Master Response 8.0
Economic Analyses Framework and Assessment Tools

Overview

Water is a shared resource that has many different beneficial uses, and all water within California is the property of the people of the state (Cal. Const. art. X, § 5; Wat. Code §102). Depending on their unique economic perspective and personal beliefs, people ascribe more or less value to certain beneficial uses. For example, growers may value maintaining agricultural water supplies as the most important use of water, whereas environmentalists may more highly value water to improve riparian habitats. The State Water Board, through the Bay-Delta Water Quality Control Plan, must consider designated beneficial uses of water and set water quality standards that ensure the reasonable protection of all water uses – including agriculture, municipal use, fisheries, hydropower, recreation, and others (see Master Response 1.1, *General Comments*, and Master Response 1.2, *Water Quality Control Planning Process*, for more information regarding the consideration of beneficial uses). This consideration is inherently challenging because individuals or groups have strongly held opinions on how uses should be prioritized and may view alternative perspectives concerning the priority of beneficial uses as threatening. This has led to arguments that over-simplify the challenge to balance beneficial uses as a “fish versus farmers” issue, which tends to overlook the much more complex considerations of individual and societal values of water, and that both healthy ecosystems and a vibrant agricultural economy provide local as well as statewide benefits. Such perceptions are partly due to longstanding economic disputes and the use of economics analysis tools that focus on measuring private-sector profits and employment effects without considering broader societal values and tradeoffs (Sukhdev 2010). The State Water Board’s task, however, is highly complex in that it must consider all relevant issues addressed in the SED and adopt plan amendments that consider all affected beneficial uses, including the provision of reasonable protection for fish and wildlife resources in the Lower San Joaquin River (LSJR) and its three major tributaries and the reasonable protection of agricultural uses in the southern Delta.

The State Water Board must consider economics as a factor in establishing water quality objectives. The SED analyses, primarily Chapter 20, *Economic Analyses*, and Appendix G, *Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results*, have helped inform the State Water Board’s consideration of economics, as have the public comments received on the SED, economic analyses and rationales to comments submitted, reviewed, and considered as part of this response to comments on the SED. As explained in this master response as well as in Master Responses 8.1, *Local Agricultural Economic Effects and the SWAP Model;* 8.2, *Regional Agricultural Economic Effects*; 8.4, Non-Agricultural Economic Considerations; and 8.5, *Assessment of Potential Effects on the San Francisco Bay Area Regional Water System,* there are many ways to design and conduct an economic analysis of potential effects. The reasonableness of such an analysis depends, to a large degree, on the supportability of assumptions, data availability, assessment methods used, and the thorough consideration of influencing factors.

As applied to water policy, natural resources economics is a transdisciplinary field of research within economics that considers the connections and interdependence between human actions and economies and aquatic ecosystems. Because most natural resources are scarce, economic analysis considers the decisions by which resources are (or might be) allocated to achieve competing objectives. In other words, from an economic perspective, choosing to use a resource one way usually means choosing not to use it another way. Potential benefits lost by the choice to use a resource in one way rather than another are referred to as *opportunity costs*, and every choice that is made "costs" something, even if the best choice is made. In modern economic theory, price signals the relative scarcity of resources because when supplies of a resource are limited, its value tends to increase.

One important factor that limits economic analyses is that the future is unknowable and there are many external factors—personal, local, and global—that affect economic outcomes. This presents a challenge for economists studying the choices that individuals make among alternative uses of resources. A late 1990s headline in *The Economist* was appropriately entitled "Better than guesswork?" and began with the broad statement that, "Economic forecasts of every kind are pretty unreliable" (Economist 1999). The article focuses on a different economic challenge, that of predicting exchange rates, but is instructive in describing how the use of different types of economic models to "predict" the future (in this case, currency) yields widely varying results. Moreover, the article illustrates that because there are so many influencing variables, including human behavior, the ability to determine an outcome with any degree of accuracy is notoriously difficult.

Although *The Economist* article focuses on monetary theory, the same general challenge is present in the SED with regards to accurately estimating potential effects of the plan amendments on beneficial uses and local and regional economies. As noted by the Public Policy Institute of California, "the relationship between any particular policy and economic growth is complex" (PPIC 2011). In its report, *Business Climate Rankings and the California Economy*, the Public Policy Institute found that the quality of the state's business climate could be ranked either best or worst out of all the states depending on the economic indices used because "each index emphasizes different variables or components in measuring the quality of the business climate." Many economic growth indices measure business climate based on levels of taxes and regulation, as these are commonly assumed to be two of the primary factors influencing economic growth; however, in California, industry composition, population density, and climate mildness are considered to have a far greater impact. For example, a University of California, Davis, report on the most recent California drought found that, with respect to agriculture, economic growth continued to occur even with water shortages because "cropping decisions are based on a number of factors in addition to water supplies, including crop prices, market access, soil type, and climate" (Medellín-Azuara et al. 2016).

As explained further in this master response (and Master Responses 8.1, 8.2, 8.4, and 8.5), the results presented in Chapter 20, *Economic Analyses*, relied either directly or indirectly on results derived from the State Water Board's Water Supply Effects (WSE) model. The WSE model calculates the surface water supplies potentially available under various hydrologic scenarios (refer to Appendix F.1, *Hydrologic and Water Quality Modeling*, for a more detailed description of the WSE model). Predicted hydrologic conditions and surface water availability help inform potential economic effects of the LSJR alternatives, including effects on agricultural resources, municipal and industrial water delivery, hydropower generation, fishery habitat, and recreational resources. For responses to comments on the WSE model and assumptions made associated with the model, please see Master Response 3.2, *Surface Water Analyses and Modeling.*

This master response is designed to more thoroughly explain how economic analysis was used in the SED to help inform the State Water Board's consideration of potential economic effects related to the plan amendments. This master response characterizes analytical framework considerations and assessment tools, both quantitative and qualitative, that are available for conducting the analyses and identifies factors that inherently limit the analyses, such as data constraints. To evaluate the economic effects of hydrologic conditions associated with the LSJR alternatives, many economic assessment methods are available. Assessment methods range from qualitative analyses that are based on generally accepted methods of determining the direction and magnitude of potential economic effects to highly quantitative analytical tools (or models) typically developed based on underlying statistical analyses.

Choosing the appropriate assessment tools should be based on the intended purpose of the assessment, combined with the analytical function of available assessment tools (e.g., estimating hydrologic-related effects, such as changes in agricultural or hydropower production), while considering the availability of data for using the tools. For example, in the SED, estimating the agricultural economic effects of the plan amendments relied on a generally accepted optimization model—the Statewide Agricultural Production Model (SWAP)—to estimate changes in agricultural production, and the widely used Impact Analysis for Planning) (IMPLAN) input-output economic impact model to estimate associated changes in regional economic activity. The SWAP model portrays rationale changes in grower behavior in response to changes in crop growing conditions (see Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model*). The IMPLAN model, which considers transactional interrelationships among different entities and institutions in different sectors of the regional economy, estimates how a given change in production within one industry would affect entities and institutions in other connected industries and sectors of a regional economy (see Master Response 8.2, *Regional Agricultural Economic Effects*, regarding IMPLAN and its use). More qualitative methods were used in the SED to evaluate potential economic effects on other resources, such as fishery resources.

The economic analysis is presented in its entirety in Chapter 20, *Economic Analyses*; however, certain appendices to the SED (for example, Appendices G, *Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results*, and L, *City and County of San Francisco Analyses*) include information that supplements the level of detail presented in Chapter 20. This master response provides information to clarify the economic analyses in Chapter 20. Reponses to comments on the SED targeted at specific economic or resource issues are included in the master responses for those respective topics or in the individual responses. For example, specifics concerning comments related to local agricultural economics are presented in Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model*. This master response, and the other master responses cited above, describe how the SED conducted its economic analyses and the factors considered. Differences between the SED's assumptions and those made by various commenters are noted, where appropriate. The supplemental material contained in this master response and others helps further inform economic considerations; however, inclusion of this material does not result in new potentially significant and adverse physical changes in the environment, or a substantial increase in the severity of existing environmental impacts.

This master response first addresses the process for developing and applying an analytical framework considered appropriate for assessing potential resource-specific economic effects then identifies and explains key factors considered in developing the assessment tools used for analyzing different resource-specific economic effects. This master response elucidates important concepts that underlie the economic analysis contained within the SED to clarify points that may have been misunderstood or mischaracterized in comments. The table of contents on the following page is provided to help guide readers in finding where the topics of their concern are addressed. This master response also serves as a road map by providing additional information that should be helpful for navigating other master responses, especially those related to economic issues.

- Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model*
- Master Response 8.2, *Regional Agricultural Economic Effects*
- Master Response 8.4, *Non-Agricultural Economic Considerations*
- Master Response 8.5, *Assessment of Potential Effects on the San Francisco Bay Area Regional Water System*

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Developing an Appropriate Analytical Framework and Applying Assessment Tools

The SED's economic analyses used widely accepted analytical tools, best available data, and reasonable analytical assumptions. The application of other methods, data, and assumptions to analyze potential effects of the plan amendments would likely yield somewhat different results. The discussion of analytical frameworks and potential assessment tools in this master response underscores that there are multiple ways to conduct an economic analysis of how to allocate water resources for beneficial uses. However, even if different assessment tools were used that produced different results, that does not invalidate the results and conclusions drawn from the economic analysis conducted for the SED, which are based on widely accepted methods and data considered appropriate for making reasonable inferences.

Regulatory Context

As described in Chapter 20, the Porter-Cologne Act (Wat. Code § 13000 et seq.) governs State Water Board development and adoption of water quality objectives. The need for an economic analysis associated with State Water Board actions is required by two sections of Porter-Cologne. Section 13141 states that, "prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan." Section 13241 states that "economic considerations" should be considered in establishing water quality objectives. However, the statutes are far from prescriptive. Often quantifying compliance costs to affected parties (e.g., growers and water districts) and assessing related impacts on local and regional economies are the focus of the analyses to comply with these statutory provisions.

The State Water Board's Water Quality Control Planning program is certified under CEQA as exempt from the requirement to prepare an EIR because it requires a plan or other written documentation (i.e., the SED) that complies with specified requirements for environmental analysis and public review. However, references to CEQA EIR requirements, although not binding on the State Water Board's SED process, can be informative. With respect to economics, CEQA does not require an analysis of project-related social or economic effects unless they are related to physical changes in the environment.[1] Nevertheless, a lead agency may include an assessment of economic or social effects in an EIR in whatever form the agency desires (State CEQA Guidelines, Cal. Code of Regs., tit. 14, § 15131).

Analytical Framework and Tools

The purpose of the economic analyses presented in Chapter 20 is to identify and assess resource-specific economic effects of the LSJR alternatives. This is generally achieved by applying an

[1] As discussed in the Executive Summary, pursuant to Public Resources Code section 21159, the State Water Board must fulfill certain obligations when adopting certain rules or regulations, including an analysis of the environmental impacts of the methods of compliance with the rule or regulation. Section 21159, subdivision (c) requires that the environmental analysis take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites.

analytical framework appropriate for addressing key policy issues, such as comparing which alternative is more cost-effective from the state's perspective and, based on consideration of estimated changes in regional economic activity, which alternative appears to provide the most benefit within a certain area, such as the plan area. Appropriate set of assessment tools and available data are identified once the analytical framework is established. The two types of quantitative economic analyses used for the SED and described in Chapter 20 are as follows.

- Economic welfare analysis.
- Regional economic impact assessment.

Economic welfare analysis and regional economic impact assessment were conducted to assess mostly quantitative effects of the plan amendments. Where evident, non-quantitative economic effects also were identified. To more comprehensively present both quantitative and non-quantitative effects, an ecosystem services framework is included as part of Master Response 8.4, *Non-Agricultural Economic Considerations*, to present in one place both quantitative effects of the plan amendments, such as angler benefits associated with increased fishing opportunities, and also more difficult to quantify, but no less important, effects associated with potential ecosystem improvements, such as improving fish and wildlife habitat.

Consistent with analytical requirements for economic welfare analysis, changes in resource costs and benefits associated with the LSJR alternatives were identified, quantified, and monetized (where possible). Resource costs were measured in terms of opportunity costs, and benefits were evaluated in terms of willingness-to-pay (WTP) by affected parties. Each resource-specific assessment considered how the LSJR alternatives could change the implied or inferred economic value of different beneficial uses[2] of water. In addition, the potential costs of complying with the Southern Delta Water Quality (SDWQ) alternatives were evaluated consistent with requirements in Water Code section 13241, focusing on how increases in water treatment costs could impact ratepayers and the regional economy.

Regional economic impact assessment considers how changes in the production of goods and services (or in the inputs to the production process) directly affect businesses and institutions in terms of the need for labor and other inputs to the production process. Then, based on empirical relationships embedded in a transaction matrix, estimates the potential "ripple" (indirect and induced) effects that occur within industries and sectors of a regional economy. For example, if production in the agricultural sector changes in response to reduced water supplies, the assessment would analyze not only how spending changes in the agricultural sector would affect that industry, but also interconnected industries.

The term *regional* could refer to a multi-county area or just a single county. The study region of analysis defines the number and composition of economic sectors analyzed, and the potential effects on economic activity within that region. As characterized in the IMPLAN input-output model, up to 440 sectors could potentially be affected by a change in production in the impact-producing industry and sector. Rather than focusing on measuring the monetary values of changes in production to affected beneficial uses (as conducted in an economic welfare analysis), regional economic impact assessments focus on estimating potential distributional effects on economic activity associated with a proposed action. The most common metrics used to measure economic

[2] Potentially affected beneficial uses are identified and described in the most recent Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (State Water Board 2006).

activity are economic output (often referred to as gross revenues from production), employment (in jobs, full-time, part-time, or full-time equivalent), and personal income (which includes wages and salaries, and proprietor income or profits).

With a few exceptions, both an economic welfare analysis and a regional economic impact assessment were conducted to assess effects on affected beneficial uses supported by the LSJR and tributary water resources (e.g., agricultural production, municipal and industrial water supply, hydropower generation, recreation, and fisheries) that would be substantially affected. However, the level of analytical rigor varied among the different resource-specific assessments depending on the availability of empirical relationships and data. Because the primary intent of each resource-specific evaluation was to identify and compare potential economic effects associated with the LSJR alternatives, applying a consistent level of analytical rigor for conducting each of the resource-specific analysis was important; however, applying the same level of analytical rigor across other resource-specific analyses was of lesser importance, which allowed for tailoring each resource-specific analysis to available data. (For purposes of the SED analyses, analytical rigor is mostly characterized as a function of the depth of analysis and level of quantitative analysis used.)

As previously mentioned, an ecosystem services analytical framework is presented in Master Response 8.4, *Non-Agricultural Economic Considerations*, to more comprehensively incorporate in one place the wide array of potential ecosystem services effects with economic implications, even those effects that are difficult to measure. The effects of a potential action were traced through the watershed or ecosystem to more fully understand the overall effect and value that potential changes in the ecosystem contribute to human well-being. Each resource-specific analyses conducted for the SED and described in Chapter 20 is generally consistent with an ecosystem services approach to an economic assessment. However, the programmatic nature of the SED assessments limits the potential for identifying resource specific effects and for supporting a more formal ecosystem services valuation analysis. Information pertinent to the ecosystem services assessment is in Master Response 8.4.

Key Considerations in Developing an Analytical Framework and Appropriate Assessment Tools

The economic analyses conducted for the SED evaluated potential economic effects of the LSJR alternatives as compared to economic conditions associated with a baseline flow condition. To the extent practical, the economic analyses relied on established empirical relationships (e.g., the effect of water supply availability on crop production, the effect of changes in crop prices on levels of crop production, the effect of recreation quality on reservoir visitation, and the timing of water availability on hydroelectric power production). The analyses conducted for Chapter 20, *Economic Analyses*, provide reasonable estimates of economic effects by relying on modeling assumptions and data that produce analytical results intended to support comparative analyses. Given the programmatic nature of the SED, developing precise, quantitative estimates of economic effects was not a foremost analytical goal.

As indicated in Chapter 20, the comparative analyses conducted for each resource topic should not be combined for purposes of summing costs and benefits for each of the LSJR alternatives or for the SDWQ alternatives. Each resource-specific analysis is limited by data availability and, as such, the results for a particular resource-specific assessment may be presented at a different level of specificity than results from another assessment. Although the topic-specific analyses include certain analytical components common to each evaluation (e.g., evaluating potential effects on the regional economy), drawing conclusions across topics concerning the overall net benefits of a particular alternative.

Certain principles, such as the following, ensured the analytical results were reasonable and sufficiently accurate for comparative purposes.

- Incorporating reasonable and generally accepted assumptions.
- Assessing appropriate spatial and temporal considerations.
- Ensuring that analyses were conducted consistent with relevant economic theory and generally accepted economic concepts.
- Employing widely accepted measurement and presentation practices.

Reasonable Assumptions

Incorporating reasonable assumptions to assess potential economic effects helps to limit potential biasing effects of uncertainty on analytical results. In general, the assumptions that underlie an economic analysis should reflect rationale human behavior, including logical consideration of interpreting key sources of uncertainty. For example, incorporating analytical assumptions concerning grower response to reduced water supply on agricultural production decisions should reflect consideration of both short-term and long-term consequences related to desired profit-maximizing outcomes.

By design, analytical models attempt to approximate real world conditions; as a result, some degree of uncertainty in analytical results is inevitable. Despite this, developing reasonable assumptions and prudent consideration of data that support assumptions can minimize potential confounding effects of uncertainty on analytical results. Although quantitative models that statistically consider underlying relationships inherently have certain advantages over assessment tools that are primarily based on a more qualitative understanding of key cause-and-effect relationships, more sophisticated tools are still subject to the effects of unknowns and factors of uncertainty. Informed decision-making require consideration of how uncertainty can affect results, no matter which tools and models are used.

One way to better understand the effects of uncertainty and the validity of key assumptions is to use sensitivity analyses where the value of certain key assumptions are modified to assess the sensitivity of the analytical results to changes in assumed values. For example, the analysis of potential economic effects associated with reductions in water deliveries to the City and County of San Francisco (CCSF) service area during extended drought periods assumed that replacement supplies could be obtained for an average price of $1000 per acre-foot (AF). This assumed price was based on a comprehensive review of prices paid in recent years for water transfers between rural and urban water districts (refer to Appendix L, *City and County of San Francisco Analyses*, and Master Response 8.5, *Assessment of Potential Effects on the San Francisco Bay Area Regional Water System*). However, as with most if not all assumptions, the basis for these assumptions represents a best estimate within a broad range of potential values. To examine the “sensitivity” of the analytical results to the assumed water price, a sensitivity analysis was conducted using values near the endpoints of the range of prices ($500 per AF to $2,000 per AF). Performing a sensitivity analysis focuses on the effects of key variables. It can help bound the likely range of results and inform decision makers of possible outcomes. This is especially insightful when there is may be considerable uncertainty affecting an analysis.

Spatial and Temporal Considerations

Generally, a geographically defined study area is used to frame the confines for evaluating potential effects of an action within an area of specific interest Defining a study area helps to more thoroughly understand the factors that are most important to an analysis. However, when effects outside the study area become apparent and determined important, the study area boundaries may need to be reconsidered, and possibly a second study area established. This can occur in cases when important indirect or induced effects occur, such as third-party effects on parties or entities that do business with entities within the primary study area. In such case, the general rule-of-thumb of establishing one study area to evaluate all potential effects within that area may need to be reconsidered.

In situations where actions result in substantial effects in areas that are not in direct geographic proximity to the study area, establishing more than one study area should be considered. Such is the case with the evaluation of the plan amendments in which the water conveyance system originating in the rural western slope of the Sierra Nevada delivers water more than 100 miles to the urban San Francisco Bay Area. Not only are the two areas separated by vast geography consisting of large, mostly undeveloped lands, the economic development characteristics of the two areas of study interest are very different. In cases such as this, establishing two distinct study areas (e.g., the plan area and the extended plan area) provides opportunities to assess potential effects in regions that are geographically distinct and to allow for more accurately framing of influencing factors that have important social and economic considerations.

For the economic analysis conducted for the SED economic effects were initially expected to occur primarily in the plan area. Potential effects in other areas, such as fishing areas in the San Francisco Bay/Pacific Ocean region, municipal and industrial water supply effects in the CCSF service area, and potential effects in the extended plan area were considered of secondary importance. As potentially substantial effects in these geographically distinct areas became more apparent, analyses were designed to suitably isolate and evaluate potential effects. Also, because each resource-specific analysis was designed to be a stand-alone comparative analysis of potential effects associated with LSJR alternatives, opportunities were available to consider the geographic locations or study areas most suitable for analyzing each resource topic. For example, the study area for evaluating effects on recreation and commercial fisheries (Chapter 20, *Economic Effects*, Section 20.5, *Effects on Fisheries and Associated Regional Economies*), which includes the Pacific Ocean marine waters and corresponding coastal areas, was a unique situation that allowed for considering not only a distinct study area. It also provided temporal flexibility to consider the extended time period in which anadromous fish migrate to the ocean, develop for usually 3–4 years, and then return to spawn and be harvested in coastal and inland commercial and recreational fisheries.

Similar to spatial considerations, the resource-specific analyses in the SED also consider different temporal issues. No uniform timeframe was established for the economic analysis because of generally different time periods during which effects associated with each resource-specific analysis would occur. Because the intent of each resource-specific assessment in Chapter 20, was to compare effects of the LSJR alternatives relative to a baseline condition, there was no need to establish one uniform time period for assessing effects across different resource topics. Alternatively, the analyses were framed as a snapshot of effects at some unspecified time in the future. This approach avoided the need to establish one uniform base year or a time series of years to which the analysis of economic values had to be adjusted. Although adjusting and discounting of values is central to certain types of analytical frameworks, such as benefit-cost analysis, these adjustments are not needed for resource-specific comparative assessments of alternatives.

Different temporal conditions serve as the foundation for the snapshot approach to characterizing economic effects. For example, whereas expected changes in agricultural production would be expected to occur on a near-term timeline corresponding with implementation of plan amendments, effects that would occur infrequently over an extended time horizon, such as potential water supply shortages that would only occur during certain infrequent types of hydrologic events, would be subject to an uncertain timeline.

Applying a resource-specific comparative assessment approach to evaluate the LSJR alternatives allows for relaxing some of the spatial and temporal considerations associated with other analytical approaches. In effect, an economic analysis is designed for each affected resource to identify and compare effects of each LSJR alternative on the use of different water-dependent resources, including crop production, provision of municipal and industrial water supply, hydroelectric power generation, fisheries, and recreation resources.

Relevant Economic Theory and Concepts

Although a comparative assessment approach allows for additional analytical flexibility in the design of economic analyses, the analyses still need to be consistent with relevant economic theory and key concepts. As indicated above, the economic analysis conducted for the SED is comprised of two types of analyses: economic welfare analysis and regional economic impacts analysis. Whereas an economic welfare analysis focuses on determining changes in human well-being, as measured to the extent possible in monetary terms, regional economic impact analysis focuses on distributional changes in economic activity, as frequently measured by economic output, employment, and personal income. Both types of economic analyses play an important role in understanding the economic implications of public policies, such as the allocation of water resources.

Each of the resource-specific assessments conducted for the SED was performed consistent with relevant theory of human behavior that underlie economic decisions. For example, potential effects of the plan amendments are based on concepts of rational profit-maximizing behavior. Decisions on how much of a product to produce is determined by consideration of marginal costs and revenues. These and other concepts form the foundation of the economic analyses and were closely adhered to in the conduct of each resource-specific economic analyses. While many economic concepts are explicit and generally apply to measuring costs and benefits, certain concepts are more flexible and allow for professional judgment to interpret their applicability. The comparative assessment framework used for the SED economic analyses allows for more flexibility in the role of professional judgment to inform an analysis.

Historically, the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, published by the U.S. Water Resources Council (1983) played an instrumental role in identifying relevant economic theory and concepts for economic analysis of water resource decisions. Because this document is dated, and due to the emergence of new economic analytical frameworks, such as ecosystem services valuation, the *Economic Analysis Guidelines* published by the California Department of Water Resources (2008) proved to be a valuable resource for framing the economic analyses and assessing appropriate methods for the SED economic analyses.

Measurement and Reporting Practices

Certain practices are considered standard to meaningfully achieve consistency in economic analyses. One such practice is enumeration of dollar values. A widely accepted practice when reporting monetary values of economic costs and benefits that are derived over different time periods (i.e., years) is to present values consistently using a selected recent year. Although not always practical, this practice is referred to as presenting dollar values in constant-year values. With a few exceptions resulting primarily from data limitations, the monetary values of effects derived from the resource-specific evaluations presented in Chapter 20, *Economic Analyses,* are reported in constant 2008 dollars.

Reporting monetary values in constant year values attempts to explicitly adjust for the effect of changes in relative prices over time (e.g., inflation). Even though adjusting a time series of dollar values to a constant-year value is far less of a concern currently than during the double-digit inflationary period from the early 1970s through the mid-2000s, adjusting prices to a constant year is generally a good practice to explicitly account for changes in the general prices of goods and services; however, adjusting prices of some economic goods and services from an extended time period to a constant-dollar year can introduce measurement error that substantially distorts the relative value of those goods and services. This is because prices for certain products tend to change at different rates over time, due in large part to scarcity effects and other factors (e.g., changes in consumer preference) that affect supply and demand that influence price. The most widely used index for adjusting prices is the consumer price index; however, other indices, such as the producer price index and product-specific indices, are available and may more accurately track the effect of changes in product-specific prices.

For the SED economic analysis, 2008 was used as the constant-dollar year to present the monetary value of resource-specific economic indicators, such as crop values. The decision to use 2008 as the constant- dollar year was made in large part because of the availability and quality of data. While using 2008 as the constant dollar year for valuing end products may appear dated, adjusting values by applying general price indices does not necessarily improve the accuracy of economic analyses because of measurement error issues. Consequently, for the SED analysis, prices were only adjusted to constant 2008 dollars for those evaluations where adjusting prices was determined to improve the overall usefulness of the resource-specific values. This variable approach to using constant-dollar years was considered feasible and appropriate only because the economic analysis consisted of a series of stand-alone evaluations that focused on comparing resource-specific effects of the flow alternatives. Alternatively, had a benefit-cost analysis in which economic costs and benefits been conducted, all monetary values would need to be reported in the same constant-year dollars consistent with the appropriate decision criteria (e.g., total benefits exceed total costs). This difference in the use of constant dollar years underscores the caveat presented elsewhere in this master response against summing values from the different resource-specific evaluations in Chapter 20 (see section entitled *Key Considerations in Developing an Analytical Framework and Appropriate Assessment Tools*).

In summary, we consider having an economic analysis consisting of values that are somewhat dated but that accurately reflect relative values of different resource effects at a particular point in time more informative to decision makers than having an analysis with updated values but which likely includes distorted important price relationships. As shown in Table 8.0-1, general prices between 2008 and 2017 have increased by about 16 percent over that time period, according to the consumer price index (U.S. Department of Labor, Bureau of Labor Statistics 2017), suggesting that presenting monetary values in 2008 constant dollars does not substantially underestimate reported 2008 values.

Table 8.0-1. Consumer Price Index Values—All Urban Consumers

		Annual Percent Change	
Year	Index Value	Percent Change from 2000	Percent Change from 2008
2000	174.1	--	--
2001	177.4	2.0%	--
2002	181.3	4.1%	--
2003	184.5	6.0%	--
2004	191.0	9.7%	--
2005	197.6	13.5%	--
2006	201.5	15.7%	--
2007	210.2	20.7%	--
2008	212.4	22.0%	--
2009	216.3	24.2%	1.8%
2010	218.8	25.7%	3.0%
2011	226.2	29.9%	6.5%
2012	230.2	32.2%	8.4%
2013	233.1	33.9%	9.8%
2014	236.2	35.7%	11.2%
2015	237.3	36.3%	11.7%
2016	241.4	38.7%	13.7%
2017	246.7	41.7%	16.1%

Source: U.S. Department of Labor, Bureau of Labor Statistics 2017.
Note: Consumer Price Index (CPI) annual percent change values are derived by dividing the index value for the current year by the index value for a base year (i.e., 2000 or 2008). For example, the CPI percent change value for 2000 to 2007 (20.7%) is derived by dividing 210.2 by 177.4, and for 2008 to 2015 (11.7%) by dividing 237.3 by 212.4. For calculation purposes, the percent change value is considered equivalent to the rate of inflation. The CPI values are based on a 1982 base year value of 100.

One additional measurement issue discussed in Master Response 2.3, *Presentation of Data and Results*, Master Response 2.5, *Baseline and No Project*, and Master Response 3.5, *Agricultural Resources*, is the use of average conditions. As indicated in these master responses, the use of average conditions is appropriate and allowed in CEQA analyses. Furthermore, the use of average conditions to characterize baseline conditions is a widespread and common practice when conducting most types of comparative analyses. This practice is used in the SED when appropriate to conduct comparative assessments in which changes in resource-specific economic conditions required baseline conditions to evaluate economic effects.

Average conditions are estimated in many different ways. Averages can be calculated as means or medians, over an extended time period or a short time period, or by calculating an average of the averages, such as calculating average monthly values over some period of time and then determining the average of 12 different monthly values. Averages serve as an appropriate representation of conditions intended to serve as a baseline. In the SED, averages are determined in different ways, tailored to the most meaningful need. Additional analyses to clarify and amplify information in the SED as part of response to comments may consider using different strata to develop appropriate average conditions, as described in Master Response 2.3, *Presentation of Data and Results in SED and Response to Comments*.

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