distinguished during multi-year projects, so estimates evenly distribute the construction costs over the number of years.

The costs for levee stability were separated from the Program total due to uncertainty in which agencies and entities would be responsible for providing the funding to establish conveyance at design capacities. The Agencies will work together to identify sources of funding to accomplish levee stability work.

2.4 Uncertainties and Potential Changes

The following uncertainties exist with respect to actions, schedule, and costs:

- Although not identified as a core need, consultation with the Settling Parties resulted in the inclusion of the Reach 2B capacity improvement as part of the core actions to remain consistent with the Settlement. Achieving minimum conveyance with the Mendota Pool Bypass alone is possible but not certain and may require construction of the Reach 2B levees.
- Although not identified as a core need, consultation with the Settling Parties resulted in the inclusion of barriers in the area of Salt and Mud Slough as part of the core actions to remain consistent with the Settlement. This *Framework for Implementation* includes the construction of a barrier on Salt Slough and the construction of a barrier on Mud Slough. Deployment of barriers may be accomplished through coordination with other entities which could be a possible source of additional funds.
- Although not identified as a core need, consultation with the Settling Parties identified the inclusion of actions over 2,000 cfs to convey up to 4,500 cfs through the Restoration Area to remain consistent with the Settlement. The Settlement does not specify conveyance actions in Reaches 2A, 3, 4A, or 5, but envisioned the ability to release the flow rates specified on Tables 1A-F in Exhibit B. This *Framework for Implementation* includes the construction of seepage and levee stability projects up to 4,000 cfs. The remaining 500 cfs was left as a secondary action.
- Generally, appraisal-level costs are not sufficient for seeking appropriations and authorization, but they do distinguish the relative difference between alternatives. Estimates include a 25% contingency for potential increases in costs. Further development of designs may reduce the contingency to some extent and better define costs.
- The range of options for site specific projects includes some combinations that fall above and some combinations that fall below the estimated available funding. The Agencies and parties will seek ways to reduce costs during the development of site-specific projects so that total costs fall within the available budget.
- The approaches for the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel and Structural Improvements Project will influence the required levee stability projects for conveyance in the Eastside and Mariposa bypasses. The aggregate cost for the Reach 4B Conveyance channel and structural improvements do not include costs for levee setbacks

or raises in the Eastside and Mariposa Bypasses. Selection of an alternative that requires modifications to bypass levees would require some of the levee stability actions.

- The construction of passage facilities on alternative routes (Chowchilla Bypass, Eastside and Mariposa Bypasses under a Main Channel Alternative for Reach 4B) assumes design criteria for adult Chinook salmon during periods of operation for flood management and water supply deliveries. Other fish can potentially navigate these facilities with minor modifications and will likely pass through structure bays during some years, but such criteria did not drive the designs. The selected high flow route is anticipated to provide passage for fish other than adult Chinook salmon in most years. The Agencies will evaluate the needs of sturgeon and other fish to address this uncertainty.
- Collection and transportation of wild source stock may require waiting additional years, until conditions are sufficient to support taking some individuals from these stocks. Delayed implementation and smaller trial scale collection efforts may result in shifting costs to later dated once methods and techniques for collecting wild source stocks are more certain.
- Trap and haul provides an interim measure while the Agencies complete passage improvements. The extent and scope of the trap and haul program will change with the understanding of passage improvements and the completion of additional facilities.
- The Agencies coordinate extensively with partners and stakeholders who occasionally request more detailed investigation of the options that have been excluded on the basis of preliminary analysis and professional judgment. Investigating these alternatives beyond the screening level analyses increases data collection costs, extends design times, and delays construction. The Agencies intend to work with partners and stakeholders to clearly articulate assumptions and will engage them in the technical merits leading to conclusions.
- DFG and DWR have not identified funding for participation after 2017. Costs were included in the estimates because it is assumed that further participation in the SJRRP will be authorized from future State bonds in support of the State commitment or provided through agreements with other agencies.
- The level of survival will be unknown until fish are reintroduced and monitored. The Agencies will monitor fish and adaptively manage secondary and improvement actions as information and funding becomes available.
- Actions within operations and maintenance include the hatchery, fish screen facilities, and seepage projects. The Agencies assume that other channel and structural improvement projects will result in negligible change in costs to the existing maintaining authorities. Designs for actions without explicitly identified funding for operations and maintenance aim to provide self-maintaining conveyance and minimal facility operation costs. The site-specific projects describe the methods.
- Uncertainties will be managed through an approach that will allow the program to: (1) maximize the likelihood of success, (2) increase learning opportunities, (3) identify data needs and reduce uncertainties, (4) use the best available information to provide technical

support and increase the confidence in future decisions and recommendations, and (5) prioritize management actions.

- While the Framework describes fish reintroduction as a "process," the Settlement contemplates reintroduction of fish as a point in time with respect to Paragraph 20(d)(1)(B) ("...the following criteria shall be considered...beginning 7 years after the reintroduction of spring run chinook (sic) salmon to the San Joaquin River, whether the annual escapement of wild spring run adult salmon has dropped below 500 in any year..."). The 2025 timeframe for evaluating requests to change flows assumed three lifecycles of salmon. The revised schedule within the framework may change the expected evaluation.
- The Framework includes monitoring of source stock populations in the event that insufficient information exists to make determinations on take. Under some circumstances sufficient information may be available and would reduce costs.

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Table 1 – Phases, Schedule, and Costs in Millions for Core Actions

Action	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Program Staffing	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$78.00
U.S. Bureau of Reclamation														
U.S. Fish and Wildlife Service														
U.S. National Marine Fishery Service														
CA Department of Water Resources														
CA Department of Fish and Game														
Flow Actions														
Mitigation and Conservation Strategy	$6.82	$4.51	$4.31	$1.31	$1.31	$2.81	$1.31	$2.81	$1.31	$2.81	$1.31	$2.81	$1.31	$34.71
Millerton Lake Boat Ramps														
Conservation Strategy														
Invasive Species Control														
Channel Capacity Advisory Group														
Consultation on Increased Flows														
Programmatic Cultural Resources														
Flow Management and Monitoring	$4.85	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$3.35	$45.05
Stream Gage														
Acquire Water														
Bank or Store Water														
Physical and Biological Processes														
Seepage	$7.00	$1.94	$9.20	$5.07	$6.11	$6.60	$6.60	$6.60	$6.60	$6.60	$6.60	$4.88	$4.88	$78.67
300 cfs Conveyance														
700 cfs Conveyance														
1300 cfs Conveyance														
2000 cfs Conveyance														
4000 cfs Conveyance														
Channel and Structural Improvements	$26.13	$40.33	$79.44	$89.22	$89.22	$89.22	$89.22	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70	$506.96
Chowchilla Bifurcation Structure														
San Joaquin River Control Structure														
Reach 2B Conveyance														
Mendota Pool Bypass														
Mendota Pool Fish Screen														
Arroyo Canal and Sack Dam														
Reach 4B Conveyance														
Eastside Bypass Control Structure														
Mariposa Bypass Control Structure														
Mariposa Bypass Drop Structure														
Salt and Mud Slough Area Barriers														
Fish Reintroduction	$3.68	$10.12	$10.55	$5.12	$5.12	$5.12	$2.43	$1.13	$1.13	$1.13	$1.13	$1.13	$1.13	$48.94
Conservation Hatchery														
Donor Stock Collection														
Monitoring of Source Streams														
Trap and Haul														
Water Management	$12.52	$16.85	$20.85	$20.85	$9.77	$9.77	$4.77	$0.77	$0.77	$0.77	$0.77	$0.77	$0.77	$100.00
Recapture and Recirculation Funding														
Friant-Kern and Madera Canal Capacity														
Part III Projects														
Sub-Total (without Levee Stability)	**$67.0**	**$83.1**	**$133.7**	**$130.9**	**$120.9**	**$122.9**	**$113.7**	**$21.4**	**$19.9**	**$21.4**	**$19.9**	**$19.6**	**$18.1**	**$892.3**
Levee Stability														
Levee Stability in 2A, 3, 4A, and 5	*$2.74*	*$0.00*	*$0.10*	*$2.71*	*$10.74*	*$10.13*	*$10.13*	*$10.13*	*$10.13*	*$10.13*	*$10.13*	*$10.13*	*$10.13*	$97.34
700 cfs Conveyance														
1300 cfs Conveyance														
2000 cfs Conveyance														
4000 cfs Conveyance														
Eastside Bypass Levee Stability	*$0.00*	*$0.97*	*$24.63*	*$9.66*	*$13.62*	*$9.19*	*$19.38*	*$14.12*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	$91.57
700 cfs Conveyance														
1300 cfs Conveyance														
2000 cfs Conveyance														
2500 cfs Conveyance														
3500 cfs Conveyance														
4000 cfs Conveyance														

Formulation
Final Design and Acquisition
Construction
Ongoing Operations and Maintenance

2

3.0 Funding

Chapter 3 provides an estimate of the potential funding available to implement the SJRRP. Funding comes from a variety of Federal and State sources. Table 2 provides the anticipated funding available through fiscal year 2025. For the purpose of this analysis, available funds include those authorized by Federal and State law. All funding, with the exception of $88 million from the San Joaquin River Restoration Fund, is subject to further appropriation.

Table 2 – Anticipated Total Funding Available to Implement the SJRRP through Fiscal Year 2025.

Funding Source	Total Anticipated Funding Available
San Joaquin River Restoration Fund	
Friant Capital Repayment (1)	$245,149,000
Friant Surcharge (2)	$89,356,000
Receipts from Sales of Water or Land (3)	$21,552,000
Central Valley Project Restoration Fund (4)	$45,000,000
New Federal Appropriations (5)	$300,000,000
State Bond Funds	$200,000,000
Total	**$892,056,000**

Notes: For the purposes of this analysis, funding available includes funds authorized by Federal and State law. All of this funding, with the exception of $88 million from the San Joaquin River Restoration Fund, is subject to further appropriation.

1. Estimated based on capital repayment to date, negotiated repayment contacts, and anticipated repayment amounts prior to negotiated repayment contracts along with anticipated amounts from the contractors that did not execute repayment contracts.
2. Assumes long-term average Class 1 and Class 2 water sales of 800,000 acre-feet. Includes actual collections from fiscal year 2010 and 2011. Future collections are estimated at $5.6 million per year until fiscal year 2019, when they reduce to $3.2 million per year (surcharge rate changes from $7/acre-foot to $4/acre-foot).
3. Assumes ramp-up of water sales over time to a long-term average of $1.5 million collected per year.
4. Includes actual funding provided from fiscal year 2007 to fiscal year 2011 and an anticipated $2 million from fiscal year 2012 to 2025.
5. Includes funding provided in Section 10009(b)(1) and Section 10203(c) of Public Law 111-11.

Since implementation of the SJRRP began in 2007, some funds have been expended. Table 4 identifies funds expended from fiscal year 2007 to fiscal year 2012 and the remaining funds available. As shown in Table 4, an estimated $99,283,000 will have been expended by the end of fiscal year 2012. Approximately $792,774,000 remains to implement the SJRRP through fiscal year 2025.

The remaining funds represent a conservative value, because the assumptions for collection of the Friant surcharge and the receipts from sales of water or land. For planning purposes, Reclamation has assumed a long-term average Class 1 and Class 2 water sales of 800,000 acre-feet. Historically, Class 1 and Class 2 water sales have averaged 1.2 million acre-feet. Although the implementation of the Settlement would reduce Class 1 and Class 2 water sales, based on historical deliveries and anticipated releases to the river under the Settlement, it is likely that long-term average Class 1 and Class 2 water sales would be greater than 800,000 acre-feet, resulting in additional funds collected as part of the Friant surcharge. In addition, and as described elsewhere in this document, it is likely that the full Restoration Flows would not be

released into the San Joaquin River for some time. Consistent with Paragraph 13(i) of the Settlement and Section 10009(b)(1)(C) of PL 111-11, the Secretary, in consultation with the Restoration Administrator, shall, under certain conditions, bank, store, exchange, transfer or sell any unused Restoration Flows, with proceeds of such transfer or sale deposited into the San Joaquin River Restoration Fund. The long-term receipts of $1,500,000 from the sale of water or land may be conservative. For these reasons, this *Framework for Implementation* is assuming that roughly $800 million is available to implement the SJRRP through Fiscal Year 2025.

Table 3 – Funds Expended from Fiscal Year 2007 to Fiscal Year 2012 and Remaining Funds Available to Implement the SJRRP through Fiscal Year 2025

Funding Source	Total Anticipated Funding Available (1)	Expenditures from Fiscal Year 2007 to 2012 (2)	Remaining Funding Available
San Joaquin River Restoration Fund	$347,057,000	$20,147,000	$326,910,000
Central Valley Project Restoration Fund	$45,000,000	$27,263,000	$17,737,000
New Federal Appropriations	$300,000,000	$7,852,000	$292,148,000
State Bond Funds	$200,000,000	$44,021,000	$155,979,000
Total	**$892,057,000**	**$99,283,000**	**$792,774,000**

Notes: For the purposes of this analysis, funding available includes funds authorized by Federal and State law. All of this funding, with the exception of $88 million from the San Joaquin River Restoration Fund, is subject to further appropriation.

1. See notes in Table 1 for assumptions.
2. Fiscal Year 2007 to 2011 expenditures from *Approved, Obligated and Expended Funds, Fiscal Year 2007-2011, San Joaquin River Restoration Program*. Fiscal Year 2012 expenditures are estimated.

4.0 Channel and Structural Improvements

Channel and structural improvement actions include the modifications to the river channel, floodplain, and infrastructure to achieve the Restoration Goal. The Agencies developed actions through the analysis undertaken for the *PEIS/R*, the site-specific projects addressing Paragraph 11(a) actions, fisheries documents and other planning efforts. Larger project activities were broken down into components called options. Each option has independent functionality and provides alternative approaches to achieve one or more objectives. Site-specific projects combine options to achieve multiple objectives for a channel or structural improvement. The Options Appendix, Themes Appendix, and Schedule Appendix provide the supporting information for the actions, costs, and schedule of the channel and structural improvements described in this chapter. The Themes Appendix describes the fisheries evaluations to classify a project as core, secondary, or improvement.

4.1 Actions

Fishery evaluations revolved around the themes of conveyance, fish passage, juvenile entrainment and predation, false adult migration pathways, and habitat creation. Potential actions were included in one or more themes and designated as core, secondary, or improvement based on the necessary level of performance to achieve a viable program. Analyses of temperature simulations indicate the need to convey at least 2,000 cfs as part of the core program. The Agencies assumed that adult salmon will enter the flood bypasses during wet years. If the adult salmon cannot navigate the channel and structures within the bypass in order to reach spawning areas in Reach 1 then the bypasses to become false migration pathways.

The Agencies identified a reliable passage corridor as particularly important, since fish will need to move down and up the system to complete their life cycle. Adult salmon must be able to return to spawn for reintroduction to be successful. Adult passage impediments can serve as a complete barrier that does not allow salmon to continue migrating to spawning grounds. Major losses through juvenile entrainment can also preclude restoring salmon populations to the San Joaquin River. Actions to reduce juvenile entrainment were identified as core actions, where the Agencies expect very frequent and a high degree of juvenile loss to occur.

Because of the importance placed on reliable passage and flow conveyance levels, several channel and structural improvements have been included in the core program as described below:

- Chowchilla Bifurcation Structure Passage: Construction of a fish ladder or ramp will allow adult fish within the Chowchilla Bypass as a result of flood flows to return to the main stem to access Reach 1. Water velocities at the existing structure are expected to exceed fish passage criteria during flood flows, which would create an impediment to adult fish passage.
- San Joaquin River Control Structure Passage: This would include the construction of a fish ladder or ramp on the existing structure or the replacement of the structure as part of

water supply facilities for Mendota Pool. Hydraulic analysis indicates that water velocities during flood flows would exceed criteria for adult Chinook salmon passage at the existing structure.

- Reach 2B Channel Capacity Improvements: This would include construction of levees for 4,500 cfs capacity without engineering floodplain habitat through grading or planting of vegetation. Temperature criteria identified conveyance of 2,000 cfs as a core action. Although the construction of the Mendota Pool Bypass may accomplish non-damaging conveyance near 2,000 cfs, the Agencies included this as a core action to meet the requirements in Paragraph 11(a) of the Settlement.
- Mendota Pool Bypass: This would include construction of a bypass channel around Mendota Pool or building a dam in the Fresno Slough and related water supply infrastructure. Evaluations of expected diversion rates and field studies on fish survival identified Mendota Pool as a potential major source of juvenile salmon loss through entrainment into water diversions in most years. Directing fish around the Mendota Pool or moving the Mendota Pool into Fresno Slough would resolve this concern.
- Arroyo Canal Screening and Sack Dam Passage: This would include construction of a fish screen on the Arroyo Canal and passage facilities at Sack Dam. Arroyo Canal was identified as very likely to entrain a large proportion of juvenile salmon. Screening the canal would avoid this loss. Sack Dam has been identified as a passage impediment for adult salmon of sufficient magnitude to warrant classification as a core need when the boards are in place. In the spring, the drop height would impede upstream passage.
- Reach 4B, Eastside Bypass, and Mariposa Bypass Conveyance: This would include construction of flow routing facilities at the Sand Slough Control Structure, levee construction or repair, low-flow channel excavation, and transportation crossing improvements in either the old river channel or the flood bypass system. A series of channel capacity constraints in these areas prevent the conveyance of 4,000 cfs.
- Eastside Bypass Control Structure Passage: This would include construction of a fish ladder or ramp. Excessive velocities at the existing structure during flood flows exceed the fish passage criteria of 5 feet per second (fps) and impede adult upstream migration.
- Mariposa Bypass Control Structure Passage: This would include construction of passage in coordination with a drop structure and low-flow channel modifications. Excessive velocities at the existing structure exceed fish passage criteria maximums and would impede upstream adult migration.
- Mariposa Bypass Drop Structure Passage: This would include construction of passage in coordination with a control structure and low-flow channel modifications. This drop structure is an adult passage impediment at all flow levels. Modification or removal would allow fish to pass.

Excessive mortality of juvenile salmon, false migration paths for adults, and lack of habitat can reduce the effectiveness of salmon reintroduction. Actions designated as secondary based on the degree of expected impairment and certainty of impacts or benefits on the reintroduction program include:

- Conveyance Improvements: Seepage and levee stability projects to increase to convey flows above up to 4,500 cfs would provide temperature benefits and potentially greater wetted areas for juvenile habitat.
- Floodplain Improvements (Grading and Vegetation): Floodplain grading and vegetation actions would jumpstart the productive potential of flood plain habitat for juvenile salmon. The core conveyance actions described above assume minimal or no actions to plant and grade in the floodplain areas.
- Spawning Habitat Augmentation: Surveys within the Restoration Area identified quality spawning gravel in the upper reaches, but some degree of gravel augmentation may be necessary to support reintroduction objectives.
- Gravel Pit Filling and Isolation: The gravel pits within the Restoration Area have been identified as potential contributors to juvenile salmon loss. The gravel pits provide habitat for predatory fish, and the slow current through these pools can expose juvenile salmon to high predation mortality. The program's current study on predator populations and juvenile salmon survival in these pits will advise future actions.
- San Mateo Road Crossing: The San Mateo Avenue road crossing was identified as a potential adult migration impediment, but the significance of this barrier for adult passage is uncertain. At high flows, adult passage is not expected to be impaired, but monitoring should be implemented to determine the degree to which the crossing would delay or impede passage.
- Chowchilla Bypass Passage at Crossings Avenue 18 ½ and Avenue 21: Fish are expected to migrate up the Chowchilla Bypass during flood flows and may encounter these crossings. Hydraulic analysis indicates a high elevation drop at each one. Modification of these crossings would increase our confidence in fish migration within the Chowchilla Bypass and their return to the main stem under flood conditions.
- Eastside Bypass Passage at Crossings and Structures:
    - Dan McNamara Road: This road crossing could potentially have an impact on adult migration, but it is not believed to completely impede upstream passage.
    - Merced National Wildlife Refuge Weirs: The Merced Refuge weir can present a vertical drop barrier for upstream migrating salmon under low to moderate flow conditions. This barrier is expected to be more of a passage impediment for fall-run Chinook, because they migrate at lower flows than spring-run Chinook in most years. Operation of the weir, such as removing the flashboards, may resolve this impediment.
- Salt and Mud Slough Barriers: Salt and Mud sloughs represent potential false migration pathways for adult salmon. The amount of water coming out of these sloughs, along with past observations of fall-run Chinook straying into Mud and Salt slough, suggest that a high percentage of migrating salmon could be attracted into them. The percentage of adult fish that would stray into these sloughs, and the fate of those that do, is not known; but there is potential for major losses. Barriers would prevent fish from entering these sloughs and potential loss of fish would be avoided.

Actions identified as potential improvements include:

- Screening of Riparian Holding Contract Diversions (Reach 1)
- Lone Willow Slough Screening (Reach 2B)
- King's River Fish Barrier (Reach 2B)
- Fresno River, Ash and Berenda Slough False Migration Barriers (Chowchilla Bypass)
- Washington Avenue Bridge Replacement (Reach 4B)
- Turner Island Road Bridge Replacement (Reach 4B)
- El Nido Road Crossing Passage (Eastside Bypass)
- Chamberlain Road Crossing (Eastside Bypass)
- Mariposa Bypass Road Crossing (Bypass)
- Newman Wasteway Barrier (Reach 5)
- Other Barriers (Reach 5)

These actions are described in more detail in the Options Appendix.

4.2 Schedule

Schedules include the necessary environmental compliance, final design, design data collection, bidding, and construction. For actions with environmental compliance currently underway, the schedule uses the estimated date for the Record of Decision. The *Reclamation Final Design Manual* includes a 3-year timeframe for design, data collection, and development of bid packages for acquisition. Construction schedule estimates use the longer of timeframes where alternatives exist. The estimated schedules for core actions are provided below.

- Chowchilla Bifurcation Structure Passage
    - NEPA/CEQA compliance begins in 2014
    - Final Design begins in 2014
    - Construction begins in 2015
    - Operational begins in 2016
- San Joaquin River Control Structure Passage
    - NEPA/CEQA: to be completed 2013 as part of the Mendota Pool Bypass and Reach 2B Channel Capacity Improvements Site-Specific Project.
    - Final Design begins in 2014
    - Construction begins in 2015
    - Operational beginning in 2016
- Reach 2B Channel Capacity Improvements
    - NEPA/CEQA: to be completed 2013 as part of the Mendota Pool Bypass and Reach 2B Channel Capacity Improvements Site-Specific Project.

- Final Design begins in 2014
- Construction begins in 2016
- Operational begins in 2020

- Mendota Pool Bypass
  - NEPA/CEQA: to be completed 2013 as part of the Mendota Pool Bypass and Reach 2B Channel Capacity Improvements Site-Specific Project.
  - Final Design begins in 2014
  - Construction begins in 2016
  - Operational begins in 2020
- Arroyo Canal Screening and Sack Dam Passage
  - NEPA/CEQA: to be completed 2012 as part of the Arroyo Canal and Sack Dam Site-Specific Project
  - Final Design begins in 2012
  - Construction begins in 2013
  - Operational begins in 2015
- Reach 4B, Eastside Bypass, and Mariposa Bypass Conveyance
  - NEPA/CEQA: to be completed 2013 as part of the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel Capacity Improvements Site-Specific Project
  - Final Design begins in 2014
  - Construction begins in 2016
  - Operational begins in 2020
- Eastside Bypass Control Structure Passage
  - NEPA/CEQA: to be completed 2013 as part of the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel Capacity Improvements Site-Specific Project
  - Final Design begins in 2014
  - Construction begins in 2015
  - Operational begins in 2016
- Mariposa Bypass Control Structure Passage
  - NEPA/CEQA: to be completed 2013 as part of the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel Capacity Improvements Site-Specific Project
  - Final Design begins in 2014
  - Construction begins in 2015
  - Operational begins in 2016
- Mariposa Bypass Drop Structure Passage

- NEPA/CEQA: to be completed 2013 as part of the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel Capacity Improvements Site-Specific Project
- Final Design begins in 2014
- Construction begins in 2015
- Operational begins in 2016

The implementation of secondary actions will be prioritized based upon the collection and analysis of additional data. Secondary actions will generally lag behind core actions, but some secondary actions may occur concurrently with core actions. Some secondary actions are addressed as part of existing site-specific studies. Other secondary actions will require additional study, formulation, and environmental compliance.

The implementation of improvement actions depends upon the collection of additional data and analysis to prioritize actions. Improvement actions will generally occur after secondary actions.

4.3 Costs

Costs are based on pre-appraisal and appraisal levels of detail. Appraisal level costs include assumptions on the necessary size and scope of engineering efforts, because detailed site-specific information on the actual material properties and conditions present at the project site are not available. The cost estimates include contingencies to address potential changes in the assumptions as additional information becomes available. These contingencies create an upper bound on cost estimates. Planning contingencies used by Reclamation and DWR include:

- Mobilization (5%) – level of effort on the site before work begins
- Design Contingency (15%) – additional construction elements not explicitly listed on the design sheet at this level of detail
- Contingencies (25%) – unforeseeable changes that may increase costs
- Non-Contract Costs (35%) – costs not directly associated with construction of the project including staffing, right-of-way, environmental compliance, site studies, and similar activities

Final design work varies depending upon the size and complexity of a project. The following assumptions were used in costing design and data collection efforts that are necessary to bring projects to bidding and award:

- Design Work – 1% of appraisal level construction estimate
- Data Collection – 4% of appraisal level construction estimate

The selection of alternatives for the Mendota Pool Bypass and the conveyance of flows through Reach 4B or the Eastside Bypass and the Mariposa Bypass substantially vary the overall cost of the core program. Alignment 4 for Reach 2B and Alignment C for Reach 4B provide an upper bound as representative costs for levee construction and land acquisition. The Options Appendix lists costs for alternative approaches. Costs do not include floodplain grading or planting. Costs for core channel and structural improvement actions must combine alternatives from each of the first-level bullets. Sub-level bullets provide the breakdown.

- Chowchilla Bifurcation Structure: $8 million
    - NEPA/CEQA: $0.5 million (approximated because NEPA/CEQA has not been initiated)
    - Final Design: $0.37 million
    - Land Acquisition: minimal
    - Construction: $7.30 million, pre-appraisal based on San Joaquin River Control Structure estimates
- San Joaquin River Control Structure Passage: $8 to $24 million depending upon the Mendota Pool Bypass alternative (see below).
- Reach 2B Conveyance: $121 million, based on Alignment 4 for a upper bound on land acquisition
    - Final Design: $5.76 million, 5% for design work and data collection
    - Land Acquisition: $27 million
    - Construction: $88.11 million including relocations, levee construction, partial removal of existing levees, and riprap bank protection on bend 10
- Mendota Pool Bypass: varies based on alternative selected
    - Compact Bypass Alignment: $174 million
        - San Joaquin River Control Structure Fish Ladder: $7.7 million
            - Final Design: $0.37 million, 5% for design work and data collection
            - Construction: $7.3 million, based on a left bank fish ladder
        - Bypass Channel: $167 million
            - Final Design: $7.9 million, 5% for design work and data collection
            - Land Acquisition: $6.7 million for the bypass footprint and alignment 5 extension levees
            - Bypass Channel Control Structure and Fish Ladder: $15.7 million
            - Bypass Channel Excavation and Levees
                - Bypass Levees: $15 million
                - Channel Excavation: $31 million
                - Extension Levees: $35.22 million including relocations and levee construction
            - Mendota Pool Control Structure: $10.5 million
            - Mendota Pool Fish Screen: $27 million
            - Columbia Canal Siphon: $17.5 million

- Fresno Slough Dam Reforming the Pool: $209 million
  - San Joaquin River Control Structure Fish Ladder: $7.7 million
    - Final Design: $0.37 million, 5% for design work and data collection
    - Construction: $7.3 million, based on a left bank fish ladder
  - Fresno Slough Dam: $201 million
    - Final Design: $9.57 million
    - Land Acquisition: $5.8 million based on alignment 5 extension levees and short canal land acquisition
    - Fresno Slough Dam: $51 million
    - Mendota Dam Fish Ladder: $3.1 million for Ladder 2
    - Extension Levees: $40.0 million including relocations and levee construction
    - Main and Helm Canal Relocations: $8.9 million
    - Mendota Pool Short Canal and Control Structure: $13.6 million
    - Mendota Pool Fish Screen: $41 million
    - Columbia Canal Siphon: $28 million
- Fresno Slough Dam with an Upstream Diversion Structure: $259 million
  - San Joaquin River Control Structure and Fish Ladder: $23.5 million
    - Final Design: $1.12 million, 5% for design work and data collection
    - Construction: $22.4 million
  - Fresno Slough Dam: $235.3 million
    - Final Design: $11.21 million
    - Land Acquisition: $1.1 million for the concrete lined south canal
    - Fresno Slough Dam: $51 million
    - Mendota Dam Fish Ladder: $3.1 million for Ladder 2
    - Extension Levees: $40.0 million including relocations and levee construction
    - Main and Helm Canal Relocations: $8.9 million
    - Mendota Pool Canal and Control Structure: $70.04 million based on a concrete canal south alignment
    - Mendota Pool Fish Screen: $22 million

- Columbia Canal Siphon: $28 million

- Arroyo Canal Screening and Sack Dam Passage: $25 million, based on 30% designs
- Reach 4B, Eastside Bypass, and Mariposa Bypass: varies based on alternative
    - Restore Reach 4B Main Channel to Convey 4,500 cfs: $123 million
        - Final Design: $5.85 million
        - Land Acquisition: $61.95 million based on alignment C
        - Sand Slough Complex: $5.86 million including the 4B Headgates and Sand Slough Control Structure modifications
        - Levee Construction: $38.81 million including relocations and levee construction for Alignment C
        - Road Crossings: $10.32 million based on Alignment C bridges
    - Restore Eastside and Mariposa Bypasses with Levee Improvements and Potential Construct Reach 4B Flood Relief of 475 cfs: $117 million of Bypass Modifications, $31 million of Reach 4B modifications, and $37 million of levee stability
        - Final Design: $7.02 million
        - Land Acquisition in the Eastside Bypass: $13.09 million (average of $11.91 million to $14.27 million) for levee setbacks alignment NW and NE in the Eastside Bypass.
        - Sand Slough Complex: $1.82 million including the 4B Headgates and Sand Slough Control Structure modifications
        - Levee Construction: $67.3 million (average of $36 million to $98.6 million) for levee setbacks in the Eastside Bypass
        - Eastside and Mariposa Bypasses Low-Flow Channel: $29 million and will require modifications to control structures to sustain sediment continuity.
        - Land Acquisition in Reach 4B: assume no acquisition in Reach 4B (state ownership) or up to $12.65 million for levee setbacks alignment Option A
        - Reach 4B Low-Flow Excavation: $13.5 million, potentially not required as part of the core program
        - Reach 4B Road Crossings: $2.97 million for partially buried box culverts based on Alignment A
        - Levee Stability: $36.96 million (half of the DWR estimate of $73.93 million at 3,500 cfs) for levee stability on unmodified levees.
    - Bypass Pulse Flows, Restore Reach 4B for Low-Flows of 475 cfs (2,000 cfs Conveyance Capacity): $104 million for Reach 4B and $74 million in the Eastside Bypass
        - Final Design: $6.56 million

        - Land Acquisition: $12.65 million based on alignment A
        - Sand Slough Complex: $4.08 million including the 4B Headgates and Sand Slough Control Structure modifications
        - Reach 4B Low-Flow Excavation: $13.5 million
        - Reach 4B Levee Construction: $64.52 million including relocations and levee construction for Alignment A
        - Reach 4B Road Crossings: $2.97 million for partially buried box culverts based on Alignment A
        - Eastside Bypass Levee Construction: $73.93 million based on DWR levee stability analysis at 3,500 cfs
    - Bypass Pulse Flows and Restore Reach 4B for 1,500 cfs: $109 million for Reach 4B and $55.11 million for the Bypasses
        - Final Design: $5.18 million
        - Land Acquisition: $12.65 million based on Alignment A
        - Sand Slough Complex: $9.15 million including the 4B Headgates and Sand Slough Control Structure modifications
        - Reach 4B Low-Flow Excavation: $13.5 million
        - Reach 4B Levee Construction: $64.52 million including relocations and levee construction for Alignment A
        - Reach 4B Road Crossings: $3.78 million for partially buried box culverts based on Alignment A
        - Eastside Bypass Levee Construction: $55.11 million based on DWR levee stability analysis at 2,500 cfs
- Eastside Bypass Control Structure: $5 million, assumes selection of a fish way type structure
    - Final Design: $0.22 million
    - Construction: $4.34 million
- Mariposa Bypass Control Structure: $7 million, may include notching for low-flow channel excavation
    - Final Design: $0.31 to $0.32 million
    - Construction: $6.25 to $6.49 million
- Mariposa Bypass Drop Structure: $2 million, may include removal and low-flow channel excavation
    - Final Design: $0.11 million
    - Construction: $2.17 million

Costs for Reach 4B, Eastside Bypass, and Mariposa Bypass Conveyance assume that the modifications to the Mariposa Bypass Control Structure and Drop Structure would occur consistent with the high flow decision and will not change substantially with alternative approaches. Long-term use of the bypass for the SJRRP may require land acquisition, which is not included. Costs for the bypass route assume exclusive use of the Eastside Bypass for routing of flows and that the Mariposa Bypass and Reach 4B2 would be comparable.

4.4 Uncertainties and Possible Future Changes

The following uncertainties and possible future changes exist:

- Construction schedules do not consider the availability of construction crews for mobilization to the area. Availability of construction crews may increase costs or delay schedules.
- Costs do not incorporate the additional staging and access requirements for the mobilization of additional crews to accelerate construction.
- Costs do not include construction of low-flow crossings or severance for private road crossings in the Eastside and Mariposa Bypass channels.
- Reclamation typically uses appraisal level estimates to compare options and does not generally consider appraisal level estimates adequate for requesting project funding. A more typical project would develop feasibility-level cost estimates prior to final design. Some feasibility-level design work will be required to initiate data collection.
- Reclamation uses a Final Design Process to identify the specific type, location, and characteristics of structures or channel modifications within the bounds of impacts and performance set by the site-specific environmental documents. During the Final Design Process, the Agencies will perform value engineering studies to explore ways to improve performance and reduce costs.
- Estimates represent the costs for a federal project. Implementation will seek to take advantage of local knowledge and partnerships to reduce costs and provide additional efficiencies.

The primary differences between program costs in the site-specific alternatives depend upon the following:

- Land Acquisition: the amount of land acquired for the purpose of creating sufficient floodplain rearing habitat to support the long-term population under the Restoration Goal.
- Vegetation Planting: the intensity of vegetation planting, level of risk for establishment, and allowable timeframe to establish vegetation will change the cost per acre of floodplain habitat by at least one order of magnitude.
- Passage Criteria at Structures: the selection and design of structures to meet criteria for transportation and species or lifestage of fish substantially changes costs due to the number of structures. Specific factors that increase costs include:
    - Raised versus Inundated “Roadways” (eliminates low-cost low-water crossings)

- Flood Routing versus Restoration Only Routing (changes the timeframe when barriers exist at existing structures and the need to address those barriers)
- Elimination of Upstream Backwater Conditions (increases the number of entrance gates, requiring larger or more complicated structures)
- Meeting Sturgeon Criteria on Ladders (requires ramp-type structures for fish passage only)
- Meeting Juvenile Salmon Upstream Passage Criteria on Ladders (requires larger structure sizes to meet criteria)
- Upstream and downstream passage of other native fishes (ie, non-jumping species, lamprey, etc.)

Uncertainty in identifying actions as core, secondary, or improvements included:

- Actions implemented may change in the future, as additional information is available to prioritize actions.
- The amount of water coming out of Salt and Mud sloughs during migrations periods is sometimes greater than Restoration Flows, which is very likely to attract upmigrating adults into a maze of canals, resulting either in death or significant migration delay.
- A fish screen on the diversions to Mendota Pool may not be required. Estimates of expected deliveries to Mendota Pool from the San Joaquin River anticipate that juvenile fish will be entrained proportional to diversion rates during the migration time frame. The Settling Parties have asked us to reconsider the need for a screen. The Agencies believe a screen to be a necessary as part of the core program, but will evaluate the frequency and site-specific conditions of water deliveries to Mendota Pool to reconsider the need for a screen.
- Fish habitat: alternative selection involves additional analysis to determine the amount and type (migration corridor, holding, and rearing habitat) of fish habitat required in each reach to meet restoration goals. Additionally, temperature and primary productivity analyses will allow better assessment of the trade-offs among habitat quality (and therefore fish survival), conveyance capacity, and cost of the selected alternative.
- Kings River connectivity and salmonid migration: In high water years, flows from the Kings River connect with the Restoration Area and may create conditions that will attract salmonids away from the San Joaquin River. Flow routing in high water years needs to be advantageous to fish, as these are important salmon production years and may be critical determinants as to whether or not the population goals can be met. It is not yet determined whether the 10(J) designation will include the Kings River. These uncertainties could dictate whether or not the King's River Barrier would be a core action and could potential increase costs by $50 million.
- How much time will be needed for stock collection of spring-run Chinook salmon to support reintroduction?
- Uncertainty about how fall-run Chinook salmon will be introduced and how intensive their management will be.

- Expense and length of time that trap and haul efforts are necessary.

5.0 Restoration Flow Releases

Restoration Flow actions include releasing, conveying, and monitoring Interim and Restoration flow releases from Friant Dam. The *PEIS/R* provides environmental compliance for the release of Interim and Restoration flows and support for a long-term change in Reclamation's water rights at Friant Dam consistent with the Settlement and the Settlement Act. Under the *Draft PEIS/R*, Reclamation analyzed limiting flows to then-existing channel capacities defined by non-damaging flow rates for both groundwater seepage and levee stability criteria. Completion of seepage management and levee stability projects will increase channel capacity over time and allow for increased release of Interim and Restoration flows.

This section identifies the measures in the *Draft PEIS/R*, monitoring actions for Interim and Restoration flows, and projects that need to be completed in order to convey Interim and Restoration flows. The site-specific project actions address long-term solutions for Reach 2B, Reach 4B, Eastside Bypass, and Mariposa Bypass, but this section also includes information on seepage and levee work in Reach 2B and the Eastside-Bypass to address potential interests in temporary measures.

Conveyance of 2,000 cfs throughout the system will allow continuity of flows for fish passage, provide temperature management ability, and allow floodplain inundation. Seepage and levee actions to achieve 2,000 cfs are part of the core program. Increasing conveyance beyond 2,000 cfs will allow for inundating a larger amount of floodplain habitat for juvenile salmon rearing and a higher pulse releases for juvenile salmon emigration.

5.1 PEIS/R Avoidance, Minimization, and Mitigation Measures and Program Biological Assessment Consultation

The *Draft PEIS/R* includes mitigation measures to reduce impacts from the release of Interim and Restoration flows to less than significant levels. Reclamation released the Public Draft in April 2011 and closed the comment period in September 2011. A *Final PEIS/R* and *Record of Decision* are scheduled for June and July 2012, respectively.

Reclamation and DWR developed a Conservation Strategy in coordination with the Service, NMFS, DWR, and DFG. This strategy is a tool built into the *Draft PEIS/R* and the *Program Biological Assessment* (BA) to minimize and avoid potential impacts on sensitive species and habitats. The Conservation Strategy is not considered mitigation, but rather a plan to implement conservation goals and protective measures for species and communities (such as avoidance, minimization, monitoring, and management measures) consistent with adopted recovery plans.

5.1.1 Actions

Actions under the *PEIS/R* and *BA* to avoid, minimize, or mitigate the impacts from the increased release of Interim and Restoration flows include:

- Millerton Lake Boat Ramps: monitoring of Millerton Lake pool elevations. If pool elevations fall below the toe elevations of the two lowest-reaching boat ramps, Reclamation will extend the existing ramp, develop a new ramp, or provide temporary access to avoid loss of boat launching capacity.
- Conservation Strategy: monitoring, reconnaissance-level surveys, comprehensive surveys, and employing methods for avoidance and minimization of impacts on sensitive Federal and State listed species or habitats, including those covered under the Migratory Bird Treaty Act and the Magnuson-Stevens Fishery Conservation and Management Act.
- Invasive Species Control: Implementation of the *SJRRP Invasive Vegetation and Monitoring Management Plan* (Appendix L of the *Draft PEIS/R*) to monitor, control, and where possible, eradicate, invasive plant infestations during flow releases and construction activities.
- Channel Capacity Advisory Group: an independent review of then-existing channel capacities in accordance with U.S. Army Corps of Engineers (USACE) levee performance criteria comprised of one member each from Reclamation, DWR, USACE, the Lower San Joaquin Levee District, and the Central Valley Flood Protection Board.
- Endangered Species Act Consultation on Increased Flows: to address Interim and Restoration flow increases up to 4,500 cfs from Friant Dam, Reclamation would present the effects to species under the Service or NMFS jurisdiction related to those flow increases, and request consultation, as deemed appropriate by Reclamation, the Service, and NMFS. This consultation would occur as changes are made that may result in effects to species that have not been previously analyzed.
- Programmatic Cultural Resources Compliance: For the recovery of cultural resources on lands under federal jurisdiction, there is a requirement to curate archaeological collections and associated records in a facility meeting federal requirements. Curation must be done in accordance with the 43 CFR §79 regulations manual, *Curation of Federally Owned and Administered Archaeological Collections*, and the *Departmental of the Interior Manual 411*. A Programmatic Agreement is currently being developed in coordination with involved parties, including the California State Historic Preservation Officer. The agreement will further stipulate cultural resources identification efforts and curation responsibilities.

The Agencies consider these core actions due to the need to release Interim and Restoration flows.

5.1.2 Schedule

Invasive species control and the Channel Capacity Advisory Group represent ongoing SJRRP activities (Activities of the Channel Capacity Advisory Group will be initiated soon). Consultation of the release of Interim and Restoration flows at rates higher than 1,660 cfs from Friant Dam will be initiated with the on-going Program Biological Assessment effort. Consultation on increased flows will occur in five increments upon completion of the following: Mendota Pool Bypass; Reach 2B conveyance improvements; 3,000 cfs channel capacity below Mendota Dam including seepage, levee, and site-specific projects; 4,000 cfs channel capacity below Mendota Dam including seepage, levee, and site-specific projects; and 4,500 cfs channel

capacity below Mendota Dam, or as required by the potential reinitiation triggers in the Section 7 consultations.

5.1.3 Costs

Costs provide for implementation of actions from FY 2012 to FY 2026. The Options Appendix lists actions and sources of information for cost estimates. Reclamation assumes an annual need for the Channel Capacity Advisory Group until 2026. The schedule for consultations on increased flows is described above. Table 4 shows *PEIS/R* costs.

Table 4 – Estimated Mitigation and Conservation Strategy Costs

Measure	Cost (millions)
Millerton Lake Boat Ramps	$0.21
Conservation Strategy	$10
Invasive Species Control	$13
Channel Capacity Advisory Group	$4
Consultation on Increased Flows	$7.5
Programmatic Cultural Resources	$1.5

5.1.4 Uncertainties and Possible Future Changes

Uncertainties and possible future changes in the PEIS/R Avoidance, Minimization, and Mitigation Measures and Program Endangered Species Act (ESA) Consultation include the following:

- Costs to manage invasive species may be reduced over time, upon establishment of native plant communities.
- As agencies and stakeholders become accustomed to the return of flows, the level of effort involved in the Channel Capacity Advisory Group may reduce.
- Regulatory agencies may identify methods to anticipate future effects and consolidate the number of times the SJRRP must consult on increased Interim and Restoration flow releases under the ESA consistent with Exhibit B and the Settlement.
- Consultation on increased Interim and Restoration flow releases may result in additional requirements and commitments before Reclamation can increase the non-damaging conveyance capacity. These additional requirements and commitments may increase costs and require additional time.

5.2 Flow Management and Monitoring of Physical and Biological Processes

Flow management and monitoring of physical and biological processes includes requirements for operations at Friant Dam, compliance with the hydrographs, recapture accounting, PEIS/R commitments, and information to prioritize future actions. Reclamation currently implements these actions through the program of Interim Flows, development of the *Restoration Flow Guidelines*, the *Monitoring and Analysis Plan* and *Annual Technical* Report process, and fisheries reintroduction studies.

5.2.1 Actions

Flow management includes the actions under paragraph 13 of the Settlement to monitor flows and acquire, bank, store, or sell water. Monitoring actions span different levels of data collection and analysis, as described within the Options Appendix. Options include:

- Stream Gage: monitoring the releases from Friant Dam and the locations specified in Exhibit B of the Settlement.
- Acquire Water for Unexpected Seepage Losses: acquisition of water or options on water to meet the flow targets consistent with the Restoration Flow Guidelines and Paragraph 13(c) of the Settlement.
- Bank or Store Unreleased Restoration Flows: use of water not released for any reason consistent with the *Restoration Flow Guidelines* and Paragraph 13(i) of the Settlement.
- Monitor Physical and Biological Processes: data collection on terrain, sediment, vegetation, groundwater, temperature, water quality, fisheries, studies, and reporting consistent with the *Monitoring and Analysis Plan* and *Annual Technical Report* (MAP and ATR).
- Cold Water Pool Management (Friant Dam): consideration of actions to release flows from higher in the water column. This action was identified as a potential improvement for consideration at a later date.

The Agencies included stream gaging as a core activity to understand river conditions. They did not identify a fisheries need to acquire water for unexpected seepage losses nor bank or store unreleased Restoration Flows but included both actions to meet the terms of the Settlement. The level of monitoring and analysis for physical and biological processes meets environmental compliance requirements under the *PEIS/R* and is anticipated to fully fund efforts to address uncertainty and guide the implementation of secondary and improvement level projects. A robust monitoring and analysis effort allows program staff to understand the current conditions within in the Restoration Area and to update their understanding, as projects are completed. Future decisions on program implementation will require this monitoring information in order to set priorities for actions identified as secondary. The Agencies will set priorities for monitoring as part of the ATR and MAP process.

5.2.2 Schedule

Each of the flow management actions represents ongoing annual activities. The MAP would identify annual monitoring actions, and activities may change from year-to-year as the program staff learns more about the restored river and addresses critical information needs.

5.2.3 Costs

Costs provide for implementation of actions from FY 2012 to FY 2026. A one-time expense to develop strategies for 13(c) and 13(i) will facilitate those flow management actions.

Table 5 – Estimated Flow Management and Monitoring Costs

Action	Cost (millions)
Stream Gaging	$2.6

13(c) and 13(i)	$1.5
Physical and Biological Monitoring	$40.95

The level of stream gaging relies upon telemetered stage records with periodic calibration, rather than extensive manual flow measurements. After an initial scoping effort, the implementation of 13(c) and 13(i) will seek to provide cost neutral solutions through ratios on exchanges.

5.2.4 Uncertainties and Possible Future Changes

Uncertainties and possible future changes in Flow Actions include the following:

- The physical and biological monitoring costs will vary year-to-year depending upon opportunities provided by hydrology and the need to develop projects.
- Estimated costs will likely occur primarily in the early years and decrease over time as the SJRRP addresses uncertainties and reduces the need for studies upon implementation of projects.
- While Reclamation can develop cost-neutral banking, storing, exchange, transfer, and sale on water and options for specific quantities, the ability to reach the quantities called for in the Settlement is unknown.

5.3 Seepage Management

In the *PEIS/R* the SJRRP commits to limiting flow releases that are within then-existing channel capacities. Reclamation developed a *Seepage Management Plan* (updated in 2011) in coordination with the landowners. It lays out a groundwater monitoring network and identifies thresholds in wells within the monitoring network. Reclamation limits the release of Interim Flows to flow rates that do not cause groundwater levels to rise above thresholds. Reclamation can sometimes recapture a portion of the releases from Friant Dam to reduce or avoid downstream impacts from groundwater seepage. Channel capacities must meet the most restrictive of seepage constraints and levee constraints. As of the time of this Framework seepage constraints would limit flows upstream of Mendota Pool to 2,100 cfs in Reach 2A. Seepage constraints vary by season and by hydrology below Sack Dam. The constraints limit flows between 0 and 140 cfs in the Eastside Bypass, between Sand Slough Control Structure and the Mariposa Bypass Bifurcation Structure.

In the *PEIS/R*, the SJRRP also commits to addressing seepage effects through easements or compensation to landowners. Implementation of physical or real-estate related seepage projects will allow higher flow rates without groundwater levels rising above thresholds. Reclamation, in coordination with the landowners, has nearly completed development of a *Seepage Project Handbook*, which specifies the process for working with landowners and shows the timelines for implementing seepage projects. Reclamation has initiated several seepage projects to increase the non-damaging conveyance capacity for the conveyance of Interim and Restoration flows.

5.3.1 Actions

Seepage projects may include physical projects, such as interceptor lines, drainage ditches, slurry walls, shallow groundwater pumping, or raising the ground surface. They may also be real estate actions, such as license agreements, easements, or acquisition. The program staff would

coordinate with the landowners to select the specific project for each location. Table 6 shows the acres that may need seepage projects at different flow rates. The Agencies identified channel capacity projects to convey 2,000 cfs of Restoration Flows as part of the core program.

Table 6: Estimated Incremental Area Protected in acres by Seepage Projects

Flow (cfs)	Reach 2A	Reach 2B	Reach 3	Reach 4A	ESB	Incremental Total	Cumulative Total
300	0	0	0	510	2,370	2,880	2,880
700	0	0	0	2,493	0	2,493	5,373
1,300	0	194	2,548	0	0	2,742	8,115
2,000	0	388	1,097	234	0	1,719	9,834
2,500	1,200	0	1,075	3478	0	5,753	15,587
3,000	0	0	3,634	351	0	3,985	19,572
3,500	0	0	4,519	1,423	0	5,942	25,514
4,000	0	0	1,286	1,498	0	2,784	28,298
4,500	0	0	708	590	0	12,98	29,596
Total	**1,200**	**582**	**14,867**	**10,577**	**2,370**	**29,596**	

The acreages for Reach 2B and the Eastside Bypass provide information for a short-term action, where the Agencies can provide for seepage protection prior to, or concurrent with, the construction of the site-specific projects. Achieving the listed flow rates will also require satisfying levee stability criteria. Achieving flow rates greater than 1,300 cfs requires site-specific actions under the Mendota Pool Bypass and Reach 2B Channel Improvement Project.

5.3.2 Schedule

The *Seepage Project Handbook* explains that it will take approximately 10 months from project initiation to completion of analysis and selection of an alternatives; add an additional three months for real estate and contracting actions for construction. The Conveyance Appendix provides the estimated timeline for implementing a seepage project consistent with the *Seepage Project Handbook*. A construction action can require an additional one or two years. Assuming implementation by local water agencies, Reclamation and the districts could likely manage 6 to 10 individual seepage projects at a time. Assuming a staggered start to the projects, Table 7 shows the potential schedule. The Agencies identified channel capacity projects to increase flows to 2,000 cfs as part of the core program. The Agencies identified increasing flows to higher rates as secondary or improvement actions.

Table 7 – Potential Seepage Management Schedule with Incremental Number of Projects

Flow Rate (cfs)	Number of Projects	Duration	Completion Year
300	3	1	2013
700	1	2	2015
1,300	7	2	2015
2,000	12	2	2016

3,000	36	3	2019
4,000	26	3	2022
4,500	8	1	2023

5.3.3 Costs

Site-specific coordination with the landowners will determine the actual project. Acquisition costs were assumed to be representative of likely costs for seepage projects located between canals adjacent to the river, e.g. Poso, Riverside, and Columbia Canals. For all other areas, costs were based on estimated costs for interceptor lines or easements. For properties that overlap with other projects, such as levee stability projects (the Mendota Pool Bypass and Reach 2B Channel Improvements project area, the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel and Structural Improvements project area), costs were estimated based on 5 or 10 year rental costs. These rental costs would allow a short-term increase in flows until the longer-term project can be completed. Likely costs for each project were then summed for reaching flow levels shown in Table 8 below.

Table 8: Estimated Incremental Seepage Construction Costs

Flow (cfs)	Reach 2A	Reach 2B	Reach 3	Reach 4A	ESB	Incremental Total	Cumulative Total
300	0	0	0	$922,000	$6,041,300	$6,963,300	$6,963,300
700	0	0	0	$918,900	0	$918,900	$7,882,200
1300	0	$816,000	$7,321,400	0	0	$8,137,400	$16,019,600
2,000	0	$1,979,400	$4,256,400	$718,700	0	$6,954,500	$22,974,100
2,500	$993,100	0	$3,320,500	$2,020,100	0	$6,333,700	$29,307,800
3,000	0	0	$6,430,800	$892,900	0	$7,323,700	$36,631,500
3,500	0	0	$5,735,400	$1,397,600	0	$7,133,000	$43,764,500
4,000	0	0	$1,981,700	$3,041,300	0	$5,023,000	$48,787,500
4,500	0	0	$1,614,200	$688,600	0	$2,302,800	$51,090,300
Total	**$993,100**	**$2,795,400**	**$30,660,400**	**$10,600,100**	**$6,041,300**	**$51,090,300**	

Seepage project costs by project are available in the Conveyance Appendix along with supporting information for a range of projects. Costs to convey 4,500 cfs range from $35 million with exclusive implementation of interceptor lines to $120 million with exclusive implementation of easements.

Annual operations and maintenance cost are estimated to be $3.05 million per year upon completion of likely seepage projects to enable flows up to 4,500 cfs.

5.3.4 Uncertainties and Possible Future Changes

Parcel groups within approximately one mile of the river were used for this analysis. Additional analysis and groundwater modeling provided by the U.S. Geological Survey (USGS) could change the extent of needed projects. Site-specific conditions are currently unknown. The extent of impact on a specific parcel could increase or decrease and change the type of project. While many of the landowners attend seepage technical feedback meetings and support site-specific

studies, participation is not universal. Landowners unwilling to participate in the activities may extend the schedule. Reclamation assumed permanent easements cost 50% of estimated fee title. Site-specific analysis and appraisals could change land value and project costs. Opportunities for landowners to participate in cost-share agreements where seepage projects improve groundwater conditions outside of Restoration Flows may reduce operations and maintenance costs.

5.4 Levee Stability

The *PEIS/R* limits Restoration Flows to then-existing channel capacity based on USACE criteria for levee through- and under-seepage. Determining levee stability risks requires data collection on levee materials. In the absence of sufficient data to evaluate levee stability, Reclamation has committed to maintaining flows below the outside toe. Levee constraints currently limit flows:

- Upstream of Mendota Pool to 810 cfs in Reach 2B; and
- Below Sack Dam to 600 cfs in the Eastside Bypass.

DWR is working on a geotechnical investigation to collect the relevant data to identify and prioritize bottleneck areas for levee remediation. The following section describes the potential costs of levee remediation to reduce potential flood impacts based on then-existing flow capacities and river lengths that were included in the *PEIS/R* to show levees potentially impacted by Restoration Flows. The estimates assume either toe drain or slurry walls for locations where water surfaces exceeded the levee toe as representative projects to provide bookends for the range of costs.

5.4.1 Actions

The analysis assumed that any flow above the levee toe could have an impact on levee stability. Table 9 shows potential levee remediation lengths at various flow levels. Table 9 assumes that a site-specific project would address Reach 2B levee repairs, and thus Mendota Pool levee costs are not included. The Conveyance Appendix includes costs for all of Reach 2B. Table 10 shows the Reach 2B (upstream of Mendota Pool) and Eastside Bypass potential levee remediation lengths without the implementation of the site-specific project costs. The Agencies identified channel capacity projects to increase flows to 2,000 cfs as part of the core program. The Agencies identified increasing flows to higher rates as secondary or improvement actions.

Table 9: Estimated Incremental Levee Repair Lengths in miles assuming no flows above the levee toe until a project is implemented

Flow (cfs)	Reach 2A	Reach 3	Reach 4A	Reach 5	Incremental Total	Cumulative Total
700	0.0	0.0	0.0	0.0	0.0	0.0
1,300	0.0	0.4	0.4	0.0	0.7	0.7
2,000	0.2	0.4	1.7	0.0	2.3	3.1
2,500	0.2	1.0	1.0	0.5	2.6	5.7
3,000	1.1	0.7	1.1	0.8	3.6	9.4
3,500	1.3	2.8	1.8	0.6	6.6	15.9
4,000	1.2	7.1	3.7	0.3	12.3	28.2

4,500	0.7	6.5	6.4	0.4	13.9	42.1
Total	**4.8**	**18.8**	**16.0**	**2.5**	**42.1**	

Table 10: Estimated Incremental Levee Repair Lengths in miles for Reach 2B and the Eastside Bypass

Flow (cfs)	Reach 2B	Eastside Bypass	Incremental Total	Cumulative Total
700	0.0	7.5	7.5	7.5
1,300	0.1	2.8	3.0	10.5
2,000	0.9	4.1	5.1	15.5
2,500	6.5	2.6	9.1	24.7
3,000	2.5	2.2	4.8	29.4
3,500	1.4	3.6	5.0	34.4
4,000	0.7	4.4	5.1	39.5
4,500	0.2	3.3	3.5	42.9
Total	**12.4**	**30.6**	**42.9**	

5.4.2 Schedule

DWR is currently preparing a project management plan to evaluate levee stability using methods consistent with the USACE levee evaluation guidelines to identify where concerns may exist. This plan will involve evaluating existing geometry, levee assessment, and past performance data; conducting a geotechnical drilling program; and performing seepage and stability modeling. Evaluation of the most critical levee sections may take until fall 2013, following which channel capacities may be revised. Concurrently, a programmatic environmental compliance document for a levee repair program will be pursued. This may take 18 months to 2 years, following which the evaluation, land acquisition, final design and site-specific environmental documentation can be completed. Progress on levee stability evaluation can proceed on the following schedule.

- 2014 – Revision of channel capacity constraints following completion of levee evaluation
- 2015 – Completion of environmental compliance and design
- 2016 – Initiation of construction activities

Upon initiation of construction, Table 11 shows the potential schedule and related conveyance capacity improvements, assuming that Eastside Bypass and Reach 2B levees are fixed as part of this project and not their site-specific projects. In reality, the site-specific projects must be completed to gain any increase in channel capacity, as those reaches are the bottlenecks. The Agencies identified channel capacity projects to increase flows to 2,000 cfs as part of the core program. The agencies may delay projects for higher flows to later dates.

Table 11 Potential Levee Stability Schedule

Flow Rate (cfs)	Length (miles)	Duration (years)	Completion Year
700	8	2	2018

1,300	4	1	2018
2,000	7	1	2018
3,000	20	3	2021
4,000	29	4	2025
4,500	17	3	2028

5.4.3 Costs

Table 12 below shows estimated levee stability costs based on an assumption that half of the levee lengths needing repairs would require the highest cost solution, slurry wall repairs, and half would require a low-cost solution, such as drains. While neither solution may be implemented, these costs result in a mid-point value useful for planning purposes.

Table 12: Estimated Incremental Levee Remediation Costs

Flow (cfs)	Reach 2A	Reach 3	Reach 4A	Reach 5	Incremental Total	Cumulative Total
700	$0	$0	$0	$0	$0	$0
1,300	$0	$1,280,000	$1,133,000	$0	$2,413,000	$2,413,000
2,000	$764,000	$1,287,000	$5,447,000	$0	$7,498,000	$9,911,000
2,500	$585,000	$3,141,000	$3,248,000	$1,539,000	$8,513,000	$18,424,000
3,000	$3,612,000	$2,120,000	$3,477,000	$2,549,000	$11,758,000	$30,182,000
3,500	$4,326,000	$9,134,000	$5,883,000	$1,800,000	$21,143,000	$51,325,000
4,000	$3,918,000	$22,771,000	$12,022,000	$925,000	$39,636,000	$90,961,000
4,500	$2,270,000	$20,857,000	$20,497,000	$1,138,000	$44,762,000	$135,723,000
Total	$15,475,000	$60,590,000	$51,707,000	$7,951,000	$135,723,000	

Table 13 shows the costs for Reach 2B (upstream of Mendota Pool) and Eastside Bypass levee remediation for an interim action or an alternative to the site-specific projects.

Table 13: Reach 2B and Eastside Bypass Estimated Incremental Levee Remediation Costs

Flow (cfs)	Reach 2B	Eastside Bypass	Incremental Total	Cumulative Total
700	$0	$24,264,000	$24,264,000	$24,264,000
1,300	$389,000	$9,129,000	$9,518,000	$33,782,000
2,000	$3,059,000	$13,279,000	$16,338,000	$50,120,000
2,500	$20,975,000	$8,434,000	$29,409,000	$79,529,000
3,000	$8,129,000	$7,223,000	$15,352,000	$94,881,000
3,500	$4,427,000	$11,597,000	$16,024,000	$110,905,000
4,000	$2,219,000	$14,118,000	$16,337,000	$127,242,000
4,500	$717,000	$10,485,000	$11,202,000	$138,444,000
Total	$39,915,000	$98,529,000	$138,444,000	

The costs shown in Table 12 above represent a best estimate. DWR developed costs for a range of potential options, as shown in the Conveyance Appendix. At 4,500 cfs, estimates of cost range of $27 million (with all toe drains) to $245 million (with all slurry walls), excluding the Reach 2B and Eastside Bypass costs, which will be addressed under the site-specific projects.

5.4.4 Uncertainties and Possible Future Changes

It was assumed that no levee stability problems would occur at the 300 cfs release from Friant Dam. Further analysis is needed in the upper reach of the Eastside Bypass to ensure that this assumption is accurate. It was also assumed that no levee repairs were needed within Mendota Pool, although water reaches the levee toe. If the core action does not include the Mendota Pool Bypass Project, these costs will need to be added in.

These results are preliminary, until further information is known about levee conditions, performance during flows, and suitable mitigation measures. The impacts on levees for individual overtopping depth will not be known until more levee data is collected. After evaluation, DWR may find that some flow above the levee toe does not result in levee stability concerns, and costs could decrease.

Levee stability concerns at 700 cfs indicate potential for repairs to levees in the Eastside Bypass, and thus the project would need to be coordinated with the Reach 4B, Eastside Bypass, and Mariposa Bypass projects. This would ensure a permanent solution for the Reach 4B Project, while levee stability is developed. This may require the completion of the Reach 4B Project Record of Decision, which could lengthen the schedule.

6.0 Fish Reintroduction

The timeline and strategy for reintroduction of Chinook salmon should consider the status of river projects and projected in-stream conditions in the Restoration Area. The Agencies will conduct a series of efforts to further the reintroduction process through developing a captive broodstock, conducting expanded studies to address key uncertainties, and implementing pilot Chinook release efforts to test and refine strategies. Section 5.2provides for reintroduction monitoring and studies integrated with overall Program monitoring efforts. The SJRRP is committed to maintaining the reintroduction of spring-run Chinook salmon as the priority, but believe both spring-run and fall-run Chinook salmon can be used, as appropriate, to test and refine reintroduction strategies, while also moving the long term program objectives forward. Consistent with the Settlement Act, no spring-run Chinook will be released into the San Joaquin River until the Experimental Population Status and associated rules are in place.

6.1 Actions

Fish reintroduction activities include activities to collect, rear, and release Chinook salmon as follows:

- Construct a Conservation Hatchery Facility: Construct and operate the San Joaquin River Salmon Conservation and Research Facility (Conservation Hatchery). The Conservation Hatchery will allow the program to develop brood stock and rear the number of juveniles necessary to restore self-sustaining salmon populations. Without the Conservation Hatchery, the program would have to rely on colonization of the Restoration Area by strays or direct transfers from other watersheds. Passive restoration is unlikely, since no spring-run Chinook populations are established within the San Joaquin Basin, and strays from the Sacramento River will be infrequent and inconsistent.
- Develop Broodstock: Develop spring-run Chinook brood stock to provide a source of fish for releases, including the collection and transportation of eggs or fish from various donor stock locations to the Conservation Hatchery.
- Monitor Source Stocks: monitor the status of potential donor stocks to determine the suitability for collection and incorporation into broodstock. The *Hatchery and Genetics Management Plan* identifies a multi-stock approach for reintroducing salmon to the San Joaquin River. Existing stocks of spring-run Chinook salmon are depressed and protected under federal and state laws. Collecting from these stocks requires the program to show that such collections would not jeopardize the survival of the existing stocks and would provide a net benefit to the species. Existing monitoring efforts may not be sufficient to determine if collecting from these stocks is appropriate.
- Fish Releases: Eggs, juvenile, and adult Chinook salmon will be released in the Restoration Area for studies, under appropriate permits, to complete their lifecycle, and to contribute to future populations.

- Trap and Haul: Both adult and juvenile fish will be moved around passage barriers. Several passage barriers will exist within the system when activities begin. Fish released into the system prior to the passage issues being completely resolved will require assistance to reach suitable rearing, holding, migration, and spawning habitat. Trap and haul operations have been used in other systems to provide salmon passage around impoundments and other barriers to allow fish releases prior to resolving all passage issues.

6.2 Schedule

The reintroduction of Chinook salmon to the Restoration Area will take place over several years and will be an adaptively managed process. The number of fish released and expectations for returns will be phased in and dependent upon the status of channel improvements, regulatory compliance, and the results of ongoing studies. Juvenile fall-run Chinook salmon were released into the system for targeted studies in 2010 and releases continue today. Contingent upon approval and receipt of a Section 10(a)(1)(a) permit, the program will begin developing a spring-run Chinook captive brood stock at the Interim Facility. If an experimental population designation is given to the Restoration Area, study releases of spring-run Chinook salmon would begin in spring 2013. The study would inform the program about the performance of spring-run Chinook salmon in the Restoration Area and provide a proof-of-concept for fish handling, rearing, and release methodologies. A trap and haul program will provide passage for any adult Chinook that return from these releases. We will increase the scale of releases in spring 2016, since we will have produced juvenile fish from our captive brood stock and will have also improved river conditions. Most passage barriers will be resolved by 2017, but the operation of a trap and haul system would continue until all passage barriers are resolved (2020). Table 14 describes major milestones for the reintroduction process, which are contingent on issuance of permits and reintroduction will be in conformance with all permit terms.

Table 14. Timeline of fish reintroduction milestones

Date	Milestones for Fish Reintroduction
Spring 2010	Begin broodstock rearing study
Spring 2011	Begin targeted studies with captive rearing and releases of fall-run Chinook Salmon
August 2012	Expected determination on Section 10(a)(1)(a) Enhancement of Species Permit
Fall 2012	Collect FRFH spring-run Chinook eggs for development of captive brood stock
December 2012	Expected determination of 10(j) experimental population designation and associated 4(d) rules.
Spring 2013	Release up to 54,400 spring-run Chinook juveniles into Restoration Area for expanded studies purposes.
Spring 2015	Operate a trap and haul program to transport any returns from spring-run Chinook salmon releases
Fall 2015	Conservation Facility operational for rearing of Chinook salmon
October 2015	Captive brood stock begins producing offspring for restoration
Spring 2016	Begin full implementation of spring-run Chinook salmon releases for

	restoration.
Spring 2020	All primary passage barriers resolved for adult Chinook salmon. Trap and haul only implemented in response to observed migration delays.

Construct Conservation Hatchery Facility

The Conservation Hatchery is currently in the planning and design process. The facility is expected to be available to rear Chinook salmon by the fall 2015. The program currently has an operational Interim Facility for rearing Chinook salmon adjacent to the existing San Joaquin Fish Hatchery. The Interim Facility will be used to rear Chinook salmon for captive broodstock or for rearing fish to release into the Restoration Area.

6.2.1 Develop Broodstock

Contingent upon regulatory compliance including the approval of an ESA Section 10(a)(1)(A) permit, the program will proceed with developing a captive broodstock of spring-run Chinook salmon. The determination on the 10(a)(1)(A) permit application is expected by the end of summer 2012, and, if approved, the development of a program broodstock is expected to begin in 2012 from the progeny of fish spawned in fall 2012 at the Feather River Fish Hatchery. Collections for broodstock will continue in subsequent years, and the number of fish in the captive broodstock program will increase as additional year classes are added and the capacity for rearing fish increases through the construction of the Conservation Hatchery. As described in the *Strategy for Spring Chinook Salmon Reintroduction* (SJRRP 2011), captive broodstock is a principle component for producing the quantity of eggs and juveniles needed to reintroduce spring-run Chinook salmon into the Restoration Area (in conjunction with direct translocation of eggs and juveniles from donor stocks). Although subject to annual review, the SJRRP intends to collect up to 560 eggs or juveniles for the first three years for use as broodstock. In years four and later, the program may collect as many as 2,760 eggs or juveniles from the Feather River Fish Hatchery (FRFH). Eggs from the captive broodstock program should be available in 2015. The number of eggs available will increase over time, and will reach full capacity when the program is able to maintain broodstock at the completed Conservation Hatchery.

6.2.2 Source Stock Monitoring

The program will also continue to pursue donor stock collections from extant wild Spring-run Chinook populations. The program will continue to work with DFG and NMFS to develop criteria that will allow collection of broodstock from these source stocks. Monitoring these stocks may become a part of the process, where existing monitoring efforts are not sufficient inform future collections.

6.2.3 Fish Release

The current status of the system with flows of at least 300 cfs release from Friant Dam can support Chinook salmon releases subject to certain constraints and expectations. The release strategies for the near future will continue to focus on progressing toward full restoration of self-sustaining fish populations. The requested spring-run Chinook take-limit for translocation to the San Joaquin River from the Feather River Fish Hatchery is 80,000 eggs or the equivalent number

of juveniles (54,400). The program proposes to use all of this stock for these releases. This number of eggs or equivalent number of juveniles is not expected to be sufficient to establish a self-sustaining population, but will allow for implementing expanded study efforts and, potentially, result in adult fish returning to the system. These activities will be conducted in concert with a monitoring and evaluation program described in Section 5.2.

The study objectives of these releases can be divided between two broad categories as follows: (1) to support studies on Chinook behavior and performance in the system; and (2) to provide a proof-of-concept for fish reintroduction activities. By proceeding with these releases of study fish, the Agencies intend to minimize the delay in meeting the long-term objective of self-sustaining populations by improving the body of knowledge and abilities. At the same time, the Agencies plan to develop Conservation Hatchery production capacity and complete improvements to the river.

To better understand Chinook salmon performance and behavior in the system, multiple studies will be conducted in coordination with fish releases. The questions addressed by these studies will be broad and depend on current conditions, but the key objective can be described as increasing the understanding of how fish will survive and behave in the system. A combination of tagging methods, release locations, and field monitoring will be used to address survival, migration rates, migration timing, and habitat use for juvenile and adult fish in the Restoration Area and as they migrate through the Delta.

Working with modest numbers of fish will allow the Agencies to work through methods for rearing and releasing juvenile fish and handling adult fish when they return. The Agencies propose to use a variety of rearing and release methods described in the *Reintroduction Strategy for Spring-Run Chinook Salmon* (SJRRP 2011), such as streamside rearing, use of net pens, and releasing fish at multiple life stages.

Fish releases at this magnitude will continue for the next few years as broodstock capacity grows and channel improvements are made. As flow capacities increase, juvenile salmon survival is expected to increase. As channel improvement projects allow flows of 700 cfs or greater, we expect juvenile migration survival to improve and more juvenile salmon to successfully migrate through the Restoration Area.

When channel improvement projects have been completed to allow for a reliable passage corridor for adult Chinook salmon, the program will pursue increased releases of Chinook salmon for reintroduction purposes above the current permit request of 54,400 juveniles from the Feather River Hatchery. In 2015, we expect eggs to start being produced by our captive broodstock; therefore, we will have the capacity to increase our release levels by using locally produced fish. When these fish return as adults to the Restoration Area in 2018, flow conveyance will exceed 2,000 cfs, which will allow for temperature management. All adult migration barriers will be resolved except for Mendota Dam. An intensive trap and haul program will be needed to assist adult migration past Mendota Dam until bypass construction is completed in 2019. From 2020 on, we expect juvenile and adult salmon to be able to migrate through the restoration area without assistance.

6.2.4 Trap and Haul

Concurrent with planning fish releases, the program will prepare for any returning adults by setting a trap and haul operation below the lowest adult passage barrier in the system. Trap and

Haul programs have been used in other systems to allow fish passage prior to resolving all fish passage impediments (Zimmerman DATE?). Returning adults would be trapped and transported to upstream areas or returned to the Conservation Facility to be incorporated into our production operations. We expect low numbers of adult returns from the initial releases, which will allow us to actively capture and transport these fish. In fall 2011, we successfully conducted a study on our ability to collect and transport adult fall-run Chinook and deliver them to a hatchery setting. We can begin the testing of a trap, haul, and release program prior to the return of released fish, if we rely on fall-run Chinook salmon from San Joaquin tributaries that stray into the Restoration Area. In fall 2012, we will conduct a pilot capture, transport, and release of adult fall-run Chinook into the Restoration Area for biological study purposes as well as to study our ability to trap, transport, and release adult salmon into the system. Fish may be trapped at the Hills Ferry Barrier or at a location further upstream. The fish will be acoustically tagged to monitor their survival and habitat use. As channel improvements are completed, we expect the location of the fish trap to move further upstream to minimize the length of travel requiring human intervention. By 2020, all primary passage impediments will be resolved, so we will phase-out the trap and haul program and allow fish to volitionally migrate to the spawning grounds. The trap and haul program can be implemented to respond to observations of stranded fish or extreme conditions.

The conditions for salmon in the Restoration Area and our understanding of those conditions may change rapidly based on water year type, completion of projects, and study results. The *Reintroduction Strategy for Spring-Run Chinook Salmon* and the *Fisheries Management Plan* acknowledges these potential changes, and outlines an annual process for technical teams to review current conditions and make recommendations on donor stock collections and release numbers.

6.3 Costs

The following costs are estimates for fishery reintroduction activities through 2026.

Action	Cost (millions)
Conservation Hatchery Construction	$14.56
Conservation Hatchery O&M	$7.0
Monitoring of Source Stock	$7.80
Collection, Transport and Release of Source Stock	$8.32
Trap and Haul Program	$11.26

6.4 Uncertainties and Possible Future Changes

Several factors influence the ability to conduct fish releases, including: expected river conditions, regulatory compliance, and addressing program impacts. Resolving these issues will affect implementation of activities (both schedule and how activities are implemented) and the degree to which we work with spring-run or fall-run Chinook salmon.

A Section 10(a)(1)(A) enhancement of species permit is necessary prior to collecting any spring-run Chinook or eggs from donor stock, and no spring-run Chinook can be released into the San

Joaquin River unless a 10(j) experimental population designation and associated 4(d) rule is completed.

It is expected that a decision on the donor stock collection permit request would be completed by August 2012, and the 10(j) experimental population designation and associated 4(d) rule by December 2012.

The specific details and when and how fall-run Chinook are reintroduced are still under development.

7.0 Water Management

Water Management Goal actions include the identification, development, and implementation of projects and programs to reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement. The reduction in water deliveries caused by the Interim Flows and Restoration Flows is monitored and recorded in the Recovered Water Accounts (RWA). Although reduction in RWA balances does not necessarily equate to recovery of water supply, the SJRRP will set priority actions and measures success by the reduction of Friant Division long-term contractors RWA balances.

Reclamation, in consultation with the other Settling Parties and coordination with the State of California, is authorized and directed to implement a plan for recirculation, recapture, reuse, exchange or transfer (R&R Plan) of the Interim Flows and Restoration Flows. Since 2008, Reclamation has been working with the Settling Parties to develop and implement the R&R Plan. The *Draft R&R Plan* was completed on February 10, 2011.

Reclamation, in consultation with the other Settling Parties and coordination with the State of California, is authorized and directed to implement a RWA Program, to make water available in wet hydrologic conditions to all of the Friant Division long-term contractors who provide water to meet Interim Flows and Restoration Flows, at a total cost of $10 per acre foot. The RWA Program is an action that will continue for the entire SJRRP, and which has delivered approximately 324 TAF of water to the Friant Contractors. Since 2008, Reclamation has been working with the Settling Parties to establish a baseline condition as of the effective date of the Settlement with respect to water deliveries for the purpose of determining the reduction in water deliveries.

Reclamation, in coordination with applicable Federal, State, regional, and local authorities, is authorized and directed to conduct feasibility studies on the restoration of the capacity of the Friant-Kern Canal and Madera Canal to such capacity, as previously designed and constructed by Reclamation. Upon completion of and consistent with the applicable feasibility study, Reclamation is authorized to construct the improvements and facilities in accordance with applicable Federal and State laws. Initially, Reclamation evaluated the capacity restoration for the Friant-Kern Canal jointly with the Madera Canal, but because of their unique differences in the design and construction, Reclamation has since separated the evaluations.

Reclamation provided draft guidelines for awarding Financial Assistance for Local Projects in March 2010. Initiation of projects will depend upon a Funding Opportunity Announcement after appropriations.

7.1 Actions

Actions identified by the Implementing Agencies to reduce or avoid adverse water supply impacts include:

- Recapture and Recirculation: A plan for recirculation, recapture, reuse, exchange or transfer of the Interim Flows and Restoration Flows, including the funding necessary measures to implement the plan. To assist decision makers in identifying the necessary measures and the amount of funding required, Reclamation, in consultation with the Settling Parties, is completing an Investment Strategy to fund projects and programs to reduce or avoid adverse water supply impacts. The Investment Strategy will identify available water resources, formulate alternatives, evaluate the effects of alternatives, compare alternatives, and recommend alternatives for consideration by decision makers. The Agencies identified Recapture and Recirculation as part of the core program with limitations on the available funds, as described under the costs section. Additional funds to improve Recapture and Recirculation or otherwise reduce or avoid adverse water supply impacts would be secondary actions.
- Recovered Water Account: a program to make water available, in wet hydrologic conditions, to all of the Friant Division long-term contractors who provide water to meet Interim Flows and Restoration Flows, at a total cost of $10 per acre foot (costs to develop and implement this program are included as part of program staffing). The Agencies identified the RWA as part of the core program.
- Restoration of the capacity of the Friant-Kern Canal and Madera Canal to such capacity as previously designed and constructed by Reclamation. The restoration of capacity on the Friant-Kern and Madera Canals are part of the core program.
- Friant-Kern Canal Reverse Flow Pump-Back: As provided in Section 10203(b) of the Act, $17 million is available for the Friant-Kern Canal Reverse Flow Pump-Back Project (FKC Reverse Pump Project), provided that the project is not already authorized and funded under the R&R Plan, and that such expenditure will not conflict with, or delay implementation of, actions required by part I of the Settlement Act. The caveats identified in the legislation resulted in the Agencies identifying FKC Reverse Pump as a secondary action.
- Financial Assistance for Local Projects (Part III Projects): Reclamation is authorized to be appropriated $50 million (October 2008 price levels) to carry out the purposes of Part III of the Act. The Agencies will use the $50 million in appropriated funds to provide financial assistance for the Part III Projects as part of the core program.

7.2 Schedule

The R&R Plan is an action that will continue for the entire program. The completion date for the Final R&R Plan is currently unknown. Due to the number of issues and uncertainties in the lower San Joaquin River, Sacramento-San Joaquin Delta, and coordination of State Water Project and CVP Facilities, it is anticipated that the Final R&R Plan will be amended and supplemented as needed. The Investment Strategy is scheduled to start in August 2012 and conclude in September 2013.

The remaining effort in the RWA is the baseline used to determine reduction in water deliveries. Reclamation anticipates completing the baseline by August 1, 2012.

The anticipated schedule for the Friant-Kern Canal Capacity Restoration Project is:

ACTIVITY	START DATE	END DATE
Feasibility Study	March 30, 2009	June 2012
Final Design	April 2012	August 2012
Construction	August 2012	January 2016

The anticipated schedule for the Madera Canal Capacity Restoration Project is:

ACTIVITY	START DATE	END DATE
Feasibility Study	March 30, 2009	June 2013
Demonstration Project	April 2012	June 2013
Final Design	June 2013	January 2014
Construction	January 2014	April 2015

The anticipated schedule for Part III Financial assistance is:

ACTIVITY	DATE
Part III Guidelines	August 2012
FY 2013 Funding	October 2012
FY 2014 Funding	October 2013
FY 2015 Funding	October 2014
FY 2016 Funding	October 2015
FY 2017 Funding	October 2016
FY 2018 Funding	October 2017
FY 2019 Funding	October 2018

7.3 Costs

The following costs are estimates for the Water Management Goal actions through December 31, 2025:

Action	Total Cost
Recapture and Recirculation	$15 million
Recovered Water Account and Program	N/A (Program Staff)
Friant-Kern Canal and Madera Canal Capacity Restoration Project	$35 million
Friant-Kern Canal Reverse Flow Pump-Back	$17 million
Part III Projects (October 2008 price levels)	$50 million

A component of the R&R Plan is to include provisions for funding necessary measures to implement the R&R Plan. While neither the Settlement nor Settlement Act authorizes a specific amount to be made available, the R&R Plan is an action required by Section 10004(a)(4), Part I

of the Act. The Agencies identified $5 million to complete an Investment Strategy that will guide implementation of core and secondary projects, and $10 million for funding necessary measures to implement the R&R Plan as part of the core program, which may include the FKC Reverse Pump Project or other conveyance or pumping facilities.

7.4 Uncertainties and Possible Future Changes

Reclamation will work with DWR and State and Federal Contractors to develop the recapture and recirculation plan. Uncertainties in the conditions of the Delta and lower San Joaquin River may limit opportunities to recapture water. The Water Management Goal may shift focus to increase the use of wet-year water supplies. The Investment Strategy will help determine the projects to undertake.

8.0 References

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