PRELIMINARY DESCRIPTION OF A WESTSIDE YOLO BYPASS MANAGEMENT OPTION FOR REARING JUVENILE SALMON

Introduction

The purpose of this paper is to present an approach to providing floodplain habitat in the Yolo Bypass during those years and times of year when the Bypass is not flooded by the Sacramento River or Westside tributaries. The floodplain ecosystem functions described here focus on benefiting juvenile salmon. This is an alternative to the eastside flooding scenario that has been described by the Bay Delta Conservation Plan (BDCP). This "Westside Option" will bring juvenile salmon onto the floodplain in a managed scenario, while preserving the flood control function, the agricultural productivity, and the wetland habitat values of the Yolo Bypass.

The Westside Option is proposed by the Yolo Basin Foundation. The content was generated during a series of meetings sponsored by Yolo Basin Foundation beginning April 15, 2010. Meetings were attended by representatives from the California Department of Fish and Game, Reclamation Districts 108, 2035 and 2068, Conaway Ranch, Knaggs Ranch, Dixon Resource Conservation District, Yolo County Flood Control and Water Conservation District, Metropolitan Water District, Wetlands and Water Resources, cbec eco engineering, MBK Engineering and Glen Colusa Irrigation District. Several information sources were brought into this review, most notably the 2008 Yolo Wildlife Area Land Management Plan (CDFG and YBF 2008) and the 2010 BDCP Fremont Weir/Yolo Bypass Conservation Measure (BDCP 2010).

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This document includes the following sections:

- Overview of the Current Yolo Bypass Uses
- Goals and Objectives of the Westside Option
- Description of Key Elements of the Westside Option
- Other Benefits
- Next Steps
- References

The paper is intended as a beginning-a first look at the Westside Option for floodplain management in the Yolo Bypass. If this option gains support, then it can be described and developed further through a process defined by the interested parties. The Yolo Basin Foundation is distributing this document with the goal of including the Westside Option in discussions and studies as the Delta Plan is developed.

Overview of the Current Yolo Bypass Uses

In order to understand the Westside Option it is important to describe the multi-faceted land management that is present today in the Yolo Bypass. The mosaic of agriculture and managed wetlands developed over the last century as the flood control system grew to accommodate the rapidly expanding agriculture industry and growth of the urban population in the cities for which the Yolo Bypass provides flood protection. The expansion of managed wetlands in the Bypass began with the hunting culture that dates back to the beginning of European settlement in the Sacramento Valley. The increase in managed wetlands accelerated in the last 20 years as the Central Valley Joint Venture was formed to address declining waterfowl populations. This successful multi-agency effort coincided with local interest in restoring the Yolo Basin wetlands.

Floodway Function

The most important land use of the 59,000-acre Yolo Bypass is flood protection. This land has been set aside to control massive flood flows coming from the Sacramento River watershed. Over half of the Yolo Bypass is located within the legal Delta. The north boundary of the Delta is Interstate 80.

The Yolo Bypass was authorized as part of the Sacramento River Flood Control Project that was adopted by Congress in 1917. It is defined by levees that frame the east and west side of this giant flood conveyance system. The Fremont Weir, constructed in 1924, is the most significant structure in the Bypass. The most notable modification within the Yolo Bypass was the construction of the Sacramento Ship Channel, completed in 1963.

At peak flow the Fremont Weir spills about 343,000 cubic feet per second (cfs) of Sacramento River and Sutter Bypass flood flows into the Bypass. The peak flow over the Sacramento Weir is about 120,000 cfs, which includes Feather River flows. The four local watershed inputs at peak flow are: Putah Creek (42,000 cfs), Cache Creek (30,000 cfs), Knights Landing Ridge Cut (20,000 cfs), and Willow Slough (6,000 cfs).

Fremont Weir Flow Conveyance into and Through the Bypass

During large flood events, approximately 80% of the Sacramento River flows are diverted into the Yolo Bypass (CDFG and YBF, 2008). The Fremont Weir spills when Sacramento River flows exceed approximately 56,000 cfs at Verona, corresponding to the spill elevation of 33.5 feet USED (CDFG and YBF 2008). Diversion of the majority of the Sacramento River, Sutter Bypass, and Feather River high flows to the Yolo Bypass from Fremont Weir controls Sacramento River flood stages at Verona.

Within the Bypass, flood flows generally move to the eastern side of the Bypass into the Tule Canal (as named for the reach north of I-80) and south into the Toe Drain (as named for the reach south of I-80). As inflows continue, the Toe Drain banks are overtopped, flooding the Bypass and "activating" the floodplain. The *2001 Framework Report* (YBWG et al 2001:pp.2-4 to 2-6) contains the most specific descriptions of how water moves through the Bypass, primarily at low flow and in relation to agricultural water and wetland management.

The extent (area and length of time) and depth of inundation are driven by 1) Bypass topography which gently slopes in a south-southeast direction, 2) amount and duration of water flowing into the Bypass

from the westside tributaries, 3) spilling of the Fremont Weir and the Sacramento Weir, 4) timing of those inflows relative to one another, and 5) how rapidly the Bypass drains at the southern end at Liberty Island.

At the northern extent of the Tule Canal, flows start to inundate the Yolo Bypass just in excess of 1,000 cfs. At the Toe Drain, in the vicinity of the Lisbon Weir, flows start to inundate the Yolo Bypass between 3,000 to 4,000 cfs (cbec, 2010). During the period between 1935 and 1999 inundation of the Lisbon Weir (measured at stages above 11.5 U.S.E.D.) occurred approximately 71% of the years (CDFG and YBF, 2008).

The floodway must be kept clear of vegetation that can impede the movement of flood water. Riparian floodplains (such as found on the Cosumnes River) are not a significant component of the Yolo Bypass for this reason. Proposals to increase frequency and duration of unmanaged spring flooding as late as May 15 run the risk of promoting large scale establishment of vegetation that would impact the flood carrying capacity of the Bypass.

Ownership

All property in the Bypass is subject to flood flow easements. Changes in land use are subject to permitting requirements mandated by the Central Valley Flood Protection Board (formerly known as The Reclamation Board.) The 16,000-acre state-owned Yolo Bypass Wildlife Area is the largest piece of property in the Bypass. The largest piece of privately owned land is the 17,244-acre Conaway Ranch (7,200 acres in the Bypass). Other large privately owned properties include the Knaggs Ranch and the Swanston Ranch. There are numerous other privately owned wetlands and agricultural lands. Thousands of acres of state and federal wetland habitat easements exist on private land.

Agriculture and Grazing

Yolo Bypass agriculture contributes tens of millions of dollars to the local and regional economy. The main agricultural crop in the Bypass is rice with a few other annual crops including tomatoes, corn, safflower and wild rice. A significant amount of cattle grazing occurs in the Yolo Bypass as well. Agriculture and grazing plays an important role in keeping the land clear of vegetation that would otherwise impact the flood control function of the Bypass.

Wildlife friendly farming is an import element of agriculture in the Yolo Bypass. Rice contributes significant operating income for the Yolo Bypass Wildlife Area, while also providing a tremendous food source for migratory waterfowl and other water birds. On both the Wildlife Area and Conaway Ranch, rice fields are flooded in the fall and winter to provide important waterfowl and shorebird habitat. Thousands of acres of livestock grazing on the Wildlife Area also contribute significant operating income while maintaining important vernal pool and upland habitat. Farming and grazing keep the floodway open by preventing the establishment of riparian and emergent vegetation that sprouts following spring flood events.

The following soil moisture conditions must be met in order to continue agricultural production in the Yolo Bypass:

- Rice: fields must be dry enough by end of March or early April to allow planting. The term "dry" means surface soils workable for planting: limited soil saturation in the upper 2 feet of the

soil horizon which translates into ditch water levels about 3 to 4 feet below field level. Past experience indicates soils need about 3 to 4 weeks from drainage to reach planting conditions.

- Grazing: fields must be dry by late March in time to promote germination of high value forage species and prevent germination of noxious weeds.

Managed wetlands

Tens of millions of dollars in federal and state funds have been invested in creating thousands of acres of managed wetlands on both private and public land in the Bypass. Restoration of wetlands in the Yolo Basin is a key objective of the Central Valley Joint Venture that was formed over 20 years ago to carry out the goals of the North American Waterfowl Management Plan, an international treaty to restore historic populations of migratory waterfowl. The Joint Venture has since been expanded to include migrating shorebird and neotropical songbird populations.

Each conservation easement is associated with a set of land management requirements to meet specific wetland goals associated with the Central Valley Joint Venture and other state and federal Programs. The management plan tied to each property ensures long-term viability of the restored wetlands. Proposals to increase the frequency and duration of flooding through mid-April to mid-May raise important questions on how to meet wetland management requirements of the existing federal and state conservation easements. The Westside Option would maintain conditions in which the terms of the various easement programs could be met.

The following conditions must be accomplished in order to meet the wetlands goals of management plans associated with the state and federal conservation easements and the Yolo Bypass Wildlife Area Land Management Plan:

- Water Management: seasonal ponds must be drained in early April to promote germination of swamp timothy and other plants of high wildlife value. Later dates promote the proliferation of invasive noxious weeds. This draw down period is also important for the sprouting of plants that provide nesting cover for ground nesting birds.
- Emergent Vegetation Control: April draw-down dates also prevent the establishment of emergent vegetation (cattails, tules, and willows) that impedes flood flow.

Yolo Bypass Wildlife Area

The Yolo Bypass Wildlife Area Land Management Plan directs how it is to be managed for wetlands habitat, agriculture, and public use while maintaining the flood carrying capacity of the Bypass. Emergent and woody vegetation in the Yolo Bypass Wildlife Area wetlands is kept to minimum levels, based on Memorandums of Understanding signed in 1994, to maintain the flood control capacity of the Yolo Bypass.

Wildlife friendly agriculture provides a significant portion of the operating funds for the Wildlife Area while maintaining the flood carrying capacity and contributing to the overall habitat goals of the Area's Land Management Plan. There are about 1500 acres of rice, several hundred acres of organic tomatoes, and over 500 head of cattle. Grazing is used to manage upland, vernal pool, and wetlands habitats. Several hundred acres of rice land are kept fallow every year and managed as a "shorebird" rotation by providing important mudflat habitat during the summer shorebird migration.

Thousands of acres of wetlands have been restored in the last 15 years using federal North American Wetland Conservation Act and California Wildlife Conservation Board funds. The restored habitat supports a diverse, vibrant and ever changing wetland ecosystem. Hundreds of thousands of migratory geese, swans, and ducks find food and shelter in the flooded rice fields and wetlands. White-faced Ibis and Tri-colored Blackbirds are nesting in significant numbers. Migratory and resident shorebird populations are increasing. A thriving giant garter snake population has been documented. The endangered Least Bell's Vireos took up residence this year and Ospreys, Peregrine Falcons, and Swainson's Hawks soar over the wetlands.

The Yolo Bypass Wildlife Area is a much-valued public resource, and its education, recreation, and habitat restoration programs represent the largest of their kind in the Delta. An estimated 30,000 people a year enjoy wildlife viewing and an equal number participate in hunting activities. *Discover the Flyway,* a partnership of the Yolo Basin Foundation and California Department of Fish and Game, is a thriving environmental education program that brings 4,000 K-12 students every year to learn about the importance of wetlands. They come from 15 school districts located in Sacramento, Yolo, Solano, Placer and El Dorado Counties and speak 26 different languages. College students trap mammal at the Wildlife Area; engineers from throughout the nation visit to learn about designing wetlands in a floodplain; and international visitors come to observe an excellent example of integrated land use.

Goals and Objectives of the Westside Option

The goal of the Westside Option is to improve rearing habitat for juvenile salmon.

Objectives:

Provide shallow water rearing habitat by adapting the existing water management infrastructure used by farmers and wetland managers on private and public lands.

1) Provide an increased extent and duration of floodplain habitat by bringing juvenile salmon in Sacramento River water into existing shallow flooded agriculture fields and wetland ponds in a managed scenario.

2) Provide for downstream movement of the juvenile salmon through the shallowly flooded fields and ponds with the goal of ensuring entry into the Tule Canal or Toe Drain to continue their voyage through the Delta and out into the ocean.

3) Provide sufficient cover to avoid predation of the young salmon while they are utilizing rearing habitat.

Integrate this plan with existing Biological Opinions addressing improvement of fish habitat in the Yolo Bypass

1) Integrate salmon rearing habitat goals with increasing food web productivity in the Delta.

2) Integrate salmon rearing habitat goals with improvement of adult salmon and sturgeon passage out of the Yolo Bypass.

3) Integrate salmon rearing habitat goals with improvement of splittail spawning and rearing habitat.

Avoid negative impacts to the floodway function of the Yolo Bypass

1) Avoid any modifications to the Yolo Bypass that would preclude future changes necessary to improve the Sacramento River Flood Control Project.

2) Support the role of wetland management and agriculture in reducing emergent and riparian vegetation that slows down the flood water carrying function of the Yolo Bypass.

3) Work with the US Army Corps of Engineers, the Central Valley Flood Protection Board and local Reclamation Districts to improve the flood control function of the Yolo Bypass.

Support Yolo County agricultural production

1) Manage water location and timing in a manner that facilitates use of Yolo Bypass lands for producing agricultural commodities.

2) Provide incentives for landowner participation in providing increased floodplain habitats to support juvenile salmon.

Support existing conservation values in the Yolo Bypass

1) Improve existing wildlife functions of Bypass wetlands for migratory and resident shorebirds, waterfowl, and many other species.

2) Provide greater water management flexibility for private landowners and the Department of Fish and Game Yolo Bypass Wildlife Area.

3) Build upon the Central Valley Joint Venture Land Management Plan, which is realizing international migratory bird goals set by the North American Wetlands Conservation Act.

4) Support land management plans associated with federal and state agriculture and conservation easements in the Yolo Bypass.

5) Support goals of the Yolo Bypass Wildlife Area Land Management Plan.

6) Support goals of the Yolo Natural Heritage Program.

Avoid negative impacts to Upper Sacramento Valley water supplies

Work with upper Sacramento Valley water suppliers to minimize the amount of water needed to improve rearing habitat for juvenile salmon.

Address Yolo Bypass stakeholder concerns

1) Participate in stakeholders' groups to plan all proposed actions in the Yolo Bypass.

2) Minimize ESA conflicts with existing uses and agricultural activities including water diversion in the Yolo Bypass and Cache Slough Restoration Opportunity Area (ROA).

3) Minimize water quality impacts and regulatory consequences of aquatic habitat restoration in the Yolo Bypass and Cache Slough ROA.

4) Other concerns are enumerated in several documents developed by the Yolo Bypass stakeholders over the last decade. Please see References section.

Description of Key Elements of the Westside Option

The basis of the Westside Option is to convey Sacramento River water into the Yolo Bypass along the higher west side where water would be moved downhill from west to east using existing and expanded canals to deliver water into managed wetlands and rice fields. The concept involves moving water (and fish) onto the land of willing property owners and the Yolo Bypass Wildlife Area using the existing water delivery infrastructure with modifications as needed, e.g. one mile where there is currently no canal north of Interstate 5. The managed wetlands of the Wildlife Area and flooded rice fields would provide shallow water residence time for young salmon during prime rearing months in February through early to mid-spring. At the appropriate time the salmon would be allowed to move through the system of ponds and canals to the eastside Tule Canal/Toe Drain and on south to continue their journey to the San Francisco Bay.

Some of this water could head to the east via existing channels to the Tule Canal and Toe Drain as needed for other uses such as adult fish passage and splittail attraction for spawning and rearing habitat in the lower Yolo Bypass.

The proposed Westside Option has the following four key elements:

Use of gravity flow to flood from above

The general effect of this strategy is to inundate the floodplain "from above" where water would flow through the Bypass from northwest to southeast. The eastside modification of the Fremont Weir proposed by the BDCP would flood "from below" where water rises in the Tule Canal and the Toe Drain and gradually floods overbank to the west. It is anticipated that the inundation "from above" would require significantly less Sacramento River water to convey migrating young salmon into the Bypass and onto the floodplain.

Use of managed flows to rear fish while protecting agriculture and managed wetlands

A managed flow strategy would move water into selected ponds for "fish management" and away from other areas to protect agricultural operations and established wetland management plans on public and private lands. This approach could be carried out on private lands using incentive programs that would pay farmers and private wetland managers to manage for fish. Interested landowners could develop double cropping schemes that would build in the flexibility to manage for fish, birds, rice, grazing, or recreational uses such as hunting and wildlife viewing. Current land managers have extensive knowledge of the Yolo Bypass landscape and the existing water management infrastructure. They could be active participants in planning for fish management.

Improvement of connectivity between the Sacramento River and Yolo Bypass Wildlife Area

The Westside Option could also allow for a direct connection between the Yolo Bypass Wildlife Area and the waters and aquatic inhabitants of the Sacramento River, thereby increasing the extent of aquatic habitat accessible to important fish species. Currently all water used for agriculture and wetland management is lifted from the east side Tule Canal and Toe Drain by pumps and conveyed to the west

side in order to fill farmed fields and managed wetlands. In the absence of flooding the water used to manage wetlands is pumped, and therefore it is fish free. Conveying Sacramento River water directly into the Bypass on the west side would bring fish and other aquatic organisms into the wetlands of the Wildlife Area, increasing the value of the wetland ecosystem. Bringing Sacramento River water directly into the 16,000-acre Yolo Bypass Wildlife Area would increase the productivity of approximately 8,000 acres of wetland habitat.

Movement of fish into the Bypass

The key factor in making the Westside Option work is to successfully move juvenile salmon from the Sacramento River into the Yolo Bypass at flows below the existing 33.5-foot elevation of the Fremont Weir.

One promising approach involves conveying water directly from the Sacramento River utilizing the infrastructure of the Colusa Basin drainage system:

- Sacramento River water could be brought through the Colusa Weir into Colusa Basin and then through the Knights Landing Cut to the Yolo Bypass, or
- Sacramento River water could be brought through the Knights Landing gates into the Ridge Cut and into the Yolo Bypass.

The Colusa Basin Drain (CBD), Knights Landing Outfall Gate (KLOG) and the Knights Landing Ridge Cut (KLRC) are currently operated to provide water to the upper Yolo Bypass for irrigation and to route flood flows from the Colusa Basin into the Bypass. The CBD conveys rainfall runoff and irrigation drainage from the Colusa Basin to either the Sacramento River or down the KLRC to the Bypass depending on irrigation needs, stage in the Sacramento River, CBD flow rate, and setting at the Wallace Weir, located at the confluence of the KLRC and the Yolo Bypass.

During the irrigation season the amount of flow entering the KLRC is controlled by the KLOG and the Wallace Weir. The California Department of Water Resources operates the KLOG to maintain an agreed upon water level in the lower CBD and KLRC at the Wallace Weir. CBD flow above that needed for irrigation either flows into the Sacramento River through the KLOG or over the Wallace Weir in to the Bypass.

During winter months the Wallace Weir is removed and the KLRC operates as a flood channel. When the Sacramento River is flowing at higher stages, approximately 25,000 cfs, water from the CBD cannot flow out of the KLOG to the Sacramento River and must flow down the KLRC to the Bypass. The KLRC is designed to covey about 20,000 cfs.

The KLOG could be operated in a similar fashion as the proposed notch in the Fremont Weir. The KLOG is in a sense already an operable "notch" in the levee system. However, it currently only operates to allow flow from the CBD to the Sacramento River and not from the Sacramento River to the KLRC. During the winter months when the Wallace Weir is not in place, a modified KLOG could be operated to allow Sacramento River water into the Yolo Bypass at Sacramento River flows of about 15,000 cfs and possibly less.

Other Benefits

The Westside Option could also provide additional important benefits:

Potential for increased food web productivity in the Delta

The water conveyed into the Bypass from the Colusa Basin Drain through a variety of Sacramento River diversions could provide the net positive flow to the Delta that is needed to transport the potential increase in food web productivity generated in shallow water habitats managed under the Westside Option.

Improvement of adult salmon and sturgeon passage out of the Yolo Bypass

Managing flows entering the Yolo Bypass through the Knights Landing Ridge Cut could provide water to both the west and east sides. This creates an opportunity to both manage wetlands and allow increased flows down the eastside of the Bypass to improve adult fish passage.

Since fish passage is a critical issue, a fish ladder may be constructed at the Wallace Weir and KLOG that may be far more effective and easier to construct than one at the Fremont Weir. This has the potential to improve fish passage for both salmon and sturgeon. This is based on the fact that a ladder needed to pass fish over the Fremont Weir must overcome higher elevations than one at the KLOG.

Improvement of splittail habitat

The net increase in water delivery into the Bypass could be used as spawning and rearing flows to improve splittail habitat. The Westside Option could be integrated with tidal habitat improvement associated with the realignment of Putah Creek at the south end of the Yolo Bypass Wildlife Area.

Potential for lower costs

An important benefit of the Westside Option is that most of the infrastructure is already in place, and the operations and maintenance costs may be lower than a notched Fremont Weir.

Reduction of pumping costs

The Westside Option could reduce pumping needs and associated costs for the Yolo Bypass Wildlife Area and others by making water available on the westside so that gravity flow could be utilized for irrigation.

Access for agricultural operations, educational programs and recreational use

The Westside Option would ensure that a usable road network is dry and intact while managing rearing habitat for juvenile salmon. Road access throughout the Bypass in the early spring is critical for farmers to prepare fields for timely planting. Spring is also a key time for public use such as environmental education and wildlife viewing activities on the Yolo Bypass Wildlife Area. Road access on private and public lands is necessary to conduct farming operations and spring maintenance of wetlands including draining of ponds, maintenance of berms and water control structures, weed management and planting of wildlife food crops.

Improvement of Giant Garter Snake (GGS) habitat

The Westside Option could increase connectivity of GGS habitat along the west side of the Bypass if levee and conveyance channel improvements are designed with GGS as a target species.

Implementation of Best Management Practices for vector control

Managing floodplain inundation within established fields and ponds allows for the implementation of established Best Management Practices to reduce mosquito production.

Implementation of management practices to reduce methylmercury production

The Central Valley Regional Water Quality Control Board recently approved a Total Maximum Daily Load requirement that will mandate landowners in the Yolo Bypass to minimize production of methyl mercury that is produced in the seasonal wetlands and rice fields. Preliminary research is showing that deepwater drainage ponds associated with rice fields and seasonal wetlands could be used to demethylate mercury before it is discharged into Tule Canal/Toe Drain. The Westside Option could facilitate the implementation of these Best Management Practices.

Potential to monitor enhancement effectiveness

With this approach, the geographic location of floodplain habitats would be well known and thus the ability to monitor fish abundance and growth would be comparatively easy. In contract, the eastside BDCP approach with its uncontrolled flooding would not provide predictable locations and spatial extent of floodplain habitat which makes monitoring enhancement effectiveness much more challenging.

Potential for pilot projects in the near term

Because water can already be provided to the Bypass from the Colusa Basin Drain, there are real possibilities for developing pilot projects. The advantage of such projects is that benefits could be evaluated in a relatively short time period. As benefits are realized, modifications to the Knights Landing Outfall Gate or other necessary infrastructure could be made. Local land managers and farmers have significant knowledge of Bypass operations and good ideas that can be used to formulate a pilot project.

Model for adaptive management

The managed scenario presented here lends itself well to the adaptive management model. With the ability to monitor the effectiveness of the proposed action comes the potential to modify actions to improve results.

Stakeholder support for the Westside Option

The Westside Option directly addresses stakeholder concerns as identified by the Yolo Bypass Working Group as early as 2001 and documented in *A Framework for the Future: Yolo Bypass Management Strategy.* These concerns are also described in the *Yolo Bypass Wildlife Area Land Management Plan*, the *Yolo Bypass Conservation Measure* proposed by the Lower Yolo Bypass Planning Forum in July 2009, and the *Management Recommendation Planning Goals* of the Lower Yolo Bypass Planning Forum, June 2010.

Many of the stakeholders maintain the current mosaic of agriculture and managed wetlands that keep the floodplain clear of dense vegetation that could impede flood flows. The Westside Option would allow them to continue to maintain this mix of land use while providing rearing habitat for young salmon by utilizing the same water delivery infrastructure.

There is significant Yolo Bypass stakeholder agreement on the following:

- Any land use modifications in the Yolo Bypass must maintain or improve the floodway function and hydraulic performance.
- Productive agriculture must be maintained for its intrinsic economic value to the community and for its critical role in managing Yolo Bypass vegetation in support of the flood conveyance function. Additionally, these agricultural fields are an important food source for wintering waterfowl.
- Managed wetland habitat restored in the last 20 years must be protected.
- Access for agricultural operations, education programs and recreational use on both public and private lands must be maintained.

Next Steps

To advance the Westside Option, an additional level of detail is needed in order to conduct feasibility and cost studies and an "effects analysis." More specific information about land elevation, existing infrastructure dimensions and proposed modifications is also needed. Coordination of multiple landowners operations should be evaluated. The development of juvenile salmon rearing strategies in a managed landscape is also necessary. We have identified the following next steps:

1) Introduce the concept to USFWS and NOAA to start the discussions regarding their goals and concerns.

2) Work with interested landowners to develop an estimate of acreage that could be available for rearing of juvenile salmon.

3) Evaluate existing easements, land management plans, operations manuals and memorandums of understanding associated with lands in the Yolo Bypass.

4) Conduct land surveys as needed from Knight's Landing on south.

5) Develop fisheries goals and biological needs descriptions.

6) Identify a range of flows, routing, acreage inundated, inundation depths and duration to meet Biological Opinion goals.

7) Examine the engineering design considerations to begin gaining a better sense of what modifications might be needed in order to achieve the desired outcomes.

8) Examine possible water rights, water use and water quality impacts of this alternative.

9) Describe potential food web benefits associated with this option.

10) Develop actions to integrate splittail spawning and rearing and adult fish passage goals into the project design.

11) Develop pilot projects to assess management actions and conditions needed to maximize juvenile salmon production in wetlands and agricultural fields.

12) Develop a more robust, detailed project description for public distribution that includes the flow and inundation outcomes, engineering aspects, and scientific investigations to determine its effectiveness and fine-tune its operations.

13) Conduct an effects analysis covering both benefits and potential adverse impacts.

14) Develop a monitoring plan.

15) Develop a business plan for the operation of this alternative that includes potential government funding for implementation of these techniques, such as the Natural Resources Conservation Service (Farm Bill) and development of crop rotations that invite compatibility with fish rearing operations.

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