Funding Scenario Analysis

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Funding Scenario Analysis

Purpose

This document supports information contained in Chapter 4 of the *California Water Plan Update 2018*. The purpose of this document is to provide a description of the funding analysis as well as the scenarios evaluated by the funding analysis. This supporting document provides the analysis called out for in the *California Water Plan Update 2013* Finance Planning Framework Component 8, which recommended the development of a decision support system (DSS) to provide guidance to the State on tradeoffs in a funding plan. To respond to this recommendation, this supporting documentation describes a funding tool used in the funding analysis and how scenarios were used in the tool to evaluate tradeoffs of different approaches to funding the recommended actions described in Chapter 3 of the *California Water Plan Update 2018*. The funding analysis used information about historical expenditures and funding need developed in the *Historical Expenditures and Current and Future Funding Needs* supporting document and information about existing and novel funding mechanisms developed in the *Funding Mechanism Inventory and Evaluation* supporting document.

Organization

This document is organized to provide information about how the funding analysis was developed, including use of a funding tool and scenarios:

- Developing a Funding Analysis
    - Building on the 2013 Finance Planning Framework
    - Complementary Funding Plans
- Funding Tool
    - Funding Tool Background and Overview
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Developing A Funding Analysis

The building blocks for the *California Water Plan Update 2018* funding analysis were established in 2013 Finance Planning Framework. Since 2013, new legislation and partnering strategic plans have been released that relate to water management in California. The *California Water Plan Update 2018* funding analysis considers these developments with an intent to stay relevant beyond 2018. The state's intent to provide an "ever-green plan" is declared:

> To be relevant, *California Water Plan Update 2018* needs to report on the *California Water Action Plan* implementation and its related State initiatives such as the *Sustainable Groundwater Management Ac*t, State drought response, Proposition 1 Water Bond, future Integrated Regional Water Management (IRWM) strategies, and flood investment strategy. In addition to being State government's long-term strategic water plan, *California Water Plan Update 2018* needs to – for the first time – identify specific outcomes and metrics to track performance, prioritize near-term State actions and investments, recommend financing methods having more stable revenues, and inform water deliberations and decisions as they unfold (DWR, 2017a).

Building on the 2013 Finance Planning Framework

As part of the *California Water Plan Update 2013*, the 2013 Finance Planning Framework (Framework) was developed and proposed actions to adapt, develop, and apply the Framework during *California Water Plan Update 2018* and beyond. It describes many activities, tasks, and deliverables that the *California Water Plan Update 2013* staff and advisory groups wanted included in the Framework, but were not completed during the *California Water Plan* Update 2013 process. In addition to the actions to improve the Framework, Chapter 8 of the *California Water Plan Update 2013*, "Roadmap for Action," contains a finance objective along with several related actions to improve the financing of integrated water management (IWM) activities in California. While the Framework is intended to guide decisions on State government funding, there is value in considering the Framework as a tool for identifying and sequencing finance planning activities at all levels of government. Future *California Water Plan* updates will continue to advance and refine the Framework and are expected to consider each component (as developed by the *California Water Plan Update 2013* Finance Caucus for the Finance Storyboard) of the Framework as described in the components shown in Table 1.

Table 1 California Water Plan Update 2013 Finance Planning Framework

Component Number	Component Name	Description of Actions
1	IWM Scope and Outcomes	Revisit, clarify, and adapt the scope of IWM to changing conditions and priorities.
2	IWM Activities	Develop more specificity regarding the types of activities that State government should invest in with a clearer nexus to the types of anticipated benefits.
3	Existing Funding	Continue to compile and synthesize data that tracks historical water-related expenditures across State, local, and federal governments in California.

Component Number	Component Name	Description of Actions
4	Funding Reliability	Work with the State Agency Steering Committee to identify where potential funding gaps exist between the State IWM activities described in Component 2 and existing funding levels and sources. Collaborate with regional water management groups to do the same for local and regional IWM activities.
5	State Role and Partnerships	Continue to clarify and elaborate on the future role of State government to support a more specific description and estimate of future costs.
6	Future Costs	Estimate future funding demands by (a) launching a data pull of IRWM, city, county, and special-district information, and (b) working with the State Agency Steering Committee to estimate the funding demand for existing and future IWM activities.
7	Funding, Who and How	Continue to collaborate with stakeholders and State, local, tribal, and federal governments to investigate and develop finance mechanisms and revenue sources. Funding mechanisms should provide a consistent financing framework for State government investments in IWM and work to: • Improve cost effectiveness, efficiencies, and accountability. • Avoid stranded costs and funding discontinuity. • Leverage funding across State government agencies. • Increase certainty of desired outcomes. • Prioritize based on shared funding values, defined principles, goals, objectives, and criteria. • Implement a prioritization method and rationale for apportioning IWM investment by the categories and subcategories developed in the *California Water Plan Update 2013* Framework (i.e., innovation and infrastructure). • Develop methods for enhancing stewardship of State government monies at both statewide and regional scales, including strategies to improve the transparency and accountability of State fund disbursements. Future deliberations on funding should include, but are not limited to, the attributes listed above.
8	Tradeoff Analysis	State government should develop a decision support system (DSS) to provide guidance and leadership for defining uncertainties of future cost, benefits, prioritization, and other tradeoffs. The DSS would inform prioritization of State government expenditures, estimation of expected IWM benefits, and methods for apportioning costs across financiers. It also includes developing a clear and consistent methodology for identifying public benefits associated with the entire range of IWM activities.

The eight-step framework led to the development of a funding tool to help identify the most viable, reliable, and applicable uses of those mechanisms for funding water resources management investment over the next 50 years, based on sets of assumptions. The *California Water Plan Update 2018* worked to address each of the components listed in Table 1. Specifically, Chapter 3 of the *California Water Plan Update 2018* outlines state activities related to IWM (Component 2), the *Historical Expenditures and Current and Future Needs* identifies historical expenditures, funding reliability, IWM needs, and funding gaps (Components 3- 6), and the *Funding Mechanism Inventory and Evaluation* outlines existing and novel funding mechanisms (component 7), and this documents a technical description of the DSS, the Funding Tool (component 8).

Complementary Funding Plans

In addition to building on the 2013 Finance Planning Framework, the *California Water Plan Update 2018* considers the recommendations and information provided in other funding plans. Table 2 contains complementary funding plans, descriptions, and related documents considered in development of the *California Water Plan Update 2018*.

Table 2 Complementary Funding Plans to the California Water Plan Update 2018

Complementary Funding Plans to the 2018 Plan	Documents	Description
California Water Plan 2013 Update (DWR, 2013)	Vol 1. Chapter 7 – Finance Planning Framework Vol 4 - Financing Strategies and Guidelines for Funding Water Resource Projects	An 8-step finance planning storyboard was developed in lieu of an actual Financing Plan along with a Finance Planning Framework. Step 8 of the storyboard proposed a decision support system (DSS) to help examine funding scenarios and analyze tradeoffs
Paying for Water in California (Public Policy Institute of California [PPIC], 2014)	Technical Appendix D: Using the Water Fee Model to Assess Funding Alternatives	Identified funding gaps across water sectors, considered nexus and reliability to match funding sources to funding gaps, used a u water fee model to assess funding alternatives, recommended legal reforms at State and local levels for sustainable water management.
List of Companion State Plans California Water Plan, Update 2013 (DWR, 2013)		Details all state agency plans and highlights those with a strong nexus to the *California Water Plan*.
Managing California Water through federal, State, and Local Cooperation (DWR, 2016)		An outline of topics that cover reliability, regional sustainability, public safety, and funding sources for sustainable resources management in California.
California Water Action Plan (California Natural Resources Agency et al, 2014 and 2016)		Outlines the method for water sustainability in California.
2017 Central Valley Flood Protection Plan - Investment Strategy Highlights (DWR, 2017b)		Provides a detailed Plan to fund flood management actions for the State Plan of Flood Control (SPFC) within the Central Valley over the next 30 years
Investing in California's Flood Future: An Outcome-Driven Approach to Flood Management (DWR, In Process)		Provides a detailed Plan to fund flood management actions statewide over the next 50 years.

Funding Tool

Component 8 of the 2013 Finance Planning Framework called for the development of a DSS to provide guidance in a tradeoff analysis. The Funding Tool is the DSS developed for the *California Water Plan Update 2018* funding analysis and has the components called for in the Framework.

Funding Tool Background and Overview

The Funding Tool was developed to evaluate different approaches to funding water resources management in California. The Funding Tool informs the State on tradeoffs when prioritizing funding for

local assistance, recommended actions, capital, or ongoing management actions. The Funding Tool is a unique version of a DSS that has had previous applications in other state investment strategies: the 2017 Update to the *Central Valley Flood Protection Plan Investment Strategy* (DWR, 2017b) and the Statewide Flood Management Planning Program's *Investing in California's Flood Future: An Outcome-Driven Approach to Flood Management* (DWR, In Process).

The Funding Tool was developed within Microsoft Excel™ and uses a linear optimization routine to provide the solution. The Funding Tool includes:

- A user interface dashboard for input values. This dashboard is unique to the scenario being analyzed.
- An input sheet containing the water management action needs as well as assumptions on cost shares, applicability, and outcome scores.
- Three phase sheets containing the solution that fills a large pivot table to generate reports and graphics.

The data, assumptions, and scenarios evaluated in the Funding Tool have been developed and reviewed by DWR staff with input from the Policy Action Committee and California Water Plan stakeholders.

Funding Tool Detail

The Funding Tool can evaluate various planning horizons. For *California Water Plan Update 2018,* the funding tool informed a funding analysis for three phases over a 50-year planning horizon. The length of each phase is as follows:

- Phase 1 is 10 years
- Phase 2 is 20 years
- Phase 3 is 20 years.

The model optimizes by allocating available capacity of State, local, and federal funding mechanisms across the different water resources management actions based on three criteria: applicability of funding mechanism to management action; weighted outcome score of the management action, and contribution of the management action to sustainability. The objective is to maximize California water resources management sustainability, which is an index of the three criteria.

$$\underset{f_{pki}}{Max\ Sustainability} = \sum_{p}\sum_{k}\sum_{i} f_{pki}\left(\alpha S_{fi} + (1-\alpha)C_{iwv} + \beta R_i\right)$$

The choice variable is *f*, which is the dollar amount of funding for each phase (p), from each mechanism (k), that is available to fund each management action (i). The optimization is constrained by the annual capacity of each funding mechanism and cost share limits. Each management action has a unique combination of State, local, and federal minimum and maximum cost share constraints based on historical or existing assistance programs. Certain scenarios also force minimum levels of funding for each of the five water sectors to mimic historical funding patterns. Table 3 defines each variable in the Funding Tool.

Table 3 Funding Tool Variables and Descriptions

Variable	Description	Notes
f	Number of dollars	The number of dollars for phase (p) and mechanism (k) is a user input and can vary across scenario depending on desired analysis.
p	Phase	The 50-year planning horizon is split into three phases. Phase 1 is the next 10 years, Phase 2 is years 11-30, and Phase 3 is years 31-50. The duration of phases can be adjusted by the user.
k	Funding mechanism	Existing and novel State, local, and federal funding mechanisms evaluated in the scenario analysis.
i	Management action	Detail on management actions is provided in the *Historical Expenditures and Current and Future Funding Needs* supporting document.
α	Preference towards applicability/ outcome score	α shifts the preference in the optimization between applicability score and outcome score.
β	Preference towards sustainability	The value of β determines the preference in optimization to those management actions that have been identified as contributing to the sustainability outlook priority
S	Applicability score	Applicability scores (high, moderate, low, or N/A) captures the general applicability of each funding mechanism to each management action based on historical record or legislative restrictions.
C	Outcome score	The outcome score for each management action is a weighted sum of the management action's contribution to each of the societal values.
w	Societal Value weights	The societal value weights adjust outcome scores to reflect preferences toward each societal value. The four societal value weights always sum to one.
v	Contribution to Societal Value	Each management action has a contribution level (high, moderate, low, or N/A) toward each societal value (Public Health and Safety, Healthy Economy, Ecosystem Vitality, and Opportunities for Enriching experience).
R	Sustainability score	Sustainability scores are given to management actions that contribute to the sustainability outlook priority. The model will attempt to fund these management actions prior to funding management actions without sustainability scores.

The Funding Tool calculates the annual contribution toward each management action from the funding mechanism included in the scenario. The Funding Tool is an optimization model; the objective is to

maximize the contribution to societal values, funding mechanism applicability, and funding toward the sustainability outlook. The Funding Tool combines qualitative scoring (applicability and outcome scores as high, moderate, low, or N/A) with quantitative constraints (annual capacity of each funding mechanism). Increasing the optimization score is achieved when management actions are funded with the most applicable funding mechanisms and the management actions that are funded have the highest contribution to societal values. The annual capacity for each funding mechanism, as well as cost shares limit the ability to achieve the highest possible optimization score.

The Funding Tool input sheet contains IWM management actions, and their level of need by phase, outcome score, fund applicability, and cost share limitations. The optimization mechanics of each phase are contained in a unique sheet of the Funding Tool. The Funding Tool solves in chronological order and independent of future phase needs. For instance, Phase 1 is solved for first without foresight of Phase 2 and Phase 3. Any capital management actions that were not fully funded in Phase 1 are added to the total need of the next phase. However, unmet ongoing management action need is not rolled over into the next phase because ongoing needs have an annualized cost. The same process for Phase 1 is repeated for Phase 2 and Phase 3.

Funding Tool Data

In addition to the data required to populate the variables described above, the Funding Tool incorporates different data sources. The water resources management need was compiled in the *Historical Expenditures and Current and Future Funding Needs* supporting document and is shown in Table 4 and 5. The quantified need is categorized by water sector and management action. This ongoing and capital management action need is combined with the recommended actions to populate the input sheet of the Funding Tool. For each management action, the unique applicability score, outcome score, cost shares constraints, and sustainability score is defined on the input sheet.

Historical expenditure data from State, local, and federal agencies on water resources management in California created the foundation of the scenario analysis. Historical expenditures by funding mechanism and by water sector provided the inputs for the current trends scenario. Table 6 provides the historical expenditure data for State, local, and federal agencies for water resources management in California (this data was developed in the *Historical Expenditures and Current and Future Funding Needs* supporting document*).* The Funding Tool imposed adjustments on historical expenditures across all State, local, and federal agencies. These adjustments allowed the tool to consider only historical expenditures applicable to the identified future need. For example, baseline local administration expenditures were removed from the capacity available because future administration need costs were not included in the Funding Tool. The matching of future need with historical expenditures allows for a more accurate calculation of annual funding mechanism capacity. For final accounting of the need, the amount excluded from the tool was added back into the total.

Table 4 Summary of Water Resources Management Capital Funding Gap in California

Management Action Type	Total Funding Need ($ millions)	Average Historical Expenditure ($ millions)	Funding Gap ($ millions)
Recommended Actions	$61,435	-	$61,435
Flood Management	$35,731	$986	$34,745
Water Supply Reliability	$77,572	$3,351	$74,221
Water Quality	$54,436	$3,091	$51,346
Ecosystem Management	$26,829	$264	$26,566
People and Water	$517	$414	$103
Total	$256,520	$8,106	$248,416

Table 5 Summary of Water Resources Management Annual Ongoing Funding Gap in California

Management Action Type	Total Funding Need ($ millions per year)	Average Historical Expenditure ($ millions per year)	Funding Gap ($ millions per year)
Recommended Actions	$638	-	$638
Flood Management	$2,404	$1,918	$486
Water Supply Reliability	$13,722	$14,006	--[a]
Water Quality	$9,296	$9,116	$180
Ecosystem Management	$551	$494	$57
People and Water	$1,850	$1,831	$19
Total	$28,461	$27,365	$1,380

Note: [a] The funding surplus in water supply reliability is due to incomplete information from State Water Project operations. In addition, water supply reliability needs are accounted for in the recommended actions under Goal 1 for infrastructure assessment and improved O&M.

Table 6 Historical Funding Levels of Current Funding Mechanisms
(Based on Average and Maximum Historical Expenditures 2006–2015[1,2])

Funding Mechanism		Historical Annual Average ($ millions)	Historical Annual Maximum ($ millions)	2015 Actual Expenditures ($ millions)
State	General Fund	$264	$466	$279
	GO Bond	$1,615	$2,238	$1,870
	Interest on GO Bond Debt[2]	$491	$695	$668
	Designated Special Fund[3]	$4,982	$7,092	$3,362
Local Agency[4]		27,823	$27,823	$33,382
federal Government[5]		788	$788	$1,074

Notes:

[1] Table columns and row totals may not sum correctly due to rounding.

[2] Interest on water related general obligation bonds debt from the California Department of Finance (http://www.ebudget.ca.gov/2015-16/pdf/GovernorsBudget/8000/9600.pdf).

[3] Designated special fund mechanism includes fees, assessments, taxes, and other revenue sources with a designated purpose.

[4] Local agency funding is from city, county and special district general funds, user fees, and GO bonds for water resources associated capital and some ongoing actions (excludes administrative and local agency O&M activities).

[5] federal government funding is from congressional appropriation for BLM, FEMA, NOAA, NPS, NRCS, Reclamation, USACE, and USFS, water resources management associated capital and some ongoing actions (excludes administrative and federal O&M activities).

Table summarized from information in Historical Expenditures and Current and Future Funding Needs supporting document.

Certain data required expert opinion and stakeholder input to generate. After agreement on the values, the applicability, outcome, and sustainability scores, as well as cost shares were fixed across scenarios. Cost escalation can be imposed on the water resources management need, but was not used to avoid complication in tracking costs over time. In addition, there may be variations in the base cost year used when developing management action needs. The lack of analysis on impact from changing variables allowed the funding analysis to focus on the State's role in funding water resources management. Although, part of the development of the Funding Tool was a sensitivity analysis on certain variables, overall, the funding analysis holds all variables constant across the scenarios except for the annual contribution by State and novel mechanisms. The funding analysis evaluates changes in variables, input data, and State, local, and federal funding mechanism capacity.

Sensitivity Analysis

The variables discussed in the sensitive analysis include: preference toward applicability score or outcome score (α), societal value weighting, and preference toward sustainability (β).

The preference toward applicability score or outcome score, (α), shifts the preference in the optimization between applicability score and outcome score. The value of α is between zero and one, so that $0 \leq \alpha \leq 1$. If the value is set to zero, the model optimizes funding to achieve the highest outcome score. If the value is set to one, the model optimizes to achieve the highest applicability score. An α of 0.5 optimizes the funding to achieve the highest combined outcome and applicability score. The value of α for the *California Water Plan Update 2018* funding analysis is 0.5. Sensitivity analysis proved that varying α, while holding all else constant, does not result in significant changes to model outputs. This is due to annual funding capacity, funding mechanism applicability, cost share constraints, and preference toward sustainability being more determinant of model output.

A societal value weight is assigned to each of the four societal values and range from zero to one. The four societal value weights always sum to one and influence the outcome score for each management action. These relative weights allow the scenario to impose preferences toward a certain societal value. Holding everything else constant, increasing the relative weight for one of the societal values will result in the funding of management actions that have high contributions to that societal value. Each management action's level of contribution (v) to the societal values are fixed and do not vary between scenarios. Each management action has an overall outcome score that is the summed product of the variable societal value weights (w) and the fixed level of contributions, defined below:

$$Outcome\ Score = w \cdot v = (w_{PS} \quad w_{HE} \quad w_{EV} \quad w_{EE}) \begin{pmatrix} v_{PS} \\ v_{HE} \\ v_{EV} \\ v_{EE} \end{pmatrix} = C_{iwv}$$

where:

w_{PS} = relative weight for outcomes that provide for public health and safety

w_{HE} = relative weight for outcomes that support a healthy economy

w_{EV} = relative weight for outcomes that support ecosystem vitality

w_{EE} = relative weight for outcomes that provide opportunities for enriching experiences.

The funding analysis assigned equal weights to all four societal values; therefore, all values in *w* are equal to 0.25. Sensitivity analysis proved that varying *w*, while holding all else constant, influences the schedule of funding for certain management actions. For example, increasing the relative weight of public health and safety will result in earlier funding of management actions in the flood management sector. Overall, the most significant changes to model output from varying societal value weights is the schedule of when management actions are funded.

The preference toward sustainability (β) acts as a scalar to the management action's contribution to the objective function. The scalar increases based on the management action's contribution to the sustainability outlook priority. These management actions are largely ongoing and recommended actions. Identifying a management action as a contributor to the sustainability outlook priority has a strong influence on the funding of that management action.

Funding Tool Considerations

The incorporation of qualitative and quantitative information into a DSS has unavoidable shortcomings. The translation of qualitative information into quantitative metrics requires consideration of scaling. This was addressed by quantifying both the contribution to societal values and the applicability scores into identical numerical ranges. Identical numerical ranges prevent the prioritization from being heavily influenced by one metric. While this helps the Funding Tool's ability to solve, the tradeoff made by decisionmakers may differ. In addition to scaling, translating qualitative information into quantitative metrics is another shortcoming of DSS. For example, the relative magnitude of outcome contributions across management actions is not fully captured in the outcome scores. The overall outcome score and level of need are a proxy for the magnitude of benefits, but still do not consider benefits that accrue locally versus statewide.

The funding tool does not consider the entire 50-year need when completing the optimization. Each phase solves independent of the next, without perfect foresight of the need in the following phase. Implementation schedules may be different if phases are defined in different temporal resolution. Therefore, the results provided in the *California Water Plan Update 2018* are for planning level efforts with a fixed implementation schedule. In addition to the temporal resolution, the categorization of projects into management actions and water sectors influences the amount of variation considered during optimization. For instance, there are applicability, outcome, and cost sharing variations across projects within a management action category. The classification assumes characteristics of a typical action within a management action, for the entire management action category. There is a distribution of characteristics across actions within a management action category. By increasing the amount of management action categories, the model would be able to capture more variation across water resources management actions.

Scenario Support

The *California Water Plan Update 2018* approach to funding water resources management in California is focused on the State's role in funding water resources management including the recommended actions detailed in Chapter 3 of the *California Water Plan Update 2018*. The *California Water Plan Update 2018*

funding analysis uses a 50-year phased funding approach to support investment in actions that contribute to sustainability, track results over time, and has the flexibility to adapt to the changing needs of California. The funding scenarios bring together quantitative assumptions and qualitative considerations to conduct an analysis of possibilities and opportunities. The exploration of these tradeoffs between annual capacity, funding recommended actions, and scoring offer funding-specific findings that provide decision-makers with a knowledge base of funding recommendations. Decision-makers may use this knowledge base to maximize the return on investment for implementing recommended actions, as well as capital and ongoing water resources management needs in California. Figure 1 demonstrates this approach to funding water resources management.

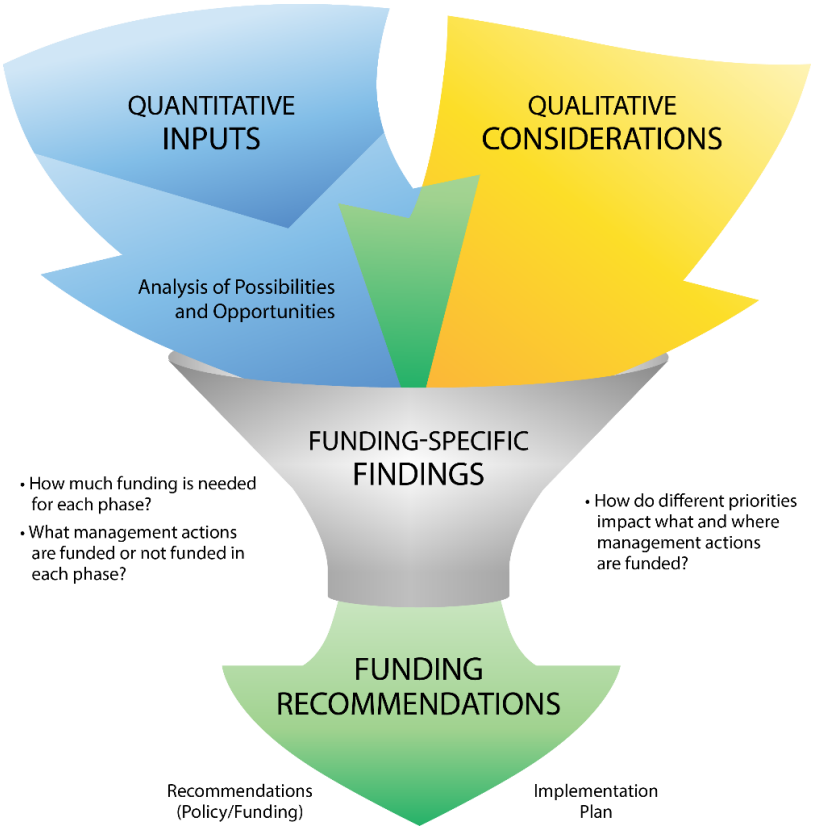

Figure 1: An Approach to Analyze Funding for Water Resources Management in California

Funding Scenarios

Several funding scenarios were developed to evaluate the plausibility and trade-offs of different combinations of funding mechanisms. Each scenario represents a different contribution of mechanisms to provide the additional funding detailed in Chapter 3 of the *California Water Plan Update 2018*. The scenarios were compared with current trends, which assume that average annual State, local, and federal funding levels remain unchanged. Historical average and maximum expenditures are shown in Table 6. By comparing the scenarios with current trends, a common frame of reference is established to examine how benefits and impacts vary among the scenarios. The scenarios were used to develop the funding options, which can be used by the Governor, Legislature, and other decision-makers to formulate funding policies needed to implement this plan. The scenarios are focused on State funding for the purposes of identifying trade-offs. Table 7 summarizes scenario constraints.

Table 7 Funding Analysis Scenarios

Funding Scenario	Assumed Funding Level by Mechanism				
	State General Funding	General Obligation Bonds	Novel	Local	Federal
Scenario A: Emphasis on Borrowing	Average	Increase	Not Used	Average	Average
Scenario B: Emphasis on State General Fund *(a.k.a. "Pay as we go" to implement Update 2018 recommended actions)*	Increase	Average	Not Used	Average	Average
Scenario C: Current Mechanisms at Maximum Historical Levels, with Novel	Maximum	Maximum	Used	Average	Average
Scenario D: State General Fund Replaces Need for Novel Mechanisms	Increase	Maximum	Not Used	Average	Average
Scenario E: Accelerated Funding	Maximum	Increase	Used	Average	Average

Notes:
Average = annual historical average
Maximum = annual historical maximum
Increase = significant increase over annual historical average
Not Used = novel mechanisms not used in scenario
Used = novel mechanism used in scenario

Scenario A: Emphasis on Borrowing – This scenario depicts the debt, and interest on the debt, throughout the 50-year planning horizon, accompanied by increased borrowing. State general funding remains at the historical average level. State GO bonds increase to pay for recommended actions; no novel mechanisms are utilized. Local and federal funding remains at historical annual averages.

Scenario B: Emphasis on State General Fund – This scenario explores increasing appropriations from the State General Fund without increased borrowing. State general funding increases to implement the recommended actions. State GO bonds remain at the historical average level; no novel mechanisms are utilized. Local and federal funding remains at historical annual averages.

Scenario C: Current Mechanisms at Maximum Historical Levels, with Novel – This scenario depicts a strategic mix of all funding mechanisms. State general funding and GO bonds are utilized at maximum historical levels to help implement the recommended actions. Novel mechanisms are used to fund the remaining need (see Table 8, Scenario C). Local and federal funding remains at historical annual averages.

Scenario D: State General Fund Replaces Need for Novel Mechanisms – This scenario uses general funds instead of novel mechanisms. GO bonds are utilized at the maximum historical levels, while the General Fund is increased to alleviate the need for any novel mechanisms. Local and federal funding remains at historical annual averages.

Scenario E: Accelerated Funding – This scenario explores an increase in annual expenditures for accelerated implementation of actions. State General Fund is utilized at the maximum historical level. Novel mechanisms are utilized (see Table 8, Scenario E), and GO bonds are increased at the level necessary to meet an accelerated implementation of the recommended actions. Local and federal funding remains at historical annual averages.

Findings

There are many complexities, considerations, and unknowns surrounding the identification, implementation, and administration of the most appropriate, feasible, equitable, and cost-effective ways to pay for the implementation of recommended actions in the *California Water Plan Update 2018*. The funding scenario metrics and findings provide a common understanding of specific trade-offs among the different funding scenarios. The metrics and findings helped determine the funding options detailed in Chapter 5 of the *California Water Plan Update 2018*.

The funding scenario metrics are the specific, quantifiable trade-offs used to assess the funding scenarios. They are:

- Total Annual Funding by Funding Mechanism — Represents annual amounts provided by each mechanism for both ongoing and capital funding needs. This helps derive the proportional funding amounts among of the mechanisms used in each scenario.
- Total Funding Required over Planning Horizon — Depicts the entire amount of State funding required to implement the recommended actions over the next 50 years. This metric is particularly useful for understanding the cost of borrowing.
- Annual Fiscal Impacts of Novel Mechanisms — Illustrates the relative magnitude of cost impacts

from novel mechanisms and their distribution in terms of households, individuals, property owners, and taxpayers. These metrics are hypothetical and not intended to signal a specific funding mechanism or literal distribution of costs among Californians or California households.
    - Cost per Household — The equivalent cost per household, assuming a range of between 67 and 85 percent of households have the ability to pay (based on federal poverty line).
    - Equivalent Cost per Capita — The equivalent cost per capita assumes 85 percent of the population pays, assuming 85 percent of the total population has the ability to pay.
    - Per Parcel — The equivalent cost per parcel, calculated as a flat amount per parcel.
    - Dollars per $100 of Assessed Value of Property — The equivalent of an ad valorem tax rate in terms of dollars per $100 of net assessed value.
    - Per Acre — The equivalent of a per-acre charge on private land ownership to mimic assessments or taxes based on acreage of property.
- Primary Payers — Identifies what portion of California's population provides the funding. Categories include urban water users, agricultural water users, income-tax payers, and property owners.

If current trends continue, the *California Water Plan Update 2018* recommended actions would go unimplemented. It is likely that some current State funding would be redirected to sustain ongoing State activities, and thus leave less funding available for State, regional, and local capital investment. If this were the case, State funding for local assistance programs would be cut.

Using current trends as a baseline, the results of exploring the trade-offs for each funding scenario are summarized below and shown in greater detail in Table 8. Table 9 shows the annual fiscal impacts of funding the recommended actions across the different scenarios. For every scenario, total annual local and federal funding is assumed to remain at current levels of approximately $28 billion and $800 million, respectively.

Scenario A: Rely Heavily on Borrowing — Historical average funding from State GO bonds would need to be more than doubled to fully fund the recommended actions. Relative to current trends, this would significantly increase interest accrued on debt (more than $65 billion over the 50-year planning horizon). Because GO bonds are intermittent and unpredictable, they are not appropriate for funding ongoing activities. Moreover, borrowing to pay for ongoing State activities is inconsistent with several shared values, including good stewardship of State government monies and recognition of the cost of borrowing and the risks of indebtedness.

Scenario B: Rely Heavily on State General Fund — This scenario would require a considerable increase (more than eight times the current trend) in State General Fund appropriations to implement the recommended actions. State General Fund appropriations have a lower inter-annual reliability because they must compete with other State services for funding. Because it is highly unlikely the State would increase General Fund appropriations by approximately 700 percent, this scenario is inconsistent with the shared value that calls for reasonable assumptions about future revenues.

Scenario C: Utilize Current Mechanisms at Maximum Historical Levels, with Novel — A tax or assessment, of about $8 per month for every household in California (above the federal poverty line), combined with historical maximum General Fund and GO bond use, would fully fund the recommended actions. Consideration of a number of shared values and principles would be integral to the authorization

and administration of any novel mechanism. An example would be no redirection of current levels, or deferral of future increases, in General Fund or GO bonds. Novel mechanisms also must improve cost effectiveness and efficiency, as well as assure value. Any new tax or assessment would require legislation.

Scenario D: Utilize State General Fund to Replace Need for Novel — This would require an increase of about six times (approximately 460 percent) the historical average of State General Fund appropriations, while sustaining the historical maximum funding from GO bonds. There are several shared values and principles that would be integral to the authorization and administration of such a large increase in General Fund appropriations. They include no redirection of GO bond or other existing mechanisms, as well as assurances regarding value, cost effectiveness, and efficiency.

Scenario E: Accelerated Funding — An accelerated implementation of the recommended actions would require an increase in State General Fund appropriations (approximately 60 percent) and more than a doubling of State GO bond funding, as well as the implementation of a novel mechanism equivalent to $8 per month for every household in California above the federal poverty level. An accelerated funding scenario may provide a more balanced approach to funding (as each State funding mechanism is increased), but significant challenges remain, including:

- Significant debt accrued from interest because of increased State GO bonds, for a total of more than $75 billion in interest over the 50-year planning horizon.
- Implementation of novel funding mechanisms would require legislation for a new tax or assessment.
- May overwhelm State and local institutional capacity to perform work. Examples include initial shortages in staffing or expertise.

Table 8 Summary of Scenario Tradeoffs

Scenario	Annual Expenditures to Implement Update 2018 Recommended Actions in $ billions[a] (% Increase from Historical Annual Average)									Trade-off Analysis	
	State										
	General Fund	GO Bonds	Interest on GO Bond Debt[b]	Designated Special Fund[c]	Novel[d]	State Total[d]	Local	Federal	Total[e]	Advantages	Challenges
Current Expenditures											
Current Trends Continue (Historic Annual Average)	$0.26 (0%)	$1.62 (0%)	$0.54	$4.98	$0.00	$7.40	$27.82	$0.79	$36.01	- Continued reliance on existing funding mechanisms. - Funding continues to be used predominately for capital management actions with some ongoing management actions funded.	- Significant funding gap exists. - Recommended actions are not funded. - Funding challenges described in the "Foundational Assertions and Assurances" section will go unaddressed.
Projected Increase from current trends (Shown below)											
Scenario A – Rely on Borrowing	$0.00 (0%)	$1.86 (120%)	$0.06	$0.00	$0.00	$1.92	$0.00	$0.00	$1.92	- Continued reliance on existing funding mechanisms. - All recommended actions are funded.	- Significant funding gap exists. - Increased interest accrued on debt from GO bonds (an additional $60 million per year above current trend continues).
Scenario B – Rely on General Fund	$1.87 (710%)	$0.00 (0%)	$0.00	$0.00	$0.00	$1.87	$0.00	$0.00	$1.87	- Continued reliance on existing funding mechanisms. - All recommended actions are funded. - Heavier reliance on general funds results in less long-term interest accrued on debt relative to Scenario A. - Reliance on general fund provides more flexibility in funding different management actions.	- Requires considerable increase in general fund appropriations (more than nine times above current trend continues). - Lack of reliability due to annual competition for general fund dollars with other State services. - General fund appropriations tend to be reactionary and may not align with long-term planning efforts.

Scenario	Annual Expenditures to Implement Update 2018 Recommended Actions in $ billions[a] (% Increase from Historical Annual Average)									Trade-off Analysis	
	State										
	General Fund	GO Bonds	Interest on GO Bond Debt[b]	Designated Special Fund[c]	Novel[d]	State Total[d]	Local	Federal	Total[e]	Advantages	Challenges
											- Large capital investments are difficult to fund with annual funding streams (i.e., no borrowing).
Scenario C: Utilize Current Mechanisms at Maximum Historical Levels, with Novel	$0.15 (60%)	$0.63 (40%)	$0.02	$0.00	$1.08	$1.88	$0.00	$0.00	$1.88	- Plausible increase in existing State funding mechanisms to match historical annual maximums. - Novel mechanisms can provide a dedicated source of funding to underfunded elements. - All recommended actions are funded. - Stable, resilient approach (utilizes multiple mechanisms) to fund providing increased flexibility by funding different management actions.	- Implementation of novel funding mechanisms will require political and public support for legislation to enact a new tax or assessment. - Must be accompanied by assurances for adherence to finance values and principles. - Increased interest accrued on debt from GO bonds (an additional $20 million per year above current trend continues).
Scenario D: Utilize State General Fund to Replace Need for Novel	$1.23 (460%)	$0.63 (40%)	$0.02	$0.00	$0.00	$1.88	$0.00	$0.00	$1.88	- Continued reliance on existing funding mechanisms. - Plausible increase in general fund and historical annual maximum GO bonds. - All recommended actions are funded. - Shares burden of funding actions across different mechanisms reducing the reliance on a single mechanism.	- Requires significant increase in general fund appropriations (almost six times current trend continues). - Competition for general fund dollars with other State services. - General fund appropriations tend to be reactionary and may not align with long-term planning efforts. - Increased interest accrued on debt from GO bonds (an additional $20 million per year above current trend continues).

Scenario	Annual Expenditures to Implement Update 2018 Recommended Actions in $ billions[a] (% Increase from Historical Annual Average)									Trade-off Analysis	
	State										
	General Fund	GO Bonds	Interest on GO Bond Debt[b]	Designated Special Fund[c]	Novel[d]	State Total[d]	Local	Federal	Total[e]	Advantages	Challenges
Scenario E: Accelerate Funding	$0.15 (60%)	$2.24 (140%)	$0.07	$0.00	$1.08	$3.54	$0.00	$0.00	$3.54	- Balanced approach to funding using existing and novel mechanisms provides increased flexibility in funding different actions. - Novel mechanisms provide dedicated sources of funding to underfunded elements. - Most management actions are funded and all recommended actions are funded.	- Increased interest accrued on debt from GO bonds (an additional $70 million per year above current trend continues). - May overwhelm local and State capacity to perform work. - Implementation of novel funding mechanisms will require political and public support for legislation to enact a new tax or assessment.

Notes: GO = general obligation

[a] Historic annual average expenditures are based on best available information from California Department of Finance (http://www.ebudget.ca.gov/2015-16/pdf/GovernorsBudget/8000/9600.pdf) and engineering judgement.

[b] Interest on water-related general obligation bonds debt from the California Department of Finance and estimates for debt accrued form new GO bonds.

[c] Designated special fund mechanism includes fees, assessments, taxes, and other revenue sources with a designated purpose.

[d] Some taxpayers, ratepayers, or land owners may not have the ability to pay for increased taxes, rates, or assessments. This table represents hypothetical implications and is not intended to signal a specific funding mechanism nor an actual distribution of costs among Californians. Ability to pay would be considered as part of the development of any increase in taxes, rates, and assessments.

[e] Table columns and row totals may not sum correctly because of rounding.

Table 9 Annual Fiscal Impacts of Funding Scenarios (Dollars/Year)

Scenario	Alternative Metrics for Current Mechanisms: General Fund and General Obligation Bond		Alternative Metrics for Novel Mechanisms				
	Cost per Household[a,b,c] (85% Pays)	Cost per Capita[b,d] (85% Pays)	Cost per Household[a,b,c] (85% Pays)	Cost per Capita[b,d] (85% Pays)	Cost per Parcel[e]	Cost per $100 Assessed Value[f]	Cost per Acre[f]
Scenario A – Reliance on Borrowing	$168	$57					
Scenario B – Reliance on General Fund	$163	$55					
Scenario C: Utilize Current Mechanisms at Maximum Historical Levels, with Novel	$71	$24	$94	$32	$92	$.02	$23
Scenario D: Utilize State General Fund to Replace Need for Novel	$165	$56					
Scenario E: Accelerate Funding	$215	$73	$94	$32	$92	$.02	$23

Notes:
GO = general obligation

The cumulative fiscal impact of each scenario is the sum of one of the current mechanism metrics and one of the novel mechanism metrics.

This table represents hypothetical implications and is not intended to signal a specific funding mechanism nor an actual distribution of costs among Californians, and does not include local or federal funding needed to complement State funding and meet all water management needs.

[a] Number of household estimates (13,307,614) and persons per household (2.79) are from California Department of Finance County/State Population and Housing Estimates, 1/1/2017 (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/).
[b] Number of households under the federal poverty level are from California Public Utilities commission *Needs Assessment for the Energy Savings Assistance and the California Alternate Rates for Energy Programs* (http://liob.cpuc.ca.gov/Docs/2016%20LINA%20Final%20Report%20-%20Volume%201%20of%202.pdf).
[c] Number of households and persons under the poverty level are from American Community Survey, Percentage of Families And People Whose Income In The Past 12 Months Is Below The Poverty Level (http://www.dof.ca.gov/Reports/Demographic_Reports/American_Community_Survey/).
[d] Population estimates are from California Department of Finance State/County Population Estimates with Annual Percent Change (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/).
[e] Number of parcels (11,649,442) and net assessed evaluation ($4,604,886,582,000) are based on Fiscal Year 2014-2015 Secured Local Tax Roles.
[f] Private land ownership in California (46,103,707 acres) was estimated based on public/private ownership maps from CALFire California Multi-Source Land Ownership (http://frap.fire.ca.gov/data/frapgisdata-sw-ownership13_2_download) and total California acreage (99,698,701 acres) from U.S. Census Bureau Quickfacts California (https://www.census.gov/quickfacts/CA).
[g] Taxpayer refers to all tax (income tax payers, corporate taxes, sales and use taxes) and revenue sources for the State General Fund. Ratepayer refers to water use or other relevant ratepayers (urban and/or agricultural) or other identified beneficiaries.

Debt Analysis

Analysis of debt from State GO bonds was based on hypothetical bond issuance across the different funding scenarios. The actual scheduling and repayment terms would differ from the simplified assumptions used in this analysis. The assumed schedule and repayment terms are for discussion and further analysis is recommended for a more detailed understanding of future GO bond use. The *California Water Plan Update 2018* funding analysis assumed the use of bonds had the following terms: 5 percent interest rate and repayment over 30 years. The historical and projected future remaining debt service averages around $1 billion per year. Future debt service (both interest and premium) for the funding scenarios increases to a peak of over $7 billion per year for Scenario E.

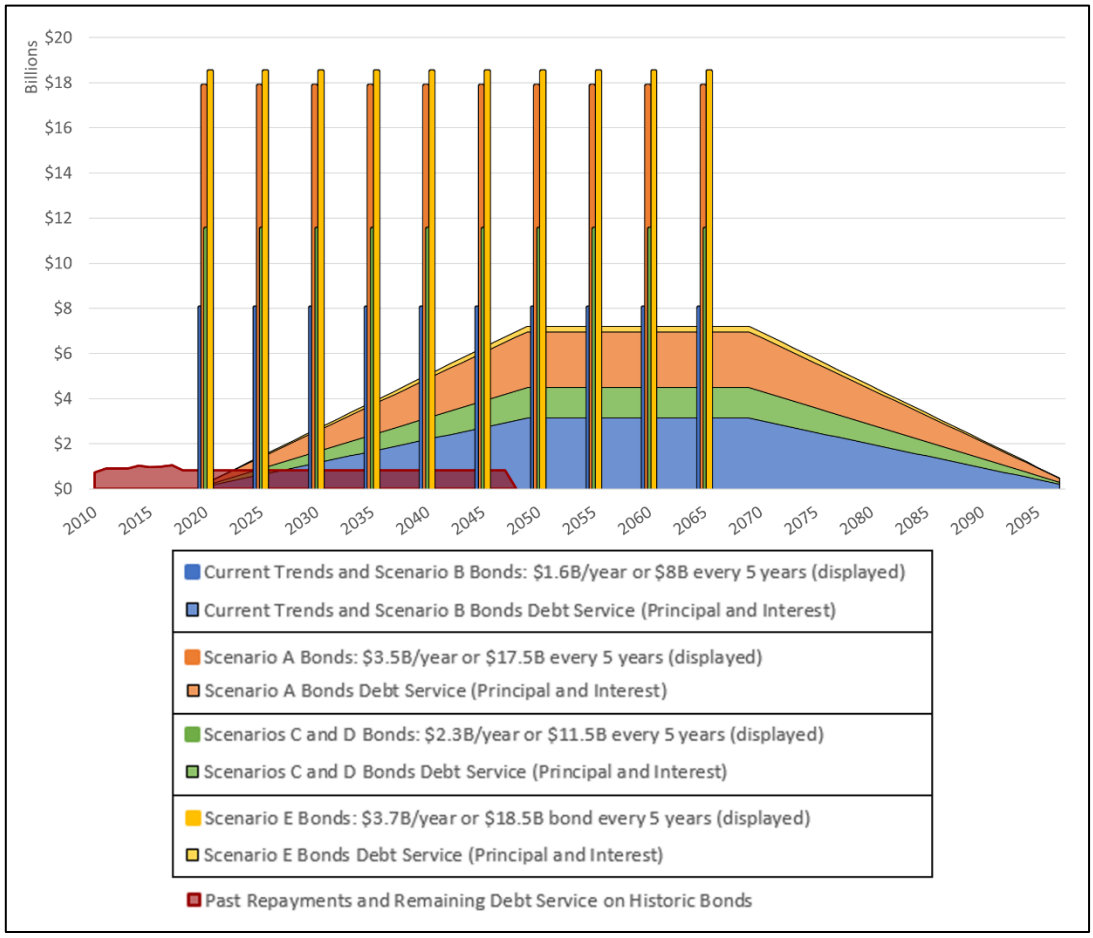

Figure 2 - Historical Repayment, Projected Remaining Repayments, and Future Scenario Bond Passing and Repayments

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