

APPENDIX E

RECOVERY ACTION COST ESTIMATES FOR STEELHEAD RECOVERY PLANNING

Introduction Cost

The ESA provides that “recovery plans, shall, to the maximum extent practicable . . . incorporate in each plan . . . (iii) . . . estimates of the time required and the cost to carry out those measures needed to achieve the plan’s goal and to achieve intermediate steps toward that goal.” NMFS interim recovery planning guidance (2010) further provides that, “There may be extreme cases in which estimating the date and cost to recovery is not possible due to uncertainty in what actions will need to be taken to recover the species.” The precision of any recovery cost estimate is necessarily governed by the specificity of the recovery action, and the availability of information regarding the costs of individual components of that recovery action (labor, materials, logistics, geographic scope and duration, *etc.*).

As noted in the Recovery Plan, there are many uncertainties regarding the recovery of South-Central California Coast steelhead, ranging from fundamental biological questions about the ecology of the species, to anticipated changes in climate. The SCCCS Recovery Plan identifies categories of systemic threat sources within individual watersheds across the SCCCS Recovery Planning Area but, because of the large number of individual threats (from site-specific activities to general land-use practices), does not provide a detailed assessment of each specific threat, and in many cases calls for further investigations to more clearly characterize and assess threats which are believed to be of particular significance for the conservation of the species (*e.g.*, fish passage barrier inventories, flows restrictions, introduction exotic species, and degradation of estuarine and other habitats). Because of the uncertainties regarding specific aspects of the life history of steelhead (*e.g.*, relationship between anadromous vs. resident reproductive life history cycles), the SCCCS Recovery Plan also provides provisional viability criteria, and identifies important research and monitoring needed to better illuminate the biological requirements of the species and thereby better refine the viability criteria, and related recovery strategy and actions.

The recovery action tables (Tables 9-4 through 12-10) developed for each BPG within the SCCCS Recovery Planning Area identify broadly conceived recovery actions for each major threat source in all the core populations (as well as providing a priority ranking for recovery action within each core watershed). These recovery actions are based on the general recovery action descriptions contained in Chapter 8, Summary DPS-Wide Recovery Actions, Table 8.2 (Recovery Action Glossary). However, implementation of the recovery actions will require detailed background studies, and in some cases, engineering and other types of site-specific plans and/or environmental documentation, to further refine the nature, scope and other relevant details of the recovery action. Within the limits of these information constraints, an effort has been made to identify, within an order of magnitude, the estimated cost of the basic types of recovery actions.

Cost Estimation Method

The following describes the methods by which the costs of individual types of recovery actions were estimated.

NMFS's has utilized a series of assumption tables for costs derived initially from the NMFS's *Habitat Restoration Cost References for Salmon Recovery Planning* (Thompson and Pinkerton 2008). These assumption tables have been adjusted to the extent practicable to reflect conditions in SCCCS Recovery Planning Area.

The "Cost of Doing Business" is estimated on a staff-time basis. When staff is required for review only, the cost is attributed to the initial fiscal year; when implementation is intended, the staff time is annually attributed across the projected duration of the recovery action. All other costs are estimated on a per project, per area, or per distance basis.

Finally the cost estimates provided in the cost assumption tables are the direct costs of implementing each recovery action, and do not reflect indirect costs, or benefits (*e.g.*, benefits to the local economy stemming from restored habitats that support recreational activities, reducing flood hazards, improving water quality, *etc.*).

Agricultural Development

The cost estimates for implementing a plan to minimize runoff from agricultural activities were derived by estimating the number of river or stream miles running through agriculturally-zoned or agriculturally-designated lands in each BPG using Geographic Information Systems (GIS). After applying a cost per linear mile, project costs were then projected over a twenty-year period (see Assumptions and Categories Tables 14, 15 and 19).

Dams and Diversions

The cost estimates to implement recovery actions associated with dams and diversions were calculated using the CalFish.org mapping tool. This tool allows the determination of the number of dams/diversions across the BPG and assigns costs according to passage barrier severity. While this method may be useful for small dams and diversion, the modification or removal of large dams is highly dependent on site-specific conditions and cannot be accurately estimated without extensive technical and planning studies (see Assumptions and Categories Tables 4, 5 and 9).

Other Passage Barriers

Culvert replacement cost estimates were calculated based on the assumption that a minimum of one culvert would need to be replaced in each identified watershed, or sub-watershed, annually for the first five years of Recovery Plan implementation (see Assumptions and Categories Tables 7 and 10).

Groundwater Management

Groundwater management cost estimates were made based on hiring one staff scientist to assess current groundwater management practices, and identify steps, if necessary, to modify practices to address potential threats. After the first year, the scientist position is dropped to 'Cost of Doing Business'. Sediment assessments are initially calculated by stream length and then on a per mile basis (see Assumptions and Categories Tables 1, 2, and 19).

Flood Control

The cost estimates for levee and channelization-related recovery actions were made using a GIS data base to perform a dimensional analysis of parameters such as stream length, acreage, *etc.* Based on these results, costs were assigned on a per mile or per acre basis. As with large dams and diversion, while this method may be useful for managing existing facilities, the modification or removal of large flood control works is highly dependent on site-specific conditions and cannot be accurately estimated without extensive technical and planning studies. Federal, state and local flood control works, as well as actions such as “minimize herbicide use near levees” are considered to be “Cost of Doing Business” (see Assumptions and Categories Tables 1, 11, 12, 13 and 15).

Mining and Quarrying

The cost estimates for aggregate mining operations were made based on hiring one staff biologist to make an initial assessment of current mining practices, and identify steps, if necessary, to modify practices to address potential threats. After the first year, the position is considered to be ‘Cost of Doing Business’. (see Assumptions and Categories Tables 1, 2 and 13).

Non-Native Species

Non-native species recovery actions consist of several distinct activities, including assessment, control, education and outreach, as well as development of monitoring programs. The cost estimates for controlling and removing non-native species were derived on a per acre basis and a staff time scenario. The education and outreach costs were based on per program scenarios. The monitoring program costs were based on hiring a biological scientist for one year to develop a monitoring program, and then transitioning that cost into a “Cost of Doing Business” scenario (see Assumptions and Categories Tables 1, 2, 17 and 18).

Urban Development

The cost estimates for recovery actions focused on urban development threat sources were based on the hiring of an Urban Regional Planner under a staff-time scenario for the first year. To assess the adequacy of current land-use planning standards and programs, and to identify step, if necessary, to address potential inadequacies. After the first year, the cost reverts to “Cost of Doing Business”. Managing effluents and storm drains were considered to be annual maintenance scenarios and “Cost of Doing Business” (see Assumptions and Categories Tables 1, 2 and 8).

General Planning

The costs associated with reviewing and updating General Plans or Local Coastal Plans, and more focused plans such as transportation, recreation, and water quality plans were all considered to be “Cost of Doing Business” (see Assumptions and Categories Table 1).

Wildfires

Public agencies are assumed to be responsible for fuel and equipment required for wildfire planning and management for the protection of listed species, including steelhead. Therefore, all costs associated with wildfire planning and management throughout the DPS are considered to be “Cost of Doing Business” (see Assumptions and Categories Tables 1 and 2).

Upslope/Upstream Activities

The cost estimates for estuarine restoration recovery actions designed to deal with a variety of upslope/upstream activities were made on a per acre basis using a staff-time scenario. Costs are based on a combination of GIS dimensional analysis to determine currently existing estuarine areas as well as factoring in the percentage of historical estuarine area that still remains. The restoration of coastal estuaries is highly dependent on site-specific conditions and cannot be estimated without extensive technical and planning studies (see Assumptions and Categories Tables 2, 16 and 19).

Regional Cost Estimate Tables: Categories and Assumptions

Table 1. Cost of Doing Business (CDB)	
Action Type	Cost Representation
CDB: Enough Staff Available	0
CDB: Inadequate Funding/Staff	0 ¹
Over and Above CDB	FTEs ²

¹Defer to inadequate regulatory mechanisms action where additional FTEs accounted for

²See U.S. Bureau of Labor Statistics, FTE assumption table (2009) for costs.

Table 2. Staff Time ²		
Occupation	Wage ¹ (\$/hr.)	Annual Wage (\$/FTE)
Biologist	33	68030
Biologist Technician	20	40900
Fish and Game Warden	27	56030
Police/Sheriff Patrol Officers	25	52810
Forest Fire Inspectors/ Prevention	18	36400
Forest and Conservation Workers	13	26110
Urban and Regional Planners	30	62400
Physical Scientists (all others)	44	91850

¹Seasonal

²Source: U.S. Bureau of Labor Statistics, 2009

Table 3. Groundwater Management ¹	
Action	Cost (\$/gage) & (\$/year)
Installation of State/Private Gage	26136
Installation of USGS Gage	29545
Annual Maintenance of State/Private Gage	7955
Annual Maintenance of USGS Gage	3409

¹Source: Rhode Island Department of Environmental Management, 2004

Table 4. Fish Passage Improvement (\$/Project) ¹				
Stream Crossing	Land Use			
	Forest	Agriculture	Suburban	Urban
Tributary: Total Barrier	63,636	159,090	318,181	556,818
Tributary: Partial/Temporal Barrier	31,818	79,545	159,090	278,409
Stream : Total Barrier	159,090	381,818	556,818	795,454
Stream: Partial/Temporal Barrier	79,545	190,909	278,409	397,727

¹Source: Thompson and Pinkerton 2008 (pp. 1-16)

Table 5. Dam Removal ¹	
Dam Height	Cost (\$/foot)
< 15'	568,181
>15'	17,045
unknown height: complete barrier	1,022,727
unknown height: partial/temporal/unknown barrier	511,363

¹Source: Thompson and Pinkerton 2008 (p. I.11)

Table 6. Bridge Construction ¹	
Bridge Type	\$/sq. ft. of decking
RC Slab	191
RC Box Girder	170
CIP/PS Slab	168
CIP/PS Box Girder	298
PC/PS "I" Girder	231
PC/PS Bulb "T" Girder	239
Average	216

Source: DOT, 2008

Table 7. Replacing a Culvert	
New Type of Crossing	Average Cost (\$)
Bridge <40ft	51,546
Bridge >40ft	103,093
Bottomless/Open Bottom Arch	193,961
Natural Bottom Pipe Arch	215,776
Box Culvert	248,352

Source: Thompson and Pinkerton (pp. 11-15)

Table 8a. Road Upgrade/Road Decommissioning ¹	
Location	Cost (\$/mile)
California	18,104
California	93,279
Table 8b. Road Construction (for relocation purposes) ²	
Type of Road	Cost (\$/mile)
Non paved: two directional 12' shared path	175,000
Undivided 2-lane rural road w/ 5' paved shoulders	1,713,000

¹ Source: Thompson and Pinkerton (pp. 43-44)

² Source: California Department of Transportation 2010

Table 9. New Fish Ladder ¹	
Waterway Size	Cost (\$)
Large	1,022,727
Small	568,181

¹ Source: Thompson and Pinkerton 2008 (p. 9)

Table 10. Culvert Replacement (\$/Culvert) ¹				
Size of Waterway	Road Type			
	Forest Road	Minor 2 Lane	Major 2 Lane	Hwy 4+ Lane
Small (0-10')	31,976	87,209	174,419	319,767
Medium (10-20')	87,209	220,930	319,767	436,047
Large (20-30')	133,721	267,442	406,977	813,953

¹Source: Thompson and Pinkerton (p. 10)

Table 11. Storm Drain Retrofit ¹	
Action	Cost (\$/filter) or (\$/program)
Catch Basin/Filter Installation	98
Annual Maintenance Program	6452

¹Source: Kosciusko County 2002

Table 12. LWD/Instream Restoration ^{1*}	
Stream Type	Cost (\$/mile)
Small, Rocky	68,182
Large, Rocky	159,091

¹Source: California Department of Fish and Wildlife 2004b (pp. 1.23 – 1.24)
^{*}includes 5 yrs. of monitoring/maintenance and 10% administrative fee

Table 13. Channel Restoration ¹	
Type	Cost (\$/mile)
Large scale reach restoration	4,217,623

¹Source: Thompson and Pinkerton (p. 27)

Table 14. Riparian Planting			
Materials/Site Accessibility	Site Preparation Costs (\$/acre) ¹		
	Flat/Light Clearing	Average Clearing	Steep/Heavy Clearing
Low Cost	17,442	40,698	93,023
Medium Cost	26,163	63,954	110,465
High Cost	46,512	78,488	1,366,279

¹Source: Thompson and Pinkerton 2008 (p. 32)

Table 15. Bank Stabilization ¹	
Distance From Road (miles)	Cost (\$/foot)
0.25 - 0.5	284
0.5 - 1	313
1 - 2	341
2 - 3	369
> 3	398

¹Source: Thompson and Pinkerton 2008 (p. 38)

Table 16. Estuary Restoration ¹	
Project Type	Cost (\$/acre)
Small: tide gate removal, culvert upgrade, tidal salt marsh restoration	6000
Medium: automated tide gates, culverts, 500 feet of new dikes	67000
Large: automated tide gates, excavation of fill, re-vegetation	20000

¹Source: Coastal Resources Management Council 2010

Table 17. Education and Outreach Programs ¹	
Type	Cost (\$)
General Education and Outreach	76,136
Coho Specific Education	55,682

¹ Source: California Department of Fish and Wildlife 2004b (p. 1.42)

Table 18. Removal of Invasive Plant Species	
Invasive Species	Cost (\$/acre)
Average	8028

¹Source: Neil 2002

²Source: Bennet 2007 (average cost)

³Source: U.S. Fish and Wildlife Service 2001

⁴Source: Northern California Conservation Center 2010

Table 19. Sediment Assessments ¹	
Location	Cost (\$/mile)
Average all assessments in CA	1,240

¹Source: Thompson and Pinkerton 2008 (pp. 61-62)

BPG: Core 1 and 2 Population Cost Estimate

BPG	FY 1-100 Total Costs	Core 1 Populations	Core 1 FY 1-100 Costs	Core 2 Populations	Core 1 + 2 FY 1-100 Costs
Interior Coast Range	242,786,265	Pajaro River Salinas River	96,590,000	No Core 2 populations Identified	N/A
Carmel River Basin	114,860,165	Carmel River	114,860,165	No Core 2 populations Identified	N/A
Big Sur Coast	18,030,165	San Jose Creek Little Sur River Big Sur River	10,029,885	Garrapata Creek Bixby Creek Willow Creek Salmon Creek	8,000,280
San Luis Obispo Terrace	197,982,390	San Simeon Creek Santa Rosa Creek Pismo Creek San Luis Obispo Creek Arroyo Grande Creek	80,654,985	San Carpofooro Arroyo de la Cruz Little Pico Creek Pico Creek Morro Creek Morro Bay Estuary (Chorro Creek, Los Osos Creek)	117,327,405

Table 20. BPG: Core 1 and 2 Population Cost Estimates**Funding Recovery Actions**

Many of the recovery actions identified in the recovery action tables are intended to restore basic ecosystem processes and function (such as more natural hydrologic conditions), water quality, and riparian and estuarine habitats. These actions will, in many cases, serve to restore multiple native species and associated human uses of these natural resources. As a result, such activities may be eligible for funding from multiple funding sources at the federal, state, and local levels.

Federal funding sources include:

- NOAA/NMFS Restoration Center Community-Based Restoration Program
- NOAA/NMFS Restoration Center Open Rivers Initiative
- NOAA/NMFS Proactive Species of Concern Grant Program
- NOAA National Sea Grant College Program
- NOAA Coastal and Estuarine Land Conservation Program
- NOAA/ACOE/USFWS/EPA/NRCS Estuary Habitat Restoration Program
- EPA Wetlands Protection Grants and Near Coastal Waters Programs
- US. Department of Transportation Highway Bridge Rehabilitation and Replacement Program
- U.S. Fish and Wildlife Service National Coastal Wetlands Conservation Grant Program
- U.S. Fish and Wildlife Service Coastal Program
- U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program
- U.S. Fish and Wildlife Service North American Wetland Conservation Act

- National Resource Conservation Service
- Federal Highway Administration – Road Aquatic Species Passage Funding

State funding sources include:

- California Department of Fish and Wildlife Pacific Coast Salmon Restoration Fund
- California Coastal Conservancy Proposition 84 Funds
- California Coastal Conservancy Community Wetland Restoration Grants
- California Wildlife Conservation Board
- California State and Regional Water Quality Control Board Clean Water Grant Program
- California Integrated Watershed Management Grant Program Proposition 50 Funds
- California Department of Parks and Recreation Habitat Conservation Fund
- CalTrans Environmental Enhancement and Mitigation Program
- U.C. California/NOAA California Sea Grant College Program

In addition to federal and state funding sources, there are also numerous private national, regional and local funding sources for South-Central California habitat restoration projects, such as:

- National Fish and Wildlife Foundation
- County Fish and Wildlife Advisory Commissions (Santa Cruz, Santa Clara, San Benito, Monterey, San Luis Obispo Counties)

Many of these grant programs also offer technical assistance, including project planning, design, permitting, monitoring. Additionally, regional personnel with NOAA, California Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service can provide assistance and current information on the status of individual grant programs.