https://doi.org/10.25923/scnz-7n65

NOAA Technical Memorandum NMFS

SEPTEMBER 2018

PROJECTED UTILITY RATE IMPACTS ASSOCIATED WITH FISH PASSAGE INVESTMENTS ON THE TUOLUMNE RIVER

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NOAA-TM-NMFS-SWFSC-606

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

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Recommended citation

Speir, Cameron, Aaron Mamula, and Michael S. Mohr. 2018. Projected utility rate impacts associated with fish passage investments on the Tuolumne River. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-606. 13 p. https://doi.org/10.25923/scnz-7n65

Projected utility rate impacts associated with fish passage investments on the Tuolumne River

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12 September 2018

Abstract

The costs of constructing and operating fish passage projects around hydro-electric dams can amount to hundreds of millions of dollars, and yet such projects may be affordable under long-term financing and distribution of costs to electric and water ratepayers. We evaluate the potential distribution of the cost of providing fish passage around the La Grange and Don Pedro Hydroelectric Projects on the Tuolumne River to Turlock Irrigation District (TID) and Modesto Irrigation District (MID) electric and water ratepayers. Estimates of the project capital and operations and maintenance costs are converted to annualized costs and allocated among various entities. For TID and MID these costs are then allocated among customer classes in proportion to annual operating revenues and presented as estimated annual utility rate increases required to finance the proposed fish passage project. We find that a fish passage project with an estimated capital cost of $170 million would result in rate increases of 3.7 percent for TID customers and 1.3 percent for MID customers. We also present estimated rate increases for a range of projected costs and for alternative cost sharing scenarios that may include other entities, such as the City and County of San Francisco.

Introduction

The costs of constructing and operating fish passage projects around hydro-electric dams can amount to hundreds of millions of dollars, and yet such projects may be affordable under long-term financing and distribution of costs to electric and water ratepayers. In this report we present an analysis of the cost impacts of providing fish passage around the La Grange and Don Pedro Hydroelectric Projects on the Tuolumne River. The analysis evaluates the potential distribution of the costs of fish passage among retail electric and water customers of Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (together, "the Districts"). The analysis projects an increase in the average customer's annual utility rate and considers how the magnitude of the increase may vary according to different assumptions regarding capital costs and cost sharing between TID, MID, and the City and County of San Francisco (CCSF).

The analysis is based on the following conceptual model. Project capital costs (a range of costs are considered) are financed and repaid over a 30 year period using annual payments. Together with the project operations and maintenance annual costs, this results in an annual cost to be

shared amongst the various entities involved. CCSF may pay some proportion of these costs (a range of proportions are considered), and the remainder is to be paid by TID and MID according to their ownership shares in the Don Pedro Hydroelectric project. These entities recover their costs by increasing annual utility rates to certain classes of customers. For TID and MID these costs are allocated among the customer classes in proportion to their class annual operating revenue, and when divided by the class annual number of customers (or kilowatt-hours of electricity sold or acre-feet of water sold) results in the class annual utility rate increase. These increases can then be compared to recent (without project) annual utility rates by customer class to get a sense of the "affordability" of the project.

Four types of information are required for the analysis: 1) construction and operations and maintenance costs; 2) financing details (interest rate, repayment period); 3) allocation of costs between responsible entities (TID, MID, and CCSF); and 4) for each District and customer class, the annual operating revenue, number of customers, and amount of power or water sold during a "test period". The test period is a representative year or combination of years from which historical data can be used to estimate and project utility rates with and without the additional cost of investing in fish passage facilities.

We begin this report with a review of the test period data and sources, followed by a detailed description of our methods. The results of the analysis are then presented, and a discussion of findings follows.

Test period data and sources

Test period annual operating revenues, number of customers, number of kilowatt-hours sold (electric customer classes), and number of acre-feet sold (water customer classes) for each District and customer class were developed using several sources of information. Classes were limited to the following retail electric and water service customers: "residential electric", "commercial electric", "industrial electric", "irrigation water", "domestic water". Our goal in each case was to use the most recently available annual data that we could find.

Electric revenues, customers, and kilowatt-hours sold

The test period data are the 2016 TID and MID data obtained from the U.S. Energy Information Administration, Annual electric power industry report, Form EIA-861 (USEIA 2016 Sales_Ult_Cust_2016.xlsx). According to USEIA, "Form EIA-861 collects information on the status of electric power industry participants involved in the generation, transmission, distribution, and sale of electric energy in the United States and its territories. The data from this form are made available in EIA publications and databases. The data collected on this form are used to monitor the current status and trends of the electric power industry and to evaluate the future of the industry." These data are collected annually and are available for the two districts from 1990–2016. The 2017 data will likely become available in November, 2018.

Irrigation water revenues, customers, and acre-feet sold

Data on irrigation water operations for TID and MID are not as detailed and not as readily available as for electric power operations.

The test period data for operating revenues is the 2017 data obtained from the Districts' 2017 financial statements (TID 2018, Consolidated Statements of Revenues, Expenses and Changes in Net Position, pg. 16; MID 2018, Statements of Revenues, Expenses and Changes in Net Position, pg.16).

The test period data for TID number of customers is the 2017 data (approximate) obtained from the District's 2017 financial statement (TID 2018 pg. 3), and for MID number of customers is the 2015 data (approximate) obtained from the District's 2015 water management plan (Provost and Pritchard 2015 pg. 32).

The test period data for TID number of acre-feet sold is the 2010–2014 average data obtained from the District's 2015 water management plan (TID 2015, Table 4.8, Farm Deliveries, pg. 73), and for MID number of acre-feet sold is the 2012 data obtained from the District's 2015 water management plan (Provost and Pritchard 2015, Table 22, pg. 32).

Domestic water revenues, customers, and acre-feet sold

MID sells wholesale water derived from its surface water rights on the Tuolumne River, to the City of Modesto for municipal and industrial (domestic) use. Data on domestic water operations for MID are not as readily available as for electric power and irrigation water operations. Annual operating revenue from domestic water sales are contained in MID's financial statements. The representativeness of this data with respect to future expectations may be complicated by the fact that a major expansion of the Modesto Regional Water Treatment Plant, which treats Tuolumne River surface water for use in the City of Modesto service area, was scheduled to come online in 2016.

The test period data for MID operating revenues is the 2017 data obtained from the District's 2017 financial statement (MID 2018 pg. 16).

The test period data for MID number of customers and number of acre-feet sold are the 2015 data (projected) obtained from the MID and City of Modesto joint 2010 urban water management plan (West Yost 2011, Table 4-6, pg. 4-5).

The complete test period dataset is presented below in Table 1.

Table 1. Test period annual source data used for this report. Units are kilowatt-hours (E_{ij}) for electric customer classes, and acre-feet (W_{ij}) for water customer classes.

Entity (i)	Customer class (j)	Revenue (R_{ij})	Customers (N_{ij})	Units (E_{ij} or W_{ij})
TID	Electric: residential	$ 114,519,000[a]	73,034[a]	714,966,000[a]
	Electric: commercial	$ 36,053,000[a]	24,193[a]	267,650,000[a]
	Electric: industrial	$ 126,770,000[a]	4,640[a]	1,017,672,000[a]
	Water: irrigation	$ 13,145,000[b]	5,800[c]	462,768[d]
	Water: domestic	—	—	—
MID	Electric: residential	$ 154,584,000[a]	97,471[a]	852,077,000[a]
	Electric: commercial	$ 121,063,000[a]	23,985[a]	846,222,000[a]
	Electric: industrial	$ 81,169,000[a]	159[a]	804,829,000[a]
	Water: irrigation	$ 5,307,000[e]	3,100[f]	296,100[g]
	Water: domestic	$ 20,963,000[e]	81,024[h]	70,500[h]

[a] 2016 (USEIA 2016 Sales_Ult_Cust_2016.xlsx).
[b] 2017 (TID 2018 pg. 16).
[c] 2017, approximate (TID 2018 pg. 3).
[d] 2010–2014 average (TID 2015, Table 4.8, Farm Deliveries, pg. 73).
[e] 2017 (MID 2018 pg. 16).
[f] 2015, approximate (Provost and Pritchard 2015 pg. 32).
[g] 2012 (Provost and Pritchard 2015, Table 22, pg. 32).
[h] 2015, projected (West Yost 2011, Table 4-6, pg. 4-5).

Methods

Specification of project costs

Capital costs for fish passage, C, are based on engineering cost estimates from two sources: a report prepared by Anchor QEA (2017) for NOAA Fisheries, and a report prepared by HDR Inc. (2018) for the Districts. The Anchor QEA base costs estimate, including contingencies (likely cost overruns), was $168,638,000 (Anchor QEA 2017 pg. 94, 97). The HDR Inc. (2018 pg. 28) base costs estimate, not including contingencies, was remarkably close to that at $168,433,390, but with contingencies increased to $321,100,000. HDR Inc. (2018 pg. 28) also produced low range and high range costs estimates for their with- and without-contingencies estimates. For our analysis, we consider the entire range of all of these estimates as follows: 1) a base costs value of $170 million approximating the Anchor QEA base estimate, 2) a low range costs value of $130 million approximating the lowest of the HDR Inc. low range estimates, and 3) a high range costs value of $415 million approximating the highest of the HDR Inc. high range estimates (see Table 2).

Table 2. Capital costs source data and values assumed for this report.

	Contingencies	Capital costs (C)		
Source	included?	Low range	Base	High range
Anchor QEA (2017)	yes	—	$ 168,638,000	—
HDR Inc. (2018)	no	$ 127,502,002	$ 168,433,390	$ 217,256,978
HDR Inc. (2018)	yes	$ 243,100,000	$ 321,100,000	$ 414,100,000
This report		$ 130,000,000	$ 170,000,000	$ 415,000,000

We assume that the capital costs (C) would be financed with long-term bond issues. We further assume a repayment period of 30 years, with one payment per year, and an annual interest rate of 8 percent. Therefore, the annualized capital costs, C_a, would be

$$C_a = C \times a, \quad \text{where } a = \frac{0.08}{1-(1+0.08)^{-30}} \tag{1}$$

The assumed interest rate of 8 percent is higher than any bond issue currently being repaid by either district. Therefore, to the extent that the Districts are able to issue debt at a lower cost, the results of this analysis may overstate the actual customer utility rate increases required.

In addition to capital costs, we include the costs of fish passage annual operations and maintenance, M. It is assumed that M = $400,000 per year based on estimates provided by Anchor QEA (2017 pg. 94, 97). Thus, the total annual costs, A, for fish passage would be

$$A = C_a + M \tag{2}$$

Allocation of costs among responsible entities

Three main entities could potentially be responsible for portions of the FERC relicensing costs, including fish passage. TID and MID jointly own and operate the Don Pedro Project, and TID owns the La Grange Project. CCSF owns rights to a significant amount of water in the Tuolumne River and derives significant benefits from water banking arrangements in Don Pedro Reservoir, and therefore it is possible that CCSF may pay some portion of the fish passage project costs.

For this analysis we evaluate CCSF potential cost shares of 0, 25, 50, and 75 percent. We assume that the remainder of the cost sharing burden would be allocated to TID and MID according to their ownership shares in the Don Pedro Hydroelectric project of 68.46 percent and 31.54 percent, respectively (TID and MID 2013 pg. 1-1). Therefore, given the annual costs, A, we allocate responsibility for recovering these costs between entities as

$$A_i = A \times s_i \tag{3}$$

where A_i is the entity i annual cost (i = TID, MID, CCSF), and s_i is the entity i share (proportion) of the total annual costs. A_i is the required revenue that entity i must recover to pay for fish passage project costs.

Given a particular CCSF share, s_{CCSF}, the remaining shares are calculated as

$$s_i = \begin{cases} (1 - s_{\text{CCSF}}) \times 0.6846, & i = \text{TID} \\ (1 - s_{\text{CCSF}}) \times 0.3154, & i = \text{MID} \end{cases} \tag{4}$$

Allocation of costs among customer classes within each entity

We do not allocate costs among CCSF customer classes in this report — only among the Districts' customer classes.

The Districts sell multiple types of services to multiple customer classes. TID sells retail electric power to residential, commercial, and industrial customers, and sells water to commercial farms for irrigation. TID also sells electric power and natural gas to wholesale buyers. MID sells retail electric power to residential, commercial, and industrial customers, and sells water to commercial farms for irrigation. MID also sells water to the City of Modesto for distribution to municipal and industrial (domestic water) customers.

We assume that the Districts' annual costs for fish passage will only be recovered from retail electric and water service customers (i.e., wholesale power and natural gas customers would not be affected). We also assume that these costs would be distributed to each class according to its proportion of allocable revenue. Allocable revenue includes only operating revenue from retail electric and water sales. Therefore, given the District i annual costs, A_i, we allocate these costs to be recovered among customer classes as

$$A_{ij} = A_i \times p_{ij} \tag{5}$$

where A_{ij} is the customer class j (j = residential electric, commercial electric, industrial electric, irrigation water, domestic water) annual costs for District i, and p_{ij} is the customer class j proportion of the test period revenue by class in District i. The proportion (p_{ij}) is determined by dividing the test period annual operating revenue, R_{ij}, by the total allocable revenue, the sum of the District i test period revenues, $\sum_j R_{ij}$, for customer classes over which the fish passage costs will be allocated.

$$p_{ij} = \frac{R_{ij}}{\sum_j R_{ij}} \tag{6}$$

To the extent that the Districts are able to recover some of their fish passage costs from other sources (such as wholesale power and gas sales), this analysis may overstate the actual utility rate increases required of the classes considered in this report.

Determination of test period annual utility rates

Test period annual utility rates, r_{ij}, for District i and customer class j are determined by dividing the test period annual operating revenue (R_{ij}) by either the test period number of customers, N_{ij}, the test period number of kilowatt-hours sold, E_{ij}, or the test period number of acre-feet sold, W_{ij}.

$$r_{ij} = \frac{R_{ij}}{Z_{ij}}, \quad \text{where } Z_{ij} = \begin{cases} N_{ij}, & \text{if per customer} \\ E_{ij}, & \text{if per kilowatt-hour} \\ W_{ij}, & \text{if per acre-foot} \end{cases} \tag{7}$$

Projection of annual utility rate increases

The annual utility rate increase, α_{ij}, for each customer class is projected by dividing the allocated fish passage costs to be recovered for that class (A_{ij}) by the test period number of

customers (N_{ij}) or the test period sales volume (kilowatt-hours of electric power (E_{ij}) or acre-feet of water (W_{ij})).

$$\alpha_{ij} = \frac{A_{ij}}{Z_{ij}} \quad (8)$$

Results

Specification of project costs and allocation among responsible entities and customer classes

The range of costs estimates based on engineering studies of the proposed fish passage project were listed in Table 2. We project utility rate increases based on three capital costs values representing low range, base, and high range costs: $130 million, $170 million, and $415 million, respectively (Table 2). These three capital costs values cover the range of estimates in the Anchor QEA (2017) and HDR Inc. (2018) reports. Table 3 shows these three costs values converted to an annual payment, including operations and maintenance costs of $400,000 per year, assuming an interest rate of 8 percent and a repayment period of 30 years.

Table 3. Annual fish passage costs under the low range, base, and high range capital costs values.

	Costs, depending on project capital costs		
Quantity	Low range	Base	High range
Capital (C)	$ 130,000,000	$ 170,000,000	$ 415,000,000
Annualized capital (C_a)	$ 11,547,566	$ 15,100,664	$ 36,863,385
Annual operations and maintenance (M)	$ 400,000	$ 400,000	$ 400,000
Total annual (A)	$ 11,947,566	$ 15,500,664	$ 37,263,385

Table 4 provides the base costs annual payment amount allocated to each entity (TID, MID, and CCSF) under four different assumptions for the CCSF cost share: 0, 25, 50, and 75 percent. We assume that the remaining costs are allocated to TID and MID according to their ownership shares in the Don Pedro Hydroelectric project of 68.46 percent and 31.54 percent, respectively. The dollar amounts presented in Table 4 also represent the amount of additional annual revenue that each entity must generate in order to cover the costs of fish passage.

Table 4. Entity annual fish passage costs for CCSF cost share values of 0, 25, 50, and 75 percent. Base capital costs assumed.

	Annual costs (A_i), depending on CCSF cost share			
Entity (i)	0 %	25 %	50 %	75 %
CCSF	$ 0	$ 3,875,166	$ 7,750,332	$ 11,625,498
TID	$ 10,611,754	$ 7,958,816	$ 5,305,877	$ 2,652,939
MID	$ 4,888,909	$ 3,666,682	$ 2,444,455	$ 1,222,227
Total	$ 15,500,664	$ 15,500,664	$ 15,500,664	$ 15,500,664

We assume that the Districts' annual costs for fish passage will only be recovered from retail electric and water service customers. We also assume that these costs would be passed on to these customers proportionally according to their class annual operating revenue. The test period class proportions within Districts are listed in Table 5.

Table 5. Test period percent of allocable operating revenue by customer class within each entity.

	Percent allocable operating revenue (p_{ij}) for each district	
Customer class (j)	TID	MID
Electric: residential	39.4 %	40.4 %
Electric: commercial	12.4 %	31.6 %
Electric: industrial	43.6 %	21.2 %
Water: irrigation	4.5 %	1.4 %
Water: domestic	—	5.5 %

Test period annual utility rates and projected rate increases

Table 6 and Figure 1 show the test period annual utility rate (r_{ij}) per customer and projected rate increases (α_{ij}) by customer class for TID and MID retail utility customers under low range, base, and high range capital costs, assuming a CCSF cost share of zero percent. For TID, recovering revenue to pay for the annualized costs of the fish passage project amounts to a projected rate increase of 2.8 percent, 3.7 percent, and 8.8 percent under the low range, base, and high range project costs values, respectively. For MID, recovering revenue to pay for the annualized costs of the fish passage project amounts to a projected rate increase of 1.0 percent, 1.3 percent, and 3.1 percent under the low range, base, and high range project costs values, respectively. Assuming base capital costs, for TID residential electric customers this equates to an increase of $57.28 per year ($4.77 per month), and for MID residential electric customers this equates to an increase of $20.24 per year ($1.67 per month). Likewise, for TID irrigation customers this equates to an increase of $82.79 per year ($6.90 per month), and for MID irrigation customers this equates to an increase of $21.85 per year ($1.82 per month). Table 7 presents these results on a price per unit (kilowatt-hours or acre-feet) sold basis.

Table 8 and Figure 2 show the test period annual utility rate (r_{ij}) per customer and projected rate increases (α_{ij}) by customer class for TID and MID retail utility customers under CCSF cost shares of 0, 25, 50, and 75 percent, assuming base capital costs. We assume that the remainder of the annualized cost of fish passage would be allocated to TID and MID according to their ownership shares in the Don Pedro Hydroelectric project (68.46 percent and 31.54 percent, respectively). The reduction in the projected annual utility rate increases to rate payers in each of the Districts is directly proportional to the CCSF costs share (s_{CCSF}). For example, if s_{CCSF} = 0.25, the District's rate increases for any of the customer classes would be reduced by 25 percent relative to a CCSF costs share of 0 percent. Table 9 presents the results on a price per unit (kilowatt-hours or acre-feet) sold basis.

Table 6. Projected annual utility rate increase per customer necessary to recover fish passage investment under low range, base, and high project costs. Test period annual utility rates per customer also shown. CCSF cost share of 0 percent assumed.

Entity (i)	Customer class (j)	Test period annual utility rate (r_{ij}) per customer	Projected annual utility rate increase (α_{ij}) per customer, depending on project capital costs		
			Low	Base	High
TID	Electric: residential	$ 1,568.02	$ 44.15	$ 57.28	$ 137.70
	Electric: commercial	$ 1,490.22	$ 41.96	$ 54.44	$ 130.87
	Electric: industrial	$ 27,321.12	$ 769.29	$ 998.07	$ 2,399.34
	Water: irrigation	$ 2,266.38	$ 63.81	$ 82.79	$ 199.03
	Water: domestic	—	—	—	—
	Percent increase	—	2.8 %	3.7 %	8.8 %
MID	Electric: residential	$ 1,585.95	$ 15.60	$ 20.24	$ 48.66
	Electric: commercial	$ 5,047.45	$ 49.65	$ 64.42	$ 154.85
	Electric: industrial	$ 510,496.86	$ 5,021.55	$ 6,514.92	$ 15,661.77
	Water: irrigation	$ 1,711.94	$ 16.84	$ 21.85	$ 52.52
	Water: domestic	$ 258.73	$ 2.54	$ 3.30	$ 7.94
	Percent increase	—	1.0 %	1.3 %	3.1 %

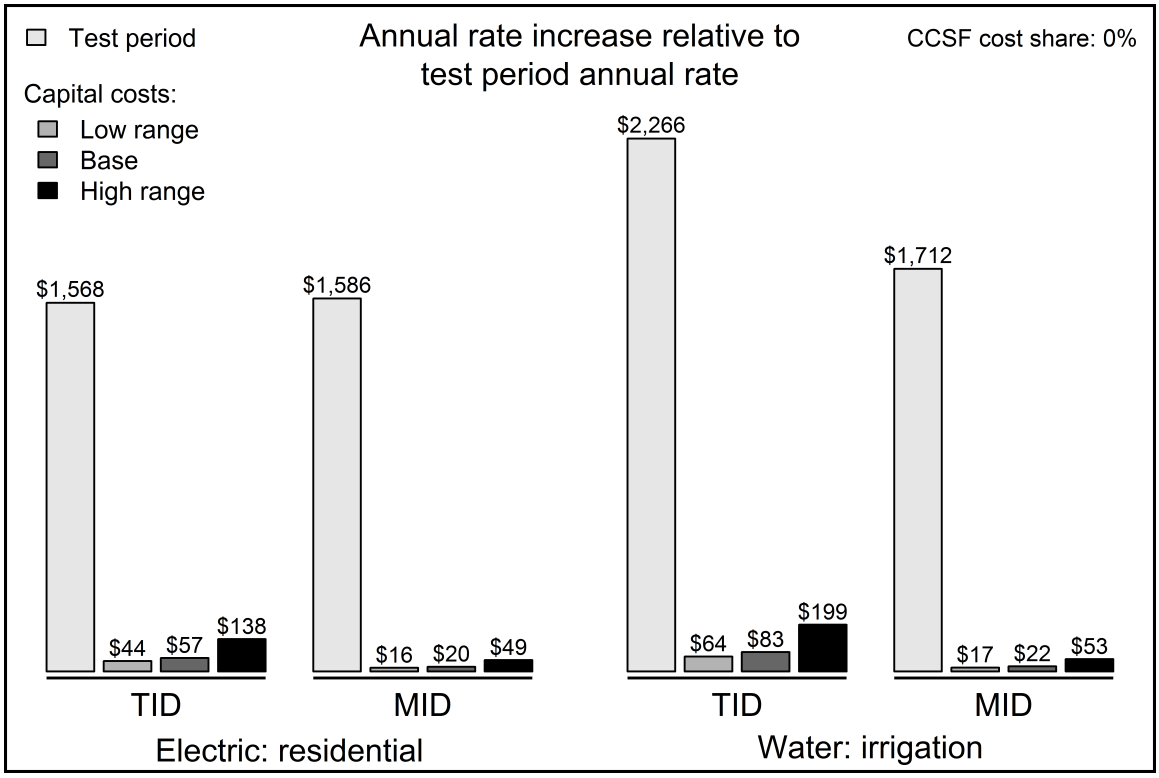

Figure 1. Projected annual utility rate increase ($\boldsymbol{\alpha_{ij}}$) per customer necessary to recover fish passage investment under the low range, base, and high range capital costs estimates relative to test period annual utility rate (r_{ij}) per customer for the residential electric and irrigation water customer classes. CCSF cost share of 0 percent assumed. Values rounded to the nearest dollar.

Table 7. Projected annual utility rate increase per unit necessary to recover fish passage investment under low range, base, and high range project costs. Test period annual utility rates per unit also shown. Units are kilowatt-hours (E_{ij}) for electric customer classes, and acre-feet (W_{ij}) for water customer classes. CCSF cost share of 0 percent assumed.

			Projected annual utility rate increase (α_{ij}) per unit, depending on project capital costs		
Entity (i)	Customer class (j)	Test period annual utility rate (r_{ij}) per unit	Low	Base	High
TID	Electric: residential	$ 0.160	$ 0.005	$ 0.006	$ 0.014
	Electric: commercial	$ 0.135	$ 0.004	$ 0.005	$ 0.012
	Electric: industrial	$ 0.125	$ 0.004	$ 0.005	$ 0.011
	Water: irrigation	$ 28.405	$ 0.800	$ 1.038	$ 2.495
	Water: domestic	—	—	—	—
	Percent increase	—	2.8 %	3.7 %	8.8 %
MID	Electric: residential	$ 0.181	$ 0.002	$ 0.002	$ 0.006
	Electric: commercial	$ 0.143	$ 0.001	$ 0.002	$ 0.004
	Electric: industrial	$ 0.101	$ 0.001	$ 0.001	$ 0.003
	Water: irrigation	$ 17.923	$ 0.176	$ 0.229	$ 0.550
	Water: domestic	$ 297.348	$ 2.925	$ 3.795	$ 9.122
	Percent increase	—	1.0 %	1.3 %	3.1 %

Table 8. Projected annual utility rate increase per customer necessary to recover fish passage investment under CCSF cost share values of 0, 25, 50, and 75 percent. Test period annual utility rates per customer also shown. Base capital costs assumed.

			Projected annual utility rate increase (α_{ij}) per customer, depending on CCSF cost share			
Entity (i)	Customer class (j)	Test period annual utility rate (r_{ij}) per customer	0 %	25 %	50 %	75%
TID	Electric: residential	$ 1,568.02	$ 57.28	$ 42.96	$ 28.64	$ 14.32
	Electric: commercial	$ 1,490.22	$ 54.44	$ 40.83	$ 27.22	$ 13.61
	Electric: industrial	$ 27,321.12	$ 998.07	$ 748.55	$ 499.03	$ 249.52
	Water: irrigation	$ 2,266.38	$ 82.79	$ 62.09	$ 41.40	$ 20.70
	Water: domestic	—	—	—	—	—
	Percent increase	—	3.7 %	2.7 %	1.8 %	0.9 %
MID	Electric: residential	$ 1,585.95	$ 20.24	$ 15.18	$ 10.12	$ 5.06
	Electric: commercial	$ 5,047.45	$ 64.42	$ 48.31	$ 32.21	$ 16.10
	Electric: industrial	$ 510,496.86	$ 6,514.92	$ 4,886.19	$ 3,257.46	$ 1,628.73
	Water: irrigation	$ 1,711.94	$ 21.85	$ 16.39	$ 10.92	$ 5.46
	Water: domestic	$ 258.73	$ 3.30	$ 2.48	$ 1.65	$ 0.83
	Percent increase	—	1.3 %	1.0 %	0.6 %	0.3 %

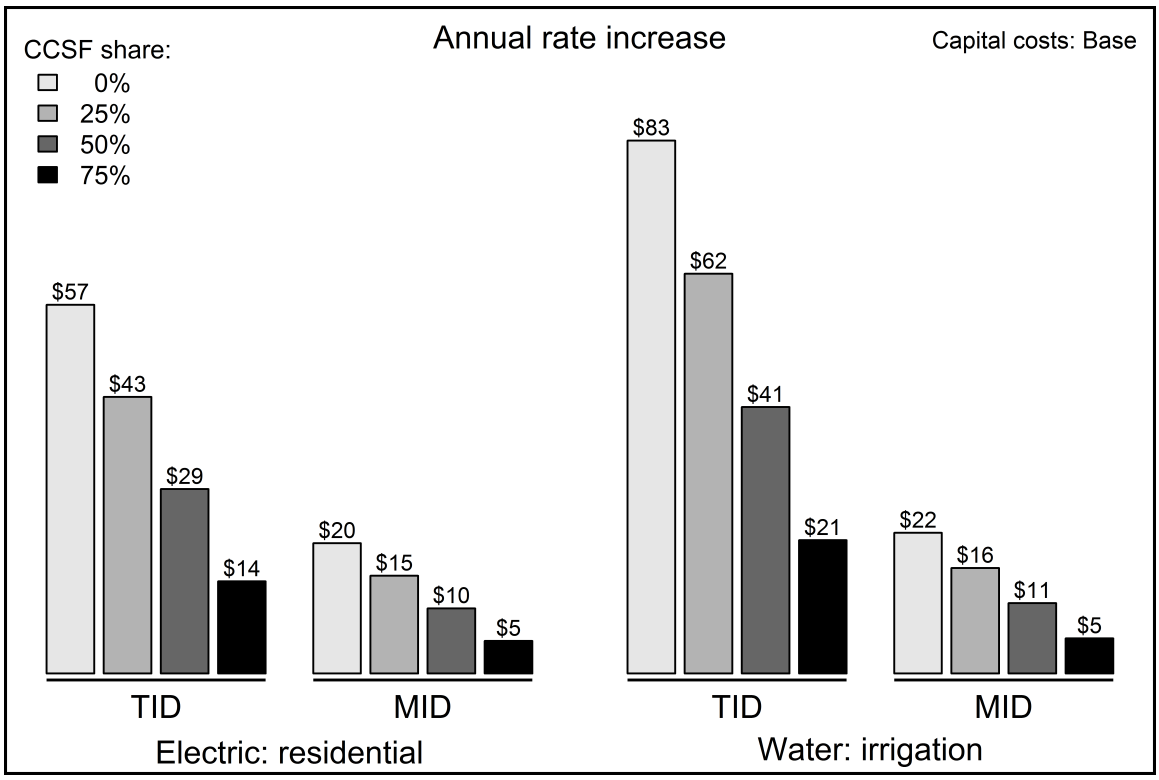

Figure 2. Projected annual utility rate increase ($\boldsymbol{\alpha_{ij}}$) per customer necessary to recover fish passage investment under CCSF cost share (s_{CCSF}) values of 0, 25, 50, and 75 percent. Base capital costs assumed. Values rounded to the nearest dollar.

Table 9. Projected annual utility rate increase per unit necessary to recover fish passage investment under CCSF cost share values of 0, 25, 50, and 75 percent. Test period annual utility rates per unit also shown. Units are kilowatt-hours (E_{ij}) for electric customer classes, and acre-feet (W_{ij}) for water customer classes. Base capital costs assumed.

		Test period annual utility rate	Projected annual utility rate increase (α_{ij}) per unit, depending on CCSF cost share			
Entity (i)	Customer class (j)	(r_{ij}) per unit	0 %	25 %	50 %	75%
TID	Electric: residential	$ 0.160	$ 0.006	$ 0.004	$ 0.003	$ 0.001
	Electric: commercial	$ 0.135	$ 0.005	$ 0.004	$ 0.002	$ 0.001
	Electric: industrial	$ 0.125	$ 0.005	$ 0.003	$ 0.002	$ 0.001
	Water: irrigation	$ 28.405	$ 1.038	$ 0.778	$ 0.519	$ 0.259
	Water: domestic	—	—	—	—	—
	Percent increase	—	3.7 %	2.7 %	1.8 %	0.9 %
MID	Electric: residential	$ 0.181	$ 0.002	$ 0.002	$ 0.001	$ 0.001
	Electric: commercial	$ 0.143	$ 0.002	$ 0.001	$ 0.001	$ 0.000
	Electric: industrial	$ 0.101	$ 0.001	$ 0.001	$ 0.001	$ 0.000
	Water: irrigation	$ 17.923	$ 0.229	$ 0.172	$ 0.114	$ 0.057
	Water: domestic	$ 297.348	$ 3.795	$ 2.846	$ 1.897	$ 0.949
	Percent increase	—	1.3 %	1.0 %	0.6 %	0.3 %

Discussion

The reported values of the projected rate increases required to recover the cost of the fish passage project can be considered conservative in that they likely overstate rate increases, given a project cost value. This is due to two assumptions made in the analysis. The first assumption is that the annual interest rate to finance the capital costs of the fish passage project would be 8 percent. It is possible (and probably likely) that the Districts could finance capital costs at a lower rate. For example as of December 31, 2017, TID's long-term debt consisted of revenue bonds with fixed interest rates of between 4.0 and 6.9 percent (TID 2018, p. 39). In 2016 and 2017, MID issued bonds with average interest rates of between 4.9 and 5.4 percent (MID 2018, p. 51). Therefore, the projected rate increases reported here are probably robust to the risk of higher interest rates, either through changes in the Districts' respective financial conditions or changes in the financial markets.

The second assumption is that the Districts' cost recovery revenue will only be recovered from retail electric and water customers. For example, 4.6 percent of TID operating revenues and 2.7 percent of MID net operating revenue in 2017 came from wholesale power or gas sales (MID 2018, Statements of Revenues, Expenses and Changes in Net Position, pg. 16). To the extent that the Districts' wholesale power and gas revenue increases, this may offset the rate increases required of retail customers.

Our analysis presumes that the costs of fish passage would be allocated between TID and MID according to their ownership shares in the Don Pedro Hydroelectric project (68.46 percent and 31.54 percent, respectively). The larger share allocated to TID is the reason why the projected rate increases are greater for TID's retail customers. Other fish passage cost sharing arrangements between TID and MID are of course possible. In this case, the projected annual utility rate increases for the Districts' customer classes shown in this report would be scaled by the ratio s_i'/s_i, where s_i' is the actual share of the non-CCSF project costs covered by District i, and s_i is the District i ownership share in the Don Pedro Hydoelectric project. For example, if TID and MID agreed to a 50:50 cost sharing of the non-CCSF project costs, the rate increases for TID's customer classes would be equal to the rate increases shown in this report multiplied by $(0.5/0.6846) \approx 0.73$, and the rate increases for MID's customer classes would be equal to the rate increases shown in this report multiplied by $(0.5/0.3154) \approx 1.59$.

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