

Draft Compatibility Determination

Title

Draft Compatibility Determination for Proposed Implementation of Big Notch Project Flowage Easements, Steve Thompson North Central Valley Wildlife Management Area, South Area Properties

Refuge Use Category

Rights-of-way and Rights to Access

Refuge Use Type(s)

Flowage easements: The right to store, convey, or drain water (e.g., aqueducts, private drainage on co-owned wetland easements, third-party drainage rights, flood water control and storage, regulating reservoirs, siltation basins, and storm water outfalls).

Refuge

Steve Thompson North Central Valley Wildlife Management Area (WMA)

Refuge Purpose(s) and Establishing and Acquisition Authority(ies)

The WMA was established in 1991:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act of 1929)

“...for the development, advancement, management, conservation, and protection of fish and wildlife resources ...” 16 U.S.C. 742f(a)(4) “... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...” 16 U.S.C. 742f(b) (1) (Fish and Wildlife Act of 1956)

“...the conservation of wetlands in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions...” 16 U.S.C. 3921 (Emergency Wetland Resources Act of 1986)

“...protection, restoration, and management of wetland ecosystems...” 16 U.S.C. 4401-4412 (North American Wetlands Conservation Act of 1989)

See Appendix 1 for more details on the history of the establishment of the WMA.

National Wildlife Refuge System Mission

The mission of the National Wildlife Refuge System, otherwise known as Refuge System, is to administer a national network of lands and waters for the conservation,

management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (Pub. L. 105-57; 111 Stat. 1252).

Description of Use

Is this an existing use?

No, the Yolo Bypass is managed as a floodway, and the State of California Department of Water Resources (DWR) has existing flowage easements that were acquired prior to the Service acquiring conservation easements on the properties. The right to flood the Steve Thompson North Central Valley WMA (WMA) properties in the Yolo Bypass consistent with DWR's existing flowage easement terms is not considered an existing use since the Service has no discretion over the activity. However, the proposed use would increase the frequency and duration of flooding in the Yolo Bypass that is beyond the scope of existing DWR flowage easements.

What is the use?

DWR is pursuing new Flowage Easements on properties within the Yolo Bypass that would experience additional flows resulting from the operation of the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Big Notch Project or Project). Sixteen of the properties requiring new Flowage Easements are existing managed wetlands where the U. S. Fish and Wildlife Service (USFWS) possesses Conservation Easements managed as part of the WMA. The USFWS purchased these Conservation Easements for the management of migratory birds. These lands are private, but the management of these properties as waterfowl hunting clubs meets the USFWS's objective of managing habitat for migratory birds.

50 CFR 25.44 requires permits for use of easement areas administered by the USFWS where proposed activities may affect the property interest acquired by the United States. This includes instances where the third-party applicant is a governmental entity which has acquired a partial interest in the servient estate by subsequent condemnation. Prior to issuing the special use permit, we must determine that the proposed activities affecting our easement interest are a compatible use¹.

If the use is found compatible, the USFWS would issue a special use permit to DWR to authorize increased flows over the conservation easement properties for the operation of the Project. During the 5-year term of the special use permit, DWR will be required to implement measures to minimize impacts from the Big Notch Project

¹ Compatible use means a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge. (50 CFR § 25.12(a))

and protect our easement interest. During this period, the USFWS will further evaluate the effects of actual Project operations on our easement interest, which may inform the development and implementation of additional measures to address impacts. After 5 years, the compatibility determination will be reevaluated.

Is the use a priority public use?

No²

Where would the use be conducted?

This CD evaluates the effects of operation of the Big Notch Project on the group of WMA easements referred to as the South Area Properties. The total acreage of the South Area Properties is 495 acres. Table 1 includes information on the South Area Properties including tract numbers, parcel numbers, property names and acreages for each parcel.

Table 1. South Area Properties Information.

FWS Tract Number(s)	Parcel Number(s)	Property Name	FWS Tract Acres
447C	033-220-060, 033-220-067	Williams	100
24C	033-220-068	Kleary	44
16C	033-220-054	EIP	122
436C	033-220-058	Aroz	70
18C	033-190-007	Kilkenny	159

None of the Big Notch Project construction activities would occur on the South Area Properties. However, all the properties would be affected by the changes in operation of the Yolo Bypass resulting from the project.

When would the use be conducted?

DWR proposes to begin operation of the Big Notch Project in the Fall of 2024 and continue annually based on hydrological conditions. Gate operations that will increase flows, up to 6,000 cubic feet per second (cfs), could begin each year on November 1 depending on river conditions. Gate operations could continue through

² Wildlife-dependent recreational uses are the priority public uses of the National Wildlife Refuge System (16 U.S. Code § 668dd(a)(3)(C)). Wildlife-dependent recreation means a use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation (16 U.S. Code § 668ee(2))

March 15 of each year, based on hydrologic conditions. The gates may remain partially open after March 15 to provide adult fish passage.

How would the use be conducted?

Big Notch Project operations may begin each year on November 1, with the gates first opening based on river conditions. All gates would be opened when the river elevation reaches 15 feet, which is one foot above the lowest gate invert. At this river elevation, about 130 cfs of water would enter the gated notch. If the river continues to rise, the gates would stay open until the flow through the gates reaches 6,000 cfs.

The flow through the gates would reach 6,000 cfs when the river elevation is about 28 feet; at this point, the two smaller gates would be programmed to start closing to maintain flows of 6,000 cfs. The flow may fluctuate so that it is a little higher or a little lower than 6,000 cfs during this time. Gate closures would be controlled so that there is not a sudden reduction in flow. Gate 1, the larger gate, would remain fully open throughout operations.

Once Fremont Weir begins to overtop, the smaller gates would remain in their last position prior to the weir overtopping (generally both would be closed at this point). After the overtopping event is over, the smaller gates would open and close as needed to keep the flow through the gate as close as possible to 6,000 cfs. All gates would close when the river elevation falls below 14 feet. Gate operations to increase inundation could continue through March 15 of each year, based on hydrologic conditions. The gates may remain partially open after March 15 to provide adult fish passage. However, flows through the gates after March 15 could not exceed the available capacity of Tule Canal, which is typically about 300 cfs, so that flows do not inundate areas outside of the canal and affect adjacent lands.

Why is this use being proposed or reevaluated?

The goal of the Big Notch Project operations is to maximize the number of out-migrating juvenile winter-run Chinook salmon that enter the Yolo Bypass.

Downstream out-migration is triggered during the first wet season event. The purposes of the Project are to: 1) improve juvenile salmonid access to seasonal habitat through volitional entry; 2) increase access to and acreage of seasonal floodplain fisheries rearing habitat; 3) reduce stranding and presence of migration barriers; 4) increase aquatic primary and secondary biotic production to provide food through an ecosystem approach; 5) improve connectivity within the Yolo Bypass for passage of salmonids and green sturgeon; and 6) improve connectivity between the Sacramento River and the Yolo Bypass to provide safe and timely passage for salmonids and green sturgeon.

The Project actions would implement Reasonable and Prudent Alternative (RPA) action I.6.1 and, in part, RPA action I.7, as described in the 2009 National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) Biological

Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project (NMFS 2009) and the 2012 Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Reclamation and DWR 2012).

The two RPA actions that formed the basis for alternatives considered for analysis in the EIS/EIR are summarized below:

- RPA Action I.6.1: Restore floodplain rearing habitat for juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead through increased acreage of seasonal floodplain inundation within the lower Sacramento River basin.
- RPA Action I.7: Reduce migratory delays and loss of salmon, steelhead, and sturgeon at Fremont Weir and other structures in the Yolo Bypass (NMFS 2009).

Availability of Resources

Table 2. Costs to Administer and Manage Use.

Category and Itemization	One-time Cost	Recurring Annual Expenses
Staff time (administration, and management)	\$15,000	\$20,000
Monitoring	\$170,000	0
Total expenses	\$185,000	\$20,000

Anticipated Impacts of the Use

Below is an analysis of the impacts of the operation of the Big Notch on the South Area Properties. Impacts of the Big Notch Project operation at the larger scale of the Yolo Bypass are addressed in the Final Yolo Bypass Salmonid Habitat Restoration and Fish Passage EIS/EIR (2019) and the Waterfowl Impacts of the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project – An effects analysis tool (Ducks Unlimited 2017), which are incorporated by reference. This compatibility determination focuses on the direct and indirect impacts of Project operations at the scale of the South Area Properties.

The Service utilized an analysis prepared by Ducks Unlimited (DU) (2024) (Attachment A) to characterize the impacts of the Big Notch Project. DU used hydraulic model data to assess how the operation of the Big Notch could impact flooding on the 59 wetland managements units comprising the WMA easement areas within the Yolo

Bypass. DU evaluated daily changes in water surface elevation between October 2nd to March 15th across 16 water years (1996-2011). The water years used by the model represent a range from exceptionally wet years (e.g. 1997) to drought years (e.g. 2007). Wetland unit specific water surface elevations were assessed at a fixed point within each unit under two scenarios, baseline conditions and with the operation of the Big Notch. Each water surface elevation reference point was located near the drain within each wetland unit.

To evaluate how changes in water depth within each wetland unit can impact wetland management actions, as well as landowner access and use of the units, DU worked with the Service to define three depth thresholds. These depth thresholds correspond to water depth categories and impacts to wetlands that may result, ranging from small to large increases in water depth. Table 3 describes the wetland management baseline and three different flooding depth impact categories.

DU calculated the total duration and the number of flood events at each depth category for each wetland unit. They then summarized these data at the wetland unit level into the total number of flood events and the total duration of flood days at each depth category for all water years.

It is important to note that the model developed by Cbec Eco Engineering used in the DU analysis has certain limitations and actual flooding impacts may differ. The Cbec model utilizes a digital elevation model that was modified such that the wetland units and surrounding water control infrastructure are “plumbed to drain”. These modifications likely have significantly increased the speed at which water moves across the landscape. Additionally, the Cbec model assumes initial conditions are dry, despite many wetland units and rice fields being annually flooded by October 2. Despite these limitations, the Cbec model was the best available to Ducks Unlimited at the time of the analysis. Future analysis may be improved by updating the Cbec model to better reflect the drainage limitations of managed wetlands, as well as incorporating the monitoring of actual flooding impacts.

Table 3. Description of Flooding Depth Impact Categories.

Flooding Depth Categories	Depth of Flooding	Rational
Wetland Management Baseline	12 inches	Seasonal wetlands that are managed to support wintering waterfowl in California’s Central Valley are shallowly flooded (approximately 12 inches deep to allow waterfowl to forage) from fall to early spring.
+ 6 inches	+ 6 inches (>18 inches)	An additional six inches of water would likely preclude dabbling ducks from foraging and reduce the value of these areas to wintering waterfowl (Taft <i>et al.</i> 2002; Baschuk <i>et al.</i> 2011).

Flooding Depth Categories	Depth of Flooding	Rational
>blind height	> average blind elevation (varies by unit)	Hunters lose the ability to hunt pit blinds when water overtops blinds and fills the blind with water. Additionally, the effectiveness and access to stand-up blinds are reduced when water exceeds the floor of the blind.
>berm height	> average maximum berm elevation (varies by unit)	Potential impacts to berm integrity and water control infrastructure

Short-term impacts

6+ Inch Flooding impacts

In DU's analysis there was an observed increase in the number of days most wetland units were flooded at 6+ inches for all the South Area Properties with operation of the Big Notch Project. The average annual increase in 6+ inch flood duration (i.e. days flooded) between baseline and Big Notch scenarios was 3.2 days (range 0.1 – 8.6) for the 15 units comprising in the South Area Properties (Figure 1). The average annual change in the number of 6+ inch flood events³ affecting the South Area Properties was 0.1 (range 0.0 – 0.4) (Figure 2). In general, wetland units along the eastern half of the South Area Properties tended to experience more impacts than units along the western half. Model results show flooding duration was much greater in some years (1998, 2002, 2010, 2003), with wetland units experiencing an average 29.4 percent increase in flood duration under the Big Notch compared to the baseline (Figure 3). Similarly, flooding event counts were also much greater in some years (1998, 2008, 2004, 2006), with wetland units experiencing an average 30.9 percent increase in the number of flood events (Figure 4).

The increase in the duration and frequency of flooding resulting from operation of the Big Notch Project may impact the South Area Properties by decreasing waterfowl and other migratory bird use due to deeper water levels that would likely reduce or eliminate the ability of dabbling ducks to access food resources (Taft et al. 2002; Baldassarre and Bolen 2006; Baschuk et al. 2011). Decreasing waterfowl abundance on the properties may also result in decreasing hunting quality.

Flooding impacts >blind elevations

Under operation of the Big Notch Project, there was an observed increase in the

³ i.e. the number of times annually when flooding equals or exceed 6 inches. A single flood event may stretch for multiple days/weeks.

number of days where flooding exceeded the average blind elevation in 3 of the 15 wetland units within the South Area Properties. The average annual increase in the duration of flooding exceeding the average blind elevation was 1.0 day (range 0 – 7.1) (Figure 5). The average annual change in the number of flood events that exceed average hunt blind elevations was 0.0 (range 0 – 0.3) (Figure 6). In general, wetland units along the eastern margins of the South Area Properties tended to experience more impacts than units along the western margin. Model results show flooding duration was much greater in some years (1998, 2002, 2010, 2003), with wetland units experiencing an average 9.8 percent increase in flood duration under the Big Notch compared to the baseline (Figure 7). Similarly, flooding event counts were also greater in some years (1998, 2008, 2004, 2006), with wetland units experiencing an average 5.6 percent increase in the number of flood events (Figure 8).

In addition to the impacts described under the +6-inch flooding category, the increase in the duration and frequency of flooding that exceeds blind elevations would further decrease hunter opportunity due to flooding of hunting blinds. Hunters lose the ability to hunt sunken pit blinds when water overtops blinds and fills the blind with water. Additionally, the effectiveness and access to stand-up blinds are reduced when water height exceeds the floor of the blind.

Flooding impacts >berm elevations

Under operation of the Big Notch Project, there was an observed increase in the number of days where flooding exceeded the average berm elevation in 6 of the 15 wetland units within the South Area Properties. The average annual increase in the duration of flooding exceeding the average berm elevation was 0.6 days (range 0 – 4.5) (Figure 9). The average annual change in the number of flood events that exceed average berm elevations was 0.0 (range 0 – 0.3) (Figure 10). In general, wetland units along the eastern margins of the South Area Properties tended to experience more impacts than units along the western margin. Model results show flooding duration was much greater in some years (1998, 2002, 2010, 2003), with wetland units experiencing an average 10.1 percent increase in flood duration under the Big Notch compared to the baseline (Figure 11). Similarly, flooding event counts were also greater in some years (1998, 2008, 2004, 2006), with wetland units experiencing an average 12.0 percent increase in the number of flood events (Figure 12).

In addition to the impacts described under the +6-inch and > blind flooding categories, the increase in the duration and frequency of flooding that exceeds berm elevations could also damage wetland infrastructure (roads, levees, water control structures, lift pump stands, hunting blinds). There would be further reduction of access to the properties for management and hunting. A critical aspect of understanding the true impact of flooding events, specifically berm overtopping, that landowners experience is the additional loss of days due to loss of access while preparing for incoming high waters. These conditions often require landowners to move equipment and adjust water control structures to prepare for incoming floods.

Moreover, once water surface elevations return to normal levels, roads and other infrastructure required for access and hunting require additional days to dry, be inspected, and repaired before they can be safely used again. DU's interviews with landowners suggest that, in general, an additional 14-20 days of lost access is added to flood events.

Long-term impacts

The seasonal managed wetlands that support wintering waterfowl in California's Central Valley are shallowly flooded (approximately 12 inches deep to allow waterfowl to forage) from fall to early spring. In present day, these conditions rarely occur naturally in the highly modified landscape of California's Central Valley. Instead, managed wetlands are created and maintained through the efforts of private landowners and state and federal agencies. Generally, wetland management actions focus on the timing and depth of applied water, with mechanical disturbance used to create conditions that produce the annual plant seeds and invertebrates that waterfowl favor (Fredrickson and Taylor 1982; Euliss and Harris 1987; Baldassarre and Bolen 2006). These management actions are expensive and time-intensive and there are additional costs associated with maintaining the water management infrastructure required for seasonal wetlands. While not obligated to undertake these habitat management actions and related expenses, easement property owners are typically willing to pay these annual management costs due to the benefits they provide in waterfowl use and related hunt opportunities. These actions benefit other migratory waterbirds and wetland dependent wildlife species, including special status species such as the northwestern pond turtles (*Actinemys marmorata*), tricolored blackbird (*Agelaius tricolor*), greater sandhill crane (*Antigone canadensis*), and giant garter snake (*Thamnophis gigas*) (Gilmer et al. 1982; USFWS 2020).

If waterfowl use and hunt opportunities decline, while infrastructure and management costs rise due to increased flooding, hunt club owners may ultimately determine that costs outweigh benefits and cease operations. This is particularly true if the flooding impacts occur multiple years in a row. If a hunt club discontinues operations, the critical migratory bird and wetlands values protected by the Service's easement interest would be lost. Without incentive for private landowners to manage and flood seasonal wetlands on USFWS Conservation Easement lands, migratory bird habitat quality and availability in the Yolo Basin would suffer. This loss of habitat value could affect the waterfowl food supply and carrying capacity within the Yolo-Delta Planning Area, as calculated within the Central Valley Joint Venture Implementation Plan (2020). Such a loss would materially detract from the purposes the WMA was established under.

The effects of flooding on hunt club operations described above are expected to accumulate over time. The increase in flood frequency and duration under the Big Notch Project would incrementally increase the cost of hunt club operation and decrease hunt opportunities. The likelihood that any hunt clubs would discontinue

operations due to the incremental impacts of Big Notch operations during the 5-year term of the proposed special use permit is low. However, the likelihood is expected to increase the longer the Big Notch Project is operated unless mitigation measures that avoid or minimize impacts are implemented.

Consistency with Comprehensive Conservation Plan Goals and Objectives

The goals and objectives in the Service's 2019 Final Comprehensive Conservation Plan (CCP) for Butte Sink, Willow Creek-Lurline, and North Central Valley Wildlife Management Areas provide important context in evaluating the short- and long-term impacts of the operation of the Big Notch Project. The CCP goals and objectives represent the desired future condition for the WMA and the strategies and management actions needed to achieve this condition. They represent the management direction needed for the WMA to fulfill the mission of the Refuge System, and the specific purposes for which the refuge was established. Appendix A includes a summary of the CCP goals, objectives, and strategies for the WMA relevant to this analysis. Ultimately, the CCP management direction for the WMA is to permanently protect 30,000 acres of managed wetlands in the 11-county acquisition boundary, including 5,835 acres within Yolo County. The long-term sustainability of existing privately managed wetlands with WMA easements is essential to meeting this objective. With improvements to drainage infrastructure and access roads and berms implemented during the 5-year term of the special use permit, the privately owned waterfowl hunt clubs in the Yolo Bypass are expected to continue to operate and be sustainable as managed wetlands. As a result, the proposed use is consistent with CCP goals and objectives.

Cumulative Impacts

Several proposed projects have the potential to add to the impacts from the Big Notch Project, including but not limited to Elk Horn slough restoration project, Food for Fish program, Egbert tract tidal restoration project and several additional tidal restoration projects proposed in the southern portion of the bypass. These cumulative landscape changes, in addition to climate change and sea level rise, may modify how water flows through the Yolo Bypass. The 2024 Draft Environmental Assessment - Issuance of Special Use Permit for the Operation of The Big Notch Project at The Steve Thompson North Central Wildlife Management Area includes more detail on potential cumulative impacts and is incorporated by reference.

Public Review and Comment

This draft compatibility determination will be available for public review and comment for 30 days from July 26 to August 25, 2024. The public will be made aware

of this comment opportunity through emails to landowners and other potential interested parties, and postings on the WMA website and social media accounts. A hard copy of this document will be posted at the Refuge Headquarters and Visitor Center (752 County Road 99W, Willows, CA 95988). It will be made available electronically on the refuge website: <https://www.fws.gov/refuge/steve-thompson-north-central-valley-wildlife-management-area>. Concerns expressed during the public comment period will be addressed in the final document.

Determination

Is the use compatible?

Yes

Stipulations Necessary to Ensure Compatibility

Based on the comparison between baseline conditions and those modeled for the Big Notch Project, it's clear that mitigation measures are needed to maintain access, facilitate efficient drainage of flood waters, and protect existing water management and hunting infrastructure for properties to continue to be managed as wetlands and utilized as waterfowl hunting clubs. These measures ensure that the USFWS interest in these properties as migratory bird habitat continues after the long-term implementation and operation of the Big Notch Project.

The Special Use Permit for the Big Notch Project flowage easements will include the following stipulations as enforceable requirements:

1. Limit the term of the use authorized by the permit to 5 years to minimize the likelihood that short-term impacts experienced during any flood years would have substantial long-term adverse effects on the sustainability of existing privately managed wetlands with USFWS Conservation Easements.
2. During the special use permit term, Reclamation and DWR will implement mitigation actions described below to minimize the impacts of increased flooding resulting from the Big Notch Project to the South Area Properties. Due to the limitations of the model used to assess impacts and the inherent uncertainties in modeling, it is difficult to prioritize and complete mitigation projects prior to initiation of the project. However, during the initial operation of the Project, specific impacts will be identified, allowing for the design and implementation of actions to minimize impacts to preserve the sustainability of existing privately managed wetlands. Mitigation measure will include:
 - a. Improvement of drainage infrastructure (water control structures, ditches) to increase the speed at which water elevations in wetland units can be returned to desired management conditions after flood events. Drainage should be addressed for the South Area Properties as a group

to ensure flood water can move off properties as quickly as possible. This benefits the landowners by reducing impacts to bird use, hunting quality, and safe access, while ensuring anadromous fish will be able to safely move off these properties as flooding recedes.

- b. Improvements to access roads and berms to support winter access and more predictable road conditions.
3. Due to the uncertainty surrounding model simulations as well and climate change in the operations of the Project, the effects of the Big Notch Project will be monitored on an annual basis and reviewed within 5 years. The focus of the monitoring will be on how increased flooding impacts wetland units and modify habitat conditions in novel ways through changes in vegetation communities.

Justification

The stipulations outlined above included as conditions of the permit would ensure that this use is compatible with the purposes of Steve Thompson North Central Valley WMA. The Service proposes to issue a shorter-term (5-year) special use permit and reevaluate the use within 5 years. By limiting the term of the permit to 5 years, the accumulation of potential flooding impacts will be limited. In addition, the Service will have the benefit of improved modeling and the monitoring needed to further formulate and implement effective mitigation strategies.

The operation of the Big Notch Project would also contribute the fulfillment of the National Wildlife Refuge System mission. It would directly benefit ESA-listed anadromous fish species which are a trust resource for the Fish and Wildlife Service. In addition, implementation of the project is required as part of the Endangered Species Act compliance for the Long-Term Operations of the Central Valley Project and State Water Project (NMFS 2009). The Central Valley Project is the primary water supply for several national wildlife refuges in the Central Valley and maintenance of this water supply is essential for the long-term sustainability of these refuges.

Based on available science and best professional judgement, the Service has determined that implementation of Big Notch Project flowage easements on Steve Thompson North Central Valley WMA, in accordance with the stipulations provided here, would not materially interfere with, or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Steve Thompson North Central Valley WMA.

Signature of Determination

Refuge Manager Signature and Date

Signature of Concurrence

Assistant Regional Director Signature and Date

Mandatory Reevaluation Date

2029

Literature Cited/References

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Figure(s)



Figure 1. Averaged annual difference of 6+ inch flood duration between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific days are presented, followed by standard deviation values. Shading corresponds to values.



Figure 2. Averaged annual difference of 6+ inch flood event count between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific values are presented, followed by standard deviation values. Shading corresponds to values.

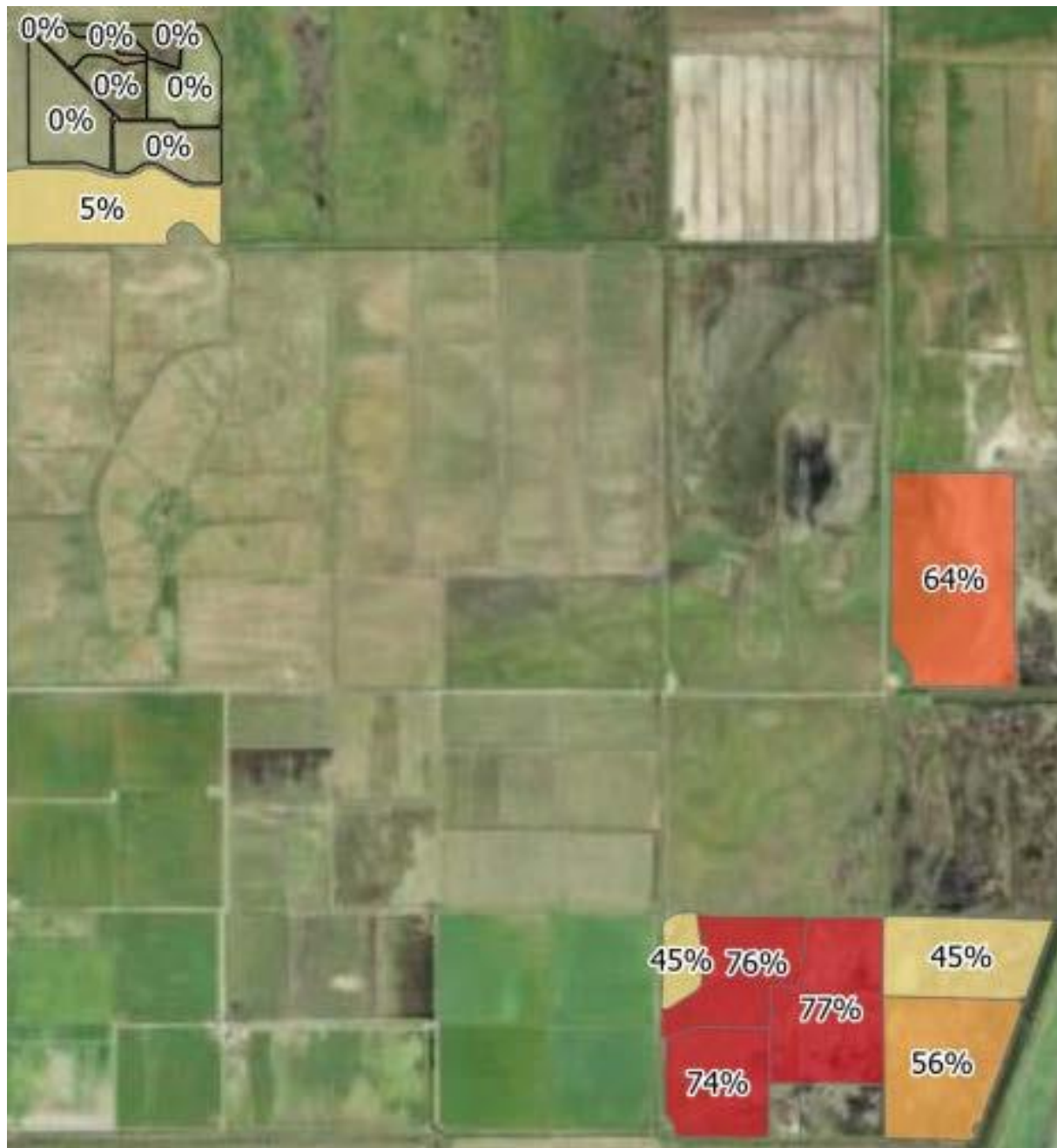


Figure 3. Proportional increase in +6 inch flood duration over baseline conditions attributable to the big notch under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in duration between baseline and Big Notch scenarios. Values are presented for each wetland unit in the South Area. Shading corresponds to values.



Figure 4. Proportional increase in +6 inch flood event count over baseline conditions attributable to the Big Notch Project under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in flood events between baseline and Big Notch scenarios. Values are presented by wetland unit in the South Area. Shading corresponds to values.



Figure 5. Averaged annual difference of >blind height flood duration between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific days are presented, followed by standard deviation values. Shading corresponds to values.



Figure 6. Averaged annual difference of >blind height flood event count between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific values are presented, followed by standard deviation values. Shading corresponds to values.



Figure 7. Proportional increase in >blind height flood duration over baseline conditions attributable to the Big Notch under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in duration between baseline and big notch scenarios. Values are presented by wetland unit in the South Area. Shading corresponds to values.



Figure 8. Proportional increase in >blind height flood event count over baseline conditions attributable to the Big Notch Project under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in flood events between baseline and big notch scenarios. Values are presented for each wetland unit in the South Area. Shading corresponds to values.



Figure 9. Averaged annual difference of >berm height flood duration between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific days are presented, followed by standard deviation values. Shading corresponds to values.



Figure 10. Averaged annual difference of >berm height flood event count between baseline and Big Notch scenarios, for wetland units in the South Area. Unit specific values are presented, followed by standard deviation values. Shading corresponds to values.

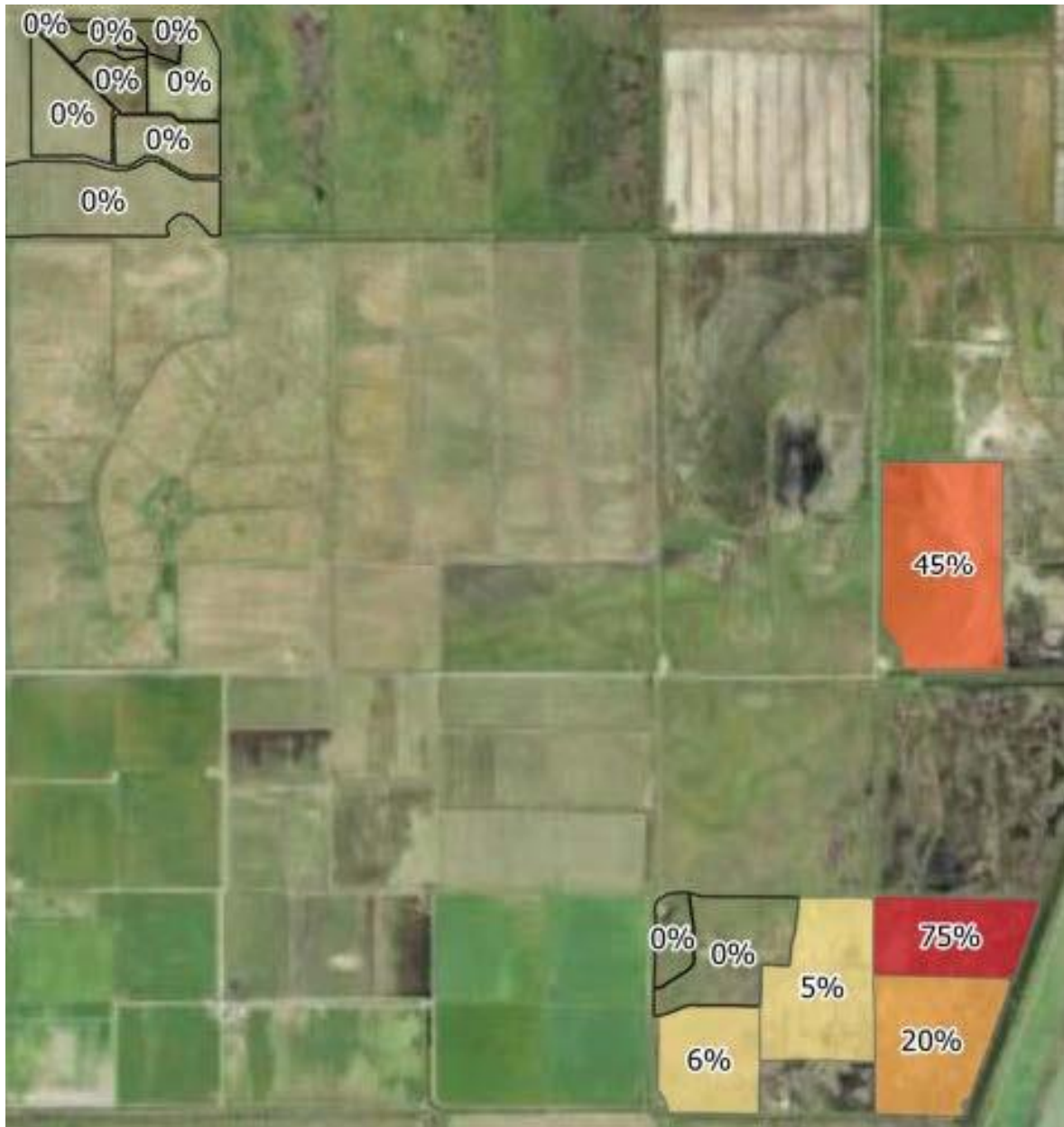


Figure 11. Proportional increase in >berm height flood duration over baseline conditions attributable to the Big Notch under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in duration between baseline and big notch scenarios. Values are presented by wetland unit in the Central Area. Shading corresponds to values.



Figure 12. Proportional increase in >berm height flood event count over baseline conditions attributable to the Big Notch under maximum impact years. Maximum impact water years defined as the four years which had the largest cumulative difference in duration between baseline and Big Notch scenarios. Values are presented by wetland unit in the Central Area. Shading corresponds to values.

Appendix 1

History of Establishment of Steve Thompson North Central Valley Wildlife Management Area (WMA)

As of 1970, only 5 percent of historic wetlands remained in the Central Valley of California and 60 percent of these were privately owned (CVHJV 1990). Given the importance of these remaining wetlands to waterfowl, the Service developed the Concept Plan for Waterfowl Wintering Habitat Preservation in 1977 (USFWS 1978). This document recognized conservation easements as an effective tool for protecting private wetlands in perpetuity in a timely and cost-efficient manner. In addition, conservation easements were looked upon favorably as they maintained lands in private ownership and landowners retained responsibility for State and local property taxes. The Concept Plan ultimately led to the establishment of the Wildlife Management Areas, which focused on protecting private wetlands with perpetual conservation easements.

The Steve Thompson North Central Valley Wildlife Management Area (WMA) was established to help meet the habitat protection and restoration goals of the 1990 Central Valley Habitat Joint Venture Implementation Plan and ultimately the waterfowl population goals of the North American Waterfowl Management Plan. In the establishment of the North Central Valley WMA, conservation easements were recognized as an effective tool for protecting private wetlands in perpetuity, maintaining land in private ownership, and meeting Service habitat objectives in a timely and cost-efficient manner. In 1991, the authorized easement acquisition objective for the North Central Valley WMA was 48,750 acres, of which approximately 14,707 acres have been acquired, leaving a remaining balance of 34,043 acres to be acquired.

The 1990 Central Valley Habitat Joint Venture (Joint Venture) Implementation Plan set an overall objective of protecting 80,000 acres of privately owned wetlands through acquisition of fee-title or perpetual conservation easements (CVHJV 1990). This represented 67 percent of the remaining unprotected wetlands in the Central Valley at the time. Within the Yolo Basin, the Joint Venture protection objective was 5,000 acres. The 2006 Joint Venture Implementation plan set a revised objective to protect all unprotected seasonal wetlands in the Central Valley (CVJV 2006). In 2020, the Joint Venture released an updated Implementation Plan which set an objective to increase the managed seasonal wetlands in the combined Yolo-Delta region from 22,000 acres to 40,000 acres (CVJV 2020).

Acquisition and Administration of WMA Easement Programs

The Service's policy is to work only with willing sellers. When purchasing conservation easements, the Service acquires the development rights and necessary water resources to protect waterfowl and migratory bird habitat in perpetuity. In all

cases, the terms of a conservation easement must be mutually agreed upon by the landowner and the Service.

Once the conservation easement is purchased, the landowners maintain a number of rights, including trespass, grazing, wetland management, hunting, and other undeveloped recreation. Landowners are not required to flood or manage their easement wetlands, however, the Service reserves the right, but not the obligation, to flood them at government cost. Accordingly, an appropriate amount of water (e.g., “easement waters”) to flood the easement wetlands to historic fall and winter levels must be maintained with the land. Service conservation easements are binding in perpetuity; the landowner reserves the right to sell or bequeath the property, but the easement and its associated restrictions remain with the property in perpetuity.

Comprehensive Conservation Plan Goals and Objectives

The Service completed the Final Comprehensive Conservation Plan (CCP) for Butte Sink, Willow Creek-Lurline, and North Central Valley Wildlife Management Areas (WMA) in 2019. The CCP goals and objectives represent the desired future condition for the WMA and the management actions needed to achieve this condition. They represent the Service’s management direction for the WMA to fulfill the mission of the Refuge System, as well as the specific purposes for which the refuge was established. Below are the goals, objectives, and strategies that are relevant to the WMA easements that are the subject of this compatibility determination.

GOAL 1: Land Protection: Protect wetlands, wetland-associated uplands and riparian habitats, and productive agricultural lands to support an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, songbirds, and other wetland-dependent species in the Central Valley.

Objective 1.2: Easement – North Central Valley WMA Wetland Easement Acquisition. Acquire 15,000 acres of conservation easements from willing sellers in North Central Valley WMA to protect existing wetlands and restored future wetlands to help meet the habitat restoration and protection objectives of the CVJV Implementation Plan (CVJV 2006) and support the waterfowl population goals of the North American Waterfowl Management Plan (USFWS et al., 1986, 2012).

Objective 1.4: Easement – Land Protection Partnership. Work cooperatively to help partners restore and protect wetlands and protect important agricultural lands within the North Central Valley WMA to help meet the habitat restoration and protection objectives of the CVJV Implementation Plan (CVJV 2006) and support the waterfowl population goals of the North American Waterfowl Management Plan (USFWS et al., 1986, 2012).

Strategy 1.4.4. Coordinate with CVJV partners and others to protect important wetlands and agricultural lands.

Table 4. Wetland easement acreage objectives for counties within Steve Thompson North Central Valley Wildlife Management Area (USFWS 2019)

County	Existing WMA Easements (acres)	Remaining Wetland Easement Acquisition Objective (acres)
Butte	6,028	4,509
Colusa	1,255	863
Glenn	1,174	428
Placer	0	1,917
Sutter	1,993	3,687
Yuba	0	2,392
Yolo	4,631	1,204
TOTAL	15,081	15,000

Importance of Yolo Basin to Waterfowl

Approximately 90 percent of California’s Central Valley seasonal and floodplain wetlands have been destroyed or modified by agricultural conversion, development, and flood control efforts (Mitsch and Gosselink 2007; Frayer et al. 1989; Hanak et al. 2011). As a result, many wetlands dependent species have suffered population declines, including waterfowl – which have declined from 50 million historically to 6 million currently – and native freshwater and pelagic fish species (Mount 1995; Reid and Heitmeyer 1995; Sommer et al. 2007). Waterfowl populations are most abundant within the Central Valley in winter, and primarily rely on seasonal wetlands and flooded rice agriculture to access the food resources required to survive winter (CVJV 2020). The Yolo Basin contains 11,554 acres of seasonal wetlands and up to 13,500 acres of winter flooded rice, which combined provide enough food resource to support approximately 3 million duck energy days between fall and spring. The 15,081 acres of managed seasonal wetlands protected with WMA easements comprise approximately 35 percent of all the seasonal wetlands present in the Yolo Basin and are expected to support over 350,000 duck energy days over winter.

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