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California Department of Fish and Game, Water Branch

The California Department of Fish and Game's (Department) Water Branch has reviewed a preliminary description of a westside Yolo Bypass management option (Westside Option) for rearing juvenile salmon. The Westside Option is presented as a technical memorandum prepared by the Yolo Basin Foundation, several landowners in the Yolo Bypass, the Department's Yolo Bypass Wildlife Area, Reclamation District 2035 and 2068, Conaway Ranch, and Dixon Resource Conservation District with funding provided by the Metropolitan Water District of Southern California.

The Westside Option is a "first look" at an option to provide alternatives to a proposed Bay Delta Conservation Plan (BDCP) action that seeks to provide/restore floodplain habitat for juvenile salmonids. The Westside Option's goals and objectives are to:

- Improve rearing habitat for juvenile salmon
- Avoid negative impacts to floodway function
- Support Yolo County agricultural production
- Support Yolo Bypass wetland values
- Avoid negative impacts to upper-Sacramento Valley water supplies
- Address Yolo Bypass stakeholder concerns

The Westside Option proposes to accomplish its goals and objectives by providing floodplain rearing habitat (habitat) for juvenile salmonids by inundating portions of the Yolo Bypass in a managed fashion with water from the westside of the bypass versus the BDCP proposed action of inundation from the east. Under the Westside Option, habitat would be created by modifications to existing water infrastructures with inundation occurring on rice fields (managed as habitat) during the non-growing season (February through mid-March). Juvenile salmonids would be allowed to rear within the managed habitat for a period of time with emigration to the Tule Canal/Toe Drain occurring as flows are reduced or eliminated from the habitat.

The Westside Option proposes two potential alternate points of water delivery to accomplish its goals. Water could be delivered via:

Alternative One: Sacramento River water could be brought through the Colusa Weir, into the Colusa Basin, and then through Knights Landing Ridge Cut (KLRC) to the Yolo Bypass.

Alternative Two: Sacramento River water could be brought through the Knights Landing Outfall Gates (KLOG), into KLRC, and into the Yolo Bypass.

This document compares and contrasts the biological implications of Westside Option to the proposed BDCP action (Eastside Option).

Background

Current Department Policy

The Department's goal has been, and continues to be, to work towards the enhancement and maintenance of diverse habitats and to improve the health and fitness of multiple fish and wildlife species that live in and/or migrate through the Yolo Bypass. As the Department moves forward, it remains committed to maintaining the management practices of the Yolo Bypass Wildlife Area, to the maximum extent feasible, while implementing actions to benefit fish and aquatic resources both within and outside of the Yolo Bypass and Delta. The Departments position statement is framed by both the long-term commitment to the conservation and management of natural resources within the Yolo Bypass and our participation in the BDCP process aimed at improving conditions for fish and wildlife resources within the Delta (DFG 2009).

The issues related to the resources in the Yolo Bypass can be broadly summarized into two issues: 1) impediments to the movement of adult salmonids, sturgeon and splittail and 2) the need to provide additional floodplain habitat for the rearing of juvenile salmonids and splittail (DFG 2009).

To facilitate the upstream movement of adult salmonids, sturgeon, and splittail through the Yolo Bypass, the Department supports the following actions:

- Modify or replace Lisbon Weir.
- Provide connectivity from the Toe Drain through the Tule Canal to the Fremont Weir to achieve adult fish upstream migration return to the Sacramento River.
- Investigate a multi-species fish passage structure at the Fremont Weir (redesign of the existing fish ladder or construction of a new structure).
- Realign lower Putah Creek to enhance multi-species fish passage and wildlife use of the restored riparian channel, particularly for salmonids and splittail.

To enhance juvenile salmonid and splittail rearing, and splittail spawning on the Yolo Bypass floodplain, the Department supports the following actions:

- Modify the Fremont Weir to increase flooding frequency and duration, to achieve 30-45 days of inundation with the frequency dependent upon hydrology. Develop protocols for the operation of a modified Fremont Weir that optimizes fishery benefits while minimizing conflicts with existing uses in the Yolo Bypass.
- Provide connectivity from the Toe Drain through the Tule Canal to the Fremont Weir to reduce stranding of out-migrating salmon smolts and other fish species in the Tule Canal.

- Investigate ways to constrain flooding resulting from the operation of a notch in the Fremont Weir (e.g. constructing of berms, recontouring, and changes in water circulation to allow use of existing managed wetlands).
- Maintain existing public access, public use and agricultural activities, and minimize adverse effects on existing wildlife use in years when the Fremont Weir normally would not spill.
- Investigate re-contouring of some areas (e.g. scour ponds) to reduce fish stranding of fish.
- Investigate whether water can be moved across the Yolo Bypass from west to east to ensure fish out-migration.

The Eastside Option has addressed and has the potential to solve both of these issues and firmly conforms to the Department's current policy. The Westside Option has not been fully developed. It is unknown how the Westside Option would facilitate the movement of fish through the Yolo Bypass, provide relevant modifications to existing barriers to increase connectivity, increase spawning habitat for splittail, or reduce fish stranding.

Yolo Bypass Water Diversion and Fish Attraction

Anadromous fish, including salmon (all races), steelhead, sturgeon, American shad, and striped bass are attracted to year-round flow from the Yolo Bypass. Flow sources include agricultural drains from the one-million-acre Colusa Basin and 59,000 acre Yolo Bypass, runoff from Putah and Cache Creeks, drainage from nearby Yolo and Elkhorn basins, and spill from the Fremont and Sacramento weirs. The largest and most consistent agricultural drainage is from the KLRC which connects the Colusa Basin Drain to the Yolo Bypass. Winter and spring flows from the KLRC are often thousands of cubic feet per second (cfs) even in years when the Fremont Weir does not spill. The Yolo Bypass floods to some extent in most winters from the KLRC alone. It is important to note that any anadromous fish that pass upstream through the Yolo Bypass and into the Colusa Basin are lost.

<u>Westside Option Review</u>

The following review of the Westside Option was conducted with assumptions made by the reviewer. It appears that the Westside Option lacks an adequate depiction of the existing Sacramento River flood control system, as Alternative One proposes to bring water and fish into the Yolo Bypass through the Colusa Weir. The Colusa Weir is on the eastside of the Sacramento River and the Colusa Basin is on the westside of the river. The Colusa Basin receives the majority of irrigation water from the Red Bluff Diversion Dam. It is unknown how the Westside Option envisioned water and fish transport to the Yolo Bypass via Alternative One. For the purposes of this review, a hypothetical structure occurring near the Colusa Weir on the westside of the Sacramento is assumed and analyzed.

Adult Fish Passage

As fish passage in the Yolo Bypass improves due to BDCP actions there should be a decrease in the adult fish that are trapped in scour pools, behind diversions, etc. Salmon that are attracted to the Yolo Bypass because of the constant flow need to be able to proceed to their natal stream to spawn, this is especially important for listed species, such as the state and federally listed spring-run Chinook salmon. The Westside Option has not been developed fully, and as a result, it is difficult to determine how it would facilitate the movement of anadromous fish through the Yolo Bypass and into the Sacramento River as they travel upstream to spawn or downstream to return to the ocean.

The Westside Option and Eastside Option have considerable differences in regards to the potential stray rate of Feather River origin Chinook salmon. The Eastside Option would potentially allow Feather River origin Chinook salmon to pass over the Fremont Weir and locate the Feather River via their olfactory responses. Feather River origin Chinook salmon immigrating through the Westside Option would enter the Sacramento River at Knights Landing (9 miles upstream of their natal waters) or at the Colusa Weir (40+ miles upstream of their natal waters). The Feather River origin Chinook salmon immigrating via the Westside Option would potentially continue up the Sacramento River and be considered lost, failing to spawn in their natal stream. As fish travel farther up the main stem of a system past their natal stream they are less likely to return to their natal stream to spawn (Keefer et al. 2008). This type of action has been shown in numerous areas such as the Delta Cross Channel (DCC), where fish from the Mokelumne River immigrate to alternative channels instead of continuing to their natal spawning ground because they can not detect the olfactory cues of their natal stream. The DCC flows are up to 3,000 cfs, while Mokelumne River flows are as low as 100 cfs. This overwhelming difference in flow rate drowns out the olfactory “scents” of their natal stream. Similarly, if Feather River origin Chinook salmon entered the Sacramento River 9 to 40+ miles above their natal stream they would not detect the olfactory cues and would be lost.

Juvenile Salmonid Movement to Rearing Habitat

The Westside Option Alternative One would require juvenile fish traveling down the Sacramento River to enter the Colusa Basin via a hypothetical structure, and then travel through approximately 32+ miles of canal before entering the KLRC. After entering KLRC juvenile fish would be required to travel through an additional 19.5 to 22.5 miles of canals before being diverted into specific fields.

The Westside Option Alternative Two would require emigrating juvenile fish to be attracted into the Knights Landing Outfall Reach (KLOR). After entering KLOR juvenile fish would pass through the KLOG, a flood control structure. After

passing through KLOG the juvenile fish would enter KLRC and be required to travel within 19.5 to 22.5 miles of canals before being diverted into designated fields. This option has potential problems not addressed in the Westside Option proposal such as:

- During high flows it may be unfeasible to move water (and fish) over the KLOG due to comparable water levels on each side of the gate.
- The KLOR current configuration is not an ideal pathway for juvenile fish due to water quality and predation.
- During high flows the KLOR inundates the boat ramp and other areas that could potentially strand juvenile fish.

The Westside Options would force juvenile fish into various canals with steep banks, limited cover, and potentially limited food sources. The canal systems below Wallace Weir are not currently designed to allow the proper flows required to achieve the appropriate inundation. These canals would require modification to ensure that they do not spill their banks and strand juvenile fish. The Westside Option would also require juvenile fish to travel through various water diversions structures with challenging fish passage issues before being diverted into designated fields for rearing. The water diversions and structures could potentially cause immediate and delayed mortality.

The Eastside Option would allow the current inundation of the Yolo Bypass to happen more frequently. Numerous scientific studies have documented the benefit of this form of inundation. The Eastside Option would not require juvenile fish to travel through an extensive canal system with water diversions and pumps prior to enter rearing habitat. As water spills over the Fremont Weir, juvenile fish would immediately enter a heterogeneous floodplain where they could actively feed while avoiding stressful conditions such as water quality and fish passage obstructions.

There is substantial difference between the proposed options with respect to how rearing habitat would be created. The Westside Option would deliver water to fields designated as rearing habitat. These fields could be homogenous in terms of water quality and structure and may not be favorable for fish. If juvenile fish were diverted into a field with non-favorable conditions, they may be subject to excessive predation and experience increased mortality rates. If fields were not previously flooded, fish could be stranded when the inundation begins and fish may potentially experience increased mortality rates. The Westside Option does not discuss how these issues would be mitigated or what monitoring would be conducted to ensure that juvenile fish were moving out of the fields as they were dried and prepared for crops.

As inundation occurred from an Eastside Option a “pool” would be created in the toe drain, as the pool expands fish could travel further into the floodplain and retreat as water recedes. Natural floodplains tend to be heterogeneous in terms

of water quality and structure, and fish can avoid stressful conditions and seek out more favorable conditions (Jeffres et al. 2008). The Eastside Option would allow juvenile fish greater movement across rearing habitat to take advantage of favorable conditions, such as cover and food sources.

Water Quality

The quality of water moved to the Yolo Bypass for juvenile fish rearing habitat is important and essential to a successful fisheries restoration project. Degraded water quality from pesticides and increased temperature can have adverse effects on juvenile fish.

There are various differences in the quantities of pesticides between the Eastside Option and the two Westside Option Alternatives. Pollutants can have acute and chronic effects on juvenile fish based on exposure time and concentration levels.

- Westside Option Alternative One would move fish through the Colusa Basin which has numerous listed pesticide problems under the Clean Water Act Section 303D (Central Valley RWQCB 2002).
- Westside Option Alternative Two would move fish through KLRC which also has numerous pesticide issues. A study conducted by the United States Geological Survey (USGS) in 2004-2005 showed that KLRC had the highest number and concentrations of pesticides present during flood events when compared to the Yolo Bypass and surrounding areas (USGS 2005).
- The Eastside Option would move water (and fish) directly from the Sacramento River potentially avoiding these pesticide issues.

A major limiting factor for juvenile Chinook salmon is temperature, which strongly affects growth and survival (Moyle 2002). Optimal temperature for growth and survival are 13-18ºC and major mortality is expected at 22-23ºC (Moyle 2002). The temperature of floodplain rearing habitat can be quite different then that of the adjacent river. A study in 1998-1999 showed that the Yolo Bypass was up to 5ºC warmer then the adjacent Sacramento River during the primary inundation period, February-March (Sommer et al. 2001).

A USGS study during 2004 compared temperatures of various inputs and locations of the Yolo Bypass during February and March. The temperature of KLRC on average was 2ºC higher than the Sacramento River at Tisdale Weir and 1ºC higher than the Toe Drain. The maximum temperature difference between KLRC and the Sacramento River was 4ºC (USGS 2005). While Sommer et al. (2001) states, “Bioenergetic modeling suggested that feeding success was greater in the floodplain than in the river, despite increased metabolic costs of rearing in the significantly warmer floodplain”, the increased temperature of KLRC in conjunction with an increase in temperature as fields are

flooding could exceed the temperature tolerance of juvenile Chinook salmon and result in major mortality.

The Eastside Option would allow for juvenile fish to travel with the cooler Sacramento River water as it inundated the eastside of the Yolo Bypass. As the water "pooled" from below, juvenile fish may be able to avoid stressful conditions that would come from Westside Options and seek more favorable habitat based on temperature and other factors.

Giant Garter Snake

The effects of restoration projects on federally and state listed species are an important factor in the selection of BDCP preferred alternatives. The Westside Option would likely have impacts on giant garter snake (GGS).

Significant modifications would be required to allow water to flow down the westside of the Yolo Bypass below Wallace Weir to facilitate the inundation of specific fields for rearing habitat. Modifications would include increasing canal capacities, fish passage structure construction, and canal maintenance.

Maintenance activities would likely include the removal of plant material within the canals below Wallace Weir. The plant material and conditions found in the existing canals south of Wallace Weir on the westside of the bypass are ideal for GGS. Past studies have shown that portions of these canals are marsh like in character and are ideal for supporting dense populations of GGS and have numerous documented sightings of GGS. The Westside Option would likely have an impact on this population and habitat. The canals below Wallace Weir would have to be maintained on a regular basis to ensure proper flows could continue. The maintenance and increased flows would displace the GGS in these canals. Additionally, canal capacities would need to be increased to deliver water in an amount appropriate for BDCP goals.

The Eastside Option would allow for this GGS population and habitat to remain while allowing for seasonal flooding to support juvenile fish rearing habitat.

Predation

The predation rate of juvenile fish traveling through the lengths of the westside canals is likely greater than for the same fish traveling through the Sacramento River and Yolo Bypass. A canal by design lacks adequate structure to provide refugia, has steep banks, and the overall volume is significantly less compared to that of a river or bypass. There may be increased predation when fish are diverted into specific fields due to the more uniform depth and confined space when compared to a floodplain such as the Eastside Option. As the fish move through the fields of the Westside Option they would have to pass through rice check gates, which are a preferred point of predation for wading bird species.

Summary

The Westside Option as proposed lacks sufficient detail to conduct a thorough review. However, certain aspects of the proposal analyzed for this review may be in conflict with the intent of fisheries restoration for the Yolo Bypass. The potentially conflicting aspects include, but are not limited to:

- Lack of adult fish passage consideration
- Impacts to GGS
- Fish mortality at diversion points
- Travel time in agricultural canal systems
- Water quality
- Predation
- Uncertainty regarding fish rearing in rice fields

Certain elements of the proposed Westside Option may be incorporated into a blended approach for fisheries enhancements in the Yolo Bypass.

References

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