Chapter 8 Implementation Costs and Funding Sources

[*Note to Reviewers:* *This chapter ultimately will address both estimated BDCP implementation costs and sources of funding. This draft provides descriptions of the assumptions used to develop cost estimates for implementing the various BDCP conservation measures and program administration. These estimates are based on the description of conservation measures contained in Chapter 3, Conservation Strategy. As these measures are still under review and discussion, they will likely be modified or may be deleted from the final plan, and final cost estimates for the plan will be adjusted accordingly. Costs for many of the conservation measures have not been estimated at this time as there is a need for additional specific cost information or the measures are not sufficiently defined to develop a cost estimate. Section 8.5 "Funding Sources and Assurances" will not be prepared until the total cost estimate is complete, and hence funding needs can be ascertained and a funding plan developed. It should be emphasized that the PREs have not committed to pay for any BDCP costs beyond the conveyance component, and substantial public and other sources of funding are expected to be provided in support of plan implementation.*]

8.1 Introduction

This chapter provides a planning-level estimate of the cost to implement the Bay Delta Conservation Plan (BDCP) over the proposed 50-year implementation period. It also describes the funding sources, mechanisms, and assurances for implementing the plan. [***Note to Reviewers****: Funding sources and assurances are not provided in this draft of the chapter*.]

8.1.1 Purpose and Scope of Cost Analysis

The ESA and NCCPA require that the funding necessary for implementing a HCP/NCCP be identified by the permit applicants. To determine the amount of funding needed an accounting of the expected costs for implementation is necessary. The BDCP implementation cost analysis provides planning-level cost estimates to implement the entirety of the Plan. The estimates address costs for the following components of the Plan:

- **Water Facilities Construction and Operations**, which consist of new water conveyance and other water management facilities both within and around the Delta and improvements in the operational parameters associated with existing and new facilities, as described in Chapter 3, *Conservation Strategy*.

- **Physical Habitat Restoration**, which includes restoration of 65,000 acres of tidal wetland and associated estuarine habitat; restoration of 5,000 acres of riparian habitat; restoration of 10,000 acres of floodplain habitat; enhancement of 20 linear miles of channel margin habitat; protection of XX acres of existing and restoration of XX acres of non-tidal wetlands; and protection of XX acres of existing terrestrial habitats, as described in Chapter 3, *Conservation Strategy*. [***Note to Reviewers:*** *the amount of*

terrestrial habitat and non-tidal wetlands habitat to be protected and restored has not yet been determined.]

- **Measures to Address Other Stressors**, which consist of conservation measures to reduce the direct and indirect adverse impacts of various stressors on the ecological functions of the Delta, covered species, and natural communities, including toxic contaminants and other water quality issues, non-native species, harvest and hatcheries, non-Project diversion entrainment, predators, and impediments to migration. Costs were estimated for each of the conservation measures addressing other stressors described in Chapter 3, *Conservation Strategy*.

- **Program Administration**, which consists of employees, facilities, equipment, vehicles, contracted services, and related overhead and associated expenses required to administer the BDCP over the 50-year permit period, as described in Chapter 8, *Implementation Structure*.

- **Monitoring and Adaptive Management**, which include on-going costs for monitoring, research, data management and analysis, and adaptive management activities, as described in Chapter 3, *Conservation Strategy*.

- **Remedial Measures**, which address expected costs to implement remedial measures in response to changed circumstances set forth in Chapter 6, *Implementation Plan*.

The cost analysis estimates both total and net costs of the BDCP. Total costs are the sum of costs for all Plan components expected to be incurred over the 50-year permit period. Net costs recognize that some of these costs would be incurred even if the Plan were not put into operation.

The cost analysis only addresses the anticipated financial costs of implementing the BDCP over the 50-year period. It does not address any potential socio-economic impacts of the Plan. Potential socio-economic impacts of the BDCP are in the BDCP EIR/EIS. [**Note to Reviewers**: This socio-economic analysis has not yet been conducted by the EIR/EIS team]

8.1.2 Purpose and Scope of Funding Analysis

[***Note to Reviewers:*** *This subsection will be added once the funding plan has been completed.*]

8.1.3 Organization of Chapter

This chapter is organized into four main parts. Section 8.2 sets forth the methodology, data, and assumptions used to develop planning-level cost estimates for BDCP implementation. Section 8.3 provides tables summarizing the resulting overall cost estimate. Section 8.4 provides the analysis of net costs of the BDCP. Section 8.5 addresses funding sources and assurances. Appendix XX provides additional details supporting the cost estimates presented in this chapter.

8.2 Cost Estimation Methodology

The BDCP cost analysis required many assumptions to be made regarding how the Plan would eventually develop and the likely costs for many items. This section describes these Plan

implementation and cost assumptions and explains how they were applied to estimate costs for each component of the Plan. Different costing approaches were taken for different Plan components, depending on data availability, level of detail required, and degree of uncertainty associated with the specific conservation measure. The approach taken for each component is described in the following subsections, as well as the sources for data and other information used for the analysis.

8.2.1 Common Assumptions

Some assumptions were commonly applied to all cost estimates. These common assumptions were as follows.

Costing Periods

All cost estimates are summarized by 5-year periods, commencing with Year 0 at BDCP authorization/permitting and ending at Year 50 with the end of the permit period. For cost estimating purposes the first 5-year period was identified as period 2011 to 2015 and the last 5-year period as the period 2056 to 2060. Initial startup costs are assumed to be incurred in 2010. Every cost element included in the analysis has a temporal dimension indicating the cost period in which it is expected to be incurred.

Financial Assumptions

All costs are reported in 2009 dollars. Historical costs were converted to 2009 dollars using one of the following price indices: (1) consumer price index, (2) producer price index, or (3) various US Army Corps of Engineers (USACE) civil works construction cost indices (CWCCIS).

A nominal discount rate of 4.375 percent was used to estimate nominal borrowing costs for present value and amortization calculations. This rate is equal to the FY 2010 rate to be used by USACE and US Bureau of Reclamation (USBR) for water project plan formulation and evaluation.[1]

A long-term rate of inflation of 2.1 percent was used for converting between future real and nominal costs over the planning period, and for calculating the real (inflation adjusted) discount rate. The rate is equal to the difference between the nominal and real interest rate on Treasury notes and bonds with 30-year maturities, as published in Appendix C of Office of Management and Budget (OMB) Circular No. A-94 (revised January 2008).

Land Acquisition Transaction Costs

Fee-simple purchases of land for physical habitat restoration and water facilities construction were assumed to entail transactional costs in addition to the purchase price of the land. Land acquisition transaction costs are divided into two components: (1) costs of due diligence, and (2) costs for pre-acquisition surveys. The common assumptions used for computing due diligence and pre-acquisition survey costs are set forth in Tables 8.1 and 8.2, respectively. The cost assumptions are the same as those contained in the Santa Clara Valley HCP/NCCP, Working

[1] The published rate of 4.0% (rounded) does not include any adjustment that may be needed to show the maximum rate of change of ¼ of one percent per year. The FY 2009 rate was 4.625%, hence the adjusted FY 2010 rate cannot be less than 4.375%.

Draft, dated June 2009[2]. Transactional costs are based on the average parcel size and boundary length computed for each BDCP Restoration Opportunity Area (ROA).

Table 8.1. Land Acquisition Due Diligence Cost Assumptions

Due Diligence Multiplier*	1.25
Appraisal Cost ($/Parcel)	$5,200
Preliminary Title Report ($/Parcel)	$520
Phase 1 Site Assessment ($/Parcel)	$6,760
Legal Description ($/Parcel)	$4,264
Boundary Survey ($/Linear Foot of Boundary)	$0.47
Monumentation ($/Linear Foot of Boundary)	$0.36
Note: * Applied to the number of acquired parcels to account for the number of parcels considered for purchase but ultimately not purchased.	

Table 8.2. Pre-Acquisition Survey Cost Assumptions

Survey Multiplier*	1.25
Land cover type survey (hrs/100 acres)	12
Covered species habitat survey (hrs/100 acres)	16
Covered plant habitat survey (hrs/100 acres)	32
Covered wildlife survey (hrs/100 acres)	28
Contractor Cost ($/hr)	$128
Note: * Applied to the number of acquired acres to account for the number of acres surveyed for purchase but ultimately not purchased.	

Delta Land Values

[*Note to Reviewers:* *Common assumptions for land acquisition costs are in development and will be provided in a future draft of this chapter. Land acquisition costs are a key component to many of conservation measure implementation costs estimates.*]

Table 8.3. Delta Land Value Assumptions

[*TABLE 8.3 TO BE INSERTED HERE WHEN COSTS BECOME AVAILABLE*]

Employee Salary Costs

Many of the BDCP conservation measures entail the creation or addition of staffed positions. The salary costs of these positions were estimated using proposed FY 2008-09 salary scales for reference positions within various departments of the California Resources Agency, as reported by the California Department of Finance.[3]

Employee Benefits Multiplier

A benefits multiplier of 1.35 was applied to all staff salary costs associated with BDCP implementation, except in cases where the estimated staffing cost already accounted for

[2] Santa Clara Valley Habitat Plan website: http://www.scv-habitatplan.org/www/default.aspx

[3] www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm

employee benefits. The benefits multiplier is intended to account for paid leave, health, retirement and other employee benefits.

Cost Contingencies

A cost contingency of 20 percent was added to all cost estimates, except for costs where a cost contingency had already been explicitly or implicitly factored into the estimate.

Other Common Assumptions

[***Note to Reviewers:*** *Additional common assumptions may be added once the cost analysis has been completed.*]

8.2.2 Water Facilities Construction and Operation

[***Note to Reviewers:*** *Cost estimates for water facilities construction and operation are in preparation by DWR engineering teams and are expected to be available in December 2009 and early in 2010.*]

North Delta Intake Facility (WOCM 1)

[***Note to Reviewers:*** *Costs to come from DWR. Costs will be divided between river intake structures, including fish screen costs and pumping plant costs. Costs for planning, design, and engineering will be estimated at 18% of total construction cost. DWR engineering teams are expected to provide cost estimates in December 2009.*]

Table 8.4. Estimated Costs of North Delta Intake Facility

[*TABLE 8.4 TO BE INSERTED HERE WHEN COSTS BECOME AVAILABLE*]

Conveyance Facility (WOCM 1)

[***Note to Reviewers:*** *Construction costs for the conveyance facilities will be broken down into the following categories: pumping plants, conveyance pipelines, canals, culvert siphons (shallow crossings), tunnels (deep crossings), bridges, utilities and infrastructure crossings, forebays, levees, controls and communications, power supply and grid connections, and Clifton Court Forebay fish facilities. Costs for planning, design, and engineering will be estimated at 18% of total construction cost. DWR engineering teams are expected to provide cost estimates in December 2009.*]

Table 8.5. Estimated Costs of Conveyance Facility

[*TABLE 8.5 TO BE INSERTED HERE WHEN COSTS BECOME AVAILABLE*]

Freemont Weir and Yolo Bypass Modification (WOCM 2)

[***Note to Reviewers:*** *Costs for Freemont Weir and Yolo Bypass Modification (WOCM2) to come from DWR. DWR engineering teams are expected to provide cost estimates in early 2010..*]

Table 8.6. Estimated Costs of Freemont Weir and Yolo Bypass Modification

[*TABLE 8.6 TO BE INSERTED HERE WHEN COSTS BECOME AVAILABLE*]

Water Operations, Maintenance, and Repair

[***Note to Reviewers:*** *Costs for facilities operations, maintenance, and repair to come from DWR. DWR engineering teams are expected to provide cost estimates in December 2009.*]

Table 8.7. Estimated Costs of Water Operations, Maintenance, and Repair

[*TABLE 8.7 TO BE INSERTED HERE WHEN COSTS BECOME AVAILABLE*]

8.2.3 Physical Habitat Protection, Enhancement, and Restoration

This section describes the data and assumptions used to estimate the costs for physical habitat restoration. Habitat protection involves the acquisition of lands (through fee title or conservation easement) that support existing functioning habitat that is not currently protected. Habitat enhancement involves the acquisition of lands (if not currently in public ownership) that support degraded covered species habitats and the physical and/or hydrological modification of those lands to improve their habitat functions. Habitat restoration involves the acquisition of lands (if not currently in public ownership) and the physical and/or hydrological modification of those lands to provide habitat functions that do not currently exist on the site, but were likely present historically. Physical habitat protection and restoration can be divided into six categories, as described in Chapter 3, *Conservation Strategy*. These are: (1) tidal marsh, (2) riparian habitat, (3) channel margin enhancement, (4) seasonally inundated floodplain habitat, (5) terrestrial habitat, and (6) non-tidal wetland habitat. This section also presents the data and assumptions used to estimate costs to manage created and restored habitat reserves on an on-going basis.

Tidal Marsh Habitat Restoration (HRCM 4-9, 16)

[***Note to Reviewers:*** *Costs for tidal marsh habitat restoration cannot be estimated until (1) the spatial and temporal modeling has been completed for tidal marsh and associated subtidal and upland acreages, and (2) common assumptions for Delta land acquisition costs have been established.*]

Table 8.8. Estimated Costs of Tidal Marsh Habitat Restoration

[*TABLE 8.8 TO BE INSERTED HERE WHEN SPATIAL AND TEMPORAL ASSUMPTIONS FOR THE RESTORATION OF TIDAL MARSH ACREAGE AND ASSOCIATED LAND VALUES BECOMES AVAILABLE*]

Riparian Habitat Restoration (HRCM 11, 14)

[***Note to Reviewers:*** *Riparian habitat restoration costs cannot be estimated until (1) the spatial and temporal distribution of riparian restoration has been identified, and (2) common assumptions for Delta land acquisition costs have been established.*]

Table 8.9. Estimated Costs of Riparian Habitat Restoration

[*TABLE 8.9 TO BE INSERTED HERE WHEN SPATIAL AND TEMPORAL ASSUMPTIONS FOR RIPARIAN ACREAGE AND ASSOCIATED LAND VALUES BECOMES AVAILABLE*]

Channel Margin Enhancement (HRCM 12, 13, 15)

This section presents cost estimates for Channel Margin Enhancement – HRCM 12, 13, and 15 - as described in Chapter 3, *Conservation Strategy*. The cost analysis assumed channel margin enhancement would entail creating low benches that support emergent vegetation and higher elevation benches that support riparian vegetation along existing levees. Large woody material (e.g. tree trunks and stumps) could be anchored into constructed low benches or in existing riprapped levees to provide similar habitat functions. A total of 20 miles of channel margin enhancement is anticipated under these conservation measures.

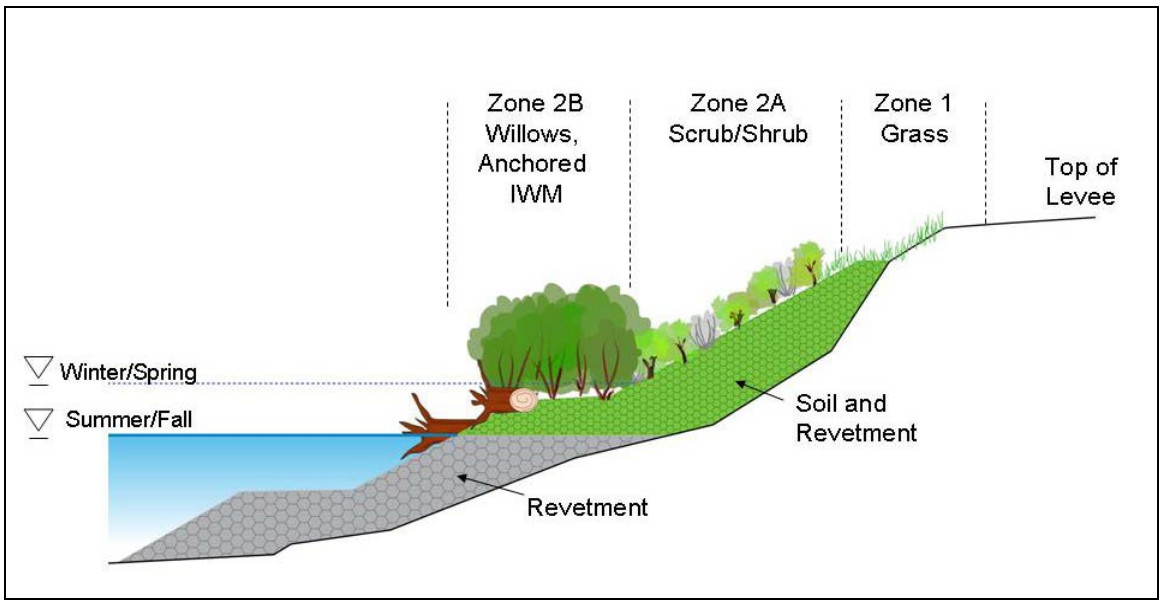
Channel margin enhancement cost estimates are based on conceptual design cross sections and budget-level cost estimates for 95 USACE bank stabilization project sites (approximately 76,000 linear feet) along the Sacramento River and its tributaries (USACE 2009). Only bank stabilization projects including channel margin enhancements to improve habitat for covered species were considered in the cost analysis. Conceptual design cross sections, including channel margin enhancements are shown in Figure 8.1.

Line item cost estimates for each project were obtained from USACE. Cost items associated with channel margin enhancement included expenditures for (1) soil cover, (2) instream woody material, (3) fascines, (4) landscape materials, and (5) wetlands construction. Across the 95 projects, the cost of channel margin enhancements averaged $538/LF (linear foot). This estimate includes planning, engineering and design (at 12 percent of construction cost), construction management (at 8 percent of construction cost), and contingency (at 20 percent of construction cost). Channel margin enhancements are not assumed to entail any land purchase or easement costs, though they would be expected to require land-side access to the target sites in order to be implemented.

Table 8.10 shows the expected schedule and associated costs of channel margin enhancements by cost period.

Table 8.10. Estimated Costs of Channel Margin Improvements by Cost Period

	Cost Period										
Miles/Costs by Period	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	***Totals***
Miles Completed in Cost Period	2.5	2.5	3.0	3.0	4.5	4.5	-	-	-	-	20.0
Running Total Miles	**2.5**	**5.0**	**8.0**	**11.0**	**15.5**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**
Costs (mil. $)	**$7.1**	**$7.1**	**$8.5**	**$8.5**	**$12.8**	**$12.8**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$56.8**
Running Total Costs	**$7.1**	**$14.2**	**$22.7**	**$31.2**	**$44.0**	**$56.8**	**$56.8**	**$56.8**	**$56.8**	**$56.8**	**$56.8**



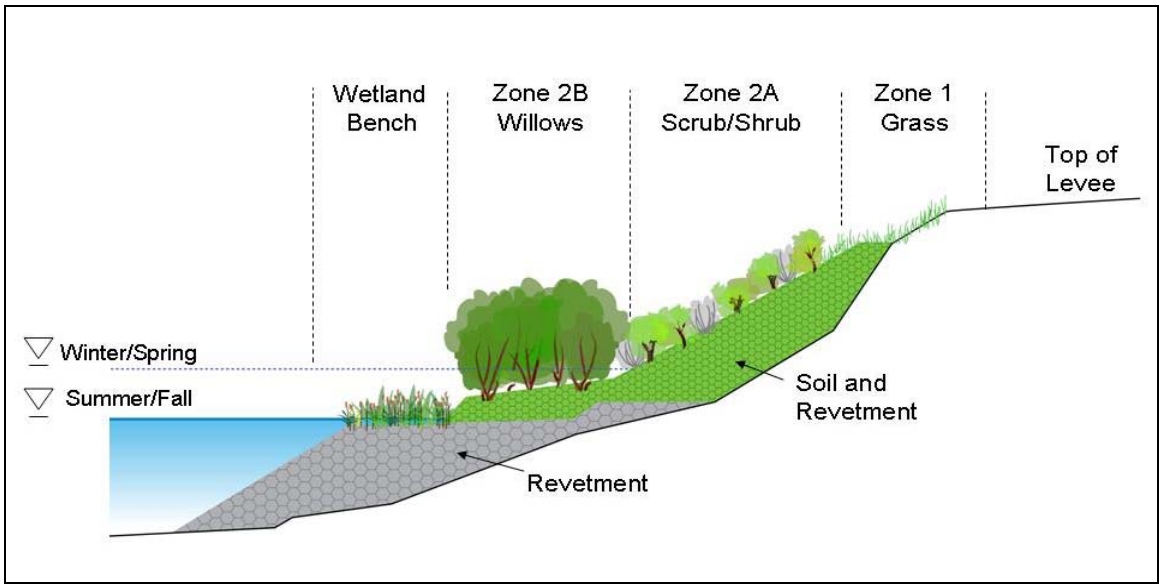


Figure 8.1. Conceptual Design Cross Sections for Channel Margin Enhancement Projects

Seasonally Inundated Floodplain Restoration (HRCM 2 and 3)

[Note to Reviewers: This measure would likely be funded as part of the state's flood management program, not directly through BDCP.]

This section presents cost estimates to create 10,000 acres of seasonally inundated floodplain habitat along the San Joaquin River downstream of Vernalis (HRCM 2) and along Old and/or Middle rivers (HRCM 3), as described in Chapter 3, *Conservation Strategy*. The cost analysis

assumed the floodplain habitat would be created by setting back existing levees. Levees were assumed to be set back 1,000 feet on each side of the channel. Along the San Joaquin River between Vernalis and French Camp Slough, it was assumed that 7,000 acres of floodplain habitat would be created by setting back approximately 29 miles of existing levees. An additional 3,000 acres of floodplain habitat would be created along Old and/or Middle rivers by setting back approximately 12 miles of levees.

The assumed schedule of setback levee construction and floodplain habitat creation are shown in Table 8.11.

Table 8.11. Estimated Miles of Setback Levees and Acres of Created Floodplain Habitat by Cost Period

Miles or Acres of Floodplain Habitat Creation	*Cost Period*										*Total Miles or Acres*
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
San Joaquin R.	-	0.9	2.0	5.2	5.2	5.2	5.2	5.2			28.9
Old/Middle R.	-	0.4	0.9	2.2	2.2	2.2	2.2	2.2			12.4
Total Miles	-	1.3	2.9	7.4	7.4	7.4	7.4	7.4	-	-	*41.3*
Running Total	-	1.3	4.2	11.6	19.0	26.4	33.8	41.3	41.3	41.3	*41.3*
Flood Plain Created (Ac)	**-**	**300**	**700**	**1800**	**1800**	**1800**	**1800**	**1800**	**-**	**-**	**10,000**
Running Total	**-**	**300**	**1,000**	**2,800**	**4,600**	**6,400**	**8,200**	**10,000**	**10,000**	**10,000**	**10,000**

Setback levees for both project and non-project levees were assumed to be constructed to the PL84-99 (Delta Specific) Standard. Existing levees along the San Joaquin River that would be setback were assumed to already meet this standard, while levees along Old and Middle rivers were assumed to be non-project levees below this standard. For purposes of cost estimation, the average levee height was assumed to be 20 feet, with a 5:1 interior slope, a 2:1 exterior slope, and a 16-foot wide crest. It was also assumed a graded, sloping bench to provide opportunities for both passive and active establishment of riparian vegetation would be added to the water-side of the levee.

Costs were divided into five categories, which were: (1) land acquisition costs for floodplain habitat and setback levee footprint; (2) planning, design, engineering, and permitting costs; (3) construction management costs; (4) construction costs; and (5) contingency costs.

Total land acquisition requirements per cost period were determined by multiplying the floodplain acreage amounts shown in Table 8.11 by a factor of 1.16 to account for levee footprint requirements.[4] Lands for floodplain creation were assumed to be acquired through a combination of fee-simple purchases and easements. Eighty percent of the land requirement was assumed to be acquired through purchases and 20 percent through easements. Land acquisition costs consisted of the purchase and easement costs plus the due diligence costs. Land acquired through fee-simple purchases was assumed to have an average cost of $XX per acre. Per acre easement costs were assumed to be XX percent of land purchase cost.[5] Due diligence costs per

[4] An average levee footprint of 160 feet was used for the cost analysis. Thus, total acreage requirements, including levee footprint, are 1160 ft/1000 ft times larger than the floodplain habitat acreage amount.

[5] The percentage is based on a comparison of easement costs to land values for wildlife and levee-related easements in the Delta. (NOTE TO REVIEWERS: EASEMENT COSTS ARE STILL BEING RESEARCHED.)

acre were assumed to be the same whether the land was acquired through purchase or easement.[6] Estimated land acquisition costs per five-year period are summarized in Table 8.12.

[*Note to Reviewers:* *Land acquisition cost estimates cannot be completed until common assumptions for Delta land values have been established. See previous notes for details.*]

Table 8.12. Land Acquisition Costs of Created Floodplain Habitat by Cost Period

	Cost Period										*Total*
Acres/Costs by Period	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Acres/Costs*
Flood Plain Created (Ac)	-	300	700	1800	1800	1800	1800	1800	-	-	10,000
Total Floodplain Habitat (Ac)	-	300	1,000	2,800	4,600	6,400	8,200	10,000	10,000	10,000	10,000
Acquisition Costs (mil $)											
Due Diligence/Surveys	$0.0	0.33	0.76	2.0	2.0	2.0	2.0	2.0	0.0	0.0	11.1
Easements	T.B.D.										
Purchases	T.B.D.										
Total											
Running Total											

Levee construction cost estimates for setback levees were taken from Betchart (2008). The 2005 dollar denominated cost estimates were updated to 2009 dollars using USACE's Civil Works Construction Cost Index for levees and floodwalls. Betchart (2008) reported a cost range of $1.5 to $2.1 million per mile to upgrade existing levees to the PL84-99 (Delta Specific) standard, plus additional cost adders of $2.3 million per mile to convert the levee to a setback and between $1.2 million and $2.3 million per mile to construct a sloping, graded bench on the water-side of the levee.[7] Based on these estimates, the construction costs used for the cost analysis were $2.1 million per mile to upgrade non-project levees to the PL84-99 standard, $2.3 million per mile to convert levees to setback levees, and $2.3 million per mile to construct the water-side bench.[8] These estimates assume necessary fill would be obtained locally. If fill were required to be imported, costs per mile would rise substantially. Embedded in the cost estimates are allowances for (1) mobilization (10 percent), surveys, design, construction management and administration (30 percent), and contingency (10 percent).

Estimated setback levee construction costs per five-year period are summarized in Table 8.13.

Table 8.13. Estimated Costs for Setback Levees for Floodplain Habitat by Cost Period

	Cost Period										*Total*
Cost by Period (mil. $)	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Cost*
San Joaquin R.	0.0	8.0	18.7	48.2	48.2	48.2	48.2	48.2	0.0	0.0	267.6
Old/Middle R.	0.0	5.0	11.7	30.0	30.0	30.0	30.0	30.0	0.0	0.0	166.5
Total Cost	**0.0**	**13.0**	**30.4**	**78.1**	**78.1**	**78.1**	**78.1**	**78.1**	**0.0**	**0.0**	**434.1**
Running Total	**0.0**	**13.0**	**43.4**	**121.5**	**199.7**	**277.8**	**355.9**	**434.1**	**434.1**	**434.1**	**434.1**

[6] Due diligence costs and pre-acquisition survey costs were estimated using the common assumptions described in Section 8.2.1. The average number of riparian parcels per river mile, acres per parcel, and parcel perimeter were calculated using parcel-level GIS data for the target river reaches. The assumptions used to calculate the due diligence costs and pre-acquisition survey costs are further described in Appendix XX.

[7] The cost ranges cited here are in 2009 dollars. The cost estimates reported in Betchart (2008) were developed by the Delta Risk Management Strategy (DRMS)/URS Levee Optimization workgroup. The estimates are based on a very basic estimating system using assumed material quantities and unit prices and are considered to be first-order planning level estimates. Actual costs for constructing levee setbacks would be subject to substantial variation based on local conditions, availability of fill material, and changes in other construction assumptions.

[8] Channel margin enhancements for USACE bank erosion projects discussed in Section 8.2.3, which would be similar to the water-side enhancements envisioned for floodplain setback levees, had an average cost of $2.8 million per mile. The lower cost estimate used here is based on the expectation of some economies of scale associated with setback levee construction.

The combined costs for land acquisition and setback levee construction are summarized in Table 8.14.

[*Note to Reviewers:* *Land acquisition cost estimates cannot be completed until common assumptions for Delta land values have been established. See previous notes for details.*]

Table 8.14. Total Estimated Costs for Land Acquisition and Setback Levees for Floodplain Habitat by Cost Period

[*TABLE 8.14 TO BE INSERTED HERE WHEN COMMON ASSUMPTIONS FOR DELTA LAND VALUES BECOMES AVAILABLE*]

Protection of Existing Terrestrial and Protection and Restoration of Non-Tidal Wetland Habitats

[*Note to Reviewers:* *Costs for terrestrial and non-tidal wetland habitat protection and restoration cannot be estimated until the amount, locations, and timing of terrestrial habitat conservation actions has been determined.*]

Table 8.15. Total Estimated Costs for Terrestrial and Non-Tidal Wetland Habitat Protection

[*TABLE 8.15 TO BE INSERTED HERE WHEN AMOUNT, LOCATIONS, AND TIMING OF TERRESTRIAL HABITAT ACREAGES BECOMES AVAILABLE*]

Habitat Reserves Management and Maintenance

[*Note to Reviewers:* *These costs will be estimated once all the habitat acreages for different habitat types have been determined. Each habitat type may have a different cost associated with management and maintenance. Some of the costs will be associated with Implementing Entity staffing, vehicle, and equipment costs, which are estimated in a later section of this chapter.*]

Table 8.16. Total Estimated Costs for Habitat Reserves Management and Maintenance

[*TABLE 8.16 TO BE INSERTED HERE ONCE AMOUNT, LOCATION, AND TIMING OF HABITAT ACREAGE TO BE MANAGED BY THE IMPLEMENTING ENTITY BECOMES AVAILABLE.*]

8.2.4 Measures to Address Other Stressors

Other stressors conservation measures comprise a broad array of scientific research, financial support, and program creation and/or support aimed at reducing stressors that have contributed to the decline of covered species, as described in Chapter 3, *Conservation Strategy*. These measures are likely to undergo considerable refinement, and thus the cost estimates for these conservation measures should be considered preliminary, with no assumption as to how they would be funded if included in the final plan. This section describes the data and assumptions used to estimate the costs for other stressors conservation measures. The measures are grouped thematically, as follows: (1) measures addressing toxic contaminants and other water quality issues in the Delta, (2) measures addressing impacts on covered species from non-native invasive species, (3) measures addressing impacts on covered species from harvest and hatcheries, (4) measures addressing impacts on covered species from non-Project diversions, (5) measures

addressing impacts on covered species from predators, and (6) measures addressing juvenile salmon migration.

Toxic Contaminant and Other Water Quality Measures

Wastewater Ammonia/um) Research and Assistance (OSCM 1)

[***Note to Reviewers:*** *Costs for this measure cannot be estimated without additional data and input from CVRWQCB and CALFED Science Program. The CALFED Science Program has organized a series of workshops to evaluate the existing data and develop a research framework. No plan or cost estimates have yet been developed.*]

Table 8.17. Total Estimated Costs for Ammonia/um) Research and Assistance

[TABLE 8.17 TO BE INSERTED HERE ONCE ACTIONS OR LEVELS OF SUPPORT ASSOCIATED WITH AMMONIA/UM) RESEARCH ARE FURTHER DEFINED.]

Wastewater Endocrine Disrupting Compounds (EDCs) Research and Assistance (OSCM 2)

[***Note to Reviewers:*** *There are currently no plans or frameworks for future research programs from which to estimate costs for this measure. Costs for this measure cannot be estimated without additional data and input from CVRWQCB and CALFED Science Program.*]

Table 8.18. Total Estimated Costs for EDC Research and Assistance

[TABLE 8.18 TO BE INSERTED HERE ONCE ACTIONS OR LEVELS OF SUPPORT ASSOCIATED WITH EDC RESEARCH ARE FURTHER DEFINED.]

Methylmercury TMDL Assistance (OSCM 3)

This conservation measure would support DWR and the Central Valley Regional Water Quality Control Board (CVRWQCB) programs to reduce methylmercury loads in the Delta. As described in Chapter 3, *Conservation Strategy*, there are three components to this conservation measure: (1) increasing the mercury-trapping capacity of the Cache Creek Settling Basin; (2) supporting remediation efforts for sources of inorganic mercury upstream of the Delta; and (3) working with CVRWQCB to identify and implement best management practices for other sources of methylmercury.

The costs for each component were estimated as follows.

Cache Creek Settling Basin Expansion

CVRWQB staff has estimated the costs to increase the mercury-trapping capacity of the Cache Creek Settling Basin (CVRWQCB, 2008). As part of their analysis of proposed amendments to the Basin Plan, three expansion options were considered. One option proposed raising the weir in 2018, and maintaining 50 percent trapping efficiency indefinitely. The second and third options proposed raising the weir in 2015 and maintaining 63 percent trapping efficiency indefinitely by annual removal of accumulated sediment. The second option delayed funding the removal of accumulated sediment until 2033, while the third option initiated low-level sediment

removal in 2016, thereby allowing more-intensive sediment removal to be postponed until 2044. The second and third options are expected to provide the same trapping capacity, but the third option is expected to be much more cost effective. The costs used for the BDCP cost analysis were therefore based on the third option.

Raising the weir was estimated to cost about $6.3 million, while expanding basin capacity was estimated to cost about $15.5 million. Additionally, land easements required for the expansion were estimated to cost about $3.1 million.

Excavation of accumulated sediment would begin in 2016 and would cost about $253,000 per year through 2043. Starting in 2044, excavation costs would increase sharply to about $8.0 million per year.

Total estimated costs by cost period to expand the Cache Creek Settling Basin and extend its useful life are shown in Table 8.19.

Table 8.19. Estimated Costs to Expand Cache Creek Settling Basin and Extend Its Useful Life by Cost Period

	Cost Period										*Total*
Cost by Period (mil. $)	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Cost*
Raise Weir	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
Enlarge Basin	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5
Land Easements	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
Sediment Removal	0.0	1.3	1.3	1.3	1.3	1.3	15.9	37.8	37.8	37.8	135.6
Total Cost	**24.9**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**15.9**	**37.8**	**37.8**	**37.8**	**160.5**
Running Total	**24.9**	**26.1**	**27.4**	**28.7**	**29.9**	**31.2**	**47.1**	**84.9**	**122.7**	**160.5**	**160.5**

SUPPORT REMEDIATION FOR SOURCES OF INORGANIC MERCURY UPSTREAM OF THE DELTA

[*Note to Reviewers:* *Cost assessment in progress.*]

Table 8.20. Estimated Costs to Support Inorganic Mercury Source Remediation

[TABLE 8.20 TO BE INSERTED HERE ONCE ACTIONS OR LEVELS OF SUPPORT ASSOCIATED WITH INORGANIC MERCURY SOURCE REMEDIATION ARE FURTHER DEFINED.]

ASSIST CVRWQCB WITH IDENTIFICATION AND IMPLEMENTATION OF BEST MANAGEMENT PRACTICES FOR OTHER SOURCES OF METHYLMERCURY

[*Note to Reviewers:* *Costs for CVRWQCB support will be estimated once the BDCP has further defined the actions that would be taken under this program.*]

Table 8.21. Estimated Costs to Support Methylmercury Best Management Practices

[TABLE 8.21 TO BE INSERTED HERE ONCE ACTIONS OR LEVELS OF SUPPORT ASSOCIATED WITH METHYLMERCURY BMPS ARE FURTHER DEFINED.]

Agricultural Chemical Load Discharge Reduction Assistance (OSCM 4)

This conservation measure would assist the CVRWQCB and farmers to reduce toxins in agricultural runoff. This measure would be implemented through the support of the CVRWQCB's Irrigated Lands Regulatory Program, and through encouragement of farmers' voluntary actions to reduce pesticides and herbicides reaching Delta Waterways.

The CVRWQCB would work with county agricultural commissioners to provide outreach and advice to farmers, conduct inspections and compliance and enforcement actions. This would require an increase in staff at the CVRWQCB of two person-years, and three person-years for the county agricultural commissioners (J. Bruns, pers. comm.).

The task of encouraging farmers' voluntary actions has not yet been completely described, but based on the Natural Resources Conservation Service's Agricultural Water Enhancement Program[9] an initial fund of $1.5 million should be used to develop a cost-share program to encourage adoption of better pesticide management practices. It is expected that this amount would last for approximately three years. At the end of that time, the program should be reevaluated, and if successful should be refunded. (J. Bruns, pers. comm.). For this cost estimation, the funding is assumed to continue at $500,000 per year, throughout the life of the BDCP.

Table 8.22 summarizes the cost estimates for this conservation measure.

Table 8.22. Estimated Costs for Agricultural Chemical Discharge Reduction Assistance by Cost Period

Cost by Period (mil. $)	Cost Period										Total Cost
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	
CVRWQCB Staff Support	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	14.0
CAC Staff Support	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	21.0
NRCS Ag Water Enhancement Program	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	25.0
Total	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**60.0**
Running Total	**6.0**	**12.0**	**18.0**	**24.0**	**30.0**	**36.0**	**42.0**	**48.0**	**54.0**	**60.0**	**60.0**

CAC = County Agricultural Commission

Urban Runoff/Stormwater Toxic Load Discharge Reduction Assistance (OSCM 5)

[*Note to Reviewers:* *For a cost estimate to be developed, this conservation measures requires additional specificity as to the type and extent of actions to be taken.*]

Table 8.23. Estimated Costs to Support Urban Runoff/Stormwater Discharge Reduction

[TABLE 8.23 TO BE INSERTED HERE ONCE ACTIONS OR LEVELS OF SUPPORT ASSOCIATED WITH URBAN RUNOFF REDUCTION ARE FURTHER DEFINED.]

[9] http://www.ca.nrcs.usda.gov/news/releases/2009/awep_7_30_2009.html

Stockton Deep Water Ship Channel Dissolved Oxygen (DO) Aeration Facility(s) (OSCM 7)

This conservation measure would fund operation of an oxygen aeration facility in the Stockton Deep Water Ship Channel to increase dissolved oxygen (DO) concentrations between Turner Cut and Stockton to meet Total Maximum Daily Load (TMDL) objectives established by the CVRWQCB (2005) - above 6.0 mg/L from September 1 through November 30 and above 5.0 mg/L at all times. DWR currently has a demonstration project that is investigating the costs and benefits of this action, and the results are not expected until FY 2010-2011. More accurate cost estimates are expected at that time.

The operations of the facility depend on the need for increased dissolved oxygen concentrations, which depends largely on the water flow levels. In dry years (low flow), the facility may need to operate for 100 days per year, while in wet years (high flow) no operations may be required. This variability results in a range of operating costs of between $10,000 and $300,000 per year. This amount includes the costs for liquid oxygen and electric power, but does not include the cost of maintenance of the equipment (W. McLaughlin, pers. comm.). Based on this range of costs, a mean annual operating cost of $150,000 was assumed. This cost estimate is probably somewhat high, because the long-term hydrology is such that more low-usage years would be expected.

The facility currently in place is owned by DWR and was installed at a cost of approximately $3.5 million. (W. McLaughlin, pers. comm.). For purposes of this estimation, the equipment is assumed to have a useful life of 15 years. Table 8.24 summarizes the estimated costs as presently developed.

Table 8.24. Estimated Costs for Stockton Deep Water Ship Channel DO Diffusers

	Cost Period										*Total*
Cost by Period (mil. $)	**1-5**	**6-0**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Cost*
Equipment Costs	0.00	0.00	3.50	0.00	0.00	3.50	0.00	0.00	3.50	0.00	10.50
Operating Costs	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.50
Total Cost	0.75	0.75	4.25	0.75	0.75	4.25	0.75	0.75	4.25	0.75	18.00
Running Total	0.75	1.50	5.75	6.50	7.25	11.50	12.25	13.00	17.25	18.00	18.00

Managed Seasonal Wetlands Discharge Water Quality (OSCM 8)

**[*Note to Reviewers:* *This cost assessment is in preparation.*]

Table 8.25. Estimated Costs to Support Managed Seasonal Wetlands Discharge Water Quality

[TABLE 8.25 TO BE INSERTED HERE ONCE ACTIONS FOR LEVELS OF SUPPORT ASSOCIATED WITH MANAGED WETLANDS DISCHARGE WATER QUALITY ARE FURTHER DEFINED.]

Non-Native Invasive Species Measures

Recreational Watercraft Inspections and Cleaning Stations for Non-Native Invasive Species (OSCM 10)

This conservation measure would provide funding and support to California Department of Food and Agriculture (CDFA) and Department of Fish and Game (DFG) to operate additional recreational watercraft and trailer inspection stations and cleaning stations to forestall invasions by non-native species, as described in Chapter 3, *Conservation Strategy*. This section presents the cost estimates to implement this measure.

This conservation measure consists of three major cost components, as follows:

1. Fund and support the operation of additional spot check stations operated by CDFA and DFG on roads at California borders that currently do not have inspection stations to increase detection of aquatic invasive species.
2. Fund additional DFG portable wash stations to kill aquatic invasives on watercraft, trailers, and other equipment leaving water bodies within California that are infested with zebra or quagga mussels.
3. Fund the DFG Invasive Species Program to improve Delta-specific outreach and education on the effects, prevention, and control of non-native species in the Delta.

ESTIMATED COST FOR ADDITIONAL CDFA/DFG SPOT CHECK STATIONS

The cost analysis assumed funding for seven additional spot check stations (see Chapter 3 for locations). According to estimates provided by CDFA (R. Cline, pers. comm.), it costs approximately $70,000 (2009 dollars) to set up a spot check station, which includes costs for a cleaning system, signage, trailers, computers, water tanks, and other related equipment. It is assumed that equipment would need to be replaced every ten years.

Staffing costs are expected to average $1,000 per day per station. This cost estimate was provided by CDFA and assumes 24-hour operation (R. Cline, pers. comm.). Other operating costs were estimated by CDFA to average $3,400 per month (R. Cline, pers. comm.). Stations were assumed to operate for 124 days per year (during the primary boating season). Given these assumptions, annual operating costs for seven additional spot check stations of approximately $1.15 million were estimated.

Total costs for the seven stations by cost period are summarized in Table 8.26.

Table 8.26. Estimated Costs for Seven Additional CDFA/DFG Spot Check Stations by Cost Period

	Cost Period										*Total*
Cost by Period (mil. $)	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Cost*
Equipment Costs	0.5	-	0.5	-	0.5	-	0.5	-	0.5	-	2.5
Operating Costs	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	58.0
Total Cost	**6.3**	**5.8**	**6.3**	**5.8**	**6.3**	**5.8**	**6.3**	**5.8**	**6.3**	**5.8**	**60.5**
Running Total	**6.3**	**12.1**	**18.4**	**24.2**	**30.5**	**36.3**	**42.6**	**48.4**	**54.7**	**60.5**	**60.5**

Estimated Cost for Additional Wash Stations at Infected California Waterways

The cost analysis assumed funding for nine additional wash stations. These stations would be placed at the boat ramps at water bodies infested with zebra or quagga mussels. According to estimates provided by DFG (D. Norton, pers. comm.), the cost of each portable wash station is approximately $60,000 (2009 dollars). It is assumed that equipment would need to be replaced every ten years. Staffing and other operating costs for the nine stations are expected to cost approximately $600,000 per year (D. Norton, pers. comm.).

Total costs for the nine portable wash stations by cost period are summarized in Table 8.27.

Table 8.27. Estimated Costs for Nine Additional DFG Portable Wash Stations by Cost Period

Cost by Period (mil. $)	*Cost Period*										*Total Cost*
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
Equipment Costs	0.54	-	0.54	-	0.54	-	0.54	-	0.54	-	2.7
Operating Costs	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	30.0
Total Cost	**3.54**	**3.00**	**3.54**	**3.00**	**3.54**	**3.00**	**3.54**	**3.00**	**3.54**	**3.00**	**32.7**
Running Total	**3.54**	**6.54**	**10.08**	**13.08**	**16.62**	**19.62**	**23.16**	**26.16**	**29.70**	**32.70**	**32.7**

Estimated Costs for DFG Invasive Species Program Outreach

This program would add a half time position at DFG to develop and distribute printed materials and displays, and supervise two teams of one DFG scientific aide and one DFG fish and wildlife technician to educate boaters. These teams would also have a portable wash station each that they could use to demonstrate how to decontaminate boats properly.

Estimated annual staffing costs are based on DFG salaried positions shown in Table 8.28. Annual salary amounts shown in the table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits.

Table 8.28. Salary Levels and Number of Positions Assumed for Invasive Species Program Outreach

Position	*Annual FTE Salary**	*FTE Positions*	*Resources Agency Reference Position*
Public Education & Outreach	$61,000	0.5	Information Officer I – Specialist, DFG
DFG Scientific Aide	$58,000	2.0	Environmental Scientist, DFG Water Branch
DFG Wildlife Technician	$40,000	2.0	DFG Wildlife Technician

Notes:
*Salary estimates based on proposed salaries for 2008-09 for corresponding positions within the Resources Agency, as reported by the California Department of Finance (www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm). Annual salary amounts shown in this table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits.

Total costs for the invasive species outreach by cost period are summarized in Table 8.29.

Table 8.29. Estimated Costs for Invasive Species Outreach by Cost Period

	Cost Period										Total
Cost by Period (mil. $)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	Cost
Equipment Costs	0.12	-	0.12	-	0.12	-	0.12	-	0.12	-	0.6
Operating Costs	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	15.3
Total Cost	**1.65**	**1.53**	**1.65**	**1.53**	**1.65**	**1.53**	**1.65**	**1.53**	**1.65**	**1.53**	**15.9**
Running Total	**1.65**	**3.18**	**4.83**	**6.36**	**8.01**	**9.54**	**11.19**	**12.72**	**14.37**	**15.9**	**15.9**

Total costs by period for the three recreational watercraft programs are summarized in Table 8.30.

Table 8.30. Estimated Costs for Recreational Watercraft Invasive Species Control Programs by Cost Period

	Cost Period										Total
Costs by Period (mil. $)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	Cost
Spot Check Stations	6.30	5.80	6.30	5.80	6.30	5.80	6.30	5.80	6.30	5.80	60.5
Wash Stations	3.54	3.00	3.54	3.00	3.54	3.00	3.54	3.00	3.54	3.00	32.7
Outreach & Education	1.65	1.53	1.65	1.53	1.65	1.53	1.65	1.53	1.65	1.53	15.9
Total Cost	**11.49**	**10.33**	**11.49**	**10.33**	**11.49**	**10.33**	**11.49**	**10.33**	**11.49**	**10.33**	**109.1**
Running Total	**11.49**	**21.82**	**33.31**	**43.64**	**55.13**	**65.46**	**76.95**	**87.28**	**98.77**	**109.10**	**109.1**

Non-Native Species Rapid Detection and Response (OSCM 11)

This conservation measure would provide assistance and coordination with DFG to implement a rapid detection and response program for non-native species in the Delta. Several coordinating actions with DFG, as described in Chapter 3, would be undertaken by the BDCP Implementing Entity. The costs associated with these efforts would primarily be staff-related and are included in the estimated costs for BDCP Program Administration presented in Section 8.2.5.

This measure would help fund a survey program to be operated by the Office of Spill Prevention and Response (OSPR), additional DFG positions for a dedicated rapid response team, and the establishment and support of a volunteer network for early detection and reporting of non-native species in the Delta.

OSPR Survey Program

The OSPR Survey Program would consist of a survey of 31 sites within the Delta. This would include the sampling of the following habitat types: epifaunal, subtidal (benthic) infaunal and invertebrate species associated with floating plant communities. The initial survey is assumed to be undertaken in 2011, with repeated surveys every three years. The cost per survey is estimated at approximately $220,000 in 2009 dollars (S. Foss, pers. comm.). Appendix XX provides additional detail on estimated OSPR Survey Program costs.

DFG Rapid Response Team

The DFG Rapid Response Team would consist of the following staff positions: (1) Fish and Wildlife Interpreter, (2) Staff Environmental Scientist, and (3) Senior Environmental Scientist (S. Ellis pers. comm.). Estimated annual staffing costs are based on DFG salaried positions shown in Table 8.31. Annual salary amounts shown in the table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits. An overhead multiplier of 0.23 was

applied to salary costs to estimate associated overhead costs DFG expects to incur to support the additional staff and equipment assigned to the program.

Table 8.31. Salary Levels and Number of Positions Assumed for DFG Rapid Response Team

Position	*Annual FTE Salary**	*FTE Positions*	*Resources Agency Reference Position*
Fish and Wildlife Interpreter	$56,000	0.5	DFG Fish and Wildlife Interpreter II
Staff Environmental Scientist	$75,000	1.0	DFG Staff Environmental Scientist, Bay Delta Region
Senior Environmental Scientist	$73,400	1.0	DFG Senior Environmental Scientist, Bay Delta Region

Notes:
*Salary estimates based on proposed salaries for 2008-09 for corresponding positions within the Resources Agency, as reported by the California Department of Finance (www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm). Annual salary amounts shown in this table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits.

Early Detection Volunteer Network

DFG has estimated that establishment and support of an early detection volunteer network would cost approximately $100,000 per year in 2009 dollars (S. Ellis pers. comm.).

Total costs for the non-native species rapid detection and response programs by cost period are summarized in Table 8.32.

Table 8.32. Estimated Costs for Non-Native Species Rapid Detection and Response by Cost Period

	Cost Period										*Total*
Costs by Period (mil. $)	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	*Cost*
OSPR Survey	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7
Rapid Response Team	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	14.6
Volunteer Network	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
Total Cost	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**19.6**
Running Total	**2.0**	**3.9**	**5.9**	**7.9**	**9.8**	**11.8**	**13.8**	**15.7**	**17.7**	**19.6**	**19.6**

Non-Native Aquatic Vegetation Removal (OSCM 13)

This conservation measure would support and expand the Department of Boating and Waterways (DBW's) *Egeria densa* and water hyacinth control programs in the Delta. BDCP funds would support eradication efforts in areas of the Delta that provide the greatest biological benefits to covered fish species, as described in Chapter 3.

Eradication costs per acre vary greatly in the Delta, depending on location, plant density, time of year, method of eradication, and need for environmental monitoring. In recent years, environmental monitoring and regulatory compliance costs have comprised approximately 40 percent of total eradication costs, adding substantially to costs of eradication per acre (DBW 2006). Between 2003 and 2005, DBW's aquatic vegetation removal program costs averaged

about $2,500/acre (2009 dollars). However, budgetary estimates contained in the 2006 addendum to DBW's *Egeria densa* EIR (DBW 2006) suggest per acre costs as high as $4,500/acre. For the BDCP cost analysis, an expected per acre cost of $2,500/acre was used, but a 20 percent cost contingency was added to this estimate, resulting in a total cost of $3,000/acre.

From 2003 through 2005 DBW's aquatic vegetation removal program treated, on average, 2,400 acres annually. Table 8.33 shows the additional acreage expected to be treated under the BDCP and the associated costs by cost period.

[*Note to Reviewers:* *Table 8.33 cannot be completed until target acreages for aquatic vegetation removal are developed.*]

Table 8.33. BDCP Aquatic Vegetation Removal Acreages and Costs by Cost Period

	Cost Period										*Total Acres/ Costs*
Acres/Costs by Period	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
Acres Treated											
Total Treatment Cost											
Running Total											

Non-Native Predatory Fish Harvest (OSCM 14)

This conservation measure would evaluate the impact on covered species of increasing recreational bag limits and reducing size limits for non-native predatory fish species, such as largemouth and striped bass, at two locations in the Delta. The locations for the pilot evaluation would be determined in conjunction with fisheries agencies staff familiar with predation trouble spots in the Delta. If the pilot program proves successful, it could be expanded to other high-predation spots in the Delta to the DFG Commission.

The costs for this measure, including completing the pilot program, evaluating and documenting program results, and coordinating with DFG and other fish agencies would primarily be staff-related and are included in the estimated costs for BDCP Program Administration presented in a subsequent section.

Harvest and Hatcheries Measures

Salmon, Steelhead, Sturgeon Illegal Harvest Reduction (OSCM 16)

This conservation measure would fund and equip 17 field wardens and 5 supervisory staff assigned to the Delta-Bay Enhanced Enforcement Program (DBEEP) over the term of the BDCP, as described in Chapter 3, *Conservation Strategy*.

Costs for this conservation measure were divided into the following categories: (1) salaries, wages, and benefits, (2) operating expenses, (3) minor equipment, (4) major equipment, and (5) overhead. Cost estimates for each category are based on information provided by DFG.

SALARIES, WAGES, AND BENEFITS

Estimated annual staffing costs are based on DFG salaried positions shown in Table 8.34. The salary amounts shown in the table were multiplied by 1.35 to account for paid leave, health, retirement and other employee benefits.

Table 8.34. DFG Game Warden and Support Staff Wage and Salary Assumptions

Position	*Annual FTE Salary**	*FTE Positions*	*Resources Agency Reference Position*
Fish & Game Warden	$60,000	17	Fish and Game Warden, DFG Law Enforcement Div.
Patrol Lieutenant - Supervisor	$73,500	1.0	Fish and Game Patrol Lieutenant – Supervisor, DFG Law Enforcement Div.
Associate Governmental Program Analyst	$60,600	1.0	Associate Governmental Program Analyst, DFG Law Enforcement Div.
Staff Services Analyst-General	$48,600	2.0	Staff Services Analyst-General, DFG Law Enforcement Div.
Secretary	$37,900	1.0	Secretary, DFG Law Enforcement Div.

Notes:
* Salary estimates based on proposed salaries for 2008-09 for corresponding positions within the Resources Agency, as reported by the California Department of Finance (www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm). Annual salary amounts shown in this table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits.

OPERATING EXPENSES

Operating expenses were estimated by DFG to be approximately $1.3 million annually, including an allowance for boat fuel and slip costs (B. Naslund, pers. comm.).

MINOR AND MAJOR EQUIPMENT

Costs for minor equipment were estimated by DFG to be approximately $410,000. It was assumed minor equipment would need to be replaced every five years. Costs for major equipment were estimated by DFG to be approximately $892,000. It was assumed major equipment would need to be replaced every ten years. Additionally, boat costs of $1.15 million were estimated by DFG. Boats were assumed to have to be replaced every 15 years.

OVERHEAD

An overhead multiplier of 0.23 was applied to labor, operating, and equipment costs to estimate associated overhead costs DFG expects to incur to support the additional staff and equipment assigned to the DBEEP program.

Total estimated costs to increase DBEEP staffing levels by cost period are summarized in Table 8.34.

Table 8.35. Estimated Illegal Harvest Reduction Costs by Cost Period

Costs by Period (mil. $)	Cost Period										Total Cost
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	
Salaries & Benefits	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	87.02
Operating Expenses	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	67.07
Minor Equipment	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	4.38
Major Equipment	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	9.62
Overhead	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	38.66
Total Cost	20.68	20.68	20.68	20.68	20.68	20.68	20.68	20.68	20.68	20.68	206.75
Running Total	20.68	41.35	62.03	82.70	103.38	124.05	144.73	165.40	186.08	206.75	206.75

Sacramento Splittail Harvest Study and Draft Regulations (OSCM 17)

This conservation measure would conduct a study on establishing new limits on recreational and commercial splittail harvest. The results of the study would be used to draft regulations for proposal to the Fish and Game Commission and DFG in 2013, as described in Chapter 3, *Conservation Strategy*. The costs for this measure, including completing the study, producing the draft regulations, and coordinating with DFG would primarily be staff-related and are included in the estimated costs for BDCP Program Administration presented in this chapter.

Salmon Hatchery and Genetic Management Plans (OSCM 18)

This conservation measure would support accelerated development and implementation of Hatchery and Genetic Management Plans (HGMPs) for all state Chinook salmon and steelhead hatcheries located in California's Central Valley, as described in Chapter 3, *Conservation Strategy*. Several coordinating actions with DFG and National Marine Fisheries Service (NMFS) listed in OSCM 18 would be undertaken by the BDCP Implementing Entity. The costs associated with these efforts would primarily be staff-related and are included in the estimated costs for BDCP Program Administration presented later in this chapter.

The conservation measure would help fund: (1) the development of the HGMPs, (2) a new DFG HGMP staff position, and (3) additional staff at Central Valley hatcheries needed for HGMP implementation and updating. The estimated costs for each of these efforts were calculated as follows.

HGMP Development and Updating

Recent plans being developed by DWR for the Feather River Hatchery have cost $125,000 on average, with approximately 90 percent of this being consultant time, and 10 percent DWR staff time (J. Kindopp, pers. comm.). It is expected that these plans would need to be updated as conditions change. The cost analysis assumed HGMPs would be updated every 5 years. A total of twelve plans would likely need to be developed (see Appendix XX for assumed plans for each Central Valley hatchery). The estimated cost to update the HGMPs at the 12 hatcheries is $1.5 million (2009 dollars) per cost period.

DFG HGMP Coordinator Staff Position

The HGMP Coordinator would coordinate the development, updating, and implementation of the HGMPS among the state hatcheries. The cost analysis assumed this position would have a pay

grade equivalent to a Supervising Biologist with DFG's Fisheries Division. The proposed salary for this DFG position for 2008-09, as reported by the Department of Finance, was approximately $80,000.[10] A benefits multiplier of 1.35 was applied to the salary cost to account for paid leave, health, retirement and other benefits. Overhead and operating costs associated with the position were expected to run about $20,000 per year (K. Shaffer, pers. comm.). The total estimated cost to fund the position, including benefits and overhead, was $128,000 per year, or $0.64 million per five-year cost period.

CENTRAL VALLEY HATCHERIES STAFF POSITIONS AND OPERATIONS

NMFS has suggested that each hatchery should add a biologist to their staff to oversee the implementation of the individual management plans. For the state hatcheries, salary costs, including benefits, are expected to be about $92,000 per year per position (K. Shaffer, pers. comm.). Equivalent costs were assumed for the federal hatcheries. It was assumed four biologists would be needed to staff the state fisheries and two would be needed for the federal fisheries. Staffing costs would run about $0.6 million annually, or $3.0 million per five-year cost period.

Operating costs associated with these staff positions were estimated at $20,000 per annum per position (K. Shaffer, pers. comm.), or about $0.6 million per five-year cost period.[11]

In addition, genetic testing would be needed approximately every three years. Assuming 50 samples per stock of fish at $200 per sample would result in a cost estimate of $10,000 per stock. With ten stocks, this would be $100,000 per three-year testing cycle, or $170,000 per five-year cost period. Finally, seasonally-employed technicians would be needed during the fish runs to collect and record population data. This is estimated to cost approximately $40,000 per year, or $200,000 per five-year cost period for a total of $370,000 per five-year cost period (D. Lee, pers. comm.).

Total estimated costs for HGMP development and implementation support by cost period are listed in Table 8.35.

Table 8.36. Estimated HGMP Development and Implementation Support Costs by Cost Period

Costs by Period (mil. $)	Cost Period										Total Cost
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	
HGMP Development	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	15.0
DFG Coordinator	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	6.4
Hatcheries Staffing	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	36.0
Genetic testing/data	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	3.70
Total Cost	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	61.1
Running Total	6.11	12.22	18.33	24.44	30.55	36.66	42.77	48.88	54.99	61.1	61.1

[10] www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm

[11] In addition, other work may be called for including alteration of the current facilities. However, plans and budget estimates for changes to current facilities have not yet been developed. Costs of potential future changes to fisheries facilities are not included in the cost analysis.

Chinook Salmon Mark-Select Fishery Program (OSCM 19)

This conservation measure would fund a full-scale mark-select fishery program to be operated by the DFG and the Pacific Fishery Management Council (PFMC), as described in Chapter 3, *Conservation Strategy*.

Costs for this measure were divided into the following categories: (1) the cost to develop a new mark-select fishery management plan; (2) capital and operating costs for marking and coded wire tagging hatchery salmon; and (3) capital and operating costs for post-catch collection of the coded wires.

MARK-SELECT FISHERY MANAGEMENT PLAN DEVELOPMENT

DFG has indicated that a new approach to managing the mark-select fishery would need to be developed, including the development of new harvest models, public education, and enforcement. This would be a one-time cost, and would be approximately $250,000 (B. Cavallo, pers. comm.).

MARK-SELECT CAPITAL AND OPERATING COSTS

There are approximately 32 million hatchery salmon from the Central Valley. Currently 25 percent are marked with fin clips and coded wire tags. To mark the remaining hatchery salmon would require five additional autofish trailers at $1.3 million each for a total of $6.5 million in 2009 dollars. Estimated equipment costs assume that Pacific Corp will purchase one additional unit as part of its relicensing agreement with the Federal Energy Regulatory Commission (FERC) for the Klamath Dam. The autofish trailers were assumed to have a 20-year useful life, resulting in an amortized annual cost of about $82,000 per trailer, or about $2.0 million per five-year period for all five trailers.

Based on the Washington state experience, the purchase of these trailers would allow the remaining fish to be fin-clipped at a cost of about $45 per thousand fish. Fin-clipping and wire coding could be done at a cost of about $145 per thousand fish (D. Knutzen, pers. comm.). The cost analysis assumed that all fish would be clipped and wire-coded, resulting in annual operating costs of approximately $3.5 million, or about $17.4 million per 5-year cost period.

POST-CATCH COLLECTION OF CODED WIRES

Post-catch collection of the coded wires would pose an additional cost. DFG has estimated post-catch collection of coded wires would cost approximately $3 million per year.[12] It is assumed that collection of coded wires would commence in the fourth year of the first five-year cost period.

Total estimated costs for the mark-select fishery program development and funding by cost period are listed in Table 8.36.

[12] Although this is a much greater cost than was experienced in Washington State, the DFG cost estimate was adopted for the cost analysis.

Table 8.37. Estimated HGMP Development and Implementation Support Costs by Cost Period

Costs by Period (mil. $)	*Cost Period*										*Total Cost*
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
Plan Develop.	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Marking Equip.	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	20.41
Marking Oper.	17.40	17.40	17.40	17.40	17.40	17.40	17.40	17.40	17.40	17.40	174.00
Wire Collection	6.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	141.00
Total Cost	25.69	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	335.66
Running Total	25.69	60.13	94.57	129.01	163.45	197.89	232.34	266.78	301.22	335.66	335.66

Delta and Longfin Smelt Propagation Programs (OSCM 20)

**[*Note to Reviewers:* *Cost estimates for smelt propagation programs are likely to be refined upon further input from staff at UC Davis Fish Culture Lab and USFWS.*]

This conservation measure would support the development of a delta and longfin smelt conservation hatchery to be operated by the US Fish and Wildlife Service (USFWS), the expansion of the University of California, Davis refugial population of delta smelt, and the establishment of a refugial population of longfin smelt, also at the University of California, Davis.

USFWS Delta and Longfin Smelt Conservation Hatchery

The proposed USFWS hatchery is described in Chapter 3, *Conservation Strategy*. Estimated construction costs for the facility, as developed by USFWS, are $19.4 million in 2009 dollars (Clarke 2008). Annual operating costs, also developed by USFWS, are $1.5 - $2.0 million in 2009 dollars (Clarke 2008). For the cost analysis, it was assumed the facility would be constructed by the end of the first cost period and that an annual operating cost of $1.75 million would commence starting in the first year of the second cost period.

Expansion of Delta Smelt Refugial Population

The University of California, Davis has estimated it would cost $2.6 million to expand the existing facility containing the delta smelt refugial population. This cost could double if expansion requires a new facility. Annual operating costs of $0.15 million were also estimated (J. Lindberg, pers. comm.). The University has said that operating costs are expected to increase at 8 percent per year for the next four years. The cost analysis assumed an expansion cost of $2.6 million plus a 20 percent contingency, for a total capital cost of $3.1 million. It was assumed expansion would occur within the first two years of plan implementation and annual operating costs would be incurred starting the third year of plan implementation.

Establishment of Longfin Smelt Refugial Population

The University of California, Davis and the Genomic Variation Lab have not estimated costs to develop and implement genetic management for a longfin smelt refugial population. For the cost analysis, it was assumed that establishing this population would require a new facility. A facility cost of $4 million (which was based on the cost of delta smelt refugial population expansion assuming a new facility) plus 20 percent contingency was assumed, for a total capital cost of

$4.8 million. Annual operating costs were assumed to be the same as for the delta smelt refugial population. It was assumed facility construction would be completed by the end of the first cost period and annual operating costs would be incurred starting with the second cost period.

A summary of the estimated costs for delta and longfin smelt propagation programs is shown in Table 8.37.

Table 8.38. Delta and Longfin Smelt Propagation Program Costs by Cost Period

Costs by Period (mil. $)	*Cost Period*										*Total Cost*
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
USFWS Smelt Hatchery	19.4	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	98.2
Delta Smelt Refugium	3.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.3
Longfin Smelt Refugium	4.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	13.2
Total Cost	26.5	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	123.6
Running Total	26.5	37.2	48.0	58.8	69.6	80.4	91.2	102.0	112.8	123.6	123.6

Non-Project Diversions Entrainment Reduction Measure

Non-Project Diversion Entrainment Reduction (OSCM 21)

This conservation measure is a program to reduce entrainment of fish in existing, unscreened, non-Project diversions in the Delta. Two actions to reduce entrainment are: 1) fund the installation of fish screens as part of existing state and federal programs; and 2) combine, relocate, or otherwise modify existing diversions.

Costs of installing screens are relatively large, especially for larger diversions (greater than 100 cfs). Costs to combine, relocate, or modify existing diversions are likely to be smaller, but are highly dependent on the characteristics of potentially eligible diversions.

Initial Study and On-Going Site Evaluation

DFG and USFWS would like to implement a 3-year fish entrainment monitoring program of diversions in the Delta. The study would organize a technical team, monitor diversions, help to prioritize the ones to screen or modify first, and help determine the most cost-effective approach for each diversion. The estimated cost of the initial study is $3.6 million for the first year and $1.8 million for 2 additional years (Dan Meier, pers. comm.). The funding source is currently unknown, and BDCP could provide funding for this critical element.

In addition, the DFG and USFWS believe an ongoing site evaluation program would help to refine the priority diversions and to evaluate the costs and benefits of screening in the Delta. This site evaluation program would support adaptive management. If screening or other modifications are found to have little additional benefit, some funding could be reallocated to other conservation measures. Ongoing site evaluation is estimated to cost $xxx per year beyond the initial study's duration.

Costs of Screening Non-Project Diversions

Costs of installing screens on existing diversions are expressed in dollars per cfs of diversion capacity. The estimates are based on recent projects completed in California and on agency

experts' judgment about costs. Costs per cfs of capacity rise steeply with diversion size, due to increasing complexity of design and construction. The number of unscreened diversions in the Delta was provided in a database from California DFG (2009). Capacity estimates were only available for a fraction of these diversions. Large diversions (greater than 100 cfs) are generally well-known, so it was assumed that diversions with unknown capacity fall in the small capacity range (less than 100 cfs). Table 8.38 summarizes the estimates of diversions by category, cost per cfs for screen installation, and total installation cost assuming all are screened. The cost of maintaining and replacing installed screens is assumed to be the responsibility of the diversion owners and operators, and is not included here.

A relatively small number of unscreened, non-Project diversions fall in the higher size categories, but they add a disproportionate amount to the total potential cost. DFG and USFWS generally believe that large diversions also have a disproportionate effect on fish populations, but would like the initial study to gather more data on this question.

*[**Note to Reviewers**: This table is based on the assumption that all unscreened diversions would be screened, and costs are presented for discussion purposes only. As it may not prove cost-effective to screen all diversions, these cost estimates may be reduced accordingly.]*

Table 8.39. Delta Diversions and Costs of Installing Fish Screens, by Size Class

Size Class of Unscreened Delta Diversion	Number of Diversions[1]	Installed Cost per cfs	Estimated Total Cost of Screening all Diversions
< 100 cfs	468	$8,400[2]	$69,400,000
100 – 250 cfs	11	$32,000[2]	$44,480,000
> 250 cfs	1	$107,500[3]	$129,000,000
Capacity unknown	2528	$8,400[2]	$93,150,000[4]
Total	3008	NA	$336,030,000

[1] Derived from a database of unscreened diversions provided in spreadsheet format by DFG.
[2] Estimated from a data set of screening costs for recent projects in California compiled by PG&E, provided by California DFG. Costs escalated to 2009 dollars.
[3]Estimate is the mid-point of a range provided by Thomas Schroyer (pers. comm.), DFG, October 7, 2009.
[4]Based on an estimated total unscreened diversion capacity of 22,000 cfs cited in Chapter 3, the diversions of unknown capacity total 11,133 cfs. Cost estimate assumes these are all in the <100 cfs size class.

COSTS TO COMBINE, RELOCATE, OR MODIFY NON-PROJECT DIVERSIONS

The initial study and on-going monitoring and evaluation is expected to identify small diversions at which fish entrainment can be reduced at a lower cost than installing screens. The number of diversions that may be eligible for a non-screening treatment is not known. The cost per diversion (or per cfs) is expected to range from $xxx to $xxx. The cost of maintaining and replacing installed equipment is assumed to be the responsibility of the diversion owners and operators, and is not included here.

COST SHARING

An existing federal program, the Anadromous Fish Screen Program provides up to 50 percent cost-sharing funding for screening of intakes that benefit anadromous fish (the program does not

include delta smelt in its funding priorities). State funding through the CALFED Ecosystem Restoration Program has, to date, provided much of the remaining costs, largely through state bond money. The BDCP could provide 100 percent funding of some high-priority projects, or it could provide a cost-sharing commitment for the costs of reducing entrainment at non-Project Delta diversions, with the remainder funded through federal, other state, or local sources.

Total Costs to Reduce Entrainment at Non-Project Delta Diversions

At this stage, the number of diversions judged to need screening versus other modification (or no change) is not known. Therefore, a range of potential costs are displayed: a high, "bookend" cost, and a lower level of support provided to existing programs.

The ***high-cost program*** is assumed to have the following program features:

- All non-Project Delta diversions would be screened, at total costs indicated in Table 8.38 above.
- An initial, 3-year study would locate, characterize, and prioritize unscreened diversions. The estimated cost of the initial study is $3.6 million for the first year and $1.8 million per year for 2 additional years.
- A continuing site evaluation program would be funded to identify prospective unscreened diversions prior to screening and to assess effectiveness of screening. For purposes of estimation, the annual cost is assumed to be similar to the latter years of the initial study, at $1.8 million per year.
- Federal and other state funding sources would be directed to upstream areas.

Total estimated costs to screen non-project diversions by cost period are summarized in the top portion of Table 8.39.

A ***lower-cost program*** would support existing state and federal programs by augmenting their budgets for studying and monitoring entrainment at diversions, and by offering cost-sharing for installation costs. An example of this approach is shown in the lower portion of Table 8.39, based on the following specific assumptions:

- All large (>100 cfs) non-Project Delta diversions would be screened, and would receive priority for early installation.
- 25 percent of small diversions would be screened; 50 percent of small diversions would receive other modifications, at an average of half the cost of screen installation; and 25 percent would not be screened or modified.
- An initial, 3-year study would locate, characterize, and prioritize unscreened diversions. The estimated cost of the initial study is $3.6 million for the first year and $1.8 million per year for 2 additional years.

- BDCP would contribute to evaluating prospective unscreened diversions prior to screening and to assess effectiveness of screening. For purposes of estimation, the annual contribution is assumed to be $0.5 million per year.

- BDCP would provide a 50 percent cost share for installation costs. Federal and other state funding sources would provide the remaining funds.

*[**Note to Reviewers**: for discussion purposes, table 8.39 shows a range of costs based on the assumptions described above.]*

1

Table 8.40. Estimated Costs for High and Lower Cost Programs to Reduce Entrainment at Non-Project Delta Diversions

Cost by Period (mil. $)	*Cost Period*										*Total Cost*
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	
Example High-Cost Program to Screen All Non-Project Diversions											
Screen Small (<100 cfs) Diversions	$16.3	$16.3	$16.3	$16.3	$16.3	$16.3	$16.3	$16.3	$16.3	$16.3	$162.6
Screen Large (>100 cfs) Diversions	$86.7	$86.7	-	-	-	-	-	-	-	-	$173.5
Initial Study, Site Evaluation	$10.8	$9.0	$9.0	$9.0	$9.0	$9.0	$9.0	$9.0	$9.0	$9.0	$91.8
Total Cost	**$113.8**	**$112.0**	**$25.3**	**$25.3**	**$25.3**	**$25.3**	**$25.3**	**$25.3**	**$25.3**	**$25.3**	**$427.8**
Running Total	**$113.8**	**$225.8**	**$251.1**	**$276.3**	**$301.6**	**$326.8**	**$352.1**	**$377.3**	**$402.6**	**$427.8**	**$427.8**
Example Lower Cost Program to Augment Existing Activities and Provide Cost-Sharing for Installation											
Screen/Modify Small Diversions	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$40.6
Screen Large (>100 cfs) Diversions	$43.4	$43.4	-	-	-	-	-	-	-	-	$86.7
Initial Study, Site Evaluation	$8.2	$2.5	$2.5	$2.5	$2.5	$2.5	$2.5	$2.5	$2.5	$2.5	$30.7
Total Cost	**$55.6**	**$49.9**	**$6.6**	**$6.6**	**$6.6**	**$6.6**	**$6.6**	**$6.6**	**$6.6**	**$6.6**	**$158.1**
Running Total	**$55.6**	**$105.6**	**$112.1**	**$118.7**	**$125.3**	**$131.8**	**$138.4**	**$145.0**	**$151.5**	**$158.1**	**$158.1**

2

3 ## *Predator Control Measures*

4 ### *Localized Predator Control Program (OSCM 24)*

5 Through this conservation measure, the BDCP Implementing Entity would evaluate the impact
6 on covered species of localized control of predatory fish species, such as largemouth and striped
7 bass, at locations in the Delta known to have high predator populations. The locations for the
8 initial evaluations and monitoring would be determined in conjunction with fisheries agencies
9 and experts familiar with predation trouble spots in the Delta. Subsequent monitoring and
10 control actions would be determined by the effectiveness of the initial control programs.

11 The costs for this measure, including completing the pilot programs, evaluating and documenting
12 program results, and coordinating with DFG and other fish agencies would primarily be staff-

related and are included in the estimated costs for BDCP Program Administration presented later in this chapter.

Juvenile Salmon Migration Measure

Non-Physical Barriers for Juvenile Salmon (OSCM 25)

This conservation measure would direct outmigrating juvenile salmonids away from Delta channels with low survival rates by installing non-physical barriers at the heads of these channels. Potential locations for non-physical barriers are described in Chapter 3, *Conservation Strategy*, and include the Head of Old River, the Delta Cross Channel, Georgiana Slough, Turner Cut, Columbia Cut, the Delta Mendota Canal intake, and the Clifton Court Forebay.

A pilot project was carried out at the Head of Old River, using 14 sections of bubble generators, each 8 meters long. This project used leased equipment and consultant operators. For the spring season of 2009, the cost estimate was $1.3 million dollars (M. Holderman, pers. comm.). It is expected that the experience gained through this pilot program would allow the same program to be implemented with a ten percent reduction in costs.

The cost of each of the potential barriers is likely to be uniquely determined by the situation at the location to be screened. For example, the Head of Old River program was not located near any electrical power supplies, so all energy for the project had to be supplied through generators. This may not be the case at other locations. In addition, the bubble curtains at some locations might be shaped to reflect fish movement patterns. For example, early consideration has suggested that a barrier at the head of Georgiana Slough might be more effective if it were V-shaped, rather than a straight barrier across the slough. A 20 percent cost contingency has been added to the cost estimates to account for current uncertainty about site conditions and other factors that could increase the actual costs of this measure.

The cost analysis assumed that non-physical barriers would be installed in seven Delta locations (see OSCM 25) during outmigration periods. The annual costs were assumed to be 90 percent of the pilot program costs plus a 20 percent cost contingency. Costs by period are summarized in Table 8.40.

Table 8.41. Estimated Non-Physical Barriers Program Costs by Cost Period

	Cost Period										*Total*
Costs by Period (mil. $)	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	***Cost***
Cost for 7 Barriers	49.1	49.1	49.1	49.1	49.1	49.1	49.1	49.1	49.1	49.1	491.4
Running Total	49.1	98.3	147.4	196.6	245.7	294.8	344.0	393.1	442.3	491.4	491.4

8.2.5 Program Administration

Program administration costs include the costs for employees, facilities, equipment, vehicles, and associated overhead to operate the office of the BDCP Implementing Entity. Associated overhead costs include employee benefits, insurance, legal and financial assistance, and travel. For the purposes of cost estimation, the BDCP Implementing Entity is assumed to be a stand-alone organization located in Sacramento, CA. This assumption provides a conservative basis from which to estimate program administration costs. Actual program administration costs may be lower than estimated if the BDCP Implementing Entity is housed within an existing agency

and is able to utilize existing staff and other administrative resources. Note that administrative costs associated with plan implementation that may be incurred by entities (e.g., supporting entities – see Chapter 7, *Implementation Structure*) other than the BDCP Implementing Entity are not included in the program administration cost estimate.

BDCP Implementing Entity Staff and Associated Cost Assumptions

The staffing plan used to estimate labor costs for program administration is shown in Table 8.41.

**[*Note to Reviewers:* *Staffing estimates are likely to be revised as the governance plan continues to be refined.*]

Table 8.42. Staffed Positions and Number of Employees for BDCP Program Administration

Staffing Levels	*Avg Annual FTEs Per Cost Period*									
Position	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**
Program Manager	1	1	1	1	1	1	1	1	1	1
Deputy Program Manager	1	1	1	1	1	1	1	1	1	1
Program Counsel	1	1	1	1	1	1	1	1	1	1
Habitat Restoration Program Manager	1	1	1	1	1	1	1	1	1	1
Other Stressors Program Manager	1	1	1	1	1	1	1	1	1	1
Monitoring/Research Program Manager	1	1	1	1	1	1	1	1	1	1
IT/Database/GIS Management	1	1	1	1	1	1	1	1	1	1
GIS Specialist	1	1	1	1	1	1	1	1	1	1
Budget Analyst	1	1	1	1	1	1	1	1	1	1
Land Acquisition Specialist	2	3	3	3	2	2	1	1	1	1
Contracts Officer	1	1	1	1	1	1	1	1	1	1
Regulatory Specialist	1	1	1	1	1	1	1	1	1	1
Public Outreach Program Manager	1	1	1	1	1	1	1	1	1	1
Admin - Secretary	2	2	2	2	2	2	2	2	2	2
Clerks	3	3	3	3	3	3	3	3	3	3
Civil Engineer	1	1	1	1	1	1	1	1	1	1
Staff Scientist	2	3	3	3	3	3	3	3	3	3
Water Operations Specialist	2	2	2	2	2	2	2	2	2	2
Habitat Restoration Project Manager	1	2	3	3	3	3	2	2	1	1
Other Stressors Project Manager	2	2	2	2	1	1	1	1	1	1
Terrestrial Preserve Manager	1	1	2	2	2	2	2	2	2	2
Technical Specialist	5	10	10	10	10	10	8	6	5	4
Laborer	2	4	4	6	6	6	6	6	6	6
Total FTE Positions	**35**	**45**	**47**	**49**	**47**	**47**	**43**	**41**	**39**	**38**

Salary assumptions for staffed positions are listed in Table 8.42. Salary assumptions are based on salaries paid by the State of California for comparable positions in various departments within the California Natural Resources Agency, as indicated by the table. The salary amounts shown in the table were multiplied by 1.35 to account for paid leave, health, retirement and other benefits. Annual travel allowances, per diem rates, and annual training costs for each salaried position were assumed in order to calculate associated employee expenses. These assumptions are listed in Appendix XX.

The staff levels shown in Table 8.41 reflect the needs for program administration as well as for physical habitat restoration, habitat reserve management, and monitoring and research. Table 8.42 below shows the percentage of salary and associated employee expenses by staff position allocated to each function.

Table 8.43. Staff Salary Assumptions for BDCP Implementing Entity

Position	*Annual FTE Salary**	*Resources Agency Reference Position*	*Percent of Cost Allocated to Function*			
			Program Admin.	**Habitat Restor.**	**Reserve Mgt.**	**Monitoring Research**
Program Manager	$115,000	C.E.A. III, DFG, Resources Management & Policy Division	100%	0%	0%	0%
Deputy Program Manager	$106,000	C.E.A. II, DFG, Bay Delta Region	100%	0%	0%	0%
Program Counsel	$113,000	Staff Counsel III-Supervisor, DFG	100%	0%	0%	0%
Habitat Restoration Program Manager	$86,000	Environmental Program Manager I – Supervisory, Habitat Conservation Branch, DFG	15%	75%	10%	0%
Other Stressors Program Manager	$86,000	Environmental Program Manager I – Supervisory, Habitat Conservation Branch, DFG	15%	20%	40%	25%
Monitoring/ Research Program Manager	$86,000	Environmental Program Manager I – Supervisory, Habitat Conservation Branch, DFG	15%	0%	0%	85%
IT/Database/GIS Management	$76,000	Research Manager II - Geographic Information Systems, DFG	100%	0%	0%	0%
GIS Specialist	$65,000	Supervising Biologist, Water Branch, DFG	100%	0%	0%	0%
Budget Analyst	$60,000	Associate Budget Analyst, Administration Division, DFG	100%	0%	0%	0%
Land Acquisition Specialist	$77,000	Sr Land Agent– Specialist, DFG	100%	0%	0%	0%
Contracts Officer	$71,000	Staff Services Manager I, DFG	100%	0%	0%	0%
Regulatory Specialist	$59,000	Associate Governmental Program Analyst, DFG	100%	0%	0%	0%
Public Outreach Program Manager	$61,000	Information Officer I – Specialist, DFG	100%	0%	0%	0%
Admin - Secretary	$40,000	Executive Assistant, Resources Management & Policy Division, DFG	50%	0%	50%	0%
Clerks	$33,000	Account Clerk II, DFG	100%	0%	0%	0%
Civil Engineer	$82,000	Associate Civil Engineer, DFG	15%	70%	15%	0%
Staff Scientist	$71,000	Staff Env Scientist, Habitat Conservation Branch, DFG	15%	20%	15%	50%
Water Operations Specialist	$77,000	Operations Research Spec III, DWR Bay Delta Office	100%	0%	0%	0%
Habitat Restoration Project Manager	$71,000	Staff Env Scientist, Habitat Conservation Branch, DFG	15%	70%	0%	15%

Other Stressors Project Manager	$71,000	Staff Env Scientist, Habitat Conservation Branch, DFG	15%	70%	0%	15%
Terrestrial Preserve Manager	$71,000	Staff Env Scientist, Habitat Conservation Branch, DFG	15%	0%	85%	0%
Technical Specialist	$46,000	Fish Habitat Specialist, Bay Delta Region, DFG	25%	25%	25%	25%
Laborer	$42,000	Laborer - Tractor Operator, Bay Delta Region, Region 3, DFG	0%	25%	50%	25%

Notes:

* Salary estimates based on proposed salaries for 2008-09 for corresponding positions within the Resources Agency, as reported by the California Department of Finance (www.dof.ca.gov/budget/historical/2008-09/salaries_and_wages/index.htm). A benefits multiplier of 1.35 is applied to salary amounts shown in the table to account for paid leave, health, retirement and other benefits is not reflected in the salary amounts shown in the table.

Office Space and Associated Costs

Office space and associated costs for BDCP program administration include the cost of office space and utilities, general office equipment, employee-assigned office equipment, GIS hardware and software, and public outreach materials. Assumptions used in the cost analysis for each of these costs were as follows:

Office Space and Utilities – Office space requirements for BDCP program administration were set to 250 square feet per FTE employee, not including field labors and other out-of-office employees. It was assumed the BDCP Implementing Entity would be housed in leased office space in the downtown Sacramento area. Unfurnished office space was assumed to cost $2.50/sf/month, including utilities. This represents about a 25 percent premium over present rental rates in the downtown area in order to account for currently depressed conditions in the Sacramento commercial real estate market.

General Office Equipment – This category was assumed to include general office equipment, such as copy machines, a telephone system, printers, fax machines, as well as specialized equipment such as digital cameras, a trunked radio system, and books and journal subscriptions. This category also included costs for office furniture in common areas. Annual costs were based on the estimated purchase cost for each item amortized over the item's useful life. In addition, some items were assumed to include annual service contract costs. The specific cost assumptions for each item as well as the quantity required during each cost period are listed in Appendix XX.

Employee-Assigned Office Equipment – This category included office equipment assigned to individual employees. This included cubicle office furniture, computers, cell phones, and office supplies. Annual costs were based on the estimated purchase cost per full-time equivalent (FTE) employee for each item, amortized over the item's useful life. In addition, some items were assumed to include annual service contract costs. The specific cost assumptions for each item as well as the quantity required during each cost period are listed in Appendix XX. Employee-assigned office equipment costs were allocated to the functions of program administration, habitat restoration, reserve management, and monitoring and research according to the allocation percentages in Table 8.42.

GIS Hardware and Software – This category included a dedicated geographic information system (GIS)/database server, tablet personal computer, plotter, GPS unit, GIS software, and

related computer software. Annual costs were based on the estimated purchase cost for each item amortized over the item's useful life. In addition, some items were assumed to include annual service contract costs. The specific cost assumptions for each item as well as the quantity required during each cost period are listed in Appendix XX.

Public Outreach Costs – This category included an annual stipend for printed materials, public meetings and focus groups, including costs for design, layout, printing, postage, web services, and facilities rental. Staff costs associated with public outreach and involvement are included as part of the BDCP Implementing Entity staff, and associated costs and are not counted here. Public outreach and involvement costs were treated as a lump sum cost per year, and were assumed to total $200,000 per year for years 1-10, $100,000 per year for years 11-15, $75,000 per year for years 16-25, $25,000 per year for years 26-35, and $10,000 per year thereafter.

Vehicles

Vehicle costs for BDCP program administration include the costs for owned and rented vehicles and associated fuel, maintenance, and vehicle insurance costs. As with staffing costs, vehicle costs were allocated across the functions of program administration, habitat restoration, reserve management, and monitoring and research according to the allocation percentages in Table 8.43. Annual costs for owned vehicles were based on the estimated purchase cost for each vehicle type amortized over the vehicle's useful life plus an annual allowance for fuel, maintenance, and insurance. Annual costs for rented vehicles were based on a daily rental rate multiplied by the number of rental days per year per 1,000 acres of habitat under management. The specific cost assumptions for each vehicle type as well as the number of vehicles estimated to be required during each cost period are listed in Appendix XX.

Table 8.44. Vehicle Types and Cost Allocation Percentages

Owned Vehicles	*Percent of Cost Allocated to Function*			
	Program Admin.	**Habitat Restor.**	**Reserve Mgt.**	**Monitoring Research**
Passenger Cars	50%	0%	25%	25%
4WD Trucks	0%	33%	33%	33%
Boats	0%	33%	33%	33%
ATVs & Trailers	0%	33%	33%	33%
Rented Vehicles				
Large Tractor	0%	0%	75%	25%
Small Tractor	0%	0%	75%	25%
Dump Truck	0%	0%	75%	25%
Fire Truck	0%	0%	100%	0%

Insurance

Insurance requirements for the BDCP Implementing Entity were assumed to include directors and officers insurance, general liability insurance, and professional liability insurance. Annual premium assumptions are the same as those adopted by the Santa Clara Valley Habitat Plan, Working Draft, dated June 2009, and are listed in Appendix XX. Liability insurance costs for

the BDCP Implementing Entity are assumed to total $20,020 per year, or $100,100 every five years.[13]

Legal and Accounting Assistance

The BDCP Implementing Entity was assumed to require outside legal and accounting assistance throughout the 50-year plan period. Legal assistance costs were based on an hourly rate for legal counsel of $375/hr. The amount of legal assistance assumed varies by cost period, as shown in Appendix XX. Accounting assistance costs assume a full outside audit every third year at an average cost of $37,000 per audit. Audit frequency and cost assumptions are the same as those adopted by the Santa Clara Valley Habitat Plan, Working Draft, dated June 2009.

Total Estimated Costs for Program Administration

The total estimated cost for program administration by the BDCP Implementing Entity, including costs for salaried employees, office space and equipment, vehicles, insurance, and outside legal and accounting assistance are summarized in Table 8.44. The table also shows how BDCP Implementing Entity costs were allocated between the functions of program administration, restoration, reserve management, and monitoring and research.

Table 8.45. Total Estimated Costs for BDCP Program Administration

BDCP Implementing Entity Costs (mil.$)	*Cost Period*										
	1-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**Total**
Staff Costs*	$15.7	$19.3	$20.3	$20.9	$19.9	$19.9	$18.2	$17.6	$16.8	$16.5	$185.0
Office Costs**	$2.9	$3.3	$2.9	$2.7	$2.6	$2.4	$2.2	$2.0	$1.9	$1.9	$24.8
Vehicles***	$0.5	$0.9	$1.0	$1.1	$1.3	$1.4	$1.4	$1.4	$1.4	$1.3	$11.5
Outside Services****	$1.9	$1.9	$1.9	$1.0	$1.0	$0.5	$0.5	$0.5	$0.5	$0.5	$10.5
Liability Insurance	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$1.0
BDCP Implementing Entity Cost Allocation											
Program Administration	$14.0	$15.4	$15.1	$14.1	$13.4	$12.7	$11.7	$11.4	$11.2	$11.1	$130.2
Restoration	$2.8	$3.9	$4.3	$4.4	$4.1	$4.1	$3.5	$3.4	$2.9	$2.8	$36.2
Reserve Management	$2.1	$3.1	$3.6	$4.0	$4.1	$4.2	$4.1	$4.0	$3.9	$3.8	$36.9
Monitoring/Research	$2.1	$3.0	$3.1	$3.3	$3.3	$3.3	$3.1	$2.9	$2.7	$2.6	$29.4
Total Costs	**$21.1**	**$25.5**	**$26.2**	**$25.9**	**$24.9**	**$24.2**	**$22.4**	**$21.6**	**$20.7**	**$20.3**	**$232.8**
Running Total	**$21.1**	**$46.6**	**$72.7**	**$98.6**	**$123.5**	**$147.7**	**$170.1**	**$191.8**	**$212.5**	**$232.8**	**$232.8**

*Includes employee benefits and incidentals.
**Includes costs for office space, general office equip., employee-assigned office equip., specialized office equip., and public outreach expenditures.
***Includes costs for owned and rented vehicles.
****Includes cost for outside accounting and legal services.

[13] Vehicle and employee health/disability/workers compensation insurance costs are calculated separately from liability insurance costs. Vehicle insurance costs are included in the vehicle cost estimate, while employee insurance costs are captured by the benefits multiplier applied to wage and salary costs.

Monitoring, Research, Data Analysis, and Adaptive Management

[***Note:*** *This section will lay out the method, data, and assumptions for estimating on-going costs for monitoring, research, data analysis, and adaptive management activities.*]

Remedial Measures

[***Note to Reviewers:*** *This section will lay out the method, data, and assumptions for estimating costs to implement remedial measures in response to changed circumstances*]

8.3 Program Cost Summaries and Tables

[***Note to Reviewers:*** *This section will present the cost summary tables for the BDCP. These tables will be added to the chapter once the cost analysis has been completed.*]

8.4 Total and Net BDCP Costs

[***Note to Reviewers:*** *This section will compare total to net costs of BDCP implementation. Total costs are the sum of costs for all plan components expected to be incurred over the 50-year planning period. Net costs recognize that some of these costs would be incurred even if the plan were not put into operation. This will be the last step in the cost analysis and cannot be completed until the analyses of total costs for all conservation measures and related activities are completed.*]

8.5 Funding Sources and Assurances

[***Note to Reviewers:*** *Funding Sources and Assurances are not included with this draft. This section will be completed following completion of the cost analysis and the development of the funding plan.*]

Technical Appendix for Cost Estimation

[***Note to Reviewers:*** *The technical appendix will provide more detailed information on data sources, assumptions, and cost models used to estimate expected BDCP costs.*]