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Chapter 4: Protect, Restore, and Enhance the Delta Ecosystem

Strategy 4.1: Create More Natural Functional Flows

Strategy 4.2: Restore Ecosystem Function

Strategy 4.3: Protect Land for Restoration and Safeguard Against Land Loss

Strategy 4.4: Protect Native Species and Reduce the Impact of Nonnative Invasive Species

Strategy 4.5: Improve Institutional Coordination to Support Implementation of Ecosystem Protection, Restoration, and Enhancement

Outcome Performance Measures

4.15 Seasonal Inundation [NEW *New*]

Description:

Restoring land-water connections to increase seasonal floodplain inundation. (Strategy 4.2)

Metrics:

Acres within the Sacramento-San Joaquin Delta and Suisun Marsh that are:

- Hydrologically connected to fluvial and tidally-influenced waterways.
- A floodplain[1] area that inundates[2] at least once every two years.

Baseline:

As of the year 2013:

- An estimated 75,000 acres of land physically connected to the fluvial river and tidal system, of which:
- Approximately 15,000 acres are inundated at a two-year or more frequent interval. This baseline is reset to zero acres for purposes of reporting.

Target:

By 2050:

- 51,000 additional acres that are physically connected to the fluvial river and tidal system, of which:
- At least additional 19,000 acres of floodplain area inundated on a two-year recurrence interval.

[1] Area that is inundated on a two-year recurrence frequency and is connected to the fluvial river or tidal system.

[2] There is no depth threshold for the inundation analysis. Although this is important for ecological processes, the available data does not include depth measurements.

4.16 Acres of Natural Communities Restored [NEW *New*]

Description:

Restoring large areas of natural communities to provide for habitat connectivity and crucial ecological processes. (Strategy 4.2)

Metric:

Acres of natural communities restored. Evaluated every five years.

Baseline:

Acres of natural communities from the California Department Fish and Wildlife (CDFW) Vegetation and Land Use Classification and Map of the Sacramento-San Joaquin River Delta and Suisun Marsh.

Riparian and Wetland Ecosystems	Existing Acres
Seasonal Wetland/Wet Meadow	5,029
Willow Riparian Scrub/Shrub and Valley Foothill Riparian	14,167
Emergent Tidal Marsh	19,892

Upland Ecosystems	Existing Acres
Inland Dune Scrub	19
Oak Woodland/Savanna	0
Grassland	32,994
Vernal Pool Complex	5,029
Alkali Seasonal Wetland Complex	698

Target:

Target acres of natural communities by 2050:

Riparian and Wetland Ecosystems	Target Acres (net increase from baseline)	Total Acres by 2050 (Net increase and baseline acres)
Seasonal Wetland/Wet Meadow	19,000	24,029
Willow Riparian Scrub/Shrub and Valley Foothill Riparian	16,300	30,467
Emergent Tidal Marsh	32,500	52,392

Upland Ecosystems	Target Acres (net increase from baseline)	Total Acres by 2050 (Net increase and baseline acres)
Inland Dune Scrub	640	659
Oak Woodland/Savanna	13,000	13,000
Grassland	0	32,994
Vernal Pool Complex	670	5,699
Alkali Seasonal Wetland Complex	230	928

4.6 Doubling Goal for Central Valley Chinook Salmon Natural Production [*Modified*]

Description:

Progress toward achieving the State and federal "doubling goal" for wild Central Valley salmon relative to the period of 1967-1991 levels. Trends will be derived from long-term salmon monitoring surveys conducted by the U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, and others. (Strategy 4.4)

Metric:

Combined annual natural production of all Central Valley Chinook salmon runs (fall, late fall, spring, and winter). To be measured annually.

Baseline:

Set by the Central Valley Protection Improvement Act (CVPIA), the baseline is the 1967-1991 Chinook salmon natural production average of 497,054 for all Central Valley runs.

Target:

The 15-year rolling average of natural production for all Chinook salmon runs: (1) will be 990,000 by 2065, doubling the baseline of 497,054; (2) the slope of the 15-year rolling average is greater than zero (i.e. positive).

4.2 Restoring More Natural Functional Flow Patterns [✓ *No Change*]

Description:

Restoring to a healthier estuary using more natural functional flows—including in-Delta flows and tributary-input flow—to support ecological floodplain processes (e.g., spring peak flows along the Sacramento River, and more gradual recession flows at the end of the wet season). (Strategy 4.1)

Metrics:

- Area and duration of inundation in the Yolo Bypass, evaluated annually on a five-year rolling basis.
- Frequency of two-year return interval peak flows, between November 1 to April 30, evaluated annually on a five-year rolling basis, at Bend Bridge on the Sacramento River.
- Rate of change in the hydrograph on the receding limb as measured from spring high flows to summer low flows, evaluated annually on a five year rolling basis, at Bend Bridge on the Sacramento River.
- 10-year rolling average slope of the Delta outflow-inflow ratio, disaggregated by seasonal, annual, and 10-year periods and evaluated annually; outflow-inflow ratio in dry and critically dry years, evaluated annually on a five-year rolling basis.

Baseline:

- Modeling, for the years 1997–2012, estimates that events with a 14-day duration inundated 45,100 acres in 33 percent of years; 19,700 acres in 50 percent of years; and 16,400 acres in 67 percent of years. Events with a duration of at least 21 days are estimated to have covered 36,300 acres in 33 percent of years; 15,800 acres in 50 percent of years; and 10,000 acres in 67 percent of years, between November 1 and May 30 (DWR 2015).
- Hydrograph data for the Bend Bridge gage station (USGS gage 11377100) indicate that the magnitude of flow for pre-Shasta Dam (1891–1943) and post-Shasta Dam (1960–2013) events, with 14-day duration, are similar (approximately 20,000 cubic feet per second, CFS). However, the pre-Shasta Dam historical 1.5-year recurrence interval peak flow (approximately 75,000 CFS) even now occurs approximately every two years, and the pre-Shasta Dam 10-year recurrence interval flow (206,200 CFS) has been nearly halved (133,842 CFS).
- Long-term hydrograph data from the U.S. Geological Survey gage station at Bend Bridge (USGS 11377100).
- Long-term ratio of Delta outflow to Delta inflow. The period before construction of the Central Valley Project, State Water Project, and select major dams (hydrograph between 1931 – 1954) had a Delta outflow-inflow ratio of 0.88. Post-completion of most components of the State Water Project (hydrograph between 1981–2015), the Delta outflow-inflow ratio was 0.75.

Target:

- By 2030, allow for at least 17,000 acres of inundation for at least 14 days in two out of three years, and at least 21 days in one out of two years, between November 1 and March 15.
- By 2030, at least one peak flow greater than 75,000 CFS, lasting at least 48 hours in duration, every two years, at Bend Bridge on the Sacramento River.
- By 2030, daily decrease in flow will be less than 3.5 percent per day, as calculated by a five-day rolling average during the period of spring flow recession, in at least 1 out of 5 years, at Bend Bridge on the Sacramento River.
- By 2030, 10-year rolling average slope of Delta outflow-inflow ratio is greater than zero (i.e., positive), and annual average Delta outflow-inflow ratio in dry as well as in critically dry years is greater than 0.5.

4.10 Terrestrial and Aquatic Invasive Species [✓ *No Change*]

Description:

Prevention and reduction of key nonnative terrestrial and aquatic invasive species in the Delta and Suisun Marsh. (Strategy 4.4)

Metrics:

Metrics are to be evaluated annually:

- Number of key new nonnative invasive species of fish, plants, and invertebrates establishing populations in the Delta (e.g., Quagga and Zebra mussels, *Hydrilla verticillata*, and others as they are identified).
- Managing nonnative fish:
    - Percentage of the total biomass of fish that are native fish species based on USFWS beach seine surveys (and other relevant surveys).
    - Percentage of total relative abundance that are native species in the Delta and Suisun Marsh based on USFWS beach seine surveys (and other relevant surveys).
- Managing invasive nonnative vegetation:
    - Number of acres treated for invasive plants as defined by individual plans and projects (e.g., Central Valley Flood Protection Plan Conservation Strategy, Arundo control project, California Division of Boating and Waterways (DBW) aquatic invasive species control programs, etc.).
    - Peak coverage, in acres, of invasive nonnative plant species (e.g., *Eichhornia crassipes, Ludwigia spp., Egeria densa, Arundo donax, and Phragmites australis*) in the Delta and Suisun Marsh.

Baseline:

- Species reported as established in the Delta prior to 2013 Delta Plan adoption will be used for baseline identification of new invasive species established post-2013.

- Fish:
    - Average percentage of total fish biomass that are native fish species based on USFWS beach seine surveys from the period of 1995-2015.
- Vegetation:
    - Number of acres treated set at zero as of 2013.
    - Peak coverage estimates, in acres, for nuisance nonnative aquatic plant species based on available hyperspectral and Landsat remote sensing surveys conducted in the Delta during the period of 2003–2016. *Arundo donax* surveys conducted for the Delta Conservancy in 2015. Suisun Marsh vegetation surveys conducted between 1999–2013.

Target:

To be achieved by 2030:

- Zero new nonnative invasive species of fish, plants, and invertebrates established in the Delta.
- Fish:
    - 20 percent increase in the biomass of the native inshore fish community, relative to total fish biomass.
    - 20 percent increase in the relative abundance of the native inshore fish community, compared to total relative abundance.
- Vegetation:
    - Acreage targets for treatment of invasive plants as defined by individual plans and projects:
        - 680 acres within lower Sacramento.
        - 800 acres within lower San Joaquin.
        - 15 acres in the Cache Slough Complex (*Arundo* control project).
        - 5,000 acres annually, for herbicide floating aquatic vegetation treatment in the Delta.
        - 2,500 acres during treatment seasons for herbicide submersed aquatic vegetation treatment in the Delta.
        - A 50 percent reduction in peak nonnative invasive plant species coverage (acres), including, but not limited to: *Eichhornia crassipes*, *Ludwigia spp.*, *Egeria densa*, *Arundo donax*, *Rubus armeniacus*, *Lepidium latifolium*, and *Phragmites australis*.

Output Performance Measures

4.12 Subsidence Reversal for Tidal Reconnection [NEW *New*]

Description:

Subsidence reversal activities at appropriate elevations to prevent net loss of opportunities

to restore tidal wetlands in the Delta and Suisun Marsh. (Strategy 4.3)

Metric:

Acres of land with subsidence reversal activity in the Delta and Suisun Marsh on islands with large areas of land capable of reaching intertidal elevations suitable for potential future restoration by 2100. Reported annually.

Baseline:

Set as zero in 2008.

Target:

By 2030, 3,500 acres in the Delta and 3,000 acres in Suisun Marsh with subsidence reversal activities on islands with large areas of land capable of reaching intertidal elevations.

4.13 Barriers to Migratory Fish Passage [NEW *New*]

Description:

Resolve fish passage at priority barriers and select large dams in Sacramento-San Joaquin Watershed, and screen diversions along native, anadromous fish migration corridors within the Delta.[3] (Strategy 4.4)

Metric:

Number of priority fish migration barriers and select large dams in the Sacramento - San Joaquin Watershed, and unscreened diversions along native, anadromous fish migration corridors in the Delta and Suisun Marsh.

Baseline:

Fish passage barriers, large dams and unscreened diversions listed in:

1. California Department of Fish and Wildlife (CDFW) Priority Barriers (2018)
2. Central Valley Flood Protection Program Conservation Strategy (Appendix K, 2016)
3. Rim dams in the Sacramento - San Joaquin River Watershed[4]
4. Unscreened diversions along native anadromous fish Delta migration corridors

Target:

By 2050, resolve all (100%) priority fish migration barriers, and screen 100% of unscreened diversions within the Delta and Suisun Marsh.

Target to be evaluated annually.

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[3] "Resolve" in this context means to construct, modify, or remove a barrier to allow for a proportion of fish to travel past the barrier or former barrier. For unscreened diversions, resolve means to screen the diversion so that juvenile or adult fish are physically protected from entrainment.

[4] Reference the Central Valley Chinook Recovery Plan and/or NOAA Biological Opinions

4.14 Increase Funding for Restoring Ecosystem Function [*New*]

Description:

Funding for projects that restore ecosystem functions and support a resilient, functioning Delta ecosystem increases. (Strategy 4.2 and 4.5)

Metrics:

Project cost of covered actions that certify under ER policy ’A’ Disclose Contributions to Restoring Ecosystem Function (Chapter 4, Appendix 2). Excludes funding for projects not related to protection, enhancement, or restoration.

Baseline:

Set at zero in 2019 (when Policy ER P’A’ went into effect).

Target:

By 2030, 80 percent of total funding for covered action projects under ER Policy ‘A’ is the cost of projects with Ecosystem Restoration Tier 1 or 2 attributes.