DRAFT ENVIRONMENTAL ASSESSMENT

Restoring the hydrology of the Williamson River and adjacent wetlands on Klamath Marsh National Wildlife Refuge

National Environmental Policy Act
(Legal Mandate under which Action Will be Carried Out)

U.S. Fish and Wildlife Service
Klamath Marsh National Wildlife Refuge
Chiloquin, OR 97624

May 30, 2013

Section I: PURPOSE AND NEED FOR ACTION

Background

The 41,230 acre Klamath Marsh National Wildlife Refuge (KMNWR) is one of 6 refuges of the Klamath Basin National Wildlife Refuge Complex located in south central Oregon and northern California (Fig. 1). KMNWR is located on the eastern slope of the Cascades, approximately 50 miles north of Klamath Falls and is bordered by the Winema-Fremont National Forest and privately owned agricultural grasslands. KMNWR was established in 1958 when approximately 16,400 acres were purchased with Federal Duck Stamp Funds. Additional lands were acquired in subsequent years bringing the refuge to its current acreage and configuration. Originally designated as *Klamath Forest National Wildlife Refuge*, the Refuge was recently renamed, as virtually all of the historic Klamath Marsh now lies within Refuge boundaries.

Similar to many western valleys, early farmers and ranchers at Klamath Marsh drained marsh lands to facilitate haying and livestock grazing during the spring and summer months. In the early 1900s, the Williamson River (within the Refuge boundary) was diverted into multiple ditches and levee systems. These canals and levee systems have lowered the local water surface elevations of the Williamson River and affiliated groundwater tables, thus reducing marsh water storage and the extent of areas that are seasonally and permanently flooded. These alterations have likely affected many native species, including redband trout, Klamath largescale sucker, Miller Lake lamprey, and wetland/riparian dependent bird and amphibian species. Water control structures and ditch diversions have directly affected aquatic organisms such as trout by blocking migration pathways, altering natural river flows, and modifying the river channel morphology.

Current marsh habitat provides important nesting, feeding, and resting habitat for waterfowl, while the surrounding meadowlands are attractive nesting and feeding areas for sandhill crane, yellow rail, and various shorebirds and raptors. The adjacent pine forests also support diverse wildlife including great gray owl and Rocky Mountain elk. KMNWR protects one of the largest and most pristine high elevation marshes in the Intermountain West, comprising a contiguous block of 35,000 wetland acres. The remote and diverse habitat provides important habitat for over 250 species of resident wildlife and migratory birds on the Pacific Flyway. Situated in the headwaters of the Upper Klamath Watershed, KMNWR wetlands also play a key role in affecting the water quality and quantity of the Upper Klamath Basin by attenuating water flows and modifying water chemistry.

Under the National Wildlife Refuge System Improvement Act (NWRSIA) of 1997, a Comprehensive Conservation Plan (CCP) was finalized for KMNWR in 2010. The CCP emphasized the need to preserve, restore, and enhance the natural hydrology and biological integrity of Klamath Marsh and the associated uplands as habitat for migratory birds and other indigenous wildlife. More specifically, Goal 2 (Riverine and Spring Riparian Habitats) of the CCP seeks to, *Restore the historic form and function of riverine and riparian systems to benefit native fish and wildlife, including redband trout, Oregon spotted frog, and migratory birds.* The CCP also directs that an environmental assessment and alternatives be developed for restoring the Williamson River and associated floodplain riparian, wetland, and sedge meadow areas. This

Environmental Assessment (EA) provides an analysis of potential impacts of the proposed Williamson River Restoration Project on resources on and surrounding KMNWR.

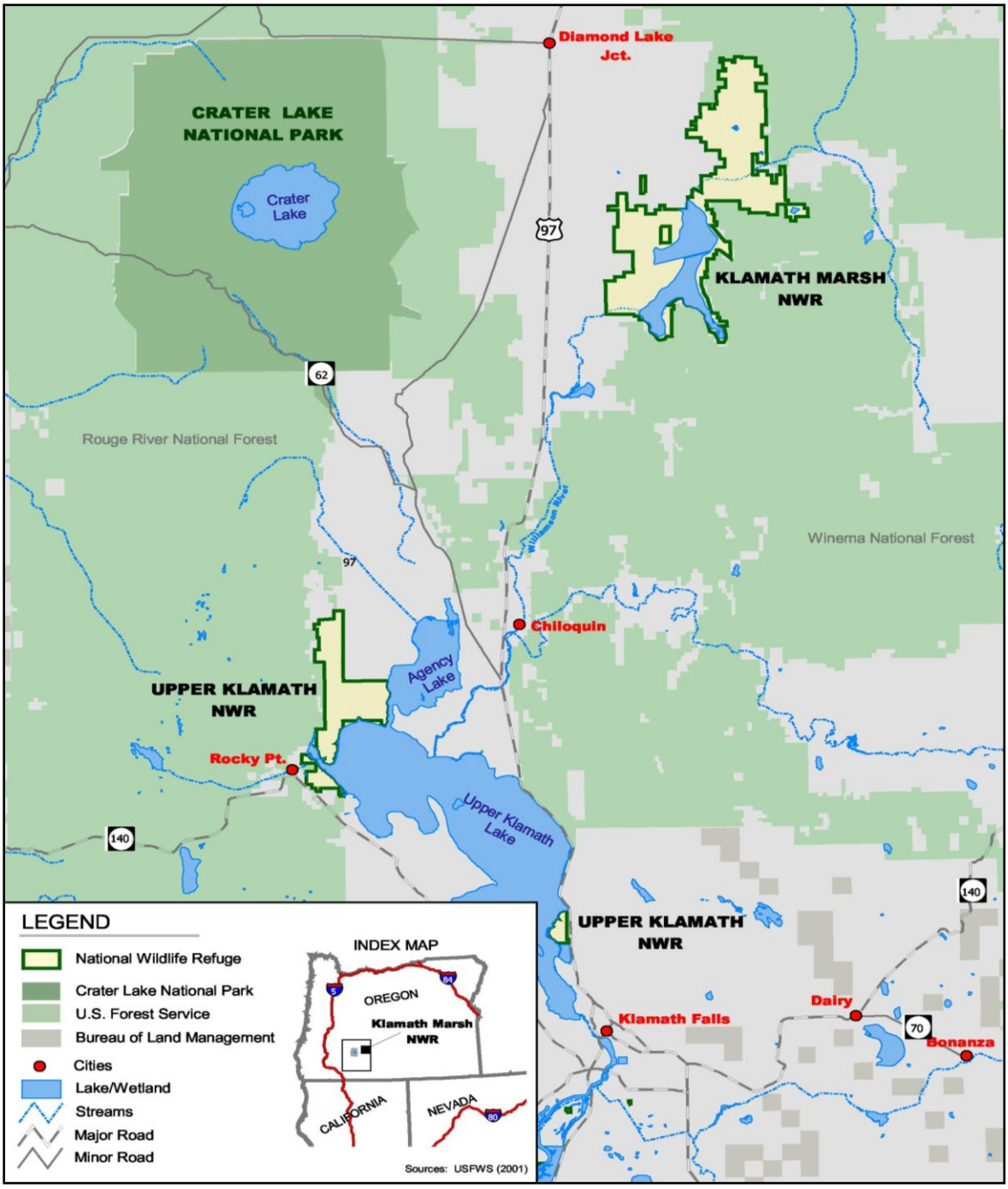

Fig.1. Location of Klamath Marsh National Wildlife Refuge.

A. Why is action being considered?

The Williamson River enters KMNWR at the east central portion of the Refuge near milepost 17 on the Silver Lake Highway (See Fig. 2). Prior to refuge establishment, the Williamson River on the Refuge was channelized and diverted for the irrigation of lands for livestock grazing and hay production. Construction of levees, ditches and water control structures allowed for the draining of vast marshes and the redirection of the waters of the Williamson River to bypass the floodplain via canals. As needed for irrigation, waters within this canal system were blocked to allow diversion of irrigation water to specific fields. Since the refuge acquired these lands in 1987, the land has been managed using the existing infrastructure of ditches and water control structures to provide water for wetlands in leveed tracts and low lying areas.

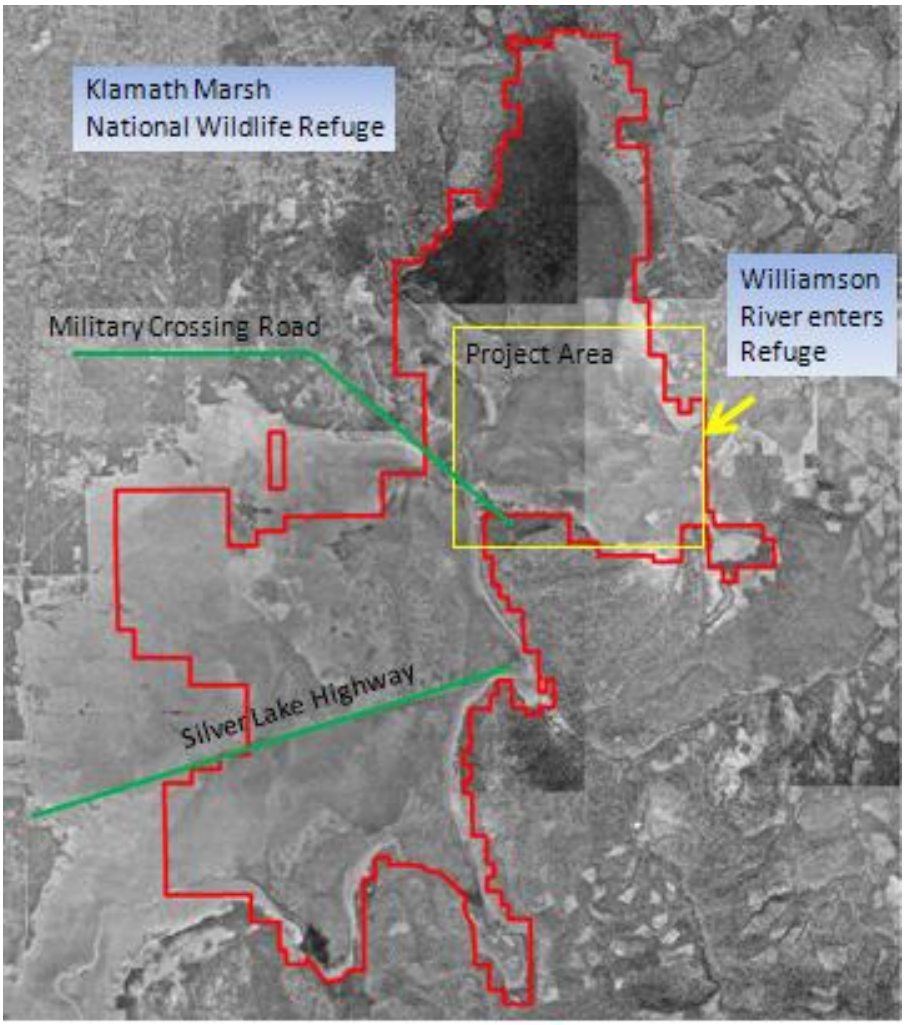

Fig. 2. Klamath Marsh NWR showing project area.

The USFWS proposes to restore the hydrology of the Williamson River and reconnect this hydrology to adjacent wetlands and riparian habitats in the project area depicted in Fig. 2. Specifically, the existing canals and water control structures block fish passage between Klamath Marsh and the Upper Williamson River at 11 locations and likely divert fish into fields during periods of irrigation. In addition, the natural overflow and subsurface water movement is compromised by existing infrastructure. Currently, artificial diversion of water is required to maintain wetland habitats, and because of the depth and straightness of the ditches, water tends to move downstream much faster than historically occurred, effecting thousands of acres of wetland habitats. Marsh hydrology is controlled through the management of water control structures, incised drains, and split flows. Overbank flow during flood events is prevented by 20 miles of levees, thus eliminating nutrients from upstream being distributed over the floodplain. The linear drains that extend in stretches of 5 miles prevent natural processes of sediment deposition that occur in natural meandering channels. The existing irrigation infrastructure limits the hydrology of the floodplain from functioning to support vegetation communities which benefit fish and wildlife.

The proposed restoration actions on Klamath Marsh are focused on sustainable solutions based on the current hydrology and hydrologic trends in the watershed. Numerous studies on the hydrology of the marsh and surrounding watershed have been described in reports by (Cummings and Melady 2002, Mayer and Naman 2011, U.S. Fish and Wildlife Service 2010, Appendix O). The project is designed to restore 10,000 acres of a unique river and marsh ecosystem that is one of the largest and most pristine high-elevation marshes in the Intermountain west.

B. How does the action relate to Service objectives?

The mission of the National Wildlife Refuge System is ”to administer a national network of lands and waters for the conservation, management and restoration of the fish, wildlife, and plant resources and their habitats within the U.S. for the benefit of present and future generations of Americans” (NWRSIA of 1997).

The National Wildlife Refuge goals include the following:

a. Conserve a diversity of fish, wildlife, and plants and their habitats including species that are endangered, or threatened with becoming endangered.
b. Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that are strategically distributed and managed to meet important life history needs of these species across their ranges.
c. Conserve those ecosystems; plant communities; wetlands of national or international significance; and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
d. Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation)
e. Foster understanding and instill appreciation of the diversity and interconnectedness of

fish, wildlife, and plants and their habitats

C. What is the action supposed to accomplish?

Alternatives to address restoration of the Williamson River have been proposed and evaluated by numerous groups since 1999, and described in various documents including, among others, the Klamath Marsh National Wildlife Refuge Wildlife and Habitat Review (2004), the Upper Williamson River Watershed Assessment (2005), and the Klamath Marsh National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment (CCP) (2010). The above documents all provided the following restoration recommendations for Klamath Marsh: 1) restore connectivity of the stream channel and floodplains, 2) restore effective geomorphic processes in the stream channel, and 3) restore migratory pathways for native fish.

Implementation of the Williamson River Restoration Project is designed to meet the following goals:

a. Restore the hydrology of KMNWR to increase both the frequency and duration of floodplain inundation from bankfull overflow thereby reconnecting riverine, wetland, and riparian habitat complexes with the floodplain.

b. Improve habitats for resident fish and wildlife and migratory species with an emphasis on sensitive species such as yellow rails, Oregon spotted frog, redband trout, and sandhill cranes.

c. Remove barriers to fish passage.

D. Identify issues not discussed in A, B, or C.

a. Rights of the Klamath Tribes: In the State of Oregon's Final Order of Determination for water rights in the Upper Klamath Basin, the Klamath Tribes were determined to have a water right to maintain minimum water levels in Klamath Marsh. The purpose of this water right is to establish and maintain a healthy and productive habitat to preserve and protect the tribe's hunting, fishing, trapping and gathering rights on former reservation lands, of which KMNWR is a part. With a "time immemorial" priority date, the Klamath Tribes have the senior water right on KMNWR. Close coordination and consultation with the Klamath Tribes will be required to ensure that the proposed project does not infringe on these water rights.

In addition to water rights, the Klamath Tribes also have subsistence right to hunt, fish, trap, and gather on the Klamath Marsh. Again, close coordination with the Tribes will be necessary to ensure that implementation of the proposed project does not infringe on these rights.

b. **Environmental and other compliance issues:** Klamath Marsh represents a

large portion of the Klamath Tribe's ancestral homeland. As such, it contains significant cultural resource sites. Areas on KMNWR where soil disturbing activities are planned will be surveyed for cultural resources. The areas known to exist with cultural resources will be excluded from earth disturbing activities. The USFWS Cultural Resources Division will work the Klamath Tribes Cultural Resource Department to review cultural resource concerns.

The Oregon spotted frog is currently under consideration for listing under the Endangered Species Act and is thus considered a candidate species. Under Service policy, KMNWR must consult with the Service's Ecological Services branch to ensure that this "candidate" species is not harmed as part of the proposed action. There are no other species known to exist on KMNWR that are currently listed.

Because of the large amount of material potentially moved under the proposed action, in a largely wetland and riverine setting, the Refuge will need to obtain permits under the Clean Water Act through the U.S. Army Corp of Engineers. A permit for blasting will also be needed from Oregon Department of Fish and Wildlife.

c. Private water rights: Currently a private landowner on the northern edge of the project area has a water right and specified diversion point on the Williamson River. The Service will work with this landowner to ensure that this water right is protected during and after project completion.

d. **Blasting as an excavation technique:** All action alternatives, B, C, and D, in this EA anticipate the use of explosives to excavate channels and wetlands, particularly in areas either unsuitable or uneconomical to use traditional earth moving equipment. Only trained and certified individuals will be associated with this activity and the public as well as uncertified Service employees will not be allowed in blasting areas.

e. **Relocation of powerline:** A five mile long powerline exists on the east-west levee along the Kirk Ditch, which bisects the project area. The levee supporting the powerline and adjacent drain interfere with the natural marsh hydrology. To restore marsh and riverine hydrology, removal or modification of the levee may be required. Discussions with Midstate Electric Power Company indicate that this powerline could be relocated, either above or below ground as part of the proposed project.

f. **Alteration of the current refuge haying program:** Currently portions of the proposed project area are hayed to produce short stature vegetation for spring migrant and resident waterbird species. In addition to providing benefits to wildlife, haying is also profitable to local ranchers. The extent and/or location of this activity will likely be modified under the proposed action consistent with the Service's Compatibility Policy (603 FW 2).

g. **Sedimentation/erosion:** The potential for movement of sediments in newly constructed channels and wetlands is likely, especially in the first several years of the project before vegetation can become established on newly exposed soils.

E. Identify the decision to be made by the responsible official.

The Klamath Basin National Wildlife Refuge Complex Project Leader will decide, after evaluating potential impacts of the alternatives, consultation with the Klamath Tribes, and public comment, which alternative will best achieve the goals of the proposed action. The Project Leader will also determine based on the analysis herein and public comment, whether implementation of the preferred alternative will result in significant impacts to the human and natural environment, thereby, requiring preparation of an Environmental Impact Statement.

Section II: DESCRIPTION OF ALTERNATIVES

At issue for this project is the specific channel type to be designed for restoration of the Williamson River and its associated flood plain wetlands. Channel type considerations and options for Klamath Marsh include a combination of channel types defined according to the Rosgen classification key for rivers (Rosgen, 1996). These include a single-thread C4/5c or E4/5 channel, or an anastomosed (braided) DA4/5 channel. The gradient of the floodplain over 24,700 feet is 0.00024 (slope less than 0.003%). This flat site is low risk relative to flooding or failure making all the above channel types feasible options. However, there are additional considerations including specific reach limitations, adjacent land ownership, and upstream limitations.

There are four alternatives evaluated as part of this draft environmental assessment including:

Alternative A: No Action – continue water management of the refuge with existing infrastructure.

Alternative B: Single thread and anastomose channel with wetland enhancement (preferred alternative)

Alternative C: Single thread channel with wetland enhancement

Alternative D: Anastomose channel only with wetland enhancement

<u>Activities/issues common to all alternatives</u> (except the No Action Alternative)

***Construction methods*:** For all earth moving activities, a combination of traditional excavation and blasting with explosives would be used for creation of channels and ponds/wetlands. The technique of blasting has been used for numerous restoration projects throughout the country due to lower costs, time savings, and efficiency. In the KMNWR project area, there are challenges using heavy equipment in the boggy conditions, or where the groundwater lies at or near the surface. In areas of unconsolidated wet soils, it is the only construction method available. Although amphibious machines can access most sites, the loose materials cannot be removed efficiently through excavation.

To test the utility of blasting, a series of small pilot projects were completed in 2010. The technique was found to be a very efficient method of creating open water while matching specified design dimensions for both channels and wetlands. Soils were spread 300 feet from the blast site eliminating the need to haul spoils. The edge of the blast area typically has a loose berm of soil which can be compacted with an amphibious tracked machine. Blasting would only be used in remote areas distant from boundary areas with homes and would not be used near areas of cultural concern.

Fig. 3. A blasted channel segment shown 10 months after blast.

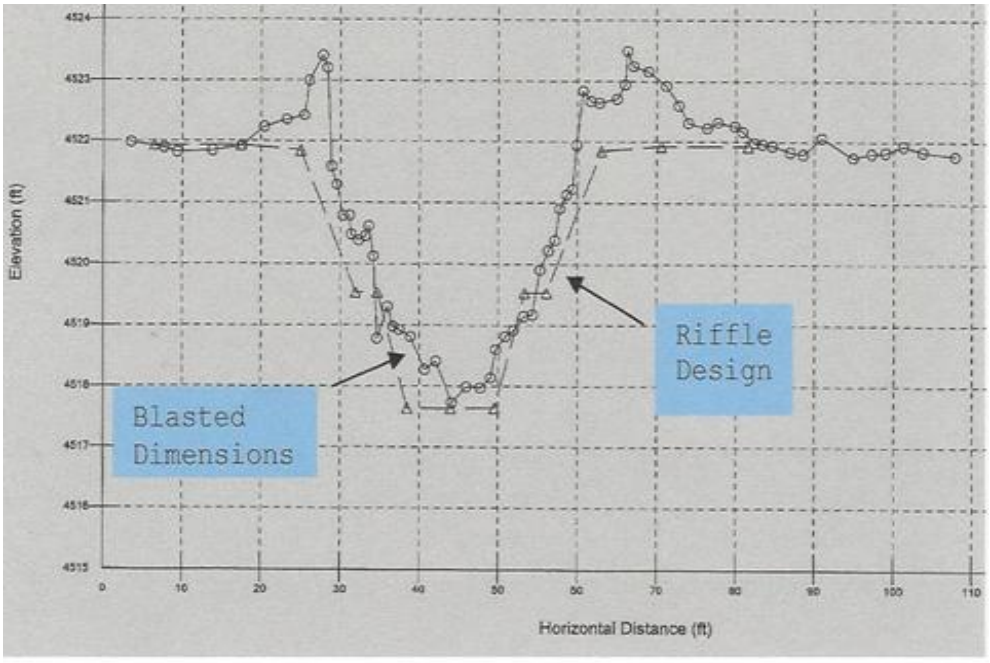

Fig. 4. As-built blasted riffle cross-section compared to designed cross-section constructed during constructability trials at KMNWR in 2012, a typical for the proposed channel.

Removal of Fish Barriers: All action alternatives, B-C, will result in the removal of

eleven water control structures which act as fish barriers to the habitat upstream in the Williamson River.

Fig. 5. Two of eleven water control structures that would be removed in Alternatives B-D currently creating fish barriers.

Private irrigation diversions: A single private irrigation diversion on the Williamson River exists in the project area. All alternatives will provide for continuation of this legally recognized diversion. The Service will provide fish screens for this diversion to prevent the entrainment of fish in irrigation water.

Effectiveness monitoring: Monitoring of pre and post project conditions will occur under whichever alternative is ultimately selected. Monitoring will include, ground and surface water hydrology, native fish and wilfle species, including sensitive species, the yellow rail and Oregon spotted frog. A population of the Oregon spotted frog, a candidate for federal listing under the ESA, inhabits the KMNWR project area. Research to study the re-colonization of new wetlands by this species would be conducted by the U.S. Geological Survey (USGS).

Removal of Kirk Ditch powerline: Under all action alternatives, the six mile long Kirk Ditch powerline would be relocated to the south edge of Klamath Marsh.

Cholo branch maintained: Upstream of the refuge, the Cholo Branch of the Williamson River is diverted south and enters the Refuge approximately ½ mile south of the Williamson River. Under all alternatives, this branch would be maintained and a series of flow through wetlands constructed. These wetlands would be designed to allow for fish passage while providing for the needs of wetland dependent wildlife species.

Haying: Continued haying in the project area would continue subject to the Service's Compatibility Policy (603 FW 2). One of the benefits of the project is to demonstrate that traditional sedge meadow haying sites can be sub-irrigated using the natural hydrology of properly functioning adjacent streams rather than the traditional methods of blocking streams and diverting surface water. Because of the expense and difficulties of keeping livestock out of the newly constructed channels and associated riparian areas, it is unlikely that livestock will be used in the project area.

Alternative A. No Action – continue wetland management using existing infrastructure

Under the No Action Alternative, Refuge staff would continue to utilize the existing infrastructure of canals, drains, and water control structures to divert water to irrigate wetlands for hay production and native marsh habitats (9,000 total acres) (Figs.5 and 6). The refuge would continue to expend funding and manpower to maintain this infrastructure. Significant additional funds would be required in the future to upgrade diversion structures to allow for fish passage. In addition, screening will be required in the future to prevent fish from being diverted from canals during irrigation periods. The Kirk Ditch powerline would be maintained, and limited, if any riparian vegetation would be planted along canals as debris from brush and trees tends to plug water control structures. A more detailed description of how water is managed via the current water control infrastructure can be found in the KMNWR CCP (U.S. Fish and Wildlife Service 2010).

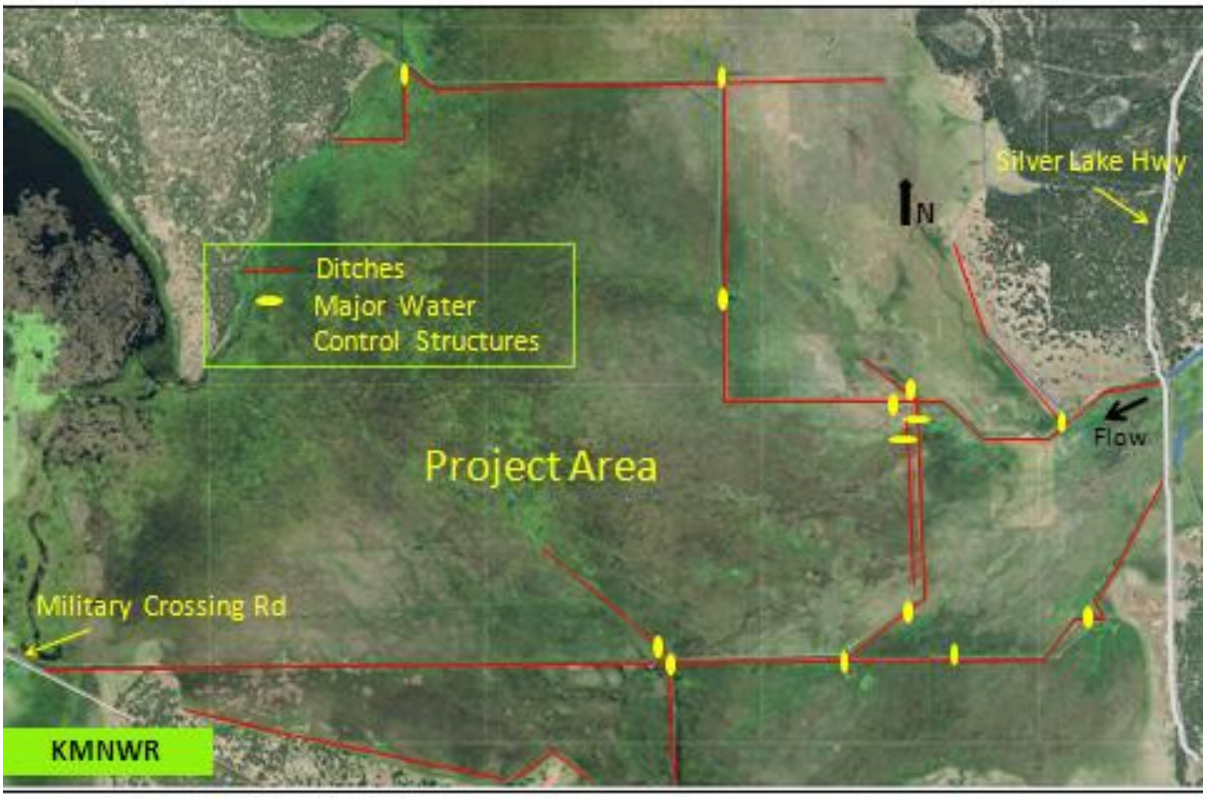

Fig. 6. Location of major canals and water control structures in the project area, Alternative A.

Alternative B (Preferred) - Combination Single-Thread and Anastomose Channel

Beginning where the Williamson River enters the Refuge, a 3.0 mile sinuous channel would be constructed (Fig. 8) that merges into a series of existing anastomose (braided) channels (Fig. 7) some of which extend as far as Military Crossing Road. The main 3.0 mile channel would be constructed using a combination of excavators and blasting (Fig. 4). The constructed stream channel would be of Stream Type C4/5 and Type E4/5 (Rosgen 1996) having a mean riffle width of 38 feet and a mean depth of 2.7 feet. Mean pool width would be 42 feet by 2.9 feet deep (mean).

Existing drains and levees would be converted into complexes of depressional wetlands and ponds. Eleven water control structures acting as fish barriers would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. In-stream woody habitat structures would be placed in the 3.0 mile channel to provide cover, shade, and macro-invertebrate habitat. Constructed streambanks would be planted with willows and other riparian species. Additional activities include the installation of a fish screen to prevent entrainment of fish in a private irrigation diversion on the north side of the project.

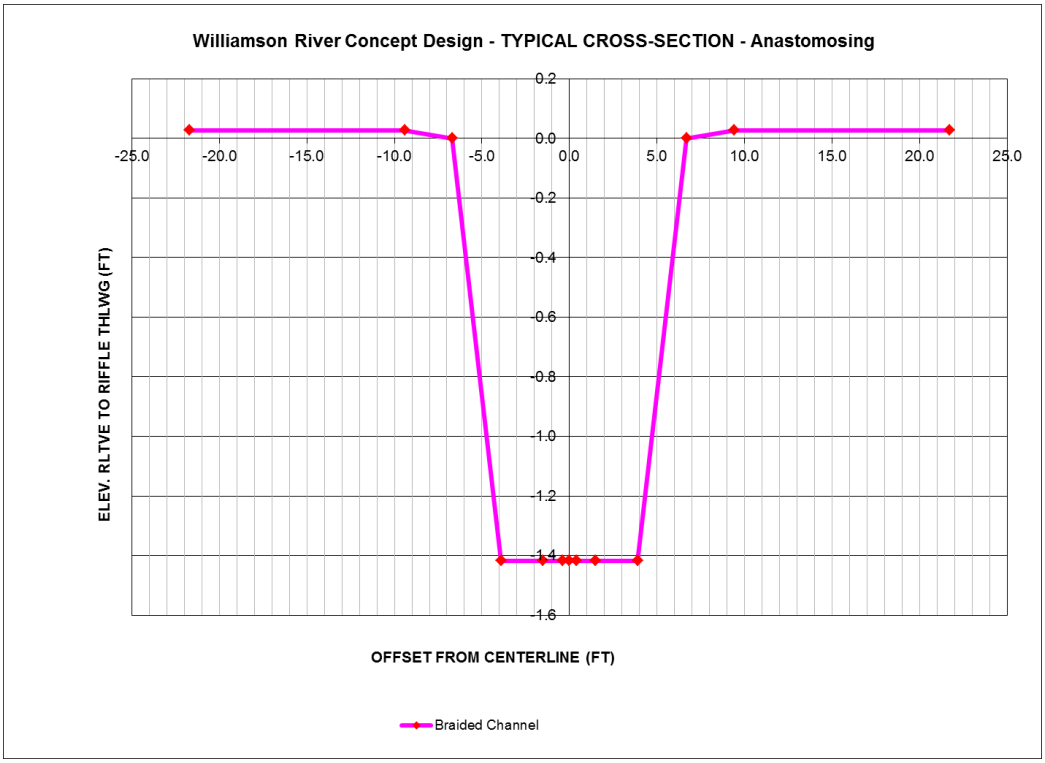

Fig. 7. Typical cross-section of the anastomosing channel of the Williamson River concept design.

Alternative C - Single-Thread Channel Only

Beginning where the Williamson River enters the Refuge, a 10 mile sinuous channel would be constructed that would extend to Military Crossing Road (Fig. 8). The dimension of this channel would be identical to Alternative B (Fig. 4). Woody structure would be added in the first 3.0 miles of the restored channel. Existing drains and levees would be converted into complexes of depressional wetlands and ponds. Eleven fish barriers would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. Instream habitat structures (wood) would be placed to provide cover, shade, and macro-invertebrate habitat. Riparian areas would be planted with willows and other riparian species. Additional activities include the installation of a fish screen for a diversion from the Williamson River to a private irrigator, and relocating the Kirk Ditch powerline that currently bisects the marsh to the forest boundary south of the project area.

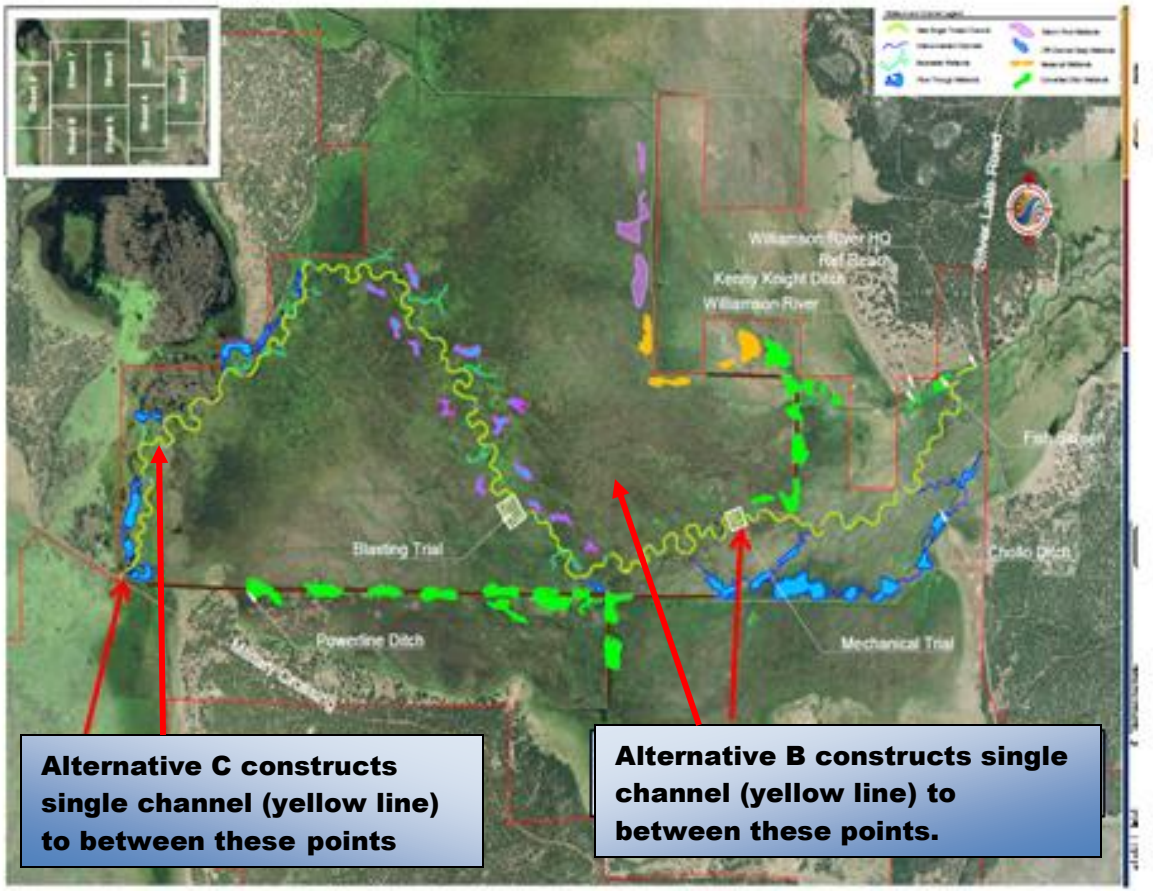

Fig. 8. Comparison of the extent of the single channel under Alternatives B and C. Constructed wetlands (multiple colored ponds) are the same for both alternatives

Alternative D - Anastomose (braided) Channel Only

Beginning where the Williamson River enters the Refuge, anastomose or braided channels would be constructed or reactivated that would extend to Military Crossing Road (Fig. 9). These channels would correspond to Rosgen (1996) type DA 4/5 channels having a maximum depth of 2.0 feet (Fig.7). Existing drains and levees would be converted into complexes of depressional wetlands and ponds. The conversion of existing canals and drains into wetlands would be done without impeding surface water flow which could affect the natural formation of anastomose channels. Eleven fish barriers would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. No riparian plantings would be made under this alternative due to the likelihood that the shallow channels would relocate during high flows. Additional activities include the installation of a fish screen for a diversion from the Williamson River to a private irrigator, and relocating a 6-mile long powerline that currently bisects the marsh to south part of the project area.

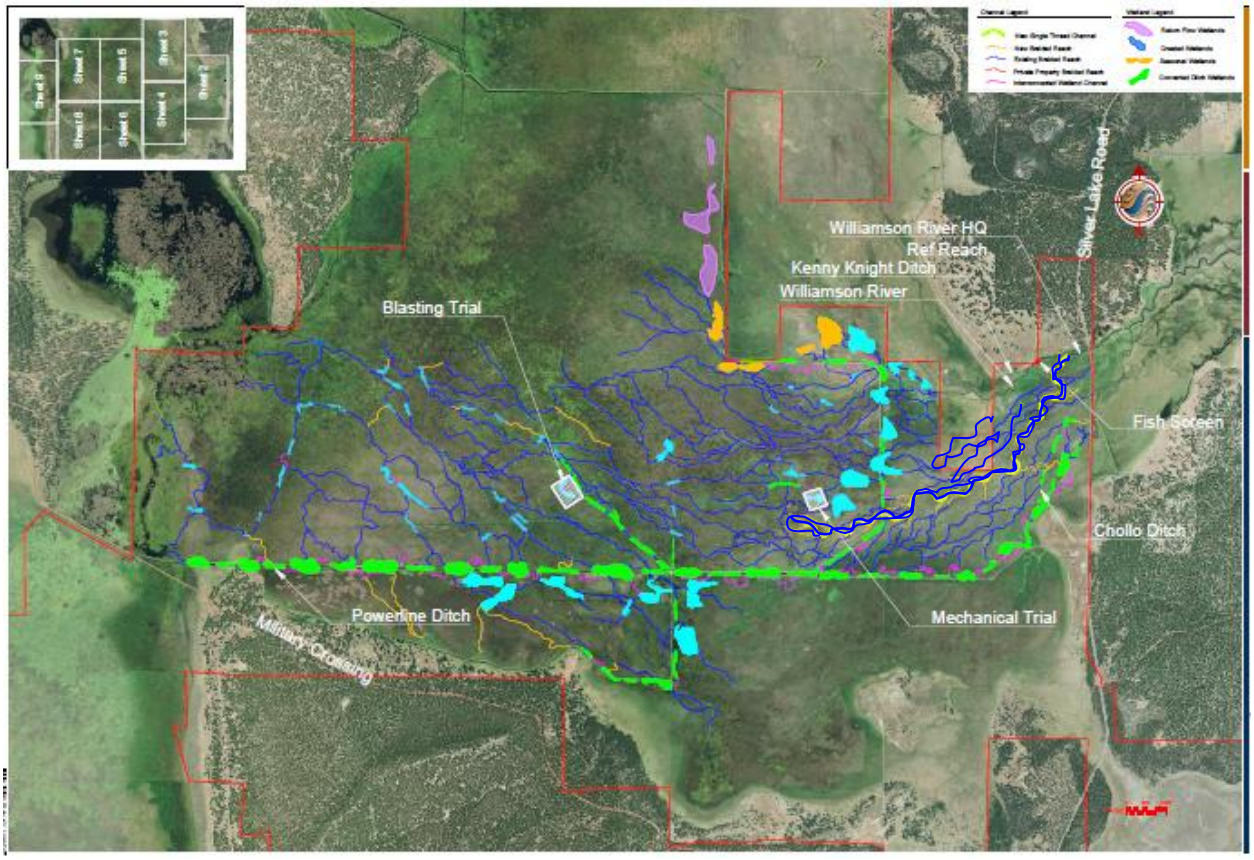

Fig. 9. Depiction of Alternative D showing the network of anastomose channels (dark blue) and constructed wetlands (multiple colors). The larger single river channel would not be constructed as part of this Alternative.

Alternatives/effects matrix

Decision making criteria	**Alternative A** **No Action**	**Alternative B** **Single channel and anastomose channel (Preferred)**	**Alternative C** **Single channel only**	**Alternative D** **Anastomose channel only**
Principal Environmental (Biophysical) effects Restore natural hydrology	Hydrology constrained within existing infrastructure of canals, drains, and water control structures	Hydrology restored within single 3-mile meandering natural channel and anatomose channels and the reconnected flood plain wetlands and riparian habitats.	Hydrology restored within single 10-mile meandering natural channel and the reconnected floodplain wetlands and riparian habitats.	Hydrology restored in anastomose channels reconnected to floodplain wetlands.
Provide diverse riverine, wetland, and riparian habitats driven by the natural hydrology of the Williamson River	No natural riverine or riparian habitats provided. Wetlands subject to flooding through artificial canals and water control structures. Overall habitat complexity low. Lack of riparian shading results in high water temps in canals for fish.	Creation of naturally functioning riverine and riparian habitats. Adjacent wetlands hydrologically connected to riverine system. Diversity and complexity of habitats greater than Alternative A. Riparian vegetation shades water in summer for cooler temps.	Same as B except complexity of anastomose channels mostly lacking. Summer water temps same as Alternative B.	Lacking large riverine and riparian habitats. Lacking instream riffle/pool features and habitat structure for native fish and wildlife compared to Alternative B or C.
Provide for native fish and wildlife and migratory birds with an emphasis on migratory birds and sensitive species.	Hydrology of refuge habitats largely man-made, which at times may not be consistent with life history needs of refuge fish and wildlife. No functioning riverine systems lead to poor habitat conditions for redband trout. No restoration of riverine or	Connecting the floodplain wetlands to the restored river will enhance the productivity of riverine habitats. Restored wetlands will increase diversity and abundance of native and migratory wildlife. Functioning river channel and	Same as B	Same as B except native fish benefits are less than Alternative B because of lack of diverse types of channels.

	wetland habitats leads to suboptimal conditions for Oregon spotted frog.	associated riparian habitats will provide improved habitat for redband trout and other native fish species. Sensitive species such as yellow rails, spotted frogs, redband trout, and sandhill cranes all expected to benefit.		
Fish passage	Fish passage blocked at 11 points on Refuge	All fish passage barriers removed	Same as B	All fish passage barriers removed, however, fish habitat less diverse.
Sedimentation/ erosion	Since the current canal system has been in existence for decades, vegetation is well developed and sedimentation and erosion potential slight.	Sedimentation and erosion potential in first few years after construction. Movement and redeposition of sediment in constructed channel a positive effect as it creates diverse habitat features	Same as B	Newly constructed anastomose channels have potential for erosion prior to revegetation. Movement and redeposition of sediment creates habitat diversity.
Degree of Public Controversy	Potential for controversy high as No Action counters recommendations of stakeholders to restore natural hydrology and riverine systems on the Refuge. No impact to private irrigation diversion	Potential for controversy low as proposed action consistent with recommendations from stakeholders to improve the Williamson River through the Refuge Medium impact to inholding irrigator Change in water management may create some uncertainty with Refuge hay permittees	Same as B	No single channel may cause controversy among those stakeholders interested in native fish habitat. Potential negative effect to inholding irrigator as the anastomose channels fork from the main channel where it enters the refuge. The private landowner, who has an inholding in the path of anastomose flow will be impacted by this new system through his pastureland
Principal Socio/Economic	No potential for recreational fishery in natural stream channel	Potential for recreational fishery in restored stream channel	Maximum potential for recreational fishery in restored stream channel	No potential for recreational fishery in natural stream channel

Impacts	Current hay program likely to continue in similar areas as the past. Water diversion of private landowner maintained No large expenditure of funds on restoration work leads to lack of opportunity for Klamath County economy.	Some uncertainty relative to the extent or area for hay cutting by adjacent ranchers Water diversion of private landowner improved with fish screens Expenditures of restoration funding beneficial to Klamath County economy	Same as B Same as B Expenditures of restoration funds maximized and beneficial to Klamath County economy	Same as B Same as B Expenditures of restoration funding minimized for benefits to Klamath County economy.

Section III: Affected Environment

A diversity of wildlife species use KMNWR including deer, elk, antelope, coyotes, river otters, beaver and muskrats, raptors, ducks and geese. Pacific flyway bird migrations through the marsh include ducks, geese, swans, cranes, shorebirds and numerous other waterbirds. The diverse communities of native fish, wildlife and plants include a species proposed for listing as federally threatened, the Oregon Spotted Frog (Rana pretiosa), the fisher (Martes pennati), and numerous species of concern, including the redband trout (Oncorhynchis mykiss gibbsi), the Miller Lake lamprey (Lampetra minima), as well as the largest population of yellow rails (Coturnicops noveboracensis) west of the Rocky Mountains. Other federal species of concern on Klamath Marsh are the Lewis's woodpecker (Melanerpes lewis), and the white-headed woodpecker (Picoides albolarvatus). Several of the State of the Oregon Sensitive species include the bufflehead (Bucephala albeola), the great grey owl (Strix nebulosa), the greater sandhill crane (G. canadensis Canadensis) and the western toad (Bufo boreas). Over 250 species of wildlife reside, migrate through, nest, forage, hunt or loaf in Klamath Marsh. A more detailed description of habitats and wildlife on KMNWR can be found in the 2010 Klamath Marsh National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment (CCP)

Historic conditions regarding vegetation and hydrology were described in the 2010 Klamath Marsh National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment (CCP) briefly as follows….

The vegetation and hydrology of Klamath Marsh has changed considerably since first described by Abbot in 1855 surveys. Henry L. Abbot described Klamath Marsh as "a strip of half submerged land about 12 miles long and 7 miles wide covered with clumps of tule and other aquatic plants separated by small sheets of water". Later in 1904, Coville described Klamath Marsh containing 10,000 acres of the great water lily, Wocus. A BIA report in 1913 described an area 15 miles long and 3 miles wide on Klamath Marsh engulfed in water and covered with tule, American slough grass and wocus. In 1955, the area was recorded to consist of 9,900 acres of shallow marsh and 15,000 acres of deep marsh. (USDI and USFWS). By 1963, the area was said to include 920 acres of open water; 8,966 acres of marsh; and 4,345 acres of wet meadow, consisting of carex, deschampsia and Scirpus, etc. and 995 acres of grassland and forests (Oneil 1965), a ratio of emergent vegetation to open water of nearly 10 to 1. The annual Refuge narrative in 1975 indicated the vegetation was dominated by dense stands of hardstem bulrush while open water –vegetation was virtually non-existent with an estimated 10 % of the marsh consisting of open water…

Section IV: ENVIRONMENTAL CONSEQUENCES

Alternative A – No Action

Description: Under the No Action Alternative, Refuge staff would continue to utilize the existing infrastructure of canals, drains, and water control structures to divert water to irrigate wetlands for hay production and native marsh habitats (9,000 total acres). The refuge would continue to expend funding and manpower to maintain this infrastructure. Significant additional funds would be required in the future to upgrade diversion structures to allow for fish passage. In addition, screening will be required in the future to prevent fish from being diverted from canals during irrigation periods. The Kirk Ditch powerline would likely be maintained, and limited, if any riparian vegetation would be planted along canals as debris from brush and trees tends to plug water control structures.

1. ***Restoration of natural hydrology:*** The natural hydrology of the Williamson River would continue to be controlled by the present water control system. Although this infrastructure could be used to mimic the natural hydrology of the river, it is doubtful that this water management could duplicate the short-term (yearly) and long-term (decades) natural hydrologic cycles.

2. ***Provide diverse riverine, wetland, and riparian habitats driven by the natural hydrology of the Williamson River:*** Natural hydrology relative to channel and floodplain wetland interaction would remain disconnected. Limited and poor quality habitat for native fish and wildlife species would continue, particularly along canals and drains. Restoration of riparian habitat would not occur as brush and trees along canals tend to produce debris that plugs water control structures. In addition, restoration of streamside wetlands would not occur which would limit the diversity of wetlands on the Refuge.

3. ***Provide habitats for native fish and wildlife and migratory birds with an emphasis on "sensitive" species:*** The limited habitat potential of this alternative depicted in item 2 above, limits expansion of fish and wildlife use in the project area. While key sensitive species such as yellow rails, spotted frogs, redband trout, and greater sandhill cranes exist in the project area, their density and numbers are far below the potential for the site.

4. ***Fish passage:*** Fish passage barriers and the potential of entrainment of fish at diversion points would continue. Ultimately, fish passage will be necessary and will be an additional monetary cost of the present system.

5. ***Sedimentation/erosion:*** Since the current vegetated canal system is vegetated has been in existence for decades, sedimentation and erosion potential is slight.

6. ***Public controversy:*** Recommendations to restore the hydrology and habitat of KMNWR were published in the KMNWR Final CCP and EA, 2010, the UPPER Williamson Watershed Assessment, 2005, and the KMNWR Wildlife and Habitat Review, 2004, as

well as others. These three documents represent the views of scientists and managers from local and regional federal and state agencies, the local watershed group, local landowners, The Klamath Tribes, The Nature Conservancy, Audubon, Oregon Wild and others. To continue the present management practices despite the identified problems listed in several forums would be controversial.

7. ***Socio/Economic impacts:*** Under the No Action Alternative, the present location of haying activities would likely continue which provides benefits to local ranchers and does increase the visibility of wildlife to the visiting public, particularly along Silver Lake Highway. In addition, the potential to open the project area for recreational fishing would remain very low as there are few fish to catch and the value of the outdoor experience would be limited to fishing in canals and drains.

   Ongoing maintenance and operation of the current water control system results in significant expenditure in manpower and funds. Upgrades to the system to allow for fish passage at 11 barriers are likely in the future will require additional funding needs, and will be costly to maintain and operate.

Alternative B – Single and anastomose channels (preferred alternative)

Beginning where the Williamson River enters the Refuge, a 3.0 mile sinuous channel would be constructed that merges into a series of existing anastomose (braided) channels, some of which extend as far as Military Crossing Road. The main 3.0 mile channel would be constructed using a combination of excavators and blasting. Woody structure would be added to the newly constructed channel to improve channel complexity.

Existing drains and levees would be converted into complexes of depressional wetlands and ponds. Eleven water control structures, fish barriers, would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. In-stream habitat structures (woody debris) would be placed in the 3.0 mile channel to provide cover, shade, and macro-invertebrate habitat. Constructed channel edges would be planted to willows and other riparian species. Additional activities include the installation of a fish screen to prevent entrainment of fish in a private irrigation diversion on the north side of the project

1. ***Restoration of natural hydrology:*** This alternative will restore the riverine system and reconnect it to the historic floodplain, thus sustaining the water table and seasonal surface water hydrology that supports diverse wetland vegetation communities. Wetland water levels will vary in water depth as well as length of inundation.

2. ***Provide diverse riverine, wetland, and riparian habitats driven by the natural hydrology of the Williamson River:*** Habitat types include emergent marsh, sedge meadows, grasslands, wet meadows, riverine, riparian and open water. This diverse combination of habitats will meet the life history needs of all stages of resident wildlife and the seasonal requirements of migratory species. The project design targets wetland complexes that are large; blocks of several thousand acres of seasonally flooded sedge/rush, to small, <200

acre wetland complexes or isolated shallow ponds off-stream or connected to the new river system. The replacement of ditches, levees, and water control structures with a free flowing river system and functioning riparian habitat will enable native fish to access upstream Williamson River reaches and move within Klamath Marsh channels, wetlands, and backwaters according to their seasonal needs.

With removal of water control infrastructure, as well as the Kirk Ditch powerline, associated access roads would be removed as well. This reduction in vehicle access will reduce the potential for the spread of noxious weeds, many species of which would threaten native habitats.

3. ***Provide habitats for native fish and wildlife and migratory birds with an emphasis on "sensitive" species:*** The diversity of habitats provided under this alternative will be tied to the natural hydrology of the Williamson River; a hydrologic cycle that species native to KMNWR are adapted. The reconstruction of the Williamson River channel and removal of fish barriers will provide an additional three miles of natural channel which will be reconnected to the upper river. In addition to fish moving upstream from the Refuge, fish from the upper watershed will have access downstream to the seasonal food and habitat resources within KMNWR. Redband trout in particular will benefit from this aspect.

   Restored streamside wetlands will be particularly beneficial to the Oregon spotted frog which presently occupies the project area at low densities and only in specific areas. The diversity of vegetation, hydrology and wetland depths will provide for the year long needs of the species. Elimination of water control infrastructure and associated access roads would reduce the amount of disturbance to wildlife near the present road system.

4. ***Fish passage:*** Fish passage barriers will be eliminated as part of the project allowing full access for fish moving upstream and downstream.

5. ***Sedimentation/erosion:*** Sedimentation and erosion are expected in the first few years after construction; however, movement and redeposition of sediment in constructed channel is a positive effect as it creates diverse habitat features; scouring in some stream reaches and depositing in others.

6. ***Public controversy:*** A low degree of public controversy is expected from implementation of this alternative as it agrees with the recommendations from stakeholders over the last decade to restore/ improve the Williamson River through the Refuge. No impacts are anticipated relative to diversion of water for private lands. There may be some uncertainty as to how much haying will be allowed under this alternative.

7. ***Socio/Economic impacts:*** This alternative will allow for the continuation of the haying program which provides important habitat for spring migrating waterbirds as well as economic resources to local ranches. The exact extent and acreage of haying allowed

will be subject to the Service's Compatibility Policy (603 FW 2) as well as where and how sedge meadow habitats respond to the project. In addition, restoration of the Williamson River channel could allow for a public recreational fishing opportunity which does not currently exist. Access for this fishery will also allow for addition public use areas on the refuge potentially increasing tourism dollars to Klamath County. The project will create 2-3 years of varied work on the project, including stockpiling wood, heavy equipment operation, blasting, planting, tree growing, monitoring, research and surveys. Much of this work would be contracted to businesses in Klamath County.

Elimination of the current water management infrastructure would allow the costs currently consumed with maintenance of this system to be diverted to other conservation oriented activities on the Refuge.

Alternative C – Single channel only

Beginning where the Williamson River enters the Refuge, a 10 mile sinuous channel would be constructed that would extend to Military Crossing Road. Large woody debris would be added to the first 3.0 to 4.0 miles to provide habitat complexity in the restored river. Existing drains and levees would be converted into complexes of depressional wetlands and ponds. Eleven fish barriers would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. Riparian areas would be planted with willows and other riparian species. Additional activities include the installation of a fish screen for a diversion from the Williamson River to a private irrigator, and relocating the Kirk Ditch powerline that currently bisects the marsh to the forest boundary south of the project area.

1. ***Restoration of natural hydrology:*** The lower five miles of the river channel, west of the single channel in Alternative B leading to Military Crossing, would be well below marsh water elevations through most of the season and would exist within the "gaining reach" of the floodplain. The period of this inundation would be greater to the west and especially significant near Military Crossing. Thus, during most of the year much of the water in this western reach would likely not flow in the constructed channel but would move as overland flow through the marsh.

   The restored riverine system and natural hydrology will be reconnected to the historic floodplain, sustaining a water table and hydrology that supports diverse wetland and riparian vegetation communities. Thus, impacts to habitats and species are similar to Alternative B, except there may be some additional functional river channel exposed, particularly late in the summer or in dry years when marsh levels are reduced.

2. ***Provide diverse riverine, wetland, and riparian habitats driven by the natural hydrology of the Williamson River:*** Alternative C will provide slightly more restored river channel compared to Alternative B, especially late in the summer or in dry years. Because anastomose channels are not constructed with this Alternative, there may be slightly less habitat diversity due to fewer of these habitat features. It is also possible that these habitat features may form naturally on the floodplain from the seasonal overflow of the

stream bank. In terms of wetlands, Alternative C will provide some additional wetlands in the westward part of the project area, potentially adding more diversity to wetland habitats.

3. ***Provide habitats for native fish and wildlife and migratory birds with an emphasis on "sensitive" species:*** This alternative will likely provide slightly more habitat for native fish including redband trout, particularly late in summer or in dry years when the functional river channel is extended further west by a reduced marsh water level. Fewer anastomose channels under this alternative may provide less potential habitat for spotted frogs, although it is possible that these channels may form naturally for overflow of the constructed stream band. It is expected that wetland and riparian dependent wildlife species will benefit similarly as to Alternative B.

4. ***Fish passage:*** All 11 fish passage barriers would be removed under this alternative.

5. ***Sedimentation/erosion:*** Sedimentation and/or erosion is expected to be greater in the first several years following construction because the length of the constructed river channel is 10 miles long as opposed to 3 miles under the preferred alternative (Alternative B). Movement of sediments is expected to diversify the constructed channel by scouring in some areas and redepositing in other areas.

6. ***Public controversy:*** This alternative would be consistent with the recommendations from stakeholders relative to restoration of the Williamson River; however, some individuals and local landowners may question the costs/benefits of this alternative. No impacts are anticipated relative to diversion of water for private lands. There may be some uncertainty as to how much haying will be allowed under this alternative.

7. ***Socio/Economic impacts:*** Construction of the additional seven miles of channel westward of the three miles proposed in Alternative B (preferred) would be exceedingly expensive and of questionable value (see item 1 above). This alternative would create 2-3 years of varied work on the project, including stockpiling wood, heavy equipment operation, blasting, planting, tree growing, monitoring, research and surveys much of which would be contracted potentially providing additional money to the Klamath County economy. The additional funds required for alternative C would be greater than for the preferred alternative. In addition, this alternative would provide potentially more stream miles to a public recreational fishery. While this alternative will provide additional funding and recreational opportunity, its excessive cost come at an expense to conservation work that could be done elsewhere on the Refuge.

Alternative D – Anastomose channel only

Beginning where the Williamson River enters the Refuge, anastomose or braided channels would be constructed or reactivated that would extend to Military Crossing Road. Existing drains and

levees would be converted into complexes of depressional wetlands and ponds. The conversion of existing canals and drains into wetlands would be done in such as way as to not impede surface water flow which could affect the natural formation of anastomose channels. The project design targets wetland complexes that are large; blocks of several thousand acres of seasonally flooded sedge/rush, small, two-hundred acre wetland complexes, and isolated shallow ponds. Eleven fish barriers would be removed allowing native fish passage upstream to spawning reaches of the Williamson River. There would be no riparian plantings under this alternative. due to the likely movement of shallow channels during high flows. Additional activities include the installation of a fish screen for a diversion from the Williamson River to a private irrigator, and relocating a 6-mile long powerline that currently bisects the marsh to south part of the project area.

1. ***Restoration of natural hydrology:*** The natural hydrology of the refuge would be restored except that most of the water entering the refuge would be through a web of anastomose channels rather than a single channel. This would reconnect the floodplain to the historic hydrology thus sustaining a water table and hydrology that supports diverse wetland vegetation communities. These effects are similar to Alternatives B and C.

2. ***Provide diverse riverine, wetland, and riparian habitats driven by the natural hydrology of the Williamson River:*** Effects to wetlands on the floodplain will be similar to Alternatives B and C. However, the diversity of those wetlands may be greater under this Alternative due to greater extent of anastomose channels. This alternative will result in less riverine and associated riparian habitats compared to Alternatives B and C.

3. ***Provide habitats for native fish and wildlife and migratory birds with an emphasis on "sensitive" species:*** Habitat for fish, particularly redband trout would be less without a single threaded channel and constructed fish habitat (woody debris). Fish from the upper watershed would have less access to refuge habitats. Other aquatic species that use larger channels may not occupy the refuge area without deeper riverine habitat. The large quantity of anastomose channels may provide additional habitat diversity to refuge wetlands and provide a large benefit to the Oregon spotted frog. The degree of this benefit will depend on period of inundation of these channels as spotted frogs require near year-round water to survive.

4. ***Fish passage:*** All 11 fish barriers would be removed under this alternative.

5. ***Sedimentation/erosion:*** Some sedimentation/erosion can be expected under this alternative, however, it is expected that erosion would be less than Alternative C and likely similar to Alternative B. The degree of erosion or sedimentation will depend on the number of anastomose channels constructed and the number which form naturally.

6. ***Public controversy:*** In general, there is a low degree of controversy regarding river and wetlands restoration on KMNWR because it agrees with the recommendations from stakeholders over the last decade to do actions to improve the Williamson River reach flowing through the Refuge. Some individuals may question the lack of a single channel

in this alternative.

This alternative has a potential to negatively affect the adjacent landowner. Although his legal point of diversion on the Williamson River is maintained, uncontrolled flows from the anastomose channels may enter his property. In addition, this alternative would allow for little if any recreational fishing opportunities as contemplated in the KMNWR CCP.

7. ***Socio/Economic impacts:*** This alternative would create 1-2 years of varied work on the project, including heavy equipment operation, blasting, planting, monitoring, research and surveys much of which would be contracted potentially providing additional money to the Klamath County economy. The funds required would be less than for the preferred alternative. This alternative would provide little if any potential for a public recreational fishery in the project area, thereby minimizing the potential for additional recreational or wildlife observation activities. This alternative may impact the private landowner whose land would lie in the path of the natural anastomose channel formation by flooding of his pasturelands at potentially inappropriate times.

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Section V: COMPLIANCE, CONSULTATION AND COORDINATION WITH OTHERS

Compliance: Cultural Resource, Clean Water Act, Endangered Species, and blasting permit compliance are in the initial stages of discussion with the appropriate agencies/individuals.

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Bruce and Penny Emory, adjacent landowner
Scott Shuey and family, adjacent landowner
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