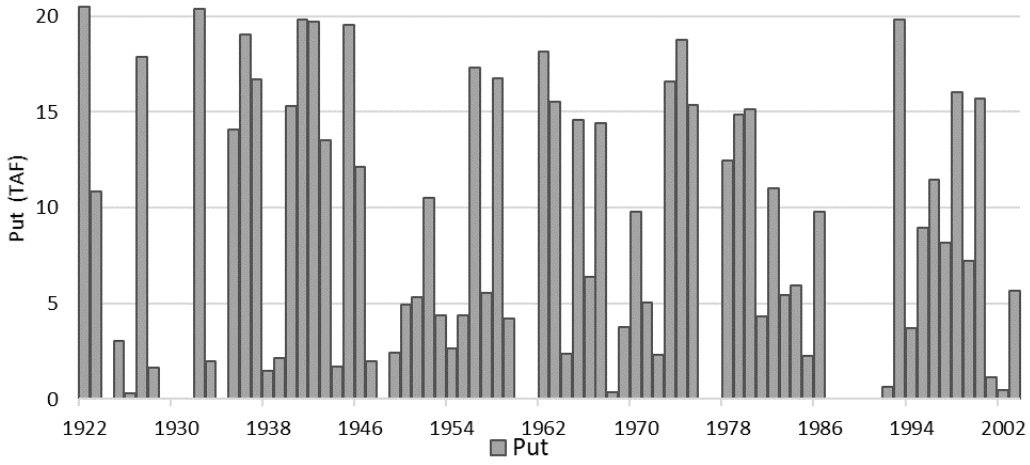
Key: TAF = thousand acre feet

Figure A.57 Terra Bella Irrigation District Annual Take



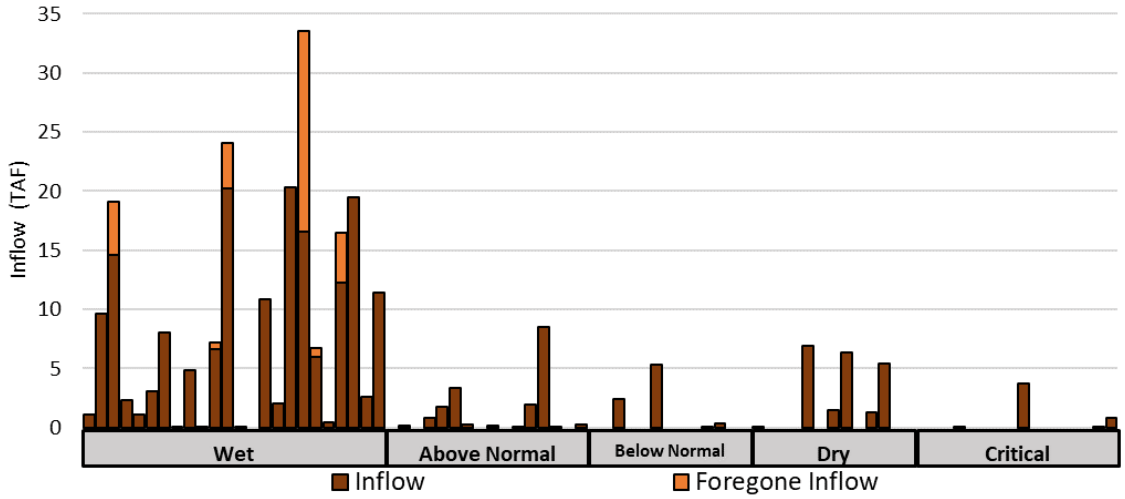
Key: TAF = thousand acre feet

Figure A.58 Terra Bella Irrigation District Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year



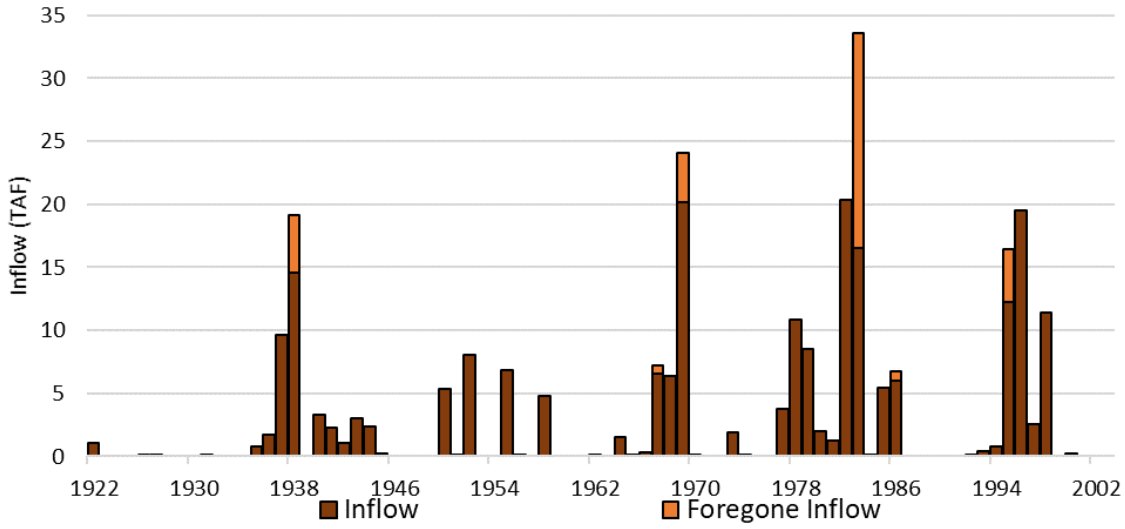
Key: TAF = thousand acre feet

Figure A.59 Terra Bella Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.60 Terra Bella Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type

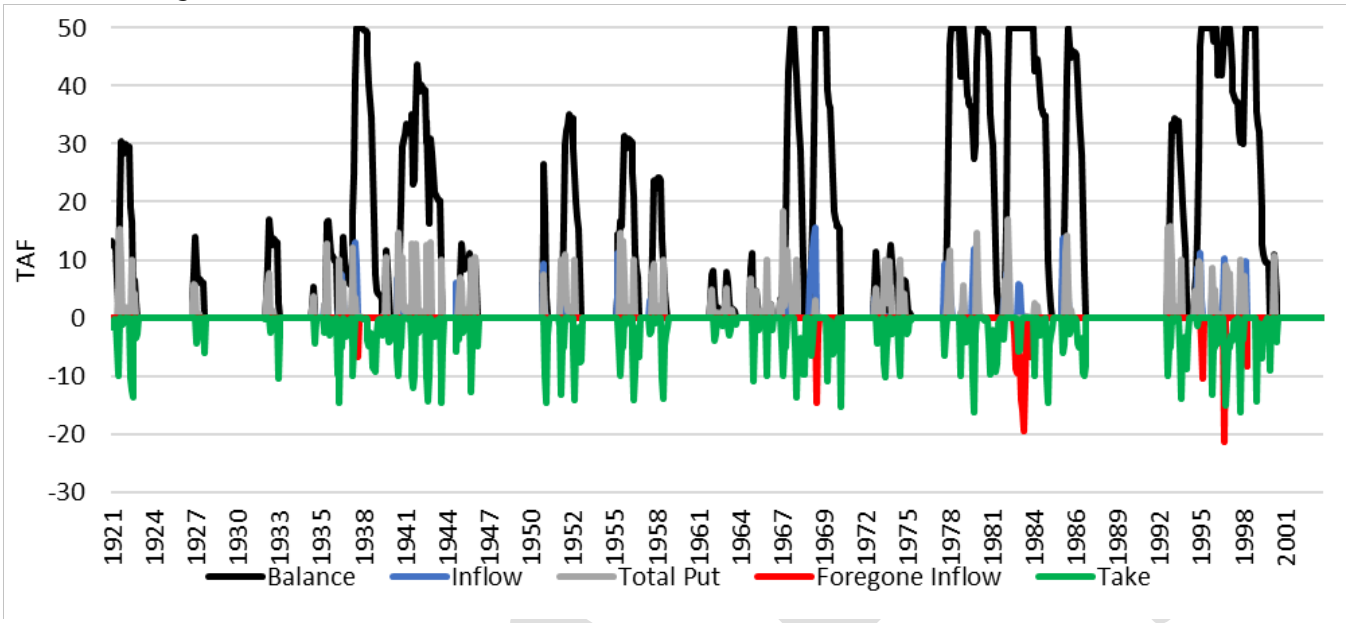


Key: TAF = thousand acre feet

Figure A.61 Terra Bella Irrigation District Annual Inflow and Foregone Inflow

TULARE IRRIGATION DISTRICT

Investor Group: Tulare Irrigation District
Investor Storage Account: 50 TAF



Key: TAF = thousand acre feet
Figure A.62 Tulare Irrigation District Monthly Operations Trace

Table A.19 Tulare Irrigation District Operations Water Year Type Summary

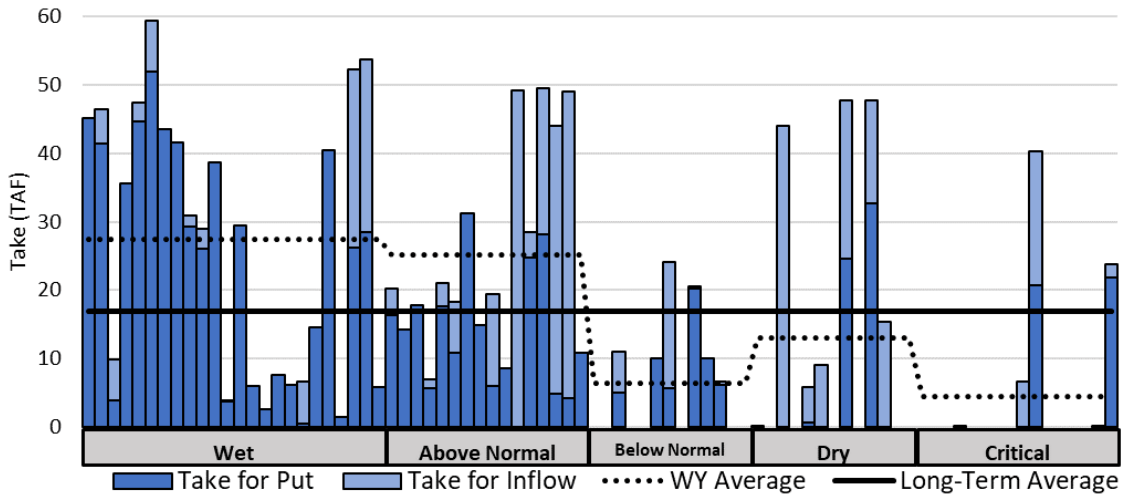
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	14	31	27	24	3	8
Above Normal	3	11	25	13	12	0
Below Normal	2	2	6	4	2	0
Dry	4	1	13	4	9	0
Critical	1	0	4	3	2	0
Long-Term Average	6	12	17	12	5	2

Key:
TAF = thousand acre-feet
WY = water year

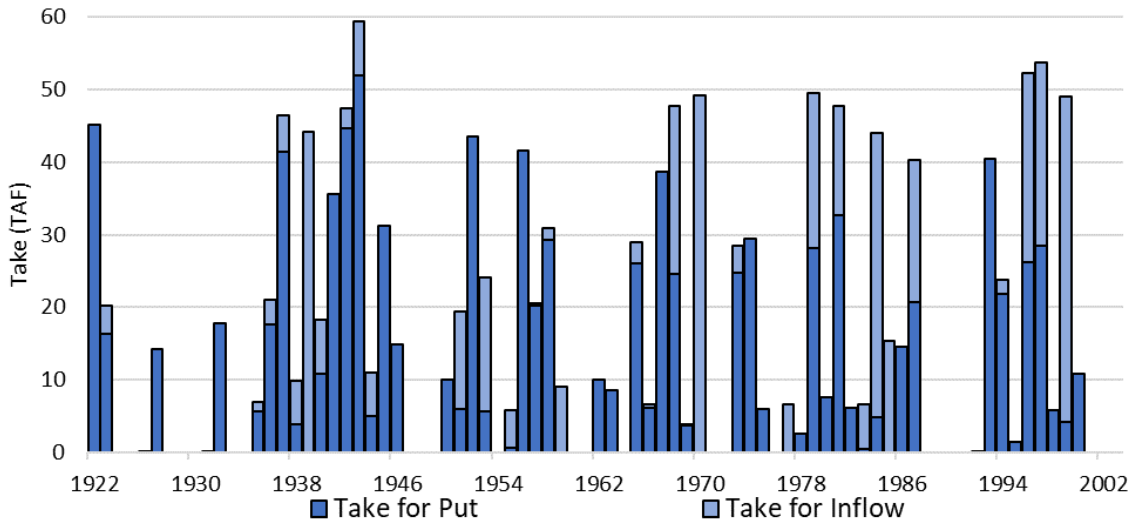
Table A.20 Tulare Irrigation District Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	50	
Investor Portion of Construction cost to repay ($M)	$195	$155
Investor Details		
Investor Annual Water Yield (TAF)	17	
Investor Costs		
Total Investment ($M)	$447	$353
Annualized Cost ($M)	$10	$8
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$614	$480
Unit cost of water, after repayment period ($/AF)	$85	$65

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

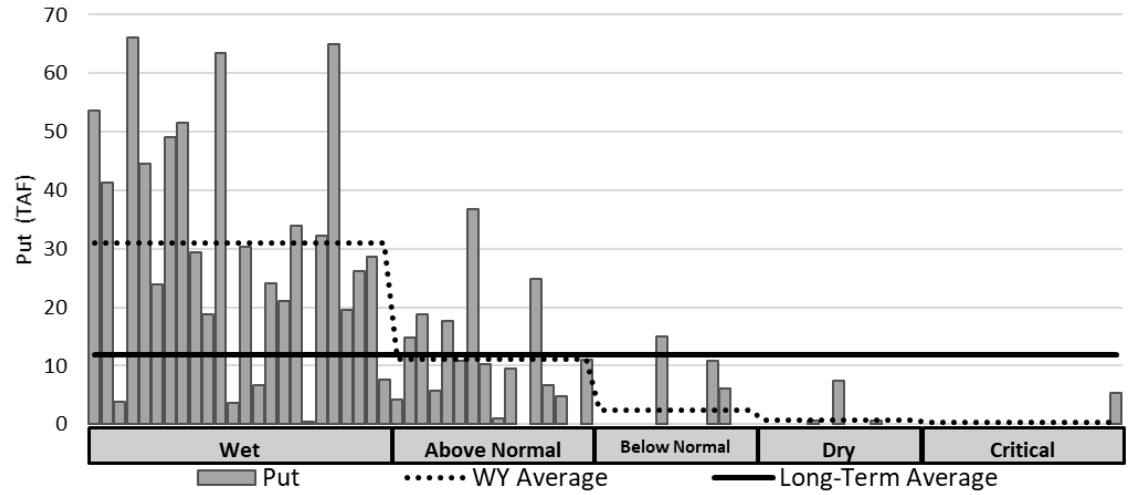


Key: TAF = thousand acre feet
Figure A.63 Tulare Irrigation District Long-Term Average Annual Take and Average Take by San Joaquin Valley Water Year Type



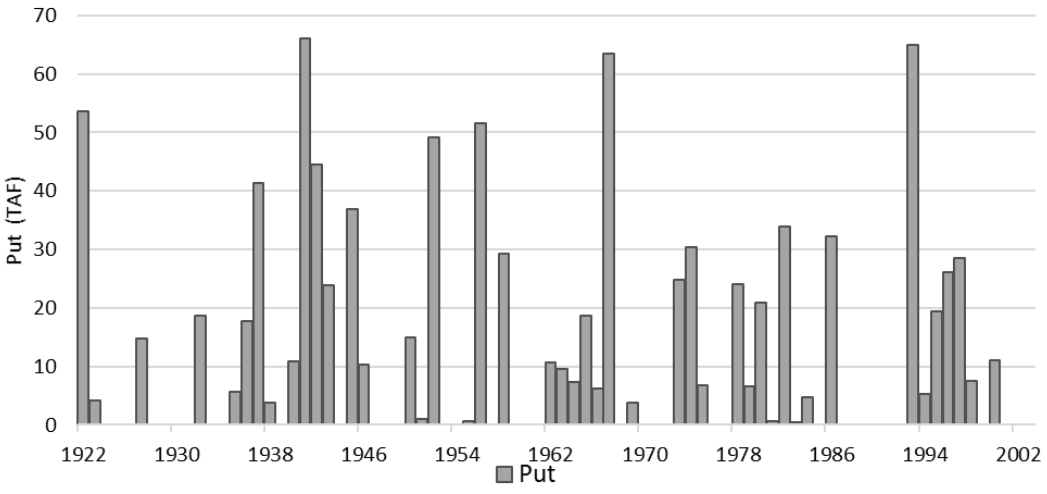
Key: TAF = thousand acre feet

Figure A.64 Tulare Irrigation District Annual Take



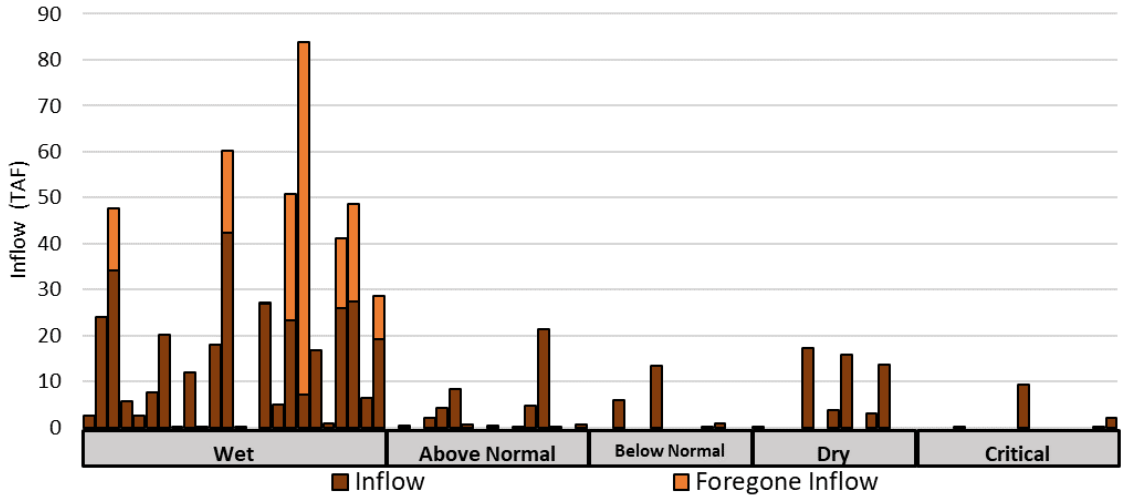
Key: TAF = thousand acre feet

Figure A.65 Tulare Irrigation District Long-Term Average Annual Put and Average Put by San Joaquin Valley Water Year Type



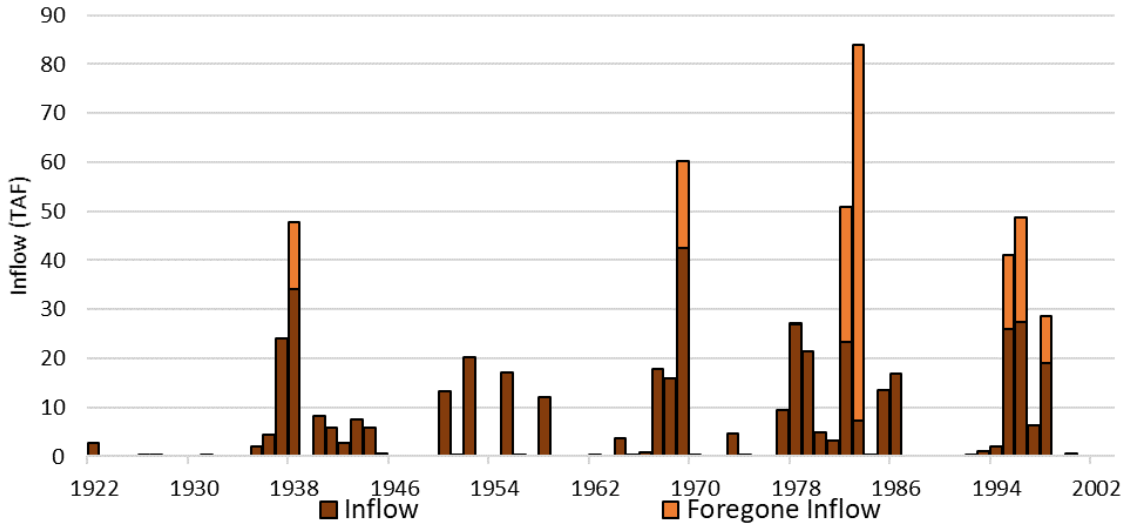
Key: TAF = thousand acre feet

Figure A.66 Tulare Irrigation District Annual Put



Key: TAF = thousand acre feet

Figure A.67 Tulare Irrigation District Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



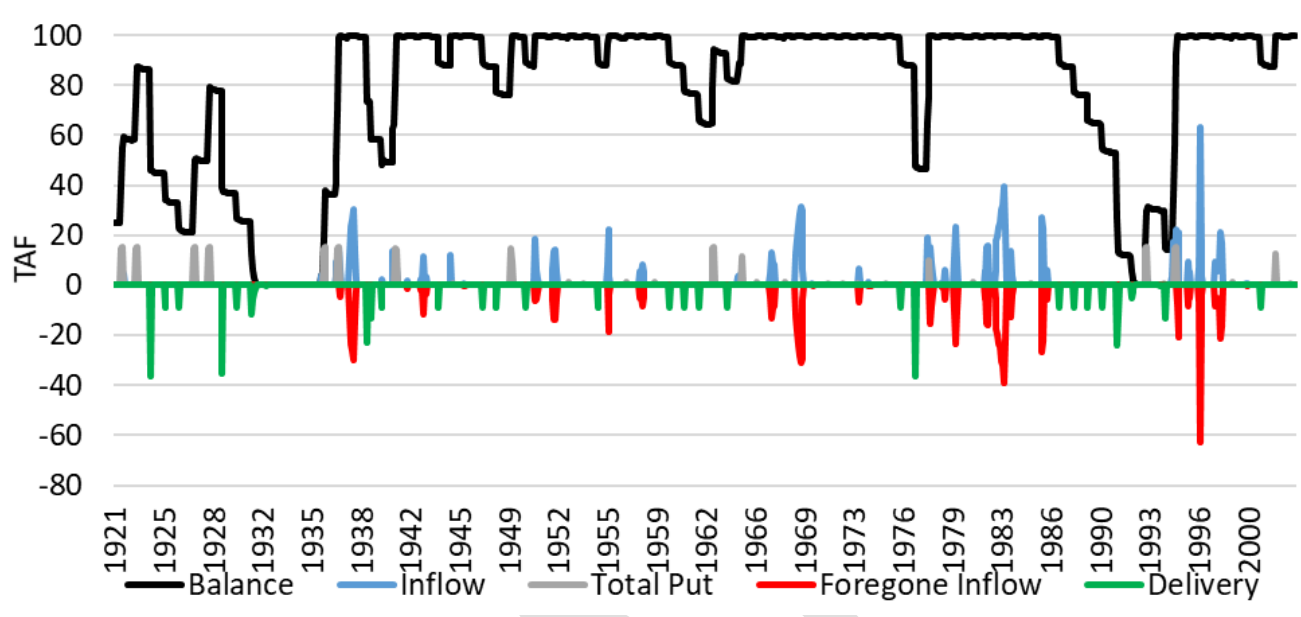
Key: TAF = thousand acre feet

Figure A.68 Tulare Irrigation District Annual Inflow and Foregone Inflow

SAN JOAQUIN RIVER EXCHANGE CONTRACTORS

Investor Group: Central California Irrigation District and San Joaquin River Exchange Contractor Water Authority

Investor Storage Account: 100 TAF



Key: TAF = thousand acre feet

Figure A.69 San Joaquin River Exchange Contractor Monthly Operations Trace

Table A.21 San Joaquin River Exchange Contractor Operations Water Year Type Summary

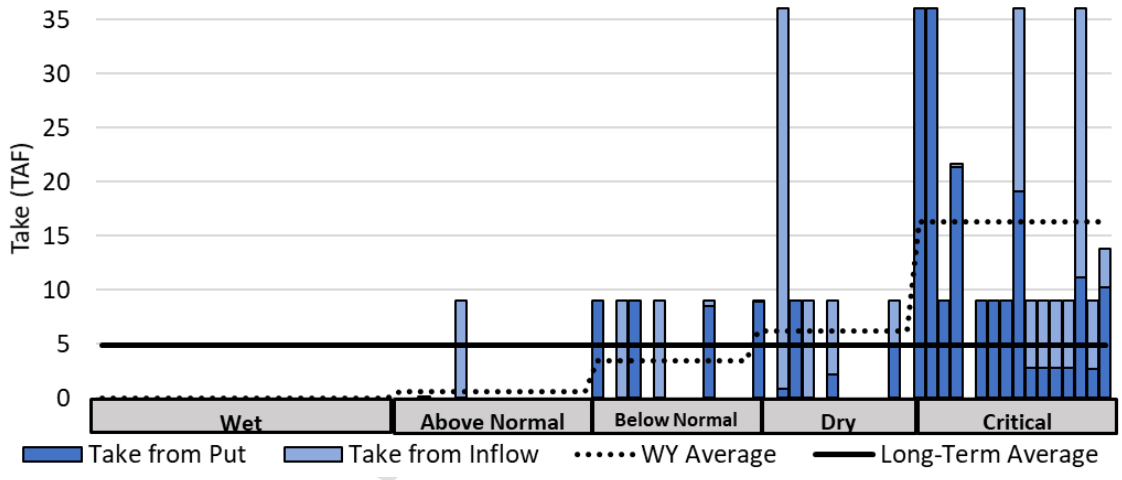
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	6	8	0	0	0	36
Above Normal	2	8	1	0	1	3
Below Normal	2	5	3	2	1	1
Dry	2	2	6	2	4	7
Critical	1	0	16	12	5	0
Long-Term Average	3	5	5	3	2	13

Key: TAF = thousand acre-feet
WY = water year

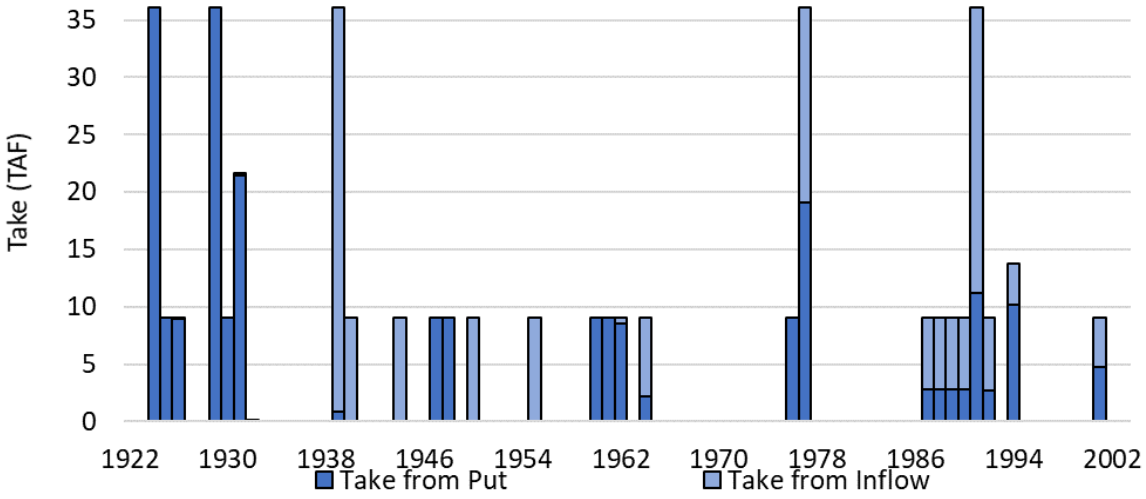
Table A.22 San Joaquin River Exchange Contractor Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	100	
Investor Portion of Construction cost to repay ($M)	$390	$310
Investor Details		
Investor Annual Water Yield (TAF)	5	
Investor Costs		
Total Investment ($M)	$894	$705
Annualized Cost ($M)	$21	$16
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$4,172	$3,262
Unit cost of water, after repayment period ($/AF)	$579	$441

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

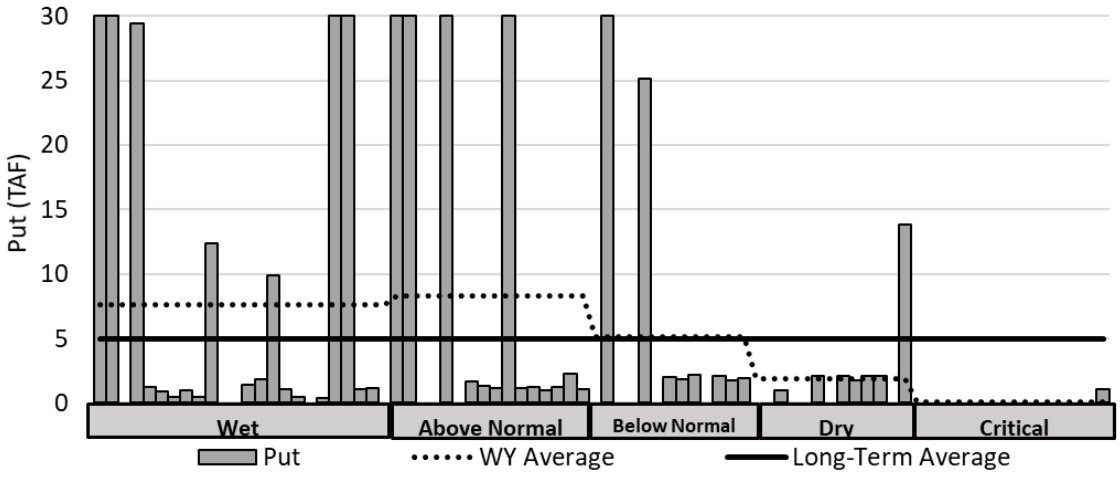


Key: TAF = thousand acre feet
Figure A.70 San Joaquin River Exchange Contractor Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



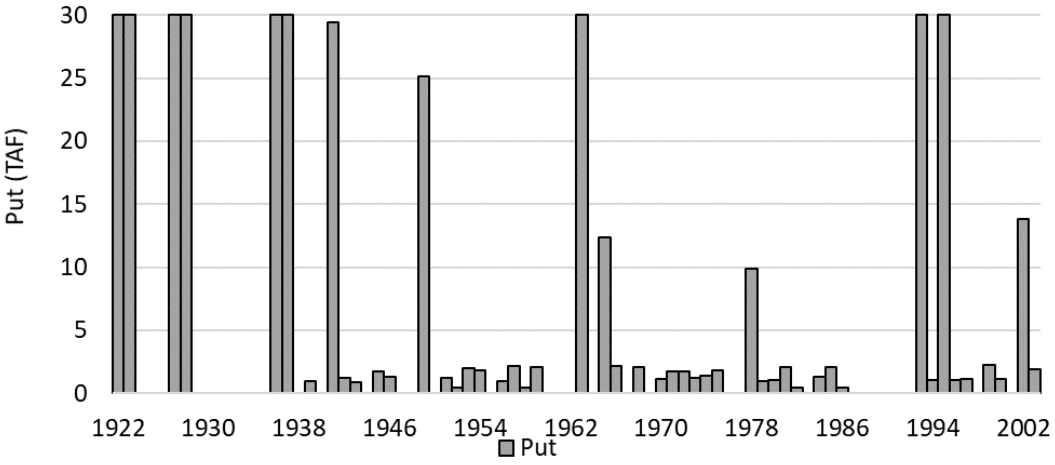
Key: TAF = thousand acre feet

Figure A.71 San Joaquin River Exchange Contractor Annual Take



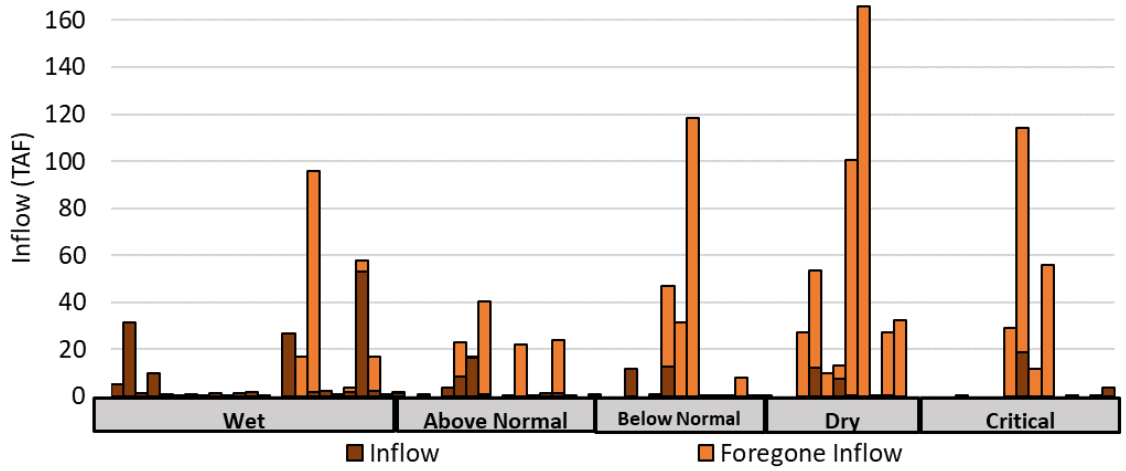
Key: TAF = thousand acre feet

Figure A.72 San Joaquin River Exchange Contractor Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



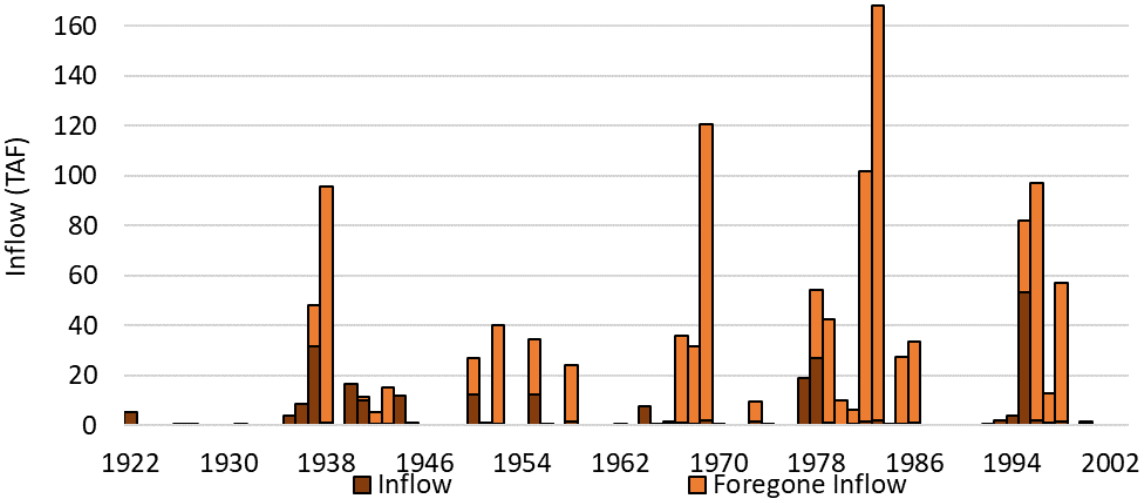
Key: TAF = thousand acre feet

Figure A.73 San Joaquin River Exchange Contractor Annual Put



Key: TAF = thousand acre feet

Figure A.74 San Joaquin River Exchange Contractor Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



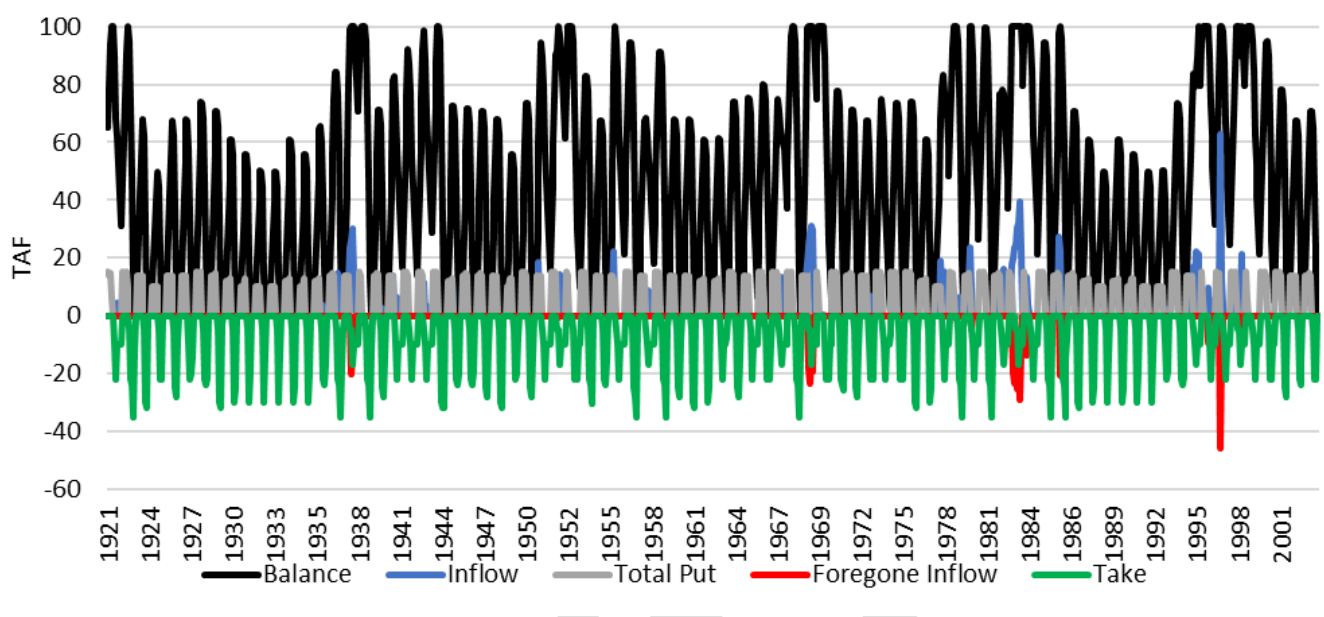
Key: TAF = thousand acre feet

Figure A.75 San Joaquin River Exchange Contractor Annual Inflow and Foregone Inflow

CENTRAL VALLEY PROJECT SOUTH OF DELTA AGRICULTURE CONTRACTORS

Investor Group: Del Puerto Water District, Panoche Water District, San Luis Water District, Tanquility Irrigation District, and Westlands Water District

Investor Storage Account: 100 TAF



Key: TAF = thousand acre feet

Figure A.76 Central Valley Project South of Delta Agriculture Contractors Monthly Operation Trace

Table A.23 Central Valley Project South of Delta Agriculture Contractors Operations Water Year Type Summary

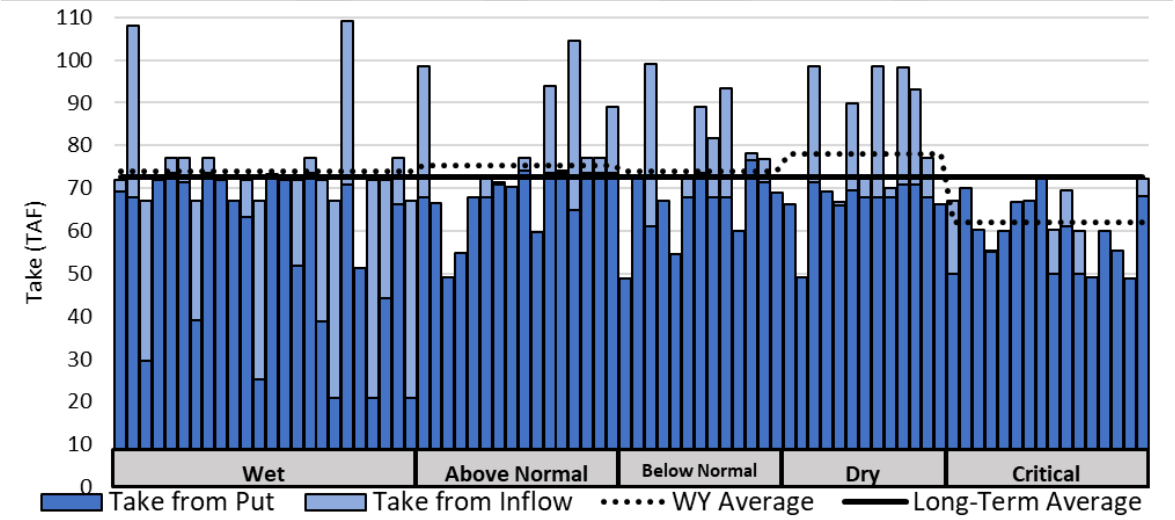
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	27	57	74	55	19	16
Above Normal	5	70	75	68	8	0
Below Normal	3	63	74	66	8	0
Dry	8	68	78	67	11	0
Critical	1	57	62	59	3	0
Long-Term Average	11	62	73	62	11	5

Key:
TAF = thousand acre-feet
WY = water year

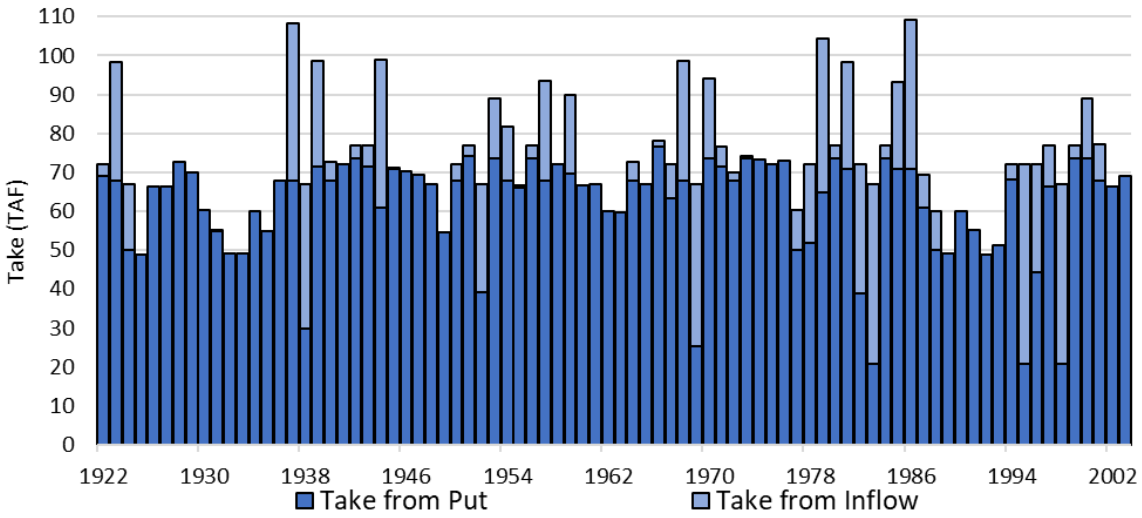
Table A.24 Central Valley Project South of Delta Agriculture Contractors Account Cost Analysis

Component	Small Reservoir	Full Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	100	
Investor Portion of Construction cost to repay ($M)	$390	$310
Investor Details		
Investor Annual Water Yield (TAF)	73	
Investor Costs		
Total Investment ($M)	$894	$705
Annualized Cost ($M)	$21	$16
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$286	$223
Unit cost of water, after repayment period ($/AF)	$40	$30

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet

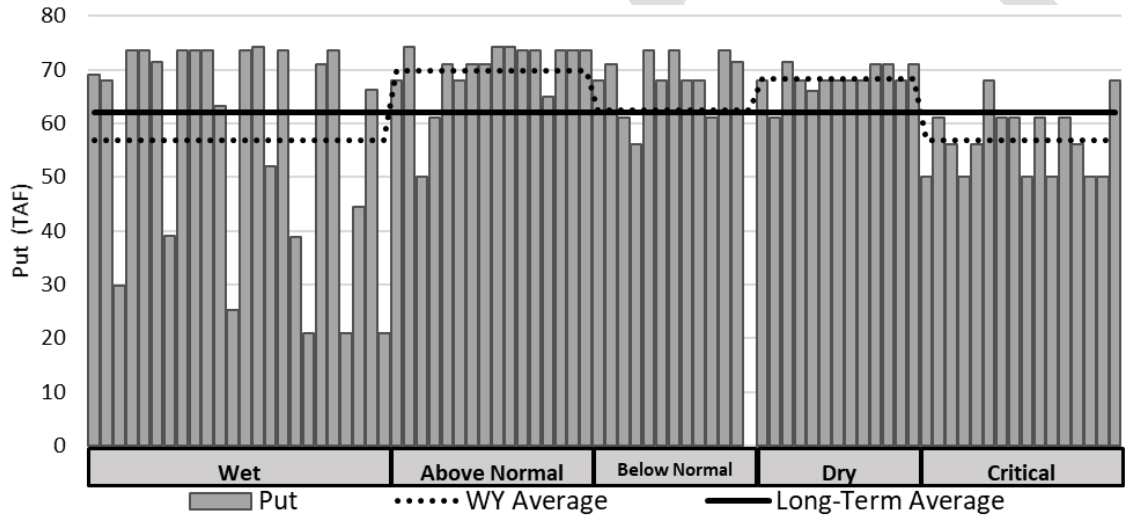


Key: TAF = thousand acre feet
Figure A.77 Central Valley Project South of Delta Agriculture Contractors Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



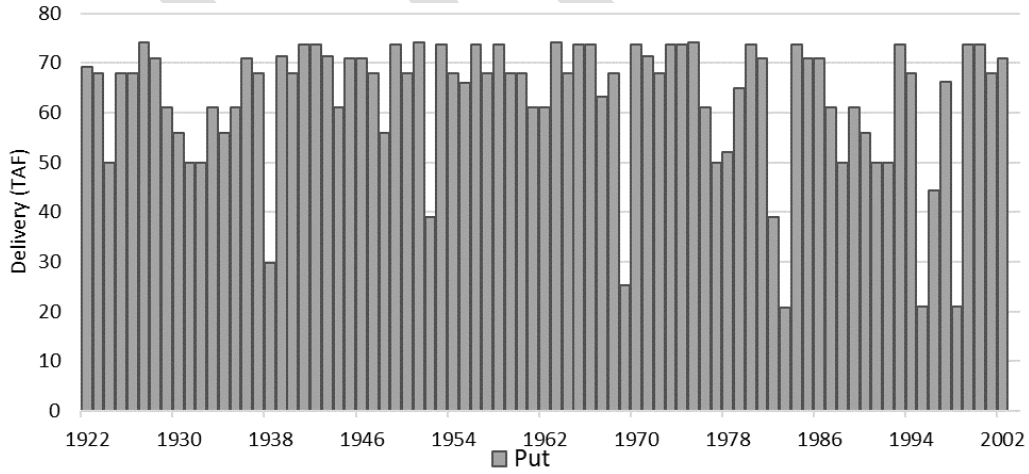
Key: TAF = thousand acre feet

Figure A.78 Central Valley Project South of Delta Agriculture Contractors Annual Take



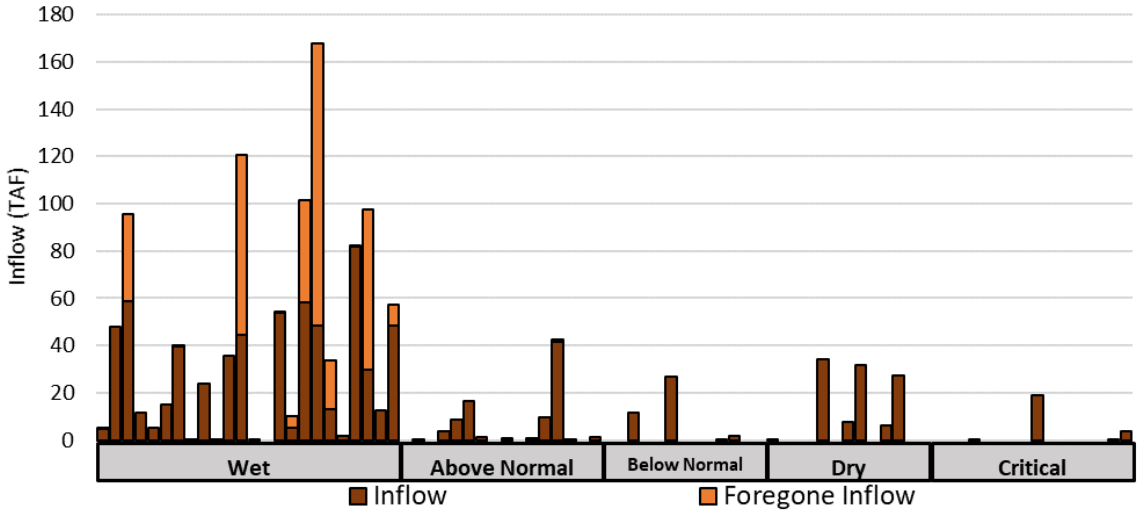
Key: TAF = thousand acre feet

Figure A.79 Central Valley Project South of Delta Agriculture Contractors Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



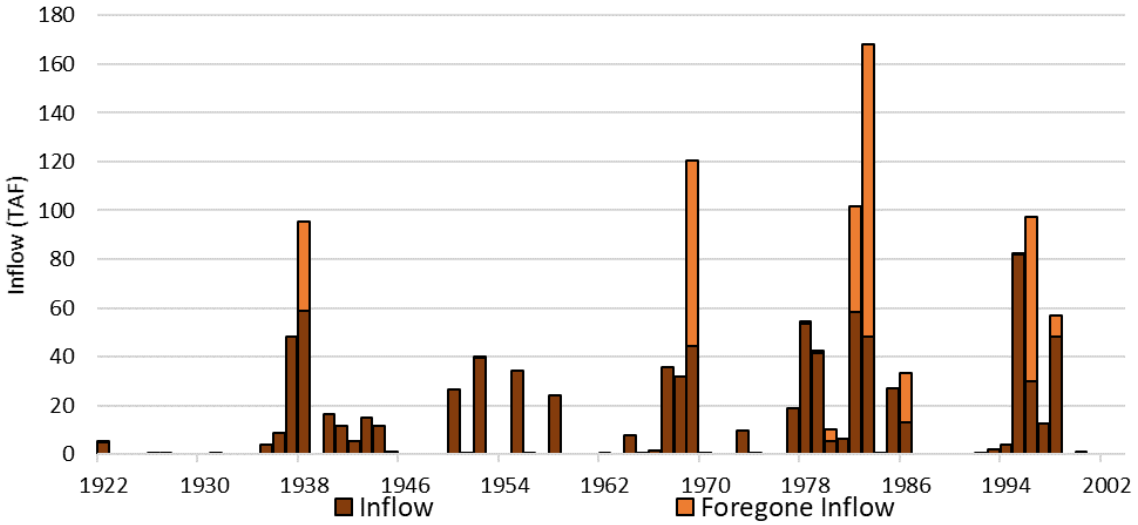
Key: TAF = thousand acre feet

Figure A.80 Central Valley Project South of Delta Agriculture Contractors Annual Put



Key: TAF = thousand acre feet

Figure A.81 Central Valley Project South of Delta Agriculture Contractors Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure A.82 Central Valley Project South of Delta Agriculture Contractors Annual Inflow and Foregone Inflow

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APPENDIX B – COMBINED ACCOUNT OPERATION SCENARIOS

The MOU Group combined account operation was evaluated under a range of operating conditions to test the sensitivity of the account's management under different regulatory conditions and conveyance facilities. For all scenarios, the existing operating capacity of Millerton Reservoir is preserved, and the individual investor storage account operations are maintained. This gives a conservative estimate of the benefits, which would likely increase if individual investor storage account operations were optimized under each scenario. Table B.1 summarizes the combined account operation scenarios. The following sections summarize the results of the combined account operations scenarios. An example storage account cost analysis was also calculated for each scenario. For cost estimates, 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed 50 years with annual interest rate of 2.875 percent, $0 upfront cash, and repayment period beginning after completion of construction. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only.

Table B.1. Summary of Combined Account Operation Scenarios

Operating Conditions	Scenario										
	MOU Initial	2	2A	3	3A	3B	3C	3D	3E	3F	3G
Existing Millerton Operations	Included										
Individual Investor Operation	Included										
Regulatory Conditions	COA Amendment							COA Amendment with ROConLTO			
Friant Physical Facilities	Historical Demands	Historical Demands with Additional 3,000 cfs Demand									
Unassigned Storage (275 TAF)	Not Used	Whitelands	Outside Participant								
Delta Surplus Supply	Not Used				Used	Not Used	Used	Not Used	Used	Not used	Used
Trans-Valley Conveyance Capacity	250 cfs					1,000 cfs		250 cfs		1,000 cfs	
	MOU Initial	2	2A	3	3A	3B	3C	3D	3E	3F	3G
	Scenario										

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
MOU = Memorandum of Understanding
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
SOD = South of Delta
TAF = thousand acre-feet
Whitelands = The storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies

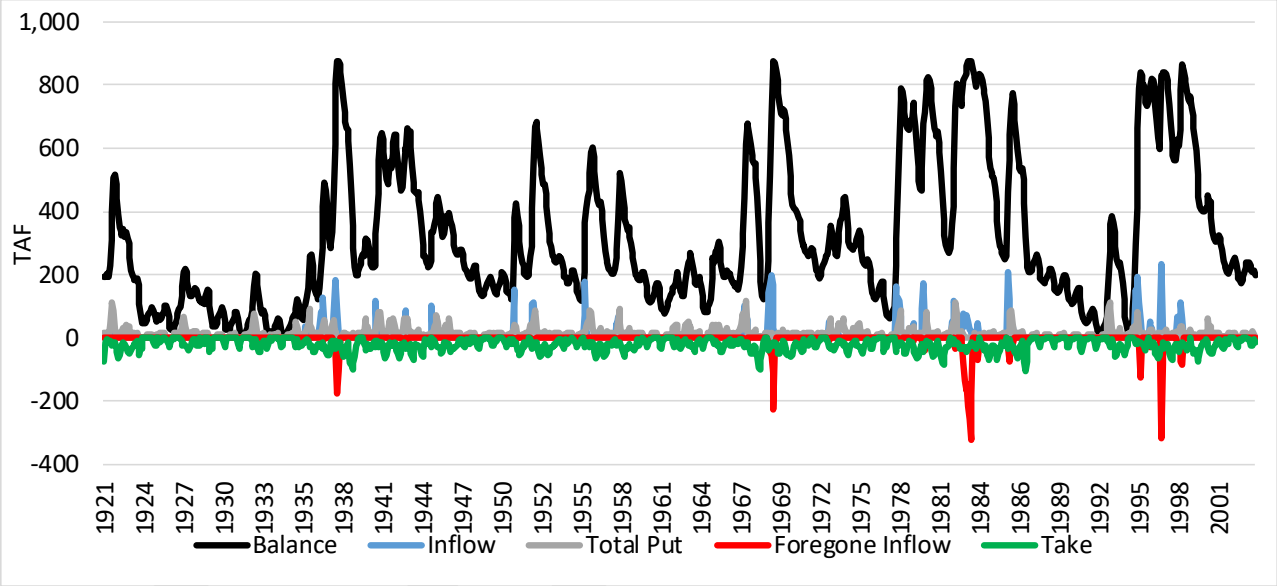
MEMORANDUM OF UNDERSTANDING INITIAL SCENARIO

Combined Storage Account: 875 TAF

Table B.2 Memorandum of Understanding Initial Scenario Operating Conditions

Operating Conditions	Scenario
	MOU Initial
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands
Unassigned Storage (275 TAF)	Not Used
Delta Surplus Supply	Not Used
Trans-Valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
MOU = Memorandum of Understanding
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.1 Memorandum of Understanding Initial Scenario Monthly Operations Trace

Table B.3 Memorandum of Understanding Initial Scenario Water Year Type Summary

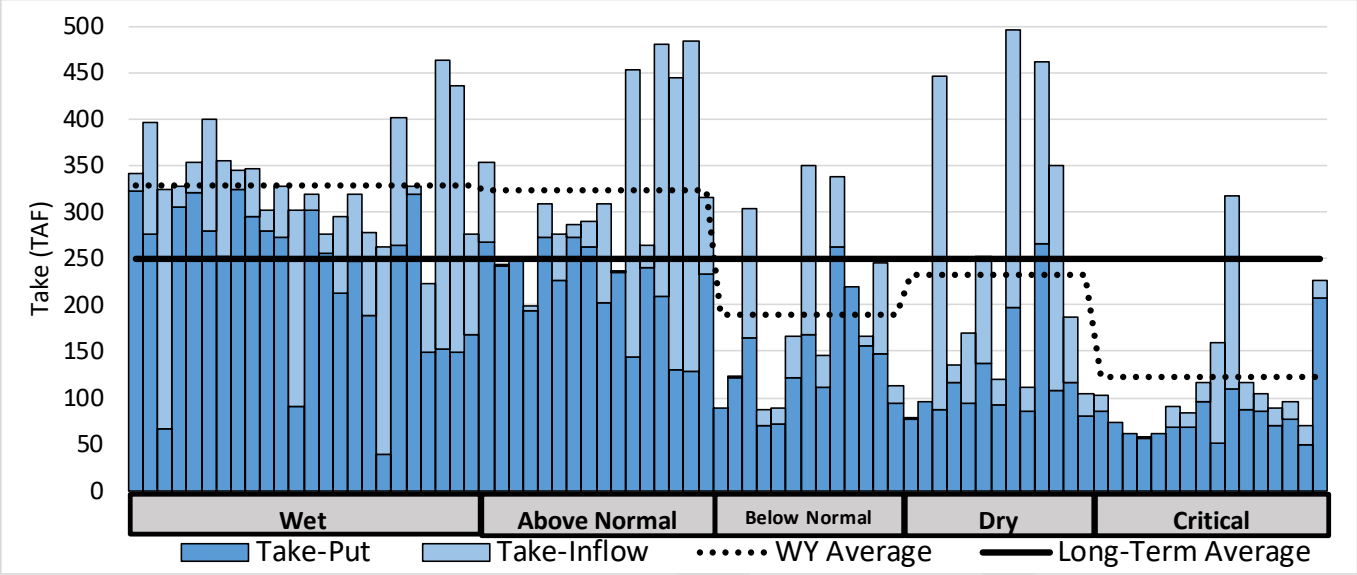
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	218	273	328	227	101	271
Above Normal	43	226	323	219	104	19
Below Normal	26	131	189	139	50	10
Dry	65	98	233	121	113	30
Critical	13	61	123	87	35	4
Long-Term Average	89	172	250	167	83	90

Key:
TAF = thousand acre-feet WY = water year

Table B.4 Memorandum of Understanding Initial Scenario Cost Analysis

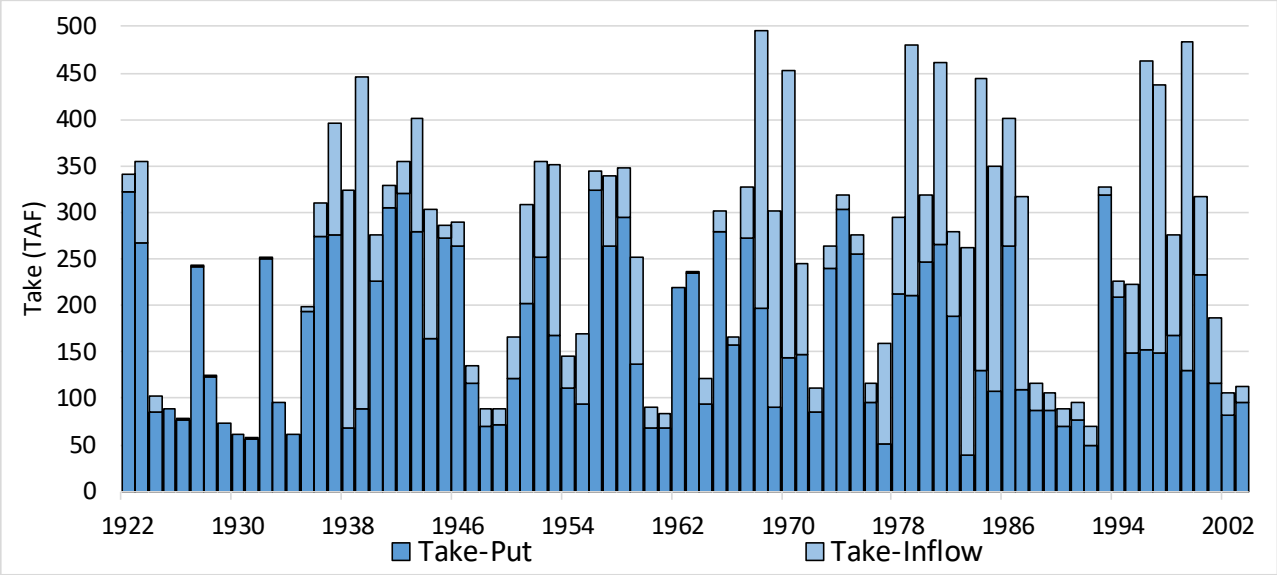
Component	Small Reservoir	Full-Size Reservoir
Potential Investor Storage Account		
Total Temperance Flat Storage (TAF)[1]	1,055	1,330
Total Temperance Flat Available Storage (TAF)	875	1,150
Investor Storage Account Size (TAF)	875	875
Investor Portion of Construction cost to repay ($M)	$3,411	$3,569
Investor Details		
Investor Annual Water Yield (TAF)	250	250
Investor Costs		
Total Investment ($M)	$7,821	$6,172
Annualized Cost ($M)	$183	$143
Investor Unit Costs		
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$730	$571
Unit cost of water, after repayment period ($/AF)	$101	$77

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



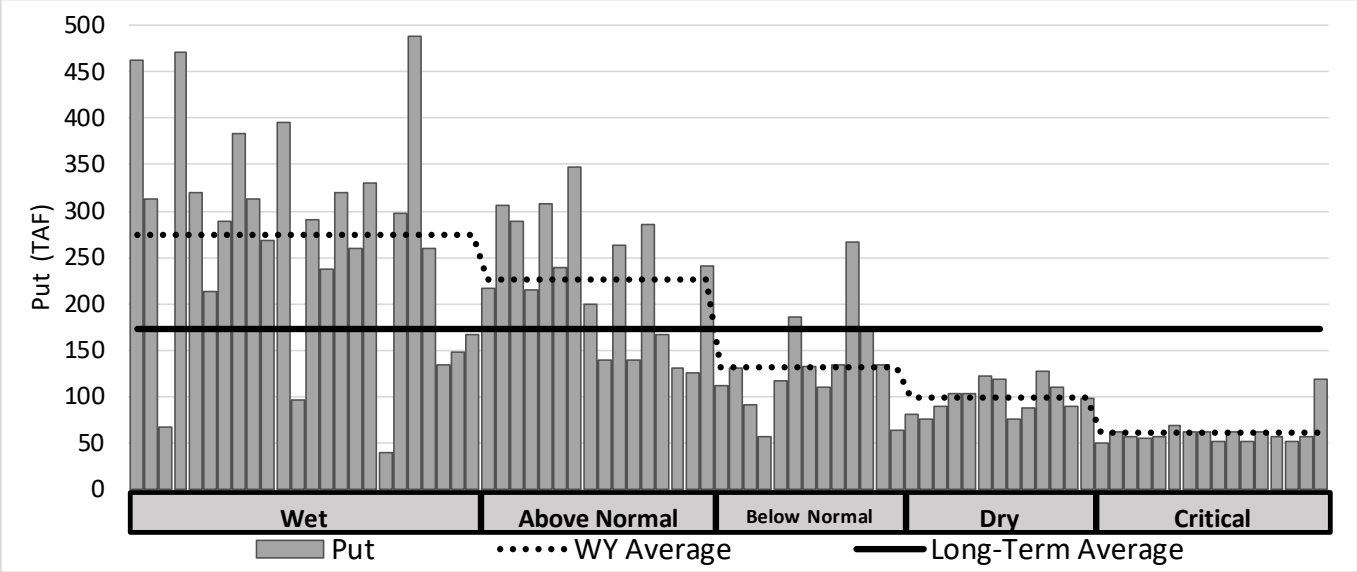
Key: TAF = thousand acre feet

Figure B.2 Memorandum of Understanding Initial Scenario Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



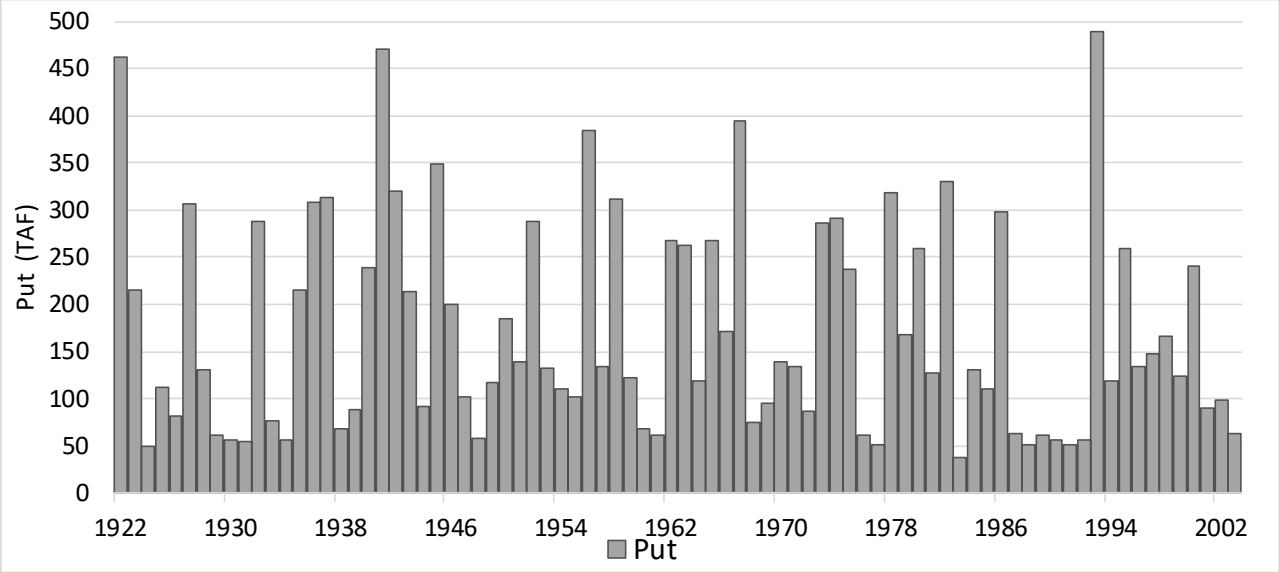
Key: TAF = thousand acre feet

Figure B.3 Memorandum of Understanding Initial Scenario Annual Take



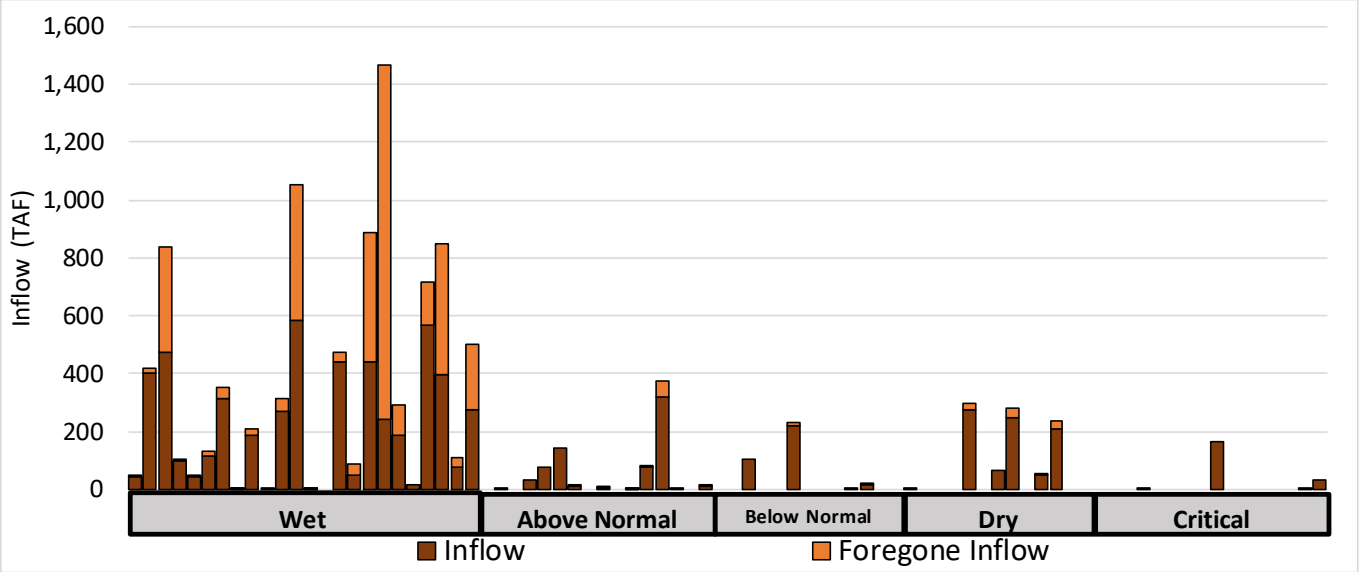
Key: TAF = thousand acre feet

Figure B.4 Memorandum of Understanding Initial Scenario Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



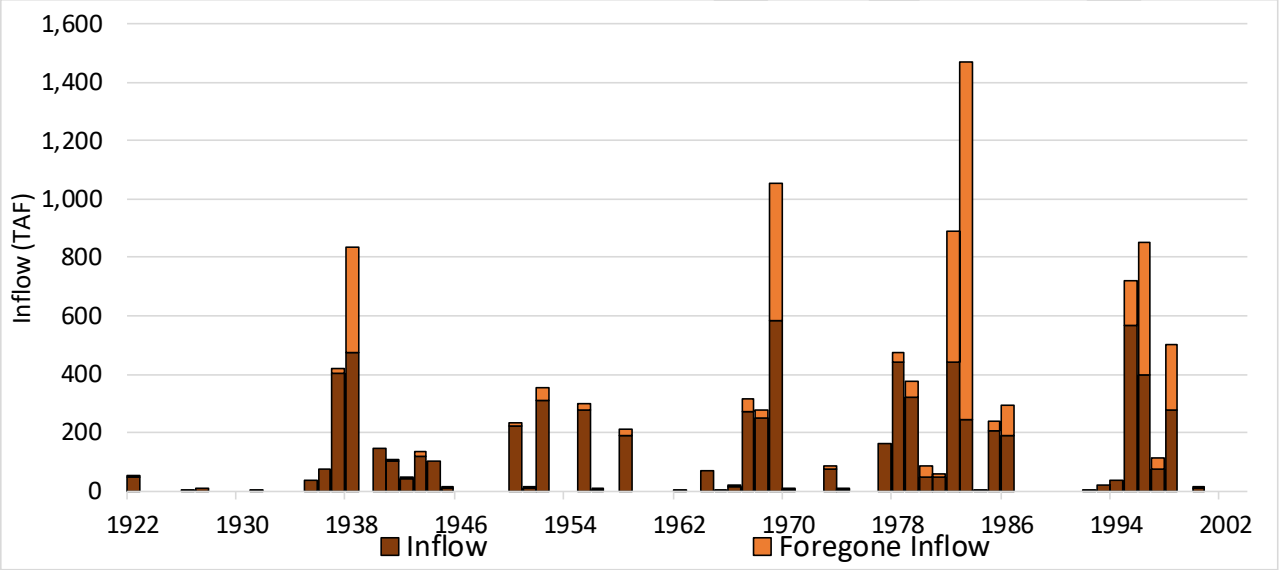
Key: TAF = thousand acre feet

Figure B.5 Memorandum of Understanding Initial Scenario Annual Put



Key: TAF = thousand acre feet

Figure B.6 Memorandum of Understanding Initial Scenario Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.7 Memorandum of Understanding Initial Scenario Annual Inflow and Foregone Inflow

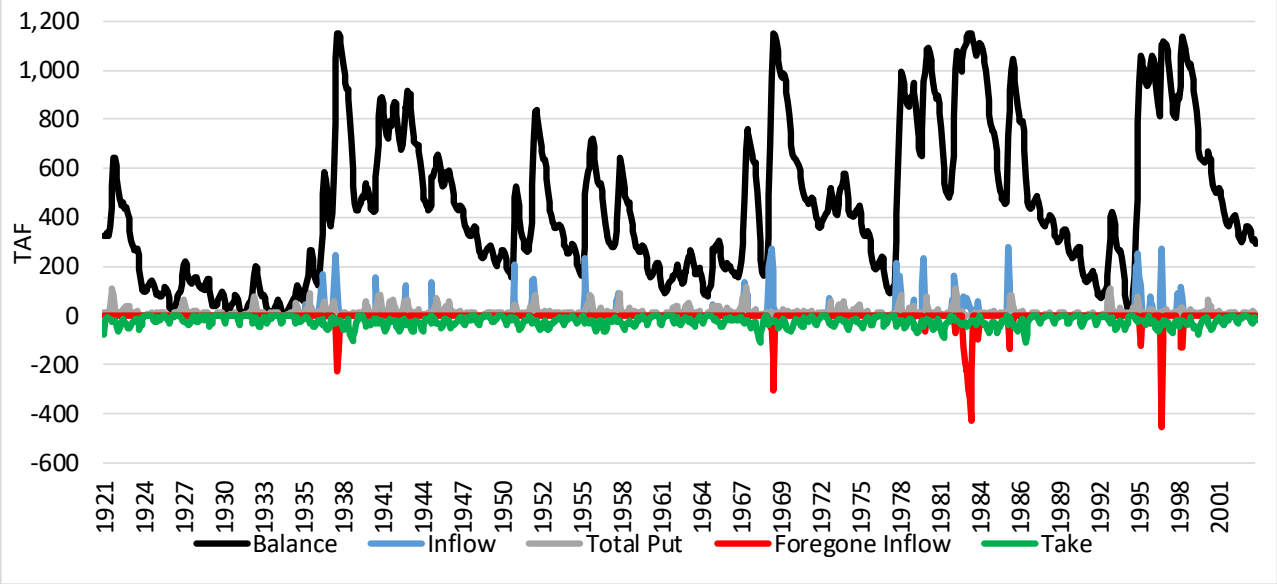
SCENARIO 2

Combined Storage Account: 1,150 TAF

Table B.5 Scenario 2 Operating Conditions

Operating Conditions	Scenario 2
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands
Unassigned Storage (275 TAF)	Whitelands
Delta Surplus Supply	Not Used
Trans-Valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
TAF = thousand acre-feet
Whitelands = The storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies



Key: TAF = thousand acre feet
Figure B.8 Scenario 2 Monthly Operations Trace

Table B.6 Scenario 2 Water Year Type Summary

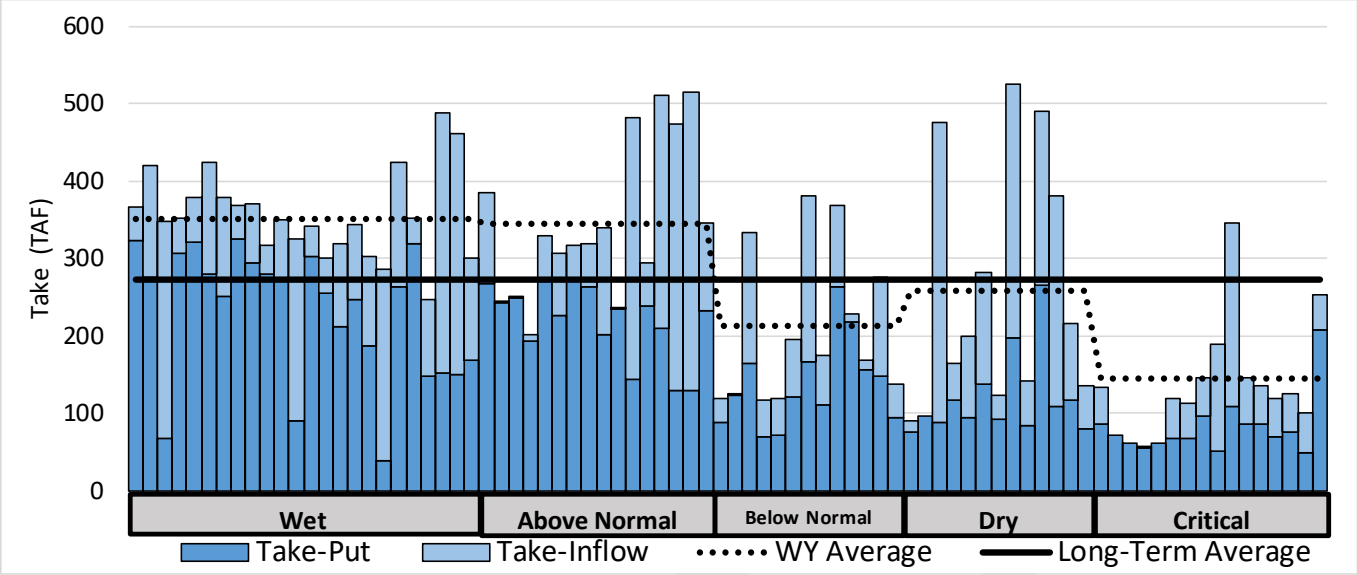
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	282	273	352	227	125	208
Above Normal	58	226	345	219	126	4
Below Normal	35	131	213	139	74	1
Dry	88	98	257	121	137	7
Critical	17	61	145	87	58	0
Long-Term Average	116	172	273	167	106	63

Key:
TAF = thousand acre-feet WY = water year

Table B.7 Scenario 2 Cost Analysis

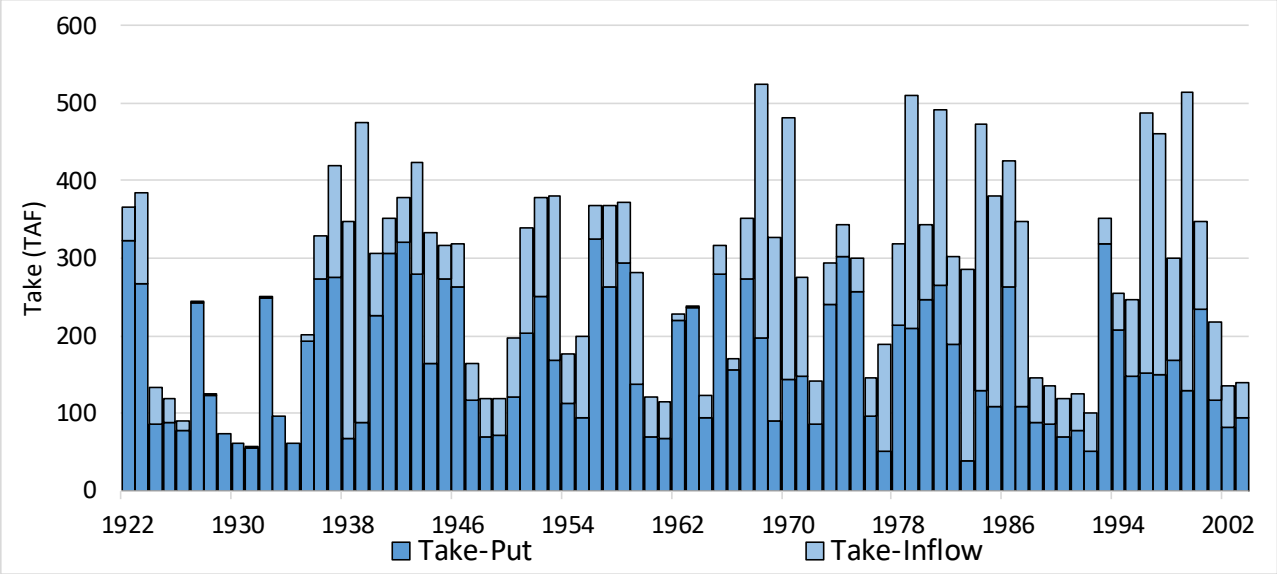
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	273
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$687
Unit cost of water, after repayment period ($/AF)	$93

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



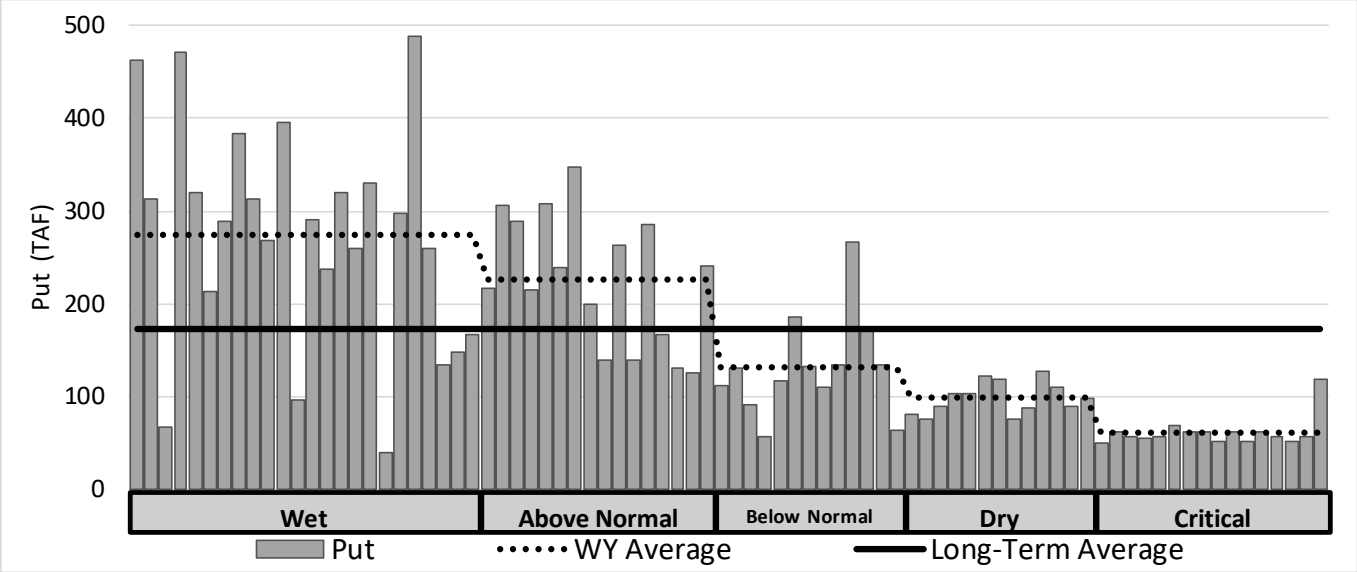
Key: TAF = thousand acre feet

Figure B.9 Scenario 2 Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



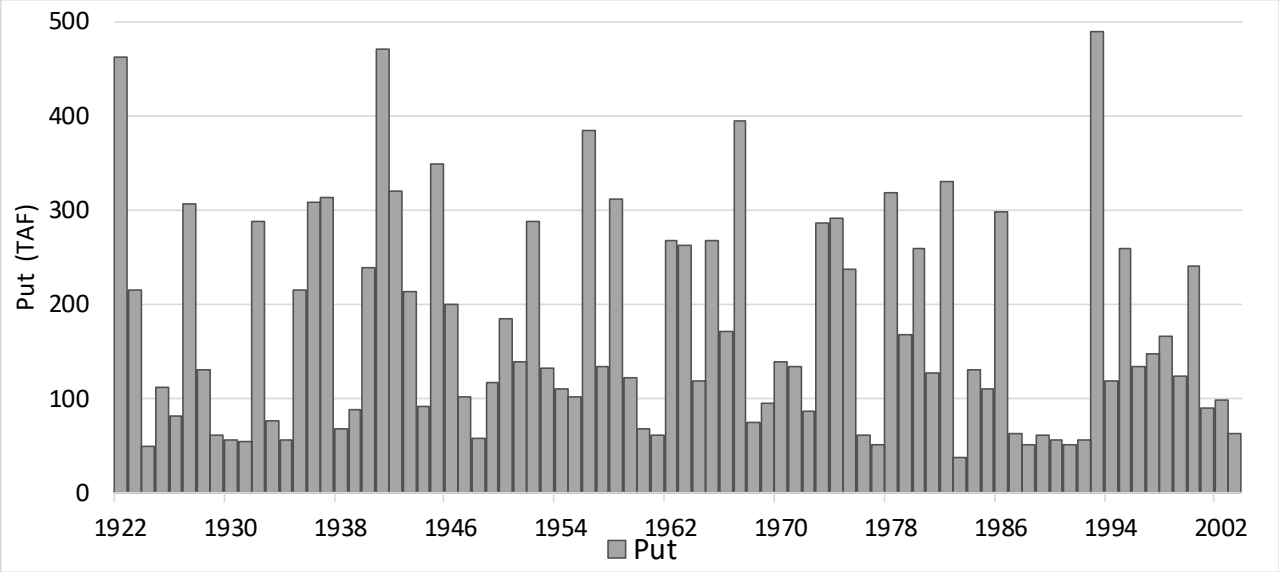
Key: TAF = thousand acre feet

Figure B.10 Scenario 2 Annual Take



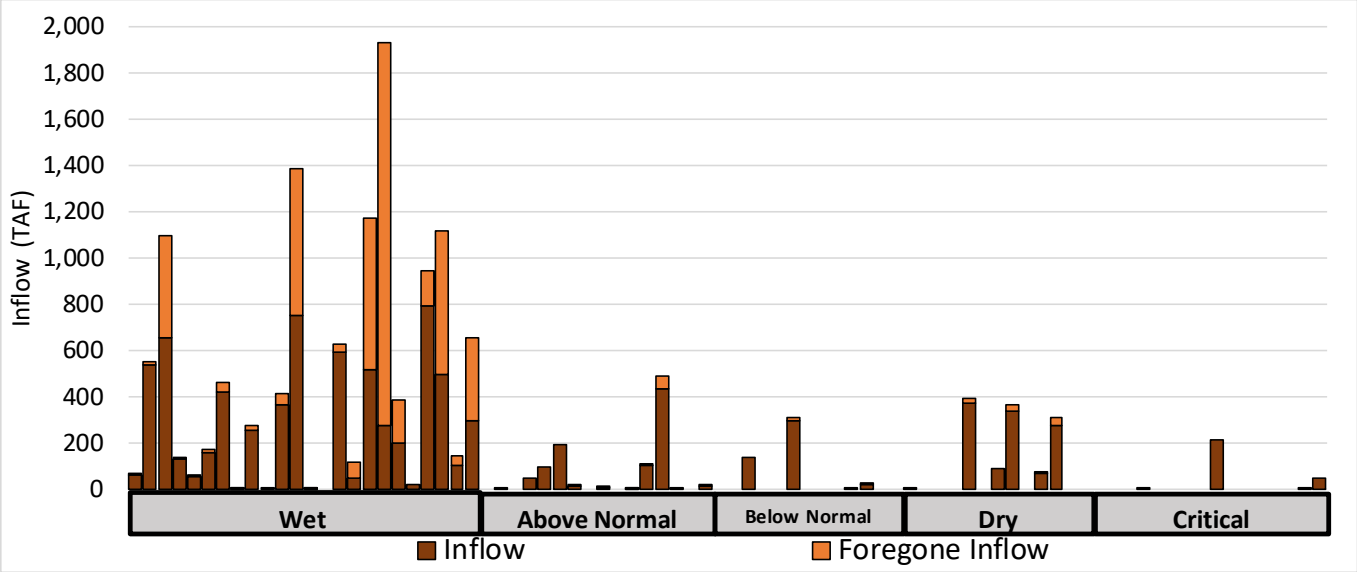
Key: TAF = thousand acre feet

Figure B.11 Scenario 2 Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



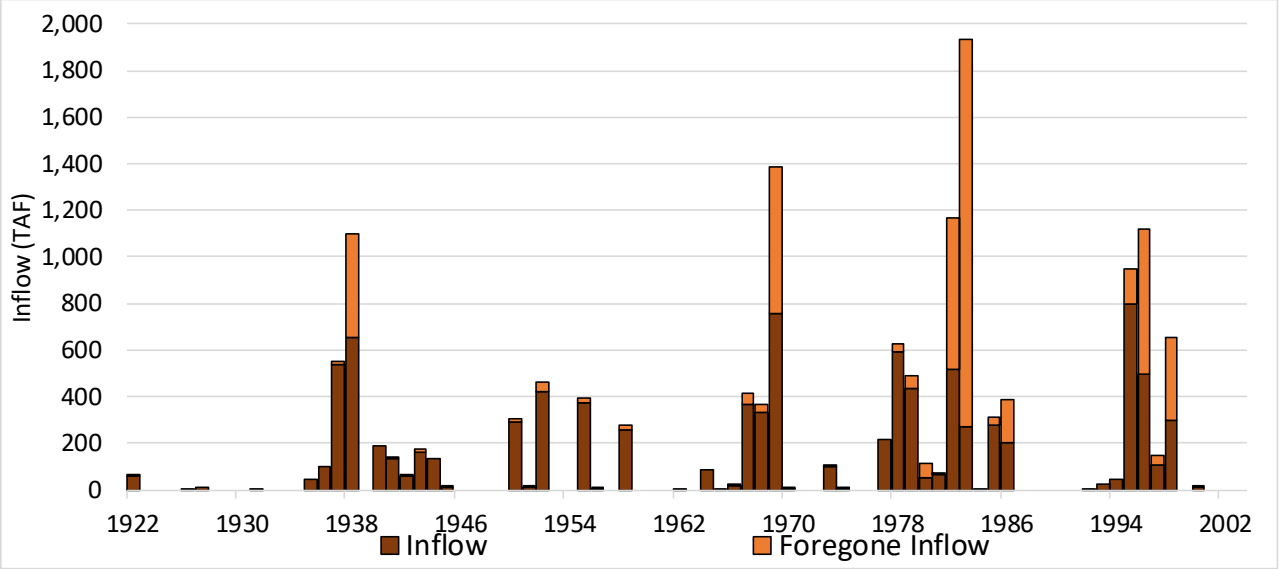
Key: TAF = thousand acre feet

Figure B.12 Scenario 2 Annual Put



Key: TAF = thousand acre feet

Figure B.13 Scenario 2 Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.14 Scenario 2 Annual Inflow and Foregone Inflow

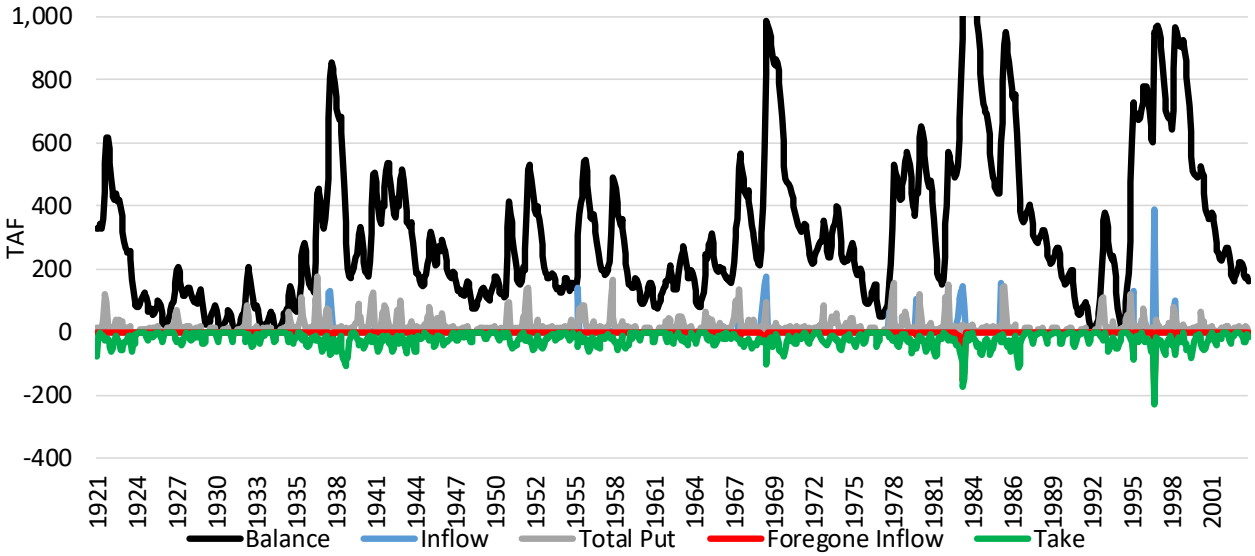
SCENARIO 2A

Combined Storage Account: 1,150 TAF

Table B.8 Scenario 2A Operating Conditions

Operating Conditions	Scenario
	2A
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Whitelands
Delta Surplus Supply	Not Used
Trans-Valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
TAF = thousand acre-feet
Whitelands = The storage was simulated as an account to represent the neighboring lands of CVP Friant Division lands not located within CVP Friant Division agencies



Key: TAF = thousand acre feet
Figure B.15 Scenario 2A Monthly Operations Trace

Table B.9 Scenario 2A Water Year Type Summary

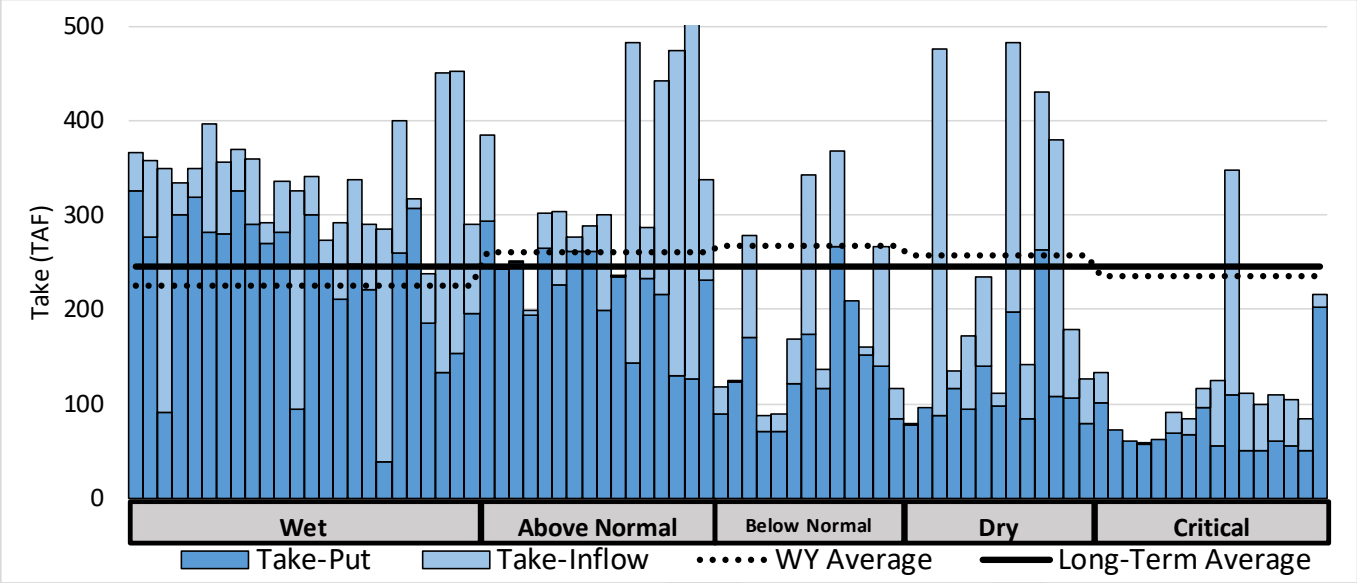
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	102	515	459	407	52	73
Above Normal	6	349	418	372	46	1
Below Normal	4	200	217	205	12	0
Dry	44	167	264	216	48	1
Critical	4	79	142	116	27	0
Long-Term Average	45	211	245	199	46	14

Key:
TAF = thousand acre-feet
WY = water year

Table B.10 Scenario 2A Cost Analysis

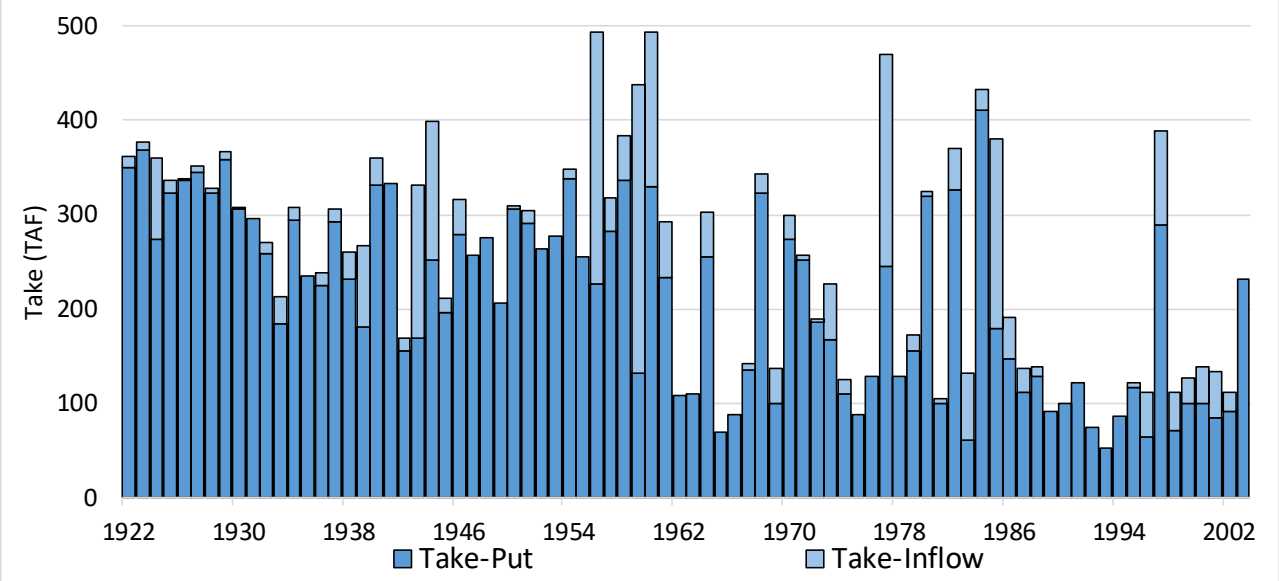
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	245
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$766
Unit cost of water, after repayment period ($/AF)	$103

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



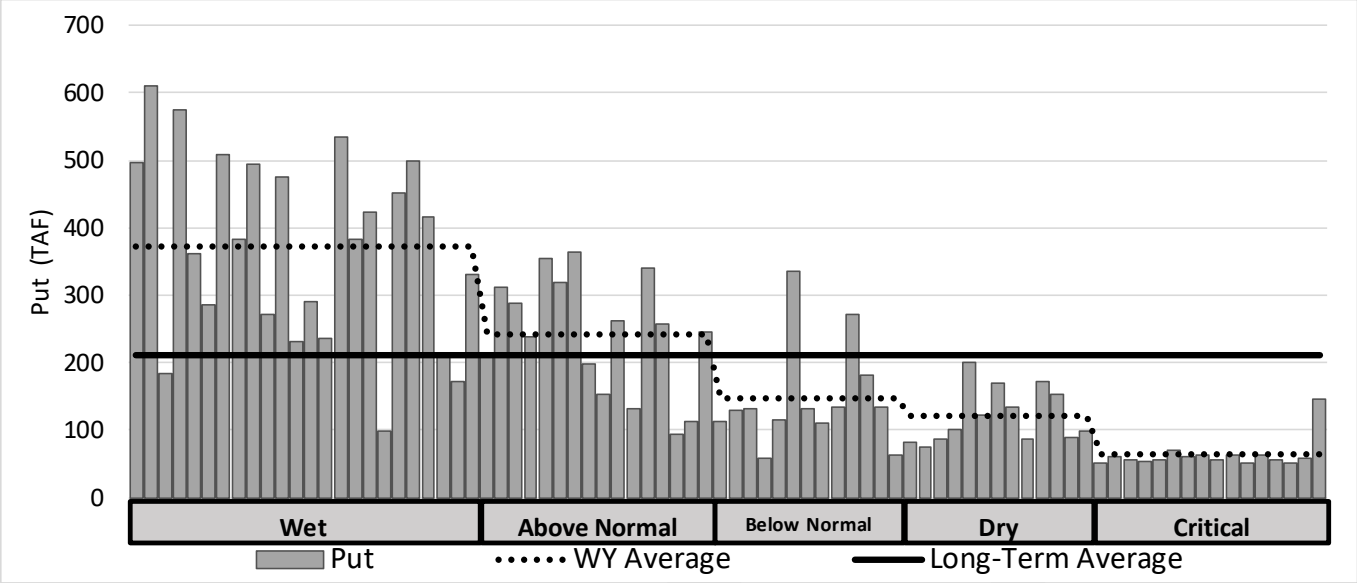
Key: TAF = thousand acre feet

Figure B.16 Scenario 2A Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



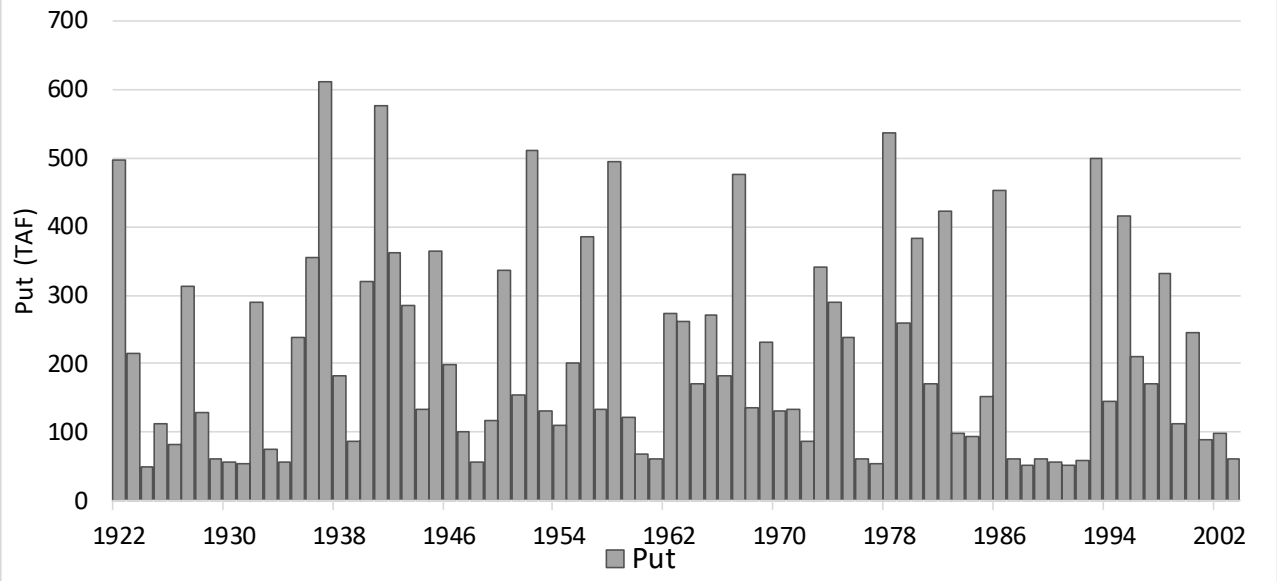
Key: TAF = thousand acre feet

Figure B.17 Scenario 2A Annual Take



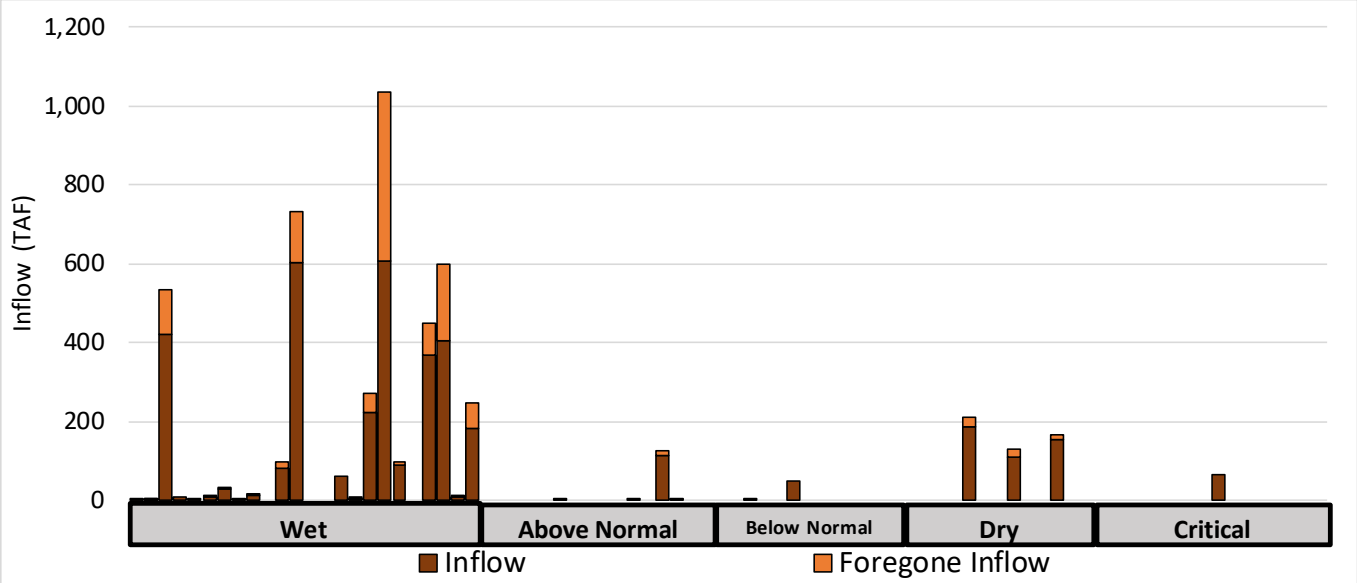
Key: TAF = thousand acre feet

Figure B.18 Scenario 2A Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



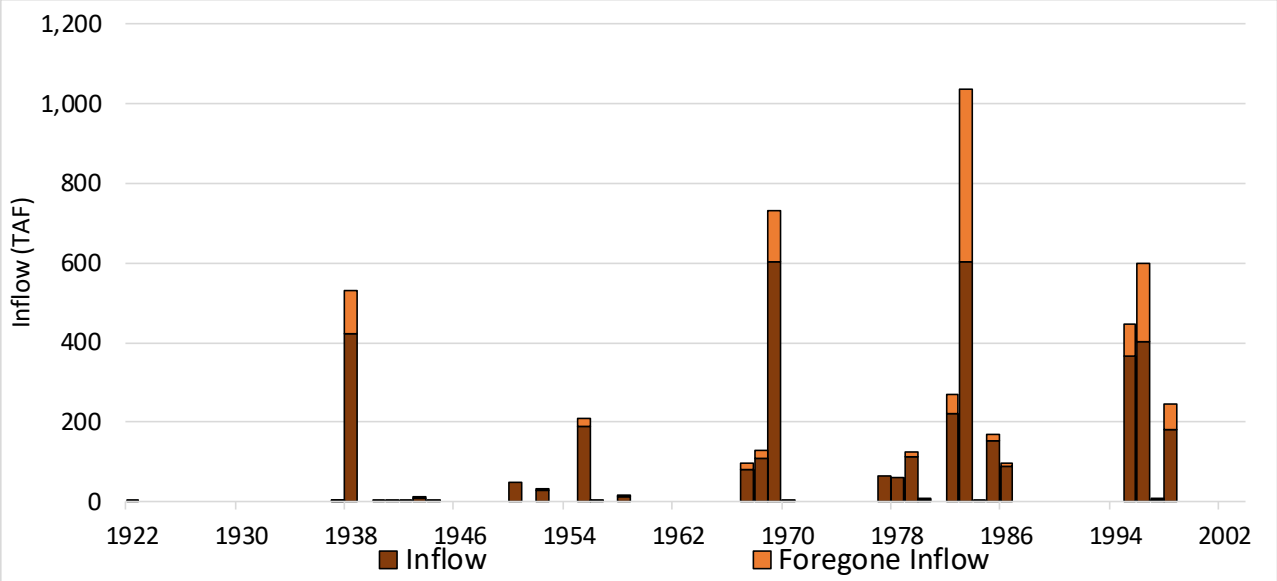
Key: TAF = thousand acre feet

Figure B.19 Scenario 2A Annual Put



Key: TAF = thousand acre feet

Figure B.20 Scenario 2A Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.21 Scenario 2A Annual Inflow and Foregone Inflow

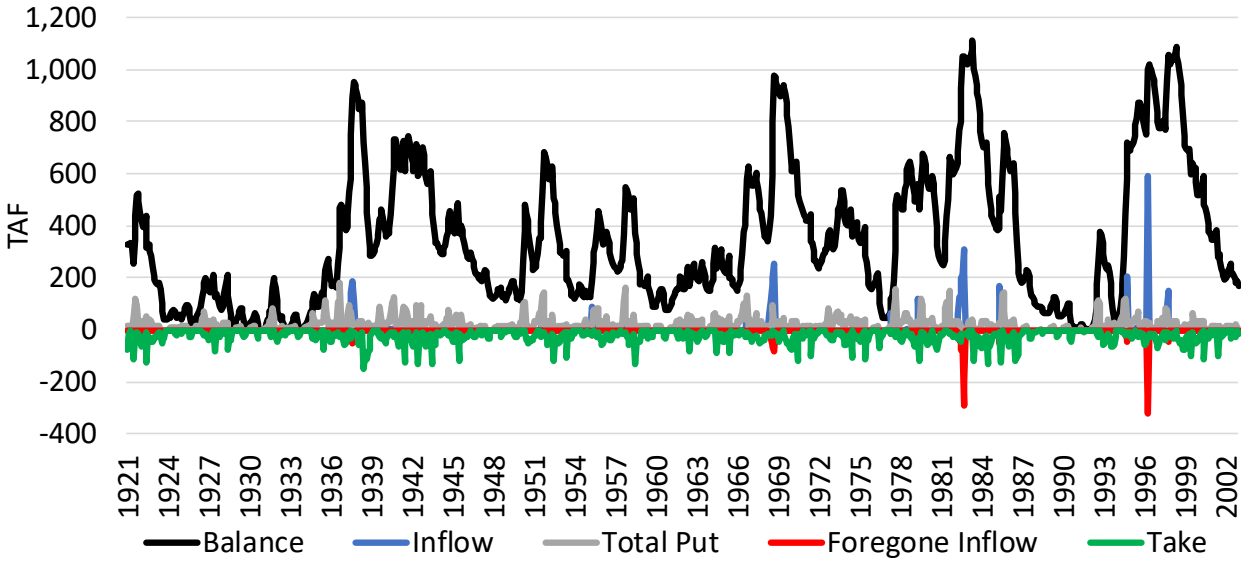
SCENARIO 3

Combined Storage Account: 1,150 TAF

Table B.11 Scenario 3 Operating Conditions

Operating Conditions	Scenario
	3
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Not Used
Trans-Valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
TAF = thousand acre-feet



Key: TAF = thousand acre feet
Figure B.22 Scenario 3 Monthly Operations Trace

Table B.12 Scenario 3 Water Year Type Summary

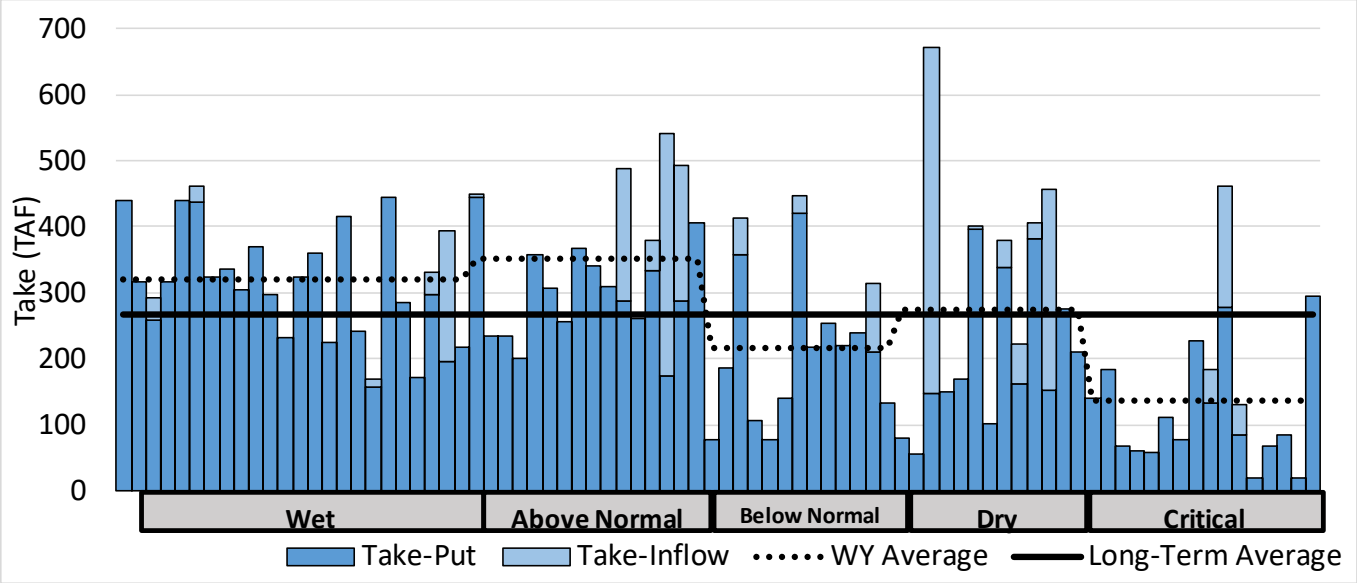
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	107	447	321	308	13	75
Above Normal	6	300	352	300	52	3
Below Normal	3	171	217	203	14	1
Dry	18	126	275	202	74	7
Critical	3	56	137	119	18	1
Long-Term Average	36	247	267	236	31	24

Key:
TAF = thousand acre-feet WY = water year

Table B.13 Scenario 3 Cost Analysis

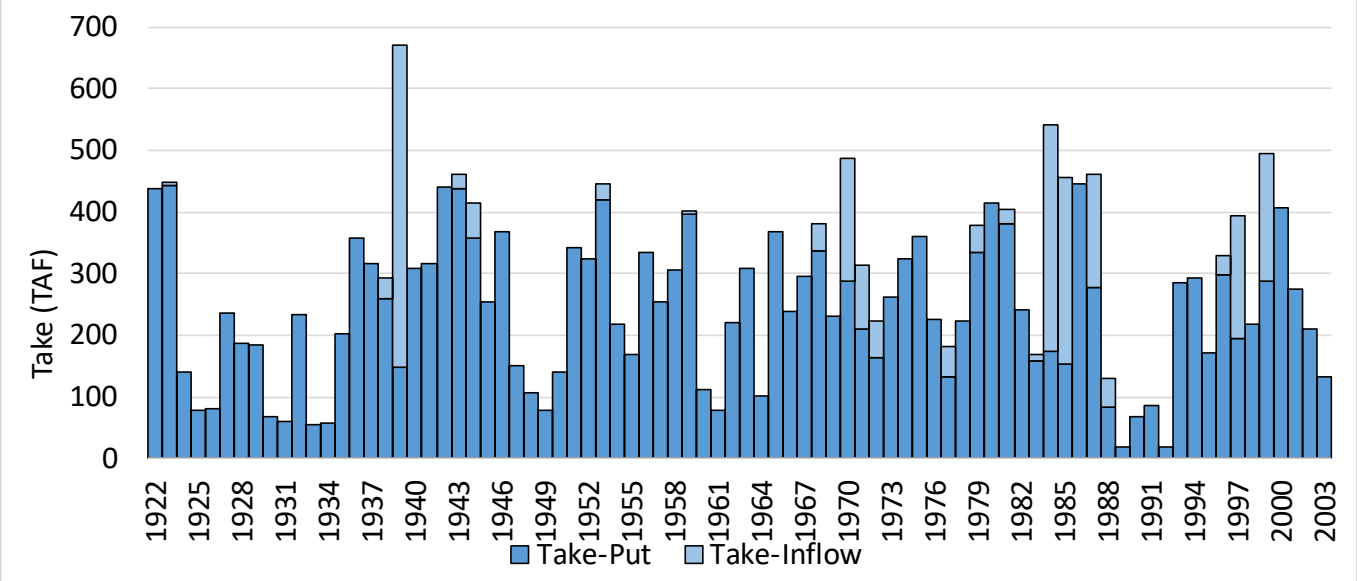
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	267
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$703
Unit cost of water, after repayment period ($/AF)	$95

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



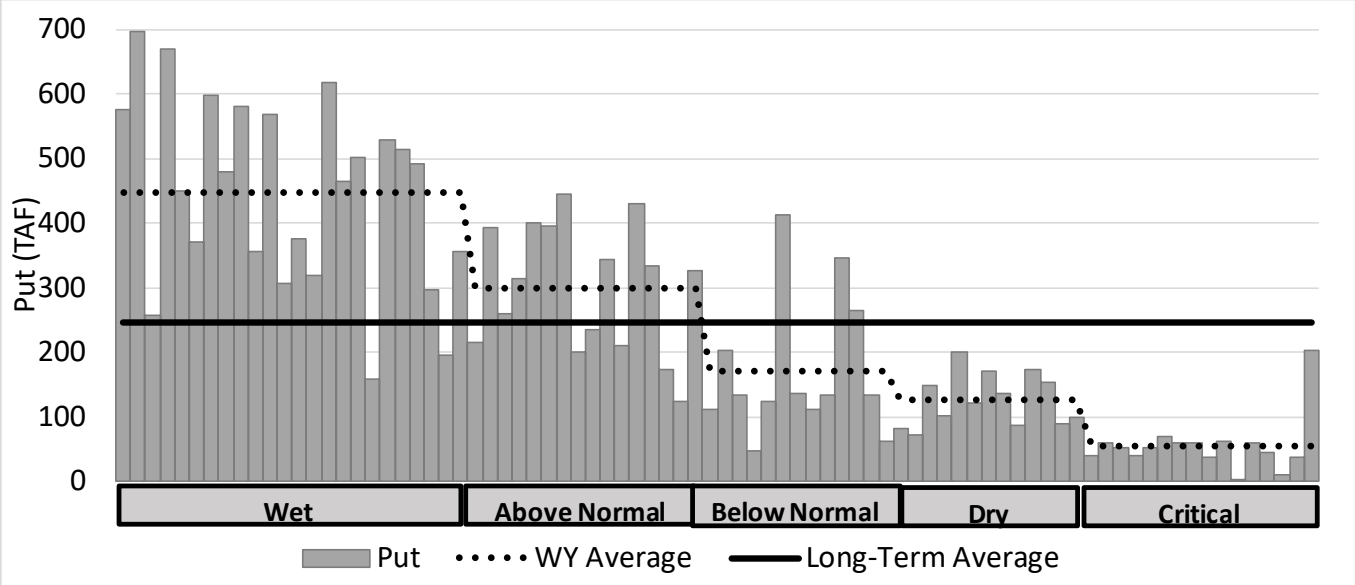
Key: TAF = thousand acre feet

Figure B.23 Scenario 3 Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



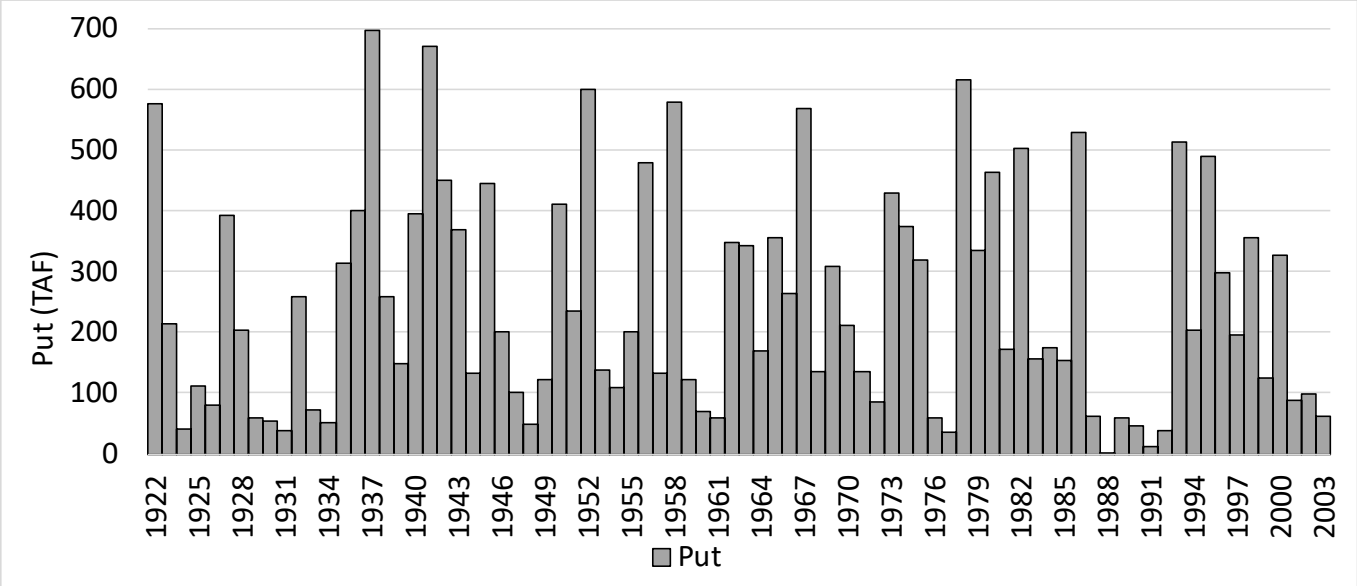
Key: TAF = thousand acre feet

Figure B.24 Scenario 3 Annual Take



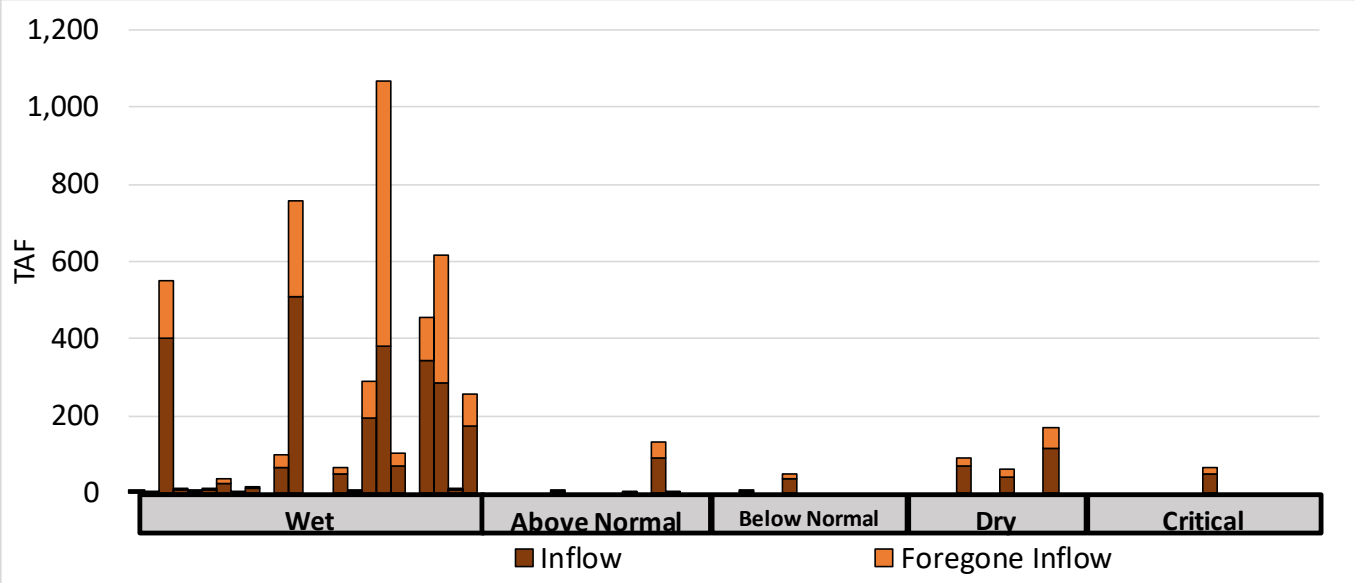
Key: TAF = thousand acre feet

Figure B.25 Scenario 3 Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



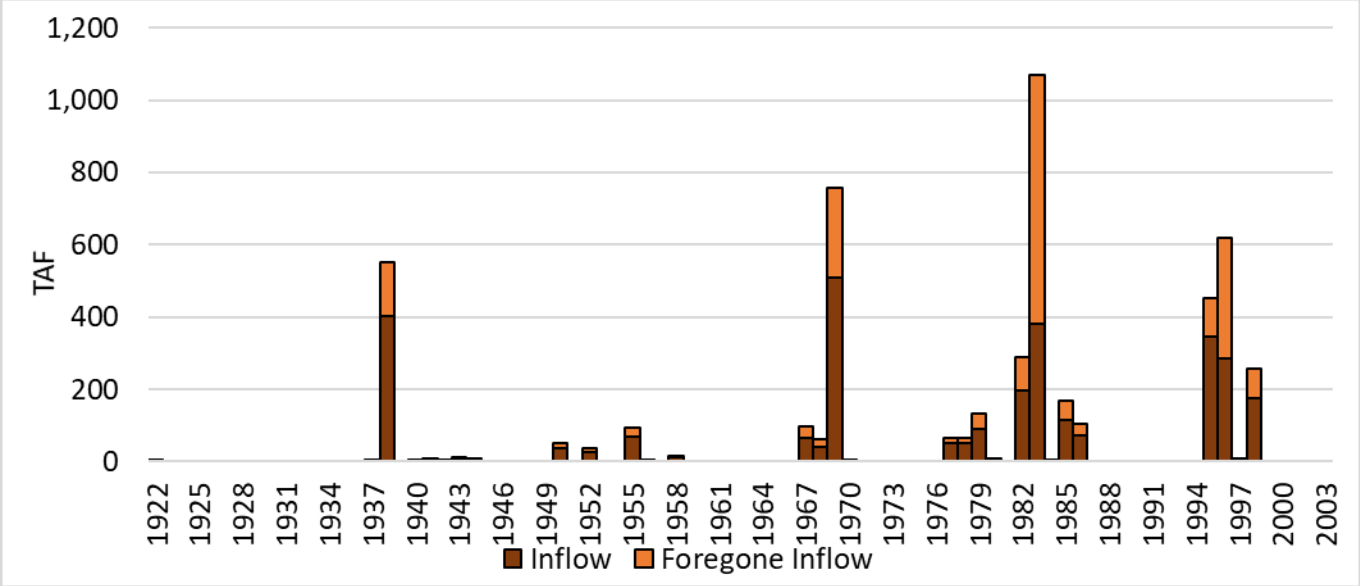
Key: TAF = thousand acre feet

Figure B.26 Scenario 3 Annual Put



Key: TAF = thousand acre feet

Figure B.27 Scenario 3 Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.28 Scenario 3 Annual Inflow and Foregone Inflow

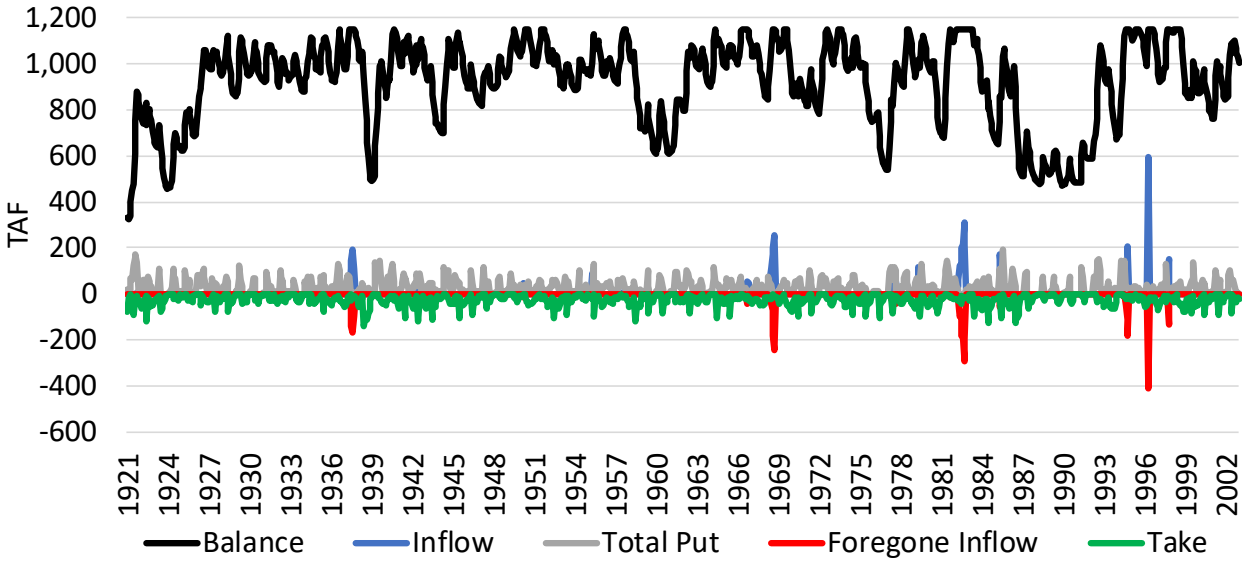
SCENARIO 3A

Combined Storage Account: 1,150 TAF

Table B.14 Scenario 3A Operating Conditions

Operating Conditions	Scenario
	3A
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Used
Trans-Valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.29 Scenario 3A Monthly Operations Trace

Table B.15 Scenario 3A Water Year Type Summary

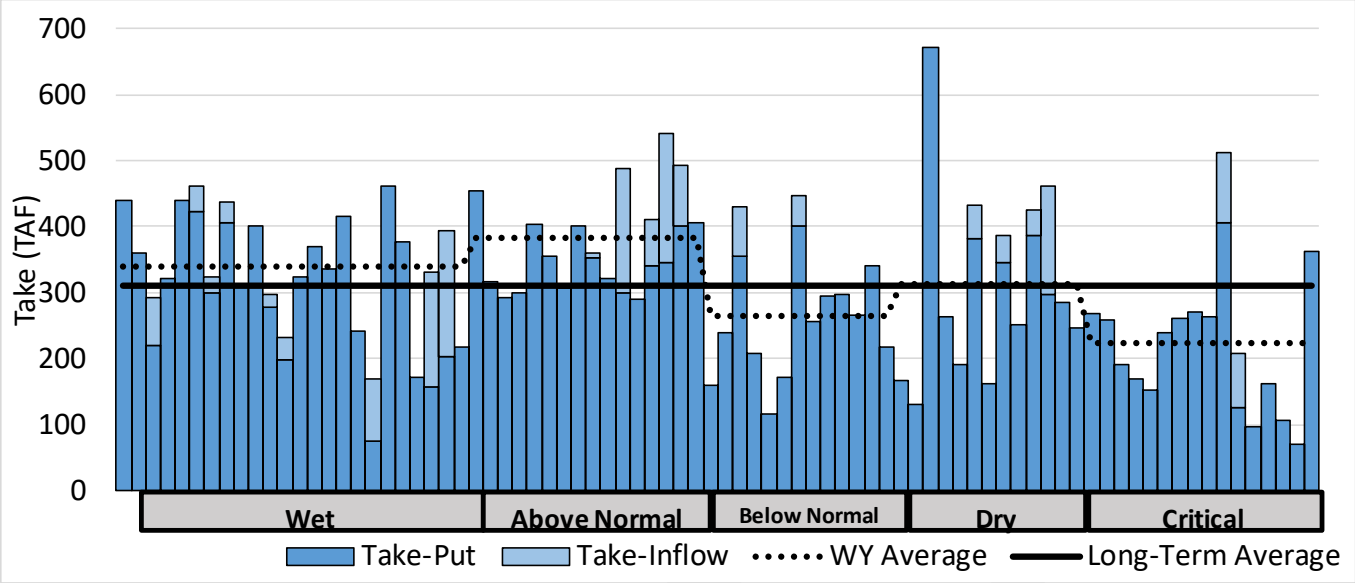
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	45	377	338	310	28	137
Above Normal	5	384	384	349	35	3
Below Normal	3	329	265	256	9	2
Dry	17	286	313	291	23	8
Critical	3	192	225	213	12	1
Long-Term Average	18	320	309	287	22	42

Key:
TAF = thousand acre-feet
WY = water year

Table B.16 Scenario 3A Cost Analysis

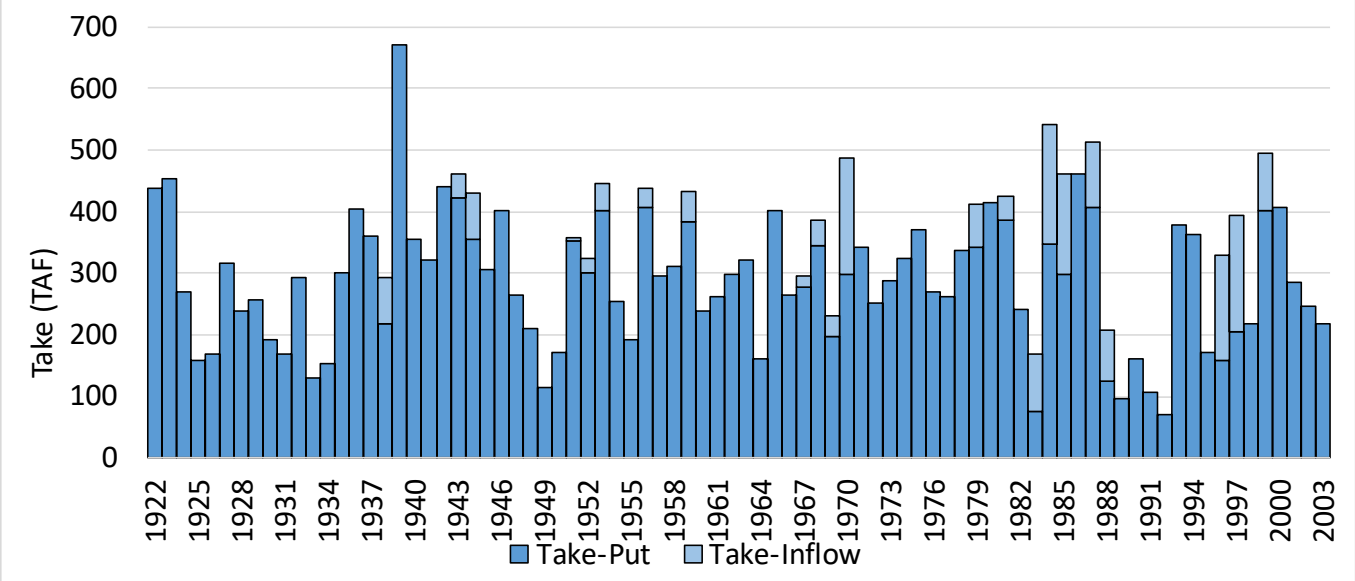
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	309
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$607
Unit cost of water, after repayment period ($/AF)	$82

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



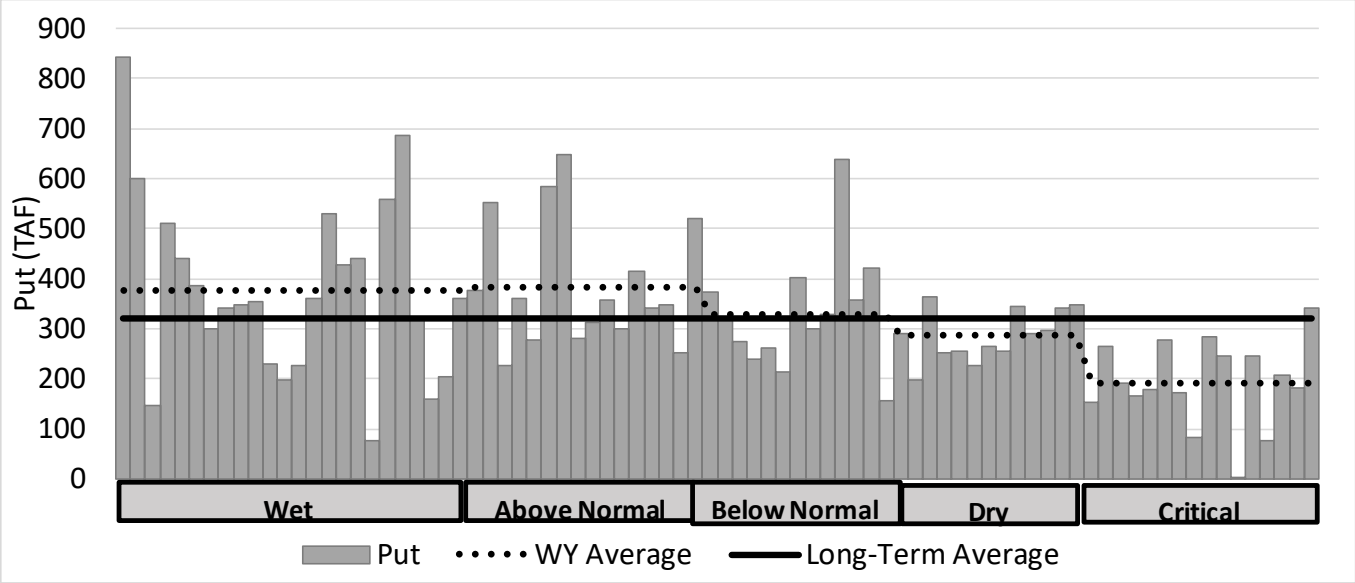
Key: TAF = thousand acre feet

Figure B.30 Scenario 3A Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



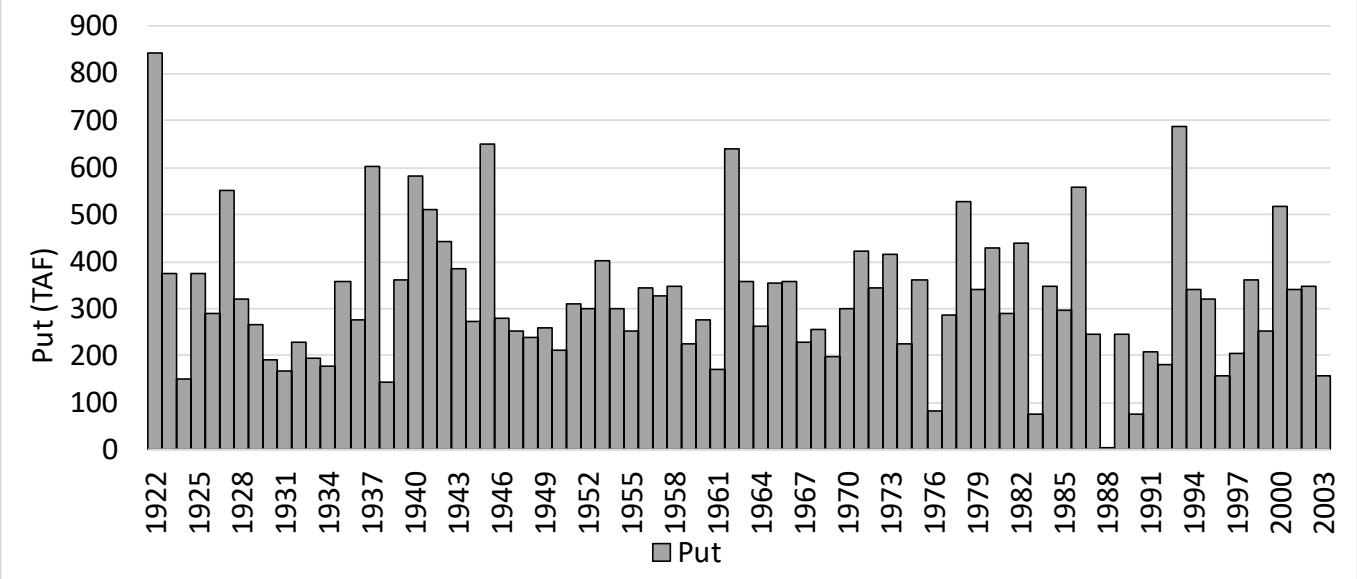
Key: TAF = thousand acre feet

Figure B.31 Scenario 3A Annual Take



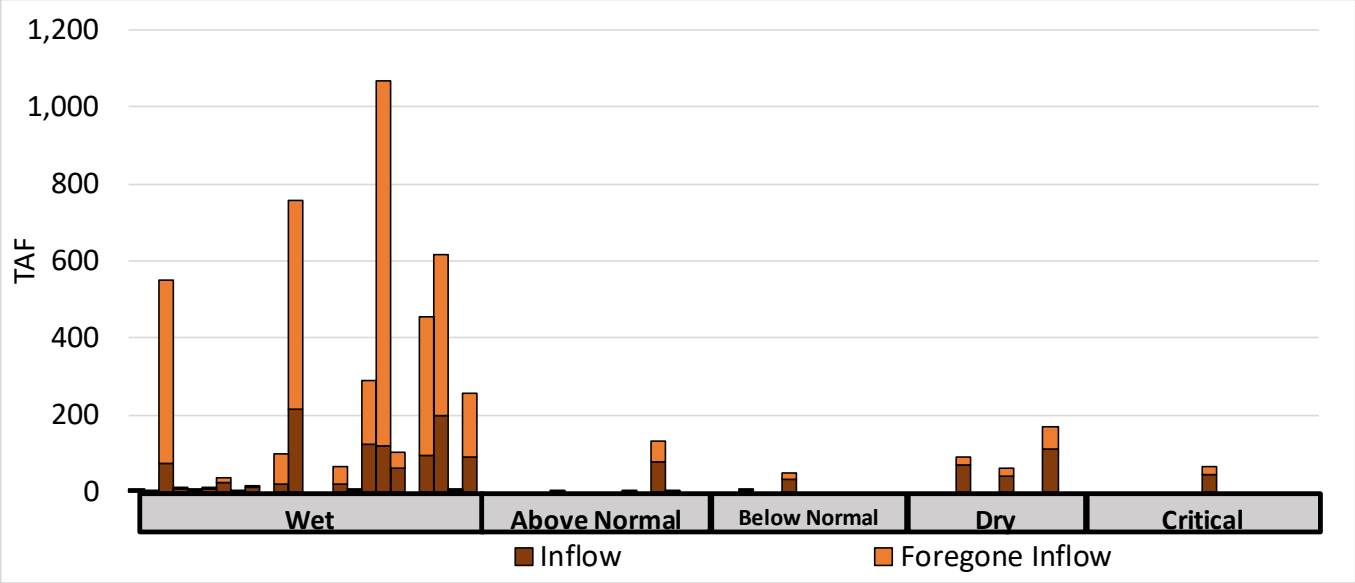
Key: TAF = thousand acre feet

Figure B.32 Scenario 3A Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



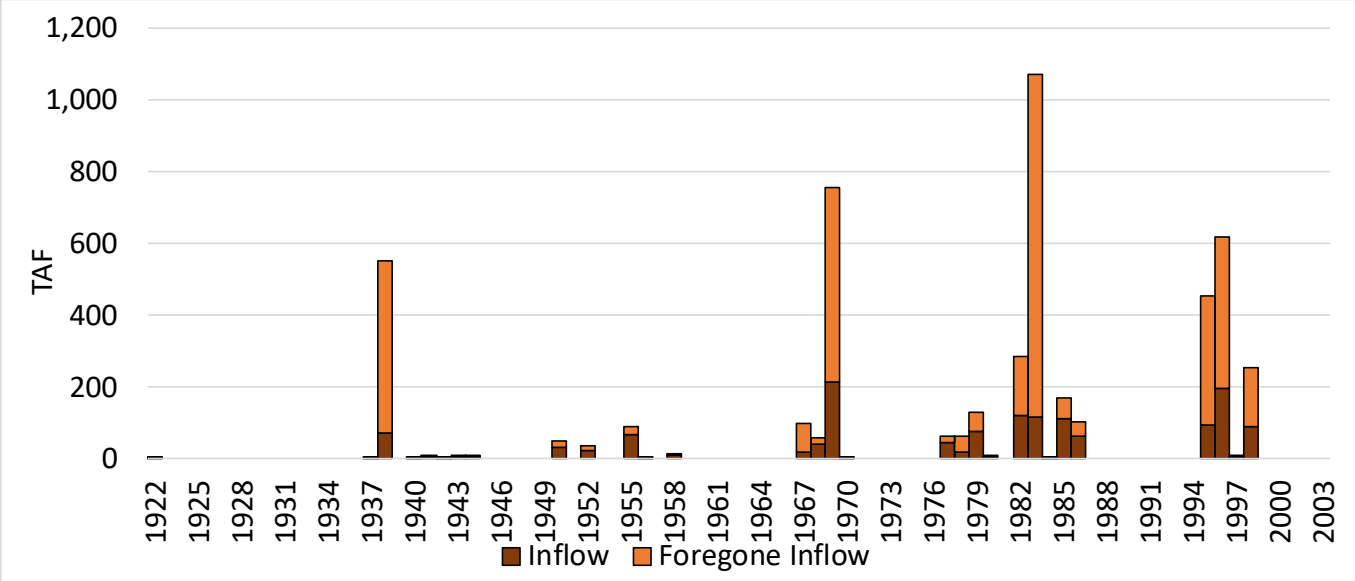
Key: TAF = thousand acre feet

Figure B.33 Scenario 3A Annual Put



Key: TAF = thousand acre feet

Figure B.34 Scenario 3A Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.35 Scenario 3A Annual Inflow and Foregone Inflow

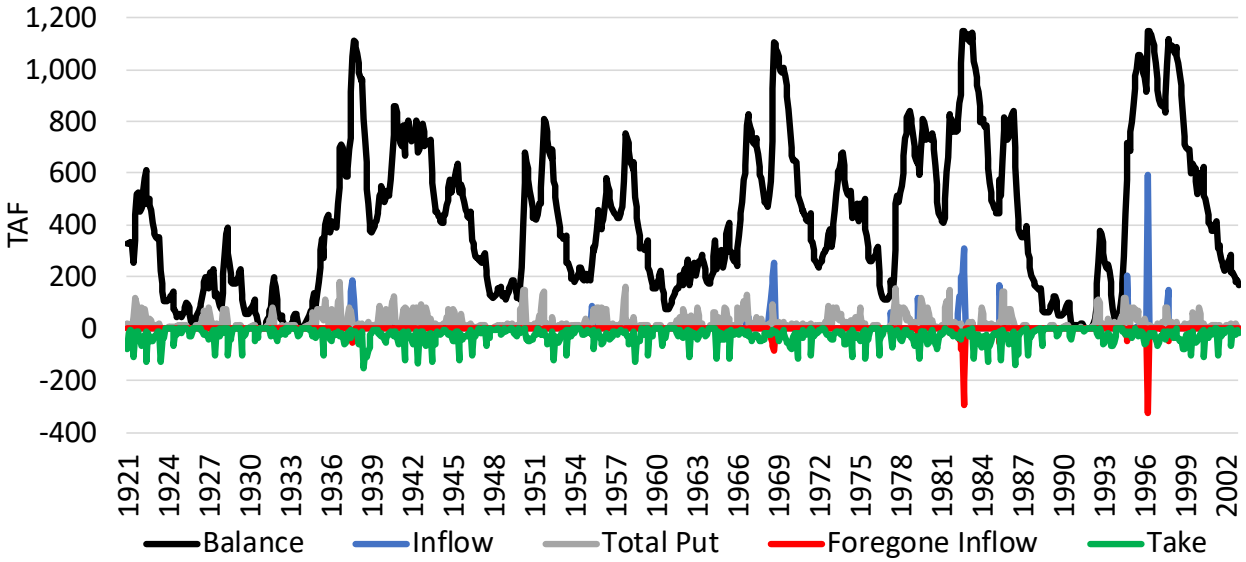
SCENARIO 3B

Combined Storage Account: 1,150 TAF

Table B.17 Scenario 3B Operating Conditions

Operating Conditions	Scenario
	3B
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Not Used
Trans-valley Conveyance Capacity	1,000 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.36 Scenario 3B Monthly Operations Trace

Table B.18 Scenario 3B Water Year Type Summary

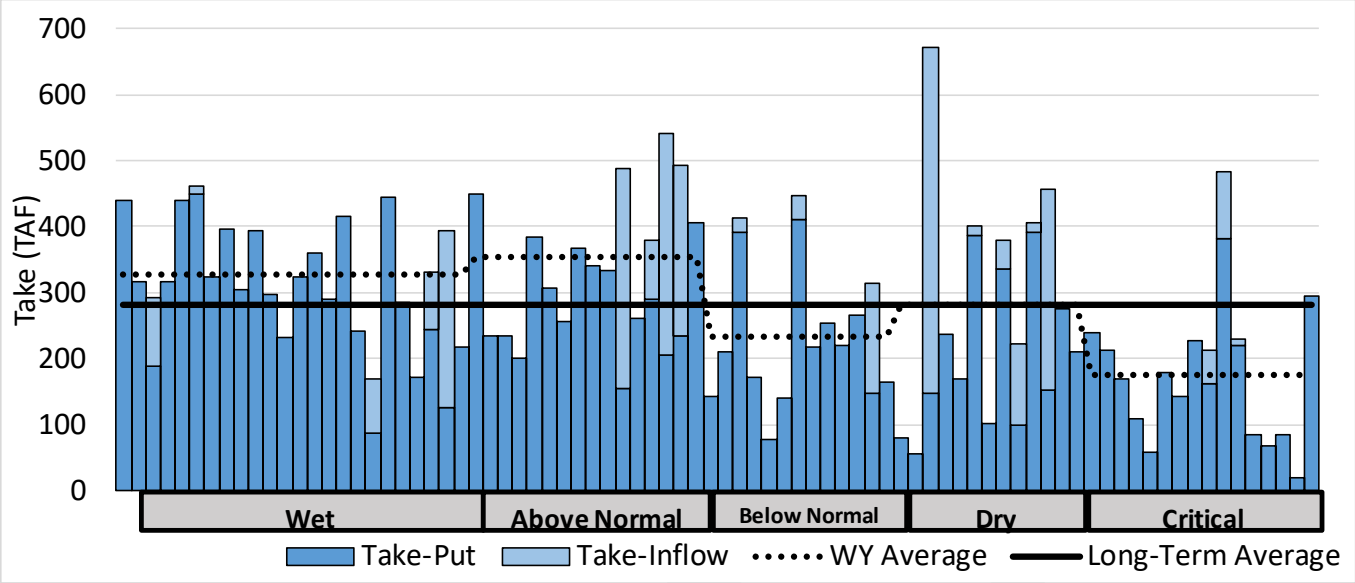
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	107	458	327	304	23	75
Above Normal	6	324	355	291	64	3
Below Normal	3	210	234	216	17	1
Dry	18	126	282	203	79	7
Critical	3	56	176	166	10	1
Long-Term Average	36	261	281	245	36	24

Key:
TAF = thousand acre-feet
WY = water year

Table B.19 Scenario 3B Cost Analysis

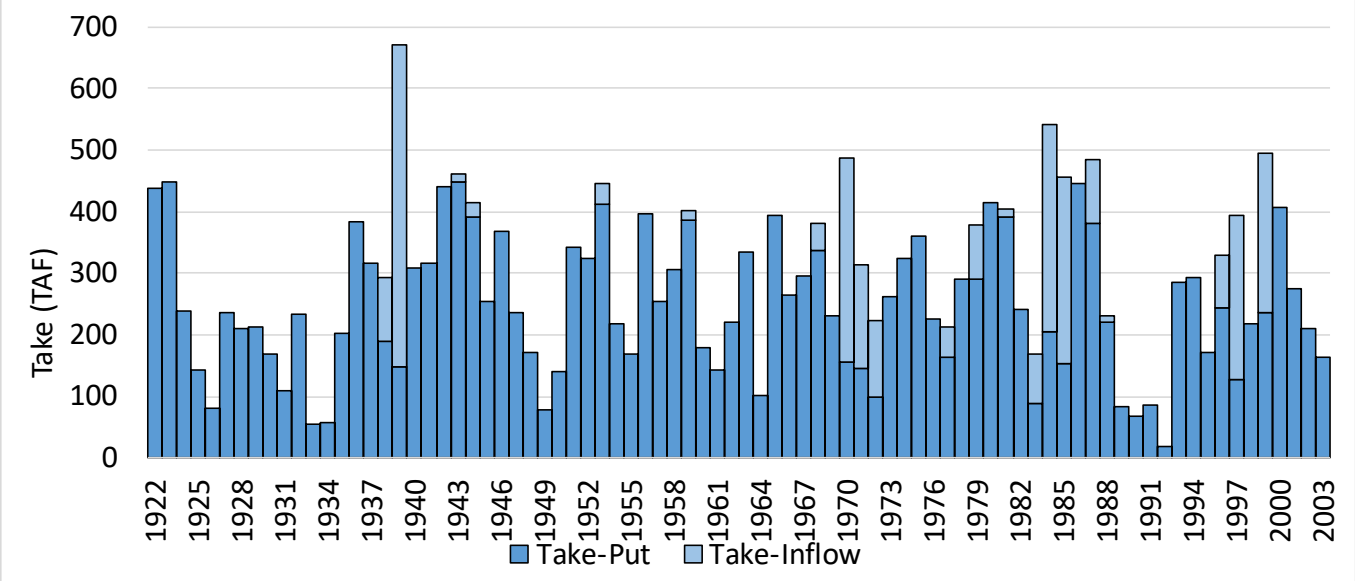
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	281
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$668
Unit cost of water, after repayment period ($/AF)	$90

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



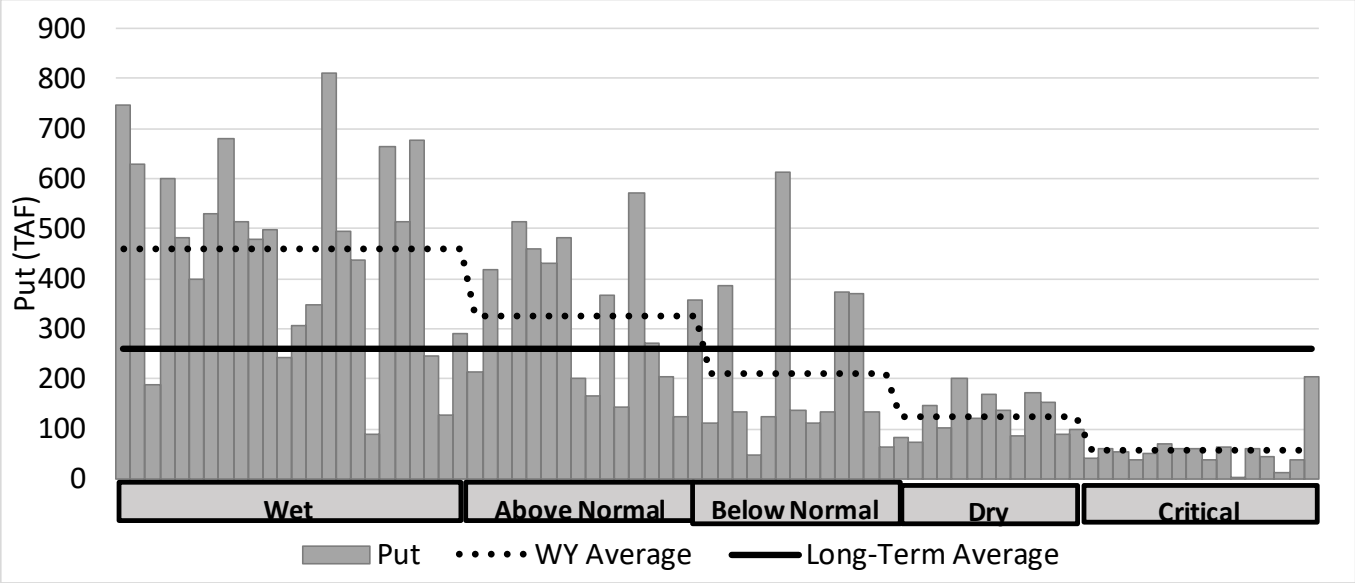
Key: TAF = thousand acre feet

Figure B.37 Scenario 3B Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



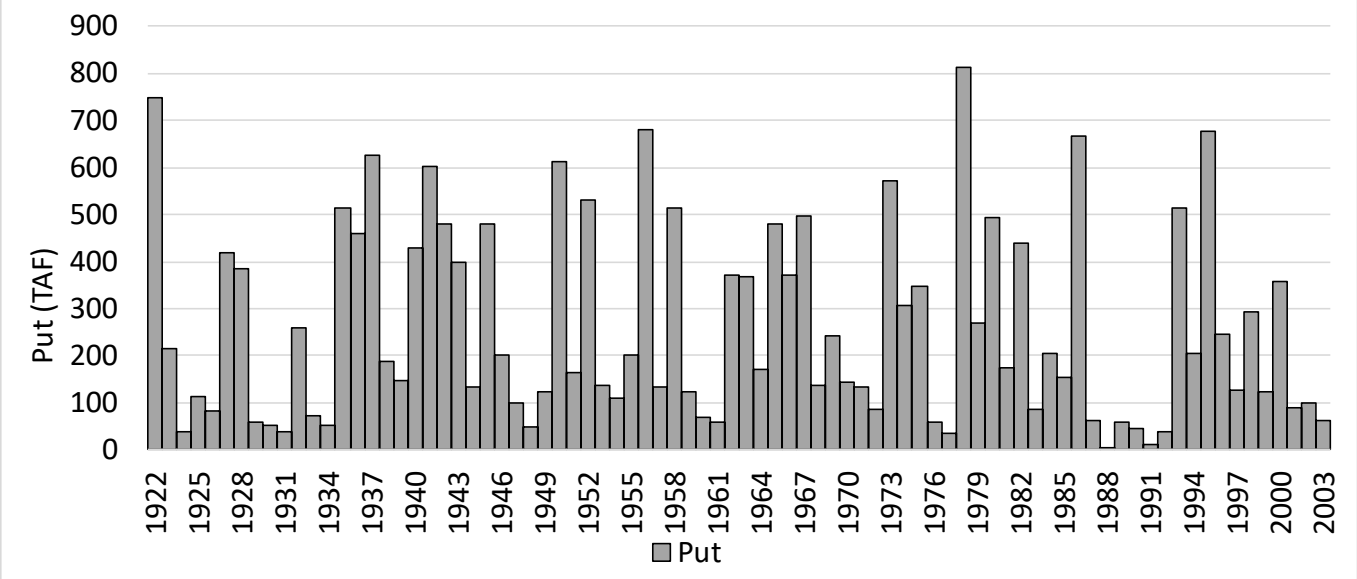
Key: TAF = thousand acre feet

Figure B.38 Scenario 3B Annual Take



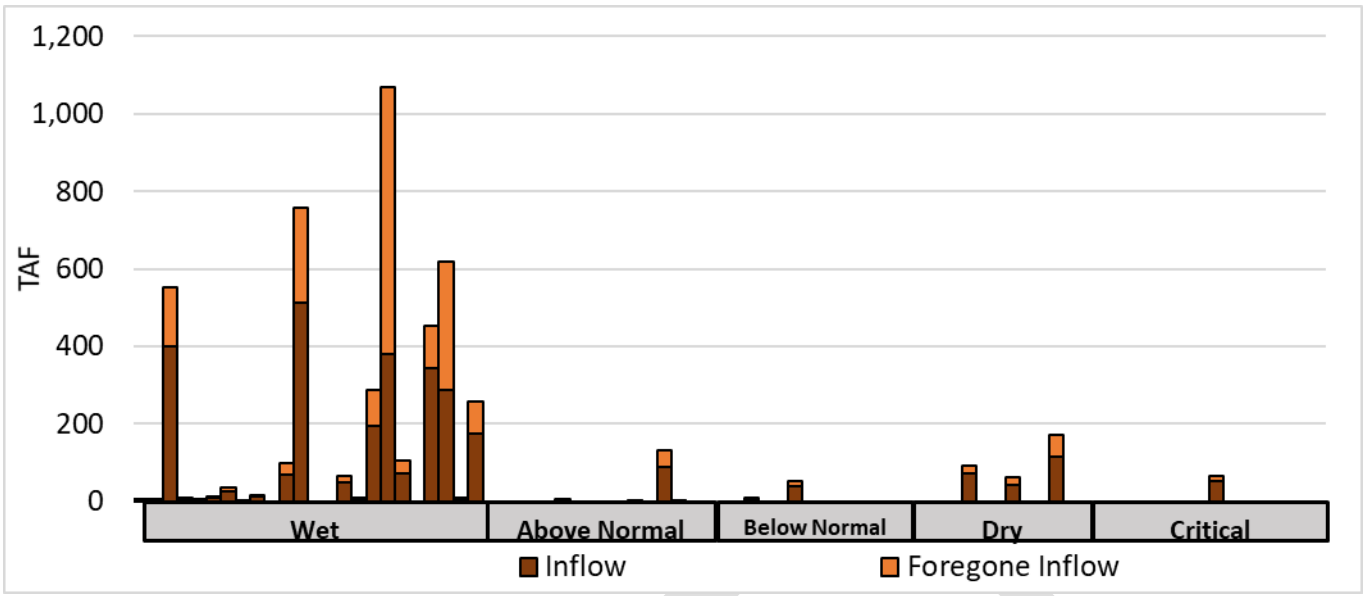
Key: TAF = thousand acre feet

Figure B.39 Scenario 3B Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



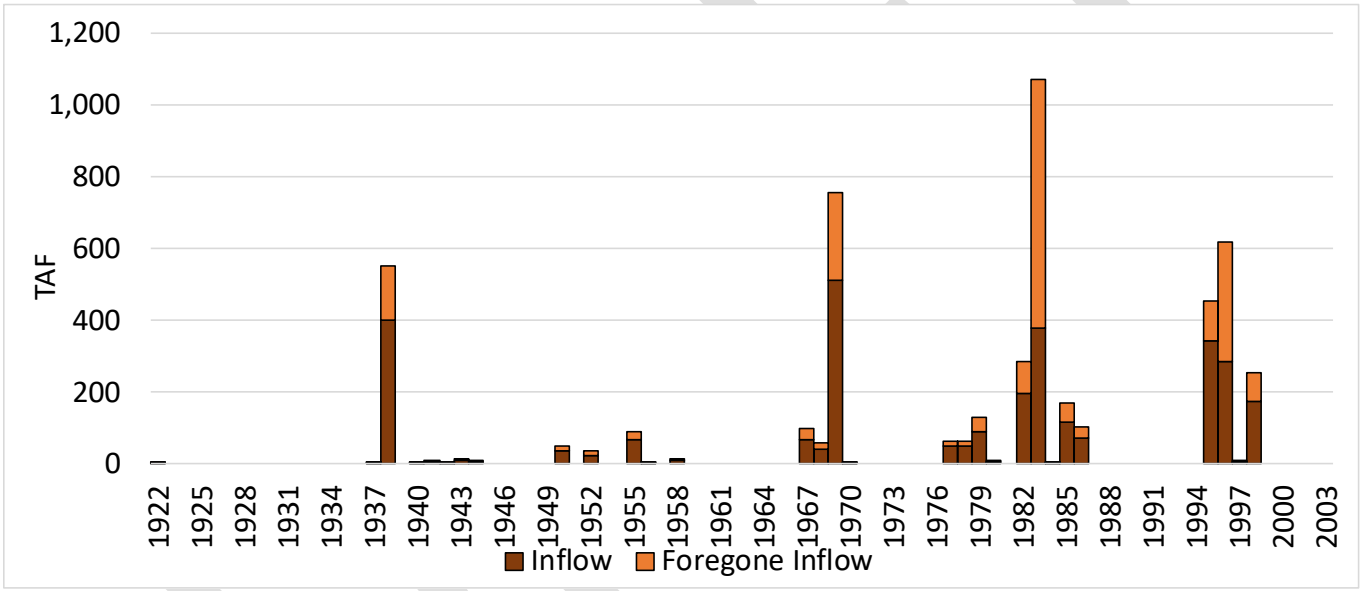
Key: TAF = thousand acre feet

Figure B.40 Scenario 3B Annual Put



Key: TAF = thousand acre feet

Figure B.41 Scenario 3B Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.42 Scenario 3B Annual Inflow and Foregone Inflow

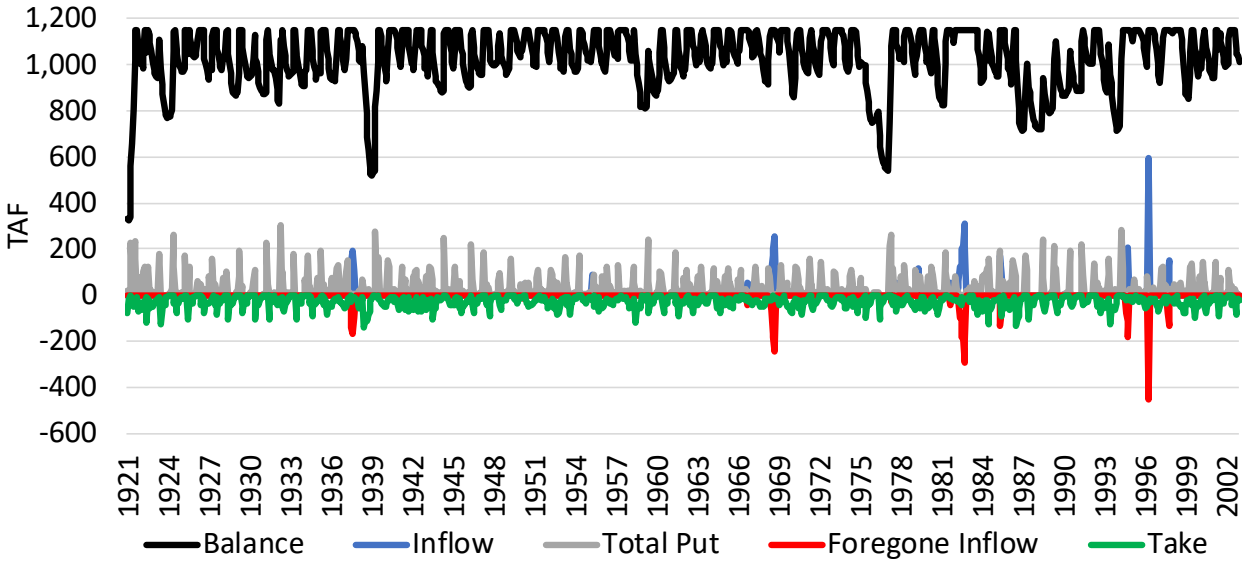
SCENARIO 3C

Combined Storage Account: 1,150 TAF

Table B.20 Scenario 3C Operating Conditions

Operating Conditions	Scenario
	3C
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Used
Trans-valley Conveyance Capacity	1,000 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.43 Scenario 3C Monthly Operations Trace

Table B.21 Scenario 3C Water Year Type Summary

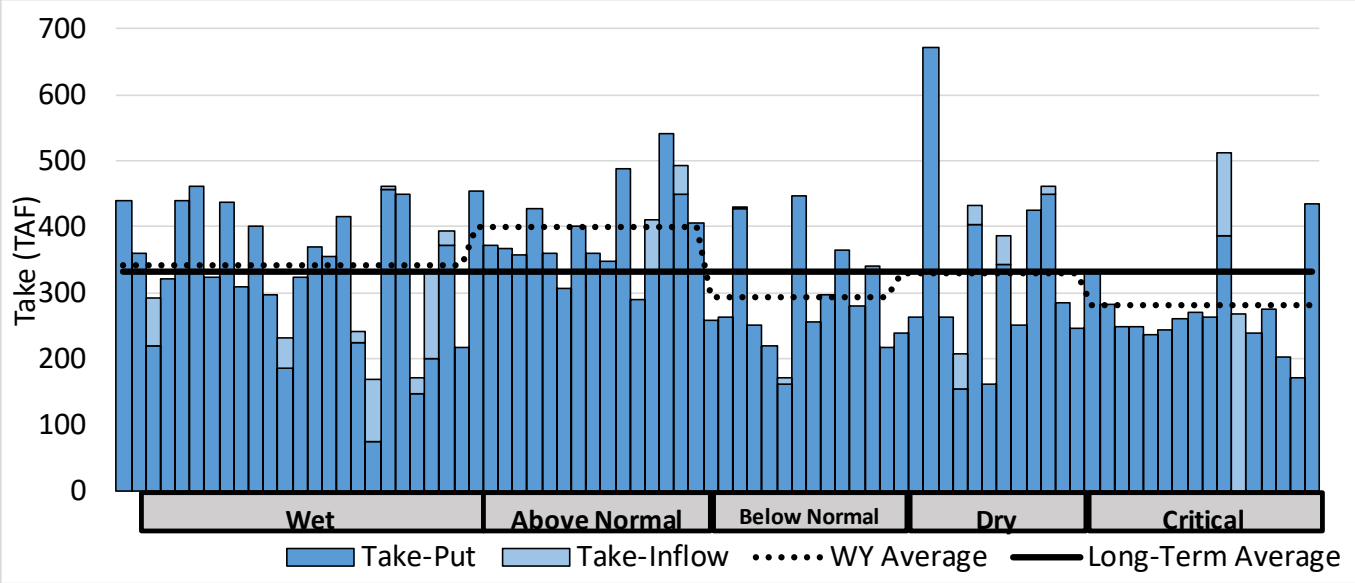
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	32	360	342	325	17	149
Above Normal	5	414	399	391	8	3
Below Normal	3	306	292	291	1	2
Dry	12	317	330	320	10	13
Critical	2	307	281	256	25	2
Long-Term Average	13	345	332	318	13	47

Key:
TAF = thousand acre-feet
WY = water year

Table B.22 Scenario 3C Cost Analysis

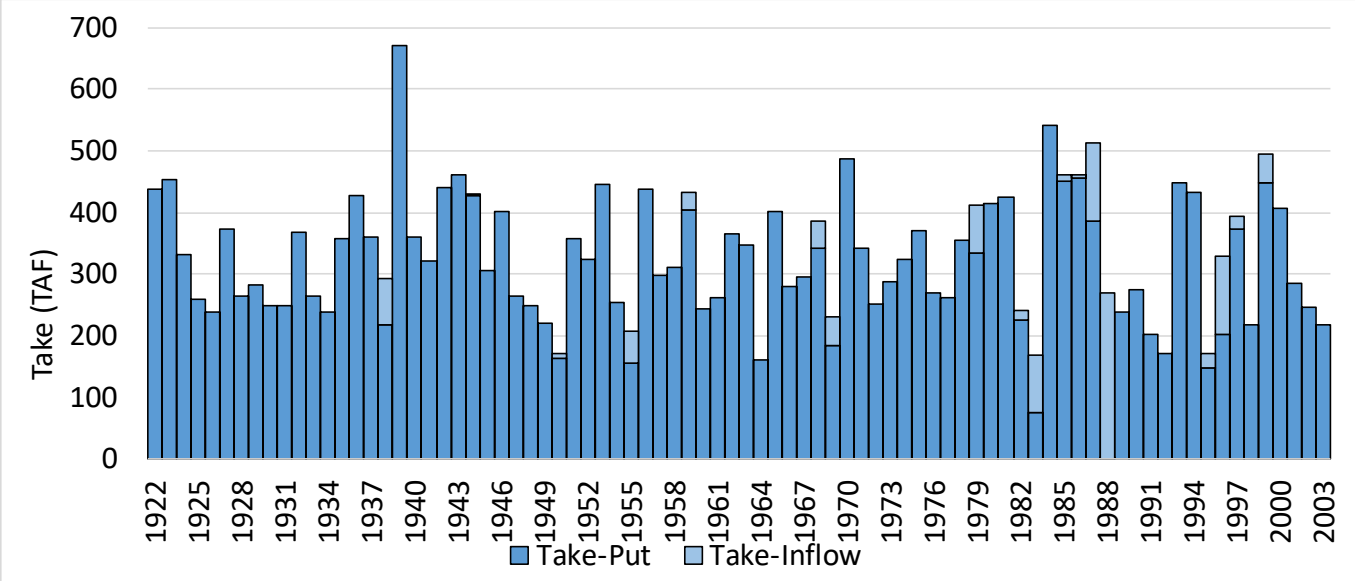
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	332
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$565
Unit cost of water, after repayment period ($/AF)	$76

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



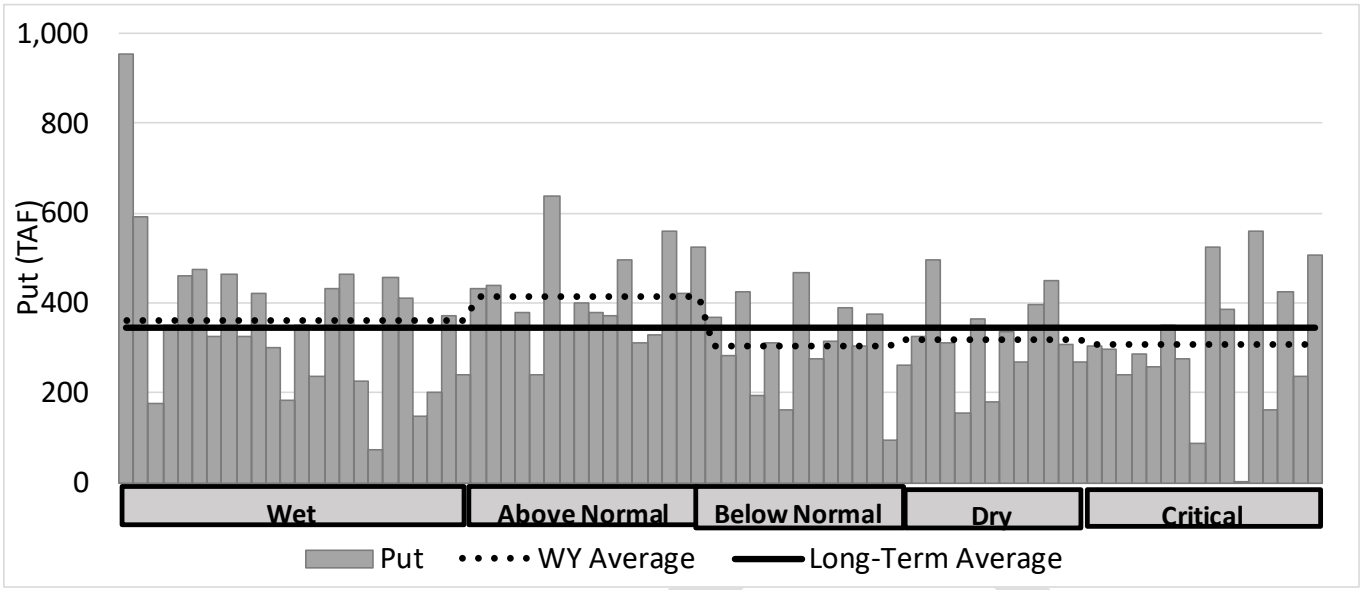
Key: TAF = thousand acre feet

Figure B.44 Scenario 3C Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



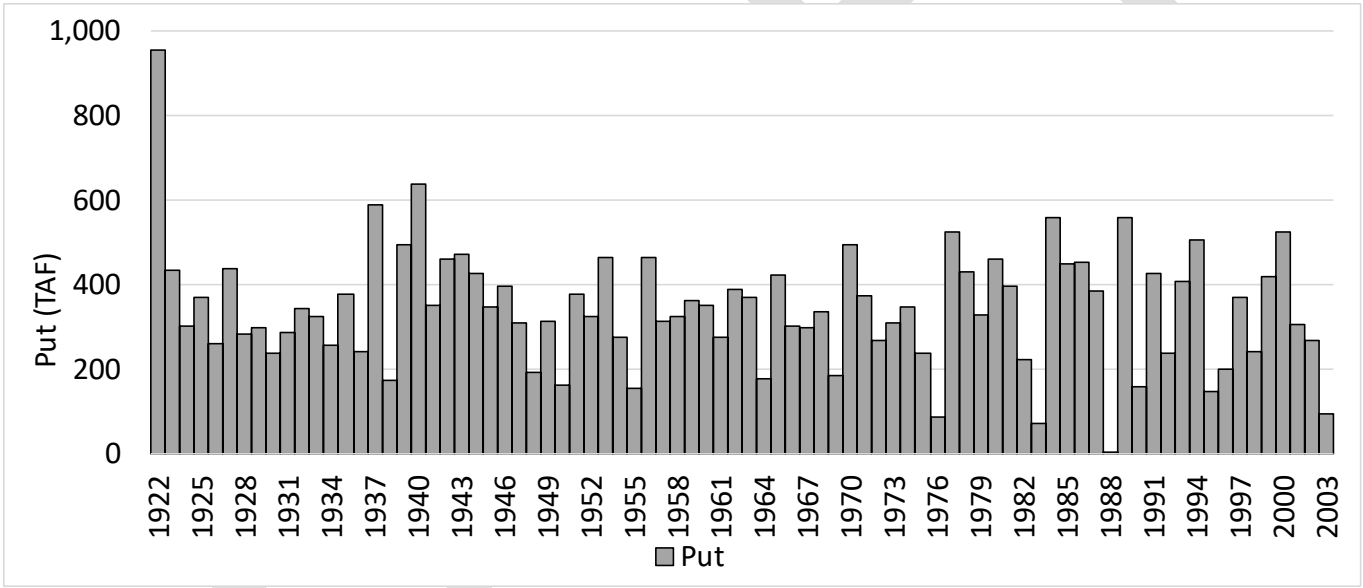
Key: TAF = thousand acre feet

Figure B.45 Scenario 3C Annual Take



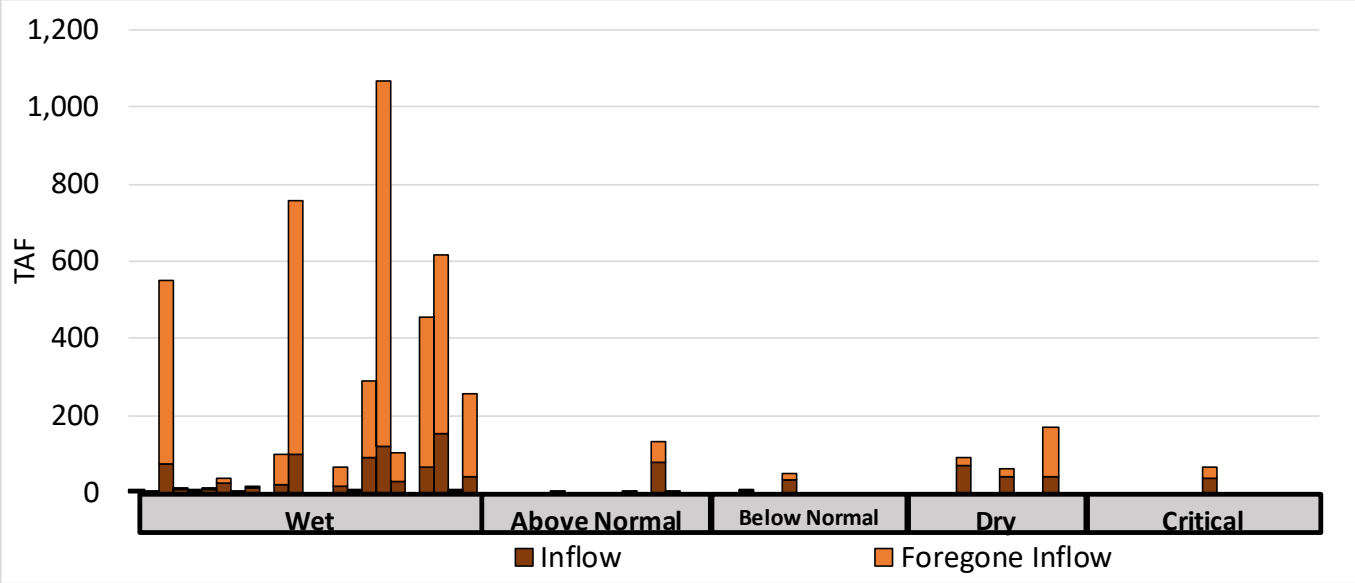
Key: TAF = thousand acre feet

Figure B.46 Scenario 3C Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



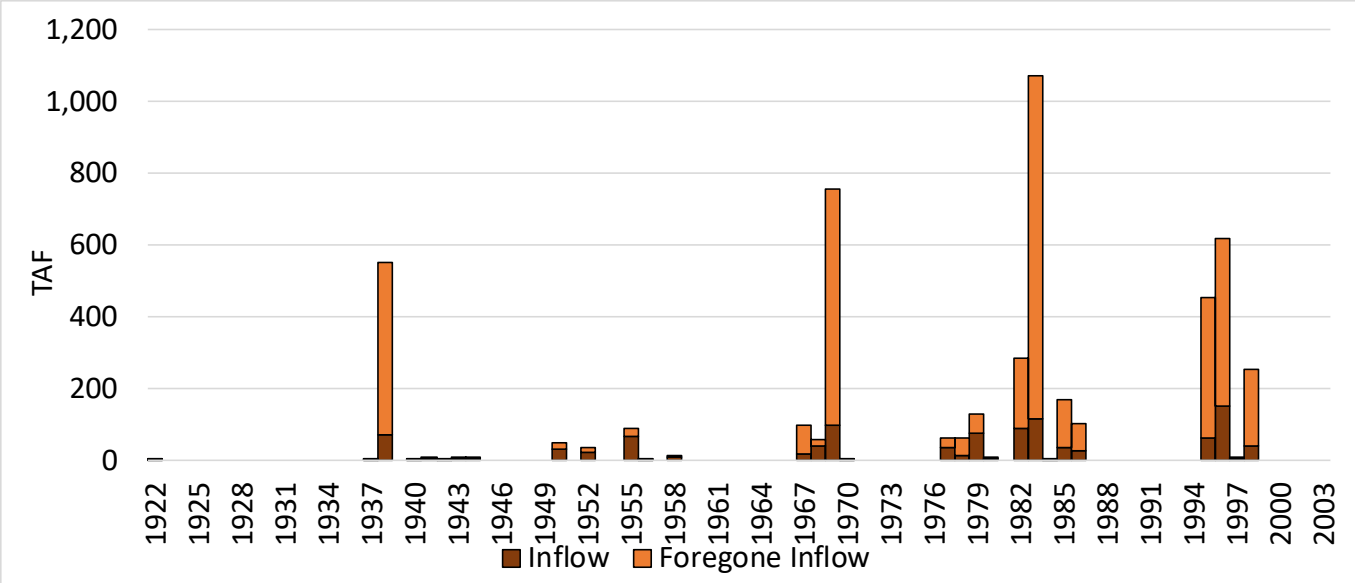
Key: TAF = thousand acre feet

Figure B.47 Scenario 3C Annual Put



Key: TAF = thousand acre feet

Figure B.48 Scenario 3C Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.49 Scenario 3C Annual Inflow and Foregone Inflow

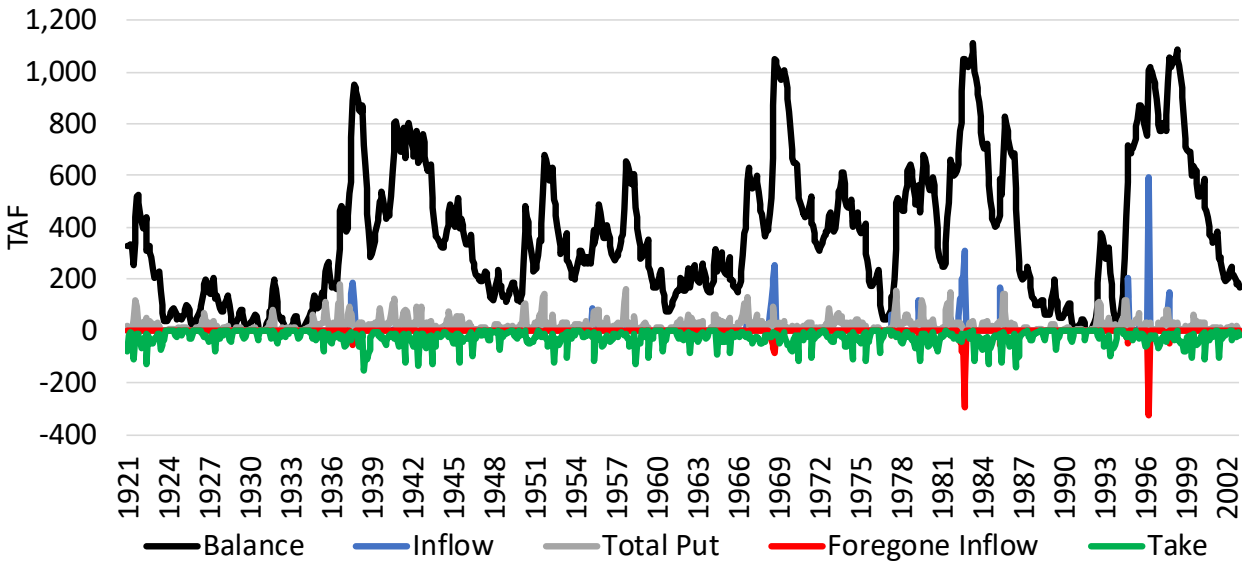
SCENARIO 3D

Combined Storage Account: 1,150 TAF

Table B.23 Scenario 3D Operating Conditions

Operating Conditions	Scenario
	3D
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment with ROConLTO
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Not Used
Trans-valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.50 Scenario 3D Monthly Operations Trace

Table B.24 Scenario 3D Water Year Type Summary

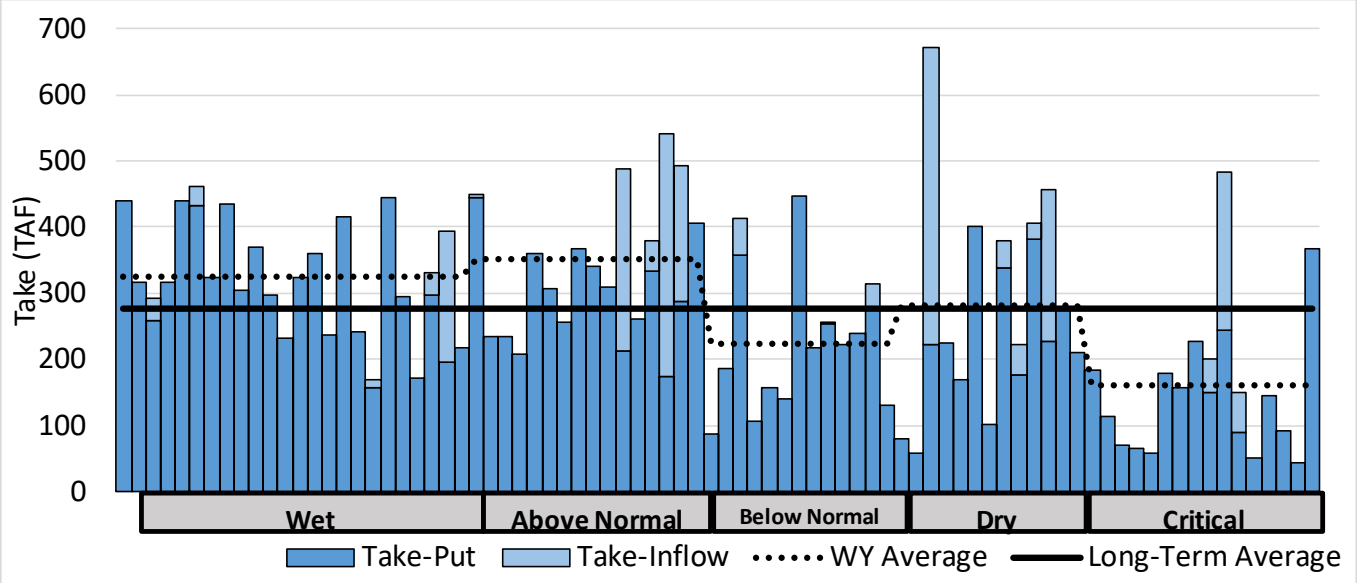
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	107	444	326	313	13	75
Above Normal	6	302	352	296	56	3
Below Normal	3	193	224	217	7	1
Dry	18	147	281	221	61	7
Critical	3	68	162	140	22	1
Long-Term Average	36	256	276	246	30	24

Key:
TAF = thousand acre-feet WY = water year

Table B.25 Scenario 3D Cost Analysis

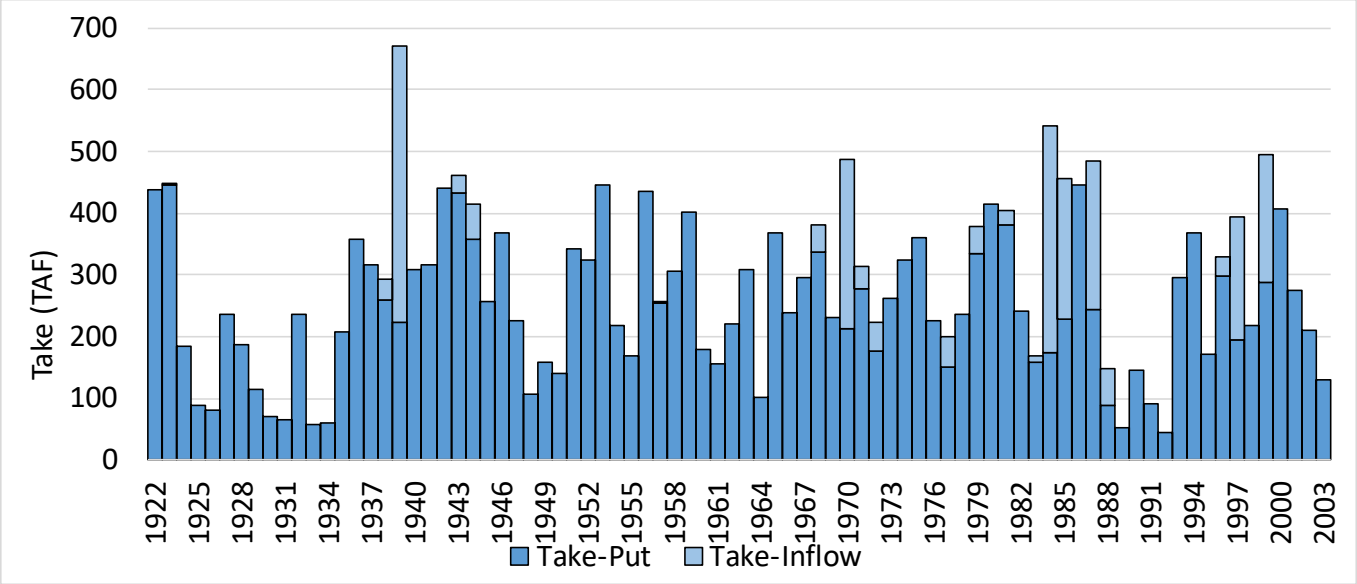
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	276
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$680
Unit cost of water, after repayment period ($/AF)	$92

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



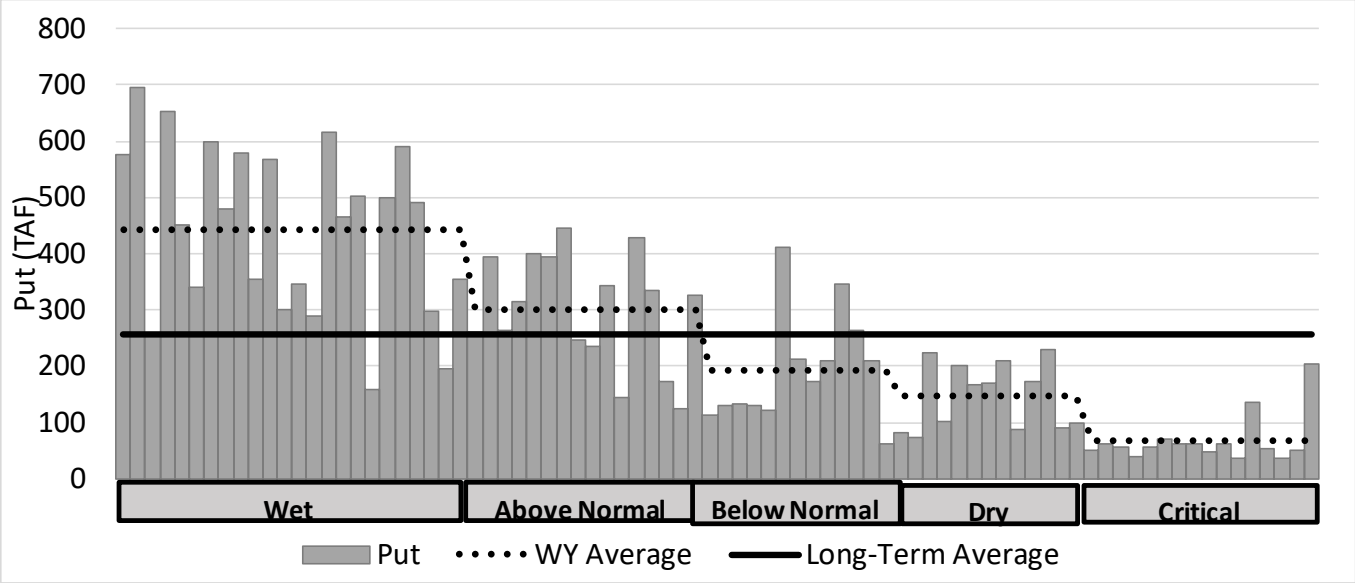
Key: TAF = thousand acre feet

Figure B.51 Scenario 3D Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



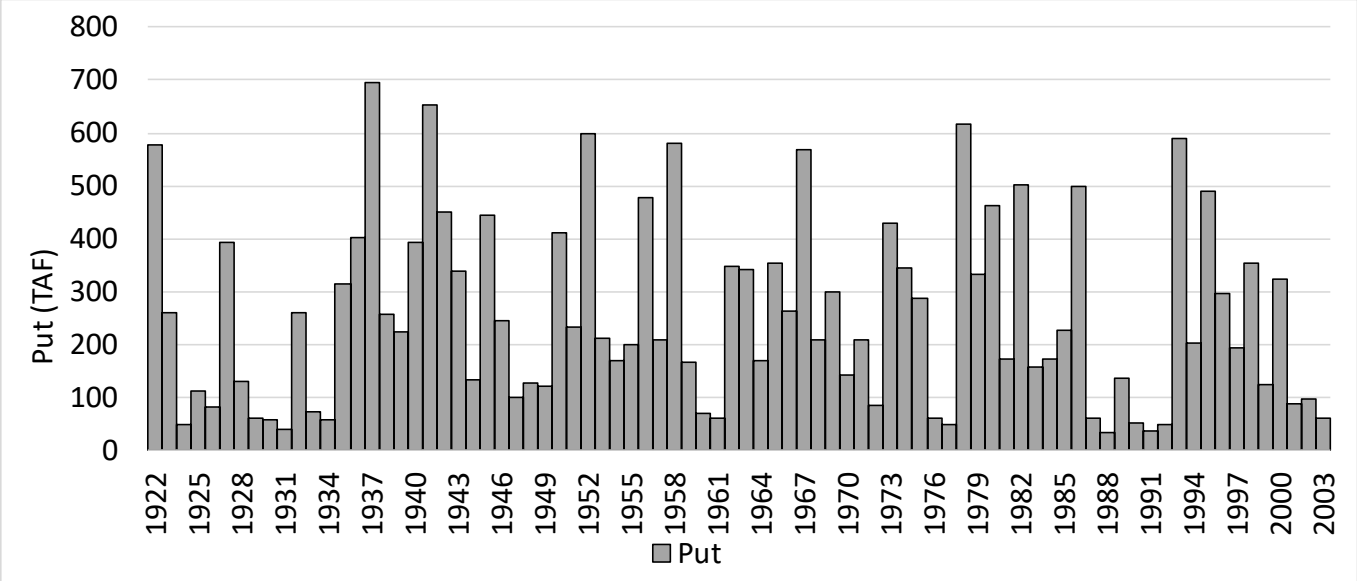
Key: TAF = thousand acre feet

Figure B.52 Scenario 3D Annual Take



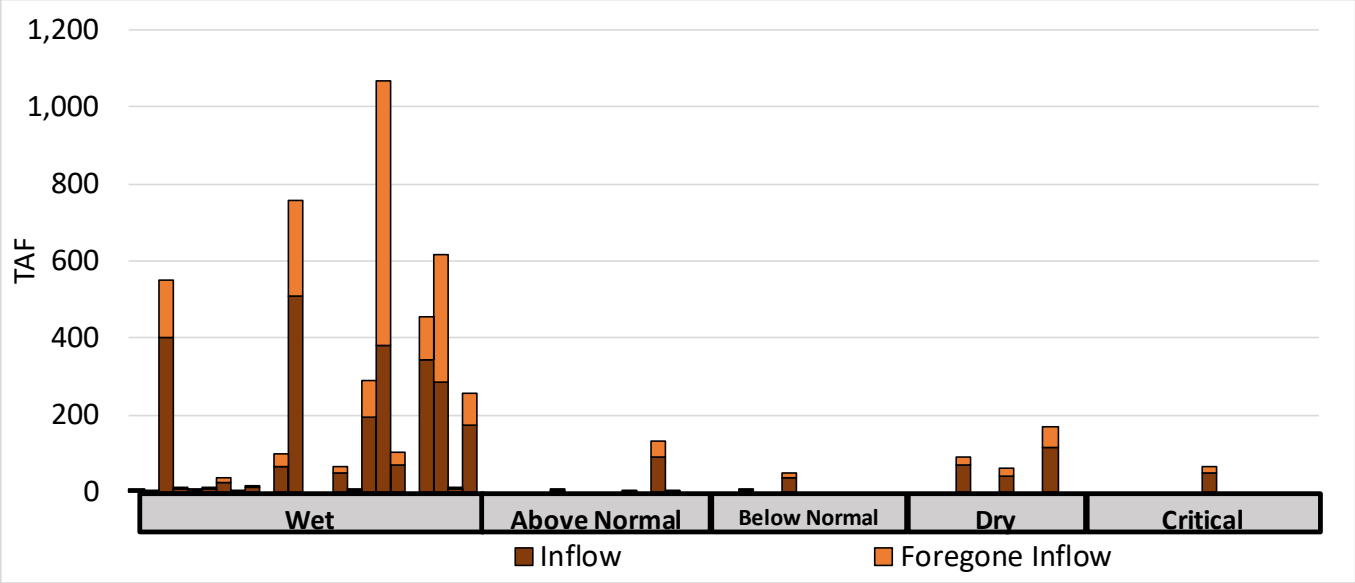
Key: TAF = thousand acre feet

Figure B.53 Scenario 3D Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



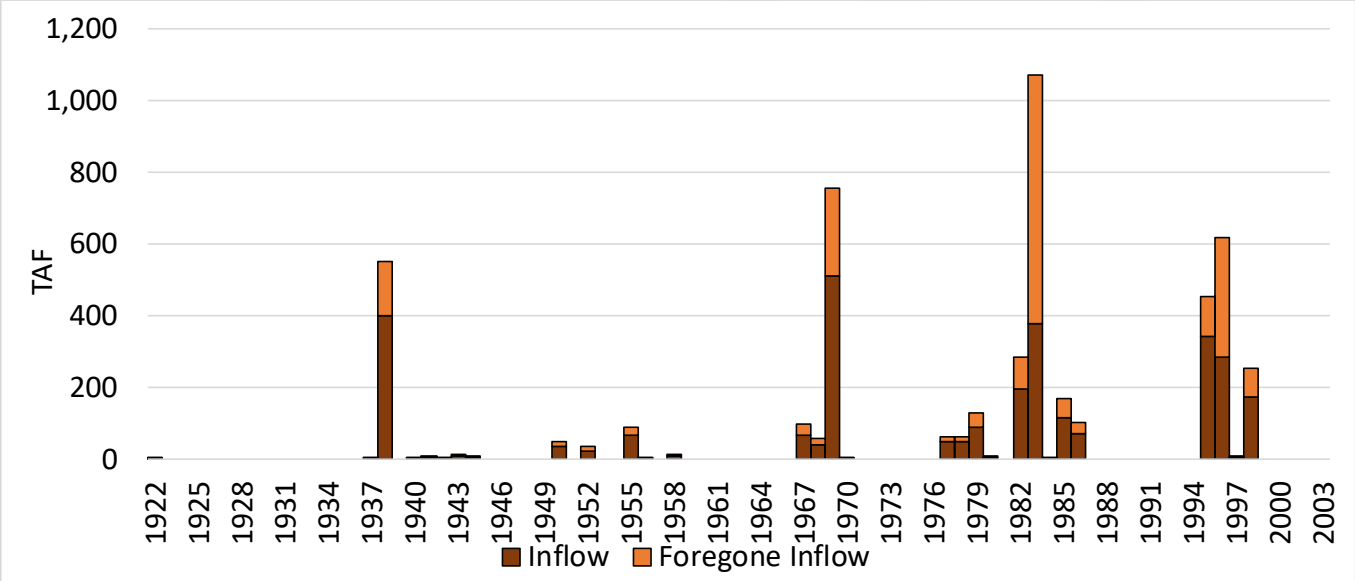
Key: TAF = thousand acre feet

Figure B.54 Scenario 3D Annual Put



Key: TAF = thousand acre feet

Figure B.55 Scenario 3D Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.56 Scenario 3D Annual Inflow and Foregone Inflow

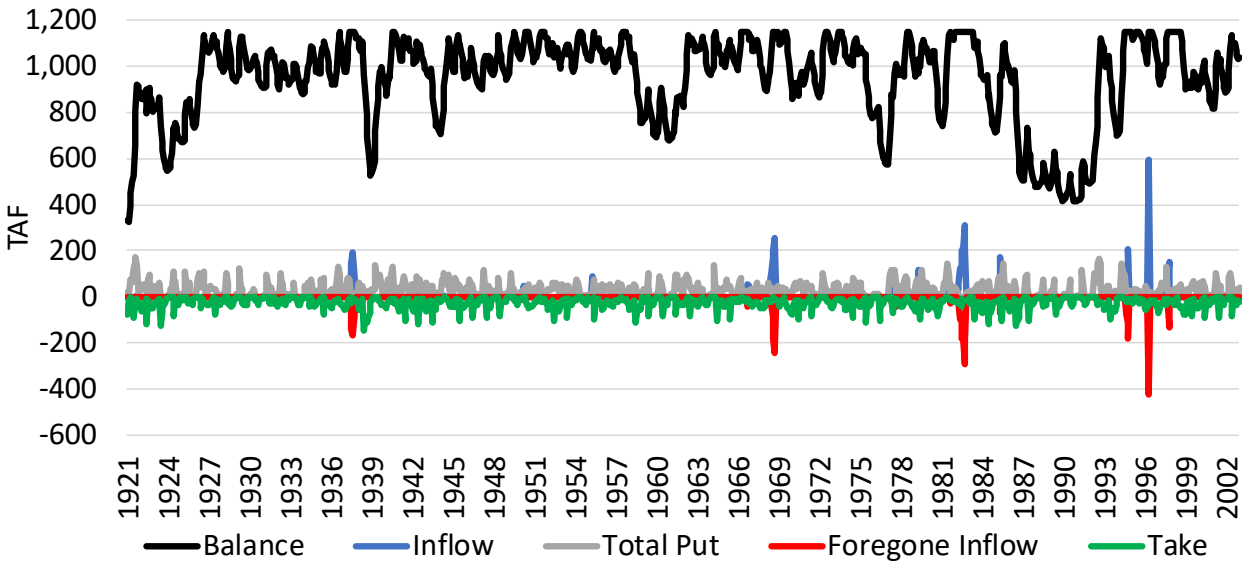
SCENARIO 3E

Combined Storage Account: 1,150 TAF

Table B.26 Scenario 3E Operating Conditions

Operating Conditions	Scenario
	3E
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment with ROConLTO
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Used
Trans-valley Conveyance Capacity	250 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.57 Scenario 3E Monthly Operations Trace

Table B.27 Scenario 3E Water Year Type Summary

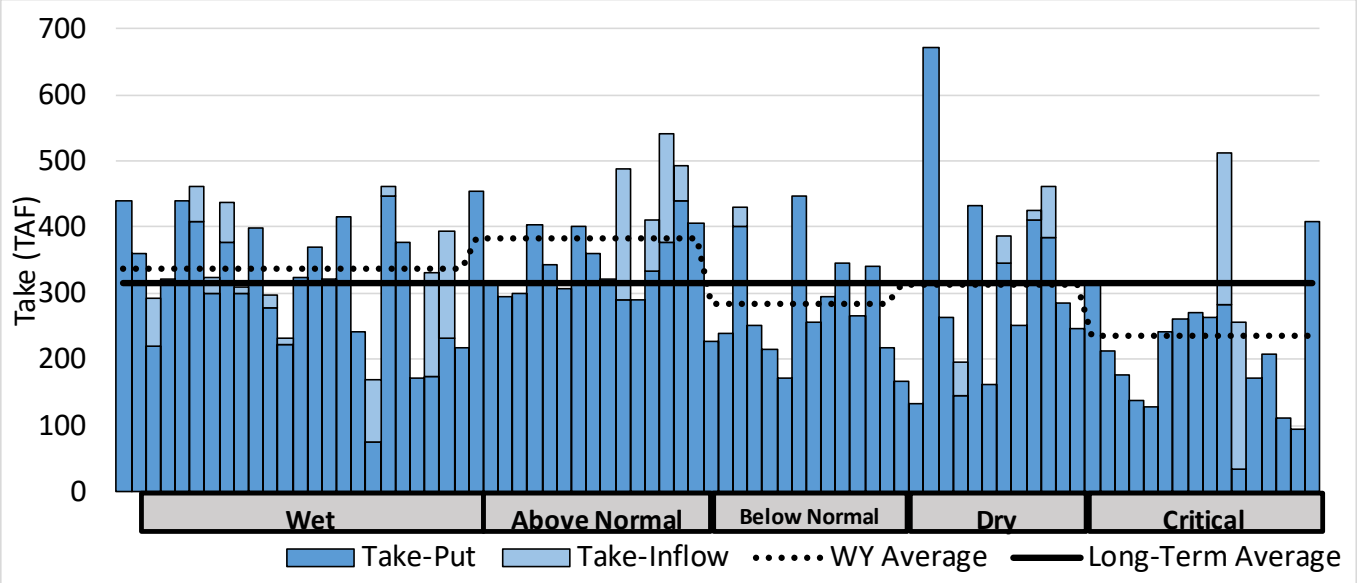
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	41	384	338	309	28	140
Above Normal	5	385	383	352	31	3
Below Normal	3	351	285	282	2	2
Dry	16	284	314	300	14	9
Critical	3	195	235	207	28	1
Long-Term Average	17	326	314	292	22	44

Key:
TAF = thousand acre-feet WY = water year

Table B.28 Scenario 3E Cost Analysis

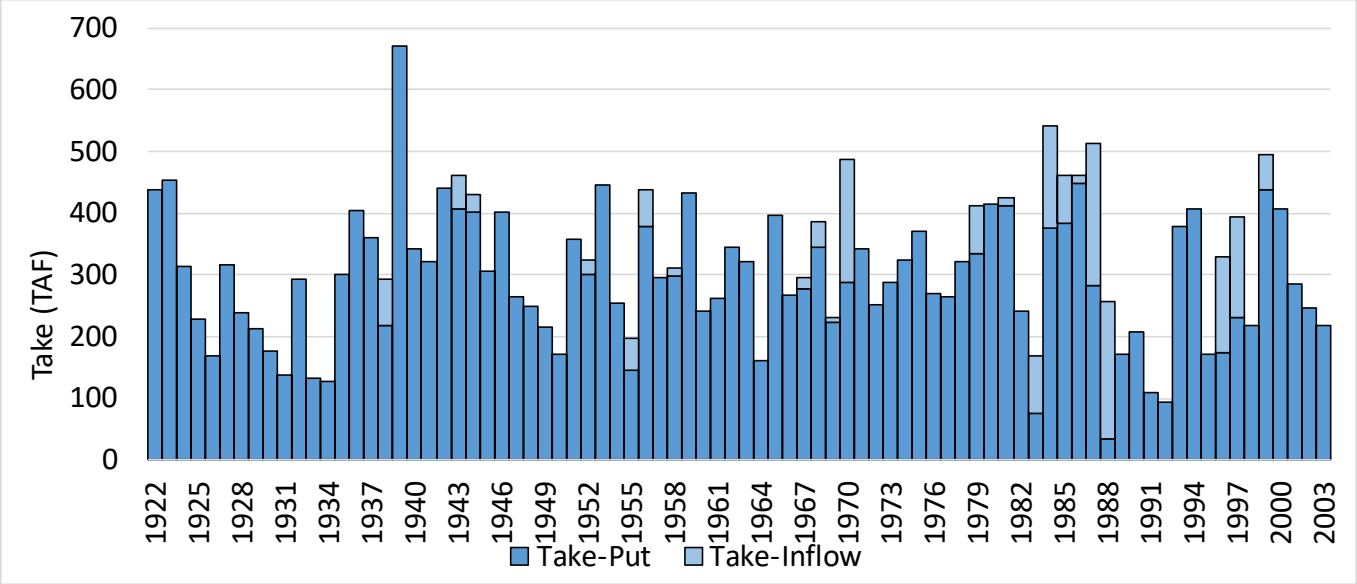
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	314
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$597
Unit cost of water, after repayment period ($/AF)	$81

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



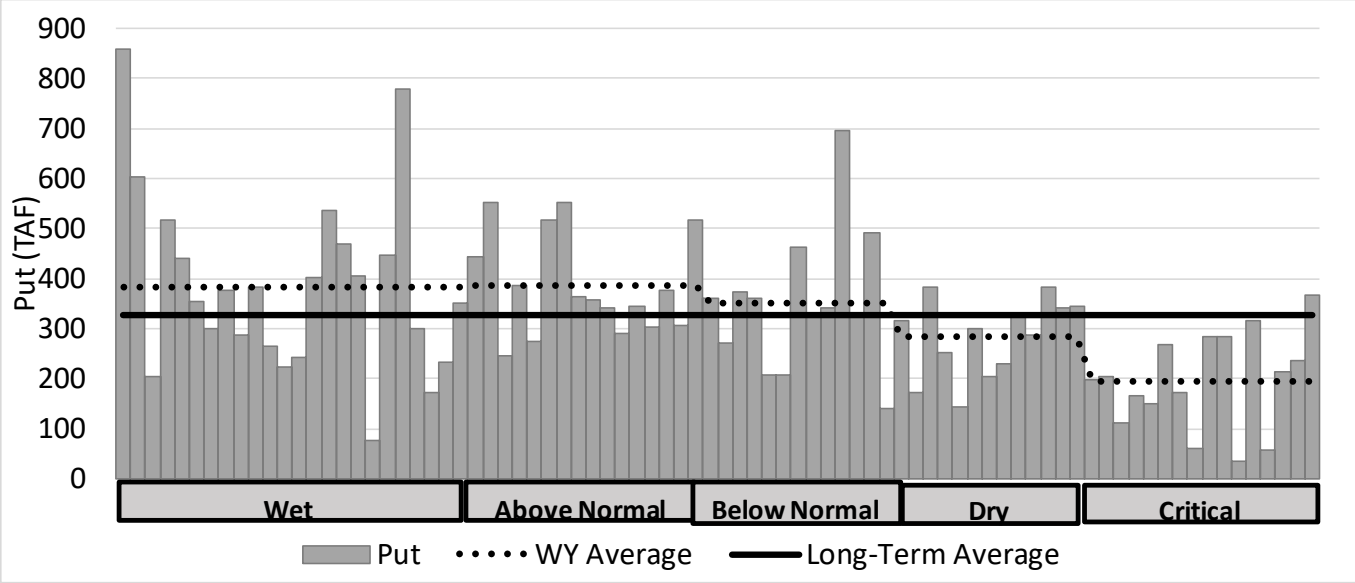
Key: TAF = thousand acre feet

Figure B.58 Scenario 3E Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



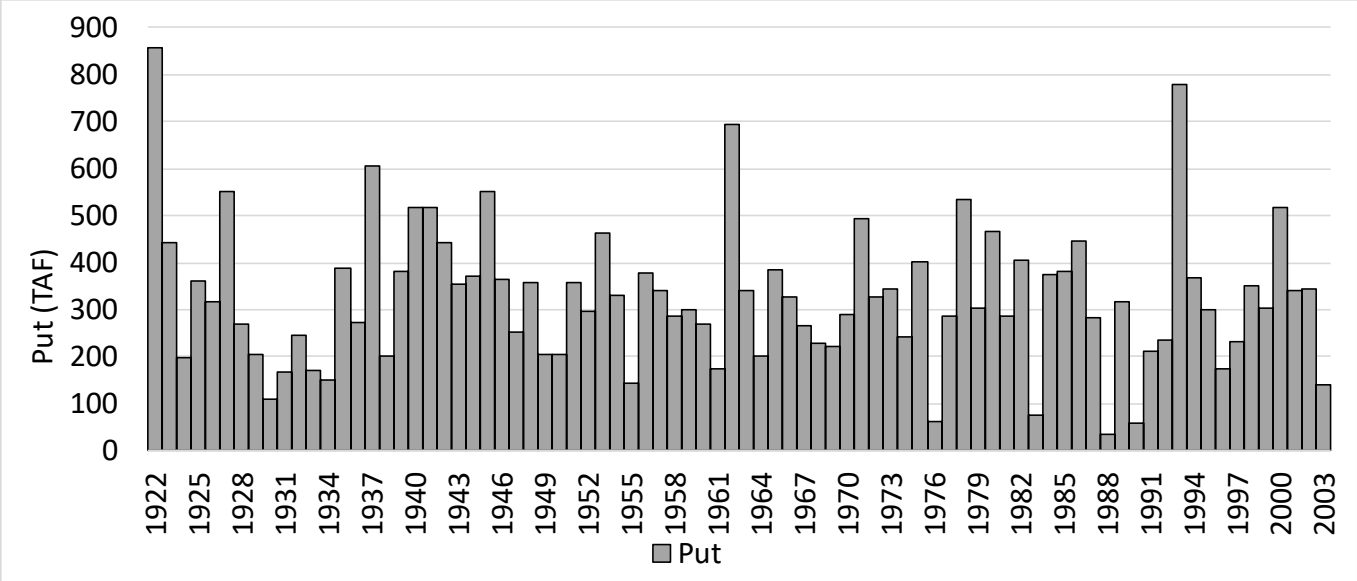
Key: TAF = thousand acre feet

Figure B.59 Scenario 3E Annual Take



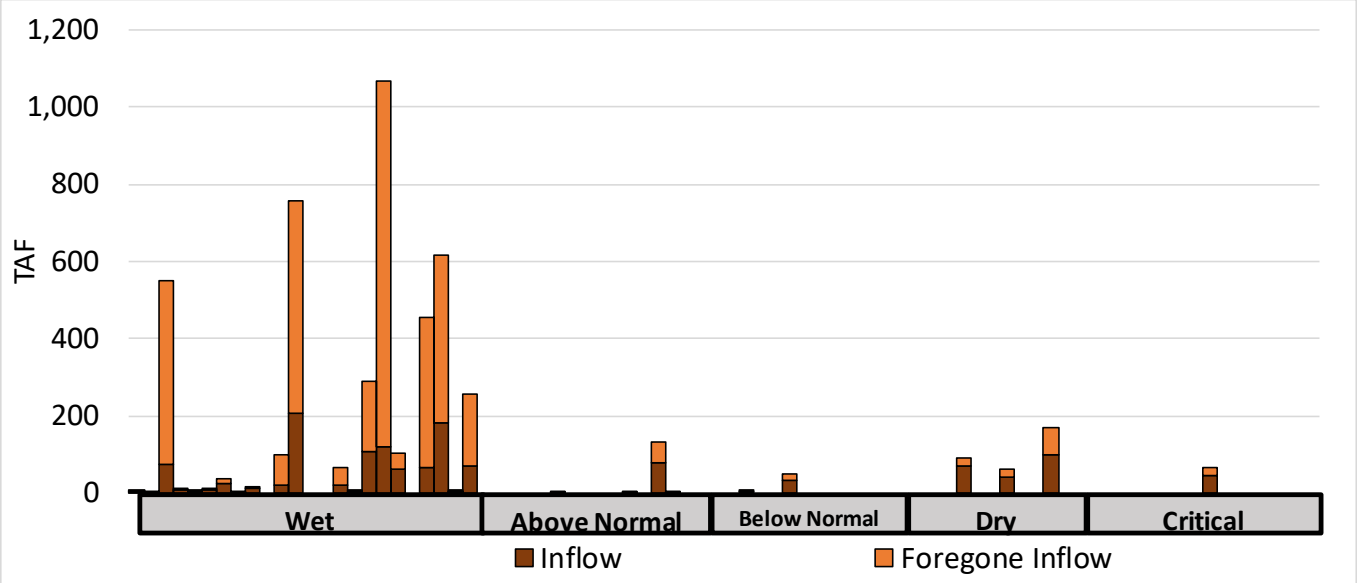
Key: TAF = thousand acre feet

Figure B.60 Scenario 3E Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



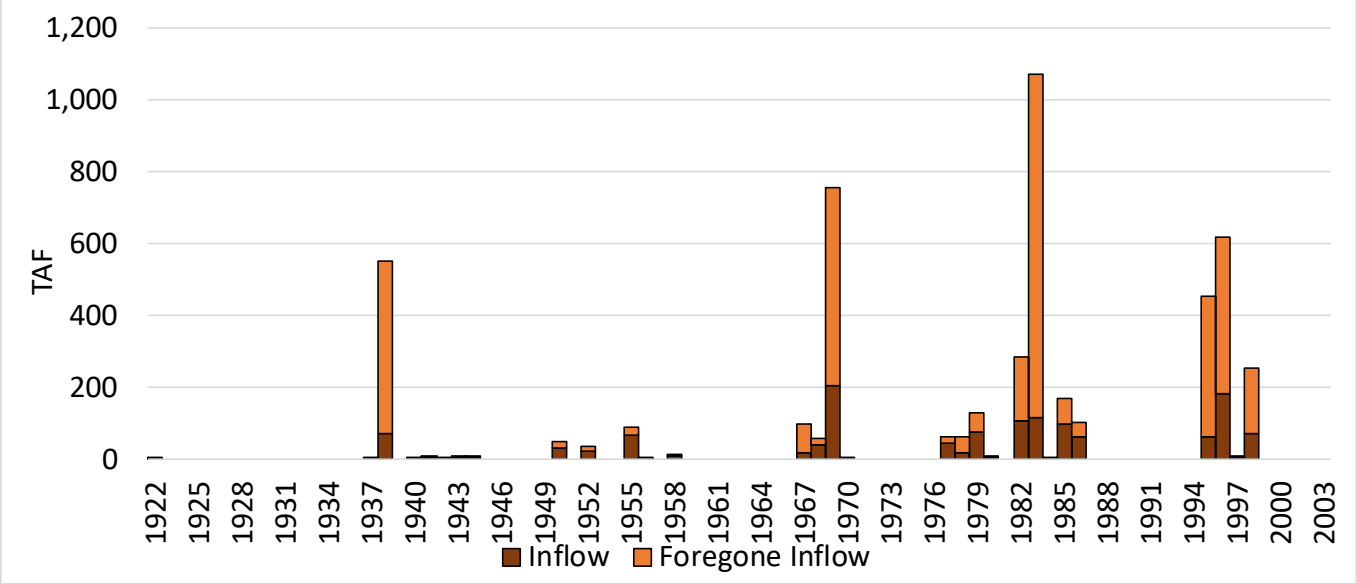
Key: TAF = thousand acre feet

Figure B.61 Scenario 3E Annual Put



Key: TAF = thousand acre feet

Figure B.62 Scenario 3E Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.63 Scenario 3E Annual Inflow and Foregone Inflow

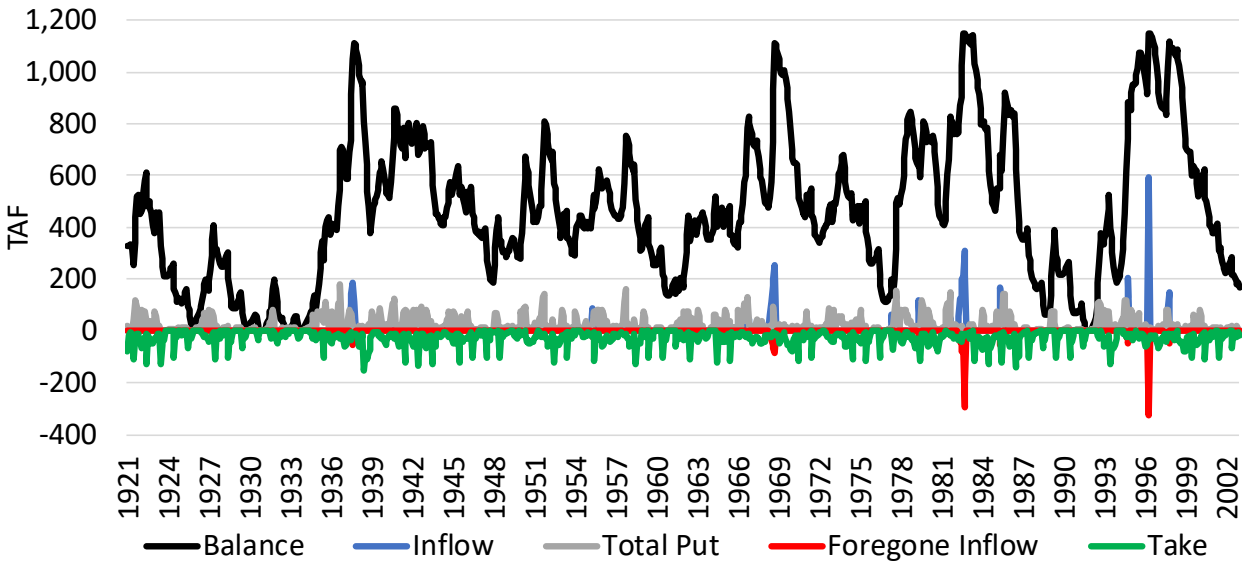
SCENARIO 3F

Combined Storage Account: 1,150 TAF

Table B.29 Scenario 3F Operating Conditions

Operating Conditions	Scenario
	3F
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment with ROConLTO
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Not Used
Trans-valley Conveyance Capacity	1,000 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet



Key: TAF = thousand acre feet
Figure B.64 Scenario 3F Monthly Operations Trace

Table B.30 Scenario 3F Water Year Type Summary

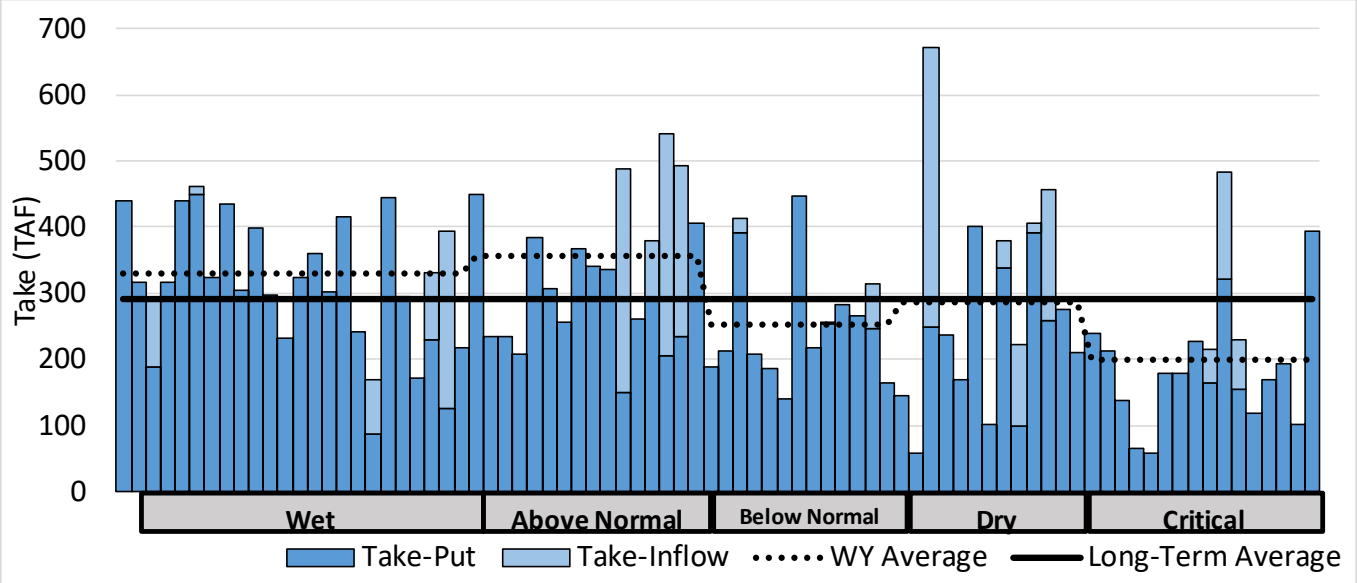
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	107	448	330	307	24	75
Above Normal	6	336	356	292	64	3
Below Normal	3	226	253	246	7	1
Dry	18	150	287	225	62	7
Critical	3	80	200	182	18	1
Long-Term Average	36	272	291	257	34	24

Key:
TAF = thousand acre-feet WY = water year

Table B.31 Scenario 3F Cost Analysis

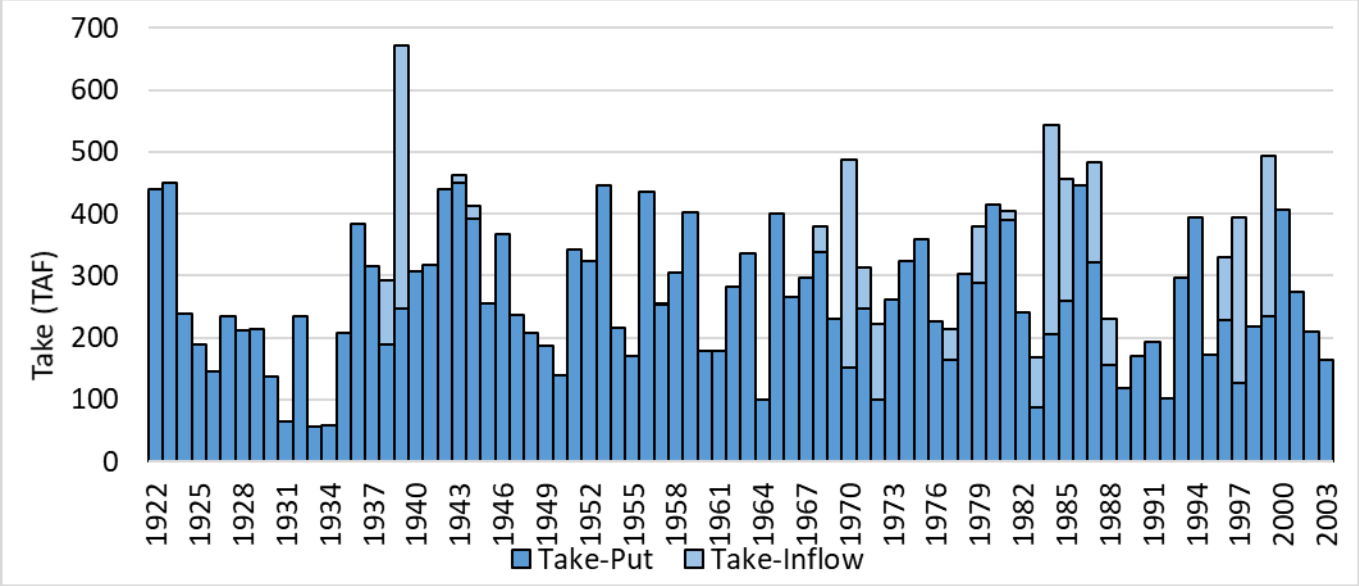
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	291
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$645
Unit cost of water, after repayment period ($/AF)	$87

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



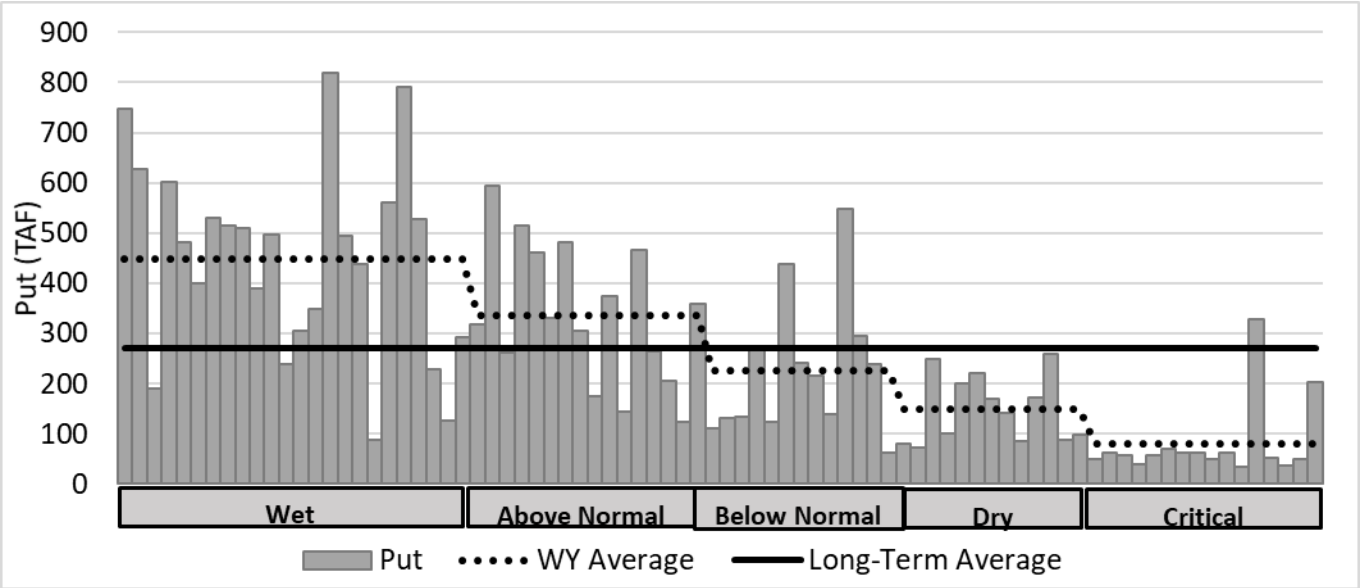
Key: TAF = thousand acre feet

Figure B.65 Scenario 3F Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



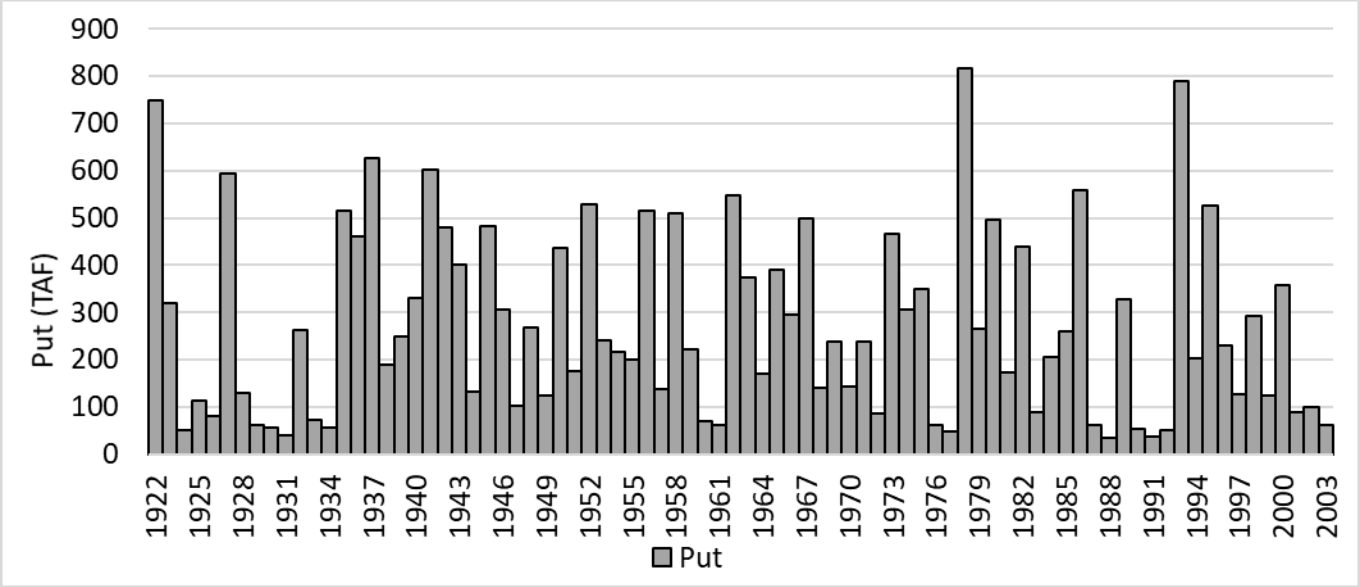
Key: TAF = thousand acre feet

Figure B.66 Scenario 3F Annual Take



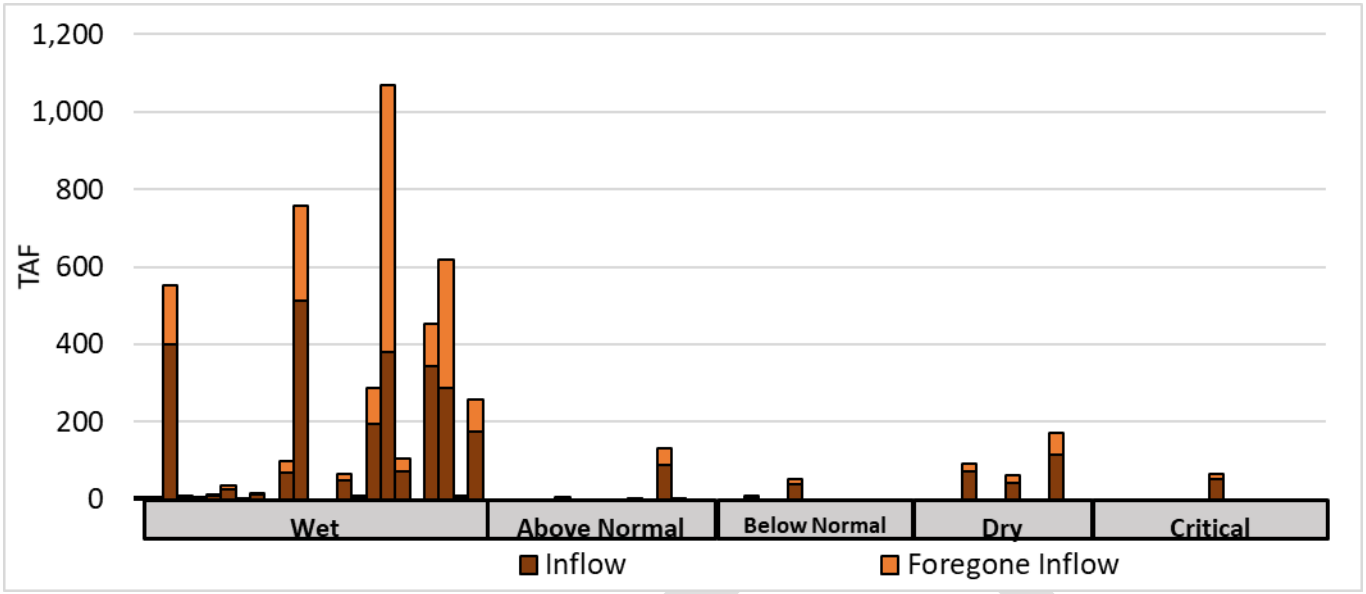
Key: TAF = thousand acre feet

Figure B.67 Scenario 3F Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



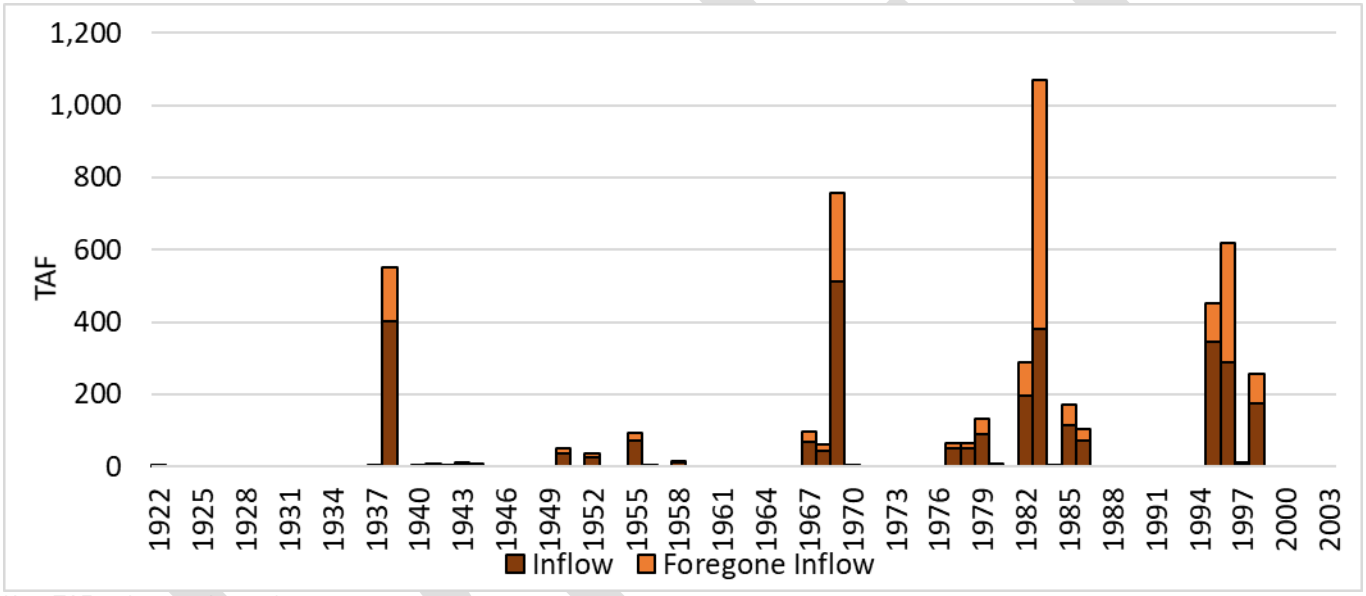
Key: TAF = thousand acre feet

Figure B.68 Scenario 3F Annual Put



Key: TAF = thousand acre feet

Figure B.69 Scenario 3F Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.70 Scenario 3F Annual Inflow and Foregone Inflow

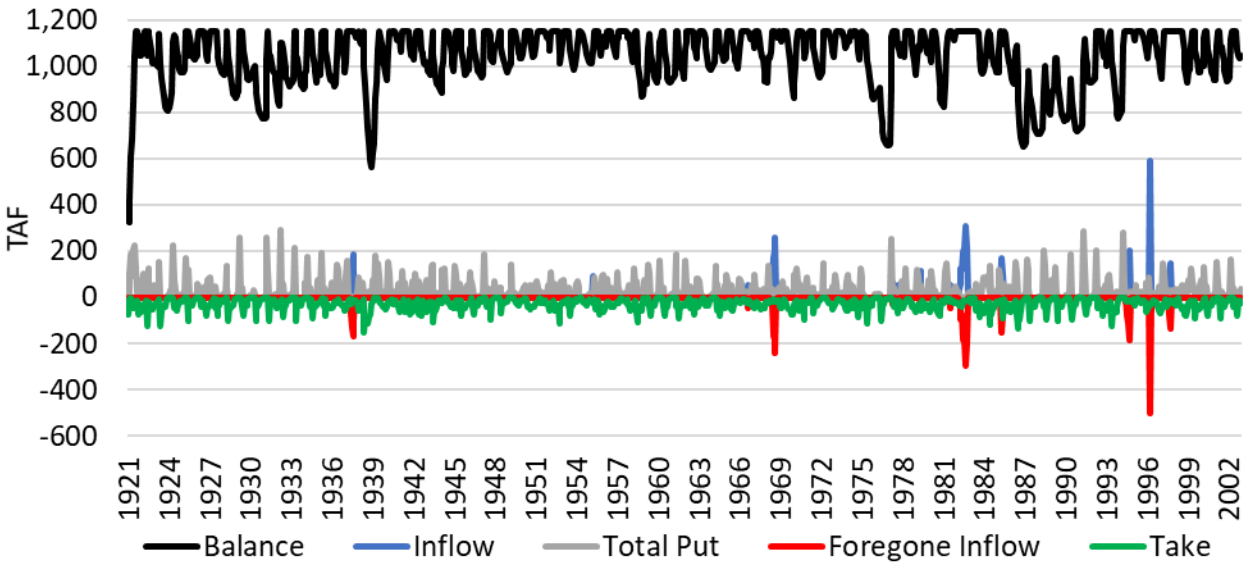
SCENARIO 3G

Combined Storage Account: 1,150 TAF

Table B.32 Scenario 3G Operating Conditions

Operating Conditions	Scenario
	3G
Existing Millerton Operations	Included
Individual Investor Operation	Included
Regulatory Conditions	COA Amendment with ROConLTO
Friant Physical Facilities	Historical Demands with Additional 3,000 cfs Demand
Unassigned Storage (275 TAF)	Outside Participant
Delta Surplus Supply	Used
Trans-valley Conveyance Capacity	1,000 cfs

Key:
cfs = cubic feet per second
COA = Coordinated Operations Agreement
CVP = Central Valley Project
Outside Participant = The storage was simulated as an account to represent a participant outside of the San Joaquin Valley
ROConLTO = Reinitiation of Consultation on Coordinated Long-Term Operations
TAF = thousand acre-feet



Key: TAF = thousand acre feet

Figure B.71 Scenario 3G Monthly Operations Trace

Table B.33 Scenario 3G Water Year Type Summary

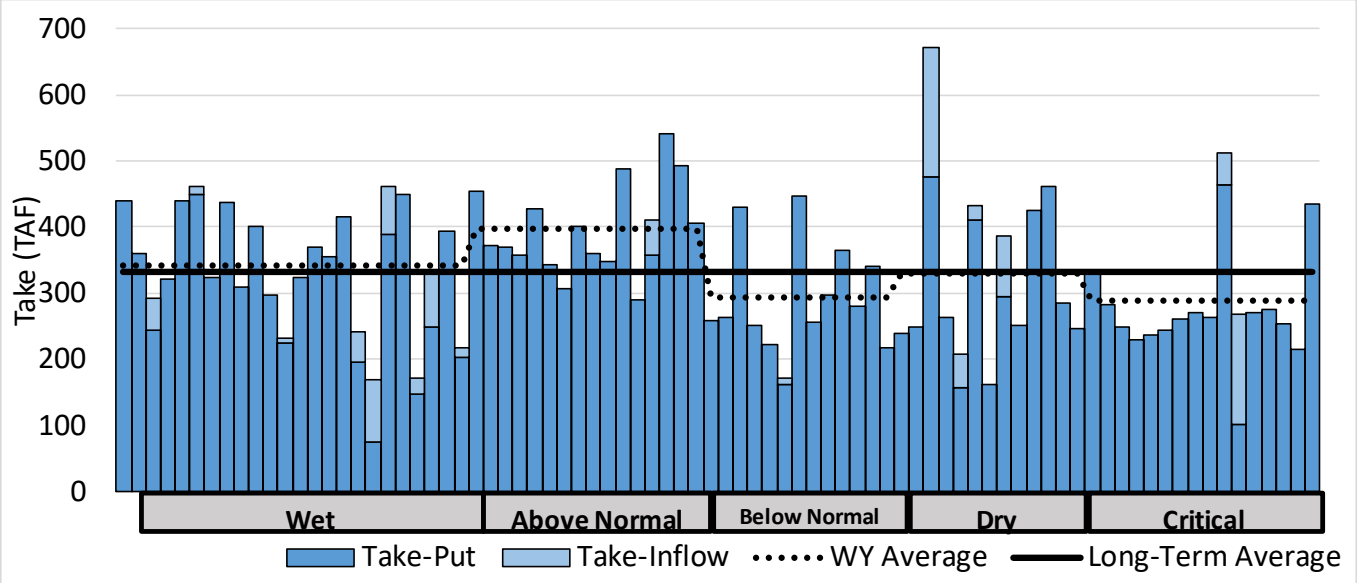
San Joaquin Valley WY Type	Inflow	Put	Take			Foregone Inflow
			Total	From Put	From Inflow	
	TAF	TAF	TAF	TAF	TAF	TAF
Wet	31	363	342	325	17	151
Above Normal	5	414	398	395	3	3
Below Normal	3	311	293	292	1	2
Dry	9	314	329	301	28	15
Critical	2	311	288	274	14	2
Long-Term Average	12	347	332	320	13	48

Key: TAF = thousand acre-feet WY = water year

Table B.34 Scenario 3G Cost Analysis

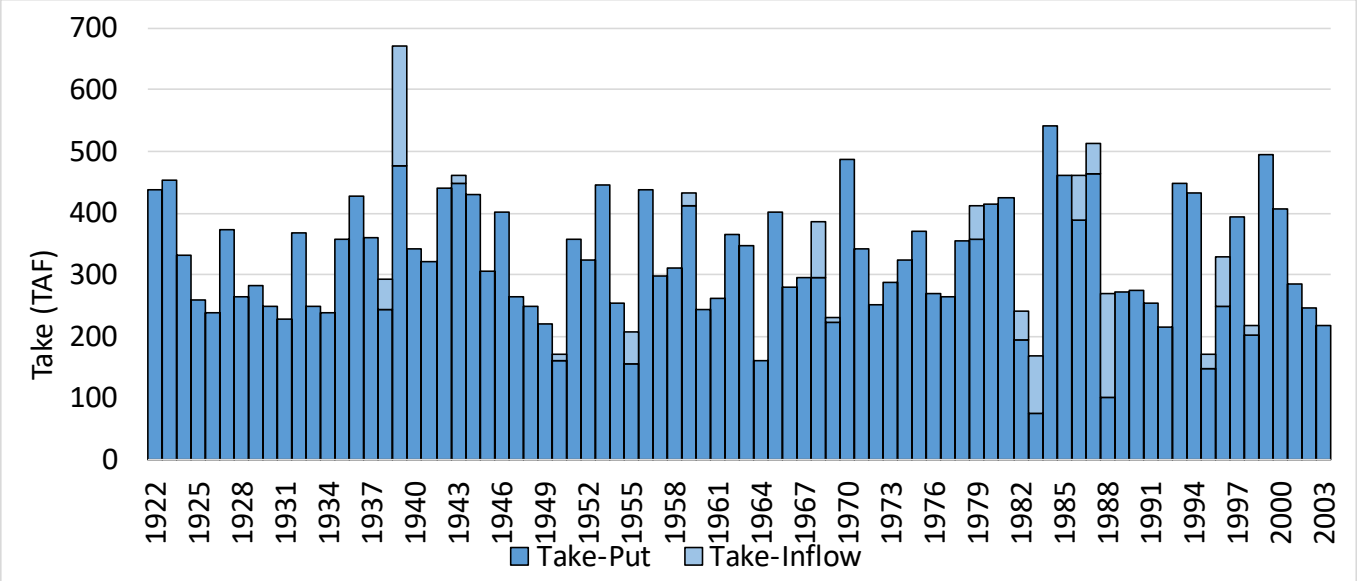
Component	Full-Size Reservoir
Potential Investor Storage Account	
Total Temperance Flat Storage (TAF)[1]	1,330
Total Temperance Flat Available Storage (TAF)	1,150
Investor Storage Account Size (TAF)	1,150
Investor Portion of Construction cost to repay ($M)	$3,569
Investor Details	
Investor Annual Water Yield (TAF)	332
Investor Costs	
Total Investment ($M)	$8,112
Annualized Cost ($M)	$188
Investor Unit Costs	
Cost of storage, relative to total investment ($/AF)	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,103
Annual cost of storage, during repayment period ($/AF)	$163
Annual cost of storage, after repayment period ($/AF)	$22
Unit cost of water, during repayment period ($/AF)	$565
Unit cost of water, after repayment period ($/AF)	$76

Note:
1.This includes 180 TAF of current Friant requirements and dead pool
Key:
$M = million dollars
$/AF = dollar per acre-foot
AF = acre-foot
TAF = thousand acre-feet



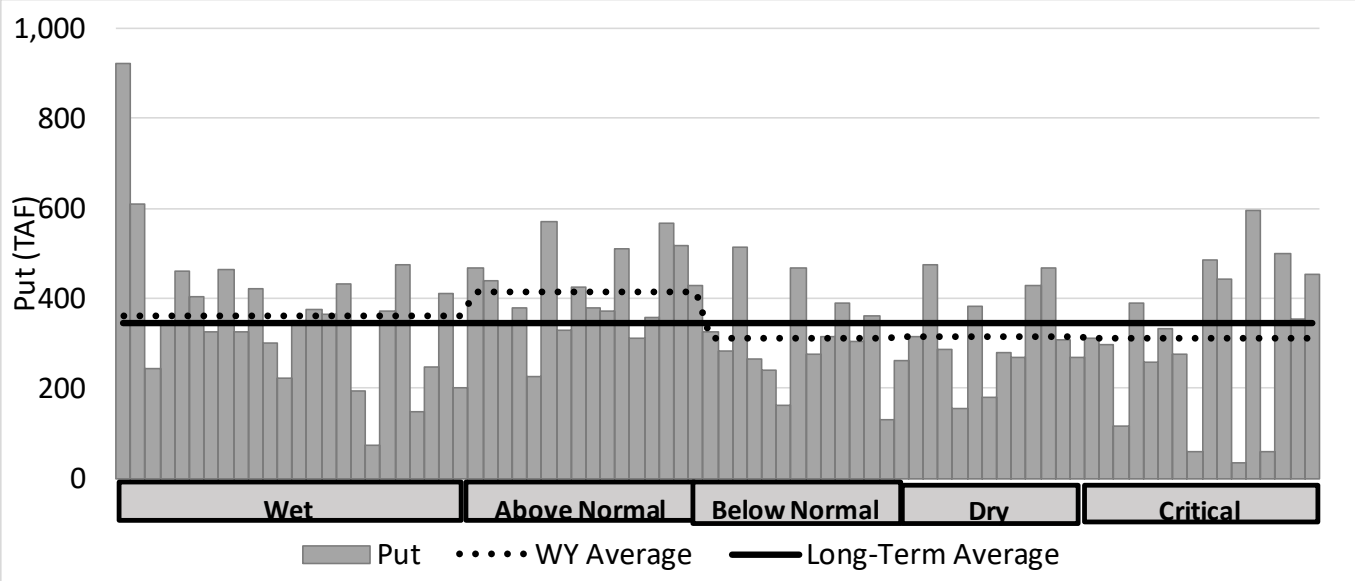
Key: TAF = thousand acre feet

Figure B.72 Scenario 3G Long-Term Average Annual Take and Annual Take by San Joaquin Valley Water Year Type



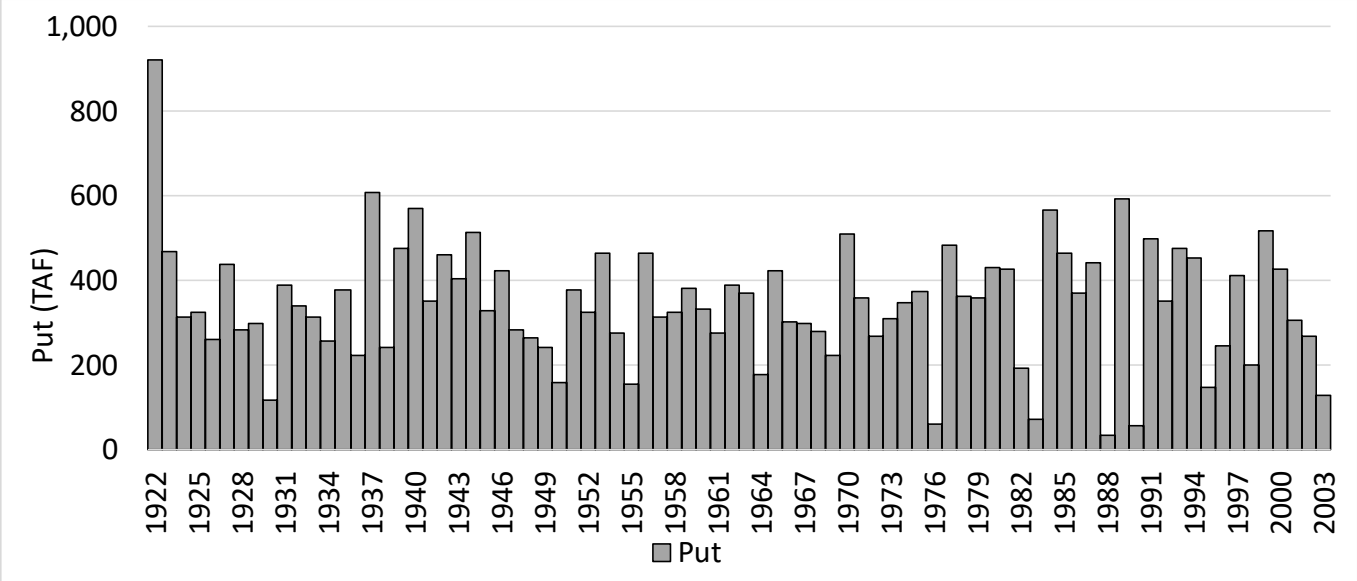
Key: TAF = thousand acre feet

Figure B.73 Scenario 3G Annual Take



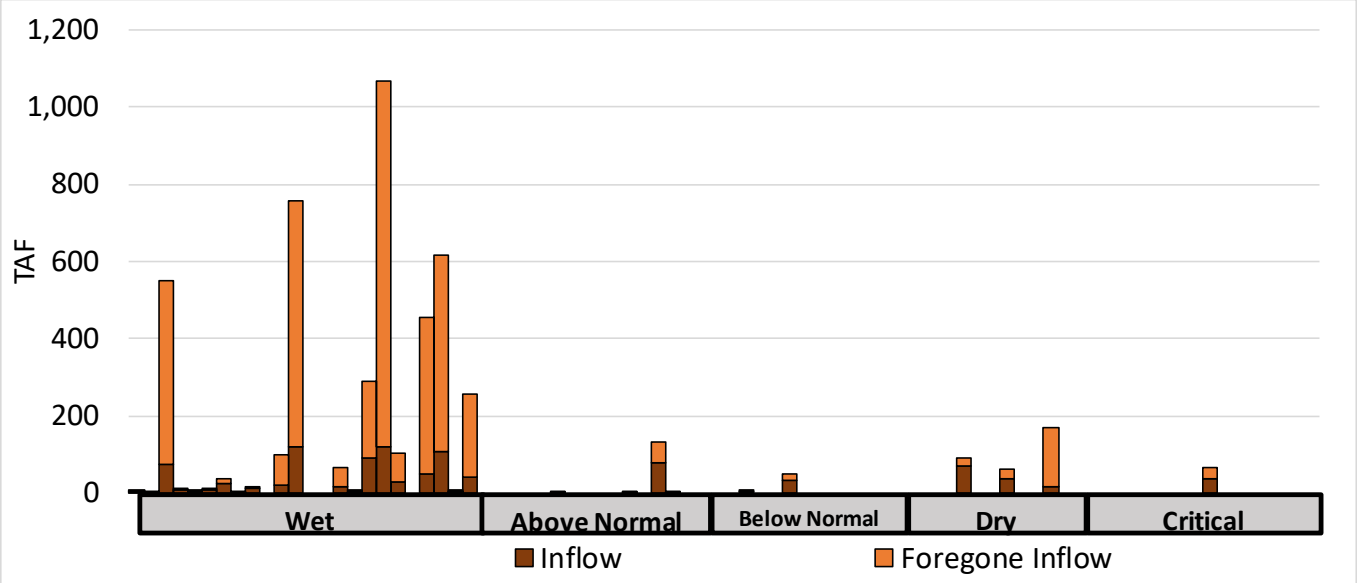
Key: TAF = thousand acre feet

Figure B.74 Scenario 3G Long-Term Average Annual Put and Annual Put by San Joaquin Valley Water Year Type



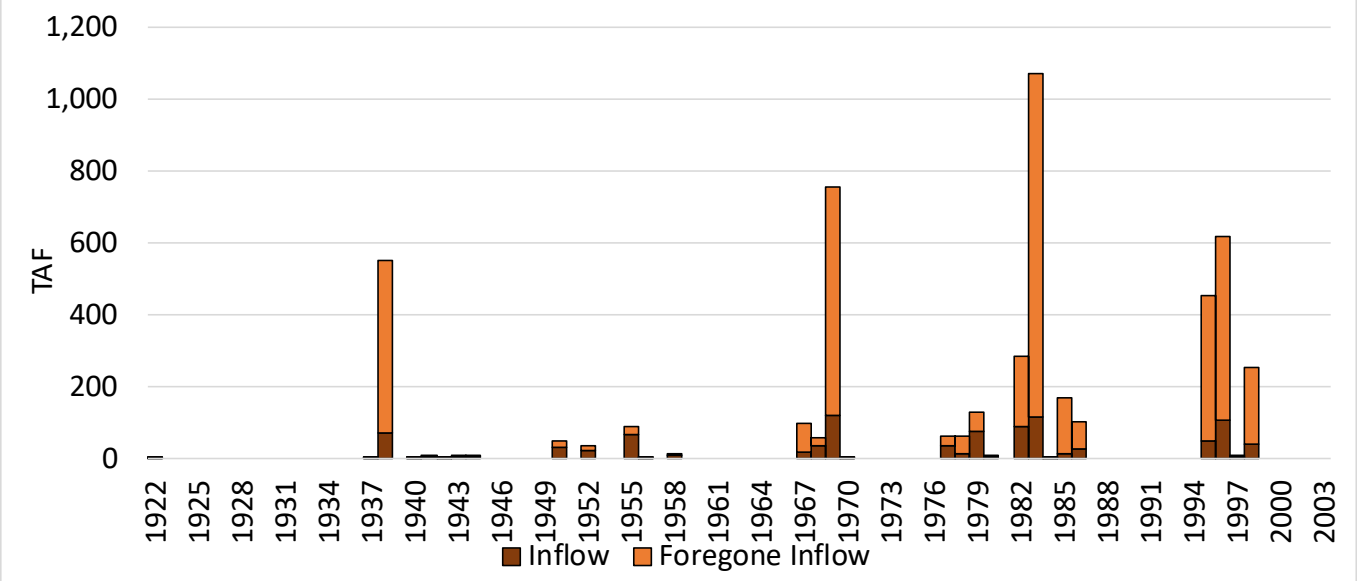
Key: TAF = thousand acre feet

Figure B.75 Scenario 3G Annual Put



Key: TAF = thousand acre feet

Figure B.76 Scenario 3G Annual Inflow and Foregone Inflow by San Joaquin Valley Water Year Type



Key: TAF = thousand acre feet

Figure B.77 Scenario 3G Annual Inflow and Foregone Inflow

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APPENDIX C – TEMPERANCE FLAT RESERVOIR PROJECT COST ESTIMATES

During the development of the MOU Group gaming tool and individual investor storage account operations, a series of workshops were held for the MOU Group to review existing TFR Project cost information and solicit feedback on the development of a cost analysis tool to evaluate a range of potential project costs and financing requirements associated with individual investor storage accounts.

EXISTING COST ESTIMATE INFORMATION

Reclamation has currently developed feasibility-level project cost estimates in 2015 dollars for the TFR Project as part of USJRBSI. During the development of project designs and costs, Reclamation performed numerous constructability and cost reviews including value planning; value engineering; and multiple design, estimating, and construction reviews. Chapter 6 of the Engineering Appendix to the WSIP application for the TFR Project contains specific project engineering and cost estimate details. Table C.1 is a summary of project facilities and corresponding field cost in 2015 dollars.

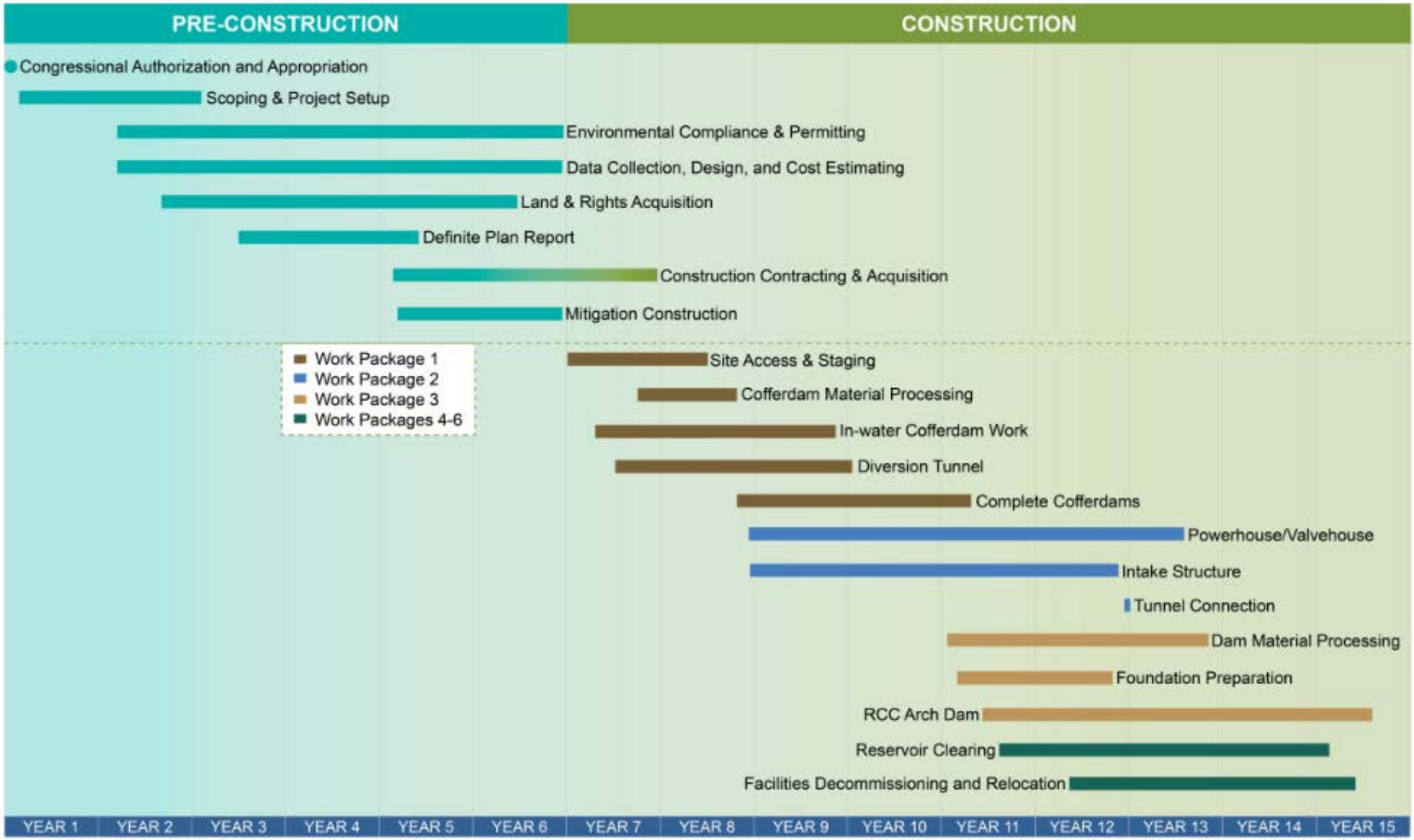
Table C.1 Field Cost Estimate Overview

COMPONENT	FIELD COST (MILLION 2015 DOLLARS)
Dam and Reservoir (i.e. RCC Dam; Reservoir Clearing; Fine Gold Creek Bridge; Contractor Use Areas; Haul Roads; and Permanent Access Roads)	$1,097
Diversion (i.e. Embankment Cofferdams and Diversion Stop logs)	$156
Spillway (i.e. RCC Spillway and RCC Spillway Bridge)	$92
Outlet Works & Power Features (i.e. Diversion and Outlet Tunnel & Portals; Low Level Intake Structure; Powerhouse, Valve House & Outlet; Transmission; Haul Roads; Permanent Access Roads; Powerhouse Access Bridge; and Works Chute)	$586
Affected Infrastructure (i.e. Kerckhoff Powerhouses Decommissioning; Utilities; Transmission Line Relocation; and Recreational Facilities)	$81
Total Field Cost	$2,013

Key:
RCC = roller-compacted concrete

Figure C.1 shows a timeline of project implementation which would take place in two phases, preconstruction and construction. Preconstruction phase is estimated to span approximately six years and would include: developing detailed project designs, acquiring necessary permits, acquiring required real estate interests, and relocating displaced parties. Once these initial phase activities are complete, the construction phase would be initiated. Construction activities for project features would likely span 8 to 10 years.

Table C.2 shows TFR Project cost estimate overview from both the USJRBSI Draft Feasibility Report (2014) and WSIP application, noting key differences between the two. WSIP evaluated the horizon of all project costs to present value, whereas the Feasibility Report evaluated the capital cost and annual costs. Figure C.2 shows the construction cost-loaded schedule preconstruction and construction phases.



Key: RCC = roller-compacted concrete

Figure C.1 Temperance Flat Reservoir Construction Activities and Implementation Schedule

Table C.2 Project Cost Estimate Overview

COMPONENT	FEASIBILITY REPORT (MILLION, 2014 DOLLARS)	WSIP (MILLION, 2015 DOLLARS)	WSIP NOTES
Field Cost (amount paid to construction contractor)	$2,013	$2,018	Indexed from 2014 to 2015
Non-Contract Costs (distributed costs – planning, design, compliance, permitting, CM, etc.)	$650	$391	Excludes environmental compliance, permitting, and land acquisition)
Construction Cost (field cost plus NCC)	$2,663	$2,409	See note above
Interest During Construction	$379	$468	3.375% (FR) vs 3.5% (WSIP)
Capital Cost	$3,042	$2,661	Excludes IDC, but does include environmental compliance, permitting, and land acquisition
Present Value Capital Cost	n/a	$3,189	Includes IDC
Interest and Amortization	$106.5	n/a	This is considered as part of Total Project Cost (horizon planning)
Annual OM&R	$18.9	$5.8	Kerckhoff mitigation much less due to baseline
Total Annual Cost	$125.4	n/a	This is considered as part of Total Project Cost (horizon planning)
Total Project Cost (Present Value)	n/a	$3,888	Present Value of Capital Cost, Interest During Construction, OM&R, and Future Monitoring/Adaptive Management)

Key:
$ = dollar
% = percentage
CM = construction management
FR = feasibility report
IDC = interest during construction
n/a = not applicable
NCC = non-contract cost
OM&R = operations, management, and replacement
WSIP = Water Storage Investment Program

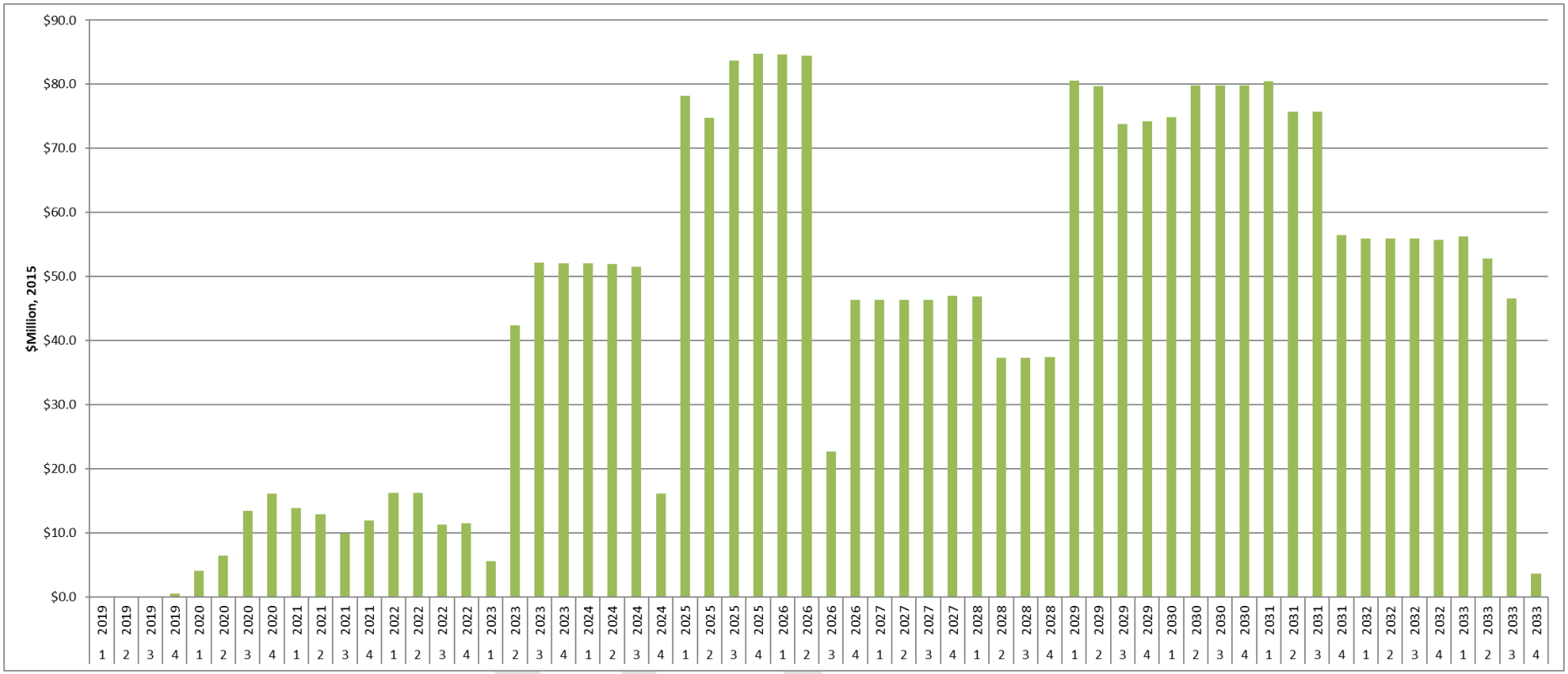


Figure C.2 Temperance Flat Reservoir Construction Cost-Loaded Schedule

Cost allocation and assignment is to derive an equitable distribution of costs among the project beneficiaries and project purposes. The basic steps associated with cost allocation and assignment are:

1. Identify costs to be allocated
    a. Capital Costs, Interest During Construction (IDC), and Annual Operations, Maintenance & Replacement (OM&R) Costs
2. Allocate costs to project purposes
    a. Identify single purpose, separable costs, and joint costs
    b. Allocate costs among beneficiaries proportional to the benefits remaining after separable costs are removed
3. Assign costs to beneficiaries
    a. Existing Federal, State, and other entity laws and objectives

Table C.3 shows an example project cost assignment from the USJRBSI Draft Feasibility Report (2014). Agricultural water supply benefits were estimated to be less than ecosystem benefits, and therefore had less costs assigned to it. IDC assists in determining Federal and State interest in non-reimbursable and reimbursable costs, however it is not included in cost assignment of construction costs.

Table C.3 Example Project Cost Assignment

PURPOSE/ACTION	TOTAL CONSTRUCTION COST ASSIGNMENT SUMMARY ($ MILLIONS)[1]						TOTAL
	Reimbursable		Non-reimbursable				
			Federal		State/Local		
	Assigned Percentage	Cost	Assigned Percentage	Cost	Assigned Percentage	Cost	
Irrigation Water Supply Reliability	100%	$572.5	0%	$0.0	0%	$0.0	$572.5
M&I Emergency Water Supply	100%	$252.8	0%	$0.0	0%	$0.0	$252.8
Fish Habitat Enhancement	0%	$0.0	23%	$385.8	77%	$1,291.5	$1677.3
Recreation	0%	$0.0	0%	$0.0	100%	$47.5	$47.5
Flood Damage Reduction	0%	$0.0	100%	$112.6	0%	$0.0	$112.6
Total	31%	$825.3	19%	$498.3	50%	$1,339.0	$2,662.7

Note:
[1] Construction cost assignment in 2014 dollars from Upper San Joaquin River Basin Storage Investigation Draft Feasibility (2014)

Key:
$ = dollar
% = percentage
M&I = municipal and industrial

COST ANALYSIS TOOL

MOU Group participants requested a cost estimate tool be developed that would include the following components:

1. Prices indexed to 2024 to account for escalation to construction notice to proceed (3.5% per year)
2. Incorporate cost horizon planning and capital cost amortization (repayment period and interest)
3. Inputs for adjusting size of Temperance Flat Reservoir, utilizing linear cost curves for the dam, contractor use areas, reservoir clearing, access and haul roads, spillway, recreation, and utilities
4. Inputs for adjusting costs assigned to irrigation water supply
5. Inputs for storage account size, annual yield, and irrigated acres to assist with apportioning construction costs and various unit cost reporting
6. Inputs for potential investor loan details, including upfront cash, repayment start date, repayment duration, and interest rate
7. Outputs for investor costs, including upfront cash, loan amount, loan interest, annualized cost, and payment schedule
8. Outputs for investor unit costs, including:
    a. Cost of storage, relative to total investment
    b. Cost of storage, relative to construction cost
    c. Annual cost of storage, during repayment period
    d. Annual cost of storage, after repayment period
    e. Unit cost of water, during repayment period
    f. Unit cost of water, after repayment period
    g. Unit cost of water per irrigated acreage, during repayment period
    h. Unit cost of water per irrigated acreage, after repayment period

Example Storage Account Cost Analysis

Table C.4 displays an example storage account cost analysis looking at two reservoir sizes: 875 and 1,150 TAF. A 70 TAF storage account size was assumed with 20 TAF average annual yield for an irrigation district with 165,000 irrigated acres. 100 percent of the construction cost was assigned to irrigation water supply. Loan duration was assumed to 50 years with annual interest rate of 2.875 percent, $0 upfront cash, and repayment beginning after completion of construction.

In the case of the full-size reservoir, the overall project cost is greater, however the unit cost of storage and water is less when compared to the smaller reservoir, mostly due to the economy of scale for construction costs. Note this analysis does not consider the cost of exchanged water supply if the storage space is used for that purpose.

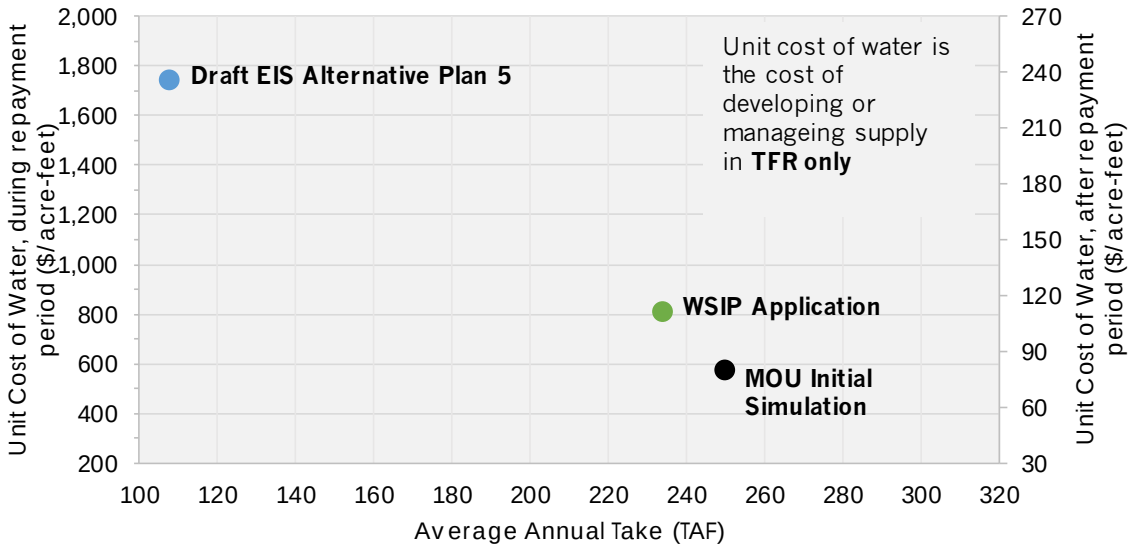
Table C.4 Example Storage Account Cost Analysis

COMPONENT	SMALLER RESERVOIR	FULL-SIZE RESERVOIR
Total Accounts (TAF)	875	1,150
Current Project Requirements/Dead Pool (TAF)	180	180
Total Reservoir Size at RM 274 (TAF)	1,055	1,330
Reservoir Water Surface Elevation (ft msl)	935	985
Total Construction Cost ($M)	$3,411	$3,569
Cost of storage, relative to total investment ($/AF)	$8,939	$7,054
Cost of storage, relative to construction cost ($/AF)	$3,899	$3,103
Annual cost of storage, during repayment period ($/AF)	$209	$163
Annual cost of storage, after repayment period ($/AF)	$29	$22
Unit cost of water, during repayment period ($/AF)	$730	$571
Unit cost of water, after repayment period ($/AF)	$101	$77
Unit cost of water per irrigated acreage, during repayment period ($/acres)	$88	$69
Unit cost of water per irrigated acreage, after repayment period ($/acres)	$12	$9

Key:
$M = million dollars
$/AF = dollar per acre-foot
$/acres = dollar per acres
ft msl = feet above mean sea level
RM = river mile
TAF = thousand-acre feet

Comparison with Other TFR Studies

Figure C.3 shows a comparison of the MOU Group Initial Scenario, Reclamation 2014 Draft EIS Alternative Plan 5, and WSIP Application Preliminary Operating Plan average annual take and unit cost of water. All unit costs are based on the same cost estimate developed for use by the MOU Group. It is important to note that the unit cost of water per acre-foot is the cost of developing or managing supply in TFR only.



Key: $/acre-feet = dollar per acre-feet
EIS = Environmental Impact Statement
MOU = Memorandum of Understanding
TFR = Temperance Flat Reservoir
WSIP = Water Storage Investment Program

Figure C.3 Memorandum of Understanding Initial Simulation, Draft Environmental Impact Statement Alternative Plan 5, and Water Storage Investment Program Application Average Annual Take and Unit Cost of Water, During and After, Repayment Period

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