

1 covered species. Attachment 1 describes preserve concepts for each of the natural
2 communities.

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10 **1.0 Covered Natural Community Biological Objectives and**
11 **Conservation Measures**

12
13 **Biological Objectives for Floodplain, Tidal Marsh, and Riparian Natural**
14 **Communities**

15
16 *Note: This section presents draft biological objectives and conservation measures for*
17 *restoration of floodplain, tidal marsh, channel margin, and riparian communities.*
18 *Restoration of these communities is expected to reestablish ecological processes*
19 *necessary to support native vegetation, habitat elements, and the plant and wildlife*
20 *species, including ~~C~~covered ~~S~~species, that inhabit them. The reestablishment of these*
21 *communities and ecological processes is expected to provide essential habitat for some*
22 *Covered Speciescovered species sufficient to protect and enhance local and regional*
23 *populations, offset adverse impacts associated with the implementation of BDCP covered*
24 *activities and conservation measures, and ~~habitats is expected to compensate for adverse~~*
25 *impacts of BDCP conservation measures and covered activities and to contribute to the*
26 *conservation of these species. Draft design parameters for each of the restored habitats*
27 *are presented in Attachment 1. Please note that the text of conservation measures and*
28 *Attachment 1 are drafted as sections of Chapter 3, Conservation Strategy, of the BDCP*
29 *document and, as such, contain cross-references to anticipated sections of Chapter 3.*
30

31 **Objective NACO1.1:** Increase hydrologic connectivity of Delta waterways with existing
32 and historical floodplains to support habitat and food production for associated native
33 species.

34
35 **Objective NACO1.2:** Increase the extent and spatial distribution of tidal marsh within
36 the Planning Area and Suisun Marsh to support habitat and food production for
37 associated native species.

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39 **Objective NACO1.3:** Increase the extent and spatial distribution of riparian forest and
40 scrub within the Planning Area to support habitat and food production for associated
41 native species. ~~and increase connectivity among native habitats within and adjacent to~~
42 ~~the Planning Area.~~
43

1 | [Objective NACO1.4: Increase connectivity among and between existing and restored](#)
2 | [native habitats within and adjacent to the Planning Area.](#)
3 |

4 | **Conservation Measures**
5 |

6 | **WOCM2a: Modify the Fremont Weir and the Yolo Bypass to provide for a higher**
7 | **frequency and duration of inundation.** Within the Yolo Bypass/Cache Slough
8 | Complex ROA (Figure 2), floodplain habitat in the Yolo Bypass would be designed to
9 | support the physical and biological attributes described in Section 3.4.2.1, *Overall*
10 | *Habitat Restoration Design Concepts*. To increase the frequency and duration of
11 | inundation of floodplain habitat in the Yolo Bypass, the Fremont Weir would be notched
12 | to an elevation that allows sufficient inundation (see WOCM2b for operational details)
13 | and fitted with an operable gate(s) that, when operated, would allow Sacramento River
14 | water to flow into the Yolo Bypass when Sacramento River stage at the weir exceeds gate
15 | height. The operable gate(s) would be designed and operated to provide for the efficient
16 | upstream and downstream fish passage to and from the Yolo Bypass into the Sacramento
17 | River. Other design elements of this measure would include:

- 18 | • excavation of a canal to convey water past the higher elevation natural levee of
19 | the Sacramento River upstream of the new gate at Fremont Weir and past
20 | accumulated sediment below the new gate at Fremont Weir to the Tule Canal;
- 21 | • acquisition of lands, in fee-title and through conservation or flood easements,
22 | necessary for restoration of seasonally inundated aquatic habitats and for
23 | accommodating future sea level rise;
- 24 | • removal and replacement of the existing Fremont Weir fish ladder with a new
25 | fish passage facility designed to effectively allow for the passage of adult
26 | salmonids and sturgeon from the Yolo Bypass past the Fremont Weir into the
27 | Sacramento River.
- 28 | • grading, removal of existing berms or levees, and construction of berms or levees
29 | to the extent necessary to improve the distribution (e.g., wetted area) and
30 | hydrodynamic characteristics (e.g., residence times, flow ramping and recession)
31 | of water moving through the Yolo Bypass, prevent stranding of covered fish
32 | species, and to protect property; and
- 33 | • construction of a structure in the Sacramento River, if needed, in the vicinity of
34 | the new weir gate to encourage the passage of juvenile salmonids migrating down
35 | the Sacramento River into the Bypass.

36 | *[Note to Reviewers: Additional Yolo Bypass design elements under consideration include*
37 | *improving connectivity of the Toe Drain with Putah Creek to improve fish passage, modifying*
38 | *the Lisbon Weir to improve fish passage and water management for fish and wildlife benefits,*
39 | *improving fish passage in the Tule Canal, and increasing the frequency for controlled*
40 | *localized seasonal flooding of managed wildlife habitats.]*

41 | To implement this conservation measure, the BDCP Implementing Entity would
42 | coordinate with the U.S. Army Corps of Engineers and other flood control entities, as
43 | appropriate, to ensure that designs of the modified Fremont Weir, fish passage

1 improvements, bypass improvements, and Fremont Weir operations are compatible with
2 the flood control functions of the Yolo Bypass.

3
4 **WOCM2b: Operate the Fremont Weir to provide for a higher frequency and**
5 **duration of inundation of the Yolo Bypass.** This action involves control of the timing,
6 frequency, and duration of inundation of the Yolo Bypass (Figure 1) with Sacramento
7 River flows via the Fremont Weir. Operations would be specific to water year types
8 because flooding of the Yolo Bypass is implicitly linked to flows in the mainstem
9 Sacramento River. Operation of a new Fremont Weir gate(s) and associated channels
10 described in Conservation Measure WOCM2a would be targeted to increase the
11 frequency and duration of inundation of the Yolo Bypass between **January 1 and April**
12 **15.** At river elevations below flood stage (Sacramento River stage <33.5 feet [USED] or
13 <33.03 feet [NAVD88]; Sacramento River flow at Fremont Weir <~56,500 cfs), the
14 operable weir gate(s) would be opened to allow controlled flooding of **3000-6000 cfs**
15 into the Yolo Bypass for **30-45 continuous days.** According to HEC-RAS modeling, this
16 flow rate would inundate between 11,000-21,500 acres of floodplain habitat to an average
17 depth of 2.6-3.9 feet and a mean velocity of 1.26-1.77 ft/s. Once the targeted duration of
18 inundation is achieved, the weir gate(s) could be operated to stop flows into the Bypass
19 from the Sacramento River if the river is below flood stage. At flood stage, the weir
20 would overtop as it does currently. Based on historical hydrology between 1929 and
21 2007, the lower end of this operational range (30-45 days at 3,000 cfs) is predicted to
22 increase the frequency of Fremont Weir spills by approximately four times over that of
23 the existing weir height (current weir height: 6 times; Proposed weir height: 24 times). It
24 is not anticipated that flooding the Bypass would require additional upstream reservoir
25 releases, but would work within the existing hydrograph.

26 When water inundates the Yolo Bypass, flows are reduced in the Sacramento River
27 between the weir and Rio Vista. Closing the weir gate would provide water to support
28 environmental benefits in Sutter and Steamboat Sloughs (WOCM4), the mainstem
29 Sacramento River between the weir and Rio Vista, the Central Delta via the Delta Cross
30 Channel (WOCM 5) and Georgiana Slough, and a potential new floodplain elsewhere in
31 the Yolo Bypass/Cache Slough Complex ROA (WOCM3a). This parameter could also
32 affect Delta salinity standards (WOCM14).

33
34 **WOCM3a: Create a new flood bypass in the Yolo Bypass/Cache Slough Complex**
35 **ROA to restore seasonally inundated floodplain habitat.** The BDCP Implementing
36 Entity would coordinate flood control planning with the Central Valley Flood Protection
37 Board, Sacramento Area Flood Control Agency, California Department of Water
38 Resources (DWR), and U.S. Army Corps of Engineers to assess the desirability and
39 feasibility for creating a new flood bypass located in the Yolo Bypass/Cache Slough
40 Complex ROA (Figure 2) adjacent to the east levee of the Sacramento River Deep Water
41 Ship Channel. This new flood bypass (hereafter referred to as the Deep Water Ship
42 Channel Bypass) would restore seasonally inundated floodplain habitats for covered fish
43 species and provide flood control benefits. If results of planning studies indicate that
44 construction of a Deep Water Ship Channel Bypass is desirable and feasible, the BDCP

1 Implementing Entity would enter into a cost sharing agreement with the U.S. Army
2 Corps of Engineers for project planning and construction and would assist with securing
3 Congressional authorization and funding for the project. If authorized and funded, the
4 BDCP Implementing Entity would enter into subsequent agreements with the U.S. Army
5 Corps of Engineers and other appropriate agencies governing bypass operations for
6 providing joint flood control and ecosystem benefits and maintenance responsibilities.

7 The Deep Water Ship Channel Bypass would be designed to reduce flood risks to
8 Clarksburg and the Pocket Area of Sacramento and reduce flood pressures along
9 downstream levees to Rio Vista. If implemented, the bypass would be designed and
10 operated to provide seasonally inundated floodplain habitat for periods of at least [redacted]
11 days from [Month/Date] through [Month/Date] during years when sufficient water is
12 available in the Sacramento River for this purpose. Restored floodplain habitat within the
13 bypass would be designed and operated to support the physical and biological attributes
14 described in Section 3.4.2.1, *Overall Habitat Restoration Design Concepts*.

15 Design elements of this measure could include:

- 16 • acquisition of lands in fee-title or through conservation easements suitable for
17 restoration of seasonally inundated floodplain habitats and for accommodating
18 future sea level rise;
- 19 • construction of a new levee east of the Sacramento Deep Water Ship Channel
20 to contain bypass flows between the new levee and the existing east levee of
21 the Deep Water Ship Channel (the bypass width would be relatively narrow
22 [an estimated 1,000-2,000 feet] to minimize impacts on existing land uses and
23 still provide substantial benefits to covered species);
- 24 • construction of an operable gate(s) along the west levee Sacramento River
25 upstream of Freeport designed to pass flows into the bypass and to provide for
26 passage of fish upstream and downstream of the gate(s);
- 27 • modify the landform within the bypass to prevent stranding of covered fish
28 species.
- 29 • removing levees at the south end of the bypass to provide flow connectivity
30 with the Delta; and
- 31 • potentially discontinuing farming within the bypass if the bypass is designed
32 with sufficient flood capacity to provide for the natural establishment and
33 growth of riparian vegetation on the floodplain surface to provide structural
34 and hydrodynamic complexity (the bypass width likely would be too narrow
35 to provide for both farming and the desired level of riparian habitat-associated
36 benefits).

37 Preliminary assessments of this concept indicate that, based on flows recorded at Freeport
38 from 1984-2007, a gate invert elevation of 6 feet in the vicinity of Freeport would allow
39 at least 3,000 cfs to inundate the floodplain for at least 45 consecutive days in 48 percent
40 of the years. The extent of inundated floodplain would be determined by the width of the
41 bypass, but would be expected to range between 2,000 and 5,000 acres. The range of
42 frequencies, durations, and periods that the operable gate(s) would be operated to
43 inundate the new bypass are described in WOCM3b.

1 If construction of the Deep Water Ship Channel Bypass is not deemed desirable and
2 feasible or if funding or authorizations necessary to construct the bypass are not obtained,
3 the BDCP Implementing Entity, in coordination with Fishery Agencies, may terminate
4 this conservation measure. If terminated, remaining funding would be deobligated from
5 this conservation measure and reallocated to augment funding for other effective
6 conservation measures identified in coordination with the Fishery Agencies through the
7 BDCP adaptive management process.

8

9 **WOCM3b: Operate a new flood bypass in the Yolo Bypass/Cache Slough Complex**
10 **ROA to restore seasonally inundated floodplain habitat.** As described in

11 Conservation Measure WOCM3a, a Deep Water Ship Channel Bypass may be
12 constructed in the future if it were deemed a necessary improvement to the Central Valley
13 flood control system. If deemed necessary, the BDCP Implementing Entity would
14 coordinate with flood control agencies to design and operate the new bypass to provide
15 joint flood control and covered fish species benefits. If the new bypass is constructed,
16 this action involves the control of the timing, duration, and frequency of inundation of the
17 new bypass using Sacramento River flows which would affect WOCM4, 6, and 14. A
18 new operable weir gate(s) at the head of the new floodplain bypass (described in
19 Conservation Measure WOCM3a) would provide for diversion of water from the
20 Sacramento River into the bypass when river stage exceeds 9.0 ft NAVD88 (~30,400 cfs
21 in the Sacramento River at Freeport) between [month/day] and [month/day]. The
22 operable gate(s) would be designed to allow up to [] cfs into the bypass for []
23 consecutive days. Once the targeted duration of inundation has been achieved, the gate
24 could be operated to reduce or eliminate flows into the bypass, except during flood stage.
25 At flood stage, Sacramento River water would overtop the weir to reduce flood risks to
26 Clarksburg and the Pocket Area of Sacramento and reduce flood pressures along
27 downstream levees to Rio Vista. It is not anticipated that flooding the Bypass would
28 require additional upstream reservoir releases, but would work within the existing
29 hydrograph.

30 Inundation of a Deep Water Ship Channel Bypass is hypothesized to provide additional
31 food and habitat to several covered fish species. When water inundates the Deep Water
32 Ship Channel Bypass, flows are reduced in the Sacramento River between the weir and
33 Prospect Island, reducing flows through Steamboat and Sutter Sloughs and the central
34 Delta.

35
36 **HRCM1: Restore floodplain habitat along [] miles of the San Joaquin River from**
37 **Vernalis to Mossdale.** The BDCP Implementing Entity would coordinate flood control
38 planning with the Central Valley Flood Protection Board, California Department of
39 Water Resources (DWR), and U.S. Army Corps of Engineers to assess the desirability
40 and feasibility for setting back levees along the San Joaquin River from Vernalis to
41 Mossdale to restore seasonally inundated floodplain habitats for covered fish species and
42 provide flood control benefits. If results of planning studies indicate that setting back
43 levees along this reach of the San Joaquin River is desirable and feasible, the BDCP
44 Implementing Entity would enter into a cost sharing agreement with the U.S. Army
45 Corps of Engineers for project planning and construction and would assist with securing

1 Congressional authorization and funding for the project. If authorized and funded, the
2 BDCP Implementing Entity would enter into subsequent agreements with the U.S. Army
3 Corps of Engineers and other appropriate agencies governing levee and floodway
4 maintenance responsibilities.

5 Located within the South Delta ROA (see Figure 1), this conservation measure would
6 expand the flood capacity of the existing constricted flood control channel downstream of
7 Vernalis to Mossdale by setting back levees along the San Joaquin River to expand the
8 floodplain to allow flood waters to attenuate, improving access of juvenile fish, such as
9 Chinook salmon and steelhead, to seasonally inundated floodplain habitat, and reducing
10 flood risk to properties upstream and downstream. If implemented, restored floodplain
11 habitat along the San Joaquin River would be designed and operated to support the
12 physical and biological attributes described in Section 3.4.2.1, *Overall Habitat*
13 *Restoration Design Concepts*. Implementation would require acquisition of lands in fee-
14 title or through conservation easements within the footprint of the expanded floodway
15 and levees.

16 Floodplain habitat would be restored by setting back levees along the San Joaquin River
17 and removing all or large sections of the existing levees. The extent that levees would be
18 set back and the extent of floodplain restored would primarily be dependent on the
19 anticipated level of covered fish species benefits relative to cost. Additional drivers on
20 the extent of this conservation measure include the need for flood protection, ~~and~~ the
21 ability to acquire lands in fee-title or through conservation easements; and the potential
22 effects of the action on other covered wildlife species, including the riparian brush rabbit.
23 Initial hydrodynamic modeling under existing hydrologic conditions suggests that, on
24 average, new floodplain habitat areas could be inundated for at least 30 consecutive days
25 from late winter to early spring on average once every 5.5 years (i.e., 18% of years).
26 The new floodplain area would be contoured, if needed, to reduce and avoid the potential
27 for stranding of juvenile and adult fish following inundation events.

28 The channel within the restored floodplain reach would be modified where practicable to
29 create low velocity habitat areas designed to provide spawning habitat for Sacramento
30 splittail and rearing habitat for splittail and salmonids. Within the restored floodplain,
31 farming potentially would be discontinued and riparian vegetation would be allowed to
32 naturally establish and the channel would be allowed to meander between the new levees
33 through the natural processes of erosion and sedimentation (the width of setback levees
34 likely would be too narrow to provide for both farming and the desired level of riparian
35 habitat-associated benefits).

36 If setting back levees along this reach of the San Joaquin River is not deemed desirable
37 and feasible or if funding or authorizations necessary to construct the bypass are not
38 obtained, the BDCP Implementing Entity, in coordination with Fishery Agencies, may
39 terminate this conservation measure. If terminated, remaining funding would be
40 deobligated from this conservation measure and reallocated to augment funding for other
41 effective conservation measures identified in coordination with the Fishery Agencies
42 through the BDCP adaptive management process.

43 **HRCM2: Restore floodplain habitat along █ miles of the San Joaquin River from**
44 **Mossdale to French Camp Slough.** The BDCP Implementing Entity would coordinate

1 flood control planning with the Central Valley Flood Protection Board, California
2 Department of Water Resources (DWR), and U.S. Army Corps of Engineers to assess the
3 desirability and feasibility for setting back levees along the San Joaquin River from
4 Mossdale to French Camp Slough to restore seasonally inundated floodplain habitats for
5 covered fish species and provide flood control benefits. If results of planning studies
6 indicate that setting back levees along this reach of the San Joaquin River is desirable and
7 feasible, the BDCP Implementing Entity would enter into a cost sharing agreement with
8 the U.S. Army Corps of Engineers for project planning and construction and would assist
9 with securing Congressional authorization and funding for the project. If authorized and
10 funded, the BDCP Implementing Entity would enter into subsequent agreements with the
11 U.S. Army Corps of Engineers and other appropriate agencies governing levee and
12 floodway maintenance responsibilities.

13 Located within the South Delta ROA (see Figure 1), this conservation measure would
14 increase seasonally inundated floodplain habitat and expand the flood capacity of the
15 existing flood control channel downstream of Mossdale to French Camp Slough by
16 setting back levees along the San Joaquin River. Restored floodplain habitat would be
17 designed and operated to support the physical and biological attributes described in
18 Section 3.4.2.1, *Overall Habitat Restoration Design Concepts*. Implementation would
19 require acquisition of lands in fee-title or through conservation easements within the
20 footprint of the expanded floodway and levees.

21 Floodplain habitat would be restored by setting back levees along the San Joaquin River
22 and removing all or large sections of the existing levees. The extent to which levees
23 would be setback and the extent of floodplain habitat restored would primarily be
24 dependent on the anticipated level of covered fish species benefits relative to cost.
25 Additional drivers on the extent of this conservation measure include the need for flood
26 protection and the ability to acquire lands in fee-title or through conservation easements;
27 [and the potential effects of the action on other covered wildlife species, including the](#)
28 [riparian brush rabbit.](#) The new floodplain area would be contoured, if needed, to reduce
29 and avoid the potential for stranding of juvenile and adult fish following inundation
30 events. Ground surface elevations along tidal reaches may need to be elevated [in soft](#)
31 [gradients](#) to allow natural establishment of tidal freshwater wetland and riparian habitat
32 [with interdependent transitional communities](#).

33 The channel within the restored floodplain reach would be modified where practicable to
34 create lower velocity habitat areas designed to provide spawning habitat for splittail and
35 rearing habitat for splittail and salmonids. Within the restored floodplain, farming
36 potentially would be discontinued and riparian vegetation would be allowed to naturally
37 establish and the channel would be allowed to meander between the new levees through
38 the natural processes of erosion and sedimentation (the width of setback levees likely
39 would be too narrow to provide for both farming and the desired level of riparian habitat-
40 associated benefits).

41 If setting back levees along this reach of the San Joaquin River is not deemed desirable
42 and feasible or if funding or authorizations necessary to construct the bypass are not
43 obtained, the BDCP Implementing Entity, in coordination with Fishery Agencies, may
44 terminate this conservation measure. If terminated, remaining funding would be
45 deobligated from this conservation measure and reallocated to augment funding for other

1 effective conservation measures identified in coordination with the Fishery Agencies
2 through the BDCP adaptive management process.

3
4 **HRCM3: Restore between [] and [] acres of inundated floodplain habitat in the**
5 **South Delta Restoration Opportunity Area.** Within the South Delta ROA (see Figure
6 1), inundated floodplain habitat would be restored on Fabian Tract along Old River or on
7 Union Island and Upper Roberts Island along Middle River. The location of restored
8 floodplain habitat would depend on the location and design of the selected conveyance
9 pathway and operations for the through-Delta component of the dual conveyance facility.
10 Floodplain habitat would be restored along the river that would provide the most
11 substantial species and ecosystem benefits with the selected through-Delta conveyance
12 configuration. Restored floodplain habitat would be designed and operated to support the
13 physical and biological attributes described in Section 3.4.2.1, *Overall Habitat*
14 *Restoration Design Concepts*.

15 Design elements of this conservation measure could include:

- 16 • acquisition of lands in fee-title or through conservation easements suitable for
17 restoration of intertidal and subtidal habitats and for accommodating future sea
18 level rise;
- 19 • setting back levees along the selected river corridor and removing the existing
20 levees or large sections of the existing levees;
- 21 • [Restoring vegetation on portions of retained existing levees to serve as refugia for](#)
22 [wildlife during flood events.](#)
- 23 • discontinuing farming within the setback levees and allowing riparian vegetation
24 to naturally establish on the floodplain; and
- 25 • re-contouring the restored floodplain surface, if needed, to avoid potential for
26 stranding of juvenile and adult fish following inundation events.

27
28
29 **HRCM4. Restore a mosaic of [] to [] acres of freshwater intertidal marsh, shallow**
30 **subtidal aquatic, and transitional grassland habitat within the Yolo Bypass/Cache**
31 **Slough Complex Restoration Opportunity Area.** Restored freshwater intertidal marsh
32 and shallow subtidal aquatic habitats would be designed to support the physical and
33 biological attributes described in Section 3.4.2.1, *Overall Habitat Restoration Design*
34 *Concepts*. The mosaic of habitats would include at least [] acres of freshwater intertidal
35 marsh habitat. Areas suitable for restoration include, but are not limited to, Haas Slough,
36 Hastings Cut, Lindsey Slough, Barker Slough, Calhoun Cut, Liberty Island, Little
37 Holland, the Westlands property, Shag Slough, Little Egbert Tract, and Prospect Island.

38 | The Cache Slough complex has been recognized as possibly the best functioning area of
39 the Delta. The complex includes Liberty Island, which is the only model for freshwater
40 tidal marsh restoration in the Delta for native fishes. The complex supports multiple
41 covered fish species and is presumably one of the last known areas where Delta smelt and

1 longfin smelt spawn and rear successfully. Restoring ~~the amount of~~ freshwater tidal
2 wetlands and subtidal habitat and protecting upland habitat ~~would likely could~~ benefit
3 multiple covered species and the Delta ecosystem. Additionally, the Cache Slough
4 Complex encompasses a substantial area of land with elevations suitable for freshwater
5 tidal marsh restoration that would involve few impacts on infrastructure or permanent
6 crops relative to other areas of the north Delta.

7 The Cache Slough complex provides an excellent opportunity to expand habitat
8 supporting multiple aquatic and terrestrial covered species. Restoration of freshwater
9 intertidal marsh and shallow subtidal habitats would be designed to support the physical
10 and biological attributes that benefit covered species. Approximately 21,000 acres of
11 public and private lands in the area are suitable for restoration. Areas for restoration
12 would be identified by working with interested landowners.

13 Design elements of this conservation measure could include:

- 14 • acquisition of lands in fee-title or through conservation easements suitable for
15 restoration of intertidal and subtidal habitats and protecting adjacent uplands
16 to accommodate future sea level rise;
- 17 • Constructing new or enhancing existing levees to provide flood protection for
18 adjacent landowners as appropriate and protecting existing land use against
19 seepage and erosion on existing levees.;
- 20 • modifying ditches, cuts, and levees to encourage more natural tidal circulation
21 and better flood conveyance based on local hydrology;
- 22 • restoring tributary stream functions to establish more natural patterns of
23 sediment transport (e.g., Ulatis Flood Control channel) to improve spawning
24 conditions for delta smelt and other fish and macroinvertebrates; and
- 25 • farming tules and using dredge material in subsided areas to raise ground
26 surface elevations to a level suitable for tidal marsh restoration on subsided
27 lands (e.g., Little Egbert Tract).

28
29 **HRCM5: Restore a mosaic of ■ to ■ acres of freshwater intertidal marsh, shallow
30 subtidal aquatic, and transitional habitat within the Cosumnes/Mokelumne ROA.**

31 Restored freshwater intertidal marsh and shallow subtidal aquatic habitats would be
32 designed to support the physical and biological attributes described in Section 3.4.2.1,
33 *Overall Habitat Restoration Design Concepts*. The mosaic of habitats would include at
34 least ■ acres of freshwater intertidal marsh habitat. Areas suitable for restoration within
35 the Cosumnes/Mokelumne ROA (see Figure 1) include McCormack-Williamson Tract,
36 New Hope Tract, Canal Ranch Tract, Bract Tract, Terminous Tract north of State
37 Highway 12, and lands adjoining Snodgrass Slough, South Stone Lake, and Lost Slough.
38 Design elements of this conservation measure could include:

- 39 • acquisition of lands in fee-title or through conservation easements suitable for
40 restoration of intertidal and subtidal habitats and for accommodating future
41 sea level rise;

- 1 • constructing levees to isolate deeply subsided lands and protect private
2 property;
- 3 • planting tules or placing fill material to raise elevations of shallowly subsided
4 lands,
- 5 • creating channels to promote the development of tidal channels; and
- 6 • breaching levees to reintroduce tidal exchange to currently leveed lands, and
7 restoring portions of breached levees for habitat diversity and refugia for
8 species during flood events.

9 If the eastern alignment of an around-Delta conveyance facility is constructed, the canal
10 levees may be incorporated into the design of intertidal emergent wetland restoration.
11 For example, in locations where the conveyance canal is located at elevations at or below
12 elevations suitable for restoration of intertidal marsh, marsh may be restored to the east of
13 canal levee, with the canal levee forming the western boundary of the restored marsh.

14
15 **HRCM6: Restore a mosaic of ■ to ■ acres of intertidal marsh, channel margin,**
16 **and shallow subtidal aquatic habitat within the West Delta Restoration Opportunity**
17 **Area.** The west Delta includes multiple small areas where intertidal marsh, subtidal
18 aquatic, and channel margin habitat can be restored or created. Restored freshwater
19 intertidal marsh, channel margin, and shallow subtidal aquatic habitats would be designed
20 to support the physical and biological attributes described in Section 3.4.2.1, *Overall*
21 *Habitat Restoration Design Concepts*. The mosaic of habitats would include at least ■
22 acres of freshwater intertidal marsh habitat. Areas suitable for restoration include Decker
23 Island, portions of Sherman Island, Jersey Island, Bradford Island, Twitchell Island, and
24 Brannon Island, and along portions of the north bank of the Sacramento River where
25 elevations and substrates are suitable. The purpose of restoring intertidal marsh in the
26 west Delta is to provide a continuous corridor of habitat and food productivity linking
27 current and future restored habitat in the Cache Slough Complex with habitat in Suisun
28 Marsh and Bay and to provide intertidal marsh habitat within the anticipated future
29 eastward position of the low salinity zone with sea level rise.

30 Design elements of this conservation measure are anticipated to include:

- 31 • placing fill material on shallowly subsided restoration sites to gradually raise land
32 surfaces to elevations suitable for restoration of intertidal marsh¹;
- 33 • planting tules, or other techniques, to raise ground surface elevations suitable for
34 intertidal marsh restoration on shallowly subsided portions of islands and
35 breaching levees when target elevations are achieved;
- 36 • breaching and setting back levees to provide for tidal exchange with restored
37 habitats; and

¹ Sources of fill material could include dredge material from ongoing dredging operations and dredge spoils and sand deposits on Decker Island, Brannon Island, and other nearby suitable sites.

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- excavating channels and/or creating berms to encourage the development of dendritic channel networks within restored marshes.

DRAFT

1 **HRCM7: Restore a mosaic of [] to [] acres of intertidal marsh, shallow subtidal**
2 **aquatic, and transitional grassland habitat within the South Delta Restoration**
3 **Opportunity Area.** Restored freshwater intertidal marsh and shallow subtidal aquatic
4 habitats would be designed to support the physical and biological attributes described in
5 Section 3.4.2.1, *Overall Habitat Restoration Design Concepts*. The mosaic of habitats
6 would include at least [] acres of freshwater intertidal marsh habitat. Suitable sites for
7 restoring freshwater intertidal marsh include Fabian Tract, Union Island, Middle Roberts
8 Island, and Lower Roberts Island. Sites selected for restoration would be depend on the
9 location and design of the selected conveyance pathway and operations for the through-
10 Delta component of the dual conveyance facility. Selected sites would be those that
11 would provide substantial species and ecosystem benefits with the selected through-Delta
12 conveyance configuration.

13 Design elements of this conservation measure could include:

- 14 • planting tules or other techniques to raise currently subsided ground surface
15 elevations suitable for intertidal marsh restoration on shallowly subsided portions
16 of islands and breaching levees when target elevations are achieved, [and](#)
17 [revegetating scalped portions of islands](#);
- 18 • scalping higher elevation portions of islands to provide fill for placement on
19 subsided portions of islands to raise surface elevations;
- 20 • breaching and setting back levees to provide for tidal exchange with restored
21 habitats;
- 22 • constructing cross levees where appropriate to protect property and preclude
23 inundation of deeply subsided portions of islands;
- 24 • locating and designing levee breaches to maximize the development of intertidal
25 marsh and minimize hydrodynamic conditions that favor non-native predatory
26 fish; and
- 27 • excavating channels and/or creating berms to encourage the development of
28 dendritic channel networks within restored marshes.

29
30 **HRCM8: Restore a mosaic of [] to [] acres of intertidal marsh, shallow subtidal**
31 **aquatic, and transitional grassland habitat within the East Delta Restoration**
32 **Opportunity Area.** Restored freshwater intertidal marsh and shallow subtidal aquatic
33 habitats would be designed to support the physical and biological attributes described in
34 Section 3.4.2.1, *Overall Habitat Restoration Design Concepts*. The mosaic of habitats
35 would include at least [] acres of freshwater intertidal marsh habitat. Areas suitable for
36 restoration in the East Delta ROA (see Figure 1) include Terminous Tract south of State
37 Highway 12, Shin Kee Tract, Rio Blanco Tract, and Bishop Bract. Design elements of
38 this conservation measure could include:

- 39 • acquisition of lands in fee-title or through conservation easements suitable for
40 restoration of intertidal and subtidal habitats and for accommodating future sea
41 level rise;
- 42 • constructing levees to isolate deeply subsided lands and protect property;

- 1 • planting tules or placing fill material to raise elevations of shallowly subsided
- 2 lands;
- 3 • creating channels and/or creating berms to encourage the development of
- 4 dendritic tidal channels; and
- 5 • breaching levees to reintroduce tidal exchange to leveed lands.

6 If the eastern alignment of an around-Delta conveyance facility is constructed, the canal
7 levees may be incorporated into the design of intertidal emergent wetland restoration.
8 For example, in locations where the conveyance canal is located at elevations at or below
9 elevations suitable for restoration of intertidal marsh, marsh may be restored to the east of
10 canal levee, with the canal levee forming the western boundary of the restored marsh.

11
12 **HRCM9: Restore a mosaic of [] to [] acres of brackish intertidal marsh, shallow**
13 **subtidal aquatic, and transitional grassland habitat within the Suisun Marsh**
14 **Restoration Opportunity Area.** The Suisun Marsh ROA (see Figure 1) encompasses a
15 substantial area of land with elevations suitable for intertidal marsh restoration that would
16 involve few impacts on infrastructure or permanent crops relative to the availability of
17 suitable lands within the Delta. Restored brackish intertidal marsh in the ROA would be
18 designed to support the physical and biological attributes described in Section 3.4.2.1,
19 *Overall Habitat Restoration Design Concepts.*

20 The Suisun Marsh Habitat Management, Preservation, and Restoration Plan (under
21 development) is evaluating alternatives which would provide for restoration of up to
22 9,000 acres of brackish intertidal marsh. Much of Suisun Marsh is currently at elevations
23 that could be restored to intertidal habitat. With future sea level rise and ongoing
24 subsidence, this opportunity could be lost.

25
26 The Suisun Marsh Habitat Management, Preservation, and Restoration Plan (under
27 development) currently proposes restoring 6,000-9,000 acres of brackish intertidal marsh
28 (S. Chappell pers. comm.).

29 Under this conservation measure, additional brackish intertidal marsh would be restored
30 opportunistically through amendments to the Suisun Marsh Habitat Management,
31 Preservation, and Restoration Plan over the term of the BDCP as lands become available
32 for restoration. Habitat would be restored as a mosaic of brackish intertidal marsh,
33 shallow subtidal aquatic, and transitional grassland habitats of which at least [] acres
34 would be brackish intertidal marsh. Anticipated actions to restore brackish intertidal
35 marsh habitat include:

- 36 • acquisition of lands in fee-title or through conservation easements suitable for
- 37 restoration of intertidal and subtidal habitats and for accommodating future sea
- 38 level rise from willing landowners;
- 39 • cultivating tules or other techniques to raise elevations of shallowly subsided
- 40 lands;

- 1 • reconnecting disconnected remnant sloughs to Suisun Bay and removing remnant
2 slough dikes to reintroduce tidal connectivity to slough watersheds to restore tidal
3 marsh; and
- 4 • breaching dikes to reintroduce tidal exchange to diked lands.

5 Hydrodynamic modeling conducted for the Suisun Marsh Restoration Plan (J. DeGeorge
6 pers. comm.) indicates that restoring marsh north of Montezuma Slough would shift the
7 low salinity zone westward and restoring marsh at sites adjacent to Suisun Bay would
8 shift the low salinity zone eastward, potentially adversely affecting delta smelt habitat
9 and water quality in the west Delta. Consequently, implementation of marsh restoration
10 projects in north and south Suisun Marsh would likely be sequenced such that these
11 potential effects would be minimized.

12 As described in WOCM11, future reoperation or removal of the Montezuma Slough
13 Salinity Control Gate would increase benefits of restoring brackish intertidal marsh in
14 Suisun Marsh by increasing access for covered fish species to existing and restored tidal
15 aquatic habitat within a large area of Suisun Marsh.

16
17 **HRCM10: Support development and implementation of levee construction and**
18 **maintenance designs that incorporate aquatic, intertidal marsh, and riparian**
19 **habitat features.** The BDCP Implementing Entity would coordinate with DWR, Central
20 Valley Flood Protection Board, and U.S. Army Corps of Engineers to track planned levee
21 construction and maintenance activities. The BDCP Implementing Entity would
22 participate in planning processes for the construction of new levees, or maintenance of
23 existing levees, located along important habitat areas for covered fish species (e.g., fish
24 migration corridors). These activities are expected to help ensure that levee designs
25 incorporate features that would benefit covered fish species, minimize adverse effects of
26 the actions on covered fish species, and avoid potential adverse effects of proposed
27 actions on the ecological functions provided by existing and planned BDCP conserved
28 habitats.

29
30 **HRCM11. Provide for the establishment of native riparian woody vegetation and**
31 **emergent vegetation on BDCP constructed levees.** BDCP site-specific habitat
32 restoration designs may require the construction of new levees (e.g., setback levees to
33 restore floodplain habitat area). The BDCP Implementing Entity would design such
34 levees to incorporate design features that would provide for the establishment of riparian
35 and tidal emergent vegetation along low elevation surfaces (e.g., levee benches).

36
37 **HRCM12: Enhance channel margin habitats along [] to [] miles of Steamboat and**
38 **Sutter Sloughs to improve habitat conditions for covered fish species.** Habitat
39 conditions for covered fish species would be enhanced along [] to [] miles of Steamboat
40 Slough and [] to [] miles of Sutter Slough. The purpose of this measure is to improve
41 the growth and survival of juvenile salmonids that use these habitat areas.

42 Design elements for this conservation measure could include:

- 1 • modifying channel geometry to improve hydrodynamic and structural complexity
2 for native species;
- 3 • establishing woody riparian vegetation along banks that do not support woody
4 riparian vegetation; and
- 5 • controlling the abundance of non-native fish predators and competitors.

6 Following implementation of habitat enhancements, the BDCP Implementing Entity may
7 undertake actions to encourage the transport of juvenile salmonids into Steamboat and
8 Sutter Sloughs if monitoring results indicate that survival and growth of juvenile
9 salmonids that rear and pass through Steamboat and Sutter Sloughs is substantially higher
10 than under current conditions. Increasing the proportion of juvenile salmonids
11 transported into the sloughs could be accomplished either by reorienting the upstream
12 mouth of Steamboat Slough and/or Sutter Slough to the Sacramento River or constructing
13 structures in the Sacramento River channel near the upstream mouths of the sloughs that
14 would guide the movement of fish into Steamboat and Sutter Sloughs. To undertake this
15 action, the BDCP Implementing Entity would need to coordinate with and receive
16 approvals from the U.S. Army Corps of Engineers to either modify the project levees or
17 construct an in-channel structure.

18
19 **HRCM13: Enhance channel margin habitats along [] to [] miles of the San**
20 **Joaquin River in the San Joaquin River ROA to improve habitat conditions for**
21 **covered fish species.** Habitat conditions for covered fish species would be enhanced
22 along [] to [] miles of the San Joaquin River from Vernalis to Mossdale. The purpose
23 of this measure is to improve rearing habitat conditions for juvenile salmonids and to
24 improve spawning habitat and rearing habitat conditions for Sacramento splittail.

25 Design elements for this conservation measure include:

- 26 • modifying channel geometry to improve hydrodynamic and structural complexity
27 and to create low velocity habitat areas designed to provide spawning habitat for
28 splittail and rearing habitat for splittail and salmonids; and
- 29 • establishing woody riparian vegetation along banks that do not support woody
30 riparian vegetation to provide shaded riverine aquatic and instream cover for
31 covered fish species.

32 To undertake this action, the BDCP Implementing Entity may need to coordinate with
33 and receive approvals from the U.S. Army Corps of Engineers to modify channel
34 characteristics within this leveed reach of the river.

35
36 **HRCM14: Restore between [] and [] acres of riparian forest and scrub**
37 **communities as a component of restored floodplain, freshwater intertidal marsh,**
38 **and channel margin habitats.** As described in Section 3.4.2.1, *Overall Habitat*
39 *Restoration Design Concepts*, the design of restored floodplain, freshwater intertidal
40 marsh, and channel margin habitats [see Conservation Measures WOCM2a, WOCM3a,
41 and HRCMs 1-8, and HRCMs 10-13] will incorporate restoration of riparian habitats as
42 described below.

1 **Floodplain Habitat Restoration.** To the extent consistent with flood control
2 requirements, restored floodplain habitat areas will allow for the natural establishment
3 and growth of woody riparian vegetation on portions of restored floodplains that support
4 appropriate soils and hydrology. At floodplain restoration sites that function
5 hydrologically as flood bypasses (e.g., the Yolo Bypass), riparian vegetation is expected
6 to establish along margins of existing and created drains and channels and other locations
7 with suitable hydrology. In bypasses co-managed for habitat and flood control benefits,
8 locations where riparian vegetation is allowed to establish would be limited to areas
9 where the presence of riparian vegetation would not compromise flood control standards
10 or hydraulic capacity of the flood control bypass.

11 Riparian habitat would be allowed to naturally establish in floodplain habitat areas that
12 are restored by setting back levees to expand the extent of the floodplain subject to
13 overbank flow.

14 **Freshwater Intertidal Marsh Restoration.** Woody riparian vegetation will be allowed
15 to naturally reestablish along the upper elevation margins of restored intertidal marsh
16 habitats where soils and hydrology are suitable, including segments of stream channels
17 that drain into restored marshes.

18 **Channel Margin Habitat Restoration.** As described under Conservation Measure
19 HMCM11, BDCP levees will be designed to provide for the establishment and growth of
20 riparian vegetation along levees. Levees constructed and maintained by other entities
21 that incorporate “green” levee components would also increase the extent of riparian
22 habitat within the Planning Area by allowing for the establishment and growth of riparian
23 vegetation on levee surfaces.

24
25