Attachment 8
Benefits and Cost Analysis

This attachment presents an economic assessment of the benefits and costs of the nine projects included within the Proposition 84 Round 2 funding proposal for the Greater Monterey County IRWM region.

We begin by describing the goals of the Greater Monterey County IRWM region, to provide context for the analysis. We then outline the framework and general assumptions we use to conduct the analysis. In the next section, we present a stand-alone economic assessment (either a cost-effectiveness or benefit-cost analysis) for each project included in the proposal package. Each assessment describes the project, the analytical assumptions for estimating benefits and costs, and the results of the analysis. In the summary at the end of this Attachment we list the benefits and costs for the proposal package as a whole.

Introduction

The Greater Monterey County IRWM region represents an expansion of a former IRWM region, the Salinas Valley region, which was created under Proposition 50. The new region was created to address significant IRWM Plan coverage voids in the Central Coast Funding Area. The mix of projects included in this proposal reflects the region's new, more inclusive approach to IRWM planning. From the former Salinas Valley region to the significantly expanded Greater Monterey County IRWM region, the proposal package covers almost all of the major geographic areas of the region.

The nine projects contained in this application have been carefully selected to address some of the most pressing water quality and water supply related problems of the Greater Monterey County IRWM region. These problems include:

1. Lack of access to safe drinking water in many disadvantaged communities (DACs) in the region
2. Seawater intrusion in the Salinas Valley Groundwater Basin
3. Water quality impairments in surface waters, groundwater aquifers, estuarine and coastal waters
4. Ecosystem degradation due to water quality impairments and invasive non-native plant species

Together the nine projects included in this proposal will provide important and multiple benefits to the region, by enhancing the amount and quality of natural resources, human resources, and physical infrastructure available to citizens of the region and the State of California. All of these benefits, together, will help the region develop a more resilient ecosystem and a more robust water system. This will help provide greater protection against the potential impacts of climate change and improve the quality of life and economic wellbeing of all Californians.

Framework

This benefit-cost analysis follows the instructions outlined in Exhibit D of the Proposition 84 Proposal Solicitation Package (DWR 2012). It follows the "DWR Method" for conducting the economic analysis. We analyze eight of the nine projects included in the proposal package using a benefit-cost approach. One of the projects, Pajaro/Sunny Mesa Community Services District: Springfield Water Project, meets the provisions outlined in Section D1 for cost-effectiveness analysis, so we use that approach to assess its economic effects.

Cost Effectiveness Analysis Methodology

We analyze one project using the cost-effectiveness methodology outlined in Section D1 of the Proposal Solicitation Package (DWR 2012). This simplified analytical approach is available to use for projects that benefit disadvantaged communities and have a total project cost less than $1 million.

The methodology involves a step-by-step assessment of the proposed project and potential alternative courses of action to solve the problem. It begins with a description of the current conditions the proposed project is intended to improve. The next step is to demonstrate that alternative projects have been considered that would solve the problem or provide a similar level of benefit. The final step involves comparing the costs across each of the alternatives and describing why the proposed alternative is the most cost-effective, or why it should be the preferred option if it is not the cheapest.

Table 11, the Statement of Cost Effectiveness, provides the framework for conducting the analysis.

Benefit-Cost Analysis Methodology

For the eight projects we analyze under the benefit-cost framework, our estimates reflect the marginal, net willingness of Californians to pay, measured in dollars of 2012, for the goods and services that the proposed projects would increase (the benefits) and consume or diminish (the costs).

The proposed projects would yield economic benefits to the extent that they increase the value of goods and services available to Californians. The proposed projects have the potential to increase the value of these goods and services in three ways:

1. By lowering the cost of providing a given good or service (e.g., by distributing water more efficiently through new pipes)
2. By increasing the supply of a given good or service (e.g., by creating new habitat for endangered species)
3. By increasing the demand for a given good or service (e.g., by educating consumers about the importance of cleaner rivers)

The projects would produce few goods and services directly; instead, they primarily would enhance the supply of capital necessary to provide goods and services.[1] Thus, the proposed projects would produce benefits to the extent that they increase the region's stock of capital, and the quantity or types of goods and services that flow from it. The proposed projects may also produce benefits to the extent that they affect the demand for, and, hence, the value of certain goods and services.

Consistent with widely accepted professional standards, we consider a broad suite of goods and services in the analysis, including those whose value comes from indirect or non-use of resources (U.S. Environmental Protection Agency 2009, National Research Council 2004, U.S. Environmental Protection Agency 2000). Economic benefits arising from some types of goods and services, especially those derived from changes in the supply of natural capital, human capital and social capital, are often difficult to

[1] Economists use the term ***capital*** to describe resources commonly used to produce things people value (e.g., different types of goods and services). Classifications vary, but most economists generally recognize four types of capital: natural, human-built, human, and social. Natural capital refers to the components of nature, e.g., water, trees, and soil, and the interactions between these components. Human-built capital refers to water-delivery infrastructure, roads, and other tangible goods and infrastructure. Human capital refers to the knowledge and skills embodied in people. Social capital refers to social networks, cultural norms, laws, and political systems.

quantify in monetary terms, because they are not traded in markets and cannot be measured using price data and price-dependent techniques. This does not mean that their value is zero.

Where sufficient data are available to estimate the physical change in the stock or flow of goods and services *and* quantify the economic value of that change, we value the economic benefit in monetary terms, consistent with the instructions outlined in Section D3–*Monetized Benefits Analysis.* Where data are unavailable to quantify the economic benefit in physical terms, monetary terms, or both, we describe the benefit consistent with Section D2–*Non-Monetized Benefits Analysis.*

In the following sections, we describe our methodology for estimating and describing non-monetized benefits, monetized benefits, and costs. For a few projects, we are only able to describe their economic importance in non-monetized terms. For most projects, however, we describe some benefits in monetized terms, and others in non-monetized terms. To understand the total economic value arising from each project, both monetized and non-monetized benefits must be considered together, then compared to the costs of the project.

Section D2. Non-Monetized Benefits Analysis

For each project, we describe the economic importance of its effects for which sufficient information does not exist to quantify in monetary terms. From an economic perspective, these effects improve the well-being of Californians, so should be accounted for in the benefit-cost analysis. Ignoring them or discounting their importance relative to the monetized benefits would result in an incomplete and biased analysis. To support the argument that these effects have economic importance, we provide a narrative description for each benefit that includes these categories of information:

- The project's marginal effect on each category of benefit presented in Table 12, comparing the without-project conditions to the with-project conditions. Where applicable, we rely on information presented in Attachment 7 to understand the physical changes arising from the project.
- Evidence of the economic importance of the effect. A biophysical effect is only important from an economic perspective if it provides something people want (and are willing to pay for). This is true even if the effect cannot be quantified in monetary terms. Thus, we describe the demand for the effect or the goods and services it might generate, including direct use, indirect use, and non-use demands. Wherever possible, we use local information to substantiate evidence of local demand. When local information does not exist, we provide evidence from the economic literature that demonstrates the value of the effect.
- When the benefit might materialize and how long it might persist.
- Who would benefit, and how the benefit would be distributed across stakeholders.
- Sources of uncertainty and how uncertainty might affect how or when the benefit materializes.

In some categories, the project may generate positive effects on biophysical parameters as described in Attachment 7 that have no additional effects from an economic perspective. These effects are not included separately in Table 12 or the accompanying narrative.

Section D3. Monetized Benefits Analysis

Benefits are monetizable only if sufficient data are available to quantify the physical effect *and* to determine an appropriate economic value. To estimate the value of monetizable benefits, we followed these steps:

- Used a with-vs.-without framework to describe the expected outcome of the project in terms of the expected net marginal increase in the supply of different types of goods and services, the

marginal avoided costs of project-related activities, and/or the marginal change in the demand for goods and services. In some cases, this information is presented in biophysical terms in Attachment 7.

- Worked with project sponsors and other individuals to identify project-specific information that would help us value the goods and services and avoided costs of the projects. Where project-specific or local information was not directly available, we reviewed the existing economic literature to identify relevant studies that identify the marginal value to Californians of each type of good and service. We used benefit-transfer guidelines expressed by the U.S. Environmental Protection Agency (2010) to apply these values derived from studies conducted elsewhere to value the changes resulting from the project.[2]
- Adjusted each estimate of per-unit value of a good or service or avoided cost to its equivalent value in 2012 dollars, using the update factors provided in Table 14 of the *Proposition 84 Proposal Solicitation Package* (DWR 2012, pg. 50). For updating values before 2007, we use the Consumer Price Index.
- Estimated the annual value of the expected increase in the supply of each type of good or service by multiplying the expected annual increase in the supply times the per-unit value, in 2012 dollars. For avoided costs, we placed expenditures in the appropriate years they would have occurred or calculated an expected annual value based on the annual probability of occurrence.
- Assessed the uncertainty embodied in each estimate of annual value for each type of good or service, and determined if it is reasonable to conclude that it offers an unbiased representation of the true value of the good or service. In all cases, we selected an estimate of per-unit value that more likely than not yields an *underestimate of the true value* of a project's benefits.
- Completed an internal review process, to ensure the information we provide gives a reasonable description of the benefits and costs for each project.

To support the quantification in the tables, we provide a narrative description for each monetizable benefit that outlines the analytical assumptions, beneficiaries, and sources of uncertainty.

Section D3. Cost Analysis

To estimate costs—for example, projected expenditures on capital, operations, and maintenance activities—we relied on information provided by project sponsors, following the guidelines presented in Section D3 (DWR 2012, pg. 48). Consistent with those guidelines, the cost estimates represent the full cost of the project, inclusive of capital, operations, and maintenance costs, and the opportunity cost of any volunteer labor, land, and other donated inputs required to implement the project.

Organization of this Attachment

In the following sections, we present a complete economic assessment of each of the nine projects included in this proposal. These assessments constitute complete, stand-alone analyses, consistent with the methodology outlined in the framework section above.

- For the single project we evaluated using a cost-effectiveness framework, we explain why it meets the threshold criteria for this type of analysis and describe the results of the cost-

[2] Insofar as possible, whenever project-specific estimates of value are not available, we have strived to identify estimates from settings with similar economic and ecological characteristics. We anticipate that the real value of some goods and services, such as high-quality water in streams, healthy riparian forests, and robust salmon populations, will increase over time, all else equal. However, we lack defensible forecasts of the rates of increase and, hence, have not folded these increases into our estimates.

effectiveness analysis (Section D1 and Table 11). Though not required, we summarize the costs of the project in Table 19.

- For the eight projects we evaluated using a benefit-cost framework, we describe the conditions with and without the project. We then present the non-monetized benefits analysis (Section D2 and Table 12), followed by the monetized benefits analysis (Section D3 and Tables 15 and 16 as appropriate). We describe the costs of the project (Table 19) last.[3]

Following the project-level economic assessments, we summarize the economic benefits and costs of the proposal package as a whole (Section D5 and Table 20).

[3] None of the projects in this proposal package have flood reduction as their primary benefit, requiring a Flood Damage Reduction Benefit Analysis (Section D4 and Table 18). To the extent that any of the projects reduce the risk of flooding and associated damage, we describe these effects as non-monetized benefits in Section D2, as data are insufficient to quantify the effects in physical terms.

Project 1. County of Monterey: San Lucas Water District Public Water Supply Project

Project Description

Conditions Without the Project

The community of San Lucas is an impoverished, predominately Hispanic, farmworker village with a population of about 490. San Lucas is a disadvantaged community (DAC) with a median household income of $47,121. The San Lucas Water District (the District) operates the community's drinking water and wastewater systems, and serves approximately 90 residential and commercial connections.

The District's water supply is derived from a single groundwater well located in the center of an agricultural field about one mile south of the community. The water system does not have a backup well. If the well becomes non-operational, there would be no water for sanitation or fire protection. The well water suffers from excessive levels of both nitrates and total dissolved solids (TDS) contamination. Nitrate levels are currently 60 to 70 parts per million, about 6-7 times the legal limit. Likewise, TDS levels in the water supply are currently about 2,000 ppm, about four times the recommended limit of 500 mg per liter (500.6 ppm).

In May 2011, the Monterey County Division of Environmental Health determined the community's public water supply exceeds state-mandated maximum contaminant levels and issued a "Do Not Drink" order for all of the District's users and directed the District to secure a source of water that meets all legal standards. The order will remain in effect until the nitrate contamination is remediated. While the "Do Not Drink" order is in place, residents must use bottled water for cooking and drinking, and the San Lucas Union School District must provide bottled water for students of San Lucas Elementary.

Furthermore, until the District resolves the water quality issues, the Regional Water Quality Control Board (RWQCB) will not certify approval of the District's new wastewater treatment system. Until the RWQCB lifts the prohibition, the District cannot approve any new service connections to the sewer system, and no new development can occur in the community. Prior to the moratorium on new connections, a developer was preparing to build a new affordable housing complex in San Lucas. Changes in the housing market since 2007 have increased the supply of housing that is affordable to San Lucas residents, but the supply is beginning to tighten again, and observers predict that demand for new affordable housing units would go unmet in San Lucas if the water system issues are not resolved.

Conditions With the Project

The project would provide the residents of San Lucas with a water supply that ensures they have access to clean, safe drinking water. With the project, the Monterey County Division of Environmental Health would retract the "Do Not Drink" and residents of San Lucas would no longer need to rely on purchases of bottled water for drinking and cooking. As a result of the improvements in water quality from the project, the District would be able to approve new sewer connections for proposed developments, including affordable housing projects.

The District would accomplish these changes by initiating a feasibility study to explore four alternatives for resolving the inadequate water supply. The feasibility study would involve drilling a test well at a proposed location, and implementing a comprehensive sampling and testing regime. Based on the results of the study, the District would implement one of four alternatives: 1) treating the existing well water; 2) drilling a new well and maintaining the existing well as-is for emergency backup 3) drilling a new well and improving the existing well to provide an emergency backup water supply; and 4) constructing a pipeline to import water from nearby municipal sources. If option 2 or 3 is chosen, the District would have both a new well to provide clean drinking water to its customers, and a back-up well to provide

backup water for sanitary and fire protection services, increasing the reliability and resiliency of the system.

Section D2. Non-Monetized Benefits Analysis

Table 12-1 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-1. Non-monetized Benefits Checklist
Project 1. County of Monterey: San Lucas Water District Public Water Supply Project

No.	Will the proposal…	Response[1]
Community/Social Benefits		
1	Provide education or technology benefits?	No
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts? Reduce contact between agricultural activities and drinking water resources	Yes
4	Promote social health and safety? Reduce risk of health effects from exposure to nitrate-contaminated drinking water	Yes
5	Have other social benefits?	No
Environmental Stewardship Benefits		
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7?	No
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
Sustainability Benefits		
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one? Replace a long-standing Do-Not-Drink Order with a functioning, safe water supply	Yes
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7? Enhance the reliability and resiliency of the water system during emergencies by maintaining a backup system	Yes
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

3. Help avoid, reduce, or resolve various public water resources conflicts: **Reduce contact between agricultural activities and drinking water resources**

Underlying change. In May of 2012, the RWQCB issued a notice of violation to the landowner on which the District's well is located, stating the landowner's agricultural activities had contaminated the public water supply. By implementing an alternative that locates the public water supply away from agricultural activities, the project would reduce the likelihood that agricultural activities would continue to pose risks to the water supply. This would help avoid future conflicts over competing uses of water.

Evidence for demand and value. Although groundwater contamination could continue to generate conflict among agricultural producers and other environmental interests, the severity and urgency of the

conflict increases as people seek to protect critically important drinking water resources. If this project successfully relocates the drinking water well away from agricultural activity, it would help resolve the ongoing conflict between two users of the groundwater resource in the Salinas Valley groundwater basin.

Timing and duration. This benefit would materialize when the District begins to operate the new water source. Project proponents expect that an uncontaminated water source would be fully operational and will begin providing clean, safe drinking water to the residents of San Lucas by 2016, possibly earlier. The design life of the new water source would be at least 20 years, so we assume the project would continue to confer this benefit through 2036, and very possibly longer.

Beneficiaries. The beneficiaries of this benefit are the agricultural producers proximate to the San Lucas Water District's well, the residents of San Lucas who pay for clean drinking water, and the San Lucas Water District's board and managers.

Sources of uncertainty. This benefit assumes the District does not choose to fix the existing well. If the District does choose this option, this benefit would not materialize.

4. Promotion of health and safety: **Reduce risk of health effects from exposure to nitrate-contaminated drinking water**

Underlying change. Nitrate-contaminated water is associated with adverse health effects if consumed, especially for vulnerable populations of pregnant women and children (Moore and Matalon 2011). Nitrate levels in San Lucas are currently 6 to 7 times the legal limit. Although the Monterey County Division of Environmental Health issued a "Do Not Drink" order, the water still flows to people's homes. Despite mailings and educational efforts, people may continue to drink the water, especially if they run out or can't afford bottled water. Moreover, even if residents exclusively drink and cook with bottled water, they are still exposed to the contaminated water when they brush their teeth, bathe, and wash their faces and hands. With the project, the residents of San Lucas would entirely eliminate their contact with nitrate-contaminated water.

Evidence for demand and value. A recent study by the Pacific Institute suggests it is not implausible that many residents of San Lucas, despite receiving information mailings, are not aware of the nitrate contamination in their drinking water. Those researchers surveyed California households whose water systems violated the Safe Drinking Water Act. They found, despite the fact that the majority of surveyed households reported they had received notices in the mail, less than half were aware of the nitrate contamination (Moore and Matalon 2011). Those surveyed households whose preferred language was Spanish were less likely to perceive unsafe tap water or know about the contamination (Moore and Matalon 2011). These findings are relevant in the context of San Lucas, which is a predominantly Hispanic community.

To the extent that the Pacific Institute's findings are applicable to San Lucas, nearly half of these residents may be drinking or cooking with contaminated tap water. The health risks of consuming water sources contaminated with nitrates are well documented in the literature. These studies have shown that excessive consumptions of nitrates can cause reparatory tract infections; thyroid disruption; pancreatitis; cancers of the digestive system, bladder, and thyroid; premature birth; central nervous system birth defects; sudden infant death syndrome; and congenital malformations (Gupta et al. 2000, Ward et al. 2005, Manassaram et al. 2006). These risks are particularly pronounced for households with infants and young children.

The economic value of this benefit is the present and future avoided health care and morbidity costs associated with reducing San Lucas residents' exposure to nitrate-contaminated water. Data regarding San

Lucas residents' nitrate exposure, health status, and medical costs are unavailable to quantify this benefit in monetary terms.

Timing and duration. This benefit would materialize when the District begins to operate the new water source and San Lucas residents begin drinking uncontaminated water. Project proponents expect that an uncontaminated water source would be fully operational and will begin providing clean, safe drinking water to the residents of San Lucas by 2016, possibly earlier. The design life of the new water source would be at least 20 years, so we assume the project would continue to confer this benefit through 2036, and very possibly longer.

Beneficiaries. The beneficiaries of this benefit are the residents of San Lucas who no longer would drink, cook with, or come into contact with nitrate-contaminated water. Other beneficiaries may include the medical institutions and tax payers of California, who would not have to pay for uncovered medical expenses for uninsured or underinsured residents who seek treatment for nitrate-related health issues.

Sources of uncertainty. Uncertainty associated with this benefit is related to the extent residents of San Lucas do not heed or are not aware of the drinking water violations in their water supply. If all residents of San Lucas are perfectly informed and compliant, they may not suffer any adverse health effects of the nitrate-contaminated drinking water. From a public health perspective, however, the risk remains as long as contaminated drinking water flows to customers, regardless of whether adverse health outcomes occur.

12. Provide a long-term solution in place of a short-term one: **Replace a long-standing Do-Not-Drink Order with a functioning, safe water supply**

Underlying change. The temporary solution to the nitrate contamination is the District's "Do Not Drink" order, which signals residents to avoid drinking contaminated water and may reduce or avoid the adverse health effects associated with nitrate consumption. This solution, which has been in place for almost two years, requires residents to secure alternative sources of water to drink and cook with. This temporary solution does not address the underlying contamination, and does not eliminate the risk associated with providing nitrate-contaminated water to customers. With the project, the District would be able to provide its customers with a safe source of drinking water for at least another 20 years.

Evidence for demand and value. Implementing a permanent water-supply solution for the residents of San Lucas would satisfy the demands for drinking water more efficiently than continuing to provide bottled water, which should be viewed only as a temporary and short-term solution. In addition to avoiding the direct costs associated with purchasing bottled water, which is quantified in monetary terms in the next section, securing a permanent, safe, and clean water source would allow the District to use its limited resources more efficiently: it would be able to invest labor and capital resources into developing and maintaining the permanent water source, instead of spending resources alerting customers to the contamination problem, communicating with regulators about compliance progress, and continuing to maintain a system that is not sustainable in the long run. It would remove the risk to public health associated with San Lucas residents accidentally drinking the water, or ignoring the "Do Not Drink" order out of poverty or ignorance. It would also potentially free up other public resources currently being spent by County and State agencies to ensure the district achieves regulatory compliance and to protect the health of the district's customers.

Timing and duration. This benefit would materialize when the District begins to operate the new water source and San Lucas residents begin drinking uncontaminated water. Project proponents expect that an uncontaminated water source would be fully operational and will begin providing clean, safe drinking water to the residents of San Lucas by 2016, possibly earlier. The design life of the new water source

would be at least 20 years, so we assume the project would continue to confer this benefit through 2036, and very possibly longer.

Beneficiaries. The beneficiaries of this benefit are the operators and customers of the San Lucas Water District. Other beneficiaries may include County and State agencies who have been involved in overseeing San Lucas' progress toward developing a new water system and protecting the health of the residents of San Lucas.

Sources of uncertainty. Assuming the District successfully implements an alternative water source, there is little uncertainty that this benefit would materialize.

14. Improved water supply reliability: **Enhance the reliability and resiliency of the water system during emergencies by maintaining a backup system**

Underlying change. If the District chooses either alternative that involves maintaining the existing well as a backup water supply, it could improve the reliability and resiliency of the system during emergencies. The feasibility study in Phase I of the project would determine whether this is a viable option.

Evidence for demand and value. Without a backup water supply, any failure of the primary supply would result in water outage for customers. At best, a water outage creates an inconvenience for water customers. This inconvenience would be partially alleviated if non-potable water were available for sanitation, though the backup well would not be safe for consumption. If an emergency, such as a fire, occurred during the outage, more costly consequences could materialize. The costs associated with a water outage and a fire event happening at the same time would either be the cost of quickly importing an alternative water supply and/or the additional property damage or loss of life from impaired fire fighting capabilities. By reducing the probability of these simultaneous occurrences, the project may avoid potential future costs associated with property damage, and may enjoy lower property insurance rates.

Timing and duration. Assuming option 2 or 3 is selected, this benefit would materialize when the District begins to operate the new water source and retrofits the existing well to provide backup supplies, likely by 2016 though it could take longer. The expected lifespan of the existing well for backup purposes is unknown at this time.

Beneficiaries. The beneficiaries of this benefit are the customers of the San Lucas Water District, and property owners within the District who may enjoy a reduced risk of property damage from a fire event or lower property insurance rates.

Sources of uncertainty. There is considerable uncertainty associated with this benefit. Most importantly, this benefit assumes that the District would both build a new well *and* retain the existing well as a back up source. The feasibility study may limit the District's ability to implement this option if it is found to be technically infeasible or cost prohibitive, which would mean this benefit would not materialize with the project..

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described for each benefit below), is $1,536,561. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Avoided costs associated with reduced drinking water purchases

Underlying change. The project would deliver clean, safe water to the residents of San Lucas through their taps for cooking and drinking. As a result, the 490 residents (67 households) of San Lucas would no longer need to rely on purchases of bottled water for these uses.

Evidence for demand and value. Bottled water for San Lucas residents and school children costs $88,500 per year. This includes bottled water provided to residents by the property owner on whose land the well is located, which amounts to $2,000 per month or $24,000 per year (personal communication with Nick Nichols, Civil Engineer, Monterey County Resources Management Agency). It also includes the bottled water residents purchase themselves to supplement the water provided by the land owner, which averages $75 per month per household, or about $60,000 per year, for the 67 households in San Lucas. In addition to residential purchases, the San Lucas School District spends about $4,500 per year to provide drinking water for its students (Bermensolo 2011).[4]

Timing and duration. This benefit would materialize when the District begins to operate the new water source and San Lucas residents begin drinking uncontaminated water. Project proponents expect that an uncontaminated water source would be fully operational and will begin providing clean, safe drinking water to the residents of San Lucas by 2016, possibly earlier. The design life of the new water source would be at least 20 years, so we assume the project would continue to confer this benefit through 2036, and possibly longer.

Beneficiaries. The beneficiaries of this benefit are the individuals and entities who would no longer need to purchase bottled water, including the residents of San Lucas, the property owner where the contaminated well is located, and other public entities that may be directly supplying or subsidizing costs (e.g., the County and school district taxpayers). San Lucas is a disadvantaged community.

Sources of uncertainty. The estimate of the annual cost of bottled water is based on several sources of information believed to be reliable, but may over or underestimate the actual cost individuals and entities incur to buy replacement bottled water. The estimate does not account for any bottled water purchases by its 25 commercial connections, with the exception of the school. It also assumes that when the project is complete, all residents would switch back to tap water. Some residents may continue to purchase bottled water, either because they have grown accustomed to their current habits or the taste of bottled water, or they mistrust the quality of the new water source.

[4] The school uses 450 gallons of bottled water per month, purchasing 5 gallon water jugs at $4.25 per jug.

2. Increased property values

Underlying change. Nitrate contamination of the District's drinking water poses a potential health risk to water users with homes in the area. To the extent that these risks are internalized into real estate values, the contamination may impose a one-time cost on property owners in the area. By eliminating contamination in San Lucas' water supply, the project may avoid costs related to reduced property values in the area. As of 2012, there were approximately 60 active residential connections in San Lucas. We use this value as a likely highly accurate, proxy for the number of properties affected.

Evidence for demand and value. Some studies have investigated the relationship between sale prices of residential properties and health risks from consumption of contaminated tap water. One study used multiple regression analysis to conclude that contaminated drinking water coupled with written notices negatively impacts residential property values. The study examined properties in Charlesbourg, Quebec, a municipality whose residents suffered from water-related health problems, found the most severely affected properties experienced drops in value ranging from 5.2 to 10.3 percent of mean sale price (Rosiers, Bolduc, and Thériault 1999).

According to the five-year American Community Survey, the median home price in San Lucas was $262,500 between 2005 and 2011 (U.S. Census Bureau 2007-2011).[5] Since the DND order occurred in 2010, it is reasonable to assume that this price has already internalized the risk of contamination. We therefore assume the property values in San Lucas, absent the contamination, would have been $276,899. To avoid false precision and reduce the risk that we are overestimating this value, we do not inflate this value to 2012 dollars.

With the project, San Lucas will eliminate the risk associated with groundwater contamination, increasing property values to the level they would have been, but for the contamination. Assuming property values do not change, the value of this benefit, per residential property in San Lucas, is $14,398.

Timing and duration. This benefit would materialize when the District begins to operate the new water source and San Lucas residents begin drinking uncontaminated water. Project proponents expect that an uncontaminated water source would be fully operational and will begin providing clean, safe drinking water to the residents of San Lucas by 2016, possibly earlier. To reduce the risk that we have overestimated this benefit, we assume the full value of this benefit will occur in that year.

Beneficiaries. The beneficiaries of this benefit are the residential property owners with connections to the San Lucas Water District. San Lucas is a disadvantaged community.

Sources of uncertainty. The study of the economic value of willingness to pay to avoid drinking water contamination used to value this benefit in monetary terms used data from Charlesbourg, Quebec. With comparable mean home sales prices between the communities (when adjusted for exchange rates and inflation), nothing suggests that their average combined value would not be appropriate to apply to the properties in San Lucas. In the study, the duration of the warning period was a statistically significant determinant of the effect of water contamination on mean sale price. In the most extreme cases in the study, these warning periods lasted from 7 to 34 days. Given that the warning period in San Lucas is significantly longer (2 years) we may expect the effect to lie toward the upper end of the range above. Because we apply the low value from the study, we are minimizing the likelihood of overestimating this benefit, and are perhaps underestimating it.

[5] Given price volatility in the California housing market over that time period, we do not update these figures to 2012 dollars.

Our calculation does not account for outliers, which may overestimate, but more likely would underestimate our results. Rosiers et al. (1999) finds outliers (properties on the high-end of the market) were more severely affected than others by water quality problems, and so discards extreme residuals in excess of two standard errors from the bank. Our calculation does not account for property value change in California between 2010 and 2016. Assuming property values increase over that time period, we have underestimated this benefit.

Table 15– Annual Benefit: Avoided costs associated with reduced drinking water purchases
(All benefits should be in 2012 dollars)

Project: San Lucas Water District Public Water Supply Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012	Reduced drinking water purchases	Dollars	0	0	0	$ 88,500.00	$ -	1.000	$ -
2013	Reduced drinking water purchases	Dollars	0	0	0	$ 88,500.00	$ -	0.943	$ -
2014	Reduced drinking water purchases	Dollars	0	0	0	$ 88,500.00	$ -	0.890	$ -
2015	Reduced drinking water purchases	Dollars	0	0	0	$ 88,500.00	$ -	0.840	$ -
2016	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.792	$ 70,100
2017	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.747	$ 66,132
2018	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.705	$ 62,389
2019	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.665	$ 58,858
2020	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.627	$ 55,526
2021	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.592	$ 52,383
2022	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.558	$ 49,418
2023	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.527	$ 46,621
2024	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.497	$ 43,982
2025	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.469	$ 41,492
2026	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.442	$ 39,144
2027	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.417	$ 36,928
2028	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.394	$ 34,838
2029	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.371	$ 32,866
2030	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.350	$ 31,005
2031	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.331	$ 29,250
2032	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.312	$ 27,595
2033	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.294	$ 26,033
2034	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.278	$ 24,559
2035	Reduced drinking water purchases	Dollars	0	1	1	$ 88,500.00	$ 88,500.00	0.262	$ 23,169
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 852,287

Comments: The avoided costs of drinking water purchases include purchases by households, by the agricultural property owner on behalf of households, and by the San Lucas School.

Table 15 – Annual Benefit: Increased property values

(All benefits should be in 2012 dollars)

Project: San Lucas Water District Public Water Supply Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Berefits (h) x (i)
2012	Increased property values	Properties	0	0	0		$ -	1.000	$ -
2013	Increased property values	Properties	0	0	0		$ -	0.943	$ -
2014	Increased property values	Properties	0	0	0		$ -	0.890	$ -
2015	Increased property values	Properties	0	0	0		$ -	0.840	$ -
2016	Increased property values	Properties	0	60	60	$ 14,398.00	$ 863,880.00	0.792	$ 684,274
2017	Increased property values	Properties	0	0	0		$ -	0.747	$ -
2018	Increased property values	Properties	0	0	0		$ -	0.705	$ -
2019	Increased property values	Properties	0	0	0		$ -	0.665	$ -
2020	Increased property values	Properties	0	0	0		$ -	0.627	$ -
2021	Increased property values	Properties	0	0	0		$ -	0.592	$ -
2022	Increased property values	Properties	0	0	0		$ -	0.558	$ -
2023	Increased property values	Properties	0	0	0		$ -	0.527	$ -
2024	Increased property values	Properties	0	0	0		$ -	0.497	$ -
2025	Increased property values	Properties	0	0	0		$ -	0.469	$ -
2026	Increased property values	Properties	0	0	0		$ -	0.442	$ -
2027	Increased property values	Properties	0	0	0		$ -	0.417	$ -
2028	Increased property values	Properties	0	0	0		$ -	0.394	$ -
2029	Increased property values	Properties	0	0	0		$ -	0.371	$ -
2030	Increased property values	Properties	0	0	0		$ -	0.350	$ -
2031	Increased property values	Properties	0	0	0		$ -	0.331	$ -
2032	Increased property values	Properties	0	0	0		$ -	0.312	$ -
2033	Increased property values	Properties	0	0	0		$ -	0.294	$ -
2034	Increased property values	Properties	0	0	0		$ -	0.278	$ -
2035	Increased property values	Properties	0	0	0		$ -	0.262	$ -
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 684,274

Comments: This benefit is based on the hedonic literature that finds property values decline when faced with an extended do-not-drink order. The assumptions of the study and our application of them to San Lucas homes is described in the narrative text accompanying this benefit.

Section D3. Project Costs

The present value of the project's costs, which would occur between 2013 and 2015, is $2,502,474 in 2012 dollars, discounted at a 6-percent annual rate.[6] These costs would fund administration, planning, environmental review, equipment, labor, and materials necessary to implement the project. This cost may underestimate the total cost of the project over its lifespan for two reasons:

- Depending on the alternative water supply option the water district selects, the project may require the purchase of an easement or right-of-way for a pipeline or treatment facility. Any easement would likely involve property that is currently in agricultural production. There is no way to know if this cost would be necessary, and if it is what it would be, until the feasibility study is completed and a preferred alternative is selected during Phase I of the project. Therefore, the costs for such an easement are not included in the calculation of the costs of the project.
- The project also may require new operations and maintenance costs for the San Lucas Water District. Again, it is impossible to determine if these costs would be higher than the district's current operations and maintenance costs until a preferred alternative is selected. Should these costs increase, they would have to be borne by the customers of the district, beginning in 2015.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: San Lucas Water District Public Water Supply Project

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost	Annual Costs						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 552,500.00							$ 552,500	0.943	$ 521,226
2014	$ 25,000.00							$ 25,000	0.890	$ 22,250
2015	$ 2,337,000.00							$ 2,337,000	0.840	$ 1,962,190
2016								$ -	0.792	$ -
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 2,505,667

Comments: Costs do not include potential expenditures on easement, if feasibility study results in a preferred alternative that requires a new pipeline or treatment facility. Costs also do not include any additional operations and maintenance costs, above what the district is already spending. Current information does not support any conclusions about whether these costs would materialize, and if they did, how much they would be.

[6] We have distributed the costs outlined Table 7 across the project's implementation period based on the expected timing and phasing described in the Work Plan. Actual distribution of costs during this period may differ somewhat.

Project 2. Pajaro/Sunny Mesa Community Services District: Springfield Water Project

The Pajaro/Sunny Mesa Community Services District (PSMCSD) operates the Springfield Water System, which serves the disadvantaged community (DAC) of Springfield. The total project costs are $634,572, so this project falls below the $1 million threshold for a DAC to use a cost-effectiveness analysis (DWR 2012, pg. 44). We assess the economic merits of the project using this methodology, below, and present Table 11 at the end of this section.

Project Description

Conditions Without the Project

PSMCSD operates the Springfield Water System, which serves 34 connections for primarily lower income residential dwellings. Approximately 165 individuals live in Springfield. The Springfield water supply has consistently tested at levels of nitrates, chloride, and other substances above the levels considered safe for human consumption. It is currently under an indefinite "Do Not Drink" order from the Monterey County Department of Public Health. The existing well is in located in an area that is currently affected by seawater intrusion, and is surrounded by agricultural land uses.

PSMCSD has obtained an easement to develop a well and storage tank at a different site. However, financial constraints prevented the project from moving forward. New information regarding hydrological conditions indicates the potential for seawater intrusion in the area proposed for the new well in the longer term. PSMCSD has determined that hydrology and geotechnical studies and additional water quality tests are needed to confirm the suitability of the site. Without IRWM funding, a clearly defined path to replacing the drinking water system does not exist at this time.

Conditions With the Project

The Springfield Project would support the development of technical studies, planning, and an engineering and feasibility analysis for a new water supply for the residents of Springfield. Several options are under consideration, including developing a well on a site at the Springfield School, consolidating with the Moss Landing Water System to the south, identifying another site for well development further inland, or treating the water from the existing well. Expansion of the water connections to adjacent underserved DAC areas would also be considered in the proposed studies.

Once the studies supported by the current project are complete, construction would begin. A new water supply system would allow the residents of Springfield to begin drinking and cooking with their tap water. If residents were purchasing bottled water, they would be able to avoid these costs, which are large proportional to the median household income in Springfield. If households are not currently purchasing bottled water and drinking the water despite the advisories, the project would eliminate the risks they are currently bearing by doing so, and avoid any healthcare costs that they (or the taxpayers of California) are incurring by drinking the water.

Types of Benefits Provided

Although the project would not directly provide Springfield residents with a safe, reliable source of drinking water, the tasks included in the Work Plan are critical to selection of the best long-term solution to the Springfield Water System's long-term water problems and would move the project forward to completion. This project would allow the PSMCSD to begin the feasibility, planning, and design process immediately, rather than continuing to wait for funds to materialize, allowing residents to realize tangible benefits sooner than without the project. The project's deliberate planning process would also likely produce a more economically efficient solution for the PSMCSD ratepayers and taxpayers of California than if PSMCSD proceeded with an option that is supported by inadequate information available today.

Alternative Methods for Achieving Benefits and Their Costs

This project would support studies to generate information for PSMCSD's operators and other decision makers to evaluate the options described above and settle on an economically efficient and cost-effective solution to fixing Springfield's water system.

No other functional alternative to this project would provide the same outcomes. The only realistic alternative to funding the project through this application would be to seek alternative sources of funding for the studies described above. If PSMCSD must do that, it would halt current planning activities and continue under the "Do Not Drink" order while it looks for other funding opportunities to complete the requisite technical studies. This process would delay an ultimate solution for Springfield's water customers, perhaps for several more years.

If PSMCSD must seek alternative sources of funding, Springfield residents would continue to purchase bottled water, or expose themselves to health risks by drinking the water. PSMCSD would continue to operate the old system, expending resources required by the County to maintain the "Do Not Drink" order. Data are insufficient at this time to calculate these costs on an annual basis, but they would accumulate over time as the project is delayed. Although the cost to complete the technical studies would likely remain the same regardless of the funding source, these additional costs would increase the total social cost of the alternative.

Based on this reasoning, the project as proposed in this application is the most cost-effective solution.

Table 11 – Statement of Cost-Effectiveness Project name: Pajaro/Sunny Mesa Community Services District: Springfield Water Supply Project		
Question 1	Types of benefits provided	Technical studies required to proceed with developing a safe and reliable drinking water supply for Springfield Water System customers.
Question 2	Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?	Yes
	If no, why?	
	If yes, list the methods (including the proposed project) and estimated costs.	There are no alternatives to conducting the technical studies proposed in this project. The only realistic alternative to this current project proposal is to delay the studies while PSMCSD operators seek funding from alternative sources. The additional costs associated with this course of action would be the accumulating costs of purchasing bottled water, maintaining the DND order, and continued risk of health effects from exposure to contaminated water.
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	The proposed project is the least-cost alternative.
Comments: See attached narrative for more detail.		

Project 3. City of Salinas and Monterey Regional Water Pollution Control Agency: Dry Weather Runoff Diversion Program

Project Description

Conditions Without the Project

During the dry summer season, water from landscape irrigation, car washing, and other activities runs off the City of Salinas' streets and parking lots and into the storm sewer system. The system drains into local waterways without treatment: runoff from south Salinas ultimately reaches the Salinas River, while runoff from north Salinas reaches the Reclamation Ditch. This runoff is particularly concentrated with pollutants that harm waterways: oil and grease, sediment, fertilizer and landscaping chemicals, heavy metals, trash, and bacteria. These pollutants increase the pollution loading of the Salinas River and its tributaries, and potentially threaten groundwater supplies. The City of Salinas is in the process of complying with a new municipal stormwater permit (MS4 permit) that regulates the way it operates its storm sewer system. In particular, the City must reduce pollutant discharges to the maximum extent practicable (CCRWQCB 2012).

Groundwater and surface water in the Salinas River watershed face quality issues. The Salinas River is one of the most polluted rivers in the state, impaired for a variety of contaminants. The Central Coast Regional Water Quality Control Board (CCRWQCB) has developed TMDLs for nutrients, fecal coliform, and agricultural chemicals. Groundwater in the area is threatened by nitrates and other agricultural chemicals, and has been tapped to the point that seawater is intruding into the aquifer at several levels, which has raised the chloride level in the water beyond what is useful for human consumption or agricultural irrigation.

The Monterey Regional Water Pollution Control Agency (MRWPCA) maintains a wastewater treatment plant that processes and treats effluent to standards acceptable for agricultural application. This recycled water plant produces about 56 acre-feet per day of water available for agricultural use during the growing season. It has capacity to treat up to 90 acre-feet per day. It sells the water to irrigators of about 12,000 acres of farmland, who would otherwise pump groundwater from the aquifer. The farms produce strawberries and vegetable crops. When recycled flows aren't sufficient to meet demand, the MRWPCA water is mixed with water from the Salinas River as part of the Salinas Valley Water Project. These flows are occasionally supplemented with groundwater.

As utilities and water users have implemented water conservation measures, the amount of water reaching the wastewater treatment plant has declined, while the demand for recycled water to reduce groundwater withdrawals to protect the aquifer has grown.

Conditions With the Project

The City has identified several opportunities to reduce its stormwater discharges by the maximum extent practicable, to comply with its new stormwater permit. In south Salinas, it would be feasible to divert dry weather flows from the Salinas River into an existing detention basin. Once there, biological activity would assimilate the pollutants. The water would then be diverted into a pipe that flows to the MRWPCA where it would combine with raw sewage and be recycled for irrigation use.

Other opportunities exist to divert dry weather and wet weather flows from receiving surface water bodies and capture them for beneficial uses. Limited data about the quality and flow rates of flows into the storm system (dry or wet) hamper managers' ability to develop plans to address these flows. The project would mine existing data sources and collect new data about these flows to inform future projects. It would lay the groundwork for proceeding with a planned Phase II of the project, to divert dry weather runoff from the City's northern neighborhoods from reaching the Reclamation Ditch.

Section D2. Non-Monetized Benefits Analysis

Table 12-3 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-3 – Non-monetized Benefits Checklist
Project 3. City of Salinas and Monterey Regional Water Pollution Control Agency:
Dry Weather Runoff Diversion Program

No.	*Will the proposal…*	*Response*
	Community/Social Benefits	
1	Provide education or technology benefits? Data collection and analysis to inform future planning	Yes
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts?	No
4	Promote social health and safety?	No
5	Have other social benefits?	No
	Environmental Stewardship Benefits	
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7? Avoided costs from reducing regulated pollutants	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
	Sustainability Benefits	
10	Improve the overall, long-term management of California groundwater resources? Reduce demands for water from saltwater-intruded aquifer	Yes
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one? Capturing and treating polluted stormwater runoff to satisfy beneficial uses	Yes
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Provide education or technology benefits: Data collection and analysis to inform future planning

Underlying Change. The project would involve data collection and analysis from existing sampling reports and monitoring data from a new flow meter. In addition to providing critical information to support current water quality projects, these data would support future efforts to plan, design, and construct diversions from other areas of the city, including North Salinas.

Evidence for demand and value. The project would advance a technical methodology and technology for future efforts to address dry water flows in the City of Salinas and beyond. For example the technology benefits would:

1. Help guide future projects on optimum design elements for a similar project in North Salinas and in the region.

2. Present costs and challenges that will help reduce costs associated with other efforts, to the extent that the region uses this effort to develop and establish procedures and tools.
3. Provide future projects with a way to optimize their performance, reducing future costs associated with similar efforts.

The City of Salinas hopes to extend the model and design from this project to address dry weather run off in other parts of the City and beyond. For example, the project would help the City determine if and how the City should proceed with diversions of flows from the Reclamation Ditch. This would help address the water quality issues associated with the Reclamation Ditch and downstream water bodies.

This project would provide the cost savings and enhanced benefits described above, as well as political momentum for expanding these efforts. Coupled with successful implementation of this project, this information would lay the groundwork for larger efforts to address dry water flows beyond the City of Salinas. In particular, project proponents hope the project would form a model for a larger, interregional project to reuse stormwater. The benefits from these future projects could be sizeable.

Timing and duration. The project would begin delivering education and technology benefits after construction of the project is complete and the City begins its initial data collection and analysis, in 2015. The project lifespan is at least 25 years, but education and technology benefits from the project would persist for long after the operational lifespan of the equipment.

Beneficiaries. The beneficiaries of this benefit are decision makers in the City of Salinas. If the project successfully exports a model to other jurisdictions, the project would also benefit other decision makers in the region, and potentially in other regions of California. To the extent that the education and technology benefit improve the efficiency of future water quality or water supply projects, the beneficiaries of this benefit are the residents of the City of Salinas, the broad array of downstream users on the Salinas River, groundwater users in the Valley, and many other groups in California.

Sources of uncertainty. The main sources of uncertainly lie in the extent to which these data are used to inform, enhance, and reduce costs associated with future water supply and quality projects.

7. Improve water quality: Avoided costs from reducing regulated pollutants

Underlying change. With the project, heavily contaminated dry water runoff would no longer flow into the Salinas River, reducing the amount of pollutants entering the Salinas River, and improving the water quality of both the River and the underground Salinas Valley aquifer.

Evidence for demand and value. The project responds to requirements in the City's new NPDES permit for controlling urban stormwater runoff, which is partially driven by TMDLs established by the CCRWQCB. The lower Salinas River is one of the more polluted water bodies in the state. It has segments that have continually failed to meet established minimum beneficial use standards, and have been federally listed for non-attainment. To the extent that this project reduces the costs for downstream users, either by lowering the levels of pollutants they must address prior to using the water, or lowering the baseline load of pollutants dischargers must treat before discharging water back to the river, it would produce benefits. The project may also have cumulative effects, combined with other efforts to reduce pollutants, that may affect the overall regulatory framework and associated compliance costs for users of the Salinas River.

Timing and duration. The project would begin delivering water quality benefits after construction of the project is complete and the City begins diverting dry water runoff to the MRWPCA, in 2015. We assume the project would continue to confer this benefit for 25 years, the project's lifespan.

Beneficiaries. The beneficiaries of this benefit are the residents of the City of Salinas, the broad array of downstream users on the Salinas River, and other stakeholders who care about water quality and its effects on the ecosystem in the Salinas River.

Sources of uncertainty. The economic value associated with this benefit, while not quantifiable, is contingent on whether this project would reduce pollutants below a level that translates into cost savings. This is unlikely, but there is likely value associated with the project's contribution to an overall effort to reduce contamination below levels that trigger regulation and impose costs on other dischargers.

10. Improve the long-term management of California's groundwater resources: **Reduce demands for water from saltwater-intruded aquifer**

Underlying change. The project would replace growers' water withdrawals from the Salinas River with recycled water from dry season runoff to the Salinas River. Project proponents estimate based on preliminary investigations the project would increase reclaimed water supplies by 40 acre-feet per year. The Salinas River is also known as the "upside down" river because of its natural underground flow during the summer-fall dry season (Benke and Cushing 2011). Given the strong connection between the River's surface and subsurface flows, avoiding surface water withdrawals likely would also benefit groundwater resources and users.

Furthermore, for the reasons described above in non-monetized benefits #1 (Education or technology benefits) the project has the potential to provide momentum for addressing problems related to the overall, long-term management of California groundwater resources. To the extent that other cities in the region adopt the approach that is being field-tested in this project, it would help generate additional benefits.

Evidence for demand and value. Economists who study the economic importance of groundwater describe this importance using two major categories of value: extractive values and *in situ* values.[7] The major extractive values include the economic importance of groundwater consumption by municipalities, business and industry, and agricultural producers. Groundwater aquifers offer significant advantages over surface storage for consumptive uses including: no costs for storage facility, no loss through evaporation, and groundwater also protect water quality at no or little cost relative to surface storage. Another advantage of groundwater aquifers is their capacity to distribute water over long distances at little to no cost. Constructing pipe systems on the surface is much more expensive than relying on an existing aquifer for water movement.

In situ values derive from the services that groundwater provides in place, rather than through consumptive use. *In situ* values include (National Research Council, CVG 1997):

- Buffer values—given that supplies of surface water can fluctuate, groundwater supplies can help smooth out, or buffer, variability in water supplies in cases where water districts manage groundwater conjunctively with surface water. One study found that the buffer capacity of groundwater can represent over 80 percent of the total value of surface and groundwater.

- Environmental values—groundwater can help assimilate harmful pollutants. These assimilative properties help avoid filtration and related costs that water users would otherwise face.

[7] National Research Council, Committee on Valuing Groundwater (CVG). 1997. *Valuing Groundwater: Economic Concepts and Approaches*. Water Science and Technology Board, Commission on Geosciences, Environment, and Resources, National Research Council. National Academy Press: Washington, D.C.

- Subsidence-avoidance values—the structural services that groundwater provides *in situ* help avoid ground subsidence and related damages to roads, pipeline, foundations and other structures and infrastructure. One way of describing the associated economic values is the avoided costs of subsidence damage.

- Saltwater intrusion values—the *in situ* presence of groundwater helps prevent intrusion of salt water into what had been fresh water aquifers. The avoided costs of saltwater intrusion include avoided: replacement costs of acquiring supplies of surface waters; pumping costs to access water from deeper freshwater aquifers; or, filtration costs.

Timing and duration. The project would begin delivering benefits of improved groundwater management after construction of the project is complete and the City begins diverting dry water runoff to the MRWPCA, in 2015. We assume the project would continue to confer this benefit for 25 years, the project's lifespan.

Beneficiaries. The beneficiaries of this benefit are groundwater users in the area, potentially other surface water users in the region, and people who value the ecological services provided by enhancing groundwater recharge and building the resiliency of groundwater-surface water interactions.

Sources of uncertainty. Biophysical data are insufficient to estimate the changes in the environment related to groundwater resources, so it is difficult to identify the potential magnitude of this economic benefit—it could be very small, or it could be very large, depending on the effects and the resources and users influenced by the effects.

12. Provide a long-term solution in place of a short-term one: Capturing and treating polluted stormwater runoff to satisfy beneficial uses

Underlying Change. The project would capture dry-weather runoff that currently contribute to environmental problems and recycle it to satisfy demands that would otherwise have to be met with limited surface or groundwater resources. Although stormwater would have become part of surface water supplies without the project, the timing and quality of the runoff would not satisfy water demands as efficiently as this project would.

Evidence for demand and value. For reasons described above in non-monetized benefit #10 and elsewhere in this description, it is imperative that the region identify long-term solutions to its water-supply constraints if it is to maintain its economic productivity and quality of life. This project represents a model for increasing the reliability of water supplies to address two trends: growing demand for scarce water resources and increasing stress on existing supplies as climate change changes the ecosystem's ability to produce water.

Timing and duration. The project would begin delivering this benefit after construction of the project is complete and the City begins its initial data collection and analysis, in 2015. The project lifespan is at least 25 years, but the model this project proves, assuming it is successful, would persist for long after the operational lifespan of the equipment.

Beneficiaries. The beneficiaries of this benefit are decision makers in the City of Salinas. If the project successfully exports a model to other jurisdictions, the project would also benefit other decision makers in the region, and potentially in other regions of California. To the extent that the education and technology benefit improve the efficiency of future water quality or water supply projects, the beneficiaries of this benefit are the residents of the City of Salinas, the broad array of downstream users on the Salinas River, groundwater users in the Valley, and many other groups in California.

Sources of uncertainty. It is relatively certain that the environmental problems the project is aiming to address are not short-term issues, and so the long-term solution would continue to generate benefits throughout the project's lifespan. The main source of uncertainty is whether the project would prove to be an efficient way to capture and reuse scarce water resources. As a demonstration project, it is inherently designed to identify the costs, risks, and benefits of capturing and reusing stormwater and provide information for better decision-making in the future.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $58,251. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Value of Instream Flows for Environmental Purposes

Underlying change. The project would be supplementing existing sources of wastewater effluent that is treated in the MRWPCA recycled water facility by approximately 40 acre-feet from dry weather runoff from south Salinas. If this phase of the project is successful, additional wet weather flows from south Salinas could be diverted to the detention basin and augment recycled water flows with little additional investment or cost. For these reasons, the 40-acre feet probably represents a lower-bound estimate of the additional water this project would generate. This additional recycled water would offset withdrawals from the Salinas River through the Salinas Valley Water Project. As described by the California Water Boards, the Salinas River provides habitat for threatened, endangered, and sensitive aquatic species including winter steelhead trout, foothill yellow-legged frog, California red-legged frog, and the Western pond turtle (California Water Boards 2010).

Evidence for demand and value. Additional instream flows in the Salinas River would help support ecosystem goods and services that people value, including improved habitat for species and clean water for recreation and other uses. A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average lease rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water quality and fish and other affected species. Using this value, the annual, undiscounted value of offsetting 40 acre-feet per year of diverted surface flows from the Salinas River would be $4,960 per year.

See our description of non-monetized benefit #10 (Improve the long-term management of California's groundwater), above, for more information on related, non-monetized values.

Timing and duration. The project would begin delivering benefits of reduced costs of groundwater withdrawals after construction of the project is complete and the City begins diverting dry water runoff to the MRWPCA, in 2015. We assume the project would continue to confer this benefit for 25 years, the project's lifespan.

Beneficiaries. The beneficiaries of this benefit would include several groups of stakeholders including commercial fishermen and recreational anglers in both marine and freshwater fisheries, and the people of California insofar as they value an increase in fish populations. It would also benefit other recreational users of water, such as kayakers and wildlife watchers, Californians who place a non-use value on maintaining sufficient instream flows for environmental purposes, and other water users, such as irrigators, who bear increased regulatory pressure and costs to increase instream flows by reducing their own use of water.

Sources of uncertainty. The estimate of dry-weather flows that could be reclaimed through this project is based on preliminary monitoring work, and may significantly underestimate the actual flows this project would generate. To the extent that it delivers more water from captured dry-weather flows, the economic benefits would be underestimated.

The value we derive from the data provided by WestWater Research, as presented in the findings of Aylward and Merrill (2012) embodies the uncertainty inherent in the individual study as well as from applying results from past research to future conditions. There is, however, no obvious reason to conclude that the estimate systematically overestimates the true marginal value of water for environmental purposes in the Salinas River. As human populations and incomes grow in California, the marginal value of wild salmonid populations and other benefits derived from instream flows for environmental purposes is likely to increase, as will the value of stream flows that support their continued existence. Because we found no reliable estimate of the rate of increase, we did not fold this increase into our estimates. For these reasons, it seems reasonable to conclude that the value estimates we apply in this analysis underestimate—perhaps substantially—the true value of future increases in water supplies that would result from the projects.

Table 15 – Annual Benefit: Value of instream flows for environmental purposes
(All benefits should be in 2012 dollars)
Project: City of Salinas and Monterey Regional Water Pollution Control Agency

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	1.000	$ -
2013	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.943	$ -
2014	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.890	$ -
2015	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.840	$ 4,299
2016	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.792	$ 4,056
2017	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.747	$ 3,826
2018	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.705	$ 3,609
2019	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.665	$ 3,405
2020	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.627	$ 3,212
2021	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.592	$ 3,031
2022	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.558	$ 2,859
2023	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.527	$ 2,697
2024	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.497	$ 2,544
2025	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.469	$ 2,400
2026	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.442	$ 2,265
2027	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.417	$ 2,136
2028	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.394	$ 2,015
2029	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.371	$ 1,901
2030	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.350	$ 1,794
2031	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.331	$ 1,692
2032	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.312	$ 1,596
2033	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.294	$ 1,506
2034	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.278	$ 1,421
2035	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.262	$ 1,340
2036	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.247	$ 1,265
2037	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.233	$ 1,193
2038	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.220	$ 1,125
2039	Increased instream flows	Acre-feet	0	40	40	$ 128.00	$ 5,120.00	0.207	$ 1,062
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 58,250.96

Comments:

Section D3. Project Costs

The present value of the project's costs, which would occur between 2013 and 2014, is $717,495 in 2012 dollars, discounted at a 6-percent annual rate. These costs would fund labor, planning, equipment, and materials necessary to implement the project.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: City of Salinas and Monterey Regional Water Pollution Control Agency

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 281,800.00							$ 281,800	0.943	$ 265,849
2014	$ 507,469.00							$ 507,469	0.890	$ 451,646
								Total Present Value of Disccunted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 717,495

Comments:

Project 4. Resource Conservation District of Monterey County: Salinas River Watershed Invasive Non-native Plant Control and Restoration Program

Project Description

Conditions Without the Project

Arundo donax (*Arundo),* or giant reed, is a robust perennial grass that grows nine to thirty feet tall, in many-stemmed clumps that form large colonies many meters across. It spreads vegetatively, either by rhizomes or fragments. Unlike native habitat, it provides little shading for in-stream habitat, alters hydrological regimes, reduces groundwater availability, alters channel morphology by retaining sediments and constricting flows, presents a fire hazard by more than doubling the available fuel for wildfires, and creates hazards during floods when trapped behind bridges and other structures (California Invasive Plant Council 2013a). Likewise, *Tamarix ramosissima* (*Tamarisk*) is a shrub or tree associated with dramatic changes in geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity (California Invasive Plant Council 2013b).

These two invasive plants, *Arundo* and, to a lesser degree, *Tamarisk*, dominate approximately 1,869 acres of the Salinas River and have overtaken areas of its tributaries. These plants' aggressive competition with native species has resulted in areas that are now enormous monocultures with virtually no food or habitat value for native wildlife. These conditions are expected to worsen in the future. As the Monterey County Water Resources Agency shifts its reservoir releases to increase year-round flows in the Salinas river, the increased water flows will mean greater water availability for *Arundo* and *Tamarisk*, potentially increasing their rate of spread, stand density, and increasing the costs associated with infestation.

In the past, Monterey County conducted removal activities of *Arundo* through its stream maintenance program. However, because *Arundo* is so pervasive in the area, it typically reestablished shortly after each removal. Moreover, when the stream maintenance program has suffered from reduced funding and controversy surrounding its channel dredging components, so these invasive removal activities have largely disappeared. No other coordinated program for *Arundo* control exists in the Salinas watershed.

Conditions With the Project

Through this project, the Resource Conservation District (RCD) of Monterey County would remove 120 acres of *Arundo*, tamarisk, and other invasive species in the channel, floodplain, and terraces of the Salinas River between King City and Soledad using a combination of physical, chemical and biological techniques. It would revegetate selected sites with native vegetation, as appropriate. This project is the first phase of a 5-phase program which project proponents expect would occur over 10 to 20 years.

The RCD would remove *Arundo* systematically, beginning at the top of the watershed and moving progressively downstream. *Arundo* spreads by water, so if it is cleared from upstream to downstream, it is virtually impossible for the strands to reinvade restored areas. By removing *Arundo* in this way, project proponents would remove the threat of future infestation after the program ends, and secure investments made in restoration. The overall approach the RCD would employ is based on successful eradication efforts conducted throughout California, utilizing spray and labor crews over several years, leaving intact roots to minimize the possibility of erosion. Where appropriate, and where partnerships with landowners allow, the RCD would implement revegetation to enhance the riparian habitat. Elsewhere, revegetation is expected to occur naturally over time.

Section D2. Non-Monetized Benefits Analysis

Table 12-4 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-4 – Non-monetized Benefits Checklist Project 4. Resource Conservation District of Monterey County: Salinas River Watershed Invasive Non-native Plant Control and Restoration Program		
No.	*Will the proposal…*	*Response*
Community/Social Benefits		
1	Provide education or technology benefits? Enhanced human and social capital	Yes
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts? Separate actions to remove Arundo from other, more controversial channel modification activities	Yes
4	Promote social health and safety?	No
5	Have other social benefits?	No
Environmental Stewardship Benefits		
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7? Passive-use value associated with increases in steelhead populations	Yes
7	Improve water quality in ways that were not quantified in Attachment 7?	No
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4? Avoided costs associated with reduced likelihood and intensity of fire	Yes
Sustainability Benefits		
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one? Reduced costs and protection of investments in restoration from watershed-based approach to eradication	Yes
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)? Avoided costs associated with reduced flood damage	Yes

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Provide education or technology benefits: Enhanced human and social capital

Underlying change. The project would educate landowners and managers about *Arundo* control and restoration techniques. It would also involve efforts to communicate with and recruit new landowners to participate in future phases of the eradication plan. To this end, it would involve an annual large, public field workshop at successful project sites, which would feature presentations, site tours, and materials and training in plant/weed identification and monitoring. Finally, the project would communicate the projects' successes to regional and agricultural media outlets, and through presentations at professional meetings and informational brochures.

Evidence for demand and value. In the *California Noxious & Invasive Weed Action Plan*, the California Department of Food and Agriculture and California Invasive Weed Awareness Coalition identify education as "one of our best tools in preventing new noxious and invasive species from being introduced and eliminating further spread" (Schoenig 2005). The California Department of Food and Agriculture and California Invasive Weed Awareness Coalition also identify effective public awareness and education, especially to affected property owners, as an integral element to an early detection and rapid response system. As they note, early detection is "the single most important element in successful and economical eradication of new weeds before they become established in new localities" (Schoenig 2005). To the

extent that the project educates landowners in the project area, they can assist with early detection at restored sites to ensure *Arundo* does not reestablish in the area in the future. This would reduce future control costs secure the investments that the RCD and other landowners plan to make in future restoration efforts.

Timing and duration. The project would begin conferring education benefits after the first field meeting, which would occur in the second year of the project, 2014. These benefits would persist for the professional lifetimes of the participating landowners, and over the long run as investments in increasing the stock of high-quality ecosystems in the Salinas watershed increase the flow of goods and services people enjoy today and in the future.

Beneficiaries. The direct beneficiaries of this benefit are the landowners who participate in the public field workshop and demonstrations, as well as those landowners who receive other educational and outreach materials. Indirect beneficiaries include all of the landowners, residents, and visitors to the Salinas watershed who benefit from *Arundo* removal.

Sources of uncertainty. These benefits would materialize to the extent that the project effectively delivers information through the educational programs for landowners and, significantly, the extent to which these landowners alter their behavior.

3. Avoid, reduce or resolve various public water resources conflicts: **Separate actions to remove *Arundo* from other, more controversial channel modification activities**

Underlying change. The County's channel maintenance program, which supported *Arundo* removal from the Salinas River in the past, has faced opposition from several environmental groups. The channel maintenance program involved gravel bar removal by landowners, in addition to other invasive control measures and restoration activities. The channel modifications were more controversial than the other actions of the program, but concurrent environmental restoration efforts often became stalled in the conflict. By focusing solely on removing *Arundo* in an environmental responsible way, the project may avoid future conflicts between environmentalists and landowners seeking to remove *Arundo* from their properties.

Evidence for demand and value. The value associated with decoupling *Arundo* removal from broader channel maintenance activities may translate into economic benefits in several ways:

- Reduced erosion of social capital among landowners and the environmental community. Healthy stocks of social capital—trust, respect, and institutional arrangements—are essential to effectively implement cooperative management programs.
- Reduced risk of delays and increased costs arising from legal challenges and other actions intended to protect specific interests and resources. These costs come in the form of expenditures and the opportunity cost of time to understand, engage, and address the conflict.

Timing and duration. We assume the project would begin conferring benefits related to avoided water conflicts as soon as it begins implementation, in 2014. This benefit would persist over the active lifespan of the project—projected to be 10-20 years—although protected and enhanced social capital resulting from the project could continue to yield benefits in the long run.

Beneficiaries. This benefit would affect the stakeholders, landowners, and other managers in the Salinas involved in *Arundo* removal and other environmental restoration efforts. It may yield benefits to others not involved in *Arundo* removal directly by diffusing conflict and allowing people to work together to solve other problems more effectively. To the extent that these avoided conflicts also avoid costs for a

broader group of citizens and taxpayers (if, for example, the avoided conflicts would have resulted in litigation), the project may improve the well-being of a broader group of Californians.

Sources of uncertainty. There is substantial uncertainty associated with this benefit. The main sources of uncertainly lie in the extent to which the project would avoid conflicts. If issues that caused tension in the past continue to surface in this program as well, the benefits described above may be diminished or may not materialize at all.

6. Benefit wildlife or habitat: **Passive-use value associated with increases in steelhead populations**

Underlying change. *Arundo* has many abiotic and biotic impacts, including changes to geomorphic form and function, hydrology, and water use, which all, often negatively, affect habitat for wildlife, particularly instream habitat for aquatic habitat. By removing invasive species on 120 acres and revegetating a portion of those, the project would provide stream shading and temperature improvements on a stretch of river that the National Marine Fisheries Services has designated critical habitat for steelhead. Data are unavailable to estimate the impact this project would have on salmonid populations.

Evidence for demand and value. Individuals derive value from salmon and steelhead populations in two ways: some (e.g., recreational anglers and commercial fishermen) directly interact with salmon and steelhead populations and derive benefit by catching and consuming the fish, others (including some from the former group) derive value from the fish solely based on the salmon and steelhead's existence. Studies have shown that regardless of direct interaction with fish populations, many Californians hold a positive willingness to pay to ensure the long-term survival of salmon and steelhead (Pate and Loomis 1997).

Several studies have attempted to estimate the passive use value of increases in salmon and steelhead populations among households in California and neighboring states. Passive use value, in this case, refers to the benefit individuals derive from knowing that healthy salmon and steelhead populations exist, regardless of their intent to directly interact with salmon and steelhead through fishing or some other means. In general, these studies have estimated households' average willingness to pay to implement policies that would increase salmon and steelhead populations. At the per fish level, these studies reveal that households are willing to pay only fractions of a penny for increases in salmon populations. When summed across a region, however, the total value Californians are willing to pay for increases in fish populations is considerable. Applying the results of two studies that have estimated willingness to pay values for increases in salmon and steelhead populations suggest that Californians, in total, would be willing to pay between $497 (Olsen, Richards, and Scott 1991) and $4,351 (Loomis 1996) per fish.[8]

Quantifying the benefits attributable to this project in biophysical or economic terms, however, is impossible given the lack of relevant data. In addition to this non-monetized benefit related to salmonid populations in particular, we quantify the economic value of the project for riparian habit, in monetized benefit #2, below. There may be some overlap between these benefits.

Timing and duration. We assume the project would begin conferring salmonid habitat benefits as soon as it begins implementation, in 2014. The improvement in habitat and resulting fish populations would increase slowly over time as invasive removal progresses and revegetation happens, both as part of the project and naturally.

Beneficiaries. The beneficiaries of this benefit are the people of California who value the continued existence of aquatic wildlife and habitat, particularly critical habitat for steelhead.

[8] This is based on about 12.4 million households in California (U.S. Census Bureau 2007-2011).

Sources of uncertainty. The value of this benefit depends on the uncertainty associated with the extent to the project confers a biophysical benefit that will result in increased salmon populations. There is also uncertainty associated with the economic value of avoiding losses to fish populations. The results from the studies listed above depend crucially on survey methodology and public perceptions on the current state of salmonid populations. Both studies listed above were conducted in the Pacific Northwest, which may over or underestimate Californians' willingness to pay for salmon.

9. Provide other environmental stewardship benefits: **Avoided costs associated with reduced likelihood and intensity of fire**

Underlying change. *Arundo* burns more readily and hotter than native vegetation due to the large amount of biomass per acre and the high levels of fuel per unit of biomass. *Arundo* stands also convey fires more efficiently across the landscape, linking riparian to upland areas and spreading fire into urbanized areas. By removing *Arundo* on 120 acres in the Salinas watershed and potentially reducing the likelihood and intensity of fires in the Salinas watershed, the project would marginally reduce the risk associated with fire. Historical conditions suggest that *Arundo* has not created or exacerbated a wildfire event in the Salinas watershed. Several factors in the Salinas watershed mitigate against fire: agricultural land buffering riparian areas would prevent fire from spreading to upland areas, and fewer homeless camps within the *Arundo* have been found: homeless camps often serve as an ignition source for fires. However, without the project, *Arundo* may expand its range into the upper Salinas river, where agricultural buffers are less prevalent. Moreover, with climate change creating hotter and drier summer conditions the risk of wildfire throughout the watershed is likely to increase.

Evidence for demand and value. As the risk of an *Arundo*-related fire increases, the economic benefit of removing *Arundo* also increases. In the cost-benefit analysis of *Arundo* control in California, the California Invasive Plant Council notes that *Arundo* initiated fires have response and suppression costs that average $50,000 per event. We cannot quantify the fire-related benefits of controlling 120 acres of *Arundo* in the Salinas watershed, but experience in other watersheds and trends in environmental conditions suggests the benefit may exist and may increase in the future.

Timing and duration. We assume the project would begin conferring benefits as soon as it begins implementation, in 2014. This benefit would persist for the lifetime of the project, at least 50 years.

Beneficiaries. The beneficiaries of this benefit are residents, agricultural landowners, businesses, and fire-protection agencies that would avoid costs related to fire damage and fire response as a result of the project.

Sources of uncertainty. All sources of uncertainty surrounding the physical estimate of reduce fire impacts and the probabilities associated with these impacts under the with and without project conditions would also affect the likelihood that economic benefits described here would materialize. The avoided costs here are based on averages for California, and may not represent the average conditions and wildfire-response capacities in the Salinas watershed. Actual costs may be greater or less than those reported here.

12. Provide a long-term solution in place of a short-term one: **Reduced costs and protection of investments in restoration from watershed-based approach to eradication**

Underlying change. Past eradication efforts have been opportunistic, but have not resulted in long-term, persistent reductions in the *Arundo* invasion in the Salinas River. In this project, the RCD would remove *Arundo* systematically, beginning at the top of the watershed and moving progressively downstream.

Arundo spreads by water, so if it is cleared from upstream to downstream, it is virtually impossible for the strands to reinvade restored areas.

Evidence for demand and value. By removing *Arundo* in this way, project proponents would remove the threat of future infestation after the program ends, and secure investments made in restoration. This would reduce costs associated with removal activities for landowners and land management agencies in the future, and would secure the environmental benefits that come with eradication for the long run.

Timing and duration. Project proponents estimate the project would improve 40 acres of habitat, as a result of *Arundo* treatment and revegetation, in each 2015, 2016, and 2017, for a total restoration of 120 acres. To reduce the risk that we have overestimated this benefit, we assume the project would begin conferring benefits related to avoided costs associated with flood damage in 2017. This benefit would exist for the lifetime of the project, 50 years.

Beneficiaries. The beneficiaries of this benefit are the landowners adjacent to the Salinas River, management agencies responsible for managing the natural resources of the watershed, and the taxpayers and other current and future funders who support environmental management activities in general, and *Arundo* management in particular.

Sources of uncertainty. There is good evidence from elsewhere in California that the proposed eradication methodology that this project would employ effectively reduces the risk of reestablishment throughout the watershed. It does not ensure that new stands wouldn't be introduced by human activities.

15. Other benefits: **Avoided costs associated with reduced flood damage**

Underlying change. *Arundo* biomass mobilizes during high flow events. This material can contribute or cause loss of structures that cross (e.g., bridges) or are located within the river channel (e.g. power poles, sewer, gas, and water lines). In the project area, there are nine bridges, including two large highway bridges, downstream of the project's starting point that could bear damage from flooding without the project.

Evidence for demand and value. In the cost-benefit analysis of *Arundo* control in California, the California Invasive Plant Council assumes a lower-bound replacement cost estimate for various sizes of bridges and multiply by 20 percent to estimate the likelihood of bridge loss within the 10-year period and to account for the portion of cost that is due to large flood events taking out bridges regardless of whether *Arundo* material is in the system or not (Giessow et al. 2011). Monterey County maintains several bridges that cross the Salinas River and would potentially benefit from this project. However, County officials could not provide any data to estimate the damage costs to bridges during past flood events, or the contribution of *Arundo* to increasing the risk of the bridges failing. Given that this project eradicates a small portion of the total amount of *Arundo* currently in the watershed, the risk reduction and associated avoided cost from this project alone is probably not very large. However, it may incrementally reduce the risk and provide an economic benefit cumulatively with the future planned *Arundo* reduction efforts. Data are unavailable to estimate this benefit in monetary terms.

Timing and duration. We assume the project would begin conferring benefits as soon as it begins implementation, in 2014. This benefit would persist for the lifetime of the project, at least 50 years.

Beneficiaries. The beneficiaries of this benefit are the downstream residents and agricultural producers, including property owners, on the Salinas River who would avoid costs related to flood damage as a result of the project.

Sources of uncertainty. All sources of uncertainty surrounding the physical estimate of the reduced flood damage would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $11,867,218. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Increased instream flows for environmental purposes

Underlying change. The project would reduce water consumption by removing 1,869 gross acres of *Arundo*, which draws approximately three times more water than native plants. After the final stage of the project, the project would reduce consumption of water by 0.668 acre feet of water each year.

Evidence for demand and value. Additional instream flows in the Salinas River would help support ecosystem goods and services that people value, including improved habitat for species and clean water for recreation and other uses. A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average lease rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water-quality and fish and other affected species. Using this value, the annual value of avoiding 0.668 acre-feet per year of diverted surface flows is $86 per year.

Timing and duration. Project proponents estimate the project would save 0.223 acre-feet of water in 2015, 0.445 acre-feet in 2016, and 0.668 acre-feet of water in 2017 and thereafter, for the lifetime of the project. Benefits would persist for the lifespan of the project, at least 50 years.

Beneficiaries. The beneficiaries of this benefit would include several groups of stakeholders including commercial fishermen and recreational anglers in both marine and freshwater fisheries, and the general public insofar as they value an increase in fish populations regardless of any potential future direct use or exposure to the impacted fish populations. It would also benefit other recreational users of water, such as kayakers and wildlife watchers, Californians who place a non-use value on maintaining sufficient instream flows for environmental purposes, and other water users, such as irrigators, who bear increased regulatory pressure and costs to increase instream flows by reducing their own use of water.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of the increased instream flows for environmental purposes created would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty. Of particular note, project proponents based their quantification of biophysical changes on averages. Actual benefits would depend on site-specific variables at each work site, such as channel configuration, density of *Arundo* population, intensity of storms following treatment, effectiveness of monitoring for retreatment, adjacent vegetation in channel and out of channel, and the quality of the revegetation work.

The value we derive from the data provided by WestWater Research, as presented in the findings of Aylward and Merrill (2012) embodies the uncertainty inherent in the individual study as well as from applying results from past research to future conditions. There is, however, no obvious reason to conclude that the estimate systematically overestimates the true marginal value of water for environmental purposes in Monterey. As human populations and incomes grow in California, the marginal value of wild salmonid populations and other benefits derived from instream flows for environmental purposes is likely

to increase, as will the value of stream flows that support their continued existence. Because we found no reliable estimate of the rate of increase, we did not fold this increase into our estimates. For these reasons, it seems reasonable to conclude that the value estimates we apply in this analysis underestimate—perhaps substantially—the true value of future increases in water supplies that would result from the projects.

2. Passive-use value associated with enhanced riparian habitat

Underlying change. By removing invasive species and planting native vegetation, the project would restore a total of 120 acres of invasive-dominated riparian acres of the Salinas River. The project would restore 40 acres in each 2015, 2016, and 2017. The areas infested in *Arundo* currently provide no habitat function for native species. Thus, the project would increase the amount of functional habitat for several threatened and endangered species, including the California red legged frog, least Bell's vireo, the arroyo toad, and the steelhead trout.

Evidence for demand and value. In the cost-benefit analysis of *Arundo* control in California, the California Invasive Plant Council uses a value of $25,000 per acre for the benefit of habitat enhancement / restoration that occurs when *Arundo* is controlled (Giessow et al. 2011). We also apply this value. It represents the average avoided cost of creating equivalent habitat in the Salinas River watershed, based on best expert judgment of specialists familiar with restoration projects in the region (personal communication with Jason Giessow, DENDRA Inc.). Assuming it adequately reflects past restoration costs in the Salinas watershed, it represents a minimum value of the willingness to pay to generate habitat and the ecosystem goods and services that flow from the habitat over time. It is applied as a lump sum at the time of the restoration. This value does not include land acquisition costs. The undiscounted, lump-sum value of this benefit in each of the three years of project implementation is $1 million.

Timing and duration. Project proponents estimate the project would improve 40 acres of habitat, as a result of *Arundo* treatment and revegetation, in each 2015, 2016, and 2017, for a total restoration of 120 acres. We include the avoided costs associated with *Arundo* control and habitat restoration in those years. This benefit would persist for the lifetime of the project, at least 50 years.

Beneficiaries. The beneficiaries of this benefit are the people of California who value enhanced riparian habitat in the Salinas River.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of the riparian habitat created would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty. The value applied here may over or underestimate the actual value of the habitat created from removing *Arundo.* Assuming it creates habitat of similar quality and function as habitat people were willing to pay to restore, it is appropriate to transfer this per-acre value to the acres in this project. Supporting data and documentation are not available to independently verify the value, however, so some uncertainty remains.

3. Avoided costs associated with sediment removal

Underlying change. The California Invasive Plant Council notes that *Arundo* has impacts to sediment transport, particularly in low-gradient areas where *Arundo* cover is high (Giessow et al. 2011). Localized sediment trapping is likely occurring in portions of highly invaded reaches, resulting in loss of flow conveyance. *Arundo* stands on their own, not even accounting for sediment trapping, were demonstrated to reduce flow conveyance by five feet where they occurred.

Evidence for demand and economic value. In the cost-benefit analysis of *Arundo* control in California, the California Invasive Plant Council estimates the cost of controlling *Arundo* based on the avoided cost

of sediment removal. They note that while "costs include the removal work itself, this often a small proportion of the total project cost. […] Therefore, valuation assigned in the benefit analysis are again highly conservative" (Giessow et al. 2011). The researchers estimate the benefits of avoided sediment removal or vegetation reduction from controlling *Arundo* in the Salinas watershed is $1,000,000 over ten years. This project would control a total of 120 acres of *Arundo* in the Salinas watershed, 6.4 percent of the total. We assume the costs of sediment removal are evenly distributed, calculating a total avoided cost of sediment removal from controlling *Arundo* of $64,205 over ten years. The annual, undiscounted value of this benefit is therefore $6,421.

Timing and duration. Project proponents estimate the project would improve 40 acres of habitat, as a result of *Arundo* treatment and revegetation, in each 2015, 2016, and 2017, for a total restoration of 120 acres. To reduce the risk of overestimating this benefit, we assume the project would begin conferring benefits related to reduced sedimentation in 2017. The benefit would persist for ten years.

Beneficiaries. The beneficiaries of this benefit are the wide array of downstream users who incur costs to dredge sediment, or who bear the costs of reduced flow conveyance and other adverse effects of sediment deposition. These beneficiaries could include the general public, municipal water treatment operators and their ratepayers, irrigators, recreationalists, downstream property owners, and fishermen.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of reduced sedimentation would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty. We assume the avoided costs associated with reduced sedimentation from *Arundo* removal are evenly distributed across the Salinas watershed. If controlling *Arundo* in this area of the watershed would affect costs by greater than the average, we have underestimated the value of this benefit. Similarly, if costs associated with sediment removal in this area from *Arundo* are less than the average for the watershed, we have overestimated the value. This is likely a conservative estimate. The California Invasive Plant Council notes that the true costs of *Arundo* impacts could be "one or two orders of magnitude greater" than the estimates provided in the analysis (Giessow et al. 2011).

4. Avoided costs associated with reduced overbank flow

Underlying change. The project would reduce the frequency and magnitude of flooding of lands adjacent to the Salinas River by reducing sediment trapping.

Evidence for demand and value. Exacerbated flooding poses a food safety risk for vegetable farms adjacent to the Salinas River. When floodwaters inundate these fields, crops cannot be sold for human consumption and fields must be treated and tested to ensure bacterial contamination does not pose a risk to food production. By controlling *Arundo* on 120 acres, the project may reduce the likelihood of overbank flow to nearby farmers, and avoiding the ensuing costs. The economic value of this benefit is the avoided costs to the local farmers of crop loss, field repair, and subsequent *e. coli* testing. Under the Salinas River Stream Maintenance Program Draft EIR Flood Study, ENTRIX (consultants to MCWRA) modeled the potential farmland flooded in 2-year storm events and 10-year storm events with and without channel maintenance for all the farmlands along the river.

They estimate that under 2-year storm flooding: 381 acres are flooded under existing conditions, and 323 acres would be flooded with full channel maintenance. They also estimated a 15 percent reduction or $600,000 reduction in crop losses between the two scenarios. For a 10-year storm event flooding under current conditions would inundate 26,577 acres, but with channel maintenance would inundate 24,869. Project proponents estimated a 6.5 percent reduction or $28 million in potential crop losses between the two scenarios.

Project proponents estimate *Arundo* removal might provide 33 percent of the total estimated benefit, since channel maintenance also includes sand/gravel bar removal. We therefore assume *Arundo* removal would provide a benefit of $198,000 in avoided costs of overbank flow during two-year storms and $9,332,400 in avoided costs during 10-year storms.

Timing and duration. Project proponents estimate the project would improve 40 acres of habitat, as a result of *Arundo* treatment and revegetation, in each 2015, 2016, and 2017, for a total restoration of 120 acres. To reduce the risk that we have overestimated this benefit, we assume the project would begin conferring benefits to reduced overbank flow in 2017. We assume the benefits related to the 2-year storms occur every two years beginning in 2018, while the benefits of the 10-year storms occur every 10 years beginning in 2026. These benefits would persist for the lifetime of the restoration, at least 50 years.

Beneficiaries. The beneficiaries of this benefit are the farmers along the Salinas River who would enjoy a reduced likelihood of losing their crops to overbank flow from the project.

Sources of uncertainty. These benefits would accrue if the project produces effects related to flood reduction at the magnitude described above, and in locations where agricultural land used for food production would be affected by flooding. These assumptions would overestimate the benefits if fewer farms were located adjacent to the river where this project is focused, or if it had a smaller effect on in-channel conveyance capacity. Moreover, if channel capacity takes time to clear after *Arundo* is removed, our assumption that benefits would begin to accrue in 2017 would overestimate the total economic value of this benefit. Conversely, if the project were located in an area with higher than average farms and sedimentation rates, the values we use may underestimate the benefits. It is possible that the benefit described above, avoided costs associated with sediment removal double-counts some of the value of this benefit. However, because the sediment benefit is underestimated, perhaps considerably, it is possible that this flood reduction benefit would be entirely additive.

Table 15 – Annual Benefit: Increased instream flows for environmental purposes

(All benefits should be in 2012 dollars)

Project: Salinas River Watershed Invasive Non-native Plant Control and Restoration Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	1.000	$ -
2013	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.943	$ -
2014	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.890	$ -
2015	Increased instream flows	Acre-feet	0	0.223	0.223	$ 128.00	$ 28.54	0.840	$ 24
2016	Increased instream flows	Acre-feet	0	0.445	0.445	$ 128.00	$ 56.96	0.792	$ 45
2017	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.747	$ 64
2018	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.705	$ 60
2019	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.665	$ 57
2020	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.627	$ 54
2021	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.592	$ 51
2022	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.558	$ 48
2023	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.527	$ 45
2024	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.497	$ 42
2025	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.469	$ 40
2026	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.442	$ 38
2027	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.417	$ 36
2028	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.394	$ 34
2029	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.371	$ 32
2030	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.350	$ 30
2031	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.331	$ 28
2032	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.312	$ 27
2033	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.294	$ 25
2034	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.278	$ 24
2035	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.262	$ 22
2036	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.247	$ 21
2037	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.233	$ 20
2038	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.220	$ 19
2039	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.207	$ 18
2040	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.196	$ 17
2041	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.185	$ 16
2042	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.174	$ 15
2043	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.164	$ 14
2044	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.155	$ 13
2045	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.146	$ 12
2046	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.138	$ 12
2047	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.130	$ 11
2048	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.123	$ 10
2049	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.116	$ 10
2050	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.109	$ 9
2051	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.103	$ 9
2052	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.097	$ 8
2053	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.092	$ 8
2054	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.087	$ 7
2055	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.082	$ 7
2056	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.077	$ 7
2057	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.073	$ 6
2058	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.069	$ 6
2059	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.065	$ 6
2060	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.061	$ 5
2061	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.058	$ 5
2062	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.054	$ 5
2063	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.051	$ 4
2064	Increased instream flows	Acre-feet	0	0.668	0.668	$ 128.00	$ 85.50	0.048	$ 4
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 1,129.02

Comments:

Table 15 – Annual Benefit: Value of enhanced riaprian habitat

(All benefits should be in 2012 dollars)

Project: Salnas River Watershed Invasive Non-native Plant Control and Restoration Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Enhanced riparian habitat	Acres	0	0	0	$ 25,000.00	$ -	1.000	$ -
2013	Enhanced riparian habitat	Acres	0	0	0	$ 25,000.00	$ -	0.943	$ -
2014	Enhanced riparian habitat	Acres	0	0	0	$ 25,000.00	$ -	0.890	$ -
2015	Enhanced riparian habitat	Acres	0	40	40	$ 25,000.00	$ 1,000,000.00	0.840	$ 839,619
2016	Enhanced riparian habitat	Acres	0	40	40	$ 25,000.00	$ 1,000,000.00	0.792	$ 792,094
2017	Enhanced riparian habitat	Acres	0	40	40	$ 25,000.00	$ 1,000,000.00	0.747	$ 747,258
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 2,373,971.12

Comments:

Table 15 – Annual Benefit: Avoided costs associated with sediment removal

(All benefits should be in 2012 dollars)

Project: Salnas River Watershed Invasive Non-native Plant Control and Restoration Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Avoided sediment removal	Dollars			0		$ -	1.000	$ -
2013	Avoided sediment removal	Dollars			0		$ -	0.943	$ -
2014	Avoided sediment removal	Dollars			0		$ -	0.890	$ -
2015	Avoided sediment removal	Dollars			0		$ -	0.840	$ -
2016	Avoided sediment removal	Dollars			0		$ -	0.792	$ -
2017	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.747	$ 4,798
2018	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.705	$ 4,527
2019	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.665	$ 4,270
2020	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.627	$ 4,029
2021	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.592	$ 3,801
2022	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.558	$ 3,585
2023	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.527	$ 3,383
2024	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.497	$ 3,191
2025	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.469	$ 3,010
2026	Avoided sediment removal	Dollars	0	6421	6421	$ 1.00	$ 6,421.00	0.442	$ 2,840
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 37,433.65

Comments:

Table 15 – Annual Benefit: Avoided costs associated with reduced overbank flow

(All benefits should be in 2012 dollars)

Project: Salinas River Watershed Invasive Non-native Plant Control and Restoration Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	1.000	$ -
2013	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	0.943	$ -
2014	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	0.890	$ -
2015	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	0.840	$ -
2016	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	0.792	$ -
2017	Avoided costs	Dollars	0	0	0	$ 1.00	$ -	0.747	$ -
2018	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.705	$ 139,582
2019	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.665	$ -
2020	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.627	$ 124,228
2021	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.592	$ -
2022	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.558	$ 110,562
2023	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.527	$ -
2024	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.497	$ 98,400
2025	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.469	$ -
2026	Avoided costs	Dollars	0	9332400	9332400	$ 1.00	$ 9,332,400.00	0.442	$ 4,127,730
2027	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.417	$ -
2028	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.394	$ 77,942
2029	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.371	$ -
2030	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.350	$ 69,368
2031	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.331	$ -
2032	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.312	$ 61,737
2033	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.294	$ -
2034	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.278	$ 54,946
2035	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.262	$ -
2036	Avoided costs	Dollars	0	9332400	9332400	$ 1.00	$ 9,332,400.00	0.247	$ 2,304,903
2037	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.233	$ -
2038	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.220	$ 43,522
2039	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.207	$ -
2040	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.196	$ 38,735
2041	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.185	$ -
2042	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.174	$ 34,474
2043	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.164	$ -
2044	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.155	$ 30,682
2045	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.146	$ -
2046	Avoided costs	Dollars	0	9332400	9332400	$ 1.00	$ 9,332,400.00	0.138	$ 1,287,046
2047	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.130	$ -
2048	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.123	$ 24,303
2049	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.116	$ -
2050	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.109	$ 21,629
2051	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.103	$ -
2052	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.097	$ 19,250
2053	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.092	$ -
2054	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.087	$ 17,132
2055	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.082	$ -
2056	Avoided costs	Dollars	0	9332400	9332400	$ 1.00	$ 9,332,400.00	0.077	$ 718,680
2057	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.073	$ -
2058	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.069	$ 13,570
2059	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.065	$ -
2060	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.061	$ 12,078
2061	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.058	$ -
2062	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.054	$ 10,749
2063	Avoided costs	Dollars	0		0	$ 1.00	$ -	0.051	$ -
2064	Avoided costs	Dollars	0	198000	198000	$ 1.00	$ 198,000.00	0.048	$ 9,567
						Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)			$ 9,450,813.37

Comments:

Section D3. Project Costs

The present value of the project's costs, which would occur between 2013 and 2016, is $1,660,332 in 2013 dollars, discounted at a 6-percent annual rate.[9] These costs would fund labor, planning, equipment, and materials necessary to implement the project.

The project might also include some adverse impacts, which we do not quantify in the costs above. These include the costs to local landowners from mechanical and chemical weed treatment, possible spray drift on non-target vegetation, unintentional harm to resident wildlife and native vegetation, and soil disturbance from heavy equipment. We do not include these costs in our estimates because project proponents plan to mitigate these adverse impacts with protection measures. To the extent that they are not mitigated, however, they would represent costs of the project. More information is available in the project's environmental documentation and associated permit conditions.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Salinas River Watershed Invasive Non-native Plant Control and Restoration Program

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 1,749,763.00							$1,749,763	0.943	$ 1,650,720
2014	$ 10,800.00							$ 10,800	0.890	$ 9,612
2015								$ -	0.840	$ -
2016								$ -	0.792	$ -
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 1,660,332
Comments:										

[9] We have distributed the costs outlined Table 7 across the project's implementation period based on the expected timing and phasing described in the Work Plan. Actual distribution of costs during this period may differ somewhat.

Project 5. Resource Conservation District of Monterey County: Monterey County Farm Water Quality Assistance Program

Project Description

Conditions Without the Project
The Resource Conservation District (RCD) of Monterey County, alongside the University of California Cooperative Extension Crop Advisors and USDA Natural Resources Conservation Service, currently provides education and technical assistance to local and regional growers on best management practices to conserve water and minimize soil erosion and fertilizer application.

These agricultural practices are consistent with efforts encouraged under the Irrigated Lands Regulatory Program (ILRP). The ILRP regulates discharges from irrigated agricultural lands to minimize impairment of receiving waters with waste discharge requirements (WDRs). The California Water Code authorizes State and Regional Water Boards to conditionally waive WDRs. Senate Bill 390 required the Regional Water Boards to review their existing waivers and to renew or replace them, the Central Coast Water Quality Control Board adopted comprehensive conditional waivers. Agricultural producers can obtain this waiver for surface discharges of irrigation water, groundwater drainage, and storm water from irrigated lands permits, as long as they take steps to improve water quality on the acreage. As a condition of the waiver, these dischargers can either participate in an established coalition group or file as an individual discharger, with the accompanying monitoring and reporting requirements.

Conditions With the Project
The project would provide funding to expand the current educational and technical assistance activities of the Resource Conservation District (RCD) of Monterey County, the University of California Cooperative Extension Crop Advisors and the USDA Natural Resources Conservation Service into a full program in the Salinas region in the next three years. It would allow the RCD to hire a bilingual agricultural water management specialist to provide education in English and Spanish.

The expanded service under this project would include 50 evaluations and site assessments to educate farmers about water and soil conservation BMPs and pollution reduction practices; 10-20 follow-through appointments to ensure the efficacy of the recommendations; and, for a subset of 5-10 of those farm sites, on-going monitoring activities and effectiveness tracking of the BMPs.

The education would focus on helping the farmers improve management of soil, water, and nutrients to improve local water quality and streamline production inputs. These changes would help the agricultural producers meet their requirements under the Irrigated Lands Regulatory Program. The project would also involve focused program outreach in both Spanish and English to communicate the need, methods and benefits of agricultural water quality improvement practices.

Section D2. Non-Monetized Benefits Analysis

Table 12-5 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a “yes” response below the table, organized in order by their number in the table.

Table 12-5 – Non-monetized Benefits Checklist Project 5. Resource Conservation District of Monterey County: Monterey County Farm Water Quality Assistance Program		
No.	*Will the proposal…*	*Response*
Community/Social Benefits		
1	Provide education or technology benefits?: Enhance human capital	Yes
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts? Assistance to understand and comply with regulatory requirements	Yes
4	Promote social health and safety?	No
5	Have other social benefits?	No
Environmental Stewardship Benefits		
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7?: Reduce costs associated with regulated pollutants	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
Sustainability Benefits		
10	Improve the overall, long-term management of California groundwater resources?	Yes
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Education or technology benefits: Enhance human and social capital

Underlying change. The project would directly enhance the human capital of regional growers involved in the project. The project would also enhance human capital for those who receive information through the program outreach. The project would significantly expand its educational program and outreach efforts for local growers. The expanded service would include: 90 on-farm consultations; 30 detailed irrigation and nutrient management assessments with recommendations; and, for a subset of 5-10 of those farm sites, corresponding implementation assistance and effectiveness tracking. RCD would offer these services in English and Spanish. Outreach activities would include: work of mouth, presentations at grower, shipper, and commodity group meetings; field demonstrations and workshops; media and educational materials production, and or dissemination.

Evidence for demand and value. The Water Board Region 3's Ag Order identifies irrigation, nutrient and vegetation management as key focal areas. Local agronomic and conservation professional anticipate a lag in local technical assistance capacity available to growers to address these issues efficiently. The lack of technical assistance is a particular problem for Spanish-speaking farmers, for whom technical materials are limited or not in appropriate formats for their modes of learning. Project proponents note they already have are a number of growers who are eager for these services.

Investing in the knowledge and skills of farmers in the region would produce benefits in several ways:

- Increased efficiency and reduced costs for the growers by learning more efficient production systems (some of these benefits are quantified in monetized benefits below).
- Enhanced environmental quality from practices farmers implement, both with the current project, and throughout their professional lifespans (some of these benefits are quantified in monetized benefits below, but some are not, and effects that are produced beyond the demonstration projects included in this project would not be monetized below).
- Enhanced well-being of the farmers themselves. Many who would take part in the program do so voluntarily. This suggests the benefit they receive from learning new skills is at least as valuable as what they could have done with their time otherwise. Some of this benefit may arise from the expectation that they would save money on operations or reduced regulatory compliance (as described in other benefits throughout this section) but for some farmers, the benefits could include personal satisfaction.

Timing and duration. The project would begin conferring education and technology benefits when the first cohort of new farmers begin receiving educational materials, consultations, assessments, and implementation assistance, likely in April of 2015. Assuming the participating farmers continue to use the knowledge they gain from the program throughout their careers, the project would confer these benefits over the professional lifetimes of each of the farmers.

Beneficiaries. The beneficiaries of this benefit are the growers in the Greater Monterey County IRWM region who participate in the consultations, assessments, and implementation assistance, as well as the broader community of farmers who receive the outreach materials. These growers would represent approximately 381 farms, of which 156 which are managed by Hispanic growers.

Many of these beneficiaries would be non-English or mostly-Spanish speaking limited resource farmers, many of whom have limited access to technical resources and assistance in irrigation, nutrient, and vegetation management.

Sources of uncertainty. The magnitude of the potential benefits depends on the effectiveness of the program's materials and outreach activities.

3. Help avoid, reduce, or resolve various public water resources conflicts: **Assistance to understand and comply with regulatory requirements**

Underlying change. The project provides an avenue for helping growers comply with new water quality regulations, including the Central Coast Water Quality Control Board's comprehensive conditional waivers. Some of these regulations were borne out of a controversial process that is still in dispute.

Evidence for demand and value. To the extent that the project helps the growers comply with new water quality regulations and avoid costs associated with time and money spent on improving compliance and political conflicts over that compliance, the project confers a benefit as a reduced public water resources conflict.

Timing and duration. The project would begin avoiding public water resources conflicts after the first cohort of new farmers begin implementing the water quality improvement approaches from the educational materials, consultations, assessments, and implementation assistance, which would occur between April 2015 and April 2017. Assuming the participating farmers continue to use the knowledge they gain from the program throughout their careers, the project would confer these benefits over the professional lifetimes of each of the farmers.

Beneficiaries. The beneficiaries of this benefit are the growers in the Greater Monterey County IRWM region who participate in the consultations, assessments, and implementation assistance, as well as the broader community of farmers who receive the outreach materials. These growers represent approximately 381 farms, of which 156 which are managed by Hispanic growers.

Sources of uncertainty. The project would not eliminate all sources of conflict or controversy around the agricultural regulations. To the extent that it helps farmers understand and better comply, this benefit would materialize.

7. Improved water quality: **Reduce costs associated with regulated pollutants**

Underlying change. The project would indirectly improve water quality in the Salinas River, Gabilan Creek, and Blanco Drain watersheds by educating farmers about more efficient use of agricultural irrigation water and nutrients. Some of the outcomes from the project include reduced contaminants (sediment and nutrients, in particular), which will benefit water quality in downslope waterways. We quantify the economic value of the reduced sedimentation expected in the project conditions in the monetized benefit #2, below; however, we do not quantify the additional expected benefits of reduced contaminants from nutrients and fertilizers.

Evidence for demand and value. The draft update of the Water Board Region 3's Ag Order identifies Central Coast irrigated crop farmers as dischargers of water quality pollutants. The regulation focuses on irrigation, nutrient and vegetation management as key elements.

Timing and duration. The project would begin conferring water quality benefits after the first cohort of new farmers begin implementing the water quality improvement approaches from the educational materials, consultations, assessments, and implementation assistance, which would occur between April 2015 and April 2017. These benefits would endure for the professional lifetimes of each of the participating farmers.

Beneficiaries. The beneficiaries of this benefit are the downstream water users of each of the affected water bodies. Some of these beneficiaries may include members of disadvantaged communities.

Sources of uncertainty. The magnitude of the potential benefits depends on the effectiveness of the program's materials and outreach activities and the extent to which the growers implement the water quality approaches from the educational materials, consultations, assessments, and implementation assistance.

10. Improve the overall, long-term management of California groundwater resources

For the reasons described above in non-monetized benefits #1 and monetized benefit #3, the project has the potential to improve the overall, long-term management of California groundwater resources.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $136,379. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Increased farm revenues from reductions in fertilizer purchases

Underlying change. The project would indirectly increase farm revenues by reducing grower marginal costs. Project proponents expect that growers who implement the RCD's recommendations would reduce their fertilizer materials costs by 30 – 40 percent per acre. They estimate that, with full implementation of the project, farmers would reduce their use of nitrogen fertilizers by 550 pounds or 0.275 tons.

Evidence for demand and value. According to the USDA, the average farm paid $554 for one ton of nitrogen-based fertilizer in 2012 (USDA National Agricultural Statistics Service 2013). We estimate that, as a result of the project, famers would save approximately $152 per year.

Timing and duration. The project would begin accruing revenue benefits to farmers after the first cohort of new farmers begin implementing the cost savings approaches from the educational materials, consultations, assessments, and implementation assistance, which would occur between April 2015 and April 2017. We assume the project would begin conferring benefits related to reduced fertilizer use in 2015, by 0.1375 tons, and would reach full implementation in 2016. These benefits would endure until 2023.

Beneficiaries. The beneficiaries of this benefit are the growers in the Greater Monterey County IRWM region who participate in the consultations, assessments, and implementation assistance, as well as the broader community of farmers who receive the outreach materials. These growers represent approximately 381 farms, of which 156 which are managed by Hispanic growers.

Many of these beneficiaries will be non-English or mostly-Spanish speaking limited resource farmers, many of whom have limited access to technical resources and assistance in irrigation, nutrient, and vegetation management.

Sources of uncertainty. The magnitude of the potential benefits depends on the effectiveness of the program's materials and outreach activities and the extent to which the growers implement the cost savings approaches from the educational materials, consultations, assessments, and implementation assistance.

These quantified values are associated with the implementation portions of the project. To the extent that the project is able to achieve greater levels of nutrient and fertilizer reduction through its broader education and outreach activities, the amount here underestimates the total benefit.

2. Avoided costs from reduced sediment deposition

Underlying change. The project would reduce sediment deposition by implementing soil erosion reductions on five 10-acre sites. In particular, RCD would recommend and assist with the implementation of the follow activities: furrow cover crops to increase infiltration and reduce sediment loss; grassed farm roads to reduce soil loss on sloped ground; water and sediment control basins; and gully stabilization. Project proponents estimate that each site would reduce sediment deposition by an average of 150 tons per year. Once fully implemented, the project would reduce sedimentation by 1,050 tons per year.

Evidence for demand and value. Economic studies have examined and monetized some of the benefits that materialize when excessive sediment does not impair streams, rivers, estuaries, and the marine environment. A study conducted by the U.S. Department of Agriculture identified 13 types of benefits associated with decreasing sediment (Hansen and Ribaudo 2008). For each benefit, the researchers modeled the potential value associated with reducing sediment, per ton, for each county across the country. For our analysis, we apply the average value for the counties in the Salinas watershed, $9.89 per

ton, to estimate the benefits derived from the prevention of sediment deposition. Included in this value are the regional benefits associated with the impacts of sediment on:

- Water-based recreation – cleaner fresh water recreation
- Irrigation ditches and channels – reduced cost of removing sediment and aquatic plants from irrigation channels
- Road drainage ditches – less damage to and flooding of roads
- Municipal water treatment – lower sediment-removal costs for water treatment plants
- Flood damage – reduced flooding and damage from flooding
- Marine fisheries – improved catch rates for marine commercial fisheries
- Marine recreational fishing – improved catch rates for marine recreational fishing
- Municipal and industrial water use – reduced damages from salts and minerals dissolved from sediment
- Steam power plants – reduced plant growth on heat exchangers
- Soil productivity – reduced losses in soil productivity
- Dust cleaning – decrease in cleaning due to reduced wind-borne particulates
- Reservoir services – less sediment in reservoirs
- Navigation – shipping industry avoidance of damages from groundings

Once fully implemented, the annual, undiscounted value of this benefit is $10,385.

Timing and duration. The project would reduce soil erosion on two sites in 2015 and three sites in year 2016. These benefits would endure for the lifetime of each of the components of the implementation that result in sediment benefits, 30 years.

Beneficiaries. The beneficiaries of this benefit are the wide array of downstream users associated with each of the benefits listed above. To some extent, these beneficiaries include the general public, municipal water treatment operators and their ratepayers, irrigators, recreationalists, downstream property owners, and fishermen.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of reduced sedimentation would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty.

At least three major factors suggest that the value of sediment we use underestimates the true value of the sediment-reduction benefits. First, the value does not reflect many potential benefits, such as the goods and services derived from potential impacts on wetlands and endangered species. Second, the estimates of sediment erosion that the projects would reduce are based on current sediment erosion rates. Climate change is expected to increase the frequency and intensity of storm events, which would likely increase the rate of sediment erosion absent the proposed projects (Hasden and Figdor 2007). If future sediment erosion rates exceed current rates, the without-project sediment erosion is likely to increase, and thus, the expected benefit of each project's sediment control activities is likely to be an underestimate. Third, this estimate does not anticipate increases in value that occur over time. We anticipate that the value of sediment-reduction benefits will increase, relative to the general price index, but have not accounted for this increase in our calculations.

These quantified values are associated with the implementation portions of the project. To the extent that the project is able to achieve greater levels of soil conservation through its broader education and outreach activities, the amount here underestimates the total benefit.

3. Increased instream flows for environmental purposes

Underlying change. The project would indirectly increase water availability downstream for other beneficial uses by educating regional growers about efficient use of agricultural irrigation water. Project proponents estimate the ten growers receiving implementation assistance will reduce their water use by approximately 20.8 acre-feet as a result of the program.

Evidence for demand and value. Additional instream flows in the Salinas River would help support ecosystem goods and services that people value, including improved habitat for species and clean water for recreation and other uses. A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average lease rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water-quality and fish and other affected species. Using this value, the annual value of avoiding 20.8 acre-feet per year of diverted surface flows is $2,662 per year.

Timing and duration. The project would begin accruing benefits related to instream flows after the first cohort of new farmers begin implementing the farming management practices from the educational materials, consultations, assessments, and implementation assistance, which would occur in April 2015. We assume each of the ten growers implements these savings in successive years for ten years. These benefits would persist until 2023.

Beneficiaries. The beneficiaries of this benefit would include several groups of stakeholders including commercial fishermen and recreational anglers in both marine and freshwater fisheries, and the general public insofar as they value an increase in fish populations regardless of any potential future direct use or exposure to the impacted fish populations. It would also benefit other recreational users of water, such as kayakers and wildlife watchers, Californians who place a non-use value on maintaining sufficient instream flows for environmental purposes, and other water users, such as irrigators, who bear increased regulatory pressure and costs to increase instream flows by reducing their own use of water.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of the increased instream flows for environmental purposes created would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty.

The value we derive from the data provided by WestWater Research, as presented in the findings of Aylward and Merrill (2012) embodies the uncertainty inherent in the individual study as well as from applying results from past research to future conditions. There is, however, no obvious reason to conclude that the estimate systematically overestimates the true marginal value of water for environmental purposes in Monterey. As human populations and incomes grow in California, the marginal value of wild salmonid populations and other benefits derived from instream flows for environmental purposes is likely to increase, as will the value of stream flows that support their continued existence. Because we found no reliable estimate of the rate of increase, we did not fold this increase into our estimates. For these reasons, it seems reasonable to conclude that the value estimates we apply in this analysis underestimate—perhaps substantially—the true value of future increases in water supplies that would result from the projects.

These quantified values are associated with the implementation portions of the project. To the extent that the project is able to achieve greater levels of water conservation through its broader education and outreach activities, the amount here underestimates the total benefit.

Table 15 – Annual Benefit: Reduced fertilizer purchases
(All benefits should be in 2012 dollars)

Project: Monterey County Farm Water Quality Assistance Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Reduced fertilizer use	tons	0		0	$ 554.00	$ -	1.000	$ -
2013	Reduced fertilizer use	tons	0		0	$ 554.00	$ -	0.943	$ -
2014	Reduced fertilizer use	tons	0		0	$ 554.00	$ -	0.890	$ -
2015	Reduced fertilizer use	tons	0	0.1375	0.1375	$ 554.00	$ 76.18	0.840	$ 64
2016	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.792	$ 121
2017	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.747	$ 114
2018	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.705	$ 107
2019	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.665	$ 101
2020	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.627	$ 96
2021	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.592	$ 90
2022	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.558	$ 85
2023	Reduced fertilizer use	tons	0	0.275	0.275	$ 554.00	$ 152.35	0.527	$ 80
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 858.29

Comments:

Table 15 – Annual Benefit: Avoided costs from reduced sediment deposition
(All benefits should be in 2012 dollars)

Project: Monterey County Farm Water Quality Assistance Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Reduced sediment deposition	Tons	0	0	0	$ 9.89	$ -	1.000	$ -
2013	Reduced sediment deposition	Tons	0	0	0	$ 9.89	$ -	0.943	$ -
2014	Reduced sediment deposition	Tons	0	0	0	$ 9.89	$ -	0.890	$ -
2015	Reduced sediment deposition	Tons	0	300	300	$ 9.89	$ 2,967.00	0.840	$ 2,491
2016	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.792	$ 8,225
2017	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.747	$ 7,760
2018	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.705	$ 7,321
2019	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.665	$ 6,906
2020	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.627	$ 6,515
2021	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.592	$ 6,147
2022	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.558	$ 5,799
2023	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.527	$ 5,470
2024	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.497	$ 5,161
2025	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.469	$ 4,869
2026	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.442	$ 4,593
2027	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.417	$ 4,333
2028	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.394	$ 4,088
2029	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.371	$ 3,856
2030	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.350	$ 3,638
2031	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.331	$ 3,432
2032	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.312	$ 3,238
2033	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.294	$ 3,055
2034	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.278	$ 2,882
2035	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.262	$ 2,719
2036	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.247	$ 2,565
2037	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.233	$ 2,420
2038	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.220	$ 2,283
2039	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.207	$ 2,153
2040	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.196	$ 2,032
2041	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.185	$ 1,917
2042	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.174	$ 1,808
2043	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.164	$ 1,706
2044	Reduced sediment deposition	Tons	0	1050	1050	$ 9.89	$ 10,384.50	0.155	$ 1,609
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 120,989.01

Comments:

Table 15– Annual Benefit: Increased instream flows for environmental purposes
(All benefits should be in 2012 dollars)

Project: Monterey County Farm Water Quality Assistance Program

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor [1]	Discounted Benefits [1] (h) x (i)
2012	Increased instream flows	Acre-feet	0	0	0	$ 124.00	$ -	1.000	$ -
2013	Increased instream flows	Acre-feet	0	0	0	$ 124.00	$ -	0.943	$ -
2014	Increased instream flows	Acre-feet	0	0	0	$ 124.00	$ -	0.890	$ -
2015	Increased instream flows	Acre-feet	0	10.41	10.41	$ 124.00	$ 1,290.84	0.840	$ 1,084
2016	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.792	$ 2,043
2017	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.747	$ 1,927
2018	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.705	$ 1,818
2019	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.665	$ 1,715
2020	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.627	$ 1,618
2021	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.592	$ 1,527
2022	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.558	$ 1,440
2023	Increased instream flows	Acre-feet	0	20.8	20.8	$ 124.00	$ 2,579.20	0.527	$ 1,359
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$ 14,531.41

Comments:

Section D3. Project Cost

The present value of the project's costs, which would occur between 2013 and 2014, is $732,261 in 2013 dollars, discounted at a 6-percent annual rate. These costs would fund labor, planning, equipment, and materials necessary to implement the project.

The project may involve some regular operation and maintenance activities that are not included in the budget, contingent upon the practices implemented by the participating growers. For example, if a participating grower installs a water or sediment control basin, it will require periodic excavation, possible once a year. Most improvements associated with this project are, however, management practice changes and will not necessarily require additional time or resources above those included in the baseline. For these reasons, we do not include an estimate of these costs in the tables.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Monterey County Farm Water Quality Assistance Program

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 547,760.00							$ 547,760	0.943	$ 516,755
2014	$ 232,030.00							$ 232,030	0.890	$ 206,506
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 723,261

Comments:

Project 6. Ecology Action: Monterey Bay Green Gardener Training and Certification Program

Project Description

Conditions Without the Project
Since 2006, the Monterey Bay Green Gardener Certification Program (the Program) has trained landscapers and gardeners in the Gabilan watershed and the City of Salinas to make water conservation and watershed stewardship the guiding principles of their landscape business or practice. The program is well funded in other regions of Monterey Bay, but difficult to implement in Salinas Valley. Many landscapers in the Valley are bilingual or Spanish-speakers and 65 percent of Salinas graduates from this program would prefer class materials in Spanish. There are currently no other programs offered in Spanish in Salinas Valley. While the Program once offered a 10-week bilingual course, funding expired in August of 2011 and the program is now on hold. Without the project, we would expect these conditions to persist.

Conditions With the Project
The project would expand the current scope of the Program by providing funding for additional bilingual courses in Spanish; extending the program to residents of Gonzales, Soledad, Greenfield, and King City; and incorporating hands-on training experiences at four water-wise demonstration sites. With the project, Green Gardeners would expand enrollment by 25 students in the certification course, including bilingual students.

The four demonstration projects, each less than 2,500 square feet, would include one demonstration site "cart access to public," one involving low impact development, and two promoting greywater use. The demonstration sites have not yet been selected. The project would also involve four public workshops, with 25 residents each, to promote sustainable landscaping practices.

Section D2. Non-Monetized Benefits Analysis

Table 12-5 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-6 – Non-monetized Benefits Checklist Ecology Action: Monterey Bay Green Gardener Training & Certification Program		
No.	*Will the proposal…*	*Response*
Community/Social Benefits		
1	Provide education or technology benefits? Enhanced human capital, especially for Spanish speakers	Yes
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts?	No
4	Promote social health and safety?	No
5	Have other social benefits?	No
Environmental Stewardship Benefits		
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7? Reduced cost associated with regulated pollutants	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4? Enhanced water supply for environmental and municipal purposes	Yes
Sustainability Benefits		
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	Yes
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Provide education or technology benefits: **Enhanced human capital, especially for Spanish speakers**

Underlying change. The project would increase the number of landscapers enrolled in the Green Gardener Program by 25 students. The project would involve residents of Gonzales, Soledad, Greenfield, and King City and would provide additional bilingual courses in Spanish and English. We also quantify the economic value of this benefit to the students themselves in the monetized benefit analysis below; however, the project would also provide some additional, non-quantifiable benefit to the local community from the students' improved human capital from education.

Evidence for demand and value. Drawing a cause-and-effect relationship between educational efforts and specific water supply or water quality outcomes is difficult, but there are several ways the project could produce tangible economic benefits through its education components:

- Stormwater and green-landscape-related education made possible by this project may increase the public's understanding of and support or demand for future watershed-enhancement projects. Increased community support for and participation in future public projects may make future stormwater and watershed restoration projects easier to implement and less costly to complete, resulting in additional water quality and quantity benefits at lower cost to the community.
- The education efforts related to stormwater management and green landscaping practices, illustrated by the demonstration projects, may inspire homeowners to explore opportunities for

installing low-impact-development features on their property, to use greywater, and to implement green landscaping practices. Increased public interest and support for these features on private property may generate more widespread and long-run improvements in water quality and water management in the region. These private efforts may in turn lower the public costs for managing stormwater.

- Opportunities to participate in educational programs and demonstration projects improve the well-being of people who choose to participate. These improvements may not result in water supply or water quality benefits directly, but they may better people's lives in other ways that have economic importance. Spending time outdoors may improve an individual's emotional and physical health, which constitutes an investment in human capital. Working with others in restoration efforts has the potential to strengthen the relationships among community members, which constitutes an investment in social capital. Both of these effects may contribute to an overall improvement in quality of life.

These effects may be small, but subtle changes arising from education should not be dismissed. For example, interactions among community members in the context of this project may be brief, compared to all of the other interactions that go on day to day, but the effect combined with all of the other small effects may accumulate into measurable improvements in quality of life in the long run. The efforts of this project, in combination with other sustained efforts in the long run, likely will translate to economic benefits for the community that reach beyond this project.

Timing and duration. The project would be conferring human capital benefits when the first cohort of new students begins training. These courses are offered in the off-season months of February-April. The first cohort would likely begin in February 2014, October 2014, or February 2015. To reduce the risk that we have overestimated this benefit, we assume the project would be conferring human capital benefits in 2015. The human capital benefits would last for each of the graduates' lifetimes.

Beneficiaries. The beneficiaries of this benefit are the 25 landscapers who participate in and graduate from the Monterey Bay Green Gardener Certification Program. Many of these beneficiaries will be underserved populations of English language learners.

Sources of uncertainty. Without detailed program evaluations of educational efforts, it is difficult to predict when particular benefits to education, outreach, and public engagement activities might emerge and what their impact might be. It likely will vary depending on the group of students, teachers, locations of projects, and other variables. However, past evaluation efforts from Green Gardener trainings suggest that people retain and implement the knowledge they gain, for at least several months beyond the trainings and workshops.

7. Improve water quality: **Reduced cost associated with regulated pollutants**

Underlying change. The project would improve water quality in the urban creeks of the Galiban watershed, Salinas River watershed, Carmel River watershed, and the coastal drainage watersheds of the Monterey Peninsula from Marina to Pacific Grove. The project would confer this benefit through three components: 1) directly through landscaping demonstration projects that enhance water quality, 2) indirectly through the application of skills graduates learn in the Program, and 3) indirectly through local residents who are inspired to use sustainable landscaping practices from the demonstration projects.

Though the demonstration stormwater management projects that maximize the landscaper's ability to filter and infiltrate stormwater, the project would marginally improve water quality in the study area. These demonstration sites would both reduce sediment, nutrients, and pesticides loads in stormwater and irrigation run-off from urban landscapes and may also inspire other residents, beyond the enrolled

landscapers, to think about sustainable landscape management practices and implement some of these strategies in their landscaping. This, in turn, would foster additional water quality benefits.

The project would also improve water quality to the extent that the attendees and graduates of the Program use the skills and knowledge from the course to improve water quality outcomes through sustainable landscaping practices (e.g., fertilization practices). There is compelling evidence that graduates of the Program will apply the skills and lessons they learn to their landscaping practices in ways that improve water quality. The recent evaluation of the 2010 and 2011 classes showed that participants significantly reduced their use of pesticides; 95 percent of graduates use *only* reduced-risk pesticides on the job. Graduates also significantly reduce their use of soluble nitrogen fertilizers; for example, 87 percent use only slow-release or natural fertilizers, preventing nutrient and nitrate/nitrite-related non-point source pollution from lawn fertilizers and weed and feed type products.

Evidence for demand and value. Groundwater and surface water in the Salinas River watershed face serious water quality issues. The Salinas River is one of the most polluted rivers in the state, impaired for a variety of contaminants. The Central Coast Regional Water Quality Control Board (CCRWQCB) has developed TMDLs for nutrients, fecal coliform, and agricultural chemicals. Stormwaer runoff is one of the sources of these pollutants. The Central Coast Water Board has found that water quality of stormwater discharges within the City of Salinas are impaired by nitrate/nitrite, ammonia, and pesticides. A leading contributor to the impairment of the middle Salinas river watershed is agricultural chemicals and pesticides.

To the extent that this project reduces the costs for downstream users, either by lowering the levels of pollutants they must address prior to using the water, or lowering the baseline load of pollutants dischargers must treat before discharging water back to the river, it would produce benefits. The project may also have cumulative effects, combined with other efforts to reduce pollutants, which may affect the overall regulatory framework and associated compliance costs for users of the Salinas River. The direct effect of the project's demonstration projects on pollutant reduction is small compared to the overall pollutant burden, but the broader aim of the program is to generate future behavior changes that would likely produce much larger effects on water quality.

Timing and duration. The project would be conferring water quality benefits when the first cohort of new students graduates, likely in April of 2014 or 2105. To reduce the risk that we have overestimated this benefit, we assume water quality benefits begin to accrue in 2015. The water quality benefits would likely last for the lifetime of the graduates' careers.

Beneficiaries. The beneficiaries of this benefit are the local residents and downstream users of each of the affected water bodies.

Sources of uncertainty. Our data on the outcomes of the program are based on a program evaluation that based its findings on self-reporting from graduates pre- and post-graduation from the Green Gardeners course. To the extent that the participants have an incentive to overestimate the extent to which they used lessons from the program to the survey administrators, these figures may be an overestimate of the true impact of the program. Even if we are comparing graduates to an appropriate baseline (non-graduates) there may be some sample selection bias; i.e., those landscapers who are already interested in sustainable landscaping may enroll in the Program.

9. Provide other environmental stewardship benefits: **Enhanced water supply for environmental and municipal purposes**

Underlying change. The demonstration projects would directly increase the water supply available for environmental and municipal purposes. We quantify the economic value of this benefit in the monetized benefit analysis below.

In addition to this quantifiable benefit, however, the project would have unquantifiable water supply benefits. For example, the demonstration project may also inspire other residents, beyond the enrolled landscapers, to think about water conservation through landscaping practices and implement some of these strategies in their landscaping. This, in turn, would create more water supply benefits.

The project would also increase downstream water supply for environmental and municipal purposes and groundwater supplies to the extent that the attendees and graduates of the Program use the skills and knowledge from the course to improve water supply outcomes through sustainable landscaping practices. For example, the course teaches graduates to implement efficient irrigation design and management, mulches and compost to build the water retention capacity of soil and to prevent erosion, drought-tolerant plant selection, greywater irrigation, rainwater harvesting, and sustainable hardscape techniques that slow, spread, and sink stormwater.

Evidence for demand and value. A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average leases rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water-quality and fish and other affected species.

Timing and duration. The project would be conferring water supply benefits when the first cohort of new students graduates, likely in April of 2014 or 2105. To reduce the risk that we have overestimated this benefit, we assume water supply benefits begin to accrue in 2015. The water supply benefits would likely last for the lifetime of the graduates' careers.

Beneficiaries. The beneficiaries of this benefit would include several groups of stakeholders including commercial fishermen and recreational anglers in both marine and freshwater fisheries, and the general public insofar as they value an increase in fish populations regardless of any potential future direct use or exposure to the impacted fish populations. It would also benefit other recreational users of water, such as kayakers and wildlife watchers, Californians who place a non-use value on maintaining sufficient instream flows for environmental purposes, and other water users, such as irrigators, who bear increased regulatory pressure and costs to increase instream flows by reducing their own use of water.

Sources of uncertainty. The value we derive from the data provided by WestWater Research, as presented in the findings of Aylward and Merrill (2012) embodies the uncertainty inherent in the individual study as well as from applying results from past research to future conditions. There is, however, no obvious reason to conclude that the estimate systematically overestimates the true marginal value of water for environmental purposes in Monterey. As human populations and incomes grow in California, the marginal value of wild salmonid populations and other benefits derived from instream flows for environmental purposes is likely to increase, as will the value of stream flows that support their continued existence. Because we found no reliable estimate of the rate of increase, we did not fold this increase into our estimates. For these reasons, it seems reasonable to conclude that the value estimates we apply in this analysis underestimate—perhaps substantially—the true value of future increases in water supplies that would result from the projects.

13. Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources

Underlying change. The project would promote energy savings to the extent that the attendees and graduates of the Program use the skills and knowledge from the course to protect air quality and reduce greenhouse gas (GHG) emissions. For example, the course teaches graduates to use manual and electric landscaping equipment and four-stroke motors that meet EPA standards.

Evidence for demand and economic value. The International Panel on Climate Change has identified anthropogenic GHG emissions as the main contributor of global warming and climate change. Carbon dioxide emissions have received the most attention as they account for the majority of these emissions – 77 percent in 2004 (IPCC 2007). Expected impacts of climate change include decreased ecosystem resilience, increased extinction rates, fluctuations in cropland productivity, increased erosion and flooding in coastal areas, and decreased availability of clean drinking water. These impacts could result in the displacement of hundreds of millions of people, increased morbidity, and irreversible damages to critical life-support systems within the environment (IPCC 2007).

Economists use the social cost of carbon to estimate the value of changes in GHG emissions. The social cost of carbon represents "the full global cost today of emitting an incremental unit of carbon at some point of time in the future, and it includes the sum of the global cost of the damage it imposes on the entire time it is in the atmosphere." (Shaw 2009) There are currently over 200 different estimates of the social cost of carbon. One review of the literature found values ranging from about $7 to $111 per ton of carbon dioxide equivalent ($2007) (Shaw 2009). Another analysis suggests increasing the social cost of carbon, in real terms, by 2–3 percent per year to reflect the rising damages from climate change (Nordhaus 2008).

California's cap-and-trade system for carbon provides one such estimate of the social cost of carbon. The cap-and-trade system, which took effect January 1, 2012, allots credits through auctions. The second such auction on February 19, 2013 elicited bids that ranged from $10.71-$50.01, with a mean and median price of $14.71 and $12.56, respectively (California Air Resources Board 2012). The cap-and-trade market, however, only applies to large producers of carbon and producers are allowed to offset up to 8 percent of carbon emissions.[10] Thus, while this range of costs for carbon is well within the broader range of costs, this market is not the appropriate mechanism for determining the cost of carbon beyond the cost for large producers.

It is impossible to quantify the reduction in carbon dioxide that would result from this project, but for the purposes of an illustration in this analysis, we use a middle value of $13 per ton of carbon dioxide equivalent sequestered to represent the social cost of carbon. Furthermore, we inflate this value by 2.5 percent per year, in real terms, to reflect the rising damages from climate change.

Timing and duration. The project would be conferring energy savings benefits when the first cohort of new students graduates, likely in April of 2014 or 2105. To reduce the risk that we have overestimated this benefit, we assume energy savings benefits begin to accrue in 2015. The energy savings benefits would likely last for the lifetime of the graduates' careers.

Beneficiaries. The beneficiaries of this benefit are all residents of California.

[10] These projects may currently include, and may only include forestry, urban forestry, dairy manure digesters, and the destruction of ozone depleting substances. California Environmental Protection Agency - Air Resources Board. Air Resources Board sets stage for carbon offset projects. December 14, 2012.

Sources of uncertainty. The project would result in energy savings and avoided carbon emissions to the extent that graduates of the Program use the skills learned in the course. If the true cost of carbon dioxide lies closer to the upper or lower end of the range we presented above, our unit value would represent an under or overestimate.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $6,574. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Enhanced human capital

Underlying change. The project would increase the number of landscapers enrolled in the Green Gardener Program by 25 students. The project would involve residents of Gonzales, Soledad, Greenfield, and King City and would provide additional bilingual courses in Spanish and English. These students would further enhance their skills and knowledge through hands-on experience of the demonstration projects, which would not be available without the project. Many of these participants would be English language learners who lack the skills to successfully attend community college classes in horticulture and, therefore, otherwise would not have had an opportunity to advance their training in the field.

Evidence for demand and value. Several state and federal agencies have determined this program is effective and provides sufficient social benefits for funding. These include a consortium of water utility, stormwater agencies, and the California Water Service Company. The Green Garden Certification program clearly has value beyond the $100 students pay to participate. One way to think about the full value of the program is the increased earning potential and career success Green Gardeners achieve by going through the program. Past graduates have go on earn a higher income and obtain promotions to foreman positions. Graduates of the Program are more likely to find and retain employment within the local landscaping industry than their non-certified peers.

These benefits are difficult to quantify and tie to this program specifically. One way to get at the value is to look at how the market values equivalent education programs. The estimated cost of a professional certificate in landscape architecture through the UC Berkeley Extension Program is $23,000 and includes 63 credits. Initial, renewing, and reciprocal license fees are each $400. The Green Gardener Certification is not a full licensing for landscape architecture, but it does provide a similar set of skills. We therefore use the cost of a renewing landscape architecture license ($400) as proxy for the market value of this education. Netting out the price students pay to participate, $100, the total benefit is $300 per student.

Timing and duration. The project would be conferring human capital benefits when the first cohort of new students begins training. These courses are offered in the off-season months of February-April and the first cohort would begin in February 2014, October 2014, or February 2015. To reduce the risk that we have overestimated this benefit, we assume the project would confer human capital benefits in 2015. The human capital benefits would last for each of the graduates' lifetimes.

Beneficiaries. The beneficiaries of this benefit are the 25 landscapers who participate in and graduate from the Monterey Bay Green Gardener Certification Program. Many of these beneficiaries will be underserved populations of English-language learners.

Sources of uncertainty. Sources of uncertainty lie in the extent to which the courses are effective at teaching bilingual students and each of their individual abilities to retain the knowledge from the Program and use their acquired skills. The economic value of the Green Garden program, translated into long-run

earning potential and success in career for some students may be much higher than the value indicated here.

2. Increased instream flows for environmental purposes

Underlying change. Through the demonstration projects, the projects would conserve a total of 144.51 HCF per year. It would conserve 98,526 gallons of water/year at two public demonstration sites by replacing 2,000 ft^2 of turf irrigated by fixed spray heads with drought tolerant landscaping irrigated by low volume irrigation. The projects would also conserve 8,826 gallons/year of greywater through recycling during the irrigation season at two residential greywater sites. The project would increase instream flows by a total of 0.33 acre-feet per year.

Evidence for demand and value. A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average lease rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water-quality and fish and other affected species. The annual, undiscounted value of this benefit is $42.

Timing and duration. The project would be conferring water supply benefits when the demonstration projects are complete, in 2015. The water supply benefits would likely last for the lifetime of the demonstration projects, 10 years.

Beneficiaries. The beneficiaries of this benefit would include several groups of stakeholders including commercial fishermen and recreational anglers in both marine and freshwater fisheries, and the general public insofar as they value an increase in fish populations regardless of any potential future direct use or exposure to the impacted fish populations. It would also benefit other recreational users of water, such as kayakers and wildlife watchers, Californians who place a non-use value on maintaining sufficient instream flows for environmental purposes, and other water users, such as irrigators, who bear increased regulatory pressure and costs to increase instream flows by reducing their own use of water.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of increased instream flows for environmental flows from the project would also affect the economic benefit described here. See Attachment 7 for a description of these biophysical sources of uncertainty.

The value we derive from the data provided by WestWater Research, as presented in the findings of Aylward and Merrill (2012) embody the uncertainty inherent in the individual study, as well as from applying results from past research to future conditions. There is, however, no obvious reason to conclude that the estimate systematically overestimates the true marginal value of water for environmental purposes. As human populations and incomes grow in California, the marginal value of wild salmonid populations and other benefits derived from instream flows for environmental purposes is likely to increase, as will the value of stream flows that support their continued existence. Because we found no reliable estimate of the rate of increase, we did not fold this increase into our estimates. For these reasons, it seems reasonable to conclude that the value estimates we apply in this analysis underestimate—perhaps substantially—the true value of future increases in water supplies that would result from the proposed projects.

Table 15 – Annual Benefit: Avoided costs associated with continuing education credits
(All benefits should be in 2012 dollars)

Project: Monterey Bay Green Gardener Training & Certification Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2012					0		$ -	1.000	$ -
2013					0		$ -	0.943	$ -
2014					0		$ -	0.890	$ -
2015	Enhanced human capital	Students	0	25	25	$ 300.00	$ 7,500.00	0.840	$ 6,297
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 6,297.14

Comments:

Table 15 – Annual Benefit: Increased instream flows for envirnmental purposes
(All benefits should be in 2012 dollars)

Project: Monterey Bay Green Gardener Training & Certification Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2012	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	1.000	$ -
2013	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.943	$ -
2014	Increased instream flows	Acre-feet	0	0	0	$ 128.00	$ -	0.890	$ -
2015	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.840	$ 35
2016	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.792	$ 33
2017	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.747	$ 32
2018	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.705	$ 30
2019	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.665	$ 28
2020	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.627	$ 27
2021	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.592	$ 25
2022	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.558	$ 24
2023	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.527	$ 22
2024	Increased instream flows	Acre-feet	0	0.33	0.33	$ 128.00	$ 42.24	0.497	$ 21
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 276.69

Comments:

Section D3. Project Cost

The present value of the project's costs, which would occur between 2013 and 2014, is $49,160 in 2013 dollars, discounted at a 6-percent annual rate. These costs would fund labor, planning, equipment, and materials necessary to implement the project.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Monterey Bay Green Gardener Training & Certification Program

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 12,197.00							$ 12,197	0.943	$ 11,507
2014	$ 42,307.00							$ 42,307	0.890	$ 37,653
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 49,160

Comments:

Project 7. Elkhorn Slough Foundation: Ridgeline to Tideline - Water Resource Conservation in Elkhorn Slough

Project Description

Conditions Without the Project

Elkhorn Slough is an estuarine watershed that lies in Monterey County. It supports a dozen rare, threatened or endangered species, as well as the largest tracts of tidal salt marsh. The North Marsh is a 196-acre branch of Elkhorn Slough with consistently poor water quality and reduced estuarine function. The existing culverts at North Marsh are severely undersized. During extreme high tide events, North Marsh can flood Elkhorn Road, a major county road. Seasonal high tides also affect the Union Pacific Railroad tracks that border the North Marsh, resulting in the periodic closure of the tracks. Historically, these events occurred approximately three times per year, although they have not occurred for a few years. Episodic heavy rains also affect nearby transportation corridors. During a rain event, water erodes the soil on steep slopes from farmland, depositing sediment across Elkhorn Road and downstream onto tidal and freshwater wetlands, delivering nutrients and pesticides as well. During some events, over a foot of sediment buries the road overnight. These conditions create periodic vehicle safety hazards on public roads, necessitating road cleanup expenses.

Decades of tidal restriction have degraded North Marsh's shallow, subtidal, intertidal mudflat and salt marsh habitats. This regime has led to higher mean water temperatures and extensive floating algal mats and hypoxic conditions more than 10 percent of the time. Low dissolved oxygen levels affect estuarine habitat, particularly invertebrates and fish. Minimal water exchange also leads to hypersaline conditions in summer months and hydrogen sulfate emissions and odors seasonally. Neighbors find these odors offensive. Mosquito breeding events in the Marsh are also exacerbated by poor water circulation.

Highlands South is adjacent to North Marsh, above the groundwater basin. The area includes two farmland properties that are chronic sources of Slough degradation. Agricultural fertilizer applications threaten the quality of the aquifer with nitrate pollution, while declining groundwater levels increase seawater intrusion. Groundwater pumping from the Highlands South and North aquifer, primarily for agriculture, is overdrafting this aquifer at a rate of 630 acre-feet per year. Groundwater depletion has resulted in the drying up of ecologically significant freshwater springs. Local residences are also dependent on the groundwater for drinking water.

Conditions With the Project

The project involves three major components. First, the project would improve water quality on 196 acres of tidal wetlands in North Marsh. The project would restore an upland buffer and increase tidal range and circulation in part of the Slough.

Second, the project would acquire the two farmland properties adjacent to North Marsh that are chronic sources of Slough degradation. The Elkhorn Slough Foundation and California Department of Fish and Wildlife would retire these 95 acres of farmland, eliminate groundwater use and fertilizer application on the properties, reduce erosion from the properties by recontouring and stabilizing their steep eroding slopes, and restore native vegetation on the land. The project would reduce groundwater extraction on these lands, improving water balance in the basin.

Third, the project would restore 7 acres of salt marsh in the Lower Slough. The project would also control invasive species, including eucalyptus and ice plants, on 2.5 additional acres. After removing the invasive plants, the project would involve habitat restoration, including coastal scalp, grass, and salt marsh.

Section D2. Non-Monetized Benefits Analysis

Table 12-7 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-7 – Non-monetized Benefits Checklist
Project 7. Elkhorn Slough Foundation: Ridgeline to Tideline - Water Resource Conservation in Elkhorn Slough

No.	*Will the proposal…*	*Response*
	Community/Social Benefits	
1	Provide education or technology benefits?	No
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts?	Yes
4	Promote social health and safety?	No
5	Have other social benefits?	No
	Environmental Stewardship Benefits	
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7? Passive-use values associated with increases in special-status species populations	Yes
7	Improve water quality in ways that were not quantified in Attachment 7? *Reduce cost and risk associated with groundwater contamination and Avoided costs associated with reducing regulated pollutants in surface water*	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
	Sustainability Benefits	
10	Improve the overall, long-term management of California groundwater resources?	Yes
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)? Avoided costs associated with reduced sedimentation on Elkhorn Road	Yes

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

6. Benefit wildlife or habitat: Passive-use values associated with increases in special-status species populations

Underlying change. Elkhorn Slough supports a dozen rare, threatened or endangered species. Under the current conditions, salt marsh degradation in Elkhorn Slough has reduced the viability of many of these species. In the 1980s, for instance, the Slough was associated with the local extirpation of the federally endangered California clapper rail. While unquantifiable, by restoring 7 acres of salt marsh habitat, this project may result in an incremental improvement in habitat for special-status species in the Slough. For example, researchers have documented that nearby salt marsh provides resting and foraging habitat for the federally threatened southern sea otter. Restoration of this habitat may benefit local populations of this species.

Evidence for demand and value. While we cannot quantify this benefit because we cannot estimate the change in populations of special-status species from the project, studies have shown that people have a positive willingness to pay for increases in the population of special-status species.

For example, several studies estimate households' willingness to pay for increases in the California sea otter. Hageman conducted a mail survey of California households regarding their willingness to pay for three population levels of sea otters with a sample size of 180. Hageman estimated the average household in California is willing to pay $13.71 per year for an increase in population of 1,500 otters (Hageman 1985). Similarly, Loomis and White use a meta willingness to pay function to estimate the marginal annual household WTP associated with an increase of 196 sea otters in California is $7.44 (Loomis and White 1996). Another study by John Loomis uses the results from both of these studies to suggest the total nonmarket value of an additional 196 sea otters to California lies between $4.4 and $34.2 million (Loomis 2006).

Timing and duration. The project would be providing salt marsh habitat as soon as restoration is complete, in the third year of the project's implementation, 2014. We assume the benefits related to increases in special-status species begin to accrue in that year. Assuming appropriate maintenance is performed to sustain operation as intended, the salt marsh would provide benefits throughout the project lifespan, 50 years.

Beneficiaries. The beneficiaries of this benefit are the people of California who value the continued existence of these special-status species.

Sources of uncertainty. The main source of uncertainty associated with this benefit is the extent to which the project would promote population growth of special-status species in Elkhorn Slough. There is also inherent uncertainty associated with any estimate of non-market values, particularly those using survey methods such as contingent valuation. To the extent that the underlying data minimize errors associated with interpretation, our confidence associated with the economic value of avoided mortality of these species is relatively high. These studies meet the traditional standards for performing reliable benefit transfer, i.e., the study site and original sites are the same (both are California households) and the original valuation study was carefully conducted with the use of sound techniques.

7. Improve water quality: **Reduce cost and risk associated with groundwater contamination and Avoided costs associated with reducing regulated pollutants in surface water**

Underlying change. The project would improve groundwater quality, which farms and residences in the region use for drinking, and improve surface water quality by reducing sediment deposition into the Elkhorn Slough watershed.

The estuarine habitat (CDFW's North Marsh), directly downhill from the farmland proposed for acquisition has been characterized as being hyper-eutrophic, due both to agricultural inputs and a highly muted tidal range (Hughes et al. 2011). Acquisition of the uphill farm and subsequent land use changes are anticipated to directly improve water quality in North Marsh. Research conducted in tidal wetlands adjacent to farmland acquired and managed by ESF has shown that ESF's land use practices can result in lower nutrients and improved water quality (Gee et al. 2010). These researchers, studying tidal wetlands immediately north of the proposed project site, documented average decreases of 50-70 percent in tidal water NO_3, NH_3, and PO_4 concentrations, compared to conditions before ESF acquired and managed the uphill farms. Requested funds will also provide project planning and environmental compliance for North Marsh improvements, bringing us several steps closer to increasing tidal range and flushing in this degraded wetland, addressing the other major factor in low water quality at that site.

Under the current conditions, sediment fans form in the Elkhorn Slough watershed as soil eroding from farms moves downslope, filling marshes, mudflats, and channels (Byrd and Kelly 2006). Since 1980, agricultural sediment from uphill farms has buried 2.5 acres of historical salt marsh in North Marsh, resulting in habitat conversion. With the project, acquisition and retirement of farmland will significantly reduce erosion and the agricultural stormwater runoff responsible for this deposition and loss of salt marsh. Project proponents estimate the project are unable to quantify the reduction in sediment as a result of the project, however.

Source of demand and value. There are significant economic benefits associated with improving groundwater quality. Some of these include better human health, passive-use value associated with environmental quality, and option value for future use. The economic literature suggests people are willing to pay both for clean groundwater now and the option to secure clean groundwater in the future. For example, Crutchfield et al. (1999) found survey respondents in Indiana, Nebraska, Susquehanna, and Washington would be willing to pay $62 to $83 per household per month to reduce the level of nitrates in their drinking water from exceeding EPA safety standards. Likewise, Sun et al. (1992) found the mean option price of groundwater pollution abatement in Southwest Georgia was between $679 and $1,227 per household.

Similarly, economic studies have examined and monetized some of the benefits that materialize when excessive sediment does not impair streams, rivers, estuaries, and the marine environment. A study conducted by the U.S. Department of Agriculture identified 13 types of benefits associated with decreasing sediment (Hansen and Ribaudo 2008). For each benefit, the researchers modeled the potential value associated with reducing sediment, per ton, for each county across the country. For our analysis, we apply the average value for the counties in the Salinas watershed, $9.89 per ton, to estimate the benefits derived from the prevention of sediment deposition.

Timing and duration. The project would begin conferring groundwater quality benefits as soon as acquisition of the agricultural properties is complete, in the third year of the project's implementation, 2014. We assume the benefits of the project begin accruing in that year. The project would provide these benefits throughout the project lifespan, 50 years.

Beneficiaries. The beneficiaries of this benefit are the current and future groundwater users in the area, as well as any Californians who value the protection of groundwater quality in the area now or in the future. To the extent that the project reduces sediment deposition downstream, as well, the beneficiaries also include a wide array of downstream users, including: the general public, municipal water treatment operators and their ratepayers, irrigators, recreationalists, downstream property owners, and fishermen.

Sources of uncertainty. There is uncertainty associated with the marginal economic value of use, passive use, and option value of protecting groundwater quality. The results from the studies listed above depend crucially on survey methodology and public perceptions on the current state of groundwater in the area. There is also inherent economic uncertainty associated with using benefit transfer to apply values derived from elsewhere in the United States to Californian's willingness to pay for protecting groundwater resources. Both studies were conducted outside of California, which may over or underestimate Californian's willingness to pay for protecting groundwater resources.

At least three major factors suggest that the value of sediment we use underestimates the true value of the sediment-reduction benefits. First, the value does not reflect many potential benefits, such as the goods and services derived from potential impacts on wetlands and endangered species. Second, the estimates of sediment erosion that the projects would reduce are based on current sediment erosion rates. Climate change is expected to increase the frequency and intensity of storm events, which would likely increase the rate of sediment erosion absent the proposed projects (Masden and Figdor 2007). If future sediment

erosion rates exceed current rates, the without-project sediment erosion is likely to increase, and thus, the expected benefit of each project's sediment control activities is likely to be an underestimate. Third, this estimate does not anticipate increases in value that occur over time. We anticipate that the value of sediment-reduction benefits will increase, relative to the general price index, but have not accounted for this increase in our calculations.

Finally, this value does not reflect the potential impacts on the habitat of the restored salt marsh and endangered species. To that extent, it may underestimate the total benefit from sediment reductions.

10. Improve the overall, long-term management of California's groundwater resources

For the reasons discussed in monetized benefit #3 (avoided costs associated with reduced groundwater extractions), below, and non-monetized benefit #7 (improve water quality), above, this project would improve the overall, long-term management of California's groundwater resources.

15. **Avoided costs associated with reduced sedimentation on Elkhorn Road**

Underlying change. During large storm events, erosion from the farmland uphill from North Marsh results in deposition of sediment on a 500-foot section of Elkhorn Road. The project would reduce erosion from farmland and reduce the risk of deposition on Elkhorn Road, which is maintained by Monterey County. Data are unavailable to estimate the project's effect on reducing the risk of closure or damage to Elkhorn Road.

Evidence for demand and value. Reduced risk of sediment erosion and deposition onto the county road would reduce the County's costs associated with emergency repair of the road, road closures, and public safety costs (e.g., law enforcement response to a closure or accident caused by the closure). In the case of road closures, the project would reduce costs associated with additional travel time travelers must use to circumnavigate the hazardous road. The County was unable to provide us with records of its costs to maintain Elkhorn Road, though anecdotal evidence suggests it has experienced closures before. FEMA estimates that the costs associated with a road closure that results in vehicle detours is about $38 per vehicle per hour (FEMA 2009). Additional mileage costs for wear and tear on the vehicle are $0.55 per mile. These illustrate the type and magnitude of costs that would be avoided if the project reduces the risk that Elkhorn Road would be closed. Data are insufficient, however, to value this benefit in monetary terms.

Timing and duration. The project would reduce erosion and sedimentation on Elkhorn Road as soon as recontouring and stabilization of the steep eroding slopes of the agricultural properties is complete, in 2014. We assume the benefits of the project begin accruing in that year. The would provide these benefits throughout the project lifespan, 50 years.

Beneficiaries. The beneficiaries of this benefit are the nearby residents who experience increased travel time as a result of occasional road closures and the taxpayers of Monterey County, which performs emergency repair of Elkhorn Road.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $480,960. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Passive-use value associated with increases in salt marsh habitat

Underlying change. The project would restore 2.5 acres of salt marsh-to-upland ecotone/buffer by removing invasive species, including eucalyptus and iceplant. Exotic plants are a significant stressor in Elkhorn Slough's marsh-to-upland ecotone (Wasson and Woolfolk 2011), but research completed by Elkhorn Slough National Estuarine Research Reserve (ESNERR) staff has demonstrated that the removal of iceplant can result in the recolonization of native high marsh plants and native grasses (Woolfolk, Wasson, and D'Amore 2009). The project would also use imported sediment from a Pajaro River flood control project to raise wetland elevations and restore 7 acres of historical salt marsh in the Lower Slough. We assume the existing habitat provides about 50 percent functionality, so the project would increase the functionality to 100 percent over time as the restoration matures.

Source of demand and value. Since data are insufficient to delineate specific impacts of the project's restoration efforts on the ecosystem services provided by this area of salt marsh, we use passive use values for our estimates (Kazmierczak 2001). A recent study summarizes the results of eight peer-reviewed studies, reporting 24 separate estimates for the disaggregated value of habitat and species protection services provided by coastal wetlands. The researcher found a typical acre of coastal zone wetland in the contiguous United States provides $222 to $403 in annual passive-use value benefits per year (Kazmierczak 2001).

Given the cultural and ecological importance of coastal zone wetlands Monterey County, it is appropriate to use the upper end of this range. For our analysis, we use a passive use value of $403 per acre of salt marsh habitat per year to estimate the value of the benefits attributable restoration. This passive use value estimates how much society would be willing to pay for the habitat solely for its existence, aside from any benefits received directly or indirectly from the habitat's function. This results in a yearly undiscounted value of $2,821.

Timing and duration. The project would be providing salt marsh habitat as soon as restoration is complete, in 2014. To reduce the risk that we have overestimated this benefit we assume these benefits would begin to accrue in 2015. We assume the benefits of the project begin accruing in that year, with 50 percent functionality, and would increase to 100 percent functionality over a period of 15 years. Assuming appropriate maintenance is performed to sustain operation as intended, the salt marsh would provide benefits throughout the project lifespan, 50 years.

Beneficiaries. Nearby residents and the people of California who value the existence of salt marsh habitat in the state.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of the acres of salt marsh created would also affect the economic benefit estimate described here. See Attachment 7 for a description of these biophysical sources of uncertainty. Applying a value derived from studies conducted elsewhere in the United States may over or underestimate the total economic value of increases in certain types of habitat. The value described above estimates society's willingness to pay for a fully-restored acre of salt marsh habitat in the United States. This value is generally applicable to salt marsh habitat in California.

By only considering passive use, we likely underestimate the total value of the benefits derived from salt marsh restoration because this value ignores direct users of restored habitat that are likely willing to pay more for its restoration. This value also may underestimate the total value to the extent that it does not account for potential increases in the biodiversity of habitat adjacent to the restored area. Moreover, as human populations and incomes in California grow, the marginal value of natural landscapes will increase, as will the value of restoration.

2. Avoided costs associated with increased carbon sequestration

Underlying change. Salt marshes sequester carbon at a higher rate than most other ecosystems. Central California salt marshes sequester carbon at a rate of approximately 111 g C^{m-2} $year^{-1}$. This project, with 7 acres of salt marsh restoration, will contribute to additional carbon sequestration, preventing additional carbon dioxide from entering the atmosphere. Project proponents estimate the restored salt marsh would sequester an additional 3,144,297 g C $year^{-1}$ or 11.5 metric tons of CO_2e per year.

Source of economic value. The International Panel on Climate Change has identified anthropogenic greenhouse gas emissions as the main contributor of global warming and climate change. Carbon dioxide emissions have received the most attention as they account for the majority of these emissions–77 percent in 2004 (IPCC 2007). Expected impacts of climate change include decreased ecosystem resilience, increased extinction rates, fluctuations in cropland productivity, increased erosion and flooding in coastal areas, and decreased availability of clean drinking water. These impacts could result in the displacement of hundreds of millions of people, increased morbidity, and irreversible damages to critical life-support systems within the environment (IPCC 2007).

Economists use the social cost of carbon to estimate the value of changes in GHG emissions. The social cost of carbon represents "the full global cost today of emitting an incremental unit of carbon at some point of time in the future, and it includes the sum of the global cost of the damage it imposes on the entire time it is in the atmosphere." (Shaw 2009) There are currently over 200 different estimates of the social cost of carbon. One review of the literature found values ranging from about $7 to $111 per ton of carbon dioxide equivalent ($2007) (Shaw 2009). Another analysis suggests increasing the social cost of carbon, in real terms, by 2–3 percent per year to reflect the rising damages from climate change (Nordhaus 2008).

California's cap-and-trade system for carbon provides one such estimate of the social cost of carbon. The cap-and-trade system, which took effect January 1, 2012, allots credits through auctions. The second such auction on February 19, 2013 elicited bids that ranged from $10.71-$50.01, with a mean and median price of $14.71 and $12.56, respectively (California Air Resources Board 2012). The cap-and-trade market, however, only applies to large producers of carbon and producers are allowed to offset up to 8 percent of carbon emissions.[11] Thus, while this range of costs for carbon is well within the broader range of costs, this market is not the appropriate mechanism for determining the cost of carbon beyond the cost for large producers.

For this analysis, we use a value of $13 per ton of carbon dioxide equivalent sequestered to represent the social cost of carbon. Furthermore, we inflate this value by 2.5 percent per year, in real terms, to reflect the rising damages from climate change. The annual, undiscounted value of this benefit is therefore $157, increasing at a real rate of 2.5 percent per year.

Timing and duration. The project would be providing carbon sequestration benefits as soon as restoration is complete, in the third year of the project's implementation, 2014. We assume the benefits of the project begin accruing in that year. Assuming appropriate maintenance is performed to sustain operation as intended, the salt marsh would provide benefits throughout the project lifespan, 50 years.

Beneficiaries. The beneficiaries of this benefit are all residents of California.

[11] These projects may currently include, and may only include forestry, urban forestry, dairy manure digesters, and the destruction of ozone depleting substances. California Environmental Protection Agency - Air Resources Board. Air Resources Board sets stage for carbon offset projects. December 14, 2012.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of increased carbon dioxide sequestered would also affect the economic benefit estimate described here. See Attachment 7 for a full description of these biophysical sources of uncertainty. If the true cost of carbon dioxide lies closer to the upper or lower end of the range we presented above, our unit value would represent an under or overestimate.

3. Avoided costs associated with reduced groundwater withdrawals

Underlying change. By changing management of the upland agricultural properties adjoining the North Marsh, the project would reduce groundwater extractions by 230 acre-feet per year.

Evidence of Demand and value. Groundwater pumping from the Highlands South and North aquifer, primarily for agriculture, is overdrafting this aquifer at a rate of 630 acre-feet per year. Groundwater depletion has resulted in the drying up of ecologically significant freshwater springs. Local residences are also dependent on the groundwater for drinking water. Without imported water and/or a willingness of landowners to voluntarily cut water use, overdraft may eventually result in a loss of productive farmlands and sensitive freshwater habitat in the Elkhorn Slough watershed (Scharffenberger 1999).

Economists who study the economic importance of groundwater describe this importance using two major categories of value: extractive values and *in situ* values (CVG 1997). The major extractive values include the economic importance of groundwater consumption by municipalities, business and industry, and agricultural producers. Groundwater aquifers offer significant advantages over surface storage for consumptive uses including: no costs for storage facility, no loss through evaporation, and groundwater also protect water quality at no or little cost relative to surface storage. Another advantage of groundwater aquifers is their capacity to distribute water over long distances at little to no cost. Constructing pipe systems on the surface is much more expensive than relying on an existing aquifer for water movement.

In situ values derive from the services that groundwater provides in place, rather than through consumptive use. *In situ* values include:

- Buffer values—given that supplies of surface water can fluctuate, groundwater supplies can help smooth out, or buffer, variability in water supplies in cases where water districts manage groundwater conjunctively with surface water. One study found that the buffer capacity of groundwater can represent over 80 percent of the total value of surface and groundwater (CVG 1997, page 60.).

- Environmental values—groundwater can help assimilate harmful pollutants. These assimilative properties help avoid filtration and related costs that water users would otherwise face. Groundwater also often supports surface water flows and riparian and wetland ecosystems during parts of the year.

- Subsidence-avoidance values—the structural services that groundwater provides *in situ* help avoid ground subsidence and related damages to roads, pipeline, foundations and other structures and infrastructure. One way of describing the associated economic values is the avoided costs of subsidence damage.

There are very few economic analyses valuing the above non-market benefits of groundwater in California. Given the lack of information and the likelihood of a connection between groundwater and surface water in this region, we use a value of instream flows for this benefit.

A recent study that included information on the lease rates paid for water rights in the Central Valley found that the average lease rate for instream flows environmental purposes between 2000 and 2009 was $128 per acre foot (*WestWater Research in* Aylward and Merrill 2012). We use this value to measure the value of additional water for in-stream flows to enhance ecosystems, water-quality and fish and other affected species. Using this value, the annual value of avoiding 230 acre-feet per year of diverted surface flows is $29,440 per year.

Timing and duration. The project would reduce groundwater withdrawals as soon as acquisition of the agricultural properties is complete, in 2014. We assume the benefits of the project begin accruing in that year. The project would provide these benefits throughout the project lifespan, 50 years.

Beneficiaries. We assume the nearby residents and other agricultural groundwater users who use the Highlands South and North aquifer are the primary beneficiaries.

Sources of uncertainty. All sources of uncertainty surrounding the estimate of avoided groundwater withdrawals from the project would also affect the economic benefit described here. See Attachment 7 for a description of these biophysical sources of uncertainty.

Our value of this benefit is somewhat uncertain because we are applying a value that was derived from water leases for ensuring environmental streamflows. The interconnection between surface and groundwater suggests that this value may serve as an appropriate proxy for the environmental value of groundwater *in situ*, if not an underestimate because it does not account for the substantial benefits associated with avoiding saline intrusion and subsidence. The value of groundwater is highly dependent on local conditions. If water continues to become scarcer in California with climate change, and if demand for water continues to increase (both likely scenarios), the value of groundwater will likely increase in real terms. If so, this value presented here may underestimate the true value of groundwater over the next 50 years.

Table 15-1 – Annual Benefit: Passive-use value associated with increases in salt marsh habitat

(All benefits should be in 2012 dollars)

Project: Ridgeline to Tideline: Water Resource Conservation in Elkhorn Slough

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value [1] (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2012	Increased salt marsh habitat	Acres	0	0	0	$ 403	$ -	1.000	$ -
2013	Increased salt marsh habitat	Acres	0	0	0	$ 403	$ -	0.943	$ -
2014	Increased salt marsh habitat	Acres	0	0	0	$ 403	$ -	0.890	$ -
2015	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.840	$ 2,369
2016	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.792	$ 2,234
2017	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.747	$ 2,108
2018	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.705	$ 1,989
2019	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.665	$ 1,876
2020	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.627	$ 1,770
2021	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.592	$ 1,670
2022	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.558	$ 1,575
2023	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.527	$ 1,486
2024	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.497	$ 1,402
2025	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.469	$ 1,323
2026	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.442	$ 1,248
2027	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.417	$ 1,177
2028	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.394	$ 1,110
2029	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.371	$ 1,048
2030	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.350	$ 988
2031	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.331	$ 932
2032	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.312	$ 880
2033	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.294	$ 830
2034	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.278	$ 783
2035	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.262	$ 739
2036	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.247	$ 697
2037	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.233	$ 657
2038	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.220	$ 620
2039	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.207	$ 585
2040	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.196	$ 552
2041	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.185	$ 521
2042	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.174	$ 491
2043	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.164	$ 463
2044	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.155	$ 437
2045	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.146	$ 412
2046	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.138	$ 389
2047	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.130	$ 367
2048	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.123	$ 346
2049	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.116	$ 327
2050	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.109	$ 308
2051	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.103	$ 291
2052	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.097	$ 274
2053	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.092	$ 259
2054	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.087	$ 244
2055	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.082	$ 230
2056	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.077	$ 217
2057	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.073	$ 205
2058	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.069	$ 193
2059	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.065	$ 182
2060	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.061	$ 172
2061	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.058	$ 162
2062	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.054	$ 153
2063	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.051	$ 144
2064	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.048	$ 136
2065	Increased salt marsh habitat	Acres	0	7	7	$ 403	$ 2,821	0.046	$ 129
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 39,702

Comments:

Table 15-2 – Annual Benefit: Avoided costs associated with increased carbon sequestration

(All benefits should be in 2012 dollars)

Project: Ridgeline to Tideline: Water Resource Conservation in Elkhorn Slough

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) - (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012	Increased carbon sequestration	Metric tons C02E	0	0	0	$ 13.00	$ -	1.000	$ -
2013	Increased carbon sequestration	Metric tons C02E	0	0	0	$ 13.33	$ -	0.943	$ -
2014	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 13.66	$ 157.07	0.890	$ 140
2015	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 14.00	$ 161.00	0.840	$ 135
2016	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 14.35	$ 165.02	0.792	$ 131
2017	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 14.71	$ 169.15	0.747	$ 126
2018	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 15.08	$ 173.37	0.705	$ 122
2019	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 15.45	$ 177.71	0.665	$ 118
2020	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 15.84	$ 182.15	0.627	$ 114
2021	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 16.24	$ 186.71	0.592	$ 111
2022	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 16.64	$ 191.37	0.558	$ 107
2023	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 17.06	$ 196.16	0.527	$ 103
2024	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 17.48	$ 201.06	0.497	$ 100
2025	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 17.92	$ 206.09	0.469	$ 97
2026	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 18.37	$ 211.24	0.442	$ 93
2027	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 18.83	$ 216.52	0.417	$ 90
2028	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 19.30	$ 221.93	0.394	$ 87
2029	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 19.78	$ 227.48	0.371	$ 84
2030	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 20.28	$ 233.17	0.350	$ 82
2031	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 20.78	$ 239.00	0.331	$ 79
2032	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 21.30	$ 244.97	0.312	$ 76
2033	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 21.83	$ 251.10	0.294	$ 74
2034	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 22.38	$ 257.37	0.278	$ 71
2035	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 22.94	$ 263.81	0.262	$ 69
2036	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 23.51	$ 270.40	0.247	$ 67
2037	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 24.10	$ 277.16	0.233	$ 65
2038	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 24.70	$ 284.09	0.220	$ 62
2039	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 25.32	$ 291.20	0.207	$ 60
2040	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 25.95	$ 298.48	0.196	$ 58
2041	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 26.60	$ 305.94	0.185	$ 56
2042	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 27.27	$ 313.59	0.174	$ 55
2043	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 27.95	$ 321.43	0.164	$ 53
2044	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 28.65	$ 329.46	0.155	$ 51
2045	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 29.37	$ 337.70	0.146	$ 49
2046	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 30.10	$ 346.14	0.138	$ 48
2047	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 30.85	$ 354.79	0.130	$ 46
2048	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 31.62	$ 363.66	0.123	$ 45
2049	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 32.41	$ 372.76	0.116	$ 43
2050	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 33.22	$ 382.07	0.109	$ 42
2051	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 34.05	$ 391.63	0.103	$ 40
2052	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 34.91	$ 401.42	0.097	$ 39
2053	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 35.78	$ 411.45	0.092	$ 38
2054	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 36.67	$ 421.74	0.087	$ 36
2055	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 37.59	$ 432.28	0.082	$ 35
2056	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 38.53	$ 443.09	0.077	$ 34
2057	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 39.49	$ 454.17	0.073	$ 33
2058	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 40.48	$ 465.52	0.069	$ 32
2059	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 41.49	$ 477.16	0.065	$ 31
2060	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 42.53	$ 489.09	0.061	$ 30
2061	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 43.59	$ 501.31	0.058	$ 29
2062	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 44.68	$ 513.85	0.054	$ 28
2063	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 45.80	$ 526.69	0.051	$ 27
2064	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 46.94	$ 539.86	0.048	$ 26
2065	Increased carbon sequestration	Metric tons C02E	0	11.5	11.5	$ 48.12	$ 553.36	0.046	$ 25
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 3,495

Comments:

Table 15-3 – Annual Benefit: Avoided costs associated with reduced groundwater withdrawals

(All benefits should be in 2012 dollars)

Project: Ridgeline to Tideline: Water Resource Conservation in Elkhorn Slough

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value [1]	Annual $ Value [1] (f) x (g)	Discount Factor [1]	Discounted Benefits [1] (h) x (i)
2012	Reduced groundwater withdrawals	Acre-feet	0	0	0	128	0	1.000	$ -
2013	Reduced groundwater withdrawals	Acre-feet	0	0	0	128	0	0.943	$ -
2014	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.890	$ 26,201
2015	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.840	$ 24,718
2016	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.792	$ 23,319
2017	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.747	$ 21,999
2018	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.705	$ 20,754
2019	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.665	$ 19,579
2020	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.627	$ 18,471
2021	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.592	$ 17,425
2022	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.558	$ 16,439
2023	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.527	$ 15,509
2024	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.497	$ 14,631
2025	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.469	$ 13,803
2026	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.442	$ 13,021
2027	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.417	$ 12,284
2028	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.394	$ 11,589
2029	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.371	$ 10,933
2030	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.350	$ 10,314
2031	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.331	$ 9,730
2032	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.312	$ 9,180
2033	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.294	$ 8,660
2034	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.278	$ 8,170
2035	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.262	$ 7,707
2036	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.247	$ 7,271
2037	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.233	$ 6,859
2038	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.220	$ 6,471
2039	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.207	$ 6,105
2040	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.196	$ 5,759
2041	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.185	$ 5,433
2042	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.174	$ 5,126
2043	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.164	$ 4,836
2044	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.155	$ 4,562
2045	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.146	$ 4,304
2046	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.138	$ 4,060
2047	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.130	$ 3,830
2048	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.123	$ 3,613
2049	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.116	$ 3,409
2050	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.109	$ 3,216
2051	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.103	$ 3,034
2052	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.097	$ 2,862
2053	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.092	$ 2,700
2054	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.087	$ 2,547
2055	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.082	$ 2,403
2056	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.077	$ 2,267
2057	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.073	$ 2,139
2058	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.069	$ 2,018
2059	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.065	$ 1,904
2060	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.061	$ 1,796
2061	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.058	$ 1,694
2062	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.054	$ 1,598
2063	Reduced groundwater withdrawals	Acre-feet	0	230	230	128	29440	0.051	$ 1,508
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 437,763

Comments:

Section D3. Project Cost

The present value of the project's costs, which would occur between 2012 and 2016, is $4,635,303 in 2013 dollars, discounted at a 6-percent annual rate.[12] These costs would fund labor, planning, equipment, and materials necessary to implement the project.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Ridgeline to Tideline: Water Resource Conservation in Elkhorn Slough

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ 2,697,604.00							$ 2,697,604	1.000	$ 2,697,604
2013	$ 1,503,775.00							$ 1,503,775	0.943	$ 1,418,656
2014	$ 569,847.00							$ 569,847	0.890	$ 507,162
2015								$ -	0.840	$ -
2016	$ 15,000.00							$ 15,000	0.792	$ 11,881
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 4,635,303

Comments:

[12] We have distributed the costs outlined Table 7 across the project's implementation period based on the expected timing and phasing described in the Work Plan. Actual distribution of costs during this period may differ somewhat.

Project 8. Central Coast Wetlands Group: Deployment of the Greater Monterey County Regional Water Quality Monitoring Network

Project Description

Conditions Without the Project

Waterbodies in the lower Salinas Valley are heavily polluted. A recent synthesis, assessment, and management project showed there are 99 threatened or impaired water bodies distributed throughout the Central Coast and relatively high proportions of those occur in the Salinas sub-basin (Conley, Hoover, and DeBeukelaer 2008).

The Greater Monterey IRWM Plan currently does not have robust monitoring systems in place to document improvements in water quality resulting from regional water quality enhancement efforts. The IRWM Plan does have the Land/Ocean Biogeochemical Observatory (LOBO) buoy monitoring array in place at the end of the Gabilan/Old Salinas River and within the Elkhorn receiving waters, but does not have the funds to manage or run the system.

Moreover, current monitoring programs can only provide a snapshot of water quality impairments at infrequent intervals, which provides insufficient data to establish accurate baselines of water quality on a regional scale or to understand the long-term impact of existing or future restoration projects. Without a well-established baseline, it is nearly impossible for the Greater Monterey County Regional Water Management Group, and other water managers in the region, to track the impact of projects on a regional level and to determine which projects are creating impacts and the degree of their effectiveness.

As a result, the Monterey County region may continue to receive funding for projects aiming to improve water quality in the region, but the results of those projects and their impacts will remain speculative, at best. The Greater Monterey County Regional Water Management Group will be unable to efficiently and effectively select future promising projects based on the success of similar projects in the past, or discard those projects that did not have their intended benefits. Compounding the urgency for better data, there is a newly instituted TMDL in the Salinas watershed for nutrients. Without the proposed project, State regulators and other land managers will have difficulty understanding the effects of existing and future projects toward meeting water quality limits, or to adapt management decisions based on their effectiveness.

Conditions With the Project

The project would provide the Greater Monterey County Region with the necessary funds to manage the existing LOBO system and analyze the data it generates. It would also allow the Region to expand the coverage of the continuous monitoring of the LOBO buoy monitoring array from the current location to an additional priority coastal confluence location that drains significant portions of the Salinas Valley, the Moro Cojo Slough.

The LOBO system would use high-tech probes to monitor water quality on several parameters on an hourly basis. These include physical parameters such as temperature, depth, salinity, current profiler, and turbidity; chemical parameters including chromophoric dissolved oxygen matter, nitrate, and dissolved oxygen; and biological parameters, including chlorophyll fluorescence with options for additional ancillary pigments. In addition to the new LOBO, the project would fund portable water quality monitoring systems that could provide data for other points within the watershed, as needed to inform specific questions, projects, or decisions.

The project would support a part-time staff and research assistant who would compile the LOBO data, analyze the results, communicate them to decision-makers and other interested stakeholders, and make

policy recommendations to the Central Coast RWQCB. This new management process would allow the Greater Monterey County Regional Water Manager Group and other water managers in the region to use the LOBO data to inform decision-making processes on water management within Monterey County, a variety of cities, and within the jurisdiction of the Monterey County Water Resources Agency.

Section D2. Non-Monetized Benefits Analysis

Table 12-8 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

Table 12-8 – Non-monetized Benefits Checklist
Project 8. Central Coast Wetlands Group:
Deployment of the Greater Monterey County Regional Water Quality Monitoring Network

No.	*Will the proposal…*	*Response*
	Community/Social Benefits	
1	Provide education or technology benefits? Better water-quality information for decision making	Yes
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts? Better data to support evidence-based decision making	Yes
4	Promote social health and safety?	No
5	Have other social benefits?	No
	Environmental Stewardship Benefits	
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7? Provide information to help reduce costs to regulate pollutants	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
	Sustainability Benefits	
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one? Better data to support long range planning and decision making	Yes
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Provide education or technology benefits Better water-quality information for decision making

Underlying change. The Monterrey Bay Sanctuary 2008 SAM Report identified the limitations of current monitoring efforts in the Salinas watershed. It calculated that load reductions would need to exceed 20 percent of current concentrations before the monitoring system would be able to distinguish any change in water quality. The project would provide the Greater Monterey County Region with higher-resolution data on the baseline conditions of current loads; reductions in loads; and results of the cumulative efforts of agencies, organizations, and individuals to enhance surface water quality.

Evidence for demand and value. By providing monitoring data on water quality for the Greater Monterey County IRWM Plan, the project would support and enhance the effectiveness of present and future projects addressing water quality issues in the region (we address this benefit in greater detail in benefit #7, *improve water quality*, below). These benefits may extend beyond the economic value of improved water quality. For example, by providing data on pollutants and salinity, the project would improve the effectiveness of projects addressing water quality for environmental uses, which in turn would create a higher marginal benefit for salmonids, tidewater gobies, and other brackish water species. It would also allow managers to select projects that provide greater water quality benefits at lower cost, increasing the overall economic efficiency of efforts to improve water quality.

The project would also provide monitoring data on flows. These data would support efforts to optimize conveyance modeling; develop watershed process models for use in managing water supply under changing climatic conditions; and determine discharge volumes that could be addressed through conservation. These increases in available data would create benefits insofar as they improve the efficiency and outcomes of projects that address water supply reliability.

It is impossible to quantify the value of this project in monetary terms, but the support and enthusiasm for this project among resource managers and cooperative agencies suggests the demand for these data are considerable and they would be put to use to improve management decisions. The extent to which they result in tangible economic benefits by reducing costs of future projects, generating greater levels of environmental benefits, or both depends on what the data reveal, how well they are communicated to people who can use the information, and how the decision makers translate the data into better water management decisions.

Timing and duration. The project would begin conferring benefits after implementation activities are complete and staff begin processing data in May of 2014. The benefits from the project would increase over time with increased data and as decision makers use the data to make better-informed decisions and design more efficient future projects. The lifespan of the buoys and other monitoring equipment is 10-15 years, funding for staff to analyze and communicate the data generated by the equipment would only last for three years. If additional funds are found to extend these positions in the future, the project would continue conferring benefits. To avoid the risk of overestimating the benefits, we assume the project would generate these benefits for three years.

Beneficiaries. The beneficiaries of this benefit are the decision-makers on the city, state and regional levels who could make better decisions as a result of improved information and, to the extent that these decisions affect outcomes, tax and ratepayers of various organizations required to fund water quality and water supply mitigation projects. Beneficiaries would also include Californians who support science-based decision making and efficient use of public funds.

Sources of uncertainty. The main sources of uncertainly lie in the extent to which these data are used to inform and enhance decision making and future water supply and quality projects.

3. Help avoid, reduce or resolve various public water resources conflicts **Better data to support evidence-based decision making**

Underlying change. Water conflicts occur when groups of people or institutions believe that they are unfairly denied water resources to meet felt needs or wants (Gasteyer 2009). The risk of water conflicts will increase in Monterey County with climate change, and growing demands on water supplies arising from an expected 14 percent increase in population by 2030 (California Department of Finance 2013). These forces will place pressure on the future allocation of scarce water resources and the quality of those

water supplies in the region. Inevitably, these dynamics will lead to and worsen existing conflicts in the county.

Researchers with the U.S. Department of the Interior, Bureau of Reclamation published a report identifying future areas of concern for water quality issues, water shortages, and potential conflicts (Clark et al 2008). In the report, they identify watersheds in and around Monterey County as impaired with "more serious water quality problems." Monterey County will not be immune to the potential water resource conflicts that will arise over these current and future water quality issues.

Evidence for demand and value. Water resource experts agree that part of the solution to avoiding future conflicts is better water management based on a thorough understanding of basin-specific problems (U.S. Department of the Interior 2003). They also agree that crisis management is not "an effective solution for addressing long-term systematic water supply problems" and that, rather, local and regional communities can minimize or avoid conflict when they address potential water supply crises well in advance. We address this benefit in greater detail, in *benefit #12 provide a long-term solution in place of a short-term one*.

The project would accomplish these ends, better water management and identification of potential crises, with a data system that would foster a better understanding of basin-specific problems. Employing a part time staff and student would allow the Greater Monterey County Regional Water Management Group to not only collect and analyze the results of improved data on the basin, but also make policy recommendations to the Central Coast RWQCB. This would create a positive feedback loop, creating a flexible system that will allow the Regional Water Management Group and other water managers in the region to identify and address water quality problems before they arise.

It is impossible to quantify the value of avoided future water resources conflicts, but this does not mean the value is zero. Water conflicts can range from political decisions made without consensus to competition between water users; from hostility to litigation. Each of these actions carries its own expense—from the stakeholders' opportunity costs of time to the often substantial legal fees associated with litigation. While we cannot predict the future water conflicts in Monterey County, nor the portion of those conflicts the project would avoid, we can assert that improved data and knowledge of the regional water supply would form part of the solution to avoiding future water resources conflicts in the region.

Timing and duration. The project would begin conferring benefits after implementation activities are complete and staff begin processing data in May of 2014. The benefits from the project would increase over time with increased data and as decision makers use the data to make better-informed decisions and design more efficient future projects. The lifespan of the buoys and other monitoring equipment is 10-15 years, funding for staff to analyze and communicate the data generated by the equipment would only last for three years. If additional funds are found to extend these positions in the future, the project would continue conferring benefits. To avoid the risk of overestimating the benefits, we assume the project would generate these benefits for three years.

Beneficiaries. The beneficiaries of this benefit are the stakeholders who will avoid conflicts as a result of the better water management decisions on the city, state and regional levels. To the extent that these avoided conflicts also avoid costs for a broader group of citizens and taxpayers, this benefit may also improve the well-being of a broad group of Californians, generally.

Sources of uncertainty. There is substantial uncertainty associated with this benefit. The main sources of uncertainly lie in the extent to which these data are used to inform and enhance future water supply and water quality projects and, in turn, the extent to which these projects avoid future or current water resource conflicts.

7. Improve water quality **Provide information to help reduce costs to regulate pollutants**

Underlying change. The Central Coast Wetlands Group is strategically placing the LOBOs at each end of particularly impaired drainages that represent the focus points of restoration work in the region. Researchers will use the mobile nutrient probe to track changes in water quality at various locations, moving it to monitor the baseline for several future IRWM Plan projects.

As a result of this better data collection, this project would directly improve water quality outcomes of future water quality projects in the region. In particular, the project would feed into better decision-making and management for the Conditional Waiver of Waste Discharge Requirements for Agricultural Wastewater Discharges; the Lower Salinas River Watershed Nutrient TMDL; and the Joint Effort for LID and Hydromodication Control.

Evidence for demand and value. A recent report assessing water quality data in the Central Coast identifies adequate detection of changes over time in water quality conditions as an information gap that impairs better water management in the region. The report recommends that agencies maintain commitments to sustain long-term monitoring stations; encourage flow measurement as a regular part of water quality monitoring; and allocate sufficient resources to data analysis (Conley, Hoover, and DeBeukelaer 2008). The benefits to water quality in the region of better decision making are likely substantial.

Timing and duration. The project would begin conferring benefits after implementation activities are complete and staff begin processing data in May of 2014. The benefits from the project would increase over time with increased data and as decision makers use the data to make better-informed decisions and design more efficient future projects. The lifespan of the buoys and other monitoring equipment is 10-15 years, funding for staff to analyze and communicate the data generated by the equipment would only last for three years. If additional funds are found to extend these positions in the future, the project would continue conferring benefits. To avoid the risk of overestimating the benefits, we assume the project would generate these benefits for three years.

Beneficiaries. The beneficiaries of this benefit are water users in the basin and downstream who would experience reduced costs or higher-quality ecosystem goods and services from improved water quality.

Sources of uncertainty. There is substantial uncertainty associated with this benefit. The main sources of uncertainly lie in the extent to which these data are used to inform and enhance future projects that address water quality in the basin and the extent to which the data from this project improves the efficiency and effectiveness of those projects.

12. Provide a long-term solution in place of a short-term one: **Better data to support long range planning and decision making**

Underlying change. The project would provide the Central Coast Wetlands Group with the necessary funds to begin managing and running the LOBO system, using high-tech probes to monitor water quality on several parameters on an hourly basis. Under current conditions the Greater Monterey County region does not have robust monitoring systems in place to document trends in water quality resulting from regional water quality enhancement efforts.

Evidence for demand and value. Without time-series, high-resolution data regarding water quality parameters in critical water bodies in Monterey County, decision making within the County tend to be inherently reactive rather than proactive. The project would put an effective data system in place to measure important indicators of water quality, allowing decision makers to respond nimbly to changing

dynamics as they present themselves, rather than after the fact. Moreover, the system would allow decision makers to assess the effectiveness of future and current programs and projects that address water quality in Monterey County as changes occur. All of these changes provide a long-term, sustainable system for addressing challenges and solutions as they arise.

Timing and duration. The project would begin conferring benefits after implementation activities are complete and staff begin processing data in May of 2014. The benefits from the project would increase over time with increased data and as decision makers use the data to make better-informed decisions and design more efficient future projects. The lifespan of the buoys and other monitoring equipment is 10-15 years, funding for staff to analyze and communicate the data generated by the equipment would only last for three years. If additional funds are found to extend these positions in the future, the project would continue conferring benefits. To avoid the risk of overestimating the benefits, we assume the project would generate these benefits for three years.

Beneficiaries. The beneficiaries of this benefit are the stakeholders and decision makers who will benefit from improved decision making on the city, state and regional levels. To the extent that these decisions also avoid costs for a broader group of citizens and taxpayers, this benefit may also improve the well-being of a broad group of Californians, generally.

Sources of uncertainty. There is uncertainty associated with this benefit. The main source of uncertainly lies in the extent to which these data are used to inform and enhance future projects that address water quality in the basin and the extent to which the data from this project improves the efficiency and effectiveness of those projects.

Section D3. Monetized Benefits Analysis

The benefits this project would produce are not monetizable given available physical and economic data.

Section D3. Project Cost

The present value of the project's costs, which would occur between 2013 and 2014, is $783,721 in 2013 dollars, discounted at a 6-percent annual rate. These costs would fund labor, planning, equipment, and materials necessary to implement the project.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Expansion of a Coastal Confluence Water Monitoring System to Support the Greater Monterey IRWMP

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 56,251.00							$ 56,251	0.943	$ 53,067
2014	$ 820,963.00							$ 820,963	0.890	$ 730,654
2015								$ -	0.840	$ -
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 783,721
Comments:										

Project 9. Save Our Shores: Watershed Protection Program - Annual Coastal Cleanup Day in Monterey County

Project Description

Conditions Without the Project
Save Our Shores coordinates the Annual Coastal Cleanup (ACC) Day in Santa Cruz and has done so since 2007. California State Parks was running an ACC in Monterey since 2001, but as of 2009, no longer had the staff or resources to continue running the event. In 2010 Save Our Shores began operating ACC in Monterey County, increasing the number of volunteers from its 1,400 average to 2,000 in two years. Save Our Shores expects to be able to continue these activities with community support.

Beach pollution is a problem in Monterey County. The data from Ocean Conservancy's International Coastal Cleanup Day indicate that approximately 60 to 80 percent of marine debris originates from land sources (Stevens 2011). It washes into waterways through storm drains, then travels through the watershed, ending up on beaches. Some of the trash also washes onto beaches from the ocean, or is left on the beach by litterers.

Monterey Bay has the largest Marine Sanctuary in the nation, and marine debris threatens the health of its many diverse marine species. For example, endangered turtles in the Monterey Bay National Marine Sanctuary can mistake plastic bags for jellyfish and die from suffocation. Trash also impairs fish passage in Monterey County rivers, causing habitat impairment for the federally threatened steelhead trout. Much of this trash is plastic and cigarette butts, which also contain chemicals that are particularly toxic for aquatic and marine life.

With Project Description
The proposed project would fund the expanded operations of the ACC for three years of cleanups. Funding for the project would allow Save Our Shores to host and educate an additional 400 volunteers, cleanup an additional 7 sites, and collect an additional 3,521[13] pounds of trash for each of the beach cleanups between 2014 and 2016 (personal communication with B. Hunt, Save Our Shores).

Section D2. Non-Monetized Benefits Analysis

Table 12-9 identifies the non-monetized benefits the Project would likely generate. We describe benefits marked with a "yes" response below the table, organized in order by their number in the table.

[13] *Estimated using the average pounds of trash collected per site (503) from the 2012 ACC Monterey Beach cleanup.*

Table 12-9 – Non-monetized Benefits Checklist **Project 9. Save Our Shores: Watershed Protection Program** **Annual Coastal Cleanup Day in Monterey County**		
No.	*Will the proposal…*	*Response*
Community/Social Benefits		
1	Provide education or technology benefits? Increased awareness of problems and solutions for beach debris	Yes
2	Provide social recreation or access benefits? Enhanced quality of experience for beachgoers	Yes
3	Help avoid, reduce or resolve various public water resources conflicts?	No
4	Promote social health and safety? Enhance social capital	Yes
5	Have other social benefits?	No
Environmental Stewardship Benefits		
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7? *Passive-use values associated with avoided mortality of special-status species*	Yes
7	Improve water quality in ways that were not quantified in Attachment 7?	No
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
Sustainability Benefits		
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	No
15	Other (If the above listed categories do not apply, provide non-monetized benefit description)?	No

Notes: [1] A "no" response may mean the project does not produce this benefit, or it may mean the benefit is already quantified in Attachment 7, or monetized directly under Section D3 below.

1. Provide education or technology benefits Increased awareness of problems and solutions for beach debris

Underlying change. On ACC day at each of the project's sites, the 400 volunteers would hear a safety talk and an explanation of the problem of beach debris. Leading up to the event, the publicity and outreach materials may also raise the public's awareness of the marine debris issue.

Evidence for demand and value. These outreach and education activities would increase the volunteers' and the publics' awareness of the issues surrounding marine debris, which may influence their future behavior. For example, a volunteer who attends a beach cleanup may be more likely to pick up trash on their next beach visit, even if the visit was not related to a formal cleanup. Another volunteer may be less likely to litter, or encourage others to pick up their trash. To the extent that the project increases this type of knowledge that influences behavior, the project confers an education benefit that could indirectly reduce future beach debris.

Studies of marine debris cleanup in Asia have concluded that education is a significant way to improve behavior in the long term and there is a need for increased community understanding and awareness of the marine debris issue (McIlgorm, Campbell, and Rule 2008; Ohkura and Kojima 2006).

Timing and duration. The project would begin conferring human capital benefits as Save Our Shores disseminates information. The greatest concentration in these benefits will occur when the volunteers participate in the ACC over the seven additional site cleanups, which will take place between June 1st and October 31st of 2014, 2015, and 2016. These benefits would persist for the lifetimes of the volunteers, site captains, and other residents who are educated through the educational outreach materials.

Beneficiaries. The beneficiaries of this benefit are the volunteers, site captains, and other residents and visitors who are educated through the educational outreach materials.

Sources of uncertainty. The value of the benefit will depend on the extent to which the volunteers and other beneficiaries gain a better understanding of the issue and apply their knowledge to future actions.

2. Provide social recreation or access benefits **Enhanced quality of experience for beachgoers**

Underlying change. Marine debris such as ropes, plastics, and derelict fishing gear, as well as trash and pollution on beaches and the coastline negatively impacts the aesthetic value of those areas to tourist and resident visitors. By reducing the amount of waste in Monterey County, the project may improve the recreational experiences of beachgoers in the weeks after the cleanup events.

Evidence for demand and value. Monterey County has 99 miles of coastline, much of which is used for beach recreation including surfing, diving, bird watching, fishing, swimming, kayaking, and picnicking. Many of these beaches are public access and visitors to the beaches enjoy a sizeable consumer surplus associated with their amenities. To the extent that the beach trash detracts from this consumer surplus—and the project restores it—this project would increase the value of recreation in Monterey County beaches for visitors. While this would generate a direct economic benefit for beachgoers, it can also affect willingness of tourists to spend time and money visiting that beach, leading visitors to visit cleaner beaches or to forgo their visits altogether (McIlgorm, Campbell, and Rule 2008). This leads to an additional economic loss of consumer surplus to those visitors in the form of increased travel time or expenses.

Timing and duration. The project would confer this benefit for at least one month after each of the seven additional ACC site cleanups, which will take place between June 1st and October 31st of 2014, 2015, and 2016.

Beneficiaries. The beneficiaries of this benefit are the tourist and resident visitors to the project cleanup sites at Monterey Beaches, after each of the additional ACC events funded by the project.

Sources of uncertainty. The value associated with this benefit depends on the extent to which the project would marginally improve the recreational experiences of beachgoers in the weeks after the cleanup and avoid economic costs associated with lost consumer surplus from recreation activities. On a large scale these impacts may be unlikely, but the project may produce large benefits on a small, localized scale, particularly on short-time horizons.

4. Promote social health and safety **Enhance social capital**

Underlying change. The project would bring hundreds of like-minded volunteers together for a day dedicated to a common cause.

Evidence for demand and value. In doing this, the project may strengthen social capital of the local communities whose members participate in the ACC event. Volunteering provides individuals with the opportunities to increase the size of their personal networks, to increase trust in their existing networks,

and to enable access to new resources from expanding and strengthening networks (Schneider 2004). Many of the volunteers who participate in the ACC event spend time together before and after the event, reinforcing the idea that this event, in particular, will confer a social capital benefit (personal communication with B. Hunt, Save our Shores).

Timing and duration. The greatest concentration in these benefits would occur when the volunteers participate in the ACC event over the seven additional site clean ups, which will take place between June 1st and October 31st of 2014, 2015, and 2016. These benefits would persist as long as the volunteers maintain benefits from the social connections and cohesion they gained during the event, up to the lifetimes of the volunteers and site captains.

Beneficiaries. The beneficiaries of this benefit are the 400 additional volunteers who participate in the ACC event as a result of the project, the seven site captains, as well as the surrounding community which benefits from increase social cohesion, and expanded social networks.

Sources of uncertainty. The value of the benefit will depend on the extent to which the volunteers use the event to increase the size of their personal networks, to increase trust in their existing networks, and to access new resources.

6. Benefit wildlife or habitat **Passive-use values associated with avoided mortality of special-status species**

Underlying change. Marine waste increases the mortality rates for several marine species in Monterey County coastal waters through ingestion and entanglement, including sea turtles and seabirds. A meta-analysis of entanglement records along central California and the northwest coast of the United States found that between 2001 and 2005 there were 454 documented entanglements, encompassing 31 bird species, nine marine mammal species, and one leatherback turtle (Stevens 2011). Similarly, a recent study analyzed the stomach contents of 141 fish from 27 species in the North Pacific Subtropical Gyre and found that 9.2 percent of the fish had ingested plastic particles. In the project area, residents have captured photographs of sea otter pups entangled in plastic bags.

By reducing the amount of marine waste in Monterey County available for animals to ingest or become entangled, the project would result in a reduction in the deaths of several types of marine and aquatic species. Some of these avoided deaths may include endangered and special-status species, such as the four species of turtles and the California sea otter which habitat the Monterey Bay National Marine Sanctuary.

Evidence for demand and value. While we cannot quantify this benefit because we cannot estimate the change in populations of special-status species from the project, studies have shown that people have a positive willingness to pay for increases in the populations of special-status species and protection of the wellbeing of individuals of the population.

Several studies estimate households' willingness to pay for increases in California sea otters. Hageman conducted a mail survey of California households regarding their willingness to pay for three population levels of sea otters with a sample size of 180. Hageman estimated the average household in California is willing to pay $13.71 per year for an increase in population of 1,500 otters (Hageman 1985). Similarly, Loomis and White use a META willingness to pay function to estimate the marginal annual household WTP associated with an increase of 196 sea otters in California is $7.44 (Loomis and White 1996). Another study by John Loomis uses the results from both of these studies to suggest the total nonmarket value of an additional 196 sea otters to California lies between $4.4 and $34.2 million (Loomis 2006).

Timing and duration. The project would confer this benefit for at least one month after each of the seven additional site cleanups, which will take place between June 1st and October 31st of 2014, 2015, and 2016.

Beneficiaries. The beneficiaries of this benefit are the people of California who value the continued existence of these special-status species.

Sources of uncertainty. The main source of uncertainty associated with this benefit is the extent to which the project would prevent the mortality or morbidity (and potential future mortality) of one or more special-status species in Monterey County. There is inherent uncertainty associated with any estimate of non-market values, particularly those using survey methods such as contingent valuation. To the extent that the underlying data minimize errors associated with interpretation, our confidence associated with the economic value of avoided mortality of these species is relatively high. These studies meet the traditional standards for performing reliable benefit transfer, i.e., the study site and original sites are the same (both are California households) and the original valuation study was carefully conducted with the use of sound techniques.

Section D3. Monetized Benefits Analysis

The present value of the monetized benefits in 2012 dollars, discounted annually at 6 percent over the relevant lifespan of each component of the project (described below), is $21,182. The calculations for each monetized benefit are shown in Tables 15 at the end of this section.

1. Enhanced and increased recreational opportunities

Underlying change. The project would increase and enhance recreational opportunities by providing an opportunity for 400 volunteers to experience an additional beach day. Similar to other beach trips, a volunteer day with the ACC involves a walk on the beach and beach amenities, including views.

Evidence for demand and value. While we are unable to find studies that have estimated the net economic value participants place on a day of beach clean up, we can estimate the value of recreational opportunities from the ACC events from the value of a day at the beach or the value of a day spent hiking. For the purposes of this analysis, we define a beach day as a beach trip taken by an individual for any amount of time for up to a full day. Since each volunteer will spend at least an hour at the beach for cleanup, and many stay after the cleanup to enjoy the beaches' recreational amenities, we find this definition appropriate for our estimates.

The literature uses two methods to estimate the consumer surplus value of a beach day: the travel cost method and contingent valuation. Leeworthy and Wiley (1993) estimate the consumer surplus associated with beach recreation in three Southern California beaches ranges from $15.11 to $272.12 per person, per day depending on the site and assumptions about the opportunity cost of travel time (Leeworthy and Wiley 1993). Similarly Lew (2002) estimates the value of a beach day visit to a San Diego beach is $82.29 (Lew 2002) and Hanemann (1997) estimates the value of consumer surplus associated with a day at Huntington Beach is $21.46 (Hanemann 1997).[14] This value is comparable to the Loomis (2006) value of a recreational day of hiking in the Pacific region, $28.[15]

[14] Hanemann, M.W. 1997. "Final conclusions of Professor Michael Hanemann regarding lost recreational damages resulting from the *American Trader* Oil Spill." Report submitted to the State of California Attorney General's Office.

[15]

We use the Hanemann (1997) value of $21 per beach day to represent the consumer surplus associated with the beach clean up. We apply this value to the number of volunteers that would participate in the ACC events as a result of this project to estimate the annualized, undiscounted value of this benefit at $8,400.

Timing and duration. The project would confer this benefit during on the days of the seven additional site clean ups, which will take place between June 1st and October 31st of 2014, 2015, and 2016. We assume the value of this benefit occurs in those years.

Beneficiaries. The beneficiaries of this benefit are the 400 additional volunteers who participate in the ACC events as a result of the project.

Sources of uncertainty. The economic value calculated above assumes each of these volunteers would not have visited the beach without the project. To the extent that volunteers substitute a cleanup with ACC for a beach day they would have taken otherwise, the estimate above may represent an overestimate. The value above, however, does not consider those volunteers who visit the Monterey Countyt beaches again as a result of their participation in the ACC event. By participating in the ACC event, volunteers may visit new beaches or discover beach amenities they would not have in the absence of the project. These volunteers may choose to visit these beaches again, garnering additional consumer surplus, which we do not include in our calculation.

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)

Project: Save Our Shores Watershed Protection Program - Annual Coastal Cleanup Day in Monterey County

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012					0		$ -	1.000	$ -
2013					0		$ -	0.943	$ -
2014	Additional beach day	1 day	0	400	400	$ 21.00	$ 8,400.00	0.890	$ 7,476
2015	Additional beach day	1 day	0	400	400	$ 21.00	$ 8,400.00	0.840	$ 7,053
2016	Additional beach day	1 day	0	400	400	$ 21.00	$ 8,400.00	0.792	$ 6,654
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 21,182.36

Comments:

Section D3. Project Cost

The present value of the project's costs, which would occur between 2013 and 2016, is $50,423 in 2012 dollars, discounted at a 6-percent annual rate. These costs would fund labor, planning, equipment, and materials necessary to implement the project.

The project would involve approximately 400 volunteers' time, each engaging in at least one hour of cleanup. Since this labor does not involve any special skills, we value its cost with California's minimum wage, which is $8.00 per hour as of January 1, 2013 (U.S. Department of Labor 2013). The undiscounted annual cost of volunteer labor is $3,200.

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Save Our Shores Watershed Protection Program - Annual Coastal Cleanup Day in Monterey County

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								$ -	1.000	$ -
2013	$ 4,800							$ 4,800	0.943	$ 4,528
2014	$ 15,200			$ 3,200				$ 18,400	0.890	$ 16,376
2015	$ 15,200			$ 3,200				$ 18,400	0.840	$ 15,449
2016	$ 15,200			$ 3,200				$ 18,400	0.792	$ 14,575
								Total Present Value of Disccunted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$ 50,928

Comments:

Summary

Table 20, on the following page, summarizes the benefits and costs of the nine projects included in the Proposition 84, Round 2 Greater Monterey County IRWM proposal package. Each row shows, for each project, the total present value of the monetizable project costs, total present value of the monetizable project benefits, and summarizes the non-monetizable benefits. For the project we evaluated using the cost-effectiveness methodology, we summarize the conclusion of that analysis in the table.

The monetary and non-monetizable benefits of these projects should be considered together to understand the full set of benefits each project would generate. This is particularly important for this set of projects, many of which produced low levels of benefits that we were able to monetize relative to costs. This arises for several reasons:

- Many of the projects are designed to test new techniques or demonstrate proof-of-concept for larger efforts. These projects may have lower monetizable benefits (especially compared to their costs) because they are small in scale. These projects likely have non-monetary benefits that would reach well beyond their direct effects, because they would lay the necessary groundwork and generate momentum for future efforts that would yield high levels of benefits.
- Quite a few projects involve actions that focus primarily on increasing the skills and knowledge—building human and social capital resources, in economic terms—of the region's farmers, landscapers, and citizens. These investments in human and social capital are difficult to quantify in monetary terms, but research indicates that, in many cases, providing people with knowledge can yield dividends well beyond the limited lifespan of a particular project.
- Many of the projects involve restoring the region's natural capital, which would provide ecosystem goods and services that people care about and value, especially over the long-term. The monetized benefits that accrue well into the future are heavily discounted in this analysis, at a discount rate that is higher than is often recommended as appropriate for adjusting ecological benefits for social time-preference (EPA 2010).

Moreover, our monetary estimates of environmental benefits likely underestimate the true value insofar as the studies on which we base the estimates have examined the value of specific ecosystem goods and services in isolation, overlooking the cumulative value provided to human society by the ecosystem as a whole. Both ecologists and economists have recognized the importance of the integrated, composite workings of ecosystems, but both disciplines have yet to develop reliable techniques for describing, let alone measuring their value (Millennium Ecosystem Assessment 2005). In effect, then, our estimates give only a partial view of the total value of improvements in environmental quality.

To further buttress our belief that our non-market estimates of value probably underestimate the true value of the potential benefits from protecting and enhancing the environment, we turn to the National Research Council's review of methods for valuing the goods and services produced by water-related ecosystems. Based on its assessment, the report concluded,

> "**There is a much greater danger of underestimating the value of ecosystem goods and services than over-estimating their value**. Under-estimation stems primarily from the failure to include in the value estimates all of the affected goods and services and/or all of the sources of value, or from use of a valuation method that provides only a lower bound estimate of value. In many cases, this reflects the limitations of the available valuation methods. Over-estimation, on the other hand, can stem from double-counting or from possible biases in valuation methods. However, it is likely that in most applications the errors from omission of relevant components of value will exceed the errors from

over-estimation of the components that are included (National Research Council 2004, p. 242)."

We believe this conclusion applies across each of the projects: the likelihood that we have underestimated the benefits of the projects is far greater than the likelihood that we have overestimated them.

Table 20 – Proposal Benefits and Costs Summary Proposal: Greater Monterey County IRWM			
Project and Project Proponent	**Total Present Value Monetized Costs**	**Total Present Value Monetized Benefits**	**Non-Monetized Benefits Summary**
County of Monterey: San Lucas Water District Public Water Supply Project	$2,505,667	$1,536,561	3. Help avoid, reduce or resolve various public water resources conflicts? Reduce contact between agricultural activities and drinking water resources 4. Promote social health and safety? Reduce risk of health effects from exposure to nitrate-contaminated drinking water 12. Provide a long-term solution in place of a short-term one? Replace a long-standing Do-Not-Drink Order with a functioning, safe water supply 14. Improve water supply reliability in ways not quantified in Attachment 7? *Enhance the reliability and resiliency of the water system during emergencies by maintaining a backup system*
Pajaro/Sunny Mesa Community Services District: Springfield Water Project	$634,572	Project is cost-effective compared to alternatives	
City of Salinas and Monterey Regional Water Pollution Control Agency: Dry Weather Runoff Diversion Program	$717,495	$58,251	1. Provide education or technology benefits? Data collection and analysis to inform future planning 7. Improve water quality in ways that were not quantified in Attachment 7? Avoided costs from reducing regulated pollutants 10. Improve the overall, long-term management of California groundwater resources? Reduce demands for water from saltwater-intruded aquifer 12. Provide a long-term solution in place of a short-term one? Capture and treat polluted stormwater runoff to satisfy beneficial uses
Resource Conservation District of Monterey County: Salinas River Watershed Invasive Non-Native Plant Control and Restoration Program	$1,660,332	$11,867,218	1. Provide education or technology benefits? Enhanced human and social capital 3. Help avoid, reduce or resolve various public water resources conflicts? Separate actions to remove *Arundo* from other, more controversial channel modification activities 6. Benefit wildlife or habitat in ways that were not quantified in Attachment 7? Passive-use value associated with increases in steelhead populations 7. Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4? Avoided costs associated with reduced likelihood and intensity of fire 12. Provide a long-term solution in place of a short-term one? Reduced costs and protection of investments in restoration from watershed-based approach to eradication 15. Other (If the above listed categories do not apply, provide non-monetized benefit description)? Avoided costs associated with reduced flood damage
Resource Conservation District of Monterey County: Monterey County Farm Water Quality Assistance Program	$723,261	$136,379	1. Provide education or technology benefits? Enhance human capital 2. Help avoid, reduce or resolve various public water resources conflicts? Assistance to understand and comply with regulatory requirements 7. Improve water quality in ways that were not quantified in Attachment 7?: Reduce costs associated with regulated pollutants 10. Improve the overall, long-term management of California groundwater resources?

Table 20 – Proposal Benefits and Costs Summary Proposal: Greater Monterey County IRWM			
Project and Project Proponent	**Total Present Value Monetized Costs**	**Total Present Value Monetized Benefits**	**Non-Monetized Benefits Summary**
Ecology Action: Monterey Bay Green Gardener Training and Certification Program	$49,160	$6,574	1. Provide education or technology benefits? Enhanced human capital, especially for Spanish speakers 7. Improve water quality in ways that were not quantified in Attachment 7? Reduced cost associated with regulated pollutants 9. Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4? Enhanced water supply for environmental and municipal purposes 13. Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?
Elkhorn Slough Foundation: Ridgeline to Tideline – Water Resource Conservation in Elkhorn Slough	$4,635,303	$480,960	3. Help avoid, reduce or resolve various public water resources conflicts? Enhanced social capital 6. Benefit wildlife or habitat in ways that were not quantified in Attachment 7? Passive-use values associated with increases in special-status species populations 10. Improve the overall, long-term management of California groundwater resources? 15. Other (If the above listed categories do not apply, provide non-monetized benefit description)? Avoided costs associated with reduced sedimentation on Elkhorn Road
Central Coast Wetlands Group: Deployment of the Greater Monterey County Regional Water Quality Monitoring Program	$783,721	N/A	1. Provide education or technology benefits? Better water-quality information for decision making 3. Help avoid, reduce or resolve various public water resources conflicts? Better data to support evidence-based decision making 7. Improve water quality in ways that were not quantified in Attachment 7? Provide information to help reduce costs to regulate pollutants 12. Provide a long-term solution in place of a short-term one? Better data to support long range planning and decision making
Save Our Shores: Watershed Protection Program – Annual Coastal Cleanup Day in Monterey County	$50,928	$21,182	1. Provide education or technology benefits? Increased awareness of problems and solutions for beach debris 2. Provide social recreation or access benefits? Enhanced quality of experience for beachgoers 4. Promote social health and safety? Enhance social capital 6. Benefit wildlife or habitat in ways that were not quantified in Attachment 7? *Passive-use values associated with avoided mortality of special-status species*

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